

eROSITA (early) Science: Performance Verification plan

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eROSITA Performance Verification

- Goals of the PV phase:
 - to demonstrate the ability of eROSITA to achieve its foremost scientific goals;
 - to make both the eROSITA scientific teams and the scientific community at large aware of the instrument capabilities and of the forecasted impact of the mission.
- “It is expected that the eROSITA PV phase will enable highly competitive early scientific programs, which will lead to a series of publications in refereed scientific journals.”
- The Ru-De Joint committee originally agreed to dedicate ~20 days (~1.73Ms) to PV observations, with half of the observations led by Russian PIs, half by German PIs

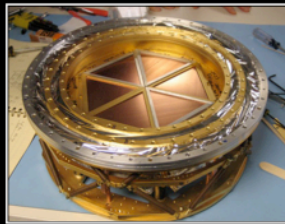
The South Pole Telescope (SPT)

10-meter sub-mm quality wavelength telescope

95, 150, 220 GHz and
1.6, 1.2, 1.0 arcmin resolution

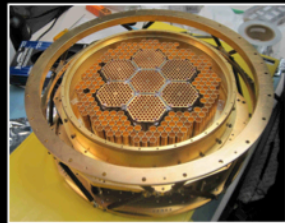
2007: SPT-SZ

960 detectors
95, 150, 220 GHz



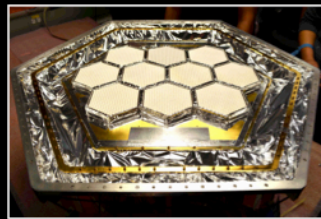
2012: SPTpol

1600 detectors
95, 150 GHz
+Polarization

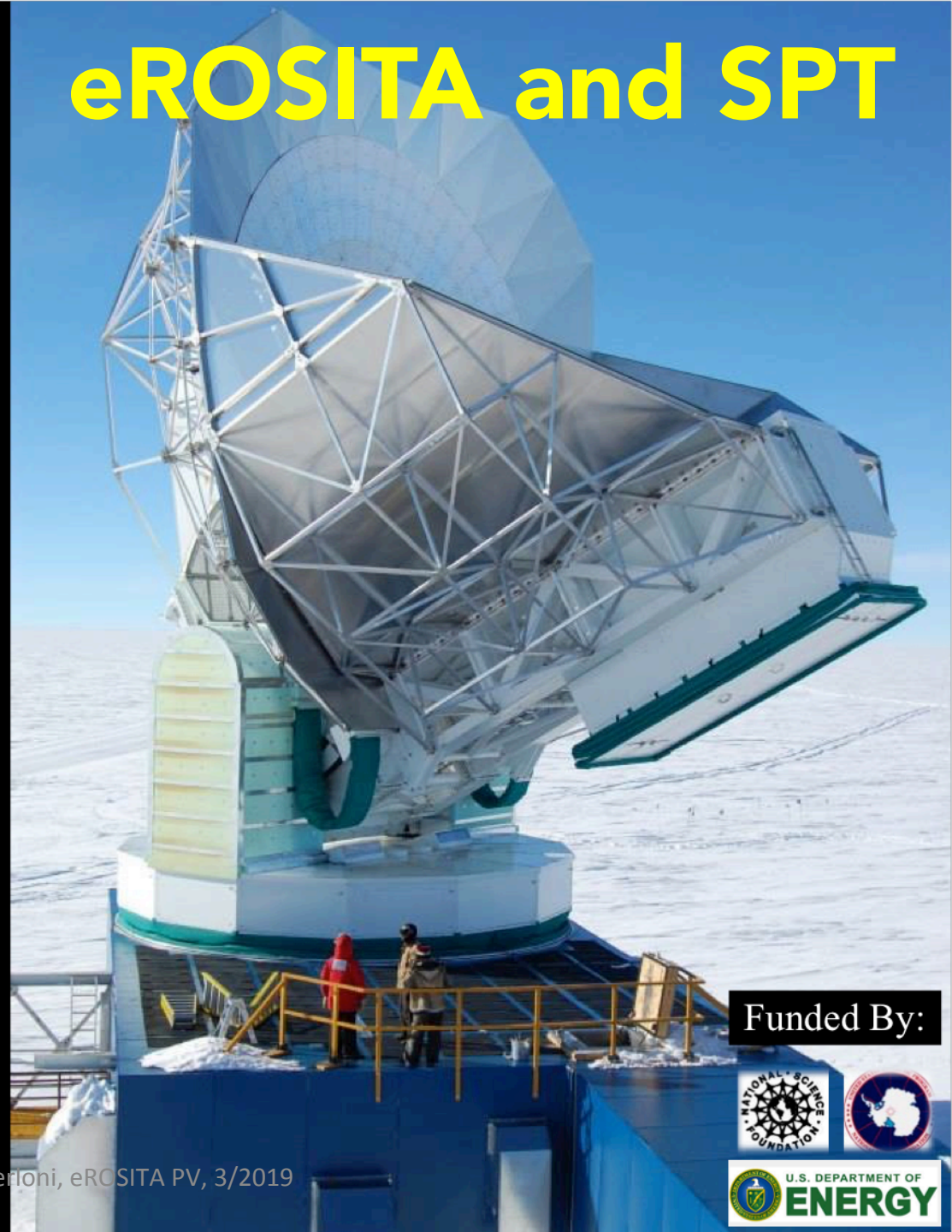


2017: SPT-3G

~16,000 detectors
95, 150, 220 GHz
+Polarization



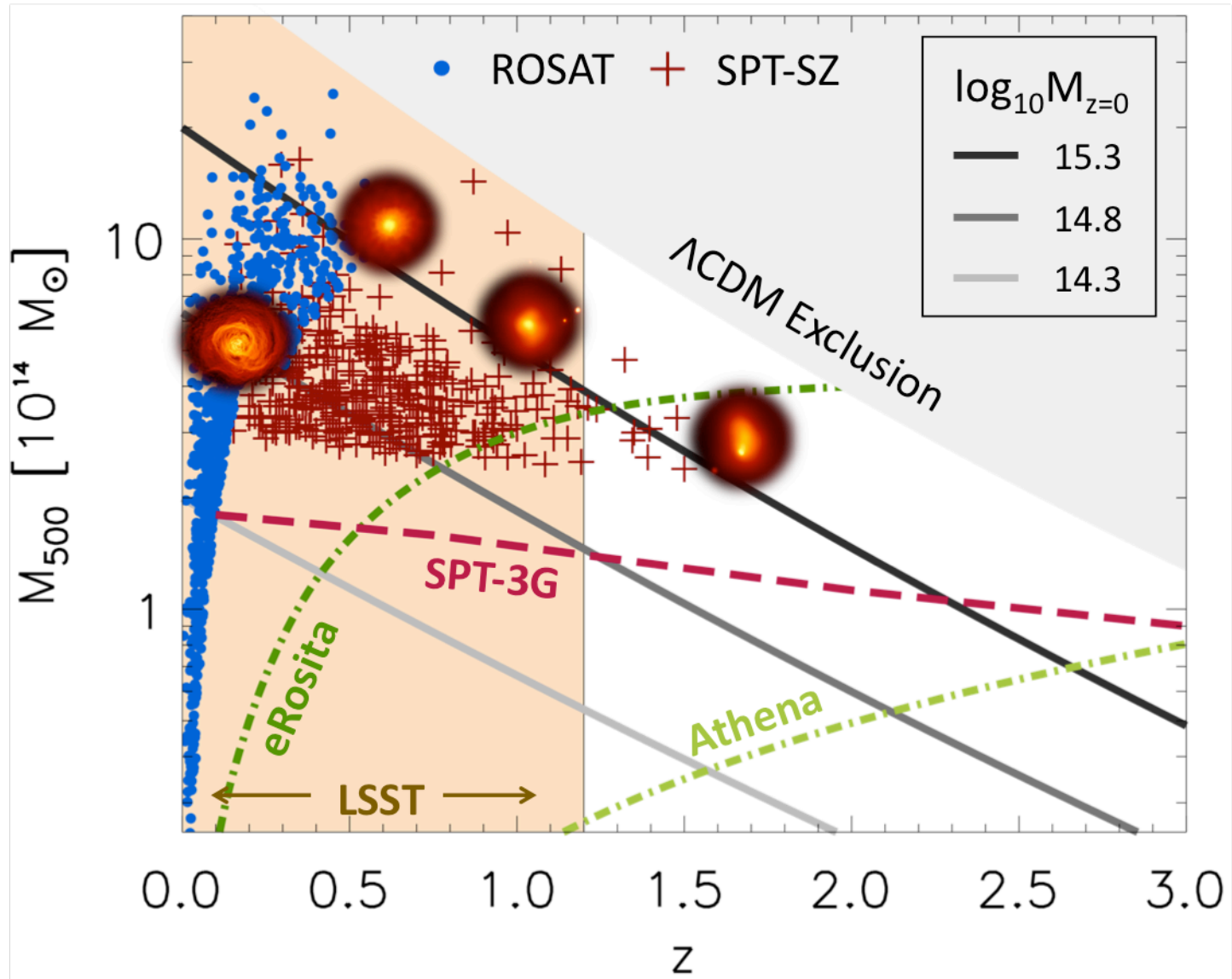
eROSITA and SPT



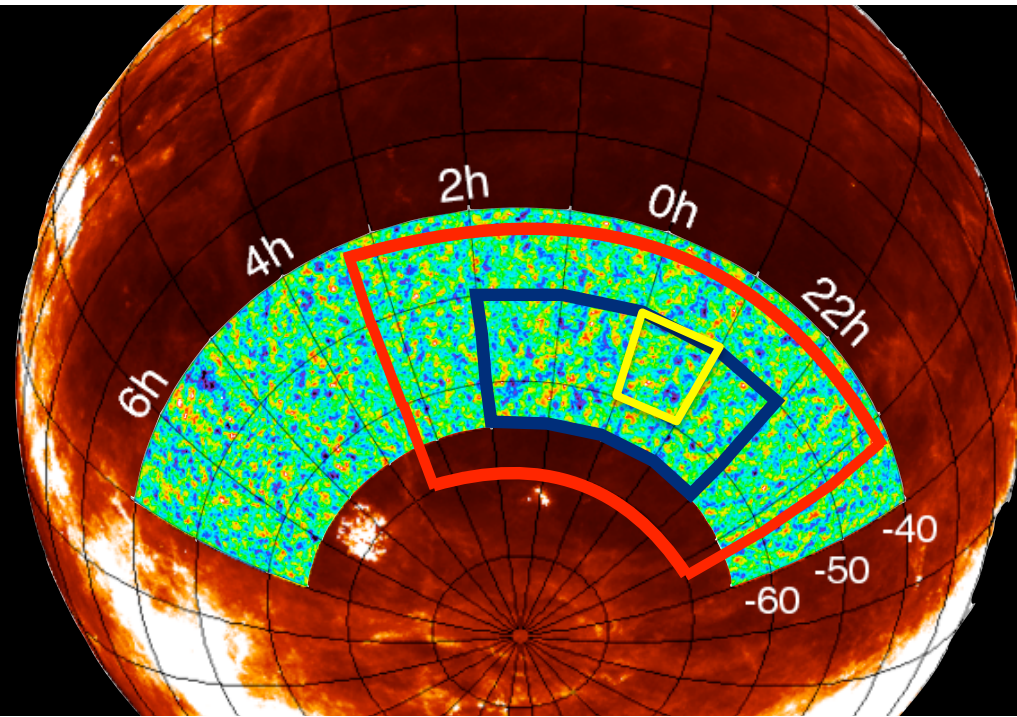
Funded By:



eROSITA and SPT



SPT deep and eROSITA PV



SPTpol (blue):
500 sq degree
T: 5 (12) μK

SPT-3G (red):
4 year survey
1500 sq degree

The JC will extend the PV phase by ~ 10 days to allow the coverage of the SPT deep field to $\sim 8\text{ks}$ depth

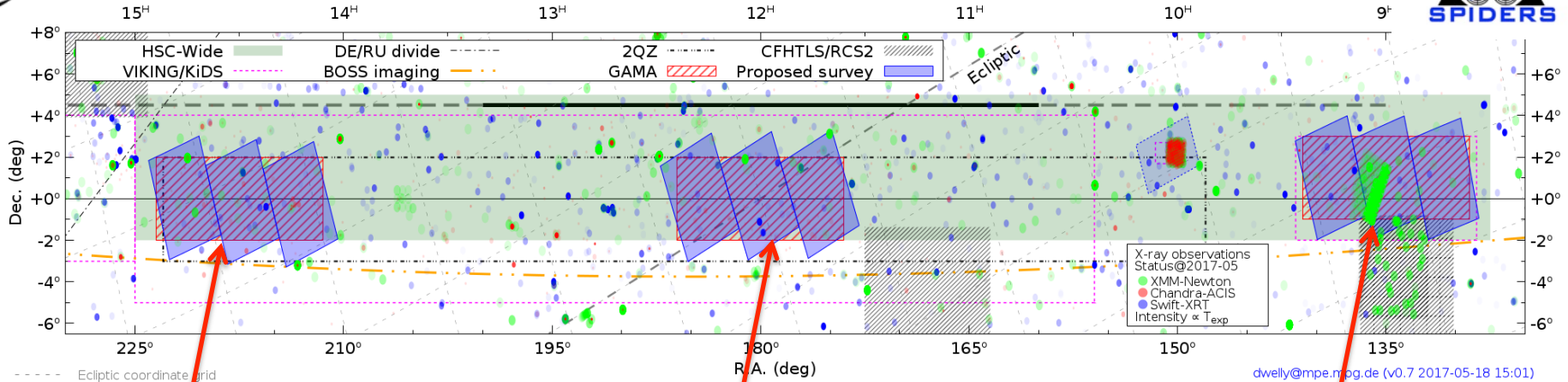
SPT deep field (yellow)
 ~ 100 sq degree

New (provisional) CalPV phase for June 21/July 12 launch date

- June 21: August 27 – October 25*
- July 12: September 17 – November 25*

* Include the additional 10 days for SPT field

PI	Title	WG	Time	Target	Mode	Hemi.	Visibility
Boller	eROSITA PV Studies using Ultrasoft NLS1	AGN	40ks	1H0707	PO	De	Always
Dennerl	Mars	Solar System	40ks (TBC)	Mars	PO	De & Ru	N/A
Freyberg	Utilizing the new window to carbon-line astrophysics of the Local ISM	SNR, Diffuse Emission	60ks	Cha III	PO	De	2019.07.12 – 2019.10.19
Georgakakis & Finoguenov	The eROSITA Final Equatorial-Depth Survey (eFEDS)	AGN & Clusters	350ks	2 fields, ~120deg ²	FS 2x[60 deg ²]	De	G09: 2019.10.14 – 2019.12.16 [14.-26.10] G12: 2019.11.25 – 2020.01.16 [25.11-07.12]
Rau	Testing the NRTA Transient Detection	Time Domain Astrophysics	N/A	N/A	N/A	De	N/A
Reiprich	eROSITA's First Galaxy Cluster Outskirts and WHIM Detection	Clusters	100ks	A3391/3395	FS [2.5x2.5 deg ²]	De	Always
Robrade	The nearby stellar cluster η Chamaeleontis	Stars	150ks	η Cham.	FS [5x5 deg ²]	De	Always
Schwobe	Phase-resolved spectroscopy of the INS RBS1223	Compact Objects	100ks	RBS1223	PO	De	2019.12.06 – 2020.01.20
Wilms	An <i>eROSITA</i> PV observation of an ultraluminous X-ray pulsar	Time Domain Astrophysics	60ks	NGC 7793 P13	PO	De	2019.11.14 – 2019.12.30
JC	SPTpol deep field		TBD	SPTpol	FS [10x10 deg ²]	De	2019-10-09 – 2019-12-25 [9.10-30.10]



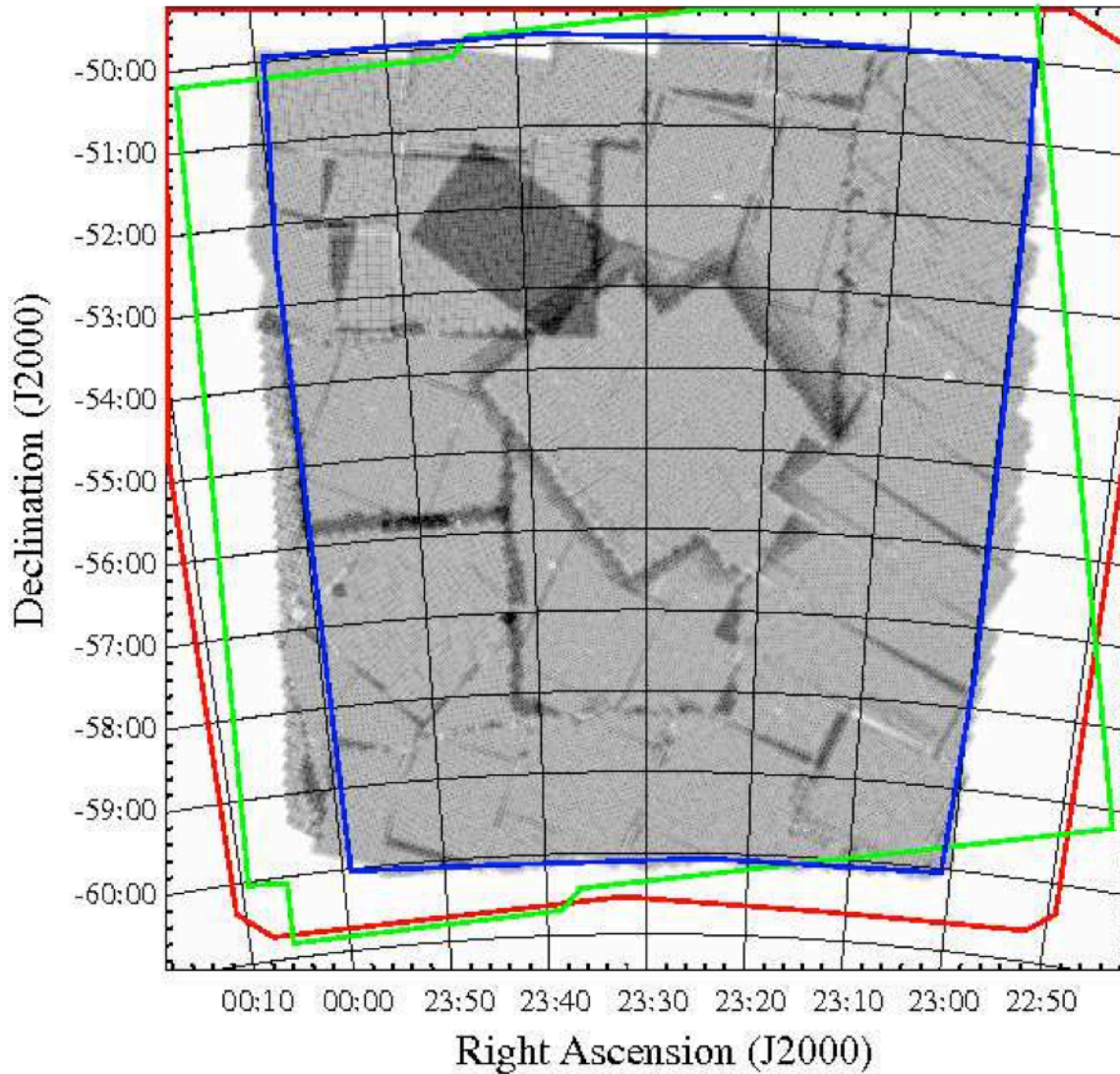
14.5hr: visible if launch within
Sep.20 $<T_0 <$ Jan 15

12hr: visible if launch within
Aug 10 $<T_0 <$ Nov. 30

9hr: visible if launch date
within Jun.23 $<T_0 <$ Sep.15

- Main goals: Clusters Mass calibration (HSC lensing, dynamics)
- AGN evolution, luminous AGN host properties
- Projects under discussion:
 - Radio coverage (LOFAR, ASKAP)
 - Spectroscopic coverage (GAMA + ...)

SPT deep field



Red: SPT
Green: Herschel/SPIRE
Blue: ATCA
Grey: Spitzer

Russian-led PV project (TBC)

Clusters of galaxies

Target	Area	Exposure	Visibility (VISCAL)
Coma	3x3 degree mosaic	160 ksec	29.05 – 18.07
Coma	5x3 degree mosaic along the Coma- A1367 line	200 ksec	29.05 – 18.07
A399/401	3 pointings along the line connecting 2 clusters	80 ksec	18.07 – 29.08
A133	1x1 degree mosaic centered on the cluster	80 ksec	03.06 – 20.07

Russian-led PV project (TBC)

Normal galaxies

Target	Area	Exposure	Visibility (VISCAL)
M31	3x1 degree along the major axis of the galaxy	80 – 160 ksec	25.06 – 14.08
M51	1 pointing	60 ksec	13.05 – 20.07
M101	1 pointing	60 ksec	02.05 – 30.07
M81	1 pointing	60 ksec	16.03 – 24.05
M82	1 pointing	60 ksec	15.03 – 24.05

Russian-led PV project (TBC)

Halos around isolated massive galaxies

Target	Area	Exposure	Visibility (VISCAL)
NGC 57	1 pointing	60 ksec	11.06 – 24.07
NGC 720	1 pointing	60 ksec	21.06 – 05.08

Russian-led PV project (TBC)

SNR, Local bubble etc

Target	Area	Exposure	Visibility (VISCAL)
Cygnus Loop	1 pointing	30 ksec	18.04 – 18.06
Draco cloud	1x1 degree mosaic	40 ksec	any time
SS433	1 pointing	30 ksec	18.03 – 03.05

Russian-led PV project (TBC)

Mini-surveys

Target	Area	Exposure	Visibility (VISCAL)
Lockman hole or another low NH extragal. field	10-30 sq.degr. to the depth of 8 ksec	100-300 ksec	06.04 – 05.06 (l=150, b=53) 28.04 – 27.07 (l=108, b=60) 01.06 – 08.08 (l=75, b=67)
Deep ACT field in the Northern sky	10 sq.degrees to the depth of 8 ksec	100 ksec	05.07 – 16.08 (l=165, b=-55) 26.05 – 06.07 (l=85, b=-59)

German-Russian collaboration on PV projects (draft)

- The data of all PV observations are available immediately to both consortia (cross-checking and performance verification purposes)
- For each approved observation, one or more projects will be identified. The proposing consortium appoints a PI for each project
- Co-Is will be identified for each project **from both consortia**: Individual members of each collaboration may apply to become involved in any project led by the counterpart team.
- The PIs review the proposals, and they can accept them if they are considered useful and valuable. Need to ensure no duplication of work, and a fair and balanced distribution of tasks between the teams.
- JC will be called to solve conflicts.
- Publications resulting from PV approved projects will have to be announced to the JC and the consortia as such.
- The data rights remain with the proposing consortium for any subsequent scientific use beyond the announced publications. The proprietary period can last up to 2 years, counted from the time (defined by JC) when stable and approved calibration data and software become available.
- The PIs of approved PV projects negotiates collaborations with 3rd parties on all projects based on PV data. Collaborations that require sharing eROSITA PV data with 3rd parties will have to be approved by the JC.