The European ALMA Regional Centers: the support to users

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IRAM school Grenoble 10/06/06

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

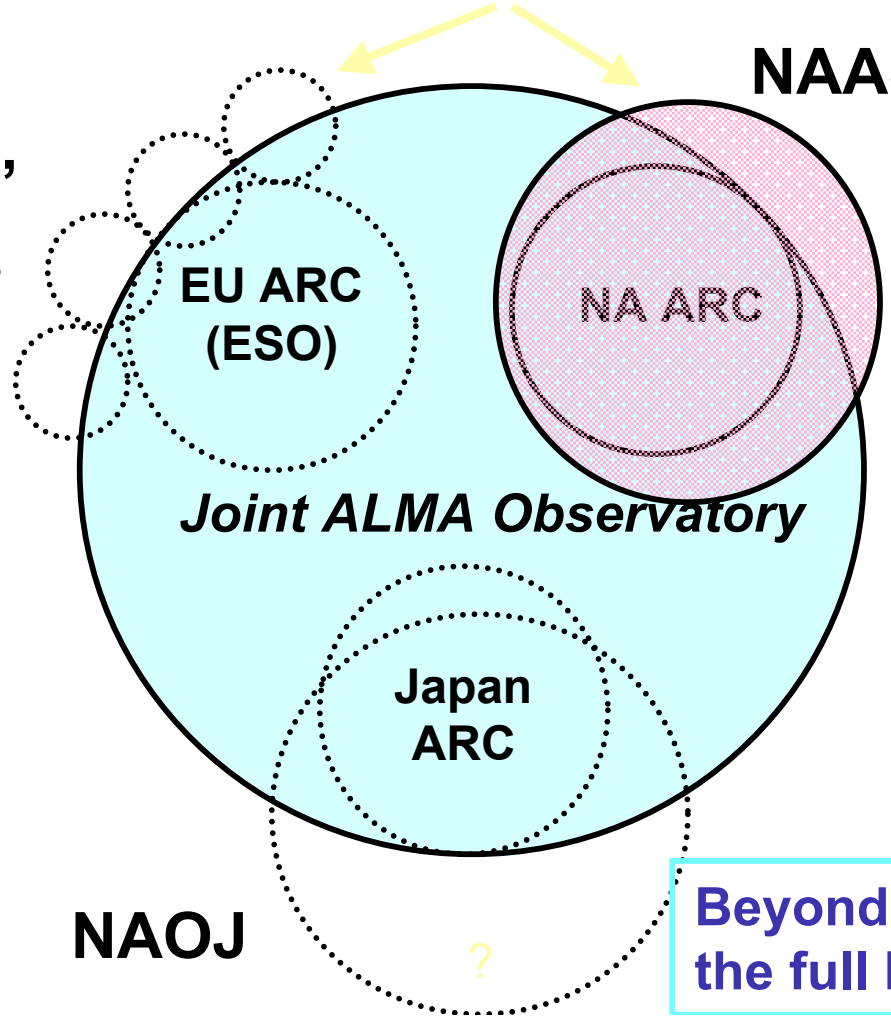
- **array scheduling + operations**
- **quick-look reduction**
- **maintenance and repair antennas + instruments**

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**

ALMA Operations: 3 ALMA Regional Centers - ARCs

Beyond ARC User Services



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

Beyond ARC is needed to provide advanced user support, algorithm development, student programs, EPO, grants

Beyond ARC is essential to realize the full benefits of ALMA

Science Operations

- Phase I + II proposals through ARCs (time estimator, end-to-end data simulator)
- Scheduling blocks to OSF
- All 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

the ALMA ARCs

- **Core functions**

Scientific support services
  - Proposal & observation preparation user support
  - Basic data analysis
  - ALMA Archive operations: host copy, data package delivery
  - OSF AoD shifts
- **DMO based - ESO role**

- **Additional functions**

Extended archive & data reduction support
  - f2f help
  - Advanced pipeline
  - Archival research projects

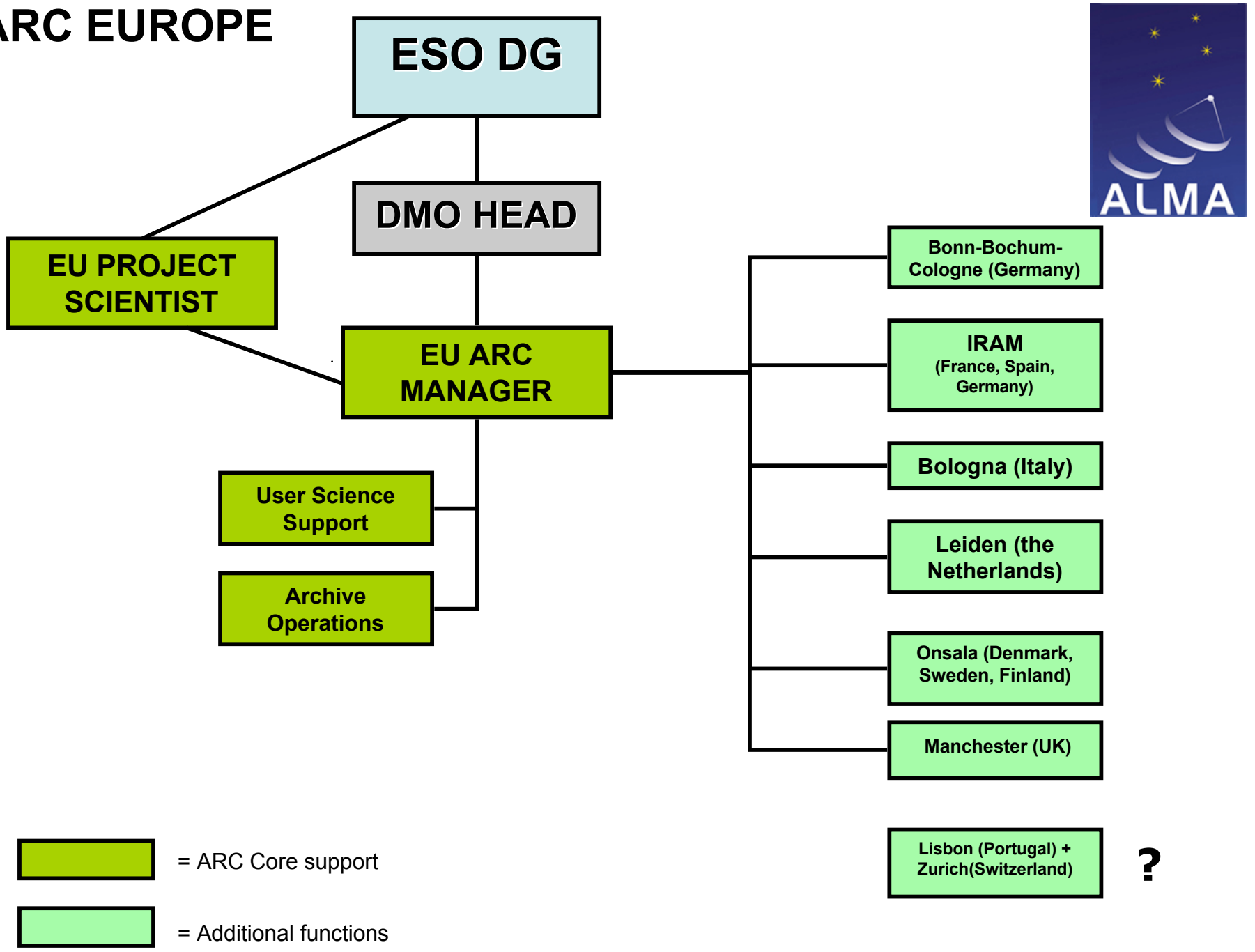
Support for special projects

Science community development

- basic training, schools, workshops

- **ARC nodes**

ARC EUROPE


ESO DG
DMO HEAD
EU PROJECT SCIENTIST
EU ARC MANAGER
User Science Support
Archive Operations
Bonn-Bochum-Cologne (Germany)
IRAM (France, Spain, Germany)
Bologna (Italy)
Leiden (the Netherlands)
Onsala (Denmark, Sweden, Finland)
Manchester (UK)
Lisbon (Portugal) + Zurich(Switzerland)
?
= ARC Core support
= Additional functions

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**

ARC nodes: each node its own expertise

- **Bonn-Cologne-Bochum** (F.Bertoldi) where?

expertise: Advanced Data analysis (MAGIX), pipeline heuristics (calibration,data capture)

- **IRAM** (F. Gueth) Grenoble

expertise: calibration, phase correction, polarimetry, imaging simulator, SMA configurations, schools + mm-interferometry expertise center

- **Italy** (J. Brand) Bologna

expertise: data handling (GRID techniques), surveys+mosaicing

- **UK** (T. Muxlow) Manchester

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

Nordic node (J. Conway) Onsala

expertise: remote reduction, GRID computing, multi-freq synthesis, phase modeling, self-cal,deconvolution

- **Netherlands** M. Hogerheijde) Leiden

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

Portugal + Switzerland (J.M.Afonso, M.Steinacher)

?

Getting ALMA time

Phase I

- **JAO issues calls**
- **Register in the ALMA web page**
- **Prepare a proposal with the ALMA Observing tool**
- **If s/he needs a help adress to one of the ARC node**

  - **EU ARC provides documentation, proposal preparation and submission help**
  - **JAO (with ARCs help) coordinates refereeing process**
  - **Program Review Committee-(s) rank-(s) proposals**

- **Proposed to ALMA Board that an International Review Committee resolves conflicts (maybe only large projects?)**

Getting ALMA time

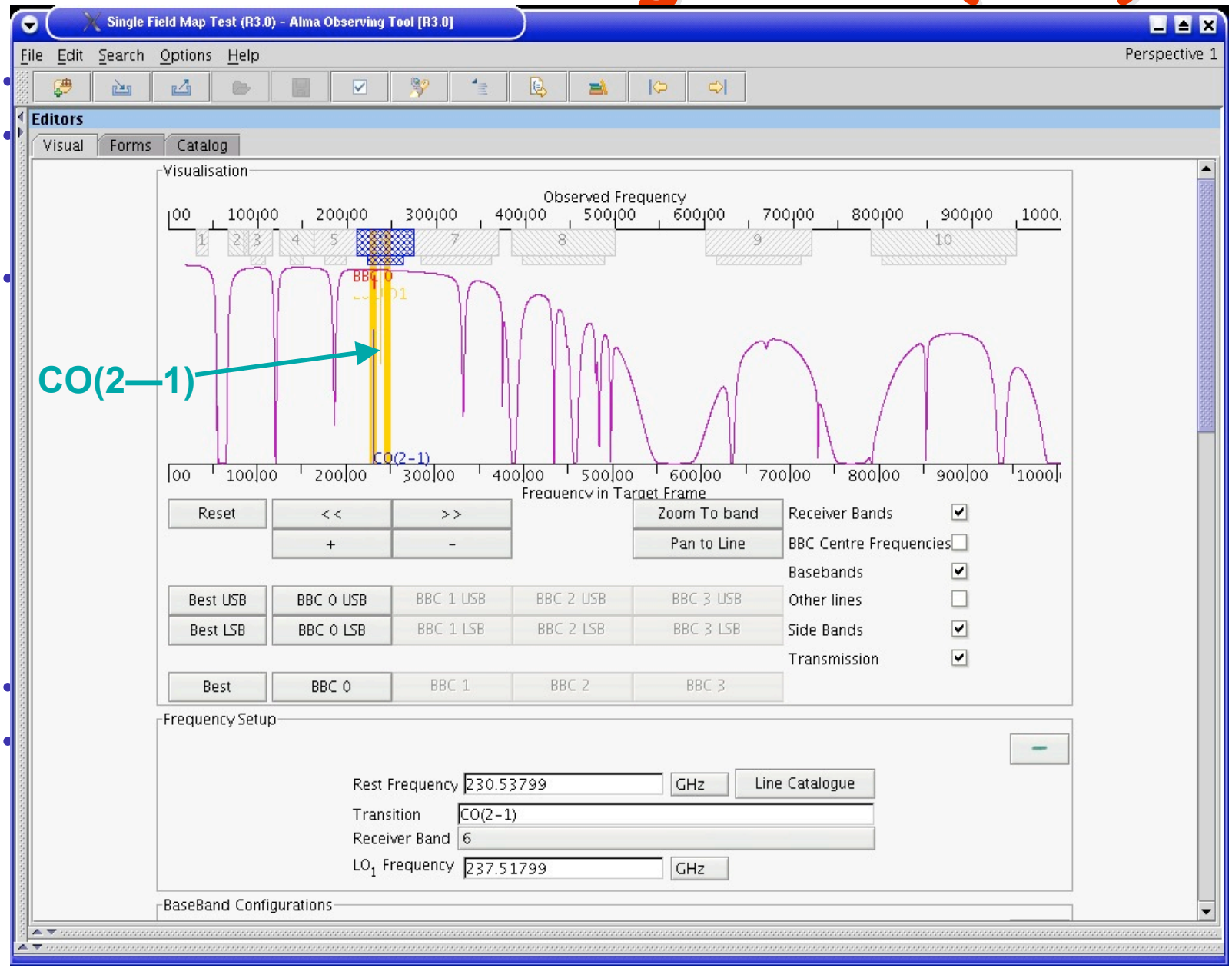
Phase II

- Phase I: Proposals are submitted using ALMA Observing Tool
  - Phase II: Successful PIs submit observing program using the Observing Tool
  - Preparation of the SBs
  - EU ARC helps with observation planning and verifies observing schedule

The ALMA Observing tool

- SW tool to construct a full Observing Project
- Split Observing Programs in two parts:
- a Phase I Observing Proposal: emphasis on the scientific justification of the proposed observations.
- a Phase II Observing Program submitted only if observing time has been granted.
- Set of Scheduling Blocks (SBs) are required to drive observing with ALMA.
- the SB is the smallest (indivisible) unit that can be scheduled independently. It is self contained and usually provides scientifically meaningful data.
- the SB contains a full description of how the science target and the calibration targets are to be observed
- sets of SBs can be combined with a description for the post processing of the data, ultimately resulting in an image.

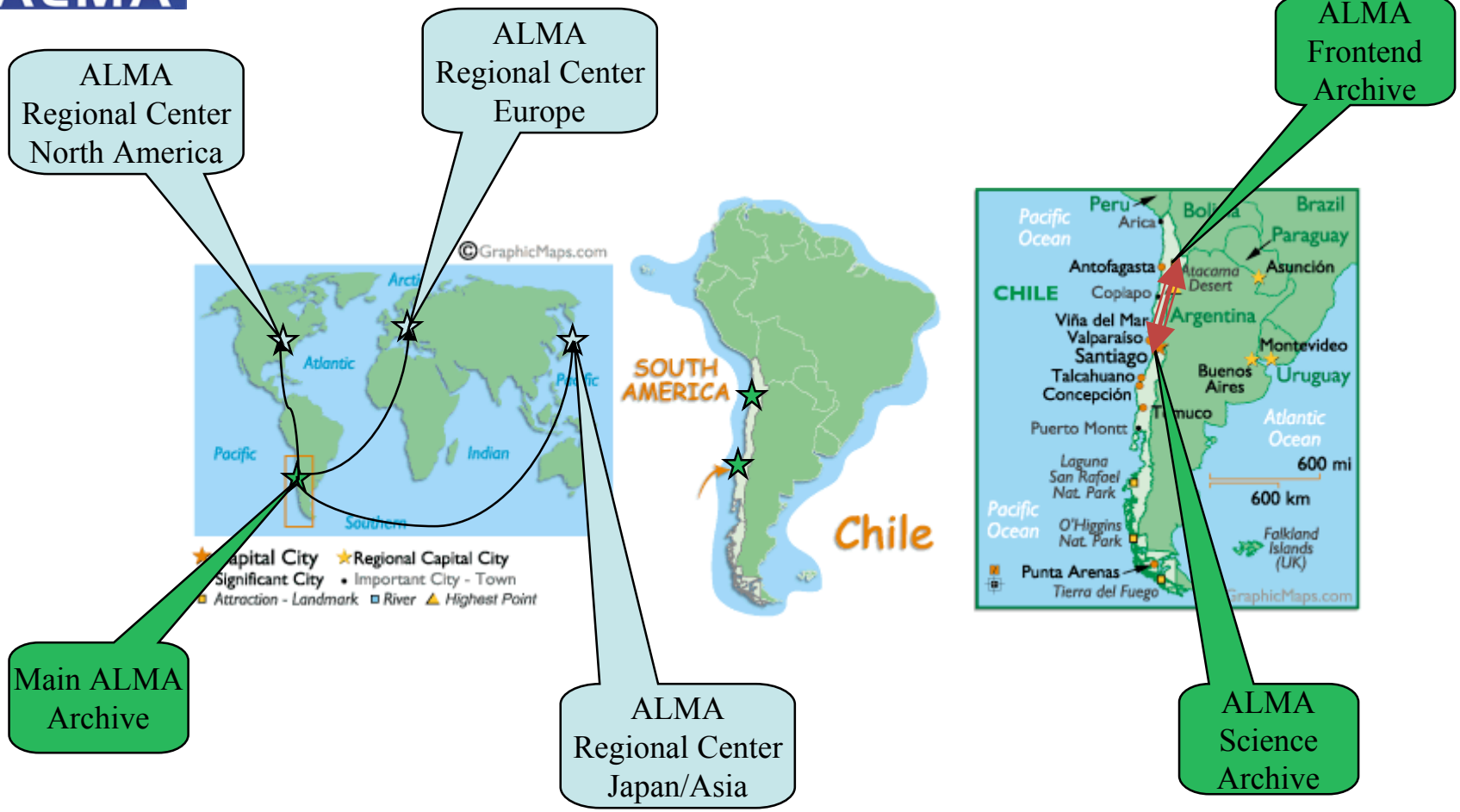
The observing Tool (OT)



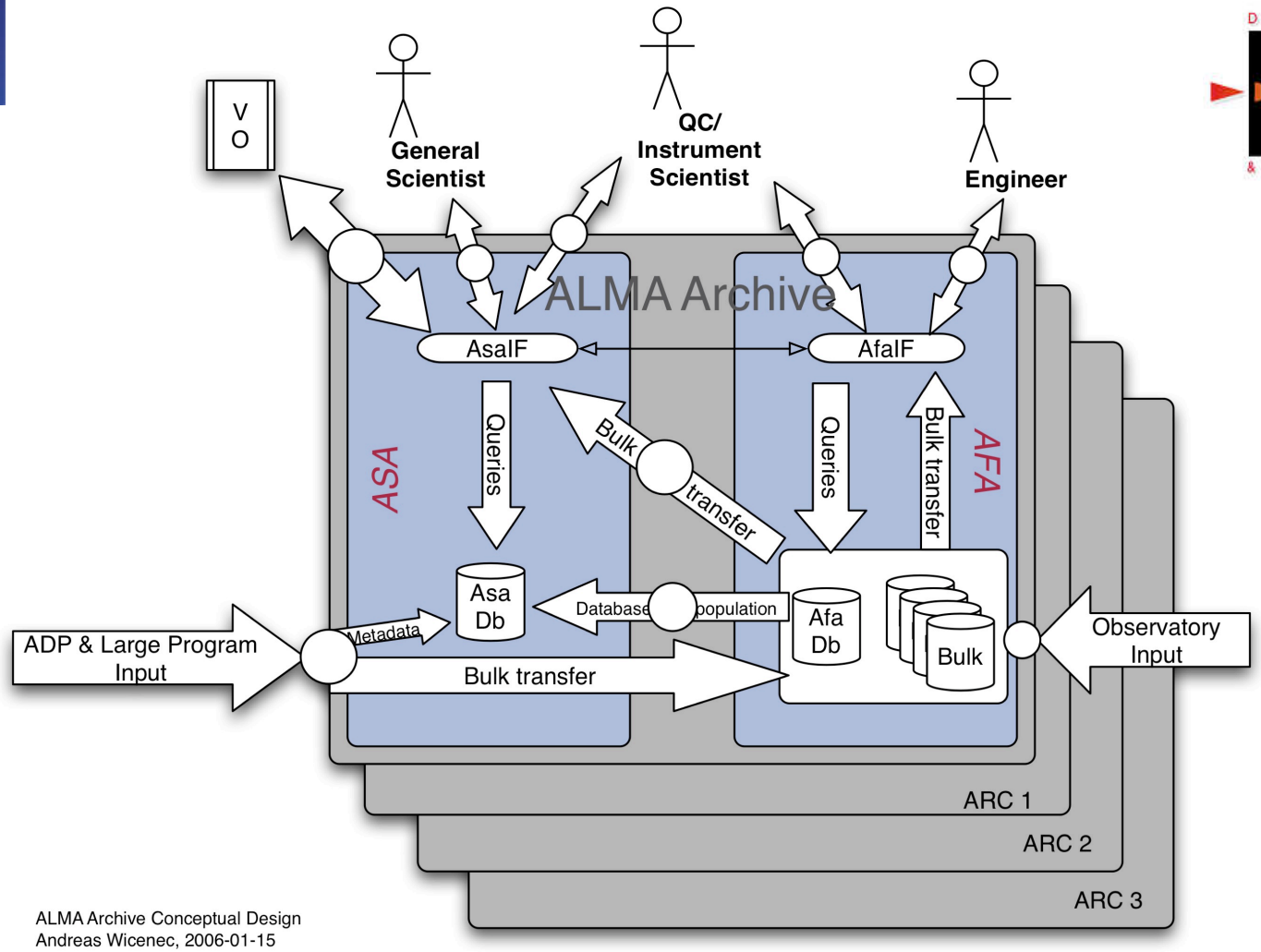
Getting ALMA data

- Queue based dynamic scheduling
  - Programs are composed of 30-60 min scheduling blocks
- Raw data passed 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)
  - Pipeline products (images and calibrated u-v data), raw data, and off-line data processing software made available to PIs
    - Pipeline available towards end of construction
  - Expert hands-on data reduction help from ARC nodes staff provided on request, helpdesk also available at ESO

The ALMA Archive Network



The ALMA Archive

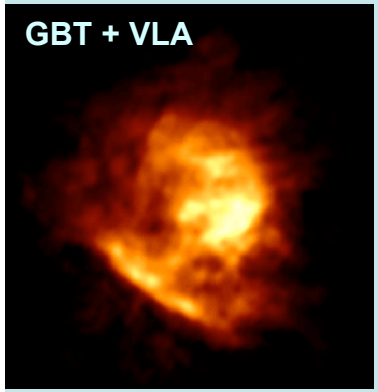


ALMA Archive Conceptual Design
Andreas Wicenec, 2006-01-15

Pipeline and Off-line Data Reduction Software

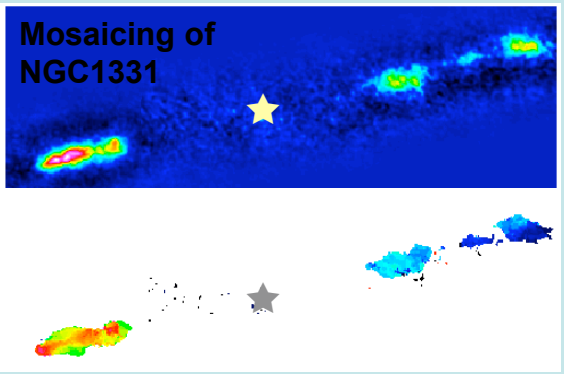
CASA (Common Astronomy Software Applications)

- CASA has subsumed AIPS++
- CASA is written in C++, Java, and Python

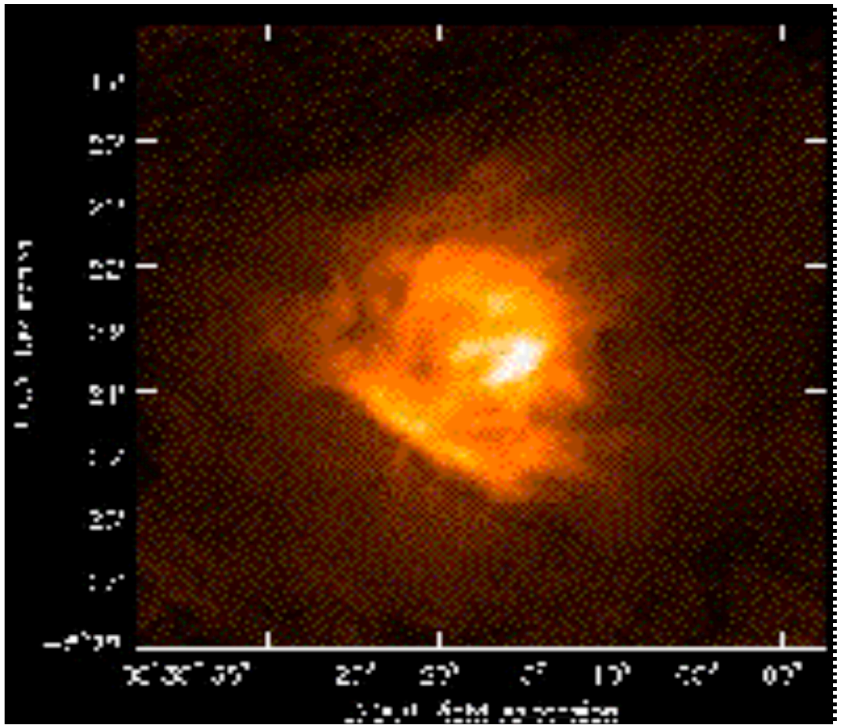


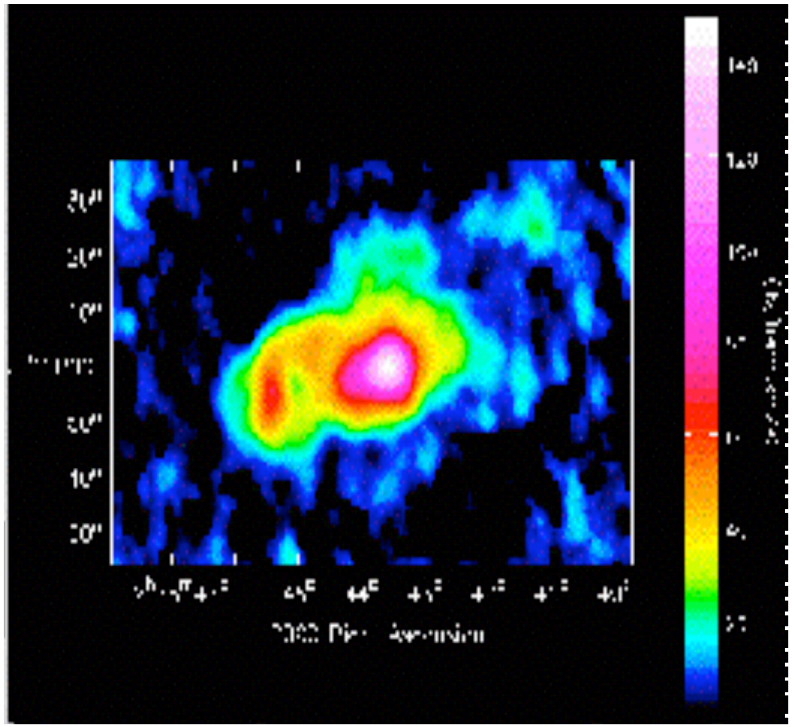
- Conversion of AIPS++ Glish user interface to Python ongoing
- Internal & External testing ongoing
- Completed tests (1) Basic imaging, (2) Mosaicing, and (3) Single dish + interferometric data combination using VLA, BIMA, and PdBI datasets

- CASA release early 2007
- Pipeline testing and development underway



Data reduction



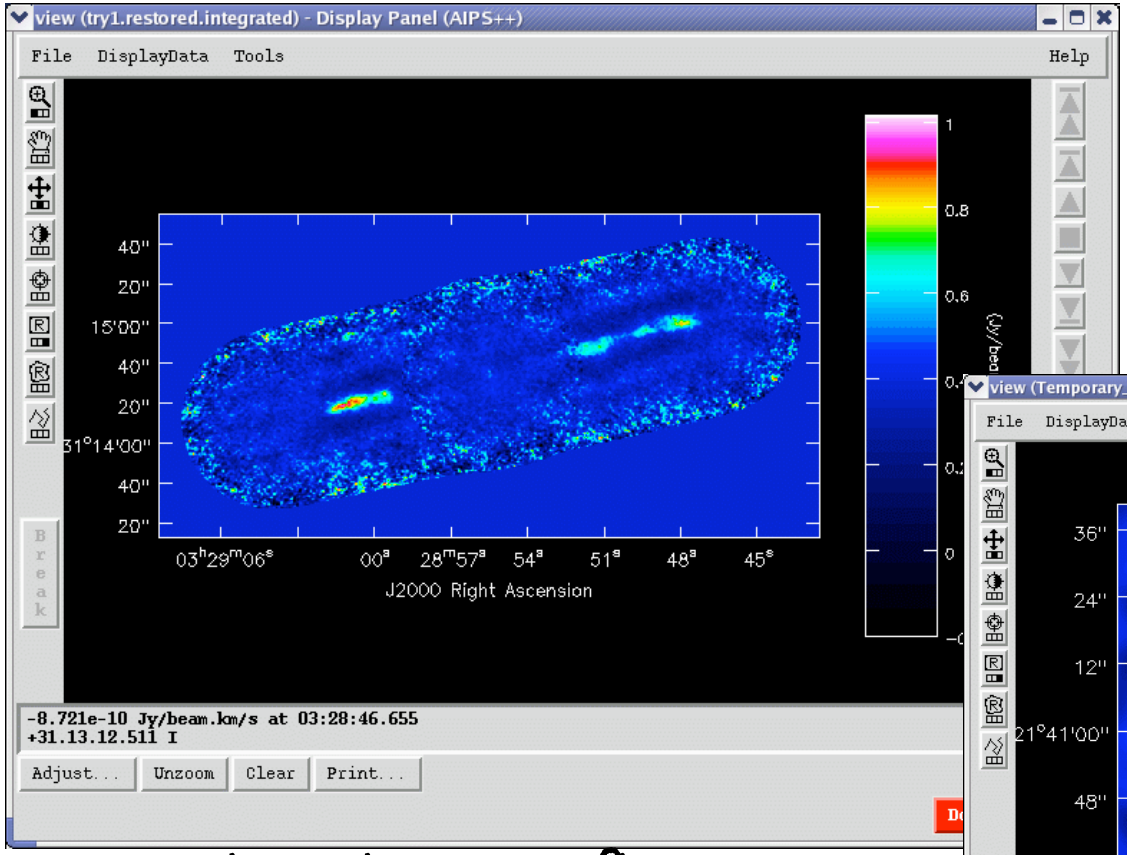


Orion nebula continuum:
Combination of single dish + interferometric
(VLA+GBT joint deconvolution)

BIMA CO

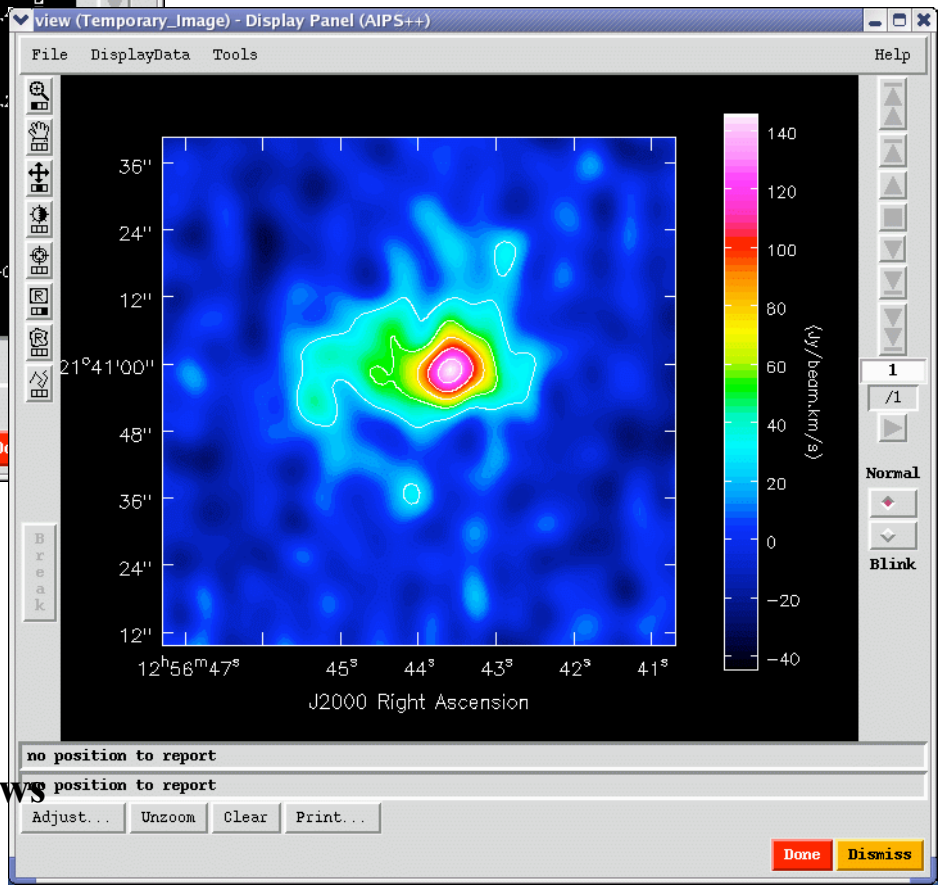
- All ALMA data will be reduced using the ALMA offline reduction and imaging package. This package is based on the C++ code base in AIPS++ with some fairly major changes to optimize it for ALMA and a redisigned user interface is For many observations the automated calibration and imaging pipelines will produce reference images suitable for analysis.

Mosaic interferometry - reduction & imaging



NGC 4826

- BIMA SONG CO(J=1-0) at 3 mm
- 7 field mosaic, 4 spectral windows
- low S/N



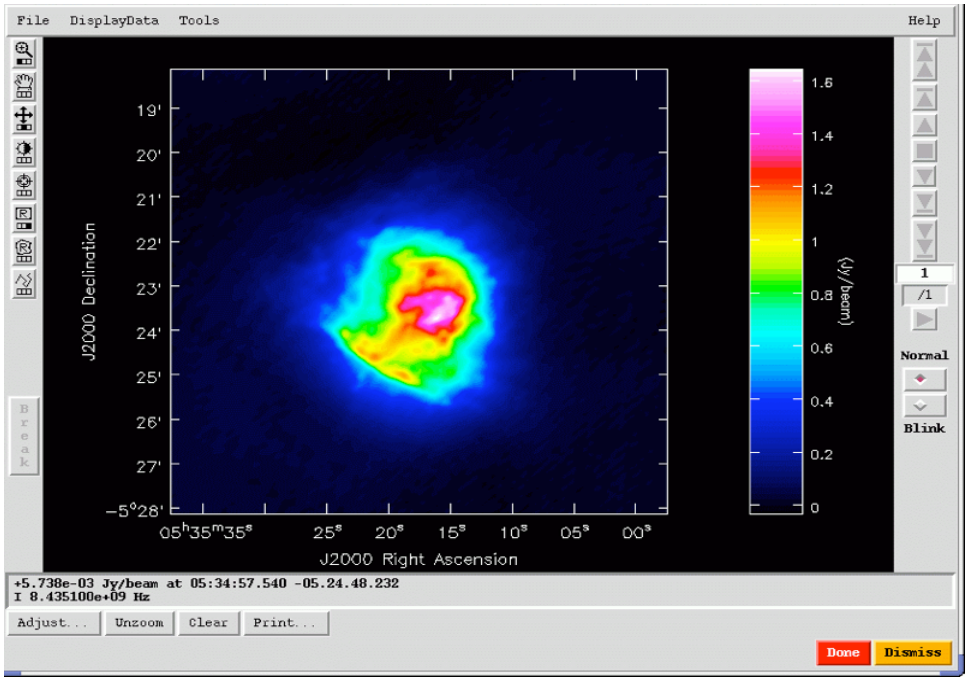
Molecular outflow

NGC 1333, CLEANed

- a VLA mosaic (SiO(J=1-0) at 7 mm)
  - 10 fields in linear mosaic, 2 spectral windows
  - high S/N

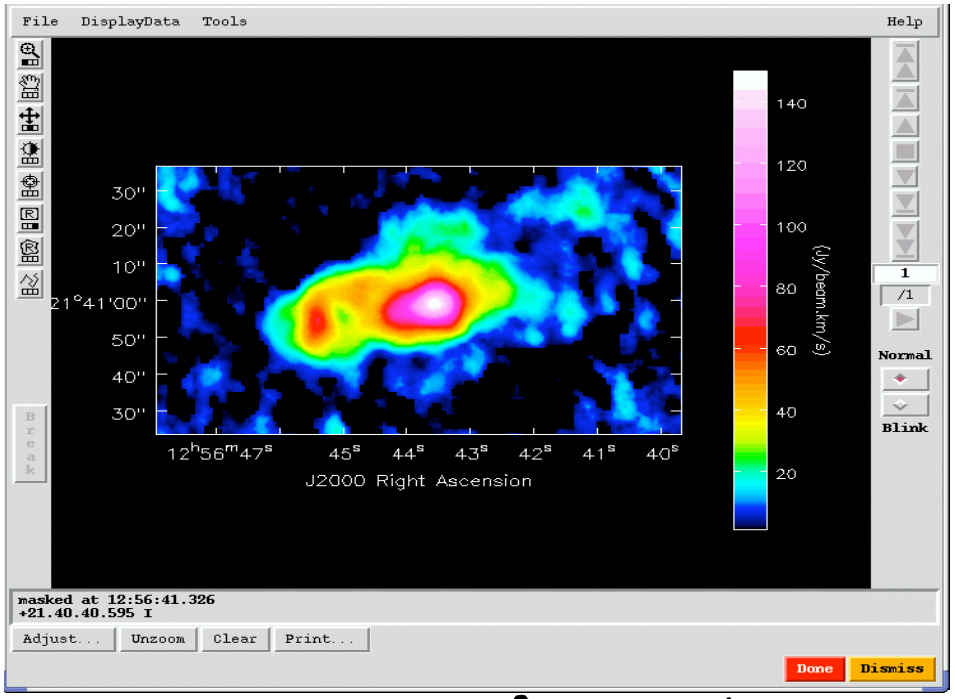
* 3.6cm continuum, VLA image + GBT OTF map,

* high S/N VLA map, factor 10 difference in resolution



Orion, feathered

CO(J=1-0) at 3 mm
combined BIMA mosaic with 12m OTF map
low S/N BIMA map, 12m striping
factor 3 difference in resolution



NGC 4826, feathered

* **combine synthesis mosaics with single dish data**
  - **Image "feathering" (2 images "feathered" together in Fourier plane).**
  - **Joint deconvolution (single dish image is input as a 'default' model subtracted from the uv data, and the resulting dirty image is deconvolved)**

```
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_dv.gui();
```

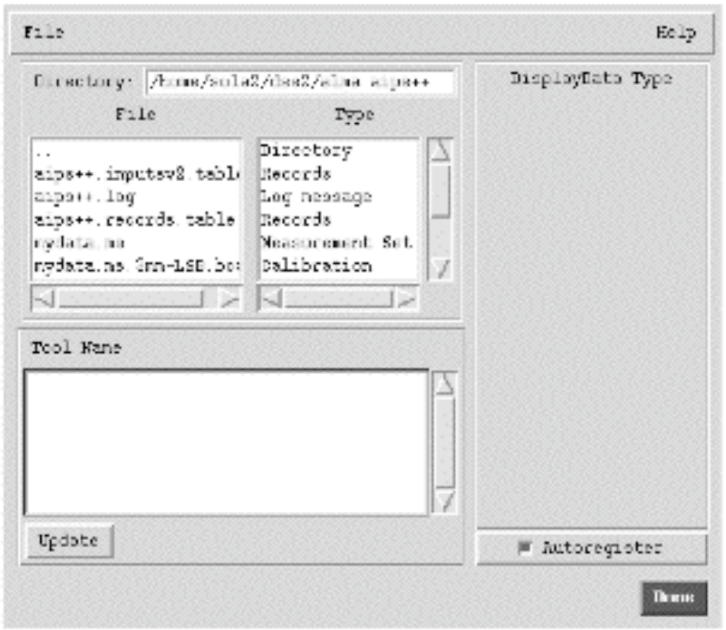

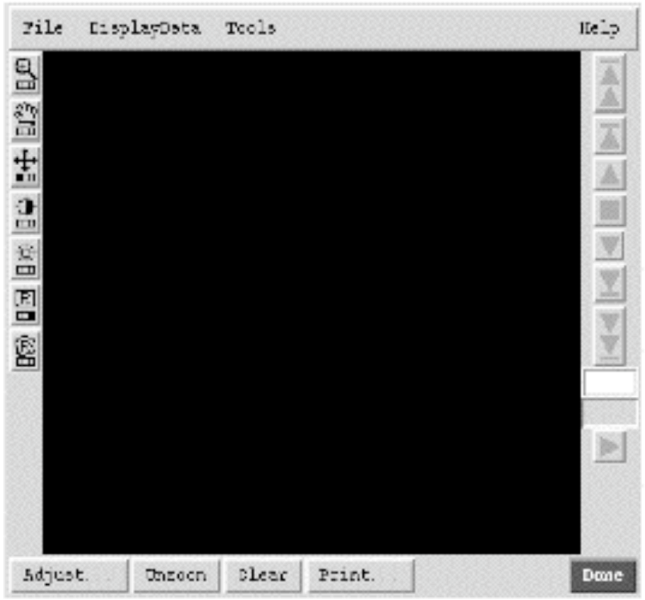

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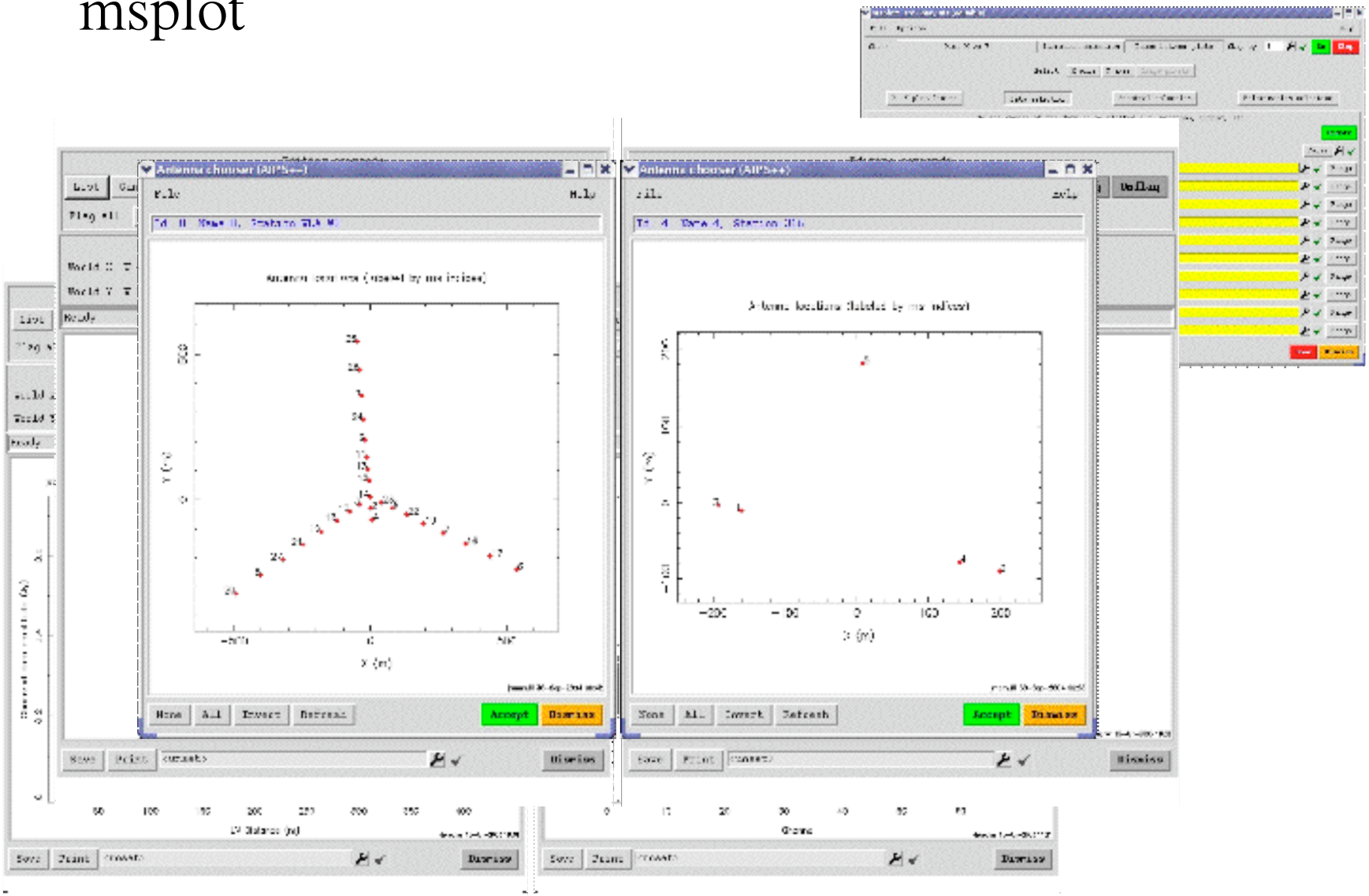
Antenna chooser (All*5++)
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Antenna chooser (All*5++)
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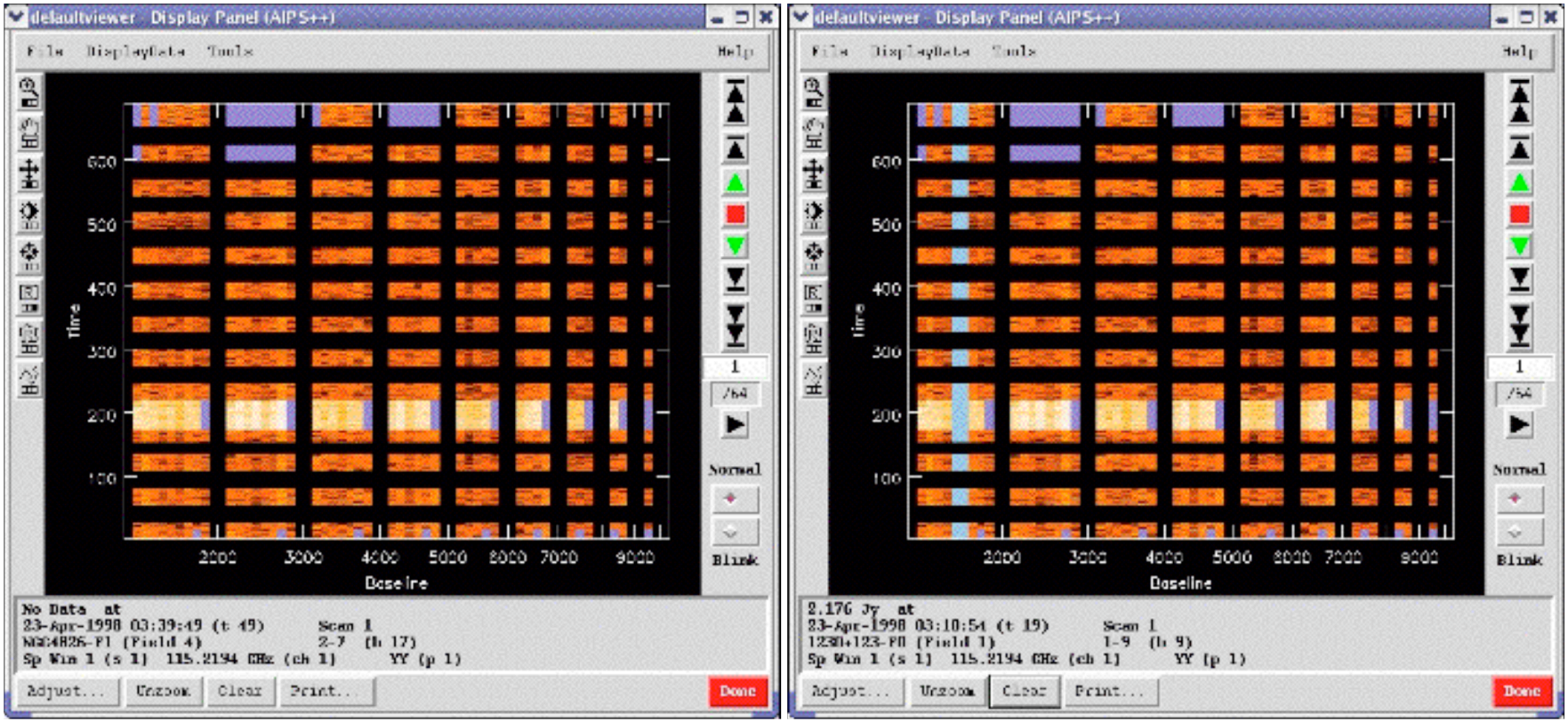
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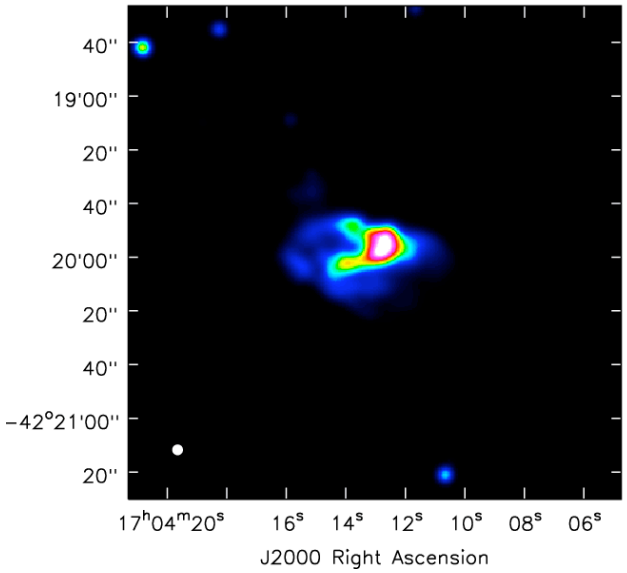
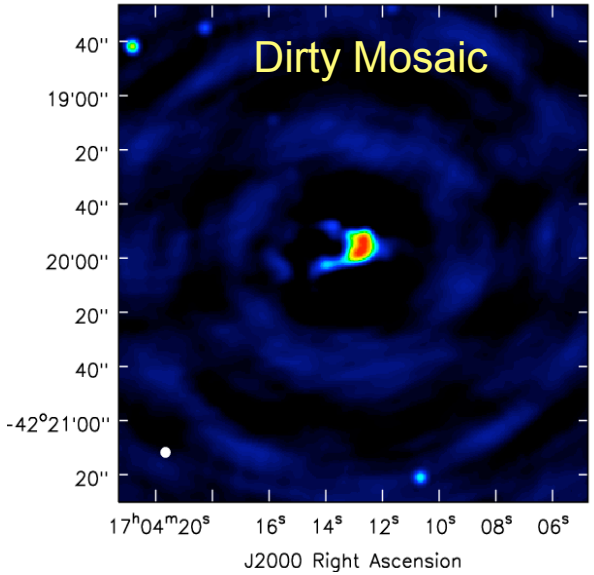
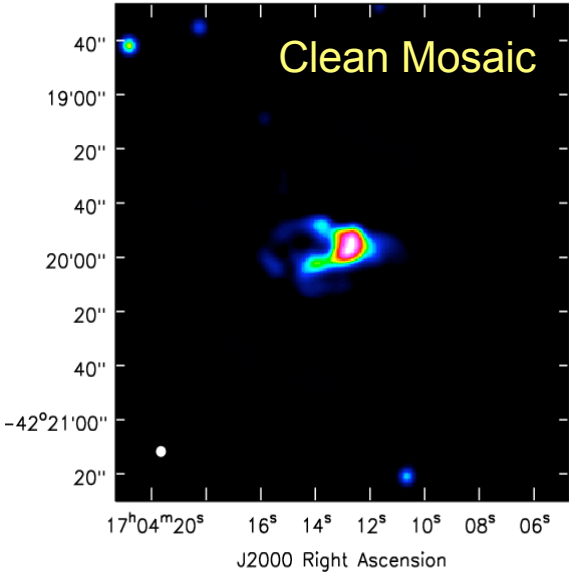
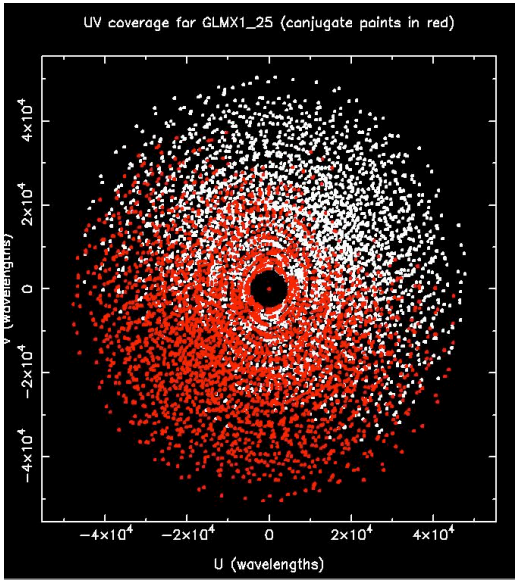
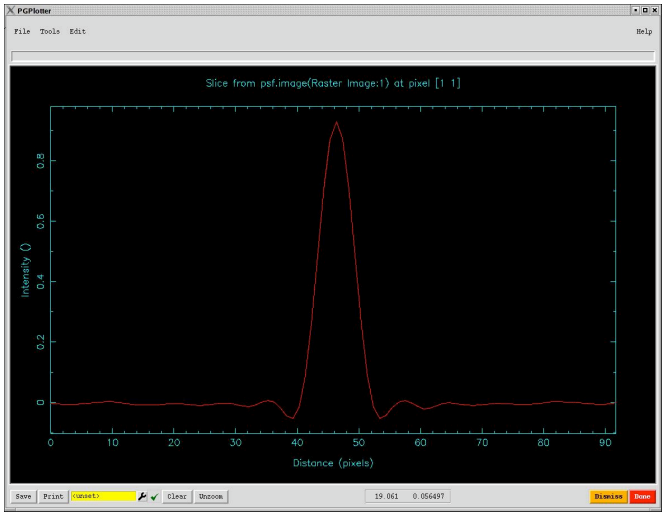
ALMA Imaging Simulations

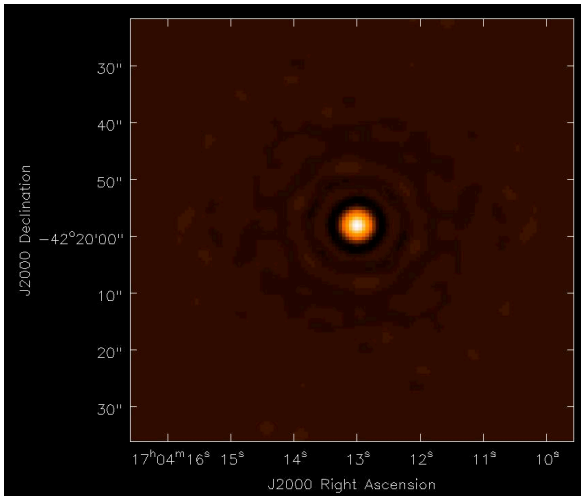












Current Timeline

2007 Continue Prototype System Testing (Socorro)

2007 ARCs testing of observing tool, offline reduction software, pipeline heuristics

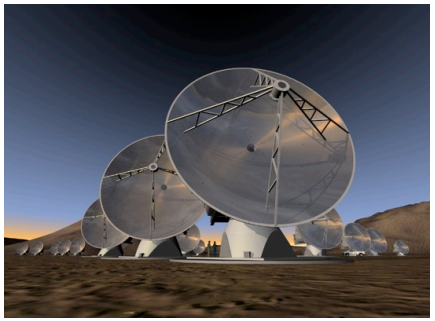
Early 2008 First antenna arrival and testing at ALMA site

Early 2009 Commissioning Begins with 3-element array

Late 2009 Science Verification begins

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

- Off line data reduction



2010 Early Science begins (16 antennas, … baselines)

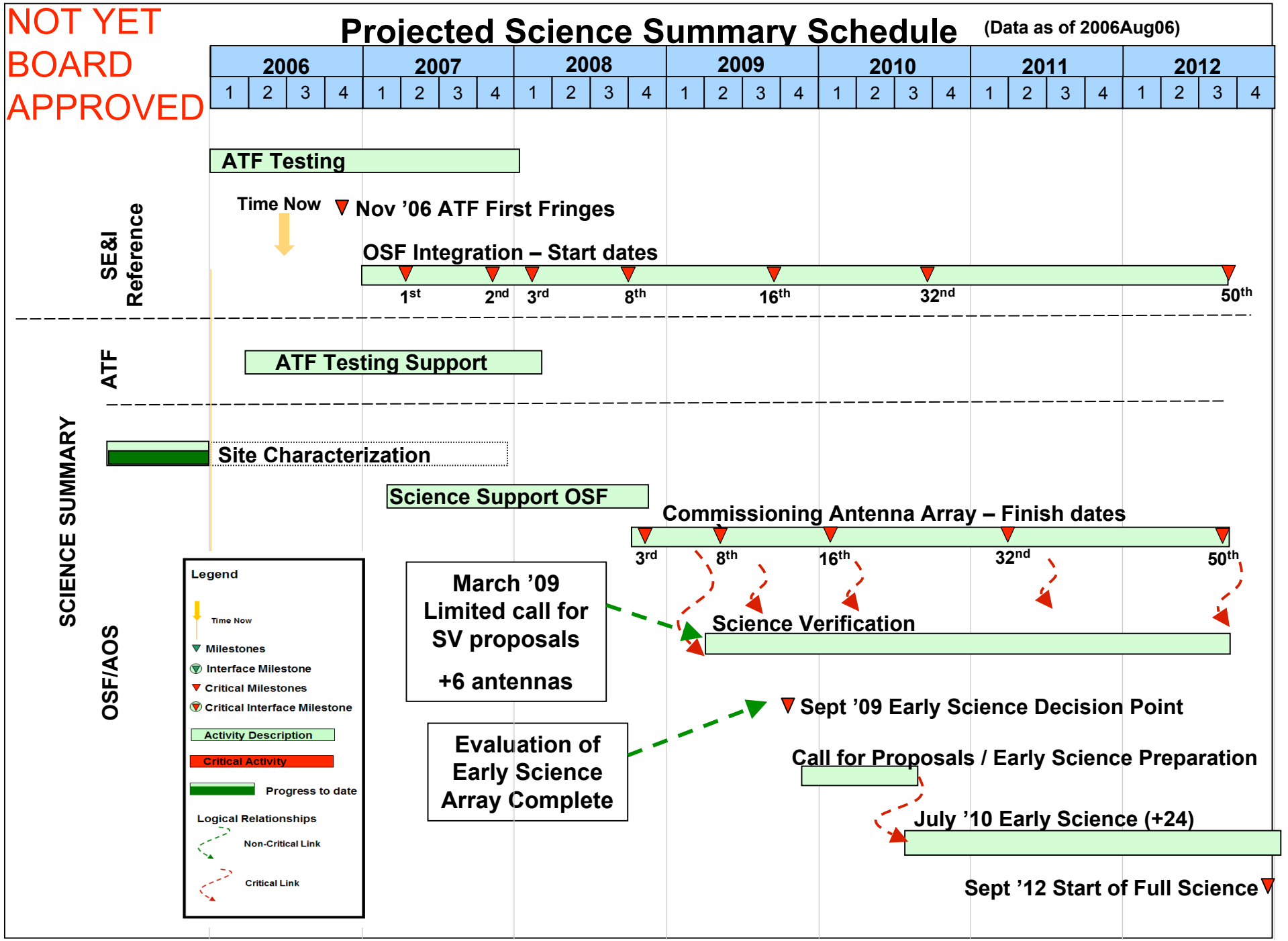
2012 Pipeline images for standard modes

2012 Baseline ALMA Construction Complete

NOT YET BOARD APPROVED

Projected Science Summary Schedule

(Data as of 2006Aug06)



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

Questions

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