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# Computing at JBCA

Dr Anthony Holloway

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# Computing at JBCA

- Development
- Current Facilities
- Future Upgrades

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# Lovell Telescope Upgrade

2000

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# Lovell Telescope Upgrade

2001

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# Lovell Telescope Upgrade

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# Lovell Telescope Upgrade


2002

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# Lovell Telescope Upgrade

2002

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# Control Room

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# Mk II

- Controlled by

  Ferranti Argus 100

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# Micro Circe

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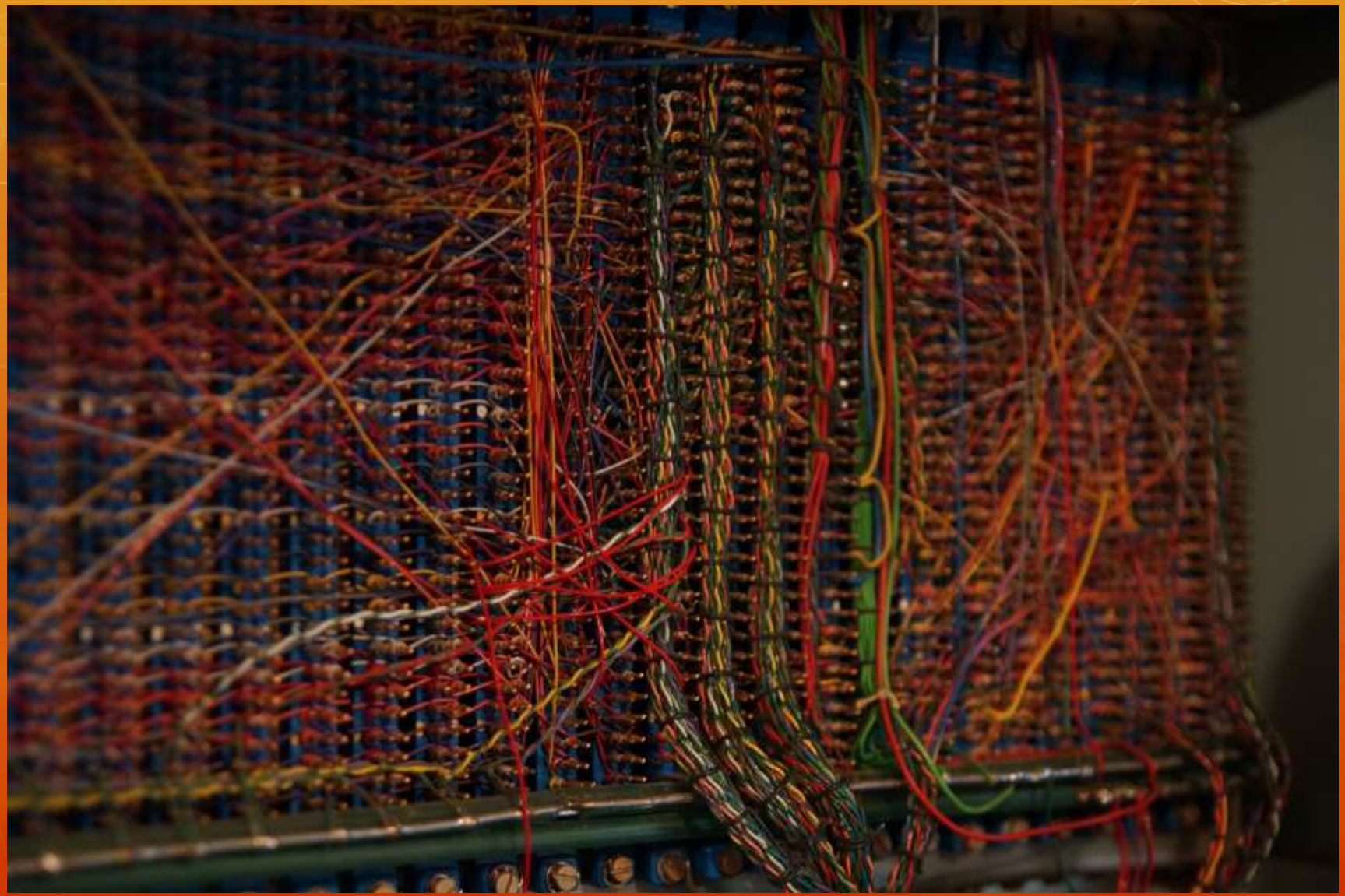
# Micro Circe



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STARLINK

1980-2005

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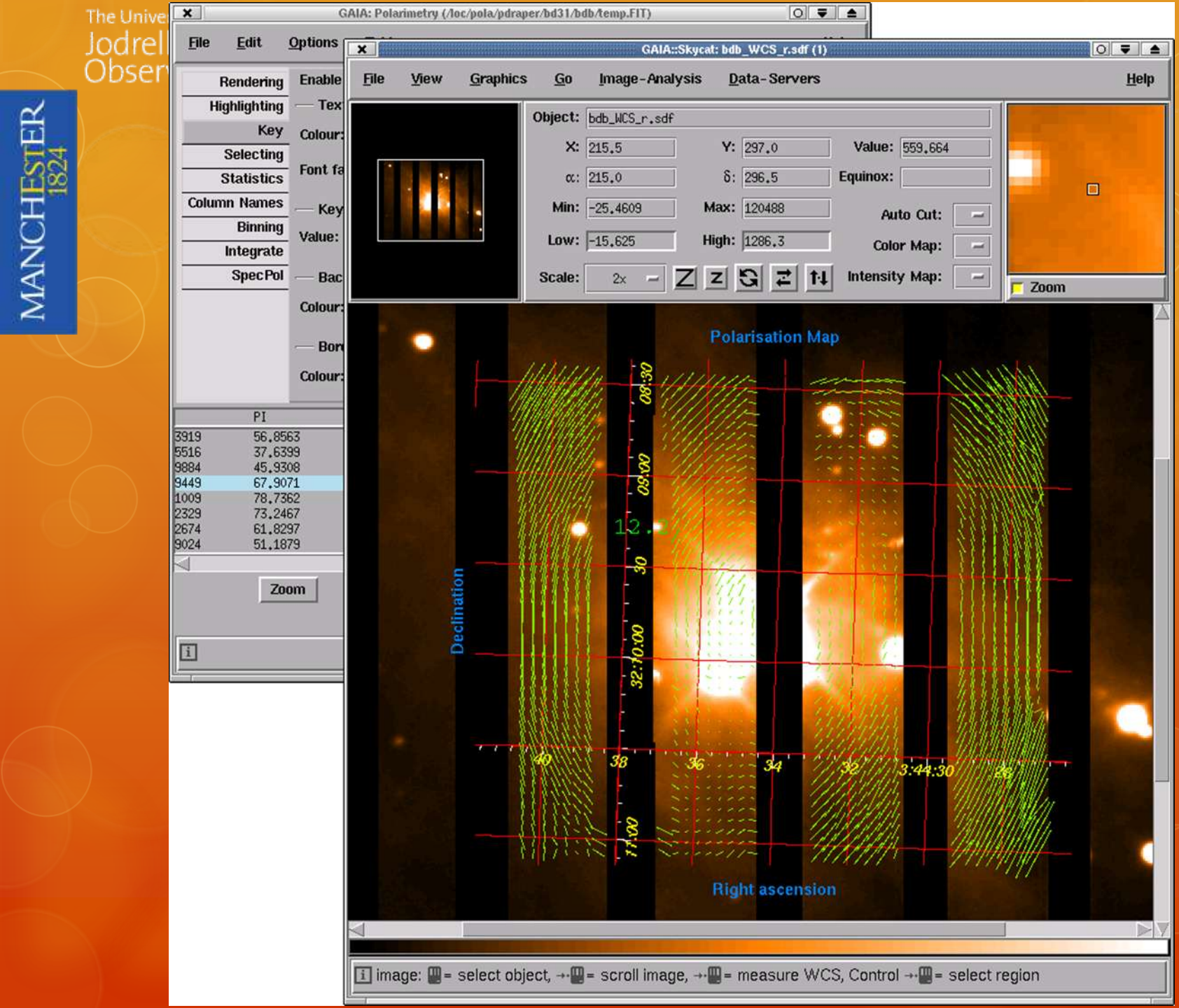
STARLINK

# 2006+ JACH

TOPCAT, GAIA, ORAC-DR, KAPPA, CCDPACK etc


GAIA: Polarimetry (/loc/pola/pdraper/bd31/bdb/temp.FIT)
File
Edit
Options
Rendering
Highlighting
Key
Selecting
Statistics
Column Names
Binning
Integrate
SpecPol
Enable
Tex
Colour:
Font fa
Key
Value:
Bac
Colour:
Bor
Colour:
PI
3919 56.8563
5516 37.6399
9884 45.9308
9449 67.9071
1009 78.7362
2329 73.2467
2674 61.8297
9024 51.1879
Zoom
GAIA::Skycat: bdb_WCS_r.sdf (1)
File
View
Graphics
Go
Image-Analysis
Data-Servers
Help
Object: bdb_WCS_r.sdf
X: 215.5
Y: 297.0
Value: 559.664
α: 215.0
δ: 296.5
Equinox:
Min: -25.4609
Max: 120488
Auto Cut:
Low: -15.625
High: 1286.3
Color Map:
Scale: 2x
Intensity Map:
Zoom
Polarisation Map
Declination
Right ascension
08:30
05:00
12.
30
32:10:00
11:00
40
38
36
34
32
3:44:30
26
image: = select object, = scroll image, = measure WCS, Control = select region

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# Desktop Infrastructure

- Starlink
- AIPS
- Casa
- IRAF / STSDAS
- IDL
- MATLAB
- Mathematica
- Intel C
- Intel Fortran
- Boa
- Gildas
- Healpix
- Miriad
- Python
- Sched
- SuperMongo
- Latex
- Libraries

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# Server Infrastructure

- Central storage
- ~ 15 Websites
- ~ 40 Wikis
- E-mail
- Mailing Lists
- Databases
- Archives

- Clusters

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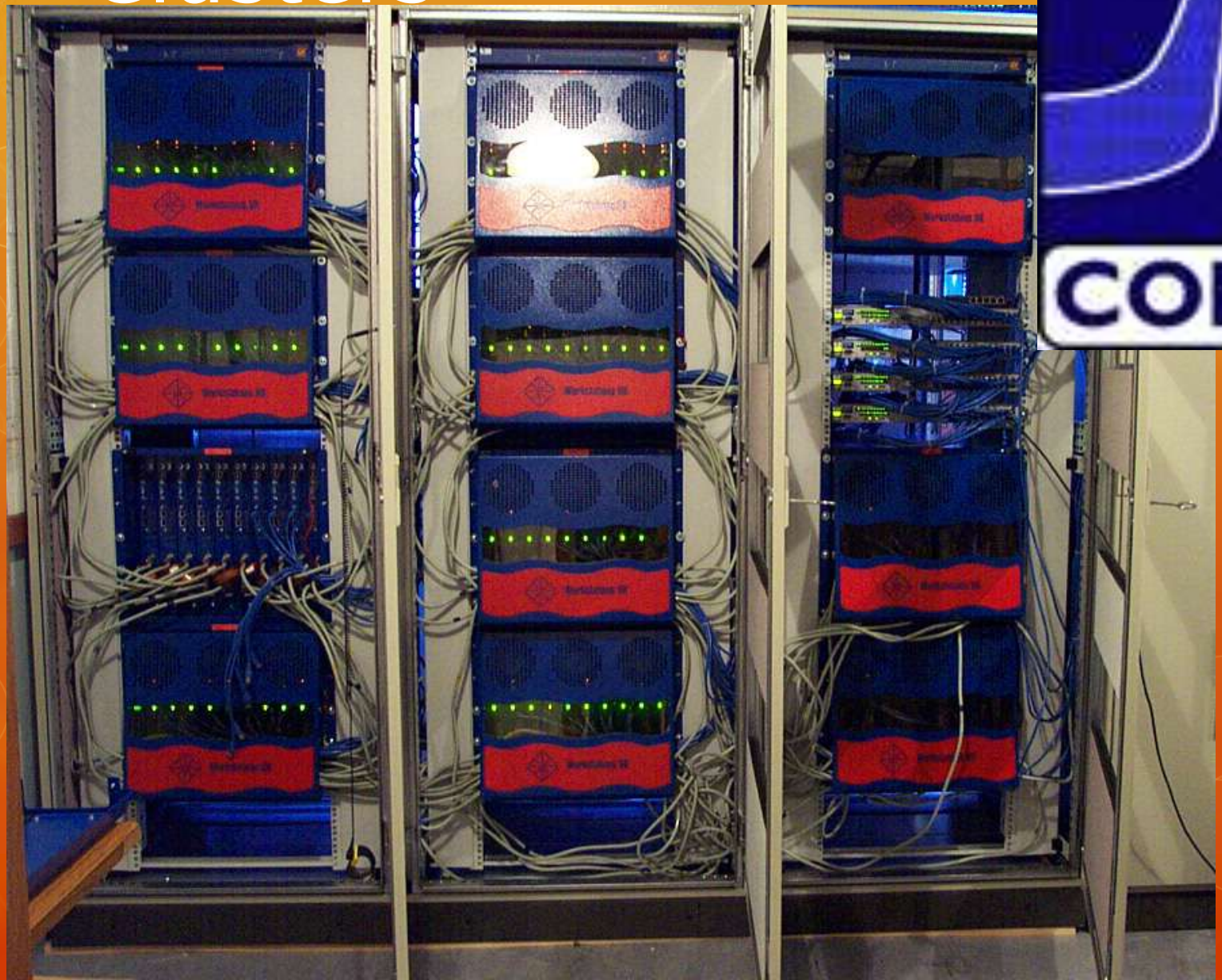
# Clusters



COBRA

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- 182 x 1.13 GHz Pentium III CPU's
- 91 Dual CPU Tyan Thunder Motherboards
- 91 x 20 GB Disks (= 1.82 TB)
- 41 x 512 MB RAM
  40 x 1024 MB RAM (= 60 GB)
- 90 x SCI High Speed Interconnect (320 MB/s)
- 91 x Fast Ethernet (12.5 MB/s)
- 1.05 TB Bulkserver

~500th Fastest Computer in the World!!

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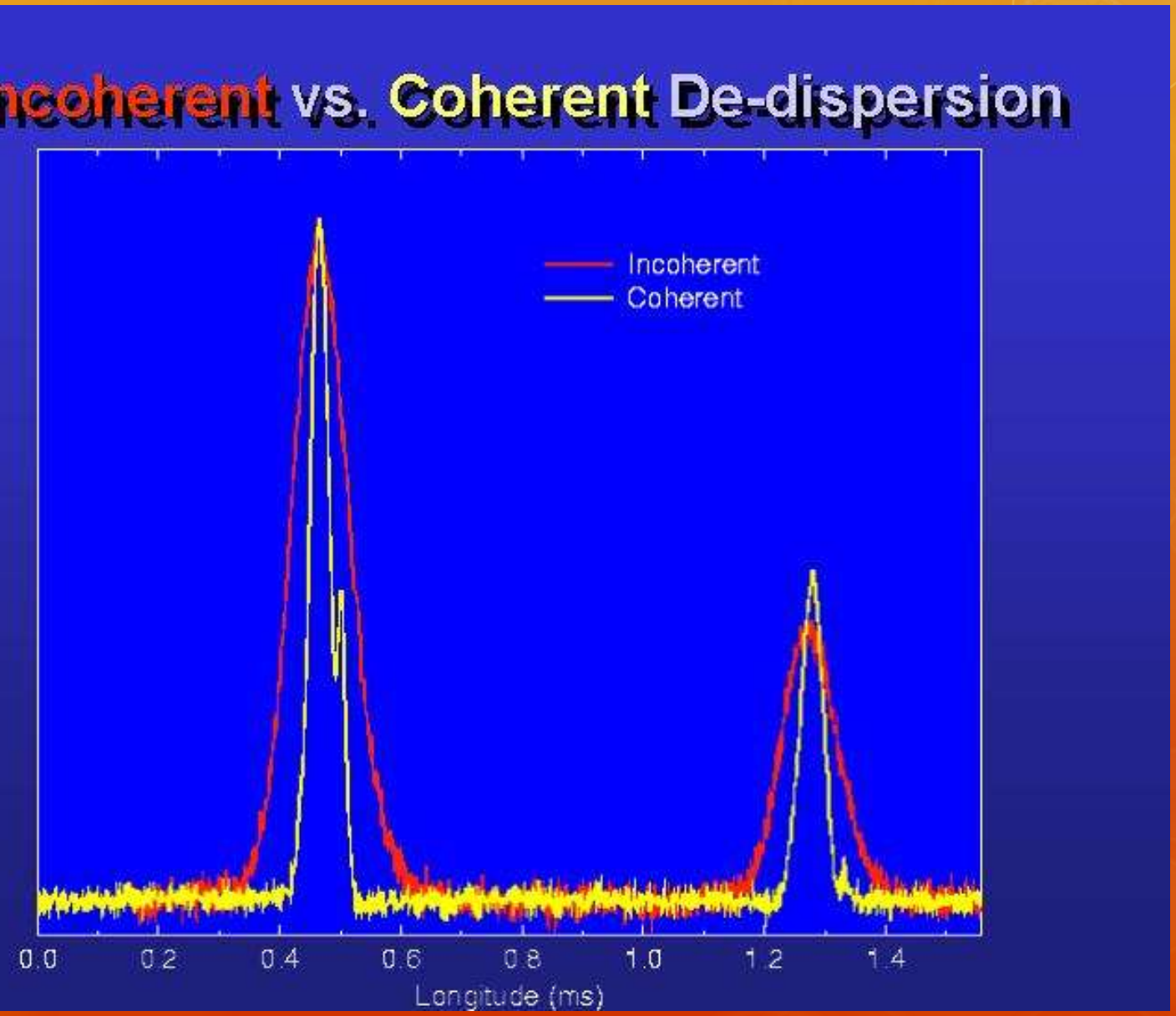
# Incoherent vs. Coherent De-dispersion



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DELL
DELL
DELL
DELL

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# Hydra & Coma

HYDRA

COMA

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# Hydra, Adder, Jumper & Coma

## Hydra/Adder/Jumper :–

182 nodes
2x Quad Core Intel Xeon 2.66 GHz E5430 CPU
4 – 16 GB RAM

1456 cores

## COMA :-

45 nodes
Mix of 2 x Quad Core Xeon 2.26 GHz E5520 with Hyper-Threading
And Pentium Dual Core 3 GHz
2 – 24 GB RAM

328 virtual cores

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# Hydra, Adder, Jumper & Coma

- Hydra :- Searching for Pulsars
- Jumper:- LEAP data acquisition
- Adder :- LOFAR Pulsars, LEAP processing, Pulsar searching
- Coma:- Theory & Cosmology – Solar Physics, CMB, Planck, QUIET, Stellar, Radiative Transfer, Galaxy Formation & Evolution

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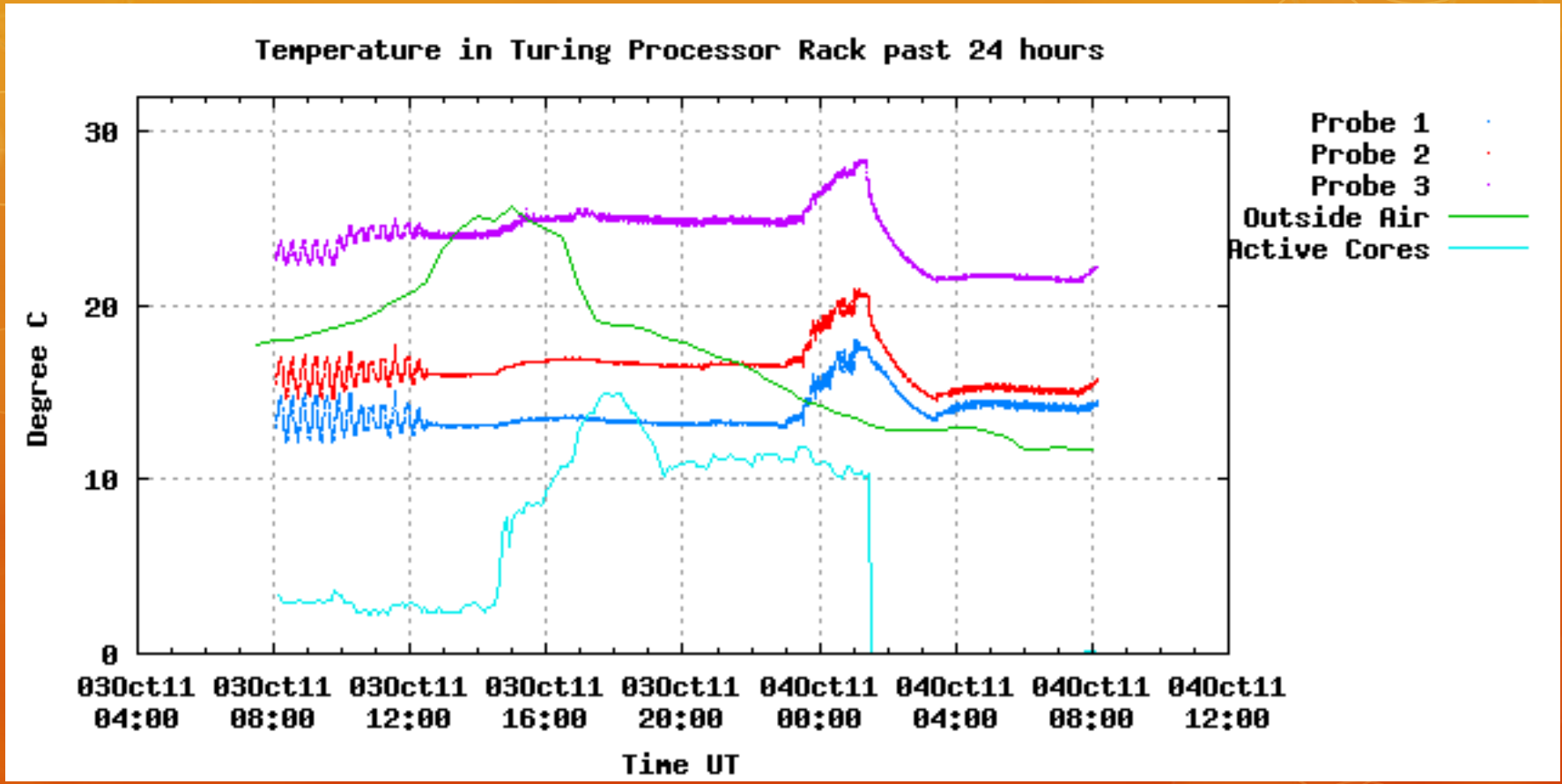

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AIREDALE

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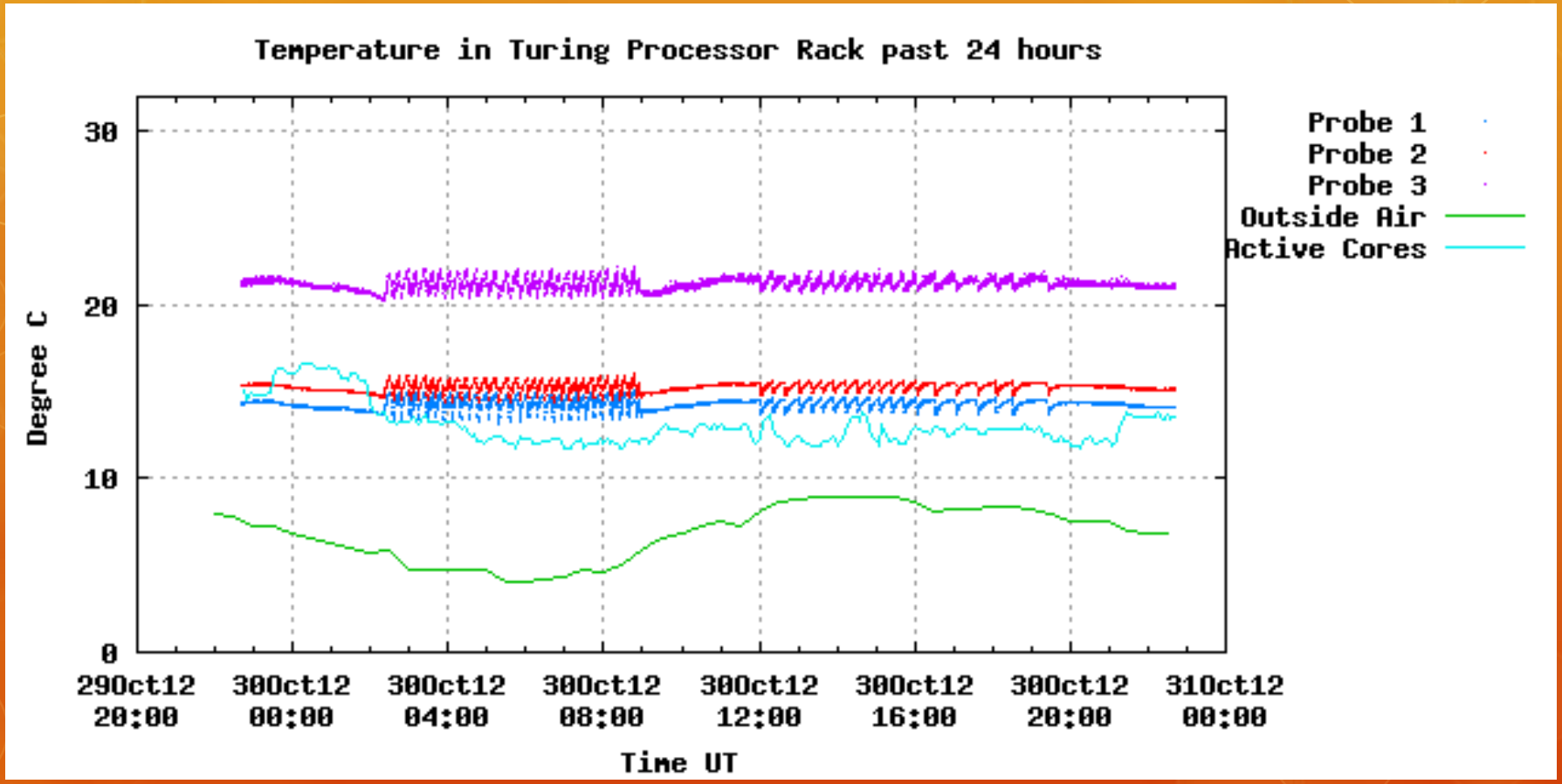

# What can you achieve?

- Embarrassingly parallel jobs scale with $N_{cpu}$ (nearly)
- Serial codes made parallel will depend on the code
- Speed up is defined by Amdahl's Law

# Amdahl's Law

- S is fraction of the code that is serial
- 1-S is fraction that can be parallelized

- The speed up using P processors is

$$\frac{R(P)}{R(1)} = \frac{1}{S + \frac{1-S}{P}}$$

# Not that simple

- Interprocess communication delay ($T_c$)
- Extra code in serial section to setup parallel parts (once per process) ($T_{is}$)
- Extra code in parallel section (once per process but occurs in parallel) ($T_{ip}$)
- Code specific communications e.g. $P(P-1)*T_c$

$$\frac{R(P)}{R(1)} = \frac{T_s + T_p}{T_s + PT_{is} + {T_p}/{P} + T_{ip} + P(P-1)T_c}$$

# How to go about it

- Look at your code – what can be done in parallel?
- How much time is spent doing it?
- Use Amdahl's Law – is it worth it?
- Extra code adds delays - setup, comms, barriers
- Is there a parallel algorithm to replace the serial one?
- How well will the code scale as you increase the number of nodes being used?

# How to go about it

- Amdahl's Law – Law of dimishing returns
- You can divide a problem so small that with many CPU's it actually runs slower

# Message Passing Interface (MPI)

- Library of routines for C/Fortran
- MPICH for Ethernet
- E.g. MPI_Send, MPI_Recv
- Runs on a set of nodes at start up

- IT Services (Research Computing Services) run courses on MPI
- 29th November
- Materials on-line

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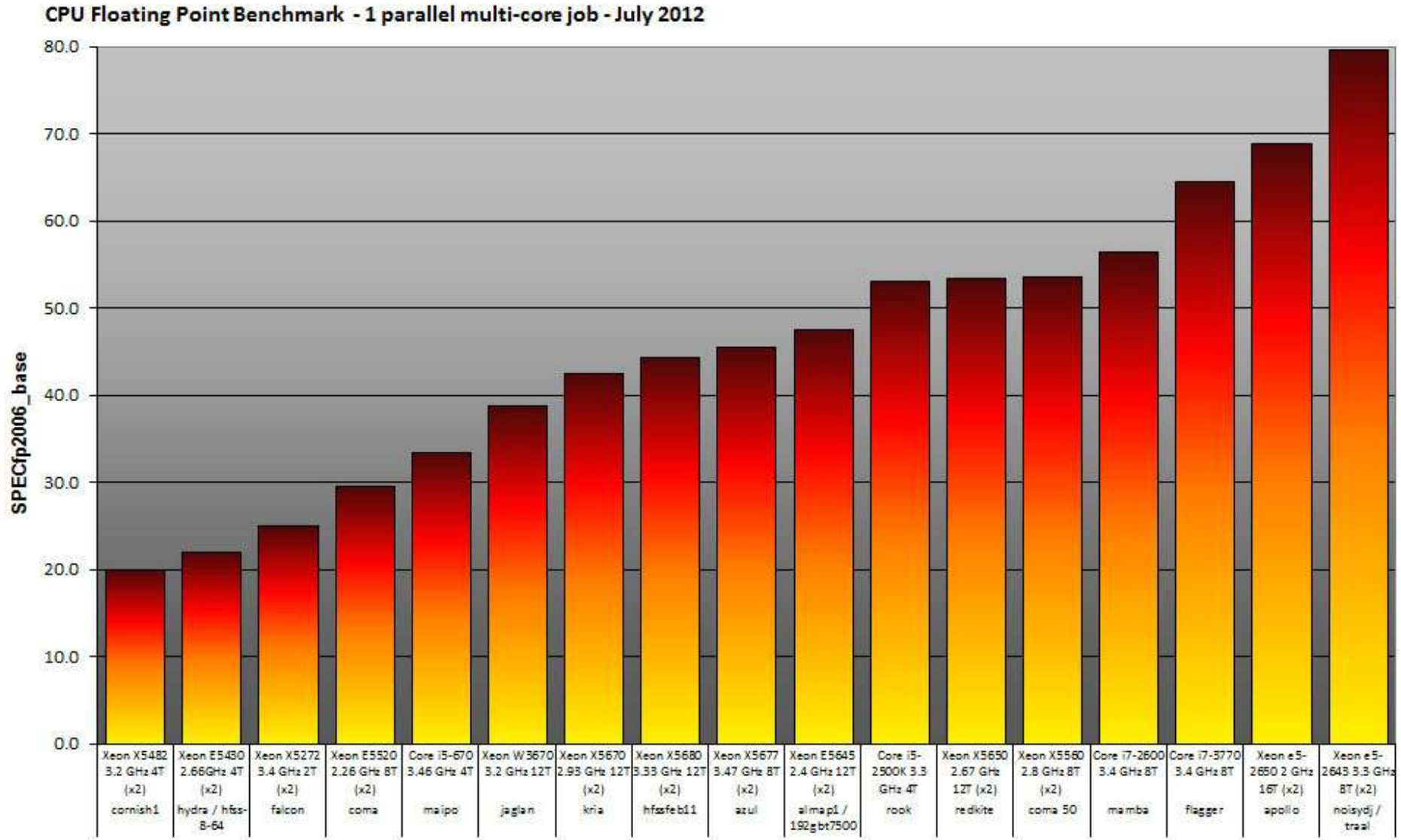
# Machine Performance



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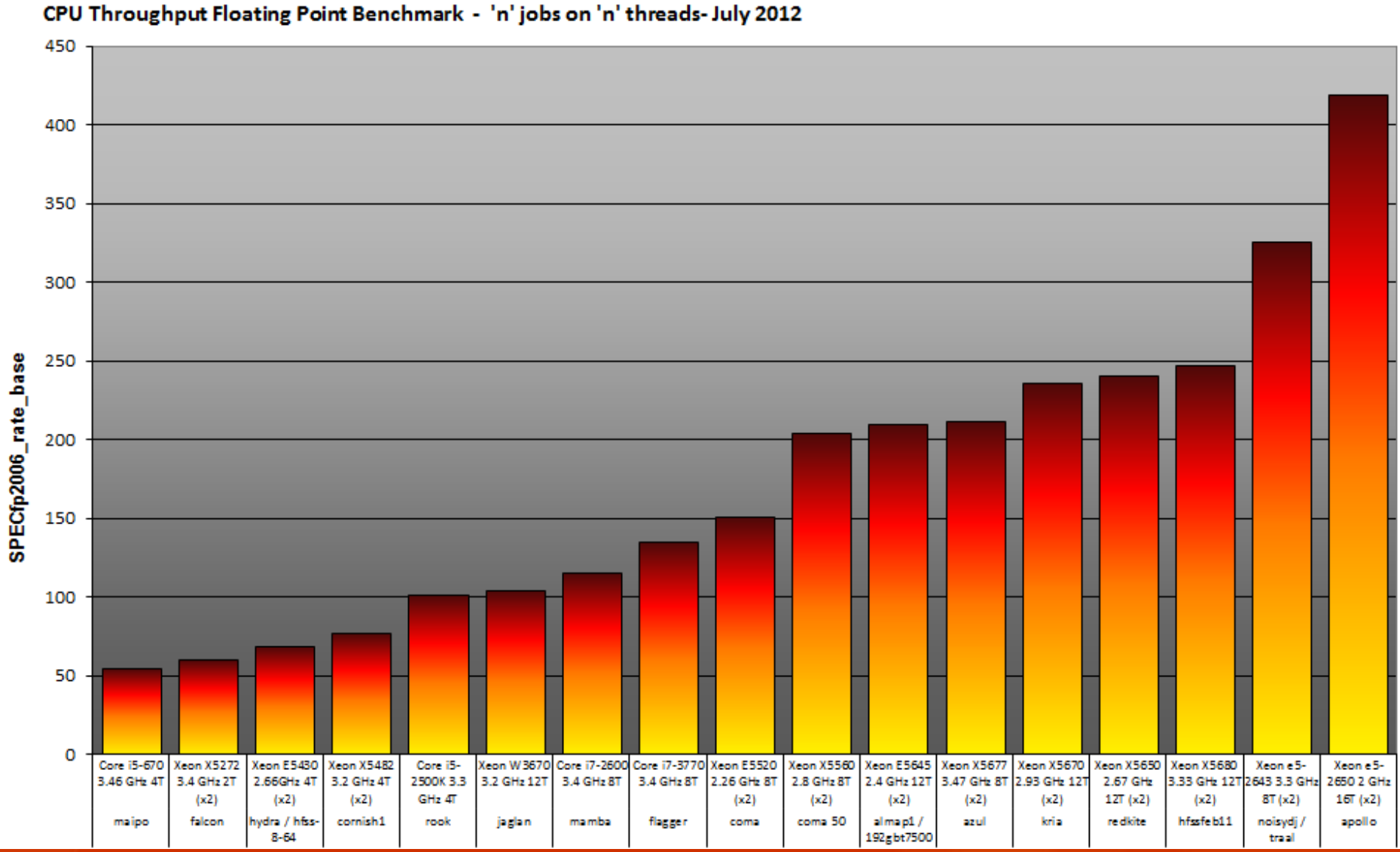
# Machine Performance



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# GPU's

- Geforce – Galaxy Simulation
- Navi – Pulsars
- Apollo - Pulsars
- New PC – Optic Fibre Transmission

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**Fibre Links**

**Wide Bandwidth**

**= 0.5 TB a day**

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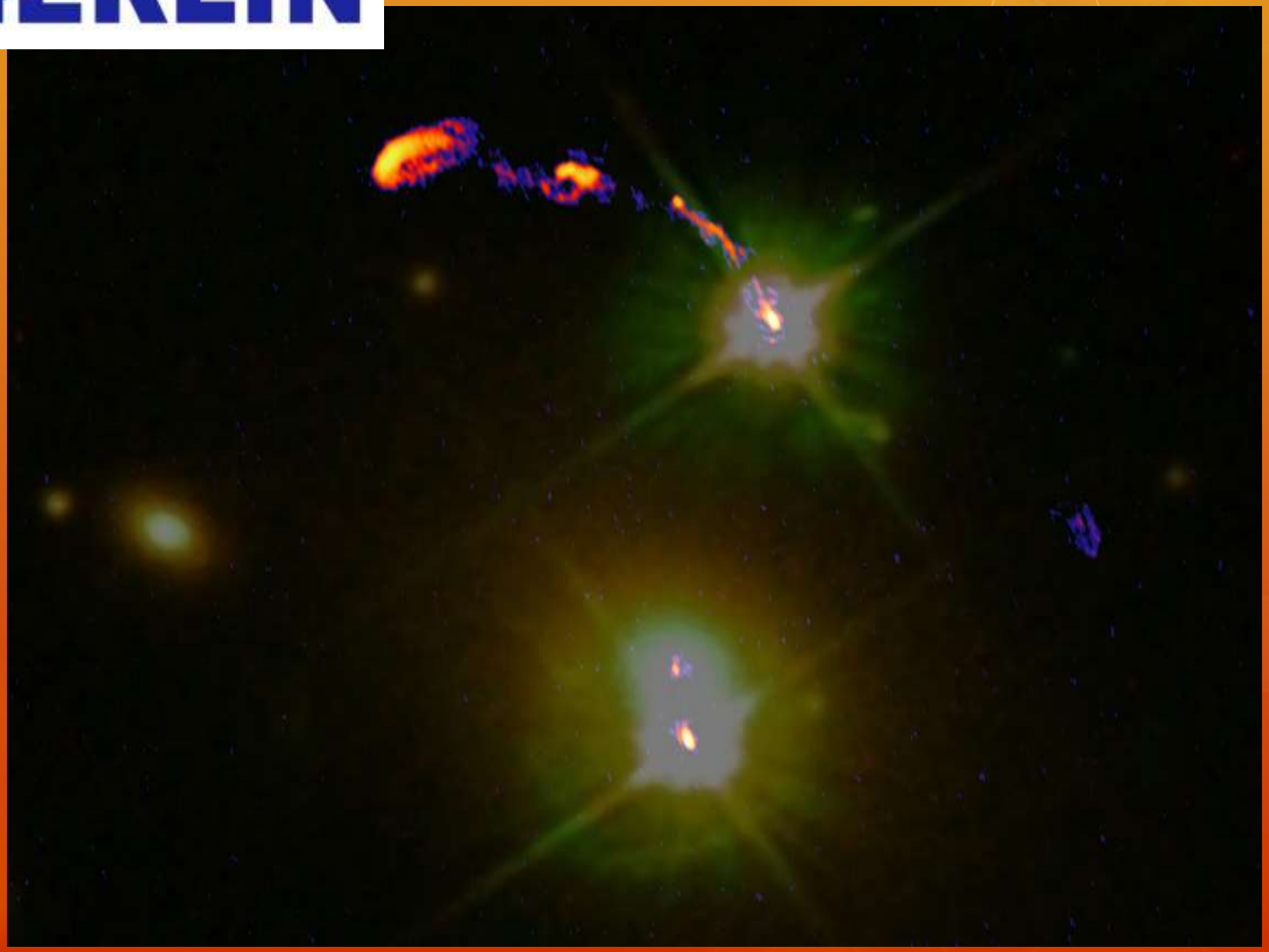

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# ALMA ARC

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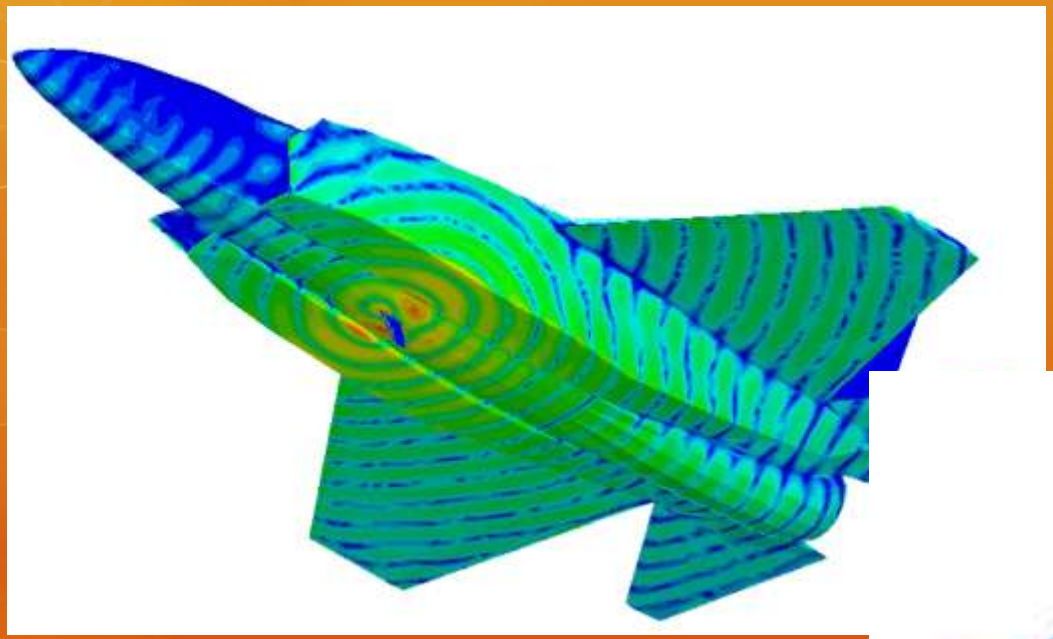
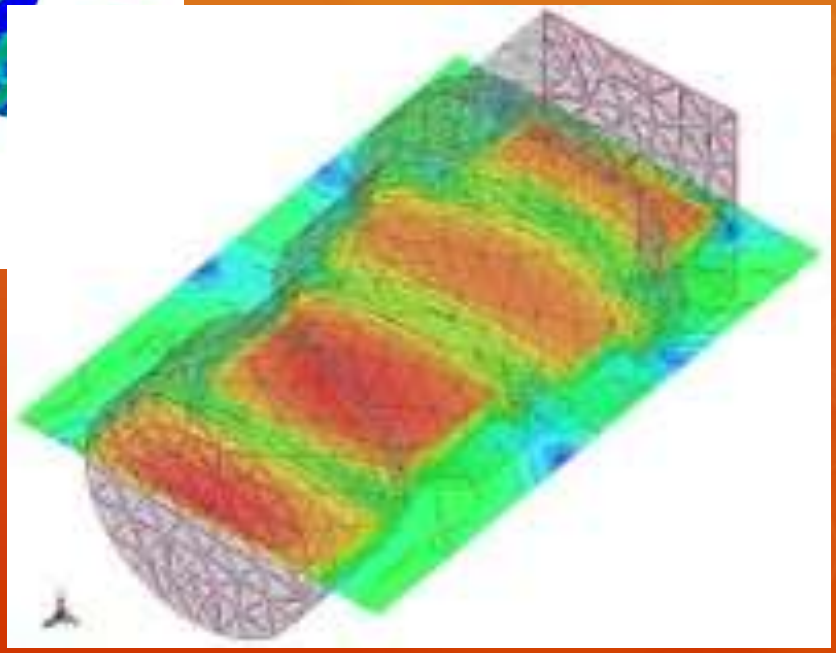
# Technology





HFSS

FEKO

GRASP

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# LOFAR Data Analysis

- Dedicated 1 Gbps Fibre Link to Netherlands

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# International Virtual Observatory Alliance

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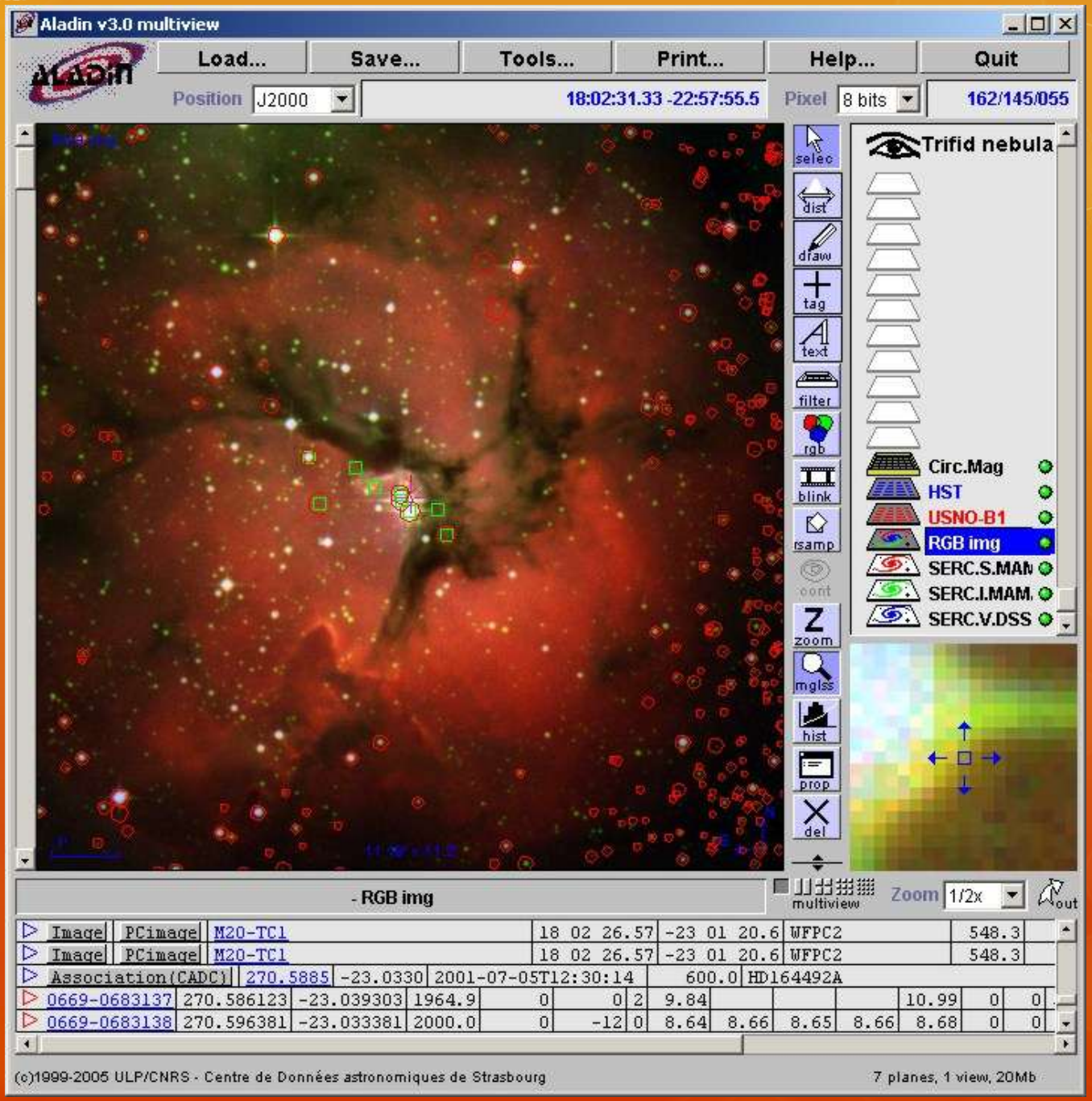
# Aladin



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# Video Conferencing - AccessGrid

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# Imaging, Audio & Video Production

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# Imaging, Audio & Video Production

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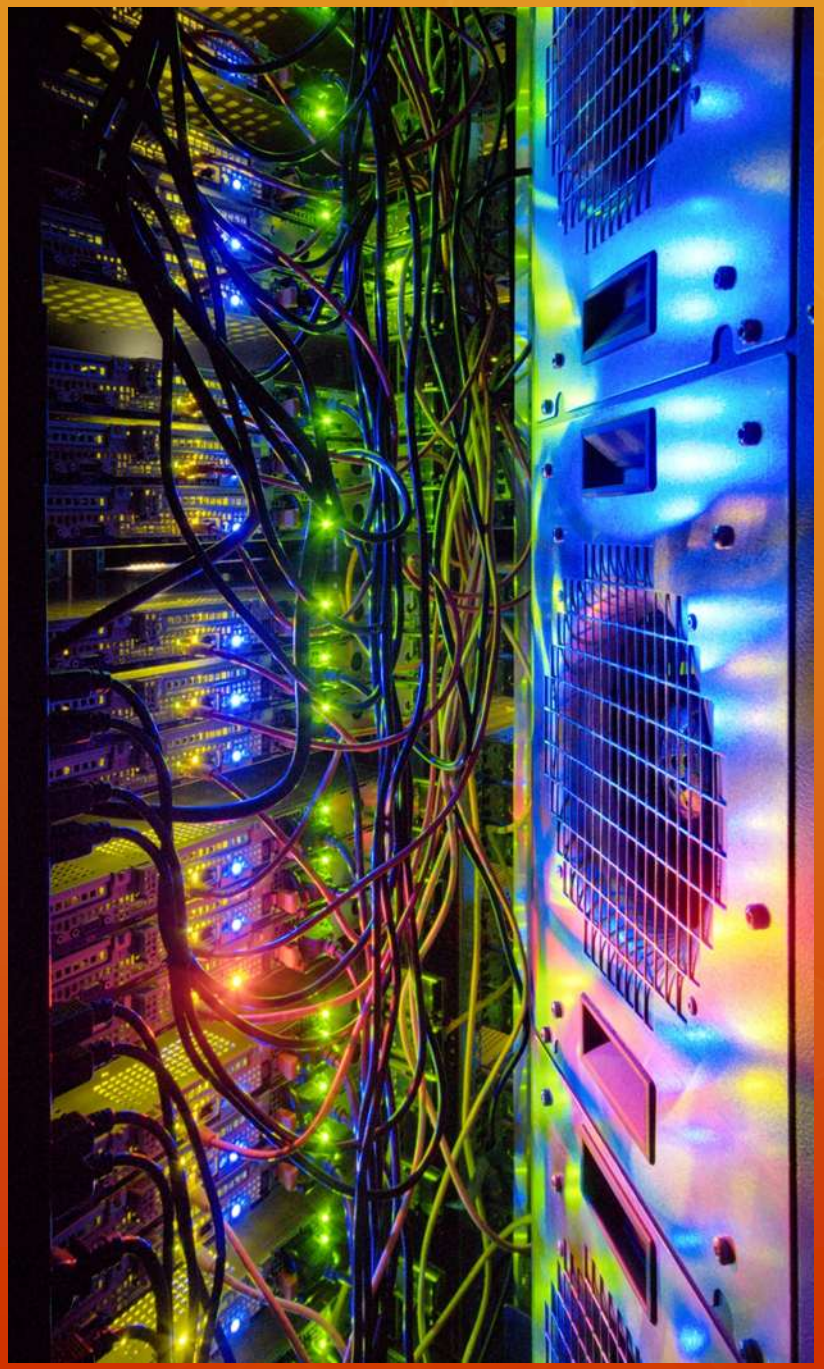
# New Developments:-

## Star2

## ALMA cluster

## COMA upgrades

## HYDRA upgrade



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# Any Questions?