ISDC for the INTEGRAL USERS GROUP

Carlo Ferrigno (ISDC)

ESOC, 11-12 June 2019

Organization status

- Swiss funding for 2019: approved with minimal direct funding (1 FTE). Operations guaranteed.
- Funding for 2020 asked and expected at the same level.
- Manpower allocation: ½ operator, ½ scientist. Contribution from infrastructure (CDCI project, led by S. Paltani) for web mastering, DB support and web-analysis. Contribution from ESA for operations.
- Synergies with other projects and past savings is essential. ½ scientist in 2019 from ESA.
- Operator retires in November 2019, very difficult to replace him. Started hiring process.

Routine tasks

- Updates of IC files provided by instrument teams
- monitoring of SPI gain at each revolution with automated procedure
- SPI gain coefficients updated last time in 2018
- Processing and archiving of CONS data
- Solve issues in transmission of aux files from MOC

ISDC Operations/data distribution

- NRT data are available within 3 hours. Smooth processing (monitoring issues more closely now for MMA).
- Page to distribute data since AO13, public for serendipitous science. Handled Russian peculiarity.
- Need for OSA energy reconstruction step both for JEM-X and ISGRI. NRT data for JEM-X2 are not always available due to difficult energy reconstruction.
- Occasional gaps in NRT telemetry due to hardware failure of the University infrastructure supporting the data transfer (switch).
- CONS data are obtained now from virtualized DVD transfer from MOC
- Service widely used for SPI-ACS data in NRT

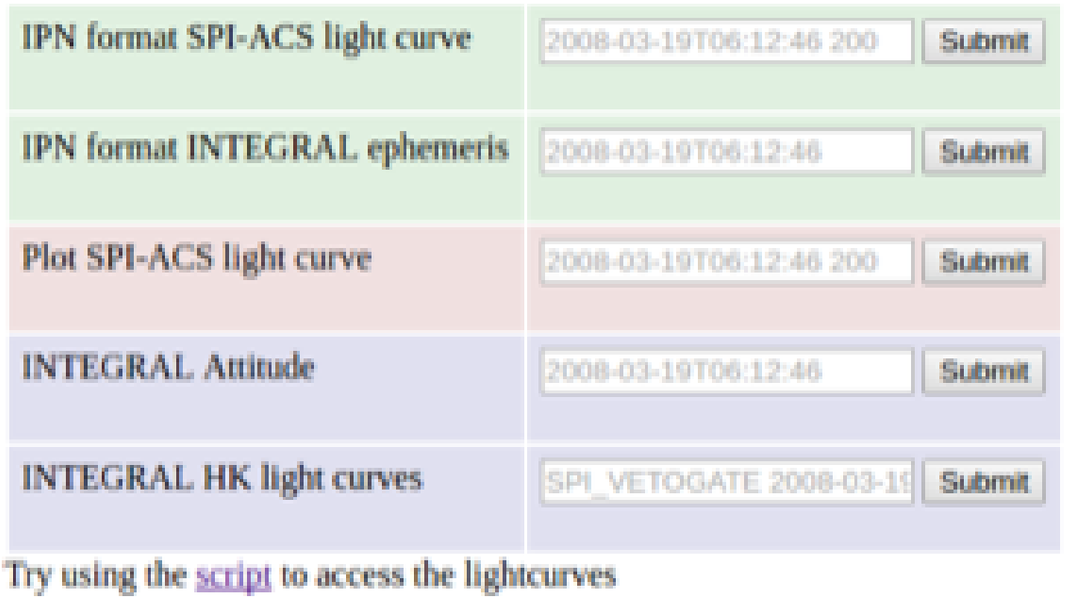
INTEGRAL SPI-ACS public data service

In 2011, a public service was set up to promptly provide SPI-ACS data with the best timing accuracy

It was extensively used for years by IPN and Konus colleagues

Since 2015, Fermi/GBM team used the service to verify their detections and challenge SPI-ACS

Several other groups started to use it. In total >100 Gb has been served.



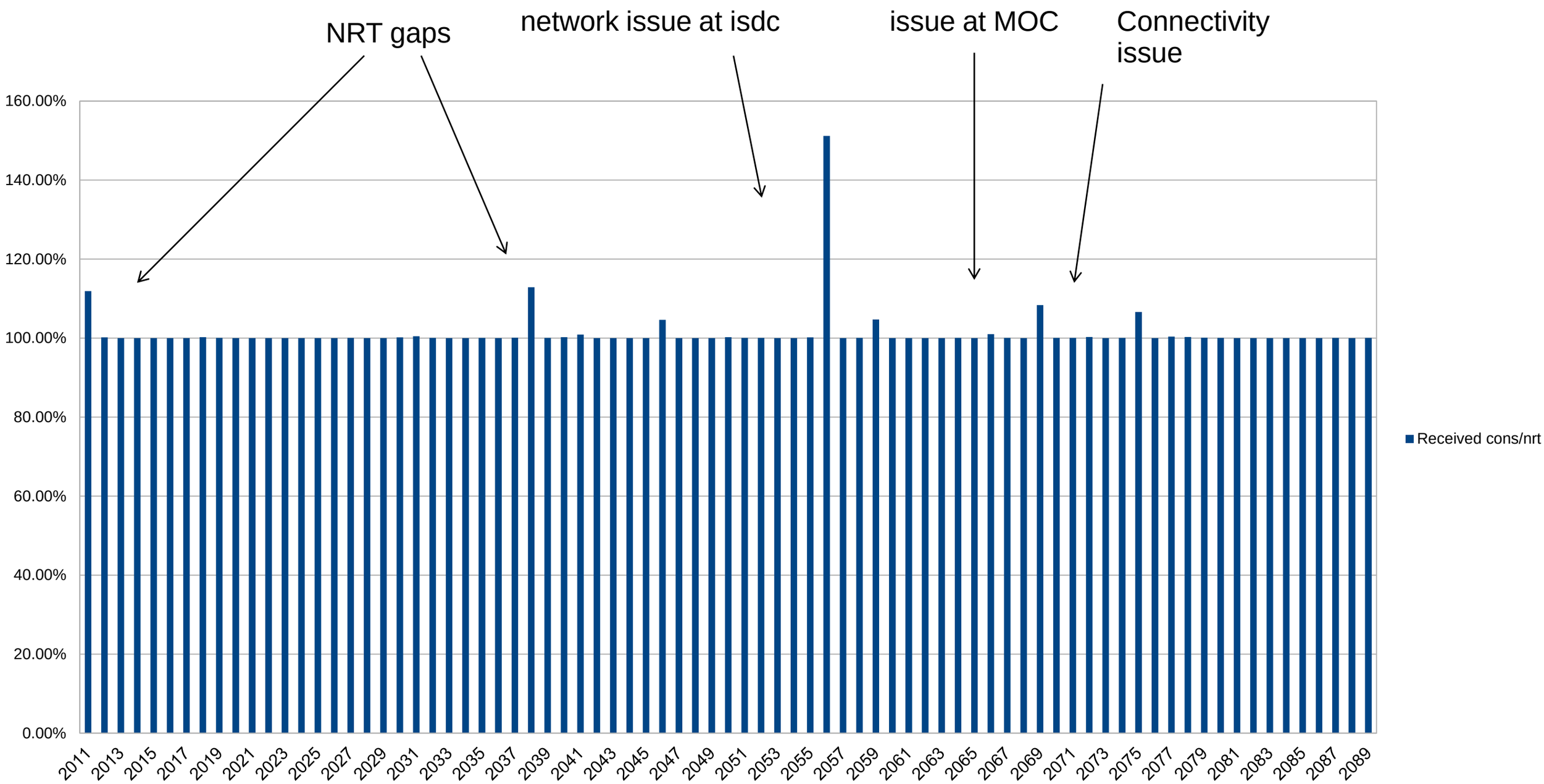
RESTful service, providing various public INTEGRAL data as well as auxiliary information

Quick look analysis of INTEGRAL data

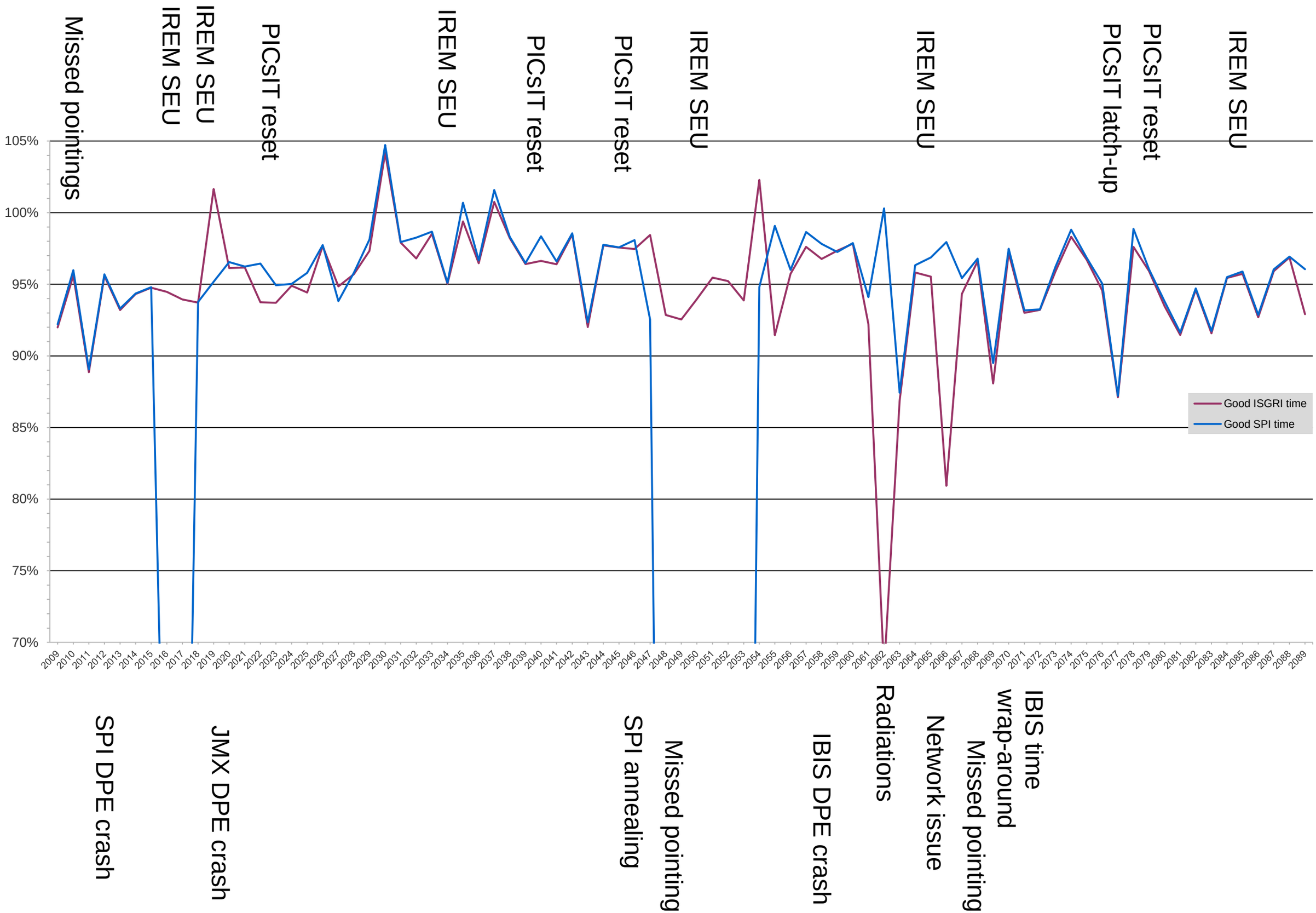
- No GRB in the IBIS FOV in 2019, 7 in 2018 (IBAS energy calibration not updated, waiting for D. Goetz's input).
- ~200 GRB/year in SPI ACS. Used for IPN triangulation.
- Inform all PIs of data rights only in case of outstanding problems or relevant serendipitous sources (no data rights).
- 14 ATeLs (3 lead by ISDC) and 23 GCNs related to INTEGRAL discoveries in 2019 (included GW and neutrino follow-up)

Telemetry

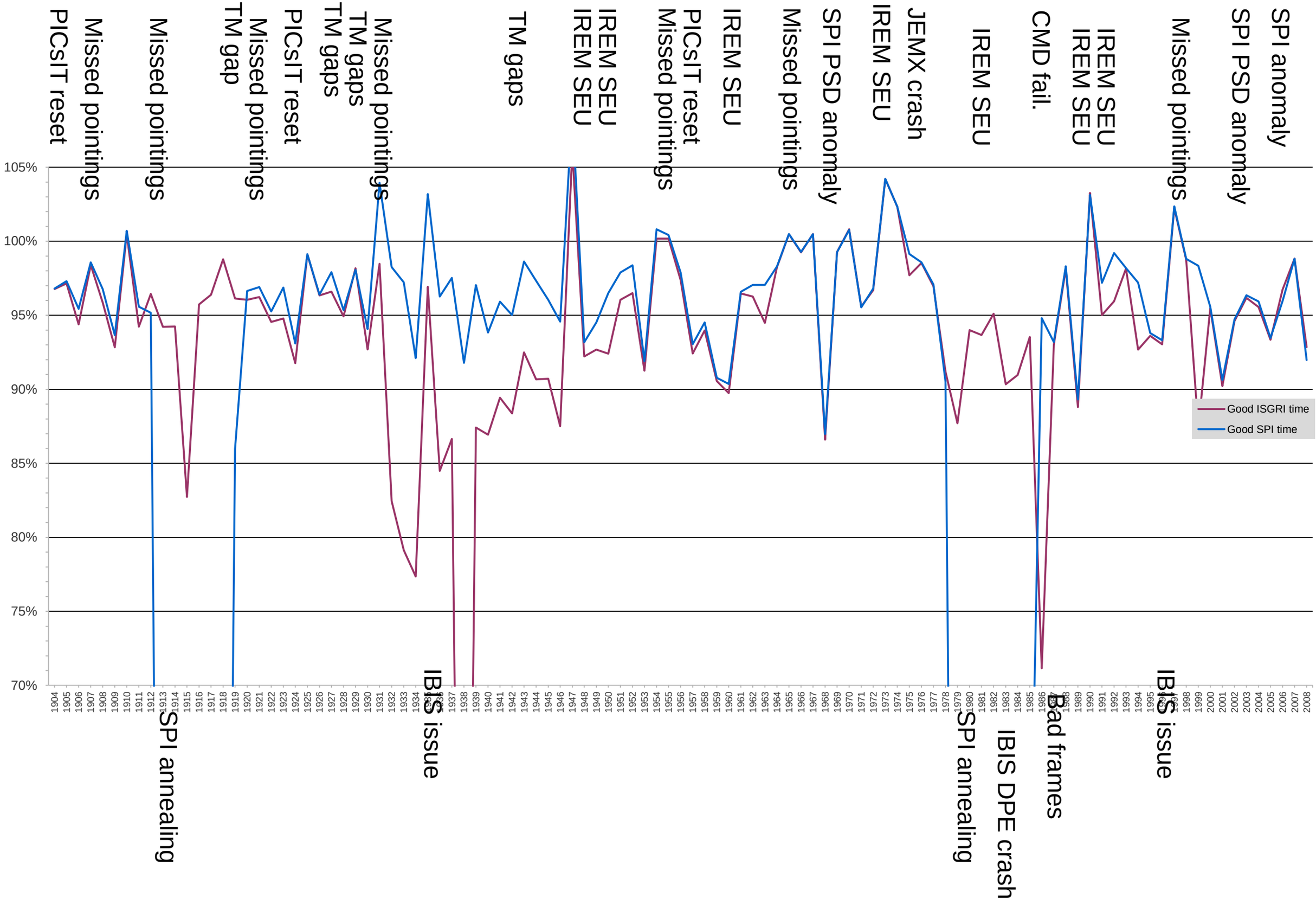
CONS / NRT, rev. 2011 - 2089



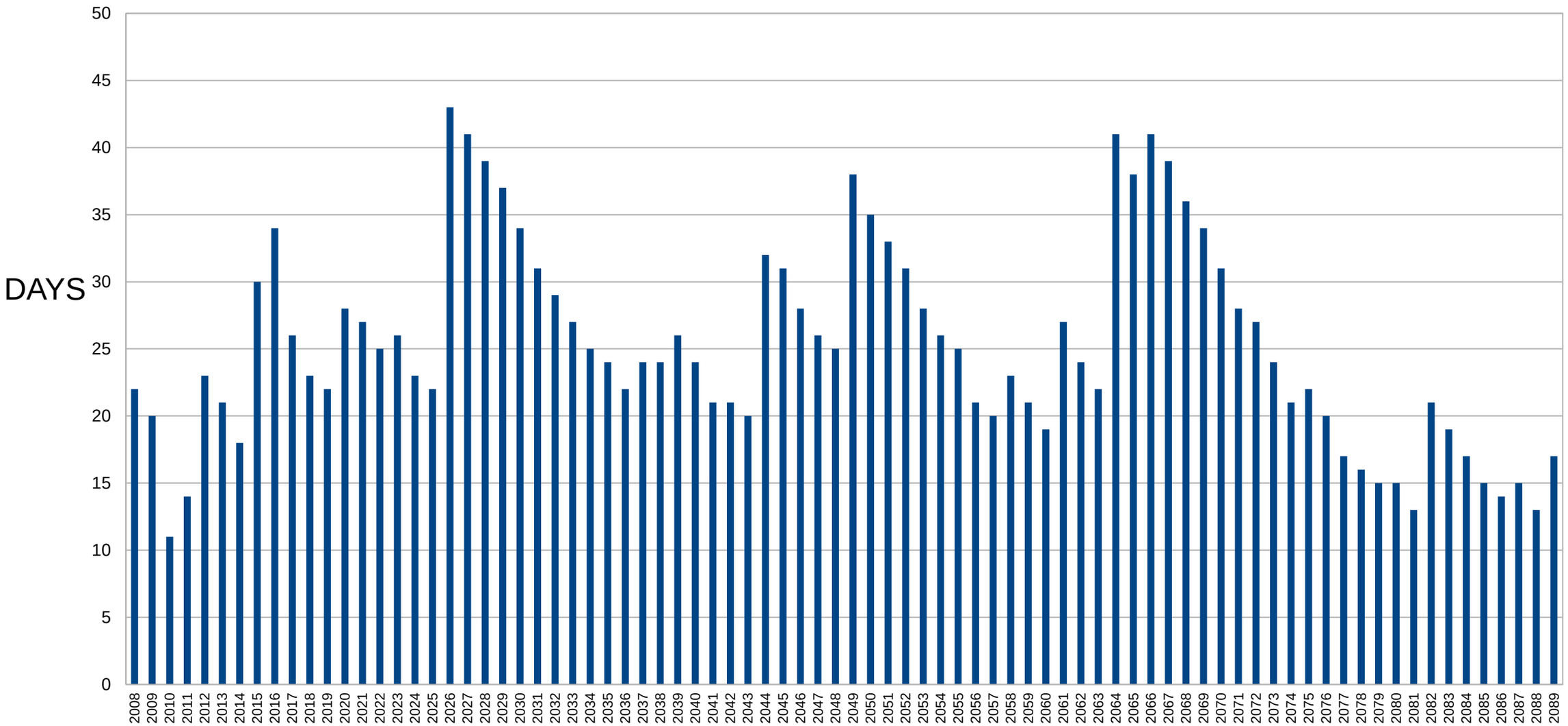
Operations: Good times vs programmed 2009 – 2089



Operations: Good times 1904 – 2008

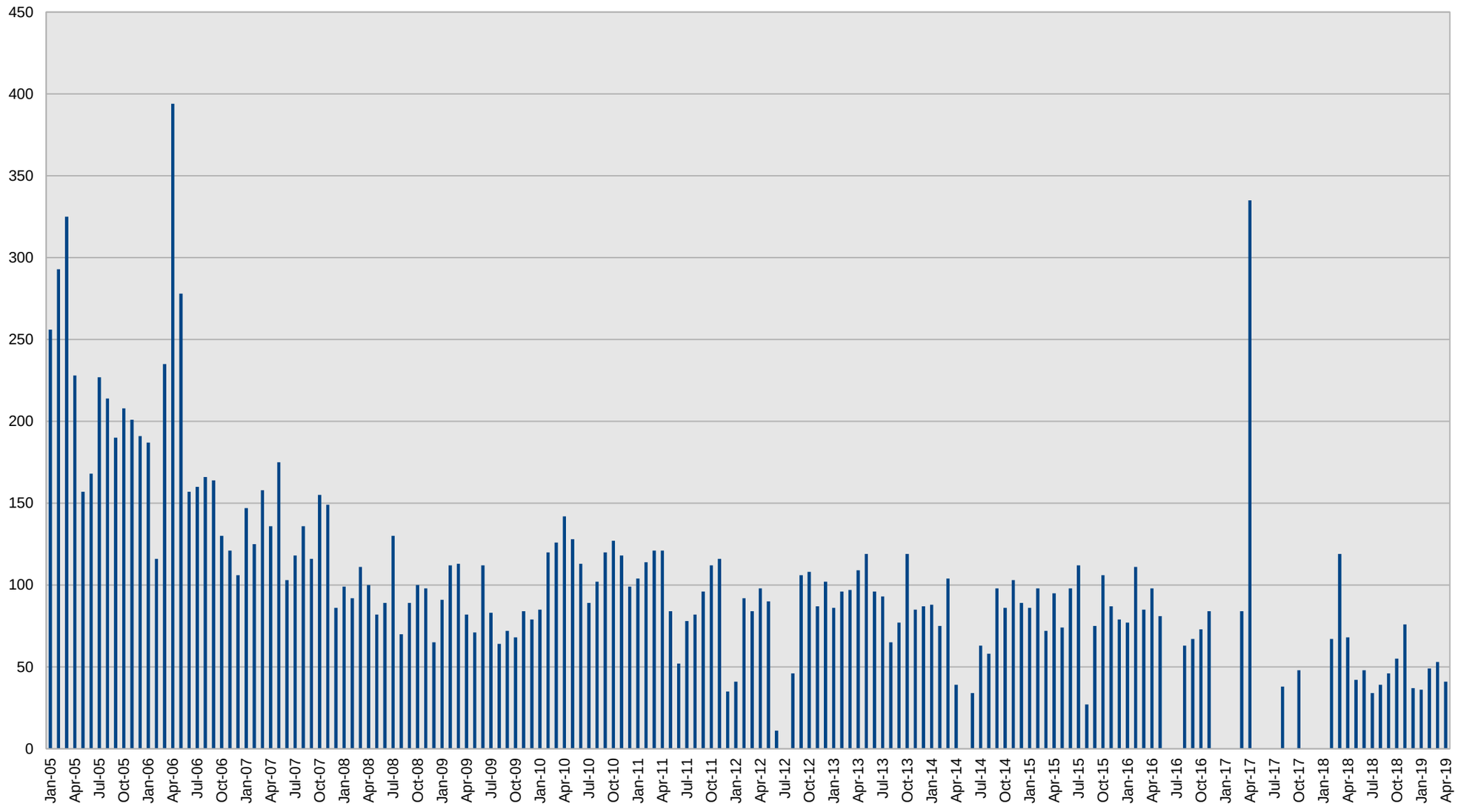


Delay between observation and distribution
rev. 2008 - 2089



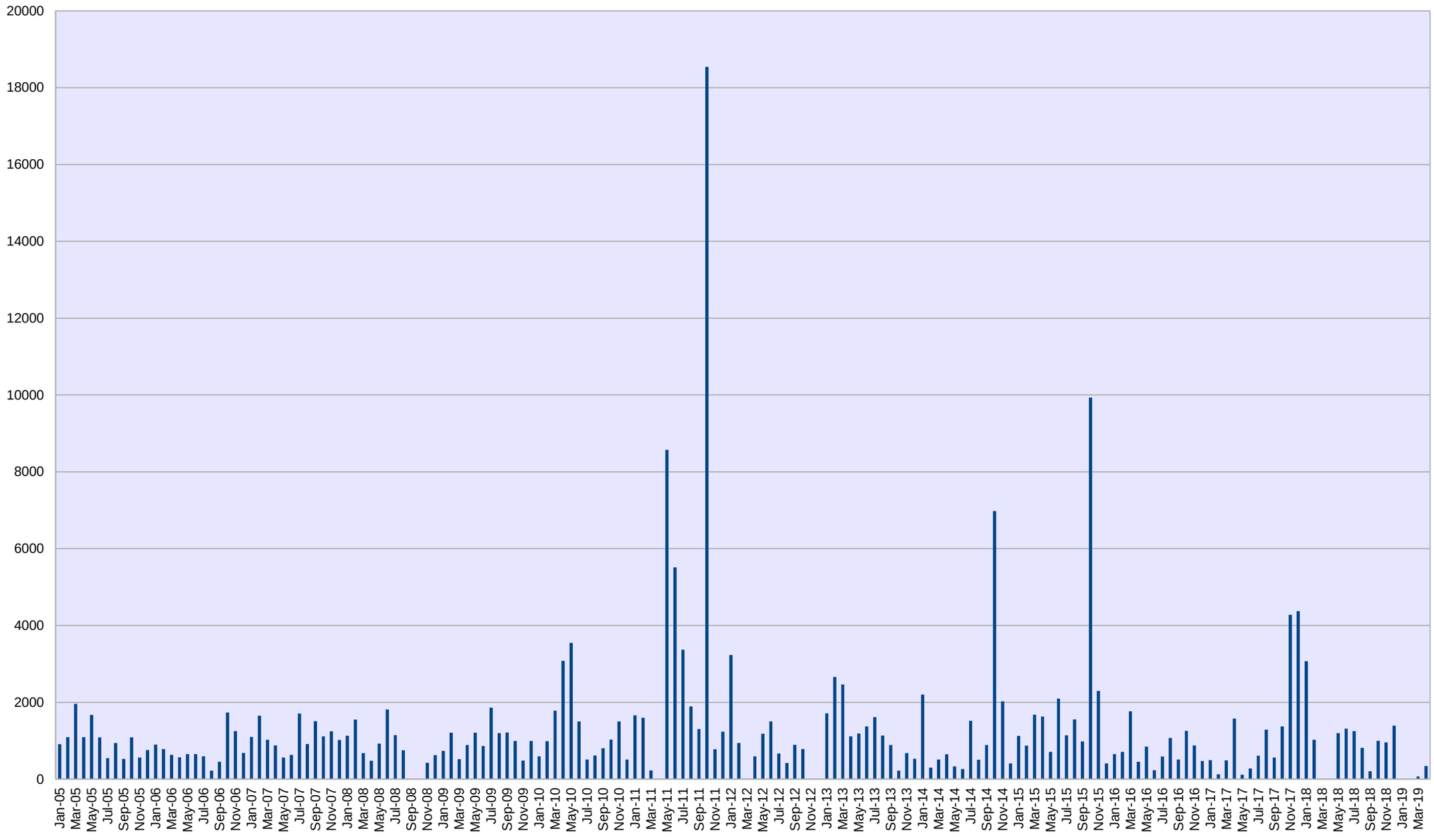
Browse unique visitors

Number of visitors

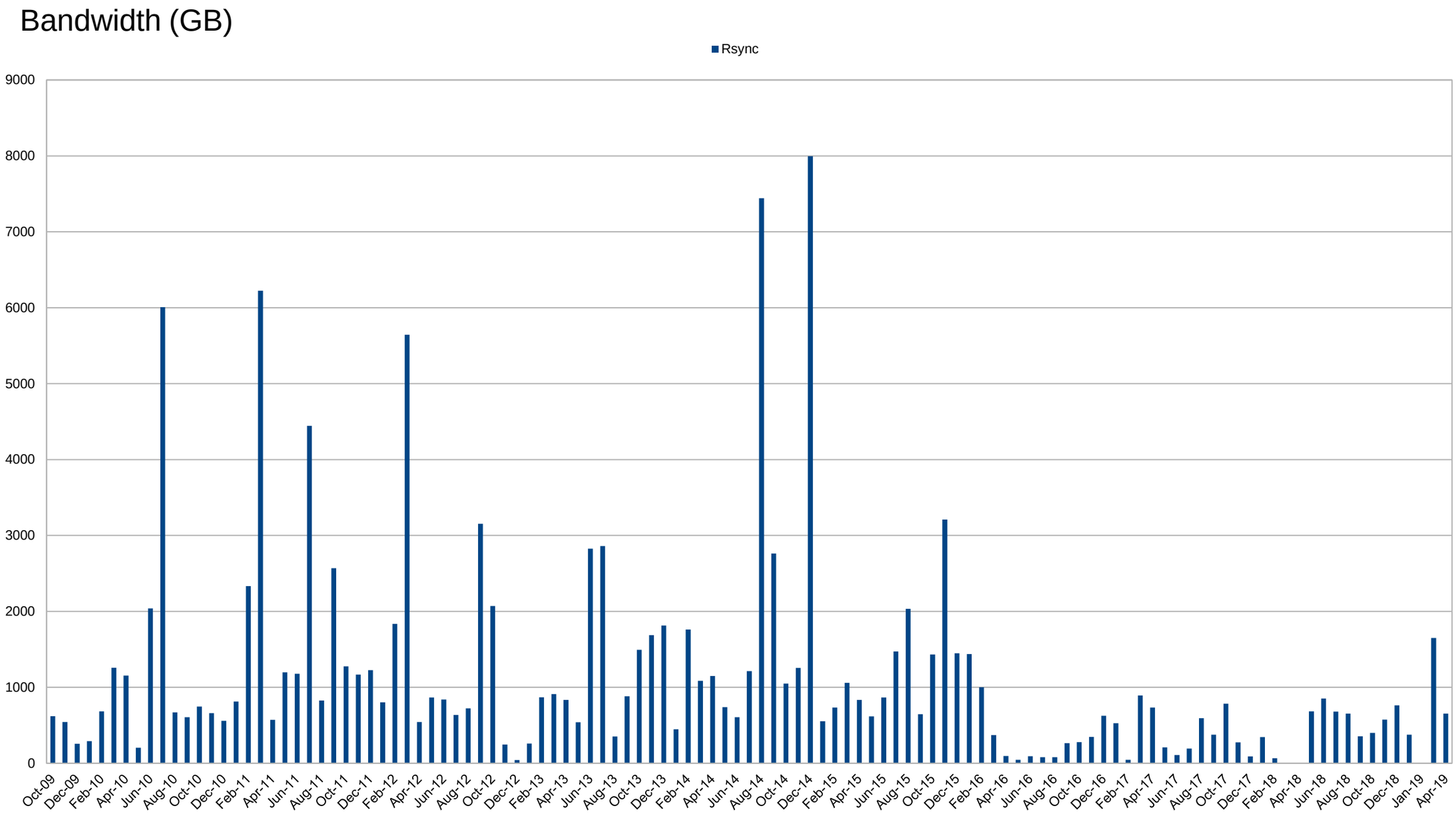


FTP access statistics

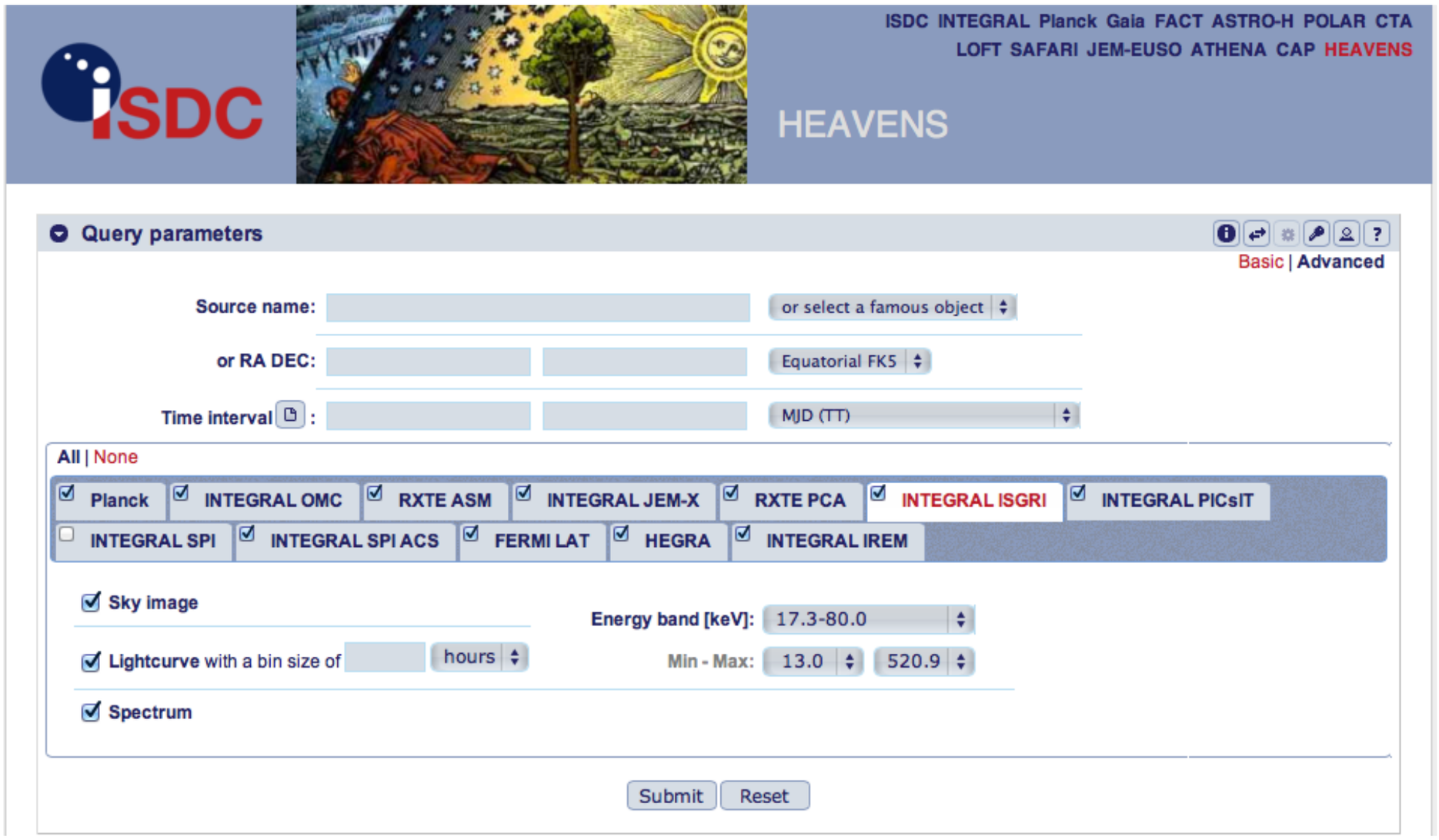
Bandwidth (GB)



Rsync


Bandwidth (GB)
Rsync
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Feb-11
Apr-11
Jun-11
Aug-11
Oct-11
Dec-11
Feb-12
Apr-12
Jun-12
Aug-12
Oct-12
Dec-12
Feb-13
Apr-13
Jun-13
Aug-13
Oct-13
Dec-13
Feb-14
Apr-14
Jun-14
Aug-14
Oct-14
Dec-14
Feb-15
Apr-15
Jun-15
Aug-15
Oct-15
Dec-15
Feb-16
Apr-16
Jun-16
Aug-16
Oct-16
Dec-16
Feb-17
Apr-17
Jun-17
Aug-17
Oct-17
Dec-17
Feb-18
Apr-18
Jun-18
Aug-18
Oct-18
Dec-18
Jan-19
Apr-19

High level quick-look products, HEAVENS



- Development on hold
- Used OSA9

~60 single accesses per month

Cross calibration

- We are working on integrating the dashboard concept to a living cross calibration archive (sketched at IACHEC)
- We will implement automatic fetching of calibration observations from IACHEC and provide comparison with INTEGRAL
- We plan to perform automated tests to check the cross-calibration of INTEGRAL instruments
- This is very relevant also for the development of ISGRI calibration

INTEGRAL conference + AHEAD workshop

INTEGRAL conference 2019

https://www.astro.unige.ch/integral2019/

- 11-15 February 2019 at Campus Biotech in Geneva
- Co-organized AHEAD workshop on future gamma-ray missions (two half days)
- Fee was 200 CHF per person including three lunches (several waived)
- 146 participants + a couple local ones
- 106 presented: 14 invited, 33 solicited, 41 contributed, 18 posters
- We received 50 proceeding contributions so far. Maybe a few more will arrive in the next days
- The Mike Revnivtsev prize was given to T. Siegert

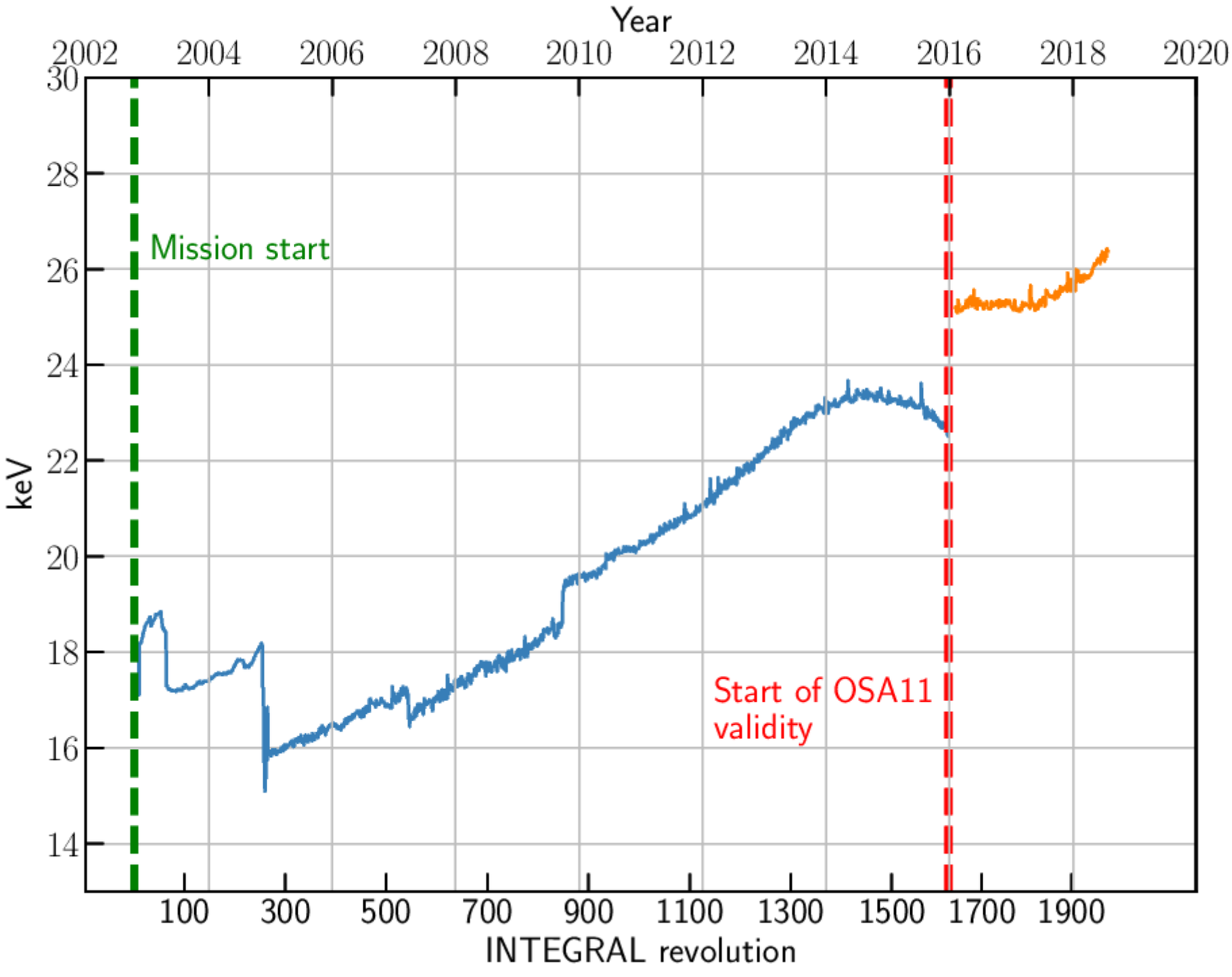
- Dinner at Ecole hoteliere de Geneve
- Conributions from ESA, INAF, UNIGE, Ville de Geneve

OSA 11 and catalog 42

- Released catalog v. 41 in June 2018
- Released catalog v. 42 in December 2018
- OSA 11 was released on 19 October 2018
  - 4 Linux binaries, source code, **docker image for portability on all platforms**
  - New JEM-X light-curve extraction method with j_ima_iros
  - Automatic burst detection in JEM-X
  - SPI: implemented the PE, SE discriminator and tool to stich spectra in different energy ranges with flatfield background
  - New ISGRI energy calibration and response from rev 1627
  - No Updates for OMC

Evolution of low threshold

- Due to drift of gain, the energy scale is much more compressed and signal starts at ~25 keV rather than at ~15 keV as at the mission start



User manuals

- We updated the User manuals and the installation guide
- We updated the “known issues” in collaboration with instrument teams.
- ISDC did not and (will not) update any inter-calibration document or advanced analysis guide etc.
- No additional documents are currently foreseen
- No major revision is feasible

OSA downloads

(since release and until 5 June)

- 220 downloads
- 3 source code (often the same user as for binaries)
- 63 test data
- 200 catalog bundles
- >1400 pulls of the docker image (not possible to trace provenance on dockerhub)

OSA future activities

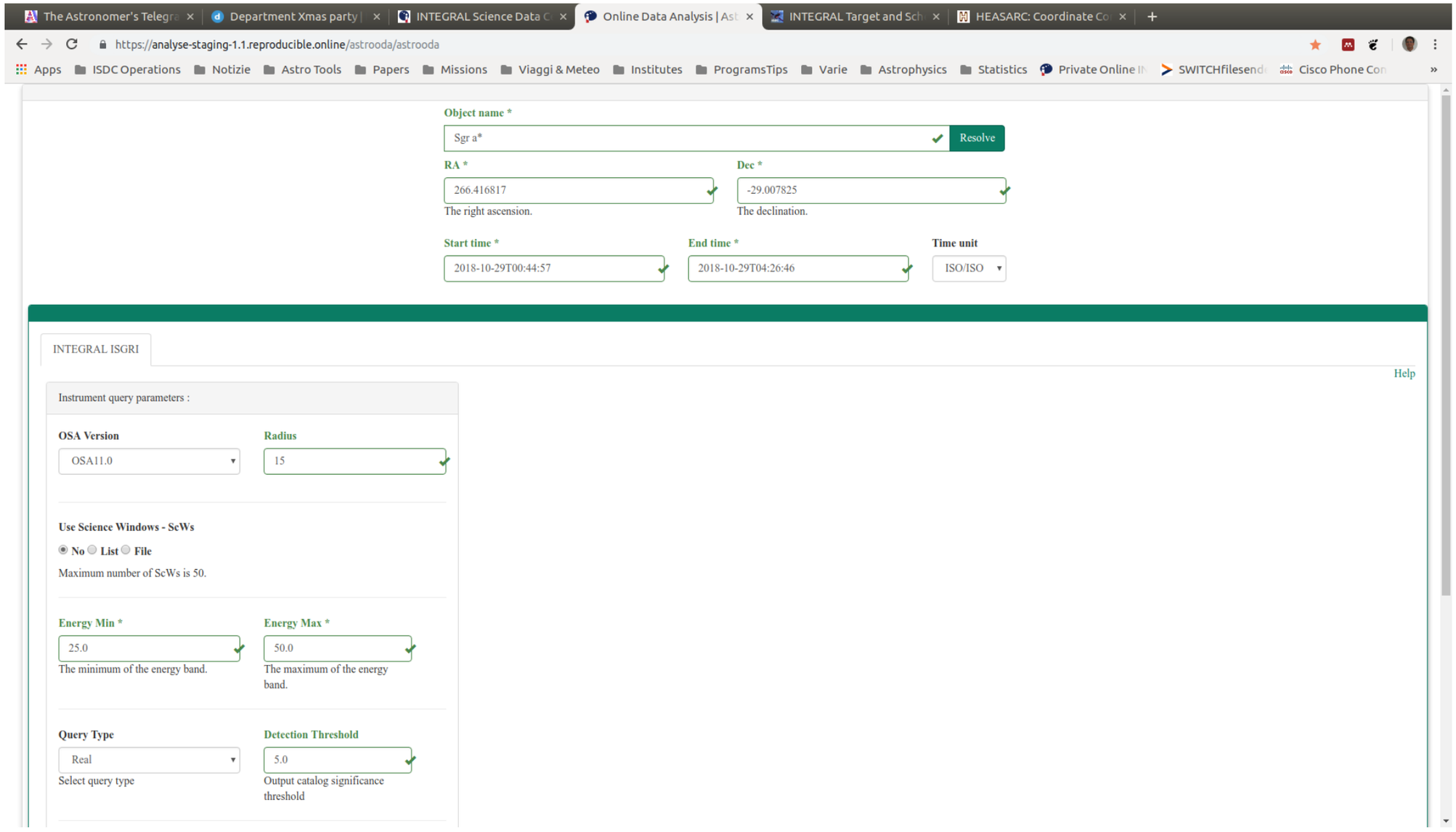
- ~200 more revolutions of ISGRI calibration files in second half 2019 to cover from rev ~1400.
- Soon after, completing the mission life time with ~100 revolution/month (or larger chunks)
- Discussion to support Volodymyr with a bright Swiss trainee at ESA
- Outcome of collaboration could be also an ISGRI calibration document in collaboration with the IBIS team
- Waiting for Compton imaging from Paris to release a delta version of OSA (11.1) with updates also for JEM-X

From ISDC to CDCI

- Raw data are not enough, we need to have the ability to run a stramlined analysis and easily access high-level data.
- Unige has obtained financial support for a common data center infrastructure (CDCI)
- As part of this, we are making a pilot project for an online tool for INTEGRAL data analysis and long-term preservation of S/W and archive
- It was extended also to another missions at UNIGE: Polar

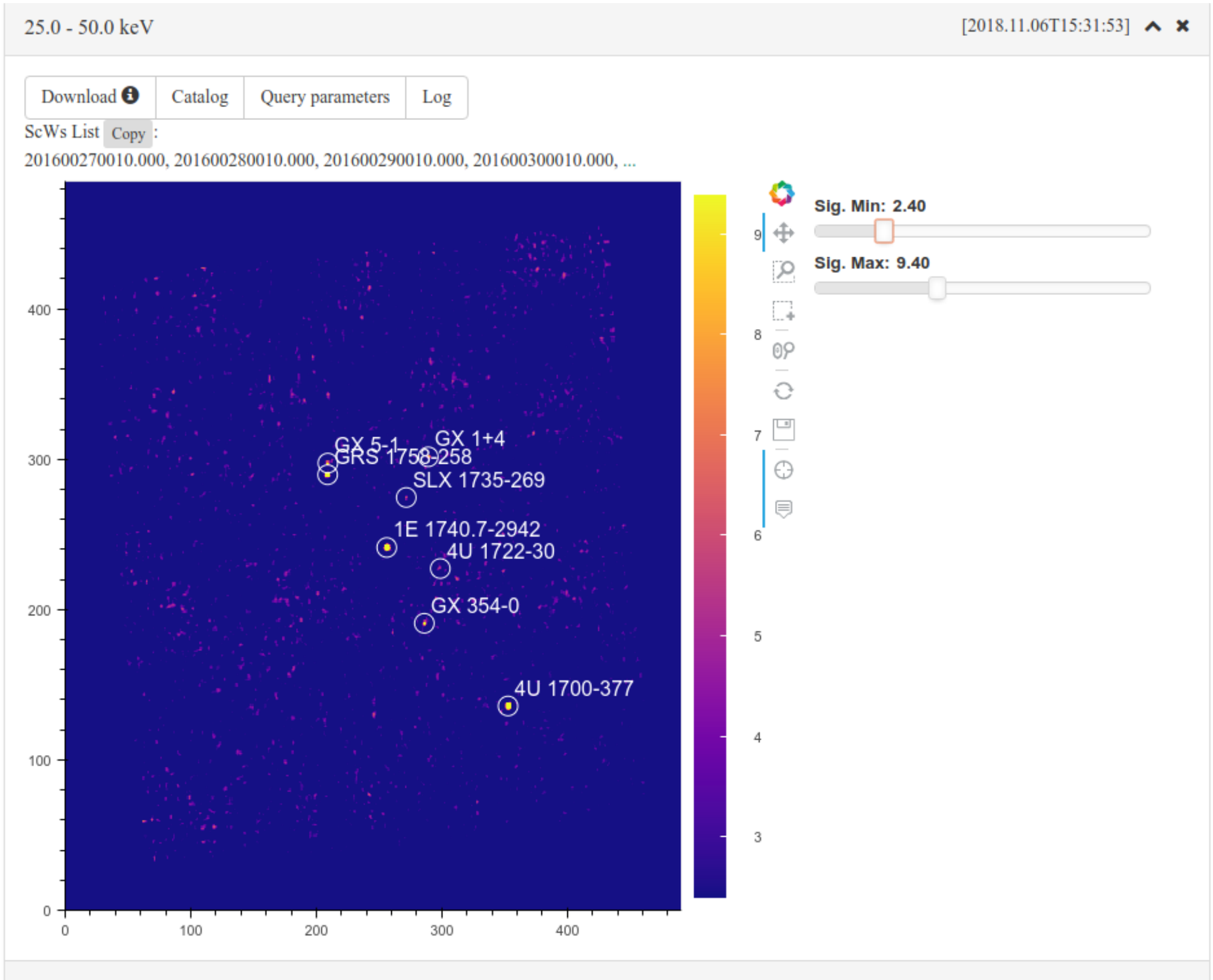
Offline Data Analysis (from OSA to ODA)

- We run OSA executable from a web tool (only IBIS/ISGRI for now and 50 scw per chunk).
- We will have a public version for public data (~1-year old)
- We have a private internal version with access to NRT data for operations and transients.



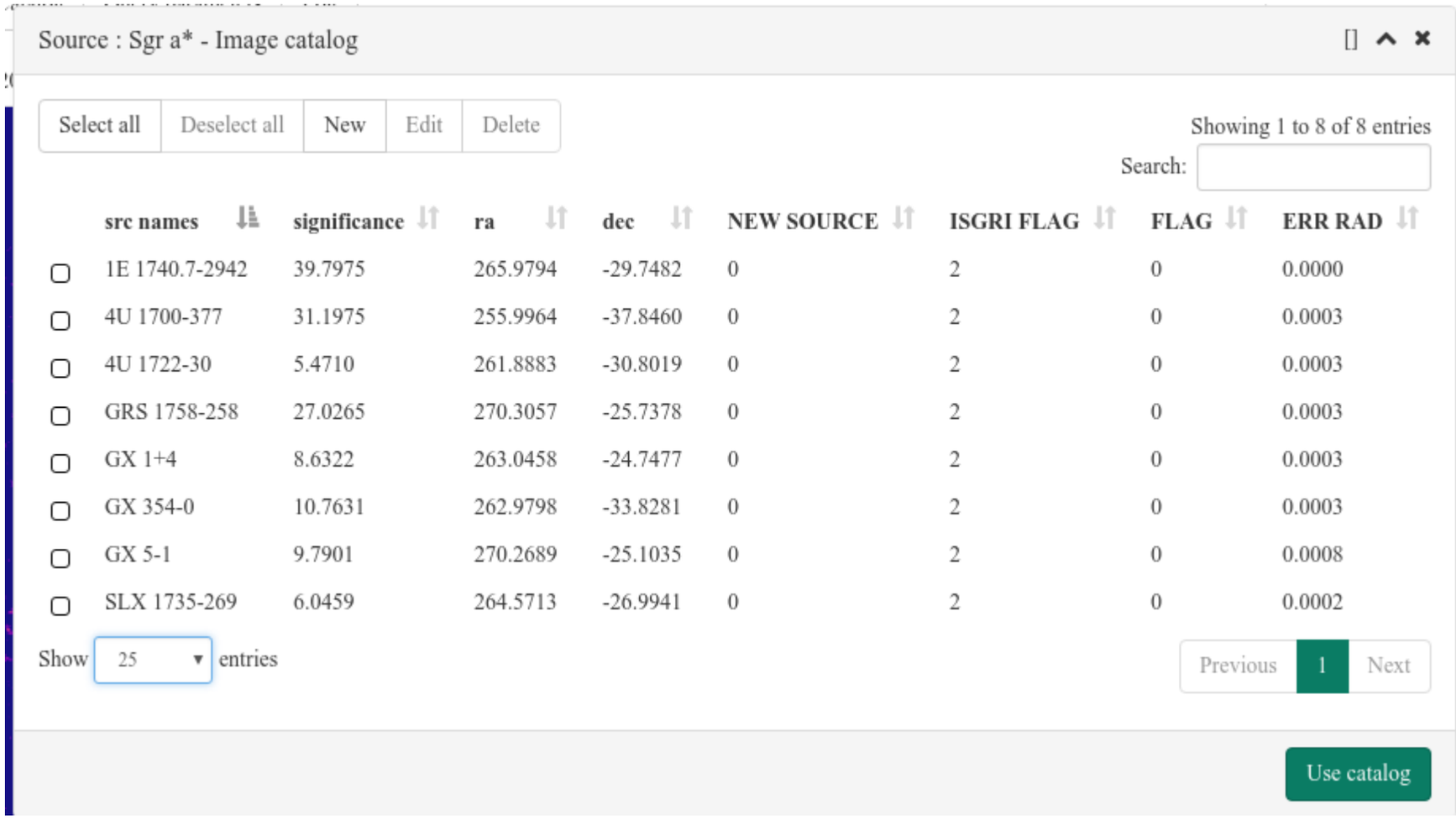
ODA v 1.0 - Imaging

- Possible to make images in one energy range



ODA 1.0 - Central role of the catalog

- Easy handling of source catalog.
- You can delete, add sources found from imaging
- You can load a catalog from a file.



ODA 1.0 - Spectra and online fitting

- From the catalog, you get all spectra simultaneously at full 256 channel resolution
- Fit individual spectra and download in fits format

Processing ...
Session : 2a10871c8d4db1429e62d218acd7b2d1 | Job Id : -7594506992834016721

2018.11.06T15:48:58 Status : ready

Data unit		ISGRISpectraSum	ii_spectra_extract	ii_skyimage	ibis_gti	ibis_dead	ISGRIEvents
001	201600270010.000						
002	201600280010.000						
003	201600290010.000						
004	201600300010.000						
005	201600310010.000						
006	201600320010.000						

2018.11.06T15:49:56 done

More details >

Source : Sgr a* [2018.11.06T15:49:56]

Query parameters | Log

Showing 1 to 10 of 27 entries

Search:

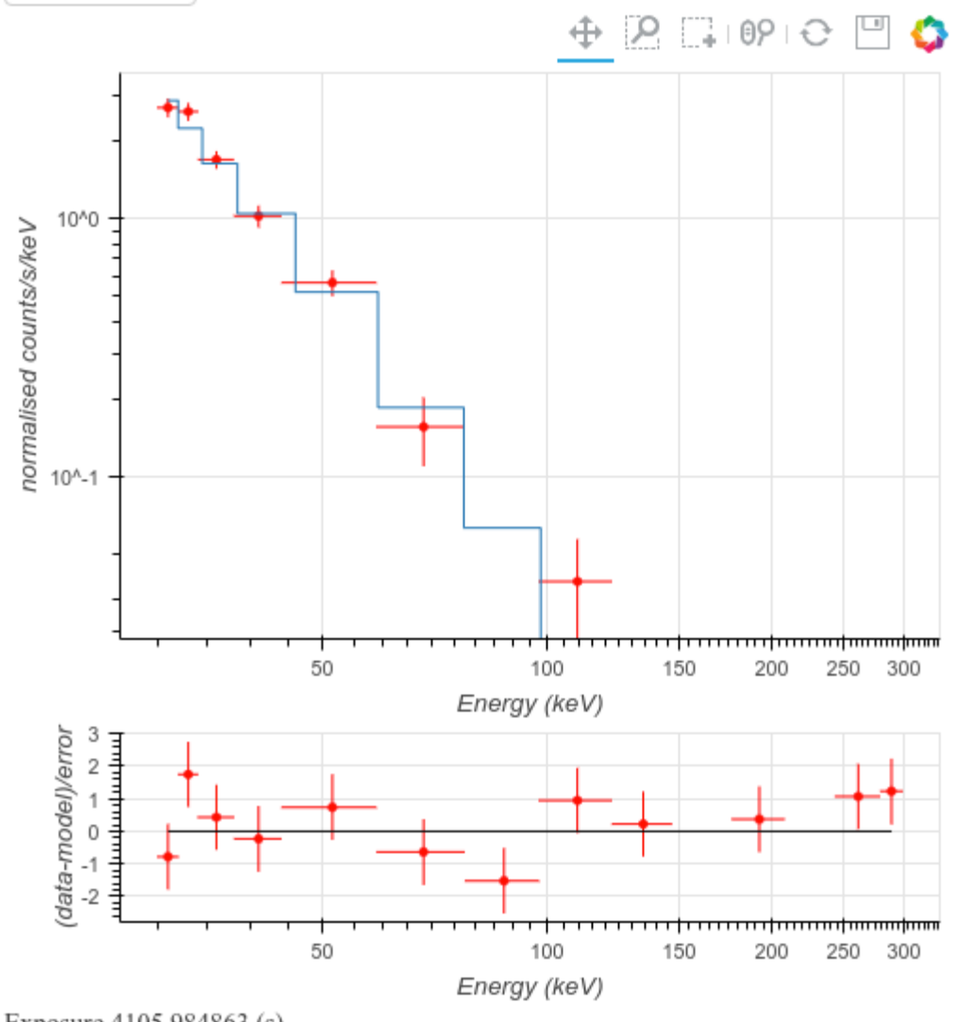
Source Name	Xspec Model	Spectrum
1E 1740.7-2942	powerlaw	Fit
1RXS J175113.3-20121	powerlaw	Fit
4U 1700-377	powerlaw	Fit
4U 1722-30	powerlaw	Fit
Background	powerlaw	Fit
GRS 1758-258	powerlaw	Fit
GX 1+4	powerlaw	Fit
GX 349+2	powerlaw	Fit
GX 354-0	powerlaw	Fit
GX 5-1	powerlaw	Fit

Show 10 entries Previous 1 2 3 N

100 200 300 40

Source : 4U 1700-377 [2018.11.06T16:23:11]

Download



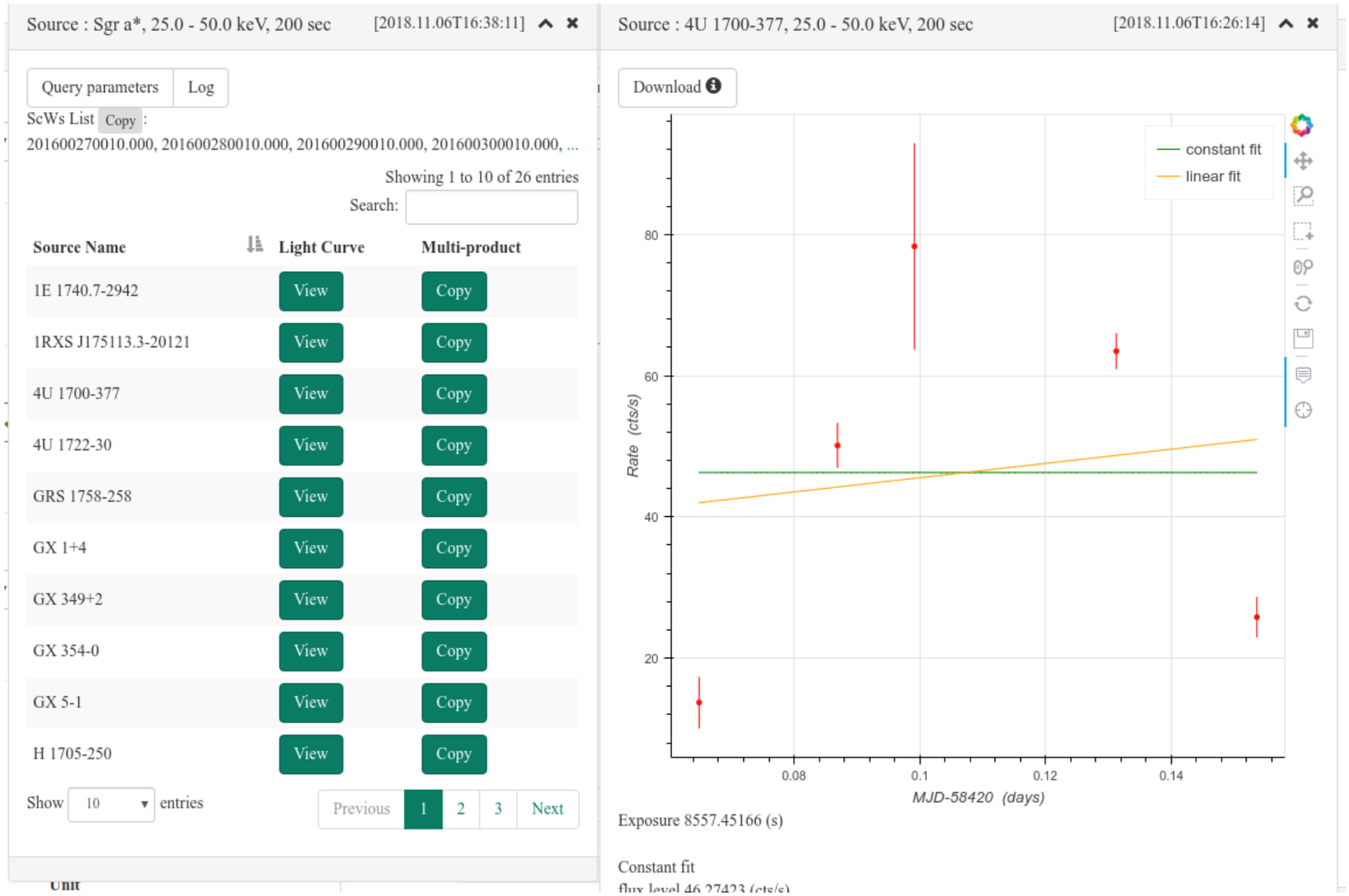
Exposure 4105.984863 (s)
Fit report for model powerlaw

Component	Par name	Value	UnitsError	Range-	Range+
powerlaw	PhoIndex	3.35404	0.17823	3.52918	3.68167
powerlaw	norm	180.31172	97.54068	349.13805	578.22412

dof 104
Chi-squared 131.64611

ODA 1.0 Light curves

- From the catalog, you can create light curves with time bins larger than 10 seconds as for OSA limitations and display them individually
- Here at science window resolution
- Downloaded in OGIP format



Reproducible and storable

- The system is built with internal cache to save intermediate products.
- The second time you make the same query, results are almost instantaneous.
- Backend can be deployed virtually anywhere, because it is based on a “singularity” cluster, which runs science windows in parallel.
- Singularity is very similar to docker as a principle, it runs virtual machines with OSA inside and passes commands while returning results

ODA current limitations

- We have very limited computing resources and virtually no sysadmin supports (self administrated cluster)
- We need to limit science window number to 50 to avoid overcharge (it can be changed)
- We have very limited human resources (~2 FTEs)
- We have implemented Polar, SPI-ACS,IBIS VETO, and JEM-X.

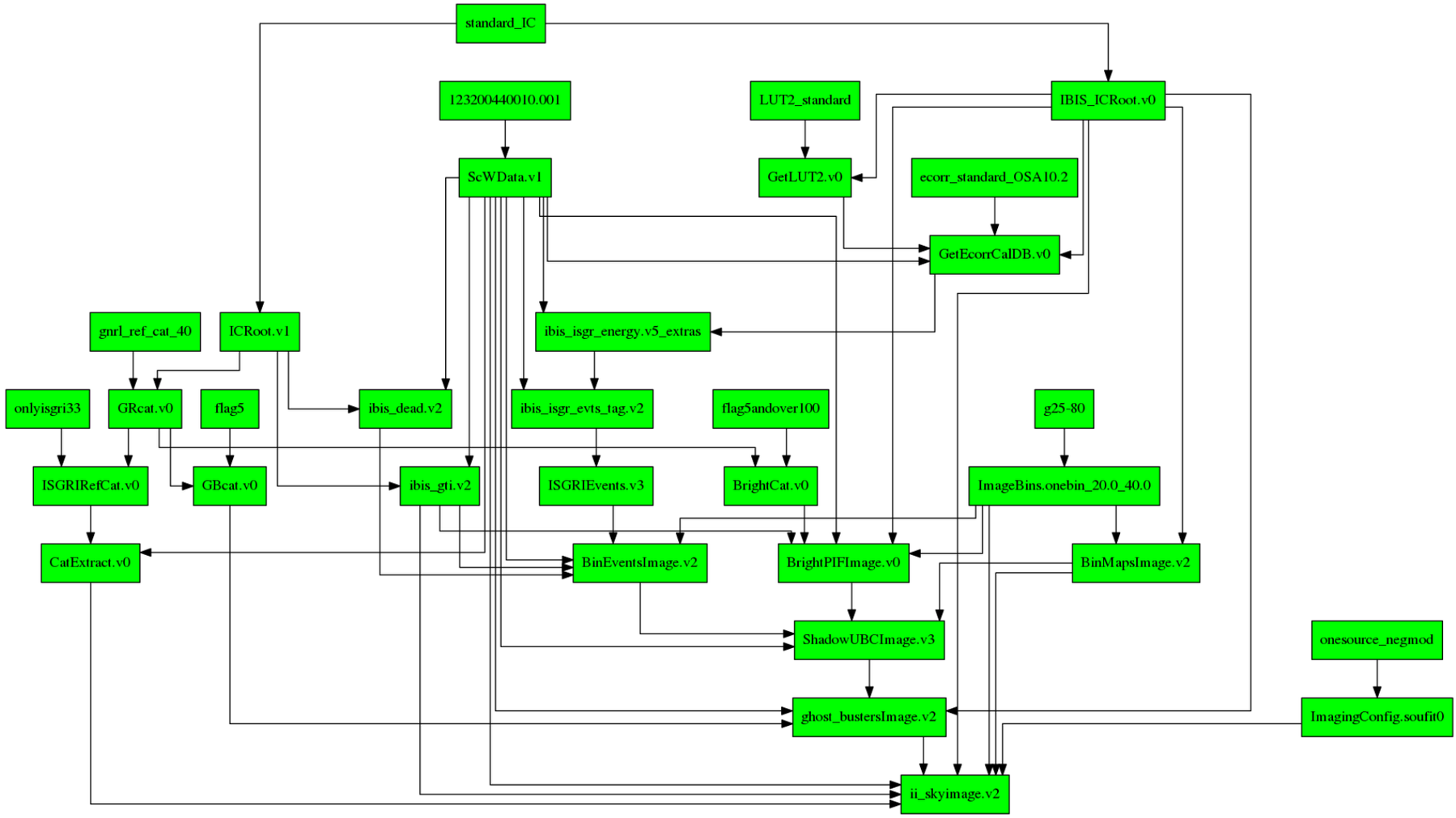
Dynamic worklflows instead of data

- The abstract concept of workflow is a “morphism of data”: the full procedure bringing from raw data to usable results and also their standardized analysis
- The workflow is based on a backend that builds the arborescence using the concept of class inheritance (with python). OSA is plugged into this framework using deployable software containers.
- Workflow can be materialized into a web interface
- Workflow can be materialized into a jupyter notebook

- Reproducibility is ensured, because changes are tracked into repositories (github) and they could, in principle, be explored.

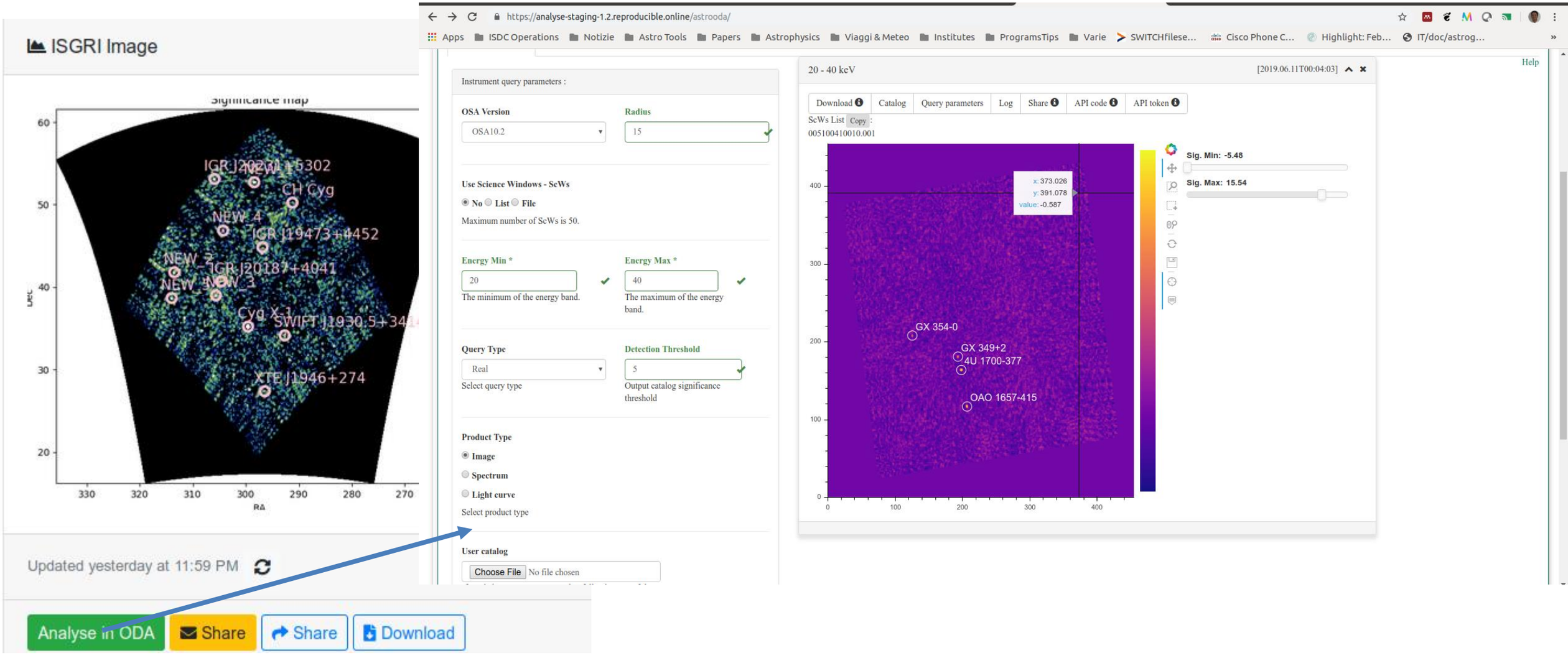
- The building blocks are already available, but we need to develop usability.

Future plans and wishes



- The current archive of cached data is constructed with a lineage of data and dependencies as in a arborescence, a noSQL database.
- User requests will effectively create an archive of results accessible with a limited latency.
- For a *legacy archive*, we should also create a SQL data base of pre-computed results with active links to the processing. This will allow an easy access to spectra, light curves and images.

A prototype of data gallery



- We plan to populate an archive of relevant results with links to the online analysis results (images,spectra lightcurve), but above all to the workflow having generated it.

- With a simple click, we can pass from the image to the workflow producing it. Access source files and in case modify the analysis.

Transient event dashboard

- Every input (GCN notice) is automatically processed and it generates results.
- We developed a repository of “manually checked” results with public static results (layout to be improved)
- Link to the workflow is private

- Limiting factor in development is manpower

The private dashboard to work on data

https://analyse.reproducible.online/transients/dashboard/

INTEGRAL status

Snapshot at 2019-06-09T18:16:25 UTC

Orbit 2100, 151.93 Mm to Earth

	State/last	Latency	RA	Dec
Real-time	ONLINE	66.0 s	4.7	59.6
NRT	210000250010	1.2 h	4.3	61.7
CONS	209000990010	25.3 d	320.0	-45.0

INTEGRAL status Schedule

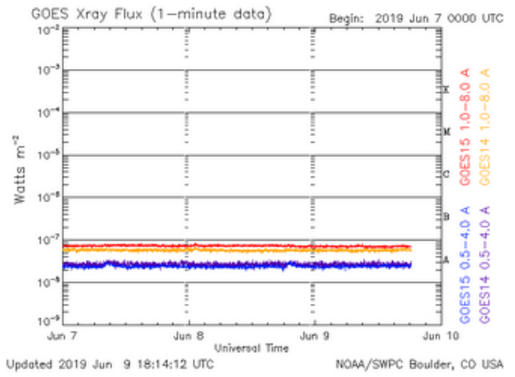
next break in data in 29 hr: 2019-06-10T23:32:59, for 9.6 hr

Gravitational Wave Detector Network

Operational Snapshot as of Jun 09, 18:16 UTC

Detector	Status	Duration
GEO 600	Observing	2:40
LIGO Hanford	Observing	15:40
LIGO Livingston	Observing	9:08
Virgo	Troubleshooting	2:53
KAGRA	Future addition	

Detector status summary pages LVC links

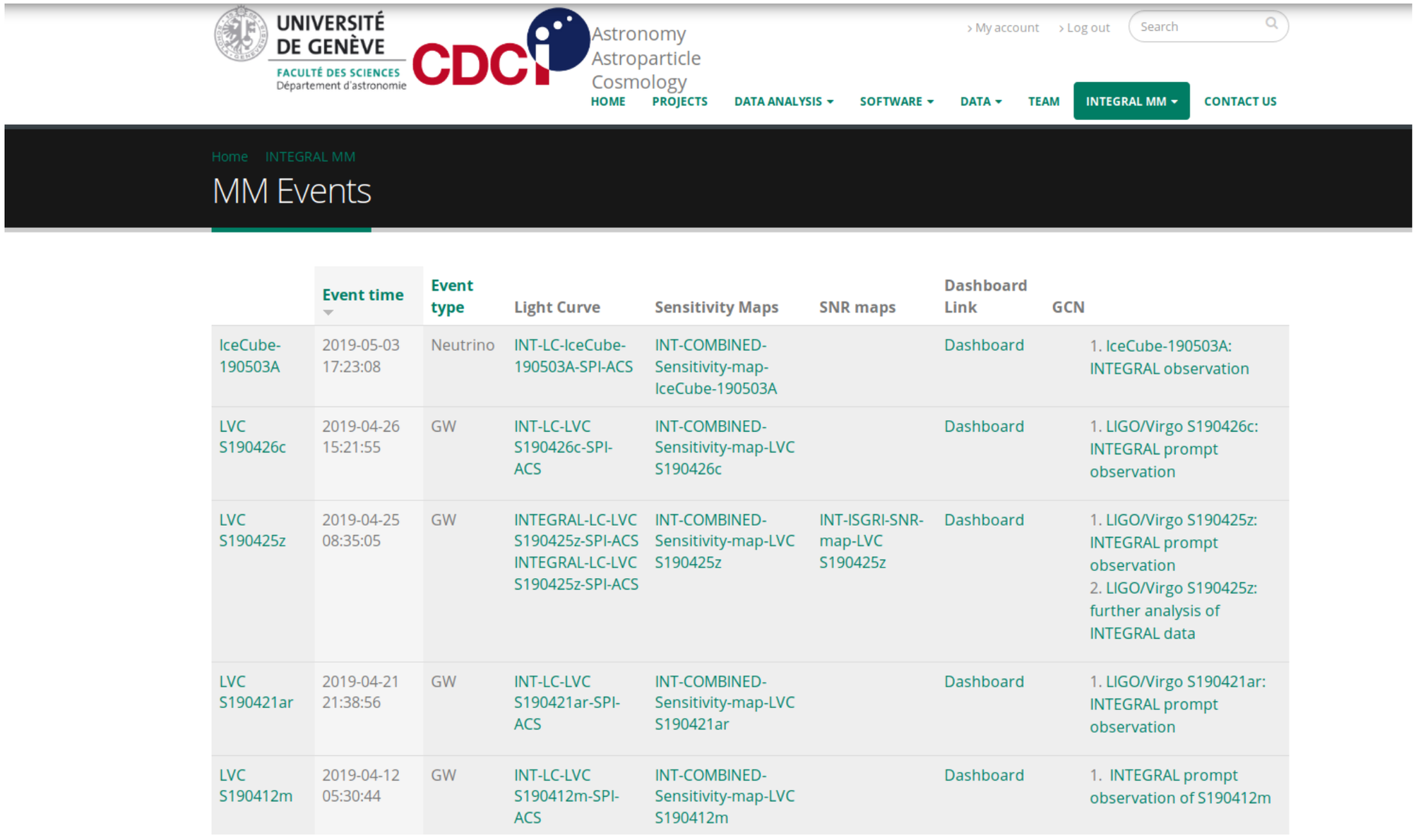


Events Observations LIGO/Virgo AMON/IceCube INTEGRAL SPI-ACS Fermi All

Event	Origin	Role	UTC	Sky Location	Orientation (θ, φ)	FoV exposure	ScW	Data	Visibility	Planning urgency	Raw Notice
S190602aq	LIGO Virgo	observation	2019-06-02T17:59:27.0	73.39 -7.03	bottom (127.8, -20.2)	0.0 ks	209700520010	NRT	1.3%		VOEvent JSON
S190602aq	LIGO Virgo	observation	2019-06-02T17:59:27.0	73.39 -7.03	bottom (127.8, -20.2)	0.0 ks	209700520010	NRT	1.3%		VOEvent JSON
S190602aq	LIGO Virgo	observation	2019-06-02T17:59:27.0	73.39 -7.03	bottom (127.8, -20.2)	0.0 ks	209700520010	NRT	1.3%		VOEvent JSON

An internal limited interface (with public links)

https://www.astro.unige.ch/cdci/mm-events



Event time	Event type	Light Curve	Sensitivity Maps	SNR maps	Dashboard Link	GCN
IceCube-190503A	2019-05-03 17:23:08	Neutrino	INT-LC-IceCube-190503A-SPI-ACS	INT-COMBINED-Sensitivity-map-IceCube-190503A		Dashboard	1. IceCube-190503A: INTEGRAL observation
LVC S190426c	2019-04-26 15:21:55	GW	INT-LC-LVC S190426c-SPI-ACS	INT-COMBINED-Sensitivity-map-LVC S190426c		Dashboard	1. LIGO/Virgo S190426c: INTEGRAL prompt observation
LVC S190425z	2019-04-25 08:35:05	GW	INTEGRAL-LC-LVC S190425z-SPI-ACS INTEGRAL-LC-LVC S190425z-SPI-ACS	INT-COMBINED-Sensitivity-map-LVC S190425z	INT-ISGRI-SNR-map-LVC S190425z	Dashboard	1. LIGO/Virgo S190425z: INTEGRAL prompt observation 2. LIGO/Virgo S190425z: further analysis of INTEGRAL data
LVC S190421ar	2019-04-21 21:38:56	GW	INT-LC-LVC S190421ar-SPI-ACS	INT-COMBINED-Sensitivity-map-LVC S190421ar		Dashboard	1. LIGO/Virgo S190421ar: INTEGRAL prompt observation
LVC S190412m	2019-04-12 05:30:44	GW	INT-LC-LVC S190412m-SPI-ACS	INT-COMBINED-Sensitivity-map-LVC S190412m		Dashboard	1. INTEGRAL prompt observation of S190412m

The complete set at LIGO and Virgo

GraceDB — Gravitational Wave Candidate Event Database

HOME | SEARCH | LATEST | DOCUMENTATION | LOGIN

Latest — as of 11 June 2019 08:29:34 UTC

Test and MDC events and superevents are not included in the search results by default; see the query help for information on how to search for events and superevents in those categories.

Query:

Search for: Superevent

Search

UID	Labels	t_start	t_0	t_end	FAR (Hz)	Created (UTC)
S190602aq	PE_READY ADVOK SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM_SENT	1243533584.081266	1243533585.089355	1243533586.346191	1.901e-09	2019-06-02 17:59:51 UTC
S190524q	ADVNO SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM_SENT	1242708743.678669	1242708744.678669	1242708746.133301	6.971e-09	2019-05-24 04:52:30 UTC
S190521r	PE_READY ADVOK SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM_SENT	1242459856.453418	1242459857.460739	1242459858.642090	3.168e-10	2019-05-21 07:44:22 UTC
S190521g	PE_READY ADVOK SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM_SENT	1242442966.447266	1242442967.606934	1242442968.888184	3.801e-09	2019-05-21 03:02:49 UTC
S190519bj	PE_READY ADVOK SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM_SENT	1242315361.378873	1242315362.655762	1242315363.676270	5.702e-09	2019-05-19 15:36:04 UTC
S190518bb	ADVNO SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM_SENT	1242242376.474609	1242242377.474609	1242242380.922655	1.004e-08	2019-05-18 19:19:39 UTC
S190517h	PE_READY ADVOK SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM_SENT	1242107478.819517	1242107479.994141	1242107480.994141	2.373e-09	2019-05-17 05:51:23 UTC
S190513bm	ADVOK SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM_SENT	1241816085.736106	1241816086.869141	1241816087.869141	3.734e-13	2019-05-13 20:54:48 UTC
S190512at	PE_READY ADVOK SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM_SENT	1241719651.411441	1241719652.416286	1241719653.518066	1.901e-09	2019-05-12 18:07:42 UTC
S190510g	ADVOK SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM_SENT	1241492396.291636	1241492397.291636	1241492398.293185	8.834e-09	2019-05-10 03:00:03 UTC
S190503bf	ADVOK SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM_SENT	1240944861.288574	1240944862.412598	1240944863.422852	1.636e-09	2019-05-03 18:54:26 UTC
S190426c	PE_READY ADVOK SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM_SENT	1240327332.331668	1240327333.348145	1240327334.353516	1.947e-08	2019-04-26 15:22:15 UTC
S190425z	ADVOK SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK	1240215502.011549	1240215503.011549	1240215504.018242	4.538e-13	2019-04-25 08:18:26 UTC
S190421ar	PE_READY ADVOK SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM_SENT	1239917953.250977	1239917954.409180	1239917955.409180	1.489e-08	2019-04-21 21:39:16 UTC
S190412m	PE_READY ADVOK SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM_SENT	1239082261.146717	1239082262.222168	1239082263.229492	1.683e-27	2019-04-12 05:31:03 UTC
S190408an	PE_READY ADVOK SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK GCN_PRELIM_SENT	1238782699.268296	1238782700.287958	1238782701.359863	2.811e-18	2019-04-08 18:18:27 UTC
S190405ar	ADVNO SKYMAP_READY EMBRIGHT_READY PASTRO_READY DQOK	1238515307.863646	1238515308.863646	1238515309.863646	2.141e-04	2019-04-05 16:01:56 UTC

LIGO VIRGO LSC

Time-domain astronomy

- MoU with Antares
- MoU with IceCube for non-public alerts
- LVC issues public notices

- Implemented the real-time dump of SPI-ACS stream to be used in fast triangulation with GBM and IPN satellites.
- Developed an API to access real-time services via python notebook and quickly react to alerts
- System of “burst advocates”