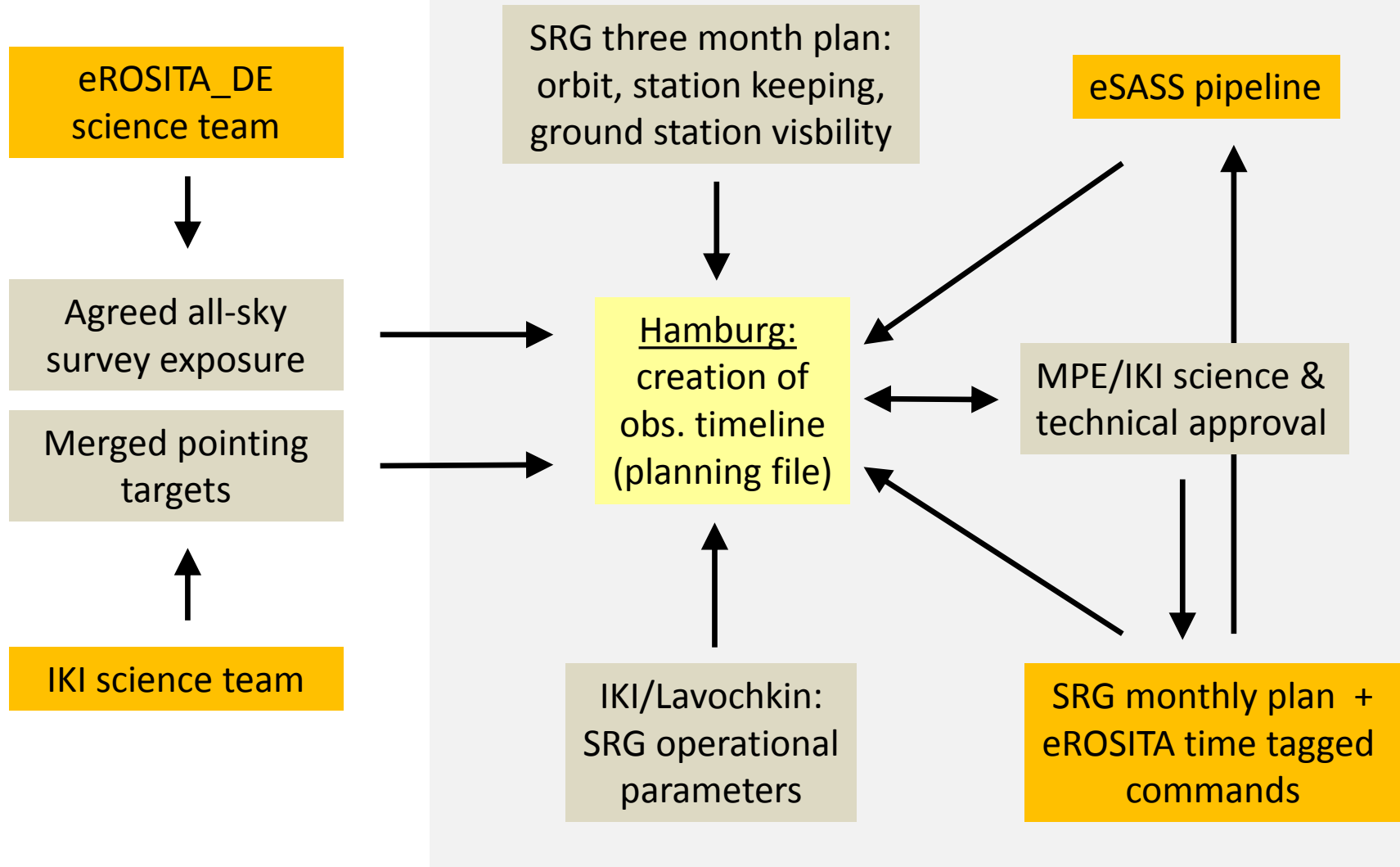# *eROSITA Ground Segment: from operations to calibrated data products*

- **Planning - operations - data transfer**
- **Pipeline processing - eSASS: recent activities**

Mission planning logistics:

eROSITA_DE science team

Agreed all-sky survey exposure

Merged pointing targets

IKI science team

SRG three month plan: orbit, station keeping, ground station visbility

Hamburg: creation of obs. timeline (planning file)

IKI/Lavochkin: SRG operational parameters

eSASS pipeline

MPE/IKI science & technical approval

SRG monthly plan + eROSITA time tagged commands

Mission planning logistics:

eROSITA_DE science team

SRG three month plan: orbit, station keeping,

eSASS pipeline

- IKI/MPE Science Ground Segment ICD (living document)
- Monthly meetings of IKI, LA ,MPE, HH and BA teams

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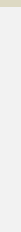- Monthly meetings of IKI, LA ,MPE, HH and BA teams

Agreed all-sky survey exposure
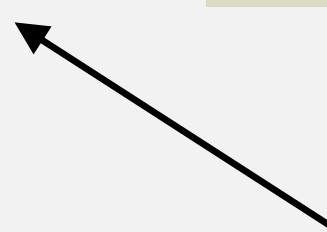
- Threeway LA-IKI-MPE data exchange server is operational
- In use for transferring data from eROSITA ground tests

Merged pointing targets

obs. timeline (planning file)

technical approval

IKI science team

IKI/Lavochkin: SRG operational parameters

SRG monthly plan + eROSITA time tagged commands

H. Brunner   From operations to calibrated data products   April 23rd, 2018

Mission planning logistics:

eROSITA_DE science team

SRG three month plan: orbit, station keeping,

eSASS pipeline

- IKI/MPE Science Ground Segment ICD (living document)
- Monthly meetings of IKI, LA ,MPE, HH and BA teams

Agreed all-sky survey exposure

- Three-way LA-IKI-MPE data exchange server is operational
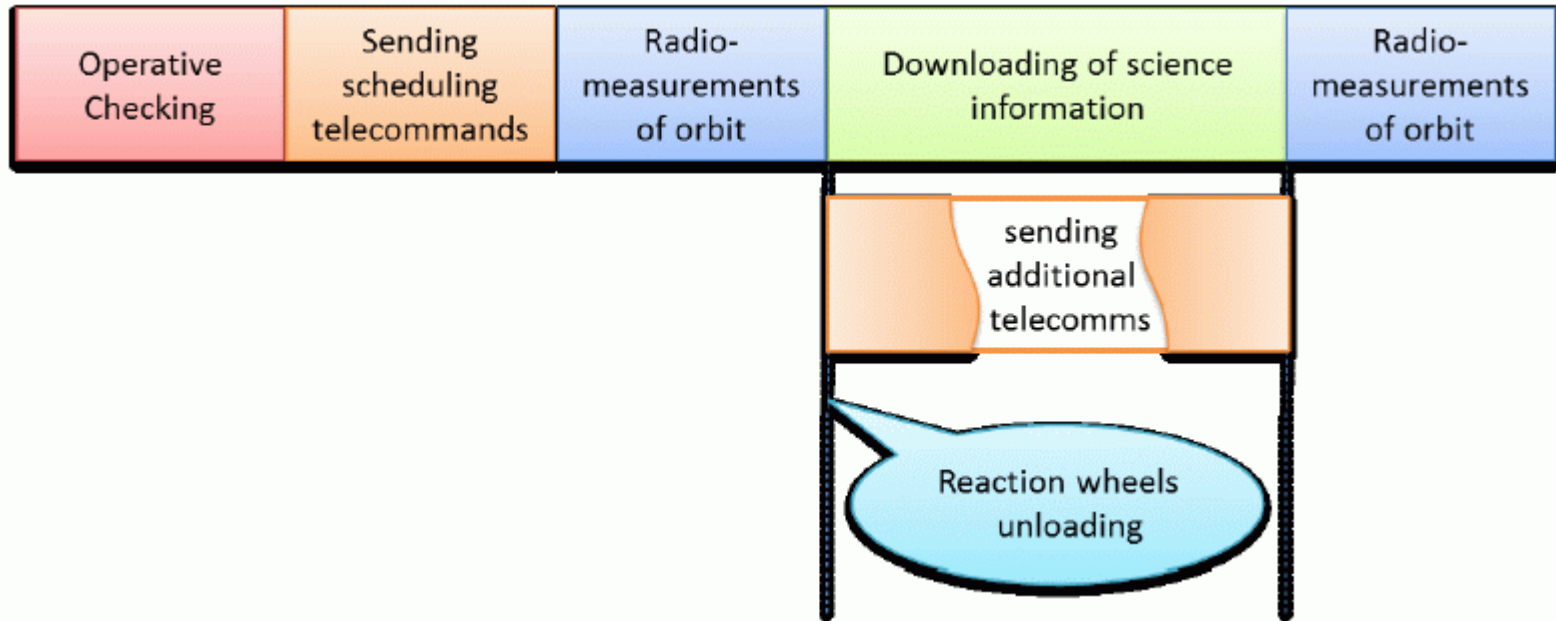- In use for transferring data from eROSITA ground tests

Merged pointing targets

obs. timeline

technical approval

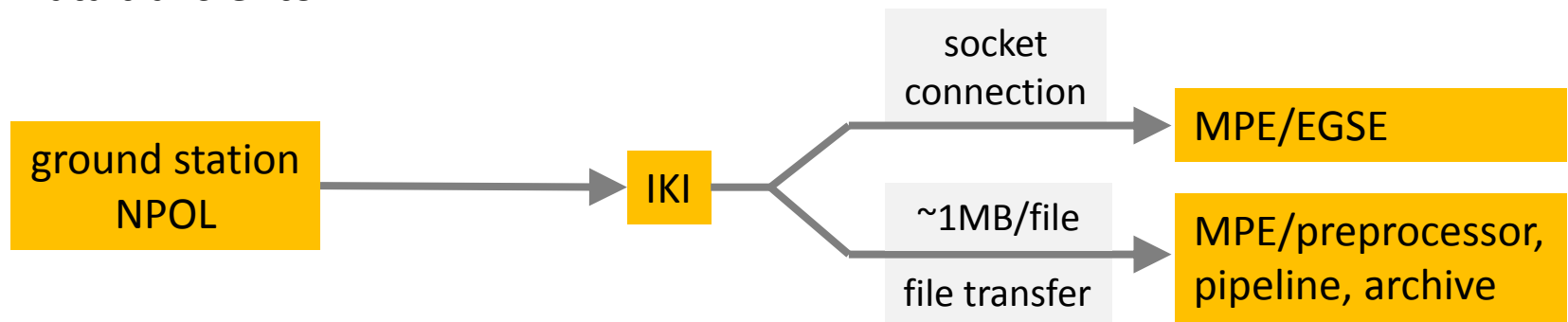- CalPV mission planning dry-run is in preparation

IKI science team

IKI/Lavochkin: SRG operational parameters

SRG monthly plan + eROSITA time tagged commands

<u>Operations during ground contacts:</u>
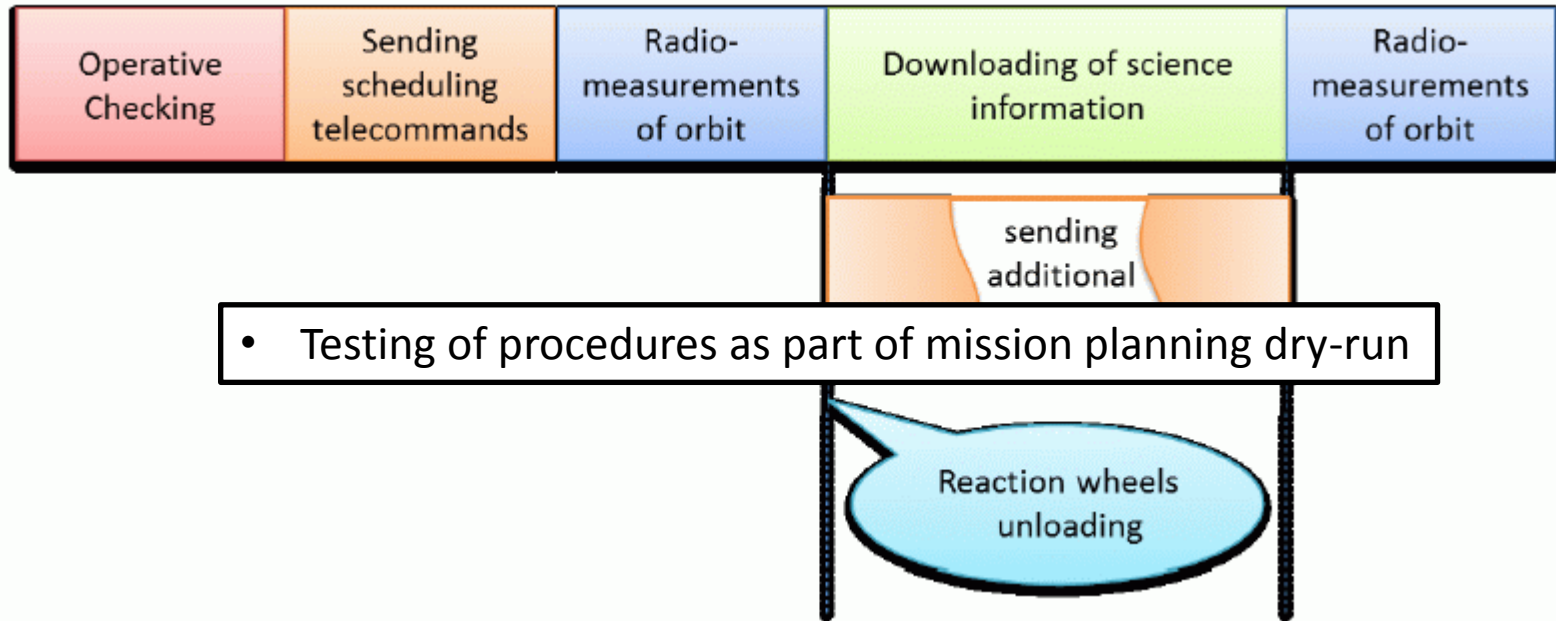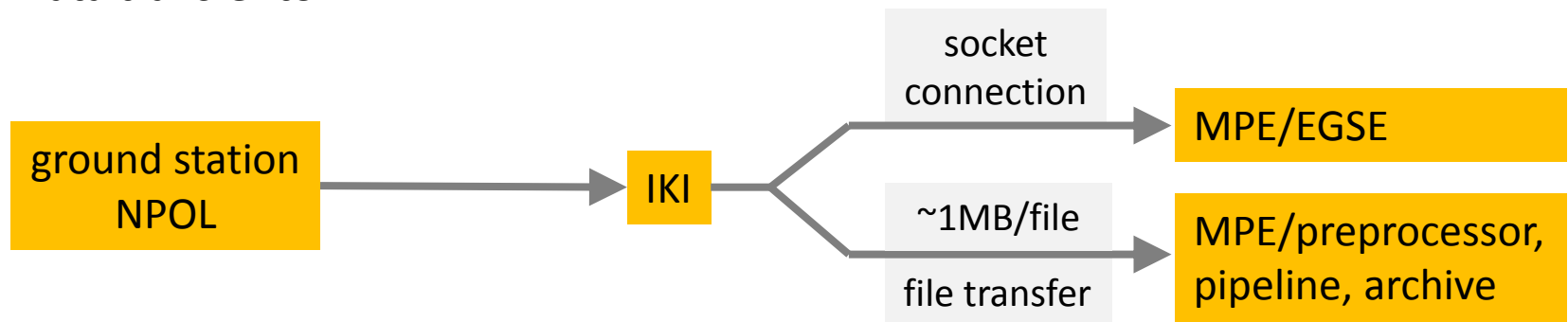
Operative Checking	Sending scheduling telecommands	Radio-measurements of orbit	Downloading of science information	Radio-measurements of orbit

sending additional telecomms

Reaction wheels unloading

Data transfer to MPE:

```
                                                    socket
                                                  connection
ground station                                                    MPE/EGSE
   NPOL            ───────►   IKI
                                                   ~1MB/file       MPE/preprocessor,
                                                                   pipeline, archive
                                                  file transfer
```

eROSITA realtime & dump data, (some) SRG enineering data, meta data
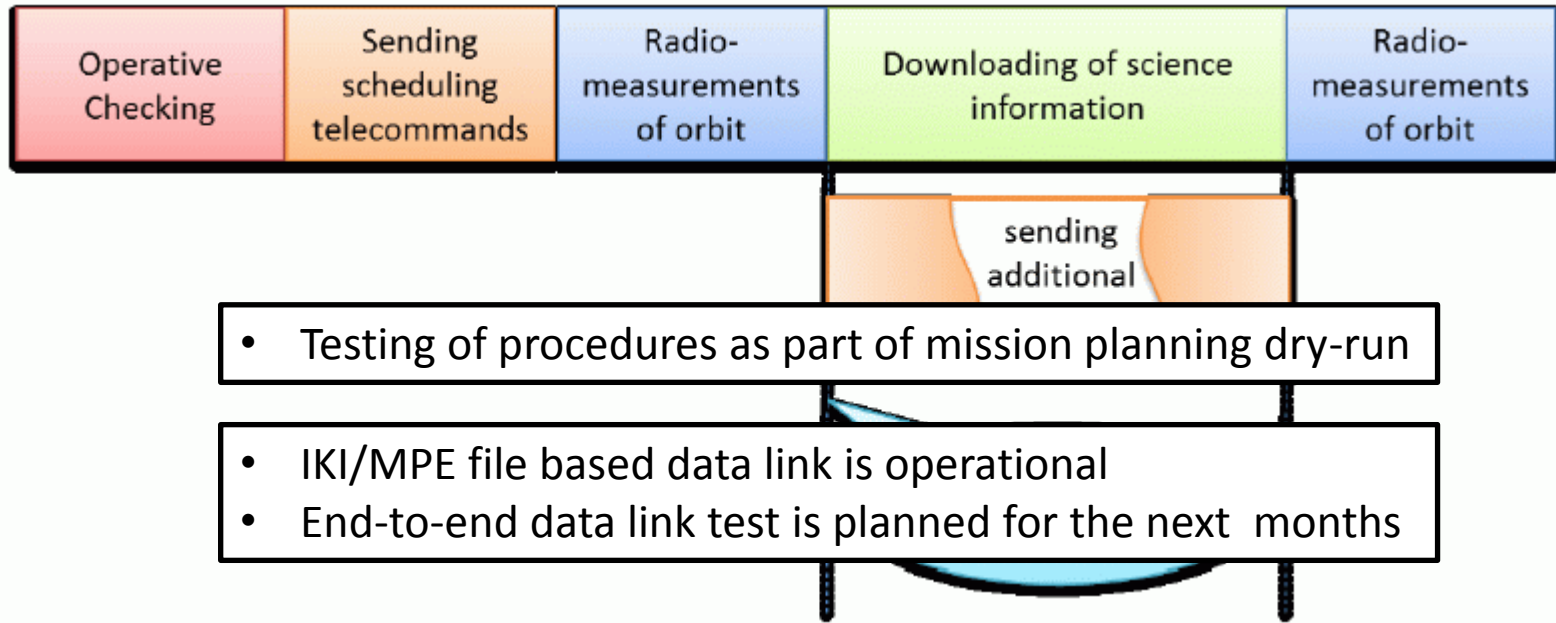
3/22

Operations during ground contacts:

| Operative Checking | Sending scheduling telecommands | Radio-measurements of orbit | Downloading of science information | Radio-measurements of orbit |

sending additional

- Testing of procedures as part of mission planning dry-run

Reaction wheels unloading

Data transfer to MPE:

ground station NPOL → IKI → (socket connection) → MPE/EGSE

IKI → (~1MB/file file transfer) → MPE/preprocessor, pipeline, archive

eROSITA realtime & dump data, (some) SRG enineering data, meta data

Operations during ground contacts:

Operative Checking	Sending scheduling telecommands	Radio-measurements of orbit	Downloading of science information	Radio-measurements of orbit

sending additional

- Testing of procedures as part of mission planning dry-run

- IKI/MPE file based data link is operational
- End-to-end data link test is planned for the next months

Data transfer to MPE:

ground station NPOL → IKI

socket connection → MPE/EGSE

~1MB/file file transfer → MPE/preprocessor, pipeline, archive
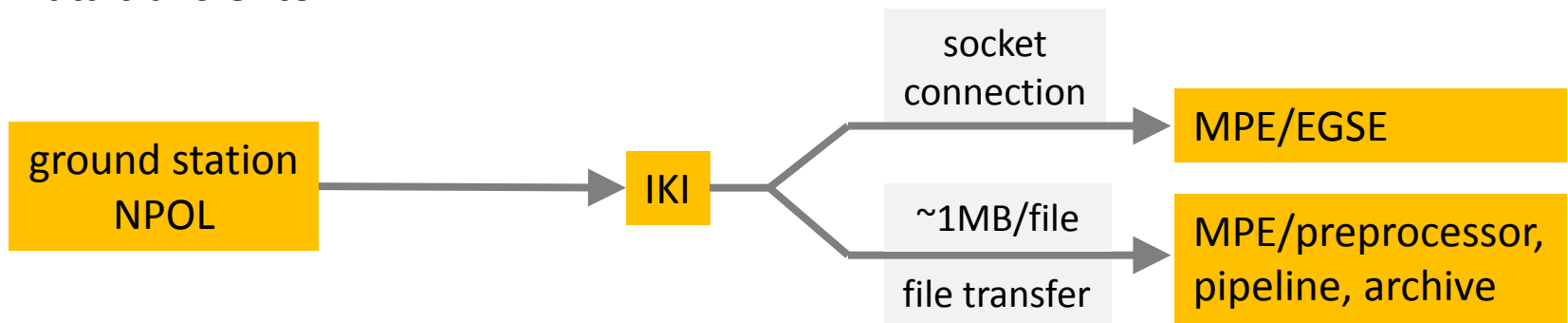
eROSITA realtime & dump data, (some) SRG enineering data, meta data

Data flow: operations to data processing to data access
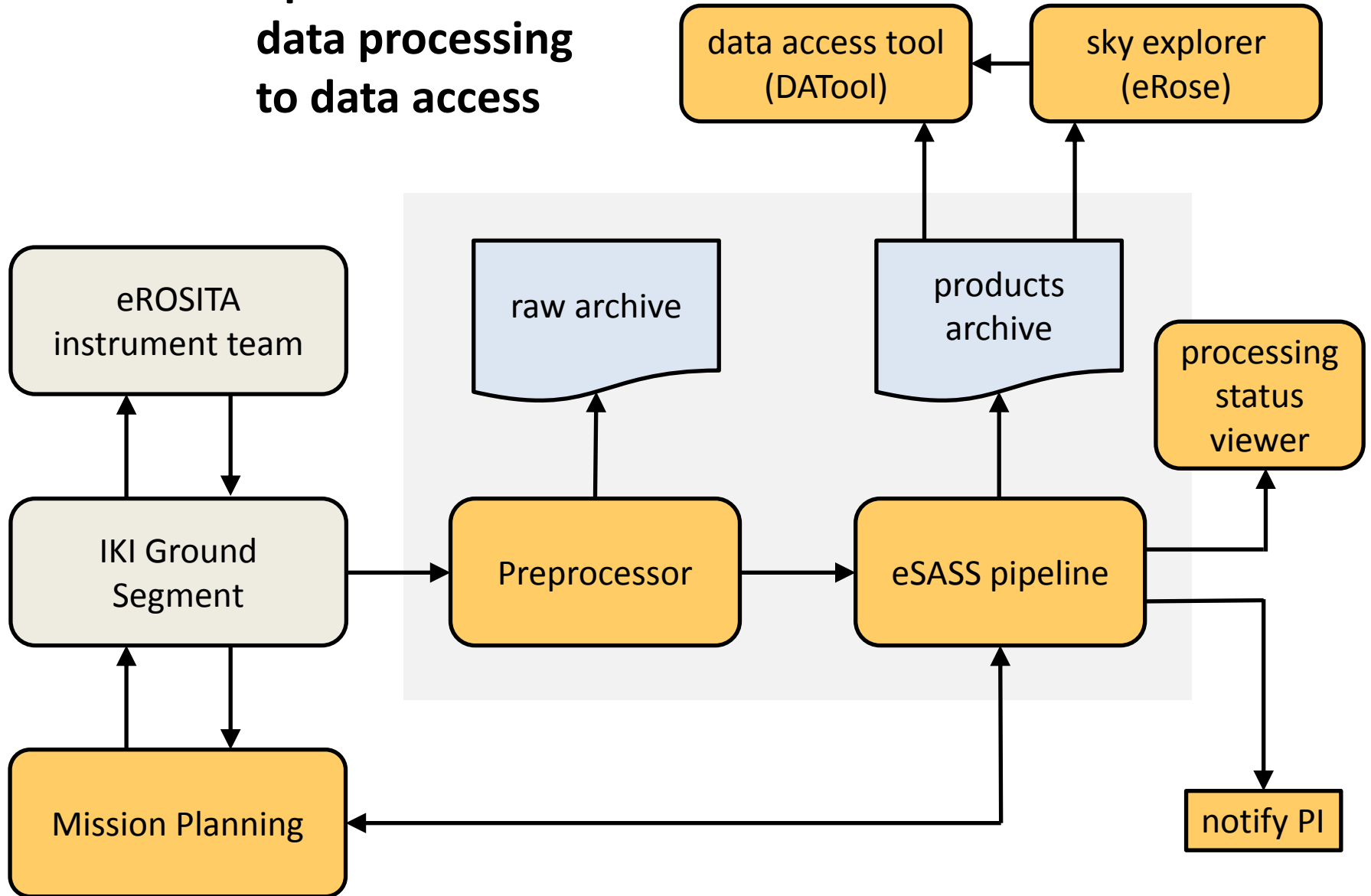
Preprocessor (Bamberg):
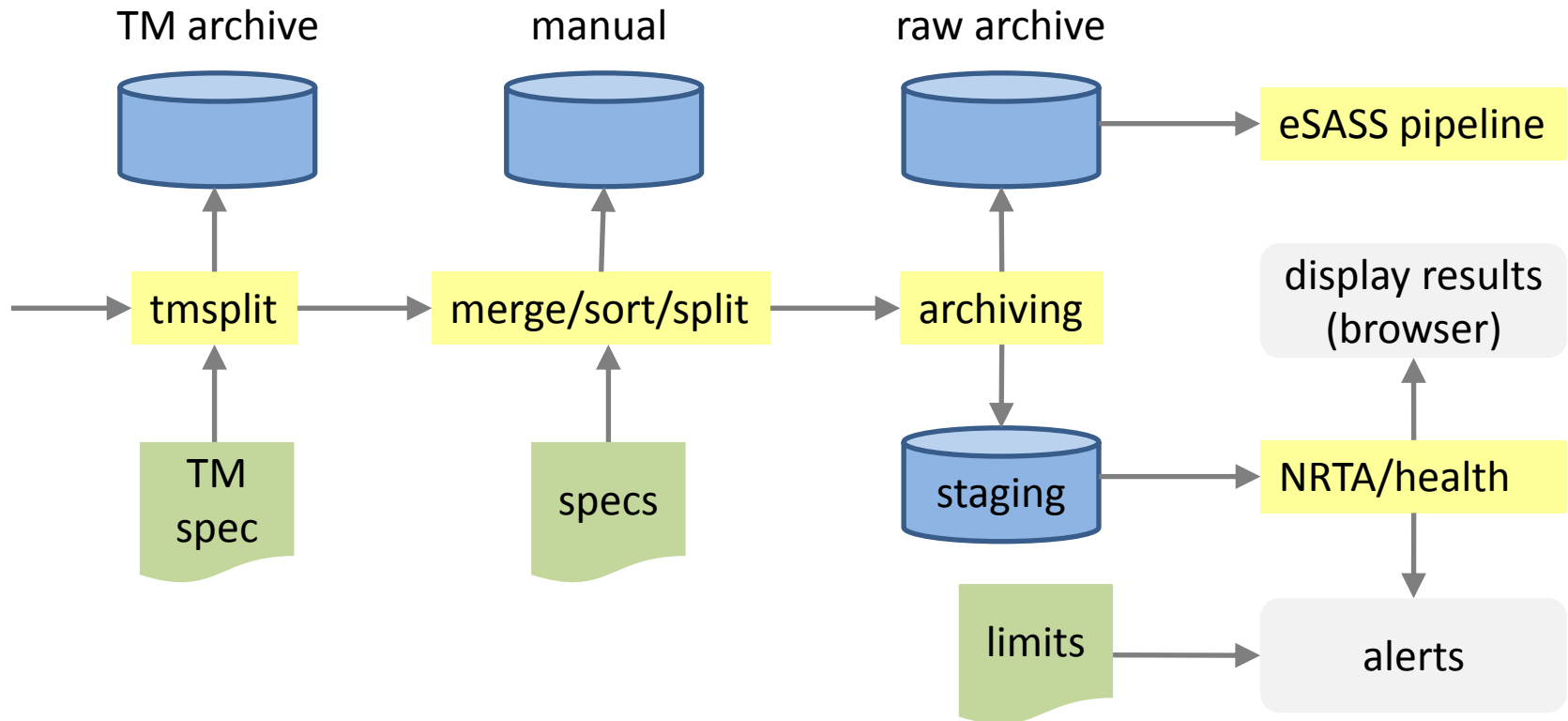
eROSITA
Event Compression

a novel, fast, efficient compression method
for maximizing the telemetry content

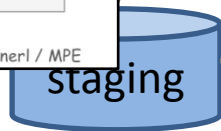18 bits: Header + (RAWX,RAWY) | 14 bits: PHA

2 bits | 30 bits: 8 relative PHAs

MPE, Garching, April 23 - 26, 2018   eROSITA Event Compression   K. Dennerl / MPE

archive

eSASS pipeline

display results
(browser)

ving

spec

specs

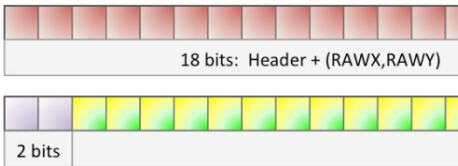staging

NRTA/health

limits

alerts

eROSITA
Event Comp

a novel, fast, efficient compre
for maximizing the teleme

18 bits: Header + (RAWX,RAWY)
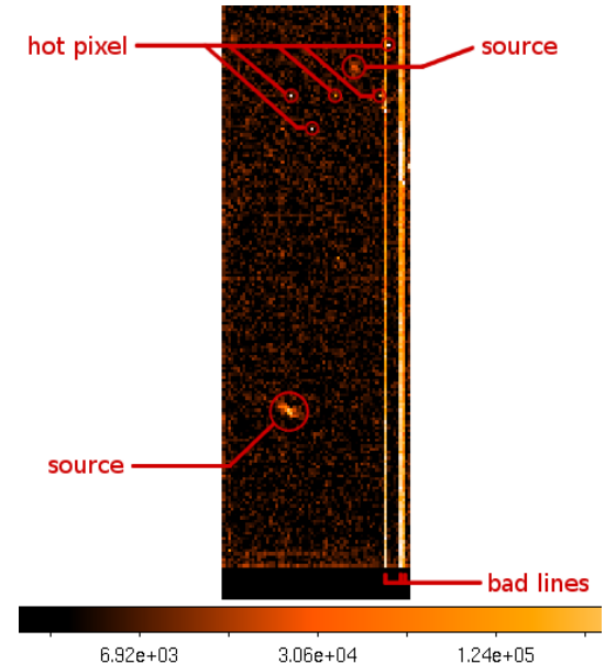
2 bits

MPE, Garching, April 23 - 26, 2018

spec

NRTA Health Checks

Ingo Kreykenbohm

Purpose: Identification of possible problems

- limit check:
  - check all housekeeping parameters against red and yellow limits
  - limits can be time dependent
  - create alert file for every HK file (with parameter name, time range, limit, . . . for every alert)

- pixel check:

  check all CCDs for hot/cold pixels

  comparison with known hot/cold pixels

  ⟹ issue alert for new hot/cold pixels

- create derived housekeeping data

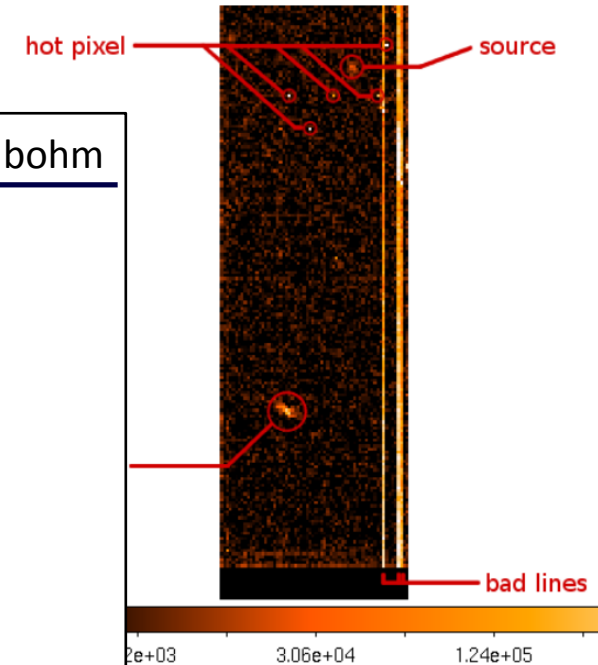hot pixel — source

source —

bad lines

6.92e+03   3.06e+04   1.24e+05

limits ⟶ alerts

eROSITA
Event Comp

a novel, fast, efficient compr
for maximizing the teleme

NRTA Health Checks

Ingo Kreykenbohm

Purpose: Identification of possible problems

- limit check:
  - check all housekeeping parameters

Visualization

Ingo Kreykenbohm

Visualize data in web-browser using client-server architecture:
⟹ data is safe on server
⟹ no need to install software, just a web browser.

Features:
- all housekeeping data of all telescopes of the whole archive accessible
- show one or more HK parameter over time (any time range)
- show corresponding limits
- show / manage alerts
- create histograms
- create parameter vs. parameter diagrams
- analyze detector images/maps (using JS9 similar to DS9)
- show bad pixels
- user management (respect data rights!)
⟹ Demo in NRTA session (Tuesday 15:45)

hot pixel — source

bad lines

2e+03   3.06e+04   1.24e+05

alerts

Pipeline processing

EROPIPE triggers pipeline chains, updates pipeline status, load balancing

input data frames (science, HK, attitude, etc) mirrored from IKI/Moscow

survey/pointing staging areas

Preprocessor: FITS conversion packaging in eROdays test for completeness archiving

SASS EXP chain: collect from staging areas & merge event files make images & exposure maps

SASS DET chain: perform several source detection & characterization algorithms make backgroud & sensitivity maps

NRTA&QL analysis: ...onitoring ...k science
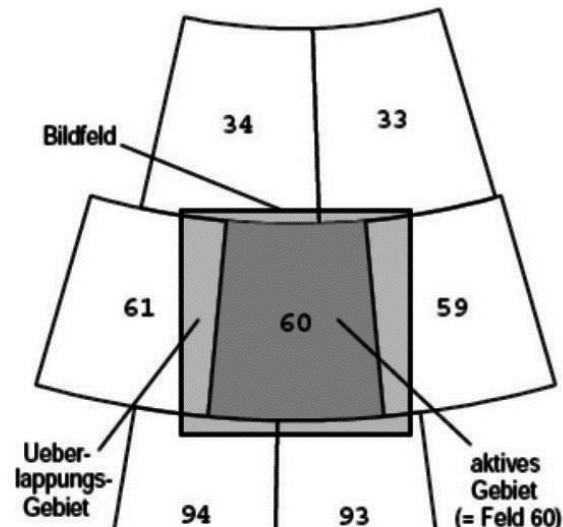
SASS SOU chain: make source specific products (spectra, time series, etc.)

SASS TEL chain: (one per telescope) event calibration quality GTI copy to survey/pointing staging areas

raw data   **archive**   **products**

Bildfeld	34 33
	61 60 59
Ueber-lappungs-Gebiet	94 93 aktives Gebiet (= Feld 60)

eSASS data products

Pipeline data products file naming scheme
Event files
Source catalogs

eSASS pipeline

Layout of the eSASS pipeline
Archive and processing directory structure
Pipeline control programs
Processing status files
Pipeline parameter files
Parameter subsitution in the pipeline
Interface routines
Environment variables

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eROSITA_DE:archive - the software, calibration and data products access

Public eROSITA Project Page | eROSITA Wiki | Visibility tool | Processing Status | eROS

eSASS task descriptions

Preparatory tasks

radec2xy
flaregti

Event calibration

pattern
energy
evatt
ftfindhotpix

Creating maps

expmap
ermask
erbackmap
ersensmap

Source detection, source catalogs

erbox
ermldet
apetool
catprep

**Event manipulation,
    source specific products**

evtool
srctool

EROSITAwiki: eSASS

eSASS-FAQ » EroCat/UserAccessControl » EroCat/SpatDeconv » erosita_con...ing_Apr2018 » eSASS

| FrontPage | RecentChanges | FindPage | HelpContents | Catalogs an...maintainers | EroCat/CatCrossmatch | **eSASS** |

Edit   Info   Subscribe   Add Link   Attachments   More Actions: ⌄

eSASS Handbook

* eROSITA Helpdesk

* eSASS Task Descriptions

* eSASS cookbook (still under construction; access restricted)

* How to Run eSASS Tasks

* How to install eSASS

* eSASS Releases

* The eSASS Calibration Database

* Using SIXTE Event Files

* Frequently Asked Questions (still under construction)

* Why is eSASS called eSASS?

EROSITA

eSASS-FA
FrontPag

Edit   Info

eSASS

* eROS

* eSAS

* eSAS

* How

* How

* eSAS

* The e

* Using

* Frequ

* Why i

eSASS Users' Frequently Asked Questions

eSASS errors messages (and crashes)

*Why do I keep getting the error message: "**STOP** Error initializing PIL" when I run eSASS task X?*

This is a relatively frequent error messages which occurs in the following situations:

1. You command line call isn't correct. Please make sure you entered all required command line parameters in the correct spelling. Array parameters require string quotes. Use FTOOLS command plist for a list of all task parameters.
2. You recently switched to a different eSASS release. It is possible that the comamnd line of the task in question has changed. Please adjust your scripts and delete the .par file of the task in question from the pfiles directory in your home directory.
3. For whatever reason the .par file of the task in question in the pfiles directory in your home directory may be garbled. Please delete it. It will be automatically recreated once you call the task again.
4. The contents of the PFILES environment variable may not be correct (for whatever reason). In this case the PIL error will occur with each eSASS task you call. The PFILES variable needs to start with the full path of the pfiles directory in your home directory followed by a semicolon. The .par directory of the eSASS release you are using as well as the pfiles directories of any other FTOOLS based tools you may have installed should be listed after the semicolon. The PFILES environment variable should normally be set correctly by the eSASS setup script.

Incorrect results, data quality

Calibration related questions

Running eSASS on SIXTE data

See notes on some identified differences between SIXTE and eSASS here: EroCat/eSASSvsSIXTE

eSASS Users' Frequently Asked Questions

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EROSITA

eSASS-FA

FrontPag

Edit   Info

eSASS

Data access

Installing eSASS

Computation Time

Why is SRCTOOL so slow to run?

The run time of SRCTOOL is very sensitive to some configuration parameters, here are some tips:

- Only turn on the list of functions you really need to be executed (via the **todo** parameter)
- Reduce the spatial density of sampling points for effective area computations (by increasing the values in the **xgrid** parameter)
- Increase the integration time step for effective area computations (by increasing the value of the **tstep** parameter), particularly for pointed observations
- Enable parallel processing across the seven instruments (by setting the **OMP_NUM_THREADS** environment variable to an integer value greater or equal to the number of instruments you wish to process).
- And although it won't speed up the processing, you can increase the SRCTOOL verbosity to get a better idea of progress (by setting the **SASS_VERBOSITY** environment variable to "chatty")

eSASS – recent activities

- ✓ Flare screening
- ✓ Scan mode detection
- ✓ Photon based detection
- ✓ Sensitivity maps
- ✓ Improved shapelet model
- ✓ Aperture photometry
- ✓ Astrometric corrections
- ✓ Spectra and lightcurve extraction
- ✓ Data access
- ✓ New eSASS users' release

- All test datasets created by SIXTE
- More on SIXTE at eSASS splinter (T. Dauser, C. Großberger)

eSASS – recent activities

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  (T. Dauser, C. Großberger)
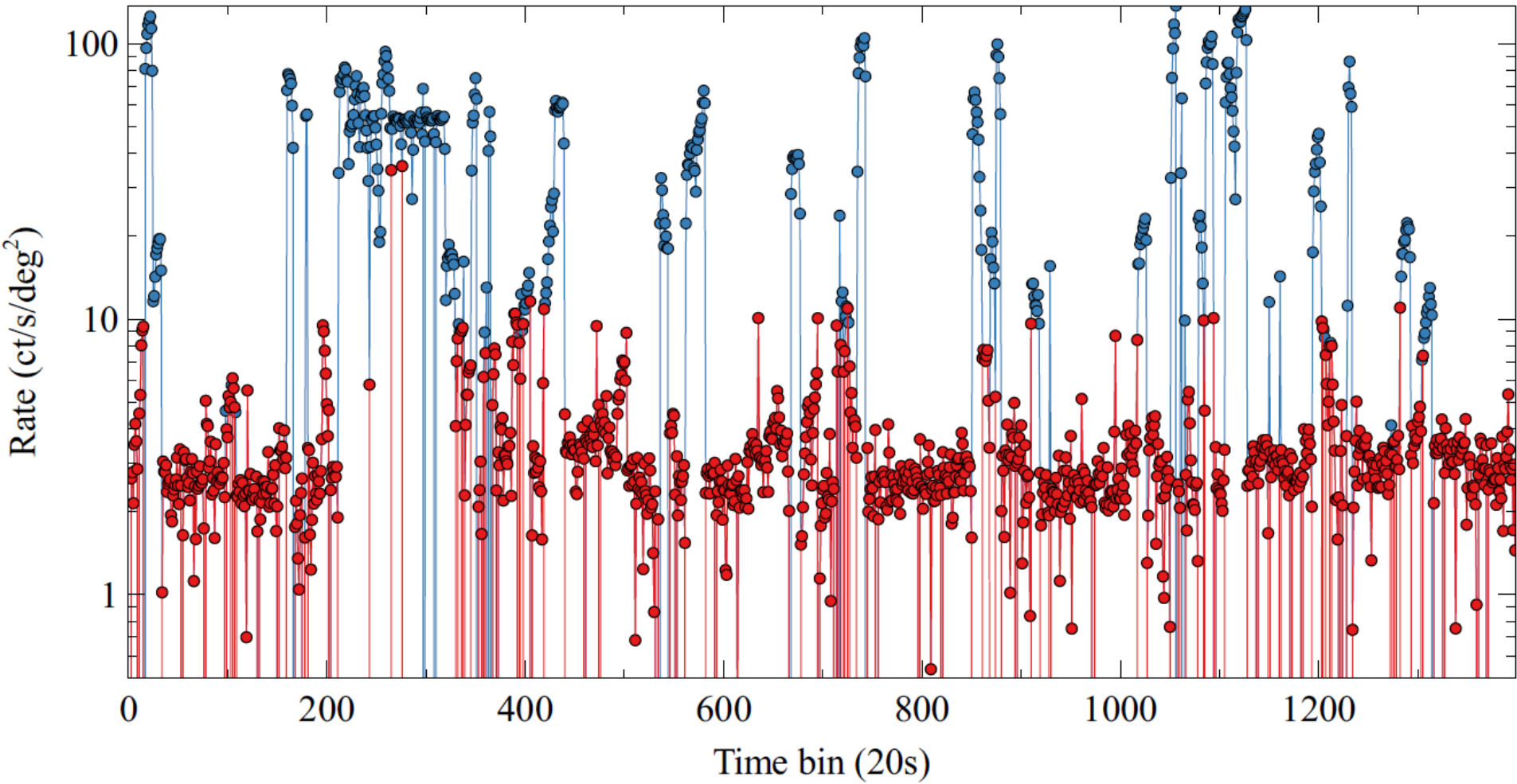
eSASSusers_180416

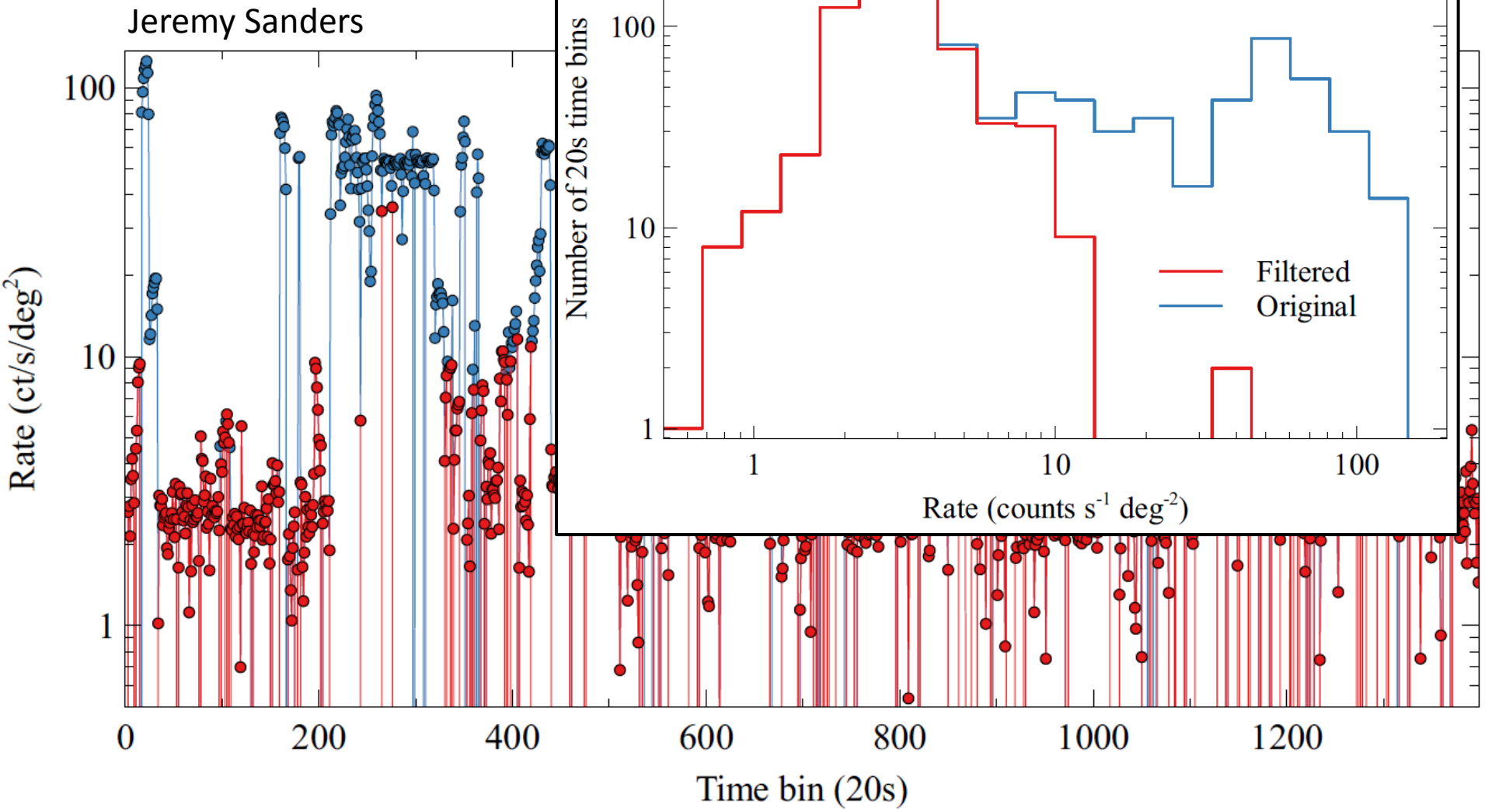| Interactive analysis	
EVTOOL	SRCTOOL
FLAREGTI	
EXPMAP	ERBACKMAP
ERMASK	ERSENSMAP
ERBOX	ERMLDET
APETOOLL	CATPREP
TIMECORR	BARYCORR
PATTERN	ENERGY
EVATT	RADEC2XY

Flare screening - eSASS task flaregti
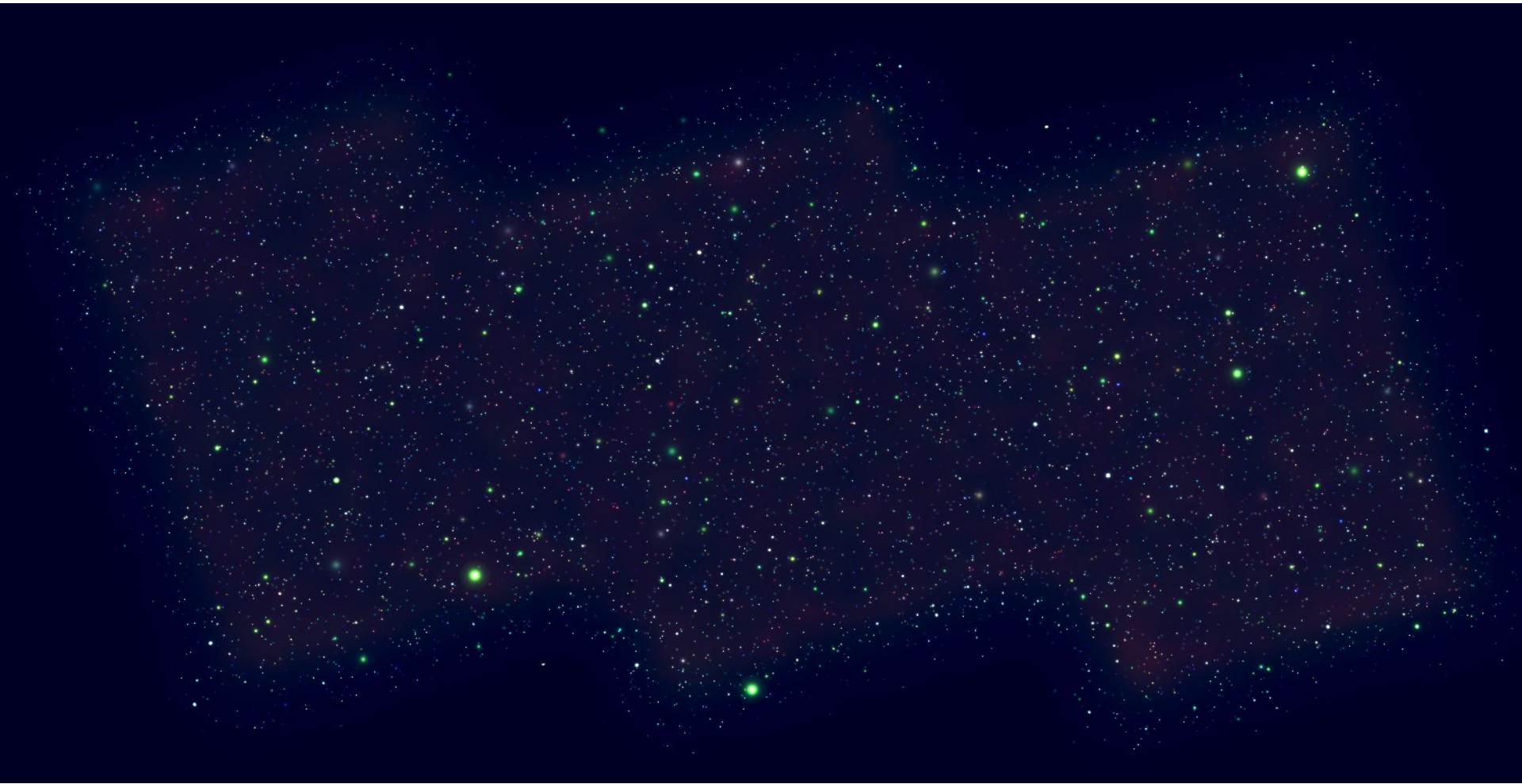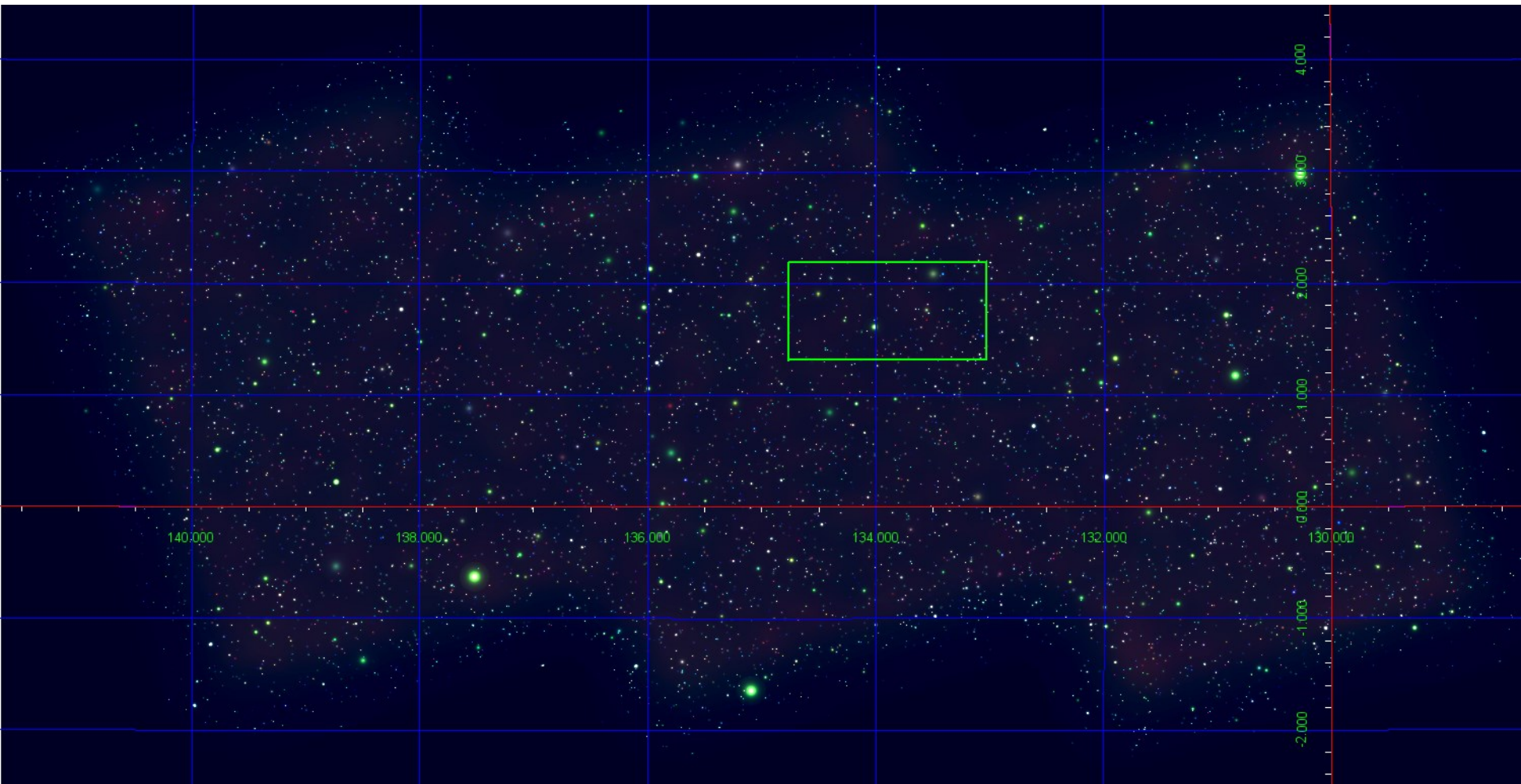
Jeremy Sanders
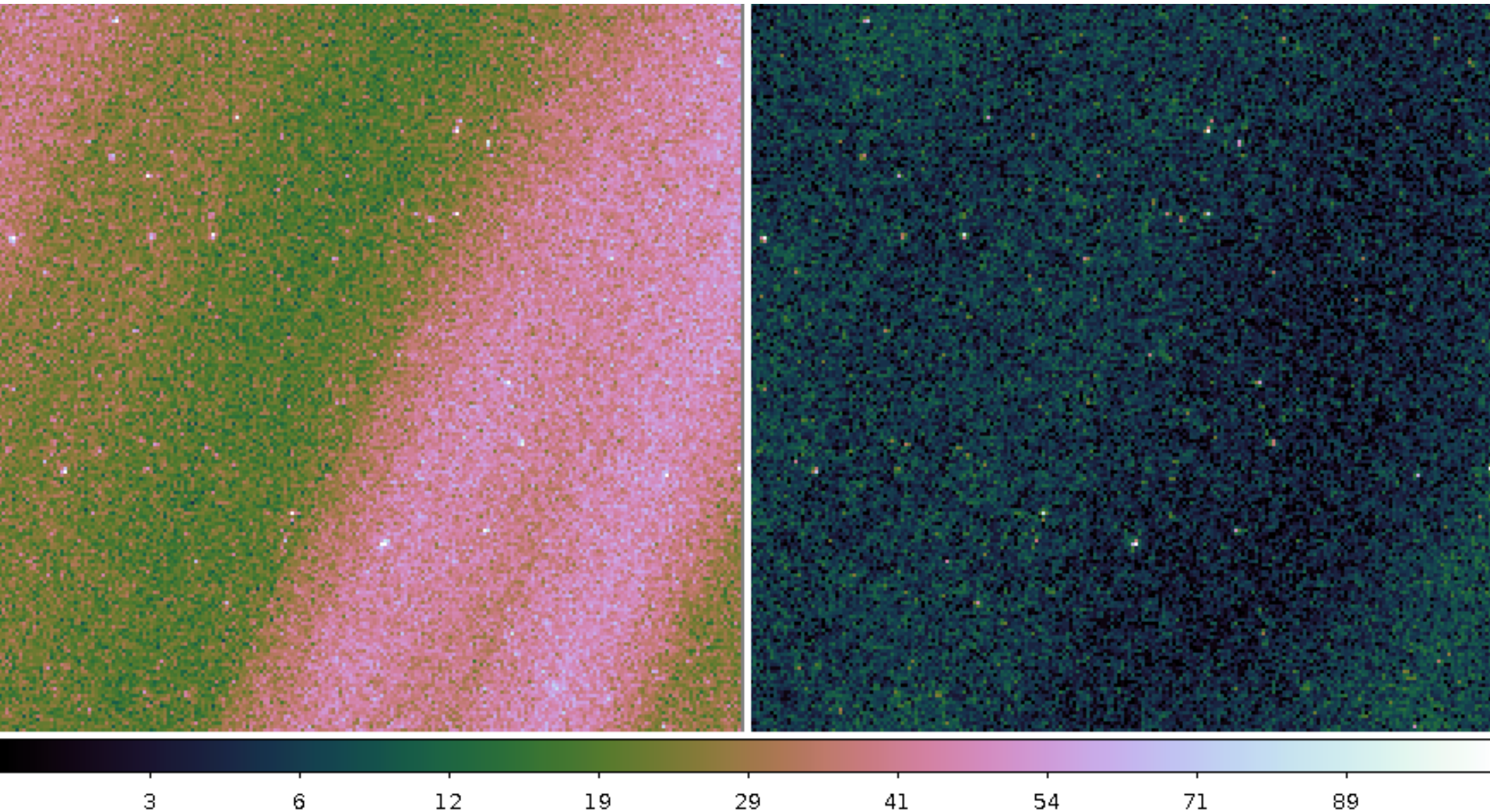
Jeremy Sanders

Jeremy Sanders

eSASS detection chain – photon-based detection

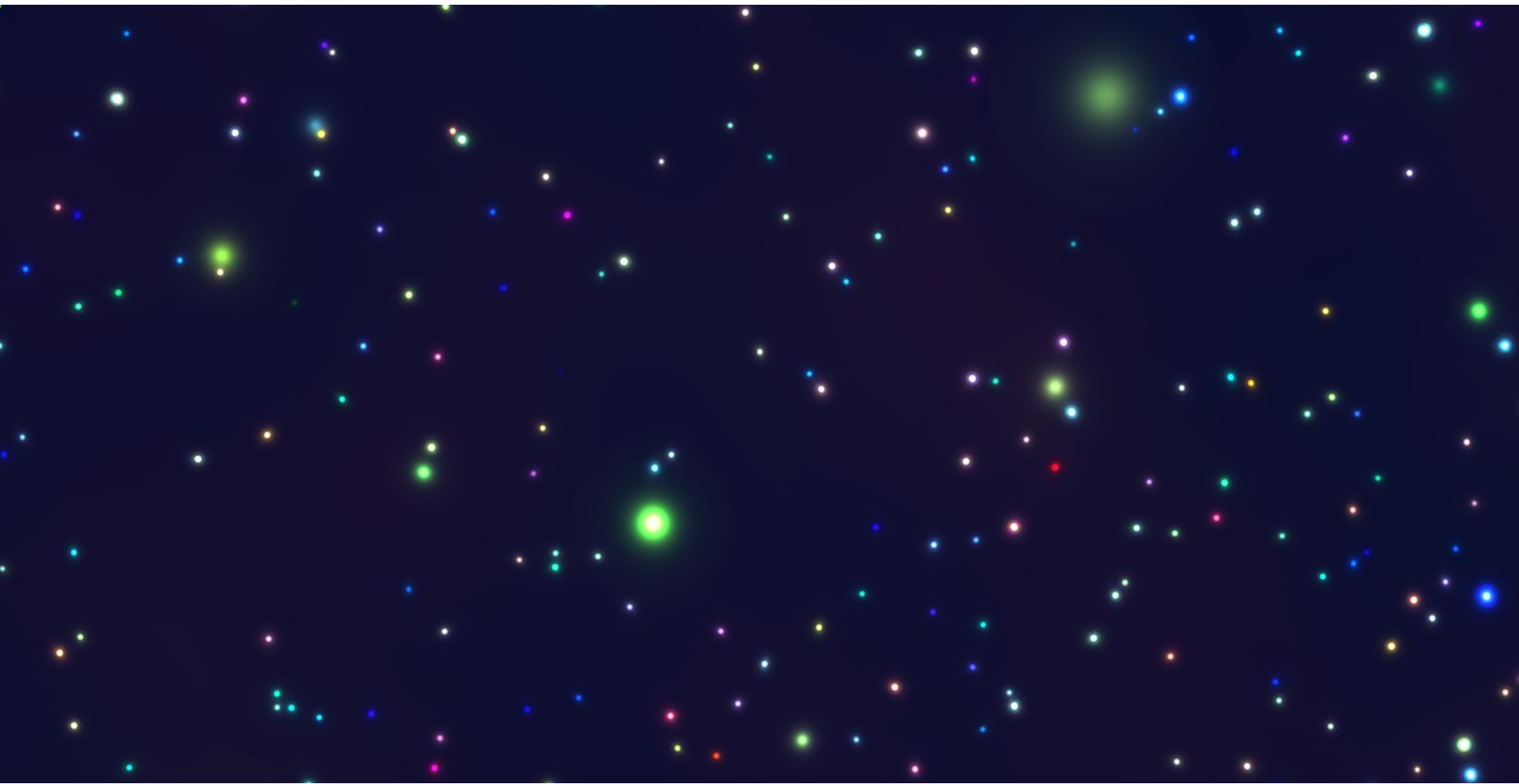
eFEDS field source map (3 x 3°x4° scan mode observation)

Georg Lamer
more: eSASS, CWG, AGN splinters

eSASS detection chain – photon-based detection

eFEDS field source map (3 x 3°x4° scan mode observation)

Georg Lamer
more: eSASS, CWG, AGN splinters

H. Brunner   From operations to calibrated data products   April 23rd, 2018

eFEDS field source map (cut-out)

Georg Lamer
more: eSASS, CWG, AGN splinters

H. Brunner   From operations to calibrated data products   April 23rd, 2018

Sensitivity map - eSASS task ersensmap

9.64e-15   1.93e-14   2.90e-14   3.86e-14   4.84e-14   5.80e-14   6.77e-14   7.74e-14

Georg Lamer

more: eSASS, CWG, AGN splinters

Sensit

Georg Lamer

more: eSASS, CWG, AGN splinters
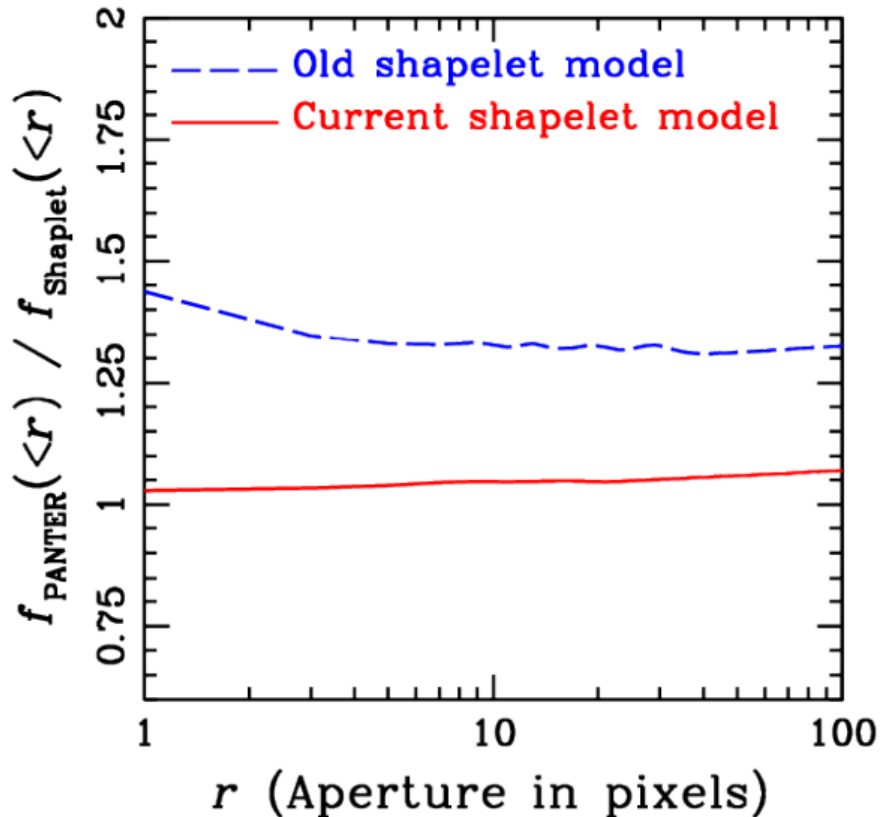
H. Brunner   From operations to calibrated data products   April 23rd, 2018

Updated shapelet PSF model

Antonis Georgakakis

PSF at 1.5keV and 15 arcmin off-axis

Aperture flux ratio between the original PANTER PSF and the shapelet-reconstucted one. Flux is estimated within an aperture of radius r.

Latest shapelet reconstruction of the eROSITA PSF measured at the PANTER.

– Flux integration within pixels (account for pixelisation)

– 3 shapelet scales used to fit the core and wings of the PSF (112 free parameters per PSF)

APETOOL: aperture photometry of X-ray sources

Antonis Georgakakis
more: AGN splinter

Background

Source+Background

From operations to calibrated data products
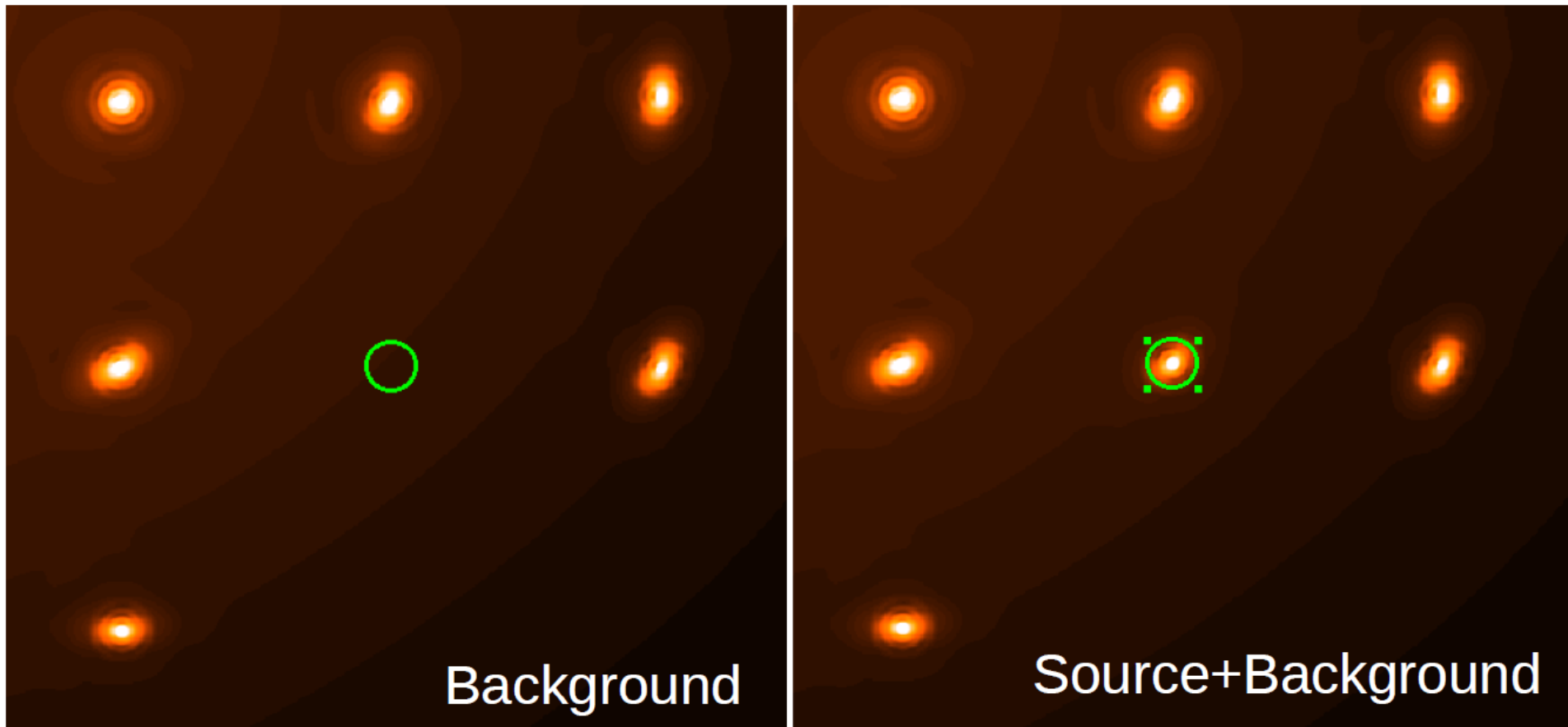
Astrometric corrections
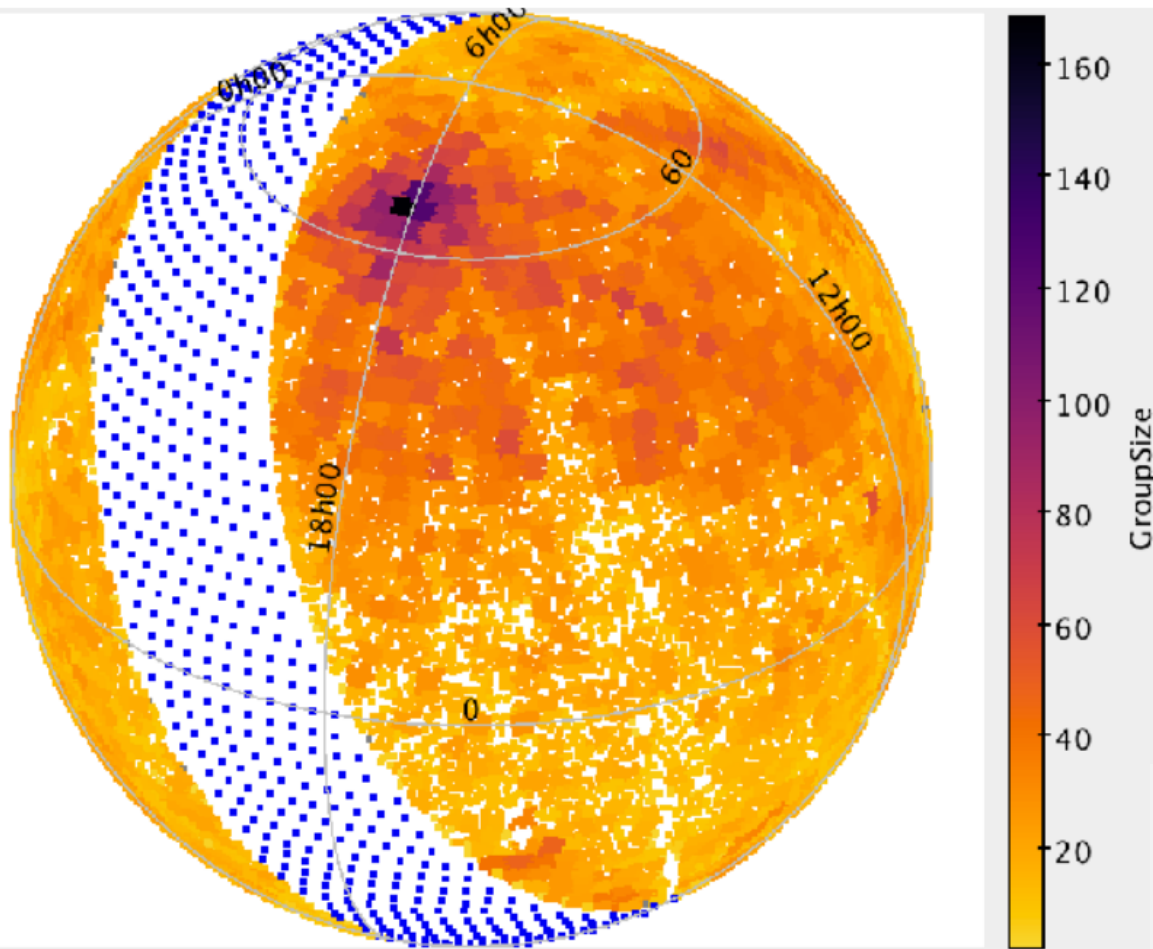
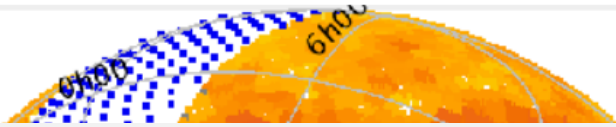
Creating an inital all-sky astrometric reference catalog of X-ray sources

Number of ROSAT ALLWISE GAIA sources within each eROSITA all-sky survey field

Salvato et al., 2017

Mara Salvato, Georg Lamer, Ji Long

H. Brunner   From operations to calibrated data products   April 23rd, 2018
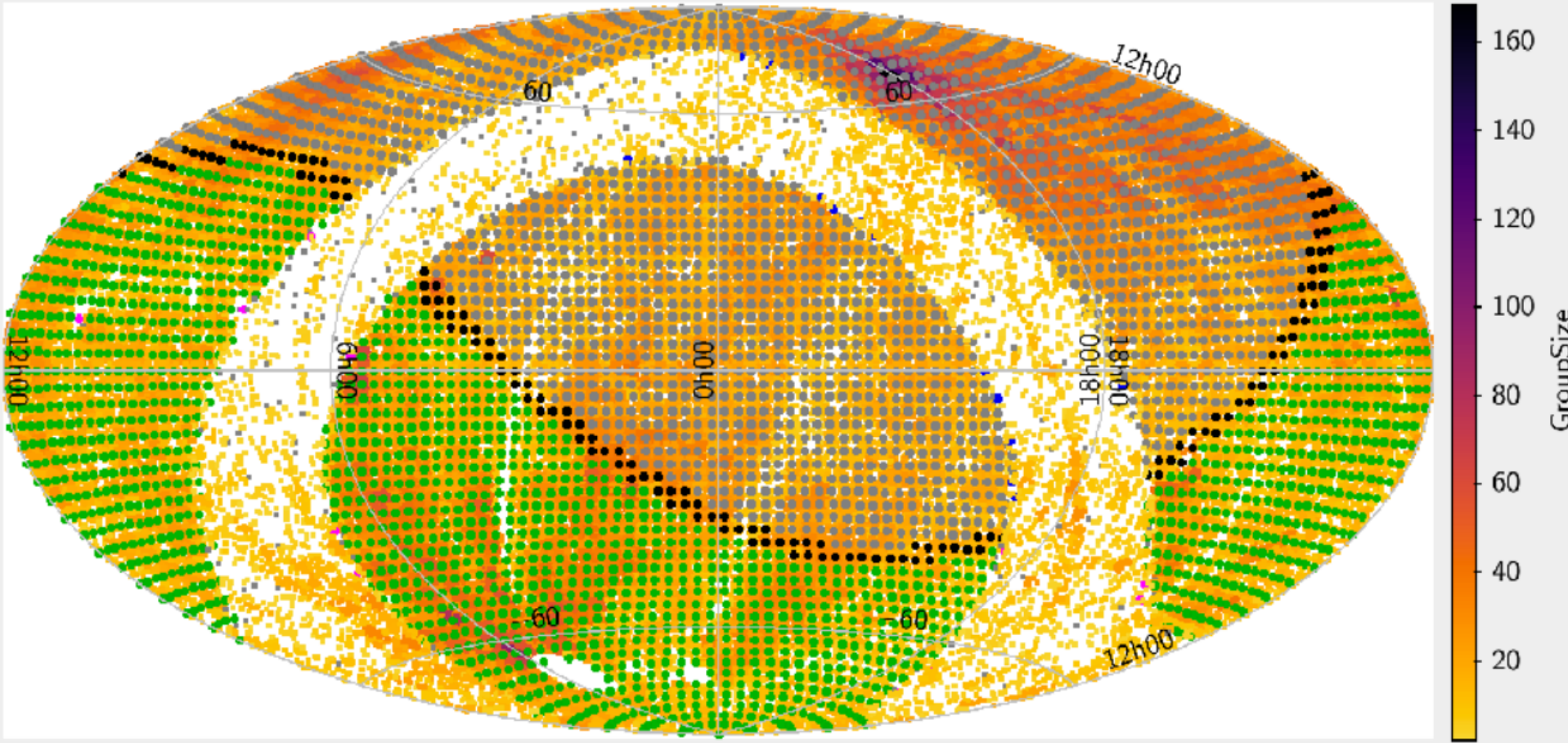
Astrometric corrections

Filling in the galactic plane (XMM slew), LMC, SMC

Creating an inital all-sky astrometric reference catalog of X-ray sources
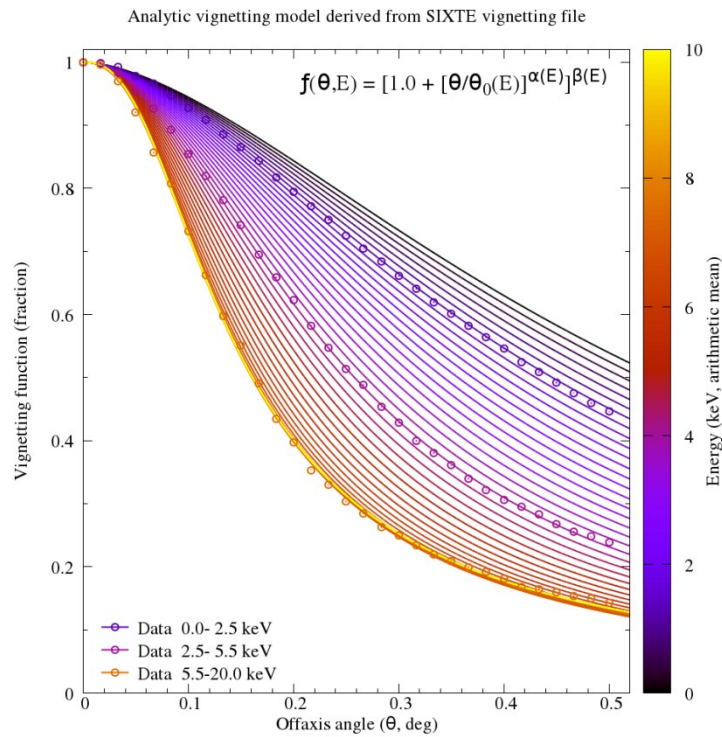
Mara Salvato, Georg Lamer, Ji Long

Spectral and lightcurve extraction

SRCTOOL – recent changes   (latest version v1.18)
Tom Dwelly

- Major overhaul of internal machinery to improve time-domain accuracy of effective area calculations, to increase robustness, and to improve code legibility
- Introduced two logically distinct modes of operation:
    - A) For point-like and symmetric compact extended sources
        - uses FFTs to convolve PSF and source extent models
    - B) For broadly extended sources
        - no PSF corrections, arbitrary extended source models are allowed, e.g. via user-supplied maps
- Vignetting is now modelled as a smooth analytic function
- Backscales expressed in absolute rather than relative units
- Numerous smaller fixes and improvements, widened test suite

Analytic vignetting model derived from SIXTE vignetting file

$$f(\theta, E) = [1.0 + [\theta/\theta_0(E)]^{\alpha(E)}]^{\beta(E)}$$

Analytic vignetting model - matches SIXTE
(to be replaced with PANTER derived model)

More: eSASS splinter (Tom Dwelly)
      time domain (Stefania Carpano)

apply SRCTOOL
corrections

Data access (DATool)

Stand alone browser tool or called from eROSE with prefilled entry fields

- Shared eROSE/DATool user database

- Supports data request by region, sky field or eROSITA souUID

more:
eSASS splinter (DATool, souUIDs)
eROpub, eROSE session

DATool: Sabine Osterhage, Christoph Großberger
eROSE: Tom Dwelly, Jeremy Sanders

...ata products   April 23rd, 2018

Data access (Datool)

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eROSITA_DE:archive - the software, calibration and data products access page of the eROSITA_DE Consortium (access restricted)

Public eROSITA Project Page | eROSITA Wiki | Visibility tool | Processing Status | eROSE | DATool | eSASS and caldb download area | Documentation | Back

eROSITA proprietary data request page

User name: SabineOsterhage
Request title: Looking for new stars
Science WG code: TDA

email: osterhage@mpe.mpg.de   Please type in your official business email adress (private addresses e.g. web.de gmx etc are not accepted)

Supervisor: hb   Please enter the name of your supervisor if you are a PHD student

Please specify either regions or skyfields for which you request all-sky survey data products: Please do not mix regions and skyfields in one request

○ regions or
● skyfields or
○ souUIDs

○ Enter one extraction area per line (accepted syntax):

```
fk5; circle(100,25,34)
```

● Upload a request file (accepted syntax):

Durchsuchen...   Keine Datei ausgewählt.

Requested data products:

☑ Event lists
☐ Catalogs with products
☑ Catalogs without products
☐ Auxiliary

Select the Version of the requested data products: 904 ▾

Submit

After submitting the request, an email with directions how to access the data will be sent to you. Depending on your status in the eROSITA_DE consortium, your request may require approval by a science working group chair.

By clicking on the "Submit" button you confirm that you will not share proprietary eROSITA data outside of the eROSITA_DE consortium and that you will take all reasonable precautions to prevent that the data will fall into the wrong hands. Intentional violation of the eROSITA_DE data policy will have serious consequences. Your request will be logged. The request logs will be accessible by all eROSITA_DE members.

---

eROSITA_DE:archive - the software, calibration and

Public eROSITA Project Page | eROSITA Wiki | Visibility tool |

eROSITA proprietary data req

List of all requested eRosita Data

Please enter your name in wiki style (upper case in

SabineOsterhage

and choose a password to protect your data:

••••••••

Enter your science working group:

Time Domain Astrophysics ▾

and a descriptive title of the request: (only OBSID

Looking for new stars

This is a request for:

○ Source catalogs
● All-sky survey data products
○ Pointing data products

Next

Dear eRosita Scientist WalterMasters,

You requested proprietary eROSITA all-sky survey catalogs:

sm1_35720_36800_00_SourceCatalog_r001_002
sm8_35720_43830_00_SourceCatalog_r001_002

You will shortly receive an email with download instructions.

Thank you!

Dear eRosita Scientist WalterMasters,

You requested proprietary eROSITA all-sky survey catalogs:

sm1_35720_36800_00_SourceCatalog_r001_002
sm8_35720_43830_00_SourceCatalog_r001_002

You will shortly receive an email with download

Thank you!

Dear eRosita Scientist WalterMasters,

You requested proprietary eROSITA all-sky survey catalogs:

sm1_35720_36800_00_SourceCatalog_r001_002
sm8_35720_43830_00_SourceCatalog_r001_002

You will find your requested data with this link   [link to your requested data]

Please do not forget to delete the data here after downloading   [delete data]

Thank you!

Sabine Osterhage & Christoph Großberger

Dear eRosita Scientist WalterMasters,

You requested proprietary eROSITA all-sky surve

sm1_35720_36800_00_SourceCatalog_r001_002

Dear eRosita Scientist WalterMasters,

You requested proprietary eROSITA all-sky survey catalogs:

00_SourceCatalog_r001_002
00_SourceCatalog_r001_002

quested data with this link link to your requested data

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eROSITA_DE:archive - the software, calibration and data products access page of

Public eROSITA Project Page | eROSITA Wiki | Visibility tool | Processing Status | eROSE | DAT

eROSITA proprietary data request page

Dear eRosita Scientist ,

please type in the password you choose for this data request:

•••••••• submit

I forgot my password

Sabine Osterhage & Christoph Großberger

Dear eRosita Scientist WalterMasters,

You requested proprietary eROSITA all-sky surve

sm1_35720_36800_00_SourceCatalog_r001_002

Dear eRosita Scientist WalterMasters,

You requested proprietary eROSITA all-sky survey catalogs:

00_SourceCatalog_r001_002
00_SourceCatalog_r001_002

quested data with this link [link to your requested data]

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Dear eRosita Scientis

please type in the pa

[••••••••] [submit]

I forgot my password

Index of /DataRequests/72bd8a25adbeae638bce0839

Name	Last modified	Size	Description
Parent Directory		-	
data/	2018-04-20 15:31	-	
log/	2018-04-20 15:31	-	

Apache/2.4.18 (Ubuntu) Server at erosita.mpe.mpg.de Port 80

Sabine Osterhage & Christoph Großberger

H. Brunner   From operations to calibrated data products   April 23rd, 2018

eSASS Splinter Meeting, Garching 24 April 2018

Preliminary agenda - please provide feedback on what should be covered

- eSASS basics: functionality, data, calibration - HB (5m)
- eSASS science requirements (review of ongoing discussion) - HB (5m)
- New eSASS users release: changes since previous release - HB (5m)
- Flare screeining: algorithm & performance - JS (5m)
- Source detection chain: improvements, hints and tips - GL (10m)
- Spectral & lightcurve extraction: improvements, hints and tips - TD (10m)
- Source catalog creation: tracking unique source IDs - CG (10m)
- Running eSASS tasks on SIXTE simulations: hints and tips - CG (5m)
- Update on SIXTE response matrices and spectra - ThD (10m)
- Data products / data access - HB (5m)
- New wiki pages (under construction): eSASS cookbook, eSASS FAQ - HB (5m)
- eSASS Q&A - all (15m)

Thank you!