ASKAP Status Update

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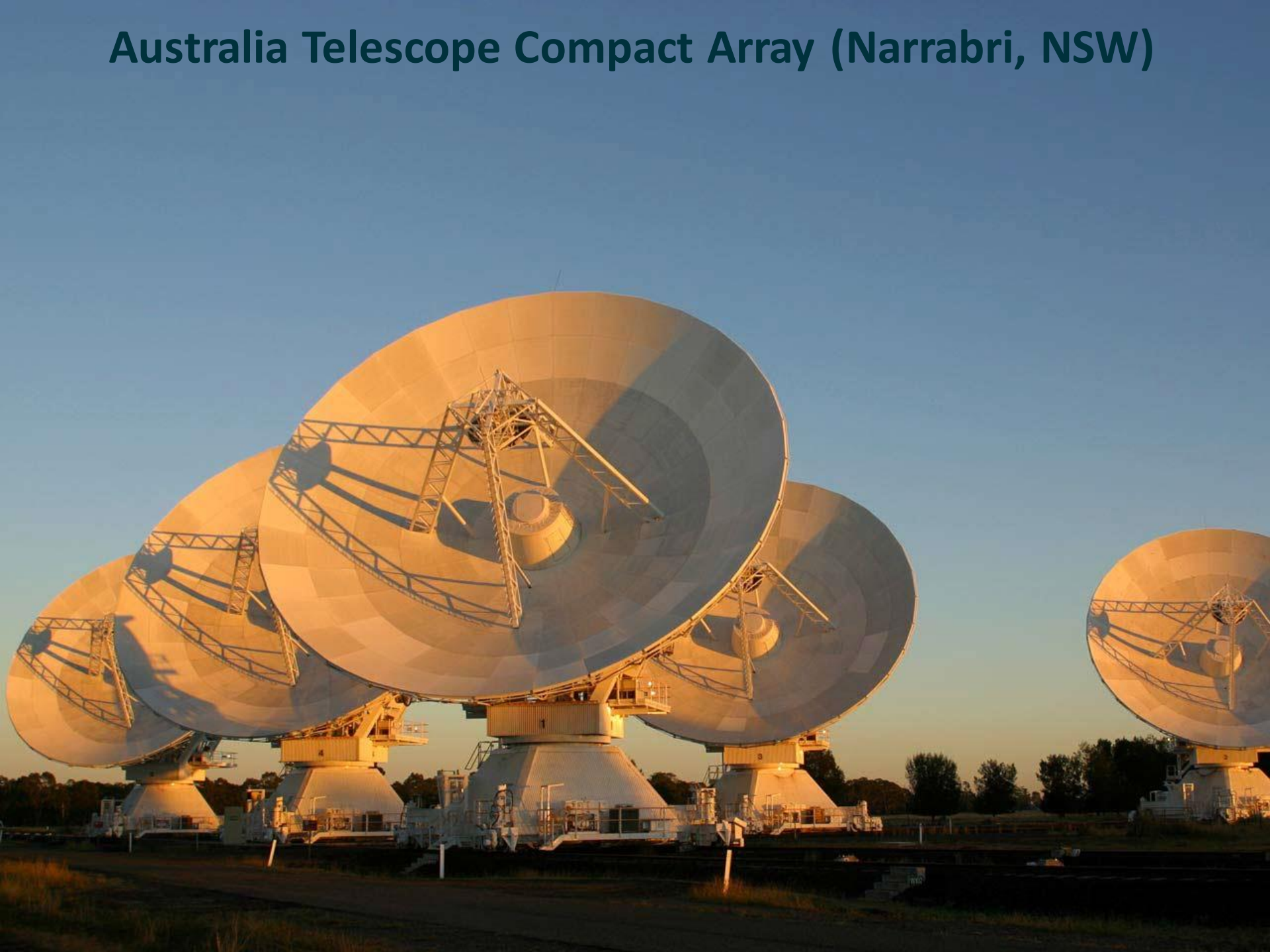
EPICS [Spring] Collaboration Meeting
22nd October 2014

CSIRO ASTRONOMY AND SPACE SCIENCE
www.csiro.au

Australia Telescope Compact Array (Narrabri, NSW)

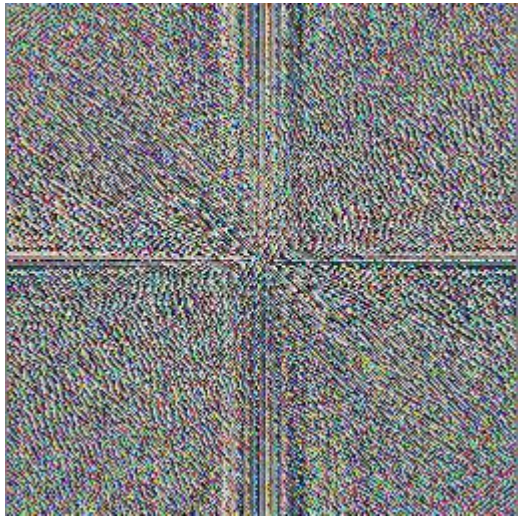


We measure the spatial coherence function

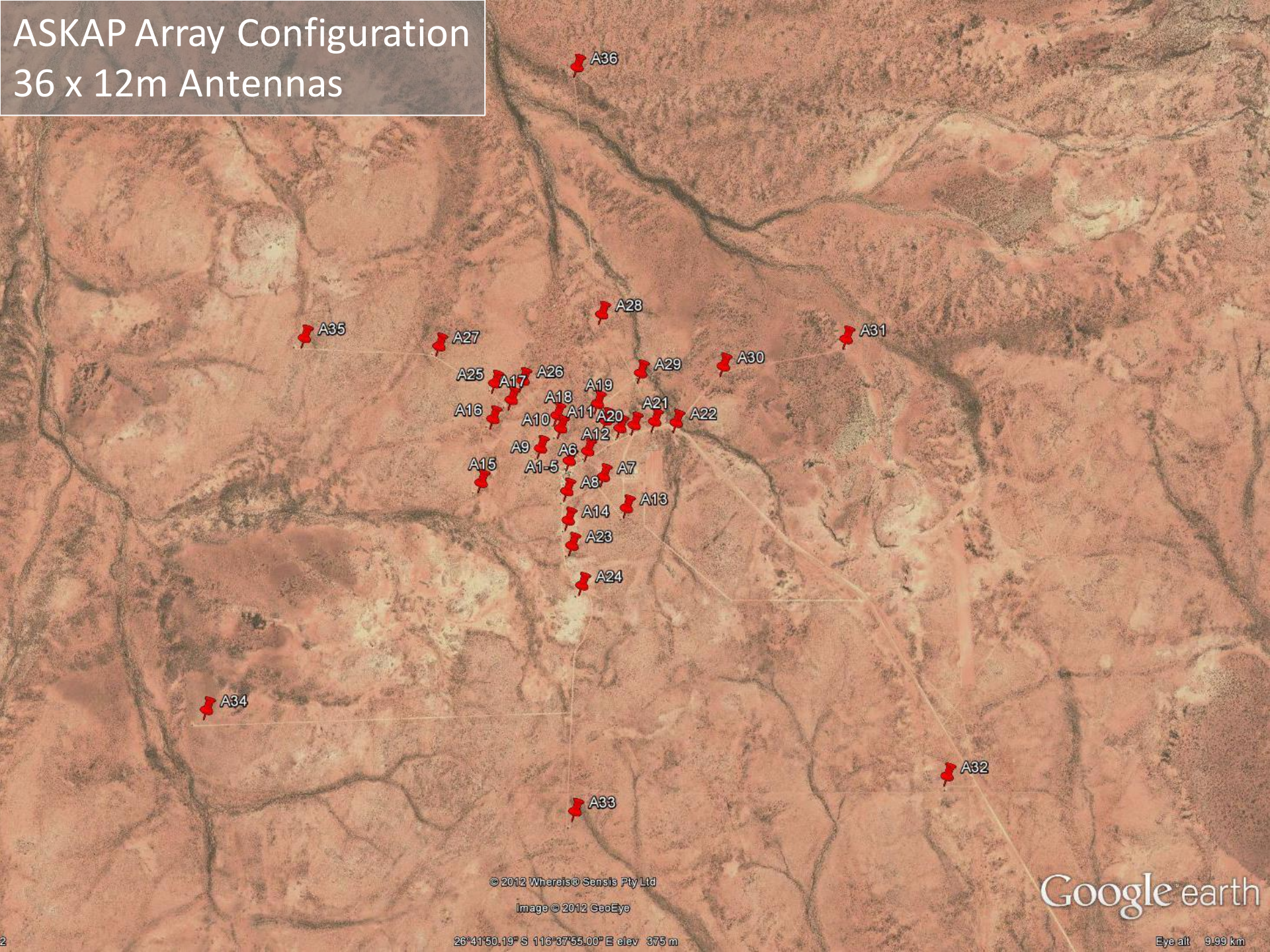
Image

Spatial Frequency domain

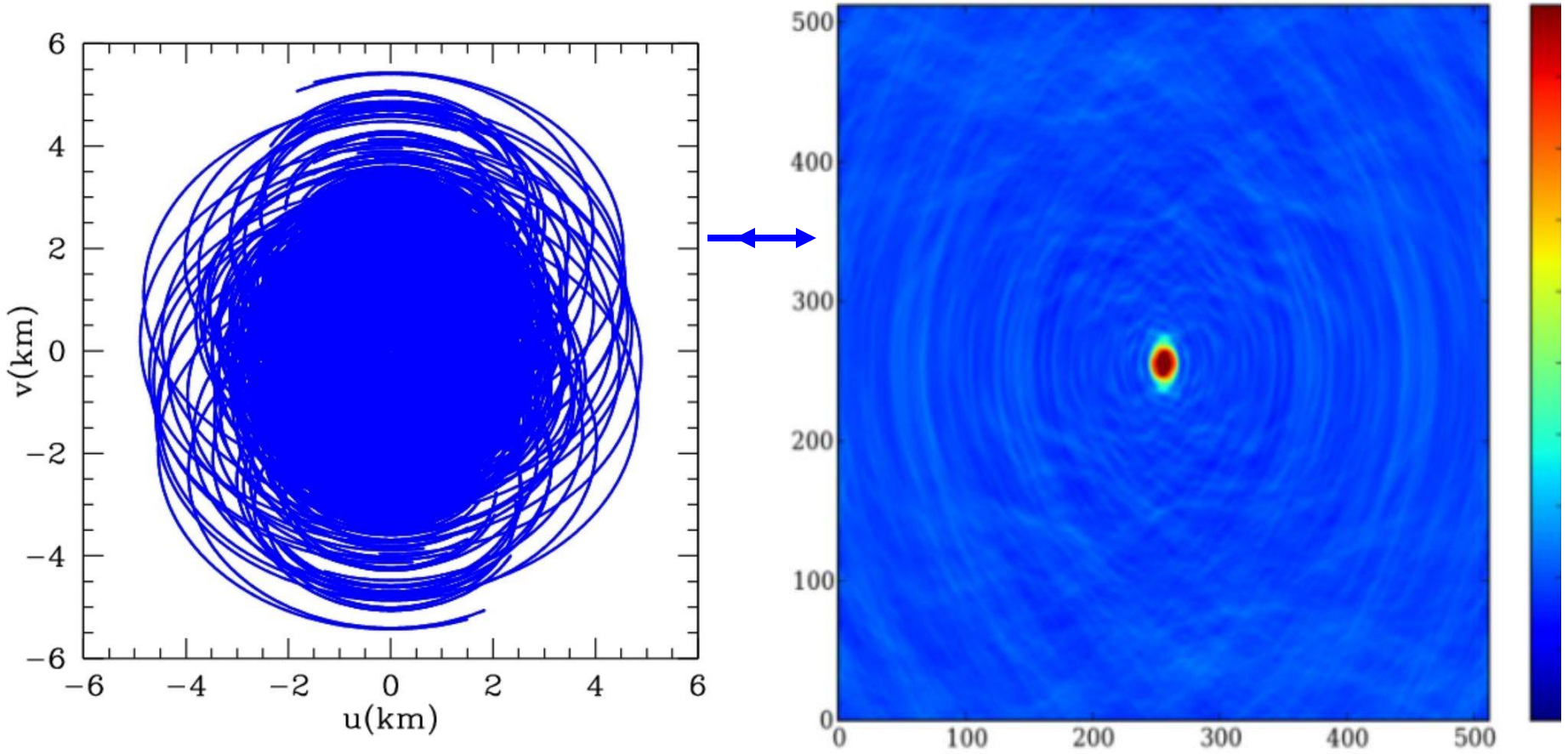
Fourier Transform



ASKAP Array Configuration
36 x 12m Antennas

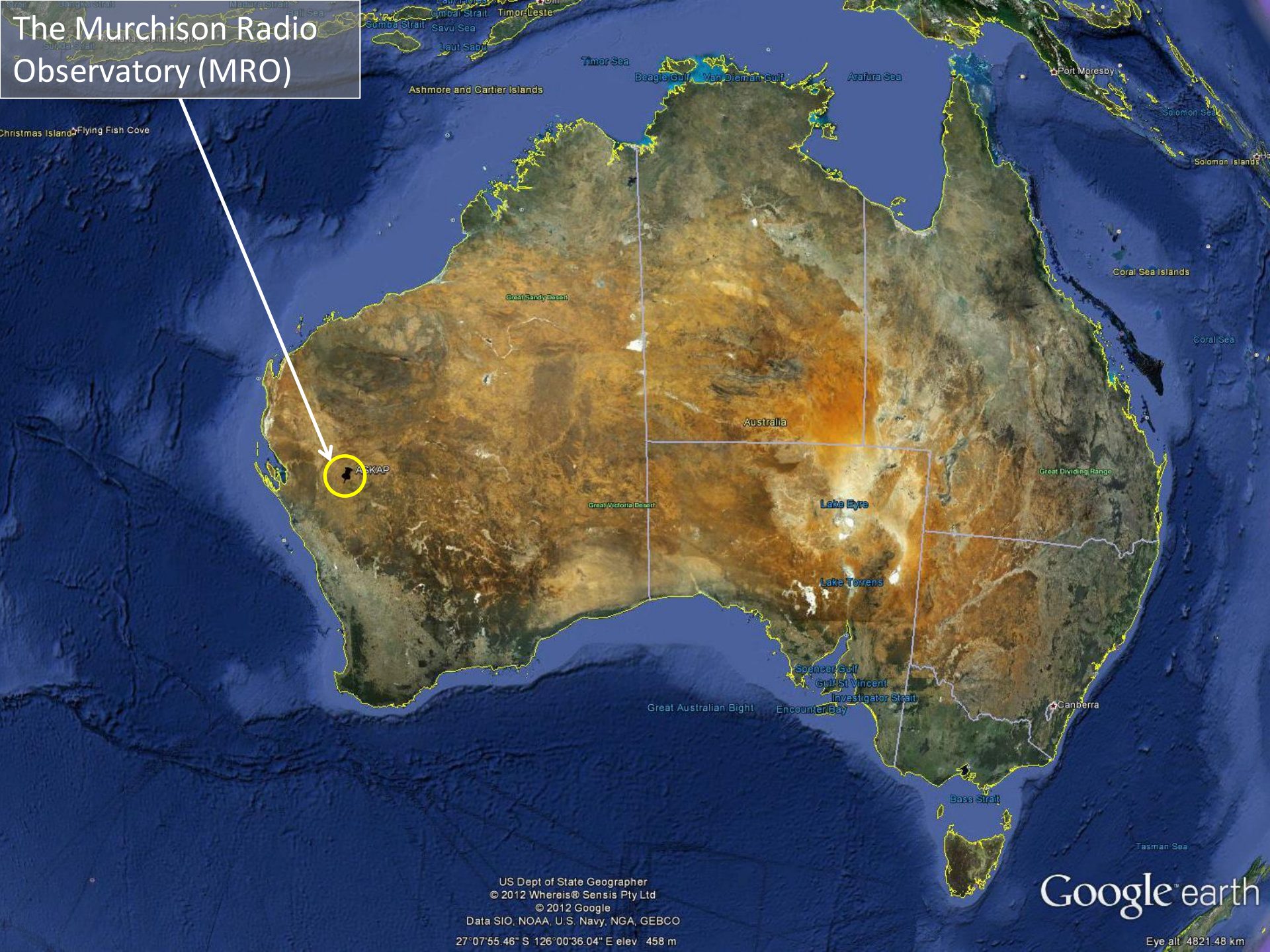


ASKAP u-v coverage



Introducing ASKAP

- The Australian SKA Pathfinder is a radio telescope array that uses new receiver technology to improve field of view and provide unprecedented survey speed
- Covers a section of the radio spectrum surrounding rest-frame neutral Hydrogen emission (700 MHz to 1.8 GHz)
- Consists of 36 individual 12m antennas fitted with PAF receivers
- Currently under construction at MRO, a radio quiet environment
- Begins early science operations with a subset of antennas in 2015
  - Some science is already being done with a prototype 6-antenna array (BETA)


The Murchison Radio Observatory (MRO)
ASKAP
Australia
Timor Sea
Ashmore and Cartier Islands
Christmas Island
Flying Fish Cove
Timor-Leste
Savu Sea
Laut Sabu
Arafura Sea
Port Moresby
Solomon Islands
Coral Sea Islands
Coral Sea
Great Sandy Desert
Great Victoria Desert
Great Dividing Range
Lake Eyre
Lake Torrens
Spencer Gulf
Gulf St Vincent
Investigator Strait
Great Australian Bight
Encounter Bay
Canberra
Bass Strait
Tasman Sea
US Dept of State Geographer
© 2012 Whereis® Sensis Pty Ltd
© 2012 Google
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
27°07'55.46" S 126°00'36.04" E elev 458 m
Google earth
Eye alt 4821.48 km

ASKAP Science Priorities

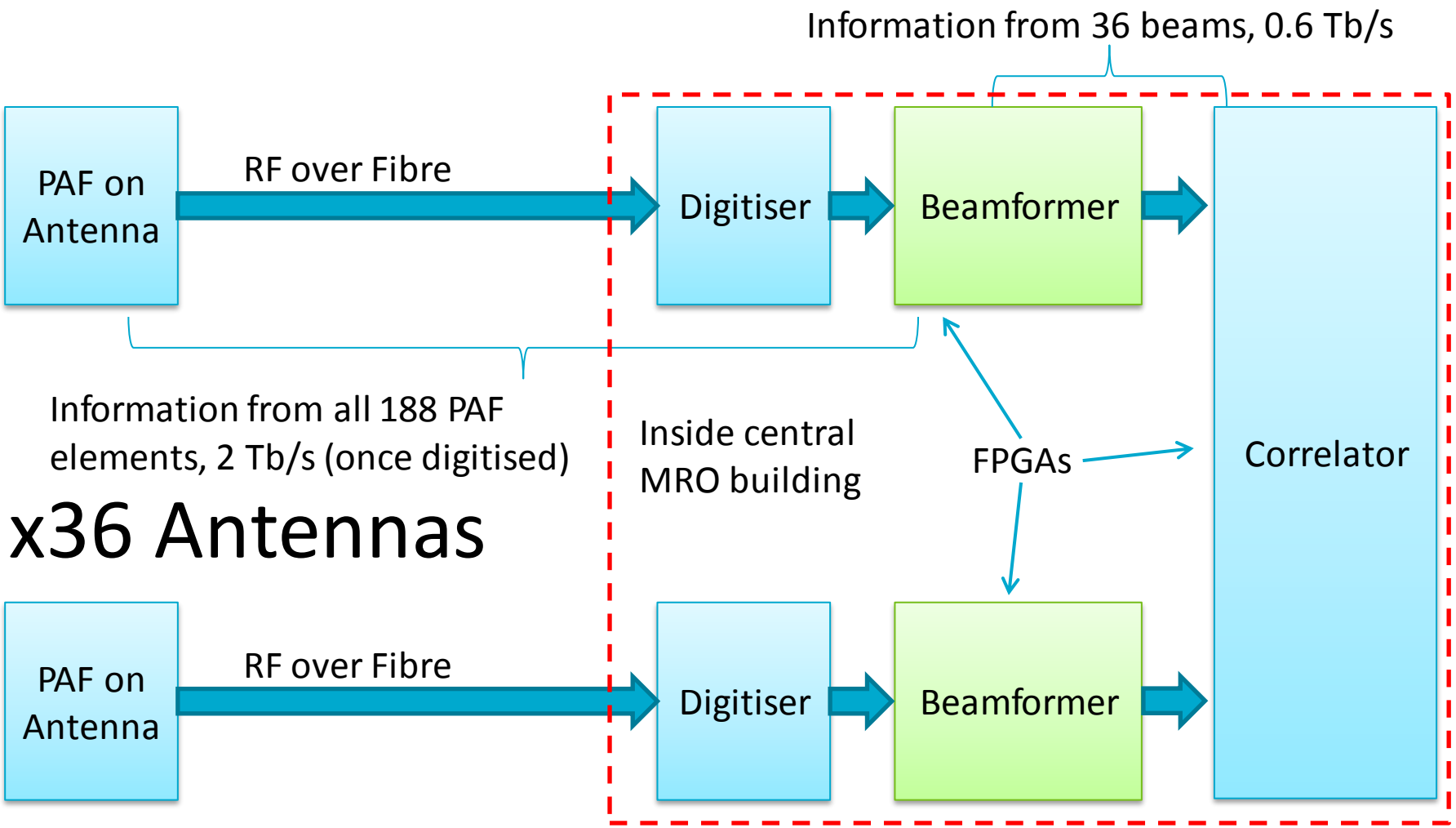
- Most of the observing time will be spent on major survey projects.
  - ASKAP will cater for large international science teams.
  - Observations will be highly automated and done by facility operators.

- 10 major projects were selected to receive time during this first 5 yrs:

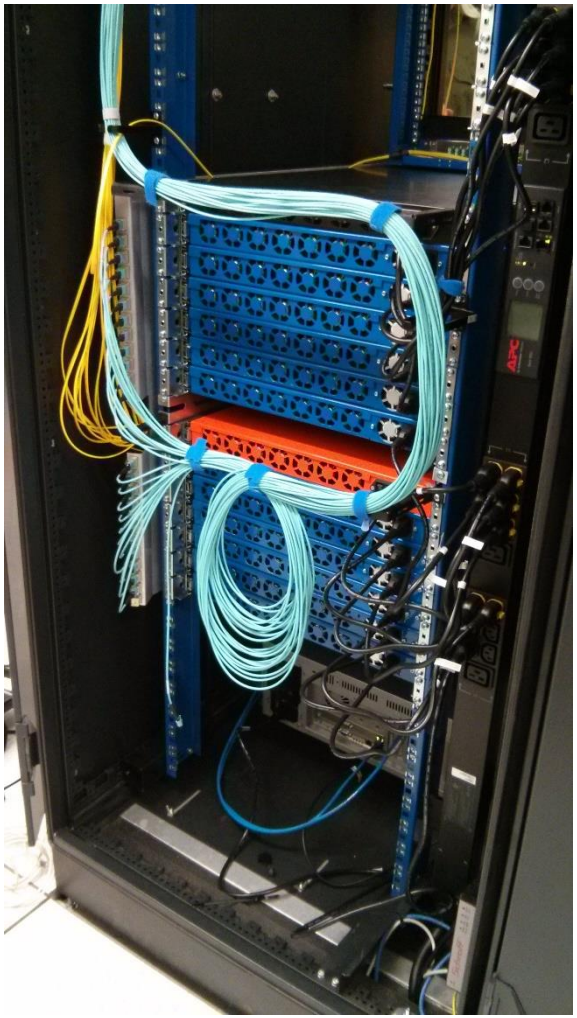
  - **Evolutionary Map of the Universe (EMU)**
  - **Widefield ASKAP L-Band Legacy All-Sky Blind Survey (WALLABY)**
  - **The First Large Absorption Survey in HI (FLASH)**
  - **An ASKAP Survey for Variables and Slow Transients (VAST)**
  - **The Galactic ASKAP Spectral Line Survey (GASKAP)**
  - **Polarization Sky Survey of the Universe's Magnetism (POSSUM)**
  - **The Commensal Real-time ASKAP Fast Transients survey (CRAFT)**
  - **Deep Investigations of Neutral Gas Origins (DINGO)**
  - **The High Resolution Components of ASKAP (VLBI)**
  - **Compact Objects with ASKAP: Surveys and Timing (COAST)**

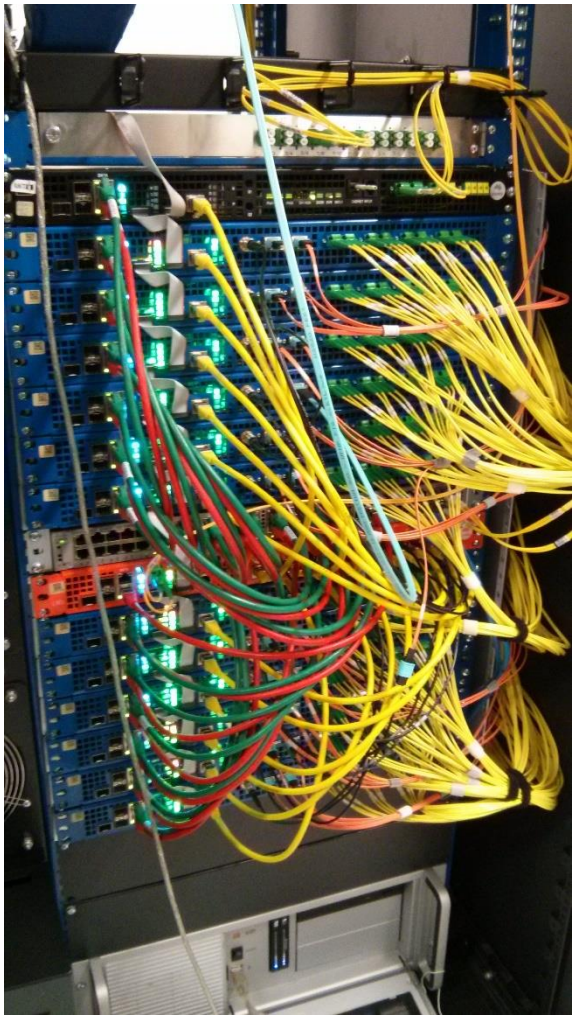
ATCA mm receiver vs. ASKAP Phased Array Feed

Data Flow at the Telescope



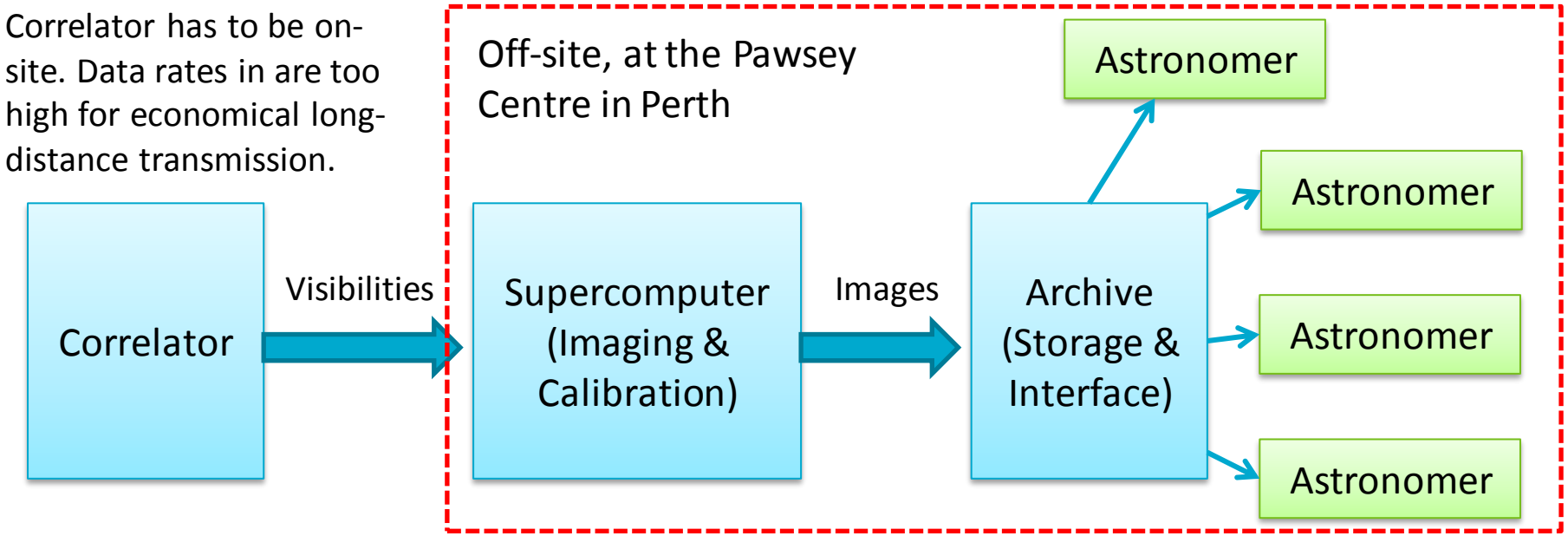
Digitisers and Beamformers





Data Flow out of the Correlator

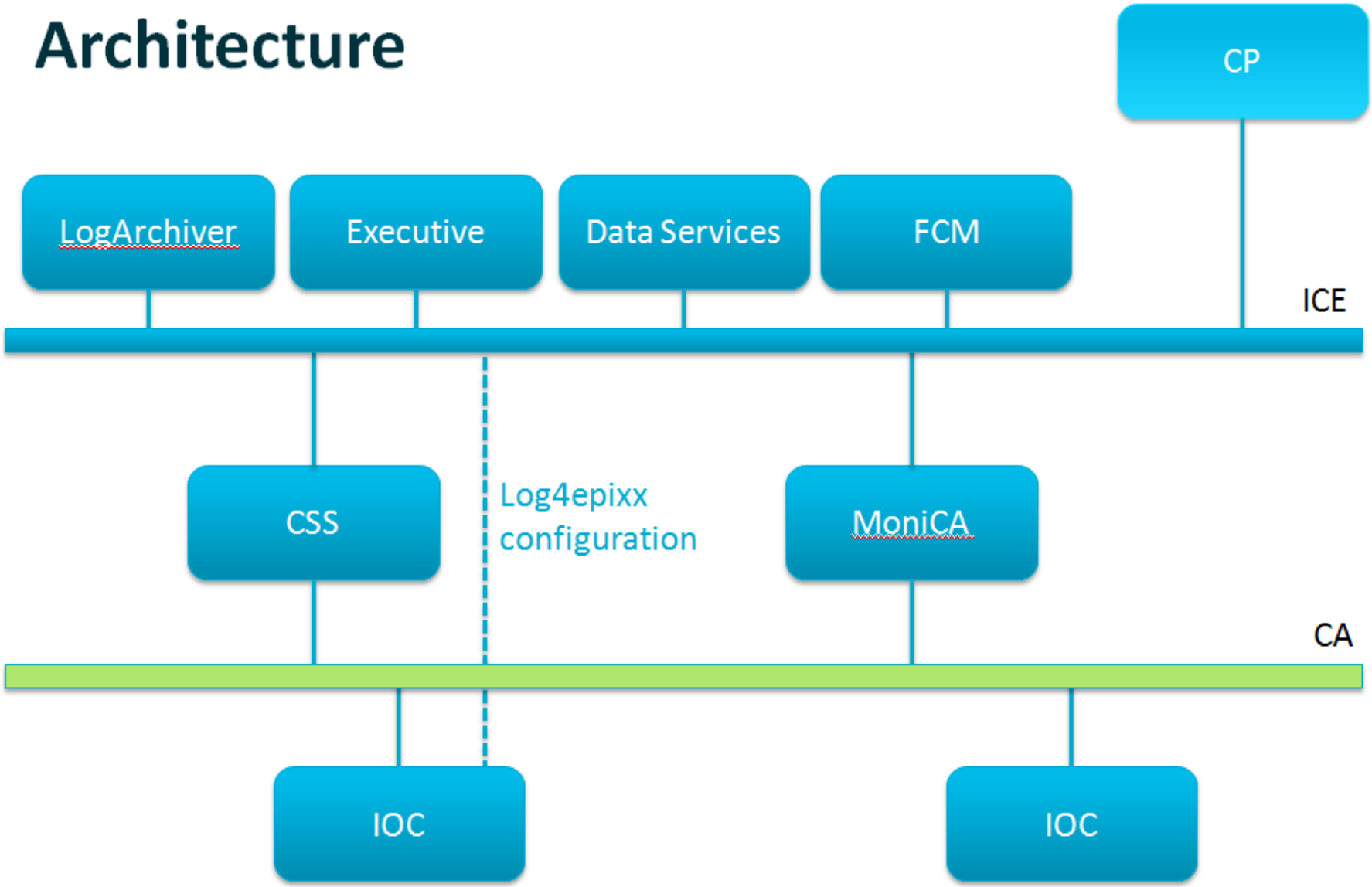
- Data rate out of the correlator is roughly 2.5 Gb/s, requiring a dedicated high-speed optical fibre link to a supercomputer.
- Imaging occurs via an automated pipeline. Raw visibilities are too large to archive, so processing needs to be right first time!



Pawsey Supercomputing Centre

Cray XC30 - 9440 Cores (Galaxy)

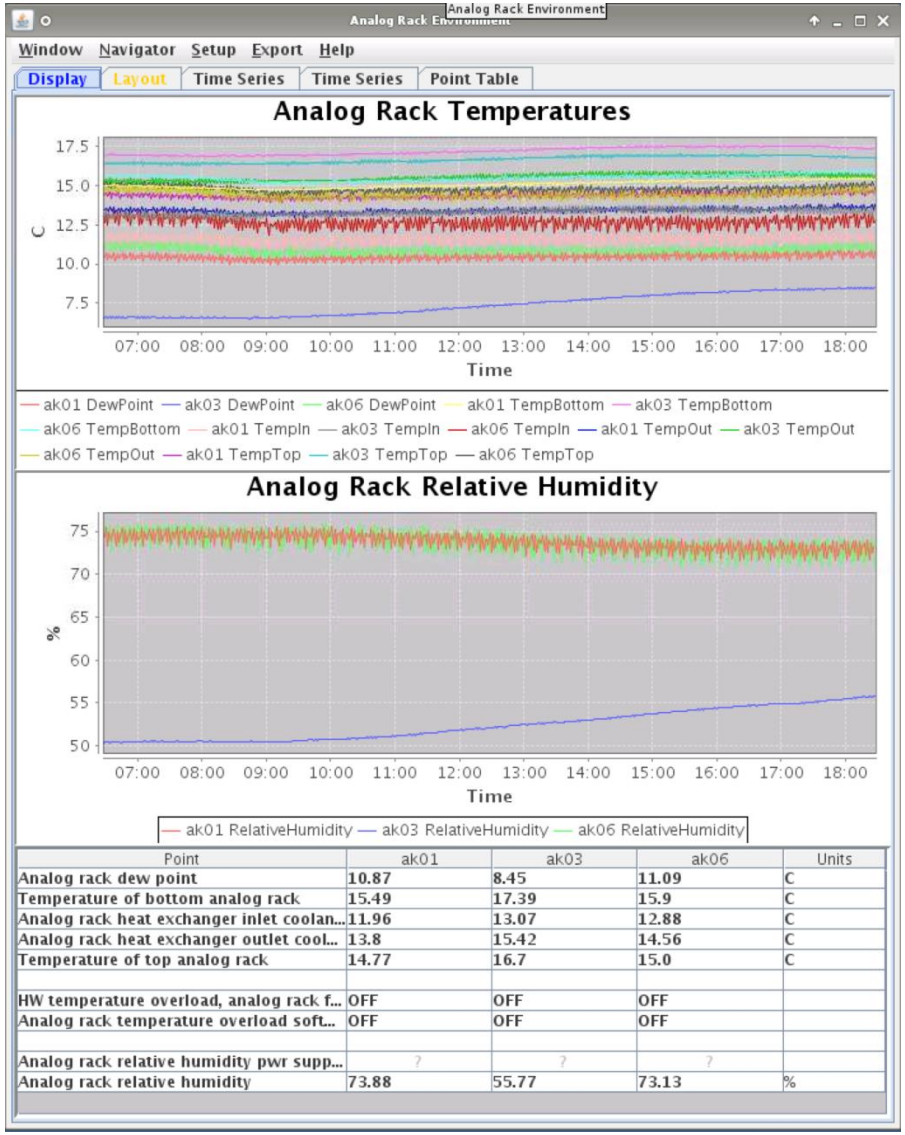
Architecture



MoniCA

- Monitoring and control system used at various radio observatories
- Supports numerous protocols
  - CA aware (via Cosylab JCA/CAJ)
- Archive PVs
- Policy per PV configuration
- CSS databrowser extension to query MoniCA

http://code.google.com/p/open-monica/



Point	ak01	ak03	ak06	Units
Analog rack dew point	10.87	8.45	11.09	C
Temperature of bottom analog rack	15.49	17.39	15.9	C
Analog rack heat exchanger inlet coolan...	11.96	13.07	12.88	C
Analog rack heat exchanger outlet cool...	13.8	15.42	14.56	C
Temperature of top analog rack	14.77	16.7	15.0	C
HW temperature overload, analog rack f...	OFF	OFF	OFF	
Analog rack temperature overload soft...	OFF	OFF	OFF	
Analog rack relative humidity pwr supp...	?	?	?	
Analog rack relative humidity	73.88	55.77	73.13	%

Antenna Drives IOC

- Soft IOC
- Interfaces with antenna Bosch-Rexroth PLC via TCP (asyn)
- Presents stateful antenna drives
  - Stowed, Tracking, Slewing, Idle, etc.
  - Built using State Notation Language
- Coordinate conversion (SLAlib)
- Trajectory generation
- Pointing parameters
- Antenna monitoring

ak08: Drives Antenna View

Bimba

General Status

Version	drives; ASKAPsoft==releases/TOS-1.1; r22590; 2014-09-19				Config...
Lock String	UNLOCKED				IOC Admin
State	ONLINE	**Substate**	Stowed		
Az	180.326	**Elev**	89.996	**Pol**	-5.898
Az Err	0	**Elev Err**	0	**Pol Err**	0
Target Az	180.3174	**Target Elev**	26.5839	**Target Pol**	-5.9
HA	00h:00:00.0	**Dec**	-26d:42:09.6	**PA(HADec)**	-5.5719
RA (App)	217.1119	**Dec (App)**	-26.7027	**Parallactic**	0.3263
RA(J2k)	14h:27:36.3	**Dec(J2k)**	-26d:38:21.3		
MJD	56944.216129	**UT1**	2014/10/14 05:11:13	**LST**	14h:28:26
Clock Err	0.184888	**Traj Stack**	0	**Wind Peak**	15.5 km/h

Requested Track Position

C1	0	**C2**	-90	**Frame**	J2000	**Pol**	pol_fixed	0

CETC54 PLC Status and Configuration

TCP	Connect	**PLC Sw ID**	CECT54_12m_V1.01	**Az Lim**		**El Lim**		**Pol Lim**	
Uptime	12867.28	**PLC S/N**	006-336-918	-174	358.9	15.1	90.0	.78.9	178.9

K4STAT OK - BB RUN, Motion ready, PLC in run AF AF **K5STAT** All the axes are safe.

Control

UNLOCK | STOW | MAINTAIN | **STOP** | START | RUN | OFF

Command stow Done

Response OK

Test Track | Driver Cmd...

Master Status

Power Contactor	OFF
Remote/Local	REMOTE
Stow at el=20	NO
Stow at el=90	STOWED@90
Pin State	NOT OUT
Pin Motor Active	NOT ACTIVE
System Error	NO
System Clk Error	NO
Ctrller Overtemp	NO
Any Drive Error	ALL_OK
Any Brake Applied	ANY_APPLIED
Any Servo Error	ALL_NO_ERROR
All On Trajectory	YES
Wind Stow Flag	CLEAR
General Alarms	No Alarm
On Source	

Motor Status...

Plots...

Emergency Stop Status

E-Stop CLEAR

Pedestal

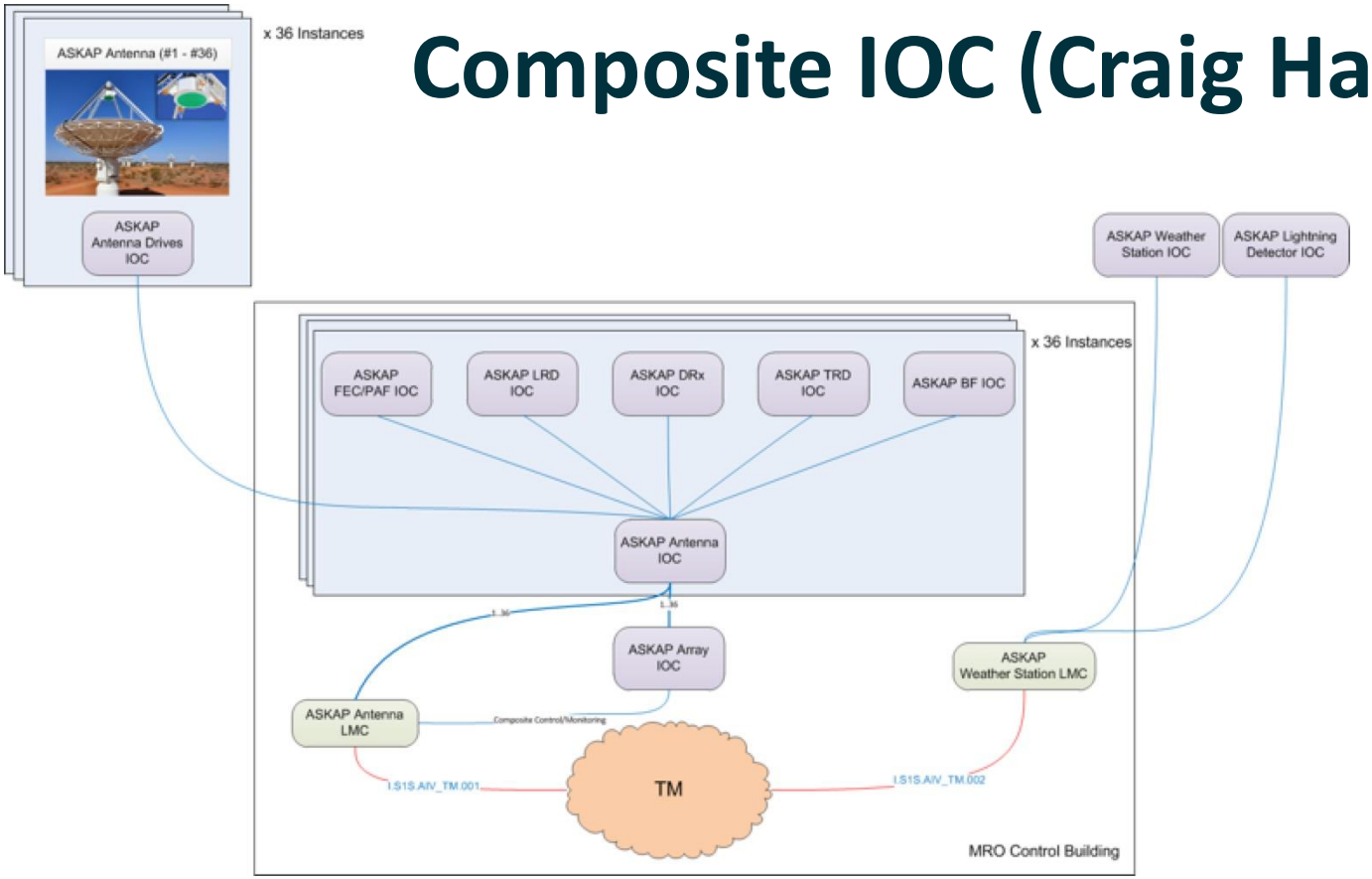
Az cable wrap

El box

Pol wrap

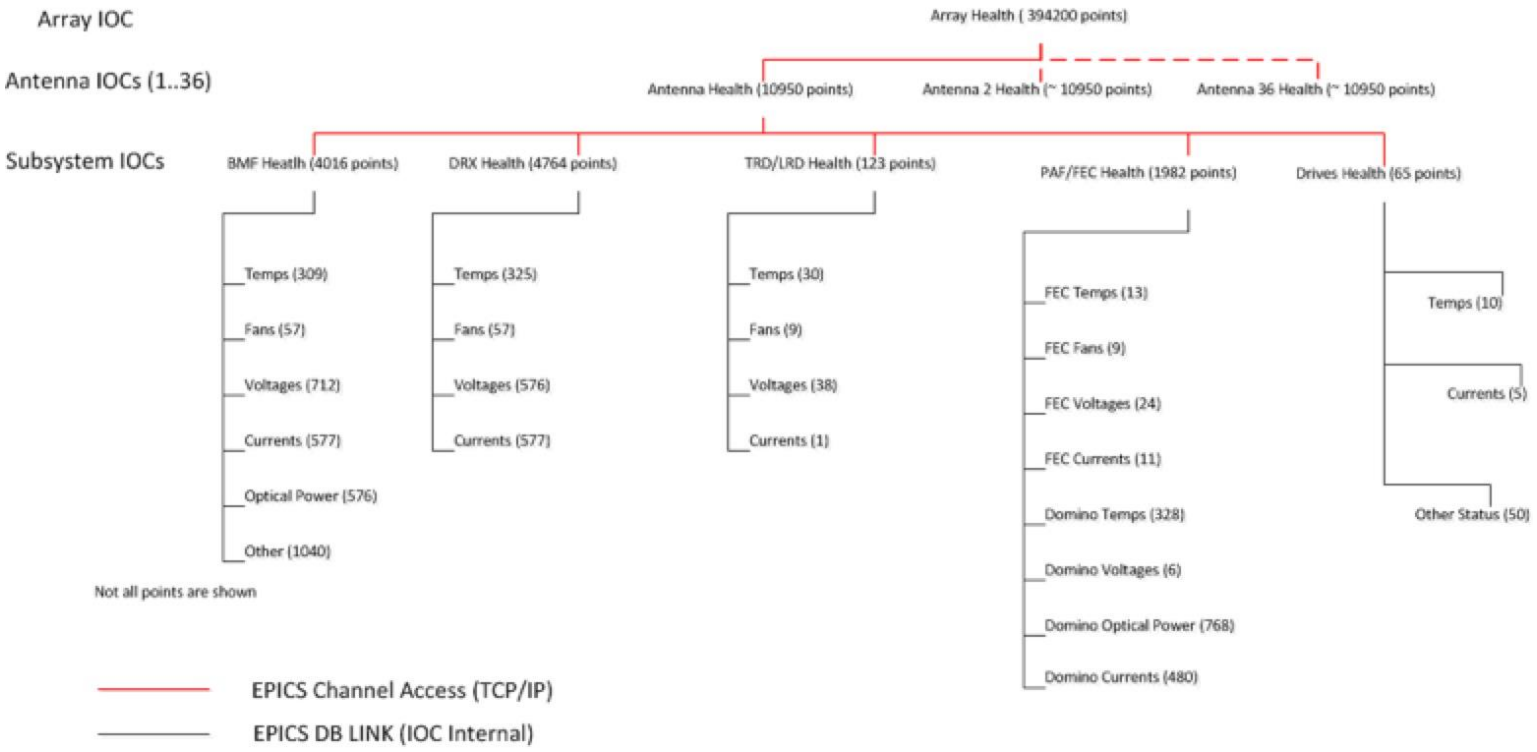
Operator Panel

Composite IOC (Craig Haskins)



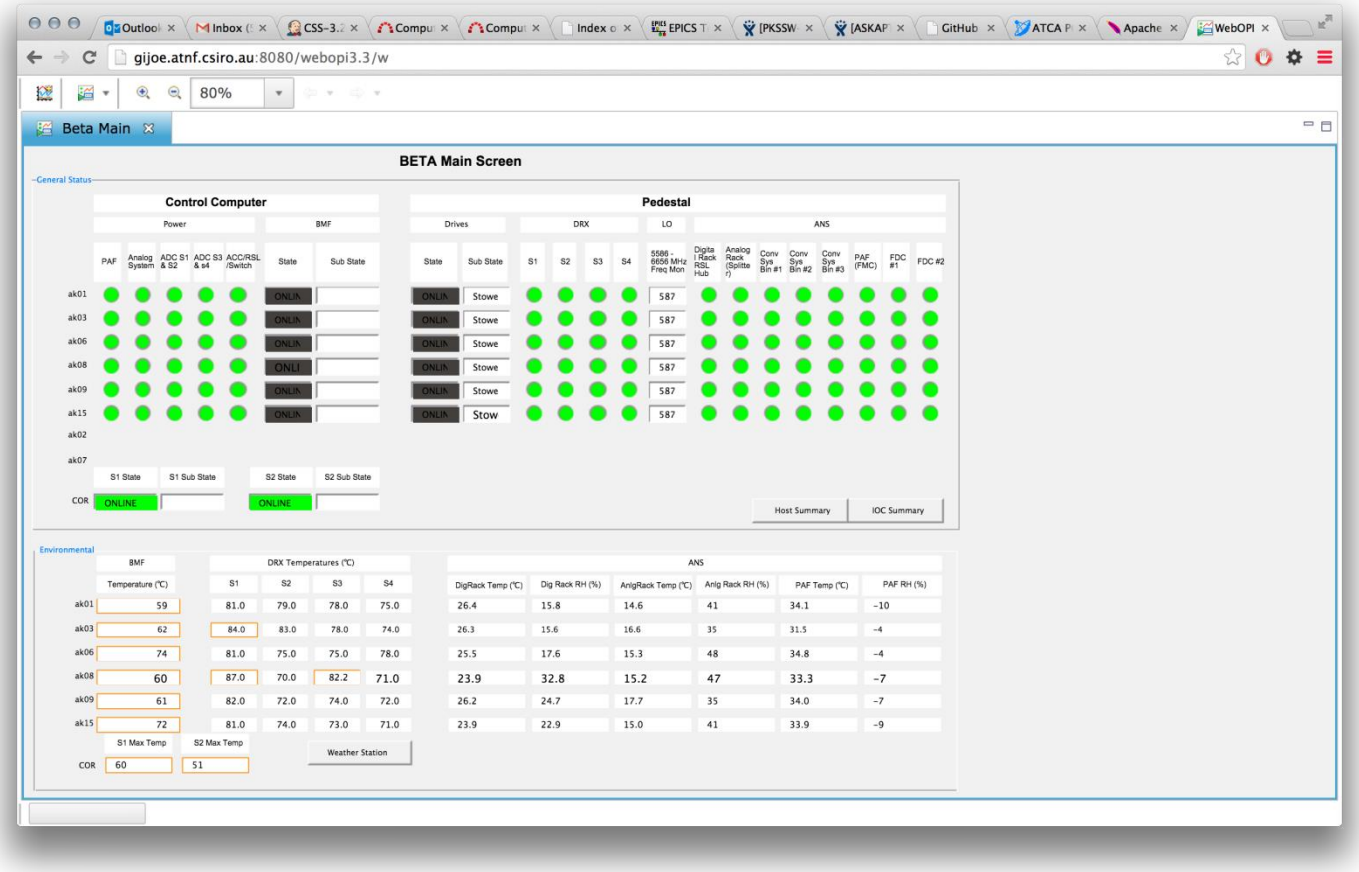
- Composite Antenna IOC to group heterogeneous subsystems
- Composite Site IOC used to group homogenous antennas
- EPICS database for both generated from single CSV file which specifies
  - PV and which subsystem IOCs contain that PV
  - optional sequence order to serialize the commands, default is parallel execution

Summary Alarm Records (Craig Haskins)



- Automatically generated from DB parsing script
- Using bigASub (128 I/O version of asub) to collect IOC alarms to single point
- PV name of point(s) in alarm can be propagated up

Interface Developments (Xinyu Wu)



- Experimenting with WebOPI / WebAlarm
- Some useful additions to CSS alarm handling, will contribute back to project

Observing Large Areas of the Sky (50 square degrees)

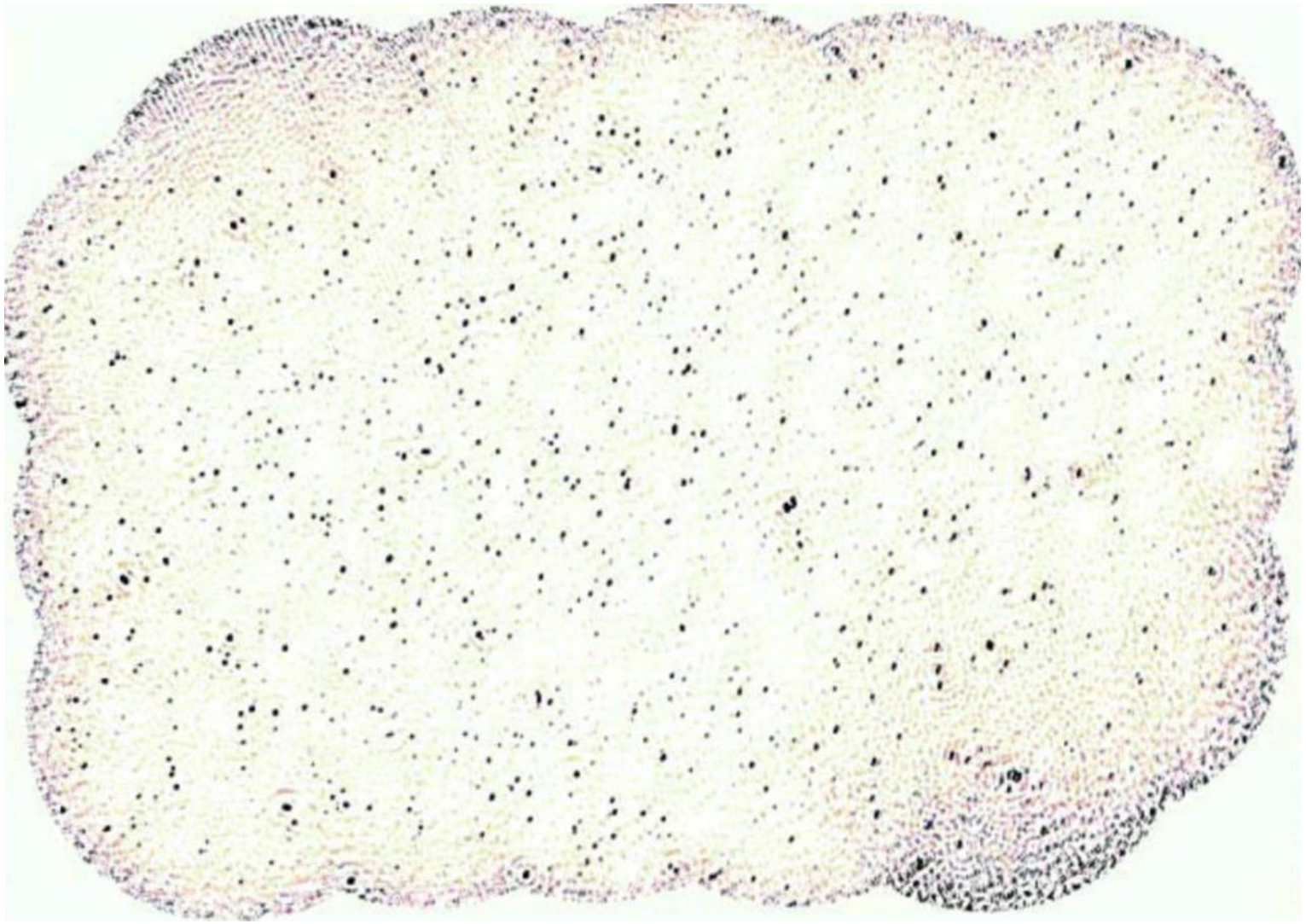


Image made by Ian Heywood