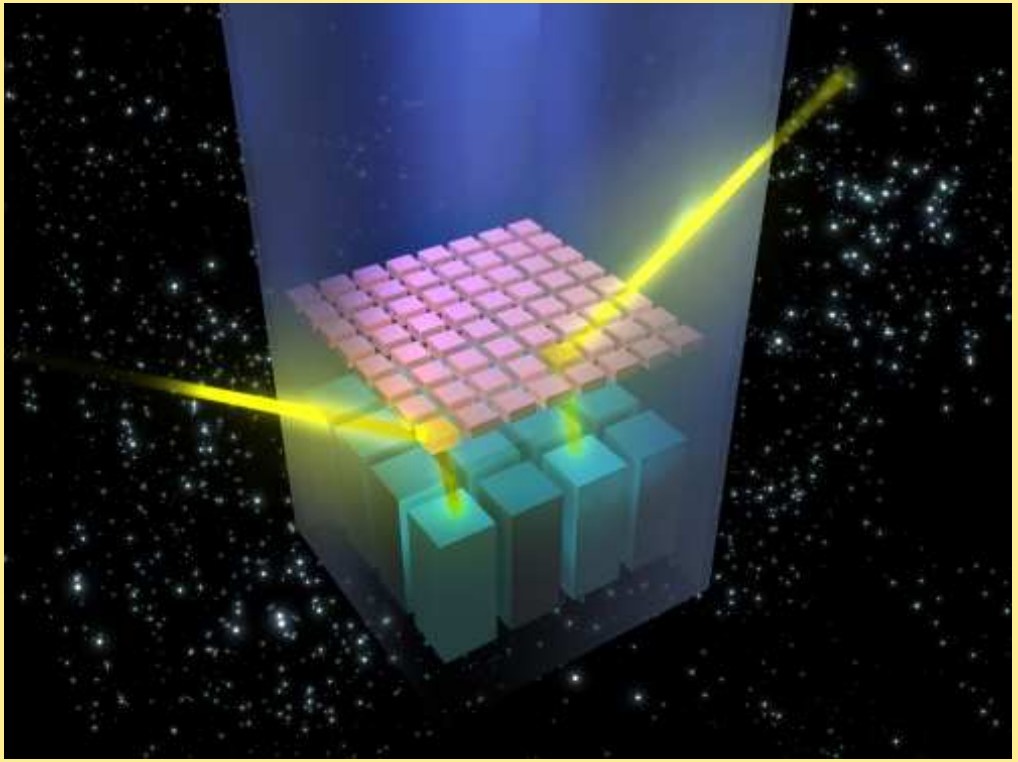
IBIS/Integral Compton mode imaging analysis



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IPJ, Swierk

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CAMK, Warsaw
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Ph. Laurent & P. Goldoni
CEA, Saclay
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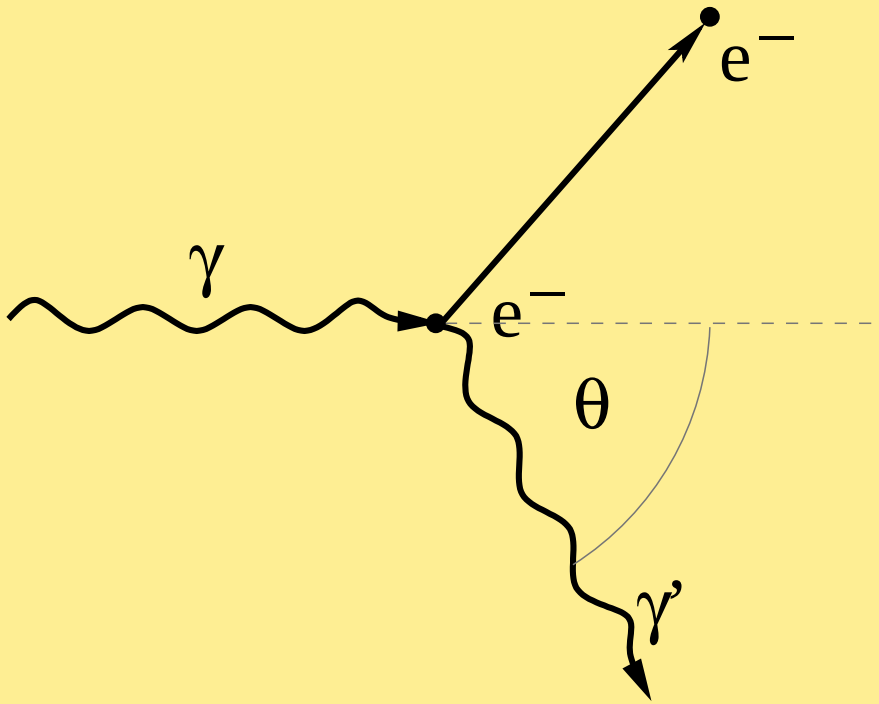
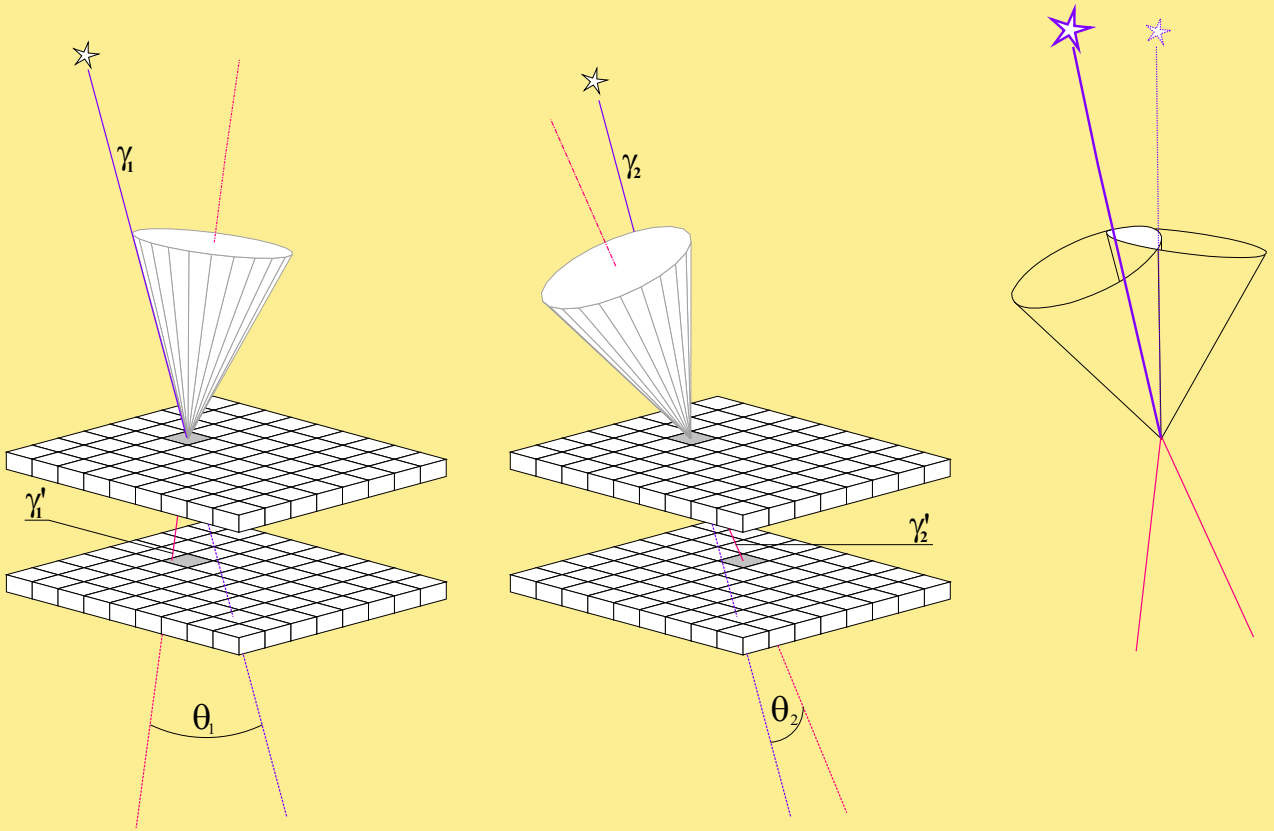
MPE, Garching
CalTech, Pasadena

Compton scattering



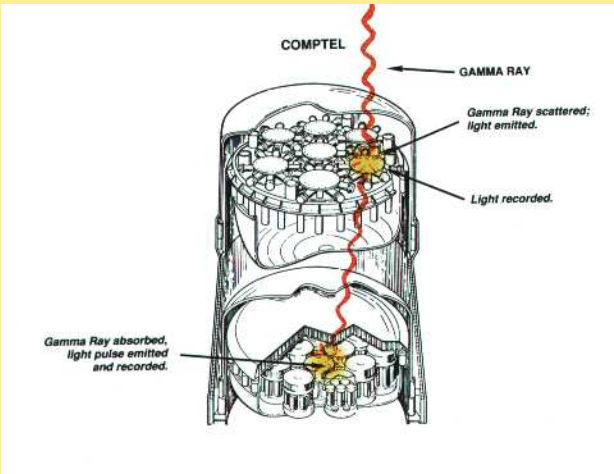
$$E_{\gamma'} = \frac{E_\gamma}{1 + \frac{E_\gamma}{m_e c^2}(1 - \cos\theta)} \qquad T_e = E_\gamma - E_{\gamma'}$$

Gamma-ray Compton telescope



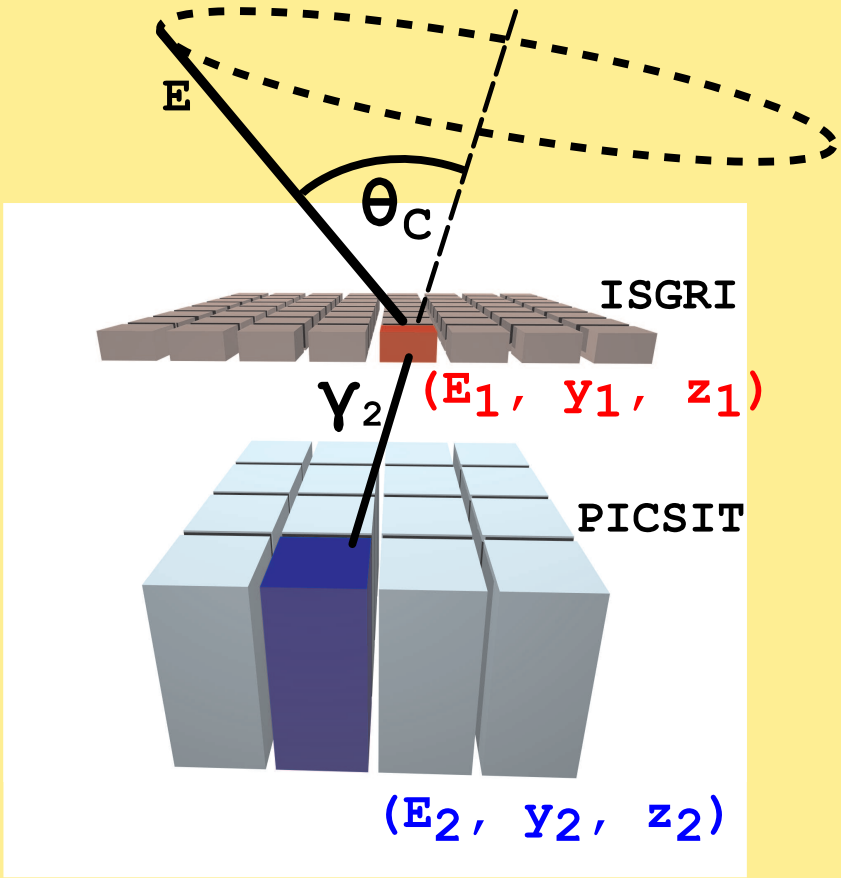
Compton telescope – real application

COMPTEL	SPI/INTEGRAL	RHESSI
1991-2000	2002 – now	2002 – now

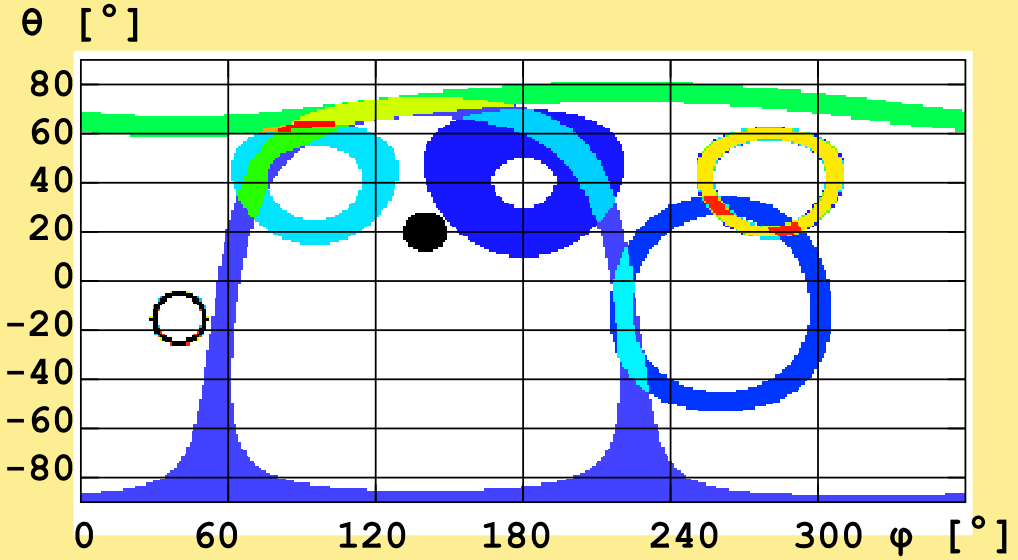


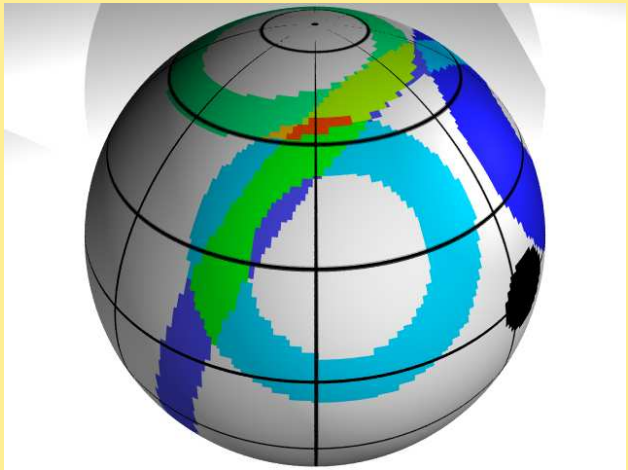
see: tomorrow presentation by Wojtek Hajdas

IBIS as a Compton telescope



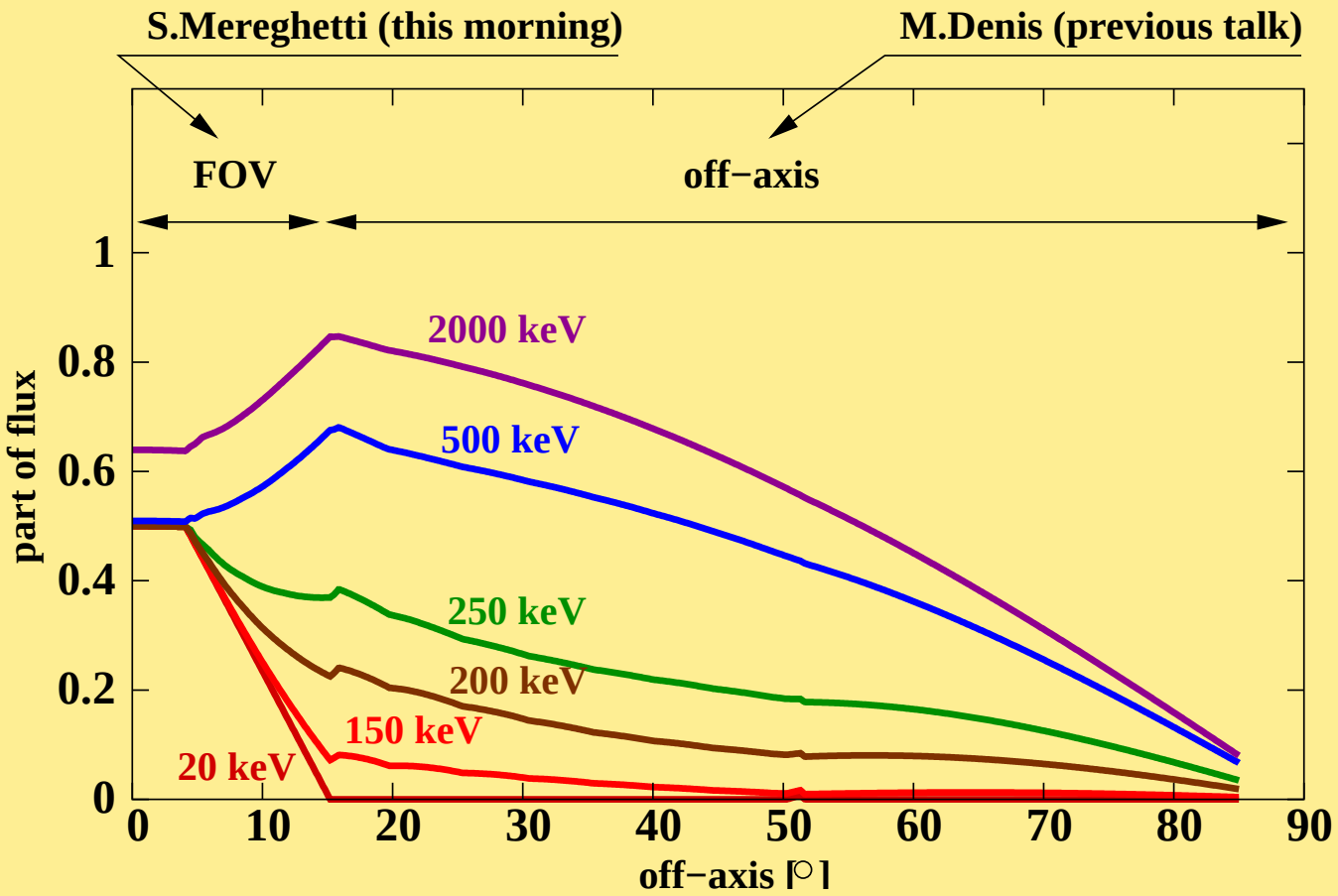
Compton circles → annuli





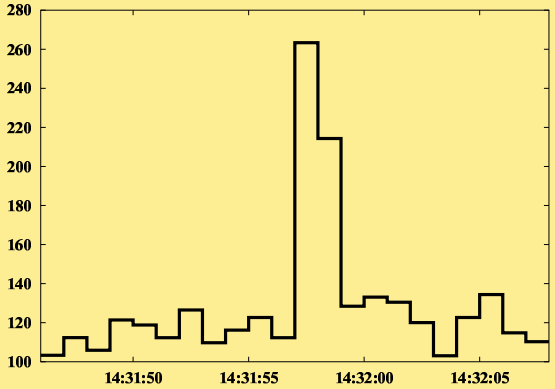
Integral sees out of the corner of its eye!

Why?

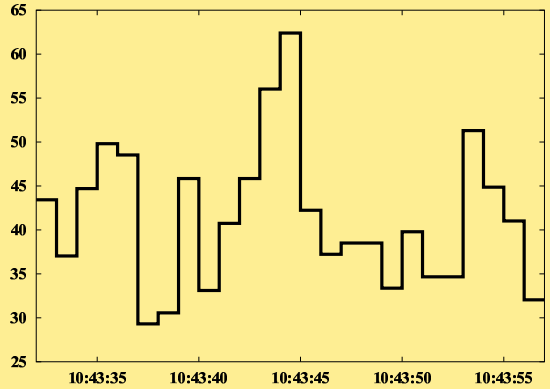


(un)Usual bursts in IBIS Compton mode

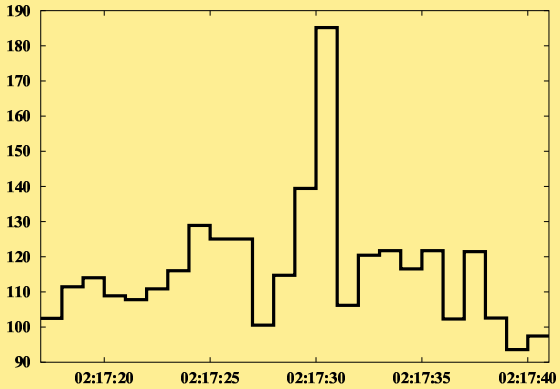
GRB 030307



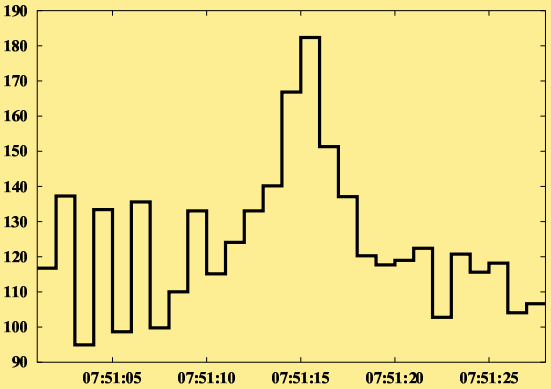
GRB 030326



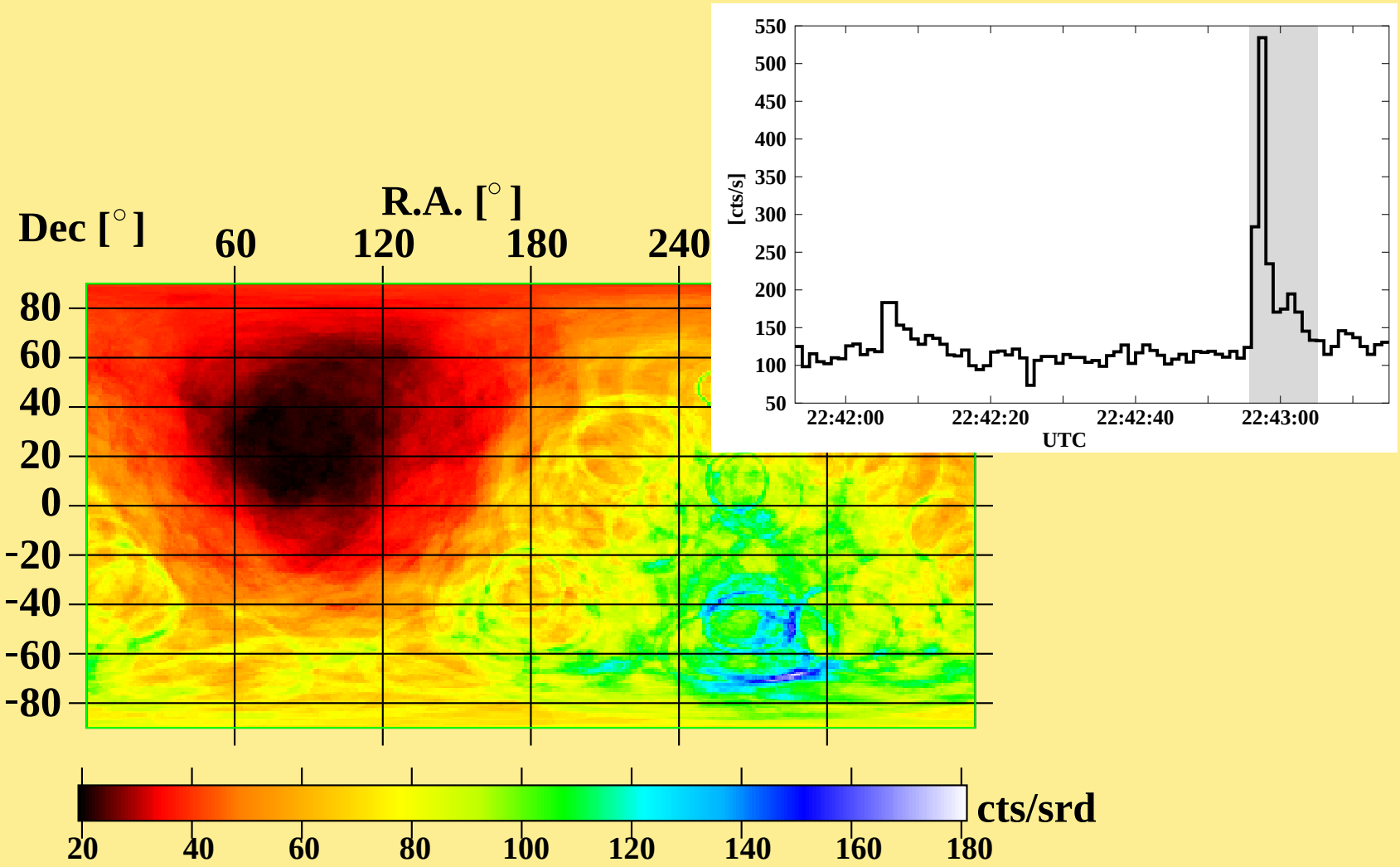
GRB 030405



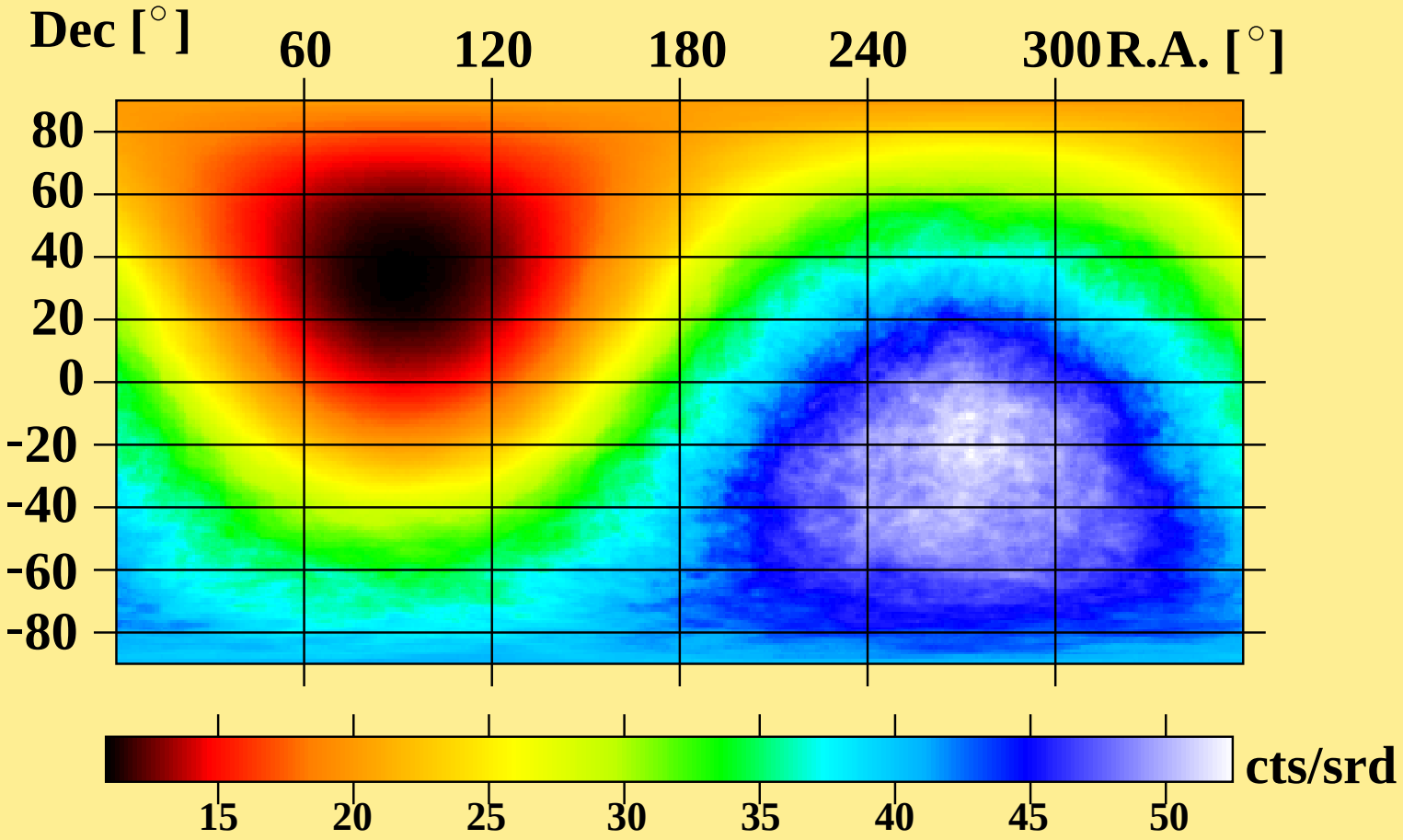
GRB 030422



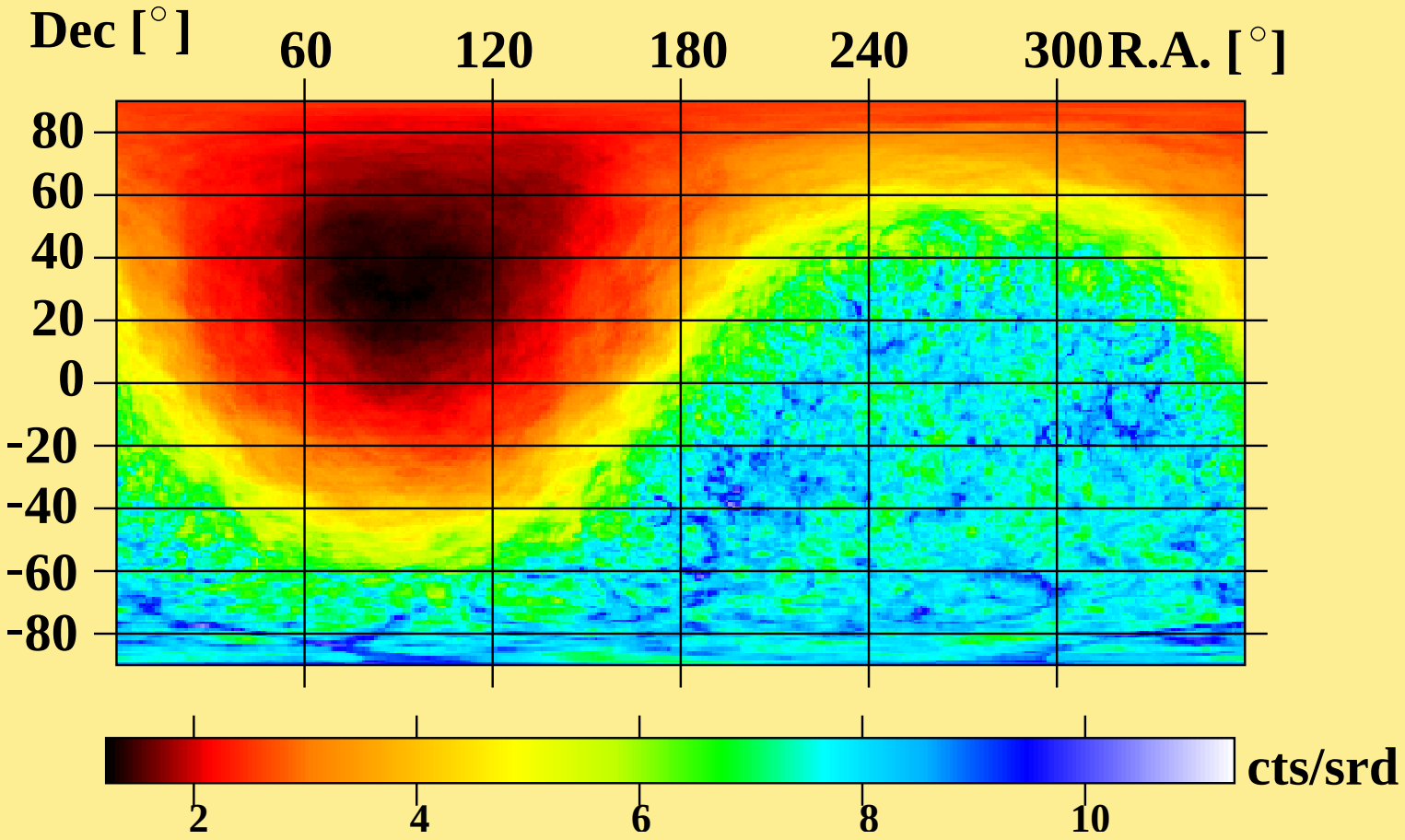
Method (step 1): total map ...



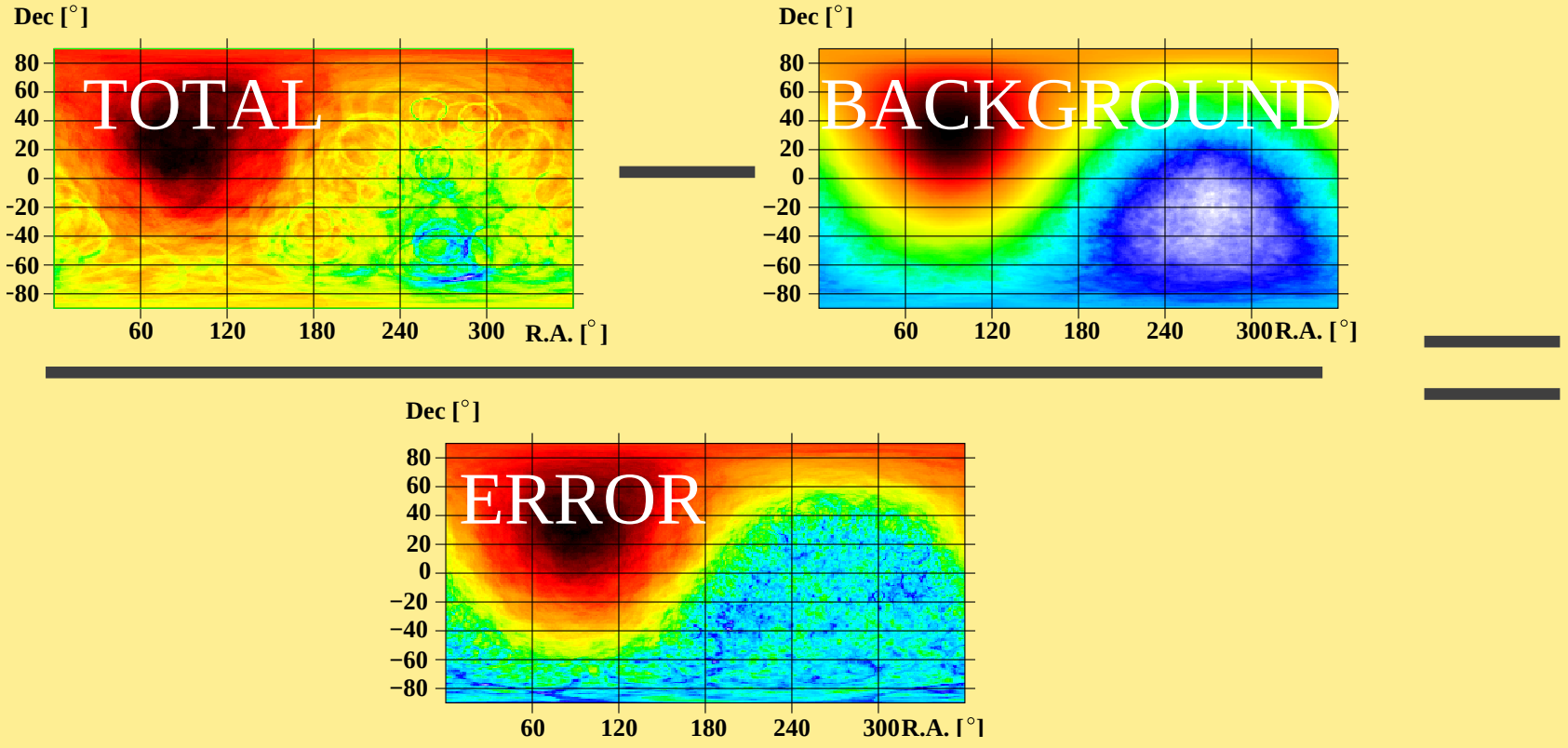
Method (step 2): ... but background ...



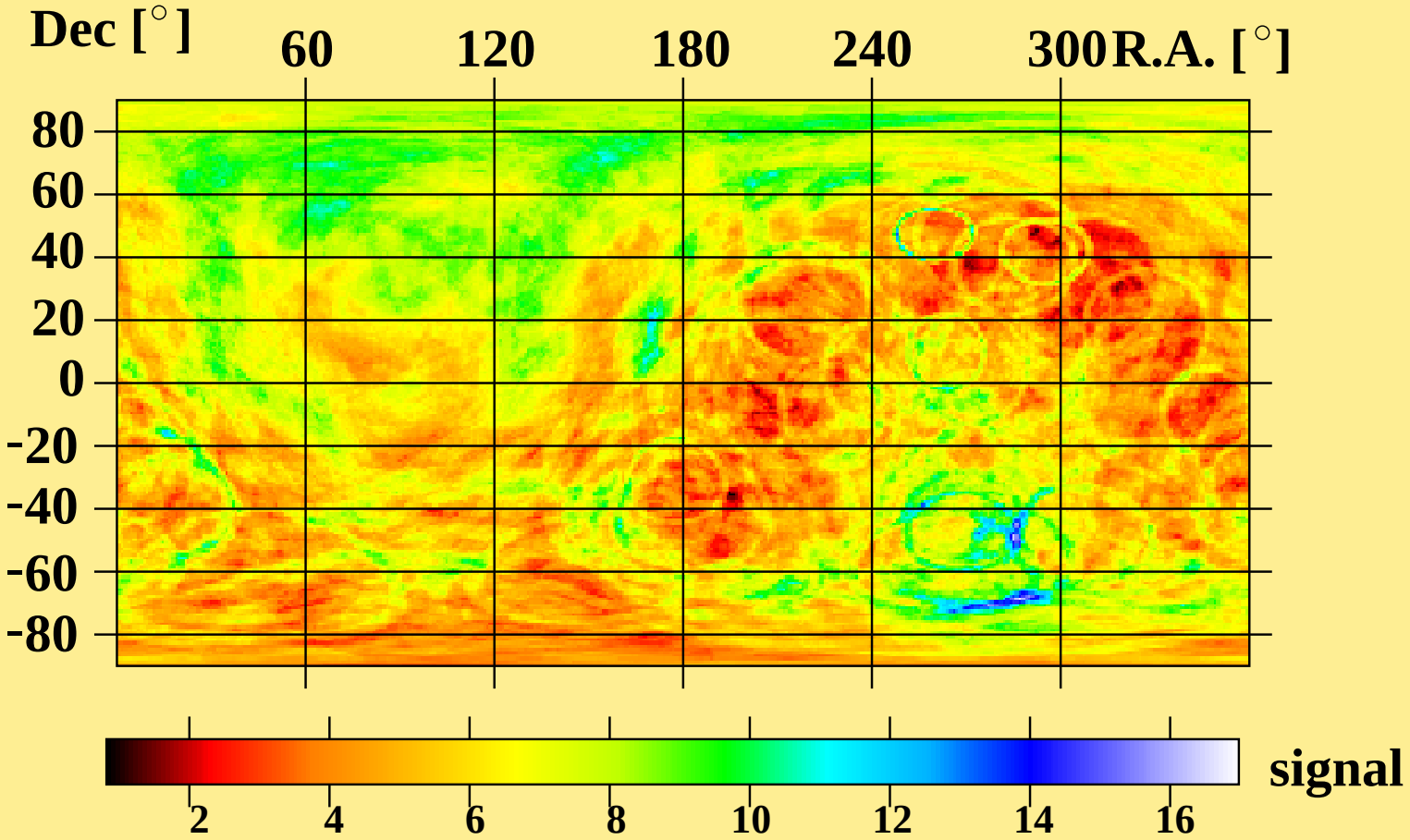
Method (step 3): ... but fluctuation (of background)



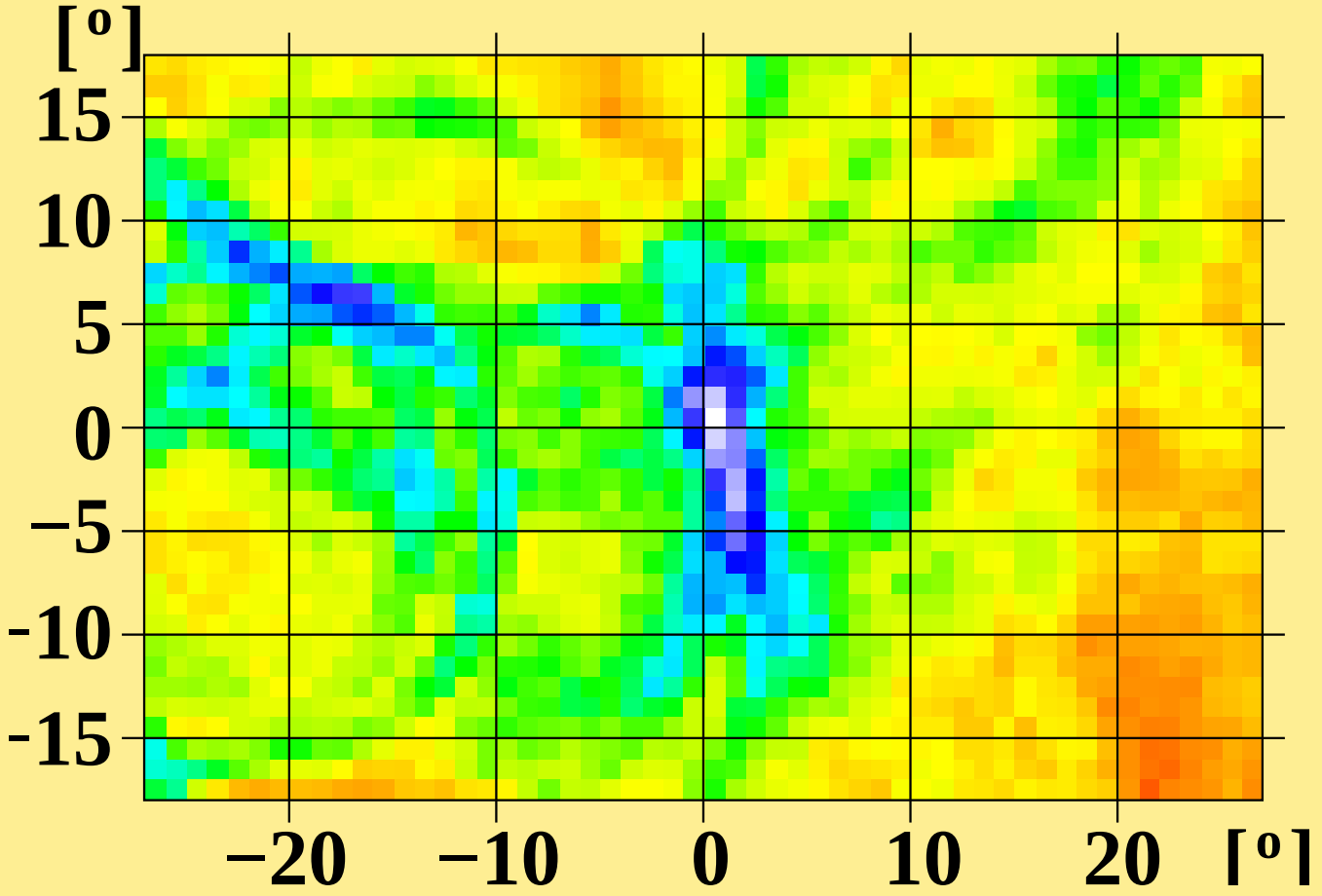
Method (step 4): signal map



Result: signal map for GRB 030406 (36° off-axis)

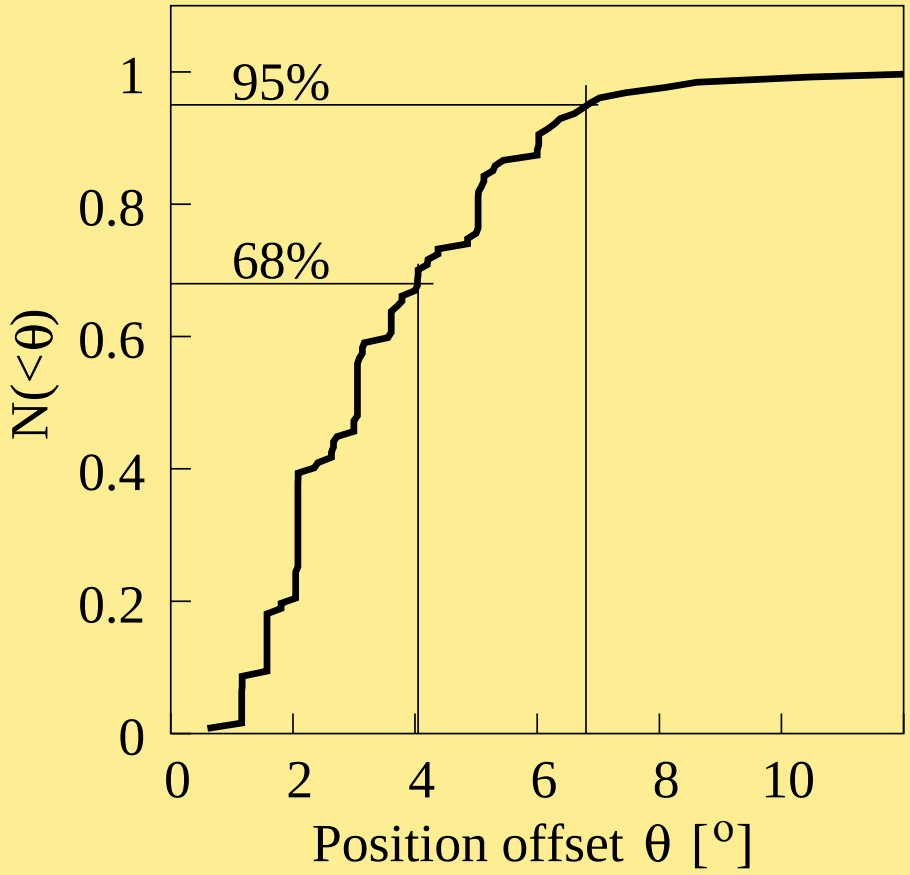


Accuracy of the method



GRB 030406 map centered on the IPN position

Error estimation: MC simulation and maximum likelihood method

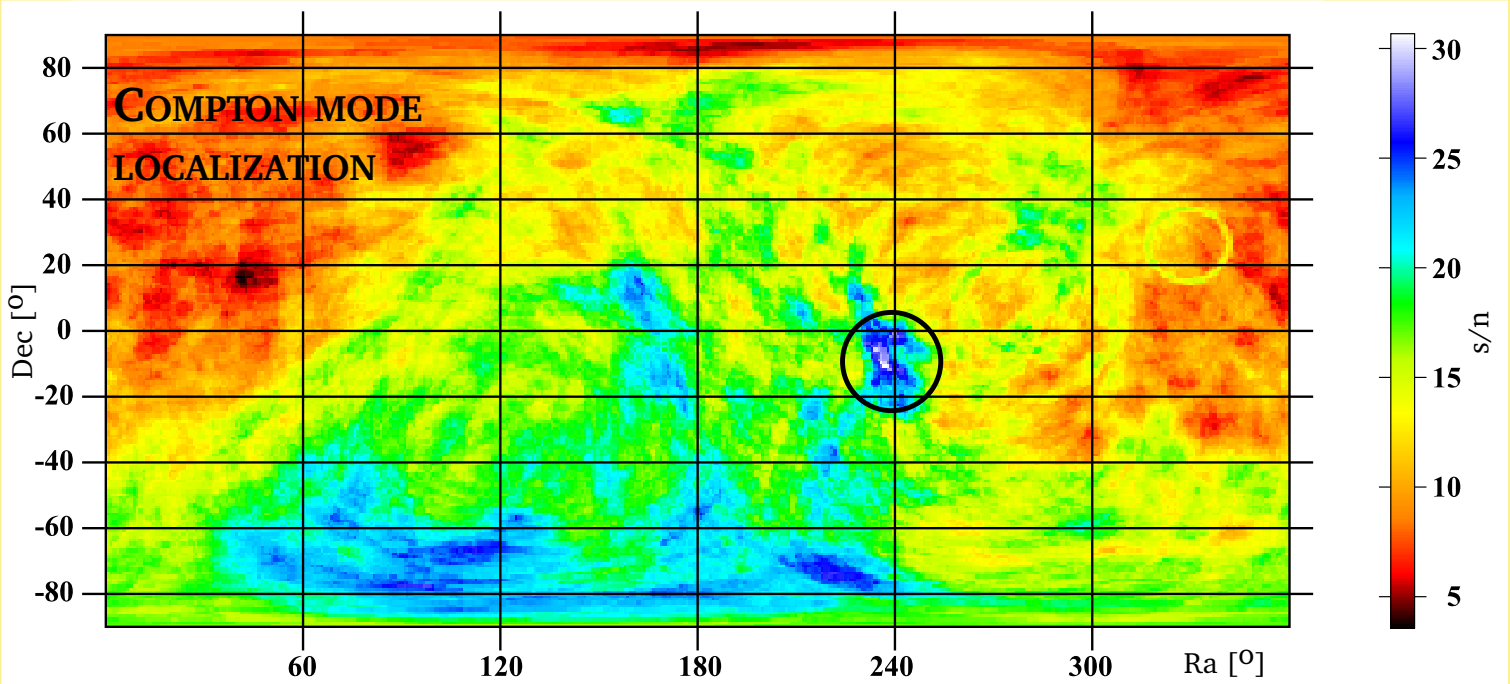


127 030406-like simulated burst mixed with experimental background samples

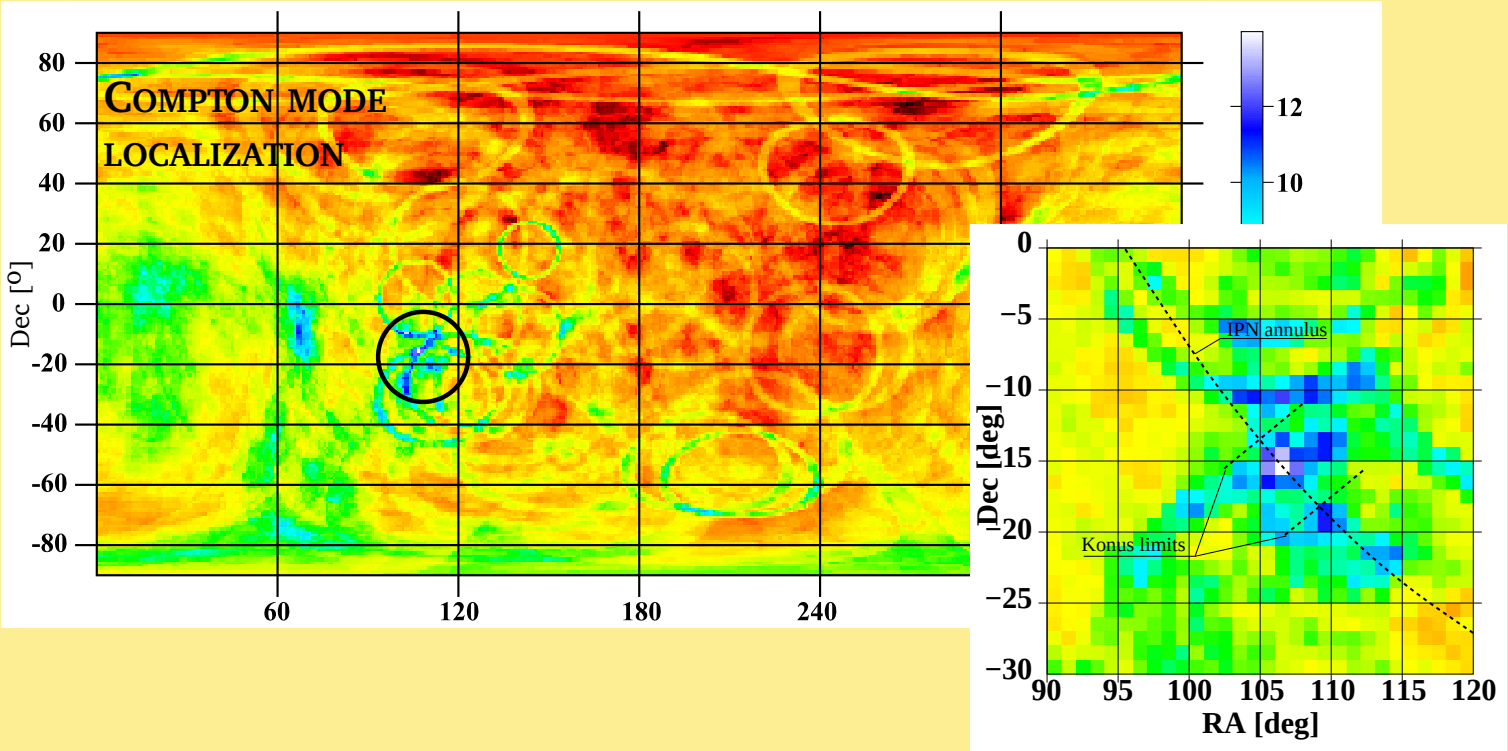
$\sigma_{\mathrm{MonteCarlo}} = 4^\circ$

$\sigma_{\max\mathcal{L}} = 3.5^\circ$

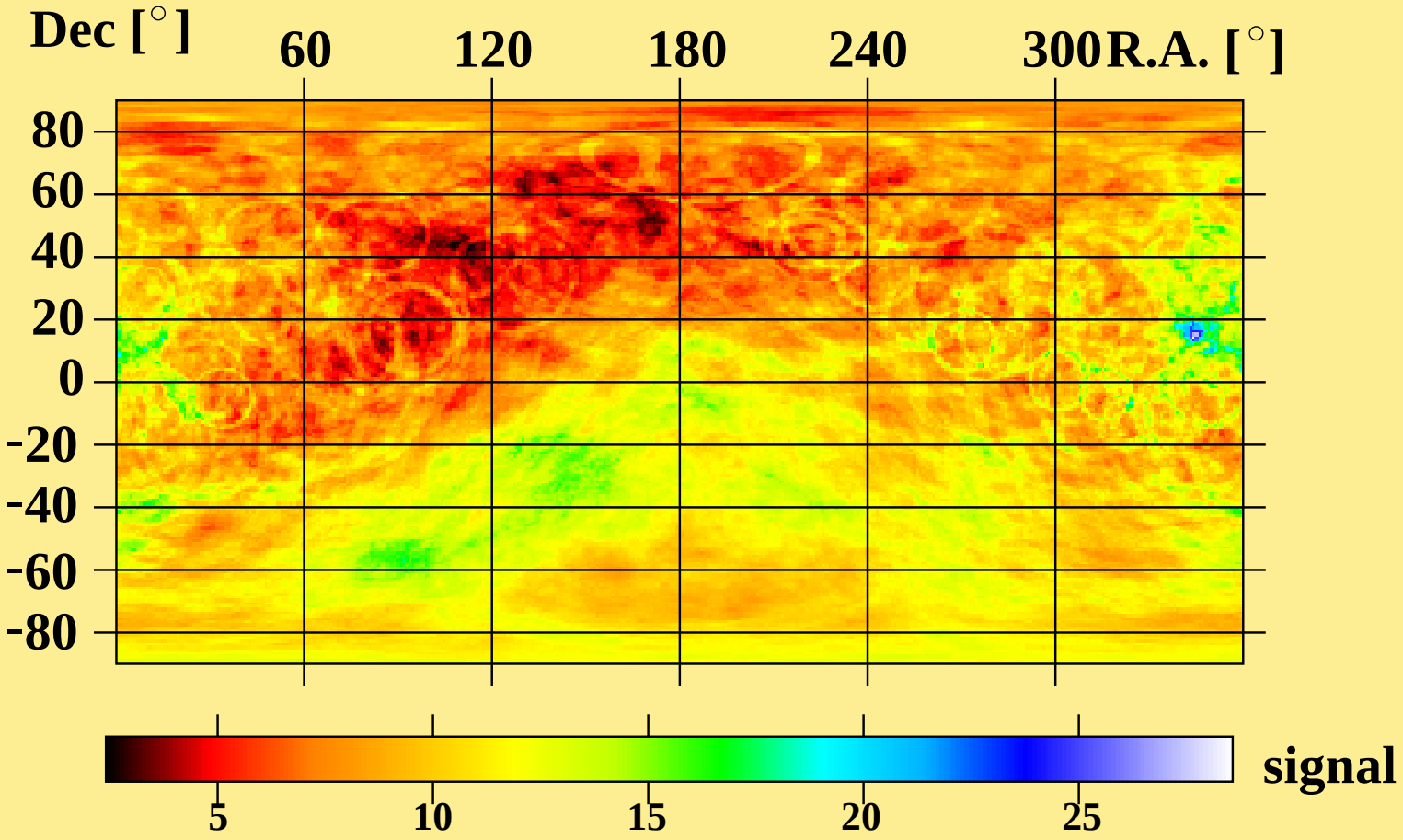
Result: signal map for GRB 021206 (72° off-axis)



Result: signal map for GRB 030722 (76° off-axis)



Result: signal map for GRB 041226



Summary

- IBIS/INTEGRAL Compton mode is able to localize GRBs in near-real time with accuracy of a few degrees.
- It increases the number of INTEGRAL localized GRBs with $\sim$20-30%.
- The field of view of the instrument is half of the Sky.
- The instrument is sensitive for **hard** and long bursts.

Dessert: GRB 041226 MOVIE