



# ALMA Science Operations Scenario

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# High-level concepts for Science Operations (from the ALMA Project and Operations Plans)

- Observations will be done in service observing mode with flexible (dynamic) scheduling.
- Observations 24h/day interrupted by maintenance periods.
- All observations are executed in the form of scheduling blocks (SBs), each of which contains all information necessary to schedule and execute the observations.
- 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.
- All science and calibration raw data are captured and archived.



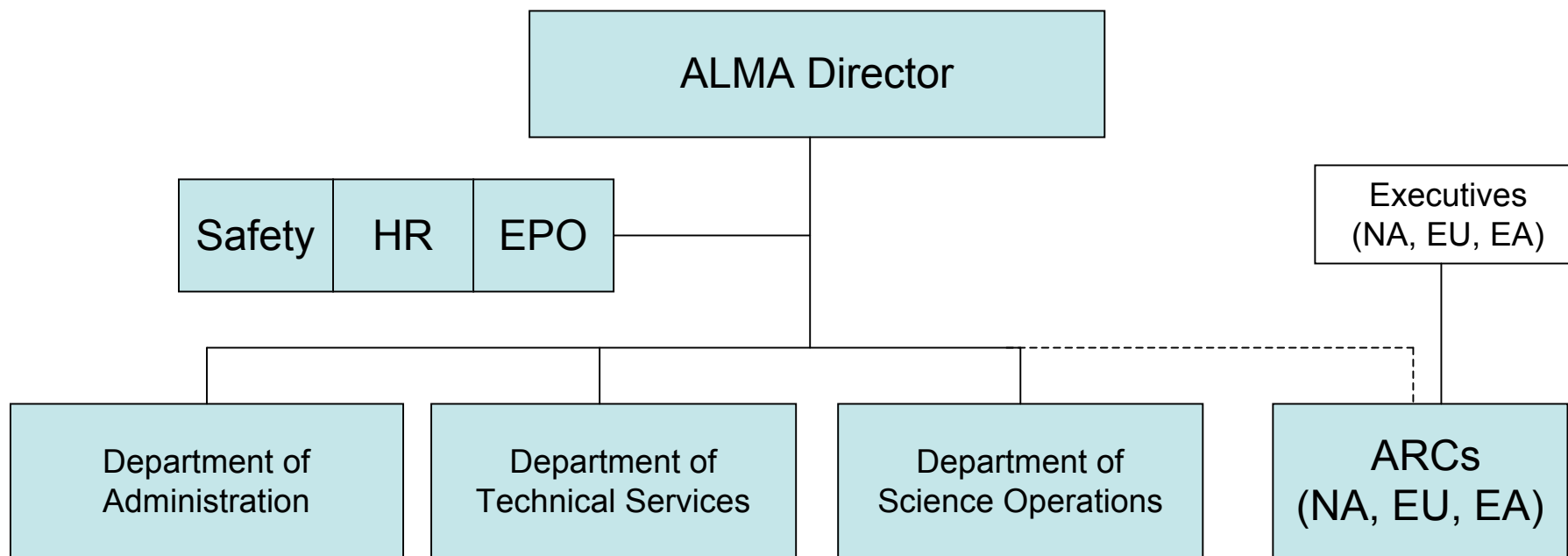
# Science Deliverables

- uv-plane astronomical source and calibration data.
- Processed images, with supporting information on the data processing and quality assurance.
- Off-line data reduction software, including user support for installation and basic usage.
- Software tools for proposal and observation preparation, including user documentation.
- ALMA users manual.



# The Joint ALMA Observatory (JAO)

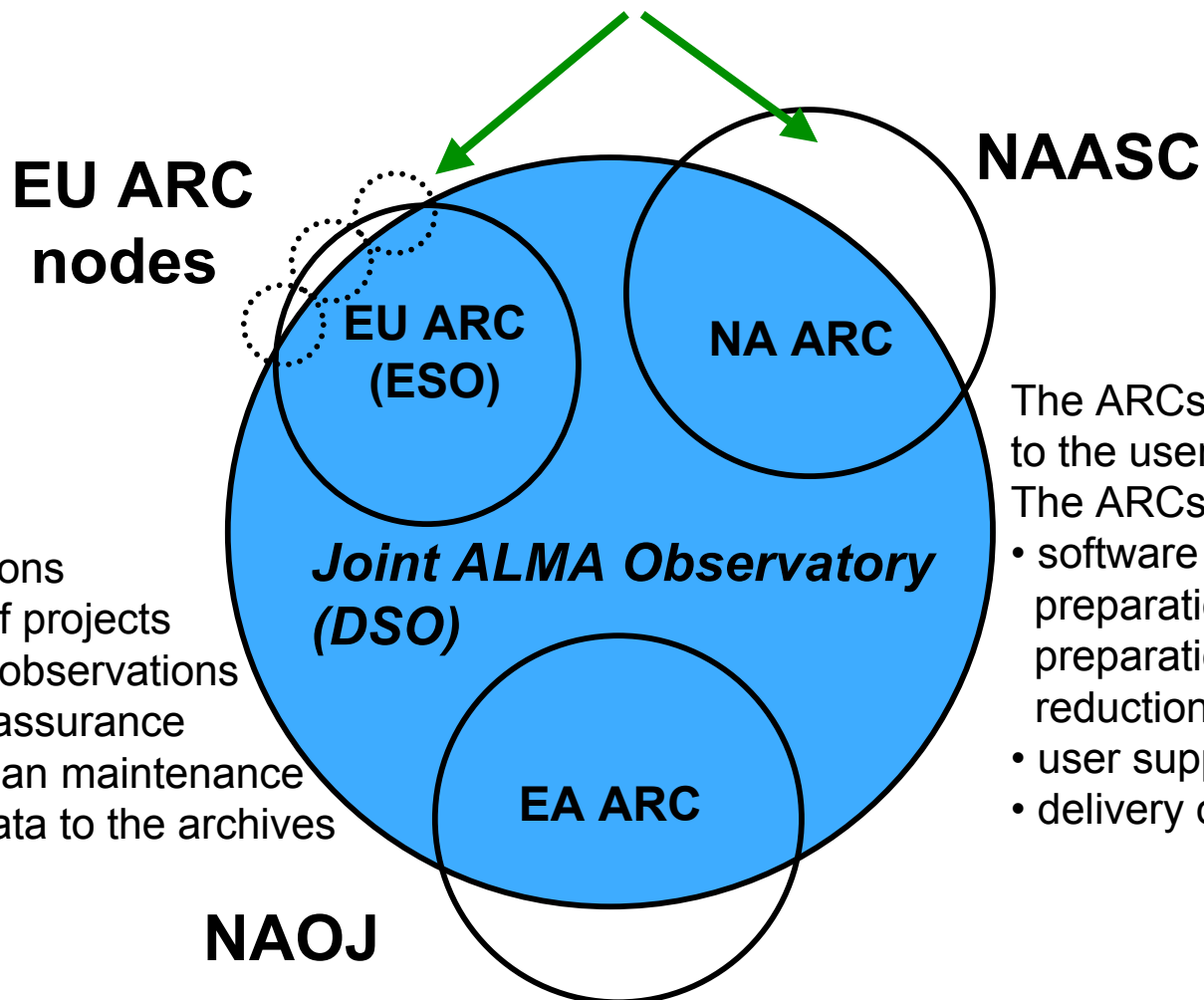
- ALMA is operated by the JAO.
- The ALMA Regional Centers (ARCs) form an integral part of JAO operations.





# Science Operations: organization

## Enhanced User Services



DSO provides:

- Array operations
- Scheduling of projects
- Execution of observations
- Data quality assurance
- Calibration plan maintenance
- Delivery of data to the archives

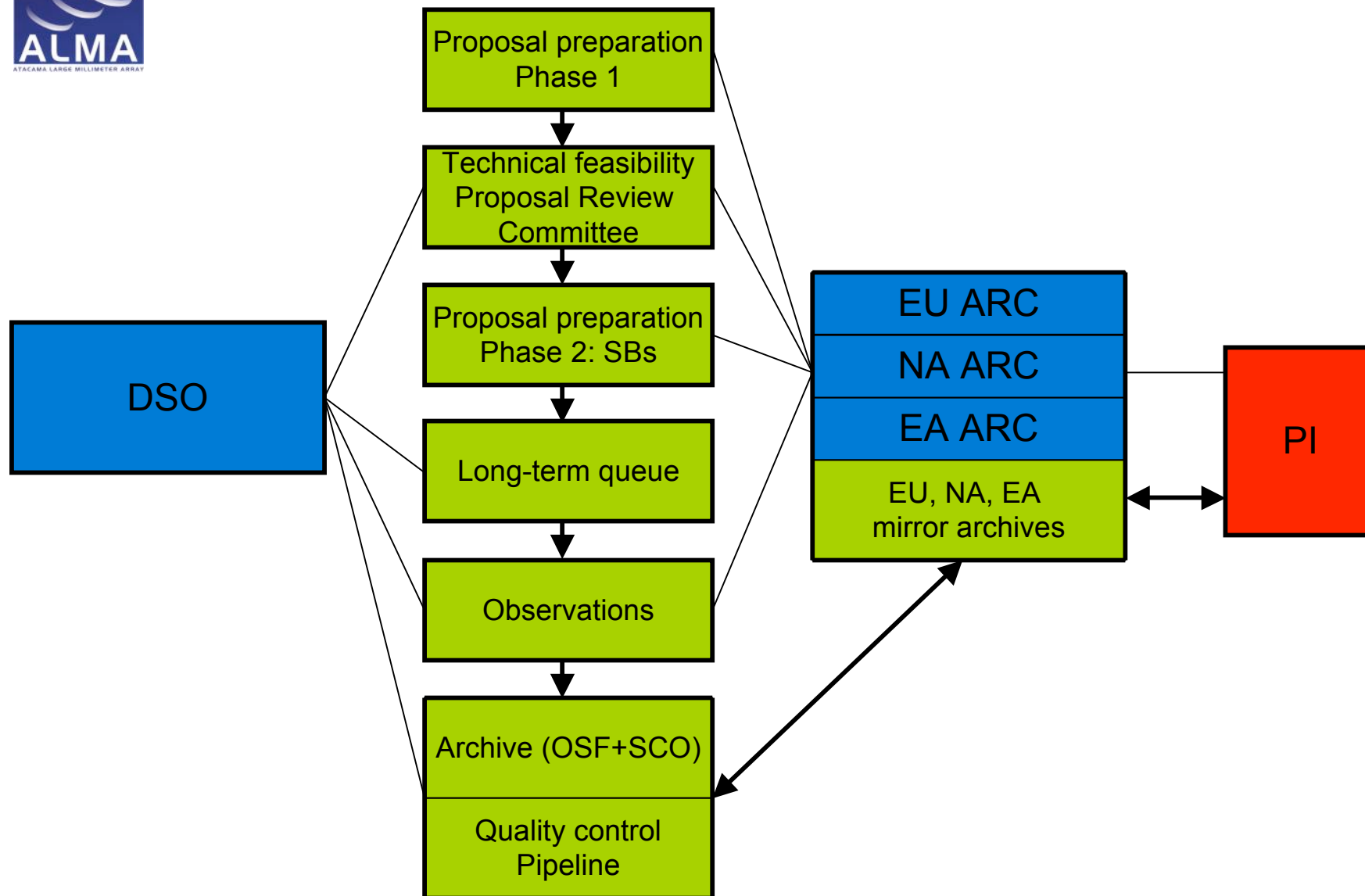
The ARCs are the interfaces to the user community.

The ARCs provide:

- software tools for proposal preparation, observation preparation, and data reduction
- user support
- delivery of data to the PIs



# Data flow



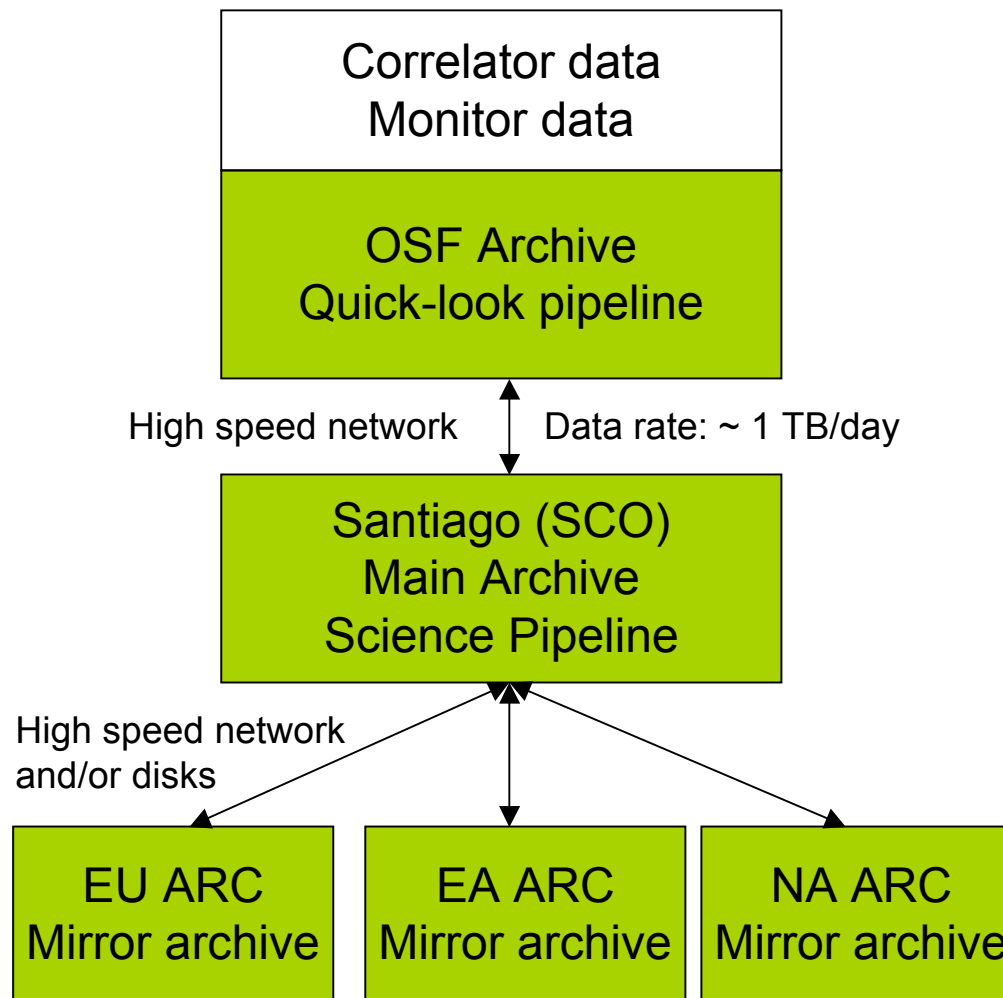


# Archiving

## 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





# Science Operations

- Proprietary time of data: 12 months after the project is complete and available in the archive.
- ToO (Target-of-Opportunity) observing included in the Operations Plan.



# Science Operations ramp-up

- **Early pre-operations** (from now until three antennas are available at the AOS):
  - Recruitment and training. AIV support. Testing of software tools.
- **Late pre-operations** (from three antennas at the AOS until Early Science Operations):
  - Continue recruitment and training. AIV and CSV support.
  - Commission software tools (Phase 1 and 2, SBs)
  - Prepare for Early Science Ops (starting 10 months earlier): Call for proposals, support of Phase 1 and 2 preparation, make Web pages, User manuals etc.
  - Perform Dry runs



# Science Operations ramp-up

- **Early Science Operations** (16 antennas, 6 receiver bands, Correlator and basic observing modes commissioned.)
  - Science Operations shares time with AIV/CSV. Continue AIV/CSV support.
  - Fine tuning of Science Operations.
  - Development of calibration plan, pipeline etc.
  - Deliver science data to the community
  - Finalize recruitment
- **Full Science Operations** (complete array)



# Science Operations ramp-up

- **Archive ramp-up:**

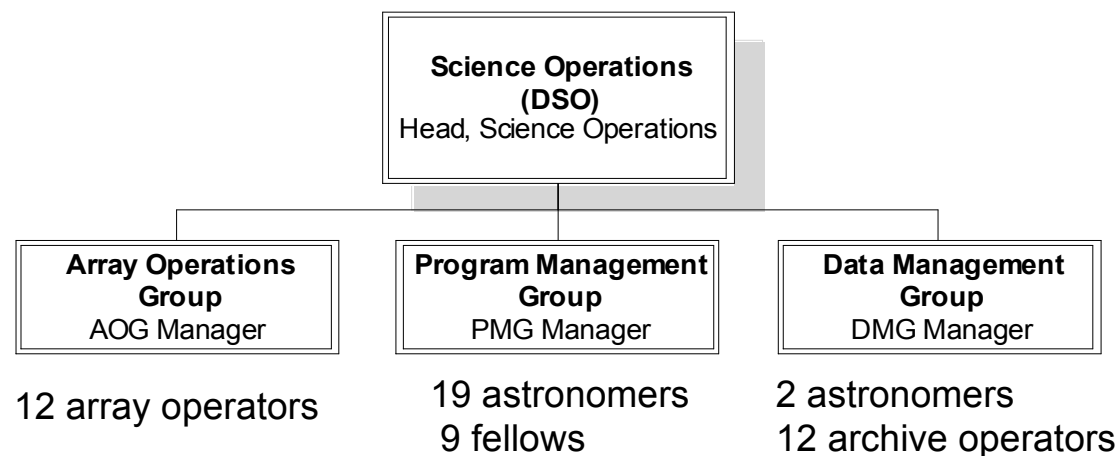
- The first central archive will be located at the OSF.
- Starting at the Early Science Decision Point the central archive will migrate to SCO.
- Before Early Science Operations the archive will be mirrored to the ARCs.

- **Pipeline:**

- Science-quality images are not delivered immediately. About 12 months of commissioning are needed after ES.
- During early months, JAO delivers the raw data, data processing software, a cookbook for data processing and imaging, and ARC-based data processing user support via a helpdesk and f2f.



# DSO: organization



AOG: Array operations and antenna transport schedule.

PMG: Observations, scheduling and data quality control.

DMG: Archive and pipeline operations, delivery of data to ARCs and data quality control.

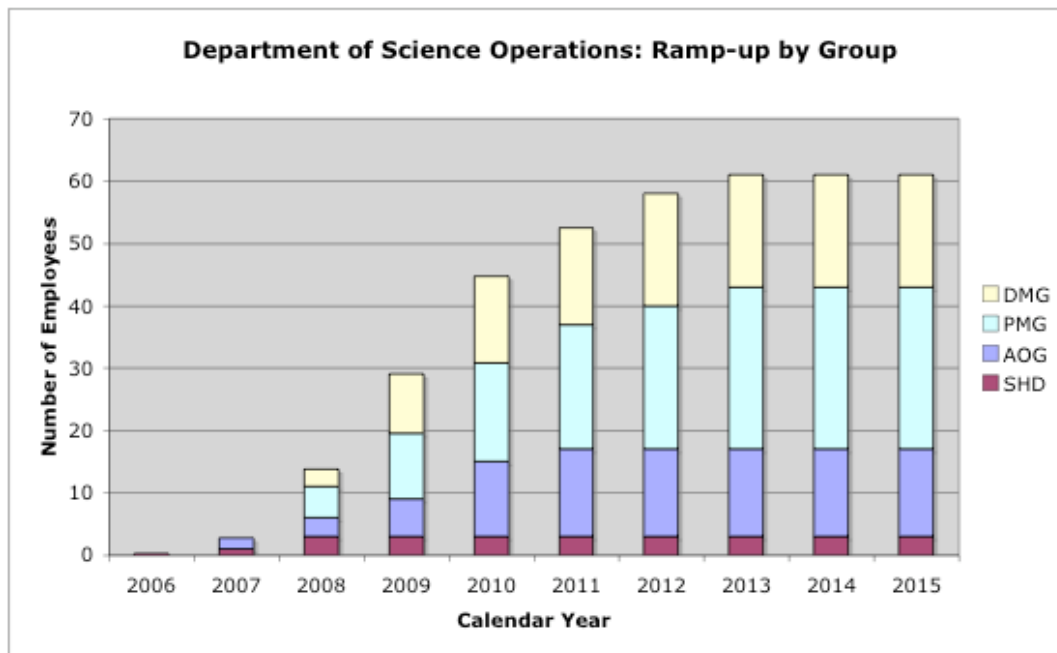


# DSO responsibilities

- Array operations, including monitoring & coordination of all AOS activity.
- Observation scheduling: Long-Term, Medium-Term, and Short-Term.
- Observation execution.
- Data processing and quality assurance.
- System performance quality assurance.
- Maintenance and execution of Calibration Plan.
- Delivery of data to the ARC mirror archives.



# DSO staff ramp-up



DMG: mainly archive operators.  
PMG: astronomers (AoD, system).  
AOG: array operators.

## Milestones:

- 2008 - AIV
- 2009 - CSV and archive
- 2010 - Early Science Operations
- 2011 - Pipeline ready



# Staff ramp-up

- Quick ramp-up during 2008-2011 both at DSO and the ARCs.
- The DSO staff will participate in AIV/CSV for training and support.
- **Many astronomers are needed.**

Group	Year	Quarter	Position
PMG	2008	1	Program Manager 1
PMG	2008	1	Program Manager 2
PMG	2008	2	PMG Astronomer 1
PMG	2008	2	PMG Astronomer 2
PMG	2008	2	PMG Astronomer 3
PMG	2008	2	PMG Astronomer 4
PMG	2008	3	System Astronomer 1
PMG	2008	3	System Astronomer 2
PMG	2008	3	System Astronomer 3
DMG	2008	4	Data Manager 1
PMG	2009	1	PMG Astronomer 5
PMG	2009	1	PMG Astronomer 6
PMG	2009	1	PMG Astronomer 7
PMG	2009	1	PMG Astronomer 8
PMG	2009	1	System Astronomer 4

DSO hiring of astronomers during 2008 and 2009 Q1. In total 15 astronomers will Be hired during this time.



[www.alma.info](http://www.alma.info)

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