



Apertif: a new wide-field camera for Westerbork

www.apertif.nl

Carole Jackson for the Apertif team
SPARCS IX, 6 May 2019



university of
 groningen

Kapteyn
 Astronomical Institute



The A team...

Imaging Science:

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Joris Verstappen

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Klass Stuurwold
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Jorrit Schaap
Klas Jan Wierenga
Leon Hiemstra
Leon Oostrum
Nico Vermaas
Pieter Benthem
Pieter Donker
Roy de Goei
Sander ter Veen
Tammo Jan Dijkema
Yan Grange
Yogesh Maan
Zheng Meyer
Arthur Coolen

ASTRON Operations

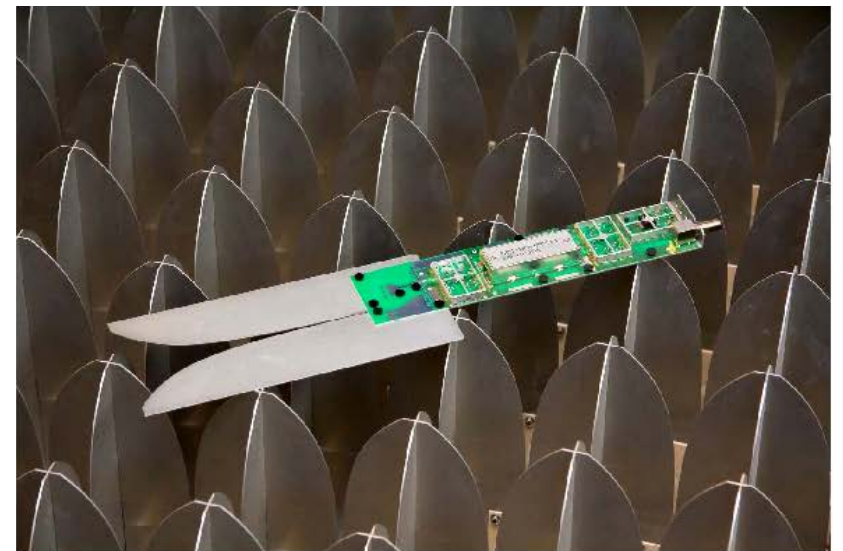
Gert Kruithof, Hans Jense
Joeri van Leeuwen, Jason Hessels

ASTRON

Netherlands Institute for Radio Astronomy

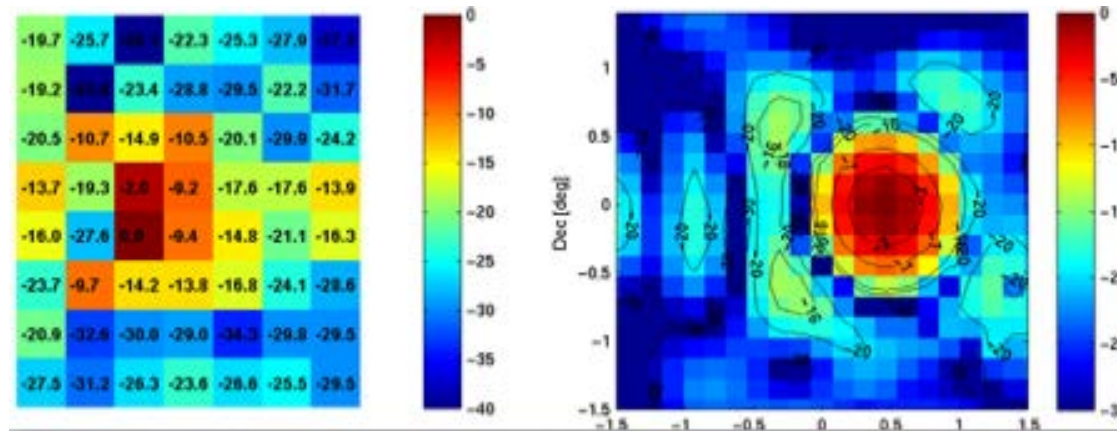


Delivering APERTIF/ARTS



Apertif PAF

“transforming the WSRT into an efficient survey facility using phased array technology”



12 WSRT dishes (25 m dia, equatorial)

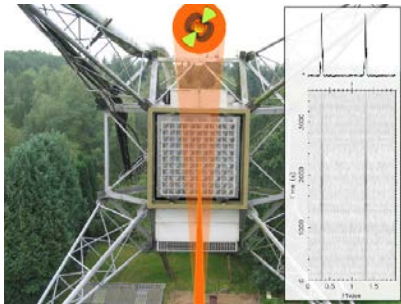
receivers 1 → 121

primary beams 1 → 40

field of view 0.28 → 5.6 deg²

bandwidth 8x20 → 300 MHz

Delivering APERTIF/ARTS



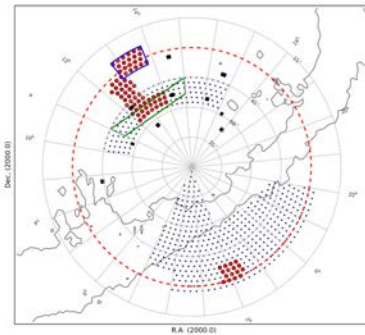
DIGESTIF



APERTIF



APROPOS



APERTIZER

Apertif Imaging Surveys – 4 year plan

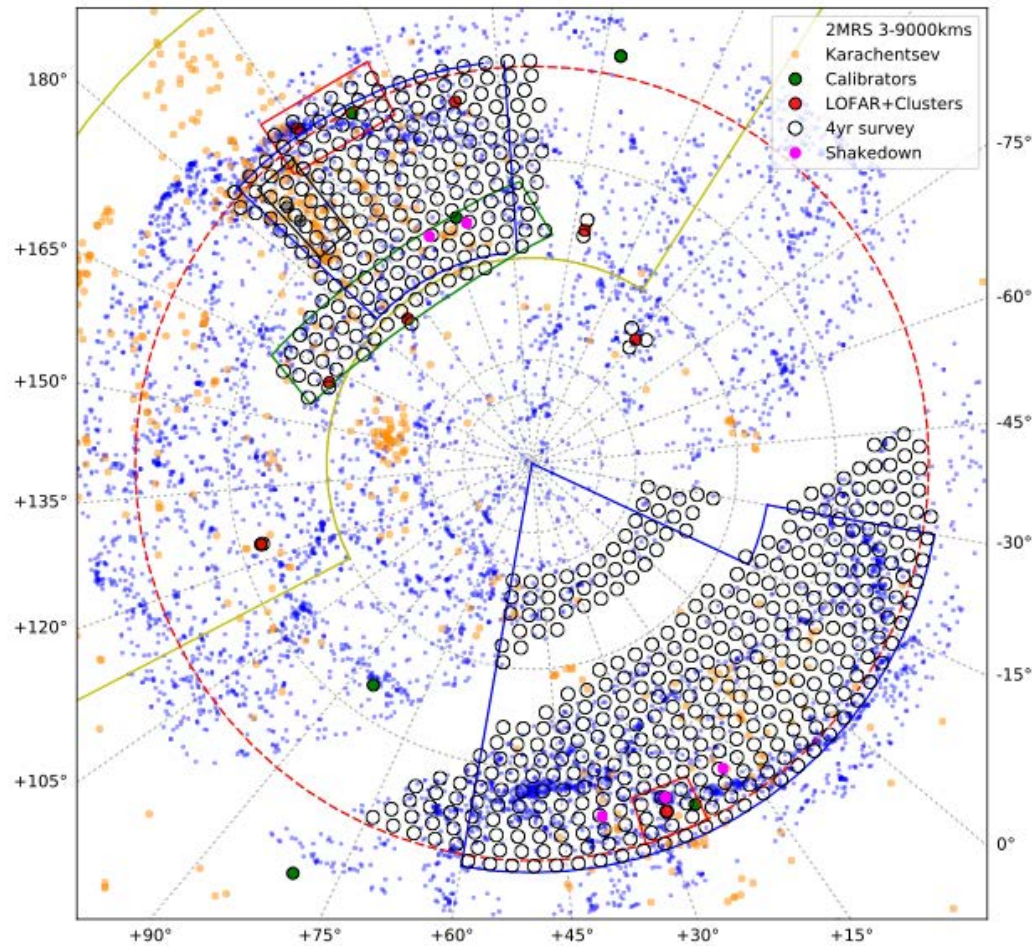
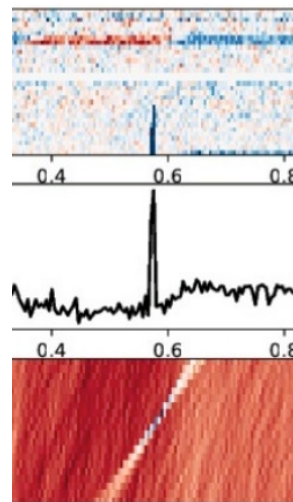


Image: K. Hess

Apertif Time-domain Survey (“ALERT”)

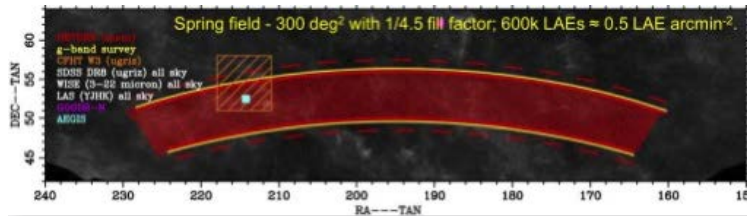
FPGAs ✓ → “ARTS” GPU Cluster ✓ → Pipelines ✓ → Control s/w → Survey



New (82)	Backlog (35)	Started (42)
<p>#1660] TAB RF driver prj: Telescope Control art driver team</p>	<p>Task #1835 (20.00%) [SC1] Add start/stop /restart/etc functionality to controller Category: Telescope Control ARTS MAC team</p>	<p>Task #2359 (1.00/0.00%) Add metadata that are required for ALTA Roy de Gooijer</p>
<p>#486 Streaming wide-field VLBI</p>	<p>Task #2074 (4.00%) [ALL] Investigate if the keys in the parset template are for SC1 and SC4 Category: Telescope Control Leon Oosterom</p>	<p>Task #1659 [ALL] Investigate if a different config file is sufficient for ARTS SignalControl Category: Telescope Control ARTS MAC team</p>
<p>#487 (10.00/100.00%) Commensal Transient Ch</p>	<p>Task #2075 (4.00%) [ALL] Investigate what needs to be changed in the parset script for SC1 and SC4 Category: Telescope Control Yogesh Maan</p>	<p>Task #2289 (0.00%) Inventory of ARTS layout and deployment needs Arno Schoenmakers</p>
<p>#512] Automatically setup a list of complete pulsar timing observations from an existing source list. prj: Telescope Control ih Maan</p>	<p>Task #2273 (20.00%) [SC4] Frequency mapping end-to-end test, IAB (2.2.6) Category: Technical Commissioning Firmware team</p>	<p>Task #2357 (12.00%) Store parset file as metadata Roy de Gooijer</p>
<p>#513] Convert an non-expert user into a complete pulsar timing observation prj: Telescope Control ih Maan</p>	<p>Task #2394 (32.00%) SNMP monitoring Apertif switches Category: Telescope Monitoring Verifier/Task Model Monitoring team</p>	<p>Task #2393 (24.00/24.00%) SNMP monitoring pilot for ALTA Category: Telescope Monitoring Verifier/Task Model Arthur Coolen</p>
<p>#522] Scheduling: Timing of images prj: Telescope Control Orange</p>	<p>Task #1036 (5.00%) [SC1] Add status updates back to MAC from timing controller Category: Telescope Control ARTS MAC team</p>	<p>Story #514 (24.00%) [SC4] Manual control of a complete SC4 observation</p>
<p>#864] New beamlet mapping for commensal observations prj: Firmware loofstra</p>		<p>Story #511 (56.00%) [SC1] Manual control of a complete pulsar timing observation</p>
		<p>Epic #485 (9.50/100.00%) SC1: Pulsar timing</p>

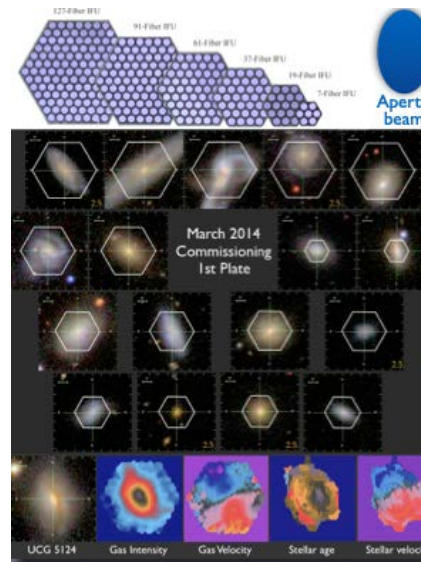
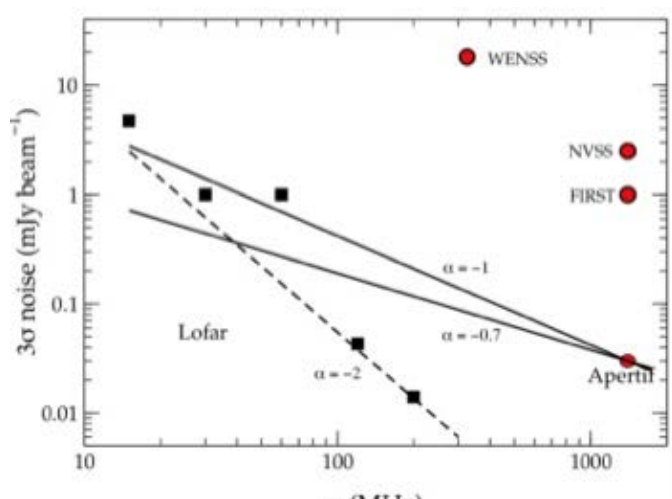


Apertif Synergies



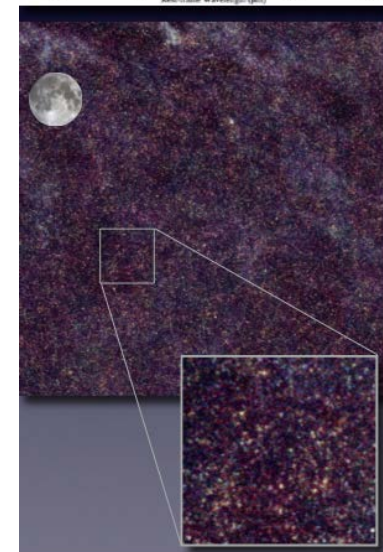
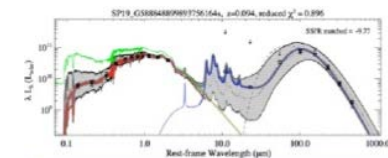
10^5 [OII] redshifts in HetDex field - HI stacking

Apertif and LOFAR synergy



MaNGA & WEAVE IFU follow-up

Full SED reconstruction for H-ATLAS sources



Delivering APERTIF/ARTS

Apertif 'the project' issues → reorganize, focus on *system delivery*
Bounded by WSRT operations funding to Dec 2020

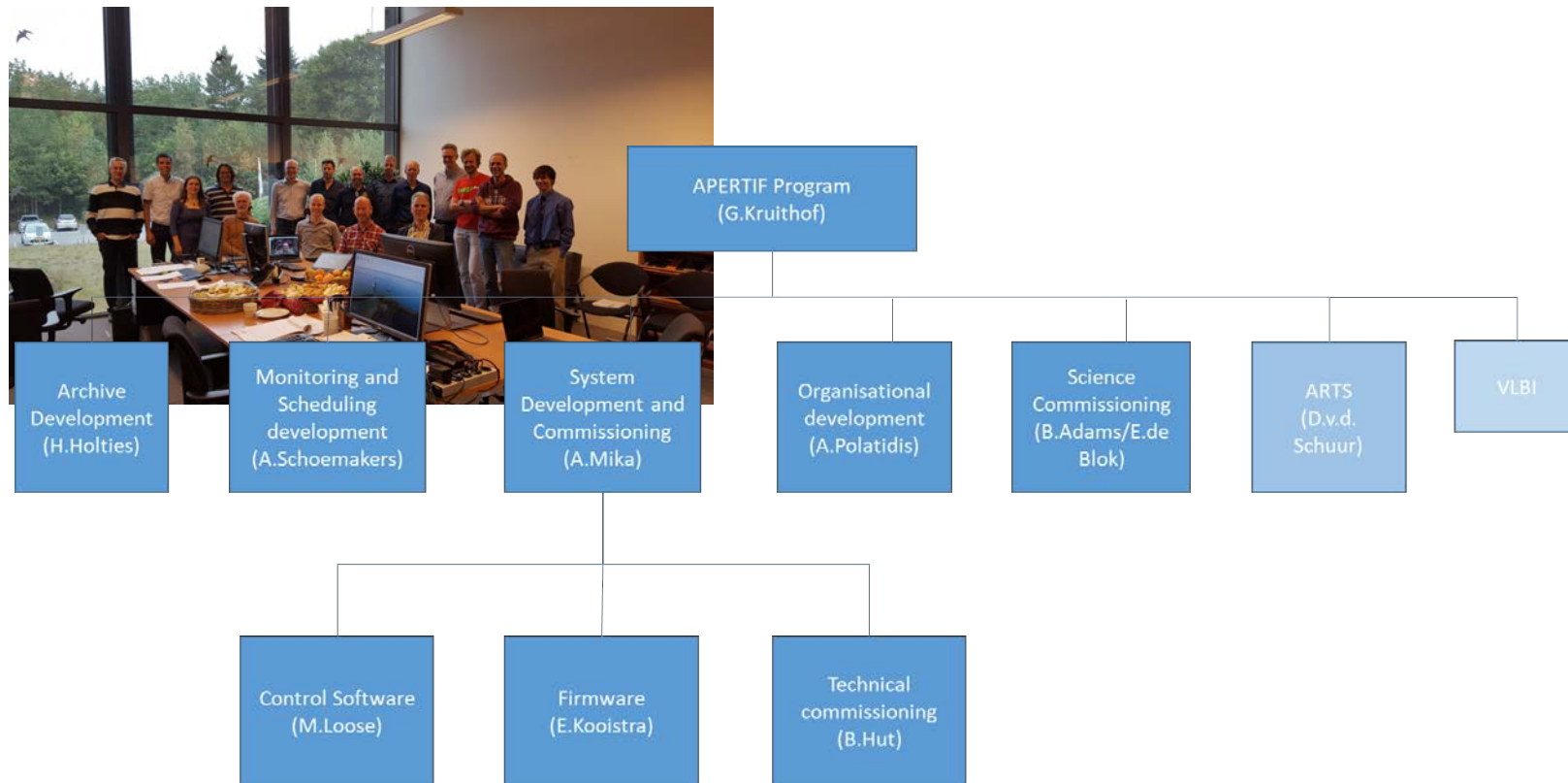
Directed efforts to deliver
:ARTS with LOFAR trigger
:APERTIF surveys (low & medium-deep)
on sky 'basic' versions



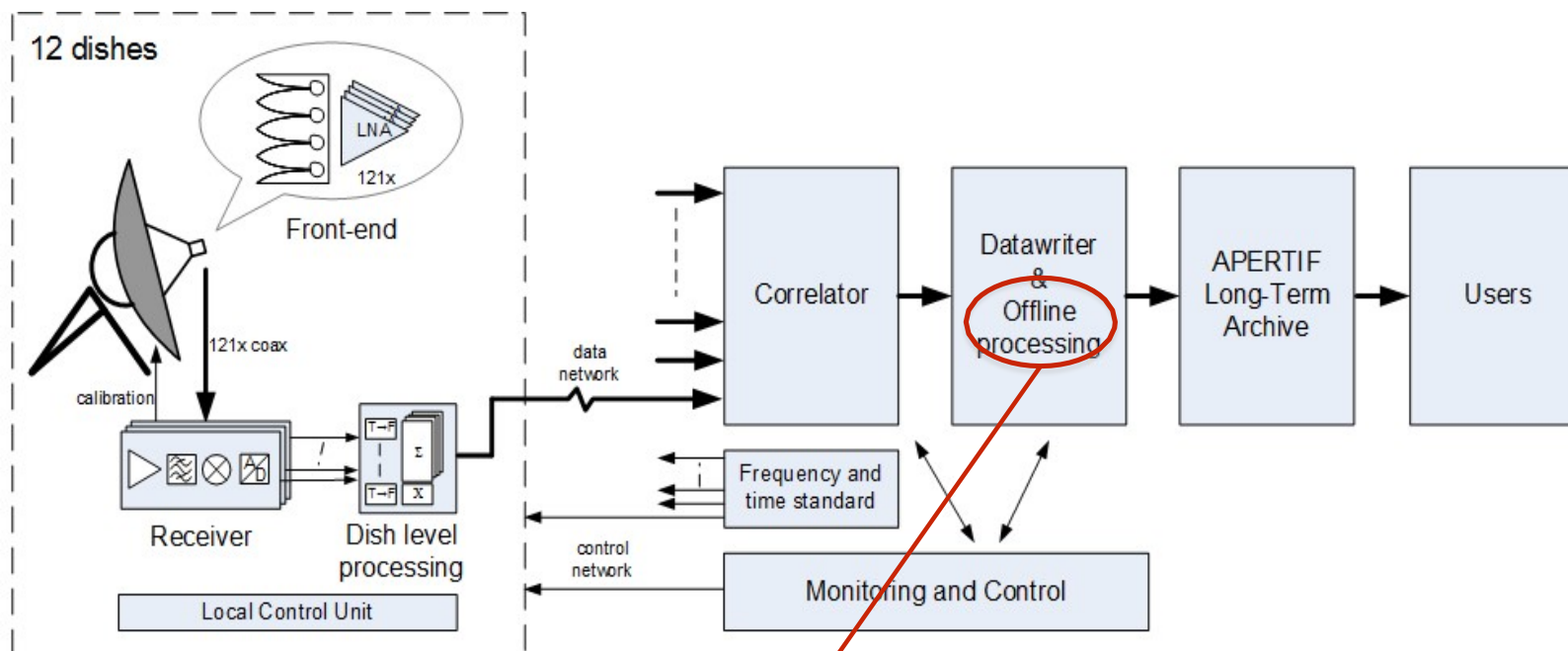
Delivering APERTIF/ARTS

- ASTRON delivering APERTIF/ARTS is vital
- We need a focused and intensified effort
- APERTIF/ARTS Program
- Full MT support
- PI's are on board
- Team in library room – central to ASTRON (in many ways!)
- Masterplan (plan to complete & operate)
- Additional resources needed -> we pay a price (cost €, people...)
- Lessons learned -> LOFAR 2.0 upgrade

Delivering APERTIF/ARTS



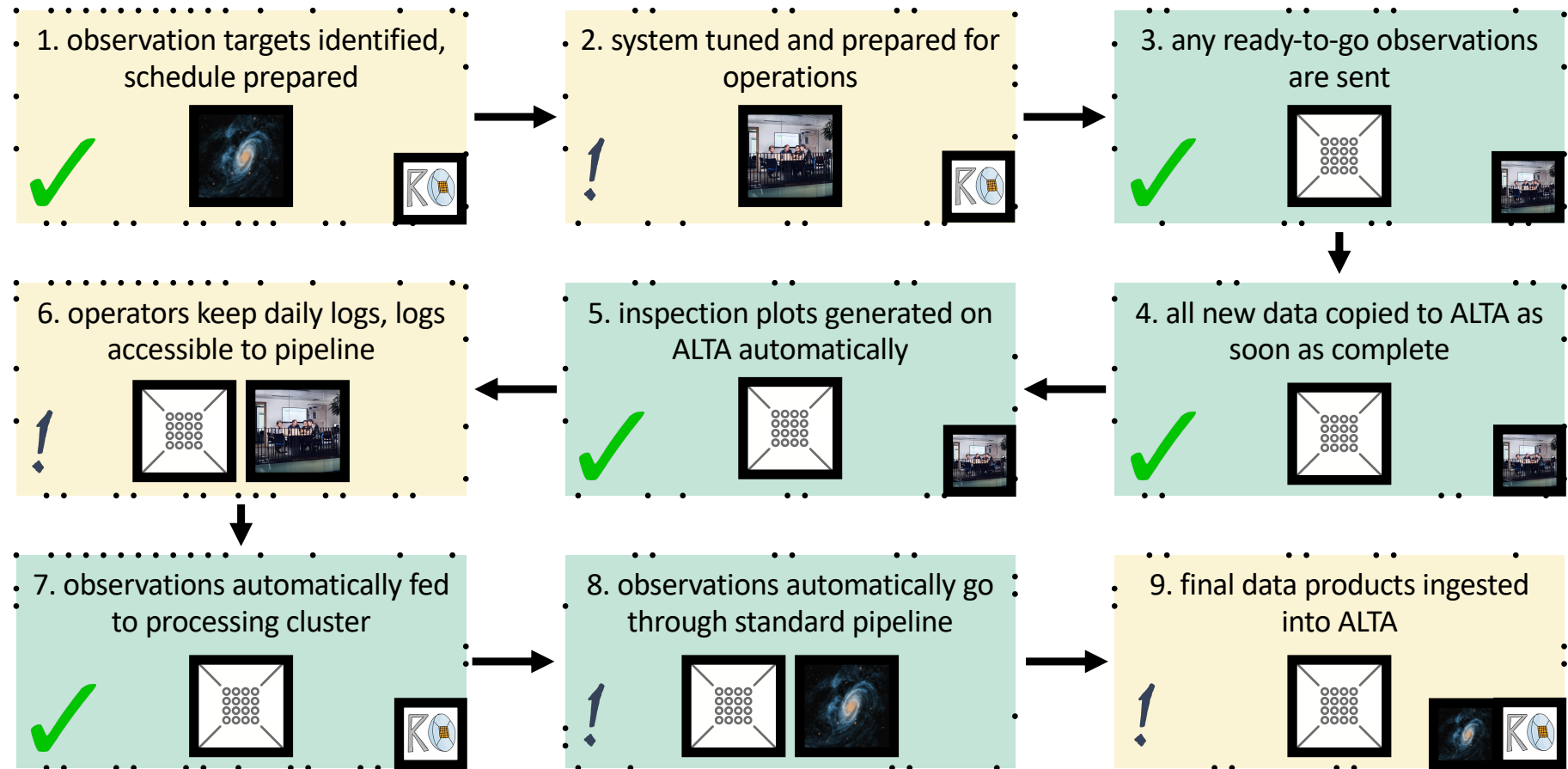
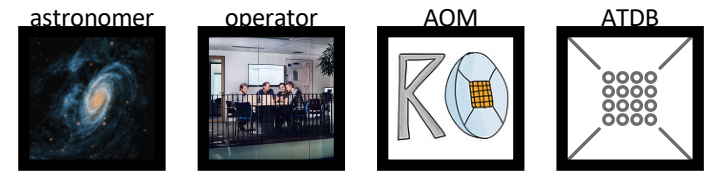
Delivering APERTIF/ARTS



APERCAL

(APERTIF Calibration Pipeline)

Apertif Imaging status



Delivering APERTIF/ARTS

Oct 2017 – Apr 2019 System development, science preparations, shakedowns & verification

Shakedown 1: October 2018

Shakedown 2: December 2018

Science Verification Campaign – 2 x 1 week surveys on-sky

Intense: confirmation of system performance

Apertif Commissioning & Science Verification Campaign results

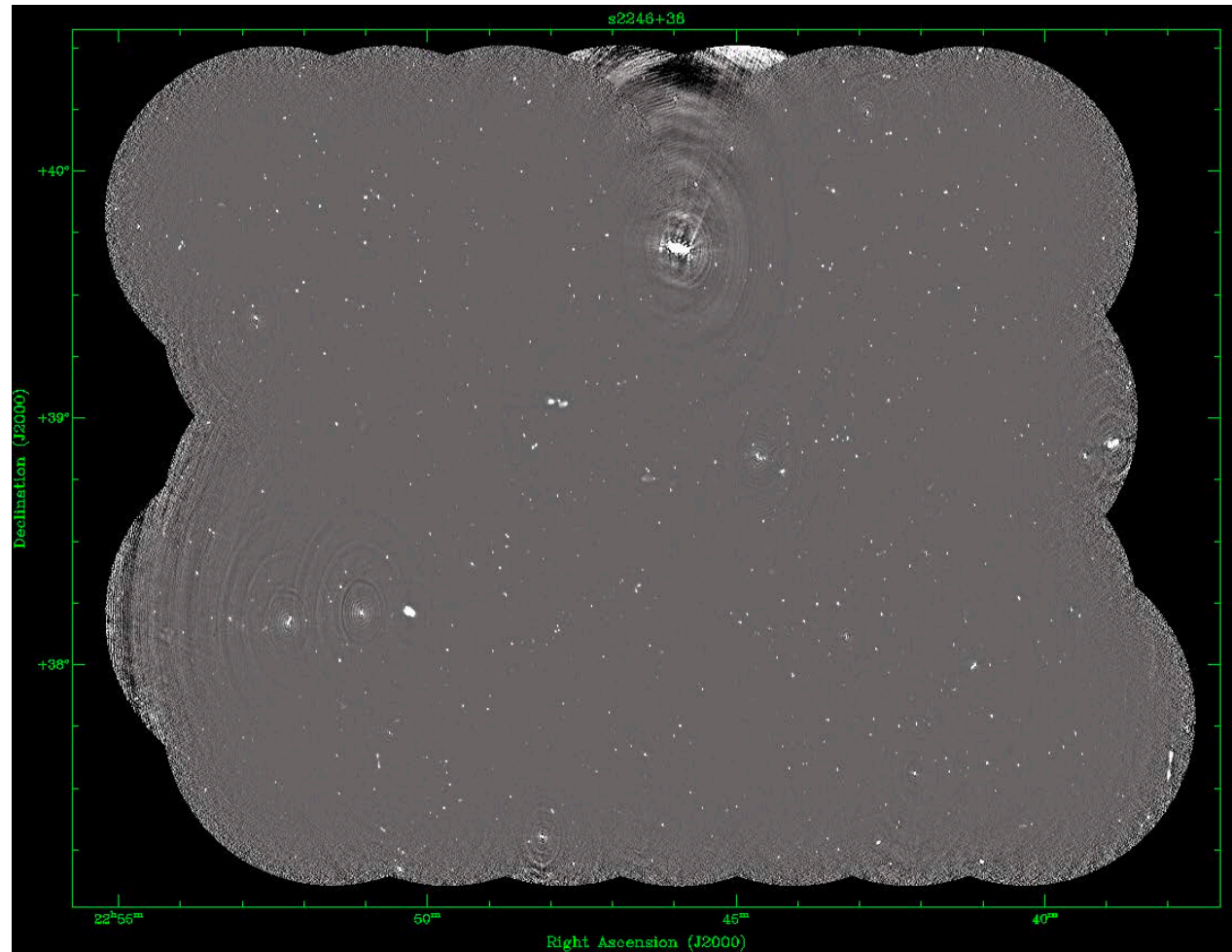
Apertif: Science Verification Campaign results

Apertif shallow survey pointing

SVC mosaic – 30 – 40 microJy rms
Full compound beam
(best 27 microJy/beam
Nominal sys sensitivity)

Bright source 3C 452 (?)
approx 22h 46' 39.6 dec

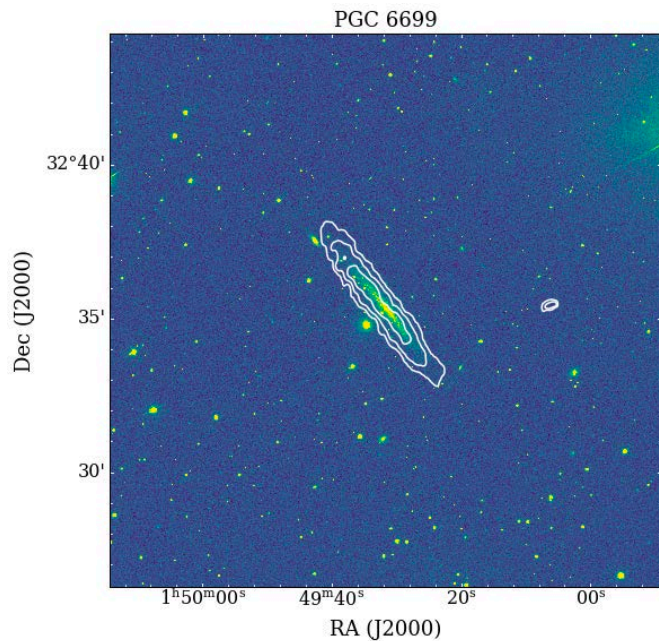
SVC team: Adams et al 2019



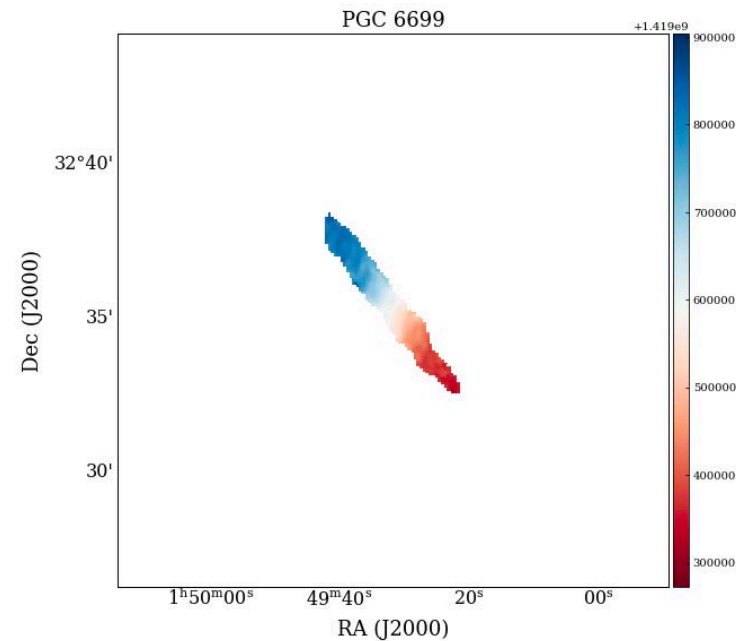
Apertif: Science Verification Campaign results

HI disc – blind detection of PGC6699

Total Intensity HI



HI velocity field

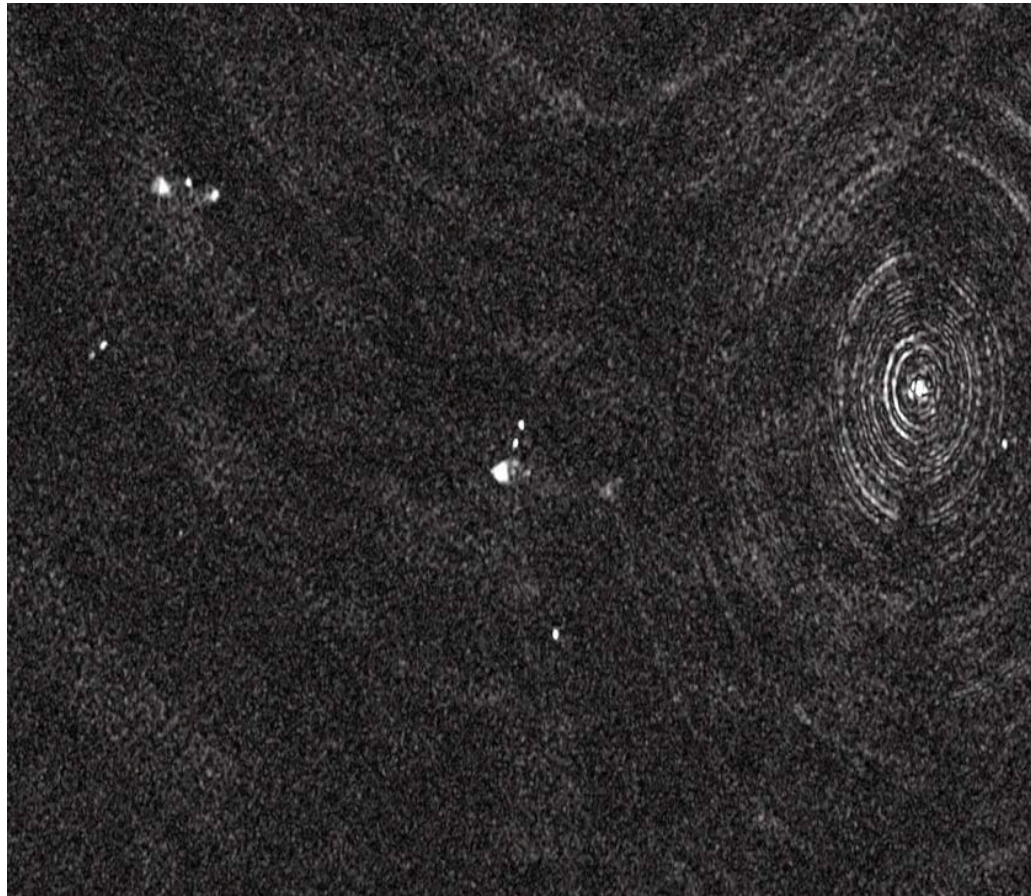


Denes et al
SVC 2019

Apertif: Science Verification Campaign results

SVC – first polarized intensity image

Adebahr 2019



Apertif – an SKA Pathfinder getting to work 2019

On sky - Survey Science & ARTS

- 20 month on sky from now to 31 December 2020
 - Transition period to full operations (2 months – May, June 2019)
 - Initial science period (survey approx. 2/3rds of 18 months)

Data release

- i. ALTA radionet SVC release - September 2019
- ii. future releases (before Dec 2020) tbd – vital!

-- driven to producing great science results

-- seeking 4 year funding (+2 years from 1 January 2021) to fulfil science (survey) mission

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