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RESIK MEASUREMENTS OF PARTICLE BACKGROUND RADIATION & NON-SOLAR EMISSION

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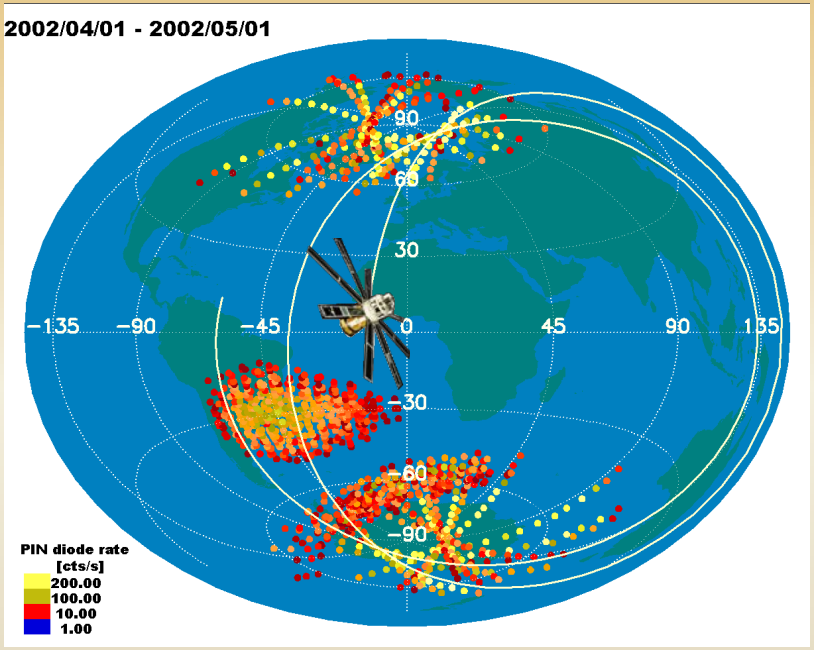
outline

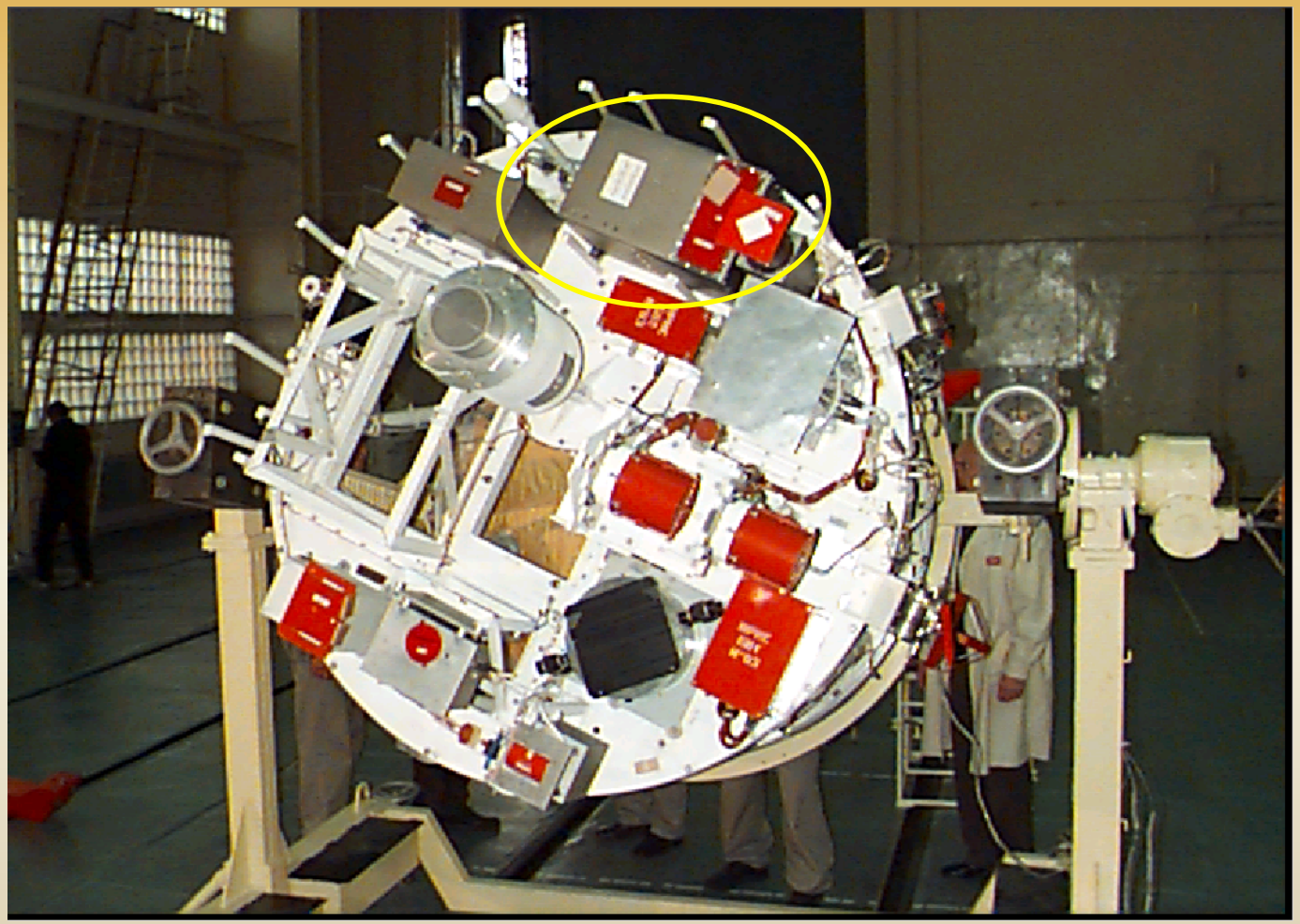
- Construction & placement of RESIK detectors
- Signals useful to study particle environment
- Calibration of RESIK particle signal against particle spectrometer MKL
- Conclusions and further work-
- Possible collaborations

CORONAS-F operation

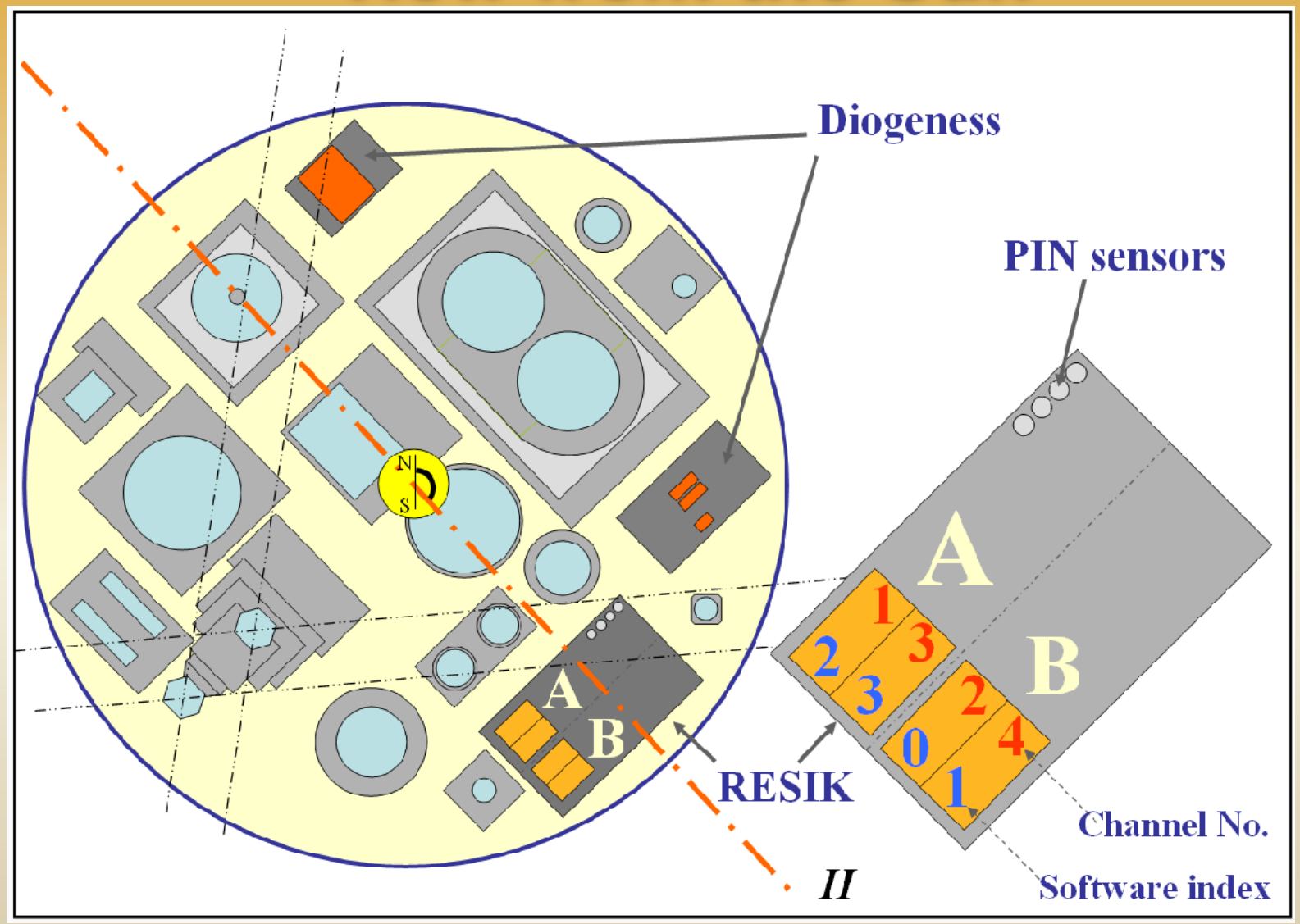
31 July 2001-Dec. 2006
polar orbit, 95min,
~500 km
semi-Sun-synchronous



RESIK on CORONAS-F



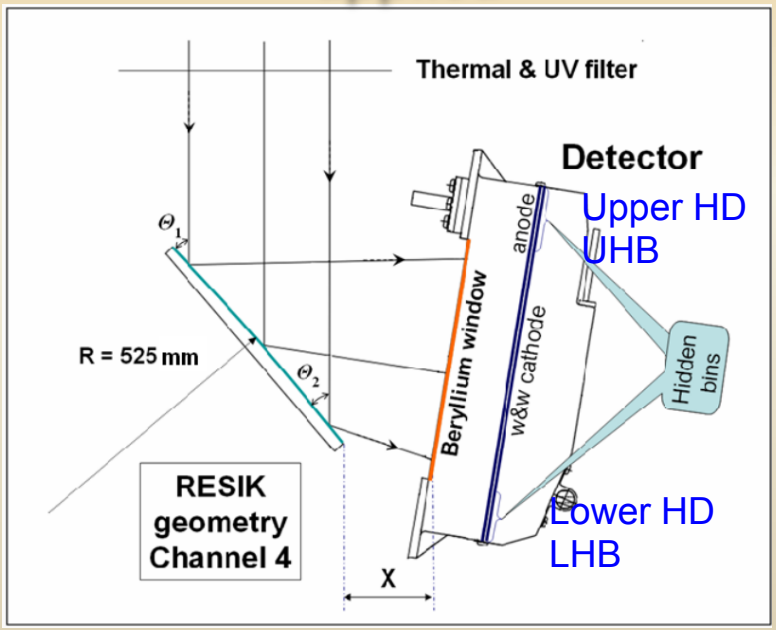
CORONAS-F payload view from the Sun



RESIK detectors

This was a great idea to put 4 PIN detectors inside RESIK the detectors were of the type NTE3033
Infrared Photodiode 7 x 8 mm behind 2 x 80 micron Al foils diameter 14 mm. This part was covered by MLI

The main spectroscopy 4 detectors contained parts of anodes (hidden bins HB) upper (better screened and lower). Every signal recorded on anode has been pulse –height analysed into 32 bin spectrum. Its energy range depends on HV applied



RESIK signals with particle signatures

- PIN detectors
  - 4 independent „identical" detectors (4 x20 mln data)
- RESIK PHA
  - 2 independent detectors with regulable HV
  - 4 independent PHA 32 bin data (4 x32 x 20mln/4 since commuted)
- Satellite conditions
  - Sat day/night, longest night 25 min →0 for long days
  - SAA, polar ovals transition, geomagnetic storms
- RESIK spectral hidden bins
  - UHB,LHB x 2 mln spectral measurements
- Total of 40 mln points, up to 40 at the same time

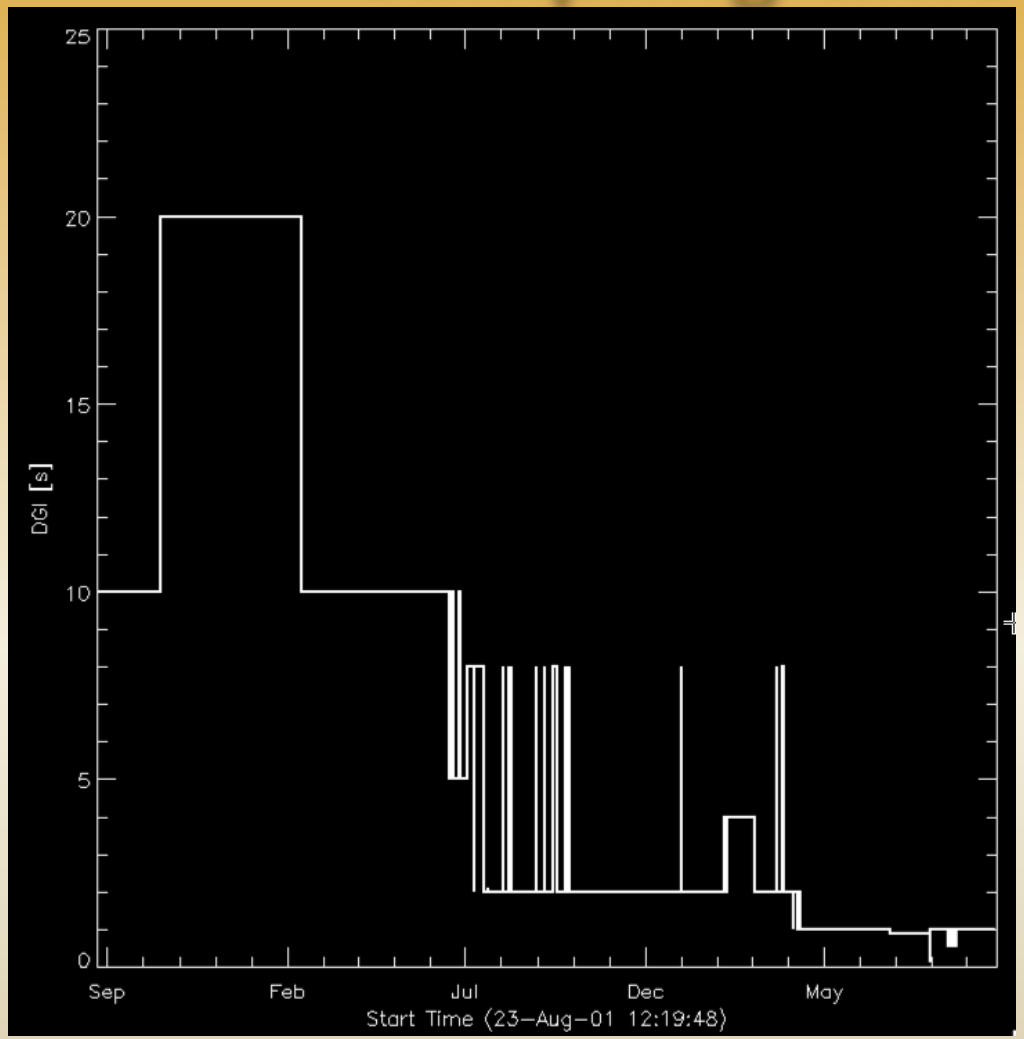
RESIK important periods of operation

- Early „learning" operations between

2001-Aug-24 12:19:48 & 2001-Oct-07 00:59:34

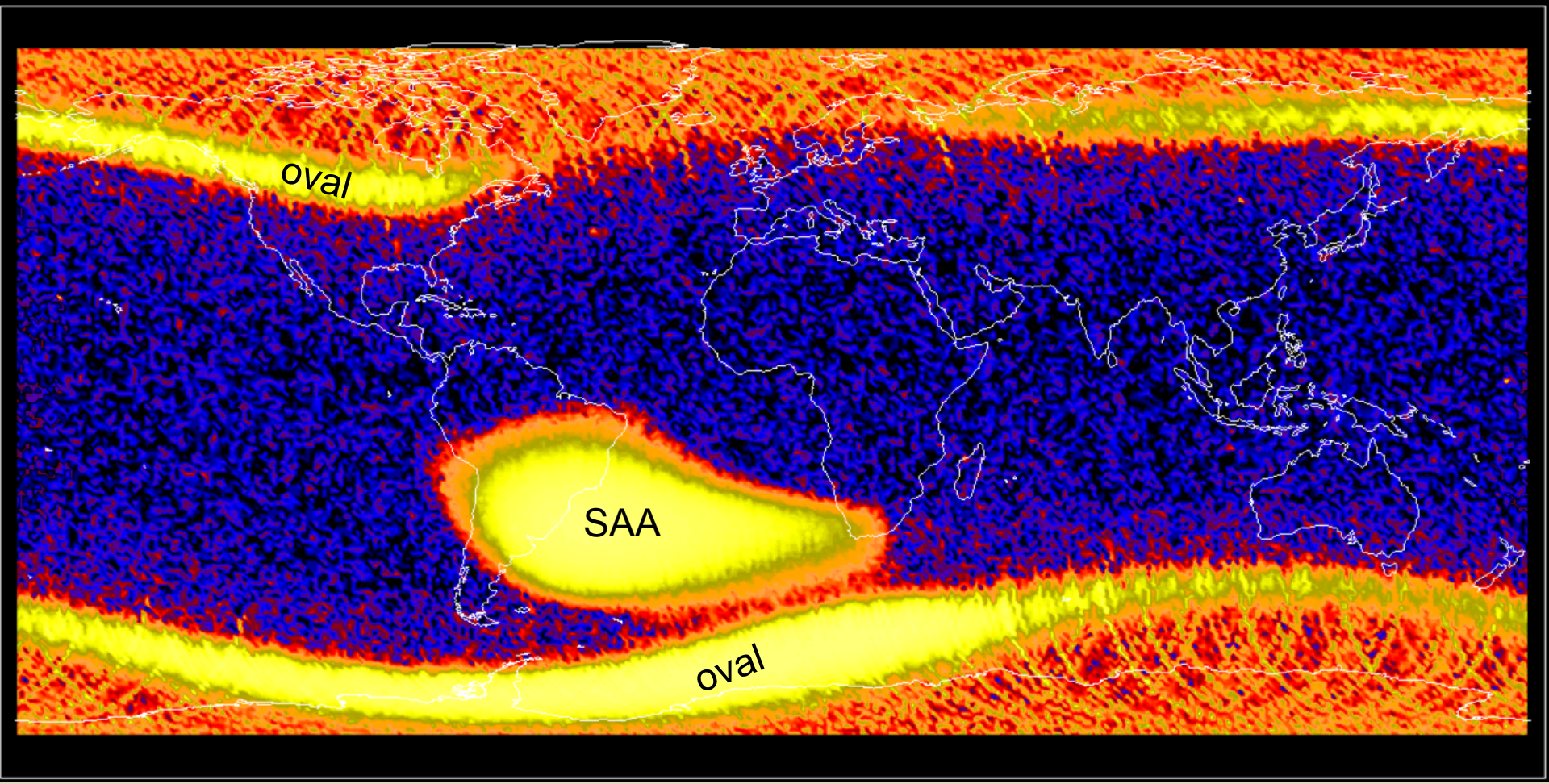
  - Const HV ON
  - Const DGI=10s
- Const DGI=20 s 2001-Oct. & 2002 Feb.
- ADS Tweaking 2002-Feb. & 2002 Jul.
  - Constant DGI = 10s
- DGI =8 or 2s 2002-Jul. & 2003 Apr.
- DGI =1 s 2003-Apr & 2003 Sep.

RESIK DGI-sampling time plot

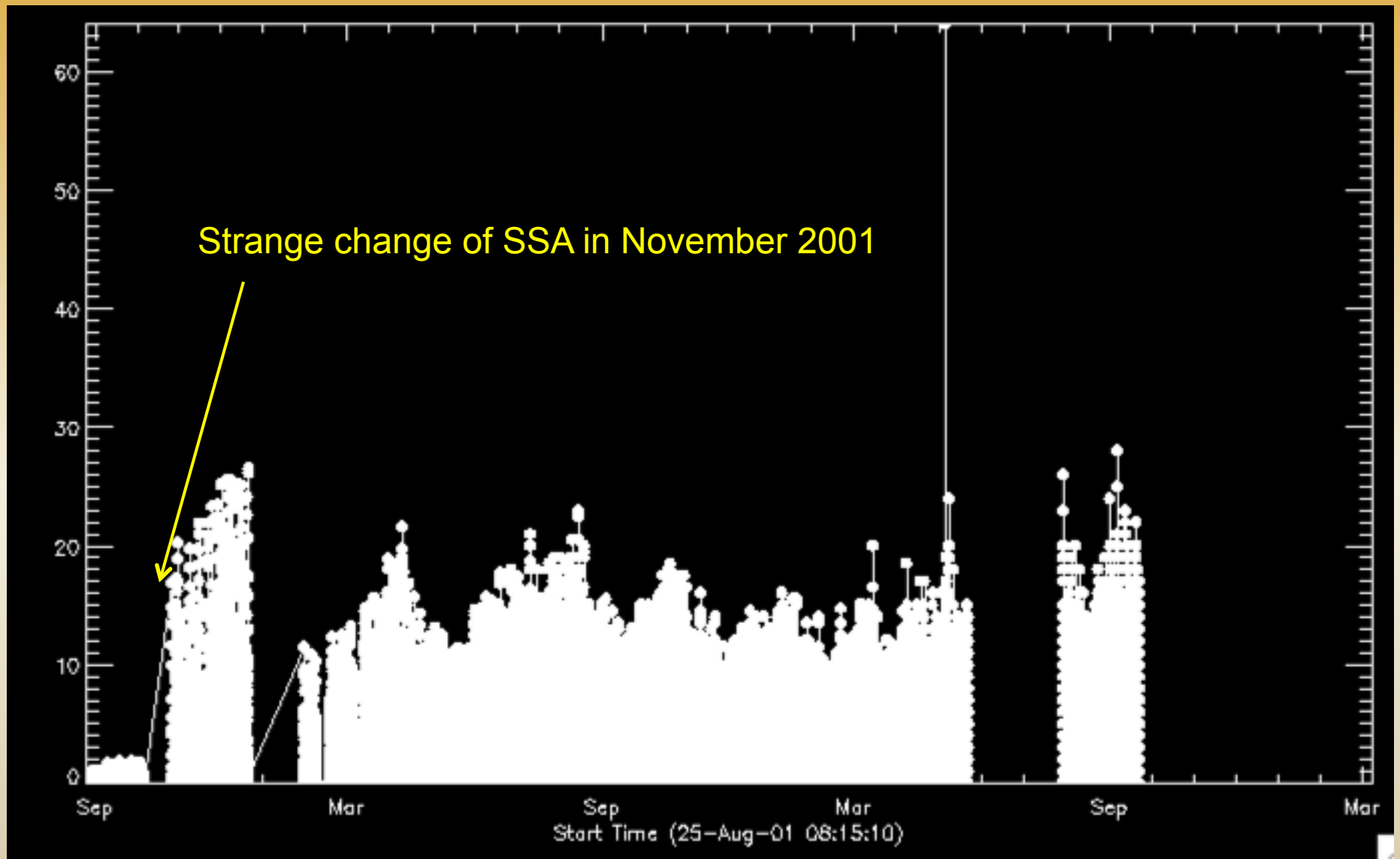


- Sampling of conditions along the orbit are ~DGI
- 8km for 1s
- 160 km for 20s

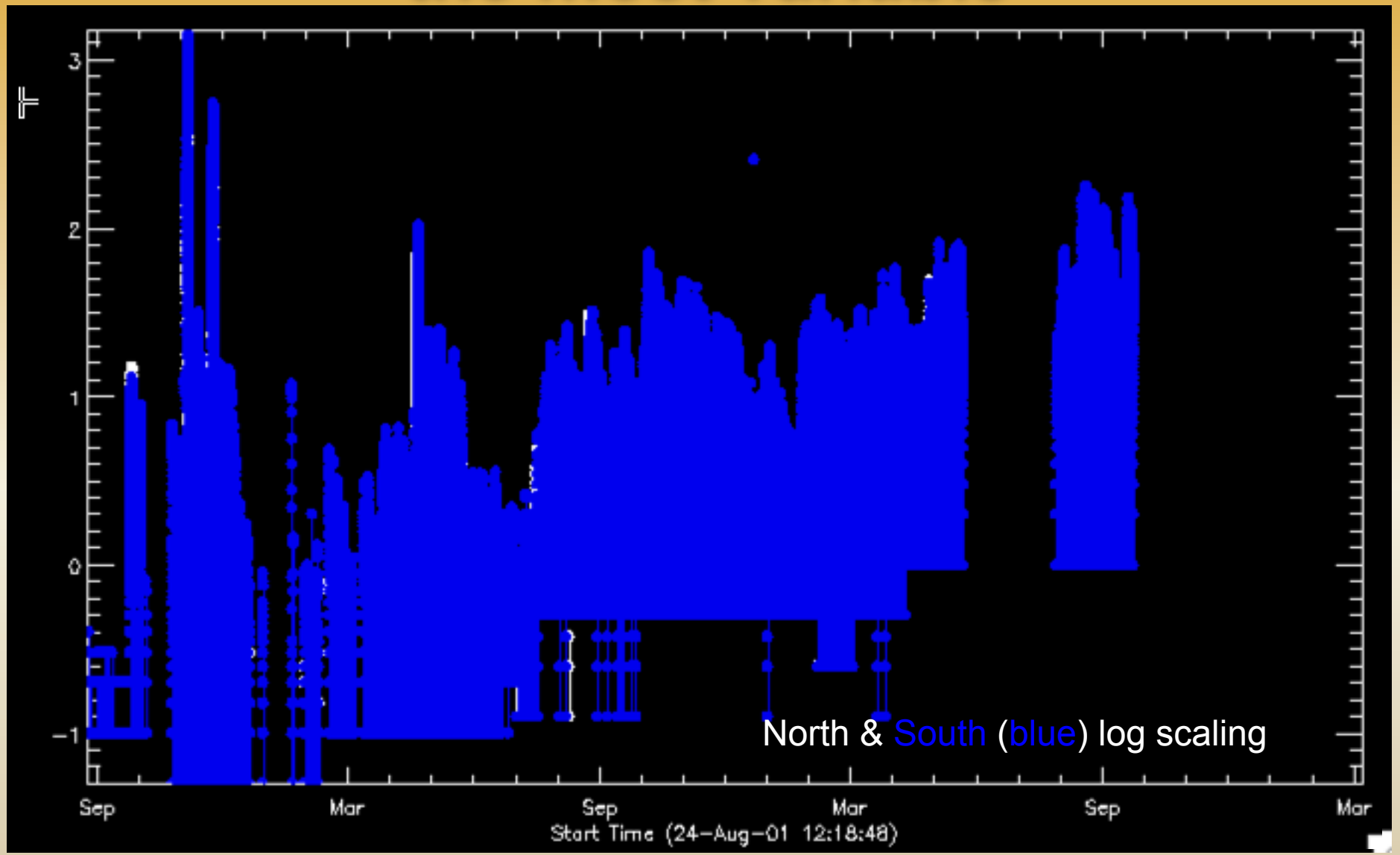
PIN sum: 3e7 events mission long 1 x1 deg



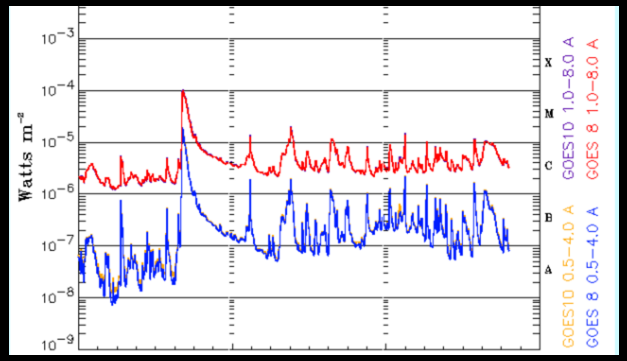
Rates in SAA


Strange change of SSA in November 2001
60
50
40
30
20
10
0
Sep
Mar
Sep
Mar
Sep
Mar
Start Time (25-Aug-01 08:15:10)

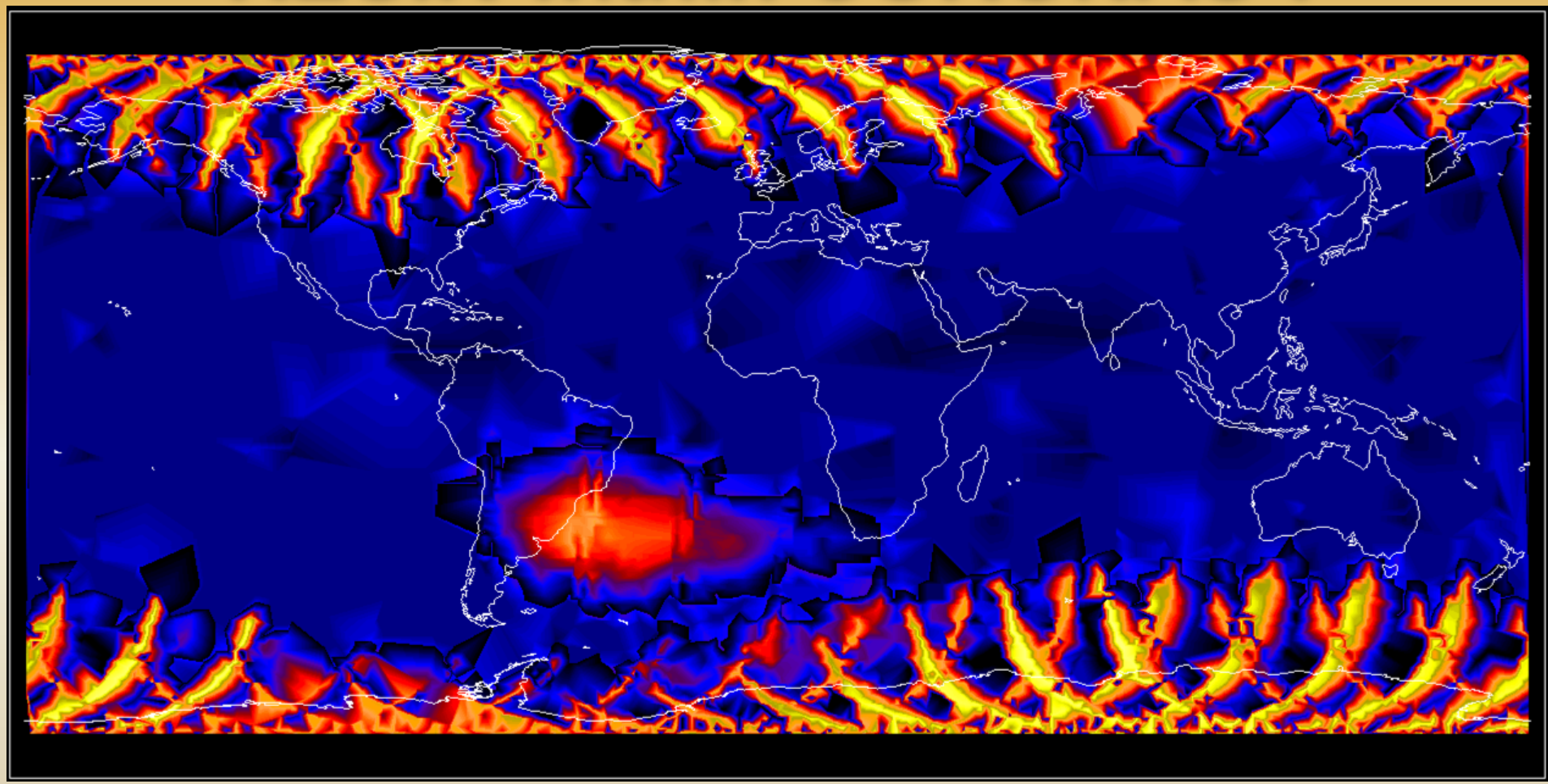
Polar regions the most variable



What is seen during a medium size storm?



RESIK within CORONAS-F



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RESIK and MKL on CORONAS-F

http://smdc.sinp.msu.ru/index.py?nav=coronasf

- Electron fluxes:
  - e.3-.6 - 0.3-0.6MeV; 1/cm2*sr*s
  - e.6-1.5 - 0.6-1.5MeV; 1/cm2*sr*s
  - e1.5-3 - 1.5-3.0MeV; 1/cm2*sr*s
  - e3-6 - 3 - 6MeV; 1/cm2*sr*s
  - e6-12 - 6 -12MeV; 1/cm2*sr*s
- Proton fluxes:
  - p1-5 - 1 - 5MeV; 1/cm2*sr*
  - p14-26 - 14 - 26MeV; 1/cm2*sr*s
  - p23-26 - 23 - 26MeV; 1/cm2*sr*s
  - p26-50 - 26 - 50MeV; 1/cm2*sr*s
  - p50-90 - 50 - 90MeV; 1/cm2*sr*s
- Mixed channels:
  - 0.5p>9 - electrons E>0.5MeV, protons E>9MeV; 1/cm2*sr*s e>1p>9 -
  - electrons E 1MeV, protons E>9MeV; 1/cm2*sr*s e1.6p23 –
  - electrons E 1.6MeV, protons E>23MeV; 1/cm2*sr*s e1.6p90 –
  - electrons E 1.6MeV, protons E>90MeV; 1/cm2*sr*s
  - Alpha (He ions)a23-33 - alpha 23-33MeV; 1/cm2*sr*s

http://www.springer.com/astronomy/extraterrestrial+physics%2C+space+sciences/book/978-3-642-39267-2

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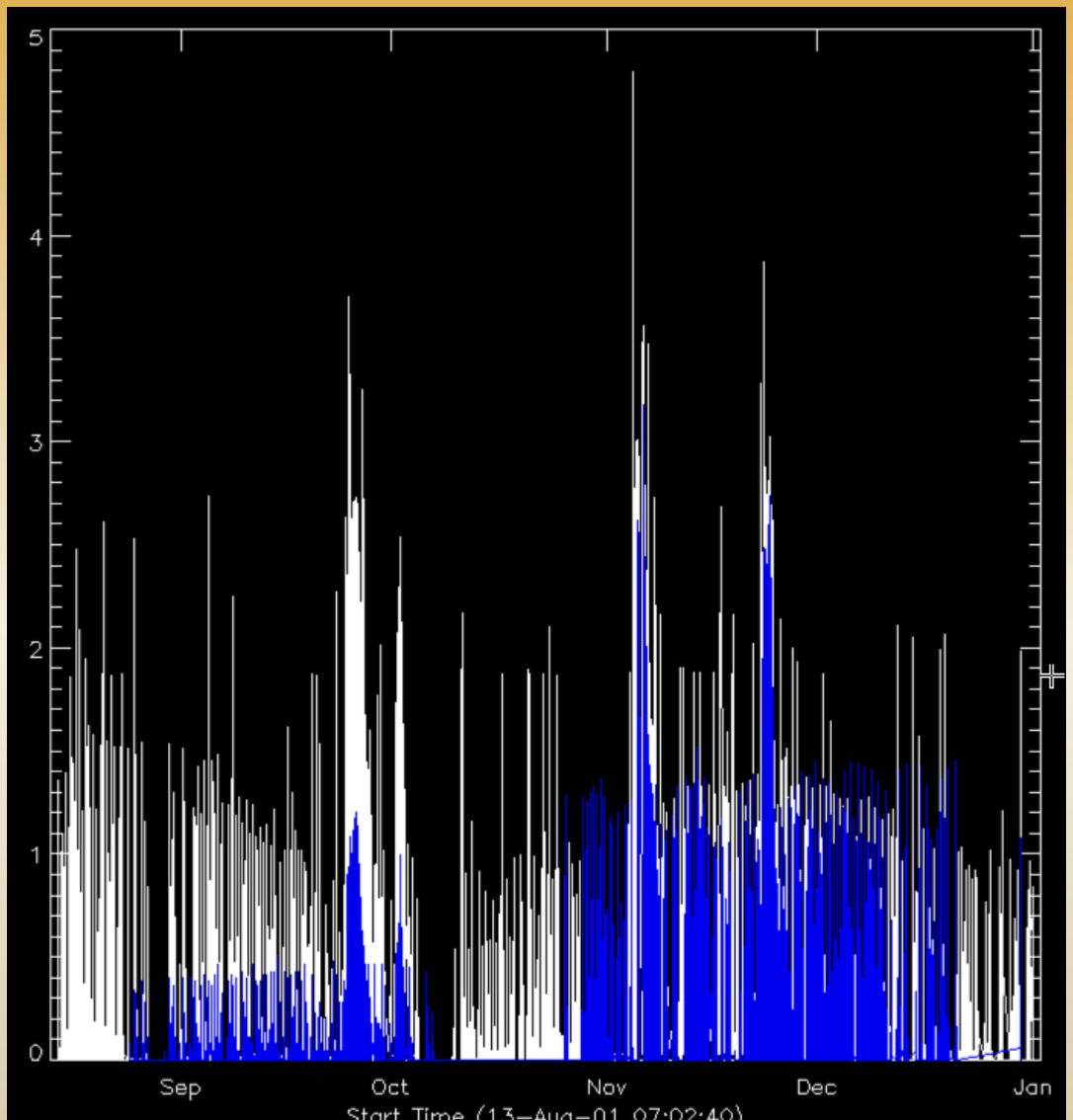
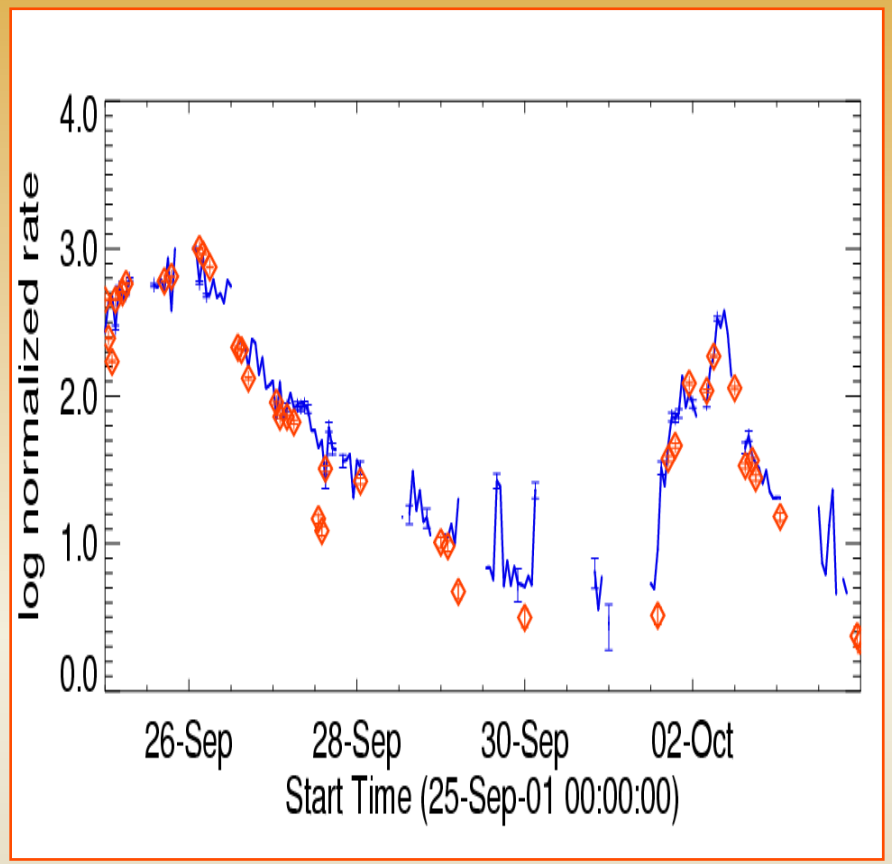
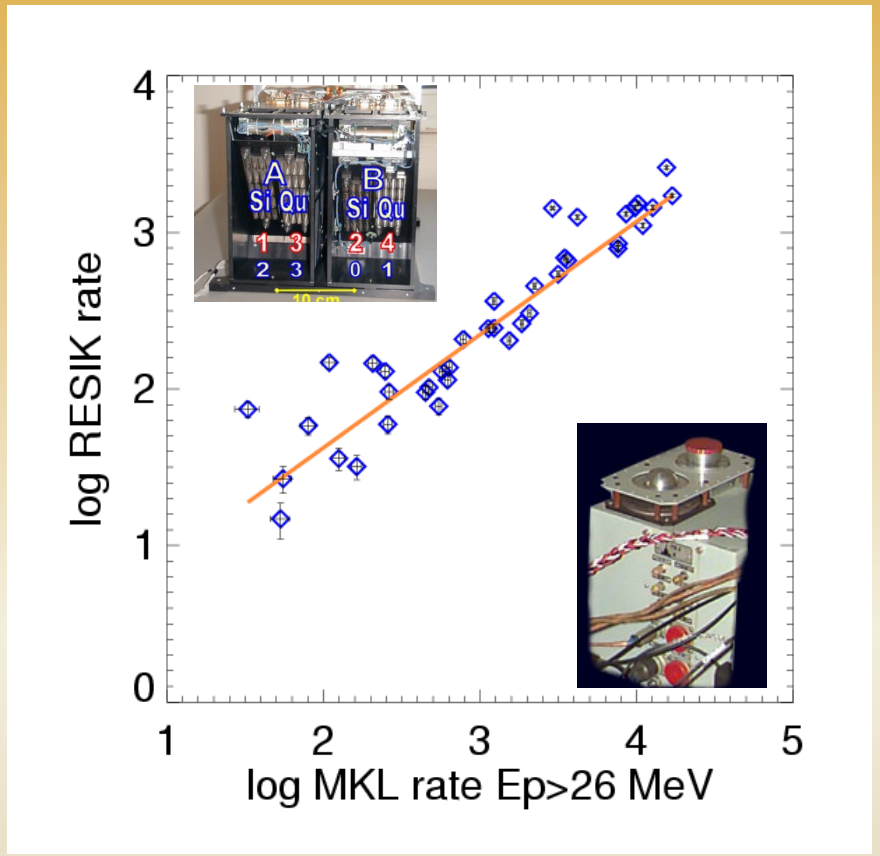
MKL protons
26-50 kev & PIN



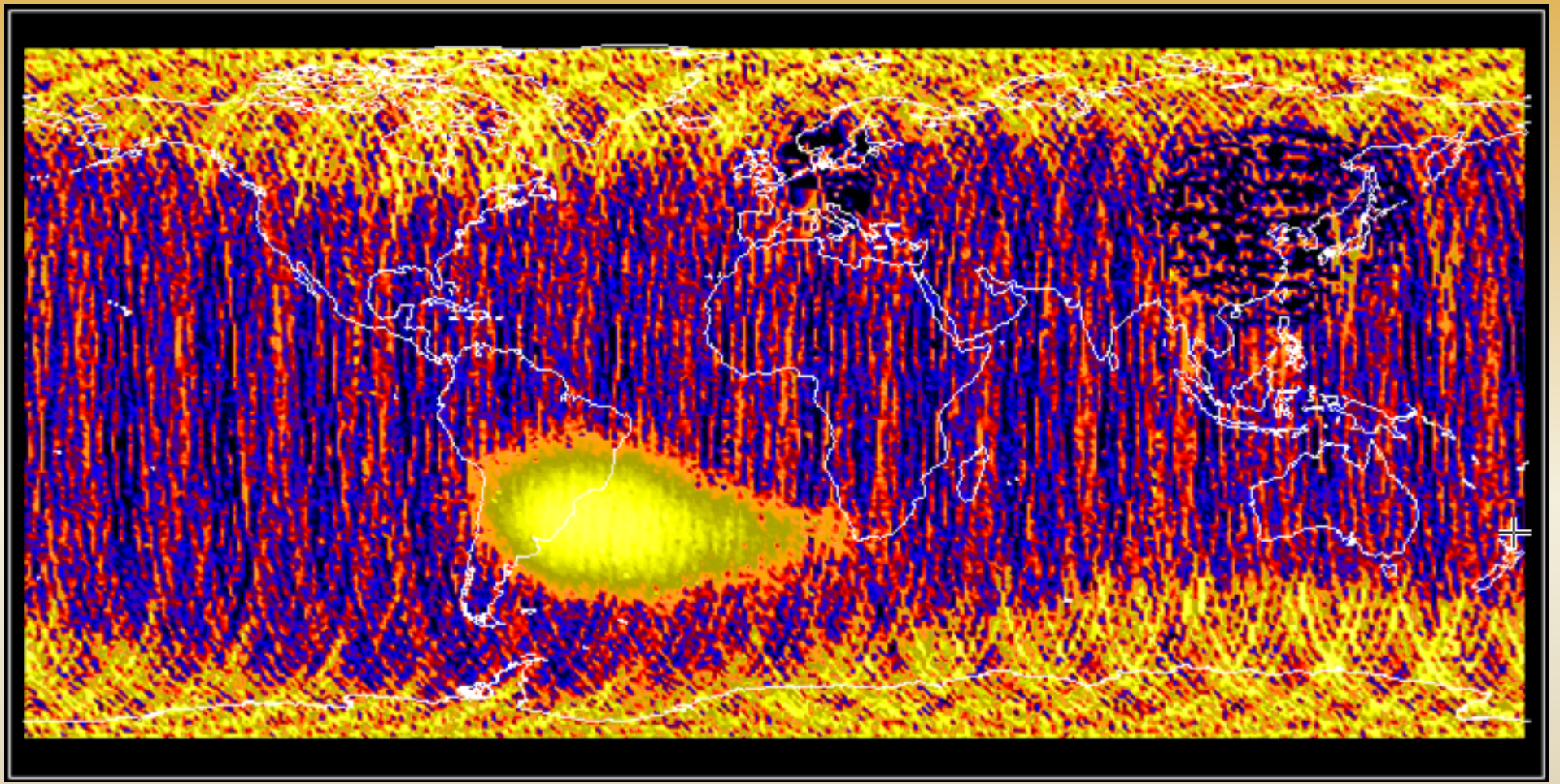
corellation of PIN signal with MKL detector's



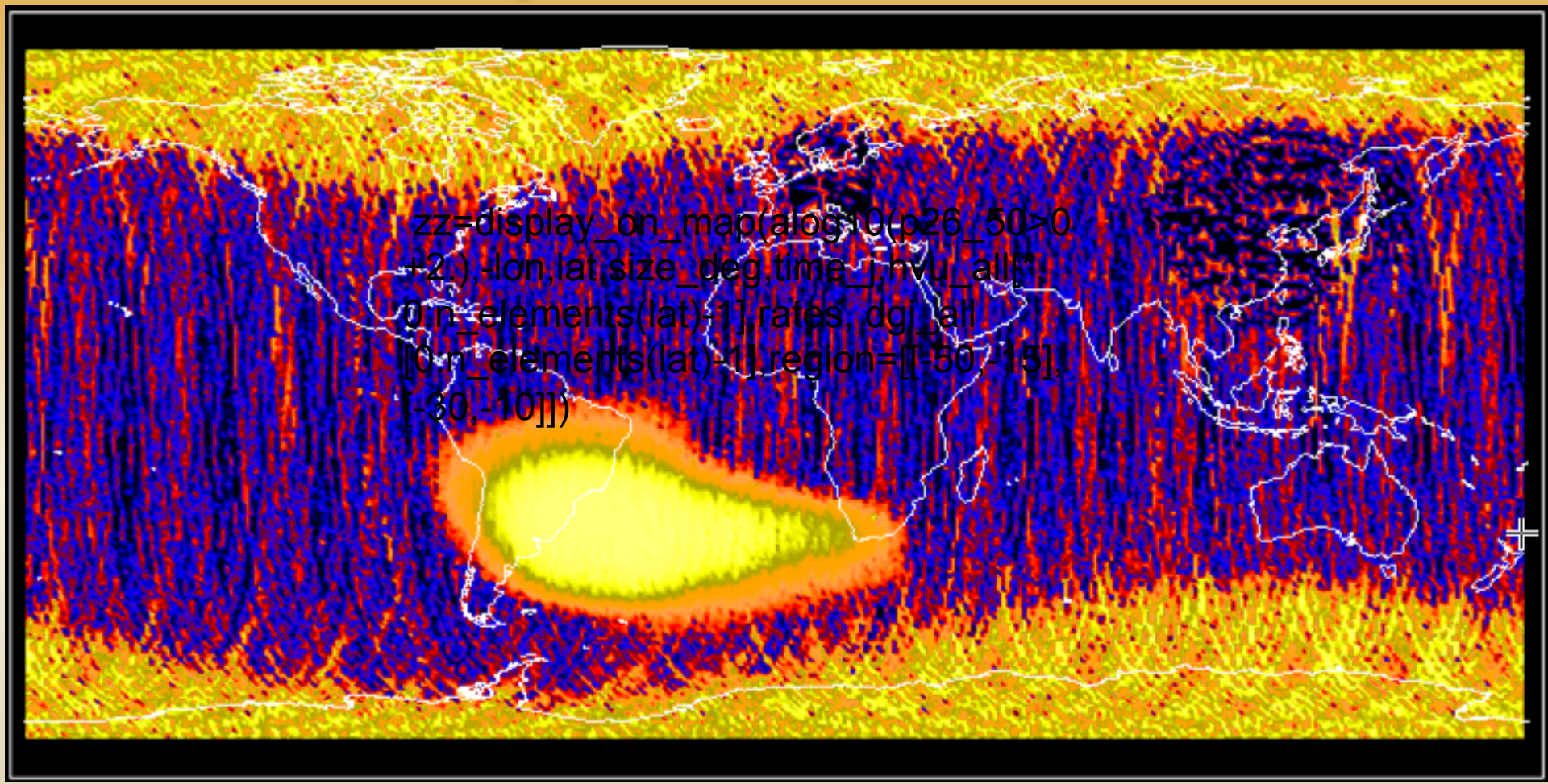


„early rather weak geomagnetic storms"

MKL protons 23-26 keV



MKL protons 26-50 keV



Now back to RESIK gas detectors (Ar + Xe)

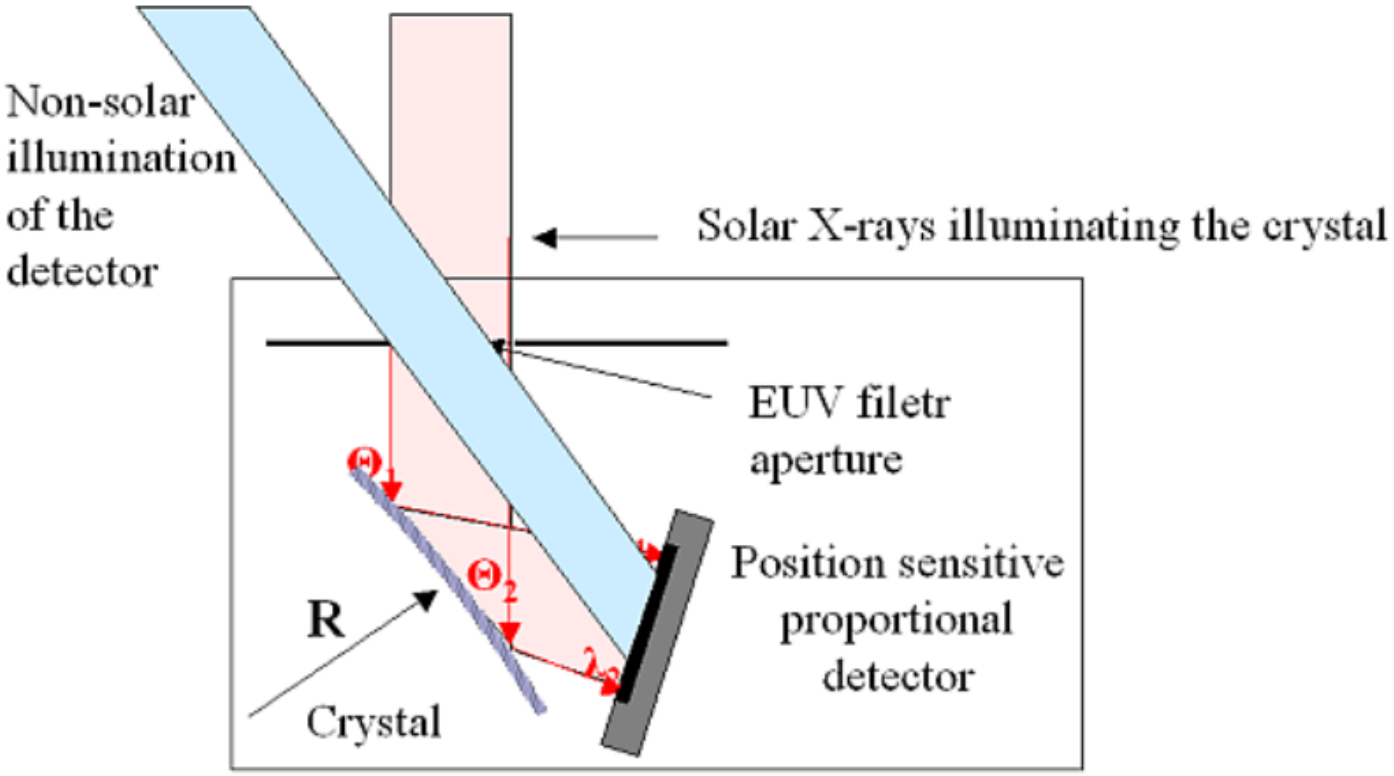
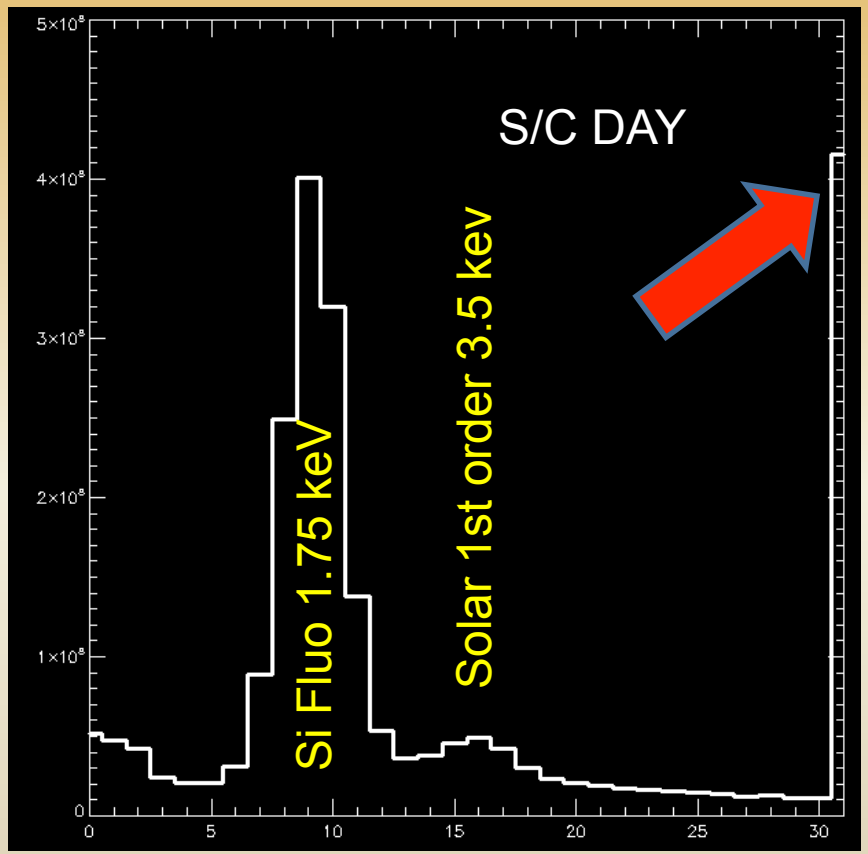
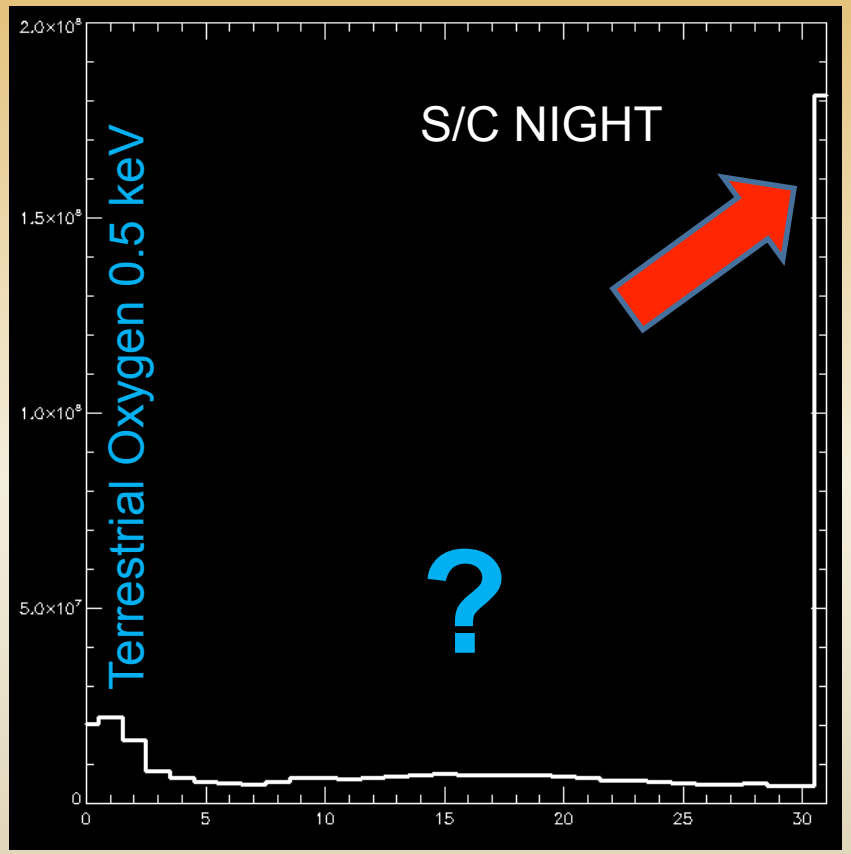


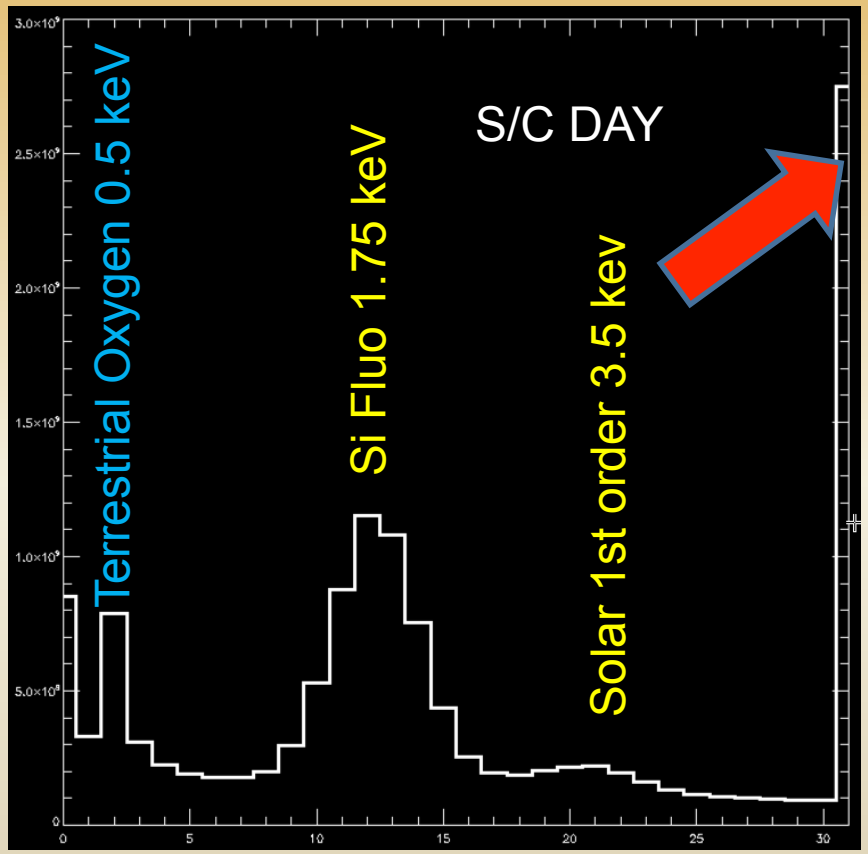
Figure 1. A scheme of X-ray beams within one section of RESIK Bragg spectrometer

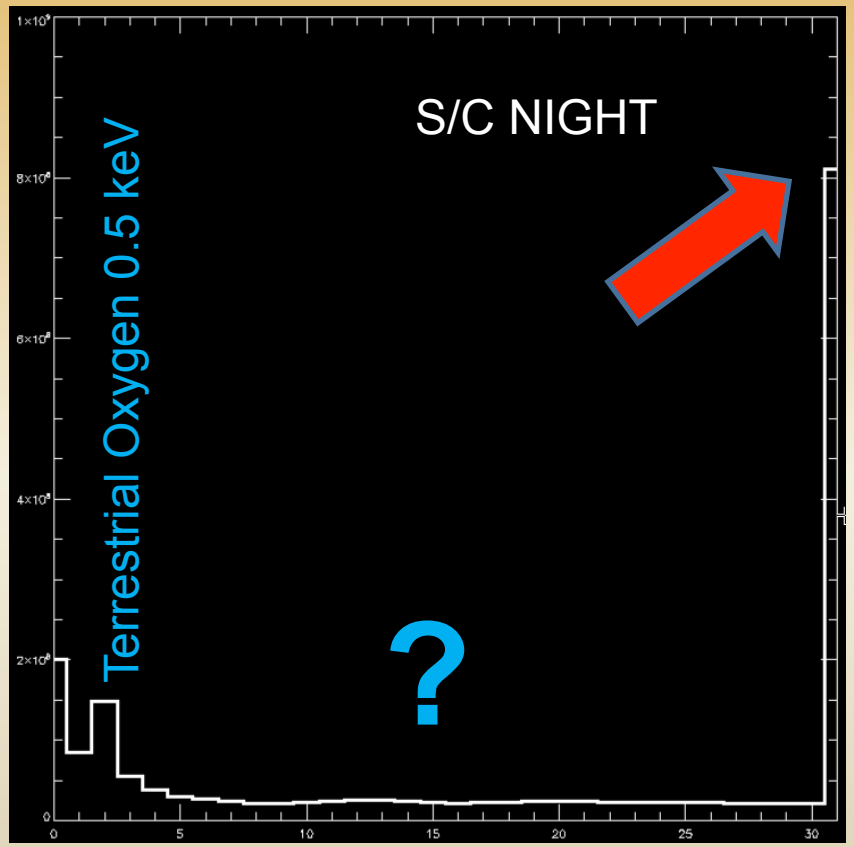
RESIK PHA Spectra
Example PHA channel #2 HV:1450 V



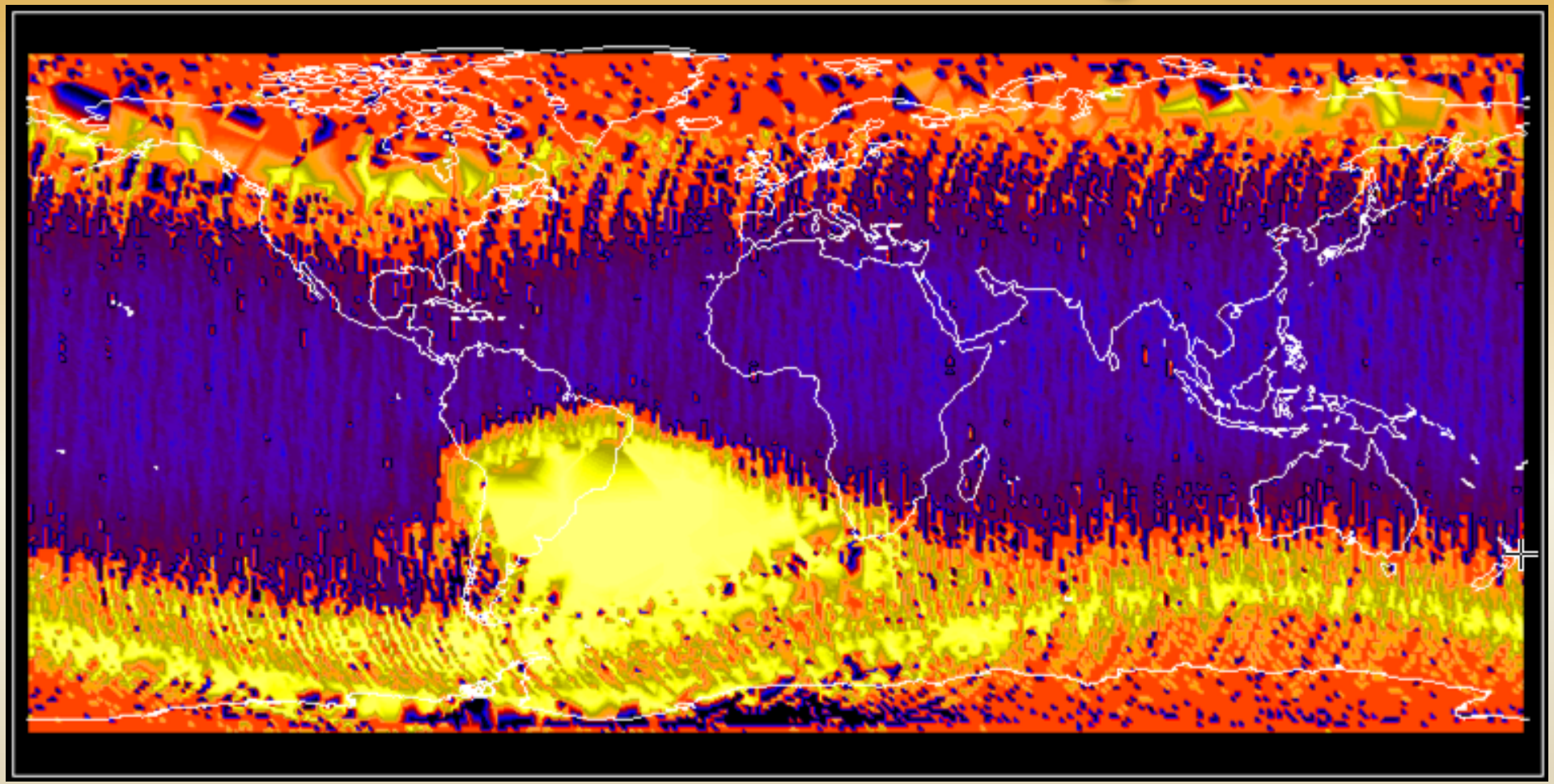


RESIK PHA Spectra
Example PHA channel #2 HV:1480 V





Terrestrial
0.5 keV emission S/C nights



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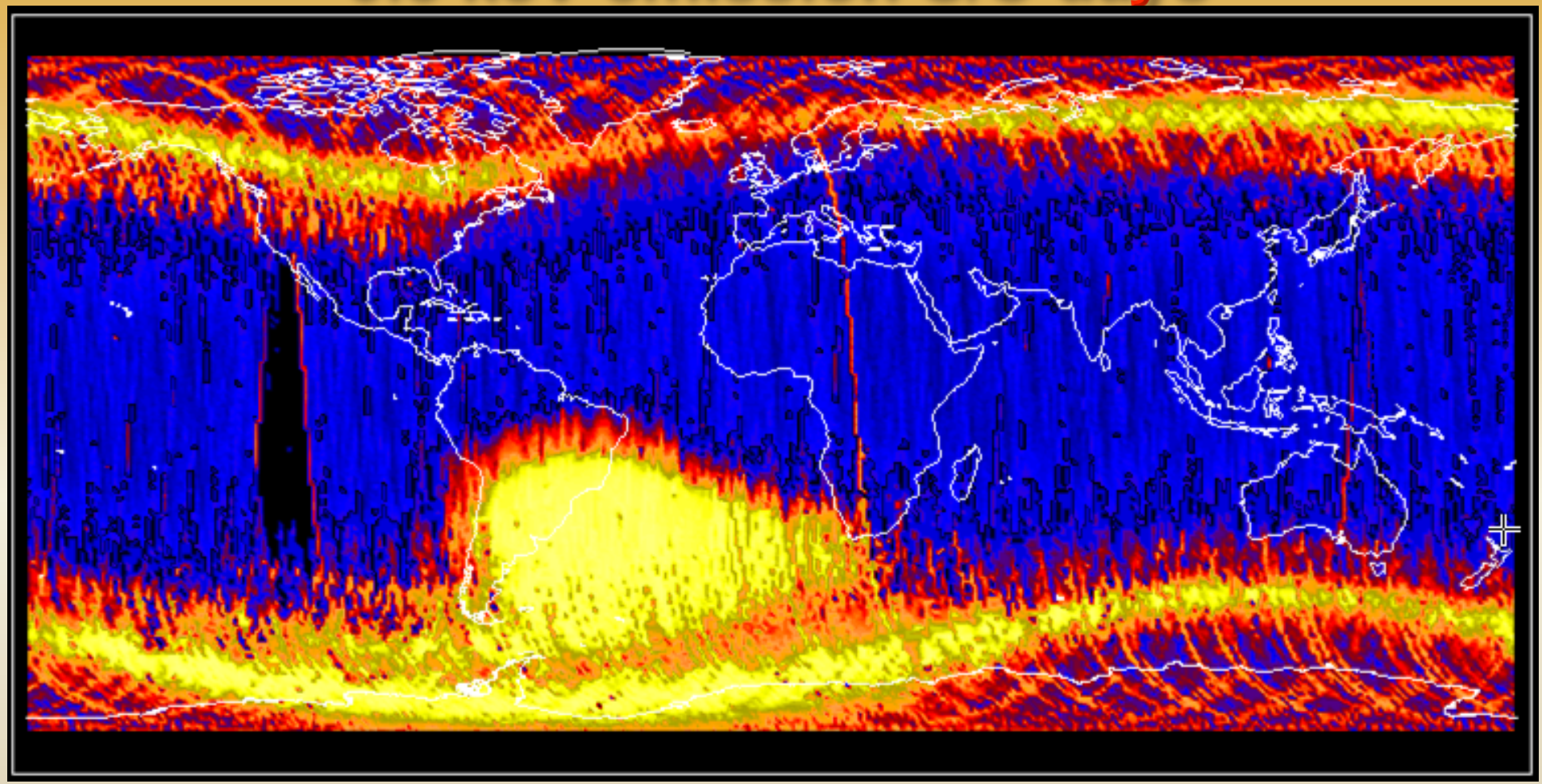
Terrestrial
0.5 keV emission S/C days



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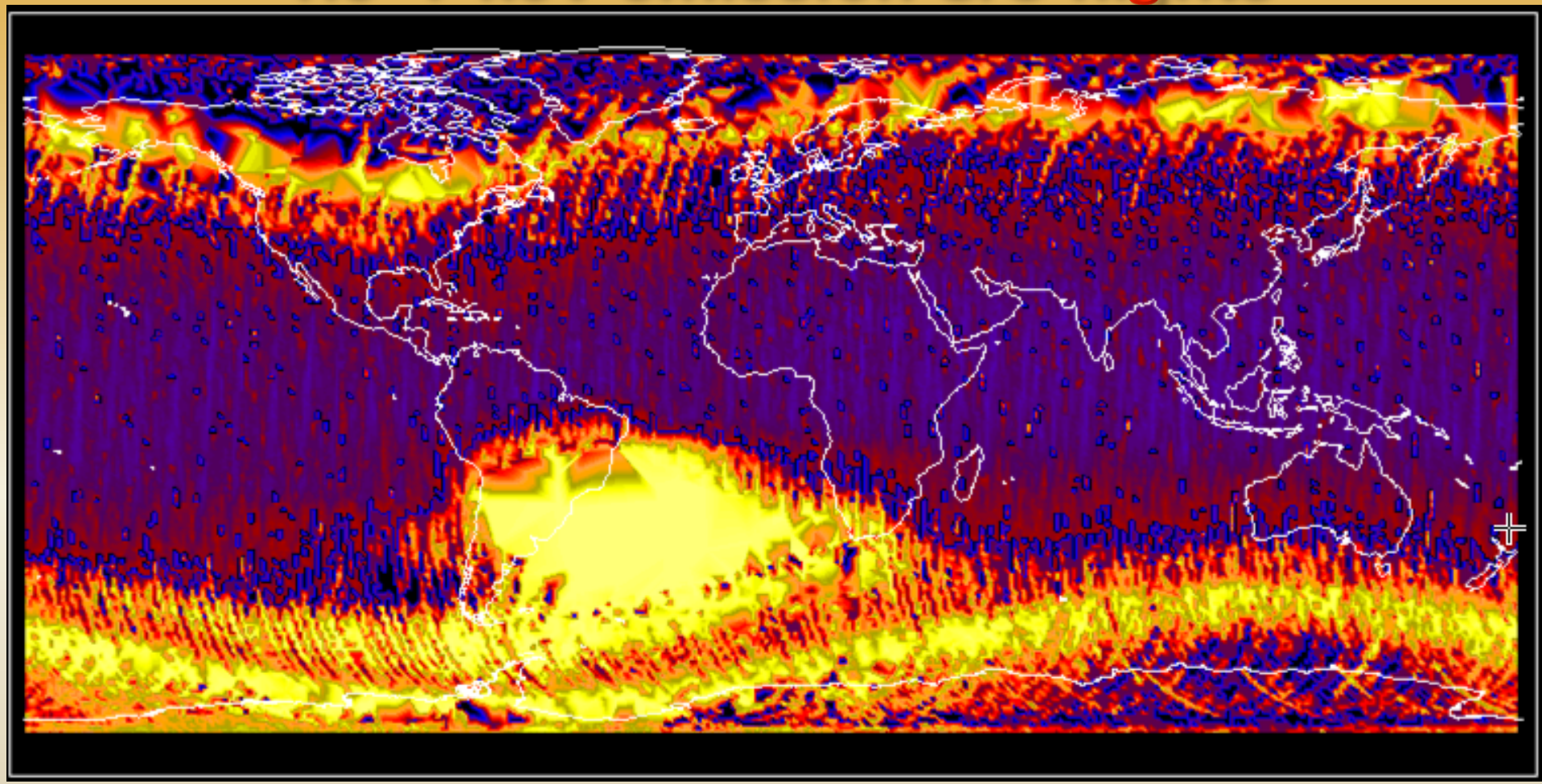
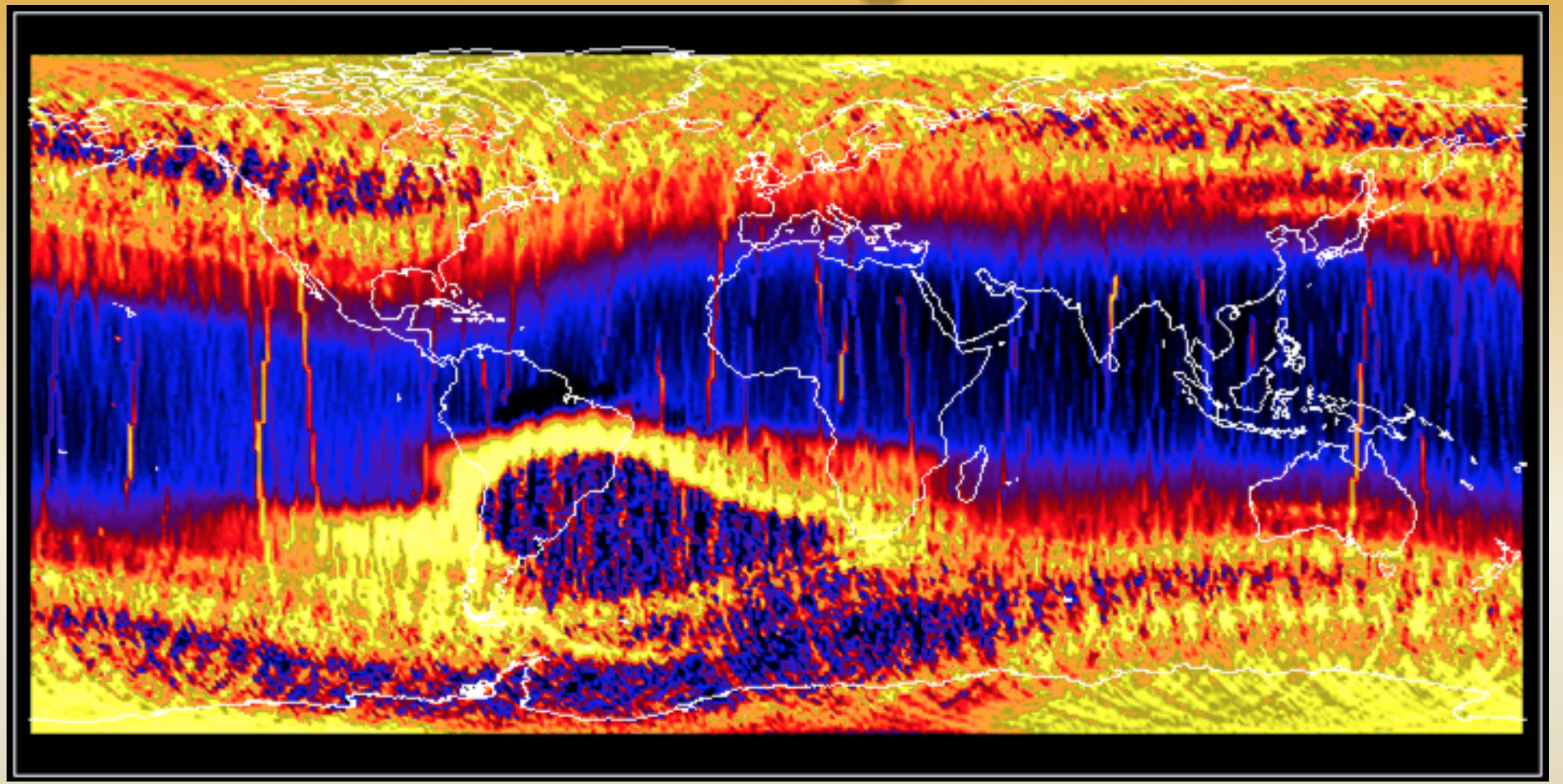
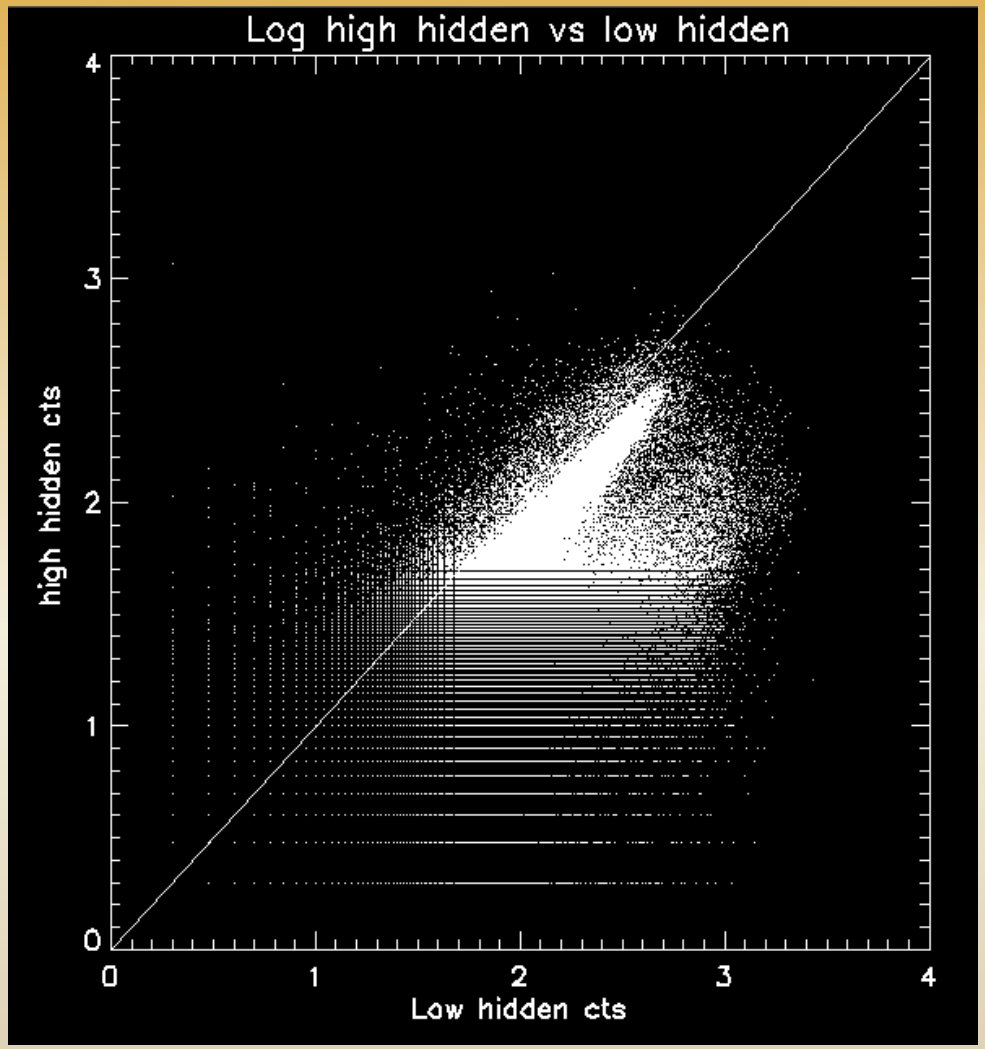
Terrestrial
1.5 -7 keV emission S/C nights

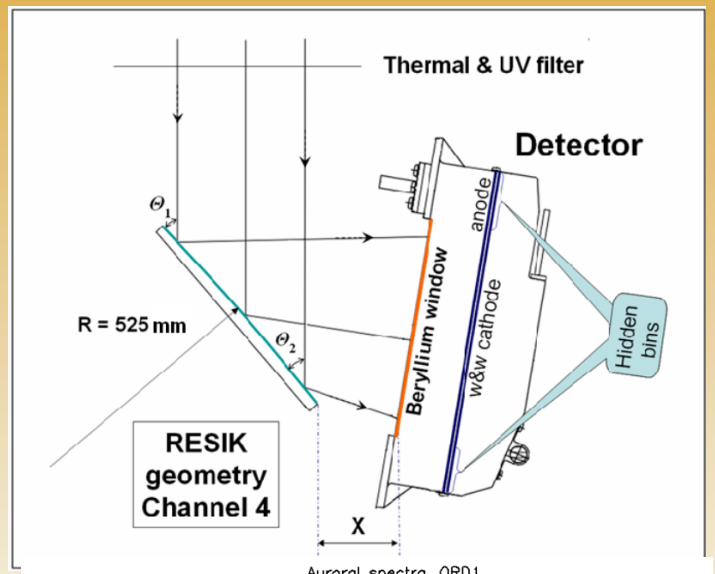


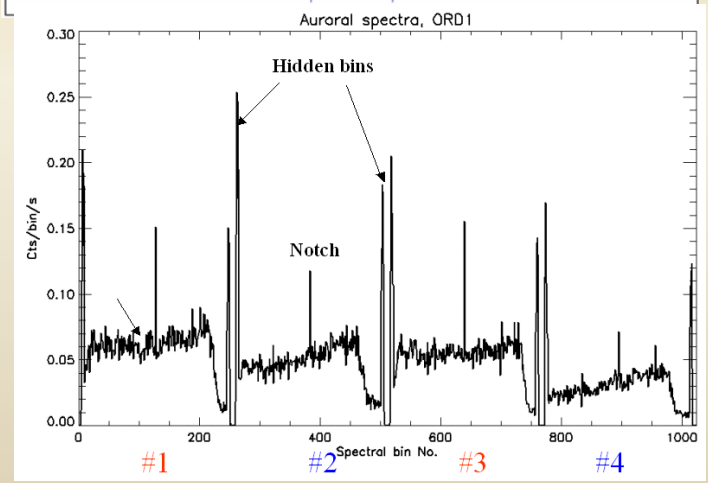
31st bin 1 x 1 deg resolution



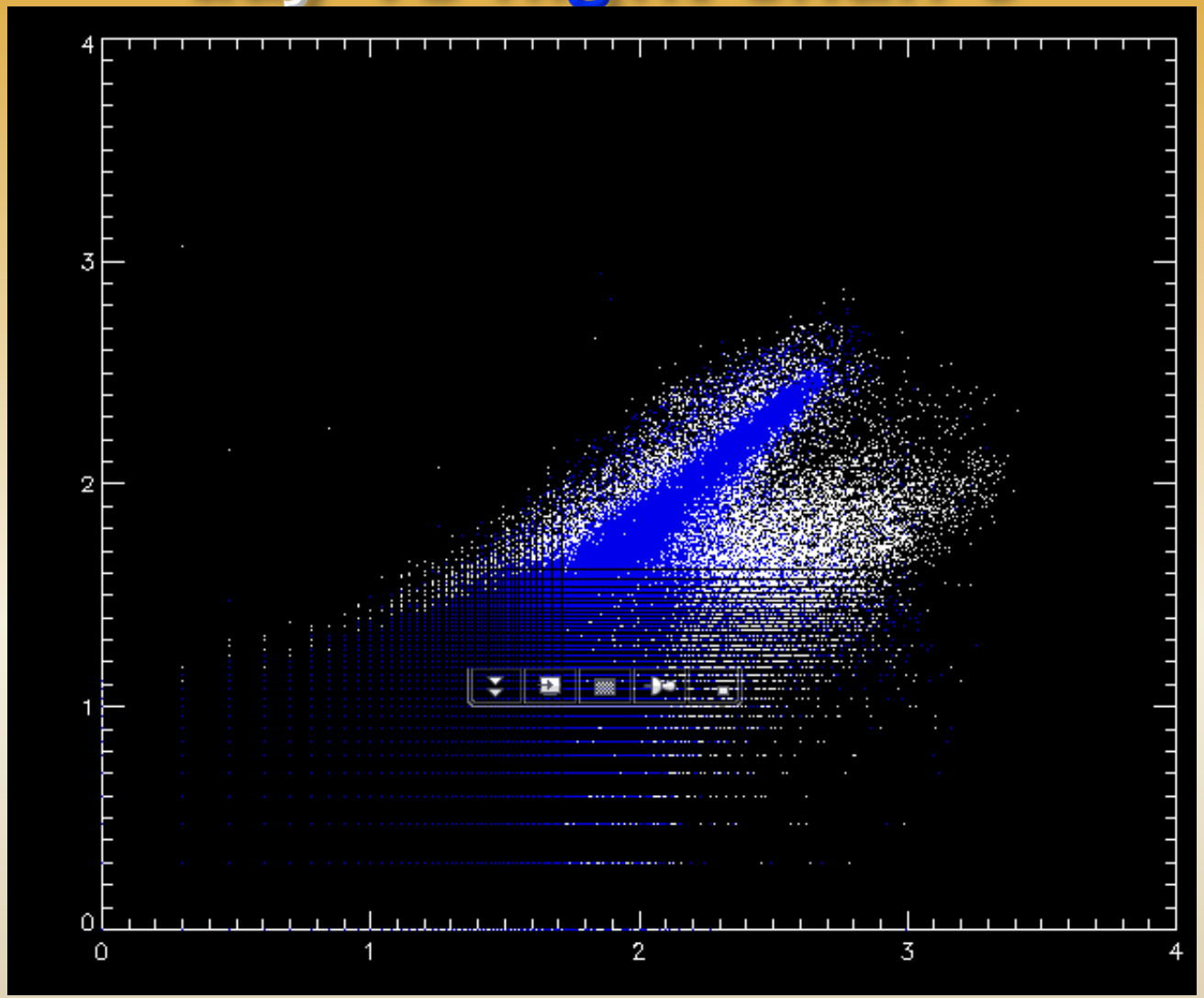
Hidden bins correlations



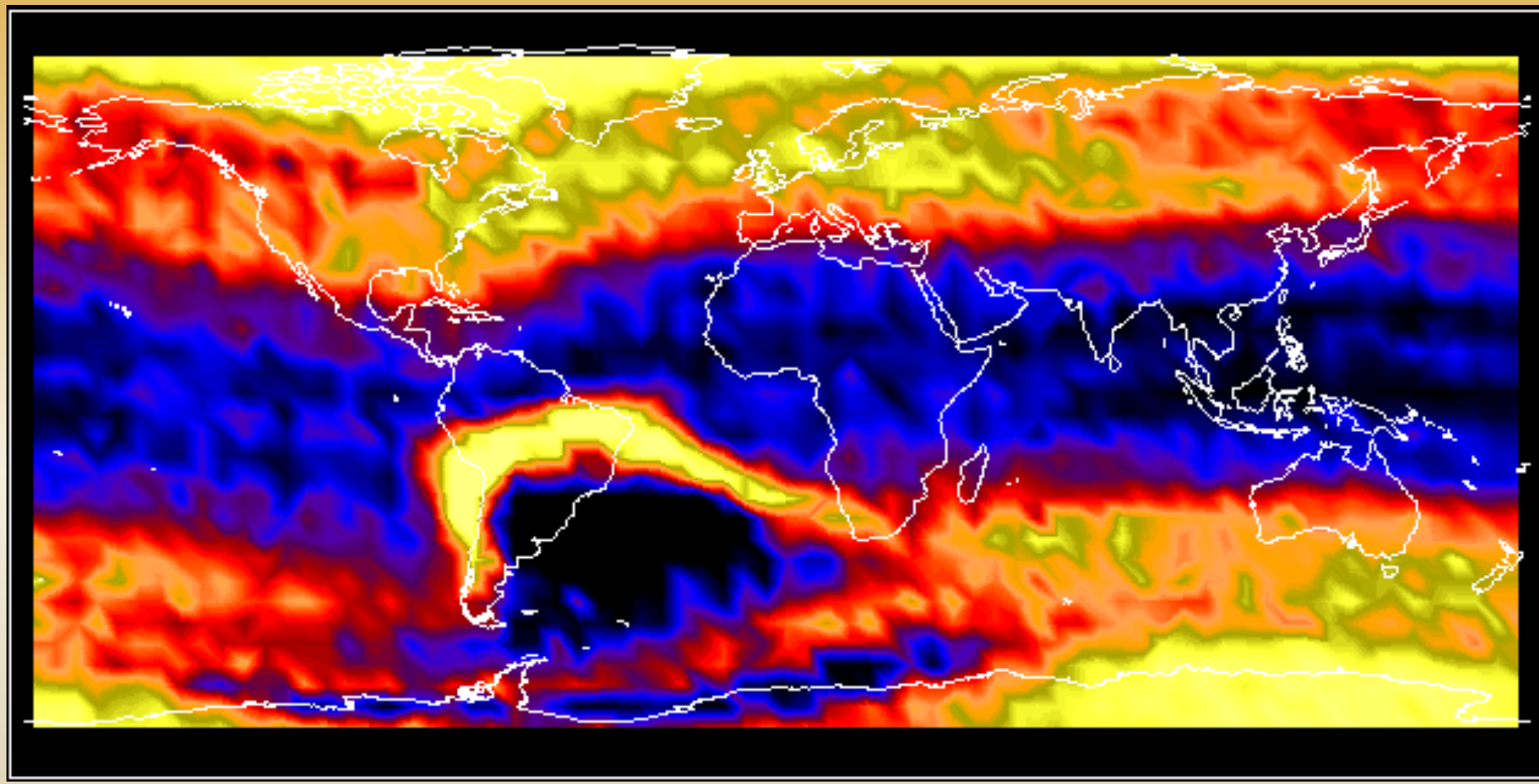




Hidenn bins
day vs night chan 0



High hidden chan 0



Non-solar contributions

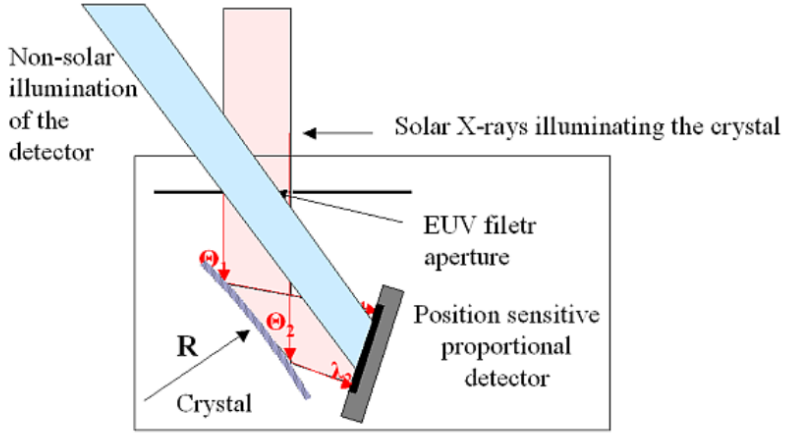
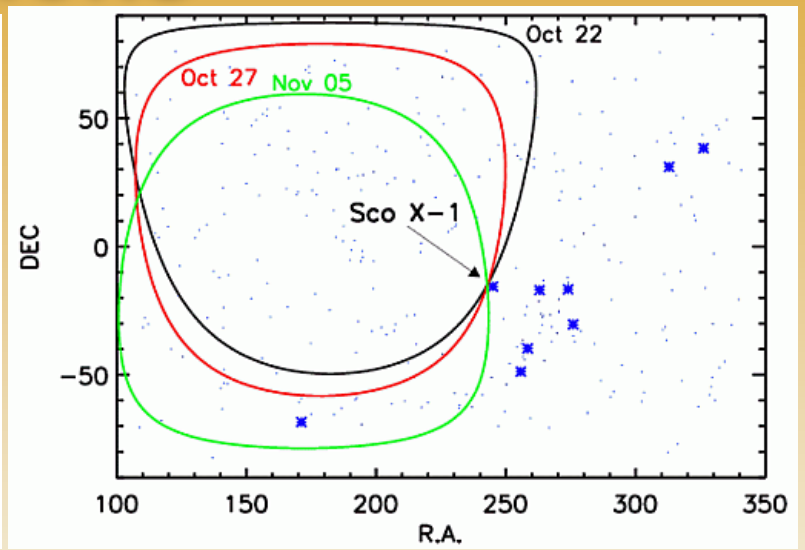
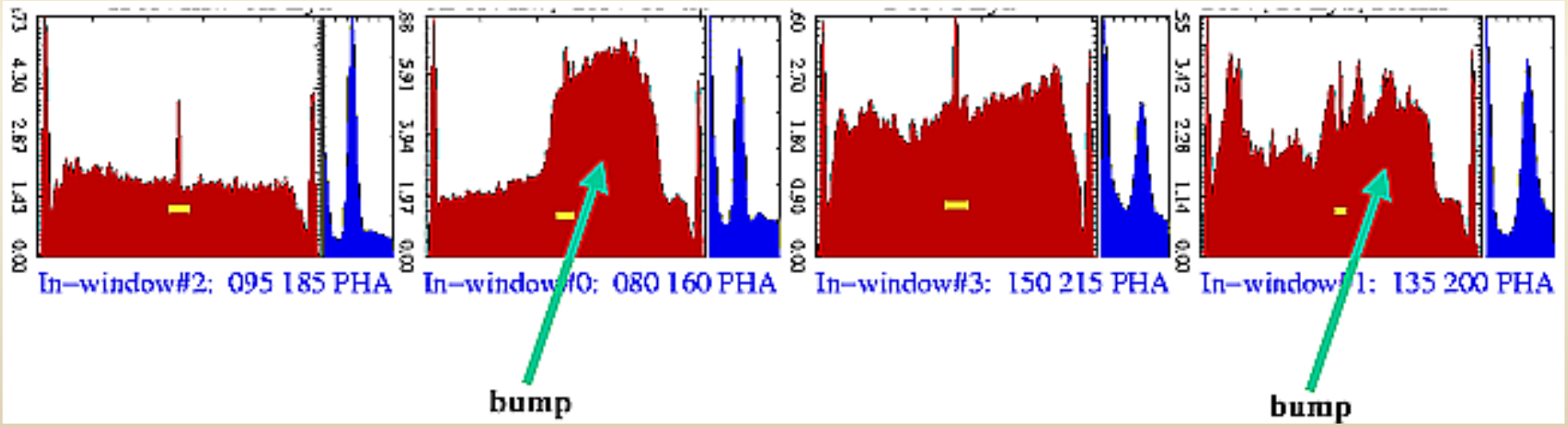


Figure 1. A scheme of X-ray beams within one section of RESIK Bragg spectrometer





Ongoing & Possible collaborations

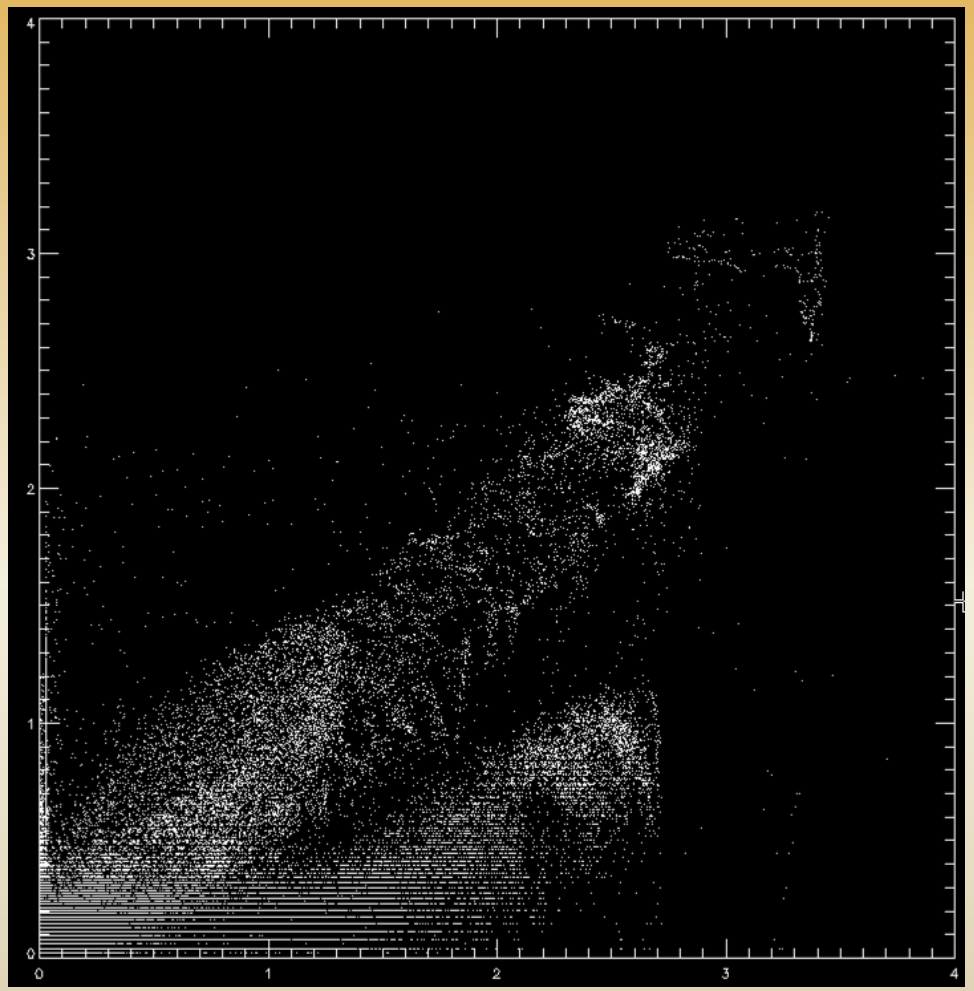
- Skobeltsyn Institute MGU, Moscow
  - Understanding & Calibrations of various RESIK Signals- for quiet and stormy conditions
- Plasma physics group, SRC Warsaw
  - Understanding signals due to severe storms
- Lebedev Physical Institute, Moscow
  - Relation between the PIN signals and CCD tracks signal
- ROB & SPENVIS groups, Belgium
  - Quiet & stormy condition response of PROBA-2

Thank you eHeroes Team

RESIK and MKL on CORONAS-F

MKL data on:

http://smdc.sinp.msu.ru/index.py?nav=coronasf



RESIK within CORONAS-F

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