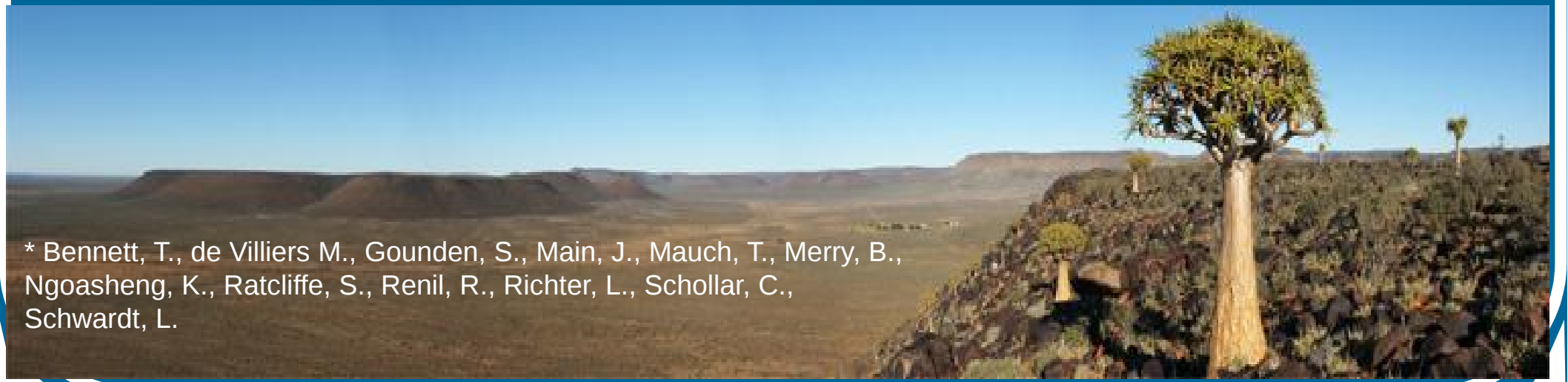
MeerKAT Science Data Processing

Tom Mauch
For the Science Processing Team*



* Bennett, T., de Villiers M., Gounden, S., Main, J., Mauch, T., Merry, B., Ngoasheng, K., Ratcliffe, S., Renil, R., Richter, L., Schollar, C., Schwardt, L.

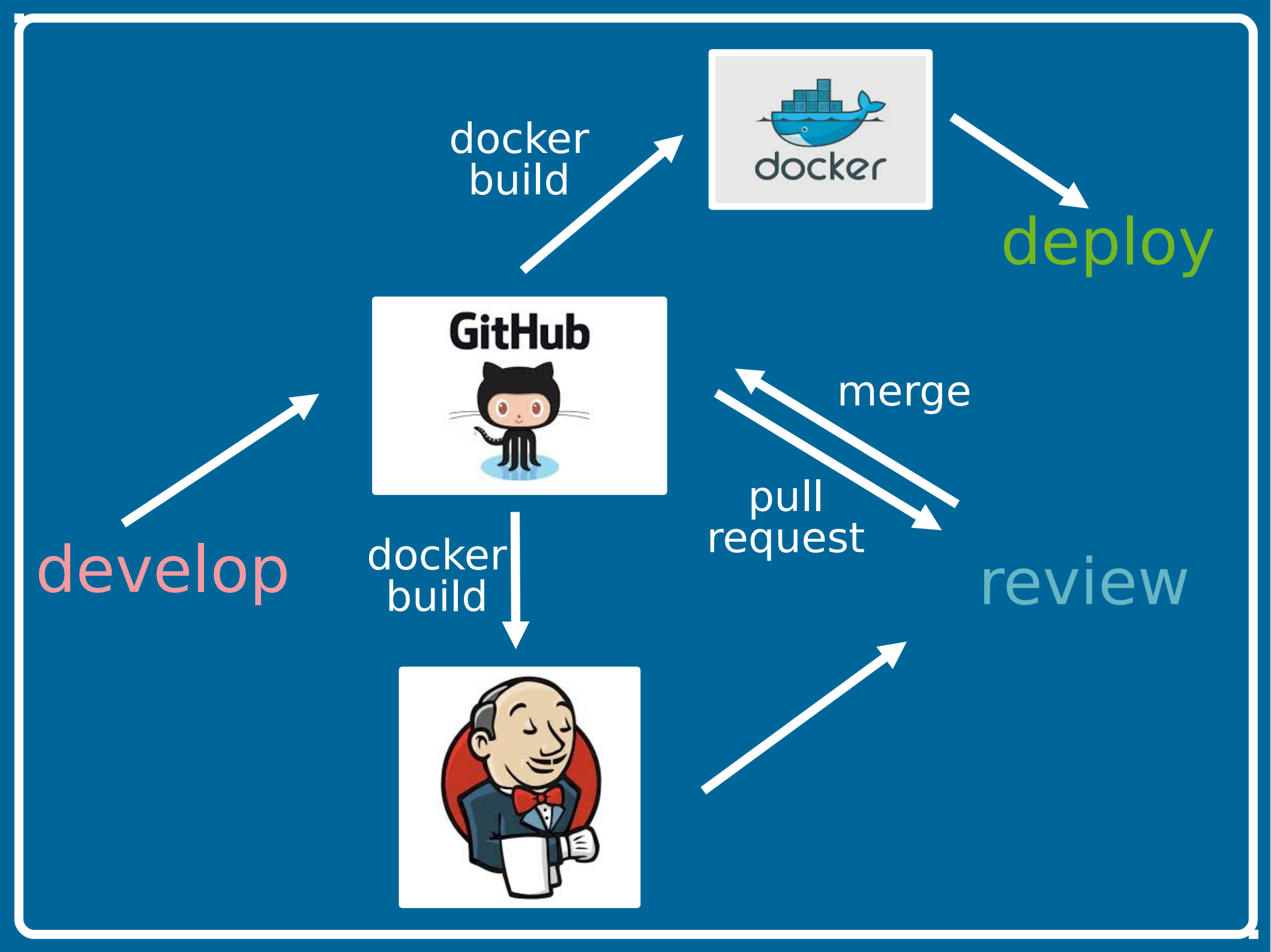
The Science Processing Team

Formal responsibility for delivery of calibrated visibility data to project teams.

Actual scope includes imaging, pulsar timing, commissioning, archiving, data product distribution, observation planning and scripting frameworks.

Close work with “User Supplied Equipment” teams.

Twelve staff in SPT area


docker
build
docker
deploy
GitHub
merge
pull
request
develop
docker
build
review

Some Packages

Spead2 – latest SPEAD receiver (20+ Gbps per core)

Katdal – data access layer for HDF5 formats

Katpoint – antennas, targets, coordinates (ephem)

Katsdpcontroller – master controller and graphs

Katsdpdata – search, tape library, file writer

Katsdpdisp – signal display library and clients

Katsdpingest – data ingest, RFI flagging, weights

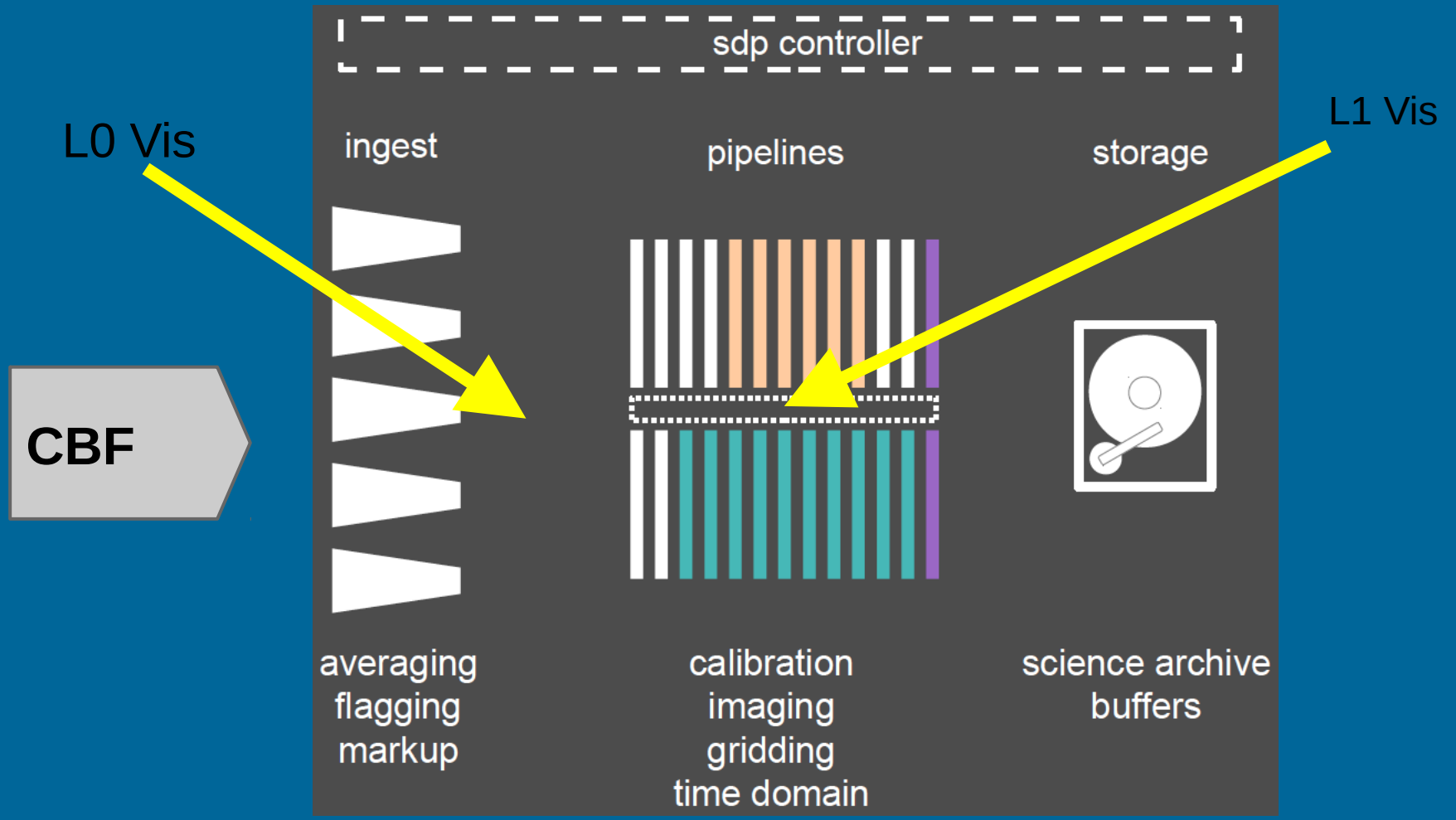
Katsdppipelines – calibration and imaging pipelines

Katsdpscripts – observing and commisioning Scripts

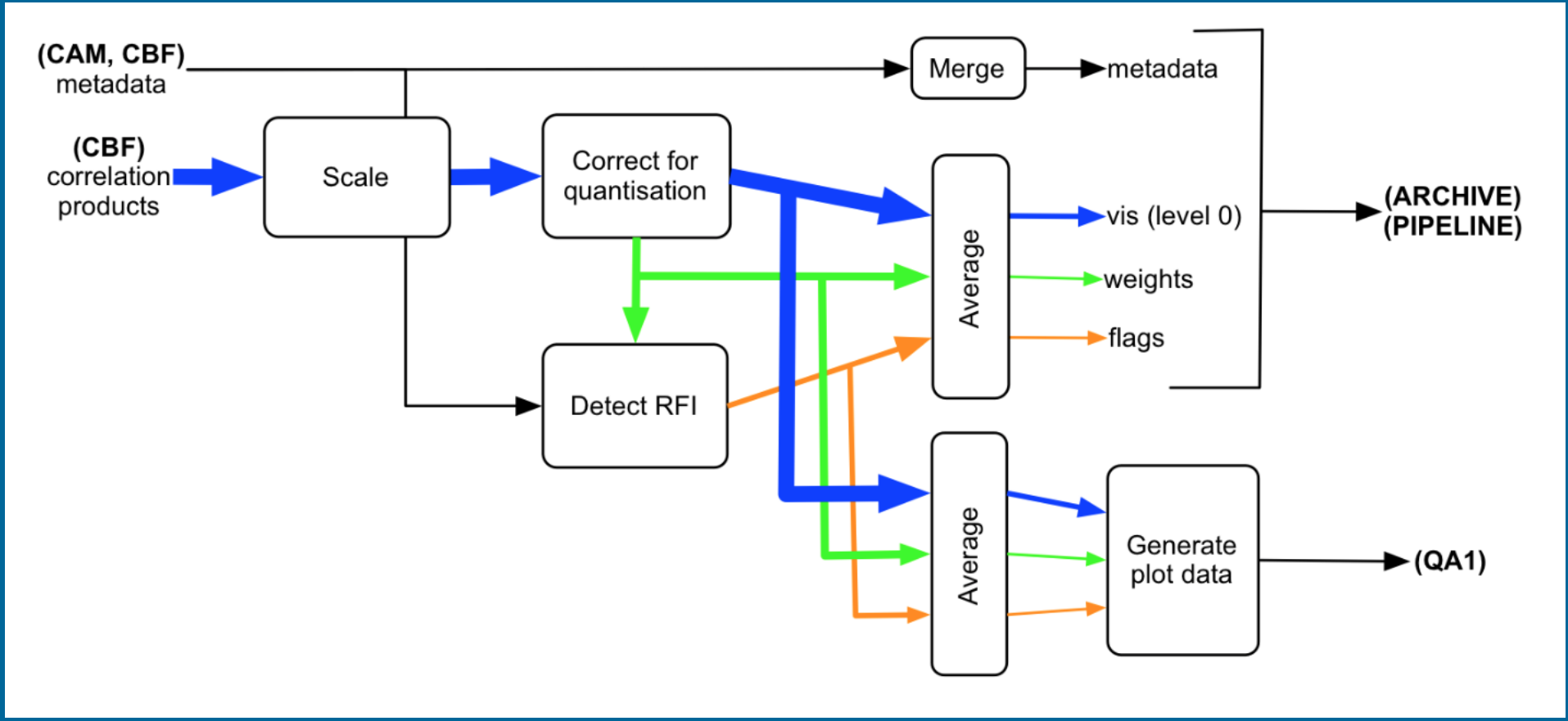
Katsdptelstate – telescope state repository

Katsdpworkflow – per telescope workflow management

SDP Overview



Ingest



0.5s correlator dumps averaged to 2s L0 vis.

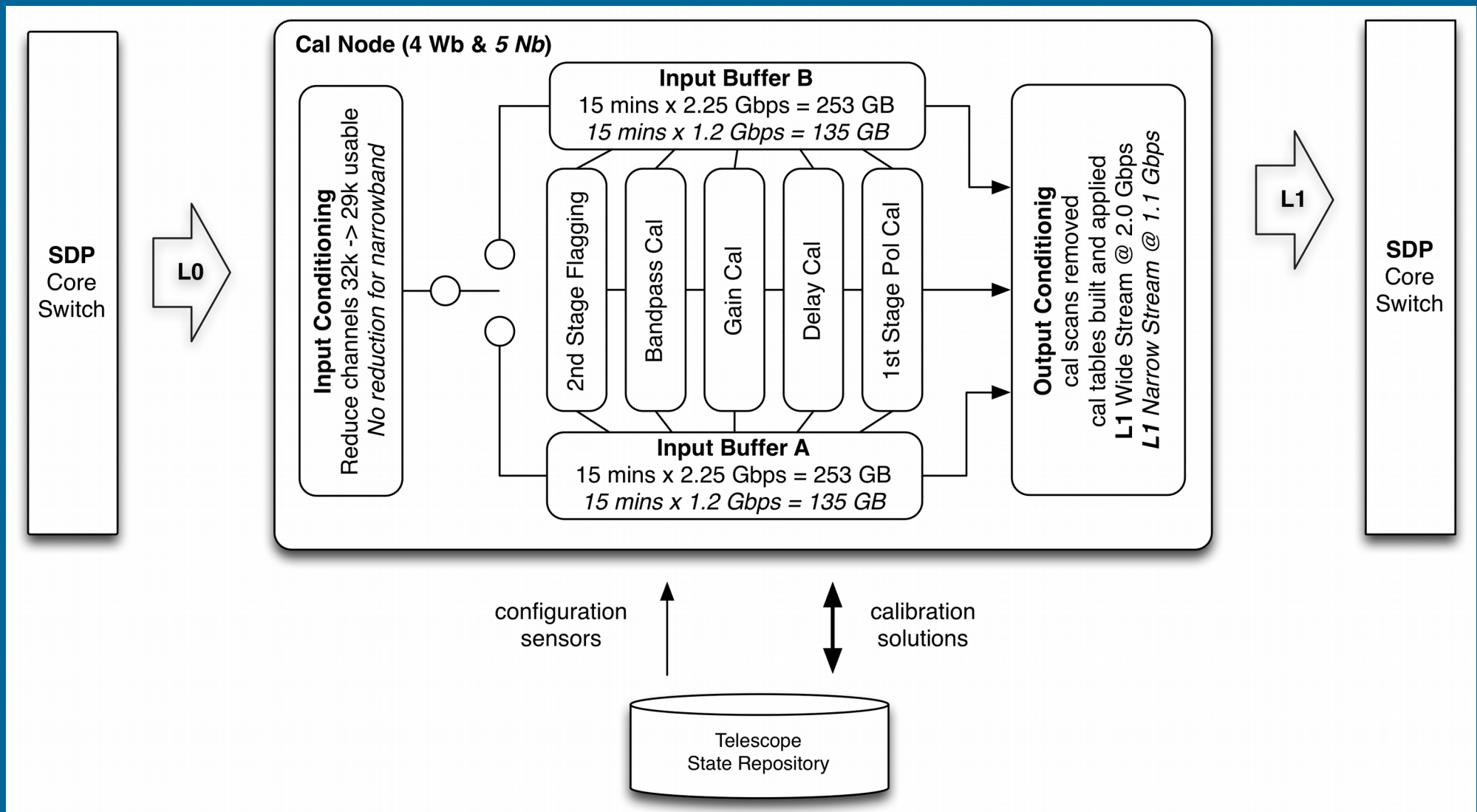
RFI Detection on single 0.5s bandpass

Implemented on graphics cards

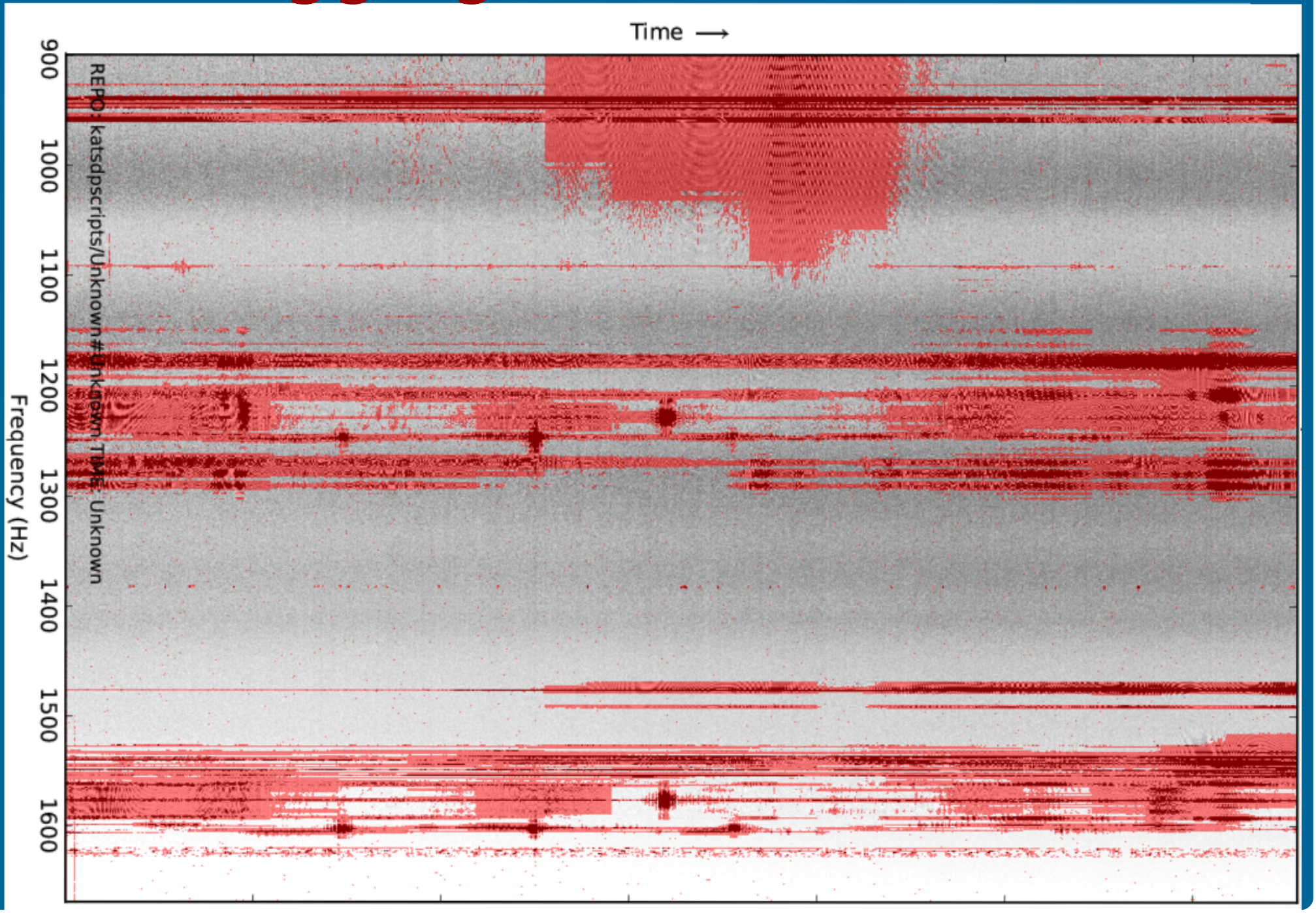
Visibility Store

Multiple SL150 – 10 PB total

Calibration



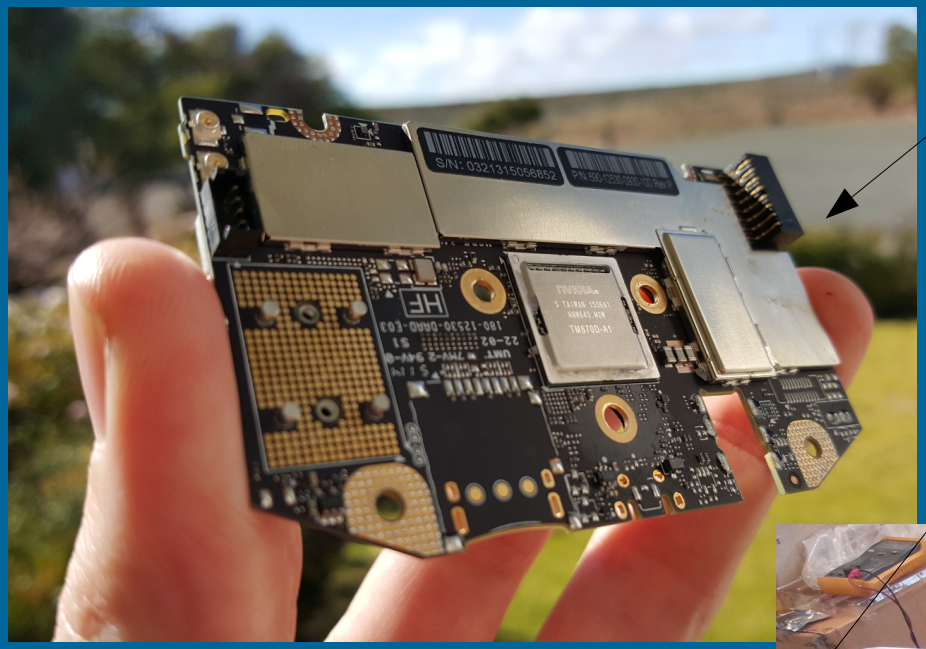
RFI Flagging



Imager

- Array of ~1000 Nvidia Tegra X1 boards each with CUDA graphics processor
- Can buffer ~50 hours of visibilities (assuming 2 second integrations)
- Will image L1 visibilities streamed from calibration node, produces images within hours of observations
- Can reprocess L1 visibilities from archive, for combining observations
- Novel cooling method using mineral oil has minimal cooling cost.

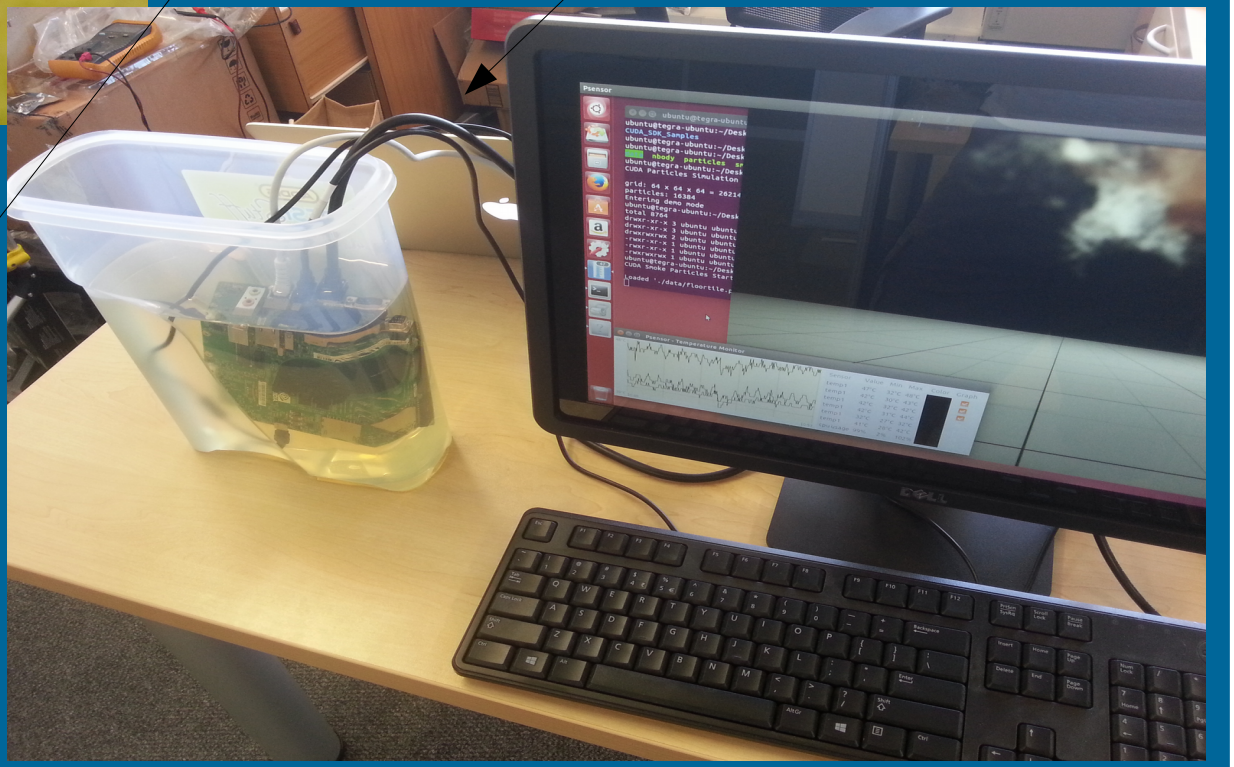
Imager



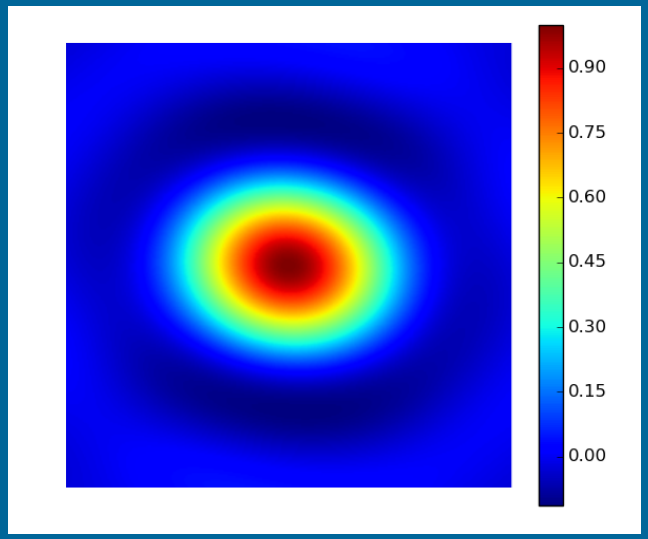
Tegra X1

In oil

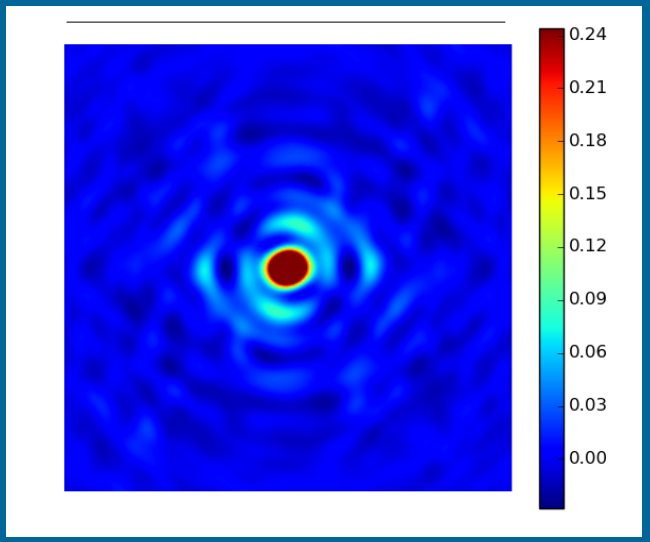
IronHive

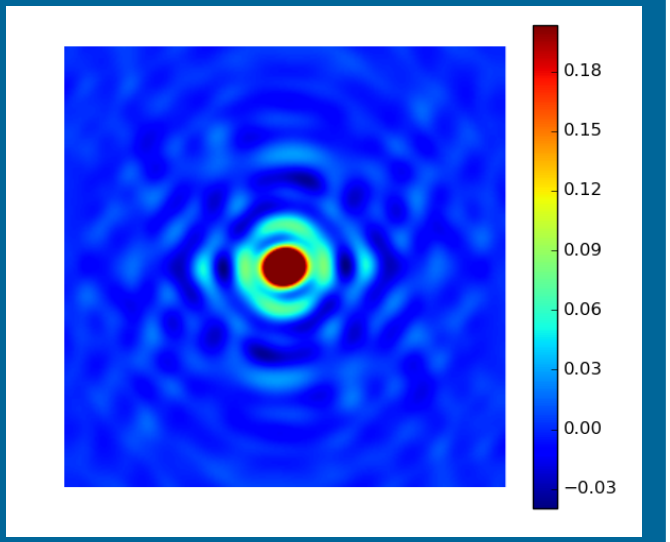


PSFs



2 arcmin





AR1
- 16 Antennas
Core only

- Restoring beam:
49” x 36”

- 12 hr Sensitivity:
1.3 mJy/channel

AR2
- 32 Antennas
16 outside core

- Restoring beam:
9.1” x 8.0”

- 12 hr Sensitivity:
0.69 mJy/channel

Full MeerKAT

- 64 Antennas

- Restoring beam:
9.1” x 8.0”

- 12 hr Sensitivity:
0.34 mJy/channel

1.4 GHz, 12 hour track, -30 deg. Declination, robust 0.0