STELLAR

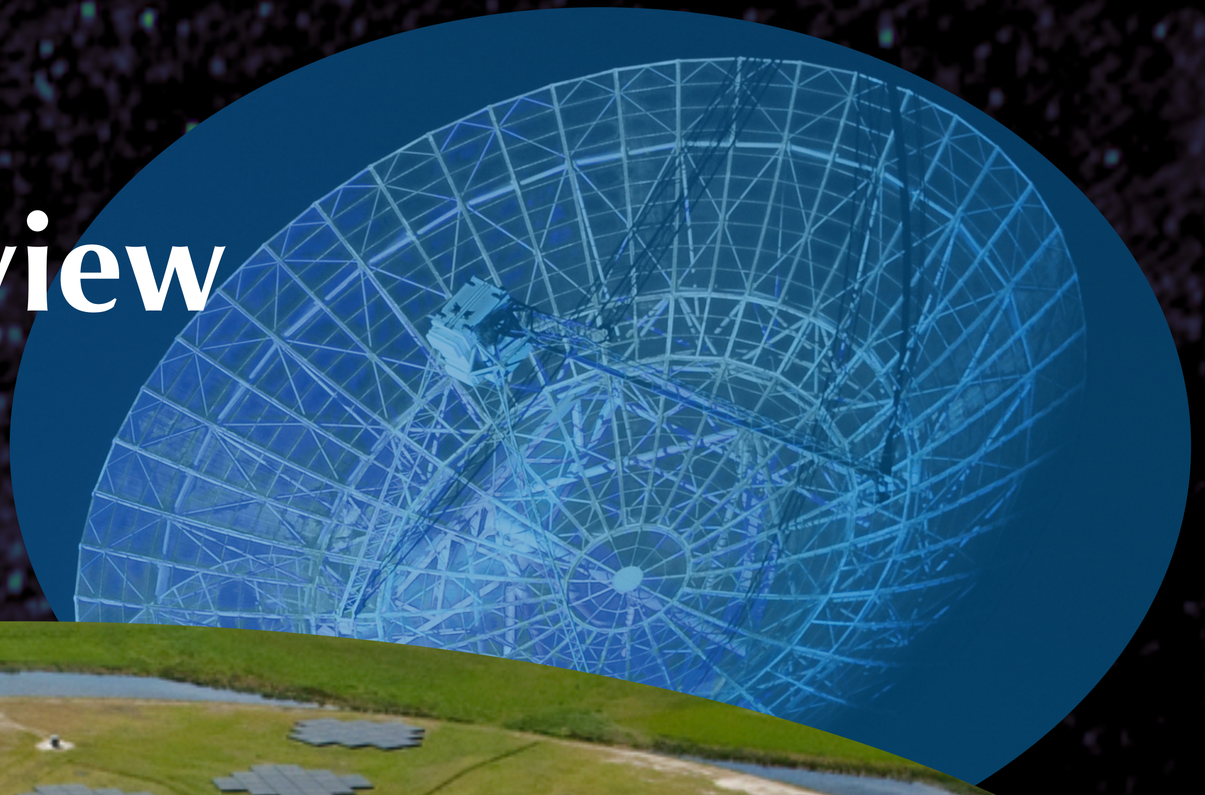
APERTIF
APERture Tile In Focus

LOFAR

ASTRON
Netherlands Institute for Radio Astronomy

Apertif system overview

Emanuela Orru'
Head of Apertif Telescope Operations



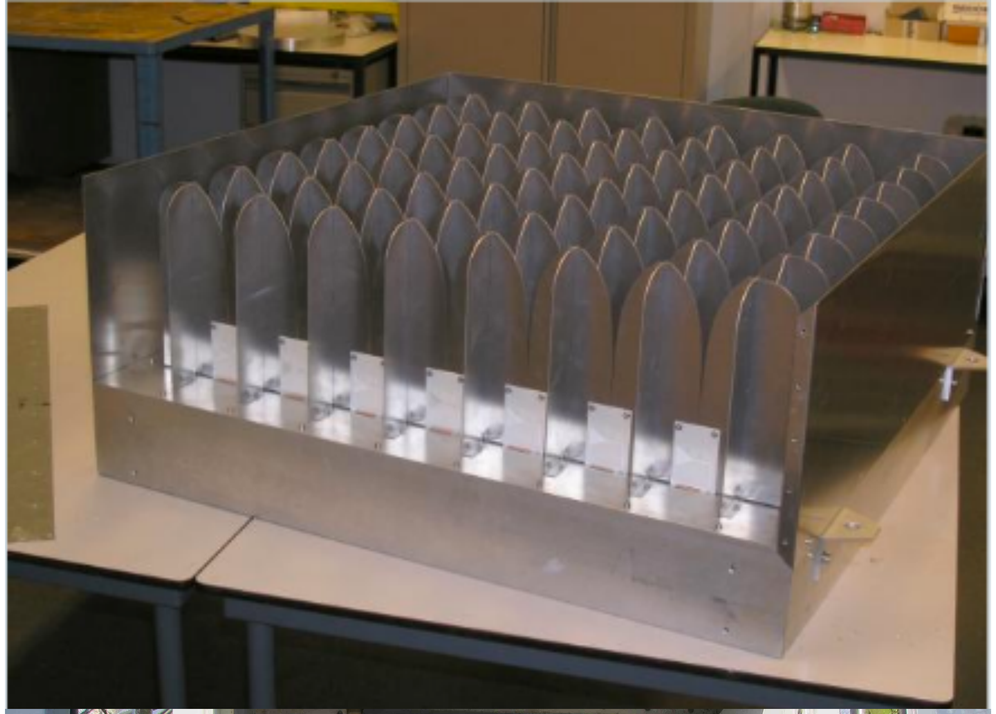
ASTRON / Leon Hiemstra / Joeri van Leeuwen

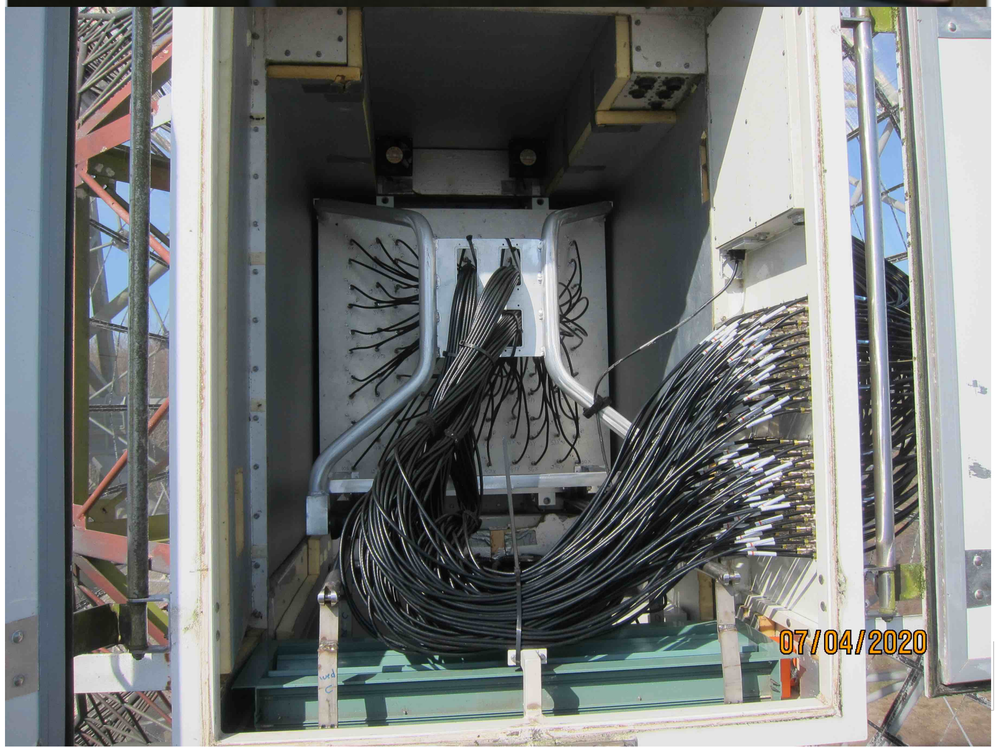
Phased Array Feed

(PAF) system installed on 12 (WSRT) dishes

PAF consists of 121 electrically connected Vivaldi antennas with integrated LNA (low noise amplifiers),

60 of which measure X polarised signal and 61 of them recording Y polarised emission.



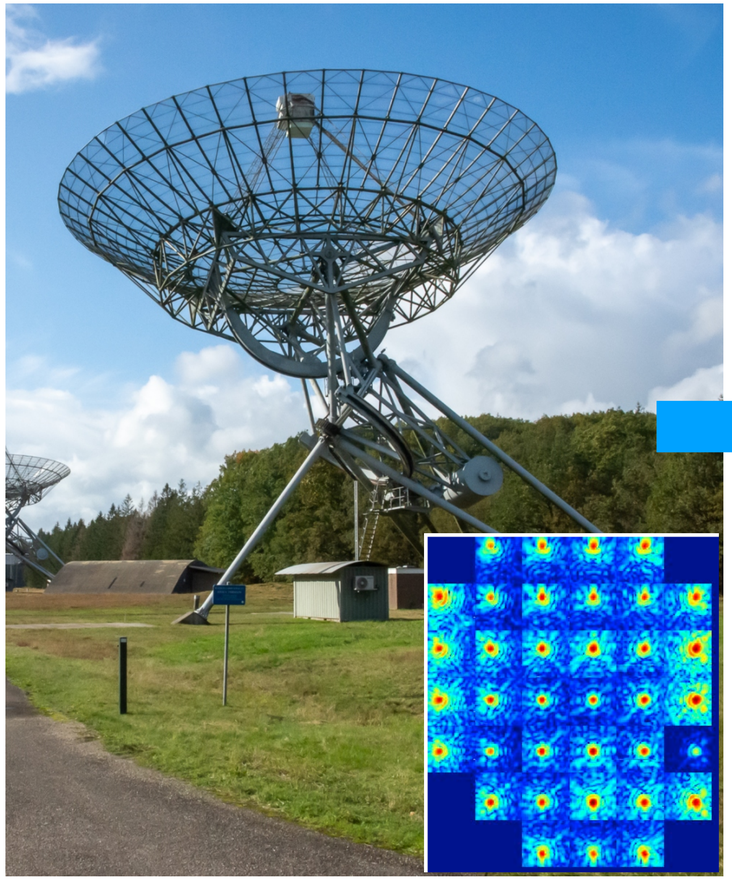


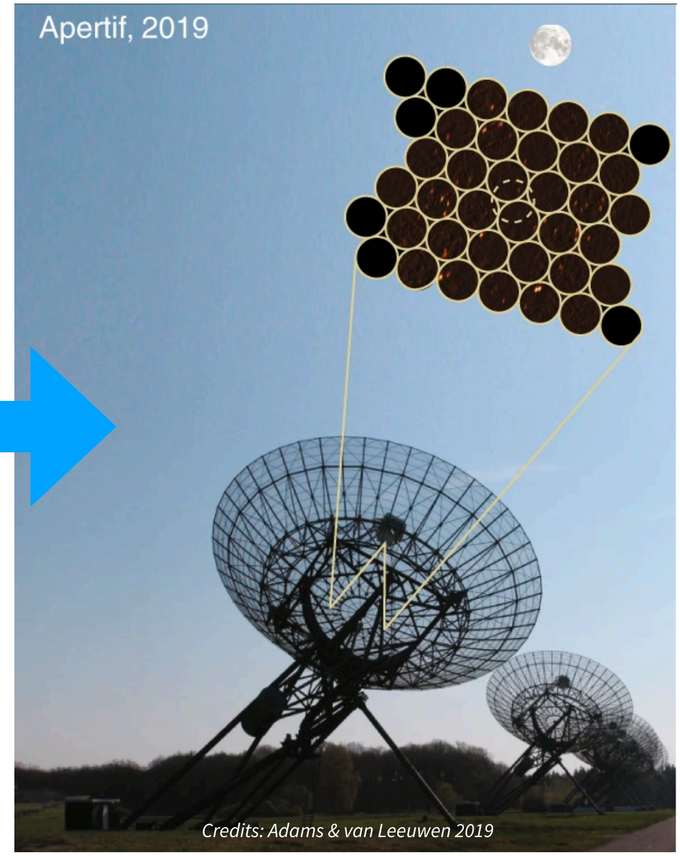
Apertif: wide Bandwidth and FOV

Operational since July 1st 2019

Frequency range 1130 -1750 MHz

40 digital beams formed with an instantaneous bandwidth of 300 MHz.

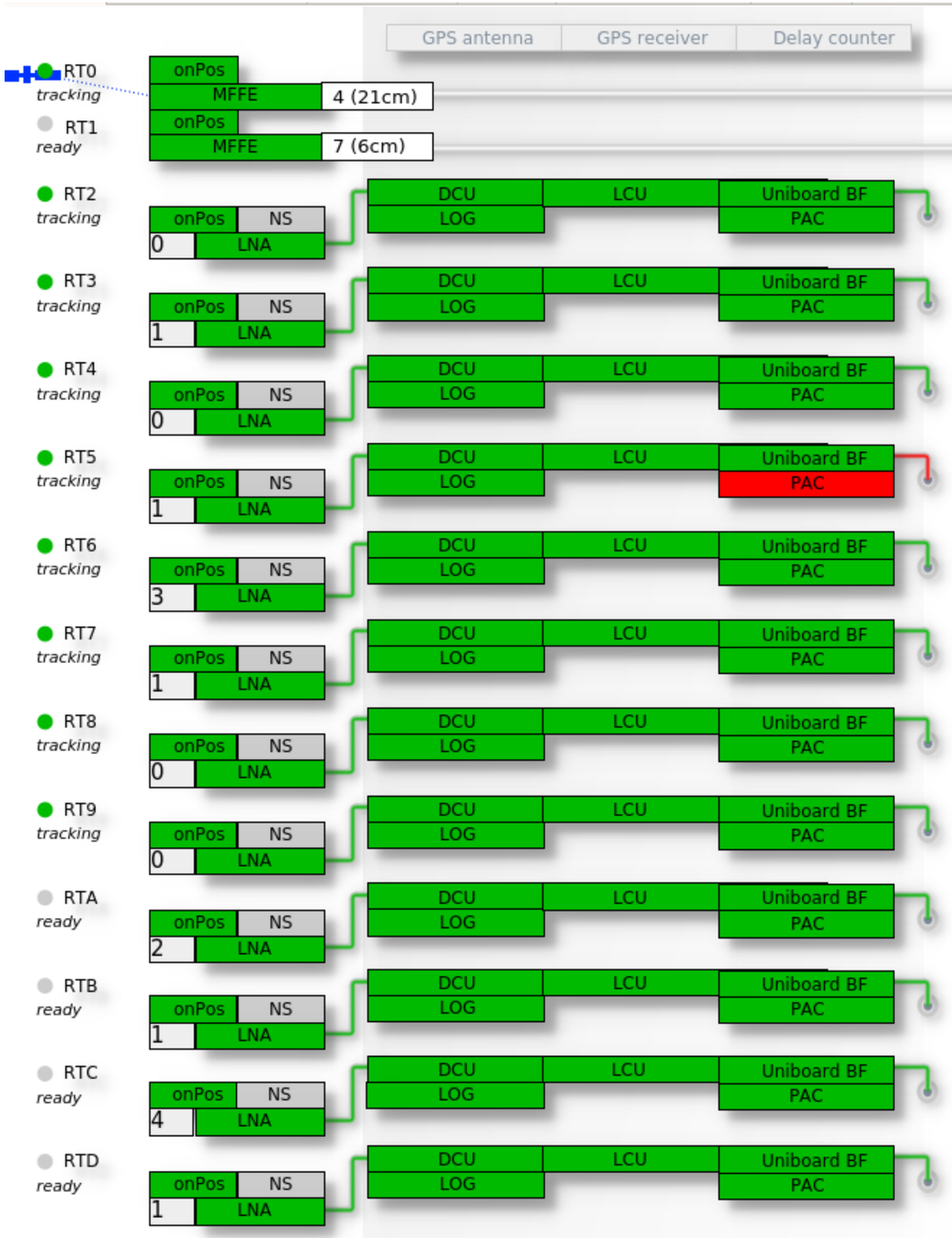


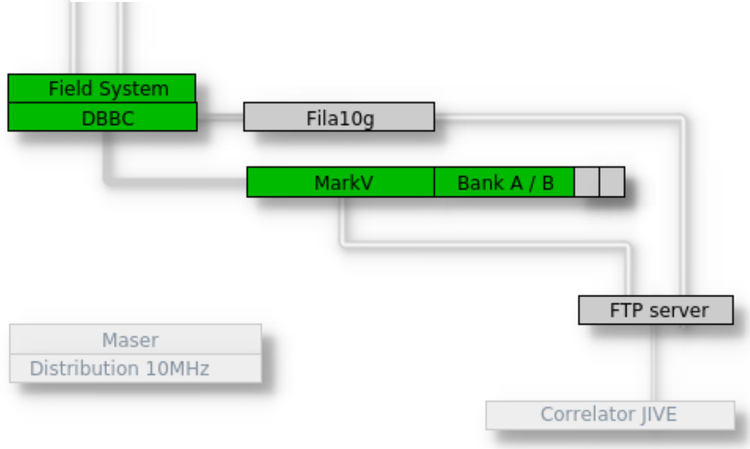


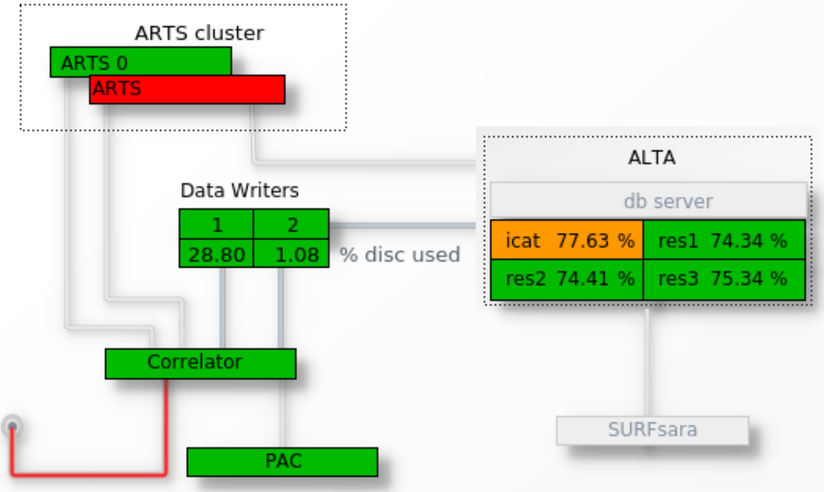
…a perfect survey instrument

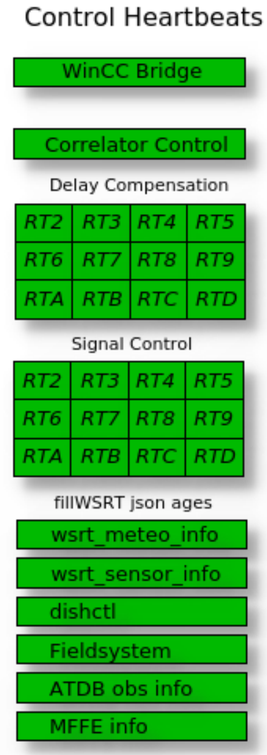
Image credits: A. Corstanje, F. Sweijen, C. Van Eck, P. Zucca

Monitoring


GPS antenna
GPS receiver
Delay counter
RT0 tracking
RT1 ready
onPos
MFFE
4 (21cm)
7 (6cm)
RT2 tracking
RT3 tracking
RT4 tracking
RT5 tracking
RT6 tracking
RT7 tracking
RT8 tracking
RT9 tracking
RTA ready
RTB ready
RTC ready
RTD ready
NS
LNA
DCU
LCU
Uniboard BF
LOG
PAC


Field System
DBBC
Fila10g
MarkV
Bank A / B
FTP server
Maser
Distribution 10MHz
Correlator JIVE


ARTS cluster
ARTS 0
ARTS
ALTA
db server
Data Writers
1
2
28.80
1.08
% disc used
icat 77.63 %
res1 74.34 %
res2 74.41 %
res3 75.34 %
Correlator
PAC
SURFsara

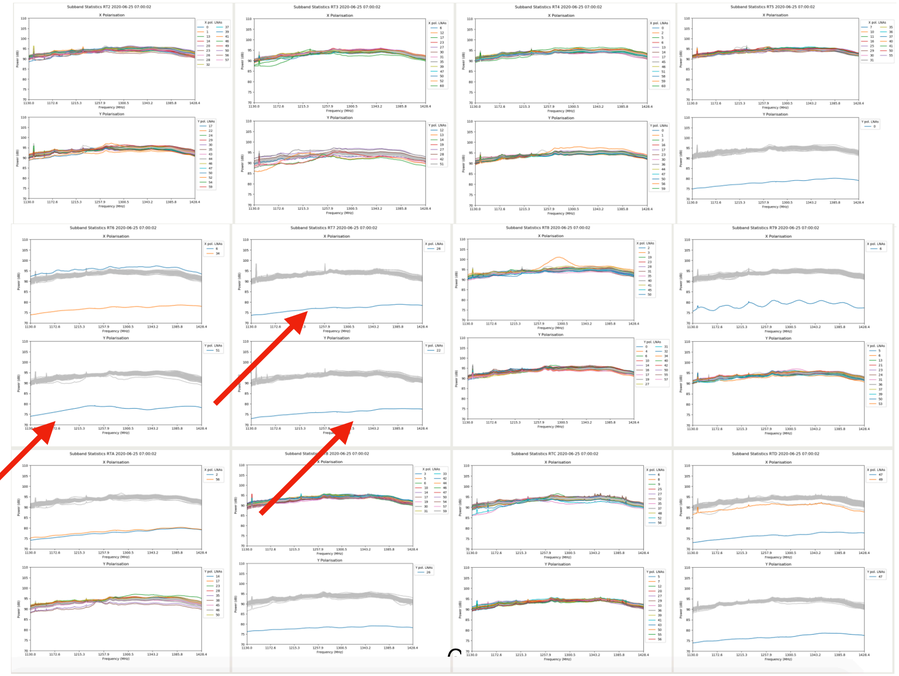

Control Heartbeats
WinCC Bridge
Correlator Control
Delay Compensation
RT2 RT3 RT4 RT5
RT6 RT7 RT8 RT9
RTA RTB RTC RTD
Signal Control
RT2 RT3 RT4 RT5
RT6 RT7 RT8 RT9
RTA RTB RTC RTD
fillWSRT json ages
wsrt_meteo_info
wsrt_sensor_info
dishctl
Fieldsystem
ATDB obs info
MFFE info

PAF maintenance

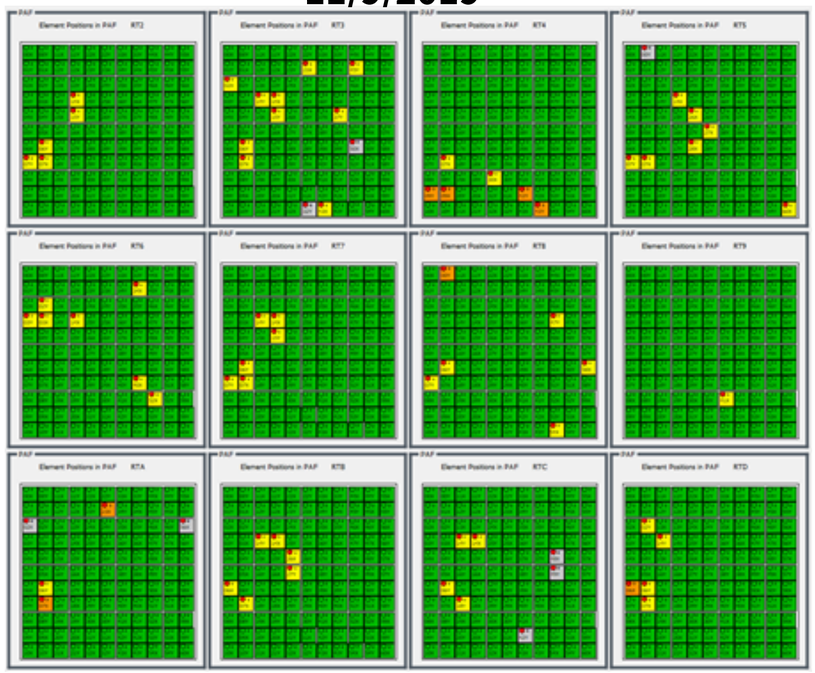
Malfunctioning elements have big effects in the data quality.

Monitor 121 antenna element 's health of each PAF

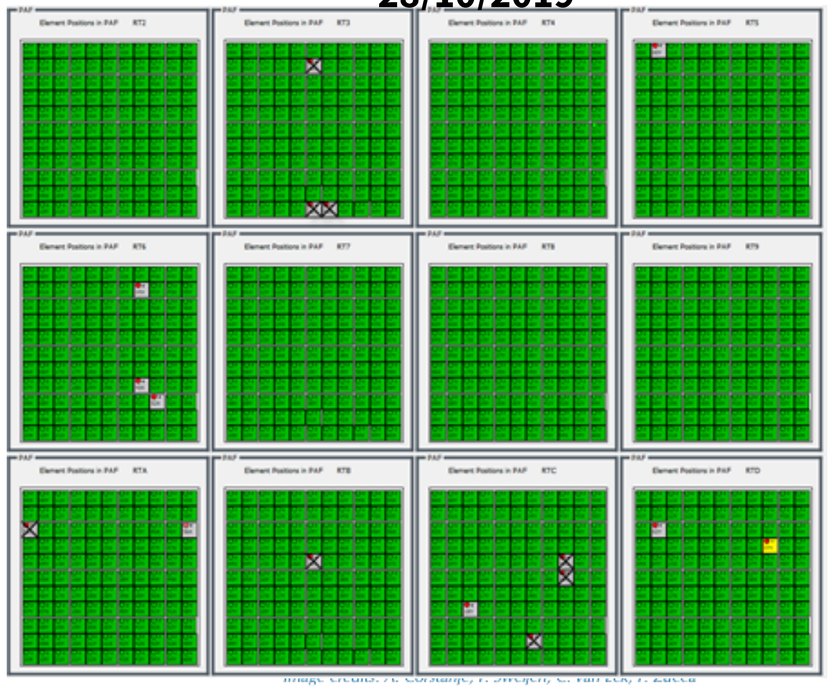
Replacing individual PAF elements involves a significant effort. It is performed in campaigns



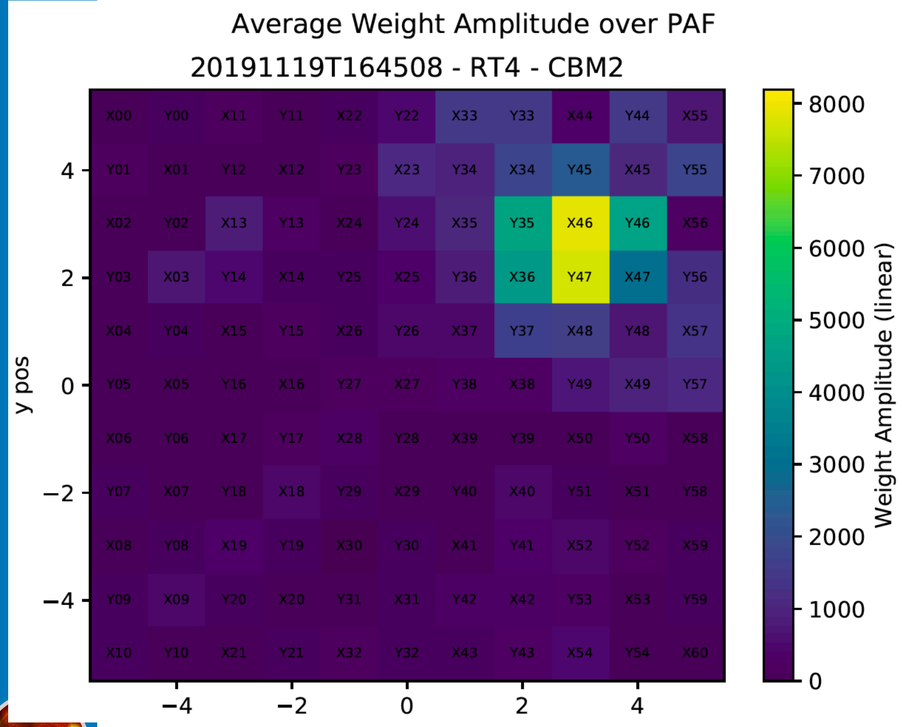
11/9/2019

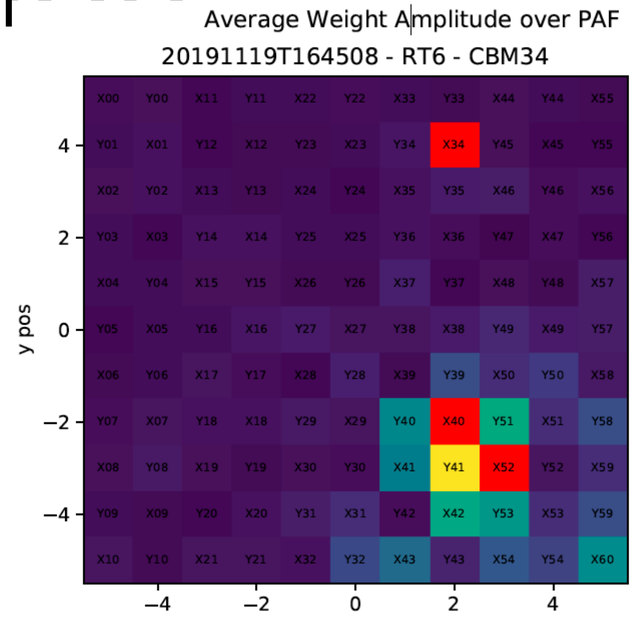


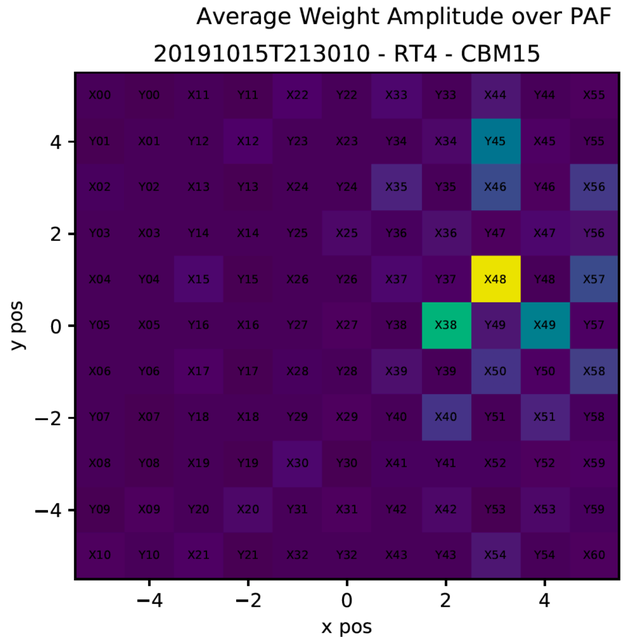
28/10/2019



PAF calibration







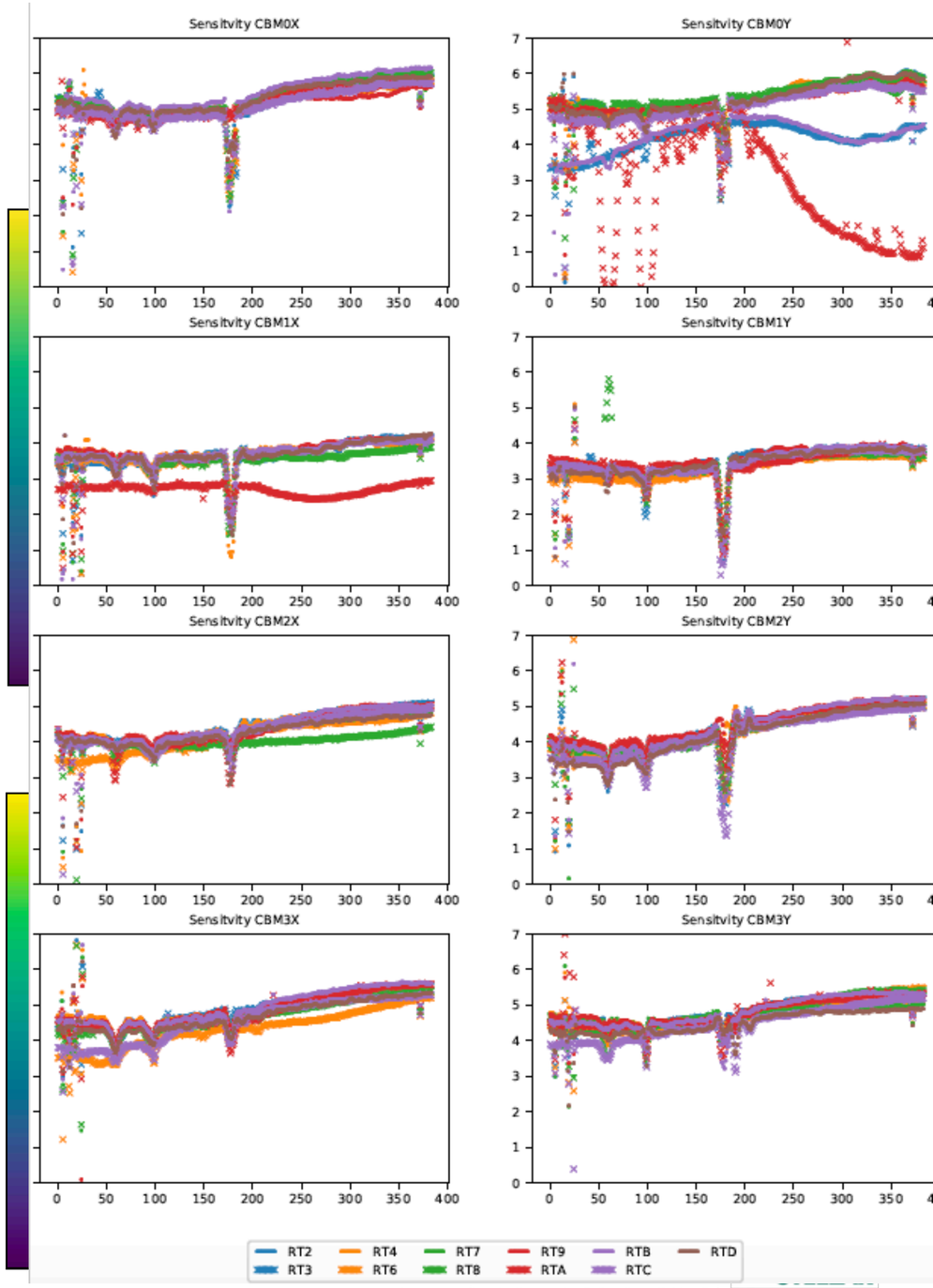


Image credits: A. Corstanje, F. Sweijen, C. Van Eck, P. Zucca

QUESTION?

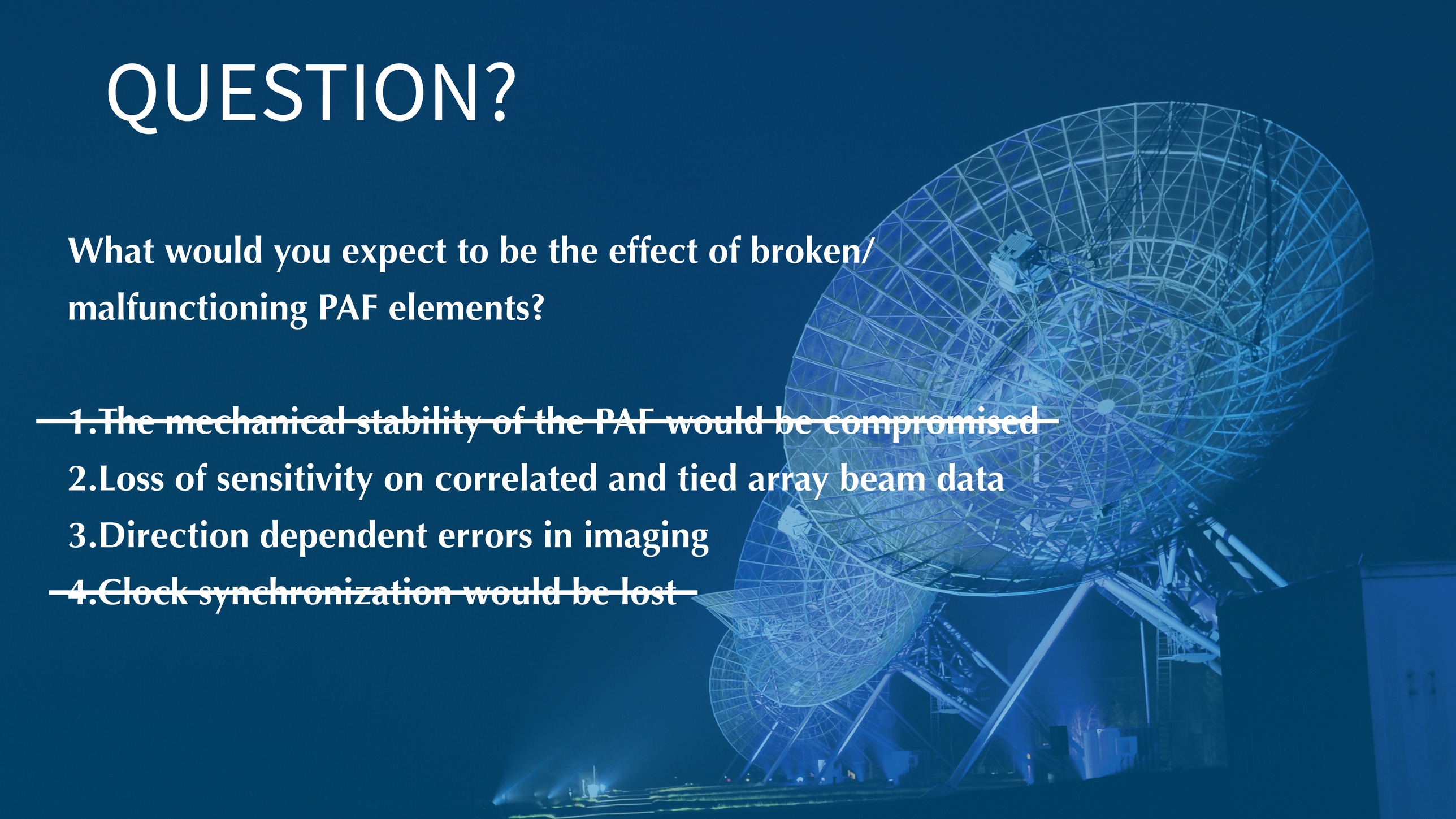
What would you expect to be the effect of broken/ malfunctioning PAF elements?

~~1.The mechanical stability of the PAF would be compromised~~

2.Loss of sensitivity on correlated and tied array beam data

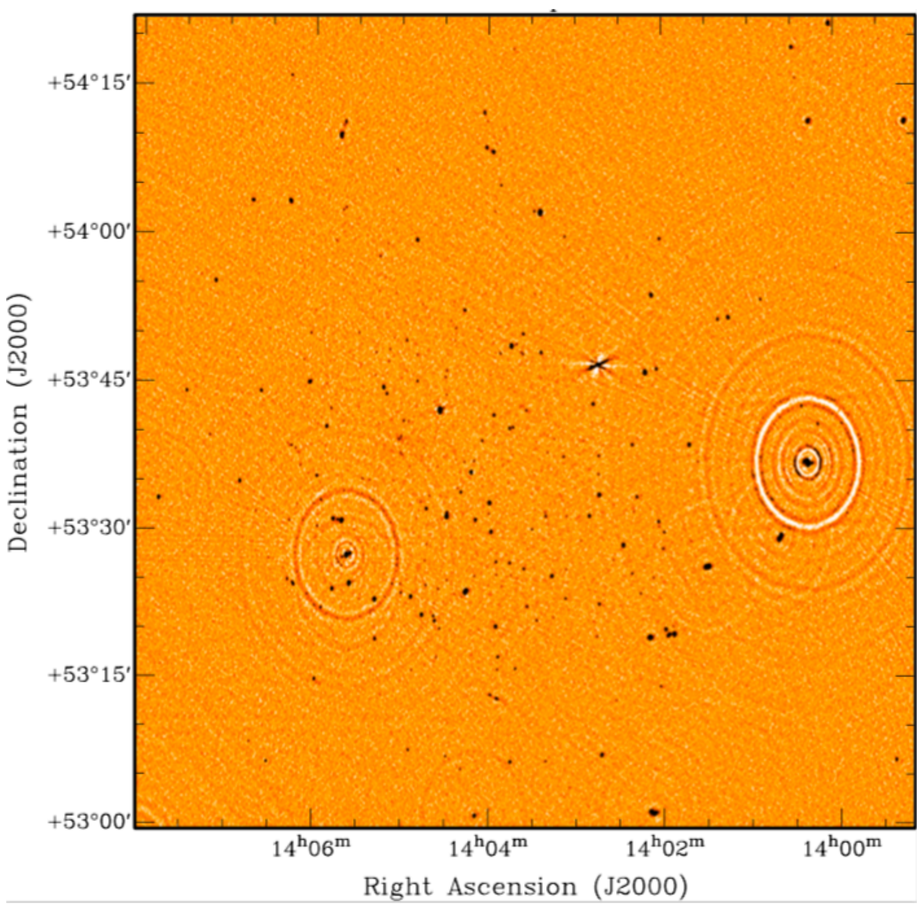
3.Direction dependent errors in imaging

~~4.Clock synchronization would be lost~~



DDEs & sensitivity loss

- LOFAR are caused by the ionosphere & variable beam
- In Apertif they caused by variable beam of a particular compound beam.
- On top of that there is also the loss of sensitivity the is reflected on BF observation as well as in imaging.



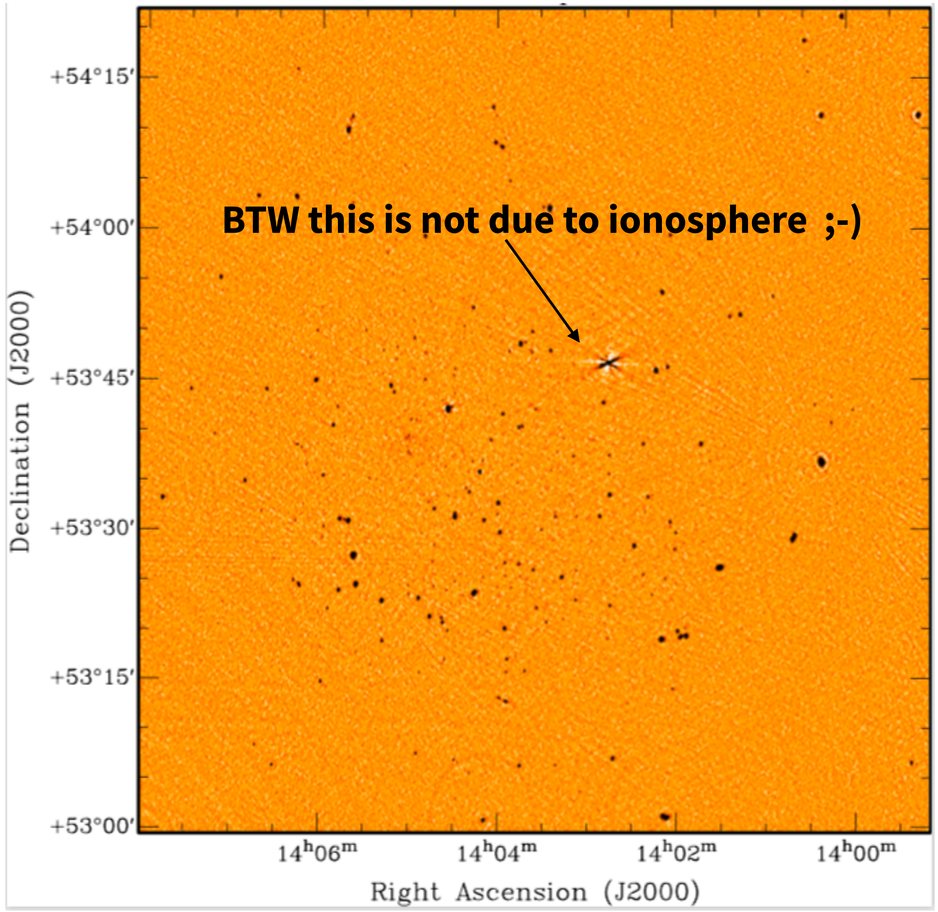
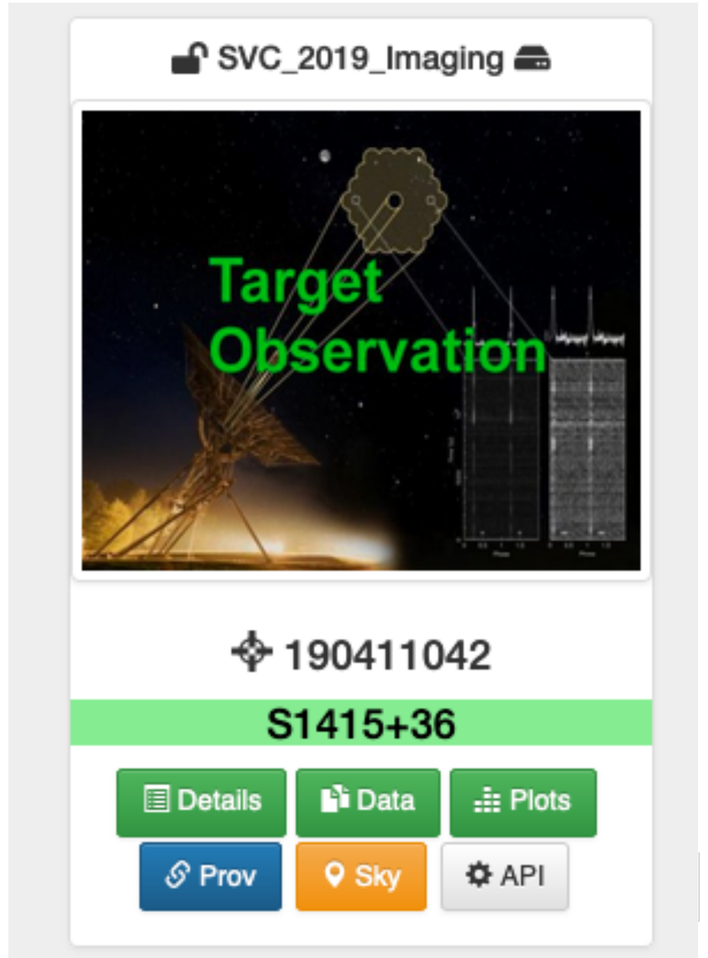


Image credits: A. Corstanje, F. Sweijen, C. Van Eck, P. Zucca

Apertif Long Term Archive

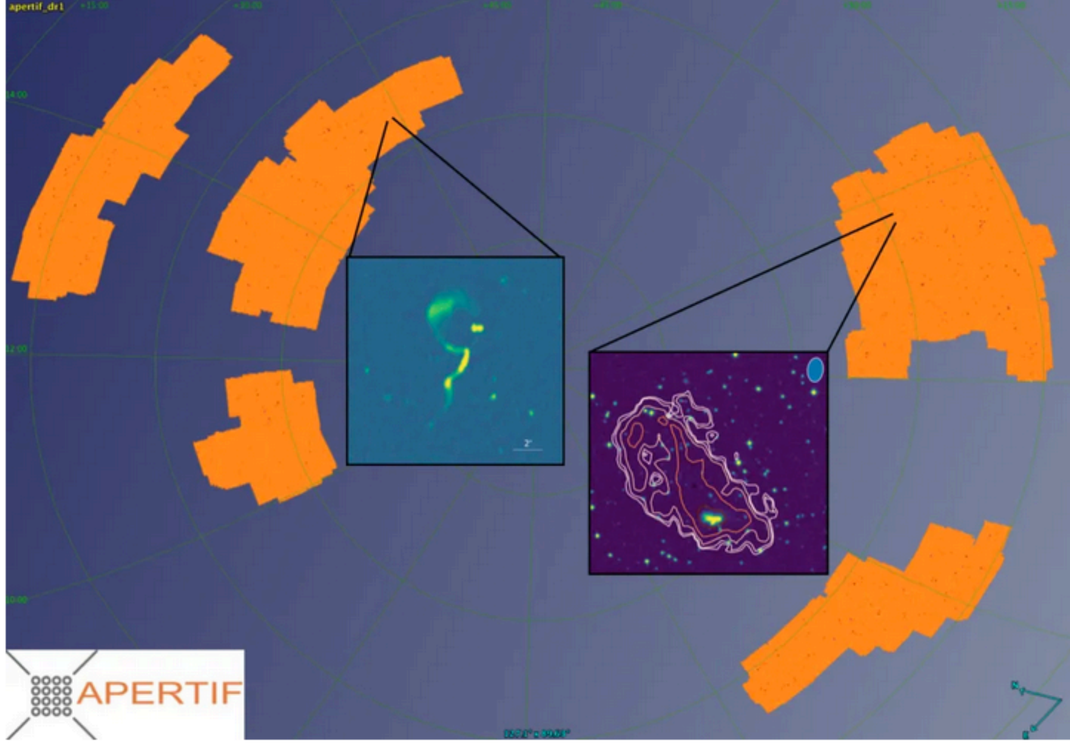
ALTA makes use of two systems to store the data:

- an online disk cluster located in Dwingeloo where science ready data products are stored and immediately available.
- The tape system at SURFsara (long term storage or “cold storage”) where visibilities and time series are stored. These can be retrieved contacting the ASTRON Helpdesk.

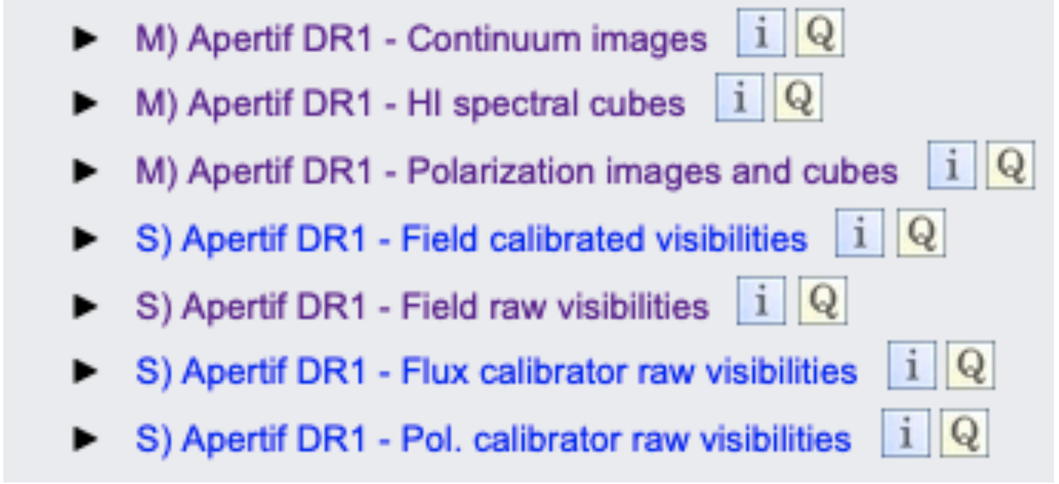


…and now Science with Apertif

DATA release and VO



- Apertif imaging DR1 is in vo.astron.nl
- Documentation apertif-dr1-documentation & Adams et al. in prep.
- Directly retrievable: Continuum images, HI spectral cubes and Polarization images and cubes.
- Visibilities upon request via SDC-Helpdesk
- Only beams that passed validation have been released.



ARTS DR1 is coming soon. Stay tuned!

To help us improve the data access services we appreciate your feedback, which can be provided at https://forms.gle/wecdDsttuYjHF8W66.

Image credits: A. Corstanje, F. Sweijen, C. Van Eck, P. Zucca

Data access described how to find the data.

Directly on vo@astron.nl

Position [deg]
ICRS Position, RA,DEC, or Simbad object (e.g., 234.234,-32.45)

Field size [deg]: 0.5
Size in decimal degrees (e.g., 0.2 or 1,0.1)

Intersection type
- (•) Image overlaps RoI
- ( ) Image covers RoI
- ( ) RoI covers image
- ( ) The given position is shown on image

Relation of image and specified Region of Interest.

Field Name
Name of the field. Matches also partial input (e.g. m1403+5324 or 1403+5324).

ObsId
Observation id

Beam number
Beam number

Max distance from the center [deg]: 0.75
Maximum distance to the center of the images

Table: Sort by _r ASC; Limit to 100 items.

Output format: HTML — More output fields

Go

& ADQL query

TOPCAT via samp

M) Apertif DR1 - Continuum images

Parameters

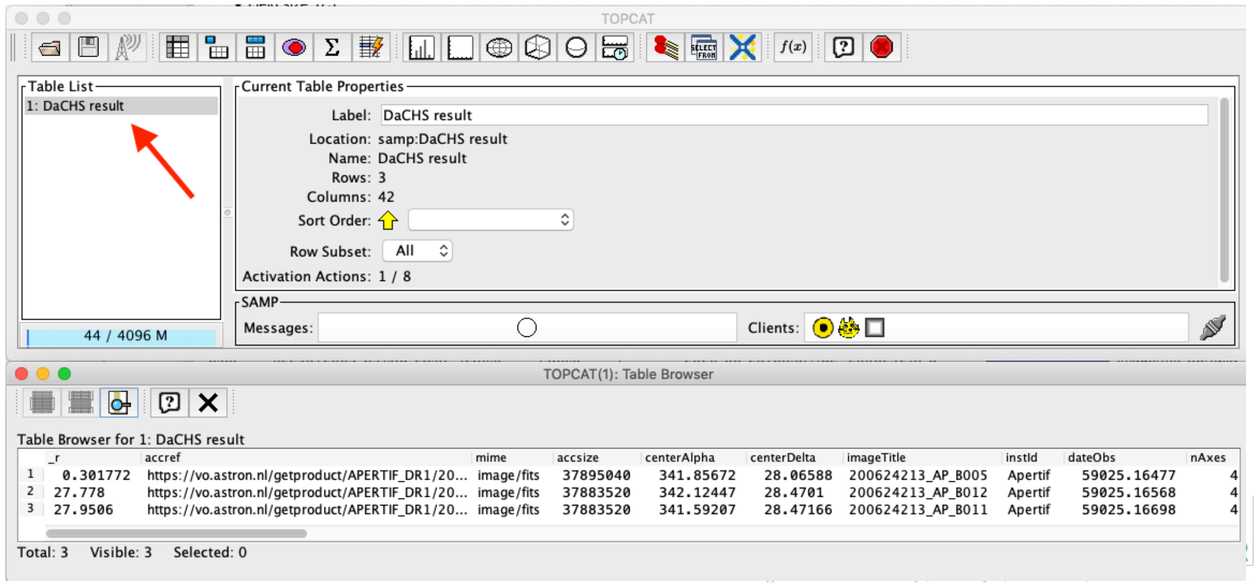
- Field size: 0.5
- Max distance from the center: 0.75
- Output format: image/fits
- Position: 341.86, 28.07

Result

Matched: 3

Send via SAMP | Quick Plot

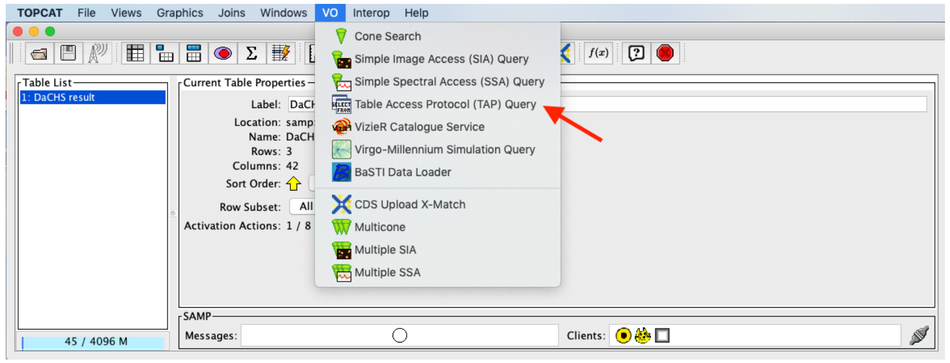
Dist [arcmin]	Field	Ctr. RA [deg]	Ctr. Dec [deg]	min. Frequency [MHz]	max. Frequency [MHz]	# channels	Obs. date	ObsId	Beam	Product key	Type	File size [byte]	Passed validation	Scales [deg/pix]	Instrument	Related products	Title	P. DID	Sigma in	Sigma out	R	Max Neg	Ex-2
0.30	s2245+2904	341.86	28.07	1280.0	1430.0	1	2020-06-25T03:57:16Z	200624213	5	image_mf_01.fits	image/fits	36.1MiB	True	[0.00111111, 0.00111111]	Apertif	dlmeta	200624213_AP_B005	ivo://astron.nl/~?APERTIF_DR1/200624213_AP_B005/image_mf_01.fits	59.7	51.4	1.16	-1.0	201.0
27.78	s2245+2904	342.12	28.47	1280.0	1430.0	1	2020-06-25T03:58:35Z	200624213	12	image_mf_01.fits	image/fits	36.1MiB	True	[0.00111111, 0.00111111]	Apertif	dlmeta	200624213_AP_B012	ivo://astron.nl/~?APERTIF_DR1/200624213_AP_B012/image_mf_01.fits	50.4	45.2	1.12	-1.0	145.0
27.95	s2245+2904	341.59	28.47	1280.0	1430.0	1	2020-06-25T04:00:27Z	200624213	11	image_mf_02.fits	image/fits	36.1MiB	True	[0.00111111, 0.00111111]	Apertif	dlmeta	200624213_AP_B011	ivo://astron.nl/~?APERTIF_DR1/200624213_AP_B011/image_mf_02.fits	51.9	43.7	1.19	-1.0	284.0

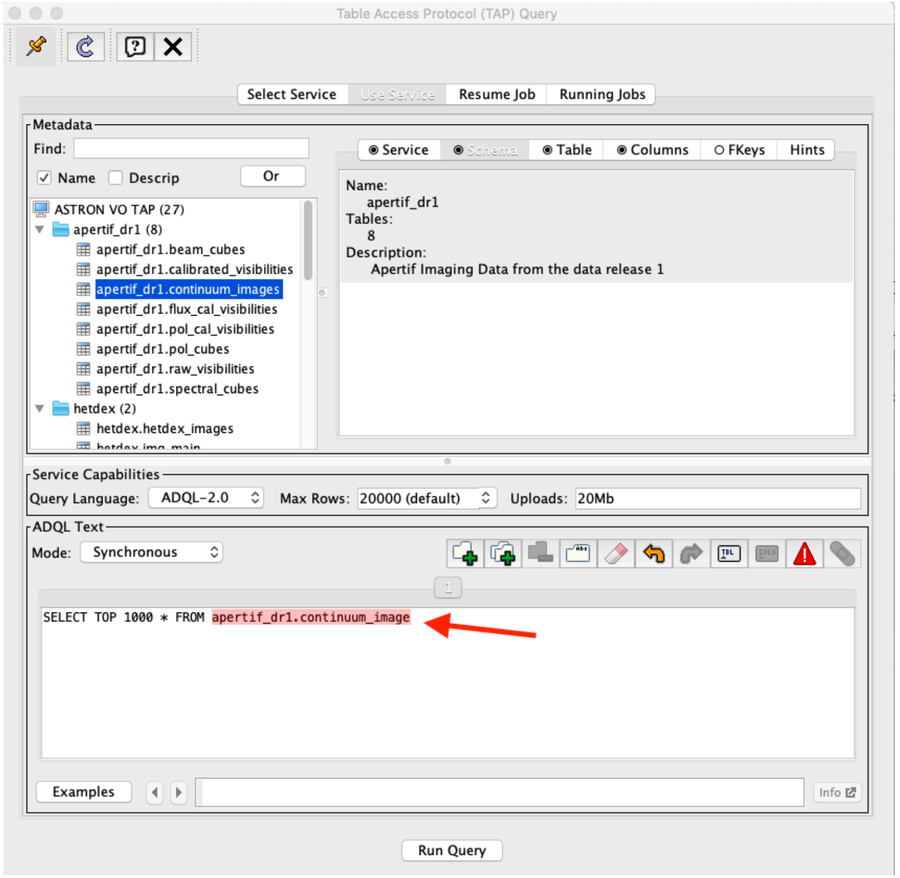


	_r	accref	mime	accsize	centerAlpha	centerDelta	imageTitle	instId	dateObs	nAxes
1	0.301772	https://vo.astron.nl/getproduct/APERTIF_DR1/20...	image/fits	37895040	341.85672	28.06588	200624213_AP_B005	Apertif	59025.16477	4
2	27.778	https://vo.astron.nl/getproduct/APERTIF_DR1/20...	image/fits	37883520	342.12447	28.4701	200624213_AP_B012	Apertif	59025.16568	4
3	27.9506	https://vo.astron.nl/getproduct/APERTIF_DR1/20...	image/fits	37883520	341.59207	28.47166	200624213_AP_B011	Apertif	59025.16698	4

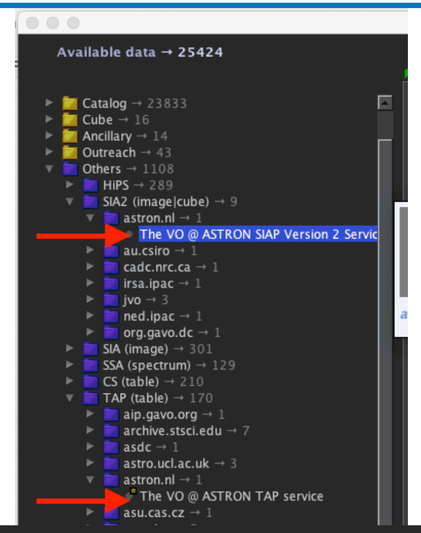
6th LOFAR Data School

TOPCAT via TAP





ALADIN



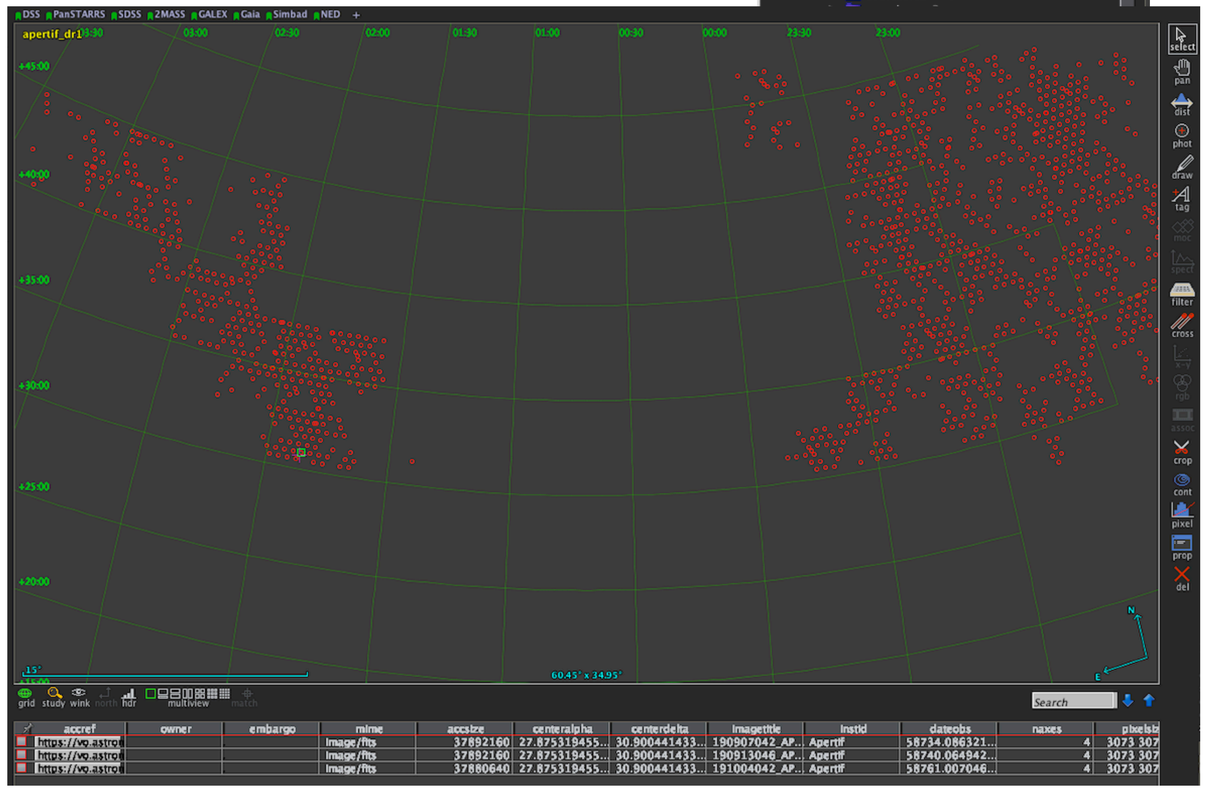


Image credits: A. Corstanje, F. Sweijen, C. Van Eck, P. Zucca