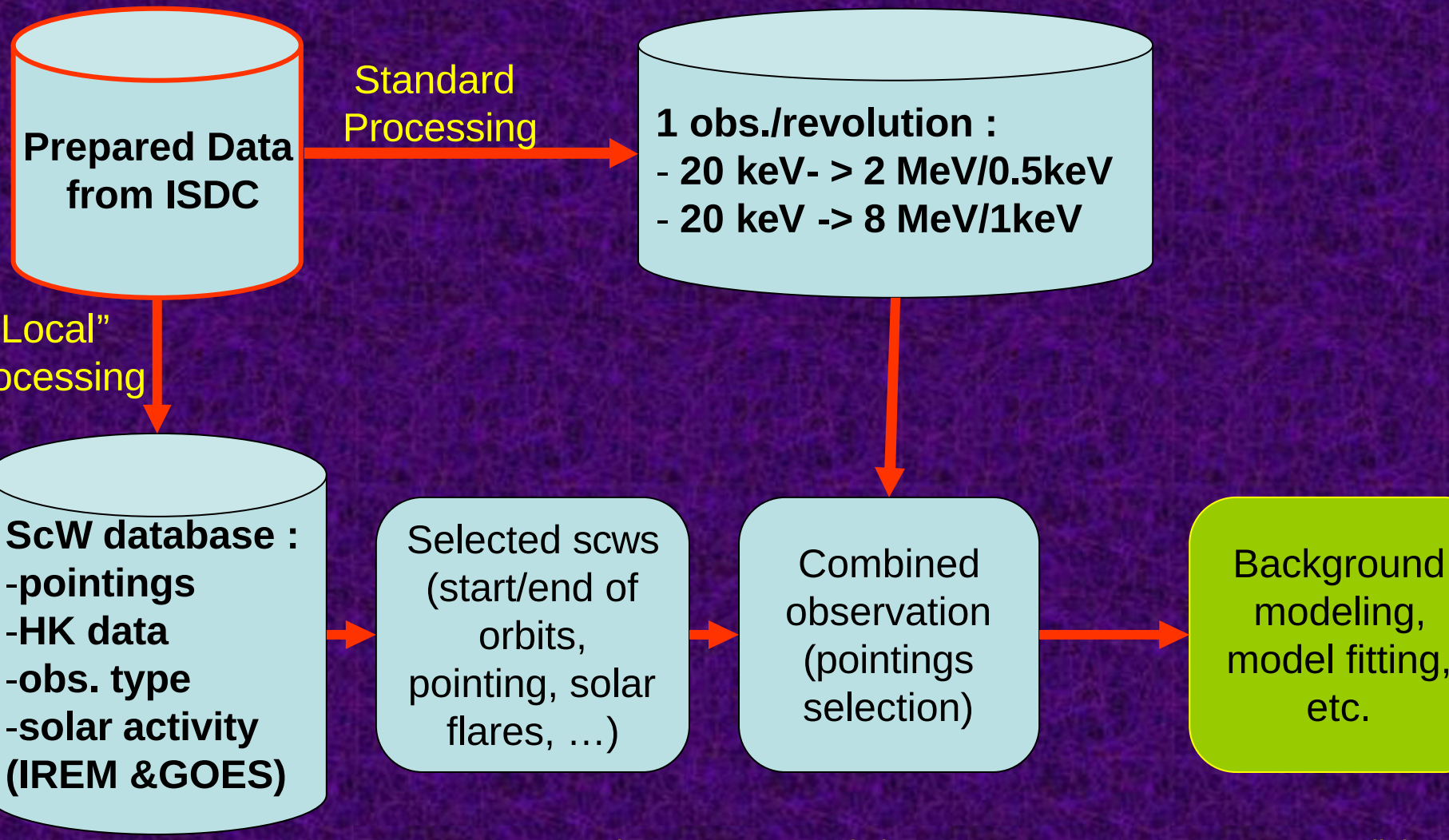
Bulge and Galactic Ridge Emission around 511 keV with SPI

(Some) background modeling
issues on flux and morphology …

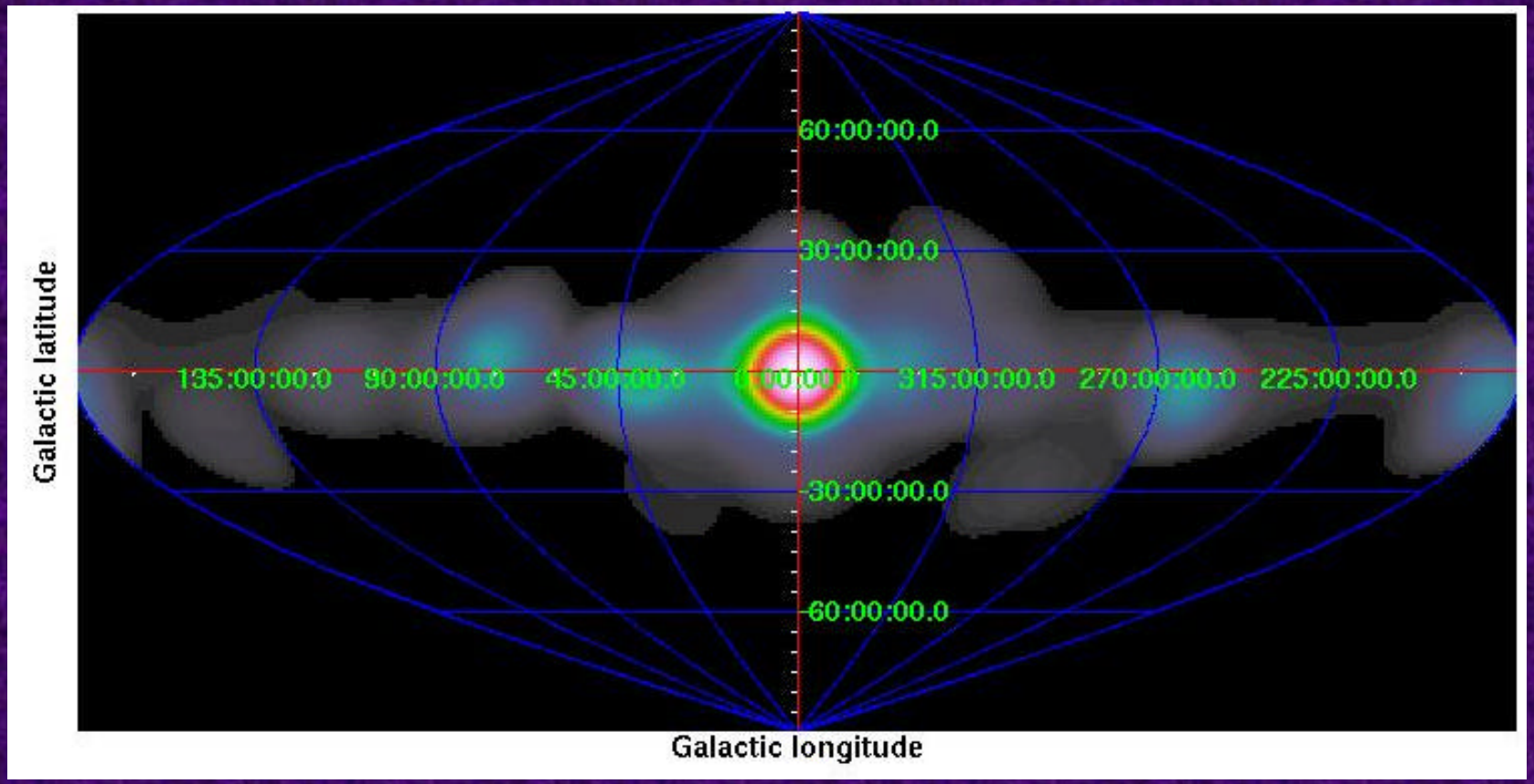
General Data Processing at MPE



Data processing in the 511 keV region

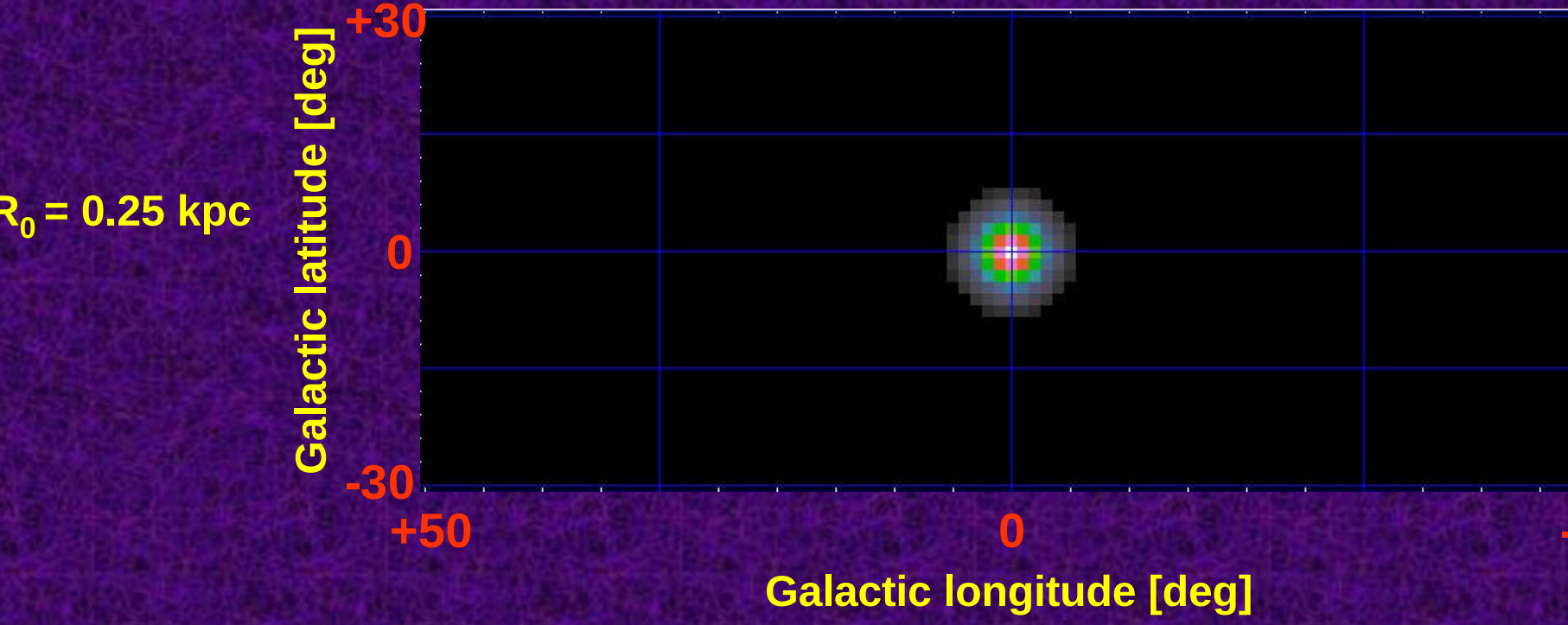
- Energy range : 484 - 550 keV / 6 keV
- Rejection of :
  - ends of orbits (first and last 10%)
  - vicinity of solar flares (from IREM data)
- Revolutions 15 ? 225 :
  - Public data (@ 10 déc. 2004)
  - GPS+GCDE
  - Gal. latitude < 30 deg

Exposure map



Fitted models

- Model fitting with 7 image components :
  - 3 bulge models : $?(R,z) = ?_0 \exp(-0.5(R^2+z^2)/R_0^2)$



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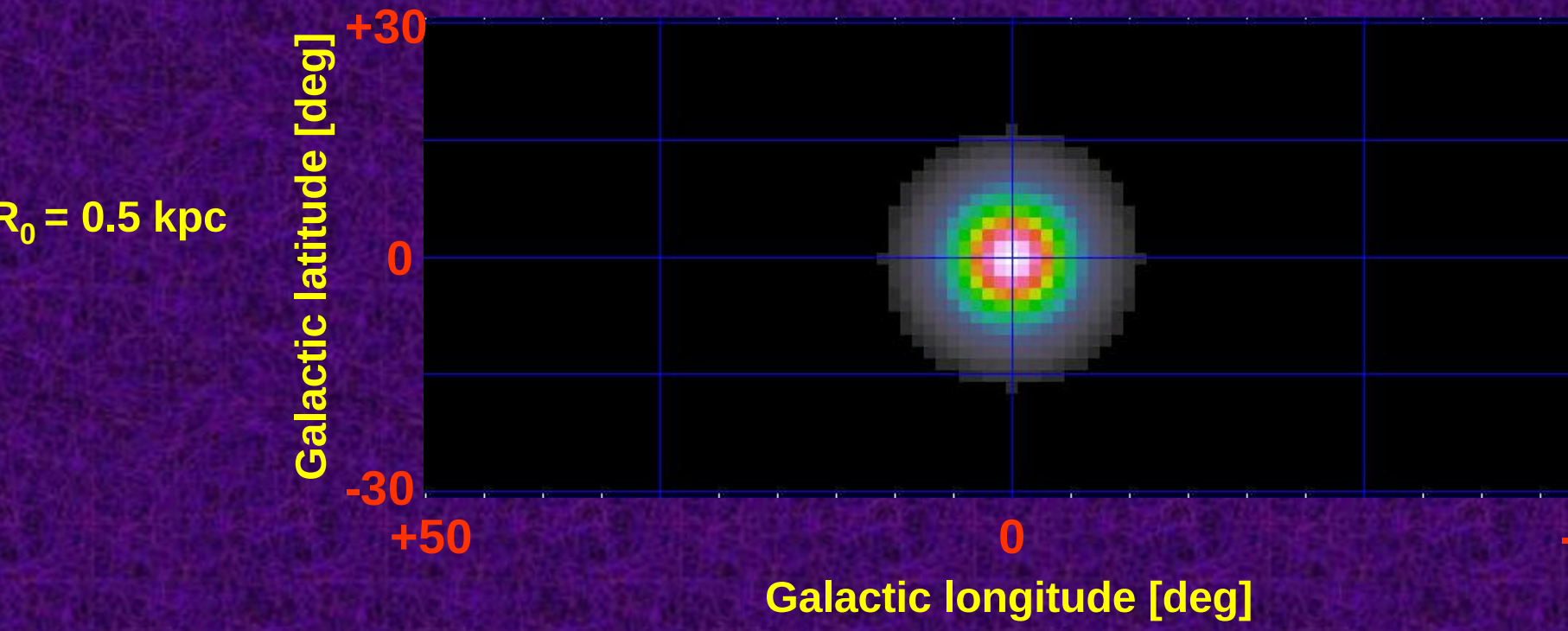

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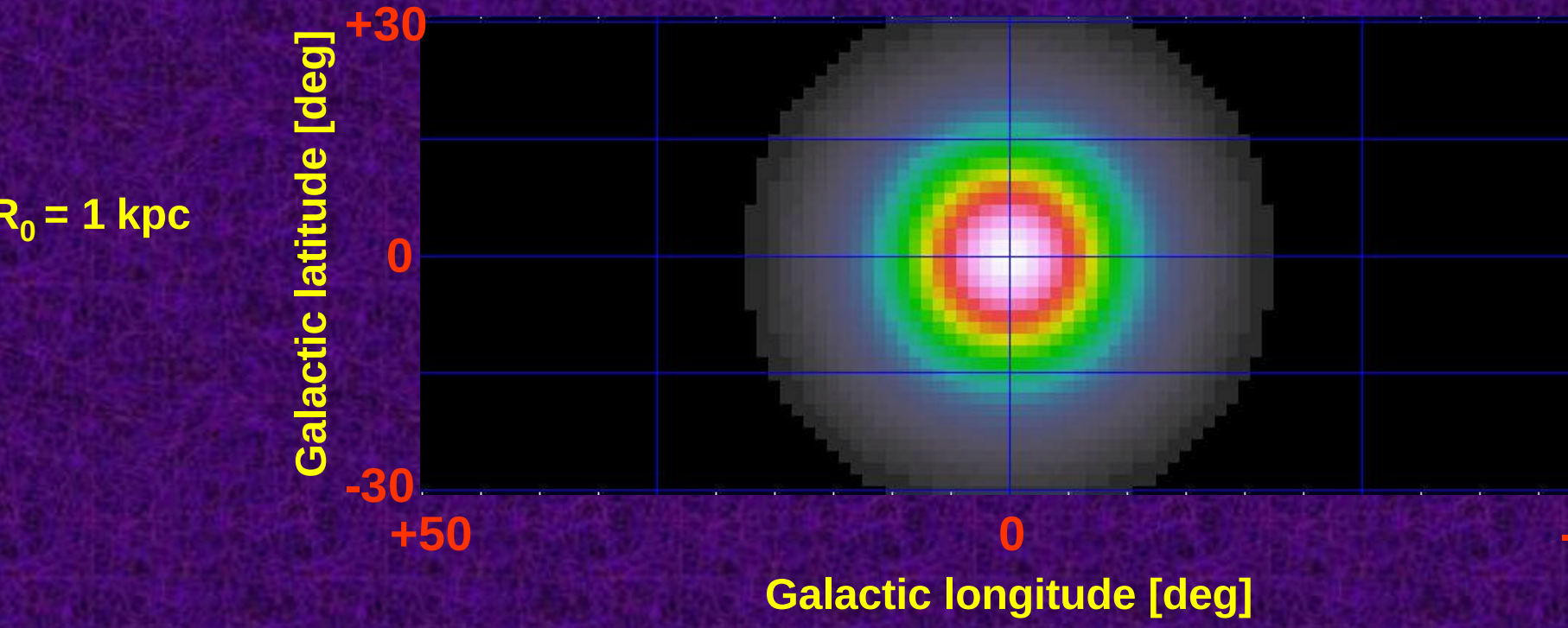
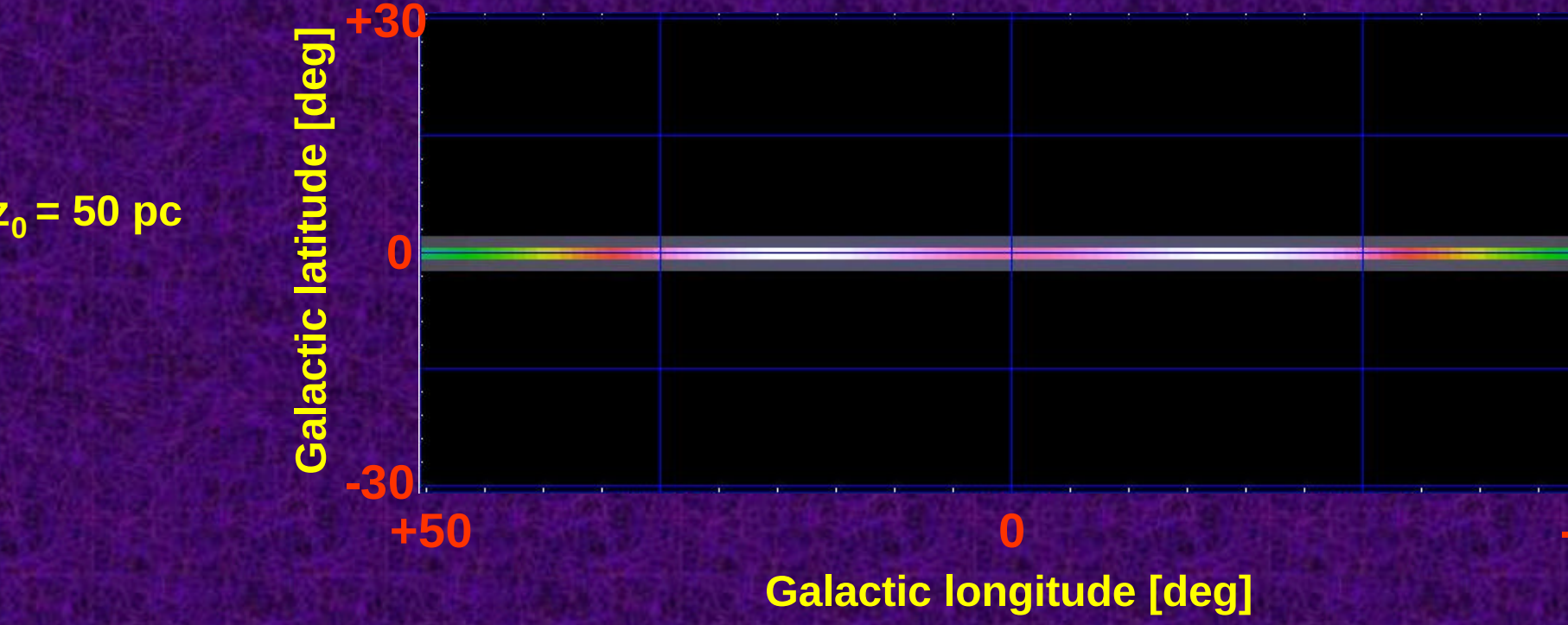


Fitted models

- Model fitting with 7 image components :
  - 4 disc models : $?(R,z) = ?_0(\exp(-(a/R_0)^2) - \exp(-(a/R_i)^2))$
    R_0=5kpc, R_i=3kpc, $a^2 = R^2+R_0^2 \cdot z^2/z_0^2$



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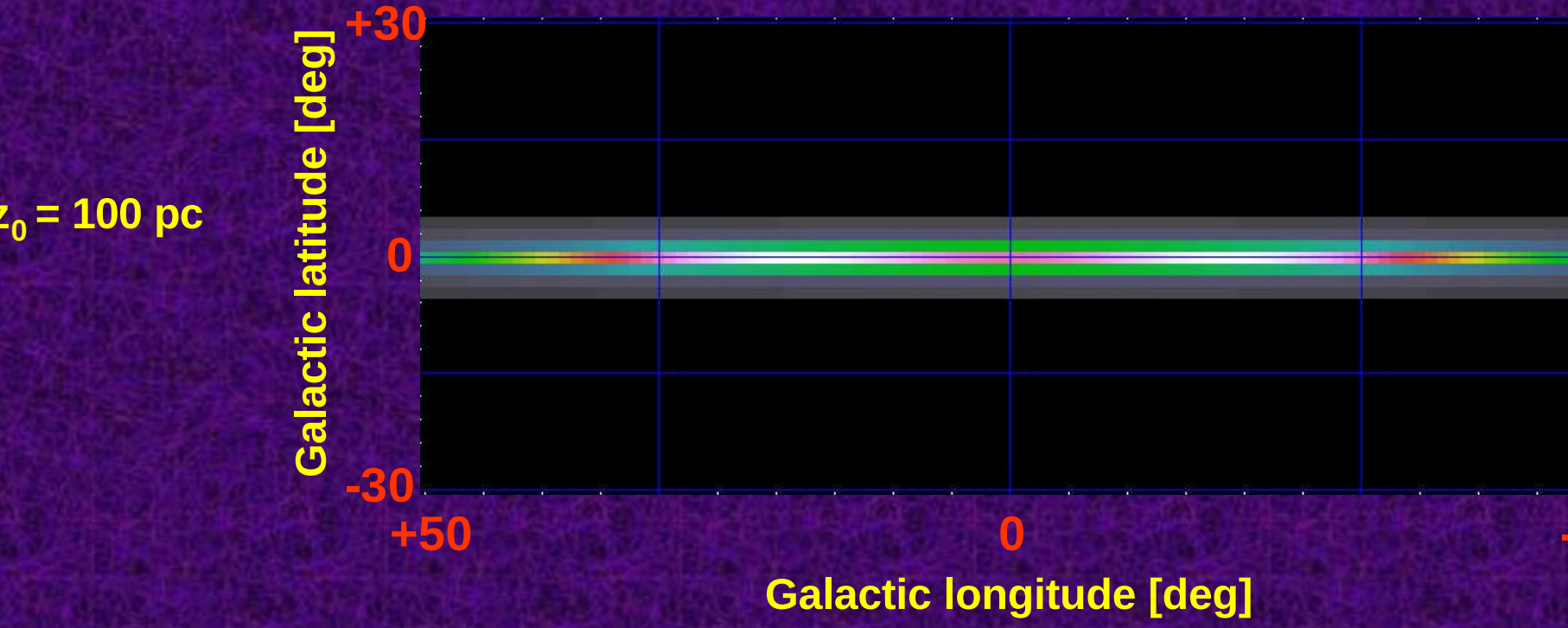

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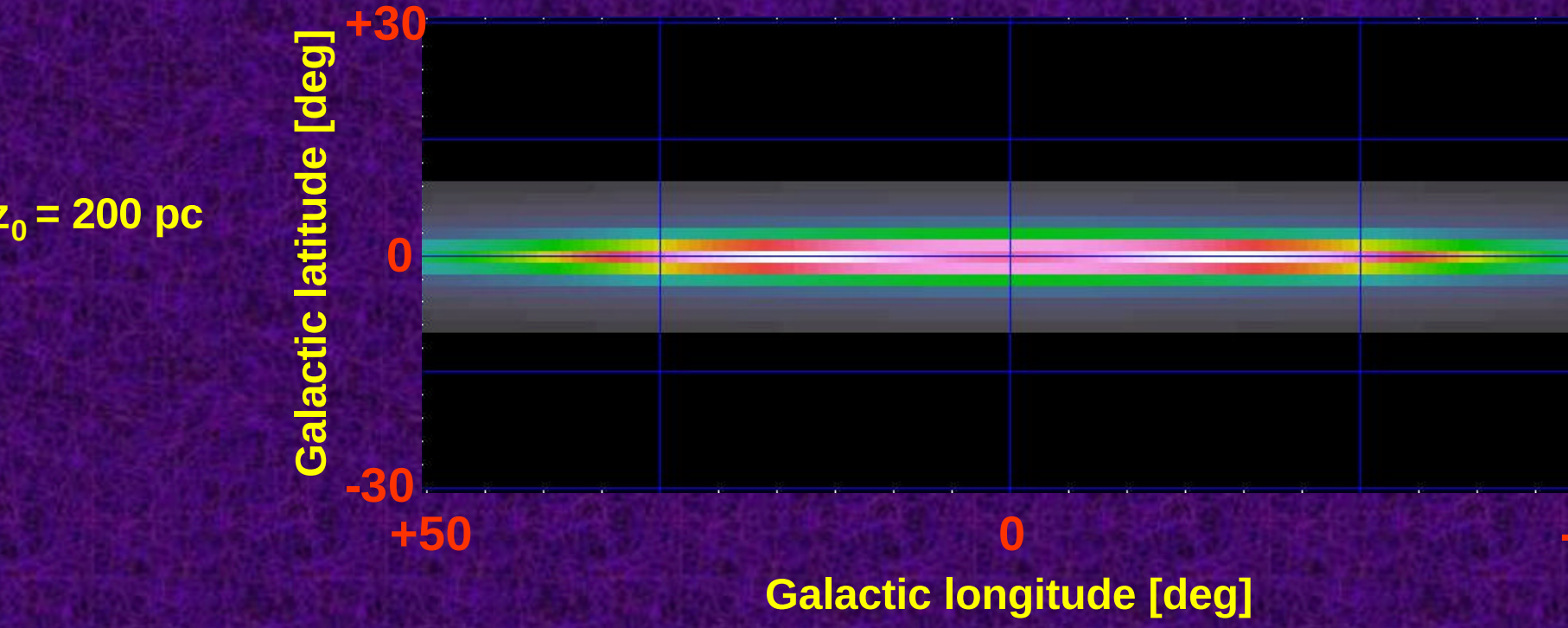

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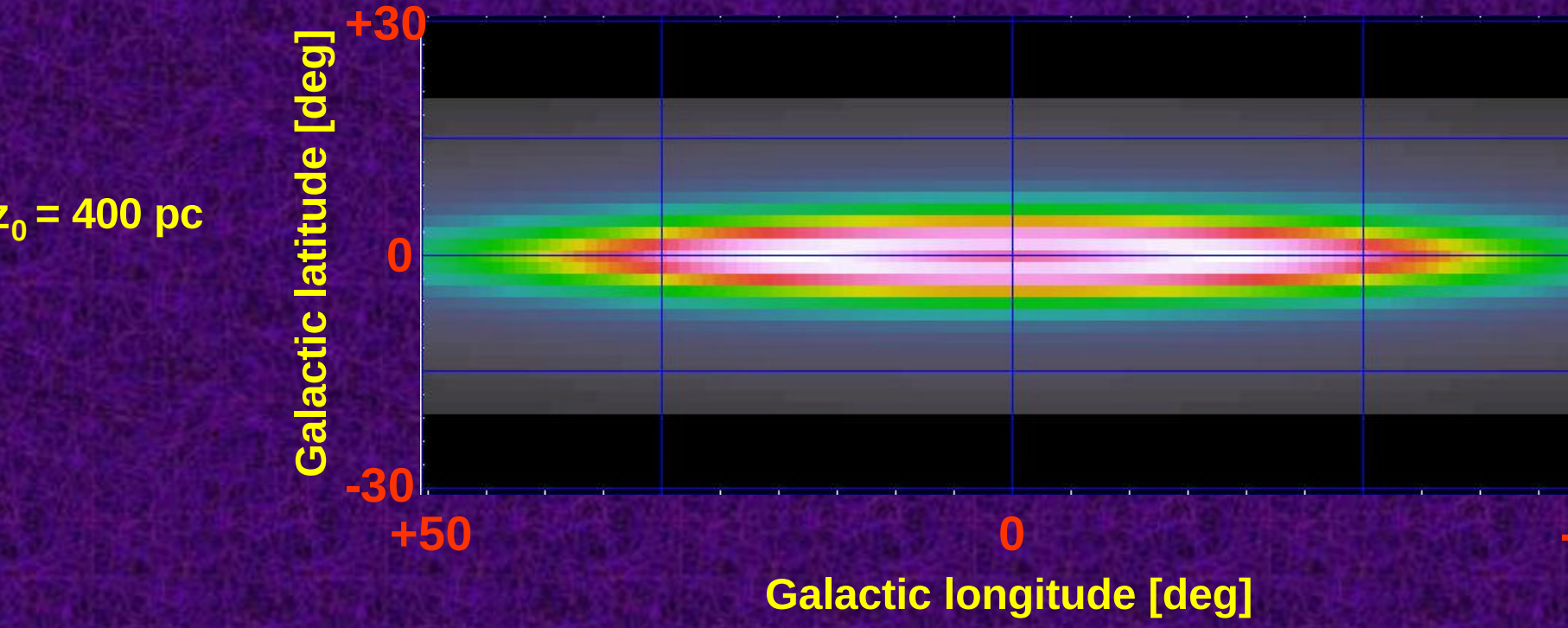
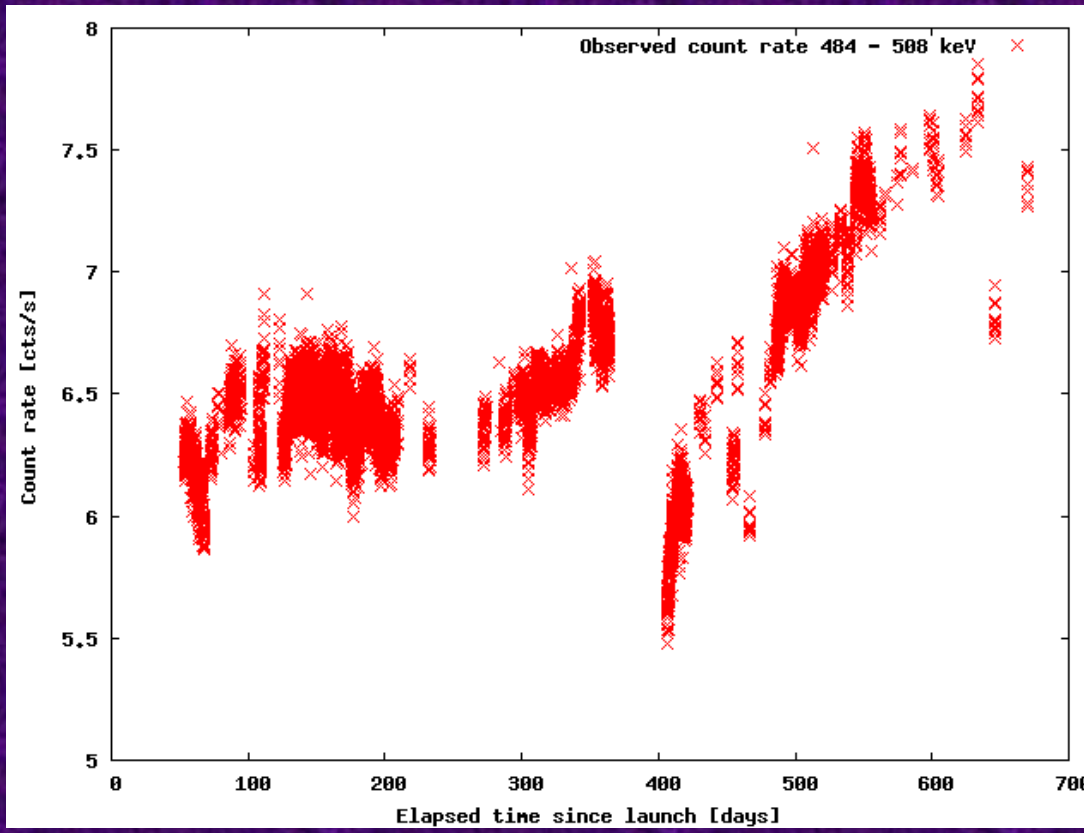


Background modeling (I)

- $\Rightarrow$ modeling background time variability for each detectors

Counts rate evolution in 484 - 508 keV



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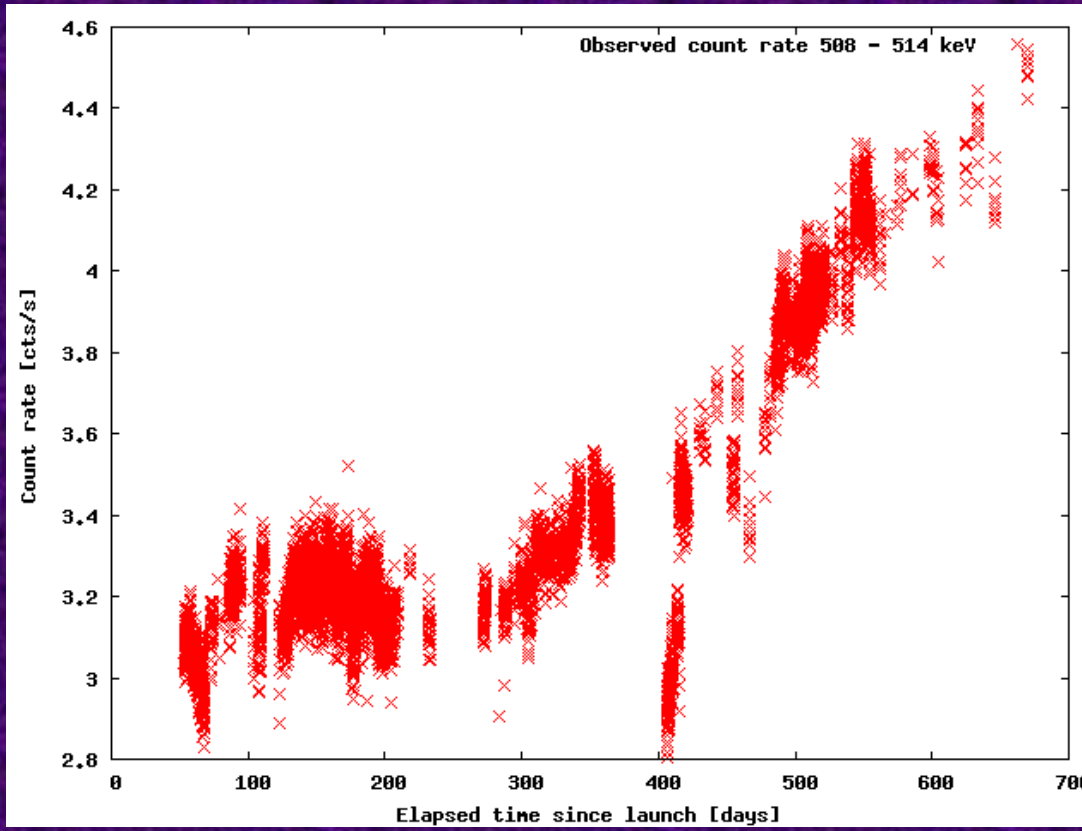
Counts rate evolution in 508 - 514 keV



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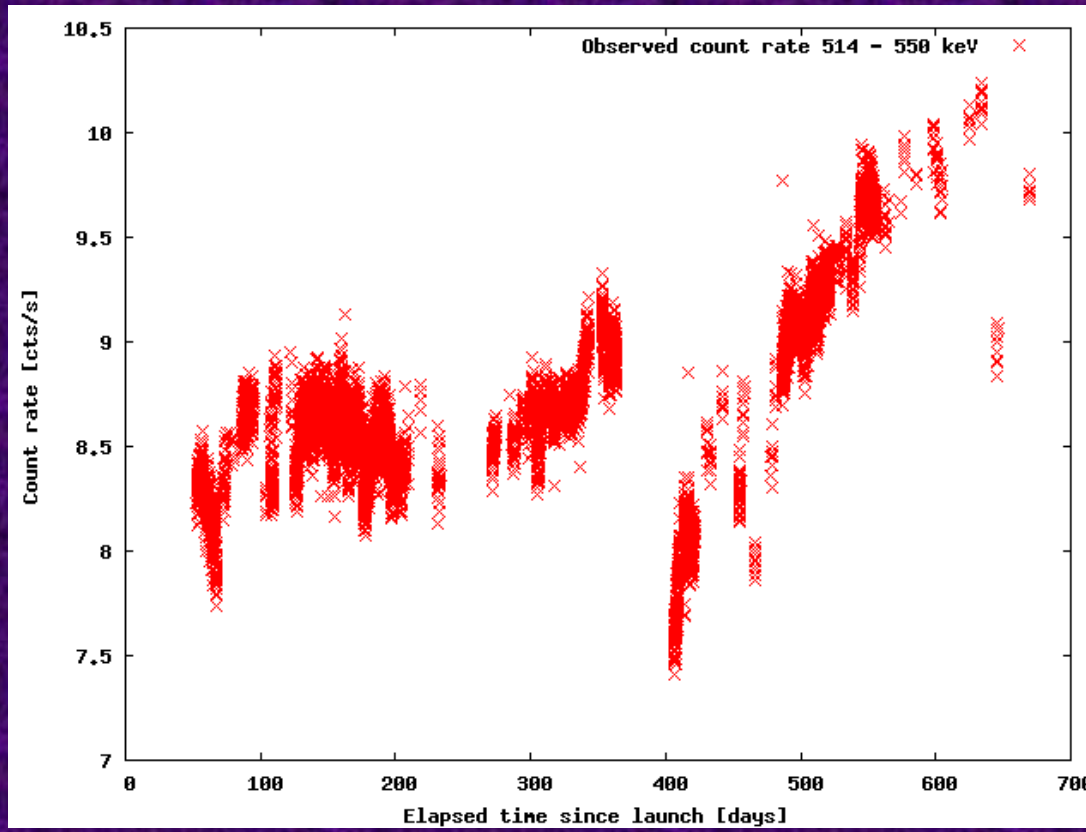
Counts rate evolution in 514 - 550 keV



Background modeling (II)

Variability tracers :

- In-situ measurements :
  - Ge Saturated events
  - Flux in the 520 – 550 keV range

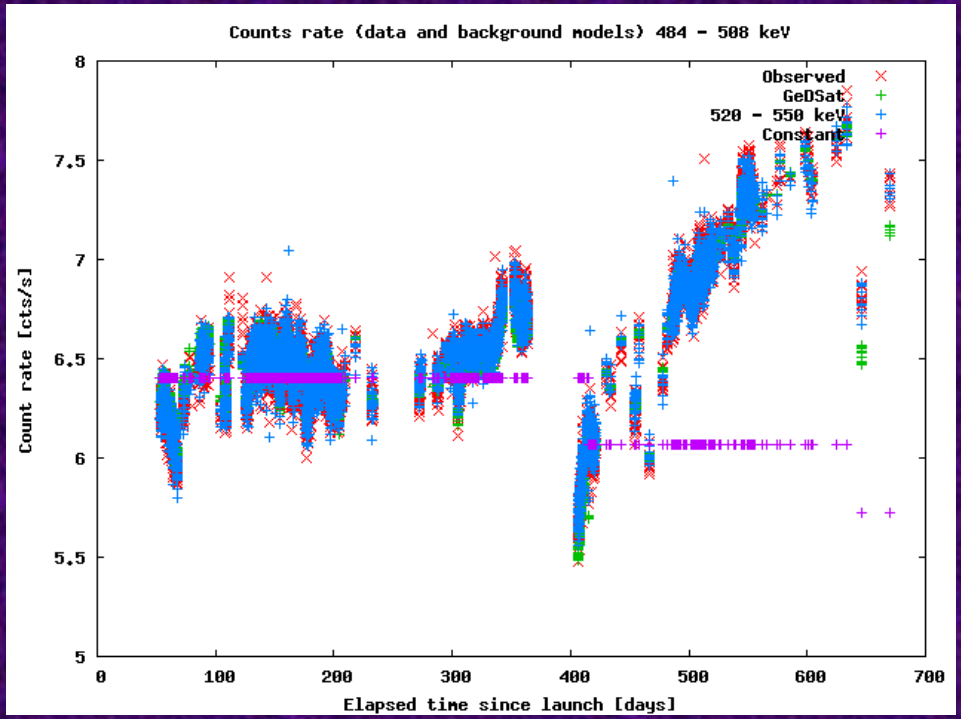
} Normalized on global count rates (before and after det 2 failure)

- Constant rate (prop. to livetime), normalized on Off obs.

Additional variability parameters : h(1), 300(3), 100(7), 30(21) and 3(124) days

Events rate compared with input background models

484 - 508 keV



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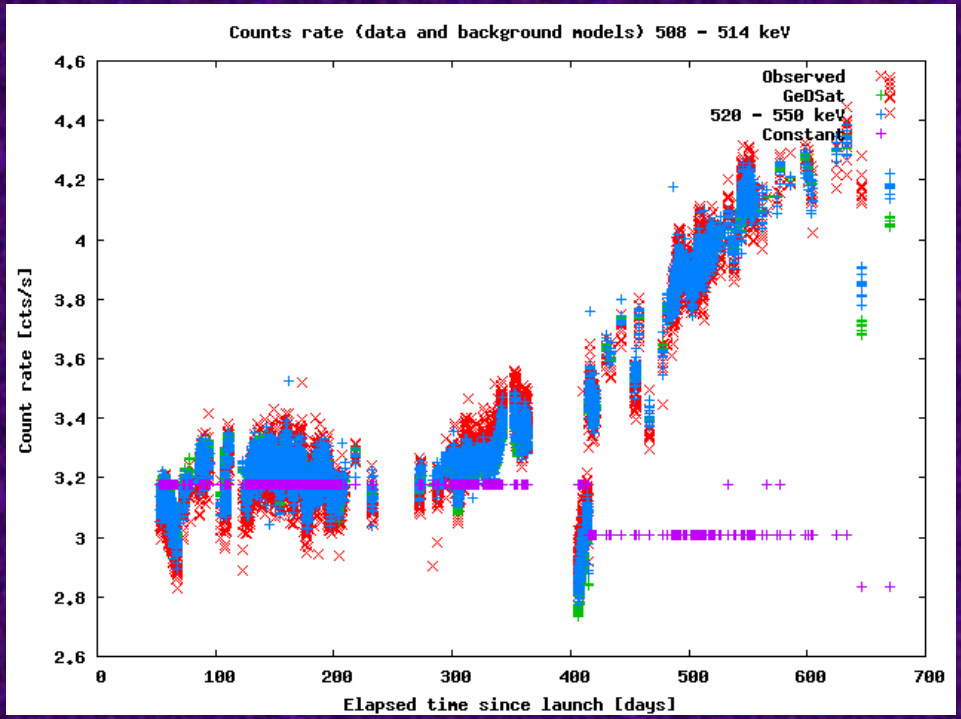

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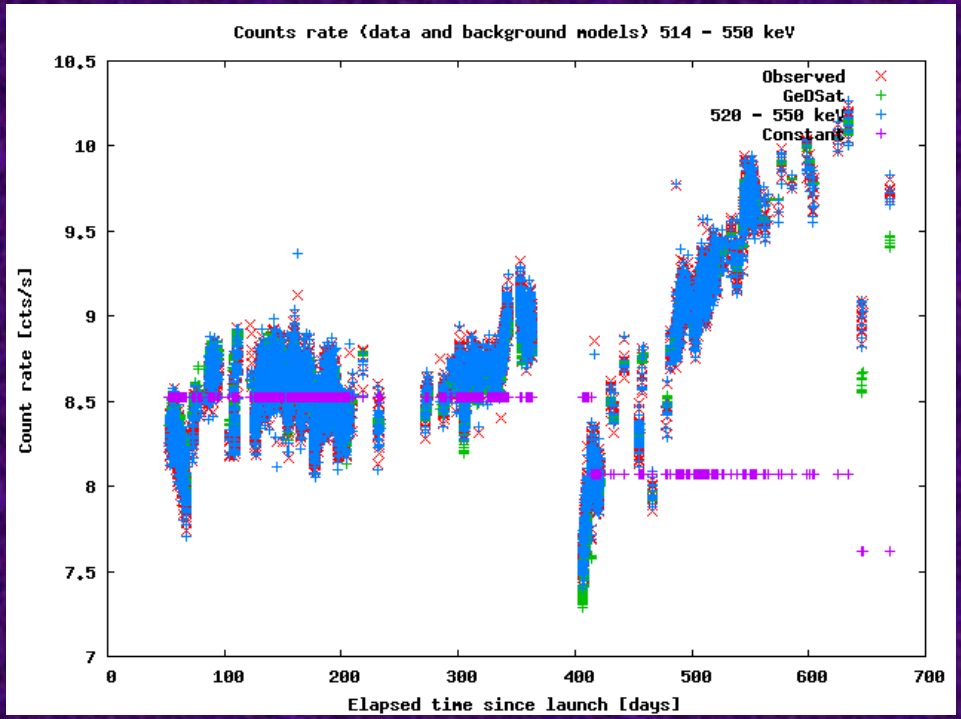
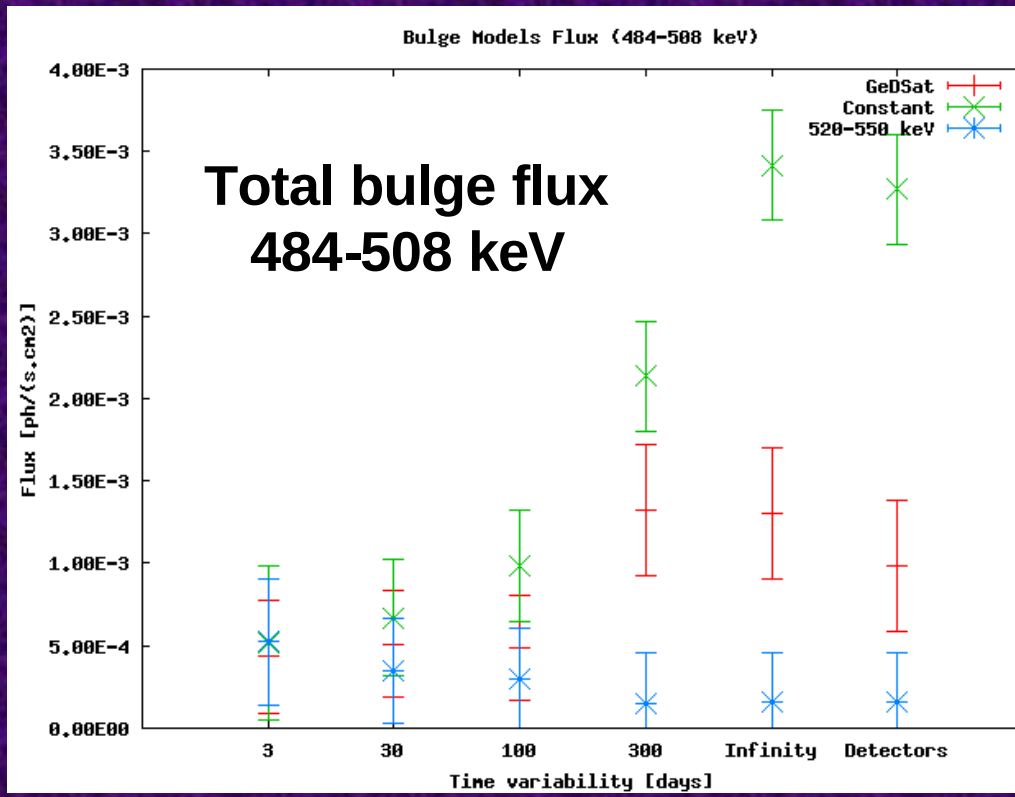


Model fitting results (preliminary)

- Maximum of likelihood method
- Probably over-estimated error bars:
  - positivity constraint ⇒ non-zero gradient …



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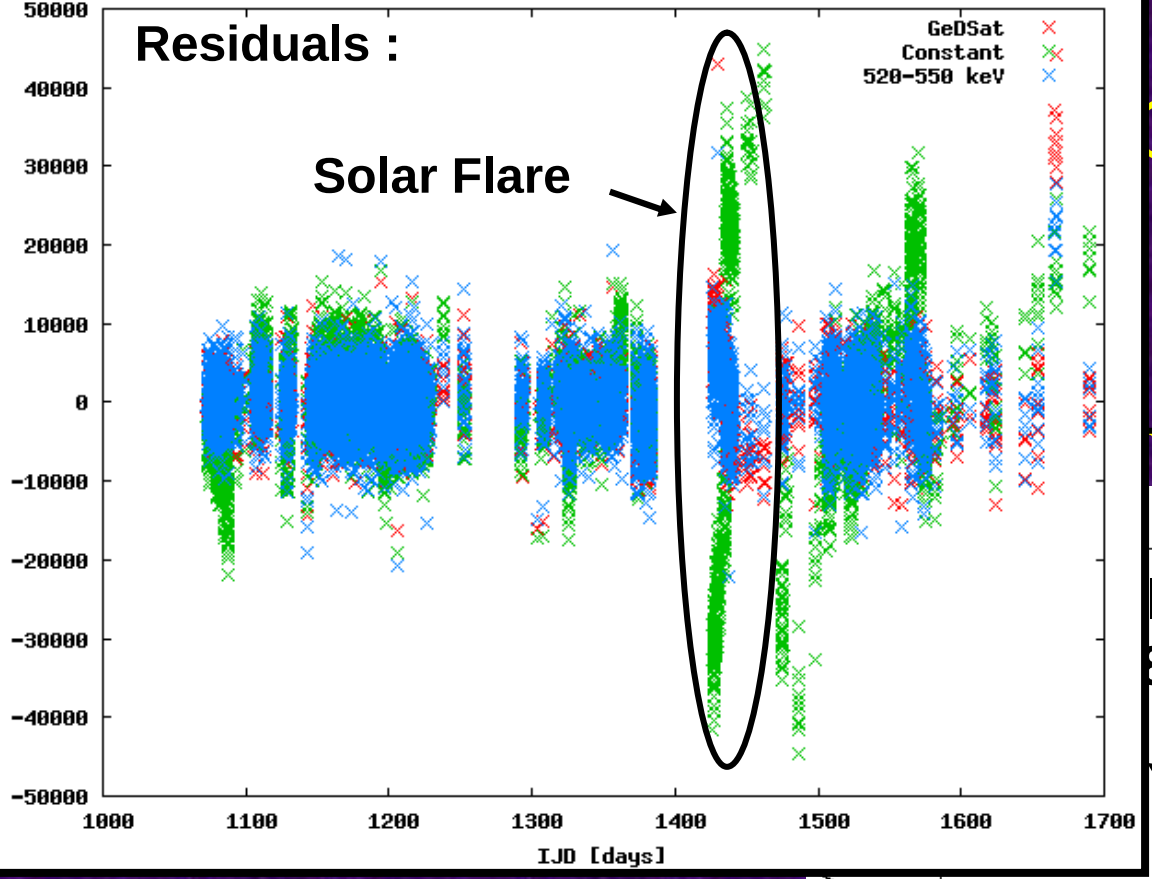
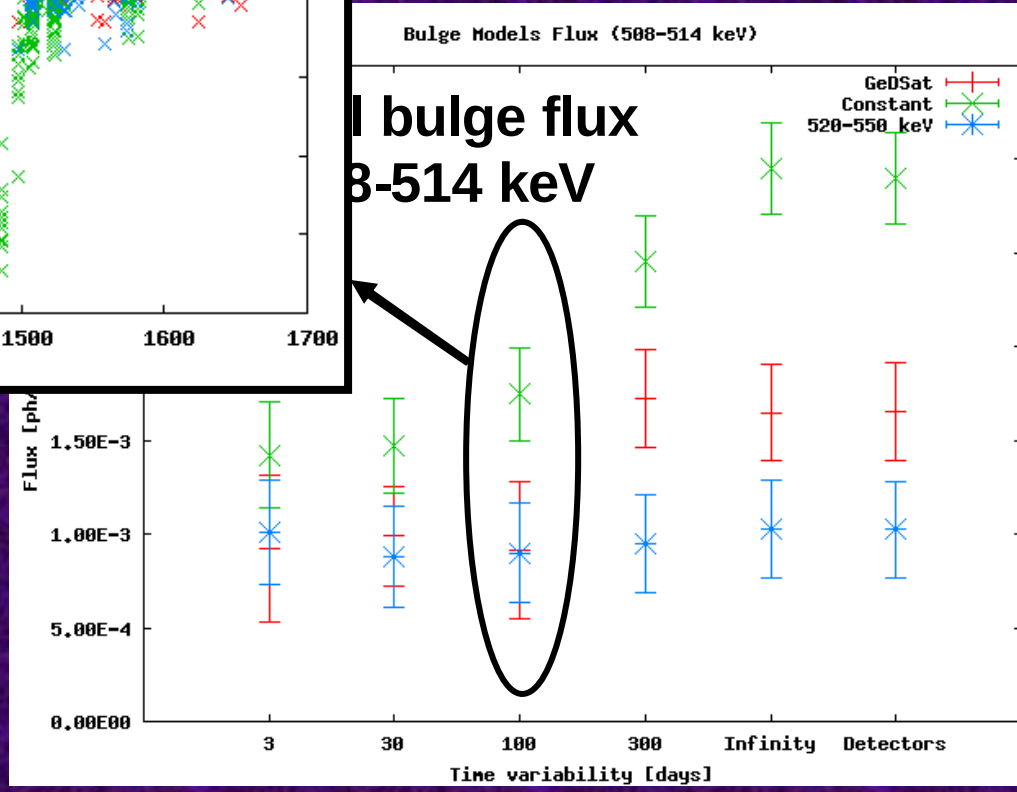
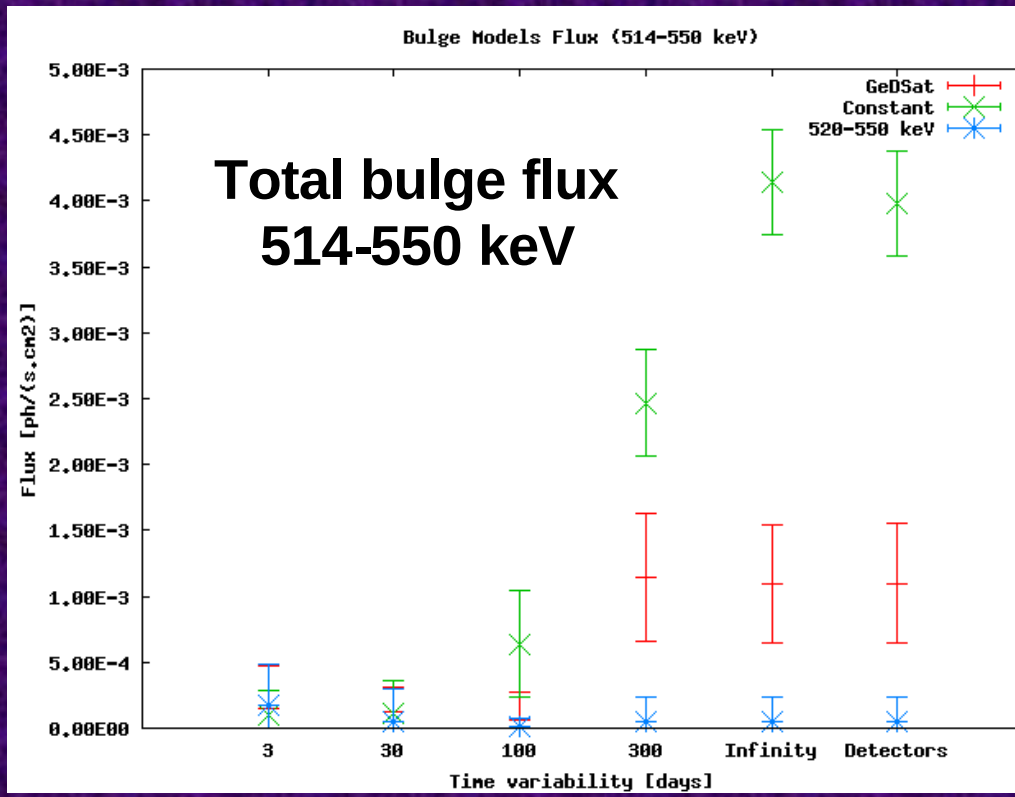




Model fitting results (preliminary)

- Maximum of likelihood method
- Bad error bars handling :
  - positivity constraint => non-zero gradient …



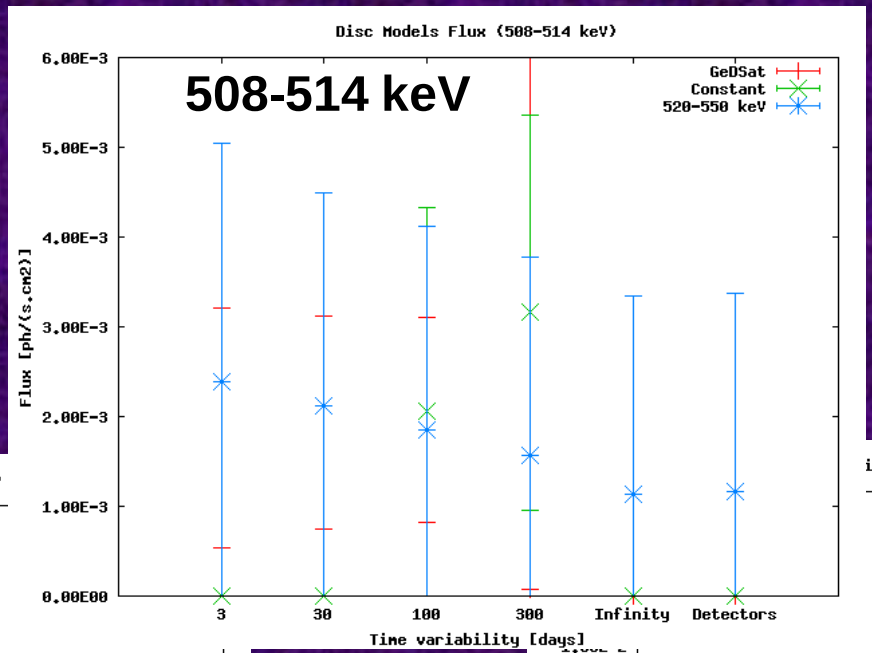
⇨ **Flux dependant on bgnd model**

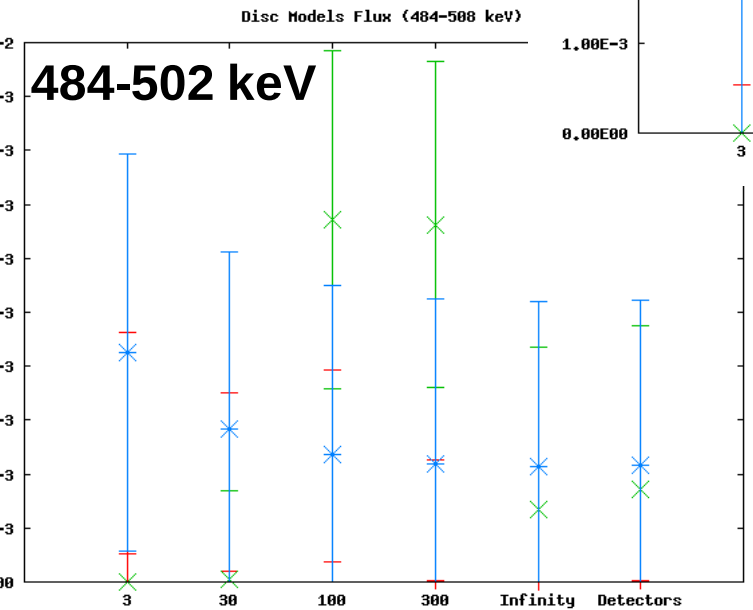
⇨ **Stability for time variability**

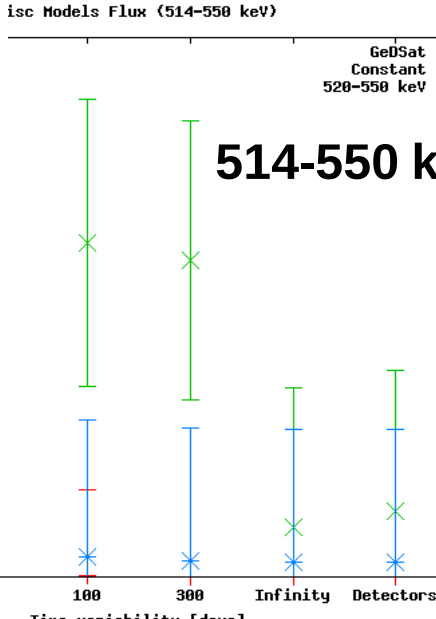
t **< ~100 days**

Model fitting results (preliminary)

Disc components : no detection ?

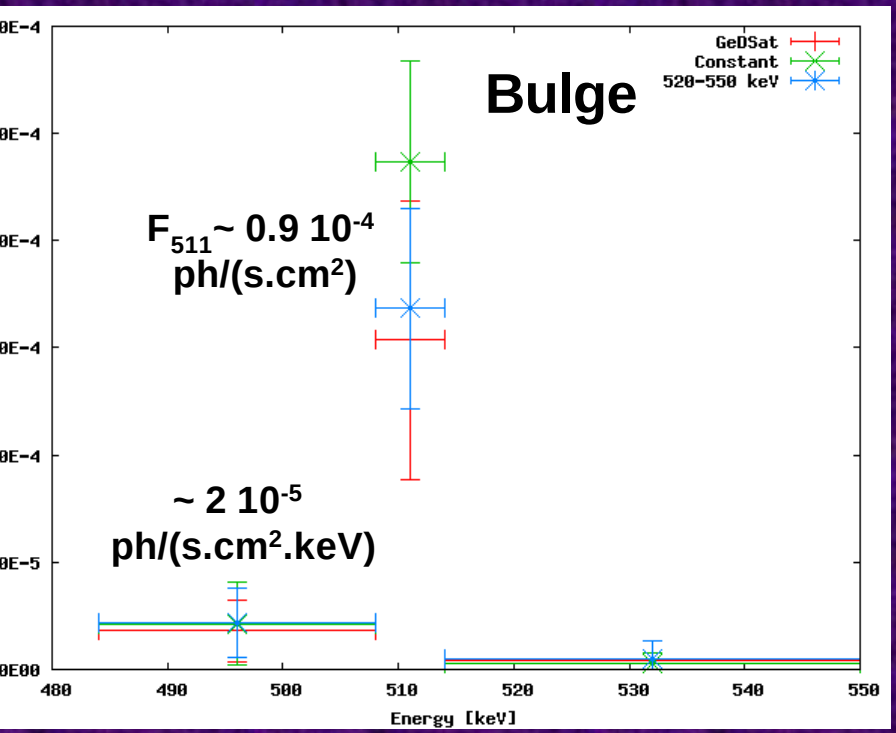


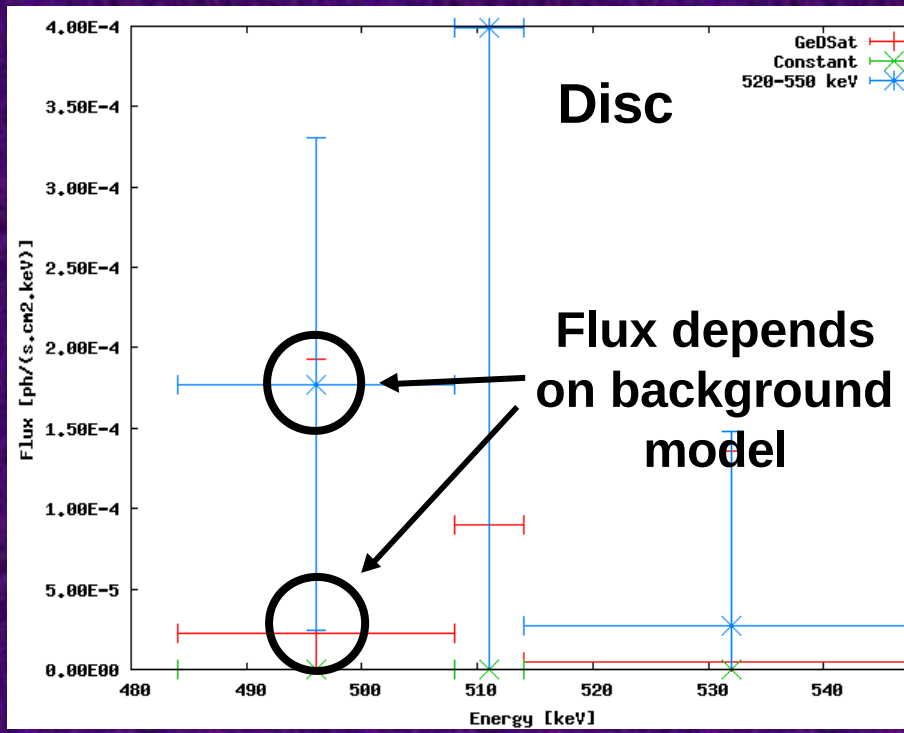




Model fitting results (preliminary)

Background variability of 3 days : spectra



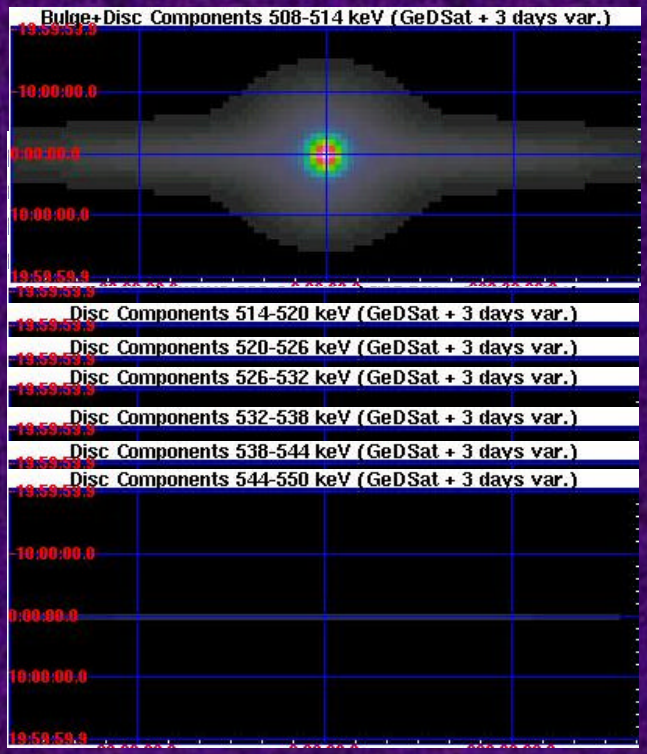


Model fitting results (preliminary)

Background variability of 3 days + GeDSat : morphology

484 – 508 keV

508 – 514 keV



514 – 550 keV

Same linear color scale, except 508-514 keV : factor

Conclusion and further work

- Background modeling issues :
  - Bad background modeling introduce strong systematic errors
  - Ge saturated events / continuum flux tracers are almost equivalent : good for short term variation, need an additional time variability (τ~1 month)
  - Large scale maps correlated with background models
- No evidence of disc emission
- No evidence of bulge emission above 511 keV
- Next steps :
  - Better error handling (unconstrained fits or MCMC estimation)
  - Multi-components background fitting
  - Smoother time variations (splines)
  - Extended energy range