The European ALMA Regional Centre:

interaction with and support to the users

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IRAM school Grenoble 10/10/08

ALMA Operations

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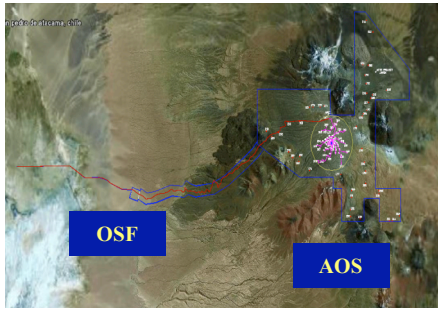
Science Operations Astronomer's perspective

Principles:

- Non-experts should be able to use ALMA
- ♣ Dynamic scheduler to match observing conditions
- ♠ Reliable and consistent calibration
- ♦ Data public in timely fashion

ALMA in operations

San Pedro (OSF) Operations Support Facilities



array scheduling + operations

quick-look reduction

maintenance and repair antennas + instruments

Santiago (SCO) Santiago Central Office

issues of calls

TAC (Time Allocating Committee) process

SB (Scheduling Block) checks

pipeline data reduction

quality assessment

production of archive

The Regional centres

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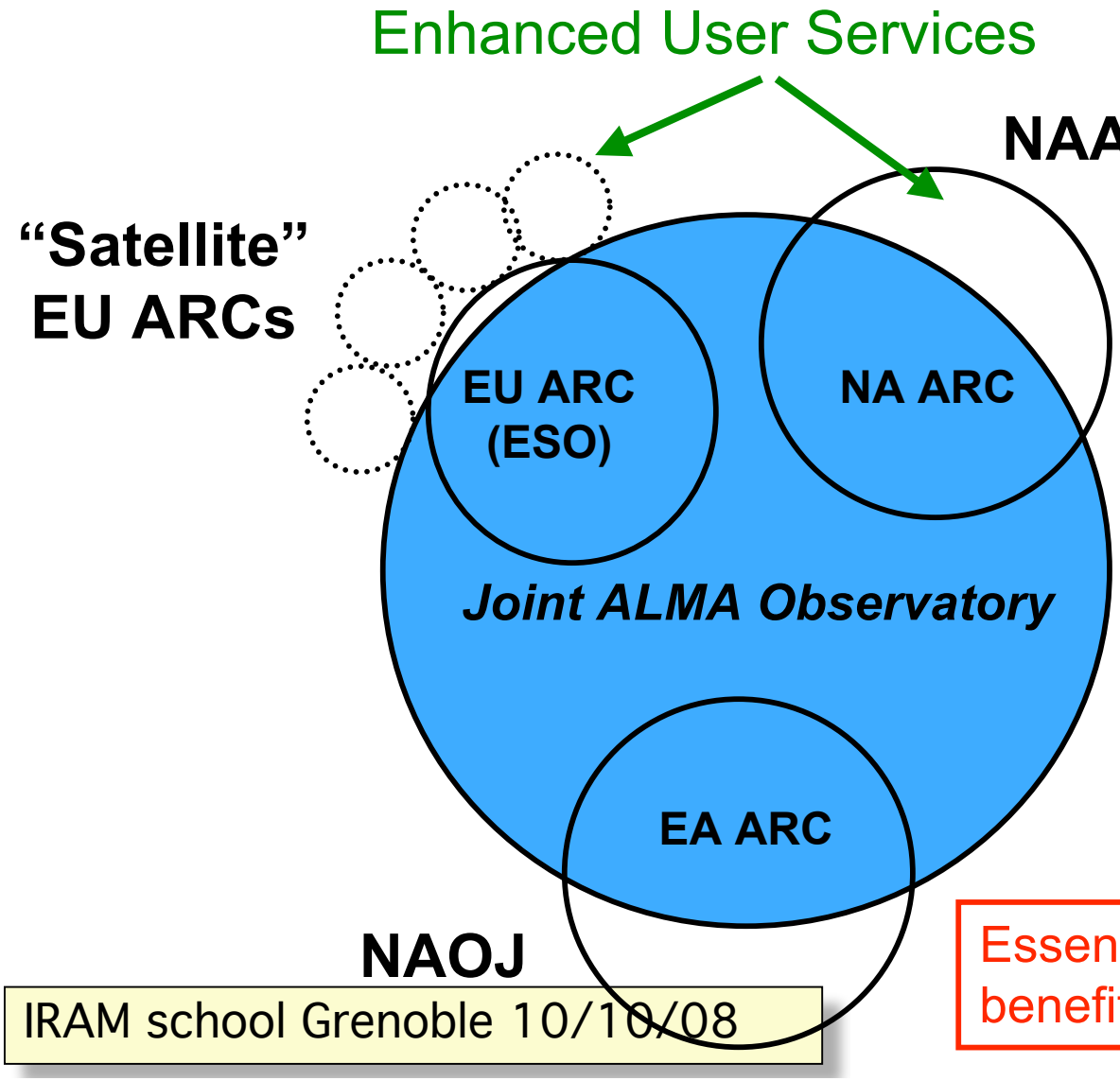
ALMA Operations: Three ALMA Regional Centres - ARCs

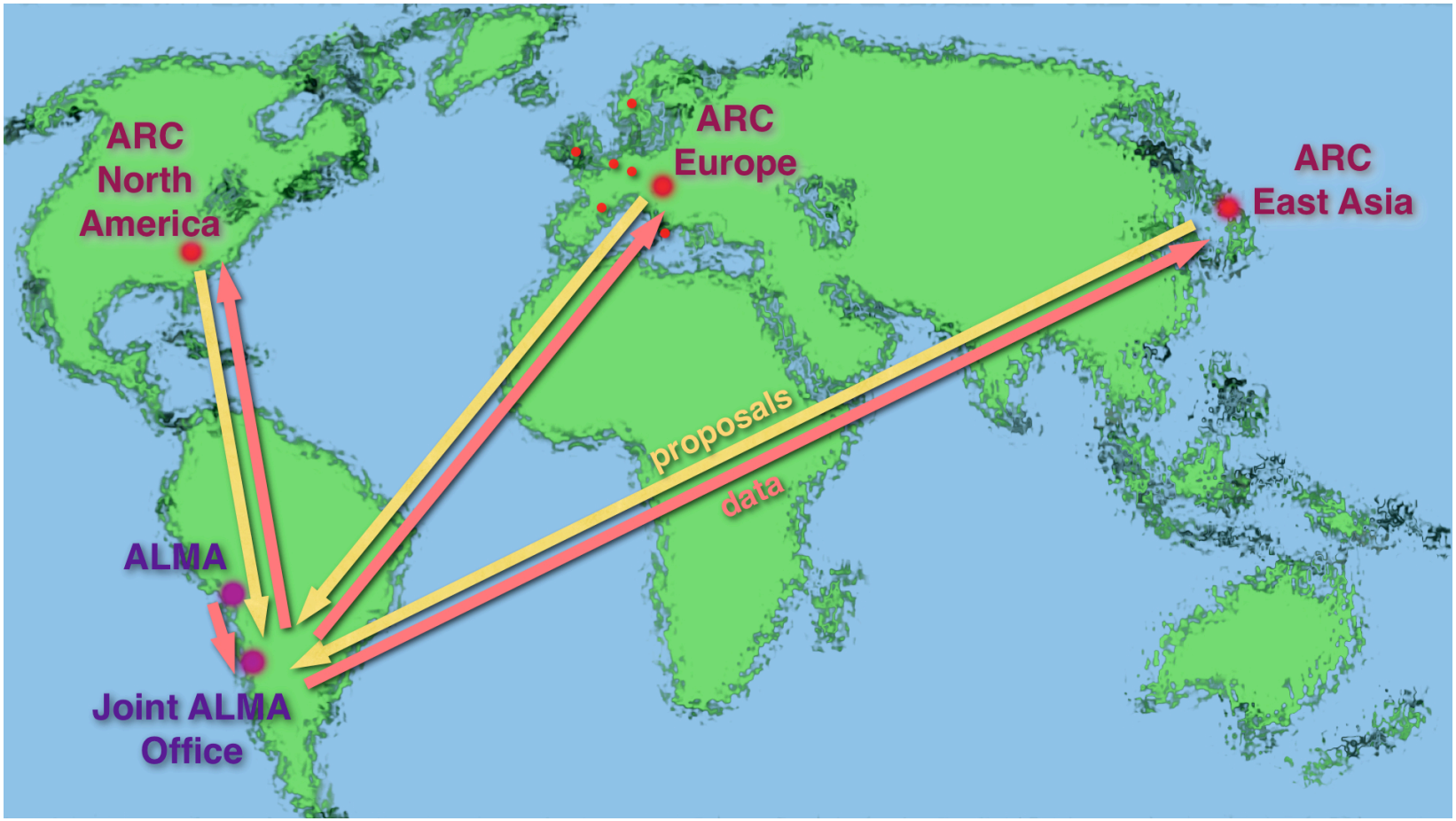


ARCs provide basic user interface, as well as basic archive, software, and hardware maintenance and development

Enhanced services are needed to provide advanced user support, algorithm development, student programs, EPO, grants

Essential to realize the full benefits of ALMA

The ARCs and their relation to the JAO



The ALMA Regional Centres

- **Core functions**

Scientific support services

- Proposal & observation preparation user support
- Basic data analysis
- ALMA Archive operations: host copy, data package delivery
- OSF AoD shifts (CSV)
- Science community development

- **Additional functions**

Extended archive & data reduction support

- f2f help
- Advanced pipeline
- Archival research projects

Support for special projects

Science community development

- basic training, schools, workshops

version D (approved): in the core functions

+ f2f help during first years
+ archival research help

Meaning of ALMA Operations

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What does science Operations mean?

- **Phase I + II proposals through ARCs**
  (time estimator, end-to-end data simulator)
- **Scheduling blocks to OSF**
- **Data taken in service mode, dynamic scheduler selects programmes according to science rating weather conditions, array configuration, consistent calibration**
- **Pipeline data reduction, quality control, archive**
- **Advanced data reduction at ARCs**

Getting ALMA time

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Getting ALMA time

Phase I

- **Joint ALMA Observatory issues calls for proposals**
  - Register on the ALMA web page
  - Prepare a proposal with the ALMA Observing Tool
  - user can contact their ARC node for assistance
    - European ARC provides documentation
- **ALMA Observatory (with ARCs help)**
  coordinates refereeing process
    - Program Review Committee ranks proposals
- **Executives approval**

Getting ALMA time

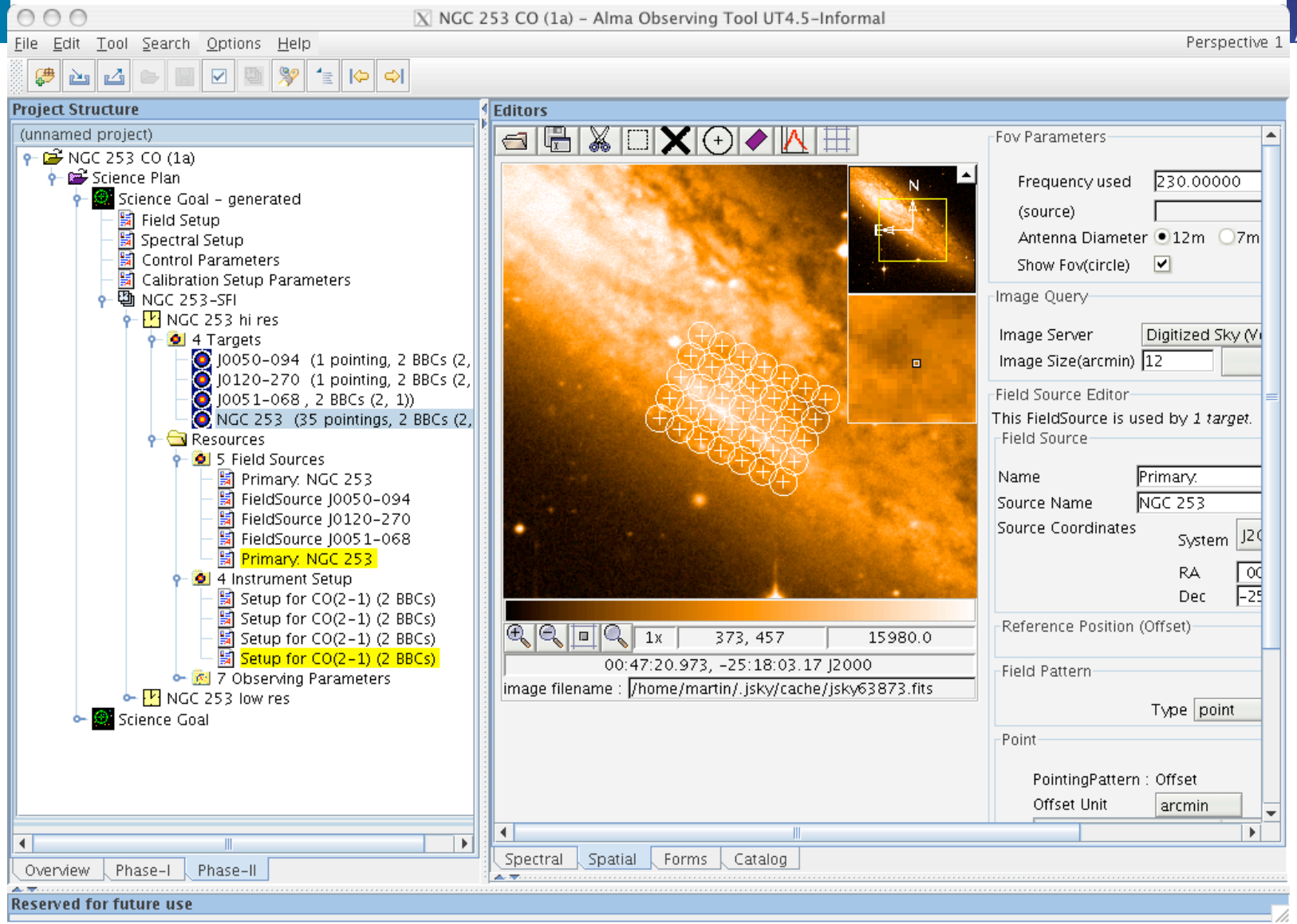
MAKE A PROPOSAL!

Phase I

- **Scientific case**
- **Instrument setup:** **frequency**
  rms
  S/N
  source extension
  spatial resolution

- ALM… …s help) coordinates referee…
  - Pr… proposals
- Execu…

The ALMA observing tool



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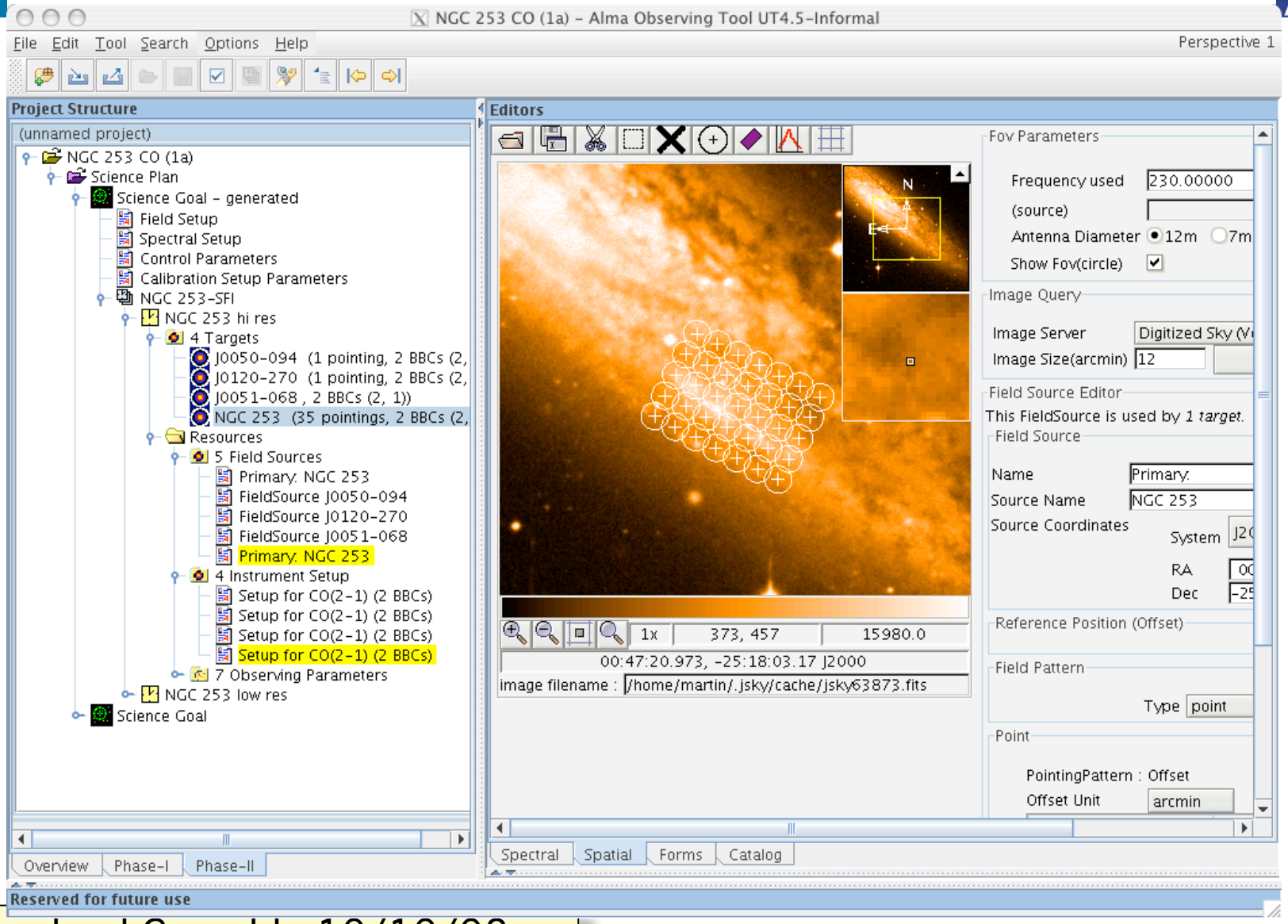
Getting ALMA time

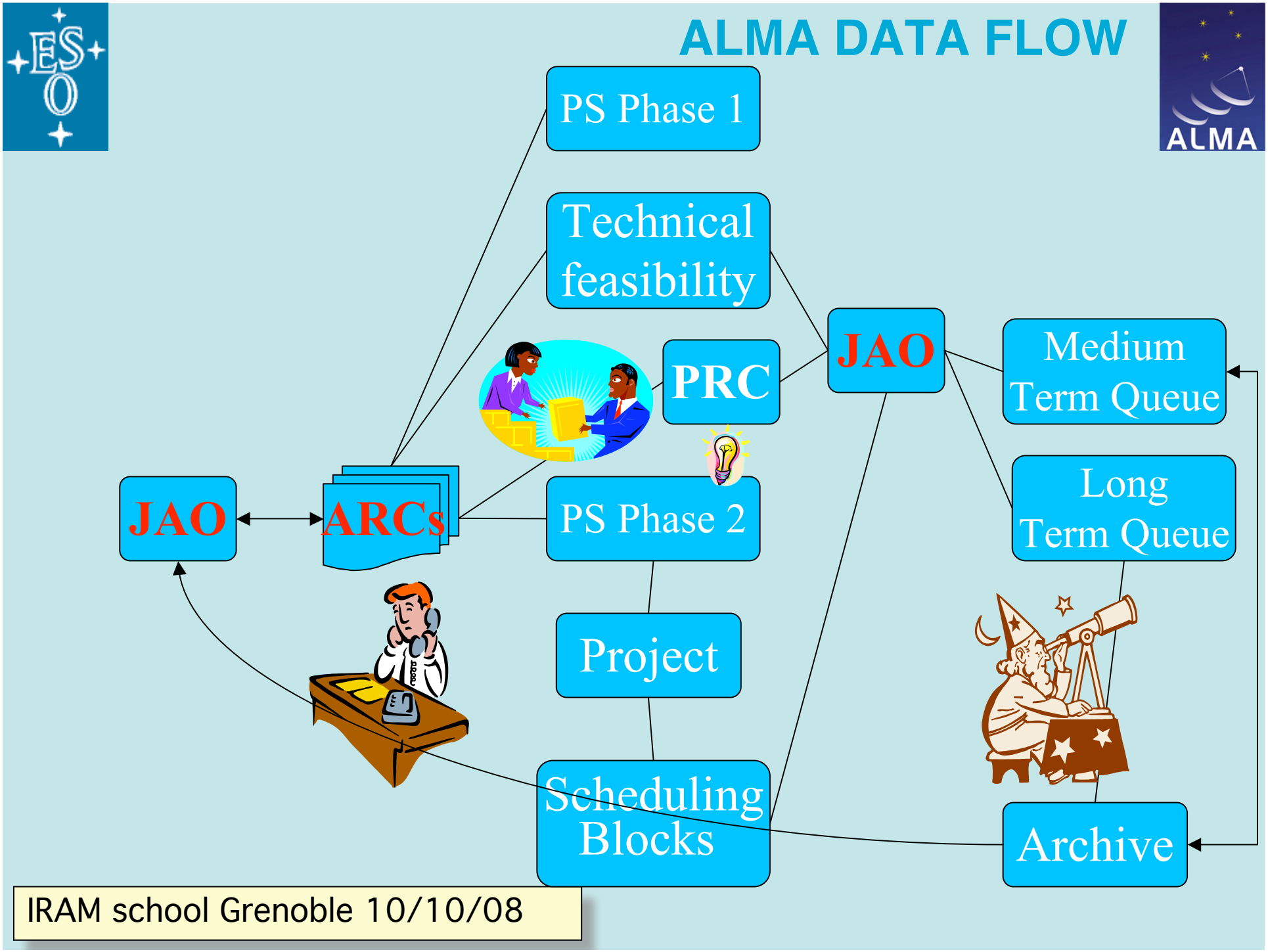
Phase II

- Phase I: Proposals are submitted using ALMA Observing Tool
  - **Phase II:** Successful PIs submit observing programme using the Observing Tool
  - Preparation of the scheduling blocks
  - European ARC helps with observation planning and validates observing schedule

The ALMA observing tool



ALMA DATA FLOW



Getting ALMA data

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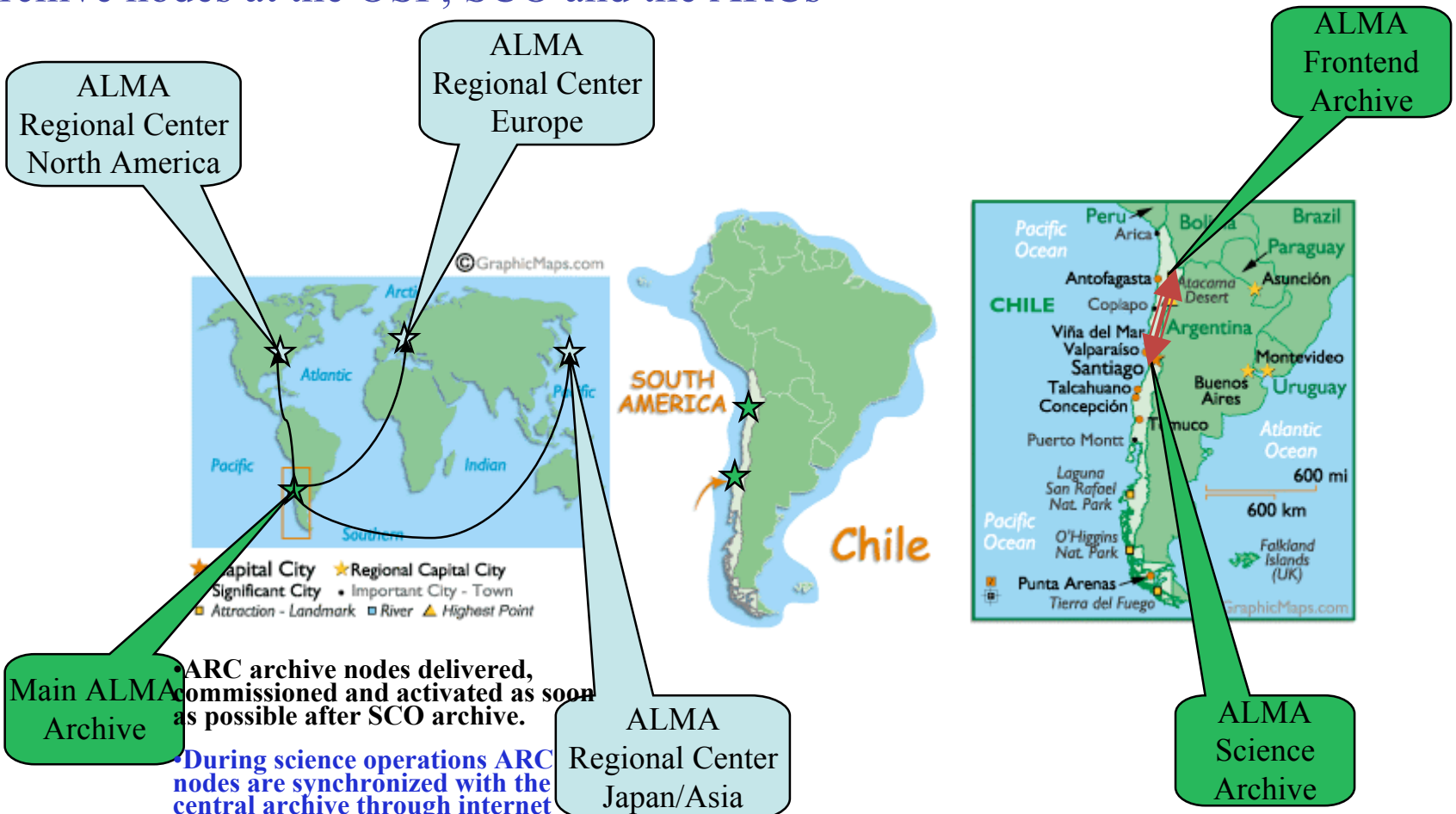
Getting ALMA data

- Queue based dynamic scheduling
  - Programs are composed of 30-60 min scheduling blocks
- Raw data pass through multi-tiered quality assurance
  - Combination of on-site duty astronomer, ARC staff, and automated checks
- Data proceeds to pipeline and archiving
  - Data available from ARC (ESO) within ~2 weeks (TBD, quick if internet available)
  - Pipeline products (images and calibrated u-v data), raw data off-line data processing software made available to PIs
  - Expert hands-on data reduction help from ARC nodes staff

provided on request, helpdesk also available at ESO

The ALMA archives and data distribution

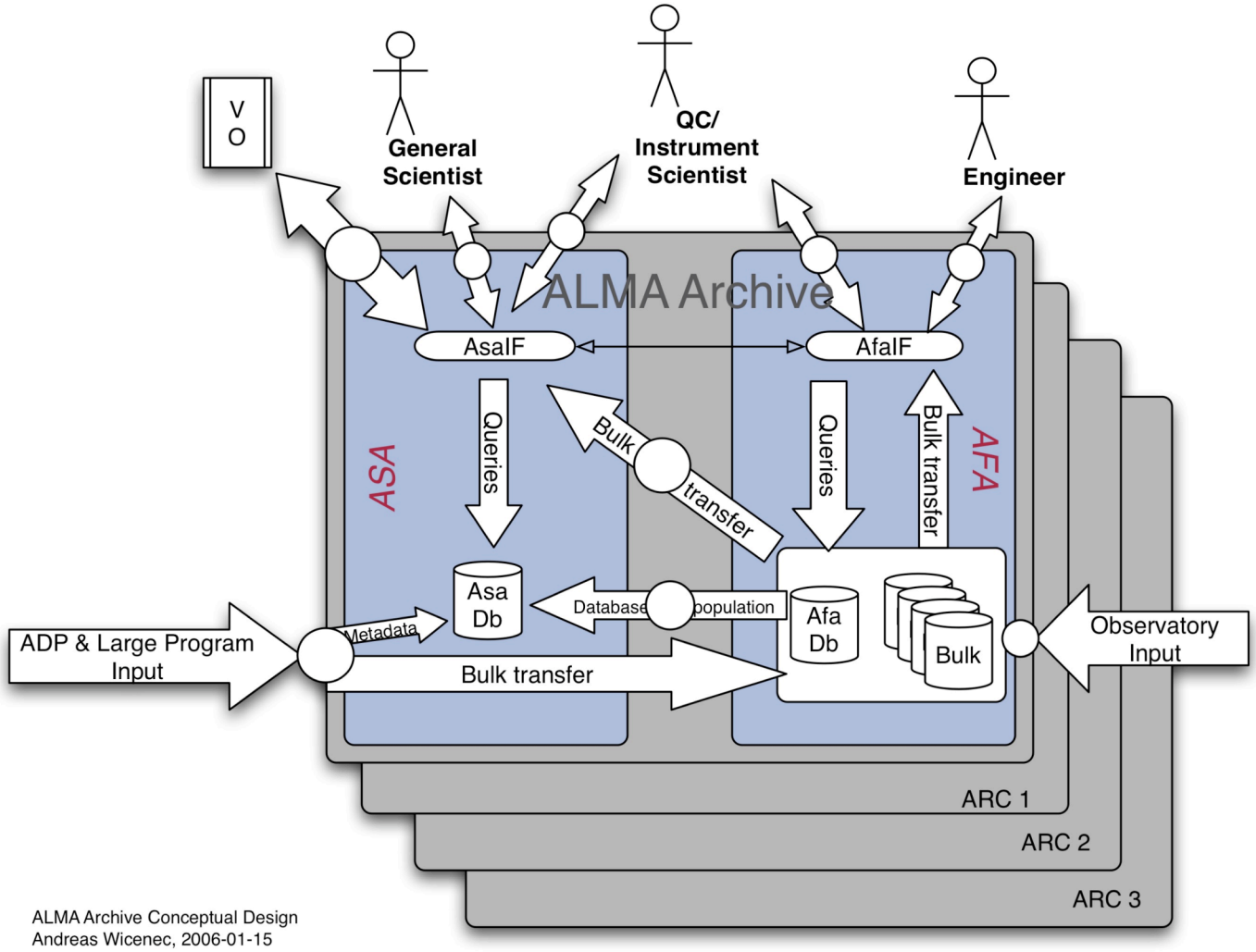
Archive nodes at the OSF, SCO and the ARCs



- **ARC archive nodes delivered, commissioned and activated as soon as possible after SCO archive.**
- **During science operations ARC nodes are synchronized with the central archive through internet (small data sets) or via physical media.**

OSF connected to SCO via high-bandwidth. It MUST be always possible to operate ALMA even if the internet link does not work

The ALMA Archive



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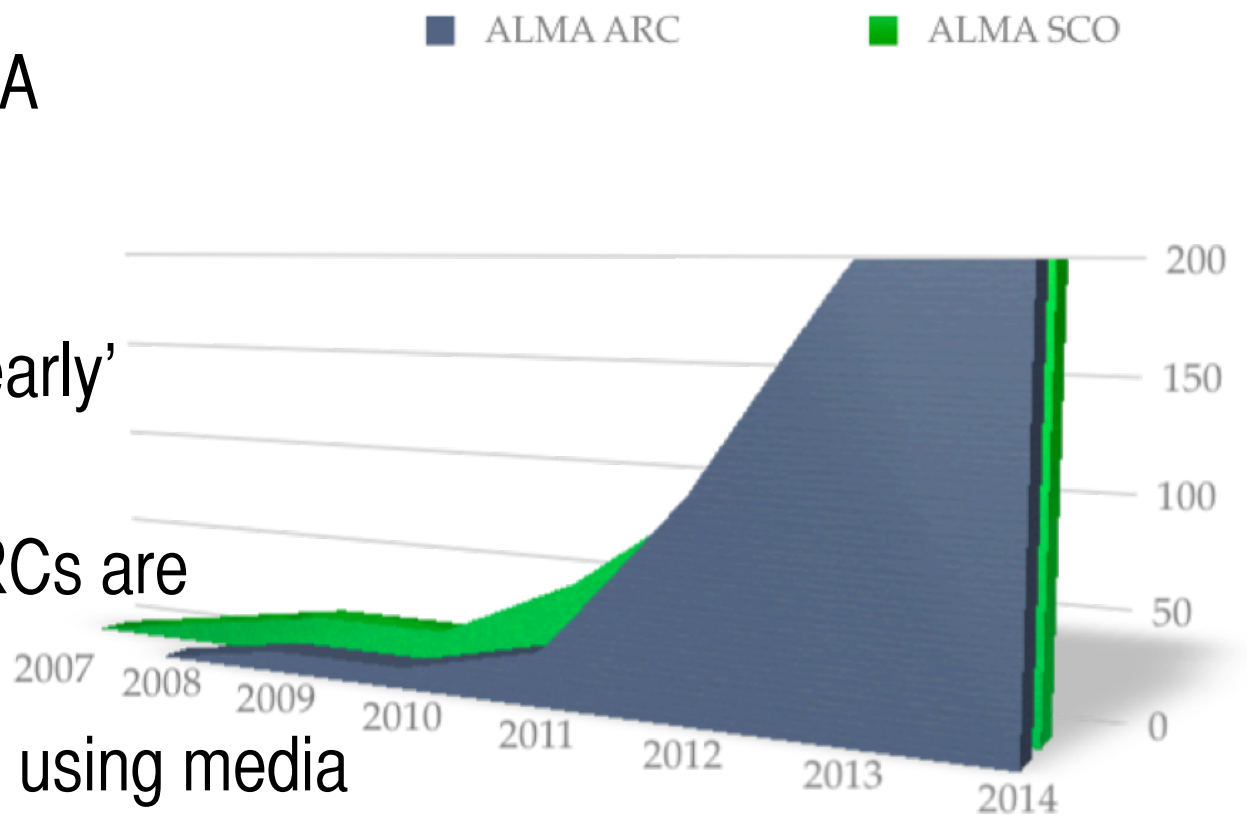
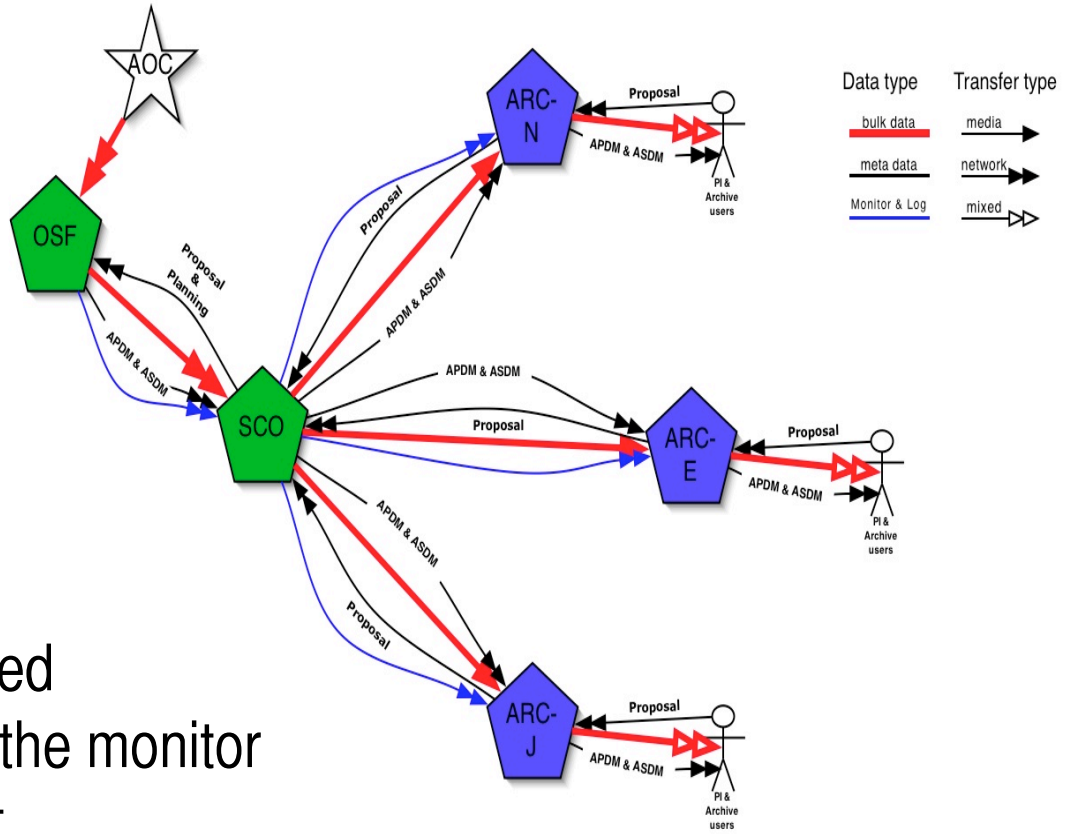
Data volume

- 1 year nominal ALMA is 200 TB.
- we've planned for 200 TB during the 'early' years in total.
- no backups! The ARCs are the backups.
- Replication to ARCs using media if necessary and over network once possible.



High level concepts

- SCO is hub for bulk and meta-data.
- OSF archive is hidden. Data are first replicated to SCO and from there to the ARCs.
- In general everything is replicated to the ARCs; in practice part of the monitor and log data might be irrelevant.
- Proposals are submitted to the SCO and replicated to the ARCs. OT submission interface talks to SCO.



Data reduction

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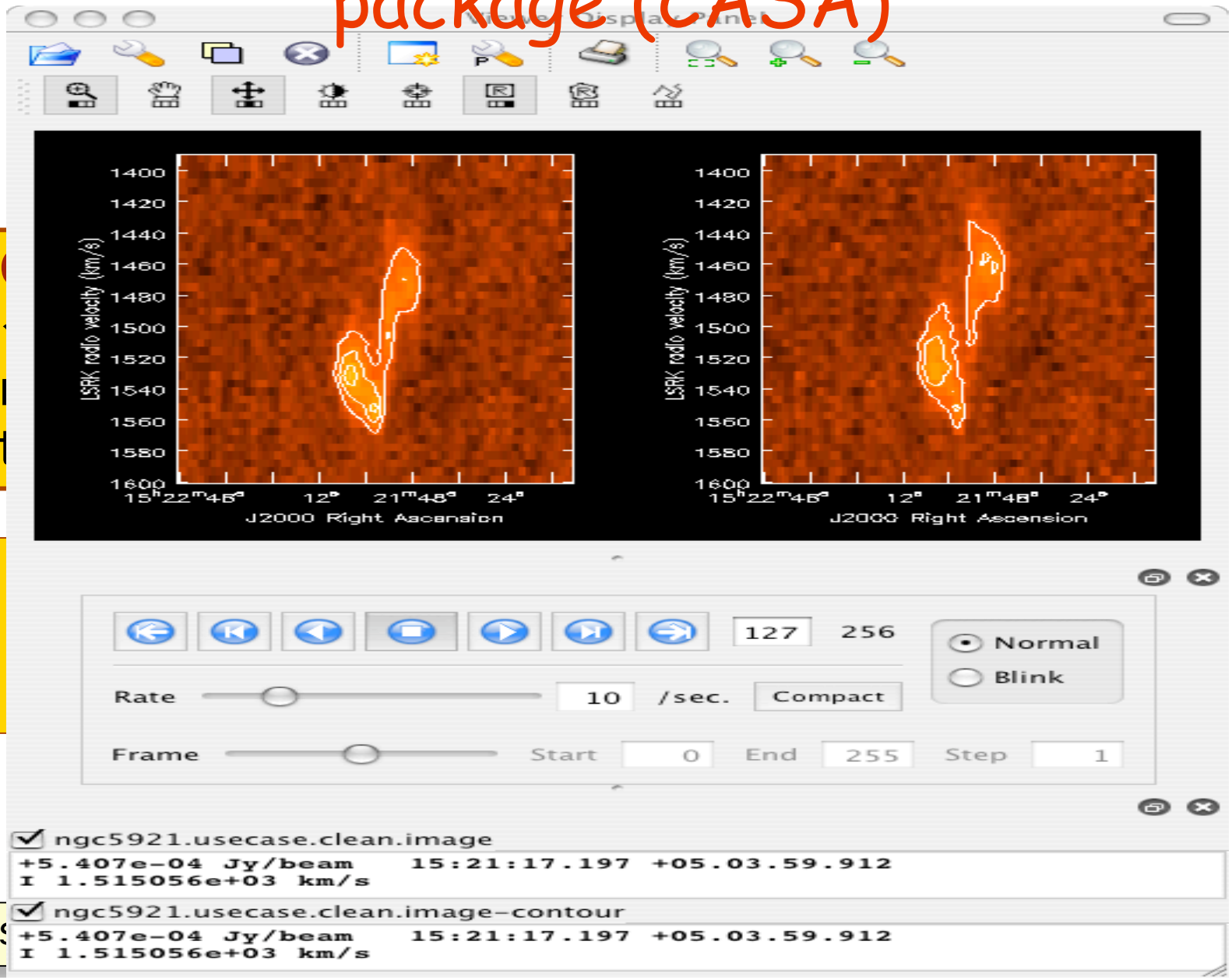
The ALMA offline reduction package (CASA)



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How many people do we need?

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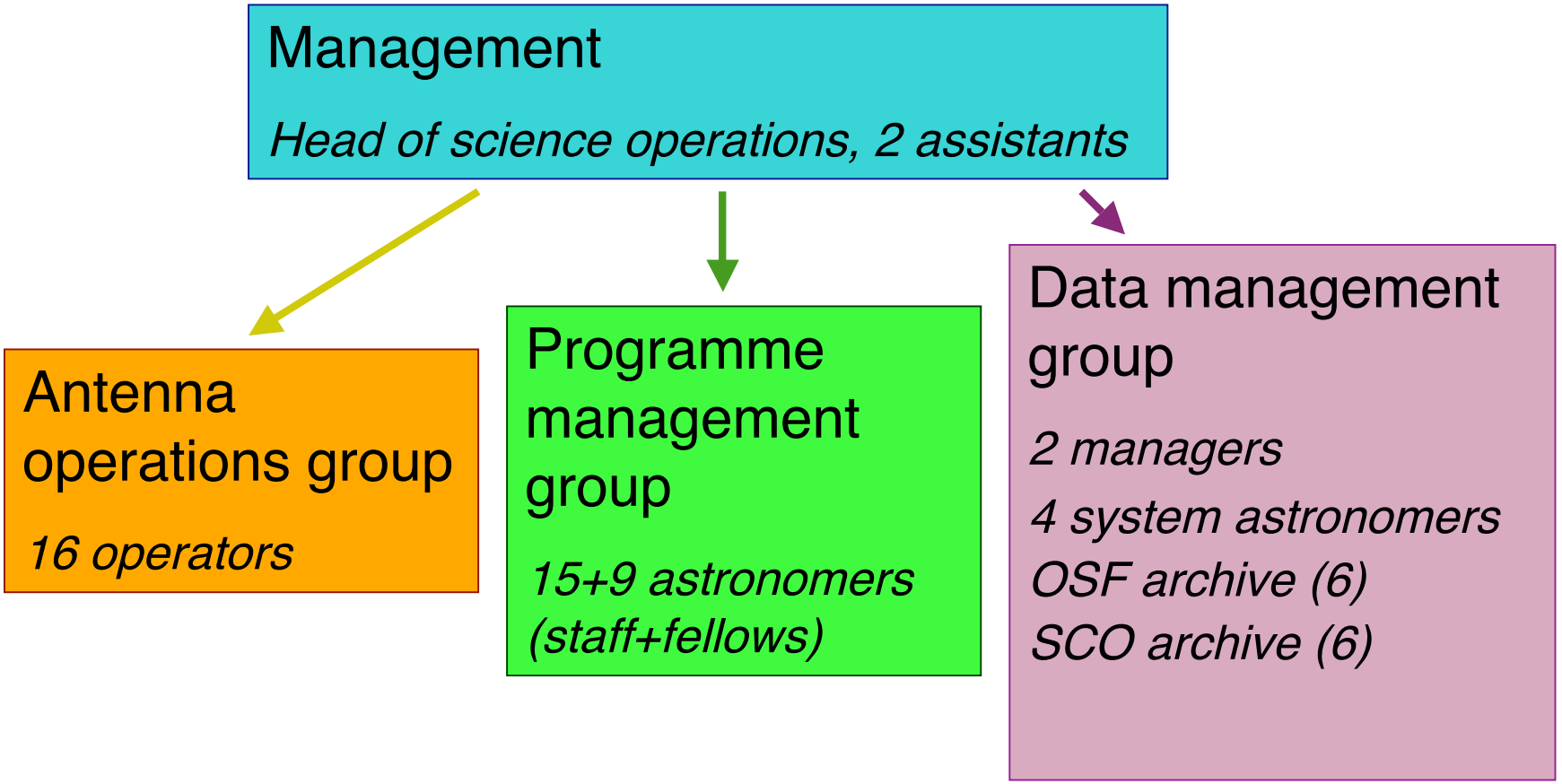
Chilean ALMA Operations

- The department of science operations (DSO)



ALMA Operations: ALMA Regional Centres: Full Operations

European ARC	North America ARC	East Asia ARC
Manager	Manager	Manager
Assistant	Assistant	Assistant
User support (7+5 astronomers+scientists)	User support (7+5 astronomers +scientists)	User support (4+4 astronomers +scientists)
Archive facility 5 operators	Archive facility 5 operators	Archive facility 5 operators

The ALMA Regional Centres

The European ARC

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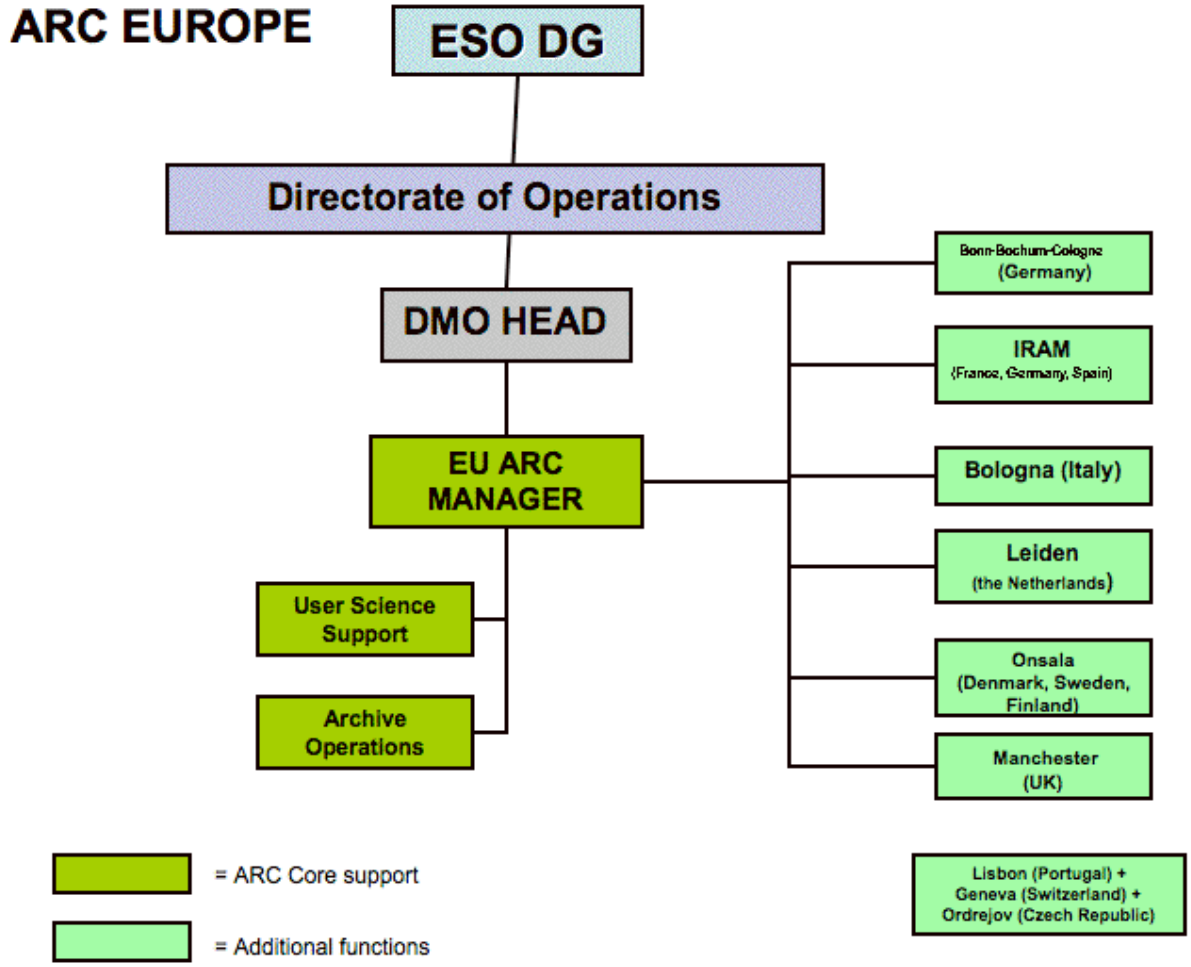
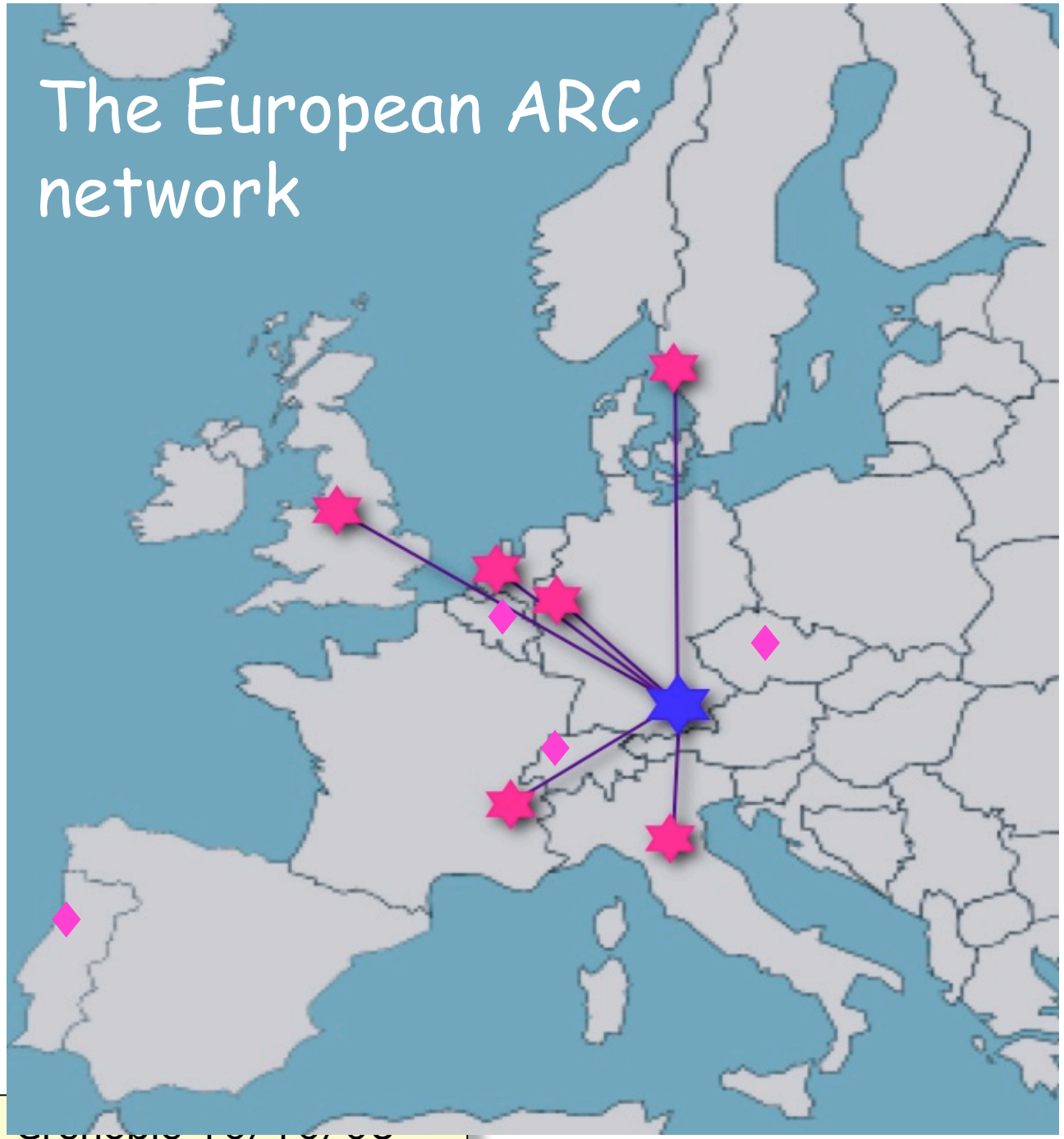
the European ARC



The ALMA Regional Centres

The European ARC network

The European ARC network



♦ : under discussion

ARC nodes tasks

(additional functions)

- Extended archive and data reduction support:
  - f2f data processing support in a dedicated physical location
  - modified pipeline versions
  - re-processing of large and/or complex datasets
  - advanced simulation development
  - advanced algorithm development and use
  - help with archival research projects
  - Support for special projects: public surveys and large programs
- Science community development:
  - support for ALMA research (e.g., basic training for new users), post-doctoral fellowships, training schools and workshops
  - ALMA-related specific science workshops, leading science community development activities with ad-hoc assistance from the ESO ARC and advanced public outreach

ARC nodes: location and expertise

Bonn-Cologne-Bochum (D) (F.Bertoldi)

expertise: Infrastructure for advanced data analysis and modeling (incl. Cologne Database for Molecular Spectroscopy), Polarimetry, Astrometry, Pipeline heuristics, Automatic data calibration

IRAM (F,D,E) (F. Gueth)

expertise: calibration, phase correction, polarimetry, imaging simulator, SMA configurations, schools

Bologna (I) (J. Brand)

expertise: data handling (GRID techniques), mosaicing, coordinating surveys/key-projects, polarimetry

Manchester (UK) (T. Muxlow)

expertise: data analysis, archive, data reduction heuristics, proposal preparation

Onsala - Nordic node (S,DK,SF) (J. Conway)

expertise: multi-frequency synthesis, GRID computing, phase modeling, self-calibration, astrometry, deconvolution, astrochemical modeling and radiation transfer

Leiden (NL) (M. Hogerheijde)

expertise: high-frequency imaging, wide field imaging,data analysis tools

Portugal + Switzerland + Czech Republic + Belgium (Lisbon, Geneva Obs., Ordenjov Obs) express interest

What ARCs are going to do

- **Participating in software pre-release tests**
- **Commissioning** (as a means of pre-AoD training)

} **Pre-Ops**

- **PST submission support (Phase I support)**
- **Phase II support**
  - **helpdesk**
  - **SB verification**
- **Offline & data reduction help-desk support**
- **Documentation** (End-user doc + web content)
- **Astronomer on Duty**
- **Coordination meetings between ARCs, JAO**
- **Science Verification**
- **TAC Support** (technical feasibility assessment)

} **Full Ops**

What ARC nodes are going to do

- Participating in offline software tests
- Commissioning?

} **Pre-Ops**

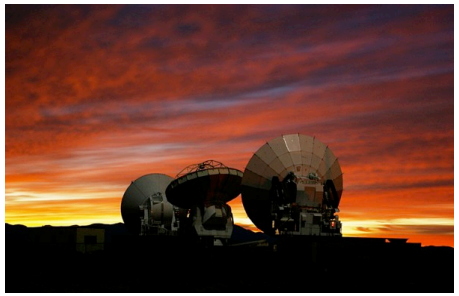
- Face to face help for Phase I and II
- Offline & data reduction face-to-face support
- Advanced data reduction
- Training of students, schools
- Science Verification?
- Special Projects

} **Full Ops**

Current Timeline

2008 Continue Prototype System Testing (Socorro)

2008-2009 ARCs testing of observing tool, offline reduction software, pipeline heuristics



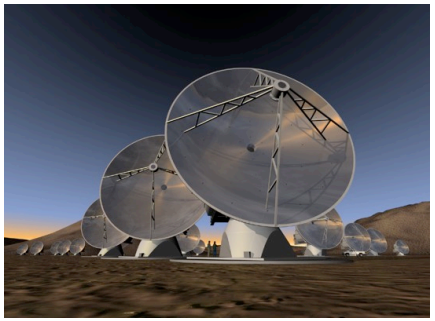
Early 2008 First antenna arrival and testing at ALMA site

Late 2009 Commissioning Begins with 3-element array

2010 Science Verification begins

- 6+ antennas, 2+ bands, continuum & spectral line, 1km baselines

- Off line data reduction



2011 Early Science begins (16 antennas, … baselines)

2012 Pipeline images for standard modes

2013 Baseline ALMA Construction Complete

Community Input

into the operations of the Global ALMA project and the EU ARC

- International community input into the ALMA project (via the ALMA Board) is through the ALMA Science Advisory Committee (**ASAC**)

  http://www.alma.nrao.edu/committees/ASAC/

- European community input into the ALMA project and operation of the EU ARC is through the European ALMA Science Advisory Committee (**ESAC**)

http://www.eso.org/projects/alma/administration/committees/esac

ALMA Operations mean

- Every astronomer will be able to observe with ALMA
- Every astronomer will get help from proposal submission to data delivery (ESO role)
- Advanced and special projects will get help as well (ARC nodes role)
- Astronomers will be trained, if they wish

Questions?