

MESSENGER SAX

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The [MESSENGER](#) (MErcury Surface, Space ENvironment, GEOchemistry, and Ranging) spacecraft's primary mission was to study Mercury, but it also had a detector pointing at the Sun. It was launched in August 2004, reached orbit around Mercury on March 18, 2011, and crashed into the surface of Mercury on April 30, 2015.

The [MESSENGER X-Ray Spectrometer](#) (XRS) included three gas-filled detectors called the MXU (Mercury X-Ray Unit) pointing at the planet, and one silicon solid-state detector called SAX (Solar Assembly for X-Rays) pointing at the Sun. SAX consists of a cooled, 500 μm thick SiPIN solid-state detector covering the energy range from ~ 1 to ~ 10 keV with an energy resolution of 598 eV at 5.9 keV. The time cadence is generally five minutes.

The SAX data are collected in an [archive](#), in file pairs called xrsyyyydoy.dat and .lbl where yyyy is the 4-digit year and doy is the day of year. (You can use date2doy and doy2date in SSWIDL to convert between doy and a date.) The file pairs must be read together. The times when the XRS was operational are given in the [Solar Data Coverage](#) document.

Two SSWIDL tools provide easy access to the SAX data - [OSPEX](#), a spectral analysis software package and SHOW_SYNOP, a synoptic data viewing tool. In addition, the routine read_messenger_pds.pro in SSW can be called directly to read the pair of .dat and .lbl files and return a structure containing the information from the files.

To analyze MESSENGER SAX data in [OSPEX](#),

1. Start the OSPEX GUI in SSWIDL, e.g. o=ospex()
2. Click File / Select Input
3. On the Select Input widget, click Browse / On remote sites...
4. On the Select Time or Flare widget, enter the time interval directly, or select a flare from the GBM or RHESSI flare catalogs to select a time
5. Change Data Type pulldown to MESSENGER
6. Click Search
7. The .dat and .lbl files found (if any) that cover your time interval will be displayed and highlighted
8. Click Accept and Close

The MESSENGER files will be copied to your current working directory. You can now proceed to plot and analyze the data in those files in OSPEX.

Notes:

- A pair of files (.dat and .lbl) together provide the XRS SAX data for each day. Once you've downloaded the files through OSPEX, you provide OSPEX the name of the .dat file and it will find corresponding .lbl file in the same directory.
- The MESSENGER response matrix is computed, so you don't need to provide a separate response file.
- Once the data files (both .dat and .lbl) are on your system, you can select them any time by clicking Browse / On this computer.... in the Select Input widget. Only select the .dat file (as mentioned, the .lbl file will be found automatically).
- The default location of the MESSENGER XRS archive is <https://umbra.nascom.nasa.gov/messenger/>. The user can change that through two environment variables, MESSENGER_XRS_HOST and MESSENGER_XRS_TOPDIR via, for example:


```
setenv,'MESSENGER_XRS_HOST=hesperia.gsfc.nasa.gov'
setenv,'MESSENGER_XRS_TOPDIR=/messenger'
```

To view the MESSENGER SAX data in SHOW_SYNOP,

1. Start the show_synop GUI by typing: show_synop
2. Select the time of interest
3. Select MESSENGER from the remote sites pulldown list and click Search
4. Highlight the found filenames you want and click Download
5. The requested files will be copied to the local directory specified in the widget
6. Highlight the desired file(s) and click Display

Resources:

- [Mission Timeline](#) - Timeline of the cruise, flyby, and orbit phases of the mission
- [Solar Data Coverage](#)
- [MESSENGER solar data archive](#)
- [List of MESSENGER solar observing times](#) - These time intervals take into account the spotty coverage in the pre-orbit phase, detector high-voltage off, detector temperature above valid thresholds, and eclipse of the Sun by Mercury.
- [Quicklook plots](#) - Daily plots showing the time profile for each day, as well as the reasons for data exclusion, both as daily files and yearly slideshows
- [Where on the Sun is MESSENGER looking?](#)
- [Where is MESSENGER?](#) - Click the MESSENGER checkbox, enter a date, and click Generate Plot to see orbital positions