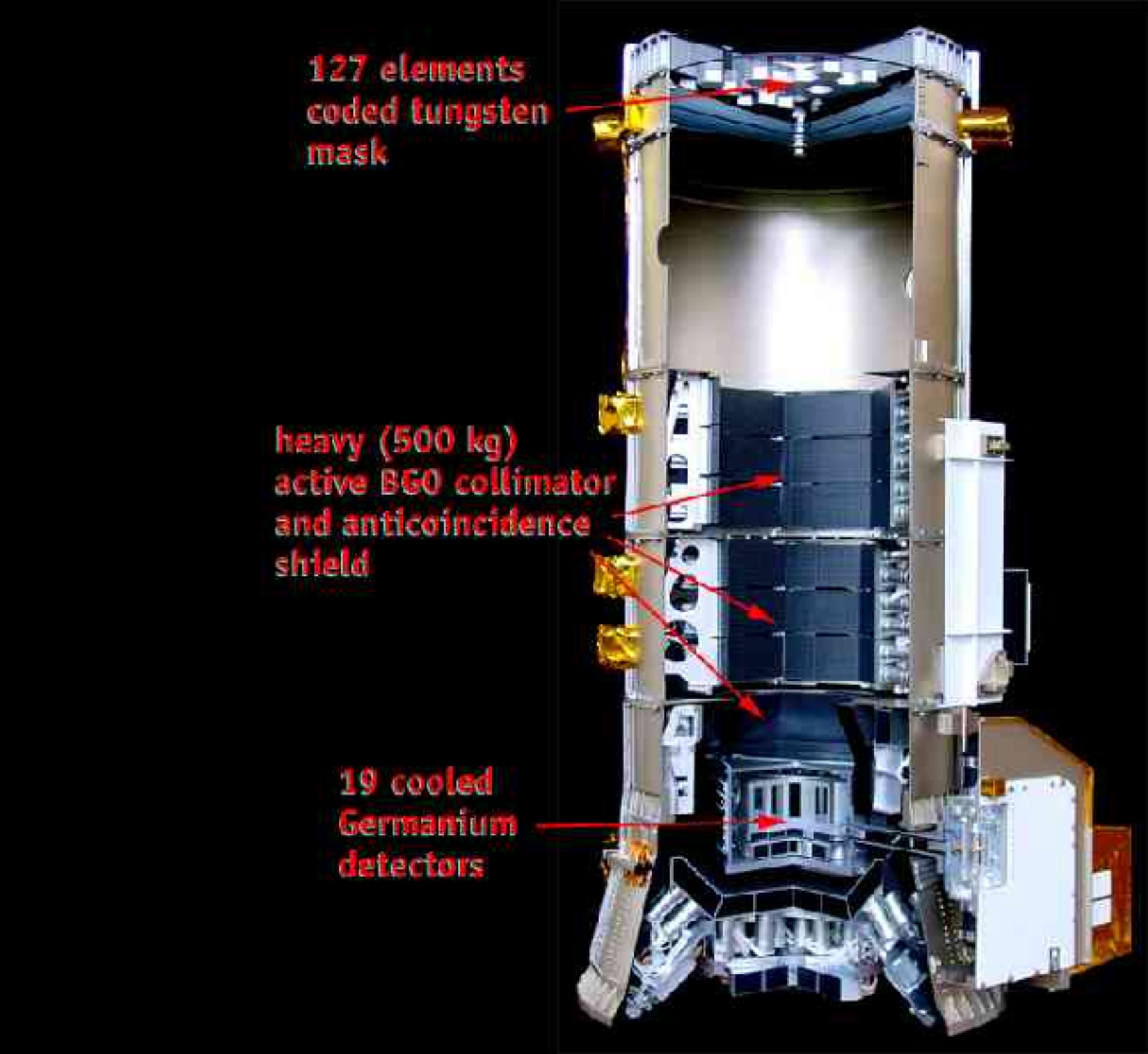
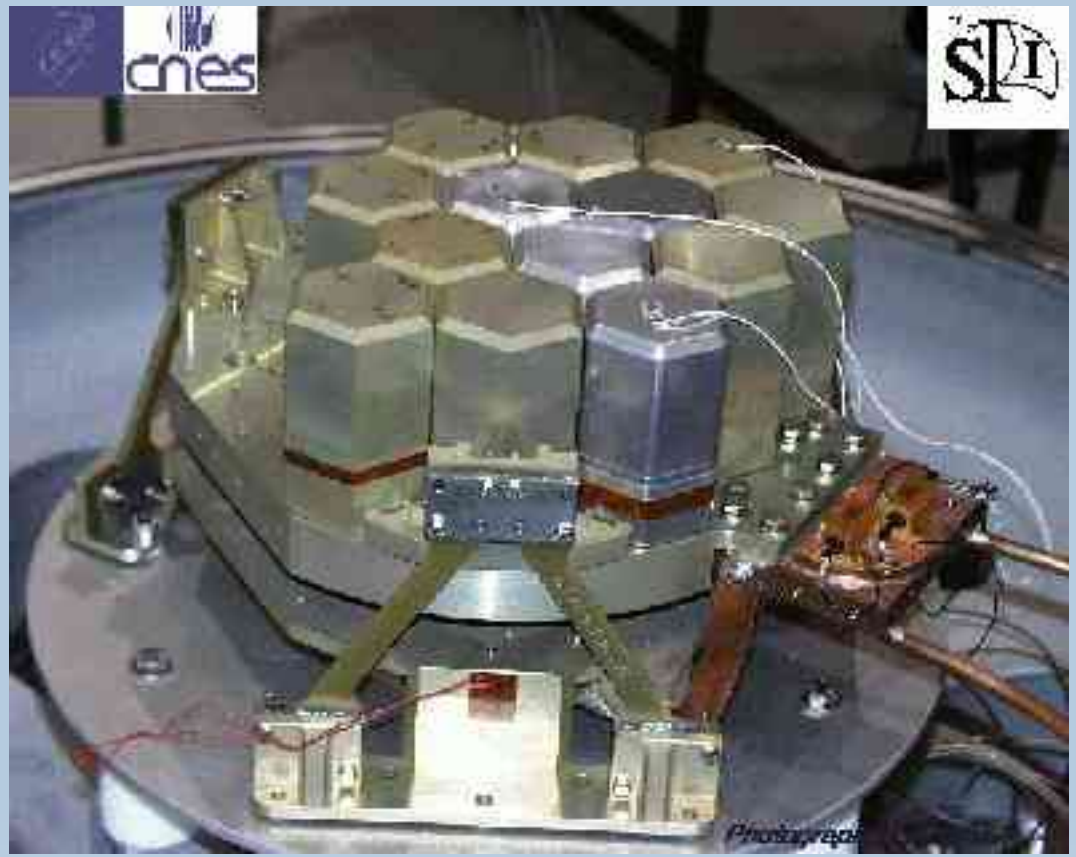
# *SPI Data Analysis*

- The SPI instrument
- Event data
- Analysis steps ( SPIROS )
- Scientific validation
- GRB and phase resolved analyses
- Conclusions

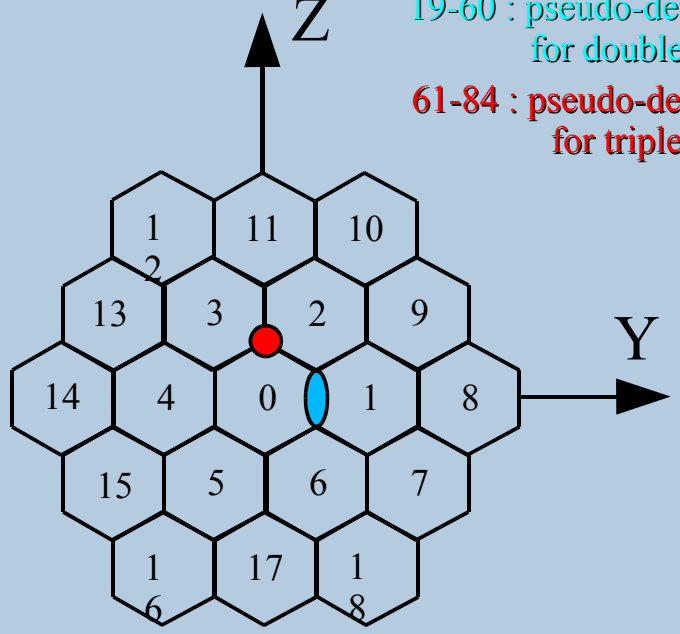

127 elements
coded tungsten
mask
heavy (500 kg)
active BGO collimator
and anticoincidence
shield
19 cooled
Germanium
detectors

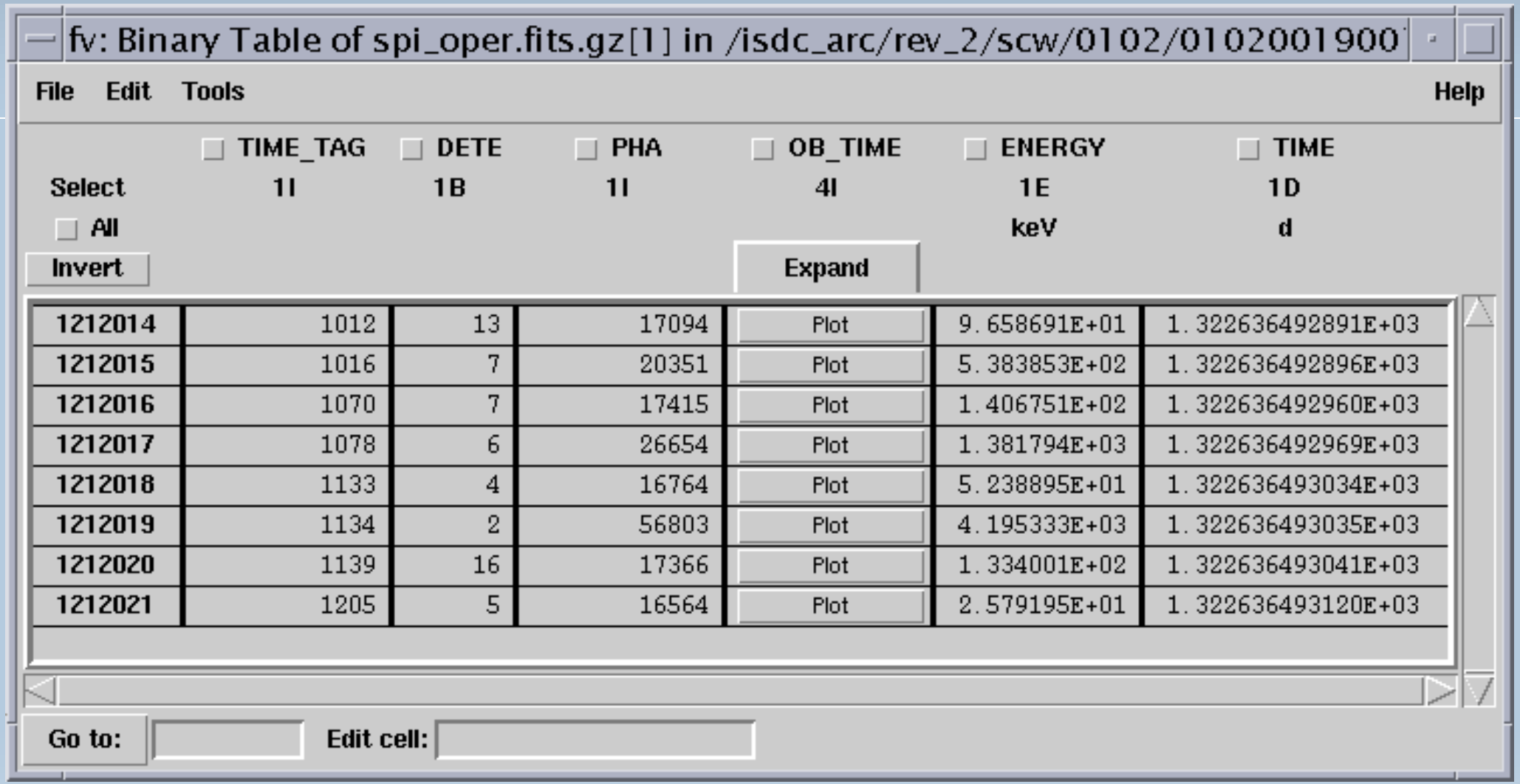



0-18 : real detectors

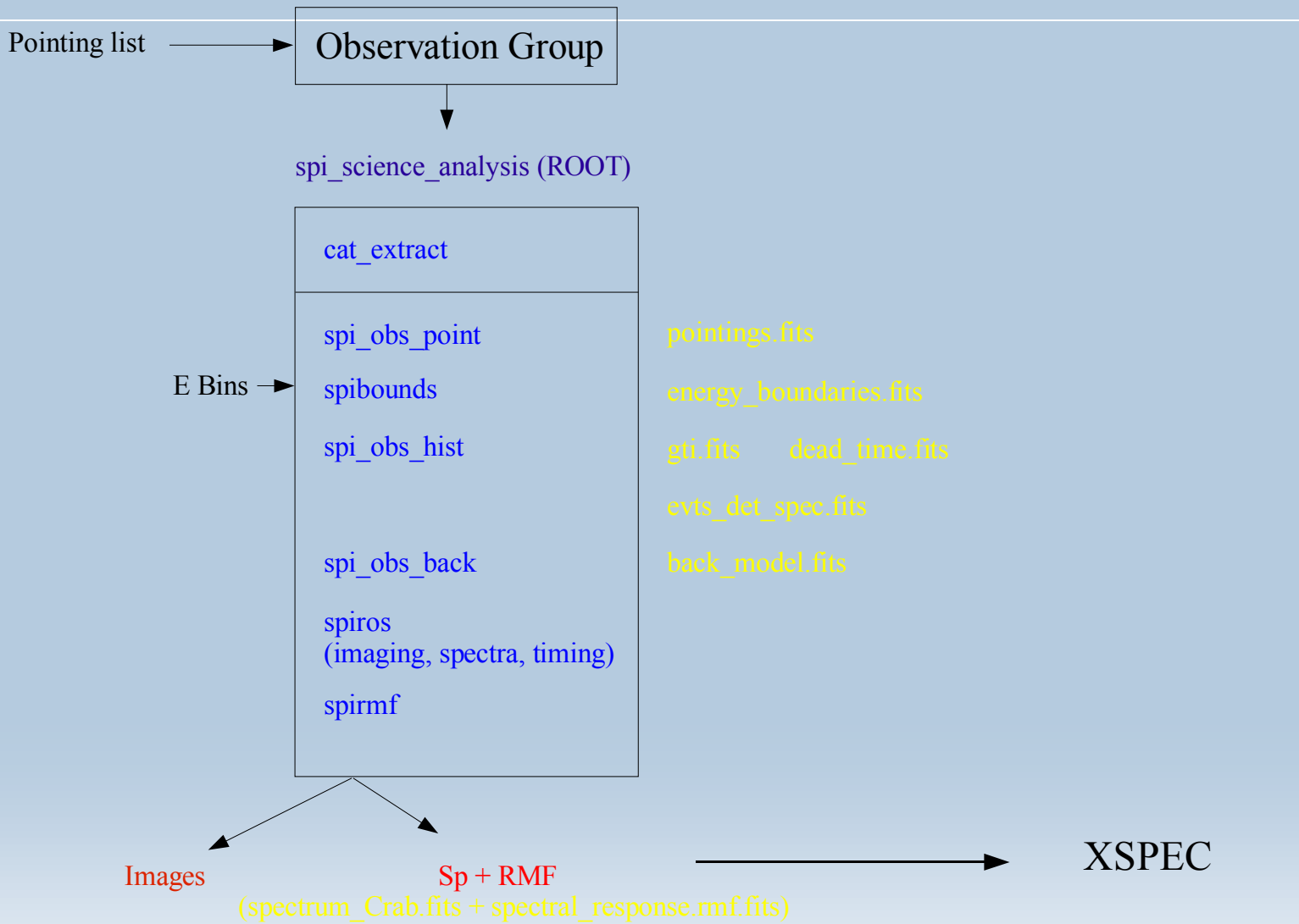
19-60 : pseudo-detectors for double events

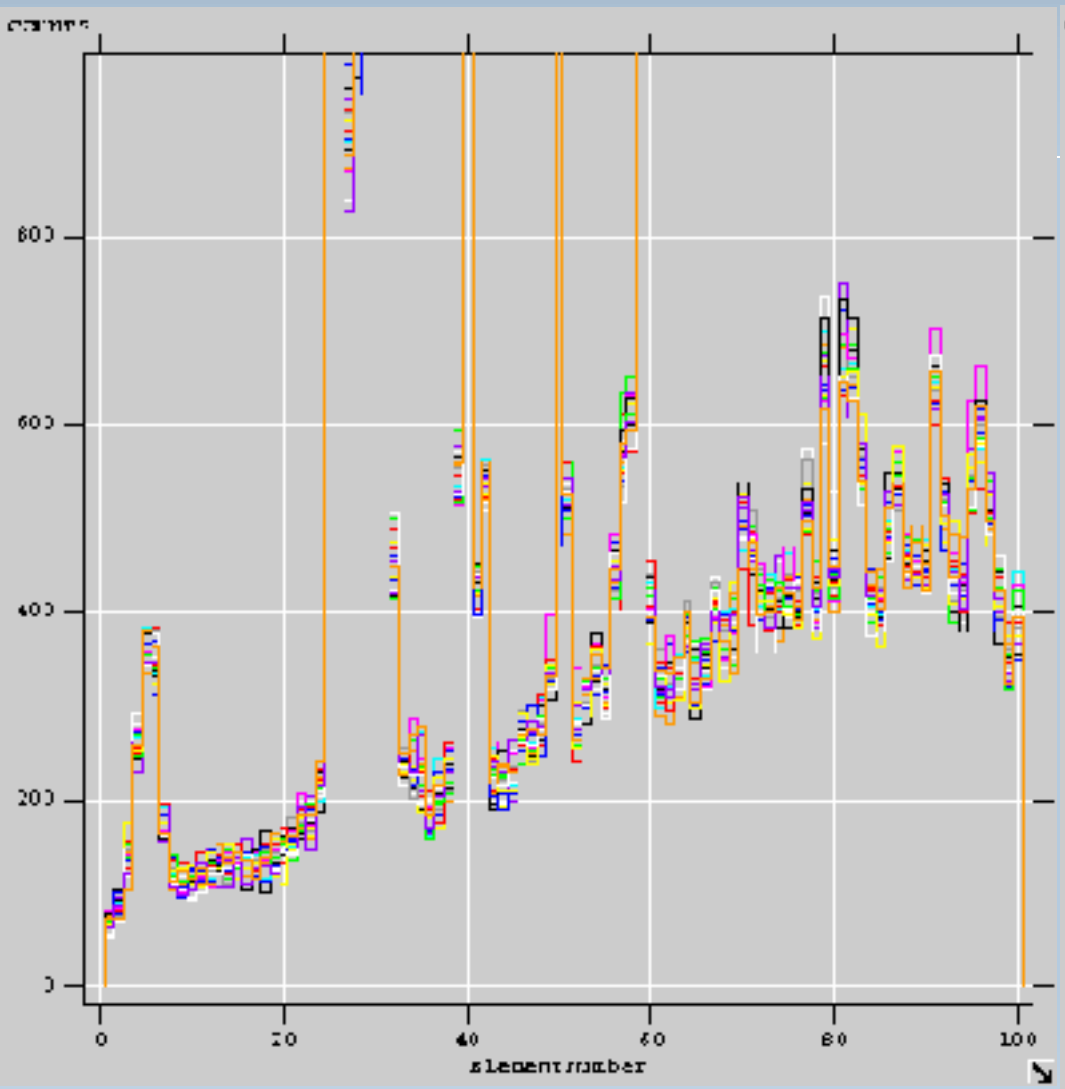
61-84 : pseudo-detectors for triple events

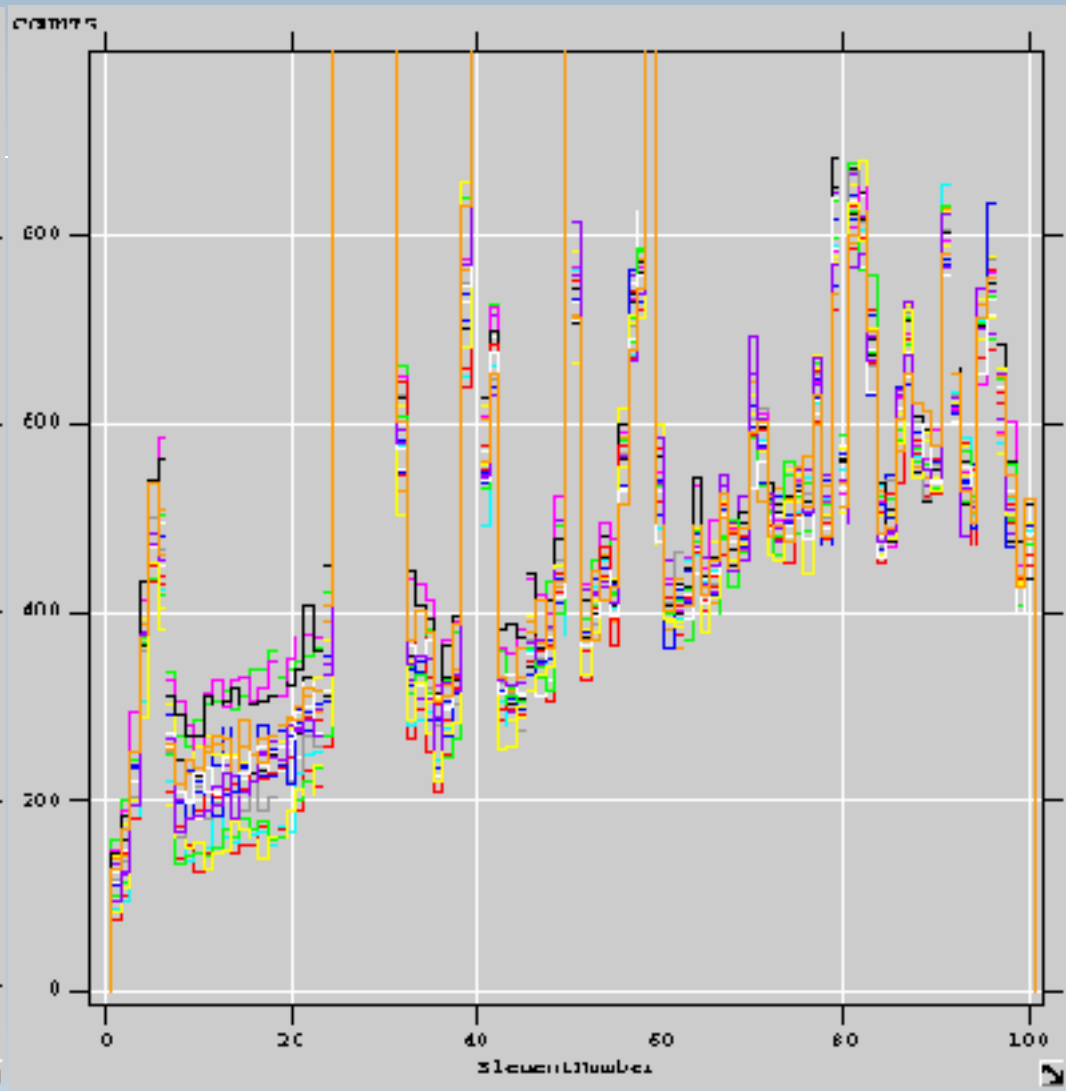



fv: Binary Table of spi_oper.fits.gz[1] in /isdc_arc/rev_2/scw/0102/0102001900
File
Edit
Tools
Help
Select
All
TIME_TAG
1I
DETE
1B
PHA
1I
OB_TIME
4I
ENERGY
1E
keV
TIME
1D
d
Invert
Expand
1212014 1012 13 17094 Plot 9.658691E+01 1.322636492891E+03
1212015 1016 7 20351 Plot 5.383853E+02 1.322636492896E+03
1212016 1070 7 17415 Plot 1.406751E+02 1.322636492960E+03
1212017 1078 6 26654 Plot 1.381794E+03 1.322636492969E+03
1212018 1133 4 16764 Plot 5.238895E+01 1.322636493034E+03
1212019 1134 2 56803 Plot 4.195333E+03 1.322636493035E+03
1212020 1139 16 17366 Plot 1.334001E+02 1.322636493041E+03
1212021 1205 5 16564 Plot 2.579195E+01 1.322636493120E+03
Go to:
Edit cell:

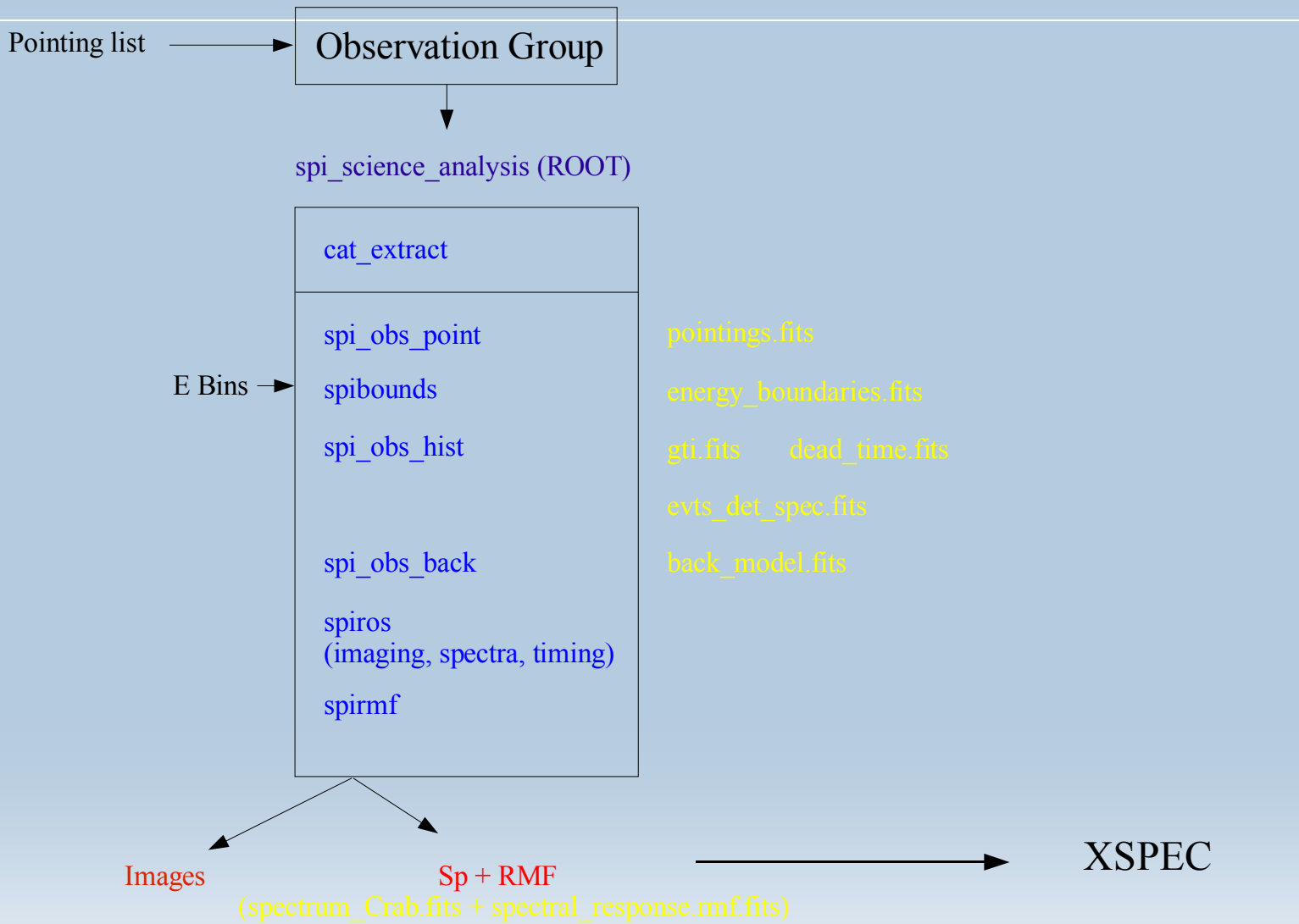
# *Analysis Steps*




0
20
40
60
80
100
Element number


0
20
40
60
80
100

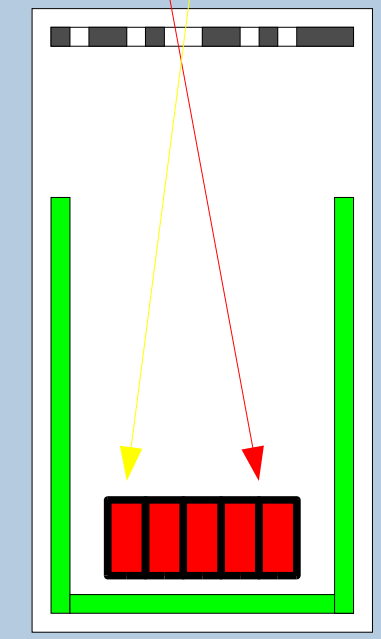
# *Analysis Steps*



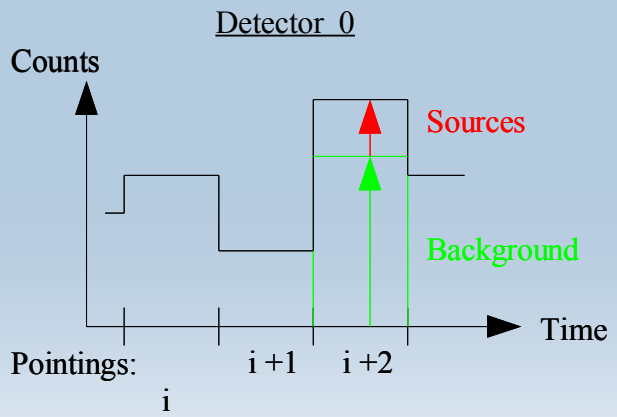
**For one energy bin:**

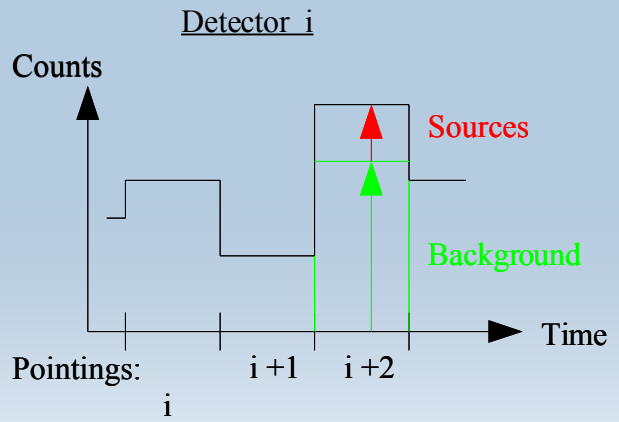
Sky model: source positions and fluxes

Instrument response: IRF



Electronic and Processing

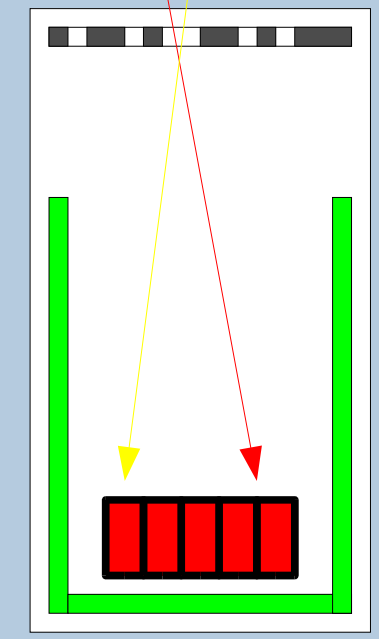


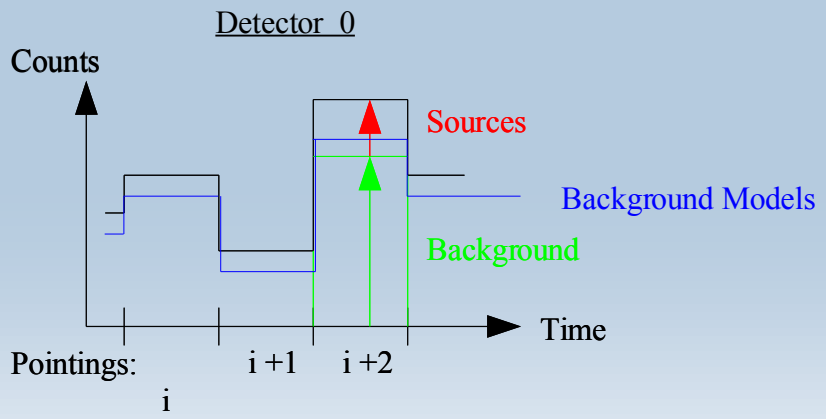
**For one energy bin:**

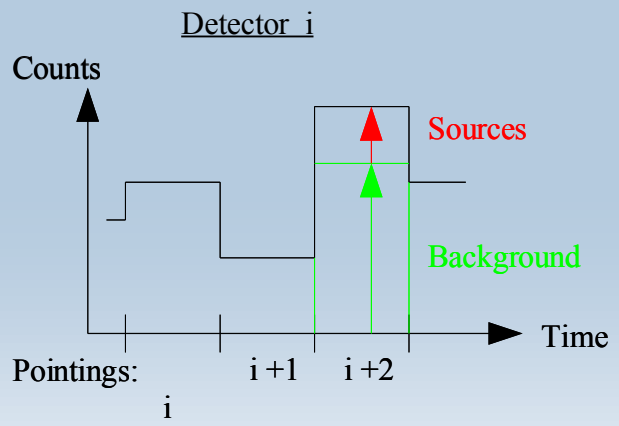
Sky model: source positions and fluxes

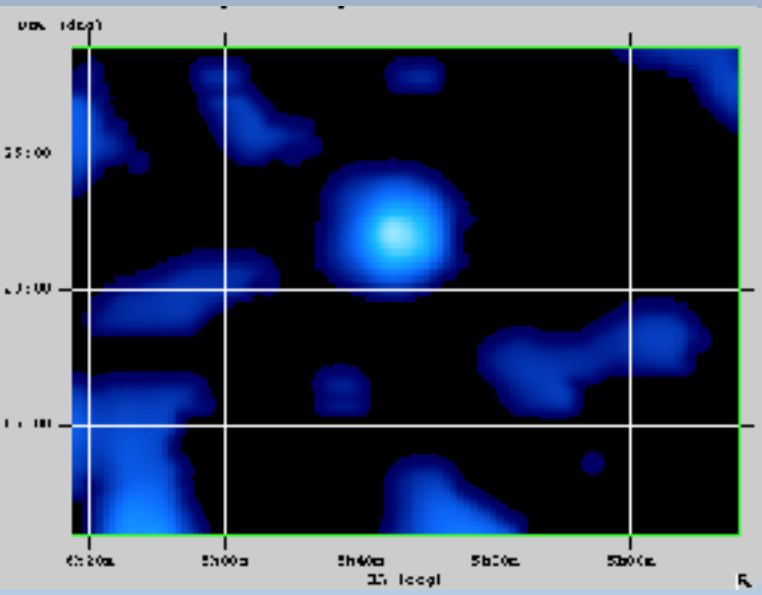
Instrument response: IRF

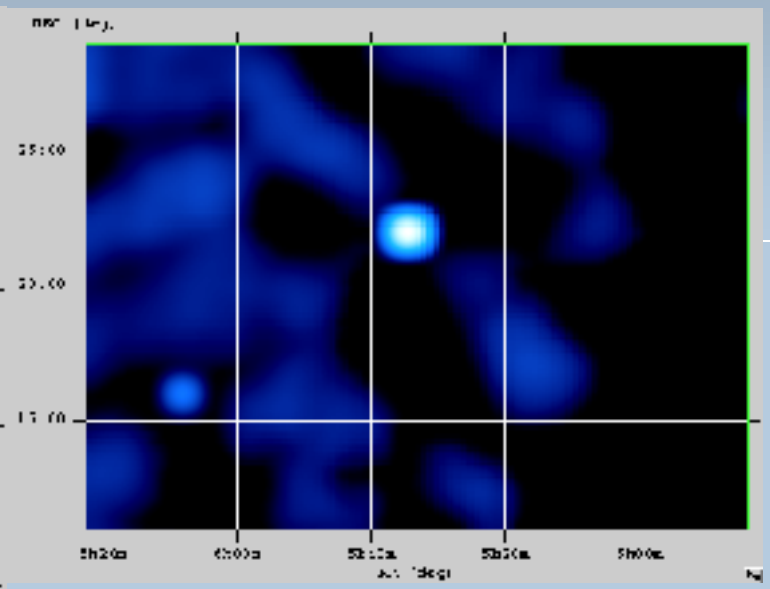


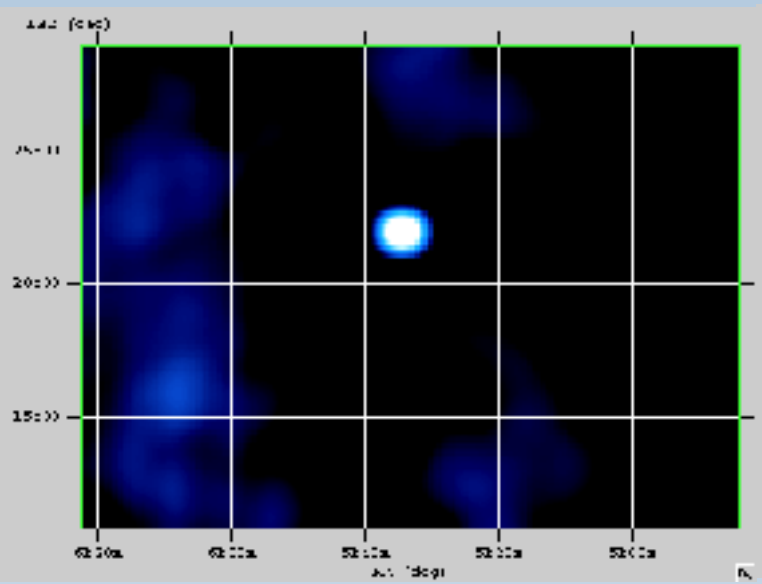
Electronic and Processing

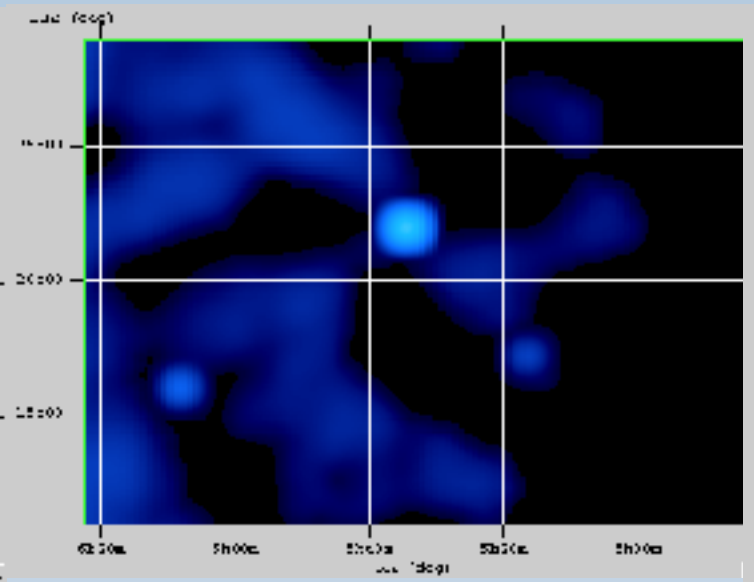


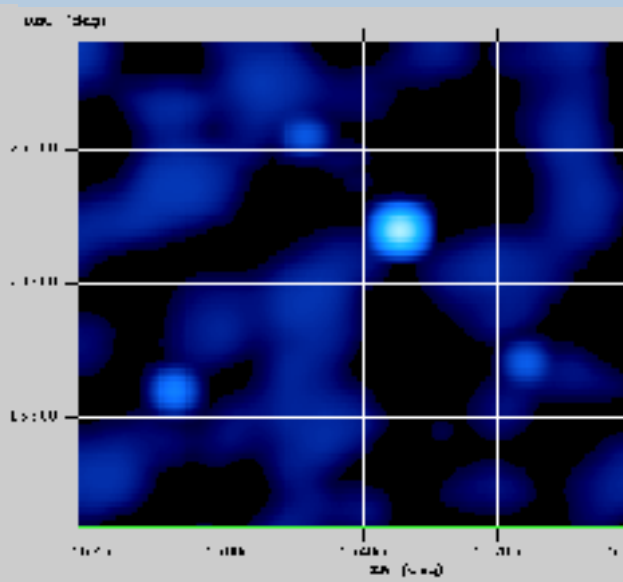







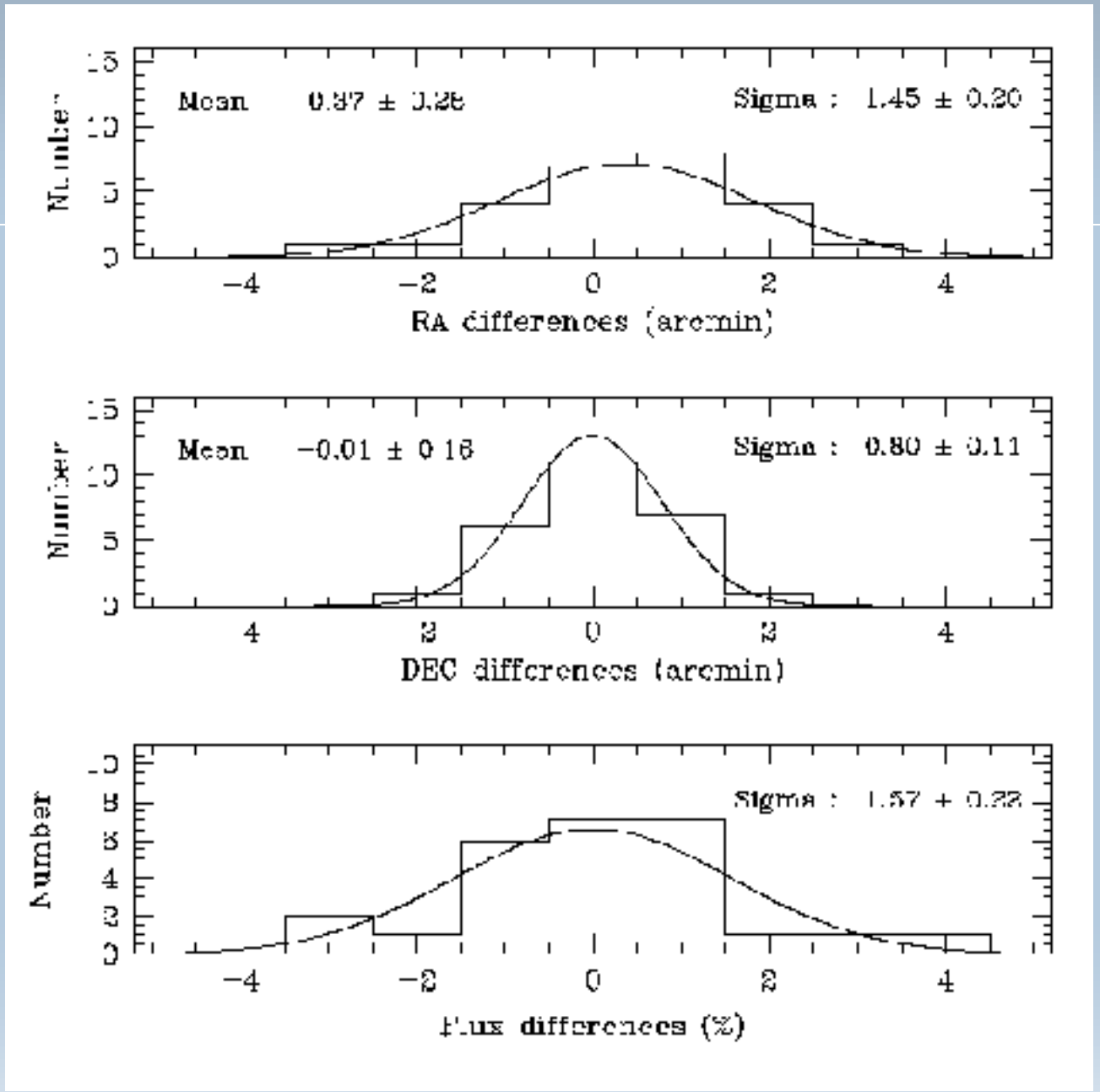


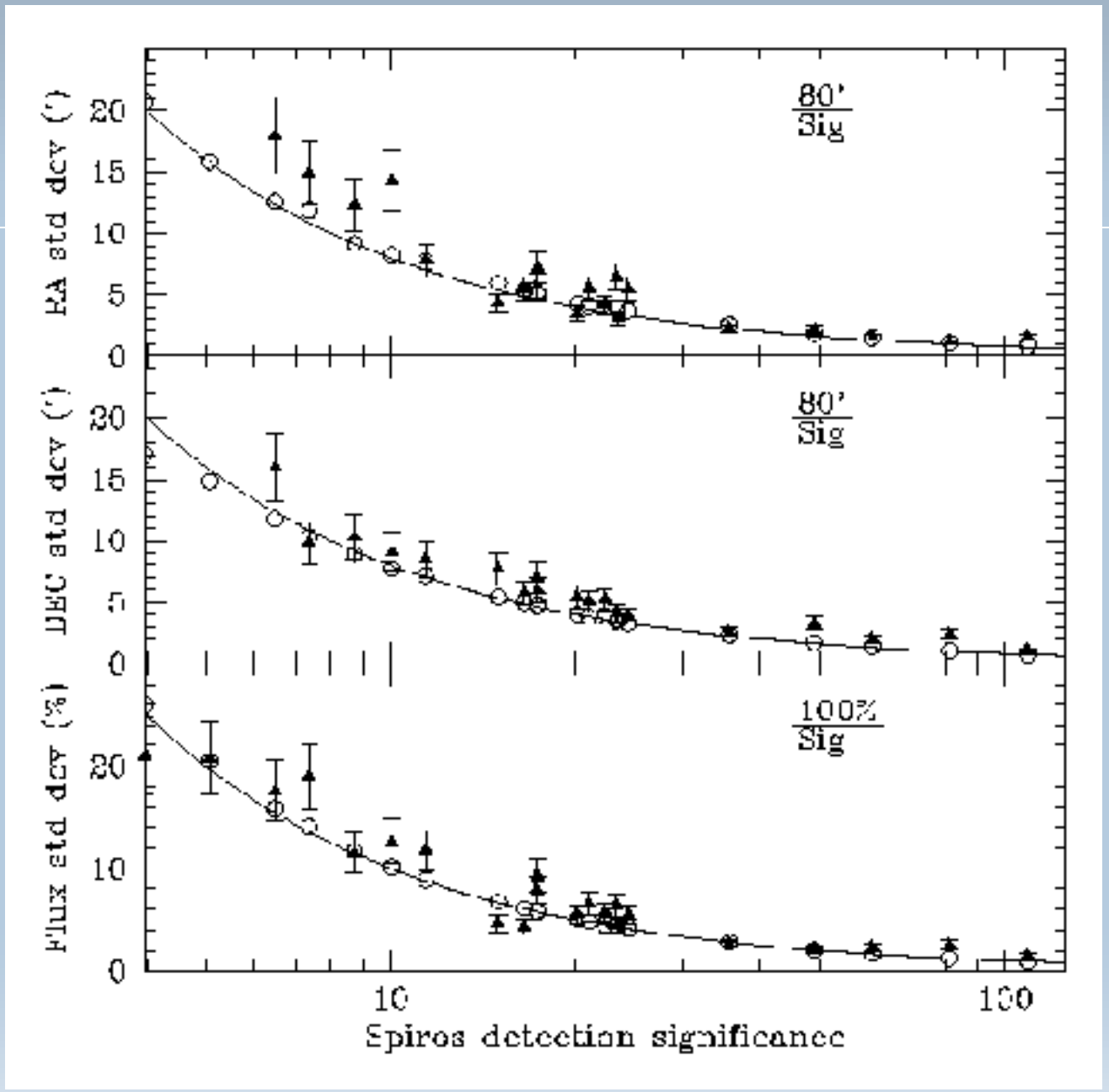


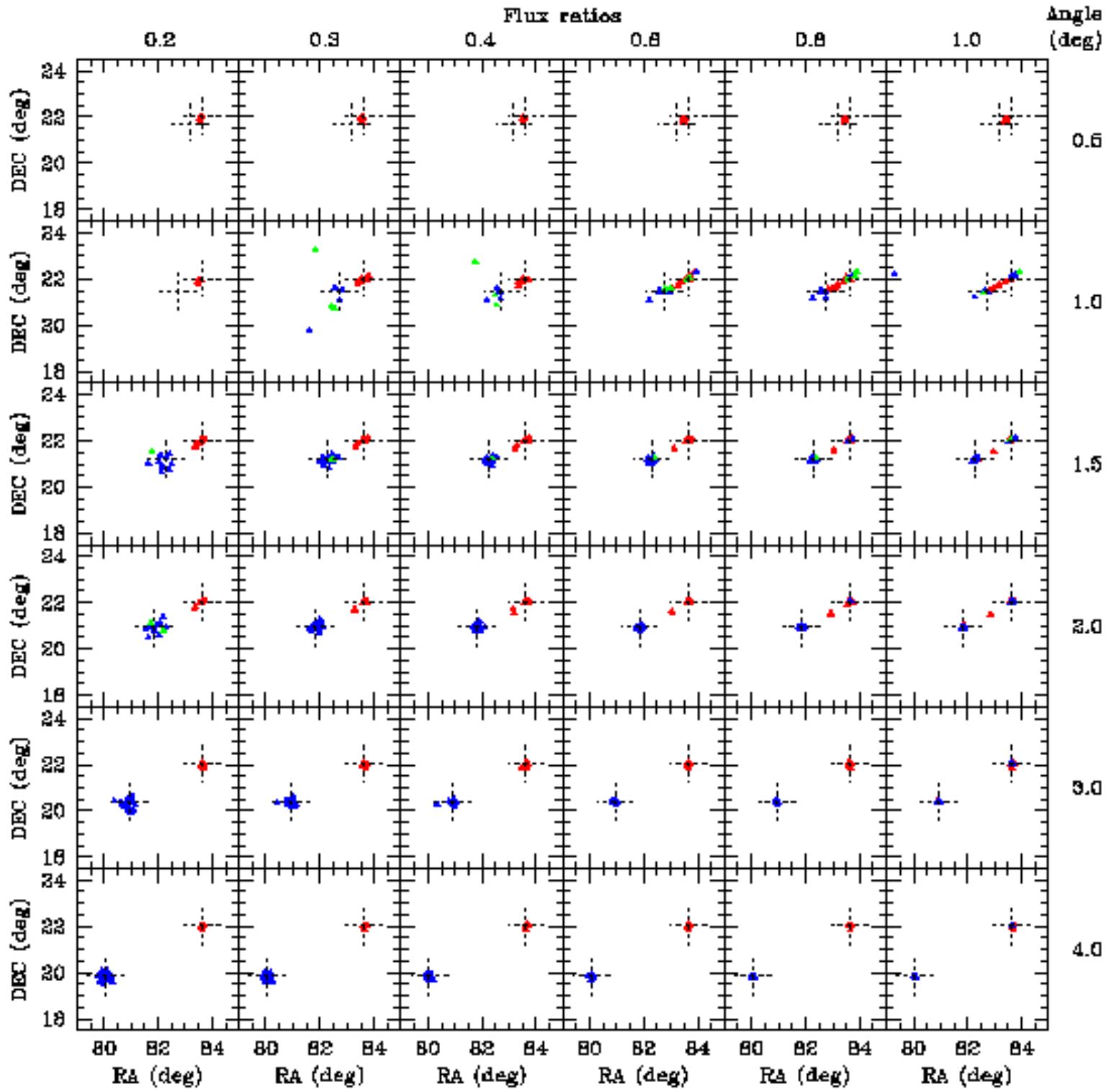


# *Scientific Validation*

- Cut the Crab data set in independent pieces (e.g. 26 independent groups of 10 pts).
- Look at the distributions of the results (source positions and fluxes) and compare them with the errors provided by spiros

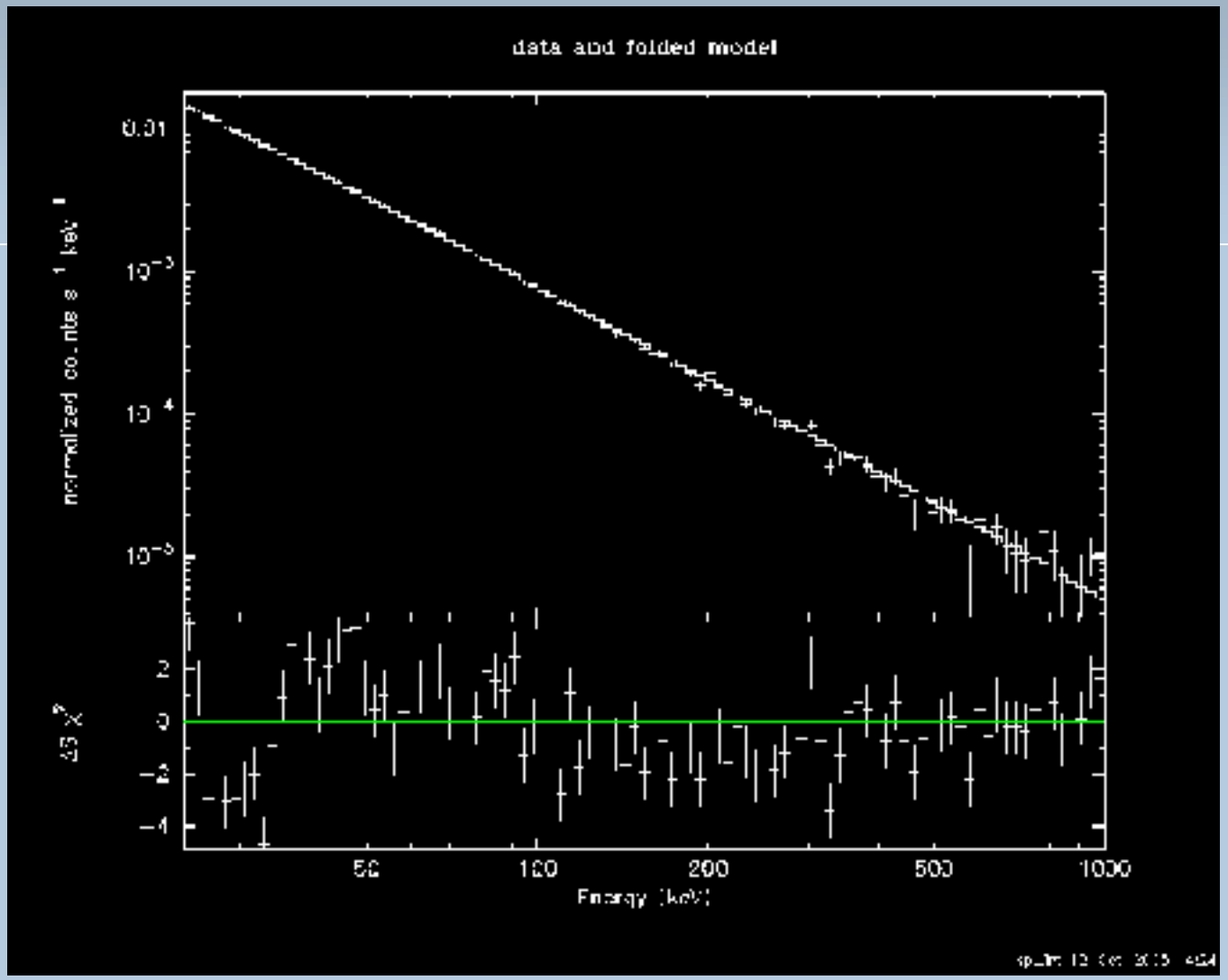

Mean 0.37 ± 0.26
Sigma : 1.45 ± 0.20
Number
RA differences (arcmin)
Mean −0.01 ± 0.16
Sigma : 0.80 ± 0.11
Number
DEC differences (arcmin)
Sigma : 1.57 ± 0.22
Number
Flux differences (%)


RA std dev (')
DEC std dev (')
Flux std dev (%)
80'
Sig
80'
Sig
100%
Sig
0
5
10
15
20
10
100
Spiros detection significance


Flux ratios
0.2
0.3
0.4
0.6
0.8
1.0
Angle (deg)
0.5
1.0
1.5
2.0
3.0
4.0
DEC (deg)
24
22
20
18
80
82
84
RA (deg)

# *Spectral Fitting Validation*

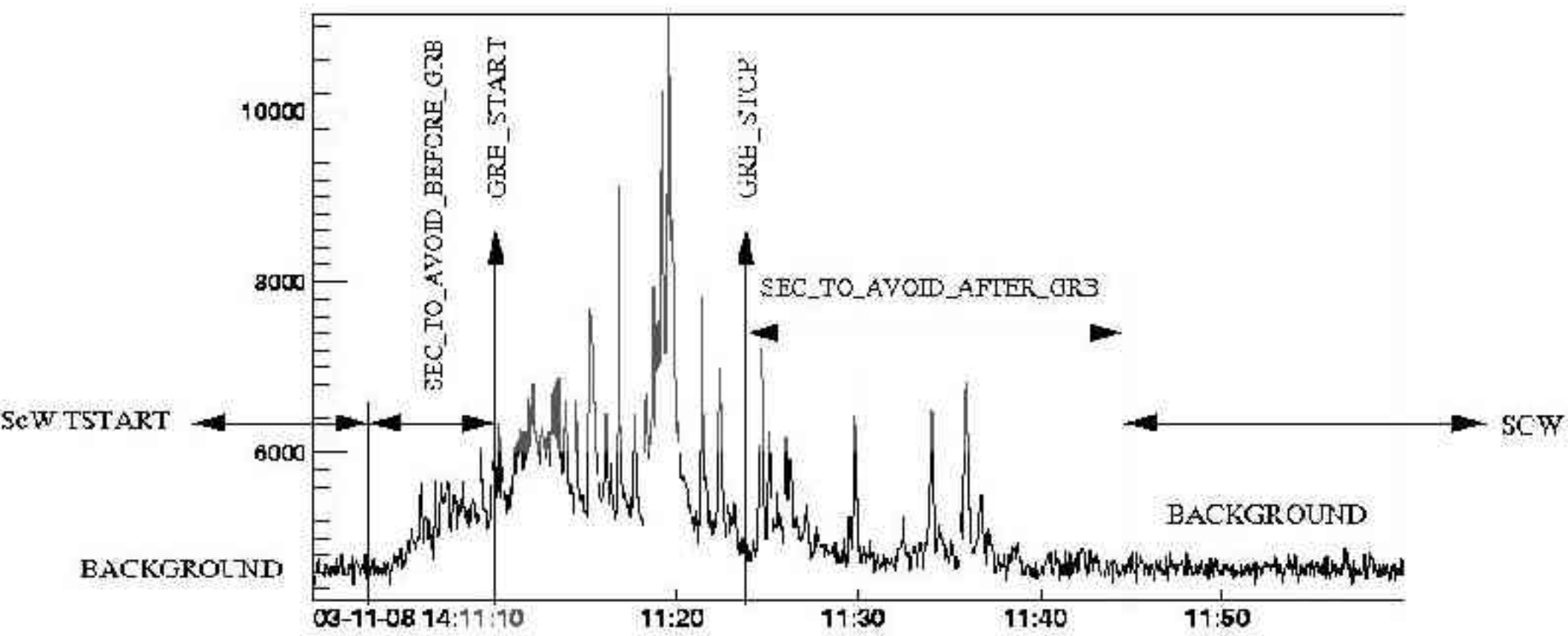
- Response validated with BLC ground calibrations
- Validation with GEANT simulations (Chris Shrader)
- Single power law fits of the Crab spectrum, with different datasets, detector lists, background models, statistic, E range (> 40 keV), IRF, RMF



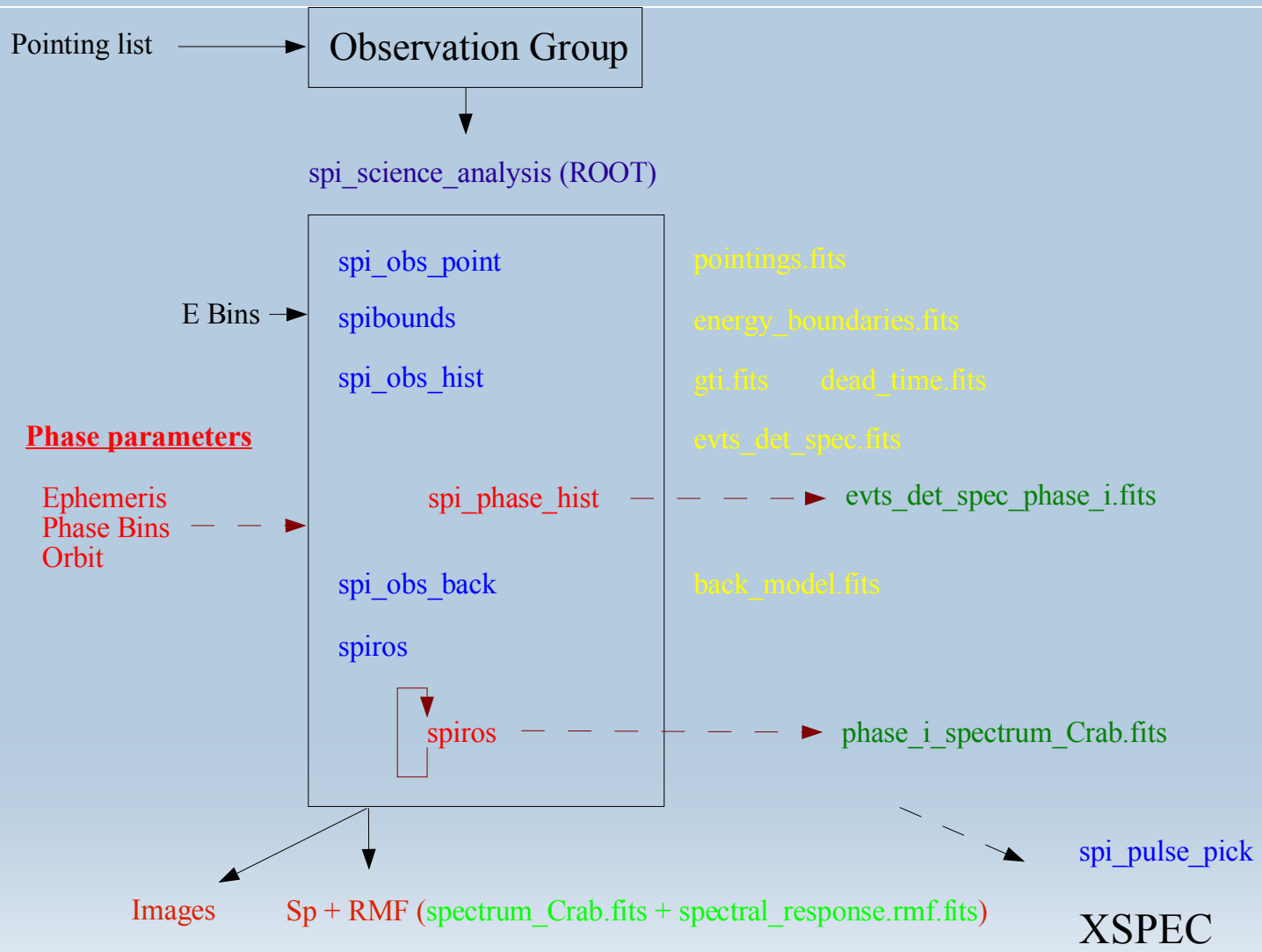

- Photon index = 2.14-2.15
- F (50-100 keV) = 7.85 10-9 erg/cm2/sec

# *GRB analyses*

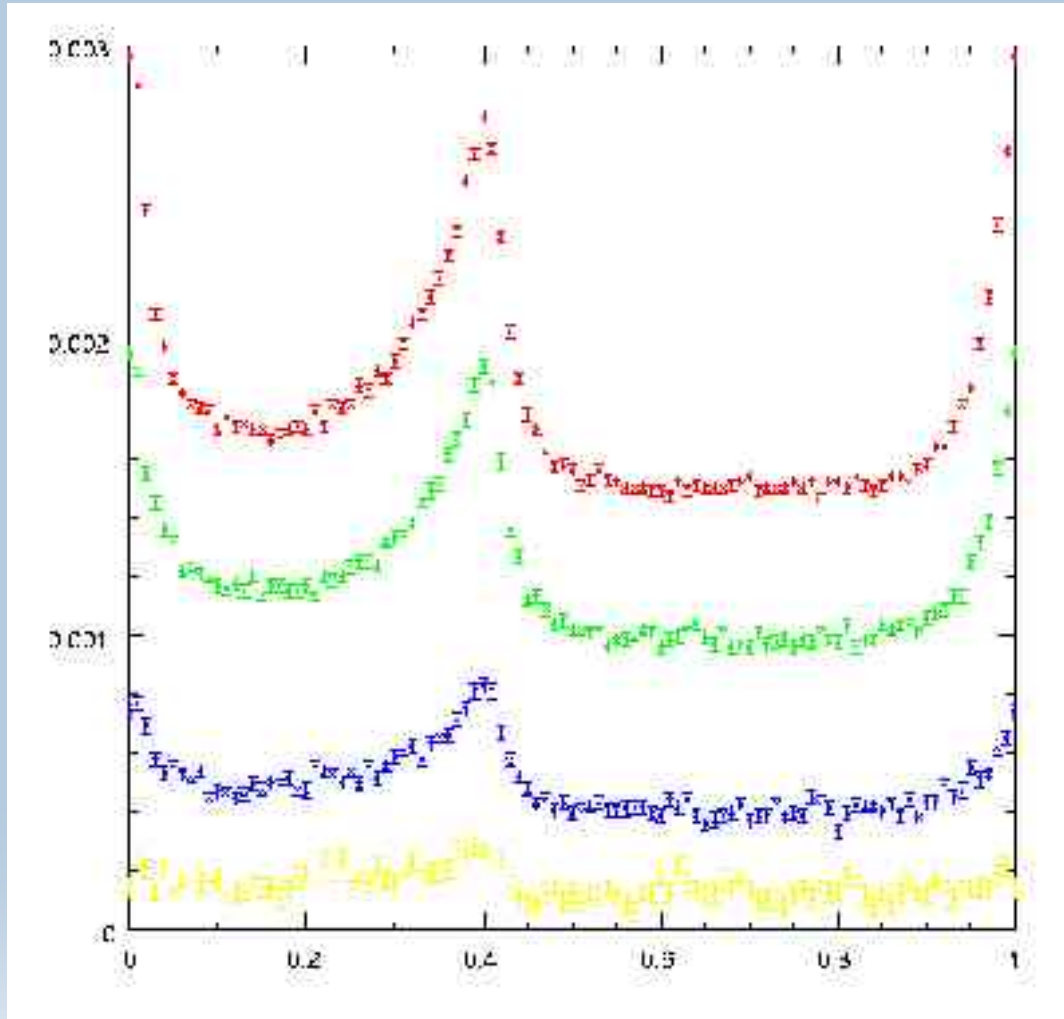
- spi_grb_analysis <grb_start> <grb_stop> UTC/IJD <sec_to_avoid_before_grb> <sec_to_avoid_after_grb>



# *Phase resolved analysis*



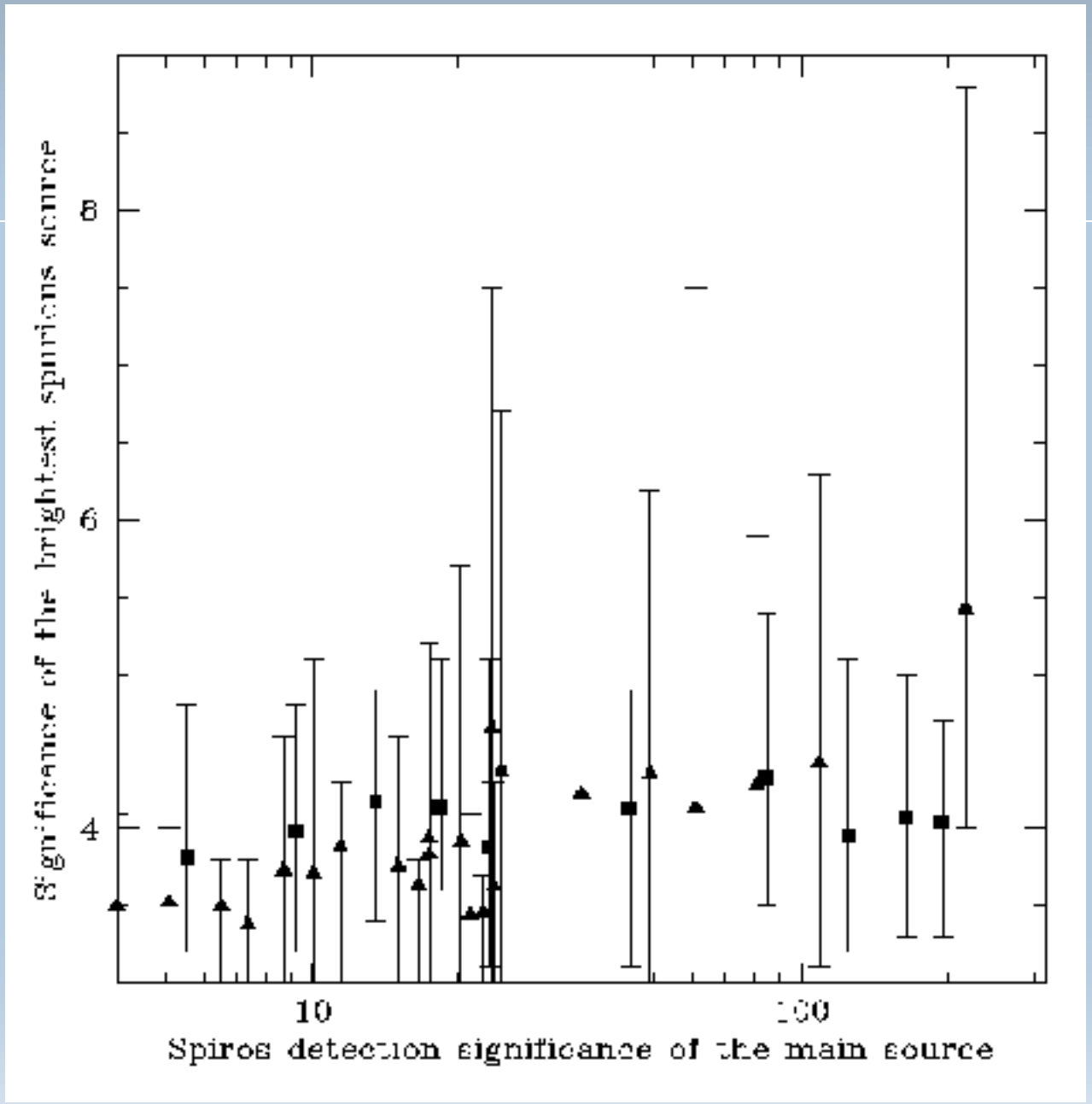
# *Phase resolved analysis: Crab pulse*

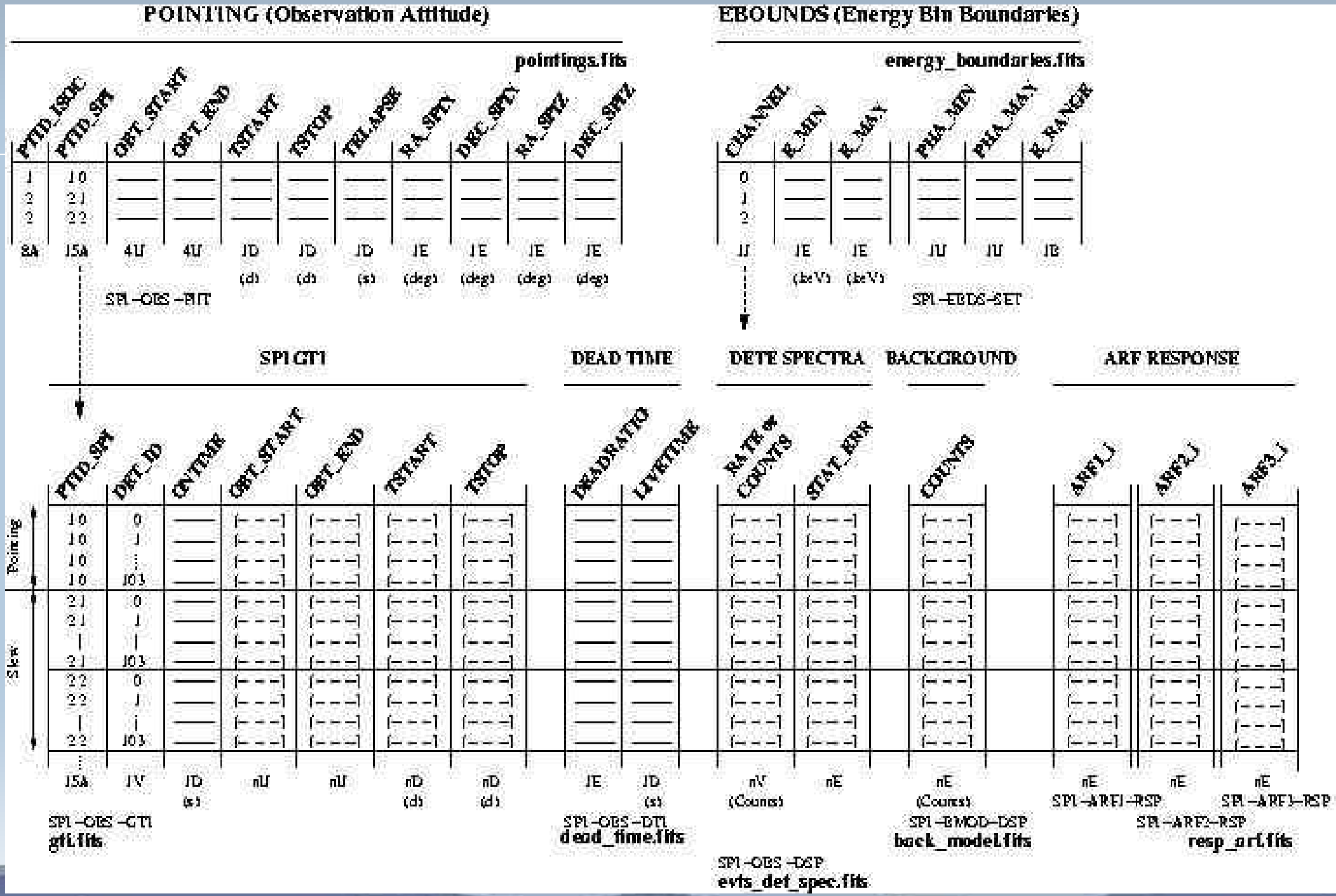


# *Conclusions*

- SPIROS imaging and spectral extraction are reliable
  - OK for sources with separation > ~2 degrees
- Well validated response - spectral continuum fitting accurate to a few %.
- Tools available for GRB and phase resolved analysis
- Further developments?  - diffuse emission tools?

# *Further Developments ?*


Significance of the brightest spurious source
8
6
4
10
100
Spiros detection significance of the main source


POINTING (Observation Attitude)
pointings.fits
PTID_ISDC
PTID_SPI
OBT_START
OBT_END
TSTART
TSTOP
TELAPSE
RA_SPIZ
DEC_SPIZ
RA_SPIX
DEC_SPIX
1
2
2
8A
I5A
4I
4I
D
D
D
E
E
E
E
(d)
(d)
(s)
(deg)
(deg)
(deg)
(deg)
SPI-OBS-PNT
EBOUNDS (Energy Bin Boundaries)
energy_boundaries.fits
CHANNEL
E_MIN
E_MAX
PHA_MIN
PHA_MAX
E_RANGE
0
1
2
I
E
E
I
I
I
(keV)
(keV)
SPI-EBDS-SET
SPI GTI
DEAD TIME
DETE SPECTRA
BACKGROUND
ARF RESPONSE
PTID_SPI
DET_ID
ONTIME
OBT_START
OBT_END
TSTART
TSTOP
DEADRATIO
LIVETIME
RATE or COUNTS
STAT_ERR
COUNTS
ARF1_I
ARF2_I
ARF3_I
Pointing
Slew
I0
I0
I0
I0
2I
2I
2I
22
22
22
0
I
I03
nI
nD
nV
nE
(Counts)
SPI-OBS-GTI
gti.fits
SPI-OBS-DTI
dead_time.fits
SPI-OBS-DSP
evts_det_spec.fits
SPI-BMOD-DSP
back_model.fits
SPI-ARF1-RSP
SPI-ARF2-RSP
SPI-ARF3-RSP
resp_arf.fits

# *Analysis Steps*

1) ( Energy Correction )
2) Catalogue extraction
3) Pointing Definition
4) GTI
5) Dead Time
6) Energy Bin Definition
7) Event binning
8) Background modeling
9) Imaging (SPIROS)
10) Spectrum extraction
11) XSPEC