SPI work at MPE

INTEGRAL User Group Meeting #27

10./11. May 2023

Jochen Greiner

News

- DLR support for INTEGRAL operation (1 full position) continues for the next 2 years (Jan. 2022 – Dec. 2024)

- Change of compute-support in Garching
  …away from MPCDF to MPE-internal (affects data exchange with ISDC)

- Thomas Siegert left for long-term position in Würzburg
  Thomas Stanke (formerly ALMA support) has taking over Aug. 1, 2022

- (PySPI for GRB analysis – Biltzinger talk in Darmstadt)
  PySPI for constant point sources in testing phase

Routine Activities @ MPE 2021+

Routine procedures (XZ/TS/TS) (→ more automatic; better documented)

Data import, routine processing

Quality checking

Spectral fitting → response database

Background database

Performance validation (incl. annealings)

Software maintenance

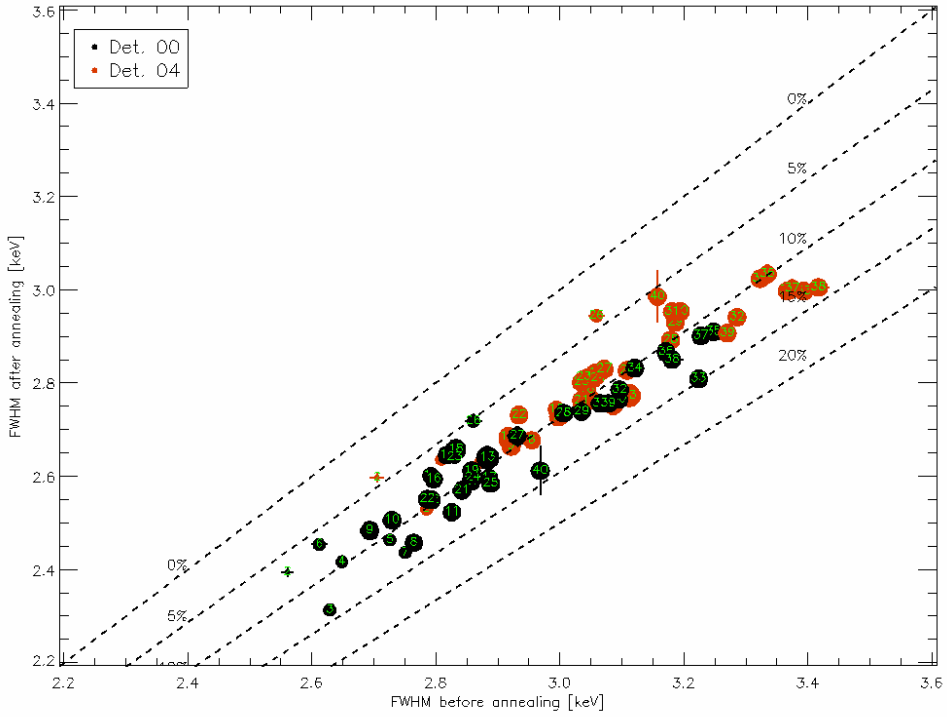
Interaction with ISDC

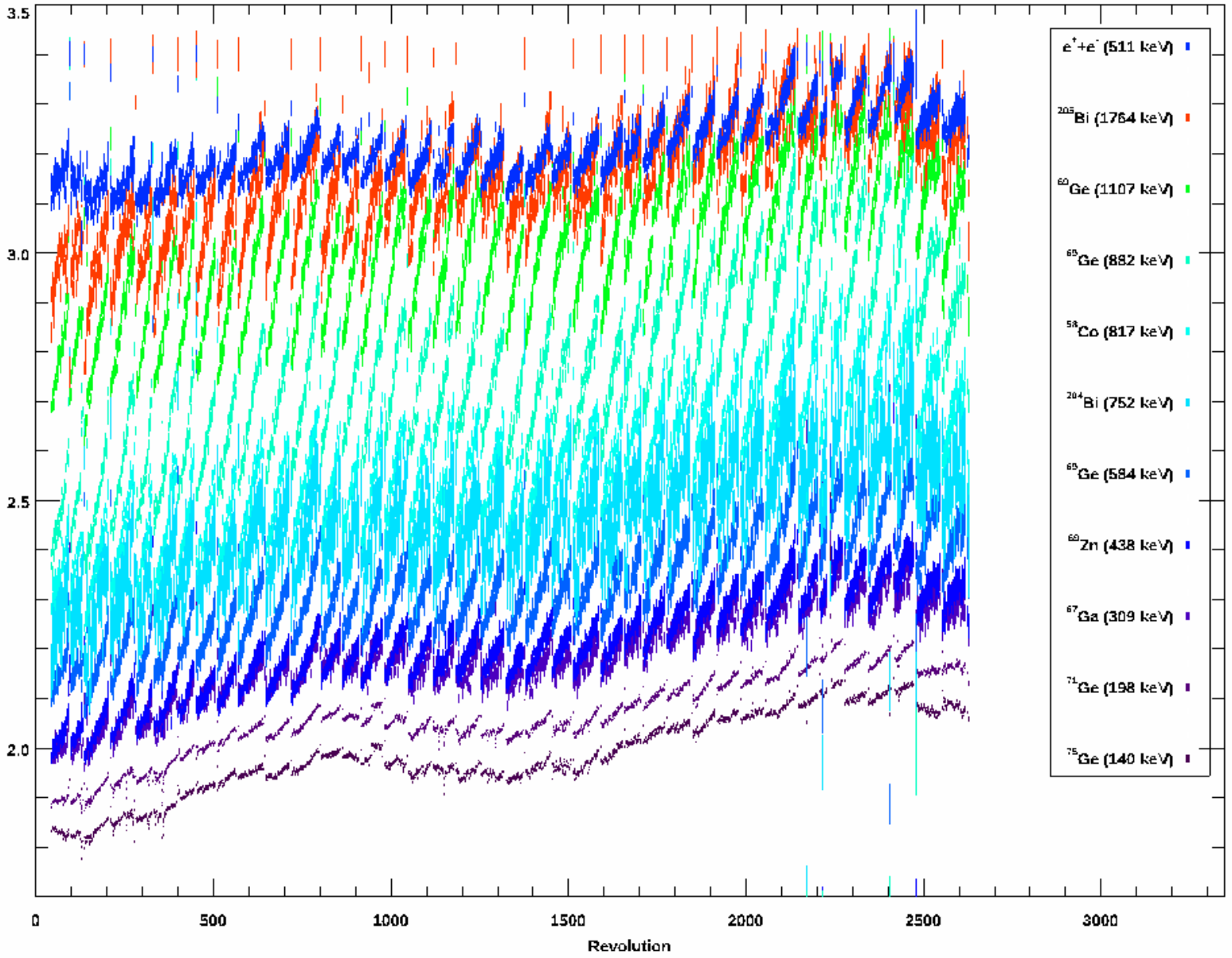
Has been compromised during the last months due to

- transition from Thomas S. to Thomas St.
- change of HPC support in Garching

Present status

- SPI annealing: very good





Present status

- SPI annealing: very good
- ACS calibration: unchanged since 11/2018 report (Diehl)
- Response database: regularly updated
- Background database: extended to 2-8 MeV (TBD since 2020)

PySPI for GRBs: [see IUG#26]

- Pure python and easy to install; no dependency on OSA
- Every detector is treated as independent detector
- Full forward folding and correct Likelihood for fits
- Allows for any PSD event selection (can fit the PSD efficiency)
- Makes joint fits with other instruments possible (Bayesian and ML)
- Presently works only for single science windows, due to missing time-dependent background implementation

Biltzinger+2021

https://github.com/BjoernBiltzinger/pyspi

Analysis Software

GRB analysis with OSA

SPI DATA

SPI POINTING

SPIROS/SPIMODFIT

ONE PHOTO PEAK SPECTRUM

19 Detectors -> one spectrum

RESPONSE MATRIX

XSPEC

GRB SPECTRUM

GRB analysis with PySPI

SPI DATA

SPI POINTING

SPI DEADTIME

Build Timeseries

Construct Response

Deadtime Correction

pyspi

Biltzinger+2021

Provides Plugin

3ML Multi-Mission Maximum Likelihood Framework

Full forward-folding

https://github.com/threeML/threeML

PySPI for constant point source(s): New

- "Problem" is the background-handling

Previous

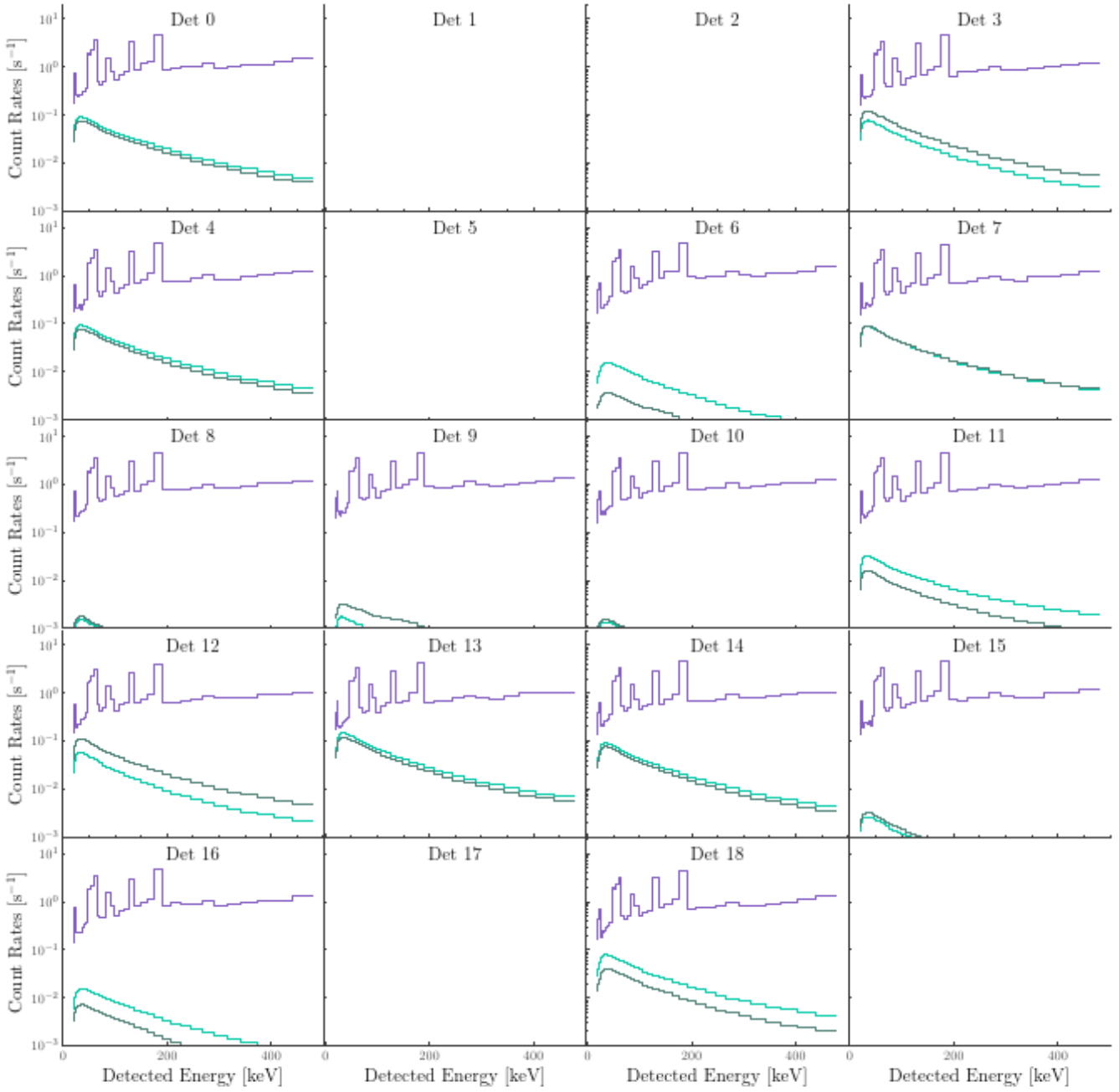
Detailed bkg-model using various tracers to map line+conti variations: depends on temporal sequence of accurate tracer measurements (<1% from s/w to s/w)
Limitations: (i) large number of free para; (ii) errors not propagated

Diehl+2018; Siegert+2019

New *Biltzinger+2023*

Assume bkg does not change between 2 s/w
Source contribution per detector is different.
Profiled likelihood: maximize L for bkg at every fit step to get b_{MLE}: similar to XSPEC's pgstat/cstat
for more than 2 s/w: add the likelihoods of many pairs of pointings
Simulations: works good
Presently: tests with Crab look promising

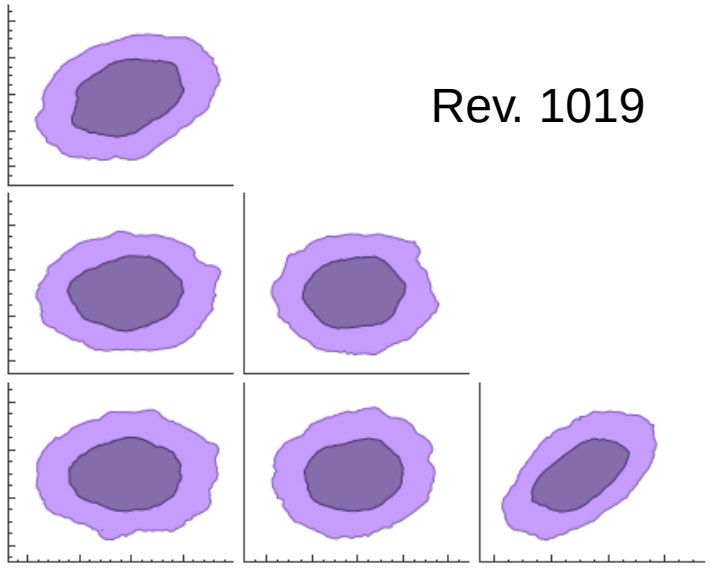
- May provide an easy-to-use tool for point sources



Simulation of (Crab-like) source and background count rates for two SPI pointings, with two degree offset in the pointing direction

PySPI for constant point source(s): Status

- Simulations look promising: retrieve input values
- First tests with data (Crab):
  - PySPI fit results grossly OK; also 2 sources in same pointing (Crab + 1A 0535+262)
  - …some scatter of 1-2% between revolutions
  - …this could be Crab-intrinsic, since spimodfit shows similar pattern
  - …but "absolute" values of spimodfit results are 10% off ➔ need to be checked



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