CSIRO Astronomy and Space Science

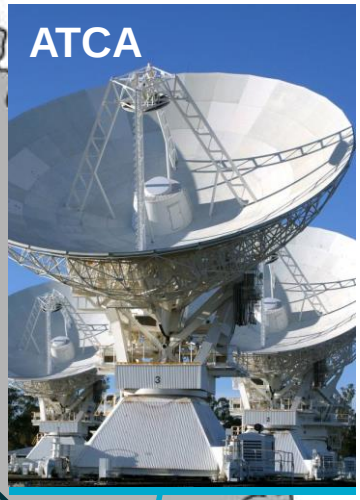
Monitoring and Control System status update

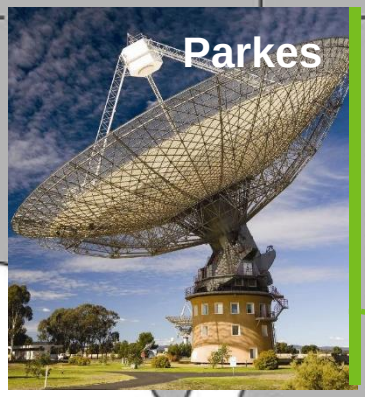
Malte Marquarding | Team Lead Monitoring and Control Software

10 October 2018

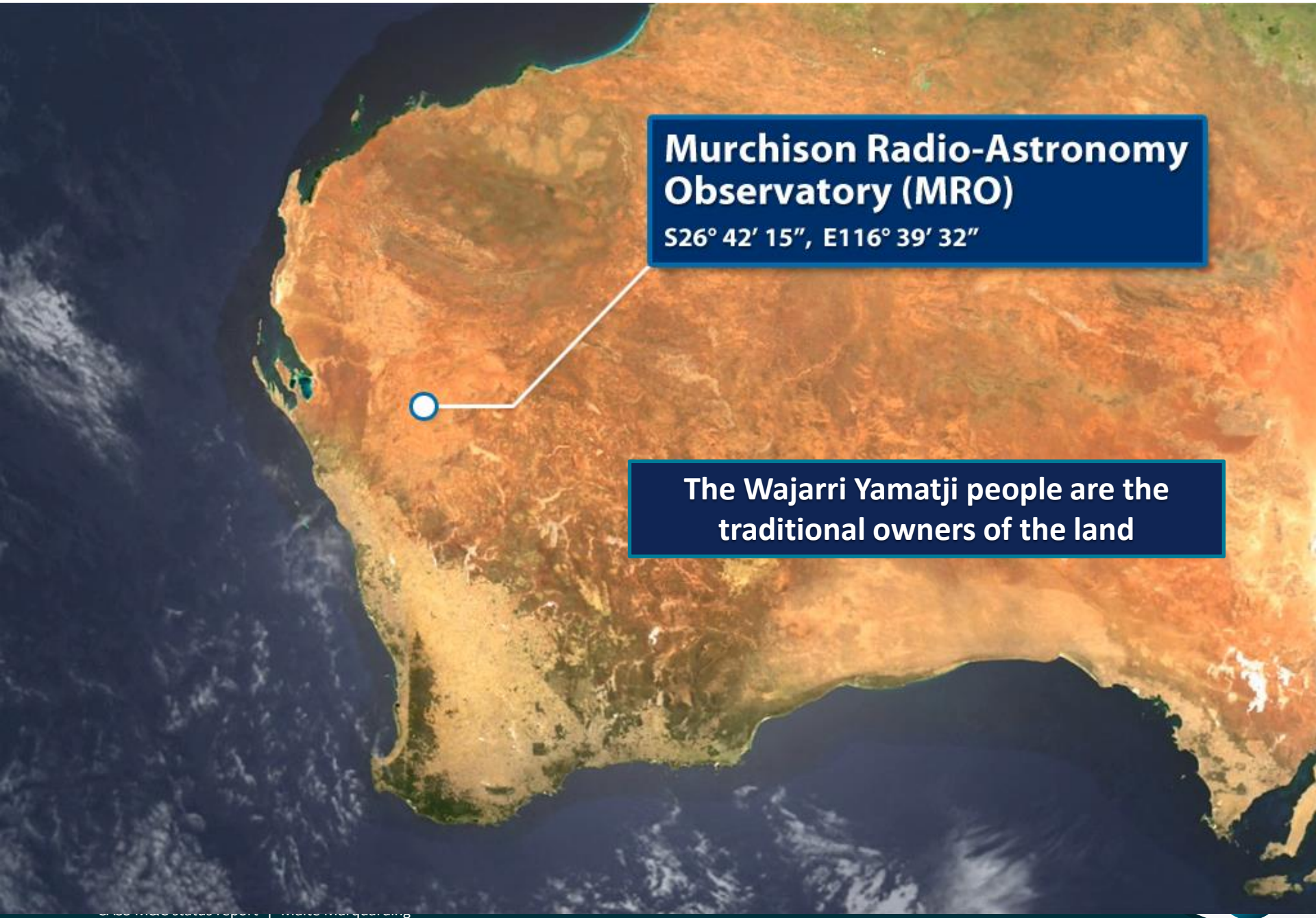
CSIRO Astronomy and Space Science

Instruments and locations

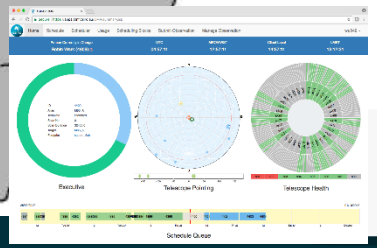




WESTERN AUSTRALIA
MRO
GERALDTON
PERTH
NEW SOUTH WALES
NARRABRI
COONABARABRAN
PARKES
SYDNEY
TIDBINBILLA


Murchison Radio-Astronomy Observatory (MRO)
S26° 42′ 15″, E116° 39′ 32″
The Wajarri Yamatji people are the traditional owners of the land

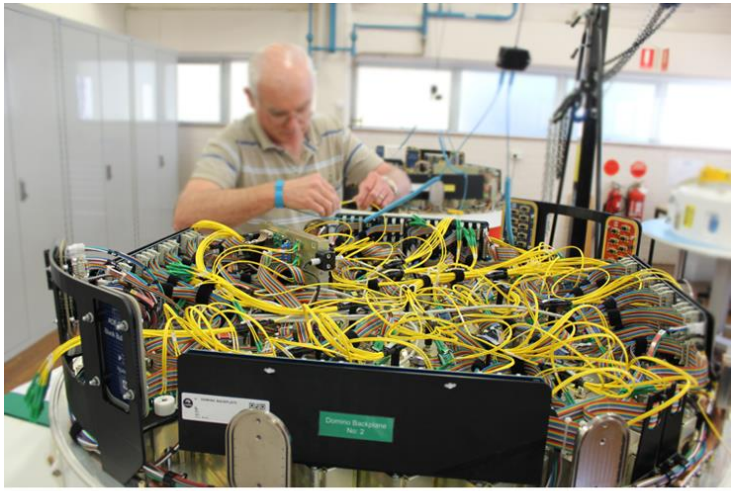
Murchison Radio Observatory



BOOLARDY STATION
Entry to MRO Site
MURCHISON
BOOLARDY
30km
NW Coastal Hwy
Mullewa Carnarvon Rd
Beringarra Pindar Rd
135km
38km
PINDAR
YALGOO
98km
MULLEWA
GERALDTON
Geraldton Mt Magnet Rd
Brand Hwy
GERALDTON
PERTH
NARRABRI
PARKES
SYDNEY

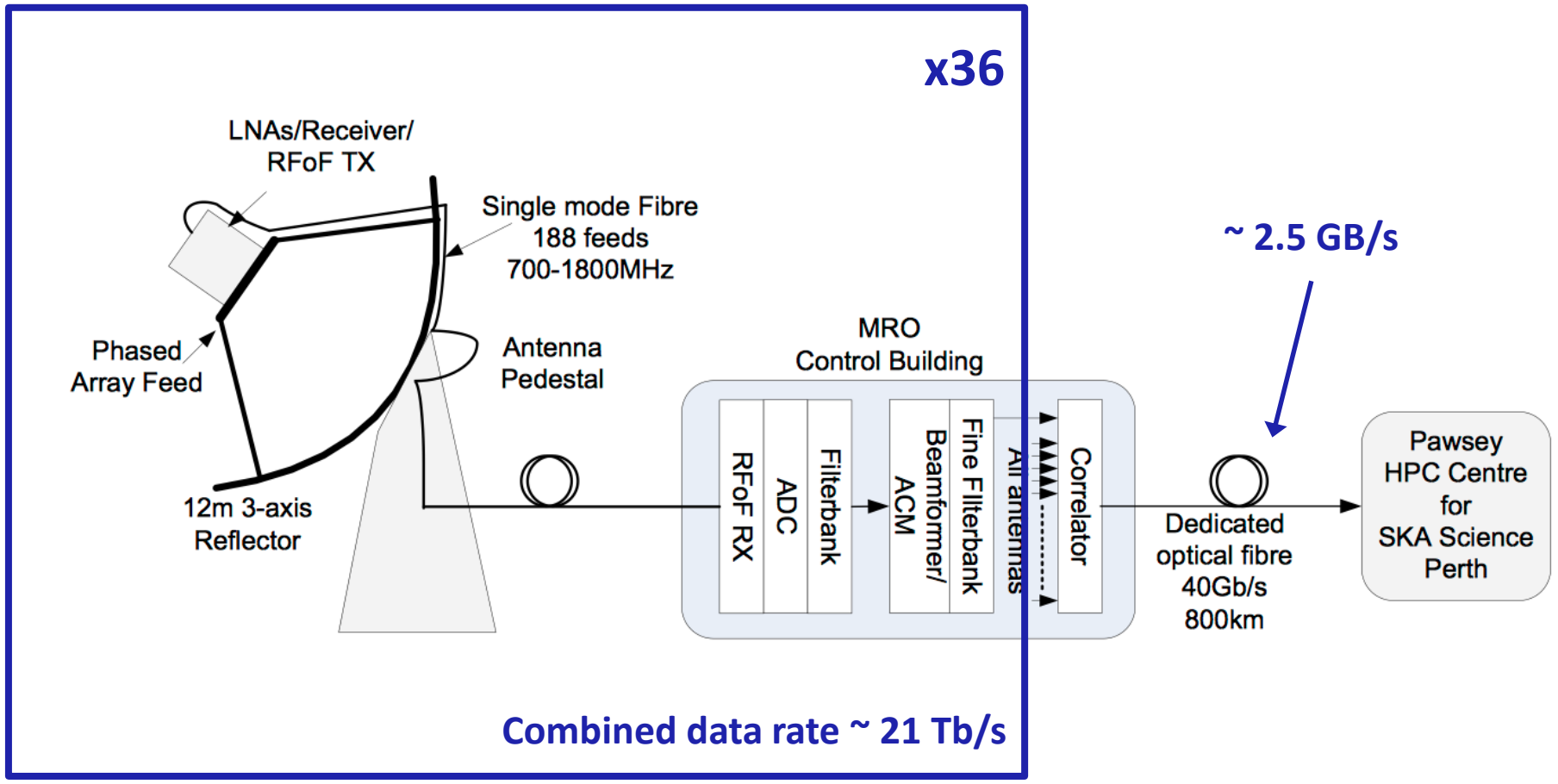
ASKAP – the telescope

- 36 x 12m antennas
- 700-1800 MHz
- Phased-array feeds
- > 350km custom fibre to site
- Remote operation
- Faraday cage building
- Hybrid solar diesel power
- Off-site data processing
- Supercomputer @ Pawsey



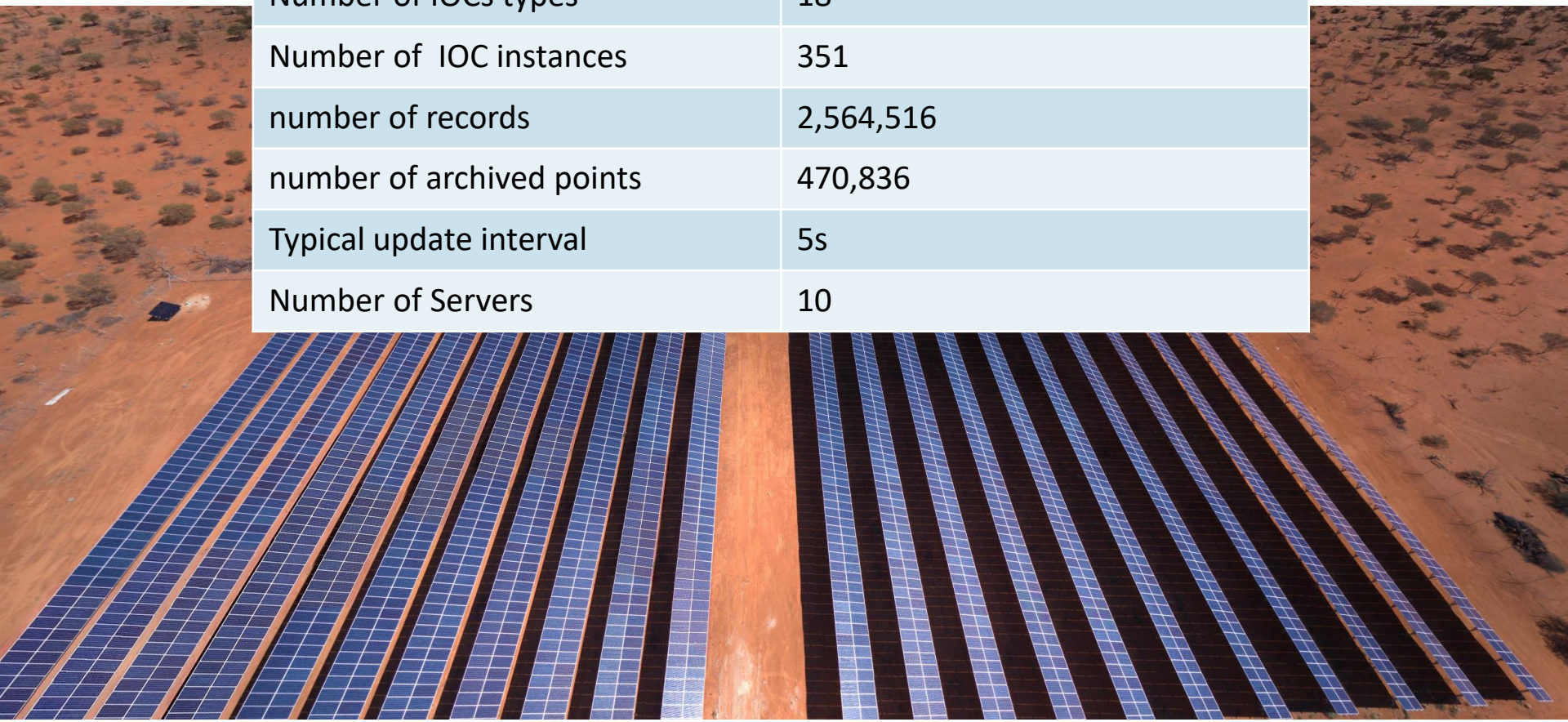
Thousands of fibres are connected to the PAF electronics before as part of the assembly process.

ASKAP – the architecture

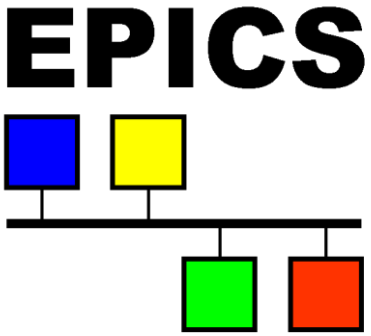


ASKAP – some numbers

Number of IOCs types	18
Number of IOC instances	351
number of records	2,564,516
number of archived points	470,836
Typical update interval	5s
Number of Servers	10

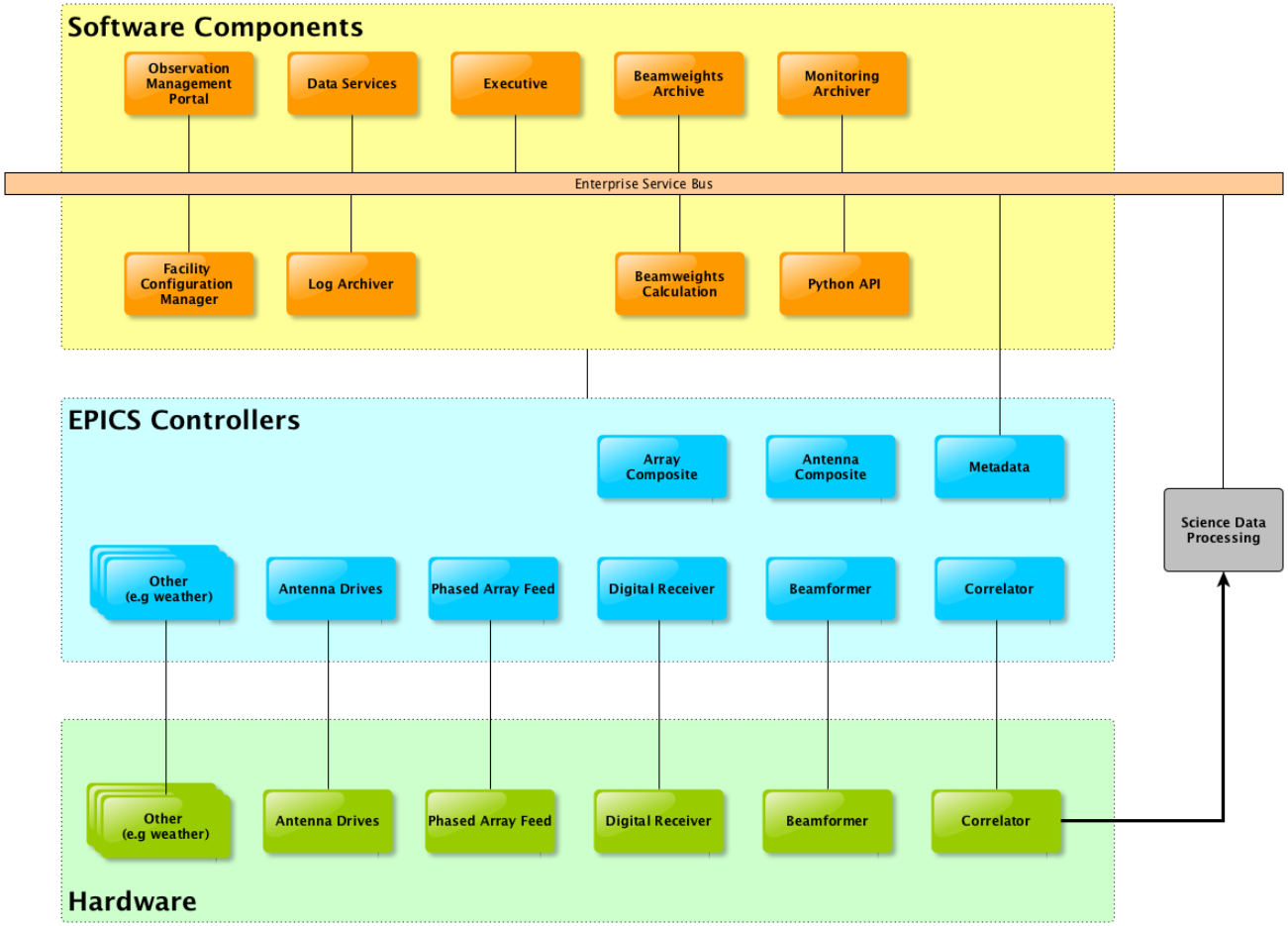


ASKAP – the software

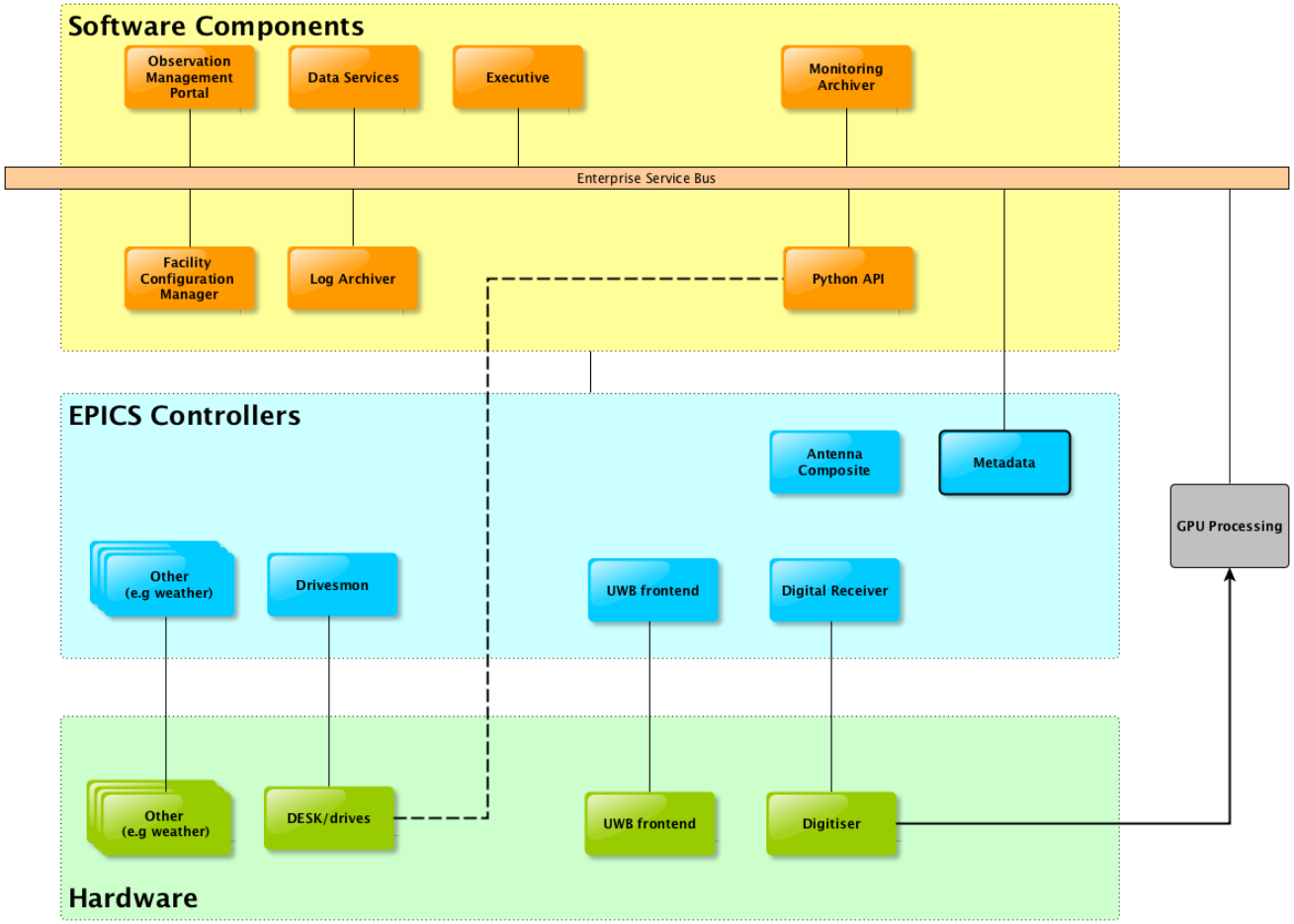


- Custom c++ libraries to interface with firmware
  - Autogenerated points/records from xml annotations
- EPICS
  - software input/output controllers
- ZeroC ICE
  - Middleware orchestration layer
- Python API
- DiaMoniCA (lightning talk)
  - Application stack of MoniCA , Influx, grafana
- Engineering UI
- Web UI
  - Operator/science control
  - Java, js, d3js

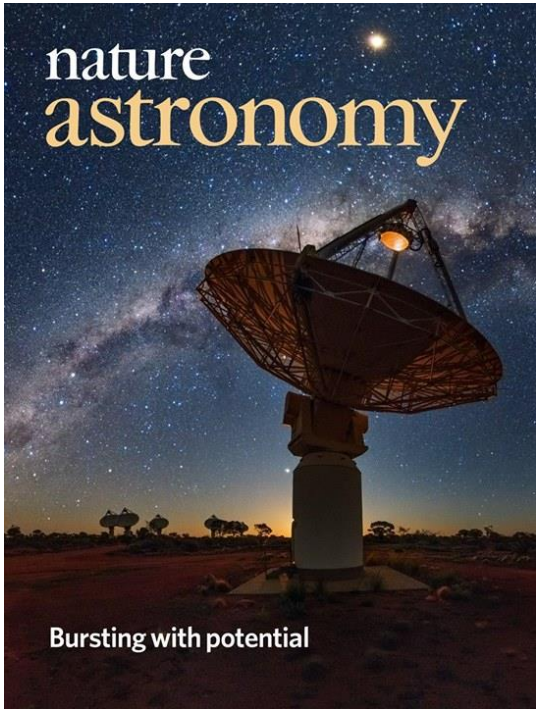
ASKAP software architecture



Parkes software architecture

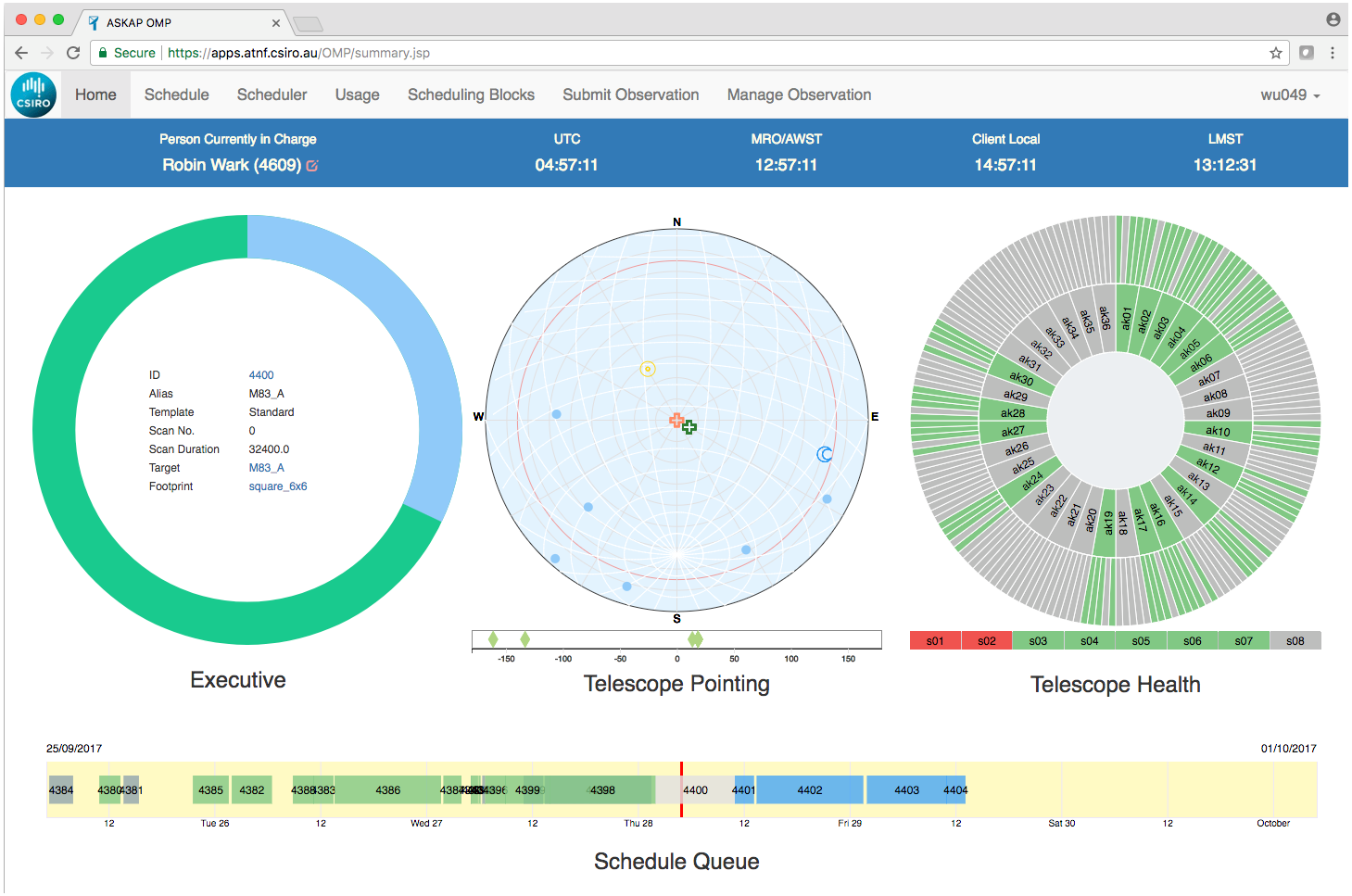


EPICS

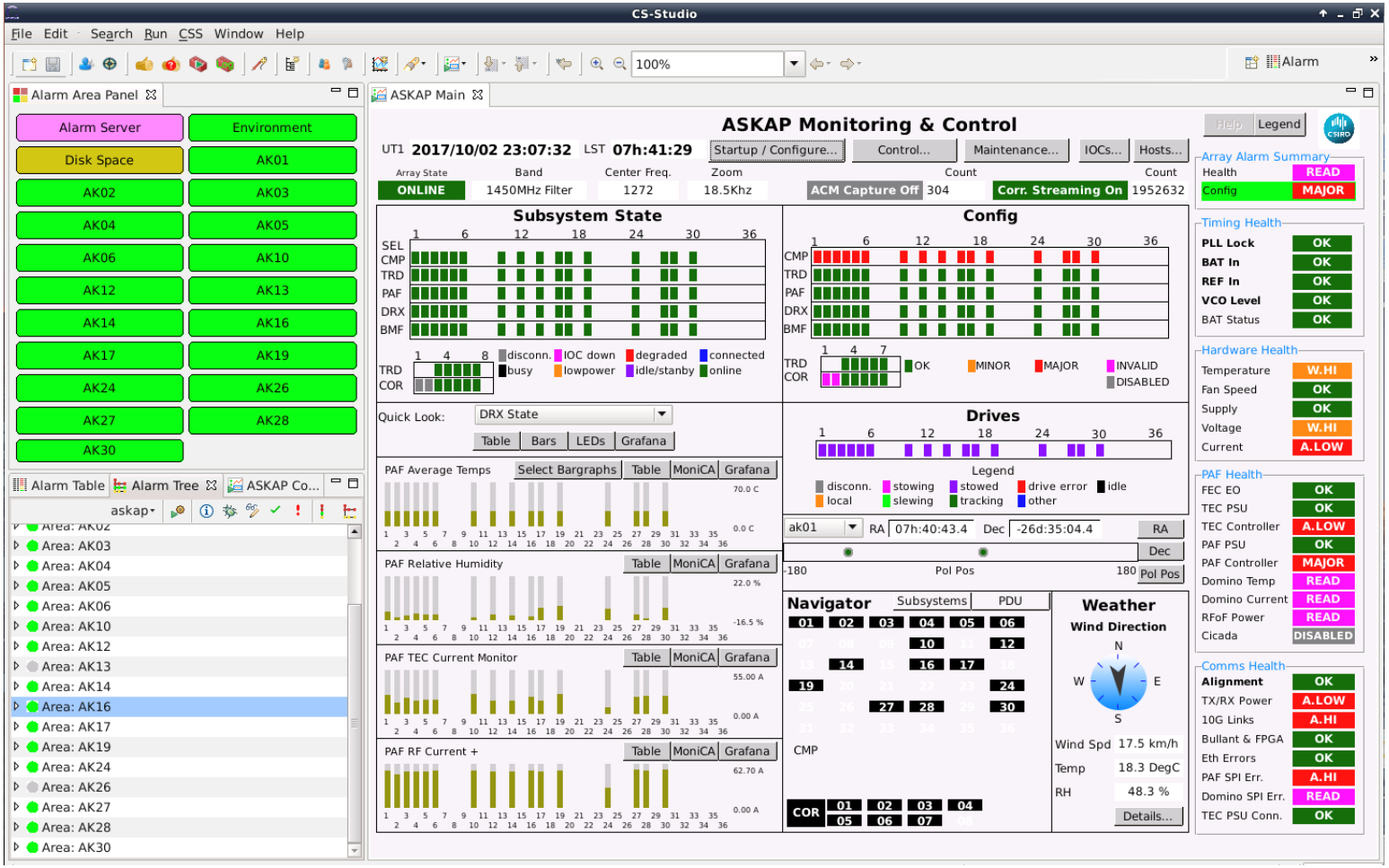


- v7 readiness
  - Recently transitioned to 3.16.1+patches
  - 4.6 (pvaSrv)
- All base on support module – askapioc
  - Logging, templating, iocadmin (stats)
  - Asyn abstraction
  - Big asub
- Composite IOCs - aggregation and delegation
- Auto-generation of databases
- Various support modules
- Pyepics for commissioning and experiment control
- Cs-studio configuration/set up

Observation Management Portal (OMP)



Control System Studio (cs-studio)



ASKAP – alarms???

- All critical alarms handled in hardware
- soft limits around those
- No critical safety alarms
- No consistent alarm handler
  - Mix of IM, email, UI colours
  - BEAST has no acceptance
  - All different requirements
  - AUTOMATION

```
var database string
var downsampled_database string
var measurement string

var data =  stream
    | from()
        .database(database)
        .retentionPolicy('autogen')
        .measurement(measurement)
        .groupBy(*)
    @deadband()
        .change(2.0)
    |influxDBOut()
        .database(downsampled_database)
        .retentionPolicy('autogen')
        .measurement(measurement)
        .precision('ms')
```

Future enhancements

- Machine Learning
  - Explore existing solutions to large parameter space anomaly detection
- Alarm handling
  - Tool and pre-processing
- Visualising visibilities
  - Quasi-realtime displays of high volume data correlations

https://github.com/webepics

Thank you

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