ALMA Science Operations and Early Science Capabilities

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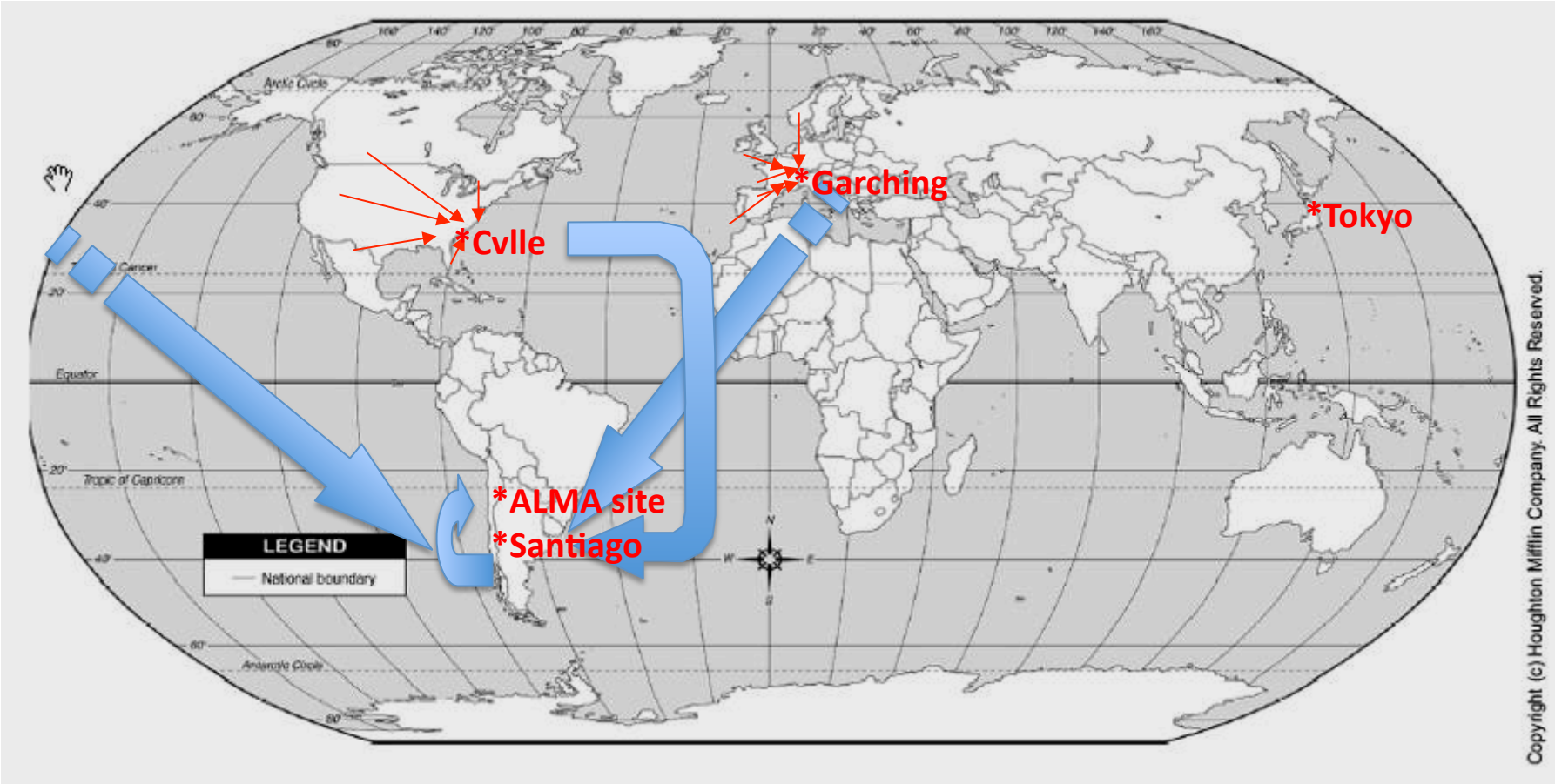
ALMA Science Operations sites

OSF, Santiago and the ALMA Regional Centers



High-level concepts for Science Operations

High-level concepts:

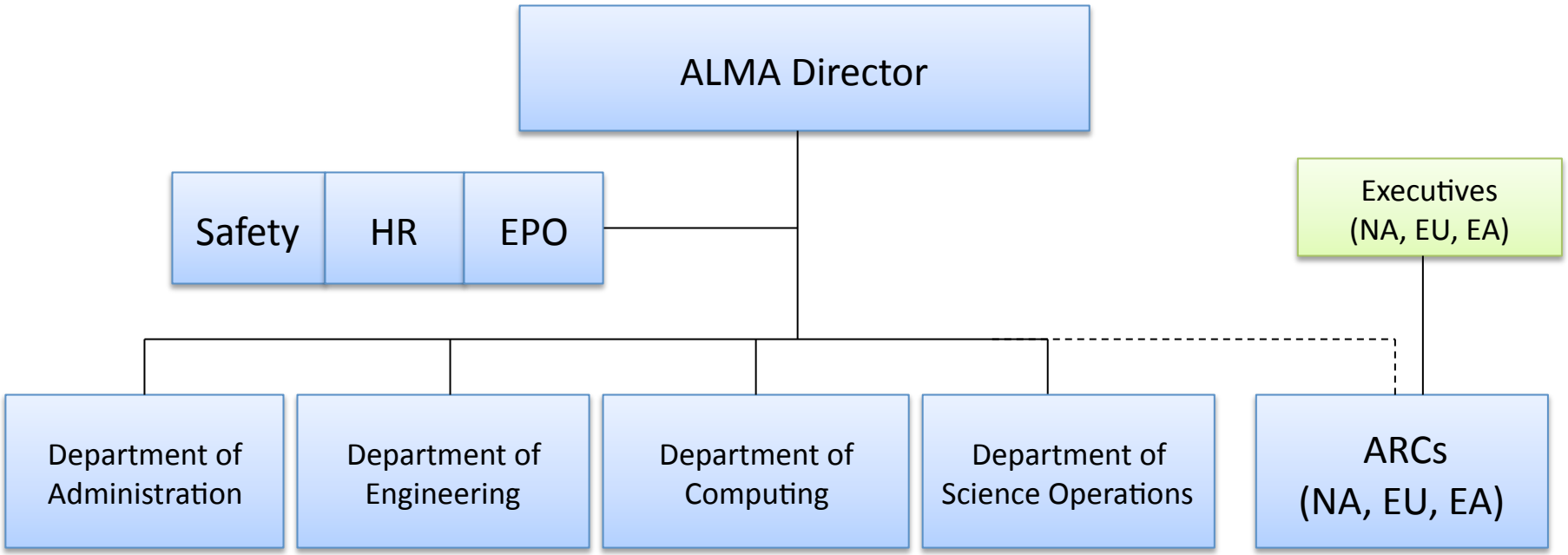
- Observations will be done in service observing mode, eventually with flexible (dynamic) scheduling.
- All observations are executed in the form of scheduling blocks (SBs), each of which contains all information necessary to schedule and execute the observations.
- All science, calibration and raw data are captured and archived
- The default output to the astronomer are reliable images, calibrated according to the calibration plan.
- The Joint ALMA Observatory (JAO) is responsible for the data product quality.

Observing time allocation according to regions:

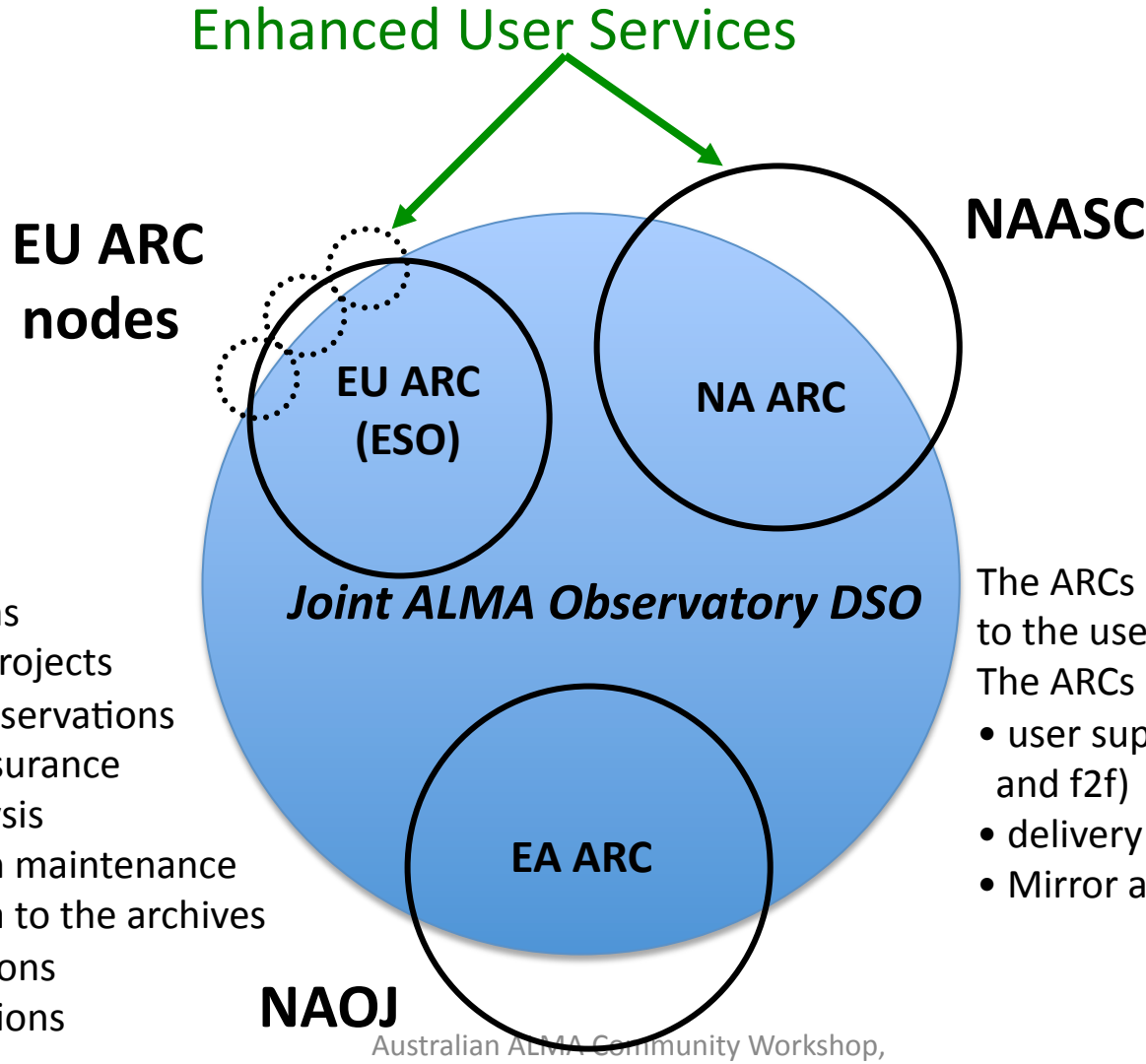
- EA: 22.5 %
- EU: 33.75 %
- NA: 33.75 %
- Chile: 10 %
- Time allocation of projects from outside of the ALMA regions will be shared between the regions

The Joint ALMA Observatory (JAO)

- ALMA is operated by the JAO
- The ALMA Regional Centers (ARCs) form an integral part of JAO operations



Science Operations: organization



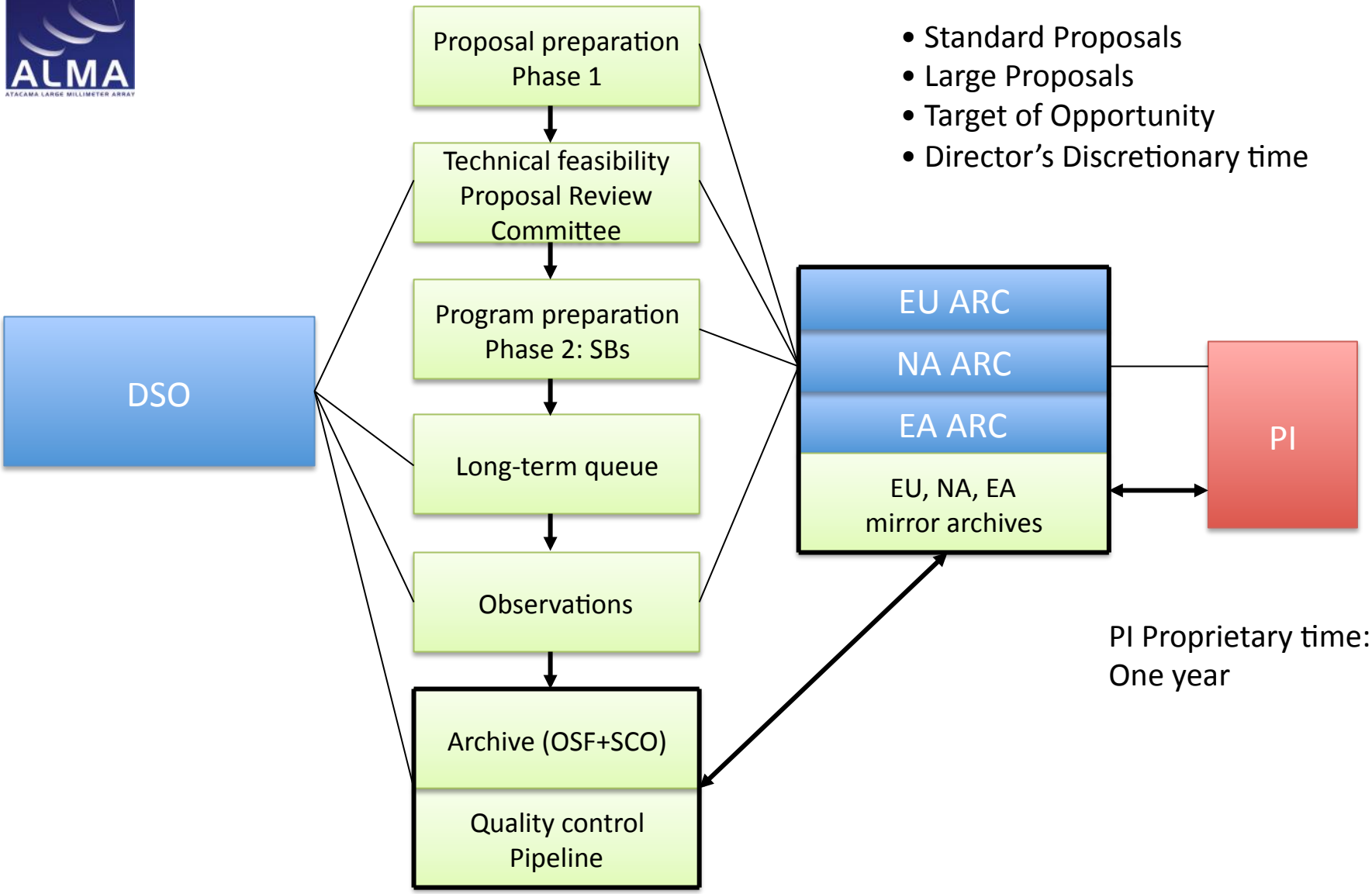
JAO provides:

- Array operations
- Scheduling of projects
- Execution of observations
- Data quality assurance and trend analysis
- Calibration plan maintenance
- Delivery of data to the archives
- Archive operations
- Pipeline operations

The ARCs are the interfaces to the user community.
The ARCs provide (core tasks):

- user support (via helpdesk and f2f)
- delivery of data to the PIs
- Mirror archive operations

Program flow

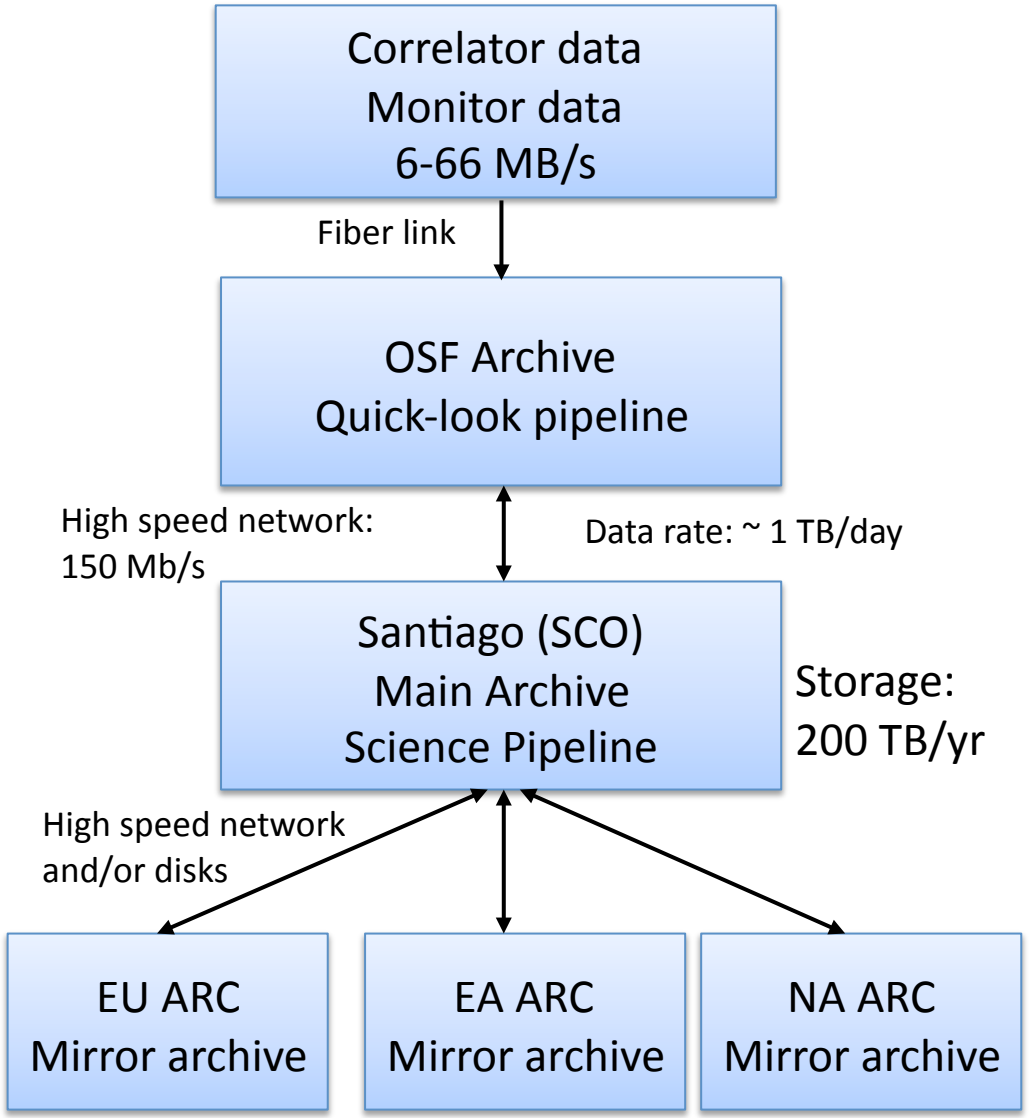


Archiving

Archive content:

- All raw and calibration data
- All monitor data
- All data products produced by the standard pipeline (images etc.)
- Observing logs
- Proposals
- SBs
- Publications and other information

Virtual Observatory compliant



Cycle 0 – the First Scheduling Period

After a set of observatory readiness reviews in 2010 the ALMA Board decided that ALMA is ready to start Early Science Observations:

- **January 6 2011:** Pre-announcement of the Call for Proposals
- **30 March 2011**: Call for Proposals for the ALMA Early Science Cycle 0 was released, including access to the offline Observing Tool
- **1 June 2011:** Opening of archive for proposal submission
- **30 June 2011:** Proposal Deadline
- **30 September 2011:** Start of ALMA Cycle 0 observing
- **February 2012:** One month engineering shutdown
- **30 June 2012:** End of ALMA Cycle 0

Cycle 0 Capabilities

The ALMA Cycle 0 capabilities are:

- Sixteen 12-m antennas
- Receiver bands 3, 6, 7 & 9 (wavelengths of about 3, 1.3, 0.8 and 0.45 mm)
- Two array configurations with baselines out to 125m and 400 m
- Single field imaging
- Pointed mosaics with a maximum of 50 pointings
- Restricted set of spectral modes chosen to meet a reasonable range of scientific goals

Cycle 0 limitations

- During Cycle 0 there will be limitations in capabilities and types of observations:
  - UV coverage will be limited
  - Data quality and calibration accuracy will be lower than the target
  - Characterization of the instrumentation and data sets might not be complete
- There will be limitations in observing time per project:
  - Cycle 0 spans 9 months
  - Cycle 0 observing time shared with CSV and Construction which have priority
  - A total of 500-700 hours array time will be available for observations
  - About 100 successful proposals are expected
  - The average time allocated per proposal is likely to be 5-7 hours (with a wide range)
- There is no guarantee that a project will be completed
- No carry over of projects from Cycle 0 to later cycles

Cycle 0 Proposals

- Only Standard proposals will be accepted (<100h of observing time, as given by the OT time estimator).
- ToOs will be possible, but can only be executed (triggered) during the Cycle 0 blocks of observing time.
  - Triggering will be done through a webform.
  - Instructions are given in the Proposers Guide what information needs to be included in ToO proposals.
- Time critical observations may be possible, but will be restricted to the Cycle 0 blocks of observing time. Therefore execution time must be specified with a "fuzziness" of not less than 3 weeks.

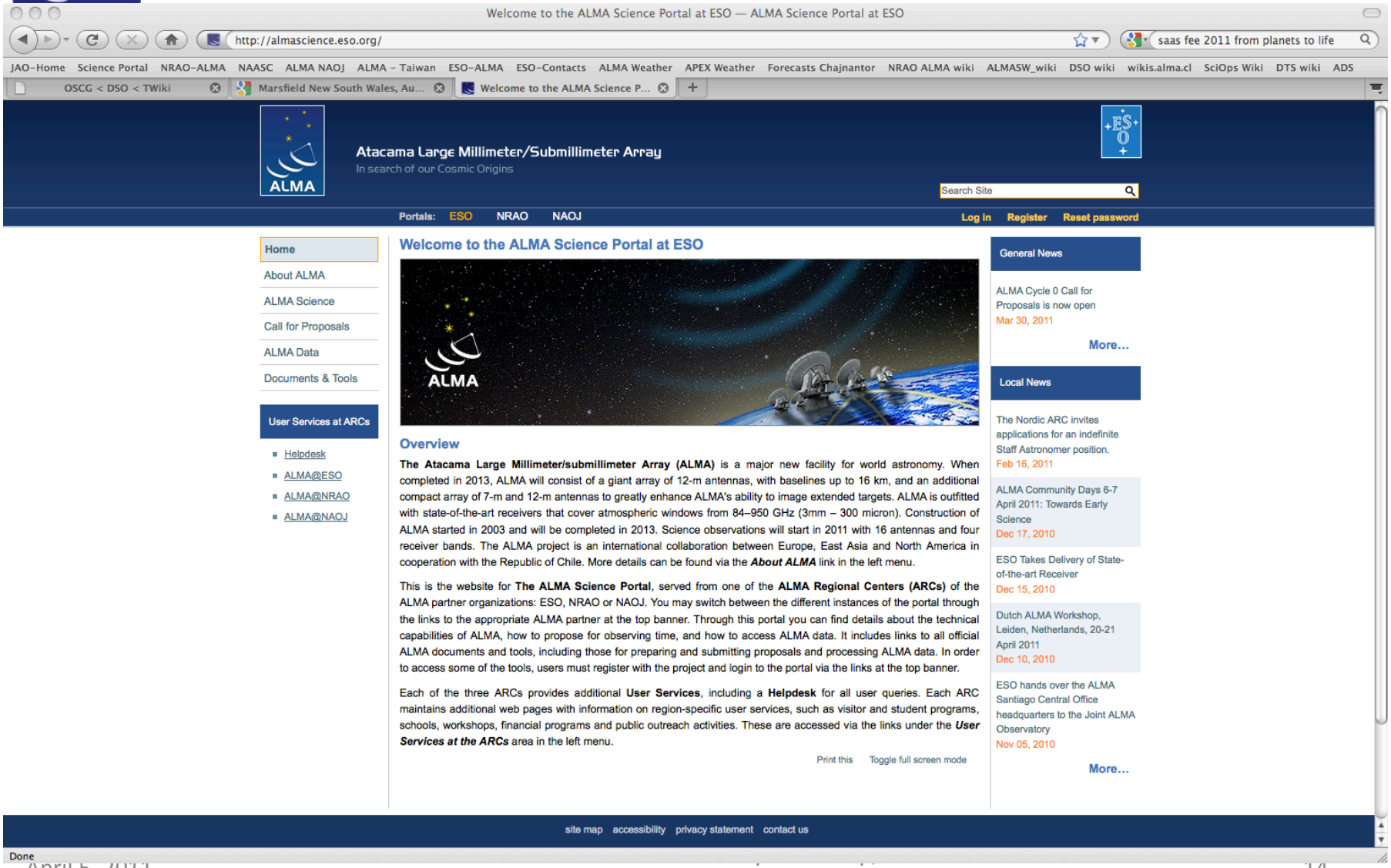
Cycle 0 proposals

- Any astronomer may submit a proposal
- Proposals should exploit the advertised ALMA Early Science Cycle 0 capabilities, producing scientifically worthwhile results from relatively short observations (averaging a few hours)
- Proposals will be assessed by peer review, and ranked strictly on the basis of scientific quality and feasibility with respect to the offered capabilities

PI Experience and Feedback

- PIs and observing teams should anticipate the need to invest their own time and expertise in the analysis of ALMA Early Science data products
  - includes the possible need to visit the relevant ARC to assist with quality assurance and data reduction (ALMA is interested in determining the science value of the data as soon as possible)
- Proposers should anticipate that significant experience in radio (in particular, millimeter) interferometry will be an advantage in working with the data products during ALMA Early Science.
- PIs will need to interact with their ARC in the creation of scheduling blocks

Science Portal



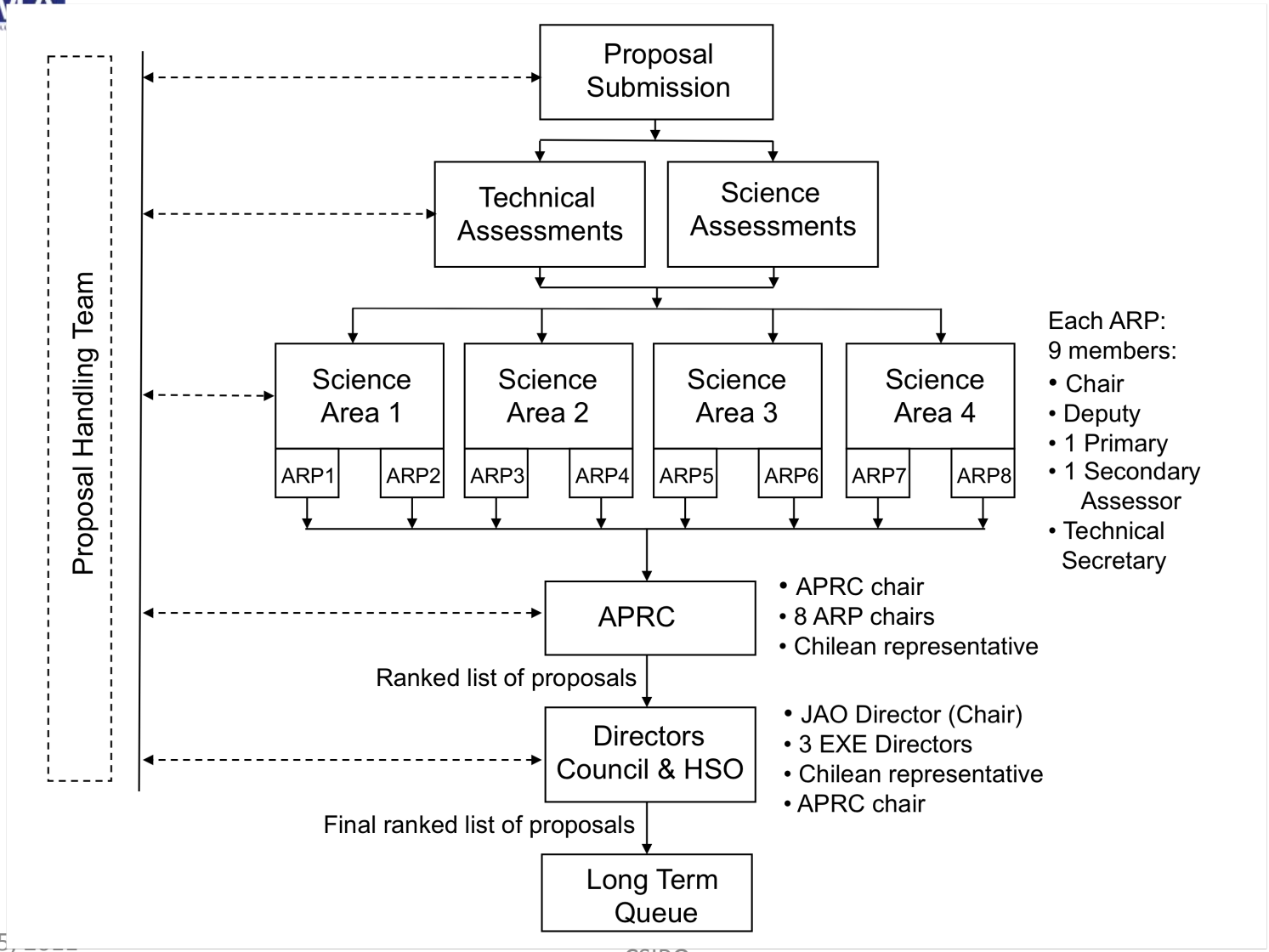
The Science Portal

- Access (landing page etc.)
- Distributed Science Portals (one at each ARC)
- User Registration
- Notice of Intent (to submit proposals)
- User documentation
  - Announcement
  - Capabilities
  - Proposers Guide
  - ES primer, OT guides, Manuals, Videos, etc.
- Helpdesk in operations
- OT download (distributed)
- Future access to the Archive
- May 15 update (Technical Handbook, Array configuration schedule)

Proposal submission

- Proposals are submitted to the Archive in Santiago using the Observing Tool (OT)
- Users need to be registered in the Science Portal in order to be PIs and CoIs of a submitted proposal
- Each Proposal gets assigned a unique code which is sent back to PI who submitted the proposal

The Proposal Review Process



The Proposal Review Process Cycle 0

- How many proposals?
- Notices of Intent: 601 received which probably implies > 1000 proposals

Technical Assessments

- Technical Assessments (TA) are done by JAO and ARC staff (on the order of 30 people)
- TAs are based on the Technical Justification of the proposal (mandatory)
- The TAs are done by many people and need to be consistent:
  - Guidelines and checklists for TAs are being developed.
  - TA workshop in Santiago in July
- In view of the expected number of proposals, TAs may have to be done after the triage

Cycle 0 Observations

- Highest priority is to finish ALMA construction
- Time is shared with Commissioning (CSV)
- Block scheduling 8-12h blocks mostly during night time

Cycle 0 Data Processing

- The pipeline will not be ready to produce processed data, and will continue to be tested and developed during the first year of Early Science.
- Meanwhile JAO will deliver quality assured data, including images in the form of data cubes
- The data will be processed and calibrated using standard scripts, converted to spectral cubes and quality assured by a combination of DSO, ARC and CSV staff (manual processing in the same way as it will be done by the pipeline)

Cycle 0 Data Processing

- The data obtained during Early Science will be used to develop the pipeline and the pipeline heuristics, and by CSV to assess the status of the array
- JAO will sign off on the data quality before the data is sent to the ARC archives and on to PIs

The ALMA Dream

www.almaobservatory.org

The Atacama Large Millimeter/submillimeter Array (ALMA), an international astronomy facility, is a partnership of Europe, North America and East Asia in cooperation with the Republic of Chile. ALMA is funded in Europe by the European Organization for Astronomical Research in the Southern Hemisphere (ESO), in North America by the U.S. National Science Foundation (NSF) in cooperation with the National Research Council of Canada (NRC) and the National Science Council of Taiwan (NSC) and in East Asia by the National Institutes of Natural Sciences (NINS) of Japan in cooperation with the Academia Sinica (AS) in Taiwan. ALMA construction and operations are led on behalf of Europe by ESO, on behalf of North America by the National Radio Astronomy Observatory (NRAO), which is managed by Associated Universities, Inc. (AUI) and on behalf of East Asia by the National Astronomical Observatory of Japan (NAOJ). The Joint ALMA Observatory (JAO) provides the unified leadership and management of the construction, commissioning and operation of ALMA.