

SMEI IDL Display System (IDL_SMEI) Reference Manual

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1 Introduction

This document is a reference summary for the IDL_SMEI package, version 2.0. It simply contains lists of procedures, and their extracted internal documentation.

This manual lists the procedures by directories and alphabetically within the directory. Note that the material has been extracted mindlessly from the comments in the routines; so if the description in the routine itself is wrong, so is the description here.

If you find a routine whose arguments or keywords don't match those listed in its documentation, please let me know (other than the `help` keys in the command-line routines which are not documented internally).

2 Architecture

The architecture of IDL_SMEI is built around IDL's object-oriented programming capabilities with its attendant blessings and curses. This allows the user to have a compact interface where he or she need only deal with a single variable to have access to all the data and settings for a particular sequence of images. It also allows easy saving of work to IDL's save files. The drawback is that there are huge numbers of little 3-line functions and procedures that are needed to set the properties.

The object that the user normally sees is a `SMEI_SEQUENCE` which contains the images and the settings used to display them (e.g. colour table, data range and annotation options).

The `SMEI_IMAGE` objects of the sequence are stored as a doubly-linked list to allow you to move forwards or backwards. The sequence links directly to the first and last images, while each image links back to its parent sequence. The image object contains the raw image as obtained from the FITS file and the normalized version, along with information extracted from the FITS header (and a pointer to the FITS header itself in case any of the more obscure fields are needed) and some processing flags. If the raw image is deleted to save memory, then the image is said to be **compacted**.

In normal use, the user does not deal with the images directly but accesses them through the sequence. Procedures for extracting information from images should normally be able to access the information either from an image object or from a sequence object and image index.

The `SMEI_IMAGE` class has a subclass `SMEI_DERIVED_IMAGE` which is used to create images that are computed from other images using combinations of IDL operators and/or functions. The definition of how to do these calculations is stored in an operator object class (`SMEI_OPERATOR`).

3 Summary

The summaries in this section give the definitive lists of routines and their arguments and keywords; if the detailed descriptions and the list here conflict (other than help keywords being omitted in the descriptions) then please let me know. There are a few routines listed from the IDL system library and from the rest of the SolarSoft libraries whose compilation is forced by the compilation of the IDL_SMEI routines.

3.1 Procedures

Routine	Arguments	Keywords
<code>aitoff</code>		
<code>aitoff_grid</code>		
<code>caldat</code>		
<code>choose_ps_actions</code>	<code>file print preview</code>	<code>id printable</code>
<code>cw_progress_set.v</code>	<code>id value</code>	
<code>cw_progress_init</code>	<code>id</code>	
<code>cw_progress_kill.b</code>	<code>cid</code>	

Routine	Arguments	Keywords
doc_library		
do_mkhdr	d0 d1	year
euler		
ffld_focus_enter	id	
ffld_set_enter	id value	
ff_data_define		
fll_grid	dlong dlat	charsize label max_elongation _extra
fpe_grid	delong dpa	charsize label max_elongation _extra
loadct		
make_model_list	dir names desc	projection
make_smei_op	ref operator arg0 arg1 arg2 arg3 arg4 arg5 arg6 arg7 arg8 arg9	get_level help return_operator _extra
marker_event	event	
marker_menu	state leader	
mask_off	image index projection	
mk_argfiles		
mk_imghdrtxt	path	force help
pe_grid	delong dpa	charsize label _extra
plot_env		restore save
print_ht	file values	
p_flags_event	event	
qd_elong	elong longin lat longout	
qd_posang	pa longin lat longout	
restore_sequence	seqref file	help menu
rll_grid	dlong dlat	charsize label shift _extra
rpe_grid	delong dpa	charsize label _extra
save_profile	profile pa elong date	group
save_prof_event	event	
schop_event	event	
sc_event	event	
self_help		
setup_keys		ansi hp9000 ibm mips sgi sun vt200 _extra
sh_zoom_event	event	
si_print_event	event	
skey_dec		app_keypad eightbit num_keypad
smei_add_image	seqref files	after before compact first help last
smei_calculate	seq opstring	file help _extra
smei_calc_menu	seqref	group help no_delete _extra
smei_colour	seqref table	help menu
smei_compact	seqref	help mk_nan
smei_delay	seqref delay	help
smei_delete_image	seqref image	help
smei_docs		admin help pdfviewer reference tu- torial
smei_image	seq index image	help
smei_image::cleanup	self	
smei_image::compact	self	mk_nan
smei_image::mk_pa_map	self elon pat p	
smei_image::mk_pixmap	self	destroy top_right zoom
smei_image::mvi_frame	self fname	new
smei_image::norm_weight	self	
smei_image::peek	self	

Routine	Arguments	Keywords
smei_image::print	self	add_range cmyk colour_table date encapsulated file flag grid id kill logarithmic no_colour null_index plane plot_file portrait preview print range xsize _extra
smei_image::print_menu	self	block group
smei_image::ps_show	self xsize ysize xposition yposition	add_range flag ivate ifile igrd irange kill logarithmic null_index plane range
smei_image::resequence	self seqref	
smei_image::set_image	self image_data	restore
smei_image::set_next	self next	
smei_image::set_plot_scale	self box	
smei_image::set_prev	self prev	
smei_image::set_skip	self flag	
smei_image::show	self	colour_table date file flag grid kill logarithmic nosave plane range smooth window zoom
smei_image::show_header	self	group
smei_image_header	source header	fitshead help index
smei_image_image	source image	flag help index latitude longitude plane raw time
smei_image_info	source info	convert file help index planes scale size start stop summary time unit x y
smei_image_move	source ishift imoved	help index
smei_image_print	source	help index menu _extra
smei_image__define		
smei_join	seq1 seq2	help preserve sort
smei_mask	seqref mask	aurora bias dark help jupiter mars mercury moon particles saturn squares sun venus
smei_mask_bits	ref bits	help index
smei_mask_bits__define		
smei_menu	seqref	file help no_progress
smei_movie	seqref file	avi codec compress ffmpeg frame_rate help mpeg multiplex mvi quality quicktime
smei_msg	message	alert dialog_parent error inform noshow warning _extra
smei_null_index	seqref index	help off_sky print screen
smei_operator::cleanup	self	
smei_operator::compute	self	
smei_operator::compute_average	self	
smei_operator::compute_csum	self	
smei_operator::compute_max	self	
smei_operator::compute_median	self	
smei_operator::compute_min	self	
smei_operator::compute_sum	self	
smei_operator::concatenate	self	
smei_operator_argument::cleanup	self	
smei_operator_argument__define		
smei_operator__define		
smei_opts	seqref	columns date file grid help order plot_file preview print range rows type xsize ysize
smei_point__define		

Routine	Arguments	Keywords
smei_print	ss	add_range cmyk colour_table encapsulated file grid help in_rows logarithmic ncolumns nodate no_colour nrows plot_file portrait range xsize ysize _extra
smei_profile	seqref npa nel pmin pmax profile pa elong date	circumferential help mask miss_nan plane save use_flags verbose
smei_range	seqref range range1	help kill logarithmic
smei_restore	seqref file	help menu
smei_save	seqref file	help
smei_sequence	seq lim0 lim1	aitoff compact fisheye help menu name nostop rectangular show silent
smei_sequence::add_menu	self	group no_progress
smei_sequence::apply_colour_map	self	
smei_sequence::calc_count	self	
smei_sequence::cleanup	self	
smei_sequence::compact	self	mk_nan
smei_sequence::concatenate	self seq2	preserve sort
smei_sequence::delete_image	self image	
smei_sequence::delete_menu	self	group
smei_sequence::flags_menu	self	block group
smei_sequence::make_agif	self giffilename	frame_rate no_progress
smei_sequence::make_avmv	self mpegfilename	avi ffmpeg frame_rate no_progress quicktime
smei_sequence::make_mpeg	self mpegfilename	compress multiplex no_progress quality
smei_sequence::make_mvi	self file	group no_progress
smei_sequence::make_png	self pngfilename	no_progress
smei_sequence::menu	self flag	group no_progress
smei_sequence::menu1	self flag iam_init	group no_progress
smei_sequence::menu2	self flag iam_init	group no_progress
smei_sequence::mk_pixmap	self	clear destroy
smei_sequence::model_menu	self	group
smei_sequence::movie_menu	self	group no_progress
smei_sequence::peek	self	
smei_sequence::png_menu	self	group no_progress
smei_sequence::print	self	add_range cmyk colour_table date encapsulated file grid id in_rows landscape logarithmic ncolumns no_colour nrows plot_file portrait preview print range xsize ysize _extra
smei_sequence::print_menu	self	block group
smei_sequence::profile_mask_menu	self state	group
smei_sequence::profile_menu	self	group
smei_sequence::range_menu	self	block group
smei_sequence::save	self file	group menu
smei_sequence::set_annotations	self	date file grid range
smei_sequence::set_colour_map	self	group map menu redraw table
smei_sequence::set_data_range	self min max	kill logarithmic
smei_sequence::set_delay	self delay	
smei_sequence::set_file	self file	
smei_sequence::set_first	self first	
smei_sequence::set_flags	self flags	
smei_sequence::set_last	self last	
smei_sequence::set_name	self name	
smei_sequence::set_null_index	self index	off_sky print screen
smei_sequence::set_plane	self plane	

Routine	Arguments	Keywords
smei_sequence::set_print_opts	self	cmyk columns file order preview print rows type xsize ysize
smei_sequence::set_pxm_hwm	self hwm	
smei_sequence::set_roll	self roll	
smei_sequence::set_shift	self shift	east north south west
smei_sequence::set_sourcedir	self sourcedir	
smei_sequence::set_window	self window	
smei_sequence::set_zoom	self factor	inverse smooth
smei_sequence::show	self image	delay group
smei_sequence::show_info	self	group
smei_sequence::sort	self	
smei_sequence::subtract_model	self model	path plane restore
smei_sequence::vmain	self value name	default_name group
smei_sequence._define		
smei_seq_info	source info	count help name n_planes size summary
smei_show	seq image	colour_map colour_table delay grid help nodate range shift
smei_subtract_model	seq model	help restore
smei_zoom	seqref factor	help inverse smooth
ss_add_controls	conbase state	
ss_add_event	event	
ss_change_dir	state event	sipath update
ss_delete_event	event	
ss_flags_event	event	
ss_info_event	event	
ss_menu1_event	event	
ss_menu2_event	event	
ss_model_event	event	
ss_movie_event	event	
ss_png_event	event	
ss_print_event	event	
ss_prof_event	event	
ss_range_event	event	
ss_show_event	event	
ss_vmain_event	event	
ss_zoom_event	event	
sunpos		
vmain	value name	default_name group
vmain_event	event	
wcssph2xy		
wcsxy2sph_smei	x y longitude latitude map_type	crval crxy ctype face latpole longpole pv2
wcs_rotate		
write_gif		
write_ppm		
xdisplayfile		
xloadct		
xmanager		
zmcopv	iwind owind x y wsize zoom smooth xoff yoff	

3.2 Functions

Routine	Arguments	Keywords
ch_ps_event	event	
colormap_applicable		

Routine	Arguments	Keywords
cvttobm		
cw_bgroup		
cw_ffield	parent	all_events array_valued box capture_focus column display double fieldfont floating font format frame graphics integer label long_int no_events scroll select_events text tracking_events uvalue value xsize ysize
cw_filesel		
cw_progress	parent	box column font frame group_leader index map maximum modal text title uname uvalue value xsize ysize
cw_progress_get_v	id	
date100	year	full print
delta_hours	t1 t0	
del_sq	x	stride
dist		
doy2jd	time	
epoch2jd	epoch	
ffd_cvt_float	txt	double valid
ffd_cvt_int	txt	long_int valid
ffd_enter_ev	event	
ffd_get_enter	id	
fft_clean	image scale	order
ff_extract	file	descriptor
ff_summary	file	callid count filelist norecurse no_file no_progress path projections startlist template update
ff_todesc	ff_str	
ff_tostr	desc	file
fitshead2struct		
fxpar		
gauss2dfit		
gauss_cleaner	img	
gauss_remove	img	order residual show threshold wsize
general_speed	t v th	vp
get_comp_name	file	return_base _extra
have_command	command command_path	
headfits		
hist_find	process history	boolean line_break
h_m_s	t	string
jd2doy	jday	
jd2epoch	jd	
kill_wild	dirty minval maxval replace	
leefilt_smei	ain nin sigin	double exact median nan
lee_filter_exact	a n sig	double median nan
lee_filter_fast	a n sig	double median nan
local_coord	lc origin size	x y
make_smei_arg	descriptor	get_level transient
make_smei_opf	operator arg0 arg1 arg2 arg3 arg4 arg5 arg6 arg7 arg8 arg9	get_level return_operator _extra
match_lists	list0 list1	
mcleaner	img thresh	iscorr max_scale resid show
mean		
min_nz	array mindex	full max _extra
mod_pm	x m	
norm_time	time	

Routine	Arguments	Keywords
orbits_average	image number	exclude
orbits_mfilter	image number threshold	fill_spatial kill no_point
parse_op	descr	code file noexec _extra
parse_op_token	token index	get_level
readfits		
read_point_file	file	
read_smei_op	file	keep
reverse		
sfit		
show_zoomed	window x y	base group size smooth zoom
smei_choose_sop		group
smei_image::copy	self	prev sequence
smei_image::eval	self	ancil flags plane raw _extra
smei_image::get_ancil	self	latitude longitude time
smei_image::get_centre	self	x y
smei_image::get_cvalue	self	x y
smei_image::get_file	self	directory full _extra
smei_image::get_flags	self	bright crays c.equal dark gpoint lpoint lsff stellar zody
smei_image::get_flag_data	self	current next
smei_image::get_header	self	ancil fitshead flag quiet test
smei_image::get_image	self	
smei_image::get_locate	self x y	print
smei_image::get_mask_bits	self	
smei_image::get_next	self	
smei_image::get_pflags	self	compact skip weight
smei_image::get_pipe_level	self	
smei_image::get_pixmap	self	id llc
smei_image::get_planes	self	all ancil flag
smei_image::get_prev	self	
smei_image::get_projection	self	astrom_code string
smei_image::get_raw_image	self	data plane weight
smei_image::get_scale	self	x y
smei_image::get_sequence	self	
smei_image::get_size	self	x y
smei_image::get_summary	self	nofile
smei_image::get_time	self	convert start stop
smei_image::get_unit	self	
smei_image::init	self top prev	ancilhead ancil_data at_end centre compact copy cvalue fakename file fitshead flaghead flags flag_data im- age_data projection scale silent start stop unit
smei_image::move	self ishift	
smei_image::read_fits	self file	silent
smei_operator::eval	self index	ancil flags
smei_operator::get_argument	self index	
smei_operator::get_arg_count	self	
smei_operator::get_class	self	
smei_operator::get_count	self	
smei_operator::get_operator	self	
smei_operator::get_sequence	self	destroy
smei_operator::init	self op arglist	_extra
smei_operator_argument::eval	self index	ancil flags
smei_operator_argument::get_class	self	
smei_operator_argument::get_count	self	
smei_operator_argument::get_image	self index	
smei_operator_argument::get_plane	self	
smei_operator_argument::get_range	self	start step stop

Routine	Arguments	Keywords
smei_operator_argument::get_size	self	
smei_operator_argument::get_transient	self	
smei_operator_argument::get_value	self	
smei_operator_argument::init	self value plane range	transient
smei_query	message	dialog_parent _extra
smei_sequence::add_image	self file	after ancilhead ancil_data before centre compact cvalue filename first fitshead flaghead flags flag_data im- age_data last projection scale silent start stop unit
smei_sequence::get_annotations	self	date file grid range
smei_sequence::get_biggest_image	self	
smei_sequence::get_colour_map	self	blue green red
smei_sequence::get_count	self	
smei_sequence::get_data_range	self	kill logarithmic
smei_sequence::get_delay	self	
smei_sequence::get_file	self	
smei_sequence::get_first	self	index noskip
smei_sequence::get_flags	self	
smei_sequence::get_image	self location	
smei_sequence::get_last	self	index noskip
smei_sequence::get_mask_bits	self	
smei_sequence::get_name	self	
smei_sequence::get_null_index	self	off_sky print screen
smei_sequence::get_n_planes	self	
smei_sequence::get_pipe_level	self	
smei_sequence::get_pixmap	self	colwidth hwm
smei_sequence::get_plane	self	
smei_sequence::get_print_opts	self	cmyk columns file order preview print rows type xsize ysize
smei_sequence::get_projection	self	astrom_code string
smei_sequence::get_roll	self	
smei_sequence::get_shift	self	degrees raw
smei_sequence::get_sourcedir	self	
smei_sequence::get_summary	self	nofile nohead numbered print
smei_sequence::get_window	self	
smei_sequence::get_zoom	self	raw smooth
smei_sequence::init	self flist	compact group menu name noex- pand no_progress silent
smei_sequence::make_profile	self npa nel pmin pmax	circumferential date elong mask miss_nan pa plane verbose
smei_sequence::zoom_menu	self	group
strsplit		
struct2fitshead		
struct_contains	struct tag	
str_sep		
sxispar	header parameter	
sxpar		
uniq		

4 Command Line

4.1 restore_sequence

Source: cli/restore_sequence.pro

NAME :

RESTORE_SEQUENCE

PURPOSE:

Obsolete name of SMEI_RESTORE.

MODIFICATION HISTORY:

Make a wrapper for SMEI_RESTORE: 9/8/04; SJT

4.2 smei_add_image

Source: cli/smei_add_image.pro

NAME:

SMEI_ADD_IMAGE

PURPOSE:

Add one or more images to a SMEI sequence

CATEGORY:

CLI

CALLING SEQUENCE:

smei_add_image, seqref, files

INPUTS:

seqref	objref	Object reference of the SMEI sequence
files	string	scalar string or string array containing the FITS file(s) to be added, such wildcards as findfile recognizes for your OS are allowed. Currently it must be an explicit path (or the files in the current dir).

OPTIONAL INPUTS:

KEYWORD PARAMETERS:

/first	If set, then add the image at the beginning of the sequence.
/last	If set, add the image at the end of the sequence (this is the default behaviour).
after	Either a location number or an image reference after which the new images is to be inserted.
before	Either a location number of an image reference before which the new image is to be inserted.
/compact	If set, then compact the image on adding it.

MODIFICATION HISTORY:

Original: 19/12/02; SJT

Fix some very visible bugs: 30/7/03; SJT

4.3 smei_colour

Source: cli/smei_colour.pro

NAME:

SMEI_COLOUR

PURPOSE:

Set the colour table for a SMEI sequence

CATEGORY:

CLI

CALLING SEQUENCE:

smei_colour, table

INPUTS:

seqref	objref	Object reference to the sequence.
table	int/byte	Either a scalar giving the colour table index, or a 256x3 array with a colour map.

OPTIONAL INPUTS:

KEYWORD PARAMETERS:

/menu If set, then use XLOADCT to select/adjust the colour table.

MODIFICATION HISTORY:

Original: 19/12/02; SJT

4.4 smei_compact

Source: cli/smei_compact.pro

NAME:

SMEI_COMPACT

PURPOSE:

Compact all the images in a SMEI sequence

CATEGORY:

CLI

CALLING SEQUENCE:

smei_compact, seqref

INPUTS:

seqref objref The object reference of the SMEI sequence to be compacted

KEYWORD_PARAMETERS
/mk_nan If set, then convert points in the weighted images with zero weight into NaN values.

MODIFICATION HISTORY:
Original: 19/12/02; SJT

4.5 smei_delay

Source: cli/smei_delay.pro

NAME:
SMEI_DELAY

PURPOSE:
Set the interframe delay for a SMEI sequence

CATEGORY:
CLI

CALLING SEQUENCE:
smei_delay, seqref, delay

INPUTS:
seqref objref Object reference of the SMEI sequence to be modified.
delay float The delay in seconds

MODIFICATION HISTORY:
Original: 19/12/02; SJT

4.6 smei_delete_image

Source: cli/smei_delete_image.pro

NAME:
SMEI_DELETE_IMAGE

PURPOSE:
Delete an image from a SMEI sequence.

CATEGORY:
CLI

CALLING SEQUENCE:
smei_delete_image, seqref, image

KEYWORD PARAMETERS

/all If set, then delete all images in the sequence.

INPUTS:

seqref objref Object reference to the sequence.
 image Either an image number, or an image reference.

MODIFICATION HISTORY:

Original: 19/12/02; SJT
 Add ALL keyword: 27/5/04; SJT

4.7 smei_docs

Source: cli/smei_docs.pro

NAME:

SMEI_DOCS

PURPOSE:

Find a suitable application and show the SMEI PDF documentation.

CATEGORY:

CLI

CALLING SEQUENCE:

smei_docs

KEYWORD PARAMETERS:

/reference If set, then show the reference manual rather than the users' guide.
 /tutorial If set, then show the tutorial.
 /admin If set, then show the administrators guide.
 pdfviewer string Specify a PDF viewer other than the default.

MODIFICATION HISTORY:

Original: 6/6/05; SJT

4.8 smei_image

Source: cli/smei_image.pro

NAME:

SMEI_IMAGE

PURPOSE:

Extract a SMEI image object from a sequence

CATEGORY:

CLI

CALLING SEQUENCE:

smei_image, seq, index, image

INPUTS:

seq objref Object reference of the sequence.
 index long The image number to get (1-based).

OUTPUTS:

image objref A named variable to contain the reference to
 the image. (If the image is not found then the
 contents are unchanged).

RESTRICTIONS:

DO NOT DESTROY the returned image, doing so will break the
 sequence.

MODIFICATION HISTORY:

Original: 8/1/03; SJT

4.9 smei_image_header

Source: cli/smei_image_header.pro

NAME:

SMEI_IMAGE_HEADER

PURPOSE:

Gets the FITS header from a SMEI_IMAGE

CATEGORY:

CLI

CALLING SEQUENCE:

smei_image_header, imref, header[, /fitshead]
 or
 smei_image_header, seqref, header, index=index[, /fitshead]

INPUTS:

imref objref Object reference to the image object

OPTIONAL INPUTS:

seqref objref Object reference to the SMEI_SEQUENCE
 containing the image to be extracted.

KEYWORD PARAMETERS:

index long Image index (1-based) used when the first

argument is a sequence
 /fitshead If set, then return a string array FITS
 header, rather than a structure.

OUTPUTS:

header struct|string A named variable to receive the header.

RESTRICTIONS:

If the source is a sequence, then the index keyword must be used. If it is an image then index is ignored.

MODIFICATION HISTORY:

Original (after SMEI_IMAGE_IMAGE): 8/1/03; SJT
 Fix clot error: 18/6/03; SJT

4.10 smei_image_image

Source: cli/smei_image_image.pro

NAME:

SMEI_IMAGE_IMAGE

PURPOSE:

Gets the actual image data from a SMEI_IMAGE

CATEGORY:

CLI

CALLING SEQUENCE:

smei_image_image, imref, image[, /raw]
 or
 smei_image_image, seqref, image, index=index[, /raw]

INPUTS:

imref objref Object reference to the image object

OPTIONAL INPUTS:

seqref objref Object reference to the SMEI_SEQUENCE
 containing the image to be extracted.

KEYWORD PARAMETERS:

index	long	Image index (1-based) used when the first argument is a sequence
/raw		If set, then extract the raw image and weights, rather than the normalized image (will fail if the image object is compacted).
plane	int	If set, then select the specified 1-based plane of the raw image.
flag	int	If set, then extract the image flag data. 1: Flags for the current orbit astrometry 2: Flags for the next orbit astrometry 3: Both flag planes

/time	If set, then extract the times from the ancillary data
/longitude	If set, then extract the s/c longitude from the ancillary data
/latitude	If set, then extract the s/c latitude from the ancillary data

OUTPUTS:

image	float	A named variable to receive the image data.
-------	-------	---

RESTRICTIONS:

If the source is a sequence, then the index keyword must be used. If it is an image then index is ignored.

MODIFICATION HISTORY:

Original: 8/1/03; SJT
 Added missing plane keyword: 20/1/04; SJT
 Added flag and ancillary data keys: 6/4/10; SJT

4.11 smei_image_info

Source: cli/smei_image_info.pro

NAME:

SMEI_IMAGE_INFO

PURPOSE:

Get various information from a SMEI_IMAGE

CATEGORY:

CLI

CALLING SEQUENCE:

smei_image_info, source, info, <selector keyword>, [, index=index]

INPUTS:

source	objref	Either a SMEI_IMAGE object or a SMEI_SEQUENCE object
--------	--------	--

KEYWORD PARAMETERS:

index	int	If source is a sequence, then this keyword MUST be set to specify which image is to be queried.
/planes		If set, then return the number of planes in the raw image
/scale		If set, then return the image scale
/size		If set, then return the image size
/summary		If set, then return a 1-line summary of the image.
/time		If set, then return the time range of the image.
/unit		If set, then return the unit of the image.
/file		If set, then return the original fits file name of the image

```

/projection      If set, then return the image projection.
/start & /stop  Qualify the /time keyword to only return the
                 start or stop time.
/convert        If set and /time and one of /start or /stop is
                 set, then return the DOY format.
/x & /y         Qualify the /scale and /size keywords to only
                 return the X or Y components.
/string         Qualify the projection key to return the name
                 of the projection
/astrom_code    Qualify the projection key to return the code
                 needed by wcsxy2sph and WCSSPH2XY

```

OUTPUTS:

```

info      various A named variable to hold the returned information

```

RESTRICTIONS:

```

Exactly one primary selector key must be given. If the source
is a sequence, then the index key must be given. Inappropriate
secondary selectors are ignored.

```

MODIFICATION HISTORY:

```

Original: 20/1/04; SJT
Add handling for projections: 13/2/04; SJT

```

4.12 smei_image_move

Source: cli/smei_image_move.pro

NAME:

```

SMEI_IMAGE_MOVE

```

PURPOSE:

```

To move a SMEI_IMAGE within its sequence.

```

CATEGORY:

```

CLI

```

CALLING SEQUENCE:

```

smei_image_move, image, ishift[, imoved]
or
smei_image_move, seqref, ishift, index=index[, imoved]

```

INPUTS:

```

image  objref  The SMEI_IMAGE to move
ishift long    How far to move the image (positive values
               move it later, negative earlier)

```

OPTIONAL INPUTS:

```

seqref  objref  Object reference to the SMEI_SEQUENCE
               containing the image to be extracted.

```

OPTIONAL OUTPUTS:

```

imoved long    A named variable to receive the actual

```


distance moved (this will be less than `ishift` if the image is moved all the way to one end of the sequence).

KEYWORD PARAMETERS:

`index` `long` Image index (1-based) used when the first argument is a sequence

RESTRICTIONS:

If the source is a sequence, then the `index` keyword must be used. If it is an image then `index` is ignored.

MODIFICATION HISTORY:

Original: 9/1/03

4.13 `smei_image_print`

Source: `cli/smei_image_print.pro`

NAME:

`SMEI_IMAGE_PRINT`

PURPOSE:

Send a `SMEI_IMAGE` to a PostScript file.

CATEGORY:

CLI

CALLING SEQUENCE:

`smei_image_print, image[, <option keys>]`
 or
`smei_image_print, seqref, index=index[, <option keys>]`

INPUTS:

`image` `objref` Reference to the `SMEI_IMAGE` to be printed.

OPTIONAL INPUTS:

`seqref` `objref` Object reference to the `SMEI_SEQUENCE` containing the image to be extracted.

KEYWORD PARAMETERS:

`index` `long` Image index (1-based) used when the first argument is a sequence

`/menu` If specified then use a widget interface to set up the print settings. If this is given, then any keywords listed below are ignored.

`/grid` If specified, then add a grid to the image

`/nodate` If specified, then do not add the date and time range of the image

`/file` If specified, then add the filename to the image.

```

range    float    The min and max values for the display
                (implies adding the range to the plot)
colour_table int  The colour table to use. (-1 or unset to use
                the sequence map)
xsize    float    The size in cm of the x-dimension of the image
                (y is always adjusted to preserve the aspect
                ratio)
/no_colour Do not generate colour PS (equivalent to
colour_table=0)
/portrait Print in portrait mode (default is landscape).
plot_file str    Specify a filename other than the default idl.ps
/encapsulated If set, then make an eps file (handled
                explicitly as other things are done
                differently for eps).

```

Any keywords to DEVICE that do not clash with the above and which are accepted by the PS device may be passed.

MODIFICATION HISTORY:
Original: 9/1/03; SJT

4.14 smei_join

Source: cli/smei_join.pro

NAME:
SMEI_JOIN

PURPOSE:
To join two SMEI sequences into a single sequence.

CATEGORY:
CLI

CALLING SEQUENCE:
smei_join, seq1, seq2

INPUTS:

```

seq1    objref  Reference to the first sequence. On return
                this will be the concatenated sequence.
seq2    objref  Reference to the second sequence. On return
                this will be a null object, unless the
                preserve keyword is set..

```

KEYWORD_PARAMETERS:

```

/preserve If set then copy the second sequence images
          rather than moving them.
/sort     If set, then sort the resultant sequence after
          concatenation.

```

SIDE EFFECTS:
The first sequence is extended and the second is destroyed (unless preserve is set).

MODIFICATION HISTORY:

Original: 8/1/03; SJT
Added preserve option: 9/1/03; SJT
Added sort keyword: 13/1/03; SJT

4.15 smei_mask

Source: cli/smei_mask.pro

NAME:

SMEI_MASK

PURPOSE:

Set the contaminant mask for a SMEI sequence

CATEGORY:

CLI

CALLING SEQUENCE:

smei_mask, seqref, mask

INPUTS:

seqref	objref	Object reference of the SMEI sequence to be modified.
mask	uint	The mask

KEYWORDS:

sun	int	Whether to mask sun contaminated data
moon	int	ditto moon
venus	int	ditto venus
jupiter	int	ditto jupiter
mercury	int	ditto mercury
saturn	int	ditto saturn
mars	int	ditto mars
bias	int	ditto high bias variance
dark	int	ditto aberrant dark charge correction
squares	int	ditto bad "squares" values
aurora	int	ditto high aurora levels
particles	int	ditto high particle fluxes.

NOTES:

If the mask argument is given, then the keyword flags are ignored. If a keyword is explicitly set to zero then the relevant bit in the mask is cleared, if it is set to a non-zero value then the bit is set, if it is not given at all then the bit is unchanged.

MODIFICATION HISTORY:

Original (after smei_delay): 25/10/07; SJT
Remove obsolete !bo_flags system variable (now only used in pipe): 8/7/09; SJT

4.16 smei_mask_bits

Source: cli/smei_mask_bits.pro

SMEI_MASK_BITS
Return the masking bits for Pipe-2.0 images.

Usage:
smei_mask_bits, ref, bits[, index=index]

Arguments:

ref	objref	input	A smei sequence or image object reference.
bits	struct	output	A named variable to receive the masking bit values.

Keyword:

index	int	input	If called on a sequence then the (1-based) index of the image in the sequence. (Default is first image).
-------	-----	-------	--

History:
Original: 8/7/09; SJT

4.17 smei_menu

Source: cli/smei_menu.pro

NAME:
SMEI_MENU

PURPOSE:
GUI for controlling display of SMEI data

CATEGORY:
CLI

CALLING SEQUENCE:
smei_menu[, seqref, files=files]

OPTIONAL INPUTS:

seqref	objref	Object reference for the SMEI_SEQUENCE object. If it is not a SMEI_SEQUENCE, a new object will be created, otherwise an existing object will be opened. If not given, then a new object will be created and then destroyed on exit.
--------	--------	---

KEYWORD PARAMETERS:

files	string	A specification of the fits files to be used in the sequence. Only used for a new object.
/no_progress		If set, then disable the progress bars (useful if slow network means the progress bars are slowing operation).

MODIFICATION HISTORY:

Original: 18/12/02; SJT
 Add no_progress keyword: 25/8/05; SJT

4.18 smei_movie

Source: cli/smei_movie.pro

NAME:

SMEI_MOVIE

PURPOSE:

Write a SMEI sequence to a movie file

CATEGORY:

CLI

CALLING SEQUENCE:

smei_movie, seqref, file, /<type selector key>

INPUTS:

seqref	objref	The SMEI sequence to save.
file	string	The file to which to save the movie (excluding the extension)

KEYWORD PARAMETERS:

frame_rate	float	Number of frames per second. [avi, quicktime]
/avi		If set, then make an avi (divx5) movie (default)
/quicktime		If set, then make a quicktime movie.
/ffmpeg		If set, then make an ffmpeg avi movie.
/mpeg		If set, then make a plain old mpeg movie.
/mvi		If set, then make a LASCO MVI format movie.
compress	int	The compression level (0..3) [mpeg]
quality	int	The quality setting [01] [mpeg]
multiplex	int	The number of times to repeat each image to get a sensible speed. [mpeg]
codec	string	Specify the codec to use for ffmpeg or quicktime movies.

MODIFICATION HISTORY:

Original (after smei_avmv): 17/2/04; SJT
 Add ffmpeg and codec keys: 7/6/05; SJT

4.19 smei_null_index

Source: cli/smei_null_index.pro

NAME:

SMEI_NULL_INDEX

PURPOSE:

To set the colour index/indices to use for missing data.

CATEGORY:

CLI

CALLING SEQUENCE:

smei_null_index, seqref, index[, /screen|/print]

INPUTS:

seqref objref Object reference to the sequence.
index byte The colour index to use (or a 2-element list).

KEYWORD PARAMETERS:

/screen If set, then only set the index for screen displays.
/print If set, then only set the index for printouts.
/off_sky If set, then set the value to use for points outside the sky area

MODIFICATION HISTORY:

Original: 11/7/03; SJT
Separate in and out of sky: 18/7/03; SJT

4.20 smei_opts

Source: cli/smei_opts.pro

NAME:

SMEI_OPTS

PURPOSE:

Set plotting annotation and printing options.

CATEGORY:

CLI

CALLING SEQUENCE:

smei_opts, seqref[, <option keys>]

INPUTS:

seqref objref Object reference of a SMEI sequence

KEYWORD PARAMETERS:

grid int Which type of coordinate grid.
date int Specify date format (0=none, 1=Year-Day, 2=Y-M-D)
range bool Whether to add the data dange
file bool Whether to add the filename.

columns	int	Set the number of columns in the layout
rows	int	Set the number of rows in the layout.
order	bool	Set the order in which the images are to be printed
type	int	Set the type of postscript file to generate (0=landscape, 1 = portrait, 2 = eps)
plot_file	string	Set the filename to use for the output.
xsize	float	Set the x-size of the printed area
ysize	float	Set the y-size of the printed area.
print	string	Set the printing command
preview	string	Set the preview command.

MODIFICATION HISTORY:

Original: 18/12/02; SJT
 Redocument grid keyword: 19/6/03; SJT
 Add printing options: 6/6/05; SJT

4.21 smei_print

Source: cli/smei_print.pro

NAME:

SMEI_PRINT

PURPOSE:

Send a SMEI sequence to a PostScript file

CATEGORY:

CLI

CALLING SEQUENCE:

smei_print, seqref

INPUTS:

seqref objref Object reference to the SMEI sequence to print.

KEYWORD PARAMETERS:

/grid		If specified, then add a grid to the images
/nodate		If specified, then do not add the date and time range of the images
/file		If specified, then add the filename to the images.
/add_range		If set, then add the range to the plot.
range	float	The min and max values for the display (implies adding the range to the plot)
colour_table	int	The colour table to use. (-1 or unset to use the sequence map)
xsize	float	The size in cm of the x-dimension of the page
ysize	float	The size in cm of the y-dimension of the page
/no_colour		Do not generate colour PS (equivalent to colour_table=0)
/portrait		Print in portrait mode (default is landscape).
plot_file	str	Specify a filename other than the default idl.ps

```

/encapsulated   If set, then make an eps file (handled
                explicitly as other things are done
                differently for eps).
ncolumns int    The number of columns to arrange the images
nrows   int     The number of rows to arrange the images
/logarithmic    If set, then use a logarithmic mapping of the
                colour table.
/in_rows        If set, then go arrange the frames in rows
                rather than in columns.
/cmyk           If set, then use the CMYK colour model

```

Any keywords to DEVICE that do not clash with the above and which are accepted by the PS device may be passed.

SIDE EFFECTS:

A PostScript file is generated.

RESTRICTIONS:

Pro-tem it doesn't print the file.

MODIFICATION HISTORY:

Original: 16/5/03; SJT
 Add row orientation: 21/7/03; SJT
 Add cmyk option" 3/6/10; SJT

4.22 smei_profile

Source: cli/smei_profile.pro

NAME:

SMEI_PROFILE

PURPOSE:

Generate a profile from a SMEI sequence

CATEGORY:

CLI

CALLING SEQUENCE:

```
smei_profile, seqref, npa, nel, pmin, pmax, profile[, pa, $
                elong, date]
```

INPUTS:

```

seqref  objref  The smei_sequence object from which to get the
                profile
npa     int     The number of bins in the position-angle
                direction
nel     int     The number of bins in the elongation direction
pmin    float   The lower limit of position angle or
                elongation (circumferential profiles)
pmax    float   The upper limit of position angle or
                elongation (circumferential profiles)

```


KEYWORD PARAMETERS:

/circumferential			If set, then make a circumferential rather than a radial profile.
/verbose			If set, then show the region being profiled.
save	string	input	A filename to which to save the profile and its axes.
plane	int	input	The image plane to use (0 for processed, 1-n for raw planes).
mask	uint	input	An optional mask pattern for conditions to exclude from the profile.
/use_flags			If set, then use the display flags setting as the mask (should not be used together with MASK key --- if it is then MASK is used).
/miss_nan			If set, then a cell with no values is NaN rather than zero.

OUTPUTS:

profile	float	The profile generated (indices are [pa, elongation, image])
---------	-------	---

OPTIONAL OUTPUTS:

pa	float	The midpoints of the bins in position angle
elong	float	The midpoints of the bins in elongation.
date	double	The Julian dates of the start and end of each image.

MODIFICATION HISTORY:

Original: 15/12/03; SJT
 Added plane keyword: 13/1/04; SJT
 Added mask, miss_nan & use_flags keywords: 8/8/09; SJT

4.23 smei_range

Source: cli/smei_range.pro

NAME:

SMEI_RANGE

PURPOSE:

Set the data range of a SMEI sequence

CATEGORY:

CLI

CALLING SEQUENCE:

smei_range, seqref, range[, range1]

INPUTS:

seqref	objref	Object reference to the sequence.
range	float	2-element array giving a min to max data range, or a scalar giving the minimum.

OPTIONAL INPUTS:

range1 float The maximum of the data range if RANGE is a scalar

KEYWORD PARAMETERS:

logarithmic int Whether to use logarithmic scaling or not.
 kill float Set a range of values outside which data are considered bad (2-element array or a scalar == [-kill, kill])

MODIFICATION HISTORY:

Original: 19/12/02; SJT
 Add logarithmic and kill keywords: 30/3/04; SJT

4.24 smei_restore

Source: cli/smei_restore.pro

NAME:

SMEI_RESTORE

PURPOSE:

Restores a SMEI sequence from a save file and clears anything that would have been lost.

CATEGORY:

CLI

CALLING SEQUENCE:

smei_restore, seqref, file

OPTIONAL INPUTS:

file string The IDL SAVE file from which to restore, if not given then a dialogue box is used to select.

KEYWORD PARAMETERS:

/menu If set, then go straight into the menu.

OUTPUTS:

seqref objref The object reference of the restored smei sequence. (optional iff /menu is given).

MODIFICATION HISTORY:

Original: 17/12/02; SJT
 Add calls to structure definers to ensure latest are used:
 18/12/02; SJT
 Renamed as SMEI_RESTORE: 9/8/04; SJT

4.25 smei_save

Source: cli/smei_save.pro

NAME:

SMEI_SAVE

PURPOSE:

Save a SMEI sequence to an IDL SAVE file.

CATEGORY:

CLI

CALLING SEQUENCE:

smei_save, seqref, file

INPUTS:

seqref objref The SMEI sequence to save.
 file string The file to which to save.

MODIFICATION HISTORY:

Original: 18/12/02; SJT

4.26 smei_seq_info

Source: cli/smei_seq_info.pro

NAME:

SMEI_SEQ_INFO

PURPOSE:

Return various information about a SMEI_SEQUENCE

CATEGORY:

CLI

CALLING SEQUENCE:

smei_seq_info, source, info, <selector keys>

INPUTS:

source objref The sequence to be queried

KEYWORD PARAMETERS:

/count	If set, then return the number of images in the sequence.
/name	If set, then return the user-defined name of the sequence.
/n_planes	If set, then return the number of planes in the image.
/size	If set, then return the size of the biggest image in the sequence.
/summary	If set, then return a summary of the sequence.

OUTPUTS:

info various A named variable to hold the requested information.

RESTRICTIONS:

The selector keywords are mutually exclusive

MODIFICATION HISTORY:

Original: 20/1/04; SJT

4.27 smei_sequence

Source: cli/smei_sequence.pro

NAME:

SMEI_SEQUENCE

PURPOSE:

Generate a SMEI sequence object

CATEGORY:

CLI

CALLING SEQUENCE:

```
smei_sequence, seqref, files[, name=name]
or
smei_sequence, seqref, start, stop[, name=name]
or
smei_sequence, seqref, /menu[, name=name]
```

INPUTS:

files	string	List of files or wildcards specifying the files to build into the sequence (optional if menu is requested).
start	dbl/int	Either a scalar JD of the start or an array with [y,d,h,m,s]. N.B. even if only the year is to be given it must be an array (e.g. [2003] rather than 2003)
stop	dbl/int	Either a scalar JD of the end point or an array with [y,d,h,m,s]. N.B. even if only the year is to be given it must be an array (e.g. [2003] rather than 2003)

KEYWORD PARAMETERS:

name	string	A name to give to the sequence
/show		If set, then go ahead and show the sequence.
/compact		If set, then compact the images.
/menu		If set, then use a GUI to set options
/aitoff		If set, then use aitoff projections only (only applicable if a time range is given).
/fisheye		If set, then use fisheye projections only (only applicable if a time range is given).
/rectangular		If set, then use rectangular projections only (only applicable if a time range is given).
/nostop		If set, then don't stop if no images are

found (useful for batch operation). It will still stop on bad inputs.
 /silent If set, then suppress messages from readfits.

OUTPUTS:

seqref objref The object reference of the sequence

RESTRICTIONS:

Will later acquire a GUI and ways of setting time bounds

MODIFICATION HISTORY:

Original: 11/12/02; SJT
 Add compact & menu: 13/12/02; SJT
 Check the we're not overwriting an existing object: 19/12/02; SJT
 Add support for aitoff & fisheye projections: 18/2/04; SJT
 Include images starting up to 1 orbit before the given start time: 12/10/06; SJT
 Add rectangular images: 25/11/09; SJT
 Add silent keyword: 8/7/10; SJT

4.28 smei_show

Source: cli/smei_show.pro

NAME:

SMEI_SHOW

PURPOSE:

Display a SMEI sequence

CATEGORY:

CLI

CALLING SEQUENCE:

smei_show, seqref[, image]

INPUTS:

seqref objref Object reference of the SMEI sequence

OPTIONAL INPUTS:

image int The number of an image for a static display. If this is specified, then the sequence is started at that image and in a paused state.

KEYWORD PARAMETERS:

delay float The delay in seconds between images.
 colour_table int The colour table to use
 colour_map byte A 256x3 byte array that contains an explicit colour map to use
 grid int Whether to add a grid

nodate	int	Whether to omit the date range
range	float	2-element array with the range from black to white
shift	int	Select the central PA for a rectangular map (0=North, 1=East, 2=South, 3=West)

RESTRICTIONS:

The keyword settings are persistent.

MODIFICATION HISTORY:

Original: 11/12/02; SJT
 Renamed: 18/12/02; SJT
 Modify colour handling: 19/12/02; SJT
 Add shift: 23/11/09; SJT

4.29 smei_subtract_model

Source: cli/smei_subtract_model.pro

NAME:

SMEI_SUBTRACT_MODEL

PURPOSE:

Subtract a background model from a SMEI sequence.

CATEGORY:

CLI

CALLING SEQUENCE:

smei_subtract_model, seqref, model

INPUTS:

seqref	object	The smei_sequence object on which to operate.
model	string	The model identifier for the model to subtract.

KEYWORD PARAMETERS:

/restore	If set, then restore the original processed image.
----------	--

SIDE EFFECTS:

The processed image is updated.

RESTRICTIONS:

Cannot be used on compacted images.

MODIFICATION HISTORY:

Original: 25/5/04; SJT
 Add restore key: 23/9/04; SJT

4.30 smei_zoom

Source: cli/smei_zoom.pro

NAME:

SMEI_ZOOM

PURPOSE:

To set zoom factors for SMEI display

CATEGORY:

CLI (sequence)

CALLING SEQUENCE:

smei_zoom, seqref, factor[, /inverse, smooth=smooth]

INPUTS:

seqref objref Object reference of a SMEI sequence
factor int Factor by which to zoom the display. (For
reductions, use the /inverse key)

KEYWORD PARAMETERS:

/inverse If set, then the zoom factor is 1/factor
smooth int 1 to smooth expanded image, 0 to use blocky expansion.

MODIFICATION HISTORY:

5 Images

5.1 smei_image::cleanup

Source: smei_image/smei_image__cleanup.pro

NAME:

SMEI_IMAGE::CLEANUP

PURPOSE:

Destructor for SMEI_IMAGE object.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

obj_destroy, imref

INPUTS:

imref objref The object to destroy

SIDE EFFECTS:

An object is destroyed, possibly those linked to it are modified.

MODIFICATION HISTORY:

Original: 9/12/02; SJT
Avoid problems when the sequence is already destroyed:
10/1/03; SJT
Allow for images parented to operators: 14/1/03; SJT
Add pipe 2.0 support: 22/10/07; SJT

5.2 smei_image::compact

Source: smei_image/smei_image_compact.pro

NAME:

SMEI_IMAGE::COMPACT

PURPOSE:

Save storage by deleting the raw image from a SMEI_IMAGE

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

imref -> compact

KEYWORD_PARAMETERS

/mk_nan If set, then convert points in the weighted
 image with zero weight into NaN values.

MODIFICATION HISTORY:

Original: 13/12/02; SJT

5.3 smei_image::copy

Source: smei_image/smei_image_copy.pro

NAME:

SMEI_IMAGE::COPY

PURPOSE:

Make a copy of a SMEI_IMAGE

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

imref2 = imref -> copy([sequence=sequence,prev=prev])

KEYWORD_PARAMETERS

sequence objref Object reference of the containing sequence of the new image.

prev objref Object reference to the image prior to the desired location of the copied image. (Must be a member of the same sequence as the new image).

OUTPUTS:

imref2 objref The new copy of the object.

MODIFICATION HISTORY:

Original: 8/1/03; SJT
 Add prev setting and make target sequence a keyword: 9/1/03; SJT
 Support copying to a SMEI_OPERATOR and copying a derived image: 14/1/03; SJT

5.4 smei_image__define

Source: smei_image/smei_image__define.pro

NAME:

SMEI_IMAGE__DEFINE

PURPOSE:

Object definition for a SMEI image.

CATEGORY:

SMEI_IMAGE

FIELDS:

top obj Object reference to the sequence containing the image

prev obj Reference to the previous image in the sequence

next obj Reference to the next image in the sequence

file string The name of the file from which it was read.

start double The JD of the start of the image.

stop double The JD of the end of the image.

unit string The unit of the image

size int 2-element array with the image size.

projection int The projection used for the image (0 = Aitoff-hammer, 1 = Angular fisheye, 2 = rectangular, -1 = unknown)

raw_image ptr The original image. (First plane is the raw image, second is the weights)

image ptr The image after any processing. (Has at least the weights divided out).

fitshead ptr A pointer to the raw (or structified) FITS header to allow access to less often needed processings information.

flags struct The processing flags of the raw image.

lsff - large-scale flat field

dark - Dark offset removed

crays - Cosmic ray filter applied

lpoint - Frame pointing correction applied

gpoint - Global pointing correction applied

zody - Zodiacal correction applied

stellar - stellar background removed.

```

pflags  struct  The processing flags between raw and display.
              weight - Final image derived from raw * weights
              compact - Raw image deleted to save memory
              skip    - Skip image in displaying movie.
pixmap  int     The window index of an X-pixmap for movies,
              and position of corner.

```

MODIFICATION HISTORY:

```

First cut: 6/12/02; SJT
Added linked list stuff: 8/12/02; SJT
Add scaling info: 10/12/02; SJT
Add compact flag: 13/12/02; SJT
Add skip flag: 14/1/03; SJT
Add n_planes and bright flag: 24/4/03; SJT
Add projection index, to handle fish-eye projections (and in
principle any others that we may think of later): 13/2/04; SJT
Add ancil_data and flag_data plane & header pointers for Pipe 2.0:
22/10/07; SJT

```

5.5 smei_image::eval

Source: smei_image/smei_image__eval.pro

NAME:

```
SMEI_IMAGE::EVAL
```

PURPOSE:

```
A Wrapper for get_image (& friends) to facilitate operators.
```

CATEGORY:

```
SMEI_IMAGE
```

CALLING SEQUENCE:

```
val = imref -> eval()
```

KEYWORD PARAMETERS

```

/raw          Return the raw-image
plane  int    The plane of the raw image (1-based) to
              return.
/ancil        Return the ancillary data
/flags        Return the contaminant flag data.
Any other keys accepted by the get_raw_image or get_ancil
methods can be used with the /raw or /ancil settings
respectively.

```

OUTPUTS:

```
val    float  The image values
```

MODIFICATION HISTORY:

```

Original: 14/1/03; SJT
Added raw keyword: 20/1/03; SJT
Support passing of selectors: 11/7/03; SJT
Add explicit plane keyword: 8/10/03; SJT
Add ancil & flags support: 24/10/07; SJT

```

5.6 smei_image::get_ancil

Source: smei_image/smei_image_get_ancil.pro

NAME:

SMEI_IMAGE::GET_ANCIL

PURPOSE:

Get the ancillary data of a SMEI image

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

ancil = imref -> get_ancil()

KEYWORDS:

/time If set, then return only the "time" plane
/longitude If set, then return only the s/c longitude
 plane
/latitude If set, then return only the s/c latitude
 plane

OUTPUTS:

The ancillary data (UT, s/c location)

MODIFICATION HISTORY:

Original: 23/10/07 (after get_image); SJT
Add plane selectors: 24/10/07; SJT

5.7 smei_image::get_centre

Source: smei_image/smei_image_get_centre.pro

NAME:

SMEI_IMAGE::GET_CENTRE

PURPOSE:

To get the image centre of a SMEI image.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

centre = imref -> get_centre()

KEYWORD PARAMETERS:

/x Only return the X-coordinate of the image centre
/y Only return the Y-coordinate of the image centre

OUTPUTS:

centre The centre of the image

MODIFICATION HISTORY:

Original (after get_size): 8/1/03; SJT

5.8 smei_image::get_cvalue

Source: smei_image/smei_image__get_cvalue.pro

NAME:

SMEI_IMAGE::GET_CVALUE

PURPOSE:

To get the image centre coordinate of a SMEI image.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

cvalue = imref -> get_cvalue()

KEYWORD PARAMETERS:

/x Only return the X-dimension of the image
/y Only return the Y-dimension of the image

OUTPUTS:

cvalue The centre coordinate of the image

MODIFICATION HISTORY:

Original (after get_size): 1/5/09; SJT

5.9 smei_image::get_file

Source: smei_image/smei_image__get_file.pro

NAME:

SMEI_IMAGE::GET_FILE

PURPOSE:

Returns the file name from which the image was read.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

file = imref -> get_file()

KEYWORD PARAMTETERS

/directory If set then return the directory rather than
the filename.
/full If set, then return the full path.

OUTPUTS:

file string The filename

MODIFICATION HISTORY:

Original: 12/12/02; SJT
Return file & dir separately: 13/1/03; SJT
Add `_extra` to silently swallow operator keys: 15/1/03; SJT

5.10 `smei_image::get_flag_data`

Source: `smei_image/smei_image_get_flag_data.pro`

NAME:

`SMEI_IMAGE::GET_FLAG_DATA`

PURPOSE:

Get the contaminant flags for a SMEI image

CATEGORY:

`SMEI_IMAGE`

CALLING SEQUENCE:

`flag_data = imref -> get_flag_data()`

KEYWORDS:

/next If set, then return the flag data for the astrometry
of the next orbit
/current If set, then return the flag data for the
astrometry of the current orbit

OUTPUTS:

The flag data

NOTES:

If no keyword is given, then both flag planes are returned.

MODIFICATION HISTORY:

Original: 23/10/07 (after `get_image`); SJT
Add plane selection: 6/4/10; SJT

5.11 `smei_image::get_flags`

Source: `smei_image/smei_image_get_flags.pro`

NAME:

`SMEI_IMAGE::GET_FLAGS`

PURPOSE:

Return the pipeline processing flags of a SMEI image.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

flag = imref -> get_flags([<Selector>])

KEYWORD PARAMETERS:

/lsff	Large scale flat fielding applied?
/dark	Dark offset removed?
/crays	Cosmic ray filter applied?
/lpoint	Frame pointing corrections applied?
/gpoint	Global pointing corrections applied?
/zody	Zodiacal background removed?
/stellar	Stellar background removed?
/bright	Lunar & Cytherean saturation eliminated.
/c_equal	Camera equalizations applied

OUTPUTS:

flag The requested flag value or the flags structure if no flag is given.

MODIFICATION HISTORY:

Original: 9/12/02; SJT
Add bright and c_equal: 24/4/03; SJT

5.12 smei_image::get_header

Source: smei_image/smei_image__get_header.pro

NAME:

SMEI_IMAGE::GET_HEADER

PURPOSE:

Get the "structified" FITS header of a SMEI image

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

fitshdr = imref -> get_header()

KEYWORD PARAMETERS:

/fitshead	If set, then convert the header structure back to a string array.
/quiet	If set, then don't emit a warning if the image has no header
/test	If set then just return whether there is a header or not.
/ancil	If set, then return values for the ANCIL data header.
/flag	If set, then return values for the FLAG data header.

OUTPUTS:

fitshdr The header structure from the original fits file.

MODIFICATION HISTORY:

Original: 9/12/02; SJT
Added /fitshead keyword: 8/1/03; SJT
Fix typo: 18/6/03; SJT
Add quiet keyword: 24/7/03; SJT
Support both new (string) and old (structure) formats:
24/7/03; SJT
Handle case where no header present gracefully: 19/02/04; SJT
Handle extension headers for new-style images as well:
23/10/07; SJT
Make return of no-header of ancil & flags with P1 data quiet:
1/11/07; SJT

5.13 smei_image::get_image

Source: smei_image/smei_image__get_image.pro

NAME:

SMEI_IMAGE::GET_IMAGE

PURPOSE:

Get the processed image data of a SMEI image

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

image = imref -> get_image()

OUTPUTS:

The normalized image

MODIFICATION HISTORY:

Original: 9/12/02; SJT

5.14 smei_image::get_locate

Source: smei_image/smei_image__get_locate.pro

NAME:

SMEI_IMAGE::GET_LOCATE

PURPOSE:

Convert image coordinates to a structure giving useful information about that location.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

loc = imref -> get_locate(x,y)

INPUTS:

x,y long The X & Y coordinates of the point of interest.

OUTPUTS:

loc struct The information on the location.

MODIFICATION HISTORY:

Original: 17/12/02; SJT
 Add RA and DEC: 24/7/03; SJT
 Support fisheye projection: 13/2/04; SJT
 Get fisheye support right: 16/2/04; SJT
 Add pipe 2.0 parameters (and make printing an option): 23/10/07; SJT
 Support rectangular PA/elong maps: 8/7/08; SJT
 Move point definition to a separate routine: 25/11/08; SJT
 Include shifts for rectangular maps: 23/11/09; SJT

5.15 smei_image::get_mask_bits

Source: smei_image/smei_image_get_mask_bits.pro

NAME:

SMEI_IMAGE::GET_MASK_BITS

PURPOSE:

To get the masking bits appropriate to the various contaminants.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

imref->get_mask_bits()

OUTPUTS:

A structure containing the masking bits.

RESTRICTIONS:

Only applicable to Pipe 2.0 and later.

MODIFICATION HISTORY:

Original: 25/10/07; SJT

5.16 smei_image::get_next

Source: smei_image/smei_image__get_next.pro

NAME:

SMEI_IMAGE::GET_NEXT

PURPOSE:

Get the reference to the next image in the sequence

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

next=imref -> get_next()

OUTPUTS:

next objref Reference to the next image in the sequence.

MODIFICATION HISTORY:

Original: 9/12/02; SJT

5.17 smei_image::get_pflags

Source: smei_image/smei_image__get_pflags.pro

NAME:

SMEI_IMAGE::GET_PFLAGS

PURPOSE:

Returns the state of local processing flags.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

flag = imref -> get_pflags([<flag specifier>])

KEYWORD PARAMETERS:

/weight	If specified then return whether a weighting normalization has been done
/compact	If specified, then return whether the raw image has been deleted
/skip	If sepecified, then return whether the image is flagged for skipping in movies.

OUTPUTS:

flag If a flag key is given, then the value of that flag, otherwise the whole pflag structure.

RESTRICTIONS:

Will have other keys added as their meanings become defined.

MODIFICATION HISTORY:

Original: 9/12/02; SJT
Added skip flag: 14/1/03; SJT

5.18 smei_image::get_pipe_level

Source: smei_image/smei_image_get_pipe_level.pro

NAME:

SMEI_IMAGE::GET_PIPE_LEVEL

PURPOSE:

Get the processing pipe level of a SMEI image

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

pipe_level = imref -> get_pipe_level()

OUTPUTS:

pipe_level The pipe_levels of the image

MODIFICATION HISTORY:

Original (after get_unit): 23/10/07; SJT

5.19 smei_image::get_pixmap

Source: smei_image/smei_image_get_pixmap.pro

NAME:

SMEI_IMAGE::GET_PIXMAP

PURPOSE:

Return details of a SMEI image pixmap

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

rv = imref -> get_pixmap()

KEYWORD PARAMETERS:

/id Just return the window ID of the pixmap

/llc Just return the lower-left corner of the image in the pixmap.

OUTPUTS:
The desired numbers

MODIFICATION HISTORY:
Original: 11/12/02; SJT

5.20 smei_image::get_planes

Source: smei_image/smei_image__get_planes.pro

NAME:
SMEI_IMAGE::GET_PLANES

PURPOSE:
Return how many planes the raw image has.

CATEGORY:
SMEI_IMAGE

CALLING SEQUENCE:
n_planes = imref -> get_planes()

OUTPUTS:
n_planes int The number of planes in the image.

Keywords:
/ancil If set, then return the number of planes in the ancillary data extension
/flag If set, then return the number of planes in the flags data extension.
/all If set then return all 3 plane counts.

MODIFICATION HISTORY:
Original: 24/4/03; SJT
Support Pipe 2.0 images: 23/10/07; SJT

5.21 smei_image::get_prev

Source: smei_image/smei_image__get_prev.pro

NAME:
SMEI_IMAGE::GET_PREV

PURPOSE:
Get the reference to the previous image in the sequence

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

prev=imref -> get_prev()

OUTPUTS:

prev objref Reference to the previous image in the sequence.

MODIFICATION HISTORY:

Original: 9/12/02; SJT

5.22 smei_image::get_projection

Source: smei_image/smei_image_get_projection.pro

NAME:

SMEI_IMAGE::GET_PROJECTION

PURPOSE:

Return the projection of a SMEI image

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

proj = imref -> get_projection()

KEYWORD PARAMETERS:

/string If set, then return a descriptive string rather than a number.
/astrom_code If set, then return the code needed by wcsxy2sph and WCSSPH2XY

OUTPUTS:

proj int/str The projection, either an index or the name.

MODIFICATION HISTORY:

Original: 13/2/04; SJT
Add rectangular projection: 8/7/08; SJT

5.23 smei_image::get_raw_image

Source: smei_image/smei_image_get_raw_image.pro

NAME:

SMEI_IMAGE::GET_RAW_IMAGE

PURPOSE:

Get the raw image from a SMEI image object

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

rimage = imref -> get_raw_image()

KEYWORD PARAMETERS:

/data Only return the raw data plane of the image
(equivalent to plane =1)
/weight Only return the weight plane of the image (the same as
plane=2)
plane The image plane to return (1-based).

OUTPUTS:

The raw image

MODIFICATION HISTORY:

Original: 9/12/02; SJT
Added plane keyword: 16/5/03; SJT
Handle "Weight-only" images: 11/7/03; SJT

5.24 smei_image::get_scale

Source: smei_image/smei_image_get_scale.pro

NAME:

SMEI_IMAGE::GET_SCALE

PURPOSE:

To get the image scale of a SMEI image.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

scale = imref -> get_scale()

KEYWORD PARAMETERS:

/x Only return the X-component of the scale
/y Only return the Y-component of the scale

OUTPUTS:

scale The scale of the image

MODIFICATION HISTORY:

Original: 9/12/02; SJT

5.25 smei_image::get_sequence

Source: smei_image/smei_image_get_sequence.pro

NAME:

SMEI_IMAGE::GET_SEQUENCE

PURPOSE:

Return a reference to the SMEI_SEQUENCE that contains this image.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

top = imref -> get_sequence()

OUTPUTS:

top objref Reference to the containing SMEI_SEQUENCE

MODIFICATION HISTORY:

Original: 9/12/02; SJT

5.26 smei_image::get_size

Source: smei_image/smei_image_get_size.pro

NAME:

SMEI_IMAGE::GET_SIZE

PURPOSE:

To get the image size of a SMEI image.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

size = imref -> get_size()

KEYWORD PARAMETERS:

/x Only return the X-dimension of the image
/y Only return the Y-dimension of the image

OUTPUTS:

size The size of the image

MODIFICATION HISTORY:

Original: 9/12/02; SJT

5.27 smei_image::get_summary

Source: smei_image/smei_image__get_summary.pro

NAME:

SMEI_IMAGE::GET_SUMMARY

PURPOSE:

Generate a 1-line summary of a SMEI image.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

desc = imref->get_summary()

KEYWORD PARAMETERS:

/nofile If set, then don't include the filename

OUTPUTS:

desc string The summary.

MODIFICATION HISTORY:

Original: 13/12/02; SJT

Add bright and c_equal fields: 24/4/03; SJT

5.28 smei_image::get_time

Source: smei_image/smei_image__get_time.pro

NAME:

SMEI_IMAGE::GET_TIME

PURPOSE:

Get the start and/or stop times of a SMEI image

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

time = imref -> get_time()

KEYWORD PARAMETERS:

/convert If set then convert to DOY format.

/start If set, then only return the start time.

/stop If set, then only return the stop time.

OUTPUTS:

time The time or times requested.

RESTRICTIONS:

The convert keyword is ignored unless one of start or stop is specified.

MODIFICATION HISTORY:

Original: 9/12/02; SJT

5.29 smei_image::get_unit

Source: smei_image/smei_image__get_unit.pro

NAME:

SMEI_IMAGE::GET_UNIT

PURPOSE:

Get the units of a SMEI image

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

unit = imref -> get_unit()

OUTPUTS:

unit The units of the image

MODIFICATION HISTORY:

Original (after get_orbit): 8/1/03; SJT

5.30 smei_image::init

Source: smei_image/smei_image__init.pro

NAME:

SMEI_IMAGE::INIT

PURPOSE:

Constructor for a SMEI image object.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

imref = obj_new('smei_image', top, prev, copy=copy, file=file)

INPUTS:

top objref Reference to the sequence or operator object.

OPTIONAL INPUTS:

prev objref Reference to the previous image in the sequence. If not given, then insert at start.

KEYWORD PARAMETERS:

file	string	The file from which to read the image.
/compact		If set, then remove the raw image after creating the normalized image.
copy	objref	Another SMEI_IMAGE which is to be copied to this one.
/silent		If set, then supress messages from readfits.
/at_end		If set, this is equivalent to setting prev to top->get_last()
image_data	Float	The image values (usually a 1-plane derived image)
ancil_data	float	The ancil data (time s/c location) (DI)
flag_data	uint	The status flag data (DI)
start	double	The start time of the image (DI only)
stop	double	The end time of the image (DI only)
unit	string	The unit of the image (DI)
centre	float	The centre point of the image coordinates (DI)
scale	float	The image scale (DI)
fitshead	string	A "fake" fitsheader for the image (DI)
fitshead	string	A "fake" fitsheader for the image (DI)
ancilhead	string	A "fake" ancil data header (DI)
flags	struct	The processing flags for the image (DI)
fakename	string	A "fake" filename for the image (DI)
projection	int	The projection of the image (DI)

SIDE EFFECTS:

Returns 0 or 1 for failure or success.

RESTRICTIONS:

Incomplete, will need ways to initialize by time etc.

MODIFICATION HISTORY:

Original: 6/12/02; SJT
 Add prev: 9/12/02; SJT
 Add compact option: 13/12/02; SJT
 Add copy option (and fix docs): 8/1/03; SJT
 Add silent keyword: 10/1/03; SJT
 Allow images to be children of an operator: 14/1/03; SJT
 Add AT_END keyword: 16/1/03; SJT
 Add keys for passing image as data: 22/10/03; SJT
 Added fakename key: 1/12/03; SJT
 Add projection key for derived images: 13/2/04; SJT
 Verify projection with rest of sequence: 16/2/04; SJT
 Add ancil and flag data keys: 23/10/07; SJT

5.31 smei_image::mk_pa_map

Source: smei_image/smei_image_mk_pa_map.pro

NAME:

SMEI_IMAGE::MK_PA_MAP

PURPOSE:

Make a map of PA and elongation (and optionally P).

CATEGORY:

SMEI_IMAGE

OUTPUTS:

elon	float	The elongation angles.
pat	float	The position angles.
p	float	The closest-approaches.

CALLING SEQUENCE:

imref -> mk_pa_map, elon, pat, p

MODIFICATION HISTORY:

Original: 12/12/03; SJT
 Add fisheye support: 17/2/04; SJT
 Fix half-pixel offset in centres: 28/4/04; SJT
 Support rectangular projection: 1/5/09; SJT

5.32 smei_image::mk_pixmap

Source: smei_image/smei_image_mk_pixmap.pro

NAME:

SMEI_IMAGE::MK_PIXMAP

PURPOSE:

To copy a displayed SMEI image to a pixmap.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

imref -> mk_pixmap
 imref -> mk_pixmap, /destroy

KEYWORD PARAMETERS:

/destroy		Remove the pixmap info for the image (indicates that a sequence setting has invalidated it).
top_right		A named variable to contain the location of the top right corner of the image in the pixmap.
zoom	float	The zoom factor for the image.

SIDE EFFECTS:

A pixmap is updated

MODIFICATION HISTORY:

Original: 11/12/02; SJT

Add check for existence of pixmap: 16/12/02; SJT

Remove explicit positioning (too dangerous and not used) and
handle 2-D layouts: 10/1/03; SJT

5.33 smei_image::move

Source: smei_image/smei_image_move.pro

NAME:

SMEI_IMAGE::MOVE

PURPOSE:

Moves an image within a sequence.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

imove = imref -> move(ishift)

INPUTS:

ishift long How many places to move the image (+ = towards
end, - = towards beginning)

OUTPUTS:

imove long How many places it was actually moved. (<=
ishift)

MODIFICATION HISTORY:

Original: 16/12/02; SJT

Fix end effects: 13/1/03; SJT

5.34 smei_image::mvi_frame

Source: smei_image/smei_image_mvi_frame.pro

NAME:

smei_image::mvi_frame

PURPOSE:

This procedure adds an image to a file in the disk movie format.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

imref -> mvi_frame, fname

INPUTS:

fname string File name of the movie disk file, with full path

KEYWORD PARAMETERS:

NEW: If set this keyword indicates that a new file is to be created.
The default is to write to an existing file

PROCEDURE:

The disk movie format is:

```
file header:  # images in the file
              # columns in each image
              # rows in each image
              # maximum number of images in file
              # bytes in image header
              # version number
```

```
for version 1: # bytes in file header
for version 1: # sunxcen * 10
for version 1: # sunycen * 10
for version 1: # arc sec per pixel * 100
for version 1: # red color vector BYTARR(256)
for version 1: # green color vector BYTARR(256)
for version 1: # blue color vector BYTARR(256)
```

```
img_hdr #1:  date of image, string (15)
              time of image, string (15)
              file name, string (15)
              filter wheel, string (10)
              polarizer wheel, string (10)
              detector, string (10)
```

```
img_hdr #2
...
img #1
img #2
...
```

MODIFICATION HISTORY:

Written by: RA Howard, NRL, 16 Mar 1996

Modified : SEP 05 Feb 1997 - Mods for mvi version 1 format.

SEP 08 Sep 1997 - Added REPLACE option.

Converted to SMEI_IMAGE method: 17/12/02; SJT

5.35 smei_image::norm_weight

Source: smei_image/smei_image_norm_weight.pro

NAME:

SMEI_IMAGE::NORM_WEIGHT

PURPOSE:

Normalize a raw SMEI image by dividing through by the weights.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

imref -> norm_weight

SIDE EFFECTS:

The image field is filled.

MODIFICATION HISTORY:

Original: 9/12/02; SJT

Use normalized plane if it's there: 24/4/03; SJT

Use best-bet plane if it's there: 9/6/03; SJT

Allow single-plane images with a warning: 3/10/03; SJT

Use plane 0 for new-type images: 23/10/07; SJT

5.36 smei_image::peek

Source: smei_image/smei_image_peek.pro

NAME:

SMEI_IMAGE::PEEK

PURPOSE:

Debugging tool to allow peeking into a SMEI_IMAGE object.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

imref -> peek

MODIFICATION HISTORY:

Original: 16/1/03; SJT

5.37 smei_image::print

Source: smei_image/smei_image_print.pro

NAME:

SMEI_IMAGE::PRINT

PURPOSE:

Make a PostScript file of a SMEI image

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

imref -> print

KEYWORD PARAMETERS:

```

/grid          If specified, then add a grid to the image
date    int    The date format for the image.
/file        If specified, then add the filename to the
             image.
range    float The min and max values for the display
             (implies adding the range to the plot)
kill     float The range of values considered "good" data.
flag     uint  What flags to omit from the output display.
             (Ignored for images without a flag plane).
colour_table int The colour table to use. (-1 or unset to use
             the sequence map)
xsize    float The size in cm of the x-dimension of the image
             (y is always adjusted to preserve the aspect
             ratio)
/no_colour Do not generate colour PS (equivalent to
             colour_table=0)
/portrait Print in portrait mode (default is landscape).
plot_file str Specify a filename other than the default idl.ps
/encapsulated If set, then make an eps file (handled
             explicitly as other things are done
             differently for eps).
/cmyk      If set, then use the CMYK colour model
plane     int  If zero (or absent) then the processed image
             is displayed, otherwise the nth plane of the
             raw image is displayed.
null_index byte A 2-element array of colour indices for
             missing data and out-of-sky

```

Any keywords to DEVICE that do not clash with the above and which are accepted by the PS device may be passed.

SIDE EFFECTS:

A PostScript file is generated.

RESTRICTIONS:

Pro-tem it doesn't print the file.

MODIFICATION HISTORY:

Original: 11/12/02; SJT
 Add log scaling: 10/1/03; SJT
 Moved mechanics of image display to SMEI_IMAGE::PS_SHOW:
 16/5/03; SJT
 Added PLANE keyword: 20/6/03; SJT
 Add null_index keyword: 18/7/03; SJT
 Pass KILL keyword through: 29/3/04; SJT
 Spool file to printer: 6/6/05; SJT
 Add flag support: 23/10/07; SJT
 Add CMYK: 3/6/10; SJT

5.38 smei_image::print_menu

Source: smei_image/smei_image_print_menu.pro

NAME:

SMEI_IMAGE::PRINT_MENU

PURPOSE:

GUI to control printing of a SMEI image.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

imref -> print_menu

KEYWORD PARAMETERS:

group long Widget ID of a group leader
/block If set, then block any other widget events.

SIDE EFFECTS:

A print file may be generated.

MODIFICATION HISTORY:

Original: 11/12/02; SJT
Add log scaling: 10/1/03; SJT
Add plane selection & extend grids: 20/6/03; SJT
Add 3-state date format: 3/6/05; SJT
Add spooling options: 6/6/05; SJT

5.39 smei_image::ps_show

Source: smei_image/smei_image_ps_show.pro

NAME:

SMEI_IMAGE::PS_SHOW

PURPOSE:

Display a SMEI image to a PS device.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

imref -> ps_show, xsize, ysize

INPUTS:

xsize float The X-dimension of the image to display
ysize float The Y-dimension of the image to display

OPTIONAL INPUTS:

xposition The X-position on the page (in cm) of the
lower-left corner of the image
yposition The Y-position on the page (in cm) of the
lower-left corner of the image

KEYWORD PARAMETERS:

```

/grid          If specified, then add a grid to the image
idate   int    The date format for the image.
/file        If specified, then add the filename to the
             image.
range   float  The min and max values for the display
             (implies adding the range to the plot)
kill    float  The range of values considered "good" data.
colour_table int The colour table to use. (-1 or unset to use
             the sequence map)
logarithmic int Whether to plot with a logarithmic data
             mapping.
plane    int   If zero (or absent) then the processed image
             is displayed, otherwise the nth plane of the
             raw image is displayed.
null_index byte A 2-element array of colour indices for
             missing data and out-of-sky
flag     uint  What flags to omit from the output display.
             (Ignored for images without a flag plane).

```

MODIFICATION HISTORY:

```

Extracted from SMEI_IMAGE::PRINT: 16/5/03; SJT
Add PLANE key (and document logarithmic): 20/6/03;
SJT
Add null_index keyword: 18/7/03; SJT
Support fisheye projections: 13/2/04; SJT
Fix kill ranges for Log scaling: 20/5/04; SJT
Add 3-state date format: 3/6/05; SJT
Add flag support: 23/10/07; SJT

```

5.40 smei_image::read_fits

Source: smei_image/smei_image__read_fits.pro

NAME:

```
SMEI_IMAGE::READ_FITS
```

PURPOSE:

```
Read a SMEI fits file and store its data in a SMEI_IMAGE object.
```

CATEGORY:

```
SMEI_IMAGE
```

CALLING SEQUENCE:

```
ok = imref -> read_fits(file)
```

INPUTS:

```
file    string  The fits file to read.
```

KEYWORD PARAMETERS:

```
/silent    If set, then suppress messages from readfits.
```

OUTPUTS:

5.42 smei_image::set_image

Source: smei_image/smei_image_set_image.pro

NAME:

SMEI_IMAGE::SET_IMAGE

PURPOSE:

To manually set the processed image of a SMEI_IMAGE (e.g. for a user-defined background subtractor).

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

imref -> set_image, image_data

INPUTS:

image_data float The new image data. Must be the same size as the image.

KEYWORD PARAMETERS:

/restore If set, then restore the default settings.

MODIFICATION HISTORY:

Original: 5/3/04; SJT

5.43 smei_image::set_next

Source: smei_image/smei_image_set_next.pro

NAME:

SMEI_IMAGE::SET_NEXT

PURPOSE:

Set the reference to the next image in the sequence

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

imref -> set_next, next

INPUTS:

next objref Reference to the next image in the sequence.

MODIFICATION HISTORY:

Original: 9/12/02; SJT

5.44 smei_image::set_plot_scale

Source: smei_image/smei_image__set_plot_scale.pro

NAME:

SMEI_IMAGE::SET_PLOT_SCALE

PURPOSE:

Set up data coordinates for a SMEI image plot.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

imref -> set_plot_scale[, box]

OPTIONAL INPUTS

box float A 4-element array with the NDC space box into which the coordinates are to go.

SIDE EFFECTS:

The !X & !Y plot variables are changed.

MODIFICATION HISTORY:

Original: 10/12/02; SJT
Add box option: 16/5/03; SJT
Add support for Fisheyes: 13/2/04; SJT
Correct for half-pixel shift in image centre: 28/4/04; SJT
Back out half pixel and add in full pixel (for FITS 1-base):
5/11/07; SJT
Revert half pixel, fix origin for rectangular: 1/5/09; SJT

5.45 smei_image::set_prev

Source: smei_image/smei_image__set_prev.pro

NAME:

SMEI_IMAGE::SET_PREV

PURPOSE:

Set the reference to the previous image in the sequence

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

imref -> set_prev, prev

INPUTS:

prev objref Reference to the previous image in the sequence.

MODIFICATION HISTORY:
Original: 9/12/02; SJT

5.46 smei_image::set_skip

Source: smei_image/smei_image__set_skip.pro

NAME:
SMEI_IMAGE::SET_SKIP

PURPOSE:
Set the skip flag on a SMEI_IMAGE

CATEGORY:
SMEI_IMAGE

CALLING SEQUENCE:
imref -> set_skip, flag

OPTIONAL INPUTS:
flag bool State to which to set the skip flag (if not
given then the flag is flipped)

MODIFICATION HISTORY:
Original: 14/1/03; SJT

5.47 smei_image::show

Source: smei_image/smei_image__show.pro

NAME:
SMEI_IMAGE::SHOW

PURPOSE:
Display a SMEI image

CATEGORY:
SMEI_IMAGE

CALLING SEQUENCE:
imref -> show

KEYWORD PARAMETERS:

window	long	Window ID to display the image (this should only be used in exceptional circumstances -- e.g. by the mpeg generator).
grid		If specified, then add a grid to the image, =2 means grid is elongation and position angle
date		Specify the date format.
/file		If specified, then add the filename to the

```

                                image.
range    float    The min and max values for the display
                                (implies adding the range to the plot)
kill     float    The range of values considered "good" data.
colour_table int  The colour table to use.
logarithmic int  Whether to plot with a logarithmic data
                                mapping.
plane    int      If zero (or absent) then the processed image
                                is displayed, otherwise the nth plane of the
                                raw image is displayed.
/nosave                                If set, then do not save the plot environment
                                and don't restore afterwards (this key is used
                                by smei_sequence::show as that handles the
                                saving itself).
zoom     float    A factor by which to zoom the image (must be
                                int or 1/int)
smooth   int      Whether to smooth when zoom > 1
flag     uint     What flags to omit from the output display.
                                (Ignored for images without a flag plane).

```

SIDE EFFECTS:

Graphics are output

RESTRICTIONS:

If keys and arguments are omitted, then values are taken from the sequence if available.
The plane keyword is silently ignored for compacted images.

MODIFICATION HISTORY:

Original: 9/12/02; SJT
 Use pixmap if present and no keys given: 11/12/02; SJT
 Handle logarithmic scalings: 10/1/03; SJT
 Add support for planes: 16/5/03; SJT
 Handle 3-state grid setting: 17/6/03; SJT
 Add nosave keyword: 18/6/03; SJT
 Add zoom support: 28/7/03; SJT
 Add fisheye support: 13/2/04; SJT
 Add kill ranges: 29/3/04; SJT
 Fix kill ranges for Log scaling: 20/5/04; SJT
 Add /nan key to min calls in renage determination: 4/8/04; SJT
 Handle 3-state date settings: 3/6/05; SJT
 Add flag support: 23/10/07; SJT
 Add shift support: 23/11/09; SJT

5.48 smei_image::show_header

Source: smei_image/smei_image__show_header.pro

NAME:

SMEI_IMAGE::SHOW_HEADER

PURPOSE:

Display the FITS header of a SMEI image

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

imref -> show_header

KEYWORD PARAMETERS:

group long Optional group leader of the widget heirarchy

MODIFICATION HISTORY:

Original: 24/7/03; SJT

Get ancillary and flag headers if available: 23/10/07; SJT

5.49 smei_mask_bits__define

Source: smei_image/smei_mask_bits__define.pro

NAME:

SMEI_MASK_BITS__DEFINE

PURPOSE:

Define the smei_mask_bits structure.

CATEGORY:

SMEI_IMAGE

CALLING SEQUENCE:

implicit

SIDE EFFECTS:

A structure is defined

MODIFICATION HISTORY:

Original: 25/10/07; SJT

5.50 smei_point__define

Source: smei_image/smei_point__define.pro

NAME:

SMEI_POINT__DEFINE

PURPOSE:

Defines the SMEI_POINT structure.

CATEGORY:

Definitions

CALLING SEQUENCE:

<Implicit>

SIDE EFFECTS:

A structure definition is created

MODIFICATION HISTORY:

Separated out from SMEI_IMAGE::GET_LOCATE: 25/11/08; SJT

6 Sequences

6.1 save_profile

Source: smei_sequence/save_profile.pro

NAME:

SAVE_PROFILE

PURPOSE:

Save a profile to a file or to top level variables.

CATEGORY:

(SMEI_SEQUENCE)

CALLING SEQUENCE:

save_profile,profile, pa, elong, date

INPUTS:

profile	float	The 3-d array with the profile.
pa	float	The position angles of the bin centres
elong	float	The elongations of the bin centres.
date	double	The start and end times of the images from which the sequence was made.

KEYWORD PARAMETERS:

group	long	The widget ID of a group leader for the menu.
-------	------	---

MODIFICATION HISTORY:

Original: 15/12/03; SJT

6.2 smei_sequence::add_image

Source: smei_sequence/smei_sequence__add_image.pro

NAME:

SMEI_SEQUENCE::ADD_IMAGE

PURPOSE:

Add a new image to a SMEI sequence

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

imref = seqref -> add_image(file)

INPUTS:

file string The FITS file containing the image.

KEYWORD PARAMETERS:

/first If set, then add the image at the beginning of the sequence.

/last If set, add the image at the end of the sequence (this is the default behaviour).

after Either a location number or an image reference after which the new images is to be inserted.

before Either a location number or an image reference before which the new image is to be inserted.

/compact If set, then compact the image on adding it.

/silent Passed via image constructor to readfits, if set, then messages about the images read are suppressed

image_data	Float	The image values (usually a 1-plane derived image)
ancil_data	float	The ancillary data for the image (DI)
flag_data	uint	The contaminant flagging data for the image (DI)
start	double	The start time of the image (DI only)
stop	double	The end time of the image (DI only)
unit	string	The unit of the image (DI)
centre	float	The centre point of the image coordinates (DI)
scale	float	The image scale (DI)
fitshead	string	A "fake" fitsheader for the image (DI)
ancilhead	string	A "fake" ancil data header (DI)
flaghead	string	A "fake" flag data header (DI)
flags	struct	The processing flags for the image (DI)
filename	string	The filename of the "dominant" image (DI)
projection	int	The projection of the "dominant" image (DI)

OUTPUTS:

imref objref The object reference of the image added (or invalid on failure)

MODIFICATION HISTORY:

Original: 10/12/02; SJT

Add compact option: 13/12/02; SJT

Corrected documentation: 19/12/02; SJT

Added silent key: 10/1/03; SJT

Added keys to handle new methods of deriving images: 22/10/03; SJT

Add filename key for derived images: 1/12/03; SJT

Add projection key for derived images: 13/2/04; SJT

Add ancil and flag data keys: 24/10/07; SJT

6.3 smei_sequence::add_menu

Source: smei_sequence/smei_sequence__add_menu.pro

NAME:

SMEI_SEQUENCE::ADD_MENU

PURPOSE:

To interactively add images to a SMEI sequence (old IDL)

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

status = seqref -> add_menu(group=group)

INPUTS:

OPTIONAL INPUTS:

KEYWORD PARAMETERS:

group long A possible group leader for the menu
/no_progress If set, then disable the progress bars (useful
if slow network means the progress bars are
slowing operation).

OUTPUTS:

status 1 or 0 for success or failure

RESTRICTIONS:

If any managed widgets are present then the GROUP keyword MUST
be present.

MODIFICATION HISTORY:

Original: 16/12/02; SJT
Hourglass TLM during read: 9/1/03; SJT
Show progress: 10/1/03; SJT
Support applying calc progs on load: 29/7/03; SJT
Update properly on picking directory: 3/10/03; SJT
Add projection handling: 16/2/04; SJT
Add copy start & end buttons and increment/decrement buttons:
26/7/05; SJT
Add no_progress keyword: 25/8/05; SJT
Update times on directory update: 2/2/10; SJT

6.4 smei_sequence::apply_colour_map

Source: smei_sequence/smei_sequence__apply_colour_map.pro

NAME:
SMEI_SEQUENCE::APPLY_COLOUR_MAP

PURPOSE:
Apply the selected colour table to the current device.

CATEGORY:
SMEI_SEQUENCE

CALLING SEQUENCE:
seqref -> apply colour_map

MODIFICATION HISTORY:
Original: 12/12/02; SJT

6.5 smei_sequence::calc_count

Source: smei_sequence/smei_sequence__calc_count.pro

NAME:
SMEI_SEQUENCE::CALC_COUNT

PURPOSE:
To calculate the number of images in a SMEI sequence

CATEGORY:
SMEI_SEQUENCE

CALLING SEQUENCE:
seqref -> calc_count

SIDE EFFECTS:
The count field is updated.

MODIFICATION HISTORY:
Original: 10/12/02; SJT

6.6 smei_sequence::cleanup

Source: smei_sequence/smei_sequence__cleanup.pro

NAME:
SMEI_SEQUENCE::CLEANUP

PURPOSE:
Destructor for a SMEI sequence

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:
obj_destroy, seqref

MODIFICATION HISTORY:
Original: 10/12/02; SJT

6.7 smei_sequence::compact

Source: smei_sequence/smei_sequence__compact.pro

NAME:
SMEI_SEQUENCE::COMPACT

PURPOSE:
Compacts all the images in a sequence

CATEGORY:
SMEI_SEQUENCE

CALLING SEQUENCE:
seqref -> compact

KEYWORD_PARAMETERS
/mk_nan If set, then convert points in the weighted
 images with zero weight into NaN values.

MODIFICATION HISTORY:
Original: 13/12/02; SJT

6.8 smei_sequence::concatenate

Source: smei_sequence/smei_sequence__concatenate.pro

NAME:
SMEI_SEQUENCE::CONCATENATE

PURPOSE:
Joins two SMEI sequences together

CATEGORY:
SMEI_SEQUENCE

CALLING SEQUENCE:
seqref -> concatenate, seq2

INPUTS:
seq2 objref The reference to the sequence to be appended.

KEYWORD_PARAMETERS:

/preserve If set then copy the second sequence images rather than moving them.
 /sort If set, then sort the resultant sequence after concatenation.

SIDE EFFECTS:

The second sequence is destroyed unless the preserve keyword is set.

MODIFICATION HISTORY:

Original: 20/12/02; SJT
 Added preserve keyword: 9/1/03; SJT
 Added sort keyword: 13/1/03; SJT

6.9 smei_sequence__define

Source: smei_sequence/smei_sequence__define.pro

NAME:

SMEI_SEQUENCE__DEFINE

PURPOSE:

Object definition of a SMEI image sequence

CATEGORY:

SMEI_SEQUENCE

FIELDS:

name	string	An arbitrary name to label the sequence
first_image	objref	A reference to the first object of the sequence.
last_image	objref	A reference to the final object of the sequence.
n_image	long	The number of images in the sequence.
colour_table	byte	The colour table to use for display.
options.date	byte	Whether to add the image date to plots
grid	byte	Whether to overlay the coordinate grid on plots
file	byte	Whether to put the filename on plots
range	byte	Whether to put the data range on plots.
window	long	The window index of the display window.
data_range	float	The data range to display.
data_kill	float	Points outside this level are set to undefined.
data_log	byte	Whether data display is linear or logarithmic.
delay	float	The delay between frames in a movie.
plane	int	The image plane to display (0 = processed, 1=raw image plane 0 etc.)
flags	uint	The contaminants to reject in display.
pa_shift	int	Alignment of Rectangular images.
no_roll	byte	Whether to wrap scrolling of sequence (this is the negation of what the methods return, so that older

		sequences keep their behaviour when restored).
mask_bits	struct	The bit patterns of the mask. (implemented as a pointer for datasets without masking info).
print_options	struct	Options for PostScript output.
pixmap.id	long	The window ID of the pixmap used for fast display
hwm	long	The next available row in the pixmap. It's 1 pixel above the top left corner of the last image added.
colwidth	long	The width of a column of images in the pixmap
sourcedir	string	The directory tree of the last image(s) added to the sequence.
file	string	The savefile name used for the sequence.
canvas	long	The widget ID of the plotting widget (N.B. this is not the same as the window ID).

MODIFICATION HISTORY:

Original: 9/12/02; SJT
 Fixed range scaling info, added colour table: 12/12/02; SJT
 Incorporate DELAY: 19/12/02; SJT
 Update Doc comments and remove disused fields: 9/1/03; SJT
 Add logarithmic option, make pixmap hwm 2-D: 10/1/03; SJT
 Add plane option, (to allow display of raw image planes): 16/5/03; SJT
 Separate in and out of sky for null pixels: 18/7/03; SJT
 Add print settings: 22/7/03; SJT
 Add sourcedir: 29/10/03; SJT
 Add data_kill: 29/3/04; SJT
 Add spooling commands for print: 6/6/05; SJT
 Add masking flags for Pipe 2.0: 23/10/07; SJT
 Add pa_shift (rect only): 23/11/09; SJT
 Add CMYK for PS: 3/6/10; SJT
 Add no_roll option: 20/7/10; SJT

6.10 smei_sequence::delete_image

Source: smei_sequence/smei_sequence_delete_image.pro

NAME:

SMEI_SEQUENCE::DELETE_IMAGE

PURPOSE:

To remove an image from a SMEI sequence

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> delete_image, image

INPUTS:

image Either an image number, or an image reference.

MODIFICATION HISTORY:
Original: 10/12/02; SJT

6.11 smei_sequence::delete_menu

Source: smei_sequence/smei_sequence__delete_menu.pro

NAME:
SMEI_SEQUENCE::DELETE_MENU

PURPOSE:
To interactively delete images from and/or sort a SMEI sequence

CATEGORY:
SMEI_SEQUENCE

CALLING SEQUENCE:
status = seqref -> delete_menu(group=group)

INPUTS:

OPTIONAL INPUTS:

KEYWORD PARAMETERS:
group long A possible group leader for the menu

OUTPUTS:
status 1 or 0 for success or failure

RESTRICTIONS:
If any managed widgets are present then the GROUP keyword MUST be present.

MODIFICATION HISTORY:
Original: 16/12/02; SJT
Fix memory leak and add sort: 13/1/03; SJT
Allow multiple deletes: 25/7/03
Fix another memory leak: 2/9/05; SJT
Add image numbers: 15/4/10; SJT

6.12 smei_sequence::flags_menu

Source: smei_sequence/smei_sequence__flags_menu.pro

NAME:
SMEI_SEQUENCE::FLAGS_MENU

PURPOSE:
Menu to set up the contaminant flags to mask.

CATEGORY:
SMEI_SEQUENCE

CALLING SEQUENCE:
seqref -> flags_menu[, group=group]

KEYWORD PARAMETERS:

group	long	A possible group leader for the menu
/block		If set, then the widget blocks other events. (So it pauses a movie for example).

SIDE EFFECTS:
The sequence masking options are changed.

RESTRICTIONS
Only applicable to Pipe 2.0 images

MODIFICATION HISTORY:
Original: 23/10/07; SJT
Add clear all and set all: 24/10/07; SJT

6.13 smei_sequence::get_annotations

Source: smei_sequence/smei_sequence_get_annotations.pro

NAME:
SMEI_SEQUENCE::GET_ANNOTATIONS

PURPOSE:
Return the state of the various plot annotation flags

CATEGORY:
SMEI_SEQUENCE

CALLING SEQUENCE:
flag = seqref -> get_annotation(<selector>)

KEYWORD PARAMETERS:

grid	Query plotting of a grid or not
date	Query adding the date
file	Query adding the filename
range	Query adding the range.

OUTPUTS:
flag byte The state of the requested option

MODIFICATION HISTORY:
Original: 12/12/02; SJT

6.14 smei_sequence::get_biggest_image

Source: smei_sequence/smei_sequence_get_biggest_image.pro

NAME:

SMEI_SEQUENCE::GET_BIGGEST_IMAGE

PURPOSE:

Find the largest image in a SMEI sequence

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

sz = seqref -> get_biggest_image

OUTPUTS:

sz The maximum X & Y sizes of the images in the sequence

MODIFICATION HISTORY:

Original: 11/12/02; SJT

6.15 smei_sequence::get_colour_map

Source: smei_sequence/smei_sequence_get_colour_map.pro

NAME:

SMEI_SEQUENCE::GET_COLOUR_MAP

PURPOSE:

Returns the colour table used for a SMEI sequence

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

map = seqref -> get_colour_map()

KEYWORD PARAMETERS:

/red Only return the red component
/green Only return the green component
/blue Only return the blue component

OUTPUTS:

map The colour map.

MODIFICATION HISTORY:

Original: 12/12/02; SJT

6.16 smei_sequence::get_count

Source: smei_sequence/smei_sequence__get_count.pro

NAME:

SMEI_SEQUENCE::GET_COUNT

PURPOSE:

Return the number of images in a SMEI sequence.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

count=seqref -> get_count()

OUTPUTS:

count long The number of images attached to the sequence.

MODIFICATION HISTORY:

Original: 9/12/02; SJT

6.17 smei_sequence::get_data_range

Source: smei_sequence/smei_sequence__get_data_range.pro

NAME:

SMEI_SEQUENCE::GET_DATA_RANGE

PURPOSE:

Return the data range of values for plotting.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

range=seqref -> get_data_range()

OUTPUTS:

range float A 2-element array containing the data_range.

KEYWORD PARAMETERS

/logarithmic If set, then return whether the scaling is logarithmic.
/kill If set, then return the "Kill range"

MODIFICATION HISTORY:

Original: 10/12/02; SJT
Renamed: 12/12/02; SJT
Added logarithmic keyword: 10/1/03; SJT
Added KILL keyword: 29/3/04; SJT

6.18 smei_sequence::get_delay

Source: smei_sequence/smei_sequence__get_delay.pro

NAME:

SMEI_SEQUENCE::GET_DELAY

PURPOSE:

Get the interframe interval of a SMEI sequence

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

delay = seqref -> get_delay()

OUTPUTS:

delay float The interframe delay in seconds

MODIFICATION HISTORY:

Original: 19/12/02; SJT

6.19 smei_sequence::get_file

Source: smei_sequence/smei_sequence__get_file.pro

NAME:

SMEI_SEQUENCE::GET_FILE

PURPOSE:

Get the name of the file to which a SMEI sequence was last saved.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> get_file()

MODIFICATION HISTORY:

Original: 16/12/02; SJT

6.20 smei_sequence::get_first

Source: smei_sequence/smei_sequence__get_first.pro

NAME:

SMEI_SEQUENCE::GET_FIRST

PURPOSE:

Get the first image of a SMEI sequence

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

imref = seqref->get_first()

KEYWORD INPUTS:

/noskip If set, then return the first image not flagged for hiding. (If all images are flagged then the true first image is returned)

OUTPUTS:

imref objref A reference to the first image in the sequence.
index long The index of the image returned (only relevant if noskip is specified).

MODIFICATION HISTORY:

Original: 9/12/02; SJT
Added noskip & index keywords: 20/7/10; SJT

6.21 smei_sequence::get_flags

Source: smei_sequence/smei_sequence__get_flags.pro

NAME:

SMEI_SEQUENCE::GET_FLAGS

PURPOSE:

Return the masked flags for plotting SMEI images

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

mask = seqref -> get_flags()

OUTPUTS:

mask long The flags to be masked out.

MODIFICATION HISTORY:

Original (after get_window): 23/10/07; SJT

6.22 smei_sequence::get_image

Source: smei_sequence/smei_sequence__get_image.pro

NAME:

SMEI_SEQUENCE::GET_IMAGE

PURPOSE:

Get the reference for an image in the sequence.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

```
imref = seqref->get_image(location)
```

INPUTS:

location long The sequence number of the required image.

OUTPUTS:

imref objref The reference to the selected image.

MODIFICATION HISTORY:

Original: 10/12/02; SJT

6.23 smei_sequence::get_last

Source: smei_sequence/smei_sequence_get_last.pro

NAME:

SMEI_SEQUENCE::GET_LAST

PURPOSE:

Get the last image of a SMEI sequence

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

```
imref = seqref->get_last()
```

KEYWORD INPUTS:

/noskip If set, then return the last image not flagged for hiding. (If all images are flagged then the true last image is returned)

OUTPUTS:

imref objref A reference to the last image in the sequence.
index long The index of the image returned (only relevant if noskip is specified).

MODIFICATION HISTORY:

Original: 9/12/02; SJT

Added noskip & index keywords: 20/7/10; SJT

6.24 smei_sequence::get_mask_bits

Source: smei_sequence/smei_sequence_get_mask_bits.pro

NAME:

SMEI_SEQUENCE::GET_MASK_BITS

PURPOSE:

Get the mask bits for the various contaminants

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref-> get_mask_bits()

INPUTS:

seqref obj The reference to the sequence object.

OUTPUTS:

A structure with the bits for the various contaminants.

MODIFICATION HISTORY:

Original: 25/10/07; SJT

6.25 smei_sequence::get_n_planes

Source: smei_sequence/smei_sequence_get_n_planes.pro

NAME:

SMEI_SEQUENCE::GET_N_PLANES

PURPOSE:

Return number of available planes in the images of a SMEI sequence.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

planes=seqref->get_n_planes()

OUTPUTS:

planes The number of available RAW images planes in the sequence.

MODIFICATION HISTORY:

Original: 19/5/03; SJT

6.26 `smei_sequence::get_name`

Source: `smei_sequence/smei_sequence_get_name.pro`

NAME:

`SMEI_SEQUENCE::GET_NAME`

PURPOSE:

Return the name of a SMEI sequence

CATEGORY:

`SMEI_SEQUENCE`

CALLING SEQUENCE:

`name = seqref -> get_name()`

OUTPUTS:

`name` string The name of the sequence

MODIFICATION HISTORY:

Original: 10/12/02; SJT

6.27 `smei_sequence::get_null_index`

Source: `smei_sequence/smei_sequence_get_null_index.pro`

NAME:

`SMEI_SEQUENCE::GET_NULL_INDEX`

PURPOSE:

Return the colour index to use for pixels with no data.

CATEGORY:

`SMEI_SEQUENCE`

CALLING SEQUENCE:

`index = seqref -> get_null_index([/print|/screen])`

KEYWORD PARAMETERS:

<code>/print</code>	If set, then return the colour index to use for printed output
<code>/screen</code>	If set, then return the colour index to use for screen displays. (This is the default).
<code>/off_sky</code>	If set, then return the value to use for points outside the sky area

OUTPUTS:

`index` byte The colour index to use.

MODIFICATION HISTORY:
Original: 11/7/03; SJT
Separate in and out of sky: 18/7/03; SJT

6.28 smei_sequence::get_pipe_level

Source: smei_sequence/smei_sequence_get_pipe_level.pro

NAME:
SMEI_SEQUENCE::GET_PIPE_LEVEL

PURPOSE:
Determine the version of the pipeline used to generate the images in the pipeline.

CATEGORY:
SMEI_SEQUENCE

CALLING SEQUENCE:
level = seqref -> get_pipe_level()

INPUTS:

OPTIONAL INPUTS:

KEYWORD PARAMETERS:

OPTIONAL OUTPUTS:

RESTRICTIONS:
Assumes that all the images in the sequence come from the same level of pipe.

MODIFICATION HISTORY:
Original: 18/1/08; SJT

6.29 smei_sequence::get_pixmap

Source: smei_sequence/smei_sequence_get_pixmap.pro

NAME:
SMEI_SEQUENCE::GET_PIXMAP

PURPOSE:
Get the window ID of the pixmap mirroring a SMEI image sequence

CATEGORY:
SMEI_SEQUENCE

CALLING SEQUENCE:

```
id = seqref -> get_pixmap()
```

KEYWORD PARAMETERS:

```
/hwm          If set, then return the pixmap high water mark.
/colwidth     If set, then return the width of the columns
              in the pixmap.
```

OUTPUTS:

```
id           The window ID of the pixmap (or hwm or column width as
              requested).
```

MODIFICATION HISTORY:

```
Original: 11/12/02; SJT
Added colwidth keyword: 10/1/03; SJT
```

6.30 smei_sequence::get_plane

Source: smei_sequence/smei_sequence__get_plane.pro

NAME:

```
SMEI_SEQUENCE::GET_PLANE
```

PURPOSE:

```
Get the image plane to display in a SMEI sequence
```

CATEGORY:

```
SMEI_SEQUENCE
```

CALLING SEQUENCE:

```
plane = seqref -> get_plane()
```

OUTPUTS:

```
plane          The image plane to display
```

MODIFICATION HISTORY:

```
Original (after get_delay): 16/5/03; SJT
```

6.31 smei_sequence::get_print_opts

Source: smei_sequence/smei_sequence__get_print_opts.pro

NAME:

```
SMEI_SEQUENCE::GET_PRINT_OPTS
```

PURPOSE:

```
Return the print-specific options for a sequence
```

CATEGORY:

```
SMEI_SEQUENCE
```


CALLING SEQUENCE:

```
value = seqref -> get_print_opts([<selector>])
```

KEYWORD PARAMETERS:

/columns	If set, then return the number of columns in the layout
/rows	If set, then return the number of rows in the layout.
/order	If set, then return the order in which the images are to be printed
/type	If set, then return the type of postscript file to generate (0=landscape, 1 = portrait, 2 = eps)
/file	If set, then return the filename to use for the output.
/xsize	If set, then return the x-size of the page.
/ysize	If set, then return the y-size of the page.
/print	If set, then return the printing command.
/preview	If set, then return the preview command.
/cmyk	If set, then return the CMYK colour flag.

OUTPUTS:

value The value of the requested option, or the whole options structure if no selector was given.

RESTRICTIONS

The only keys that is meaningful to combine is columns and rows, or xsize and ysize in which case a 2-element array with both is returned.

MODIFICATION HISTORY:

Original: 22/7/03; SJT
 Add print & preview: 3/6/05
 Add CMYK: 3/6/10; SJT

6.32 `smei_sequence::get_projection`

Source: `smei_sequence/smei_sequence_get_projection.pro`

NAME:

`SMEI_SEQUENCE::GET_PROJECTION`

PURPOSE:

Return the image projection of a SMEI sequence.

CATEGORY:

smei sequence

CALLING SEQUENCE:

```
proj = seqref -> get_projection()
```

KEYWORD PARAMETERS:

/string If set, then return a descriptive string rather than a number.
/astrom_code If set, then return the code needed by wcsxy2sph and WCSSPH2XY

OUTPUTS:

proj int/str The projection, either an index or the name.

MODIFICATION HISTORY:

Original: 18/5/04; SJT

6.33 smei_sequence::get_roll

Source: smei_sequence/smei_sequence__get_roll.pro

NAME:

SMEI_SEQUENCE::GET_ROLL

PURPOSE:

Return whether to roll at the end of a sequence when scrolling.

CATEGORY:

smei sequence

CALLING SEQUENCE:

iroll = seqref -> get_roll()

OUTPUTS:

iroll bool Wheter to roll or not

MODIFICATION HISTORY:

Original: 20/7/10; SJT

6.34 smei_sequence::get_shift

Source: smei_sequence/smei_sequence__get_shift.pro

NAME:

SMEI_SEQUENCE::GET_SHIFT

PURPOSE:

To get the PA shift for showing a smei sequence.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

shift=seqref -> get_shift()

OUTPUTS:

shift int/fl The factor by which to scale the images.

KEYWORD PARAMETERS:

/raw If set, then return the internal format of the factor
(i.e. how many right angles)
/degree If set, then return the number of derees of shift

NOTE:

The default is to return the number of Pixels to shift

MODIFICATION HISTORY:

Original (after get_zoom): 23/11/09; SJT

6.35 smei_sequence::get_sourcedir

Source: smei_sequence/smei_sequence_get_sourcedir.pro

NAME:

SMEI_SEQUENCE::GET_SOURCEDIR

PURPOSE:

Get the name of the dir from which a SMEI sequence last
added images.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> get_sourcedir()

MODIFICATION HISTORY:

Original: 29/10/03; SJT

6.36 smei_sequence::get_summary

Source: smei_sequence/smei_sequence_get_summary.pro

NAME:

SMEI_SEQUENCE::GET_SUMMARY

PURPOSE:

Generate a summary of the images in a SMEI sequence

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

desc = seqref->get_summary()

KEYWORD PARAMETERS:

```
/nofile      If set, then don't include the filename
/print      If set, then print the description.
/nohead     If set, then don't add a header.
/numbered   If set, then add a sequence number before the
            description
```

OUTPUTS:

```
desc      string  A string array with the descriptions.
```

MODIFICATION HISTORY:

```
Original: 13/12/02; SJT
Add NUMBERED keyword: 15/4/10; SJT
```

6.37 smei_sequence::get_window

Source: smei_sequence/smei_sequence__get_window.pro

NAME:

```
SMEI_SEQUENCE::GET_WINDOW
```

PURPOSE:

```
Return the window index for plotting SMEI images
```

CATEGORY:

```
SMEI_SEQUENCE
```

CALLING SEQUENCE:

```
index = seqref -> get_window()
```

OUTPUTS:

```
windex long      The index of the window.
```

MODIFICATION HISTORY:

```
Original: 9/12/02; SJT
```

6.38 smei_sequence::get_zoom

Source: smei_sequence/smei_sequence__get_zoom.pro

NAME:

```
SMEI_SEQUENCE::GET_ZOOM
```

PURPOSE:

```
To get the zoom factor for showing a smei sequence.
```

CATEGORY:

```
SMEI_SEQUENCE
```

CALLING SEQUENCE:

```
factor=seqref -> get_zoom()
```

OUTPUTS:

```
factor float The factor by which to scale the images.
```

KEYWORD PARAMETERS:

```
/raw If set, then return the internal format of the factor
      (i.e. integer with negative values for 1/n)
/smooth If set, then return the smoothing flag.
```

MODIFICATION HISTORY:

```
Original: 28/7/03; SJT
```

6.39 smei_sequence::init

Source: smei_sequence/smei_sequence__init.pro

NAME:

```
SMEI_SEQUENCE::INIT
```

PURPOSE:

```
Constructor for a SMEI sequence
```

CATEGORY:

```
SMEI_SEQUENCE
```

CALLING SEQUENCE:

```
seqref = obj_new("SMEI_SEQUENCE", flist, name=name)
```

OPTIONAL INPUTS:

```
flist string Optional list of FITS files to be added as
              attached SMEI_IMAGES (findfile() wildcards are
              allowed).
```

KEYWORD PARAMETERS:

```
name string A name for the sequence
/compact If set, then compact the images as they are
          added (N.B. This only applies to images added
          during initialization).
/menu If set, then generate a menu to select files
       and options
group long A possible group leader for a menu.
/noexpand If set, then do not try to expand wildcards in
          a file list.
/no_progress If set, then disable the progress bars (useful
            if slow network means the progress bars are
            slowing operation).
/silent If set, then suppress any messages from readfits.
```

OUTPUTS:

```
ok      int      Status flag returned to obj_new
```

MODIFICATION HISTORY:

```
Original: 10/12/02; SJT
Add compact option: 13/12/02; SJT
Make sure we destroy attached images after a quit & destroy
from the menu: 10/1/03; SJT
Add no-data index: 11/7/03; SJT
Add off sky colours: 18/7/03; SJT
Add print options: 22/7/03; SJT
Add noexpand keyword and change findfile to file_search:
29/7/03; SJT
Add print spooling commands: 6/6/05; SJT
Add no_progress keyword: 25/8/05; SJT
Change default grid to Elong-PA: 14/1/10; SJT
Add silent keyword: 8/7/101 SJT
```

6.40 `smei_sequence::make_agif`

Source: `smei_sequence/smei_sequence_make_agif.pro`

NAME:

```
SMEI_SEQUENCE::MAKE_AGIF
```

PURPOSE:

```
Generates an animated GIF from a SMEI sequence
```

CATEGORY:

```
SMEI_SEQUENCE
```

CALLING SEQUENCE:

```
seqref -> make_agif, file
```

INPUTS:

```
file      string  The name stem of the file to which to write the AGIFs
```

KEYWORD PARAMETERS:

```
frame_rate      (float) The frame rate desired (fps)
/no_progress     If set, then disable the progress bars (useful
if slow network means the progress bars are
slowing operation).
```

MODIFICATION HISTORY:

```
Original (after make_png): 18/3/08; SJT
Skip hidden frames: 13/6/03; SJT
Add no_progress keyword: 25/8/05; SJT
```

6.41 `smei_sequence::make_avmv`

Source: `smei_sequence/smei_sequence_make_avmv.pro`

NAME:

SMEI_SEQUENCE::MAKE_AVMV

PURPOSE:

Generates a movie from a SMEI sequence

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> make_avmv, file

INPUTS:

file string The name of the file to which to write the movie

KEYWORD PARAMETERS:

frame_rate (float) The frame rate desired (fps)
 /avi If set, then make a DIVX5 AVI movie.
 /quicktime If set, then make a Quicktime movie
 /ffmpeg If set, then make an FFmpeg AVI movie.
 codec string For quicktime and ffmpeg, specify the
 codec to use for the movie.
 /no_progress If set, then disable the progress bars (useful
 if slow network means the progress bars are
 slowing operation).

RESTRICTIONS:

Requires that transcode be installed on the system.

MODIFICATION HISTORY:

Original (from MAKE_MPEG): 17/2/04; SJT
 Updated transcode options: 3/12/04; SJT
 Add ffmpeg & codec selections: 7/6/05; SJT
 Fix file-decriptor leak: 8/6/05; SJT
 Add no_progress keyword: 25/8/05; SJT

6.42 smei_sequence::make_mpeg

Source: smei_sequence/smei_sequence_make_mpeg.pro

NAME:

SMEI_SEQUENCE::MAKE_MPEG

PURPOSE:

Generates an mpeg movie from a SMEI sequence

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> make_mpeg, file

INPUTS:

file string The name of the file to which to write the MPEG

KEYWORD PARAMETERS:

compress int The compression level (0..3)
 quality int The quality setting [01]
 multiplex int The number of times to repeat each
 image to get a sensible speed.
 /no_progress If set, then disable the progress bars (useful
 if slow network means the progress bars are
 slowing operation).

RESTRICTIONS:

Requires that mpeg_encode and pngtopnm or pngtoppm be
 installed on the system.

MODIFICATION HISTORY:

Original (from LASCO original by JW): 18/12/02; SJT
 Skip hidden frames: 13/6/03; SJT
 Use IDL's WRITE_PPM if no PNG->PPM converter found: 31/3/04; SJT
 Add no_progress keyword: 25/8/05; SJT

6.43 smei_sequence::make_mvi

Source: smei_sequence/smei_sequence_make_mvi.pro

NAME:

SMEI_SEQUENCE::MAKE_MVI

PURPOSE:

Saves a SMEI sequence to a LASCO MVI format movie.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref->make_mvi, file

OPTIONAL INPUTS:

file string Name of the MVI file to create

KEYWORD PARAMETERS:

group long A possible group leader (strictly dialogue
 parent) for the menu.
 /no_progress If set, then disable the progress bars (useful
 if slow network means the progress bars are
 slowing operation).

SIDE EFFECTS:

An MVI file is created

MODIFICATION HISTORY:

Original: 17/12/02; SJT
Skip hidden images: 13/6/03; SJT
Add no_progress keyword: 25/8/05; SJT

6.44 smei_sequence::make_png

Source: smei_sequence/smei_sequence_make_png.pro

NAME:

SMEI_SEQUENCE::MAKE_PNG

PURPOSE:

Generates a set of PNG images from a SMEI sequence

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> make_png, file

INPUTS:

file string The name stem of the file to which to write the PNGs

KEYWORD PARAMETERS:

/no_progress If set, then disable the progress bars (useful if slow network means the progress bars are slowing operation).

MODIFICATION HISTORY:

Original (cut down from MPEG): 16/9/03; SJT
Skip hidden frames: 13/6/03; SJT
Add no_progress keyword: 25/8/05; SJT

6.45 smei_sequence::make_profile

Source: smei_sequence/smei_sequence_make_profile.pro

NAME:

SMEI_SEQUENCE::MAKE_PROFILE

PURPOSE:

Generate a radial or circumferential profile set for a SMEI sequence.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

```

profile = seqref->make_profile(npa, nel, pamin, pamax)
or
profile = seqref->make_profile(npa, nel, elmin, elmax, $
/circumferential)

```

INPUTS:

```

nel      int      The number of bins in the elongation axis.
npa      int      The number of bins in the position angle axis.
pamin    float    The lowest position angle to use
pamax    float    The highest position angle to use
                In future if pamin >
                pamax, then the sector will be assumed to
                cross north, but for the moment pamin must be
                less than pamax.
elmin    float    The lowest elongation angle to use.
elmax    float    The highest elongation angle to use.

```

KEYWORD PARAMETERS:

```

/circumferential    If set, then make a ring all around
                    the image at a fixed elongation range.
pa      float      output  A named variable to hold the position
                    angles of the bin centres.
elong   float      output  A named variable to hold the
                    elongations of the bin centres.
date    double     output  A named variable to receive the dates
                    of the images.
/verbose
plane   int        input   Specify a raw image plane to use
                    (default=processed)
mask    uint       input   A mask of to apply to the flag plane
                    in version 2 data. (e.g. '800'xu to
                    exclude Sun contaminated data).
/miss_nan
                    If set, then a cell with no values is
                    NaN rather than zero.

```

OUTPUTS:

```

profile float      An nel x npa x nimages array holding the
                    profiles.

```

MODIFICATION HISTORY:

```

Original: 12/12/03; SJT
Add plane keyword: 12/1/04; SJT
Replace old clumsy REVERSE_INDEX method with pointers owing to
off by one per step error: 20/7/04; SJT
Fix memory leak: 6/7/09; SJT
Add mask and miss_nan keywords: 8/7/09; SJT

```

6.46 smei_sequence::menu

Source: smei_sequence/smei_sequence_menu.pro

NAME:

```
SMEI_SEQUENCE::MENU
```

PURPOSE:

To interactively define a SMEI sequence

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

status = seqref -> menu([flag, group=group])

INPUTS:**OPTIONAL INPUTS:****KEYWORD PARAMETERS:**

group	long	A possible group leader for the menu
/no_progress		If set, then disable the progress bars (useful if slow network means the progress bars are slowing operation).

OPTIONAL OUTPUTS:

flag	1 or 0 for success or failure (needed when called from the constructor)
------	---

RESTRICTIONS:

If any managed widgets are present then the GROUP keyword MUST be present if the sequence doesn't already exist.

MODIFICATION HISTORY:

Reduced to stub for alternates depending on IDL version:
26/11/03; SJT
Add no_progress keyword: 25/8/05; SJT

6.47 smei_sequence::menu1

Source: smei_sequence/smei_sequence_menu1.pro

NAME:

SMEI_SEQUENCE::MENU

PURPOSE:

To interactively define a SMEI sequence

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

```
status = seqref -> menu([flag, group=group])
```

INPUTS:

OPTIONAL INPUTS:

KEYWORD PARAMETERS:

```
group    long    A possible group leader for the menu
/no_progress  If set, then disable the progress bars (useful
                if slow network means the progress bars are
                slowing operation).
```

OPTIONAL OUTPUTS:

```
flag     1 or 0 for success or failure (needed when called from
                the constructor)
```

RESTRICTIONS:

If any managed widgets are present then the GROUP keyword MUST be present if the sequence doesn't already exist.

MODIFICATION HISTORY:

```
Original: 16/12/02; SJT
Rearranged layout: 6/1/03; SJT
Added progress bar: 10/1/03; SJT
Added print option: 16/5/03; SJT
Redesigned: 11/6/03; SJT
Handle 3-state grid setting: 17/6/03; SJT
Renamed as __menu1 (for IDL <= 5.5): 26/11/03; SJT
Merge movie types into a single button: 31/3/04; SJT
Add support for background model subtraction: 7/5/04; SJT
Add 3-state date settings: 3/6/05; SJT
Add no_progress keyword: 25/8/05; SJT
Add support for masking flags: 23/10/07; SJT
```

6.48 smei_sequence::menu2

Source: smei_sequence/smei_sequence_menu2.pro

NAME:

```
SMEI_SEQUENCE::MENU
```

PURPOSE:

To interactively define a SMEI sequence

CATEGORY:

```
SMEI_SEQUENCE
```

CALLING SEQUENCE:

```
status = seqref -> menu([flag, group=group])
```

INPUTS:

OPTIONAL INPUTS:

KEYWORD PARAMETERS:

group	long	A possible group leader for the menu
/no_progress		If set, then disable the progress bars (useful if slow network means the progress bars are slowing operation).

OPTIONAL OUTPUTS:

flag	1 or 0 for success or failure (needed when called from the constructor)
------	---

RESTRICTIONS:

If any managed widgets are present then the GROUP keyword MUST be present if the sequence doesn't already exist.

MODIFICATION HISTORY:

Original: 16/12/02; SJT
 Rearranged layout: 6/1/03; SJT
 Added progress bar: 10/1/03; SJT
 Added print option: 16/5/03; SJT
 Redesigned: 11/6/03; SJT
 Handle 3-state grid setting: 17/6/03; SJT
 Renamed menu2 and changed to use tab widgets (for IDL >= 5.6): 26/11/03; SJT
 Merge movie types into a single button: 31/3/04; SJT
 Add support for background model subtraction: 7/5/04; SJT
 Add 3-state date settings: 3/6/05; SJT
 Add no_progress keyword: 25/8/05; SJT
 Add support for masking flags: 23/10/07; SJT
 Added support for shifted rectangular maps: 23/11/09; SJT

6.49 smei_sequence::mk_pixmap

Source: smei_sequence/smei_sequence_mk_pixmap.pro

NAME:

SMEI_SEQUENCE::MK_PIXMAP

PURPOSE:

To create a pixmap window in which to store SMEI images.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

```
seqid->mk_pixmap
```

KEYWORD PARAMETERS:

```
/destroy      Delete the pixmap window (needed if images are
              added or removed from the sequence)
/clear        Clear the pixmap flags of the images (when
              display options are changed)
```

SIDE EFFECTS:

```
A pixmap window large enough to store all the images is
created
```

MODIFICATION HISTORY:

```
Original: 11/12/02; SJT
```

6.50 smei_sequence::model_menu

Source: smei_sequence/smei_sequence_model_menu.pro

NAME:

```
SMEI_SEQUENCE__MODEL_MENU
```

PURPOSE:

```
Select a background model set and subtract it.
```

CATEGORY:

```
SMEI_SEQUENCE
```

CALLING SEQUENCE:

```
seqref -> model_menu[, group = group]
```

KEYWORD PARAMETERS:

```
group    long    A possible group leader for the menu
```

SIDE EFFECTS:

```
A background is subtracted from the sequence.
```

RESTRICTIONS:

```
Can only be applied to uncompact sequences.
```

MODIFICATION HISTORY:

```
Original: 7/5/04; SJT
```

```
Add ability to change model directory: 23/11/04; SJT
```

6.51 smei_sequence::movie_menu

Source: smei_sequence/smei_sequence_movie_menu.pro

NAME:

```
SMEI_SEQUENCE::MOVIE_MENU
```

PURPOSE:

GUI to set up making a SMEI sequence movie

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> movie_menu

KEYWORD PARAMETERS:

group long A group leader for the widgets
/no_progress If set, then disable the progress bars (useful if slow network means the progress bars are slowing operation).

MODIFICATION HISTORY:

Original (After avmv version): 31/3/04; SJT
Add ffmpeg & codec selections: 7/6/05; SJT
Remove Codec selection again: 10/6/06; SJT
Add no_progress keyword: 25/8/05; SJT
Add support for animated GIFs: 18/3/08; SJT

6.52 smei_sequence::peek

Source: smei_sequence/smei_sequence_peek.pro

NAME:

SMEI_SEQUENCE::PEEK

PURPOSE:

Debugging tool to allow peeking into a SMEI_SEQUENCE object.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

imref -> peek

MODIFICATION HISTORY:

Original: 16/1/03; SJT

6.53 smei_sequence::png_menu

Source: smei_sequence/smei_sequence_png_menu.pro

NAME:

SMEI_SEQUENCE::PNG_MENU

PURPOSE:

Set the filename stem for saving a SMEI sequence to a series of PNG files.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref->png_menu[, group=group]

KEYWORD PARAMETERS:

group long A group leader for the widgets
/no_progress If set, then disable the progress bars (useful if slow network means the progress bars are slowing operation).

MODIFICATION HISTORY:

Original: 16/9/03; SJT
Add no_progress keyword: 25/8/05; SJT

6.54 smei_sequence::print

Source: smei_sequence/smei_sequence_print.pro

NAME:

SMEI_SEQUENCE::PRINT

PURPOSE:

Make a PostScript file of a SMEI sequence

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> print

KEYWORD PARAMETERS:

/grid If specified, then add a grid to the images
date int Date format for the images.
/file If specified, then add the filename to the images.
/add_range If set, then add the range to the plot.
range float The min and max values for the display (implies adding the range to the plot)
colour_table int The colour table to use. (-1 or unset to use the sequence map)
xsize float The size in cm of the x-dimension of the page
ysize float The size in cm of the y-dimension of the page
/no_colour Do not generate colour PS (equivalent to colour_table=0)
/portrait Print in portrait mode.
/landscape Print in landscape mode
plot_file str Specify a filename other than the default idl.ps
/encapsulated If set, then make an eps file (handled

explicitly as other things are done differently for eps).

ncolumns int The number of columns to arrange the images
 nrows int The number of rows to arrange the images
 /logarithmic If set, then use a logarithmic mapping of the colour table.
 /in_rows If set, then go arrange the frames in rows rather than in columns.
 /cmyk If set, then use the CMYK colour model

Any keywords to DEVICE that do not clash with the above and which are accepted by the PS device may be passed.

SIDE EFFECTS:

A PostScript file is generated.

RESTRICTIONS:

Pro-tem it doesn't print the file.

MODIFICATION HISTORY:

Original (after image version): 16/5/03; SJT
 Add row orientation: 21/7/03; SJT
 Use print options: 22/7/03; SJT
 Add spooling of print file: 6/6/05; SJT
 Add cmyk option: 3/6/10; SJT

6.55 smei_sequence::print_menu

Source: smei_sequence/smei_sequence_print_menu.pro

NAME:

SMEI_SEQUENCE::PRINT_MENU

PURPOSE:

GUI to control printing of a SMEI sequence.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> print_menu

KEYWORD PARAMETERS:

group long Widget ID of a group leader
 /block If set, then block any other widget events.

SIDE EFFECTS:

A print file may be generated.

MODIFICATION HISTORY:

Original: 11/12/02; SJT
 Add log scaling: 10/1/03; SJT

Add plane selection & extend grids: 20/6/03; SJT
 Add no-data index: 11/7/03; SJT
 Add off_sky colour: 18/7/03; SJT
 Use print_options: 22/7/03; SJT
 Add kill range support: 29/3/04; SJT
 Add 3-state date settings: 3/6/05; SJT
 Add spooling options: 6/6/05; SJT
 Add cmyk options: 3/6/10; SJT

6.56 smei_sequence::profile_mask_menu

Source: smei_sequence/smei_sequence_profile_mask_menu.pro

SMEI_SEQUENCE::PROFILE_MASK_MENU

PURPOSE:

Menu to set up the contaminant flags to mask.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> profile_mask_menu, state[, group=group]

ARGUMENT:

state struct The profile options setting structure.

KEYWORD PARAMETERS:

group long A possible group leader for the menu
 /block If set, then the widget blocks other
 events. (So it pauses a movie for example).

RESTRICTIONS

Only applicable to Pipe 2.0 images

MODIFICATION HISTORY:

Original (after smei_sequence::flags_menu): 8/7/09; SJT

6.57 smei_sequence::profile_menu

Source: smei_sequence/smei_sequence_profile_menu.pro

NAME:

SMEI_SEQUENCE::PROFILE_MENU

PURPOSE:

Create a radial or circumferential profile of the images in a smei sequence.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> profile_menu[, group = group]

KEYWORD PARAMETERS:

group long The widget ID of a group leader for the menu.

MODIFICATION HISTORY:

Original: 15/12/03; SJT

Add plane selection: 12/1/04; SJT

Add masking menu and missing=nan option: 8/7/09; SJT

6.58 smei_sequence::range_menu

Source: smei_sequence/smei_sequence__range_menu.pro

NAME:

SMEI_SEQUENCE::RANGE_MENU

PURPOSE:

Simple GUI to set display range for SMEI data.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref->range_menu

KEYWORD PARAMETERS:

group long Widget ID of a group leader.
/block If set, then the widget blocks other events. (So it pauses a movie for example).

SIDE EFFECTS:

A widget menu is generated, and the range settings of the sequence may be changed.

MODIFICATION HISTORY:

Original: 11/12/02; SJT

Add logarithmic support: 10/1/03; SJT

Add no-data index: 11/7/03; SJT

Add off_sky colour: 18/7/03; SJT

Add Kill ranges: 29/3/04; SJT

6.59 smei_sequence::save

Source: smei_sequence/smei_sequence__save.pro

NAME:

SMEI_SEQUENCE::SAVE

PURPOSE:

Save a SMEI sequence to an IDL save file.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> save[, file]

INPUTS:

OPTIONAL INPUTS:

file string The file to which to save the sequence.

KEYWORD PARAMETERS:

/menu If set, then use a dialogue box to choose the file. (If file is provided it will be treated as a filter).

group long A possible group leader (strictly dialogue parent) for the menu.

MODIFICATION HISTORY:

Original: 16/12/02; SJT

6.60 smei_sequence::set_annotations

Source: smei_sequence/smei_sequence_set_annotations.pro

NAME:

SMEI_SEQUENCE::SET_ANNOTATIONS

PURPOSE:

Select which annotations to add to the plot.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> set_annotations, <selector keys>

KEYWORD PARAMETERS:

grid Select plotting of a grid or not
 date Select adding the date (0=none, 1=DoY, 2=Y-M-D)
 file Select adding the filename
 range Select adding the range.

MODIFICATION HISTORY:

Original: 12/12/02; SJT
 Handle 3-state grid setting: 17/6/03; SJT
 Handle 3-state date setting: 3/6/05; SJT

6.61 smei_sequence::set_colour_map

Source: smei_sequence/smei_sequence__set_colour_map.pro

NAME:

SMEI_SEQUENCE::SET_COLOUR_MAP

PURPOSE:

Load and store colour map to use when plotting SMEI images

CATEGORY:

SMEI_SEQUENCE

KEYWORD PARAMETERS:

/menu		If set, then load a table using xloadct.
group	long	A widget group leader for xloadct
table	int	If set, then load the numbered colour table
map	byte	A 256x3 byte array that contains an explicit colour map to use
redraw	int	A named variable to return the redraw requirement.

CALLING SEQUENCE:

seqref -> set_colour_map

MODIFICATION HISTORY:

Original: 9/12/02; SJT
Merge with set_colour_table and allow explicit tables:
19/12/02; SJT
Made call to XLOADCT modal so that it stores the colour table correctly: 17/9/03; SJT
Return redraw state if needed: 23/11/09; SJT

6.62 smei_sequence::set_data_range

Source: smei_sequence/smei_sequence__set_data_range.pro

NAME:

SMEI_SEQUENCE::SET_DATA_RANGE

PURPOSE:

To set the data range to show in plots.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> set_data_range, min, max
or
seqref -> set_data_range, range

INPUTS:

min	float	The lower bound to set
max	float	The upper bound to set
range	float	2-element array containing the above.

KEYWORD PARAMETERS:

logarithmic	int	Whether to use logarithmic scaling or not.
kill	float	Set a range of values outside which data are considered bad (2-element array or a scalar == [-kill, kill])

MODIFICATION HISTORY:

Original: 10/12/02; SJT
 Renamed: 12/12/02; SJT
 Add logarithmic option: 10/1/03; SJT
 Add KILL keyword: 229/3/04; SJT

6.63 smei_sequence::set_delay

Source: smei_sequence/smei_sequence__set_delay.pro

NAME:

SMEI_SEQUENCE::SET_DELAY

PURPOSE:

Set the inter-frame interval for a SMEI sequence.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> set_delay, delay

INPUTS:

delay float The inter-frame delay in seconds.

RESTRICTIONS

Delays less than 0.05s cannot be set. This is to prevent the possibility of an event pile-up

MODIFICATION HISTORY:

Original: 19/12/02; SJT

6.64 smei_sequence::set_file

Source: smei_sequence/smei_sequence__set_file.pro

NAME:

SMEI_SEQUENCE::SET_FILE

PURPOSE:

Sets the filename for saving a SMEI sequence

CATEGORY:
SMEI_SEQUENCE

CALLING SEQUENCE:
seqref -> set_file, file

INPUTS:
file string The filename to use.

MODIFICATION HISTORY:
Original: 17/12/02; SJT

6.65 smei_sequence::set_first

Source: smei_sequence/smei_sequence__set_first.pro

NAME:
SMEI_SEQUENCE::SET_FIRST

PURPOSE:
Set the first image of a SMEI sequence

CATEGORY:
SMEI_SEQUENCE

CALLING SEQUENCE:
imref = seqref->set_first, imref

INPUTS:
imref objref A reference to the first image in the sequence.

MODIFICATION HISTORY:
Original: 9/12/02; SJT

6.66 smei_sequence::set_flags

Source: smei_sequence/smei_sequence__set_flags.pro

NAME:
SMEI_SEQUENCE::SET_FLAGS

PURPOSE:
Set the masking flags for a SMEI sequence.

CATEGORY:
SMEI_SEQUENCE

CALLING SEQUENCE:

```
seqref -> set_flags, flags
```

INPUTS:

```
flags  uint    The masking flags
```

MODIFICATION HISTORY:

```
Original (after set_delay): 23/10/07; SJT
```

6.67 smei_sequence::set_last

Source: smei_sequence/smei_sequence__set_last.pro

NAME:

```
SMEI_SEQUENCE::SET_LAST
```

PURPOSE:

```
Set the last image of a SMEI sequence
```

CATEGORY:

```
SMEI_SEQUENCE
```

CALLING SEQUENCE:

```
imref = seqref->set_last, imref
```

INPUTS:

```
imref  objref  A reference to the last image in the sequence.
```

MODIFICATION HISTORY:

```
Original: 9/12/02; SJT
```

6.68 smei_sequence::set_name

Source: smei_sequence/smei_sequence__set_name.pro

NAME:

```
SMEI_SEQUENCE::SET_NAME
```

PURPOSE:

```
Set name of a SMEI sequence
```

CATEGORY:

```
SMEI_SEQUENCE
```

CALLING SEQUENCE:

```
seqref -> set_name, name
```

INPUTS:

```
name    string  The name of the sequence
```


MODIFICATION HISTORY:
 Original: 10/12/02; SJT

6.69 smei_sequence::set_null_index

Source: smei_sequence/smei_sequence__set_null_index.pro

NAME:
 SMEI_SEQUENCE::SET_NULL_INDEX

PURPOSE:
 Set the colour indices to use for missing data/out of sky.

CATEGORY:
 SMEI_SEQUENCE

CALLING SEQUENCE:
 seqref -> set_null_index, index[, /print|/screen]

INPUTS:
 index byte The colour index or indices to use. (If no key
 is given, then it should be a 2x2-element array,
 else a scalar)

KEYWORD PARAMETERS:
 /screen If set, then only set the index for screen displays.
 /print If set, then only set the index for printouts.
 /off_sky If set, then set the value to use for
 points outside the sky area

MODIFICATION HISTORY:
 Original: 11/7/03; SJT
 Separate in and out of sky: 18/7/03; SJT

6.70 smei_sequence::set_plane

Source: smei_sequence/smei_sequence__set_plane.pro

NAME:
 SMEI_SEQUENCE::SET_PLANE

PURPOSE:
 Set the plane to show in a SMEI sequence

CATEGORY:
 SMEI_SEQUENCE

CALLING SEQUENCE:
 seqref -> set_plane, plane

INPUTS:
 plane int The plane to display.

MODIFICATION HISTORY:
 Original (after set_delay): 16/5/03; SJT

6.71 smei_sequence::set_print_opts

Source: smei_sequence/smei_sequence__set_print_opts.pro

NAME:
 SMEI_SEQUENCE::SET_PRINT_OPTS

PURPOSE:
 Set the print-specific options for a sequence

CATEGORY:
 SMEI_SEQUENCE

CALLING SEQUENCE:
 seqref -> set_print_opts, <keys>

KEYWORD PARAMETERS:

columns	int	Set the number of columns in the layout
rows	int	Set the number of rows in the layout.
order	bool	Set the order in which the images are to be printed
type	int	Set the type of postscript file to generate (0=landscape, 1 = portrait, 2 = eps)
file	string	Set the filename to use for the output.
xsize	float	Set the x-size of the printed area
ysize	float	Set the y-size of the printed area.
print	string	Set the printing command
preview	string	Set the preview command.
cmyk	bool	Set the colour model.

MODIFICATION HISTORY:
 Original: 22/7/03; SJT
 Add print & preview keys: 3/6/05; SJT
 Add cmyk key: 3/6/10; SJT

6.72 smei_sequence::set_pxm_hwm

Source: smei_sequence/smei_sequence__set_pxm_hwm.pro

NAME:
 SMEI_SEQUENCE::SET_PXM_HWM

PURPOSE:
 Set the high-water mark of a SMEI sequence pixmap.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> set_pxm_hwm, hwm

INPUTS:

hwm long The new high water mark (2 element array).

MODIFICATION HISTORY:

Original: 11/12/02; SJT

6.73 smei_sequence::set_roll

Source: smei_sequence/smei_sequence__set_roll.pro

NAME:

SMEI_SEQUENCE::SET_ROLL

PURPOSE:

To set whether to roll around when scrolling through a sequence.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> set_roll, roll

INPUTS:

roll int Set whether to roll or not.

NOTES:

The negated storage is to preserve the original behaviour as the default.

MODIFICATION HISTORY:

Original: 20/7/10; SJT

6.74 smei_sequence::set_shift

Source: smei_sequence/smei_sequence__set_shift.pro

NAME:

SMEI_SEQUENCE::SET_SHIFT

PURPOSE:

To set the shift factor for showing a smei sequence.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> set_shift, shift

INPUTS:

shift int Set the shift in right-angles for displaying
 rectangular projection images.

KEYWORD PARAMETERS:

/north Make the central axis North (shift=0)
/east Make the central axis East (shift=1)
/south Make the central axis South (shift=2)
/west Make the central axis West (shift=3)

MODIFICATION HISTORY:

Original: 28/7/03; SJT

6.75 smei_sequence::set_sourcedir

Source: smei_sequence/smei_sequence__set_sourcedir.pro

NAME:

SMEI_SEQUENCE::SET_SOURCEDIR

PURPOSE:

Sets the dirname for reading to a SMEI sequence

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> set_sourcedir, sourcedir

INPUTS:

sourcedir string The dirname to use.

MODIFICATION HISTORY:

Original: 29/10/03; SJT

6.76 smei_sequence::set_window

Source: smei_sequence/smei_sequence__set_window.pro

NAME:

SMEI_SEQUENCE::SET_WINDOW

PURPOSE:

Set window index to use when plotting SMEI images

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> set_window, window

INPUTS:

window long The window index

MODIFICATION HISTORY:

Original: 9/12/02; SJT

6.77 smei_sequence::set_zoom

Source: smei_sequence/smei_sequence__set_zoom.pro

NAME:

SMEI_SEQUENCE::SET_ZOOM

PURPOSE:

To set the zoom factor for showing a smei sequence.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> set_zoom, factor

INPUTS:

factor int The factor by which to scale the images.
The for reductions, use the inverse key. (0 is
the same as 1)

KEYWORD PARAMETERS:

/inverse If set, then the factor is a reduction.
smooth Controls whether smoothing will be done on
rebinning the image (Note this is only
applicable to zoom-in).

MODIFICATION HISTORY:

Original: 28/7/03; SJT

6.78 smei_sequence::show

Source: smei_sequence/smei_sequence__show.pro

NAME:

SMEI_SEQUENCE::SHOW

PURPOSE:

Show a sequence of SMEI images, better version.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref->show[, image]

OPTIONAL INPUTS:

image int The location of a single image to select. If this is specified then that image will be the first shown and the movie will be started in a paused state.

KEYWORD PARAMETERS:

delay float The wait between images
group long Widget ID of a group leader for the widget.

MODIFICATION HISTORY:

Original: 11/12/02; SJT
Add image argument and send drag events from the slider: 19/12/02; SJT
Add reverse play and hiding options: 15/1/03; SJT
Handle 3-state grid setting: 17/6/03; SJT
Add ability to use a wheelmouse to scroll though a movie: 19/6/03; SJT
Extend wheel mouse to mark mode and flag mark mode with a different cursor: 2/7/03; SJT
Rationalize and fix updates on option changes: 6/8/04; SJT
Add blinking capability im mark mode: 6/8/04; SJT
Print location stats on ctrl or shift click: 15/9/04; SJT
Add 3-state date settings: 3/6/05; SJT
Add support for masking flags: 23/10/07; SJT
Handle systems where wheel events are distinct from button events: 10/12/07; SJT
Only show the masking option if it's applicable: 25/1/08; SJT
Added support for shifted rectangular maps: 23/11/09; SJT
Add keyboard events (only forward & back arrows so far): 26/5/10; SJT
Add control to enable/disable wrapping of scrolling at the ends of the sequence: 20/7/10; SJT

6.79 smei_sequence::show_info

Source: smei_sequence/smei_sequence__show_info.pro

NAME:

SMEI_SEQUENCE::SHOW_INFO

PURPOSE:

Print basic information about a SMEI sequence

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> show_info

KEYWORD PARAMETERS:

group If this is a valid widget ID, then the info will be displayed in a pop-up window, otherwise it is printed on the terminal.

MODIFICATION HISTORY:

Original: 19/5/03; SJT

6.80 smei_sequence::sort

Source: smei_sequence/smei_sequence__sort.pro

NAME:

SMEI_SEQUENCE::SORT

PURPOSE:

Sorts the images of a SMEI sequence into time order.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> sort

SIDE EFFECTS:

The order of the images in the sequence is changed.

PROCEDURE:

Simple minded slide sort, this will still sort the biggest mess that something with 1GB can cope with in well under a second.

MODIFICATION HISTORY:

Original: 13/1/03; SJT

6.81 smei_sequence::subtract_model

Source: smei_sequence/smei_sequence__subtract_model.pro

NAME:

smei_sequence::subtract_model

PURPOSE:

Subtract a background model from a smei sequence

CATEGORY:

smei_sequence

CALLING SEQUENCE:

seqref -> subtract_model

INPUTS:

model string The background-model identifier

6.82 smei_sequence::vmain

Source: smei_sequence/smei_sequence_vmain.pro

smei_sequence::vmain

Put a value into a top-level variable.

Usage:

seqref -> vmain, value[, name]

Arguments:

value	input	any	The value to be sent up to the main program level
name	input	string	The name of the variable to use.

Keywords:

default_name	input	string	A default value for the variable name
group	input	long	The widget ID of a calling widget.

Notes:

If the name argument is not given, then the user is prompted for a name (possibly with a default).
If the group keyword is given, then the prompt is via a widget interface, otherwise it is via the command line.

History:

Original: 13/7/01; SJT
Add ability to send to a file: 19/12/02; SJT
Move to smei_sequence method as save-to-file is detail specific:
6/1/02; SJT

6.83 smei_sequence::zoom_menu

Source: smei_sequence/smei_sequence_zoom_menu.pro

NAME:

SMEI_SEQUENCE::ZOOM_MENU

PURPOSE:

Menu to set the zoom factor for showing a smei sequence.

CATEGORY:

SMEI_SEQUENCE

CALLING SEQUENCE:

seqref -> zoom_menu

KEYWORD PARAMETERS:

group long Group leader of the widget heirarchy

MODIFICATION HISTORY:

Original: 28/7/03; SJT

7 Operators

7.1 smei_operator::cleanup

Source: smei_operator/smei_operator__cleanup.pro

NAME:

SMEI_OPERATOR::CLEANUP

PURPOSE:

Destructor for a smei operator

CATEGORY:

SMEI_OPERATOR

CALLING SEQUENCE:

obj_destroy, sop

INPUTS:

sop objref The object to be destroyed

MODIFICATION HISTORY:

Original: 22/10/03; SJT

Delete transient arguments: 5/11/03; SJT

7.2 smei_operator::compute

Source: smei_operator/smei_operator__compute.pro

NAME:

SMEI_OPERATOR::COMPUTE

PURPOSE:

Generate a SMEI_SEQUENCE from an operator.

CATEGORY:

SMEI_OPERATOR

CALLING SEQUENCE:

sop -> compute

MODIFICATION HISTORY:

Original: 22/10/03; SJT

Get times etc. from first multi-image sequence if available:

4/11/03; SJT

Pass filename of "dominant" file down: 1/12/03; SJT

Add %median operator: 19/2/04; SJT

Add %csum operator: 8/10/09; SJT

7.3 smei_operator::compute_average

Source: smei_operator/smei_operator__compute_average.pro

NAME:

SMEI_OPERATOR::COMPUTE_AVERAGE

PURPOSE:

Evaluate the %mean operation on a SMEI_OPERATOR

CATEGORY:

SMEI_OPERATOR

CALLING SEQUENCE:

sop -> compute_average

MODIFICATION HISTORY:

Original: 23/10/03; SJT

Pass projection information: 13/2/04; SJT

Handle Pipe 2 images: 24/10/07; SJT

7.4 smei_operator::compute_csum

Source: smei_operator/smei_operator__compute_csum.pro

NAME:

SMEI_OPERATOR::COMPUTE_CSUM

PURPOSE:

Evaluate the %csum operation on a SMEI_OPERATOR

CATEGORY:

SMEI_OPERATOR

CALLING SEQUENCE:
sop -> compute_csum

MODIFICATION HISTORY:
Original (after compute_sum): 8/10/09; SJT

7.5 smei_operator::compute_max

Source: smei_operator/smei_operator__compute_max.pro

NAME:
SMEI_OPERATOR::COMPUTE_MAX

PURPOSE:
Evaluate the %max operation on a SMEI_OPERATOR

CATEGORY:
SMEI_OPERATOR

CALLING SEQUENCE:
sop -> compute_max

MODIFICATION HISTORY:
Original: 23/10/03; SJT
Pass projection information: 13/2/04; SJT
Modify for Pipe 2. images: 24/10/07; SJT

7.6 smei_operator::compute_median

Source: smei_operator/smei_operator__compute_median.pro

NAME:
SMEI_OPERATOR::COMPUTE_MEDIAN

PURPOSE:
Evaluate the %median operation on a SMEI_OPERATOR

CATEGORY:
SMEI_OPERATOR

CALLING SEQUENCE:
sop -> compute_median

RESTRICTIONS:
This is likely to run out of memory for big sequences.

MODIFICATION HISTORY:
Original (after compute_average): 19/2/04; SJT
Support Pipe 2 images: 24/10/07; SJT

7.7 smei_operator::compute_min

Source: smei_operator/smei_operator__compute_min.pro

NAME:

SMEI_OPERATOR::COMPUTE_MIN

PURPOSE:

Evaluate the %min operation on a SMEI_OPERATOR

CATEGORY:

SMEI_OPERATOR

CALLING SEQUENCE:

sop -> compute_min

MODIFICATION HISTORY:

Original: 23/10/03; SJT

Pass projection information: 13/2/04; SJT

Modify for Pipe 2. images: 24/10/07; SJT

7.8 smei_operator::compute_sum

Source: smei_operator/smei_operator__compute_sum.pro

NAME:

SMEI_OPERATOR::COMPUTE_SUM

PURPOSE:

Evaluate the %sum operation on a SMEI_OPERATOR

CATEGORY:

SMEI_OPERATOR

CALLING SEQUENCE:

sop -> compute_sum

MODIFICATION HISTORY:

Original: 23/10/03; SJT

Pass projection information: 13/2/04; SJT

Handle Pipe 2 images: 24/10/07; SJT

7.9 smei_operator::concatenate

Source: smei_operator/smei_operator__concatenate.pro

NAME:

SMEI_OPERATOR::CONCATENATE

PURPOSE:

Evaluate the %cat operation on a SMEI_OPERATOR

CATEGORY:

SMEI_OPERATOR

CALLING SEQUENCE:

sop -> concatenate

MODIFICATION HISTORY:

Original: 5/11/03; SJT

7.10 smei_operator__define

Source: smei_operator/smei_operator__define.pro

NAME:

SMEI_OPERATOR__DEFINE

PURPOSE:

To define the structure of a smei operator.

CATEGORY:

SMEI_OPERATOR

CALLING SEQUENCE:

<implicit>

ELEMENTS:

operator	string	The operator or function to apply.
class	int	The class of operator (function or op etc.) this is a convenience as it can be determined from the rest of the elements.
arg_count	int	How many arguments.
arglist	pointer	A pointer to a list of arguments for the operator
extras	ptr	A pointer to any keywords (function ops only).
array_count	int	The number of elements returned by any array returning arguments.
sequence	objref	The generated sequence.
is_cumulative	byte	A flag to indicate if the operator returns a sequence or an image.

MODIFICATION HISTORY:

Original (this version is a clean-sheet rethink of the whole operations system): 22/10/03; SJT

7.11 smei_operator::eval

Source: smei_operator/smei_operator__eval.pro

NAME:

SMEI_OPERATOR::EVAL

PURPOSE:

Return a value from a SMEI operator.

CATEGORY:

SMEI_OPERATOR

CALLING SEQUENCE:

value = sop -> eval(index)

KEYWORDS:

/ancil Return the ancillary data
/flags Return the contaminant flag data.

INPUTS:

index int The index of the value to return.

MODIFICATION HISTORY:

Original: 22/10/03; SJT
Add ancil and flags keywords: 24/10/07; SJT

7.12 smei_operator::get_arg_count

Source: smei_operator/smei_operator__get_arg_count.pro

NAME:

SMEI_OPERATOR::GET_ARG_COUNT

PURPOSE:

To return the number of arguments of a smei operator

CATEGORY:

SMEI_OPERATOR

CALLING SEQUENCE:

count = sop -> get_arg_count()

OUTPUTS:

count int The number of arguments to the operator.

MODIFICATION HISTORY:

Original: 22/10/03; SJT

7.13 smei_operator::get_argument

Source: smei_operator/smei_operator__get_argument.pro

NAME:

SMEI_OPERATOR::GET_ARGUMENT

PURPOSE:

To return an argument of the operator

CATEGORY:

SMEI_OPERATOR

CALLING SEQUENCE:

argument = sop -> get_argument(index)

INPUTS:

index int Which argument is required.

OUTPUTS:

argument objref The operator's argument

MODIFICATION HISTORY:

Original: 22/10/03; SJT

7.14 smei_operator::get_class

Source: smei_operator/smei_operator__get_class.pro

NAME:

SMEI_OPERATOR::GET_CLASS

PURPOSE:

To return the operator class.

CATEGORY:

SMEI_OPERATOR

CALLING SEQUENCE:

class = sop -> get_class()

OUTPUTS:

class int The operator's class.

MODIFICATION HISTORY:

Original: 22/10/03; SJT

7.15 smei_operator::get_count

Source: smei_operator/smei_operator__get_count.pro

NAME:

SMEI_OPERATOR::GET_COUNT

PURPOSE:

To return the length of sequence that will be returned by evaluating the operator.

CATEGORY:

SMEI_OPERATOR

CALLING SEQUENCE:

count = sop -> get_count()

OUTPUTS:

count int The length of the sequence that will be returned by evaluating the operator

MODIFICATION HISTORY:

Original: 22/10/03; SJT

7.16 smei_operator::get_operator

Source: smei_operator/smei_operator__get_operator.pro

NAME:

SMEI_OPERATOR::GET_OPERATOR

PURPOSE:

To return the operator operator.

CATEGORY:

SMEI_OPERATOR

CALLING SEQUENCE:

operator = sop -> get_operator()

OUTPUTS:

operator string The operator's operator.

MODIFICATION HISTORY:

Original: 22/10/03; SJT

7.17 smei_operator::get_sequence

Source: smei_operator/smei_operator__get_sequence.pro

NAME:

SMEI_OPERATOR::GET_SEQUENCE

PURPOSE:

Return the SMEI sequence generated by the operator

CATEGORY:

SMEI_OPERATOR

CALLING SEQUENCE:

seqref = sop -> get_sequence()

KEYWORD PARAMETERS:

/destroy If set, then the operator will be destroyed
 before returning.

OUTPUTS:

seqref objref The sequence object reference

MODIFICATION HISTORY:

Original: 23/10/03; SJT

7.18 smei_operator::init

Source: smei_operator/smei_operator__init.pro

NAME:

SMEI_OPERATOR::INIT

PURPOSE:

Constructor method for a SMEI operator.

CATEGORY:

SMEI_OPERATOR

CALLING SEQUENCE:

sop = obj_new('SMEI_OPERATOR', op, arglist)

INPUTS:

op string The operator (or function) to apply
arglist obj An array of SMEI_OPERATOR_ARGUMENT objects.

KEYWORD PARAMETERS:

If the operator is a function, then any keywords to the
function are accepted.

OUTPUTS:

sop The SMEI_OPERATOR object generated.

MODIFICATION HISTORY:

Original: 22/10/03; SJT
Add median special OP, and correct flagging in %cat: 19/02/04;
SJT

8 Operator Arguments

8.1 smei_operator_argument::cleanup

Source: smei_operator/smei_operator_argument/smei_operator_argument__cleanup.pro

NAME:

SMEI_OPERATOR_ARGUMENT::CLEANUP

PURPOSE:

Destructor for a smei operator argument

CATEGORY:

SMEI_OPERATOR_ARGUMENT

CALLING SEQUENCE:

obj_destroy, soparg

INPUTS:

soparg objref The object to be destroyed

MODIFICATION HISTORY:

Original: 22/10/03; SJT

8.2 smei_operator_argument__define

Source: smei_operator/smei_operator_argument/smei_operator_argument__define.pro

NAME:

SMEI_OPERATOR_ARGUMENT__DEFINE

PURPOSE:

Structure definition for an argument to a smei operator

CATEGORY:

SMEI_OPERATOR_ARGUMENT

CALLING SEQUENCE:

<implicit>

ELEMENTS:

value	pointer	One of (a) a smei_sequence, (b) a smei_image (c) a smei operator or (d) a regular numeric value which will be used in the operation.
class	int	A flag to indicate which of the above it is. 1 = sequence 2 = image 3 = operator 4 = number
plane	int	Which plane of the image to use. (sequences

		and images).
range	int[3]	Start image, stop image and stride (sequences only)
transient	byte	Whether this arg has been created transiently, used by the interpreters to flag that it should be deleted with its operator

MODIFICATION HISTORY:

Original: 22/10/03; SJT
 Added transient flag: 5/11/03; SJT

8.3 smei_operator_argument::eval

Source: smei_operator/smei_operator_argument/smei_operator_argument__eval.pro

NAME:

SMEI_OPERATOR_ARGUMENT::EVAL

PURPOSE:

Return the value from a smei operator argument

CATEGORY:

SMEI_OPERATOR_ARGUMENT

CALLING SEQUENCE:

value = arg->eval(index)

INPUTS:

index int Which element of the value is needed.

KEYWORDS:

/ancil If set, then return the ancillary data of images, sequences or operators.
 /flag If set, then return the contaminant flags of images, sequences or operators

MODIFICATION HISTORY:

Original: 22/10/03; SJT
 Handle different dimensionalities of numericals:6/11/03; SJT
 Add options to return ancillary data or flags: 24/10/07; SJT

8.4 smei_operator_argument::get_class

Source: smei_operator/smei_operator_argument/smei_operator_argument__get_class.pro

NAME:

SMEI_OPERATOR_ARGUMENT::GET_CLASS

PURPOSE:

Return the class of argument that this is.

CATEGORY:

SMEI_OPERATOR_ARGUMENT

CALLING SEQUENCE:

class = arg -> get_class()

OUTPUTS:

class int The class of argument that this is

MODIFICATION HISTORY:

Original: 22/10/03; SJT

8.5 smei_operator_argument::get_count

Source: smei_operator/smei_operator_argument/smei_operator_argument__get_count.pro

NAME:

SMEI_OPERATOR_ARGUMENT::GET_COUNT

PURPOSE:

Return how many values will be generated by evaluating the argument.

CATEGORY:

SMEI_OPERATOR_ARGUMENT

CALLING SEQUENCE:

count = arg -> get_count()

OUTPUTS:

count int The number of elements generated by the evaluation.

MODIFICATION HISTORY:

Original: 22/10/03; SJT

Use get_range method for class=1: 31/10/03; SJT

Handle different dimensionalities of numericals:6/11/03; SJT

8.6 smei_operator_argument::get_image

Source: smei_operator/smei_operator_argument/smei_operator_argument__get_image.pro

NAME:

SMEI_OPERATOR_ARGUMENT::GET_IMAGE

PURPOSE:

Return a smei image from a smei operator argument

CATEGORY:

SMEI_OPERATOR_ARGUMENT

CALLING SEQUENCE:

```
value = arg->get_image(index)
```

INPUTS:

```
index    int        Which element of the value is needed.
```

MODIFICATION HISTORY:

```
Original: 22/10/03; SJT
```

```
Handle different dimensionalities of numericals:6/11/03; SJT
```

8.7 smei_operator_argument::get_plane

Source: smei_operator/smei_operator_argument/smei_operator_argument__get_plane.pro

NAME:

```
SMEI_OPERATOR_ARGUMENT::GET_PLANE
```

PURPOSE:

```
Return how many values will be generated by evaluating the  
argument.
```

CATEGORY:

```
SMEI_OPERATOR_ARGUMENT
```

CALLING SEQUENCE:

```
plane = arg -> get_plane()
```

OUTPUTS:

```
plane    int        The image plane to use (for images and sequences)
```

MODIFICATION HISTORY:

```
Original: 22/10/03; SJT
```

8.8 smei_operator_argument::get_range

Source: smei_operator/smei_operator_argument/smei_operator_argument__get_range.pro

NAME:

```
SMEI_OPERATOR_ARGUMENT::GET_RANGE
```

PURPOSE:

```
Return how many values will be generated by evaluating the  
argument.
```

CATEGORY:

```
SMEI_OPERATOR_ARGUMENT
```

CALLING SEQUENCE:

```
range = arg -> get_range()
```

KEYWORD PARAMETERS:

```
/start  If set, then return only the initial image number
/stop   If set, then return only the final image number
/step   If set, then return only the step between images.
```

OUTPUTS:

```
range  int      The image range to use (for sequences)
```

MODIFICATION HISTORY:

```
Original: 22/10/03; SJT
Allow limit on sequences to be negative (count from end):
31/10/03; SJT
```

8.9 smei_operator_argument::get_size

Source: smei_operator/smei_operator_argument/smei_operator_argument__get_size.pro

NAME:

```
SMEI_OPERATOR_ARGUMENT::GET_SIZE
```

PURPOSE:

```
Return the effective size of a smei operator argument
```

CATEGORY:

```
SMEI_OPERATOR_ARGUMENT
```

CALLING SEQUENCE:

```
size = argref->get_size()
```

OUTPUTS:

```
size  int/long The size of the argument image
```

MODIFICATION HISTORY:

```
Original: 19/2/04; SJT
```

8.10 smei_operator_argument::get_transient

Source: smei_operator/smei_operator_argument/smei_operator_argument__get_transient.pro

NAME:

```
SMEI_OPERATOR_ARGUMENT::GET_TRANSIENT
```

PURPOSE:

```
Return whether this object was transiently created or not.
```

CATEGORY:

```
SMEI_OPERATOR_ARGUMENT
```

CALLING SEQUENCE:

```
transient = arg -> get_transient()
```

OUTPUTS:

```
transient      byte      Whether the object is "transient".
```

MODIFICATION HISTORY:

```
Original: 22/10/03; SJT
```

8.11 smei_operator_argument::get_value

Source: smei_operator/smei_operator_argument/smei_operator_argument__get_value.pro

NAME:

```
SMEI_OPERATOR_ARGUMENT::GET_VALUE
```

PURPOSE:

```
Return the value wrapped by the operator argument
```

CATEGORY:

```
SMEI_OPERATOR_ARGUMENT
```

CALLING SEQUENCE:

```
val = argref -> get_value()
```

OUTPUTS:

```
val      obj/num The value which the object wraps.
```

MODIFICATION HISTORY:

```
Original: 31/10/03; SJT
```

8.12 smei_operator_argument::init

Source: smei_operator/smei_operator_argument/smei_operator_argument__init.pro

NAME:

```
SMEI_OPERATOR_ARGUMENT::INIT
```

PURPOSE:

```
Constructor for a smei operator argument
```

CATEGORY:

```
SMEI_OPERATOR_ARGUMENT
```

CALLING SEQUENCE:

```
arg = obj_new('SMEI_OPERATOR_ARGUMENT', value, [plane, [range]])
```

INPUTS:

value various The value to be used, this can be a regular numerical value, a SMEI_SEQUENCE, a SMEI_IMAGE or a SMEI_OPERATOR.

OPTIONAL INPUTS:

plane int The image plane to extract from smei_images (only applicable for images or sequences)

range int[3] A 3-element array indicating which images of a sequence to use (only applicable to sequences). A stride of zero is equivalent to a stride of 1 (however negative strides are meaningful).

/transient If set, then this object was created by an interpreter and should be deleted with the operator that it is attached to. N.B. there is nothing to prevent you abusing this.

OUTPUT:

arg objref The SMEI_OPERATOR_ARGUMENT object reference generated.

MODIFICATION HISTORY:

Original: 22/10/03; SJT
 Added transient flag: 5/11/03; SJT
 Handle different dimensionalities of numericals:6/11/03; SJT

9 Calculator

9.1 make_smei_arg

Source: ops/make_smei_arg.pro

NAME:

MAKE_SMEI_ARG

PURPOSE:

Generate a SMEI_ARGUMENT from a sequence, image or number and descriptors.

CATEGORY:

OPS

CALLING SEQUENCE:

argref = make_smei_arg(descriptor)

INPUTS:

descriptor str/num A descriptor or a number (or array).

KEYWORD_PARAMETERS:

get_level int The calling level from which to get

the object being argumentified
 (usually only used by the
 /transient If set, then any new argument object
 is generated with the transient flag.

OUTPUTS:

argref objref The argument object reference

NOTES:

When the argument is expressed as a string, then the object referred must exist in the caller or at the top (\$MAIN\$) level in SSWIDL. The format is "name{plane}[start:stop:step]", if no plane is given then the "processed" plane is assumed, if no range specifier is given for a sequence then the whole sequence is assumed.

MODIFICATION HISTORY:

Original: 28/10/03; SJT
 Get from caller or specified level: 30/10/03
 Tidy up level handling: 4/11/03; SJT
 Added transient flag: 5/11/03; SJT

9.2 make_smei_op

Source: ops/make_smei_op.pro

NAME:

MAKE_SMEI_OP

PURPOSE:

Simple interface to generating SMEI operations

CATEGORY:

OPS

CALLING SEQUENCE:

make_smei_op, ref, operator, arg0[, ... argn]

INPUTS:

operator	string	The operator or function to apply
arg0	obj/str	Either: a SMEI_ARGUMENT object reference, or a string defining an argument, or a numeric (possibly array) value.

OPTIONAL INPUTS:

arg1 .. arg9	obj/str	Up to 9 further arguments to the operator in the same form as arg0
--------------	---------	--

KEYWORD PARAMETERS:

/return_operator	If set, then return the SMEI_OPERATOR object reference, by default the
------------------	--

generated sequence is returned.
 get_level int The calling level from which to get
 the object being argumentified
 (usually only used by the
 interpreter).
 For "function" operators, any keys to the function can be passed.

OUTPUTS:

ref objref The sequence or operator reference generated.

NOTES:

When the argument is expressed as a string, then the object referred must exist at the top \$MAIN\$ level in SSWIDL. The format is "name{plane}[start:stop:step]", if no plane is given then the "processed" plane is assumed, if no range specifier is given for a sequence then the whole sequence is assumed.

RESTRICTIONS:

A Maximum of 10 arguments to the operator may be specified

MODIFICATION HISTORY:

Original: 28/10/03; SJT

9.3 make_smei_opf

Source: ops/make_smei_opf.pro

NAME:

MAKE_SMEI_OPF

PURPOSE:

Functional interface for MAKE_SMEI_OP

CATEGORY:

ops

CALLING SEQUENCE:

ref = make_smei_opf(operator, arg0[,...argn])

INPUTS:

operator string The operator or function to apply
 arg0 obj/str Either: a SMEI_ARGUMENT object
 reference, or a string defining an
 argument , or a numeric (possibly
 array) value.

OPTIONAL INPUTS:

arg1 .. arg9 obj/str Up to 9 further arguments to the
 operator in the same form as arg0

KEYWORD PARAMETERS:

/return_operator		If set, then return the SMEI_OPERATOR object reference, by default the generated sequence is returned.
get_level	int	The calling level from which to get the object being argumentified (usually only used by the interpreter).

For "function" operators, any keys to the function can be passed.

OUTPUTS:

ref objref The sequence or operator reference generated.

NOTES:

When the argument is expressed as a string, then the object referred must exist at the top \$MAIN\$ level in SSWIDL. The format is "name{plane}[start:stop:step]", if no plane is given then the "processed" plane is assumed, if no range specifier is given for a sequence then the whole sequence is assumed.

RESTRICTIONS:

A Maximum of 10 arguments to the operator may be specified

MODIFICATION HISTORY:

Original: 28/10/03; SJT
Add get_level keyword: 30/10/03; SJT

9.4 parse_op

Source: ops/parse_op.pro

NAME:

PARSE_OP

PURPOSE:

Convert a description of a set of ops into code and execute it.

CATEGORY:

OPS

CALLING SEQUENCE:

seq = parse_op(descr)

INPUTS:

descr string The description of the operation sequence.

OPTIONAL INPUTS:

KEYWORD PARAMETERS:

```

/noexec      If specified, then only generate the code, do
             not try to run it. (The CODE key must then be
             set).
code        string  A named variable to contain the IDL code
             generated by parsing the descriptor.
file        string  A file from which to read the description.
             Name mappings may be given as keys: for example if you have a
             sequence called EVNT, but the descriptor expects SS then the
             key SS=EVNT may be given.

```

OUTPUTS:

```

seq         objref  The smei_sequence generated from the descriptor.

```

RESTRICTIONS:

```

The descriptor argument and the file spec are exclusive.

```

MODIFICATION HISTORY:

```

Original: 30/10/03; SJT
Allow passing of remappings, and descriptor as a file:
4/11/03; SJT
Fix indexing error that caused complex expressions to fail:
30/3/04; SJT

```

9.5 parse_op_token

Source: ops/parse_op_token.pro

NAME:

```

PARSE_OP_TOKEN

```

PURPOSE:

```

Convert an operator token string from PARSE_OP into idl code.

```

CATEGORY:

```

OPS

```

CALLING SEQUENCE:

```

code=parse_op_token(token, index)

```

INPUTS:

```

token      string  The token (a whitespace separated list of op
                 and args)
index      int     The token index number.

```

OUTPUTS:

```

code      string  The IDL call generated.

```

MODIFICATION HISTORY:

```

Original: 30/10/03; SJT

```

9.6 read_smei_op

Source: ops/read_smei_op.pro

NAME:

READ_SMEI_OP

PURPOSE:

Read a SMEI ops specification from a file.

CATEGORY:

OPS

CALLING SEQUENCE:

op = read_smei_op(file)

INPUTS:

file string The file from which to read the ops specifier.

KEYWORDS:

/keep If specified then keep formatting characters and comments.

OUTPUTS:

op string The specifier. (IF /keep is given then this is an array).

PROCEDURE:

If the filename is a full path, then it is used unchanged. If it is a plain name, then the current directory is checked first followed by the directory specified by the SMEI_OPS_PATH environment variable. If no extension is given, then ".sop" is used.

MODIFICATION HISTORY:

Original: 4/11/03; SJT
Add keep keyword: 1/11/07; SJT

9.7 smei_calc_menu

Source: ops/smei_calc_menu.pro

NAME:

SMEI_CALC_MENU

PURPOSE:

GUI to control the SMEI calculator.

CATEGORY:

OPS

CALLING SEQUENCE:

smei_calc_menu, seqref

KEYWORD PARAMETERS:

group long Group leader for the menu system, required if any other widgets are present
 <names> Name mappings for programs. (e.g. if you have a sequence called MYSEQ but the program has SS, then passing ss=myseq will map your myseq to the program's ss.

OUTPUTS:

seqref objref Object reference of the new sequence to be generated.

MODIFICATION HISTORY:

Original: 17/1/03; SJT
 Support passing of no_delete flag: 22/1/03; SJT
 Add support for name mapping: 3/7/03; SJT
 Adapt to new formats: 4/11/03; SJT

9.8 smei_calculate

Source: ops/smei_calculate.pro

NAME:

SMEI_CALCULATE

PURPOSE:

To generate a new SMEI_SEQUENCE by applying a calculation ruleset.

CATEGORY:

OPS

CALLING SEQUENCE:

smei_calculate, seq, opstring

OPTIONAL INPUTS:

opstring string A string or string array with the ruleset.

KEYWORD PARAMETERS:

file string A file containing the ruleset.
 Any variable in the ruleset can be matched to a real variable by keyword.

OUTPUTS:

seq objref Reference to the sequence with the derived image(s)

RESTRICTIONS:

If an opstring is given, then the FILE keyword is ignored.
This is really just a convenient wrapper for the PARSE_OP
function.

MODIFICATION HISTORY:

Original (After old format): 4/11/03; SJT
Ensure scalar string is passed on: 5/11/03; SJT

9.9 smei_choose_sop

Source: ops/smei_choose_sop.pro

NAME:

SMEI_CHOOSE_SOP

PURPOSE:

To pick a predefined OPS program

CATEGORY:

operations

CALLING SEQUENCE:

file = smei_choose_sop()

KEYWORD PARAMETERS:

group Widget ID of a group leader

OUTPUTS:

file The file name in a form suitable for PARSE_OP

MODIFICATION HISTORY:

Original: 15/7/03; SJT

10 Utility routines

10.1 choose_ps_actions

Source: utils/choose_ps_actions.pro

NAME:

CHOOSE_PS_ACTIONS

PURPOSE:

Choose whether to print or preview a postscript file

CATEGORY:

Utilities (Plot)

CALLING SEQUENCE:

```
choose_ps_actions, file, print, preview
```

INPUTS:

```
file      string  The file to be printed/previewed
print     string  The command to print a file.
preview   string  The command to preview a file.
```

KEYWORD PARAMETERS:

```
printable      If explicitly set to zero then the file cannot
                be printed directly.
```

MODIFICATION HISTORY:

```
Original: 6/6/05; SJT
```

10.2 cw_ffield

Source: utils/cw_ffield.pro

CW_FFIEILD

A labeled text entry field

Usage:

```
id = cw_ffield(parent, ...)
```

Return:

```
id      long      The ID of the compound widget
```

Argument:

```
parent  long      input  The ID of the base in which the widget
                        will sit.
```

Keywords:

```
label   string  input  The label to be attached to the entry box
value   ...     input  The initial value of the widget
uvalue  ...     input  A user-value for the compound.
floating      input  If set then the values are floating point
double        input  If set, then the values are double
                precision fp
integer       input  If set then the values are short
                integers
long_int      input  If set then the values are long
                integers
text          input  If set, then the values are text
                strings (default action)
format  string  input  The format for displaying the value.
xsize   int     input  The size of the text input box (chars)
ysize   int     input  The number of rows in the box
column  input   input  If set then put the label above the
                text box (default is to the left)
frame    input  input  If set, then put a box around the
                whole compound
box      input  input  If set, then put a box around the text
                field.
all_events      input  If set, then return all events except
                selection events
```


no_event	input	If set, then don't return events at all.
select_events	input	If set and all_events is set, then even return selection events
tracking_events	input	If set, then enable cursor tracking events in the text window.
capture_focus	input	If set, then putting the cursor into the text-box gives the focus to the widget.
array_valued	input	If set, then the widget can accept & return an array of values (normally only scalar values are accepted)
scroll	input	If set then make the text widget a scrolling widget.
graphics	input	If set and this is a text input box, don't return strings ending in a single pling "!" (To avoid hershey character errors).
font	string input	The font to use for the label.
fieldfont	string input	The font to use for the entry box.

Restrictions:

If the text window does not contain a valid value for the given type, then the null string is returned by a `get_value` call.

History:

Original: 25/8/95; SJT
 use decoders rather than internal reads: 29/8/95; SJT
 Add tracking_events key: 4/12/95; SJT
 Add array_valued and scroll keys: 9/12/96; SJT
 Modify handler so tracking events can be returned by "non-editable" or "non-event" widgets: 14/1/97; SJT
 Add CAPTURE_FOCUS key: 6/2/97; SJT
 Add GRAPHICS key: 12/2/97; SJT
 Put in "event backlog" trapping to prevent the multiple updating of the plot when a title is typed rapidly: 3/7/97; SJT
 Renamed as cw_ffield, added font keys and included keyboard focus events (to get right feel for IDL_HS): 7/12/99; SJT

10.3 cw_progress

Source: `utils/cw_progress.pro`

NAME:

CW_PROGRESS

PURPOSE:

Generate a progress bar.

CATEGORY:

UTILS

CALLING SEQUENCE:

`wid = cw_progress(parent[, <options>])`

INPUTS:

parent long Widget ID of the base widget in which it is located.

KEYWORD PARAMETERS:

title string A title for the progress bar
 /column If set, then any title is placed above the bar and the text progress below it.
 xsize int The x-size of the bar in pixels
 ysize int The y-size of the bar in pixels
 index int a 2-element array with the colour indices to use index[0] is the unprocessed part [255] and index[1] is the processed part [0]
 font string Font to use for the title and text progress.
 /frame If set, then put a frame round the whole compound
 /box If set, then put a frame round the draw_widget. (default is set (use box=0 to remove it)
 uvalue any A user value for the widget.
 uname string A user name for the widget
 value float An initial setting of the progress state.
 text int The format of the textual display of the progress, 0 -- no text display, 1 -- display as a fraction, 2 (default) -- display as percentage, 3 -- display as N of Nmax (for this the maximum keyword must be given)
 map bool Whether the widget is initially mapped or not (since the widget you see is a BASE, it can be mapped and unmapped directly).
 maximum int The maximum value for the progress (implies TEXT=3)
 group_leader long A Group leader for the base widget (ignored if a parent is specified)

OUTPUTS:

wid long The widget ID of the resulting widget.

SIDE EFFECTS:

A pixmap 2*xsize x ysize is created.

RESTRICTIONS:

The size may not be greater than 32k. widget_control's get_value key is supported but not very useful.
 If it is created before any graphics windows, then unless you explicitly create a window, your graphics will go to the progress bar.

EXAMPLE:

The widget is used by using widget_control to set its value to the completed fraction. e.g.

```

progid = cw_progress(base, title='Progress')
.
.
.
for j =0, n-1 do begin
.
.
widget_control, progid, set_value=float(j)/float(n-1)
endfor

```

MODIFICATION HISTORY:

Original: 9/1/03; SJT
 Redesigned internals: 10/1/03; SJT
 Fixed so it doesn't crash with NaN inputs: 13/5/03; SJT
 Allow it to run as a standalone: 18/7/03; SJT
 Add "3-D look" and make /box the default: 4/11/03; SJT
 Add TEXT=3 (N of M) mode: 5/11/03; SJT
 Fixes to prevent it changing input keys: 20/11/03; SJT
 Add group_leader keyword: 20/7/10: SJT

10.4 date100

Source: utils/date100.pro

DATE100

Return a "mod 100" year in the range 50 to 150

Usage:

```
y100 = date100(year[, /print])
```

Return:

y100 <input> The fixed year value

Argument:

year any input The year to be normalized

Keywords:

print ??? input If set, then return a true mod 100 value suitable for printing.
 Full ??? input If set, then convert to a full year with century

History:

Original: 1/12/95; SJT

10.5 del_sq

Source: utils/del_sq.pro

NAME:

DEL_SQ

PURPOSE:

Return an approximation to Del^2 of the supplied array.

CATEGORY:

Utilities (Maths)

CALLING SEQUENCE:

```
d2 = del_sq(x)
```

INPUTS:

x (float) The array of 1, 2 or 3 dimensions to be differentiated.

KEYWORD PARAMETERS:

stride (float) The spacing of the points in the array (must be the same in all dimensions (if not given unit spacing is assumed)).

OUTPUTS:

d2 Float The values of del^2 of the data. A border of zeroes will be left around the array.

MODIFICATION HISTORY:

Original: 2/6/05; SJT

10.6 delta_hours

Source: utils/delta_hours.pro

DELTA_HOURS

returns the difference in hours between two times.

Usage:

dt = delta_hours(t1, t0)

Return Value:

dt float The difference in hours between the two times.

Arguments:

t1	int/float	input	The "later" time in array [y,d,h,m,s]
t0	int/float	input	The "earlier" time

Method:

Returns t1 - t0 with due allowance for leap years.

History:

Original: 7/6/93; SJT
 Fix negative difference crossing year boundary: 28/10/93; SJT
 Fix for century boundary: 1/12/95; SJT
 Make double to allow sub-second accuracy over whole mission:
 16/11/99; SJT

10.7 do_mkhdr

Source: utils/do_mkhdr.pro

10.8 doy2jd

Source: utils/doy2jd.pro

DOY2JD

Return the Julian day of a yy,dd,hh,mm,ss type time.

Usage:

jd = doy2jd(time)

Argument:
time any input Array with year, day, hour, minute,
second. (Less significant parts may be
omitted).

History:
Original: 16/11/99; SJT
Rename hours as delta_hours: 27/11/03; SJT

10.9 epoch2jd

Source: utils/epoch2jd.pro

NAME:
EPOCH2JD

PURPOSE:
Convert SMEI epoch to Julian Day.

CATEGORY:
Utils

CALLING SEQUENCE:
jd = epoch2jd(epoch)

INPUTS:
epoch numeric The SMEI epoch(s) to convert.

OUTPUTS:
jd double The julian day number(s) of the epoch(s)

MODIFICATION HISTORY:
Original: 25/3/03; SJT

10.10 ff_data_define

Source: utils/ff_data_define.pro

10.11 ff_extract

Source: utils/ff_extract.pro

NAME:
FF_EXTRACT

PURPOSE:
Extract image summary from a SMEI fits file.

CATEGORY:

UTILS

CALLING SEQUENCE:

```
desc = ff_extract(file[, ff_str])
```

RETURN:

```
ff_str  struct  The summary structure.
```

INPUT:

```
file    string  The FITS file to process.
```

KEYWORDS

```
/descriptor  If set, then return a descriptor string
              instead of a structure
```

HISTORY:

```
Extracted from FF_SUMMARY: 20/4/10; SJT
```

10.12 ff_summary-orig

Source: utils/ff_summary-orig.pro

NAME:

```
FF_SUMMARY
```

PURPOSE:

```
Get a 1-line summary of a FITS file (SMEI)
```

CATEGORY:

```
UTILS
```

CALLING SEQUENCE:

```
desc = ff_summary(file)
```

INPUTS:

```
file    string  The file to summarize (if the path key is set,
              then it can be a wildcard).
```

KEYWORD_PARAMETERS:

```
/template  Return a title bar for a summary
path      string  A directory to search for the files. (If this
                 is given then file is optional and defaults to
                 the current directory.
filelist  str     If this is a named variable, then it will
                 return the list of filenames (only really
                 useful when path is given).
startlist  dbl   If this is a named variable then it will
                 contain the JD's of the image start times.
count     long   If this is a named variable, on return it will
                 contain the number of files found.
/no_file   If set then actually open each file rather
                 than using the img_hdr.txt file to get the info.
/norecure  If set, then do not look in subdirectories.
projections str  A named variable to hold the list of
                 projections of the images.
```

/no_progress If set, then do not create a progress bar to show progress through files and directories (mainly for running over a slow network).

MODIFICATION HISTORY:

Original: 13/12/02; SJT
 Modify for degenerate Aitoff files: 7/3/03; SJT
 Modify to allow use of a tree to store files: 1/7/03; SJT
 Add fold_case keyword to file_search calls: 23/7/03; SJT
 Fix crash in single plane images: 2/10/03; SJT
 Deal with possibility of files called .fts: 20/11/03; SJT
 Add projection information, and projections keyword, and save list: 16/2/04; SJT
 Do recursion explicitly to allow symlinked subdirs to work: 12/8/04; SJT
 Major efficiency changes: 11/11/04; SJT
 Add list of mal-indexed directories: 31/5/05; SJT
 Support compressed fits files: 24/5/05; SJT
 Add no_progress keyword: 25/8/05; SJT

10.13 ff_summary

Source: utils/ff_summary.pro

NAME:

FF_SUMMARY

PURPOSE:

Get a 1-line summary of a FITS file (SMEI)

CATEGORY:

UTILS

CALLING SEQUENCE:

desc = ff_summary(file)

INPUTS:

file string The file to summarize (if the path key is set, then it can be a wildcard).

KEYWORD_PARAMETERS:

/template Return a title bar for a summary
 path string A directory to search for the files. (If this is given then file is optional and defaults to the current directory.
 filelist str If this is a named variable, then it will return the list of filenames (only really useful when path is given).
 startlist dbl If this is a named variable then it will contain the JD's of the image start times.
 count long If this is a named variable, on return it will contain the number of files found.
 /no_file If set then actually open each file rather than using the img_hdr.txt file to get the info.

```

/norecuse      If set, then do not look in subdirectories.
projections str A named variable to hold the list of
                projections of the images.
/no_progress   If set, then do not create a progress bar to
                show progress through files and directories
                (mainly for running over a slow network).
/update        If set, then force a reprocessing just as if
                the directory has been changed
callid long    The widget ID of a calling widget.

```

MODIFICATION HISTORY:

```

Original: 13/12/02; SJT
Modify for degenerate Aitoff files: 7/3/03; SJT
Modify to allow use of a tree to store files: 1/7/03; SJT
Add fold_case keyword to file_search calls: 23/7/03; SJT
Fix crash in single plane images: 2/10/03; SJT
Deal with possibility of files called .fts: 20/11/03; SJT
Add projection information, and projections keyword, and save
list: 16/2/04; SJT
Do recursion explicitly to allow symlinked subdirs to work:
12/8/04; SJT
Major efficiency changes: 11/11/04; SJT
Add list of mal-indexed directories: 31/5/05; SJT
Support compressed fits files: 24/5/05; SJT
Add no_progress keyword: 25/8/05; SJT
Several major speedups (removed an N^2 operation) & handle
Pipe 2 processing flags: Oct-Nov 07; SJT
Don't convert headers to structures (fails randomly &
intermittently): 4/8/09; SJT
Major rewrite, mainly to only scan modified directories on
call with /UPDATE: 20/4/10; SJT
Add callid key: 20/7/10; SJT

```

10.14 ff_todesc

Source: utils/ff_todesc.pro

NAME:

```
FF_TODESC
```

PURPOSE:

```
Convert a SMEI image description structure to a description
string
```

CATEGORY:

```
UTILS
```

CALLING SEQUENCE:

```
desc = ff_todesc(ff_str)
```

INPUTS:

```
ff_str struct An {ff_data} structure (or array thereof).
```

MODIFICATION HISTORY:

```
Original: 20/4/10; SJT
```


10.15 ff_tostr

Source: utils/ff_tostr.pro

NAME:

FF_TOSTR

PURPOSE:

Convert a SMEI image descriptor string to a structure.

CATEGORY:

UTILS

CALLING SEQUENCE:

ff_str = ff_tostr(desc)

INPUTS:

desc string The descriptor string (from img_hdr.txt).

OUTPUTS:

ff_str struct The {ff_data} structure derived.

MODIFICATION HISTORY:

Original (extracted from FF_SUMMARY): 20/4/10; SJT

10.16 fll_grid

Source: utils/fll_grid.pro

NAME:

FLL_GRID

PURPOSE:

Ad a latitude/longitude grid to a fish-eye image

CATEGORY:

Utils

CALLING SEQUENCE:

fll_grid[, dlong, dlat]

OPTIONAL INPUTS:

dlong int The step in longitude
dlat int The step in latitude

KEYWORD PARAMETERS:

/label If set, then label the grid.
charsize Float Set a size for the labels (ignored if label is not set).
max_elongation float Set the largest elongation to show (default=135)
Any key accepted by PLOTS will be passed through.

RESTRICTIONS:

Steps will be rounded to the nearest whole degree

MODIFICATION HISTORY:

Original: 13/2/04; SJT
Add labelling: 16/2/04; SJT

10.17 fpe_grid

Source: utils/fpe_grid.pro

NAME:

FPE_GRID

PURPOSE:

Add a grid of elongation and position-angle to a SMEI Fisheye plot.

CATEGORY:

utils

CALLING SEQUENCE:

fpe_grid[, delong, dpa]

OPTIONAL INPUTS:

delong int The step in elongation angle.
dpa int The step in position angle.

KEYWORD PARAMETERS:

/label If set, then label the grid.
charsize Float Set a size for the labels (ignored if label is not set).
max_elongation float Set the largest elongation to show (default=135)
Any key accepted by PLOTS will be passed through.

RESTRICTIONS:

Steps will be rounded to the nearest whole degree

MODIFICATION HISTORY:

Original: 13/2/04; SJT
Add labelling support: 16/2/04; SJT

10.18 gauss_cleaner

Source: utils/gauss_cleaner.pro

NAME:

GAUSS_CLEANER

PURPOSE:

Convenient compound call of GAUSS_REMOVE to clean up SMEI images (probably better-suited to Fisheyes than Aitoffs)

CATEGORY:

Utils

CALLING SEQUENCE:

```
imgc = gauss_cleaner(img)
```

INPUTS:

img float The image to be cleaned

OUTPUTS:

imgc float The cleaned image.

EXAMPLE:

A typical usage of this procedure would be in conjunction with the SMEI_CALCULATE interface. e.g.:

```
smei_calculate, ssl, '(gauss_cleaner ss)'
```

MODIFICATION HISTORY:

Original: 30/7/04; SJT

10.19 gauss_remove

Source: utils/gauss_remove.pro

NAME:

GAUSS_REMOVE

PURPOSE:

Clean up an image by subtracting discrete gaussian features from it.

CATEGORY:

Utils

CALLING SEQUENCE:

```
imgn = gauss_remove(img[, wsize=wsize, threshold=threshold, $
    show=show, order=order, residual=residual])
```

INPUTS:

img float The image to be cleaned, this must be a named variable as the cleaning is done in place.

KEYWORD PARAMETERS:

wsize int The size of the window to use for the fitting (default 25x25)

```

threshold float The threshold for subtracting a feature.
show      int   If present and non-zero display extra
              information about the fitting, if explicitly
              zero, then suppress progress info.
order     int   The order of the polynomial fit to precede the
              gaussian fit (default 2)
residual  float A named variable to hold the blemishes subtracted.

```

OUTPUTS:

```
imgn      float   The image with the "blemishes" removed
```

MODIFICATION HISTORY:

```

Original: 28/7/04; SJT
Converted to function and renamed: 30/7/04; SJT

```

10.20 general_speed

Source: utils/general_speed.pro

NAME:

```
GENERAL_SPEED
```

PURPOSE:

```
Calculate apparent HT of TIPD from speed and size
```

CATEGORY:

```
Utils
```

CALLING SEQUENCE:

```
p = general_speed(t, v, th)
```

INPUTS:

```

t          the times at which to get heights (hours)
v          The actual speed (km/s)
th         The size (half angle of the transient) (degrees)

```

OUTPUTS:

```
p          The apparent height as a function of time.
```

OPTIONAL OUTPUTS:

```
vp         The apparent speeds
```

MODIFICATION HISTORY:

```
Original: 12/6/03
```

10.21 get_comp_name

Source: utils/get_comp_name.pro

NAME:

```
GET_COMP_NAME
```

PURPOSE:

Return the actually existing possibly compressed name of the file matching the requested name.

CATEGORY:

Utils

CALLING SEQUENCE:

```
cfile = get_comp_name(file)
```

INPUTS:

file string The base filename (including directory if needed)

KEYWORD INPUTS:

/return_base If set, then strip off any compression suffix. No checks are made for existence in this case.

Any keywords accepted by the FILE_TEST function may be passed.

OUTPUTS:

cfile string The actually existing filename. (Returns the empty string if nothing is found).

PROCEDURE:

Just check for the existence of the possible compressed forms. And returns the first match.

MODIFICATION HISTORY:

Original: 24/6/05; SJT

Modify return_base case to accept array: 1/11/07; SJT

10.22 h_m_s

Source: utils/h_m_s.pro

H_M_S

Convert decimal hours to hours, minutes, seconds & hundredths

10.23 have_command

Source: utils/have_command.pro

NAME:

HAVE_COMMAND

PURPOSE:

Determine if a shell command exists or not.

CATEGORY:

Utils

CALLING SEQUENCE:

ihave = have_command(command[, command_path])

INPUTS:

command string The command for which to search.

OUTPUTS:

ihave bool 1 if the command is found, 0 if it isn't

OPTIONAL OUTPUTS:

command_path string A fully qualified path to the command.

RESTRICTIONS:

Probably Unix/Linux only. Note we use spawn rather than file_which as the latter doesn't find shell built in commands.

MODIFICATION HISTORY:

Original: 17/2/04; SJT

10.24 hist_find

Source: utils/hist_find.pro

NAME:

HIST_FIND

PURPOSE:

Find whether an operation has been applied from the history records.

CATEGORY:

UTILS

CALLING SEQUENCE:

version = hist_find(process, history)

INPUTS:

process string The process to look for (e.g. 'Large-scale flatfields')

history string The history fields from the fits file (extracted as found in the structure format).

KEYWORD PARAMETERS:

boolean If set, then only return a -1/0/1 code rather than the version number.

line_break If set, then the value lies on the next line,

rather than on the end of the keyword line

OUTPUTS:

version int/float/bool The version number of presence flag
for the process requested. Note: -1
indicates the process was not found at all.

MODIFICATION HISTORY:

Original: 24/3/03; SJT
Added line_break key and allow "none" as a synonym for "not
applied": 20/10/03; SJT
Better type checking: 21/10/03; SJT

10.25 jd2doy

Source: utils/jd2doy.pro

jd2doy
Return, [y,d,h,m,s] given a julian day.

Usage:
time = jd2doy(jday)

Argument:
jd double input The julian day number to be converted.

Restrictions:
Only works to the nearest millisecond: because of a cop-out
work around for a tendency to return exact hours
(e.g. 3:00:00.00) as (e.g.) 2:59:59.999998. It's not pretty
but it works.

History:
Original: 3/12/99; SJT

10.26 jd2epoch

Source: utils/jd2epoch.pro

NAME:
JD2EPOCH

PURPOSE:
Convert Julian Day to SMEI epoch.

CATEGORY:
Utils

CALLING SEQUENCE:
epoch = jd2epoch(jd)

INPUTS:
jd double The julian day number(s) to convert

OUTPUTS:
epoch double The SMEI epoch(s)

MODIFICATION HISTORY:
Original: 25/3/03; SJT

10.27 kill_wild

Source: utils/kill_wild.pro

NAME:
KILL_WILD

PURPOSE:
To set wild values to a predetermined value

CATEGORY:
Utils

CALLING SEQUENCE:
clean = kill_wild(dirty, minval, maxval, replace)

INPUTS:
dirty An array which may have wild points in it.
minval The value below which a point is considered wild
maxval The value above which a point is considered wild
replace The value to use in place of the wild values.

OUTPUTS:
clean A copy of dirty with the bad values replaced.

MODIFICATION HISTORY:
Original: 2/7/03; SJT

10.28 leefilt_smei

Source: utils/leefilt_smei.pro

\$Id: leefilt.pro,v 1.12 2001/11/08 00:08:00 dave Exp \$

10.29 local_coord

Source: utils/local_coord.pro

NAME:
LOCAL_COORD

PURPOSE:

Convert a "local" NDC coordinate to a global one

CATEGORY:

Utils

CALLING SEQUENCE:

```
gc = local_coord(lc, origin, size)
```

INPUTS:

lc	float	The "local" NDC position
origin	float	The origin of the local coordinates in cm.
size	float	The size of the local system in cm.

KEYWORD PARAMETERS:

/x	If set then this is an X coordinate (default)
/y	If set, then this is a Y coordinate.

OUTPUTS:

gc	Float	The real NDC position
----	-------	-----------------------

RESTRICTIONS:

Only works if the current device is PS

MODIFICATION HISTORY:

Original: 16/5/03; SJT

10.30 mask_off

Source: utils/mask_off.pro

NAME:

MASK_OFF

PURPOSE:

To set the off sky regions of the image to a specified colour

CATEGORY:

Utils

CALLING SEQUENCE:

```
mask_off, image, index
```

INPUTS:

image	byte	The image to mask
index	byte	The value to use in the off-sky area
projection	int	The projection of the image

RESTRICTIONS:

The proper plot transform must have been set.

MODIFICATION HISTORY:

Original: 18/7/03; SJT

Handle projection information: 13/2/04; SJT

10.31 match_lists

Source: utils/match_lists.pro

NAME:

MATCH_LISTS

PURPOSE:

Return where in list0 each member of list1 is found.

CATEGORY:

Utils

CALLING SEQUENCE:

locations = match_lists(list0, list1)

INPUTS:

list0 any The master list

list1 same The test list

OUTPUTS:

An array of the same length as list1 mapping it into list0, -1 when not found.

MODIFICATION HISTORY:

Original: 1/11/07; SJT

10.32 mcleaner

Source: utils/mcleaner.pro

NAME:

MCLEANER

PURPOSE:

Remove blemishes from images by successive median filters.

CATEGORY:

Utils

CALLING SEQUENCE:

cimg = mcleaner(img[, thresh])

INPUTS:

img float The images to be cleaned.

OPTIONAL INPUTS:

thresh float The threshold at which to consider a feature to be a blemish (default 0.5)

KEYWORD PARAMETERS:

max_scale int The largest median scale to use (default 21)

iscorr byte A names variable to hold a map of which pixels have been corrected.

resid float A named variable to hold the corrections applied.

/show If set, then show the progress of the cleaning. (Assumes a window big enough for 2 copies of the input image is available).

OUTPUTS:

cimg float The cleaned image.

PROCEDURE:

Median filters of increasing sizes from 3 up to max_scale are applied. If a the difference between the original image and the median-filtered version divided by 1 plus the sum of the original and the filtered exceeds the threshold, then the pixel is replaced by the median filtered version.

MODIFICATION HISTORY:

Original: 9/8/04

Increase spacing of scales from 2 to 4: 24/11/04; SJT

10.33 min_nz

Source: utils/min.nz.pro

MIN_NZ

Extract the smallest positive element of an array.

Call:

val = min_nz(array[, mindex, max=max])

Return Value:

val any The smallest positive value or -1 if no positive values.

Argument:

array any input The array whose min is needed

mindex long output The (first) location in the array at which the min value is found.

Keyword:

max any output The maximum value in the array.

```

full          input  If set, then just return the regular
                  minimum (to allow a procedure to
                  choose which by flag)

```

History:

```

Prototype: 24/1/91; SJT
Improve and changes to smallest >0: 22/2/91; SJT
Add MAX keyword: 31/3/92; SJT
Add optional second argument for location of min value:
                                          20/8/93; SJT

Add "finite" condition: 6/12/93; SJT
Add full key: 2/5/02; SJT
Add _extra to pass any extra keys direct to min (e.g. /nan):
4/8/04; SJT

```

10.34 mk_imghdrtxt

Source: utils/mk_imghdrtxt.pro

NAME:

MK_IMGHDRTXT

PURPOSE:

Make an image header listing file (to speed up searching for images).

CATEGORY:

UTILS

CALLING SEQUENCE:

mk_imghdrtxt, path

INPUTS:

```

path      string  The directory for and in which to make the
                  img_hdr.txt file (if omitted use the $SMEI_IMAGES
                  directory).

```

KEYWORDS:

```

/force      If set & non-zero, then force regeneration of
            the img_hdr.txt file from scratch even if it
            exists.

```

SIDE EFFECTS:

A file called img_hdr.txt if generated in the specified directory

FILE FORMAT:

```

The fields written are:
Filename      A35
Start time    (I4.4,I4.3,I3.2,':',I2.2)
Duration      F7.3
Image size    (I5,'x',I4)
Flags         (' ',A7)

```

MODIFICATION HISTORY:

Original: 7/1/03; SJT
Modify to allow use of a tree to store files: 1/7/03; SJT
Add check to see if the directory exists and whether the
header file is up to date: 4/6/08; SJT
Added /force keyword: 27/10/09; SJT

10.35 mod_pm

Source: utils/mod_pm.pro

MOD_PM
Return a 2-sided modulo.

Usage:
mv = mod_pm(x,m)

Return Value:
mv as x The modulo'ed value

Arguments:
x num The value to modulo
m num The modulus.

History:
Original: 23/11/09; SJT

10.36 norm_time

Source: utils/norm_time.pro

NORM_TIME
Convert a possibly unnormalized time array into a normalized
one.

Usage:
time_array = norm_time(time)

Return Value:
time_array int The normalized time.

Argument:
time int/fl input The time to be normalized in
y, d, h, m, s form.

History:
Original: 24/8/93; SJT
Removed integer restriction: 24/11/93; SJT
Fix for dates beyond 2000: 1/12/95; SJT

10.37 orbits_average

Source: utils/orbits_average.pro

ORBITS_AVERAGE
Make an image that is the average of several orbits.

Usage:

```
im=orbits_average(image, number)
```

Return value:

A floating-point array with the image.

Arguments:

```
image  obj    The smei_image object with the central orbit.
number int    The number of orbits before and after to
              average
```

Keyword:

```
/exclude      If set, then do not include the current image
              in the average.
```

Example:

To make an image that is a 5-orbit average centred on a specific image use:

```
img = orbits_average(image, 2)
```

History:

Original: 11/3/08; SJT

10.38 orbits_mfilter

Source: utils/orbits_mfilter.pro

ORBITS_MFILTER

Make an image that is the result of median filtering in the time-domain

Usage:

```
im=orbits_mfilter(image, number)
```

Return value:

A floating-point array with the image.

Arguments:

```
image  obj    The smei_image object with the central orbit.
number int    The number of orbits before and after to
              compare
threshold float The threshold at which to replace the value.
```

Keyword:

```
/kill          If set, then replace the value with NaN
              instead of the median.
fill_spatial int If this is set to a non-zero value then
              replace flagged pixels with the nxn spatial
              median rather than a temporal median.
/no_point      Do not stop when frames have different pointing.
```

Example:

In a sop file to do a 5-orbit filter with a threshold of 3ADU use:
(orbits_mfilter ss{-1} #2 #3.0)

History:

Original (after orbits average): 13/11/09; SJT

10.39 pe_grid

Source: utils/pe_grid.pro

COMMON BLOCKS:

smei_plot_common

SIDE EFFECTS:

The 4 plot environment system variables are changed or saved.

RESTRICTIONS:

If it gets used in a nested way it will get confused. If neither key is given it silently does nothing at all.

MODIFICATION HISTORY:

Original: 13/6/03; SJT

10.41 qd_elong

Source: utils/qd_elong.pro

NAME:

QD_ELONG

PURPOSE:

Quick & dirty routine to calculate path of lines of a given elongation

CATEGORY:

utils

CALLING SEQUENCE:

qd_elong, elong, longin, lat, longout

INPUTS:

elong	float	The elongation line desired.
longin	float	The longitudes at which to calculate its latitude

OUTPUTS:

lat	float	The latitudes computed
longout	float	The longitudes of those latitudes.

RESTRICTIONS:

Care must be take with elongations > 90 to ensure that there are no discontinuities in the outputs (only do one side and start from the edge).

MODIFICATION HISTORY:

Original: 17/6/03; SJT
Add dirty fix for the broken lines at 80 & 100: 24/7/03; SJT

10.42 qd_posang

Source: utils/qd_posang.pro

NAME:

QD_POSANG

PURPOSE:

Quick and dirty routine to compute tracks of specified position angles.

CATEGORY:

Utils

CALLING SEQUENCE:

qd_posang, pa, longin, lat, longout

INPUTS:

pa	float	The desired position angle (all 4 quadrants are generated)
longin	float	The elongations at which to calculate its latitude

OUTPUTS:

lat	float	The latitudes computed
longout	float	The longitudes of those latitudes.

RESTRICTIONS:

Only angles between 0 and 90 exclusive really mean anything.

MODIFICATION HISTORY:

Original: 17/6/03; SJT

10.43 read_point_file

Source: utils/read_point_file.pro

NAME:

READ_POINT_FILE

PURPOSE:

Reads a height-time file.

CATEGORY:

UTILS

CALLING SEQUENCE:

points = read_point_file(file)

INPUTS:

file string The file to be read.

OUTPUTS:

points struct The list of points.

MODIFICATION HISTORY:

Original: 25/11/08; SJT

10.44 rll_grid

Source: utils/rll_grid.pro

NAME:

RLL_GRID

PURPOSE:

Add a latitude/longitude grid to a rectangular image

CATEGORY:

Utils

CALLING SEQUENCE:

rll_grid[, dlong, dlat]

OPTIONAL INPUTS:

dlong	int	The step in longitude
dlat	int	The step in latitude

KEYWORD PARAMETERS:

/label		If set, then label the grid.
charsize	Float	Set a size for the labels (ignored if label is not set).
max_elongation	float	Set the largest elongation to show (default=135)
shift	float	The shift in degrees for the display. Any key accepted by PLOTS will be passed through.

RESTRICTIONS:

Steps will be rounded to the nearest whole degree

MODIFICATION HISTORY:

Original (after fll_grid): 9/7/08; SJT
Support shifting (and make it work): 23/11/09; SJT

10.45 rpe_grid

Source: utils/rpe_grid.pro

NAME:

RPE_GRID

PURPOSE:

Add a grid of elongation and position-angle to a SMEI rectangular plot.

CATEGORY:

utils

CALLING SEQUENCE:

rpe_grid[, delong, dpa]

OPTIONAL INPUTS:

delong	int	The step in elongation angle.
dpa	int	The step in position angle.

KEYWORD PARAMETERS:

/label		If set, then label the grid.
charsize	Float	Set a size for the labels (ignored if label is not set.)
shift	float	The shift in degrees for the display.

Any key accepted by PLOTS will be passed through.

RESTRICTIONS:

Steps will be rounded to the nearest whole degree

MODIFICATION HISTORY:

Original (after fpe_grid): 9/7/08; SJT
Add shift: 23/11/09; SJT

10.46 rps_grid

Source: utils/rps_grid.pro

NAME:

RPE_GRID

PURPOSE:

Add a grid of elongation and position-angle to a SMEI rectangular plot.

CATEGORY:

utils

CALLING SEQUENCE:

rpe_grid[, delong, dpa]

OPTIONAL INPUTS:

delong	int	The step in elongation angle.
dpa	int	The step in position angle.

KEYWORD PARAMETERS:

/label If set, then label the grid.
 charsize Float Set a size for the labels (ignored if
 label is not set.)
 Any key accepted by PLOTS will be passed through.

RESTRICTIONS:

Steps will be rounded to the nearest whole degree

MODIFICATION HISTORY:

Original (after fpe_grid): 9/7/08; SJT

10.47 self_help

Source: utils/self_help.pro

self_help

A quick and dirty proc to run DOC_LIBRARY for its caller.

Usage:

self_help

History:

Original: 20/7/00; SJT
 Drop xdl -- it's too slow: 20/4/01; SJT

10.48 show_zoomed

Source: utils/show_zoomed.pro

NAME:

SHOW_ZOOMED

PURPOSE:

Show a zoomed section of an image.

CATEGORY:

Utils

CALLING SEQUENCE:

wid = show_zoomed(window, x, y)

INPUTS:

window long The window from which to read the image to zoom.
 x, y int The centre of the region to be zoomed.

OUTPUTS:

wid long The widget ID of the top-level base.

KEYWORD PARAMETERS:

zoom int The initial zoom factor (default = 4)

/smooth		If set, then use the smoothing in REBIN
size	int	The size of the window to create (if it's a scalar then make a square window; default = 256)
group	long	A group leader of the widget heirarchy.
base	long	If this is a valid widget, then it is an already existing zoom tool, then a new tool is not created.

MODIFICATION HISTORY:

Original: 28/7/03; SJT
 Add modifier support and change to function: 29/7/03; SJT
 Add support for systems that differentiate button and wheel events: 10/12/07; SJT
 Add image drag mode: 2/2/10; SJT

10.49 smei_msg

Source: utils/smei_msg.pro

SMEI_MSG

Display an error message, in a suitable manner.

Usage:

smei_msg, message

Argument:

message string input The error message to be displayed.

Keywords:

error If set, then the message is an error.
 warning If set, then the message is a warning.
 alert If set, then then message is a warning that needs to be noticed.
 inform If set, then the message is for information only.
 noshow If set, then don't pop the main widget to the front.
 dialog_parent long Optional "parent" for the dialogue.

Other keys used by dialog_message can also be passed (they will of course be ignored if no pop-up is generated).

History:

Temporary Version: 18/11/99; SJT
 Use dialog_message: 2/12/99; SJT
 Rewrote to use the message panel on the TLM: 11/7/00; SJT
 Added alert keyword: 21/2/01; SJT
 Add dialog keys and remove common block: 22/2/01; SJT
 Prevent duplication of alert and error level messages: 19/6/01; SJT

10.50 smei_query

Source: utils/smei_query.pro

smei_query

Get a Yes/No answer to a question

Usage:

ireply = smei_query(message)

Arguments:

message string The message to be displayed.

Keywords:

dialog_parent long Optional "parent" for the dialogue.

Other keys used by dialog_message can also be passed (they will of course be ignored if no pop-up is generated).

History:

original: 20/12/99; SJT

Support dialog_message keywords: 22/2/01; SJT

10.51 struct_contains

Source: utils/struct_contains.pro

NAME:

STRUCT_CONTAINS

PURPOSE:

Utility function to see if structure contains a particular tag name

CATEGORY:

Utils

CALLING SEQUENCE:

ok = struct_contains(struct, tag)

INPUTS:

struct The structure to search.
tag The tag to be searched for.

OUTPUTS:

ok byte 1 if the structure contains the tag, 0 otherwise

MODIFICATION HISTORY:

Original: 7/3/03; SJT

10.52 sxispar

Source: utils/sxispar.pro

SXISPAR

Determine if a parameter is present in a FITS header.

Usage:

ispar = sxispar(header, parameter)

Arguments:

```

header      string  A FITS header array.
parameter   string  The parameter to look for.

```

History:

Original: 4/8/09; SJT

10.53 vmain

Source: utils/vmain.pro

vmain

Put a value into a top-level variable.

Usage:

```
vmain, value[, name]
```

Arguments:

```

value  input  any    The value to be sent up to the main
                        program level
name   input  string  The name of the variable to use.

```

Keywords:

```

default_name  input  string  A default value for the
                        variable name
group         input  long    The widget ID of a calling
                        widget.

```

Notes:

If the name argument is not given, then the user is prompted for a name (possibly with a default).
 If the group keyword is given, then the prompt is via a widget interface, otherwise it is via the command line.

History:

Original: 13/7/01; SJT
 Add ability to send to a file: 19/12/02; SJT
 Removed it again (made specific version for that): 6/1/03; SJT

10.54 wcsxy2sph_smei

Source: utils/wcsxy2sph_smei.pro

NAME:

WCSXY2SPH_SMEI

PURPOSE:

Convert x and y (map) coordinates to spherical coordinates

EXPLANATION:

To convert x and y (map) coordinates to spherical (longitude and latitude or sky) coordinates. This procedure is the inverse of WCSSPH2XY.

This is a lower level procedure -- given a FITS header, the user will usually use XYAD which will then call WCSXY2SPH with the appropriate parameters.

CATEGORY:

Mapping and Auxiliary FITS Routine

CALLING SEQUENCE:

```
wcsxy2sph_smei, x, y, longitude, latitude, [map_type], [ CTYPE = , $
                FACE = , PV2 = , CRVAL = , CRXY = , LONGPOLE=, LATPOLE=]
```

INPUT PARAMETERS:

x - x coordinate of data, scalar or vector, in degrees, NOTE: x increases to the left, not the right
y - y coordinate of data, same number of elements as x, in degrees
map_type - optional positional parameter, scalar corresponding to a particular map projection. This is not a FITS standard, it is simply put in to allow function similar to that of less general map projection procedures (eg AITOFF). The following list gives the map projection types and their respective numbers.

FITS code	Number code	Name	Comments
DEF	0	Default = Cartesian	
AZP	1	Zenithal perspective	pv2_1 required
TAN	2	Gnomic	AZP w/ pv2_1 = 0
SIN	3	Orthographic	pv2_1, pv2_2 optional
STG	4	Stereographic	AZP w/ pv2_1 = 1
ARC	5	Zenithal Equidistant	
ZPN	6	Zenithal polynomial	PV2_0, PV2_1....PV2_20 possible
ZEA	7	Zenithal equal area	
AIR	8	Airy	pv2_1 required
CYP	9	Cylindrical perspective	pv2_1 and pv2_2 required
CAR	10	Cartesian	
MER	11	Mercator	
CEA	12	Cylindrical equal area	pv2_1 required
xy	13	Conical perspective	pv2_1 and pv2_2 required
COD	14	Conical equidistant	pv2_1 and pv2_2 required
COE	15	Conical equal area	pv2_1 and pv2_2 required
COO	16	Conical orthomorphic	pv2_1 and pv2_2 required
BON	17	Bonne's equal area	pv2_1 required
PCO	18	Polyconic	
SFL	19	Sanson-Flamsteed	
PAR	20	Parabolic	
AIT	21	Hammer-Aitoff	
MOL	22	Mollweide	
CSC	23	Cobe Quadrilateralized Spherical Cube	inverse converges poorly
QCS	24	Quadrilateralized Spherical Cube	
TSC	25	Tangential Spherical Cube	
SZP	26	Slant Zenithal perspective	PV2_1,PV2_2, PV2_3 optional

OPTIONAL KEYWORD PARAMETERS:

CTYPE - One, two, or three element vector containing 8 character strings corresponding to the CTYPE1, CTYPE2, and CTYPE3 FITS keywords:

CTYPE[0] - first four characters specify standard system ('RA--', 'GLON' or 'ELON' for right ascension, galactic longitude or ecliptic longitude respectively), second four letters specify the type of map projection (eg '-AIT' for Aitoff projection)

CTYPE[1] - first four characters specify standard system ('DEC-', 'GLAT' or 'ELAT' for declination, galactic latitude

or ecliptic latitude respectively; these must match the appropriate system of `ctype1`), second four letters of `ctype2` must match second four letters of `ctype1`.
`CTYPE[2]` - if present must be the 8 character string, 'CUBEFACE', only used for spherical cube projections to identify an axis as containing the face on which each x and y pair of coordinates lie.

`FACE` - a input variable used for spherical cube projections to designate the face of the cube on which the x and y coordinates lie. Must contain the same number of elements as X and Y.
`CRVAL` - 2 element vector containing standard system coordinates (the longitude and latitude) of the reference point
`CRXY` - 2 element vector giving the x and y coordinates of the reference point, if this is not set the offset of the x coordinate is assumed to be 0.
`LATPOLE` - native latitude of the standard system's North Pole
`LONGPOLE` - native longitude of standard system's North Pole, default is 180 degrees, numeric scalar
`pv2_1` - scalar with first projection parameter (`PV2_1`), this may or may not be necessary depending on the map projection used
`pv2_2` - scalar with second projection parameter (`PV2_2`), this may or may not be necessary depending on the map projection used

OUTPUT PARAMETERS:

longitude - longitude of data, same number of elements as x, in degrees
 latitude - latitude of data, same number of elements as x, in degrees

Longitude and latitude will be set to NaN, wherever elements of X,Y have no corresponding longitude, latitude values.

NOTES:

The conventions followed here are described in more detail in the paper "Representations of Celestial Coordinates in FITS" by Calabretta & Greisen (2002, *A&A*, 395, 1077, also see <http://www.aoc.nrao.edu/~egreisen>). The general scheme outlined in that article is to convert x and y coordinates into a "native" longitude and latitude and then rotate the system into one of three generally recognized systems (celestial, galactic or ecliptic).

This procedure necessitates two basic sections. The first converts x and y coordinates to "native" coordinates while the second converts "native" to "standard" coordinates. The first section contains the guts of the code in which all of the map projection is done. The second step is performed by `WCS_ROTATE` and only involves rotation of coordinate systems. `WCSXY2SPH` can be called in a form similar to `AITOFF`, `EQPOLE`, or `QDCB` by calling `wcsxy2sph` with a fifth parameter specifying the map projection by number and by not using any of the keywords related to the map projection type (eg `ctype1` and `ctype2`).

PROCEDURE:

The first task of the procedure is to do general error-checking to make sure the procedure was called correctly and none of the parameters or keywords conflict. This is particularly important because the procedure can be called in two ways (either using FITS-type keywords or using a number corresponding a map projection type). All variables are converted into double precision values.

The second task of the procedure is to take x and y coordinates and convert them into "native" latitude and longitude coordinates. Map-specific error-checking is done at this time. All of the equations were obtained from "Representations of Celestial

Coordinates in FITS" and cases needing special attention are handled appropriately (see the comments with individual map projections for more information on special cases). WCS_ROTATE is then called to convert the "native" coordinates to "standard" coordinates by rotating the coordinate system. This rotation is governed by the keywords CRVAL, and LONGPOLE. The transformation is a straightforward application of euler angles. Finally, longitude values are converted into the range from 0 to 360 degrees.

COMMON BLOCKS:

none

PROCEDURES CALLED:

WCS_ROTATE

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MODIFICATIONS/REVISION LEVEL:

- 1.1 8/31/93
- 1.2 9/12/93 W. Landsman Vectorized CRXY, CRVAL, CTYPE
- 1.3 29/12/93 I. Freedman Eliminated LU decomposition
- 1.4 22/09/94 W. Landsman If scalar input, then scalar output
- 1.5 02/03/05 W. Landsman Change variable name BETA for V4.0 compatibility
- 1.6 06/07/05 W. Landsman Change loop index from integer to long
Converted to IDL V5.0 W. Landsman September 1997
- 1.7 02/18/99 W. Landsman Fixed implementation of ARC algorithm
- 1.8 June 2003 W. Landsman Update conic projections, add LATPOLE keyword
- 1.81 Sep 2003 W. Landsman Avoid divide by zero
- 1.82 Sep 2003 W. Landsman CTYPE keywords need not be 8 characters
- 1.83 Sep 2003 W. Landsman Preserve input array sizes
- 1.9 Jan 2004 W. Landsman don't modify scalars, fix PARabolic code
- 2.0 Feb 2004 W. Landsman Fix AIR and AZP projections
- 2.1 Feb 2004 W. Landsman Fix tangent projection for matrix input
- 3.0 May 2004 W. Landsman Support extended SIN (=NCP), slant zenithal
(SZP), and zenithal polynomial (ZPN) projections, use
PV2 keyword vector instead of PROJ1, PROJ2
- 3.1 May 2004 W. Landsman/J. Ballet Handle NaN values, flag invalid output
for AITOFF projection
- 3.1_smei Sep 2005 SJT: Remove invalid prints on Aitoff again -- it's
nothing but a pest

11 Xmanager, structure and common block names

The following lists the routines which define widget handler systems to xmanager, and the names under which they are registered The handler names should not be replicated

smei_sequence__flags_menu	ss_flags
smei_sequence__movie_menu	ss_movie
smei_sequence__png_menu	ss_png
smei_sequence__profile_mask_menu	p_flags
smei_sequence__print_menu	ss_print
smei_sequence__menu1	ss_menu1
marker_menu	marker
smei_sequence__range_menu	ss_range
smei_sequence__show_info	ss_info
smei_sequence__model_menu	ss_model
smei_sequence__add_menu	ss_add
smei_sequence__show	ss_show
smei_sequence__menu2	ss_menu2
smei_sequence__profile_menu	ss_prof
save_profile	save_prof
smei_sequence__zoom_menu	ss_zoom
smei_sequence__delete_menu	ss_delete
smei_sequence__vmain	ss_vmain
smei_calc_menu	sc
smei_choose_sop	schop
smei_image__print_menu	si_print
show_zoomed	sh_zoom
vmain	vmain

These are the named structures defined

smei_operator__define	smei_operator
smei_operator_argument__define	smei_operator_argument
smei_sequence__flags_menu	ss_flag_state
smei_sequence__movie_menu	ss_movie_state
smei_sequence__png_menu	ss_png_state
smei_sequence__print_menu	ss_print_state
smei_sequence__menu1	ss_menu1_state
marker_menu	ss_mark_state
smei_sequence__range_menu	ss_range_state
smei_sequence__define	smei_sequence
smei_sequence__define	smei_seq_opts
smei_sequence__define	smei_s_print_opts
smei_sequence__define	smei_seq_pm
smei_sequence__model_menu	ss_model_state
smei_sequence__add_menu	ss_add_state
smei_sequence__show	ss_show_state
smei_sequence__menu2	ss_menu2_state
smei_sequence__profile_menu	ss_prof_state
save_profile	save_prof_state
smei_sequence__zoom_menu	ss_zoom_state
smei_sequence__delete_menu	ss_delete_state
smei_sequence__vmain	ss_vmain_state
smei_calc_menu	sc_state1
smei_choose_sop	schop_state
smei_point__define	smei_point
smei_mask_bits__define	smei_mask_bits
smei_image__print_menu	si_print_state
smei_image__define	smei_image
smei_image__define	smei_flags
smei_image__define	smei_pflags
cw_progress	cw_progress_state
ff_data__define	ff_data
show_zoomed	sz_state
vmain	vmain_state

These are the common blocks defined

```
.plot_env      smei_plot_common
ff_summary    ff_summary_lastpath
```

12 Programming notes

This section is a collection of (largely) random thoughts on coding requirements and practices needed to add things to the IDL_SMEI package.

Command line routines

Normally command line routines designed to be accessed by the end-user should be procedures rather than functions. They should always have a `HELP` keyword which accesses the following code (which must precede all the rest of the procedure):

```
if keyword_set(help) then begin
    self_help
    return
endif
```