Ion imager/spectrometer

Goals:

Identify time variation, location, and spectrum of interacting ions from 1 MeV to >= 1 GeV and compare to other observations

More flares – smaller flares – movies

Parmeters:

10” resolution

> 2 orders of magnitude imaging sensitivity beyond RHESSI

> 1 order of magnitude spectroscopy sensitivity beyond RHESSI

Image pion component, deexcitation lines, neutron capture

Some Doppler lineshape capability for angular distribution

Design thoughts:

A graded-Z barrier prevents saturation in large flares (give up < 150 keV to another instrument)

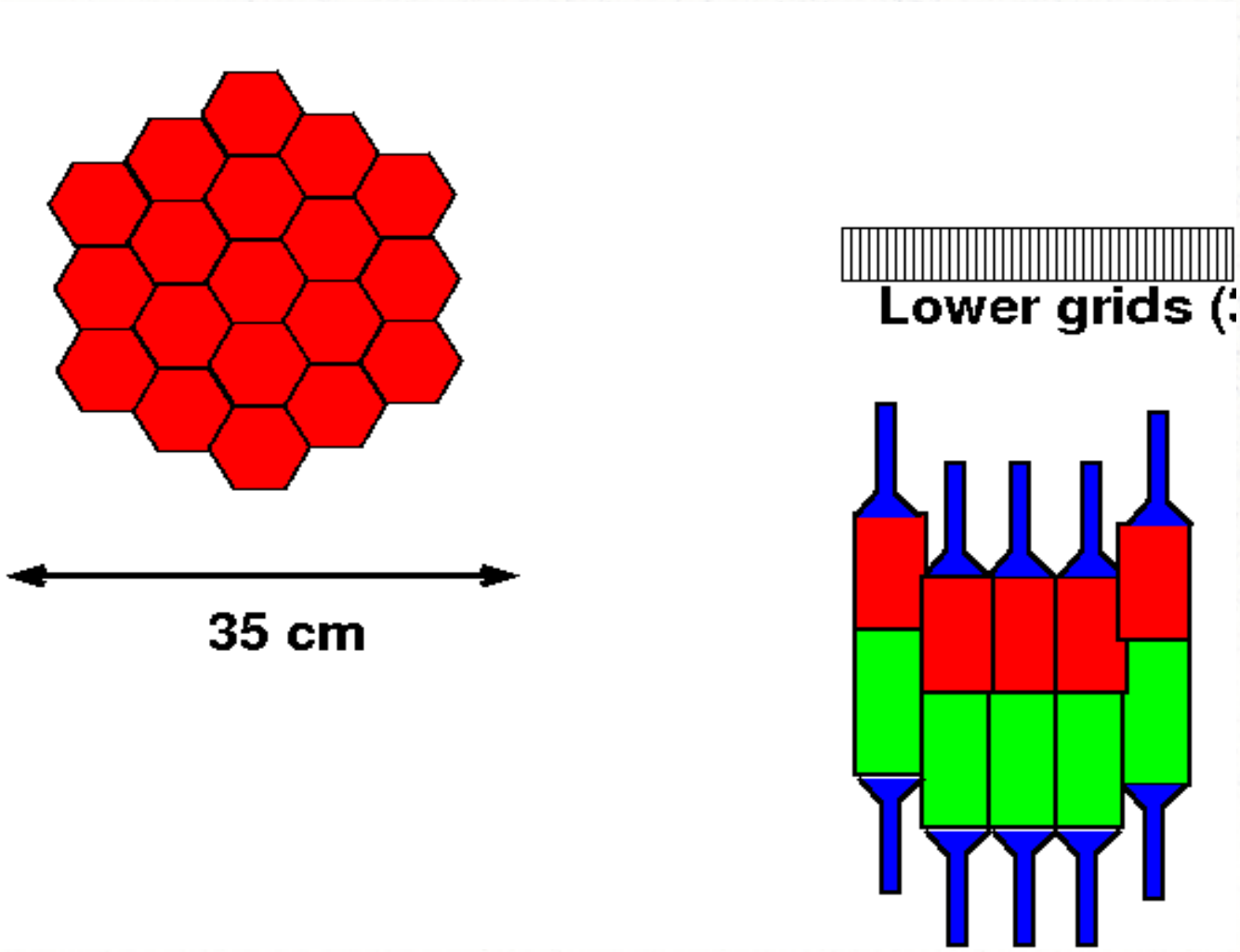
Grids that can modulate 2.2-6.1 MeV can modulate 150 MeV – imaging the pion component is feasible

“Detector” and “shield” are flexible concepts

LaBr3 can resolve the shape at 6.1 MeV (near 1% FWHM resolution vs line up to 3% broad)

A gridless detector module is a good spectrometer

Sketch of a module with some polarimetric capability



Proposed instrument parameters:

MODULES: 6 grids (10” to 3') + 1 open

SIZE: about 1 meter diameter, 3.5 meters long

including grid spacing of 2.5 m

MASS: ~ 1200 kg

Effective area for imaging:

300cm2 @2.2 MeV 75% modulation RHESSI: 2.9cm2

450cm2 @150 MeV 50% modulation

Effective area for MeV spectroscopy: ~600cm2

RHESSI: 20cm2

PROBLEM:

Do you really want to spin this thing?

POSSIBLE SOLUTION:

Yohkoh-style imaging with many more elements, each a 4”x2.5” LaBr3/BGO stack, to the same total mass and slightly less sensitivity. Gives up polarization and some sensitivity from coincidence in the > 2 MeV range.

PROBLEM:

Grids this thick do not image the full Sun

POSSIBLE SOLUTIONS:

Tohban keeps instrument pointed to appropriate active region (problem for other instruments?)

Realtime repointing guided by hard x-ray imaging (not a spinner!)

PROBLEM:

What about 511 keV line width?

POSSIBLE SOLUTION:

Replace gridless module with a Ge spectrometer as a separate instrument