Background in AstroSat CZTI

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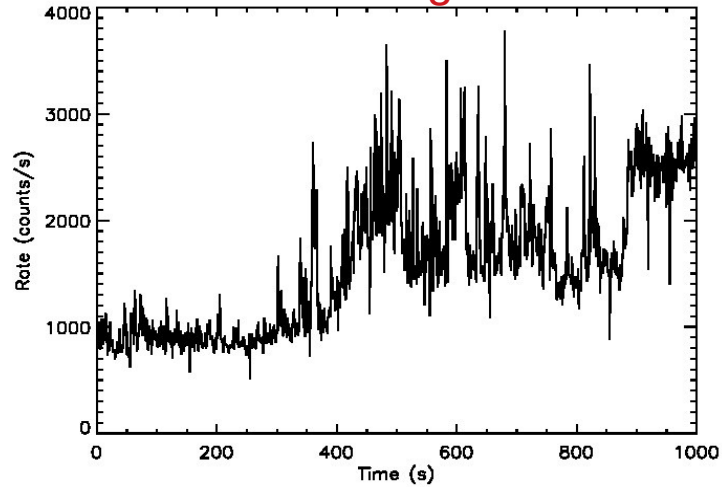**Email: mithun@prl.res.in**
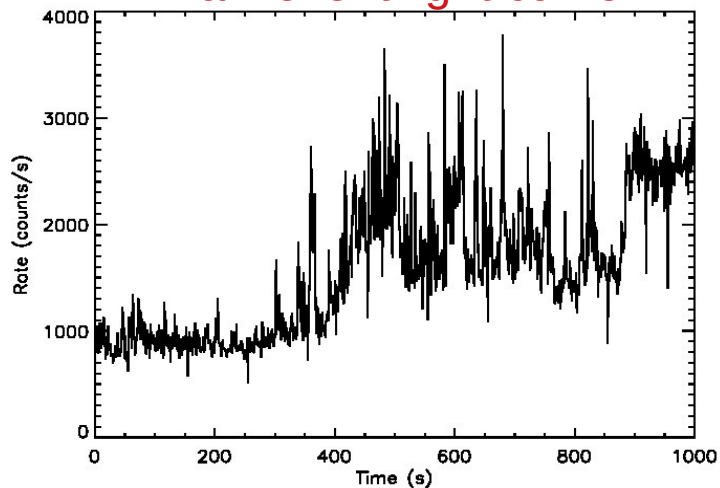
On behalf of CZTI team

Event selection algorithms: First stage of background removal

Raw event light curve

Event selection algorithms: First stage of background removal
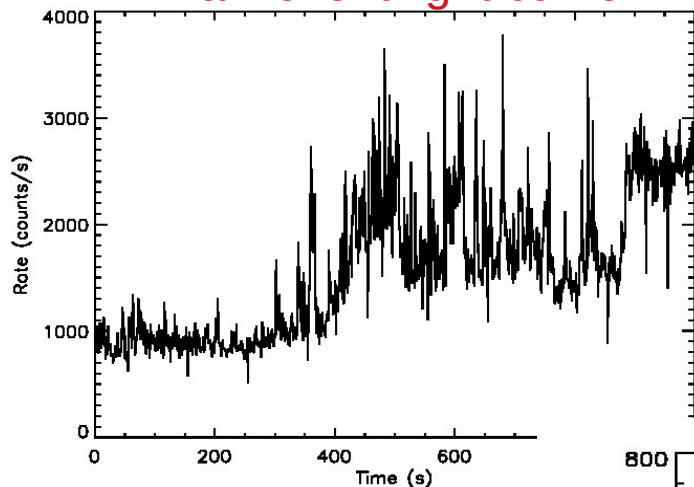
Raw event light curve

Bunch cleaned event light curve

Cztbunchclean: Multi-hit events induced by particle are removed

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Clean event light curve
All quadrants added

GRB151006A

Crab

Crab

Earth

Cztpixclean: Noisy and flickering pixel events removed

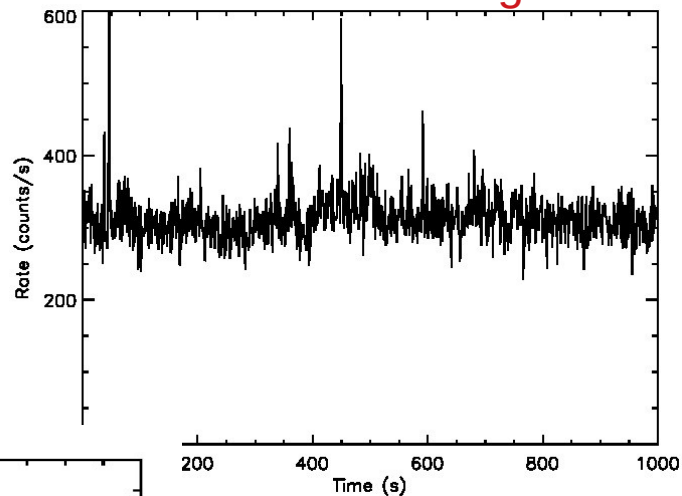Cztevtclean: veto tagged events removed

Event selection algorithms: First stage of background removal

Raw event light curve

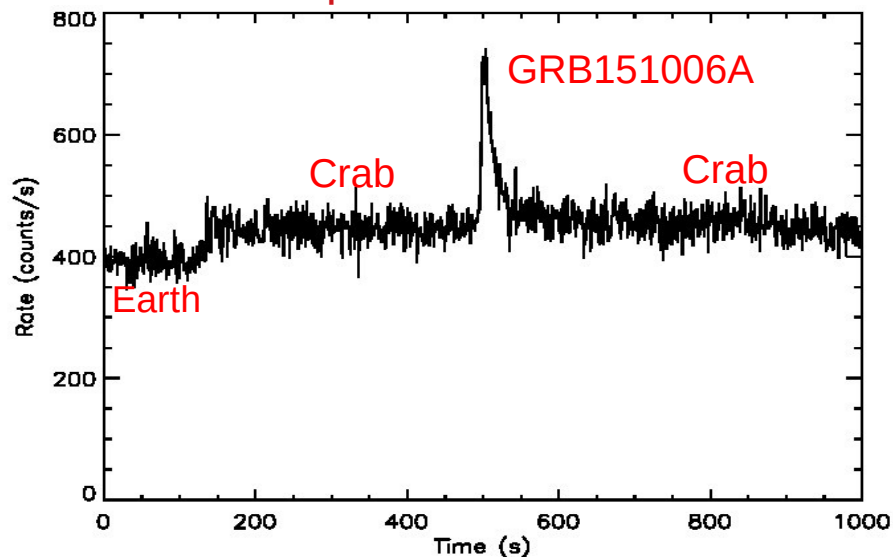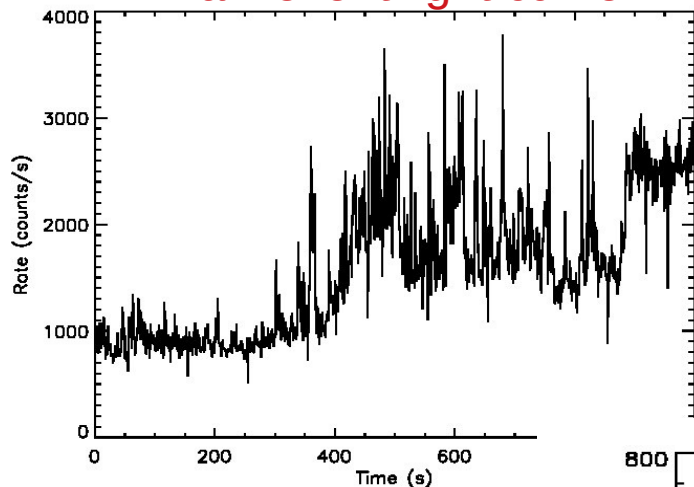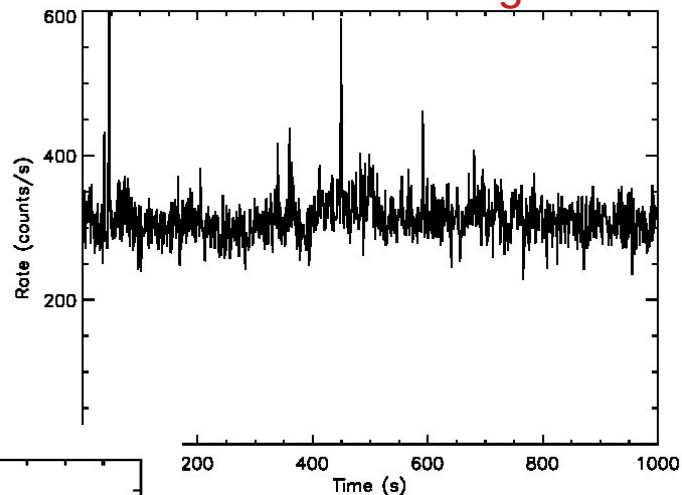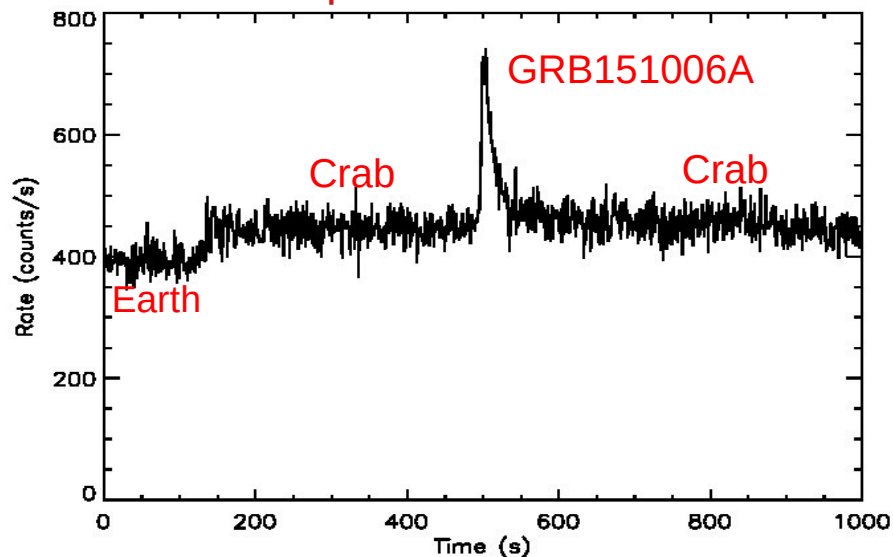Cztbunchclean: Multi-hit events induced by particle are removed

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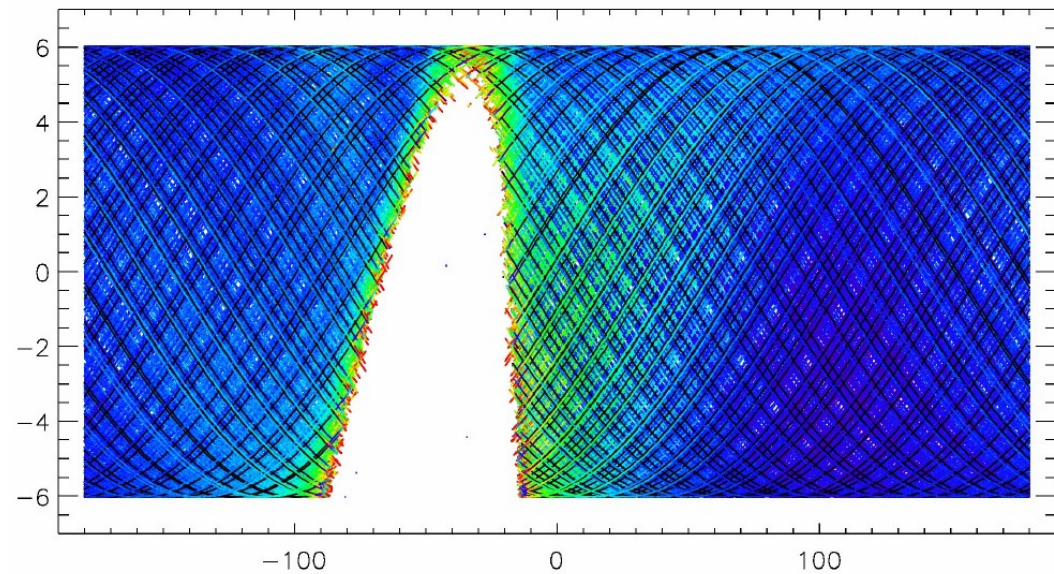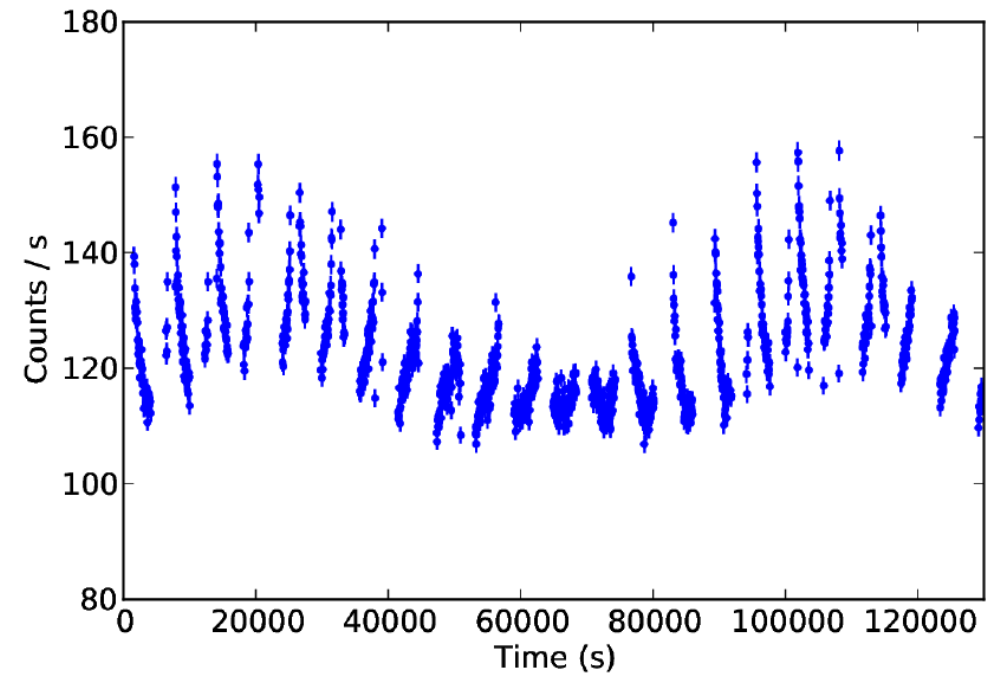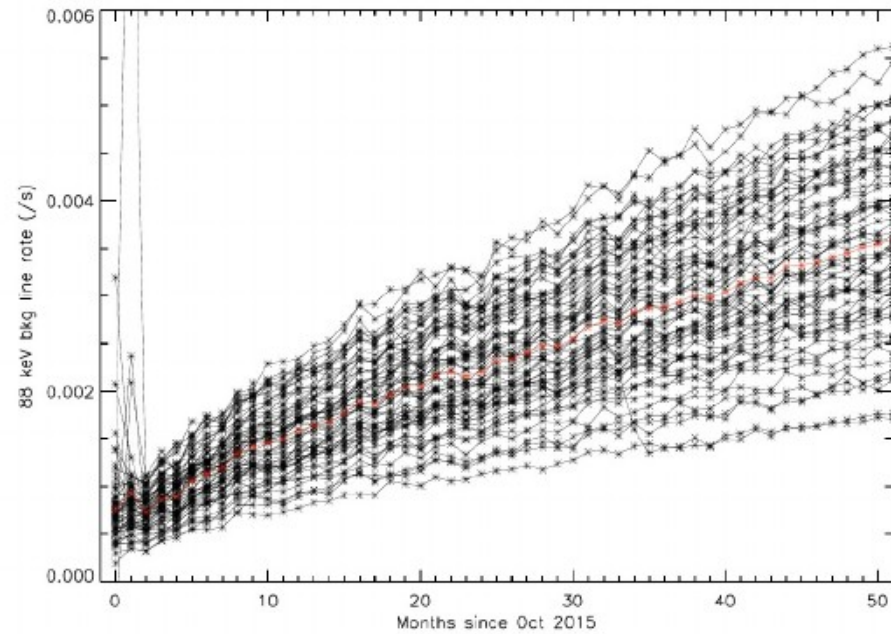Remaining background events: CXB + particle etc.
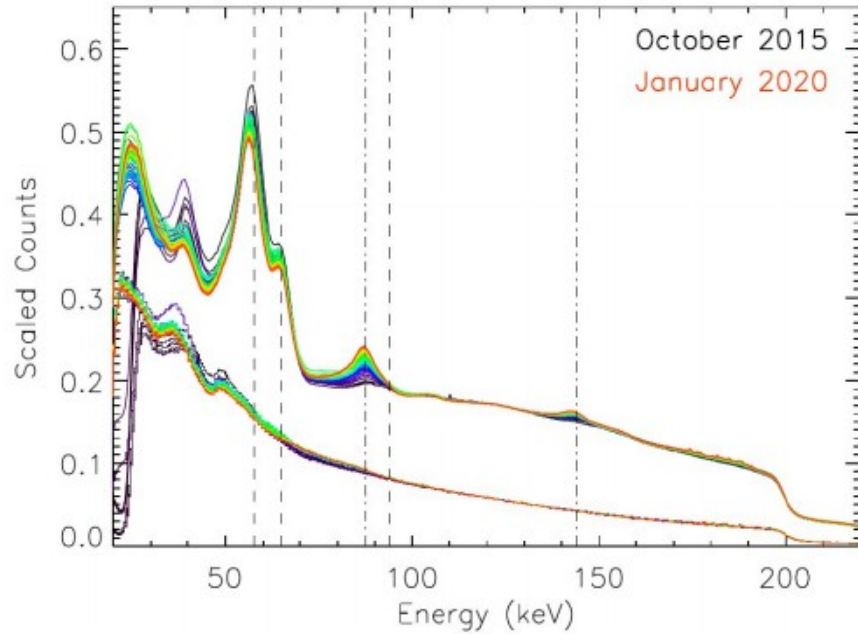
Dominated by background

Background: ~400 cts/s
Crab   : ~50 cts/s

Short term background variation

Long term background variation: Spectra
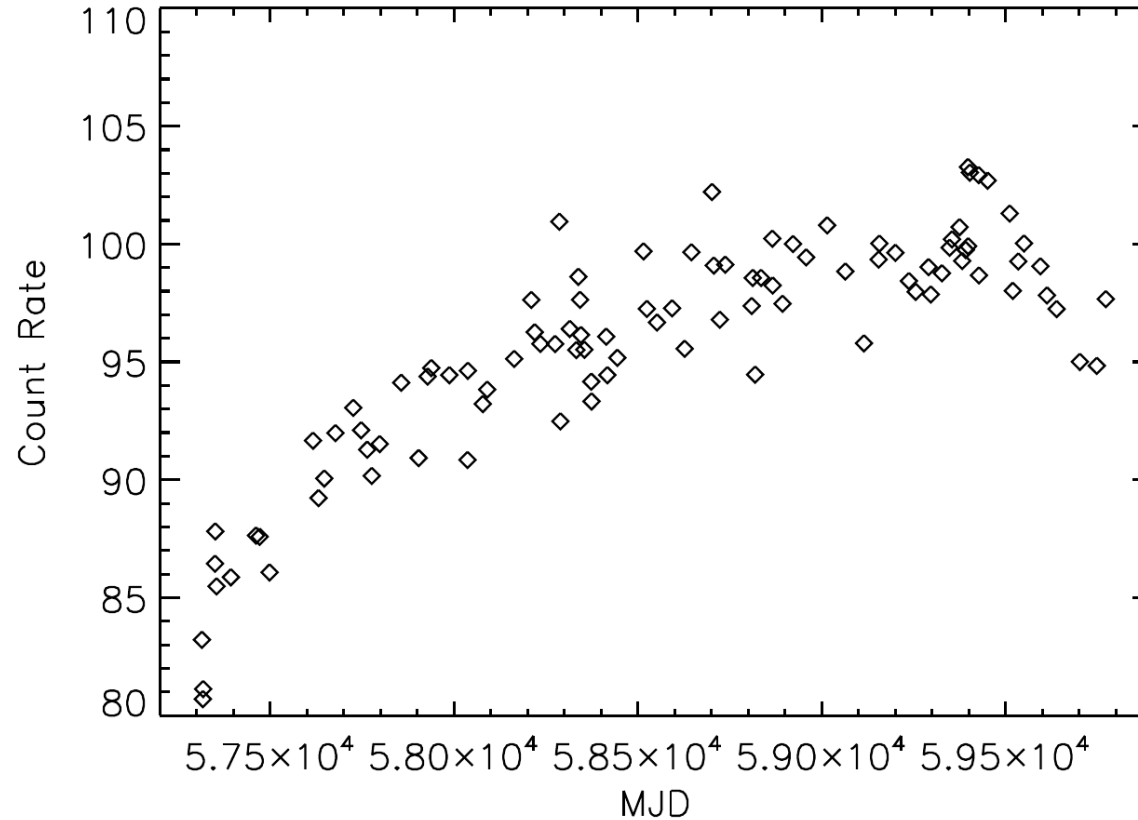

Background spectra as a function of time: Monthly spectra

New lines at 88 and 144 keV: Activation of Cd and Te

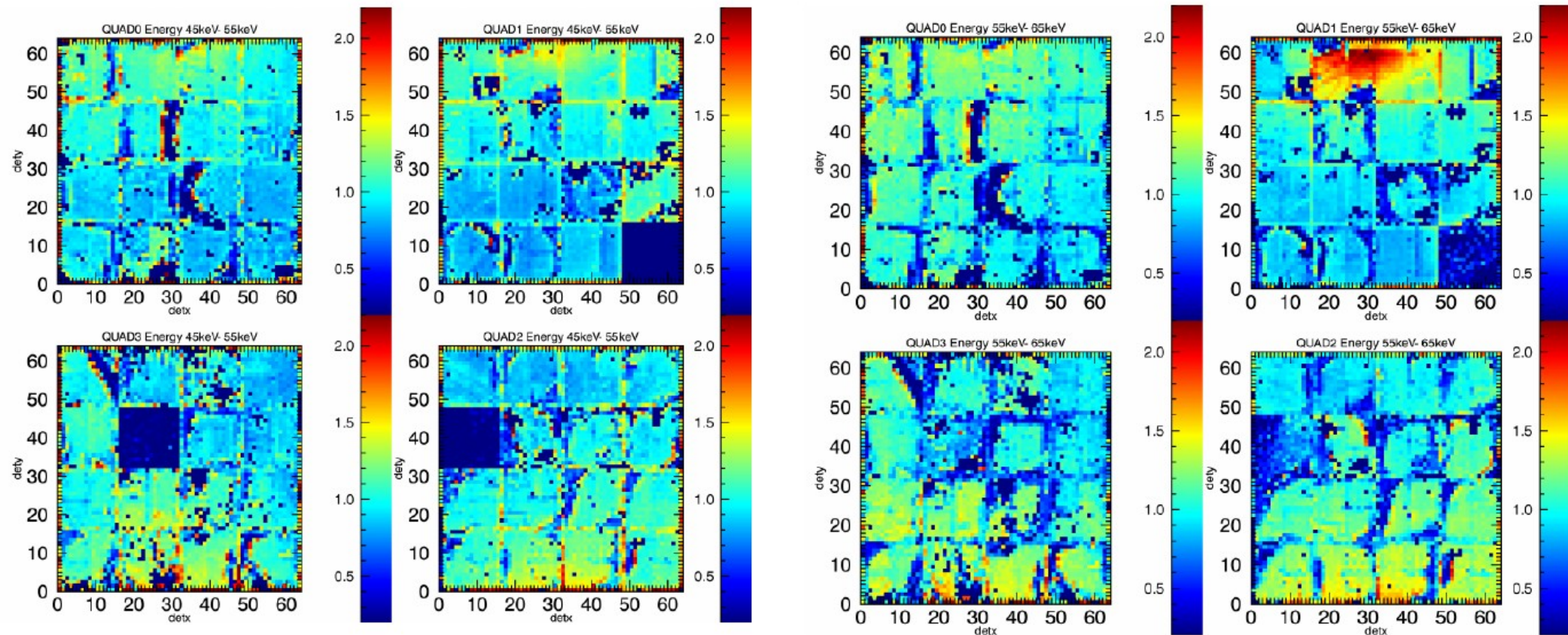Increasing line flux, but different across modules: Spectra varies with time and position

Long term background variation: Count rates

Background rates increase till solar minimum and then starts to decrease:
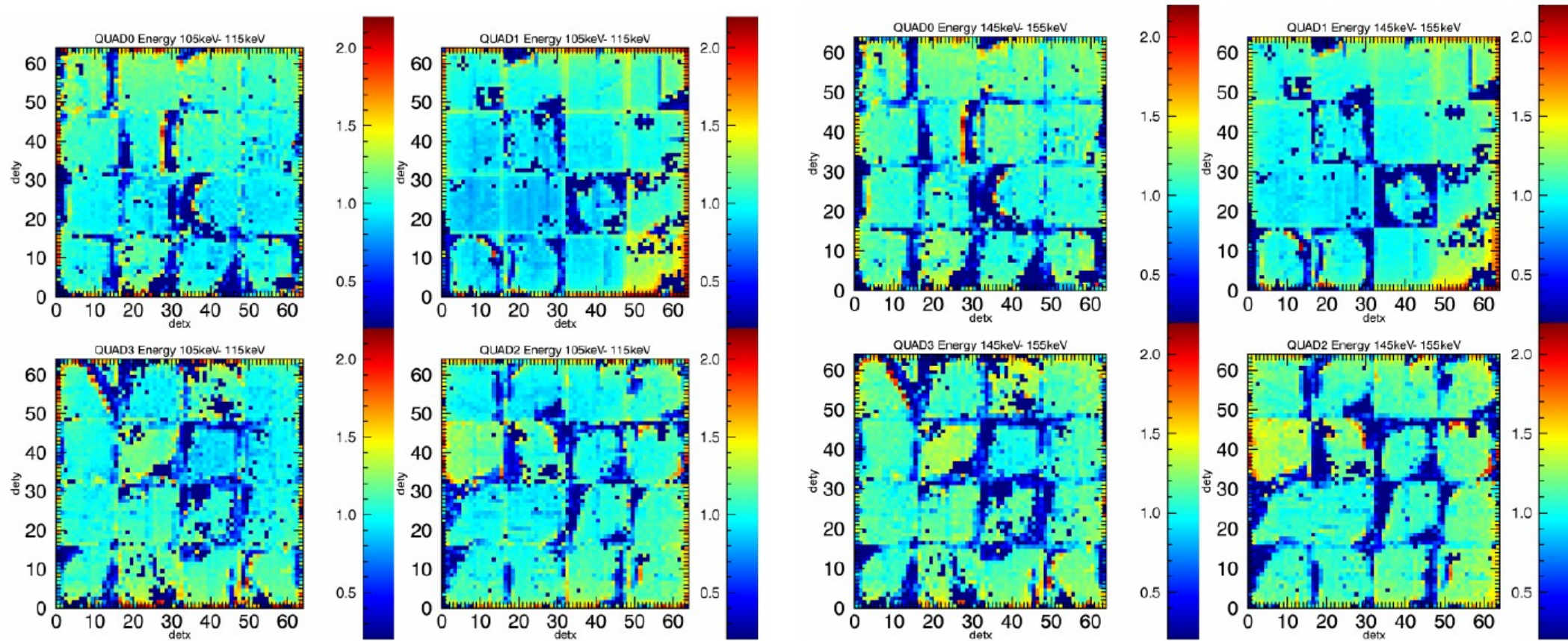Inverse correlation of cosmic ray flux with solar activity

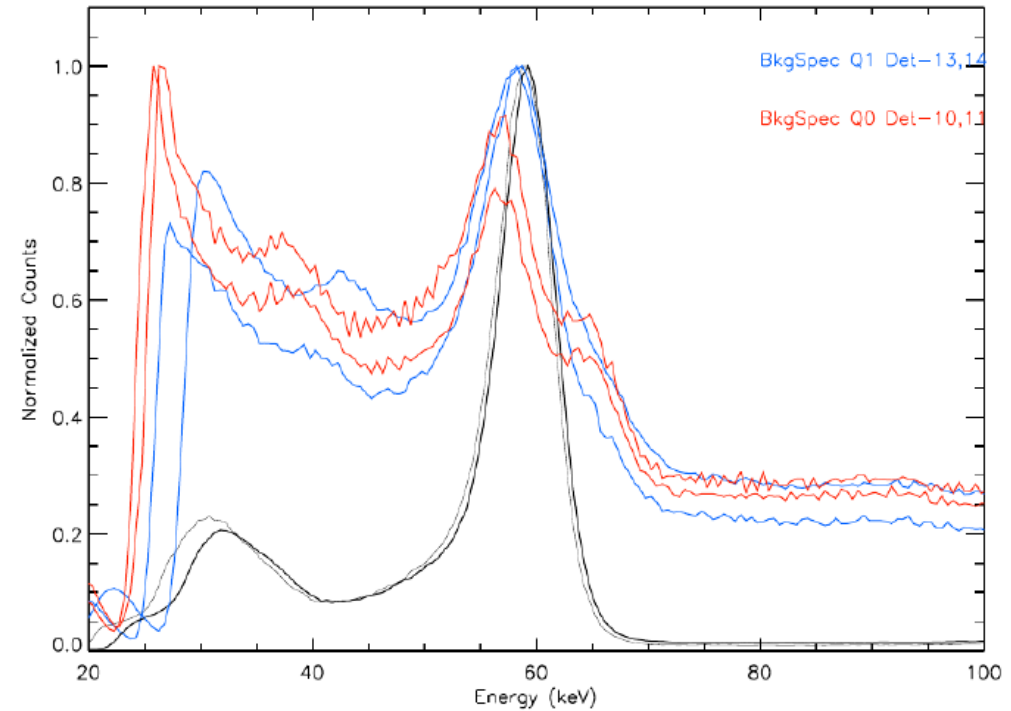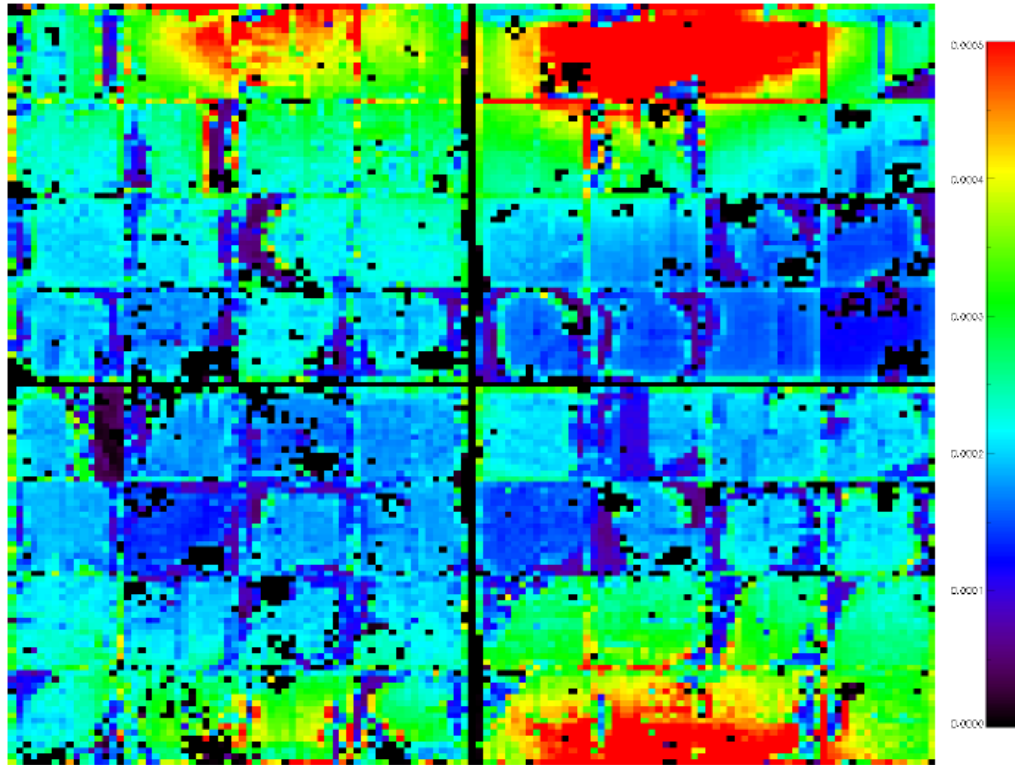# Background characteristics: Spectral Variation over detector plane

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Background becomes uniform at higher energies: Different shielding

Background characteristics: Am-241 contamination

Addes to the non-uniformity of background across the detector plane

Background characteristics: Summary

- Count rates have diurnal variation: Trapped charged particles near SAA and sometimes outside SAA

- Long term variation: Count rate inversley correlated with solar activity

- Spectral variation: Spectral shape also varies over time with appearance of new lines with increasing strength

- Variation across detector plane: Spectral shape and count rates also vary across the detector plane pixels at any given time

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CAM

CZT

DEAD

SRC
BKG
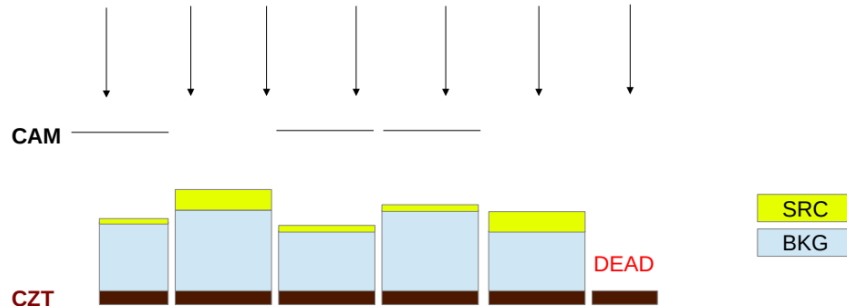
Not required to model the temporal variation: Simultaneous measurements available from masked pixels ...

...if relative background spectra between detector pixels is known

Background subtraction

$$w_i' = 2\, f_i - 1$$

$$\mathbf{D} = \frac{\sum_i w_i'\, \mathbf{B_i}}{\sum_i \mathbf{B_i}}$$

$$\mathbf{w_i} = w_i' - \mathbf{D}$$

Counts in each energy bin for pixel i from template background spectrum

- Compute this factor for each energy bin.

- Separately for each detector module: Use background observed by masked pixels of respective detector module alone
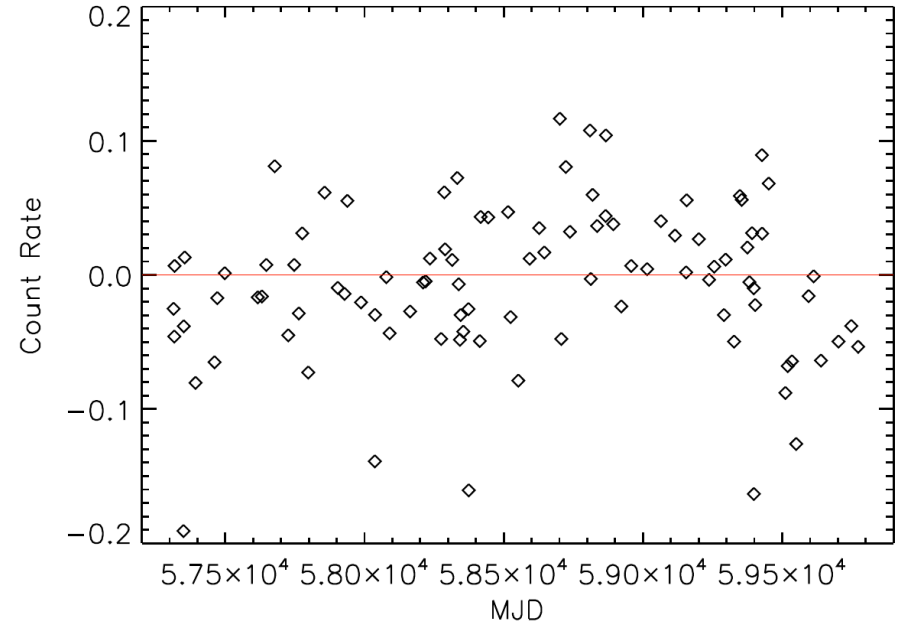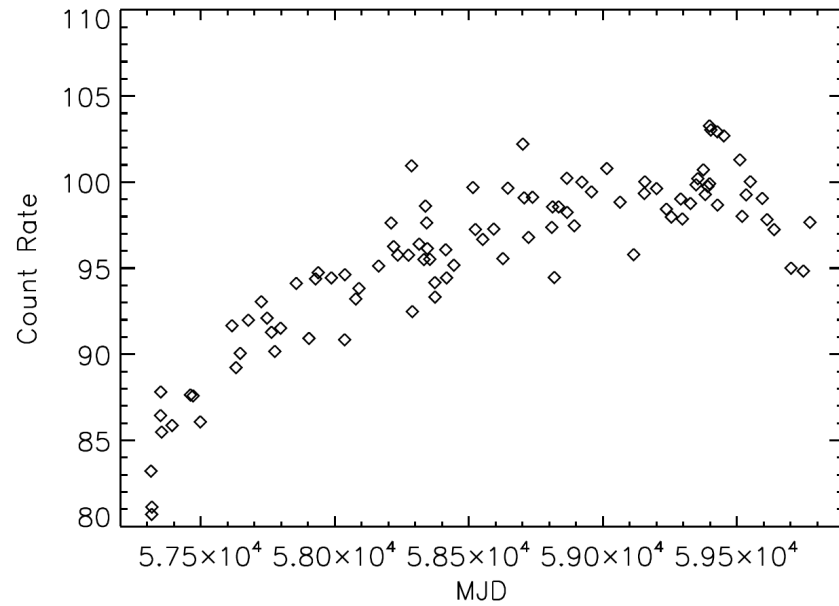
- If not sufficient number of pixels available such as near LLD and ULD: Set weights to zero

Background subtracted count rates
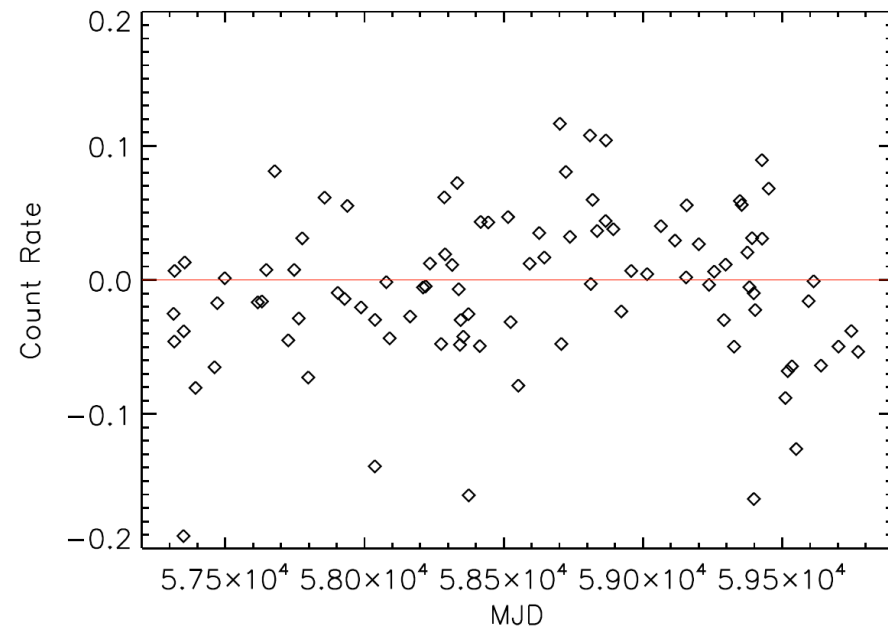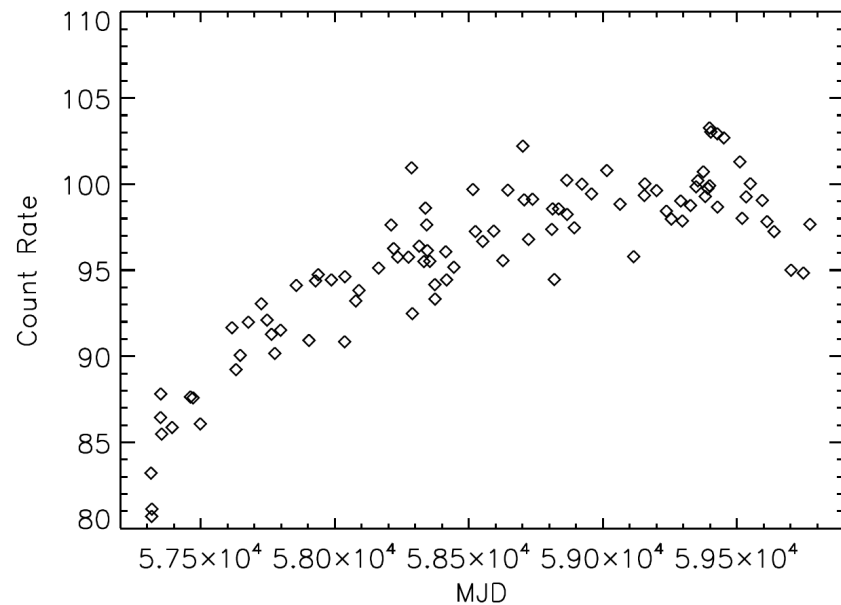
Background subtracted count rates

Thank you!