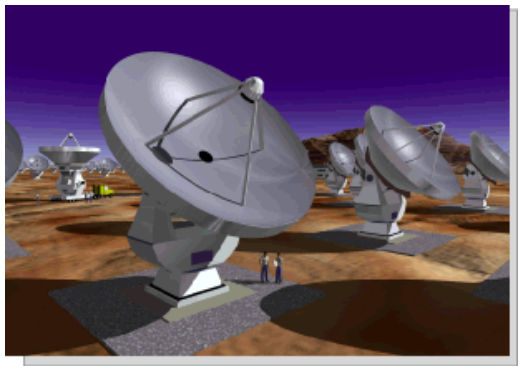


ALMA
Science Operations

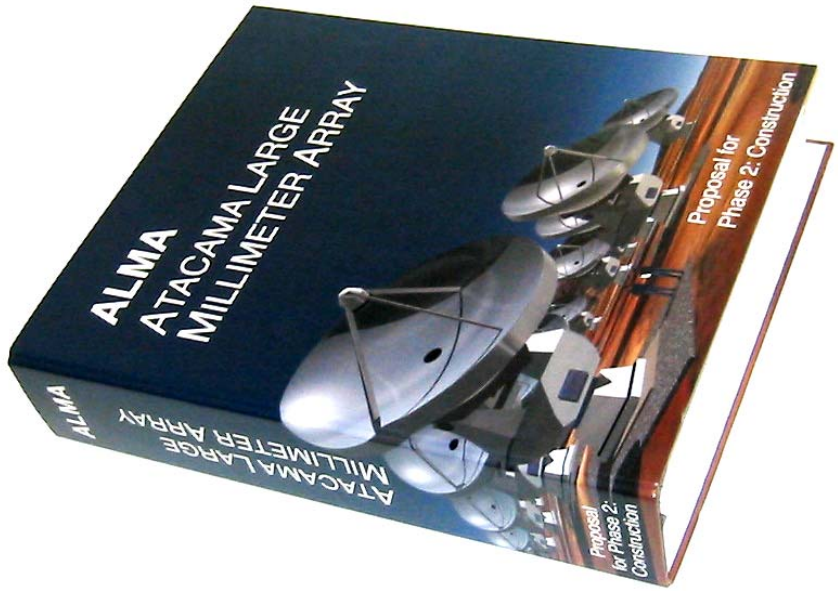
Atacama Large Millimeter Array

ESO-Wide Review
13-17 February 2003

ALMA Project

Some Background

- 2001: European ALMA proposal - volume 6 on operations



- ASAC study 2001
- ALMA Project Plan 2002
- Operations meeting at ESO: Nov. 8, 2002

ALMA Project

Guiding Principles

- Non-experts should be able to use ALMA
- Dynamic scheduling to match observing conditions

  → *service observing*

  → *pipeline data reduction*

  → *homogeneous and consistent calibration*

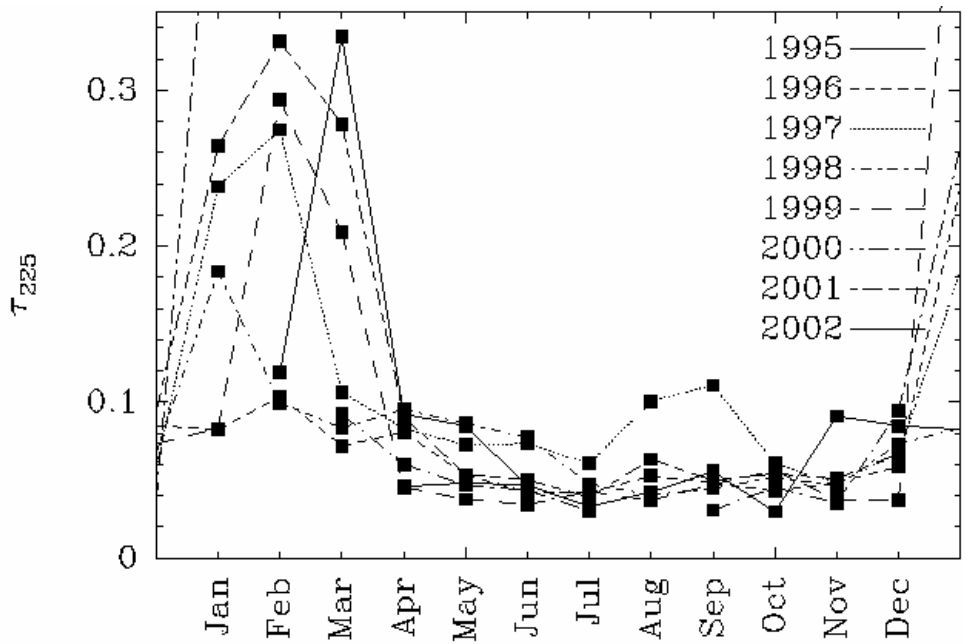
  → *user support for proposals, data reduction, archival research*

ALMA Project

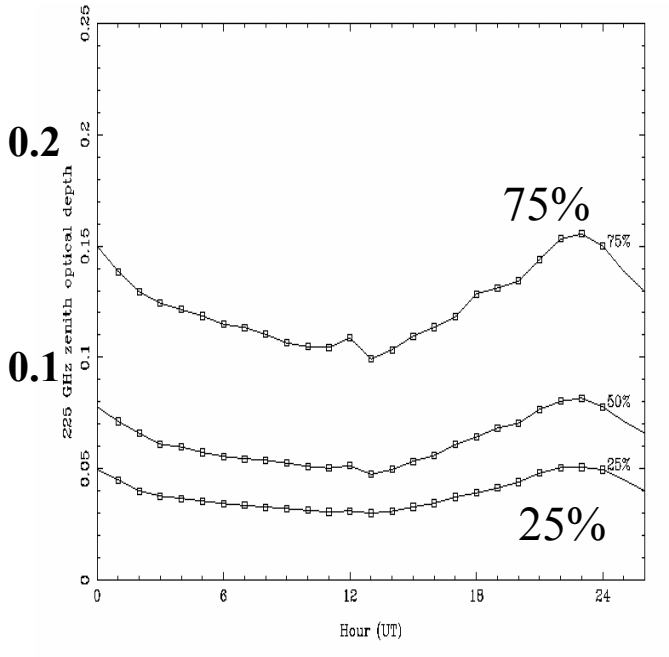
Transparency Variations

Median 225 GHz zenith optical depth

Annual Variation



Diurnal Variation



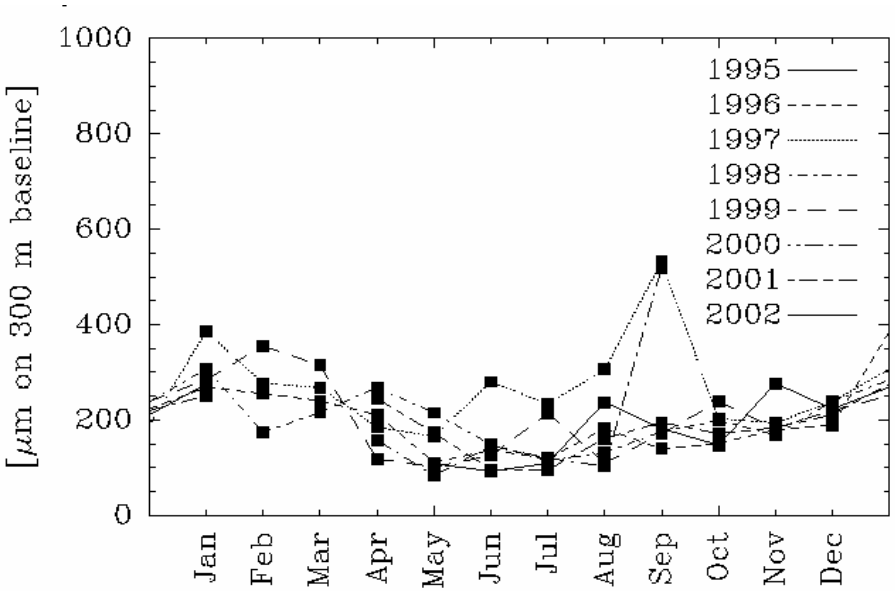
τ=0.05 corresponds to ~1 mm precipitable water vapor

ALMA Project

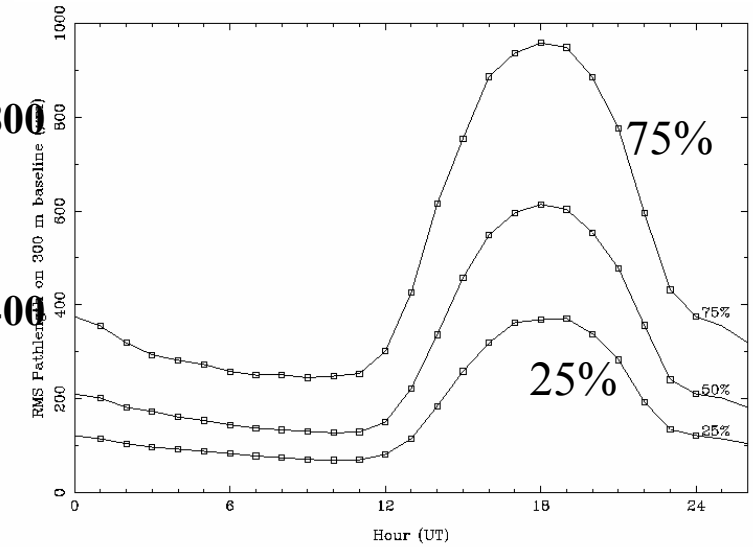
Phase Variations

Median rms zenith phase fluctuations

Annual Variation



Diurnal Variation



800

400

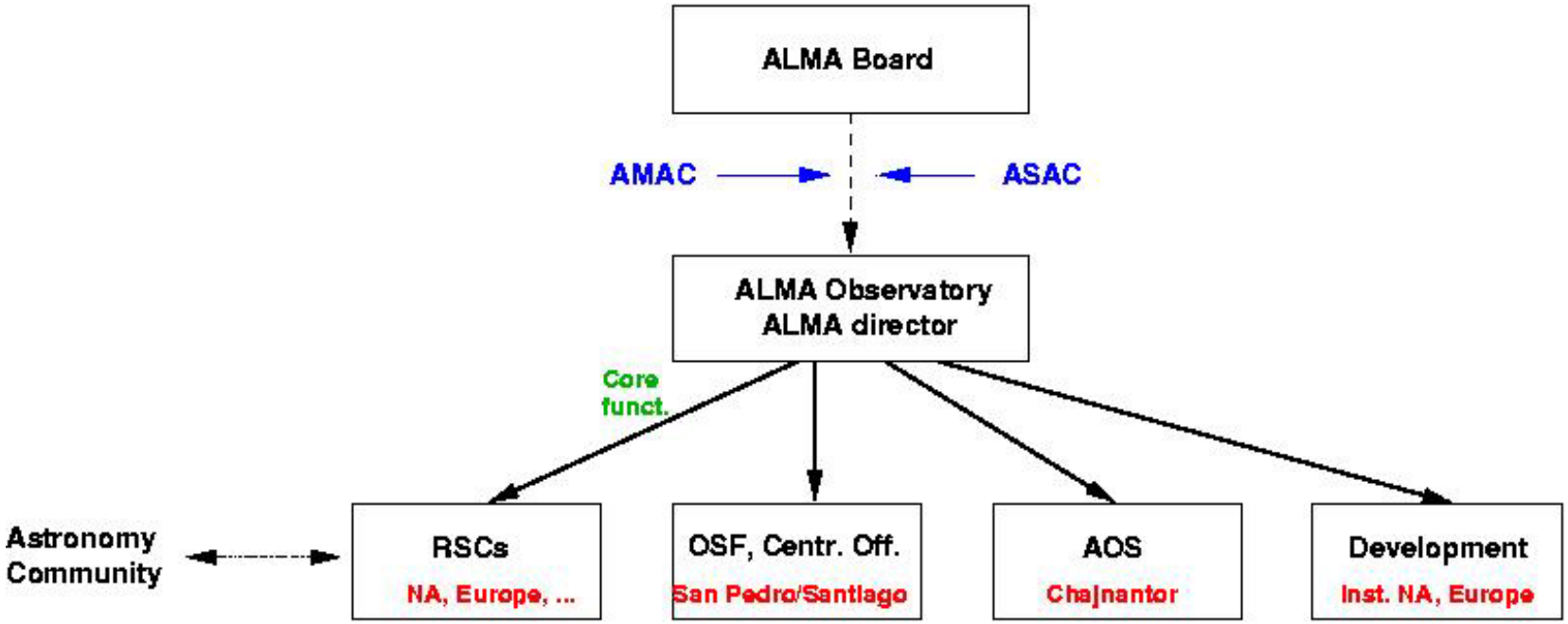
ALMA Project

Science Operations Centres

- Array Operations Site — Chajnantor
- Operations Support Facility — San Pedro
- Central Office — Santiago
- Regional Support Centers — Europe, N. America

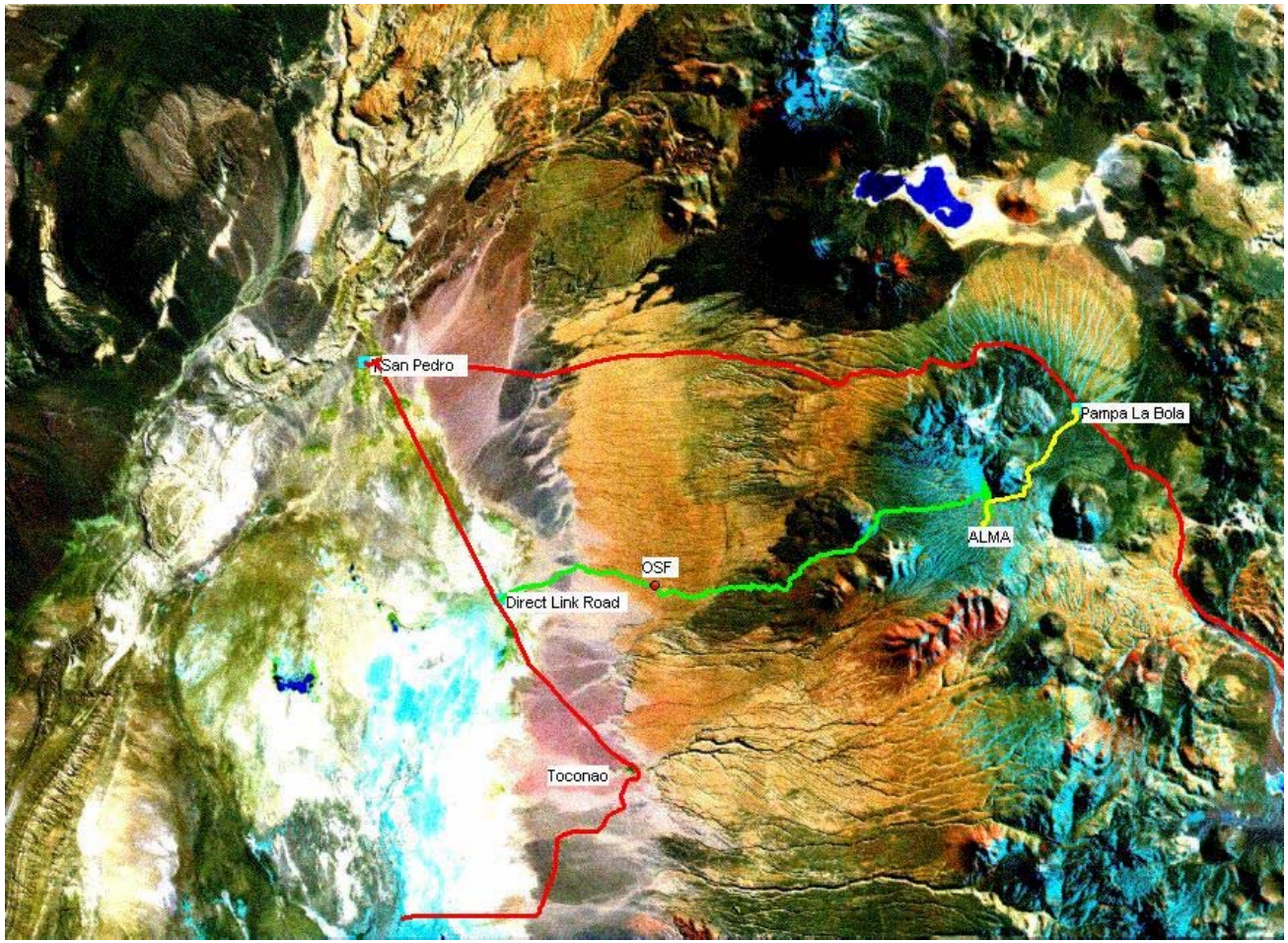
ALMA Project

ALMA Operations Organization



ALMA Project

AOS and OSF



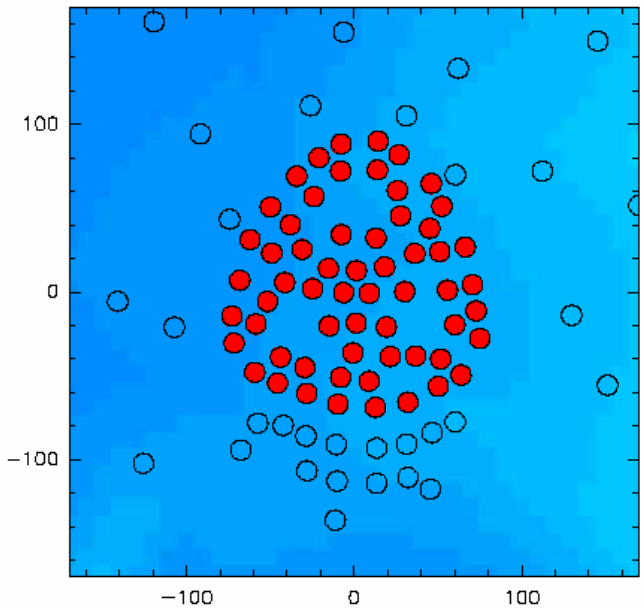
ALMA Project

AOS
Array Operations Site

- Antenna reconfigurations
  - *(continuous)*
- Daily maintenance
- Instrument repair
  - *(modular replacement)*
- Antenna repair
  - *(on site or at OSF)*

(Minimize number of staff at AOS)

"zoom array"



(100x in physical scale; 10x in wavelength)

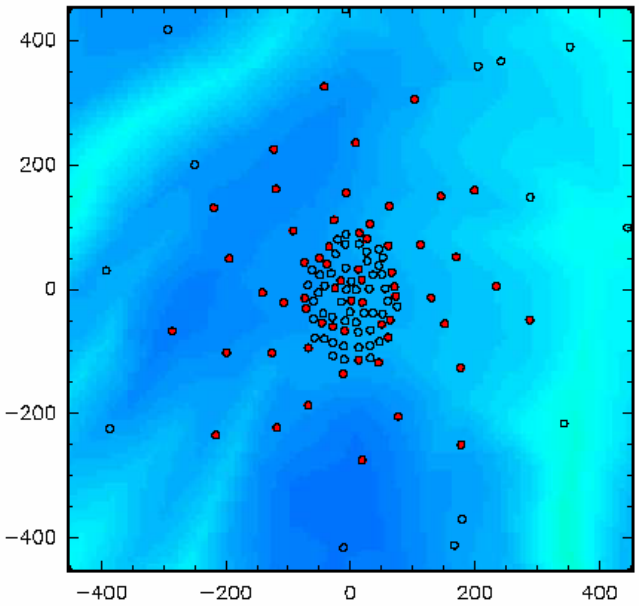
ALMA Project

AOS
Array Operations Site

- Antenna reconfigurations
  - *(continuous)*
- Daily maintenance
- Instrument repair
  - *(modular replacement)*
- Antenna repair
  - *(on site or at OSF)*

(Minimize number of staff at AOS)

"zoom array"



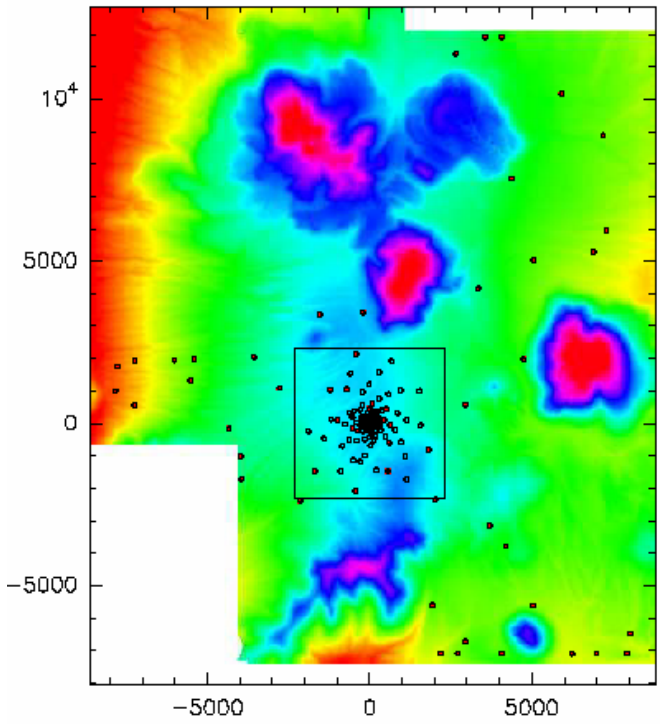
(100x in physical scale; 10x in wavelength)

ALMA Project

AOS
Array Operations Site

- Antenna reconfigurations
  - *(continuous)*
- Daily maintenance
- Instrument repair
  - *(modular replacement)*
- Antenna repair
  - *(on site or at OSF)*

"zoom array"



(Minimize number of staff at AOS)

ALMA Project

OSF
Operations Support Facility

- Array scheduling and operations
  - dynamic scheduler selects programs according to: science rating, weather conditions (transparency, phase stability..), execution status, array configuration, etc)
- Quick-look data reduction
- Maintenance & repair antennas, receivers

ALMA Project

Central Office Santiago

- Pipeline data reduction
- Quality control
- data shipment to astronomers and archive
- Production of archive
- Science offices
- Business functions

ALMA Project

RSCs
Regional Support Centers

Core Functions:

- User support for proposals
- User support for data reduction beyond the standard pipeline products
- User support for archival research
  - (host of copy of archive)

(Core functions are responsibility of ALMA Observatory)

ALMA Project

RSCs
Regional Support Centers

Additional Functions:

- Advanced software and techniques
- Training, summer schools
- Further possibilities (eg. research funding?)

(Additional functions may differ between RSCs)

ALMA Project

European RSC

Possible Models for European RSC:

- One centre in single location
- Central node with distributed network
  - favoured by ESAC
  - strong central node for user support
  - development within distributed network, to ensure optimal use of expertise in European institutes
- Virtual centre distributed throughout Europe

ALMA Project

European RSC

- ESO will do phase I proposal handling and some aspects of archiving
- Then
  - either: there will be a call for proposals to host RSC
  - or: ESO becomes main node of RSC, with network of expertise

ALMA Project

Overview of ALMA Science Operations

- Phase I + II proposals
  - use of simulator and time estimator
- Scheduling blocks to OSF
- Scheduler selects programmes
  - possibility of eavesdropping and breakpoints
- Pipeline data reduction, quality control, data to astronomer and archive, VO compatible
- Advanced data reduction at RSCs

ALMA Project

Early Science Operations

- Science operations can already start in 2007 with limited array (~6-10 antennas)
  - *four years before completion of construction (2011)*
- Follows commissioning and science verification; open to community
- Provides early science with unique ALMA capabilities
- Provides feedback to ALMA operations

ALMA Project

Some References

- European ALMA Proposal, March 2001
  - Chapter 6: Operations Proposal
- ASAC Report, October 2001
  - http://www.eso.org:8082/committees/ASAC/asacreport_2001Sep.pdf
- Operations Meeting at ESO, Nov. 8, 2002
  - http://www.eso.org/projects/alma/meetings/gar-nov02/
- ALMA Project Book Chapter 18