



CSIRO Astronomy and Space Science

Monitoring and Control System status update

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10 October 2018

ASTRONOMY AND SPACE SCIENCE

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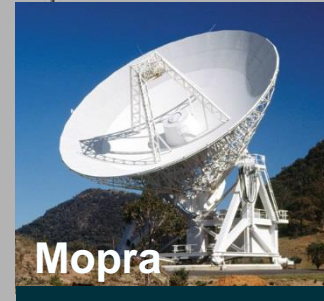


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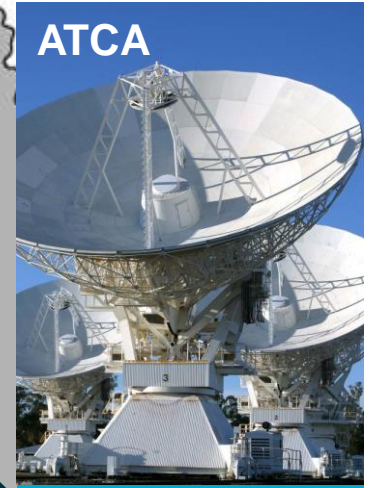
Instruments and locations



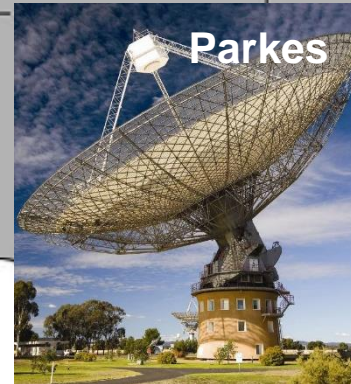
ASKAP



Mopra



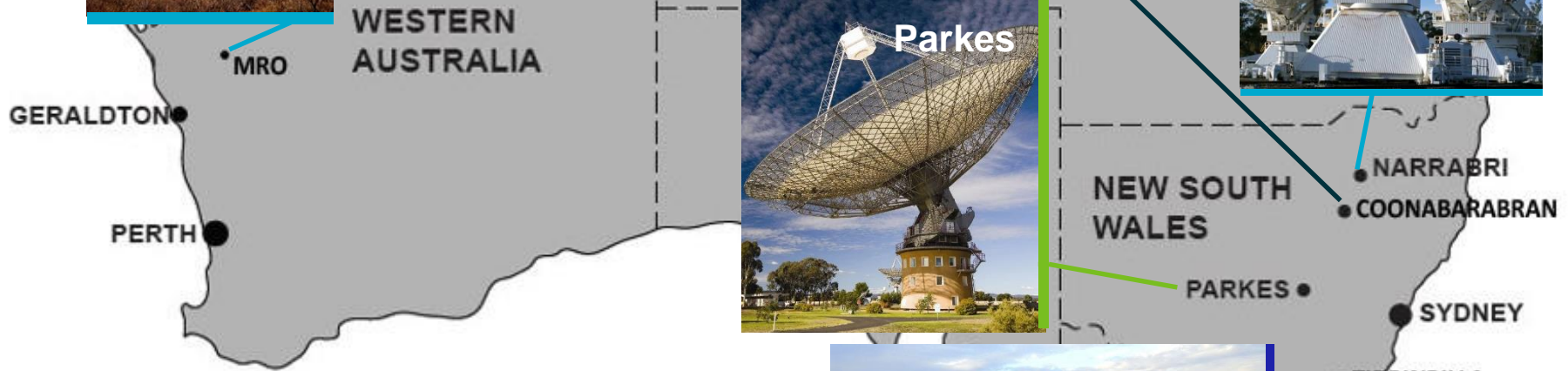
ATCA



Parkes



CDSCC



A satellite-style map of Australia showing the continent's terrain in shades of brown and orange. A white line with a blue circular endpoint points from a text box to a specific location in the western part of the continent. The text box contains the name of the observatory and its coordinates.

**Murchison Radio-Astronomy
Observatory (MRO)**

S26° 42' 15", E116° 39' 32"

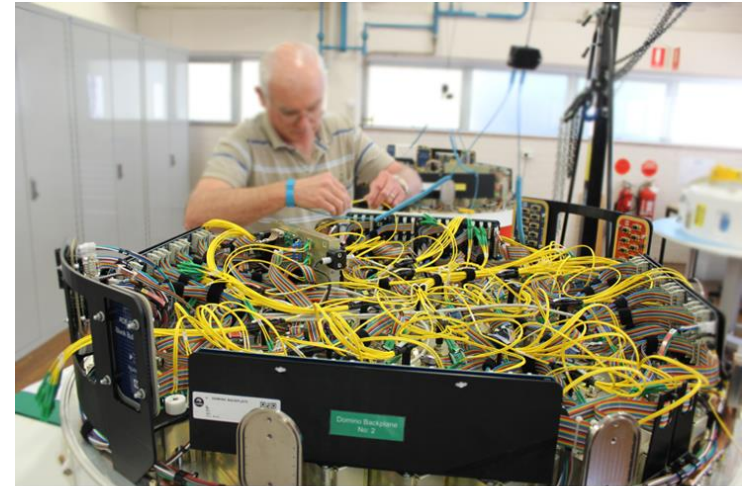
**The Wajarri Yamatji people are the
traditional owners of the land**

Murchison Radio Observatory



ASKAP – the telescope

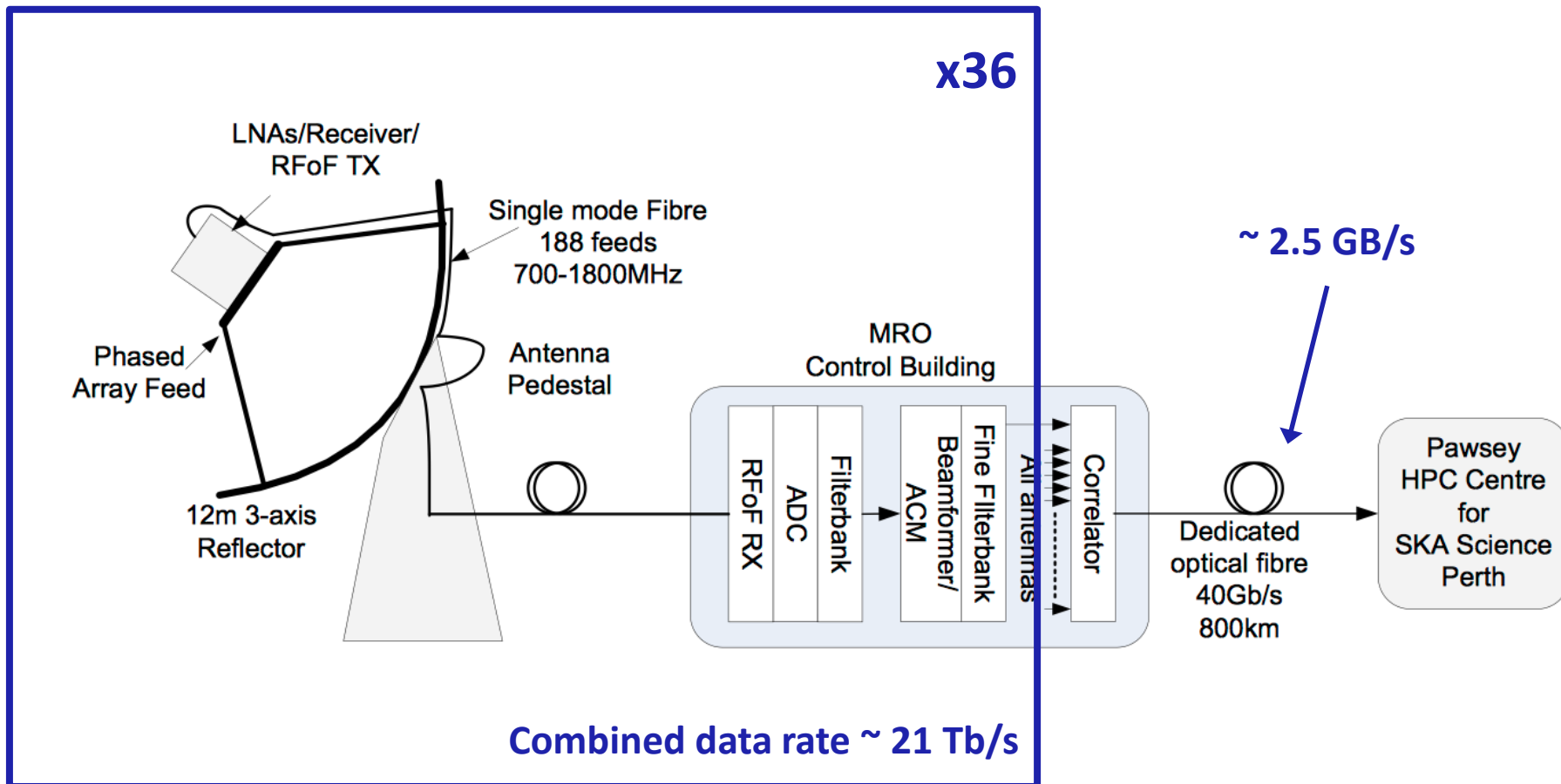
- 36 x 12m antennas
- 700-1800 MHz
- Phased-array feeds
- > 350km custom fibre to site
- Remote operation
- Faraday cage building
- Hybrid solar diesel power
- Off-site data processing
- Supercomputer @ Pawsey



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



ASKAP – the architecture



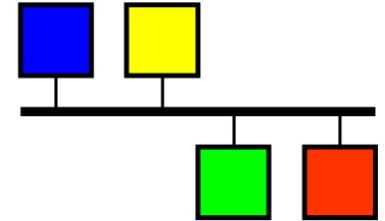
ASKAP – some numbers

Number of IOC 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

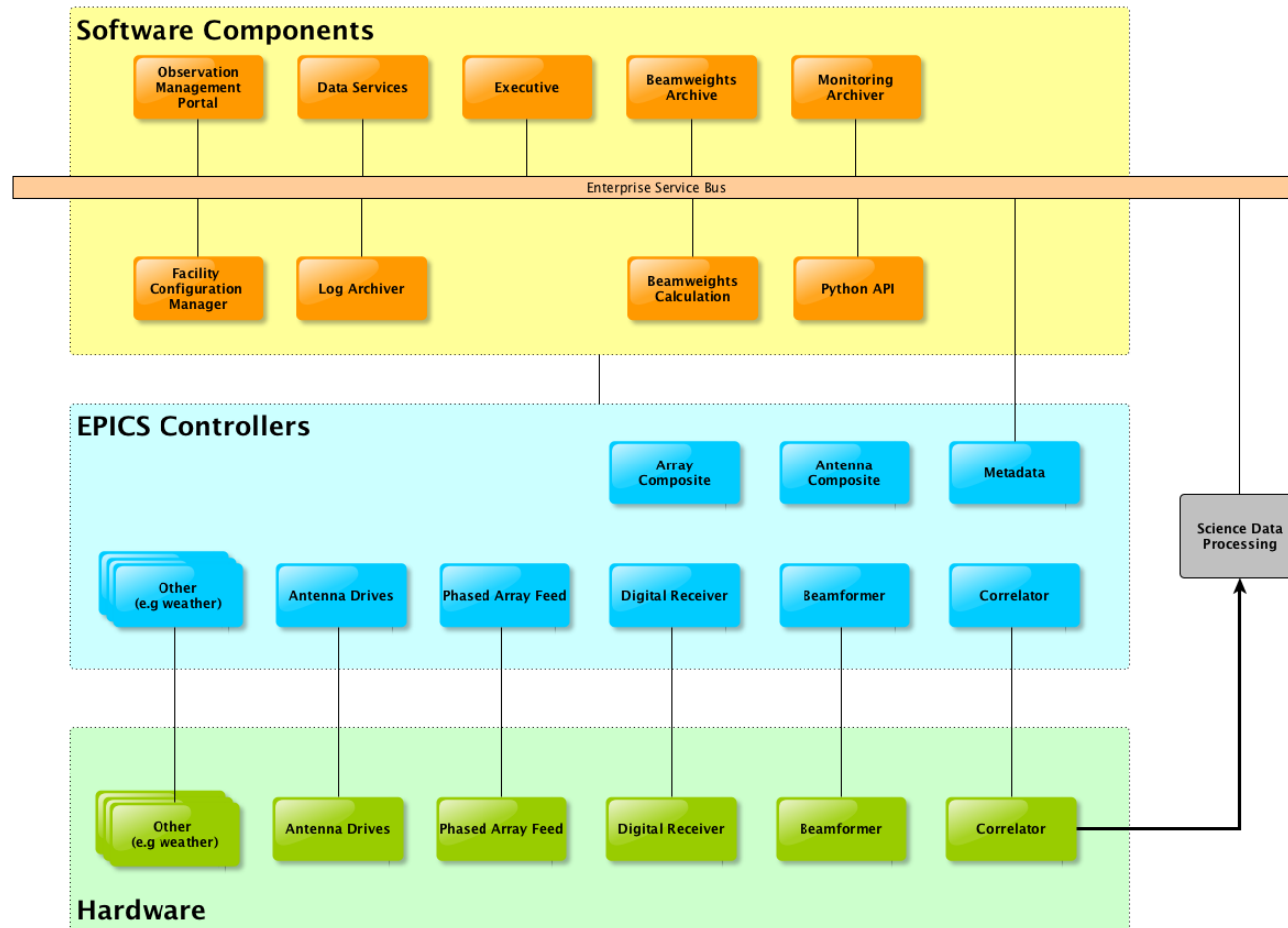
ASKAP – the software

- 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

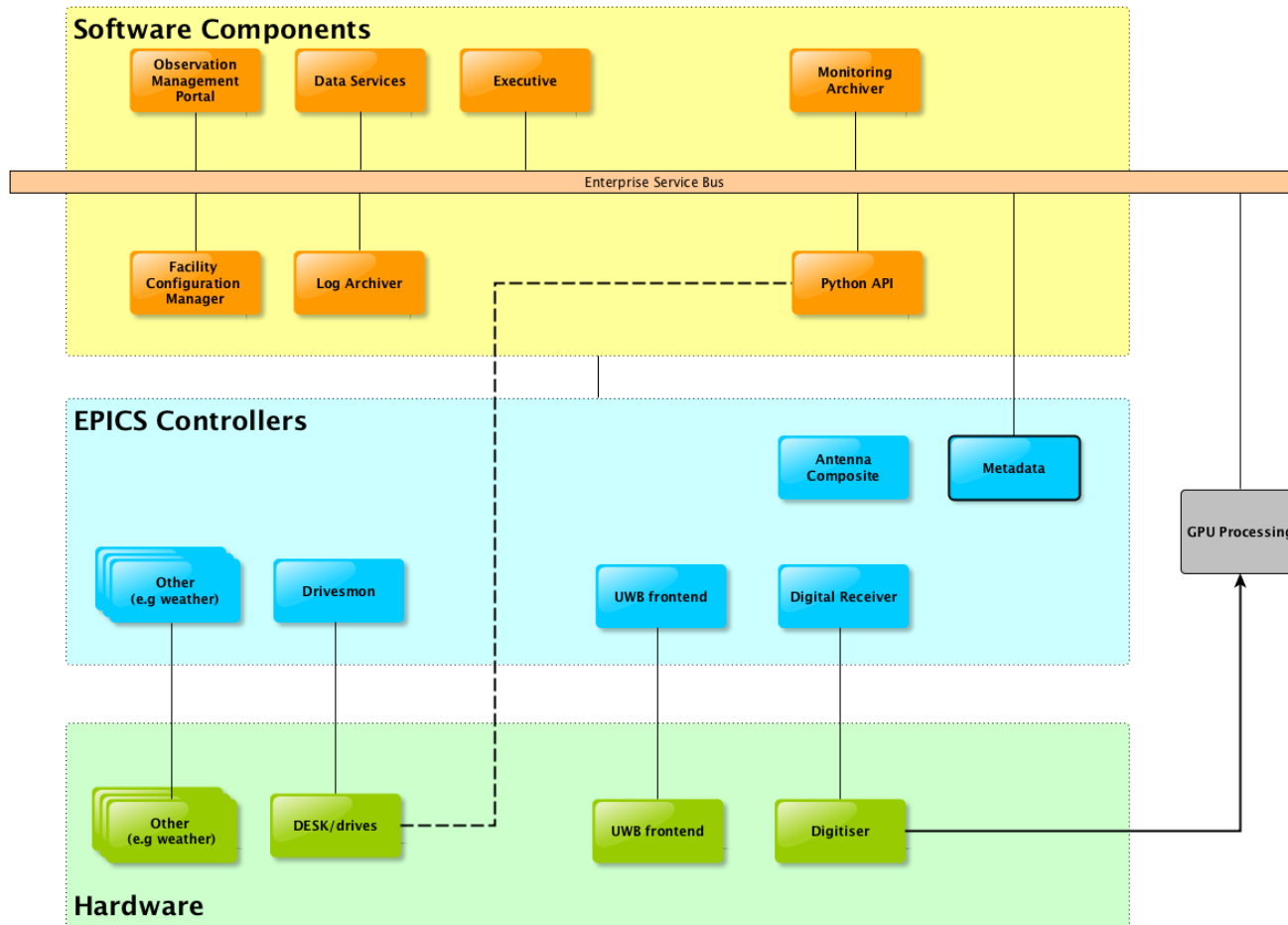
EPICS



ASKAP software architecture

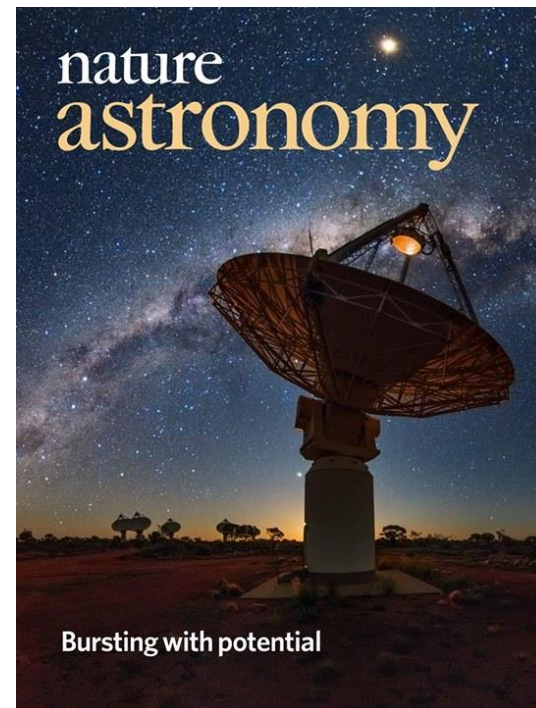


Parkes software architecture

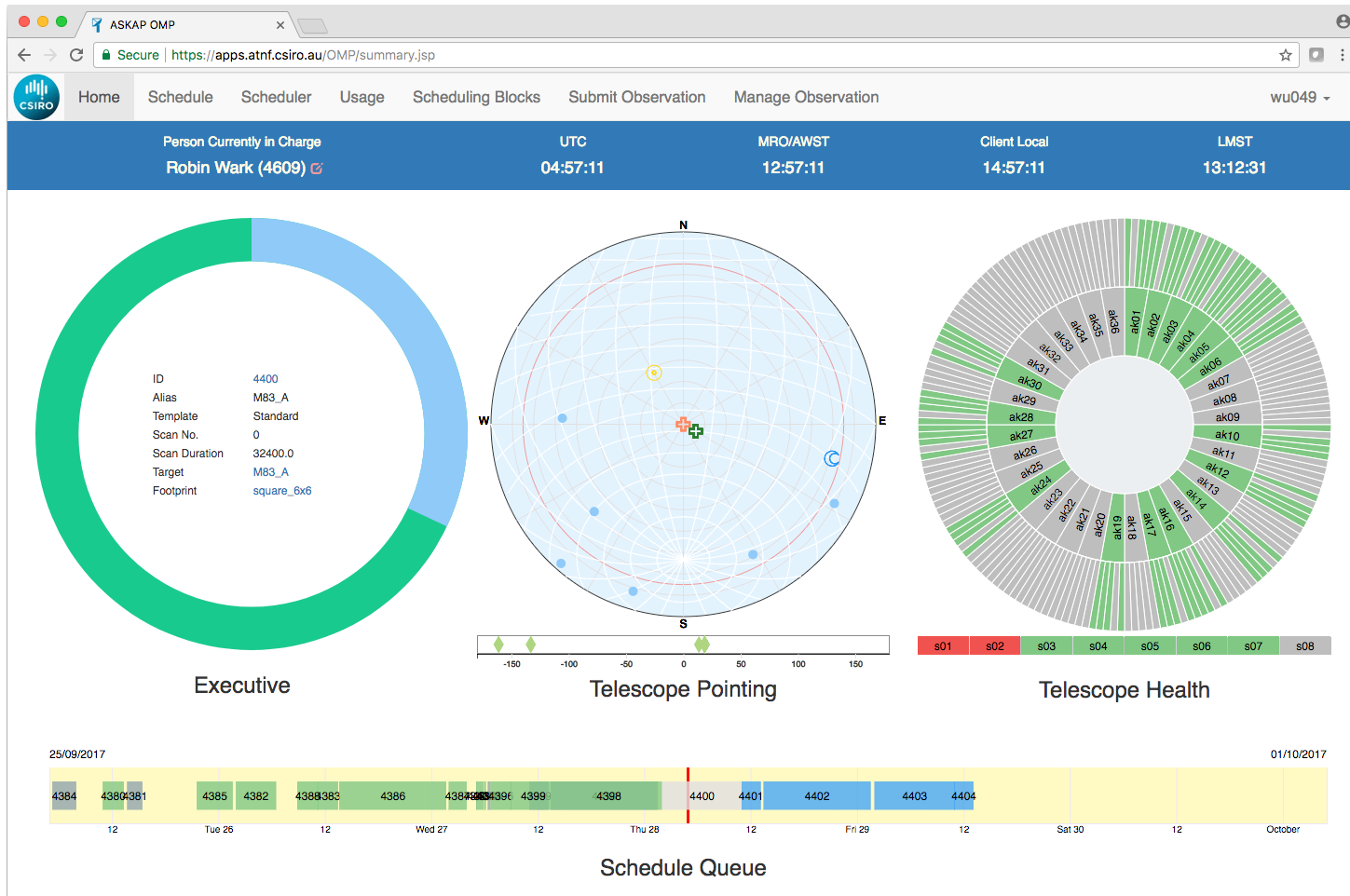


EPICS

- 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 Monitoring & Control

UT1 2017/10/02 23:07:32 LST 07h:41:29

Array State: **ONLINE** Band: 1450MHz Filter Center Freq.: 1272 Zoom: 18.5Khz Count: 304 ACM Capture Off: **Corr. Streaming On** Count: 1952632

Subsystem State

SEL	1	6	12	18	24	30	36
CMP	█	█	█	█	█	█	█
TRD	█	█	█	█	█	█	█
PAF	█	█	█	█	█	█	█
DRX	█	█	█	█	█	█	█
BMF	█	█	█	█	█	█	█

Config

CMP	1	6	12	18	24	30	36
TRD	█	█	█	█	█	█	█
PAF	█	█	█	█	█	█	█
DRX	█	█	█	█	█	█	█
BMF	█	█	█	█	█	█	█

Drives

1	6	12	18	24	30	36
█	█	█	█	█	█	█

PAF Average Temps

70.0 C

PAF Relative Humidity

22.0 %

PAF TEC Current Monitor

55.00 A

PAF RF Current +

62.70 A

Navigator

Subsystems	PDU
01 02 03 04 05 06	07 08 09 10 11 12
13 14 15 16 17 18	19 20 21 22 23 24
25 26 27 28 29 30	31 32 33 34 35 36

Weather

Wind Spd: 17.5 km/h
Temp: 18.3 DegC
RH: 48.3 %

Health

Array Alarm Summary: Health **READ** Config **MAJOR**

Timing Health: PLL Lock **OK** BAT In **OK** REF In **OK** VCO Level **OK** BAT Status **OK**

Hardware Health: Temperature **W.HI** Fan Speed **OK** Supply **OK** Voltage **W.HI** Current **A.LOW**

PAF Health: FEC EO **OK** TEC PSU **OK** TEC Controller **A.LOW** PAF PSU **OK** PAF Controller **MAJOR** Domino Temp **READ** Domino Current **READ** RToF Power **READ** Cicada **DISABLED**

Comms Health: Alignment **OK** TX/RX Power **A.LOW** 10G Links **A.HI** Bullant & FPGA **OK** Eth Errors **OK** PAF SPI Err. **A.HI** Domino SPI Err. **READ** TEC PSU Conn. **OK**

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

Astronomy and Space Science

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