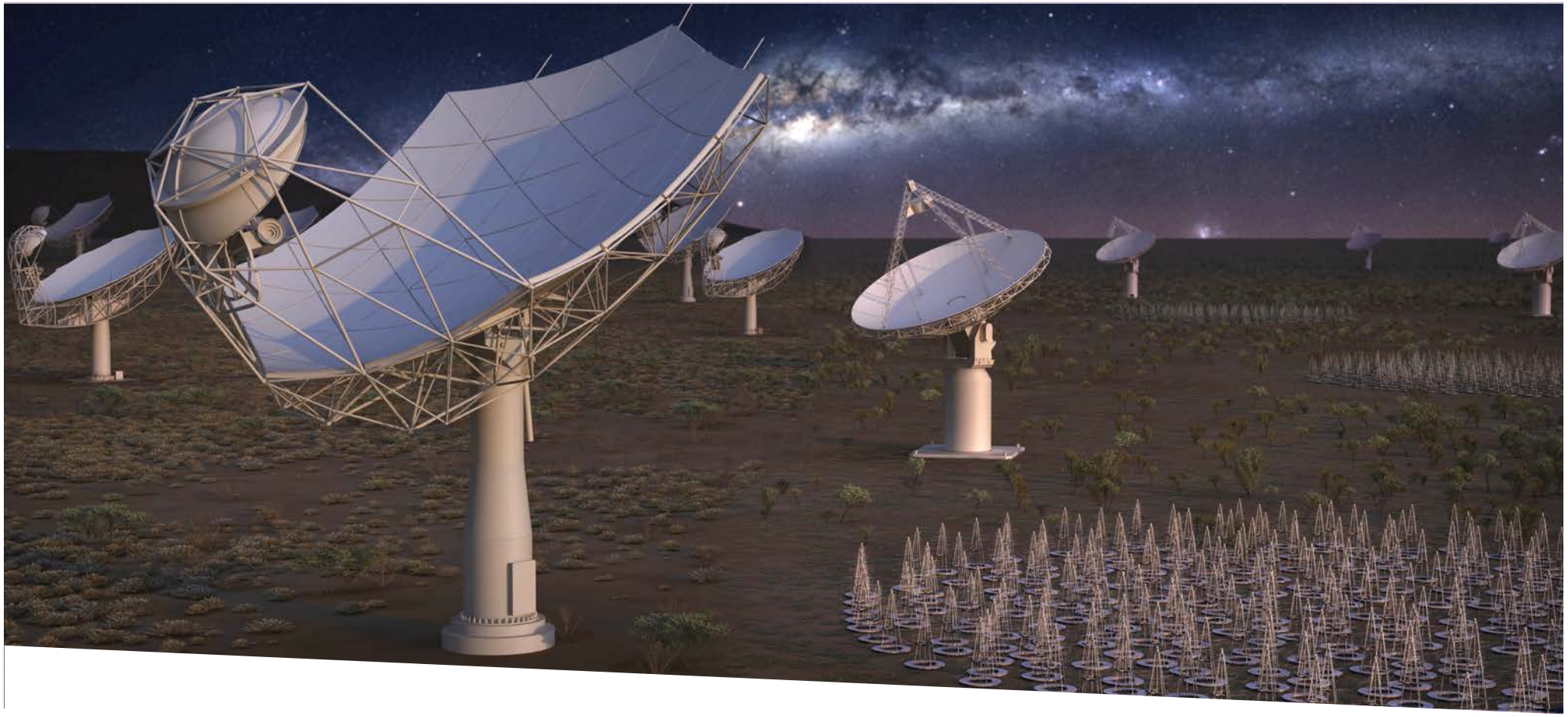
# SKA SWG Update



**Robert Braun, Science Director**

SQUARE KILOMETRE ARRAY

Exploring the Universe with the world's largest radio telescope

21 May 2019

# Science Activity Updates

- Update of High Frequency Science Case (Jeff)
- Science Data Challenge Update (Anna)
- Round table SWG updates (All)
- SKA related meetings
- AOB

# Update to the high frequency science case

- Advanced Single Pixel Feeds and Receivers (ASPFR) collaboration has a work package on a possible band 6 (>15 GHz) receiver (Sweden, China, France, Spain, UK, South Africa).

- Deployment of high frequency receivers will ultimately depend on *i)* dish performance, *ii)* scientific priorities, and *iii)* availability of funds. Potentially part of a long term future upgrade.

- ASPFR team require scientific justification and guidance to demonstrate the need for such capabilities on SKA1-MID (15 to 25 and 25 to 50 GHz)

# Update to the high frequency science case (cont'd)

- Community-led effort (Beswick, Conway, Coriat, Ferrari, Muller, Sargent) to update the science case for band 6, and all are invited to contribute (3 to 5 pages for each chapter). Some lead authors already identified/volunteered

- Latex template and pbworks pages are being completed and will be shared with 'swg-all' along with an invitation to contribute

- Sensitivity information will be distributed in user-friendly form to enable quantitative observing time estimates for different science applications

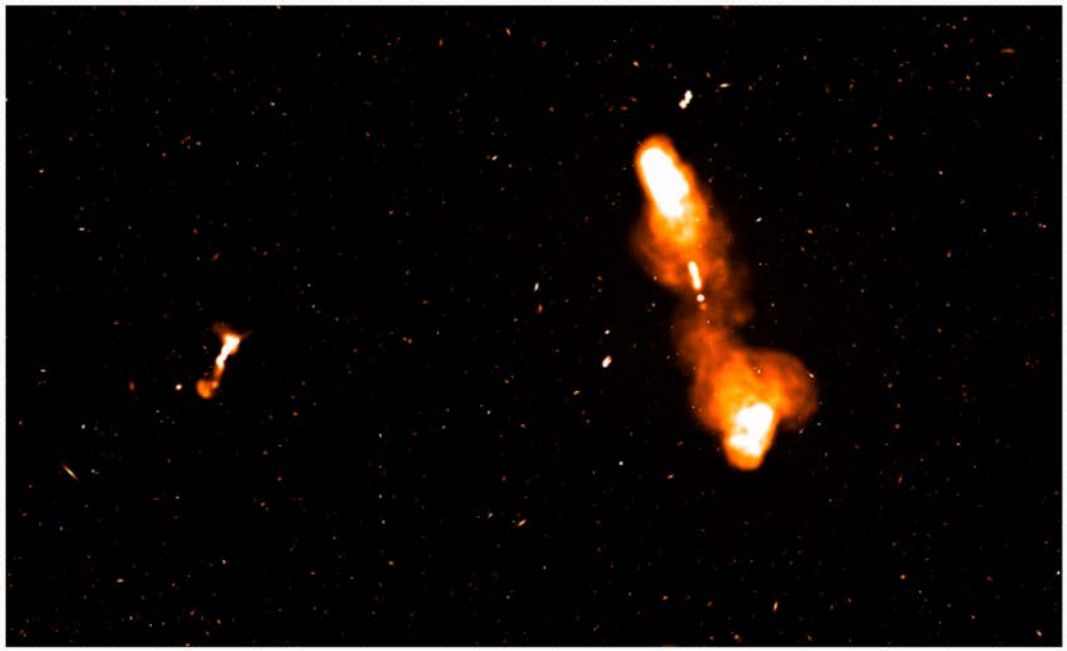
# Science data challenge 1 (SDC1)

- Science-ready (SRC) imaging product
- Radio continuum, SKA Mid
- Not too challenging data sizes
- 1 pointing, 3 freqs, 3 depths
- Source finding
- Source identification, classification & characterization





## SKA Launches First Science Data Challenge For Astronomy Community



*A snapshot from the SKA Science Data Challenge image, showing a large Active Galactic Nucleus (AGN) as if observed by SKA-mid at 1.4 GHz. (Credit: SKA Organisation)*

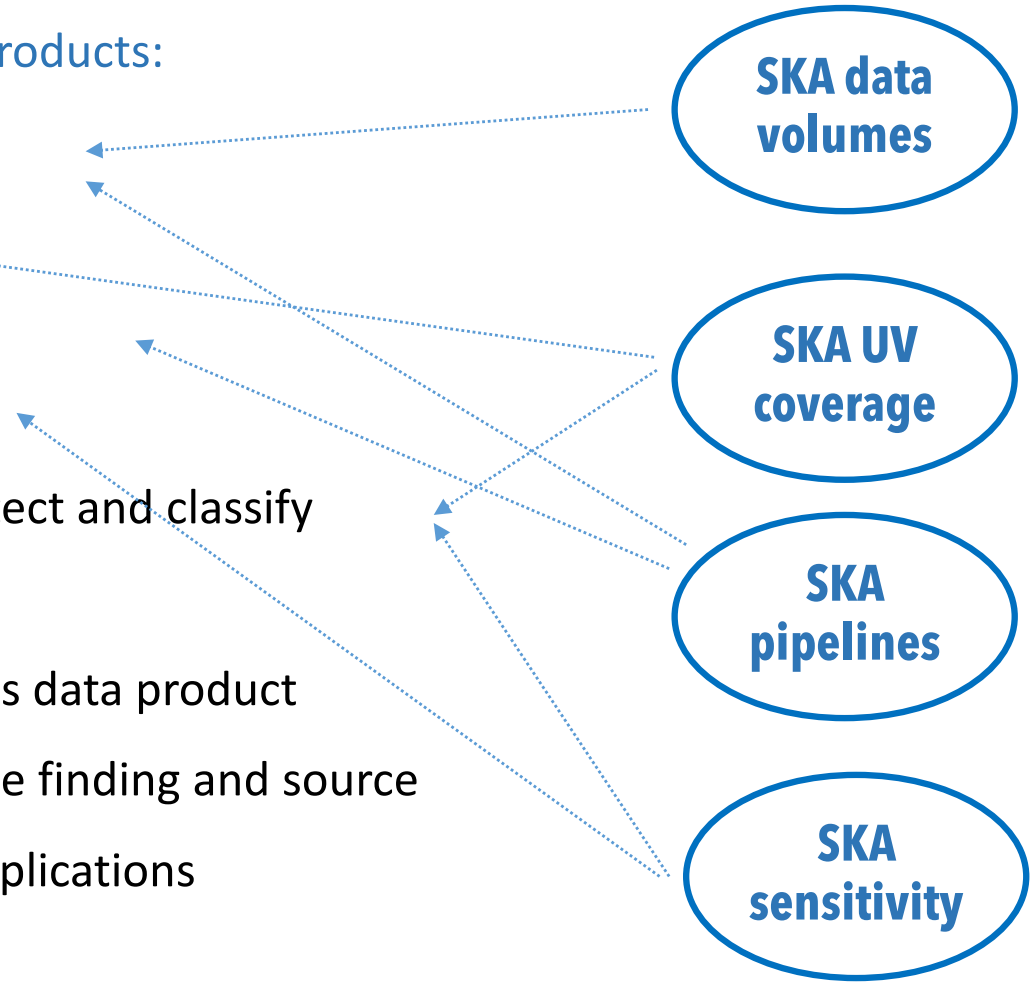
**SKA Global Headquarters, 26 November 2018** – The Square Kilometre Array Organisation (SKAO) is today releasing its first ever Science Data Challenge, giving astronomers a taste of the highly detailed images the SKA will produce.

Developed by the SKAO's Project Science team, the challenge requires the analysis of a series of high resolution images created through data simulations. Researchers are invited to download the images and use their own software to find, identify and classify the sources.

The key aim of the series of Data Challenges is to prepare the science community for the kind of data products they will receive from SKA observations, and to gather valuable feedback which will inform the development of data reduction procedures.

# Science data challenge 1 (SDC1)

- SKA unique features map into the data products:
  - ✓ In the image plane, not visibilities
  - ✓ "Benign" dirty beam
  - ✓ Deconvolved down to 8h exposures
  - ✓ Very deep -> confusion limited
  - ✓ Very large number of sources to detect and classify
- SDC1 goals:
  - ✓ Get the community familiar with this data product
  - ✓ Develop efficient methods for source finding and source characterization -> SWG and SRC applications



## Data

| | | | |
|---|---|---|---|
| 560 MHz, 8 hours | 4 Gb | DOWNLOAD | B1 |
| 560 MHz, 100 hours | 4 Gb | DOWNLOAD | |
| 560 MHz, 1000 hours | 4 Gb | DOWNLOAD | |
| 1400 MHz, 8 hours | 4 Gb | DOWNLOAD | B2 |
| 1400 MHz, 100 hours | 4 Gb | DOWNLOAD | |
| 1400 MHz, 1000 hours | 4 Gb | DOWNLOAD | |
| 9200 MHz, 8 hours | 4 Gb | DOWNLOAD | B5 |
| 9200 MHz, 100 hours | 4 Gb | DOWNLOAD | |
| 9200 MHz, 1000 hours | 4 Gb | DOWNLOAD | |

Short

Medium

Long

## Ancillary data

| | | |
|---|---|---|
| 560 MHz, primary beam | 300 Kb | DOWNLOAD |
| 560 MHz, synthesized | 4 Gb | DOWNLOAD |
| 1400 MHz, primary beam | 300 Kb | DOWNLOAD |
| 1400 MHz, synthesized | 4 Gb | DOWNLOAD |
| 9200 MHz, primary beam | 300 Kb | DOWNLOAD |
| 9200 MHz, synthesized | 4 Gb | DOWNLOAD |

Data access: from

https://astronomers.skatelescope.org/

Data reside on the Italian Center for Astronomical Archive (IA2) operated by INAF

## Training set

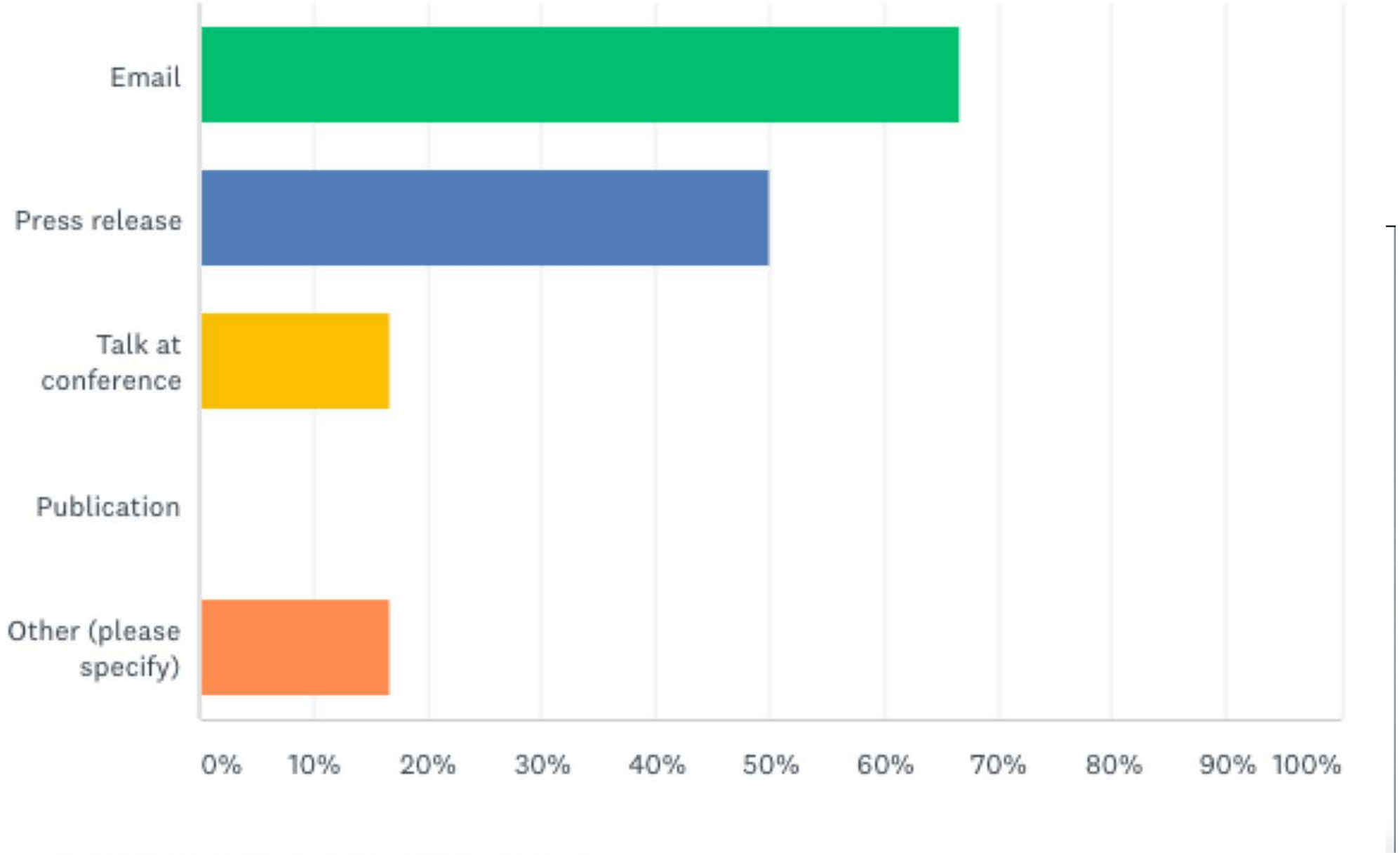
| | | | |
|---|---|---|---|
| 560 MHz, truth catalogue | 54 Mb | DOWNLOAD | Truth table for a 5% sky area: training set |
| 1400 MHz, truth catalogue | 14 Mb | DOWNLOAD | |
| 9200 MHz, truth catalogue | 340 Kb | DOWNLOAD | |

Explor

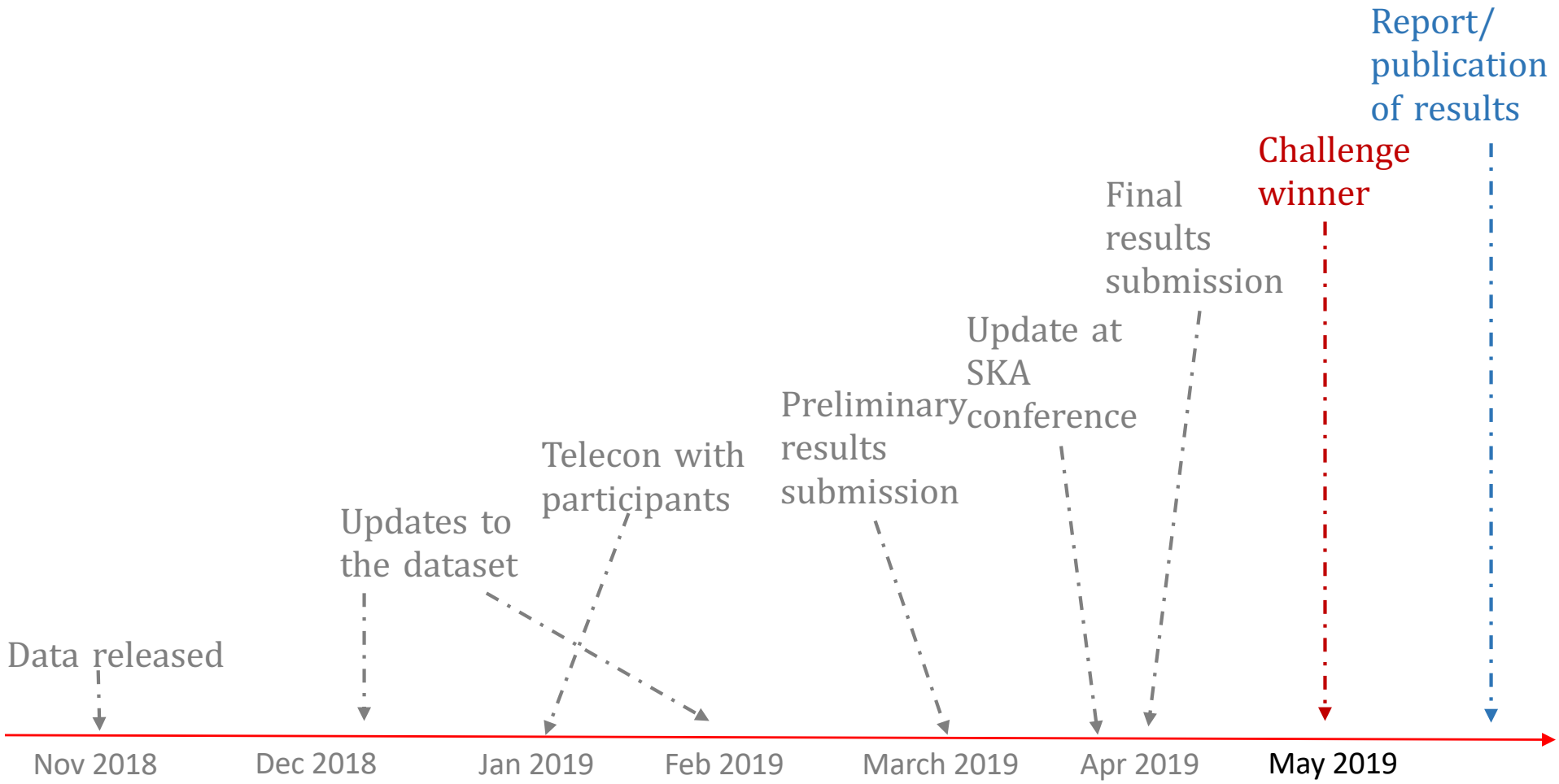
# SDC1 communication strategy

Square Kilometre Array Science Data Challenge 1

ANNA BONALDI & ROBERT BRAUN, FOR THE SKAO SCIENCE TEAM *
SKA Organization, Jodrell Bank, Lower Withington, Macclesfield, Cheshire, SK11 9DL, United Kingdom



# SDC1 timeline and progress



# The SDC1 teams!

17 teams registered to SDC1

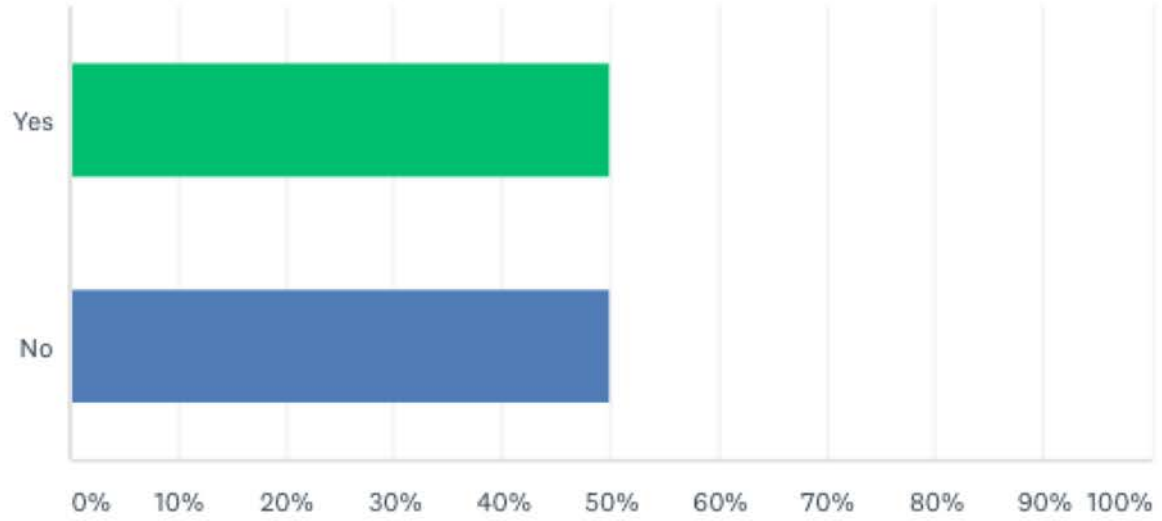
# The SDC1 teams!

9 teams submitted results by the deadline of 30th April

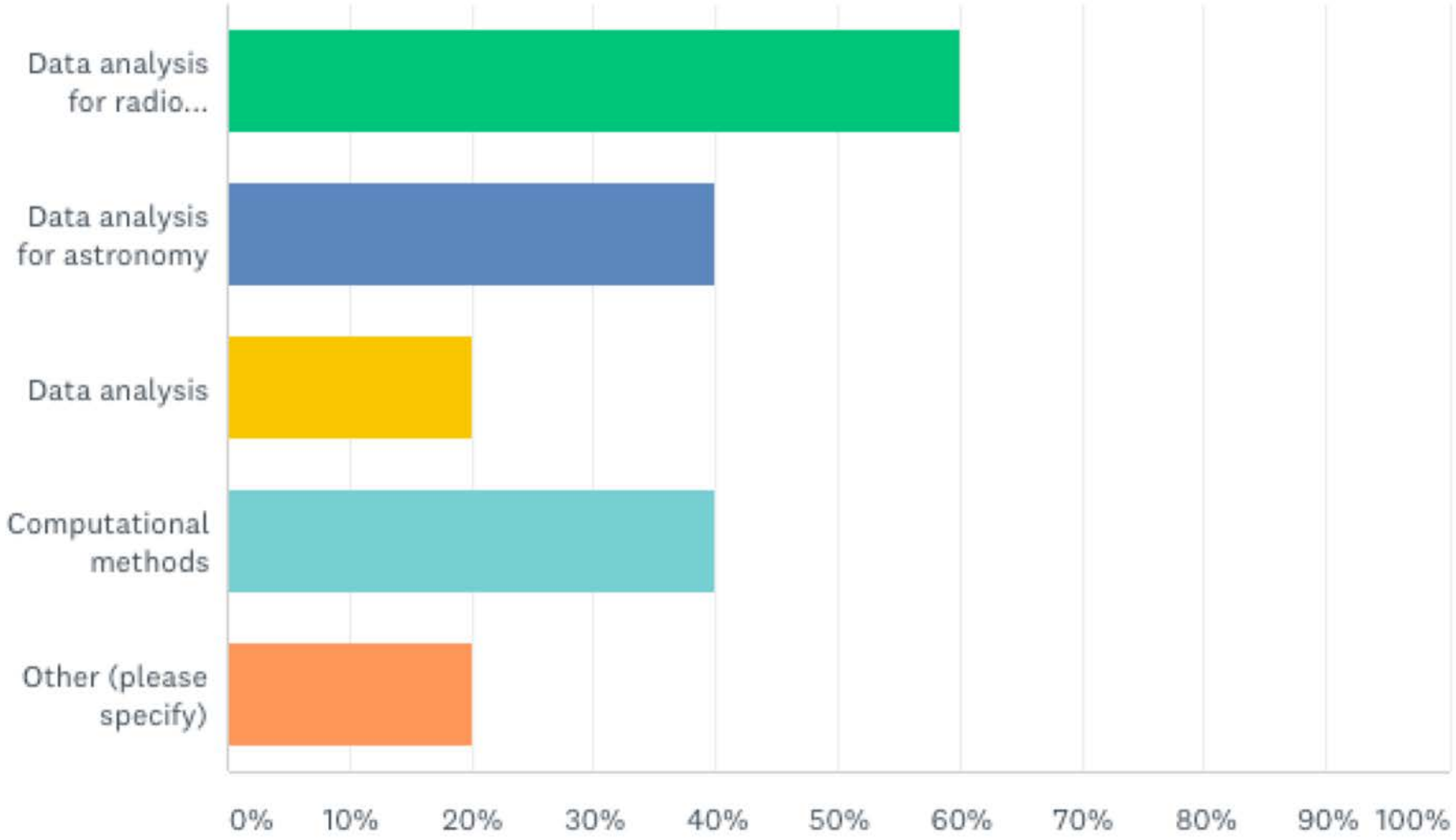
# Team’s provenance

Are there people in your team who are formally affiliated with an SKA Science Working Group?

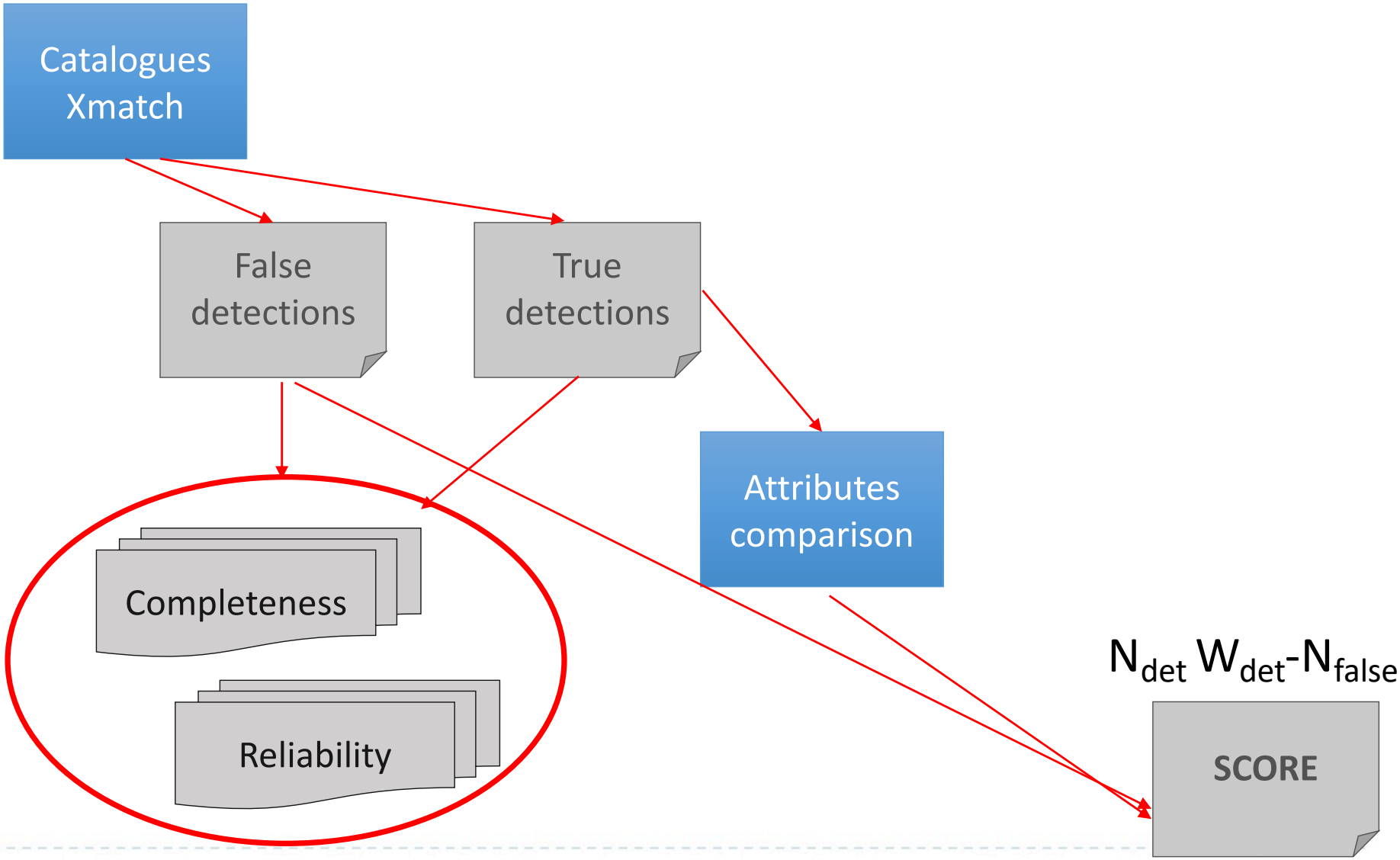
Answered: 6 Skipped: 0

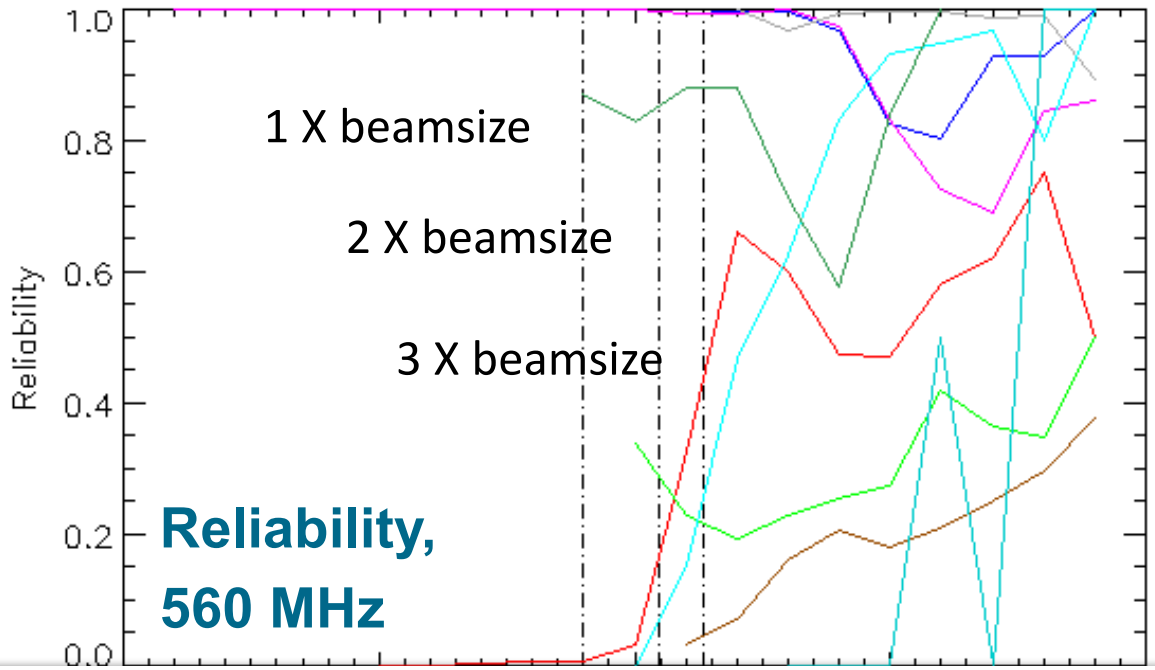


# Team’s expertise

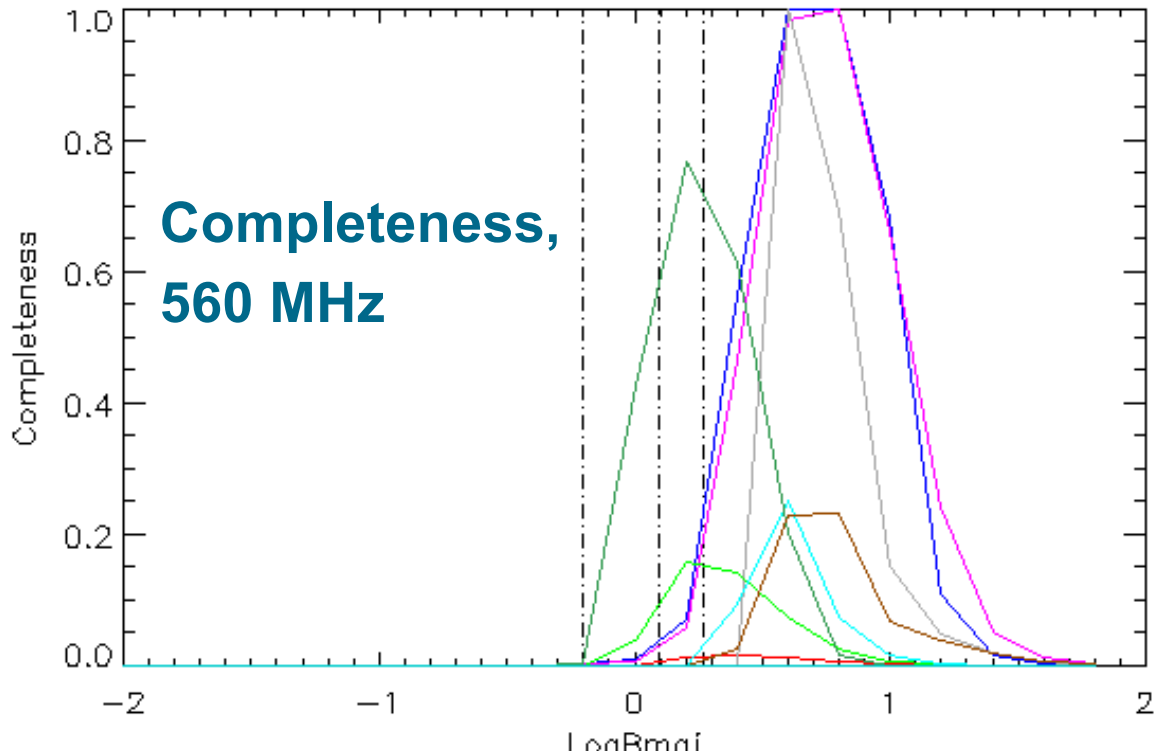


# SDC1 scoring method






**Reliability, 560 MHz**

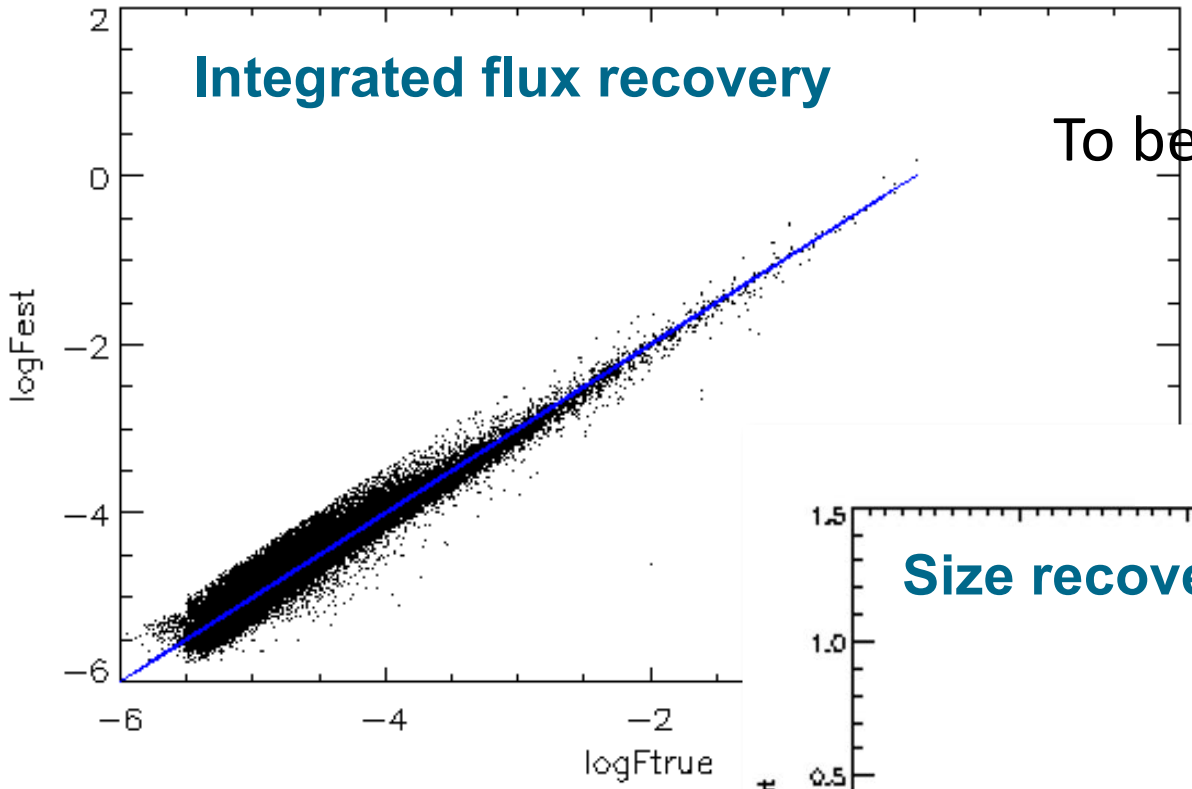



**Completeness, 560 MHz**

# SDC1 Results….

To be announced imminently on the SKA news!

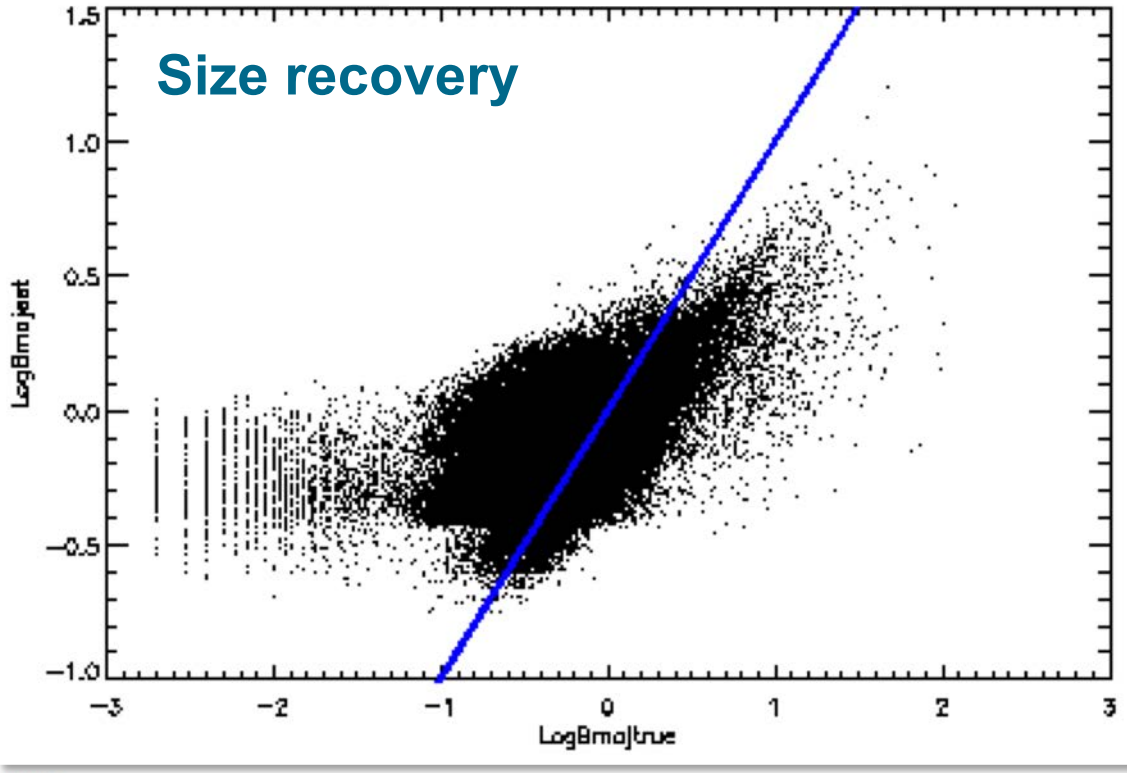
## Integrated flux recovery




To be announced imminently

on the SKA news!

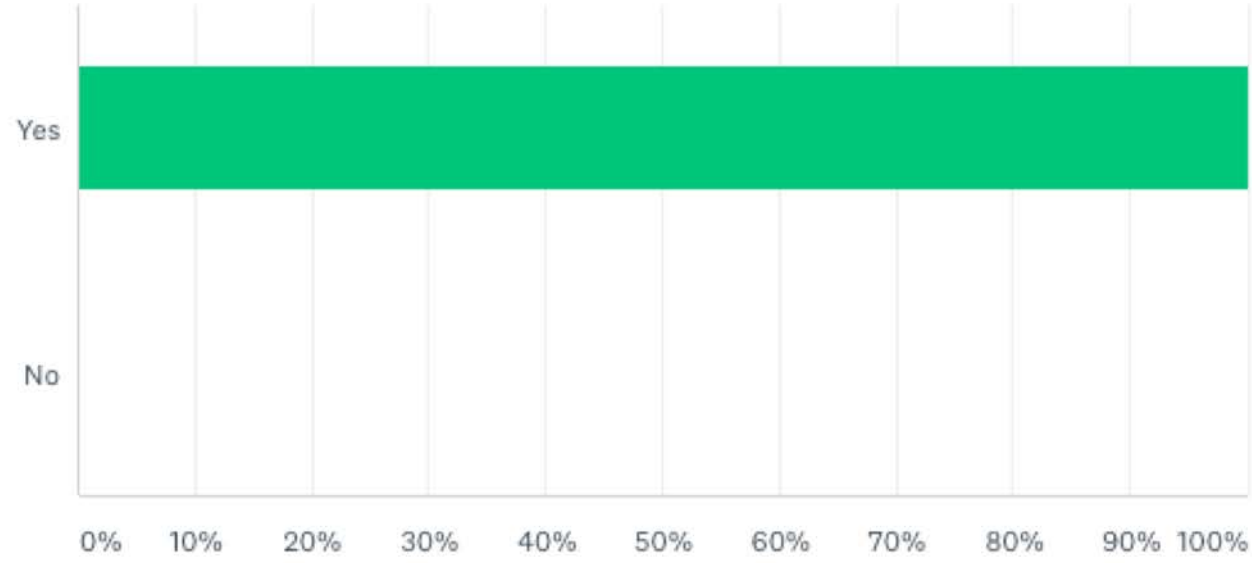
## Size recovery



# Positive feedback!

Based on your experience with SDC1 would you consider participating in future SKA science data challenges?

Answered: 5 Skipped: 0



# Moving forward…..

- SKA science data challenges issued regularly, representing
  - Different SKA observing modes
  - Different SKA science cases
- Increasing realism, e.g.:
  - Time variability
  - Polarization
  - Instrumental  systematics
- **Long-term goal: combine with the SDP and SRC challenges to "end to end" simulations**

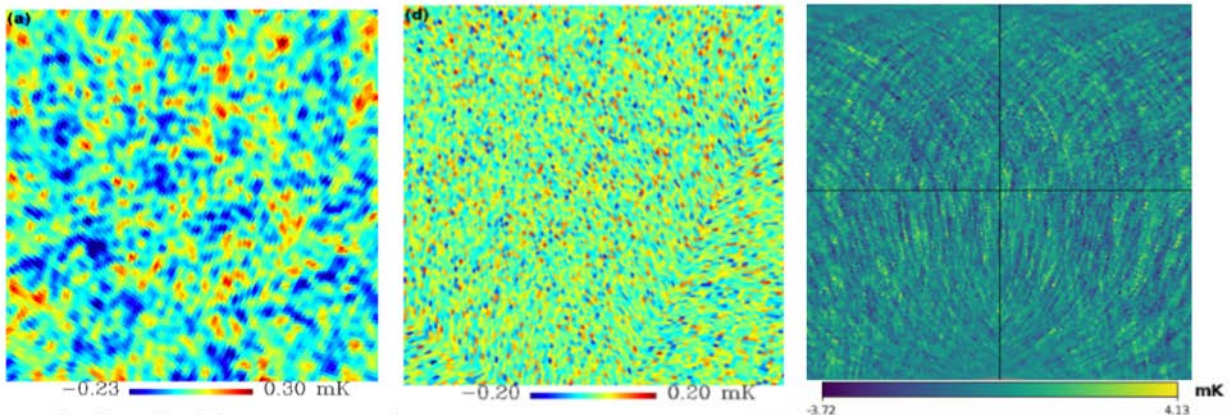
**SKA Science team + Philippa Hartley, postdoc @ SKAO**

# Possible SDC2: Intensity Mapping

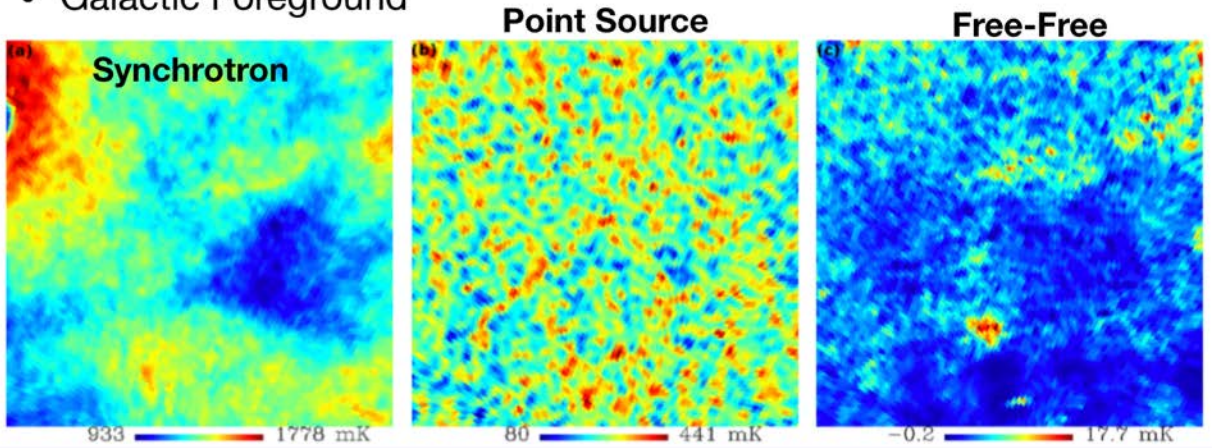
- Wide area, including diffuse Galactic emission
- Total power, “single dish” measurement
- Investigate foreground removal methods
- Investigate systematics

**Tianyue Chen, STFC industry placement @ SKAO**

- HI signal
- Thermal noise
- Systematics (1/f)




- Galactic Foreground



# Upcoming SKA-related Meetings

- SKA in Spain, June 10 – 11, Grenada
- New Perspectives on Galactic Magnetism, June 10-14 https://conferences.ncl.ac.uk/galacticmagnetism/
- SKA Swiss Days, 19-20 June https://ska.epfl.ch/swiss-ska-meetings/swiss-ska-days-2019
- EWASS SS11: New Inputs, prospects Milky Way Magnetic Fields https://eas.unige.ch/EWASS2019/session.jsp?id=SS11
- EWASS FRBs Special Session, 24 June, Lyon https://eas.unige.ch/EWASS/session.jsp?id=SS24
- EWASS SKA Special Session, 26 June, Lyon https://eas.unige.ch/EWASS2019/session.jsp?id=SS29
- CESRA Workshop, 8 – 12 July, Potsdam https://meetings.aip.de/cesra2019/cms/
- VLBI Workshop, 14 – 18 October, SKA HQ
- SKA Eng. and Ops. Meeting, 25 – 28 Nov Shanghai https://indico.skatelescope.org/event/551/

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