

# ALMA overview

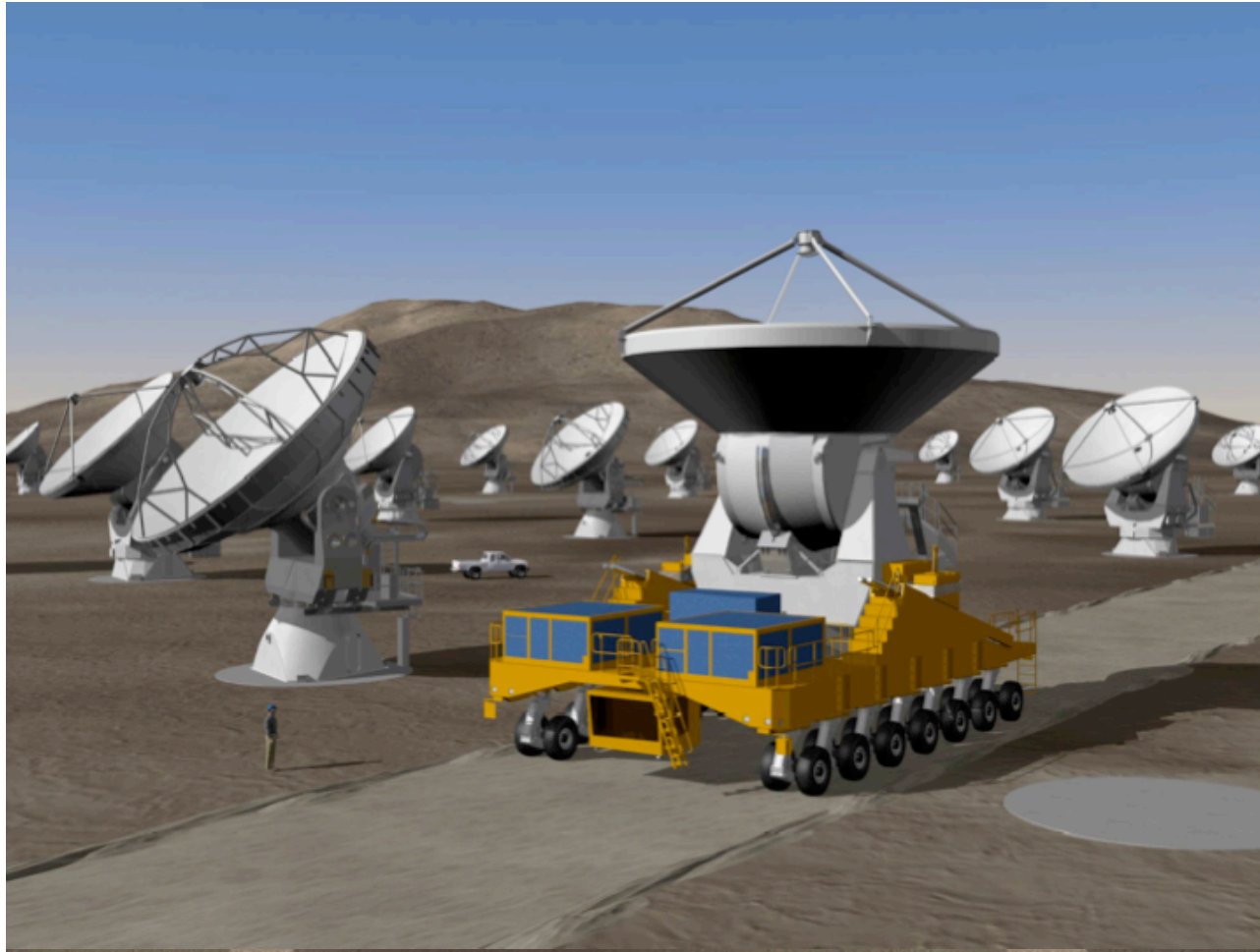
2011-04-13

**Anthony Rushton**  
ESO fellow  
(Onsala Space Observatory)





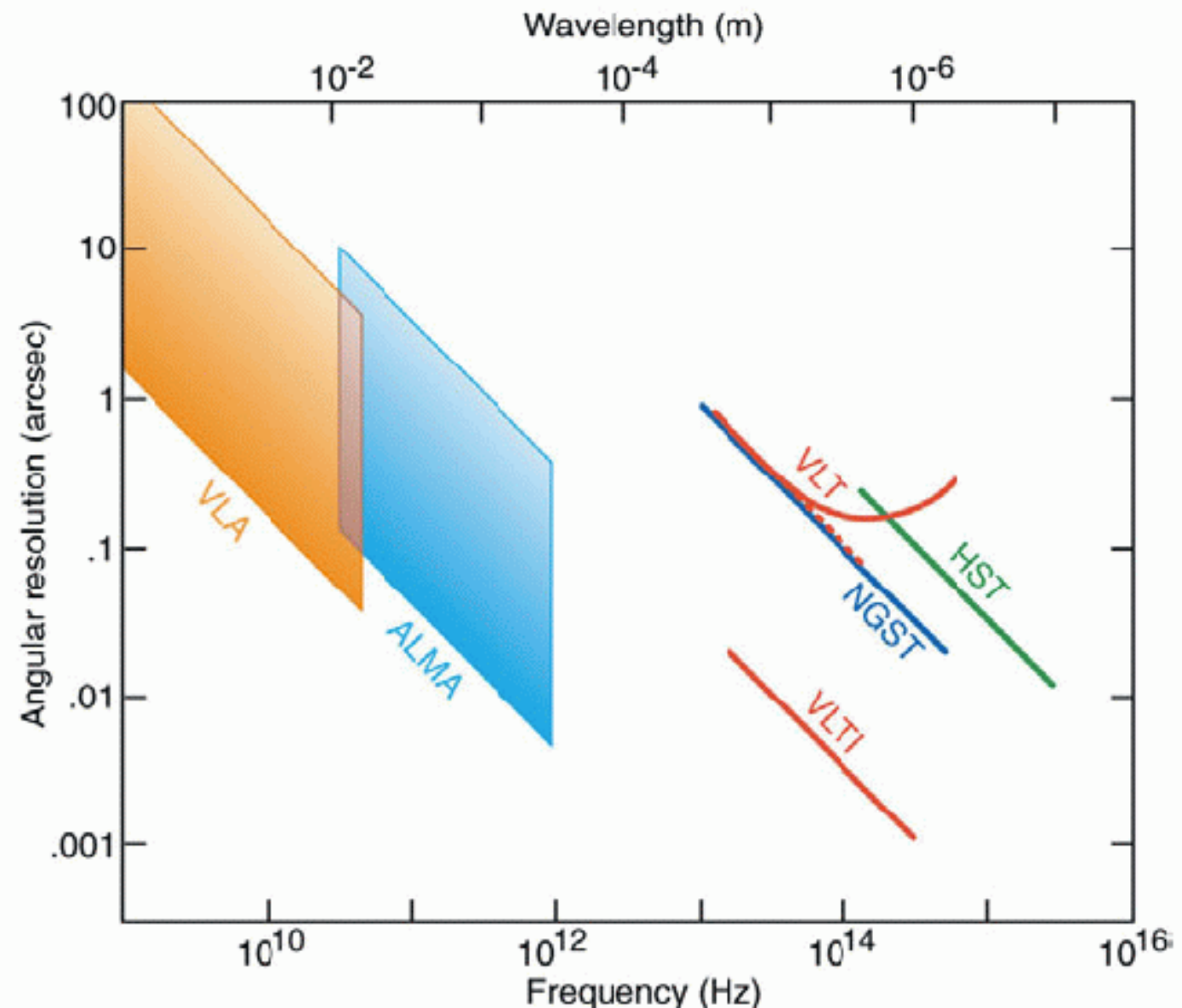
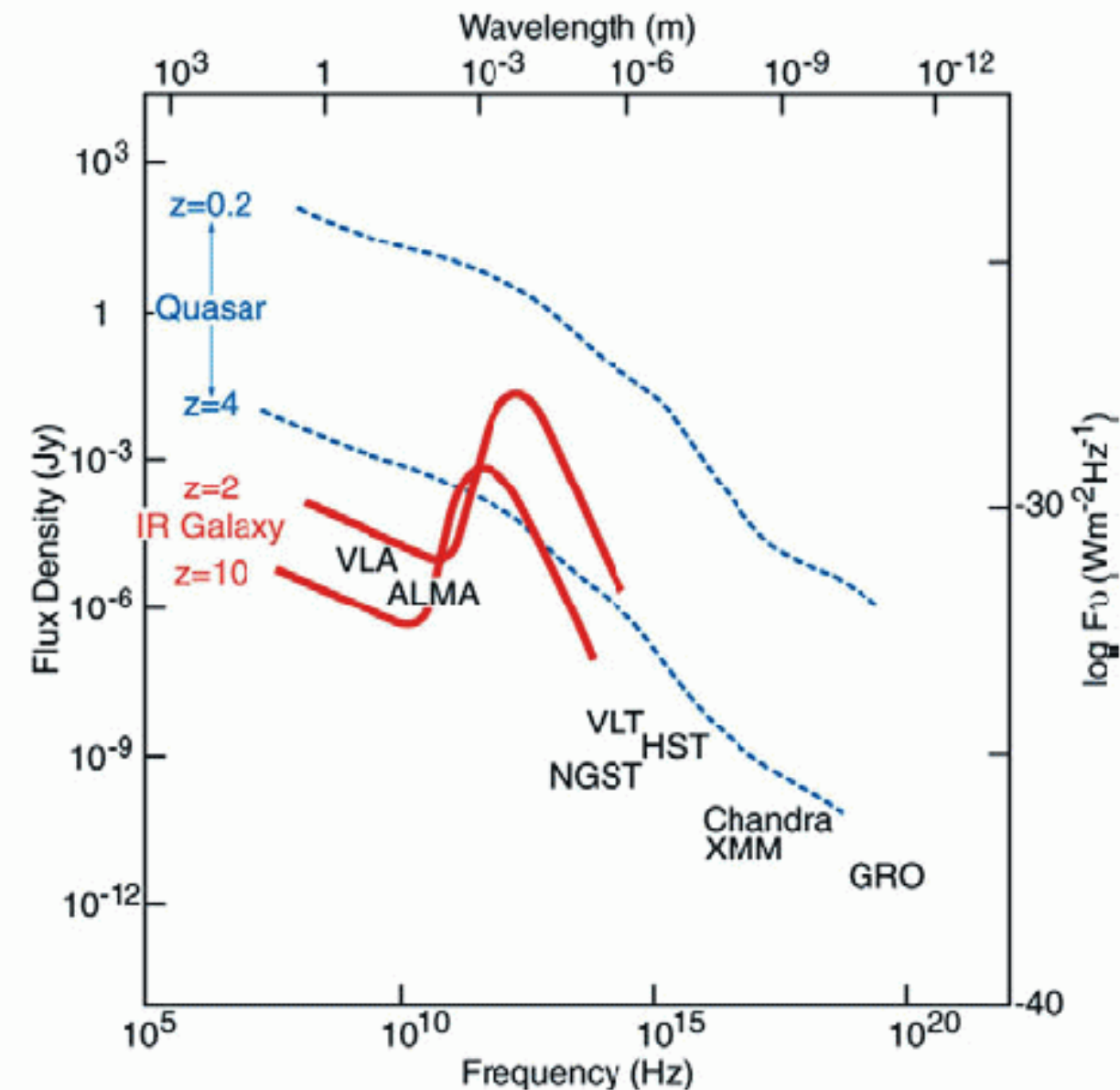
# Atacama Large Millimeter Array



- ◆ At least 50x12m Antennas
- ◆ Frequency range 30-1000 GHz (0.3-10mm)
- ◆ 16km max baseline (<10mas)
- ◆ ALMA Compact Array (4x12m and 12x7m)

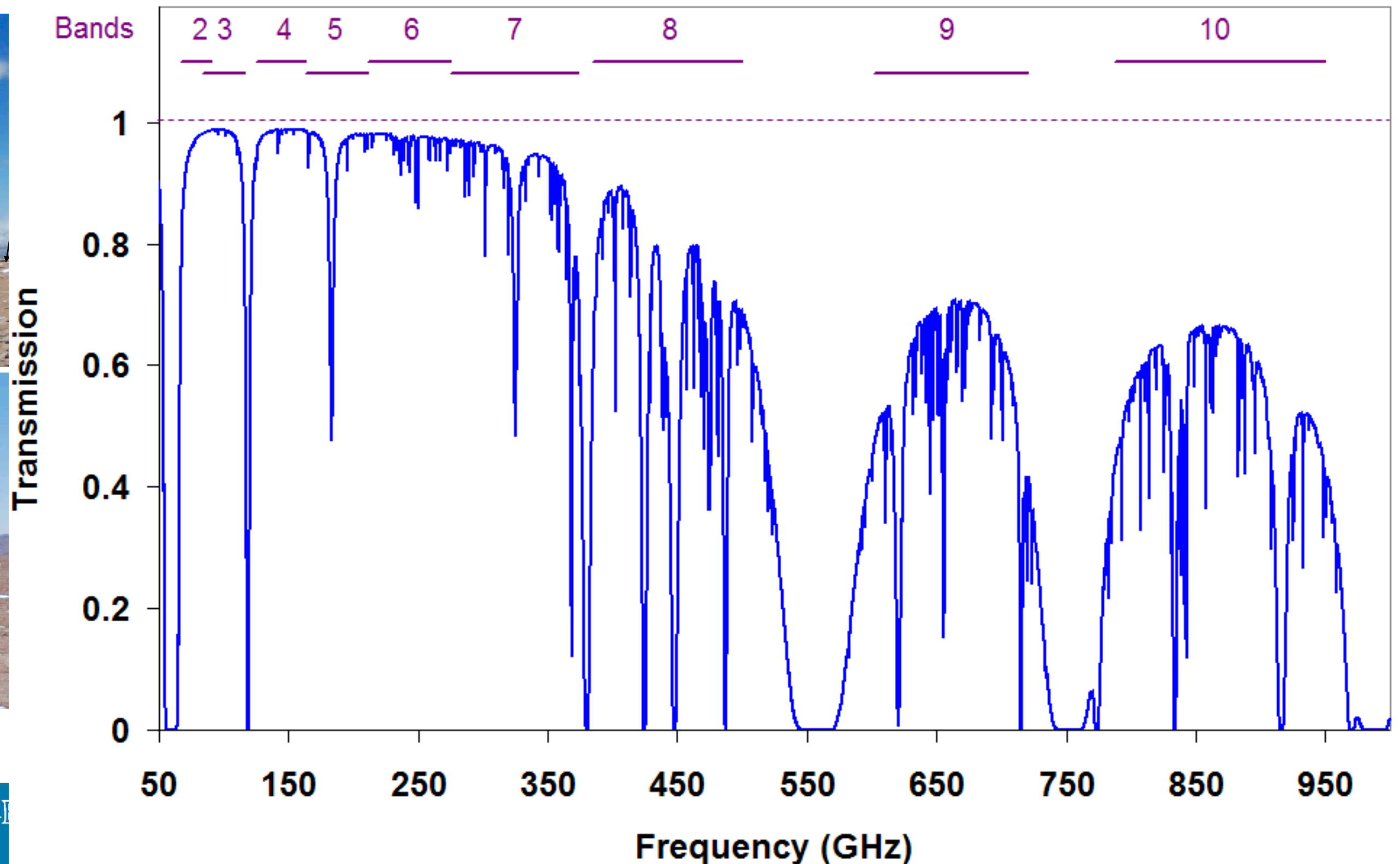
1. Detect and map CO and [C II] in a Milky Way galaxy at  $z=3$  in less than 24 hours of observation
2. Map dust emission and gas kinematics in protoplanetary disks
3. Provide high fidelity imaging in the (sub)millimeter at 0.1 arcsec resolution

# Sensitivity and Resolution



# Chajnantor Plateau - 5000m

Chajnantor - 5000m, 0.25mm pwv







**San Pedro de Atacama**

**Operations Support Facilities  
OSF (2900m altitude)**

**ALMA Operations Site  
AOS (5000m altitude)**

**Toconao**



# ALMA Construction Status



OSF - 2900m



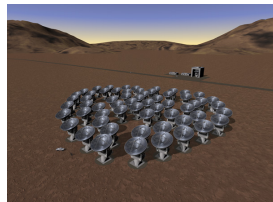
AOS - 5000m





EUROPEAN ARC  
ALMA Regional Centre

## ALMA Operations Sites in Chile



**Antenna  
Operations  
Site (AOS)**

**60 MB/s  
(peak)**

**Operation  
Support  
Facility (OSF)**

array scheduling + operations  
quick-look, maintenance and repair

**6 MB/s  
(average)**

**Santiago Central  
Office (SCO)**

issues of calls  
PRC process  
SB checks  
pipeline data reduction  
quality assessment  
Population of the archive



Paola Andreani

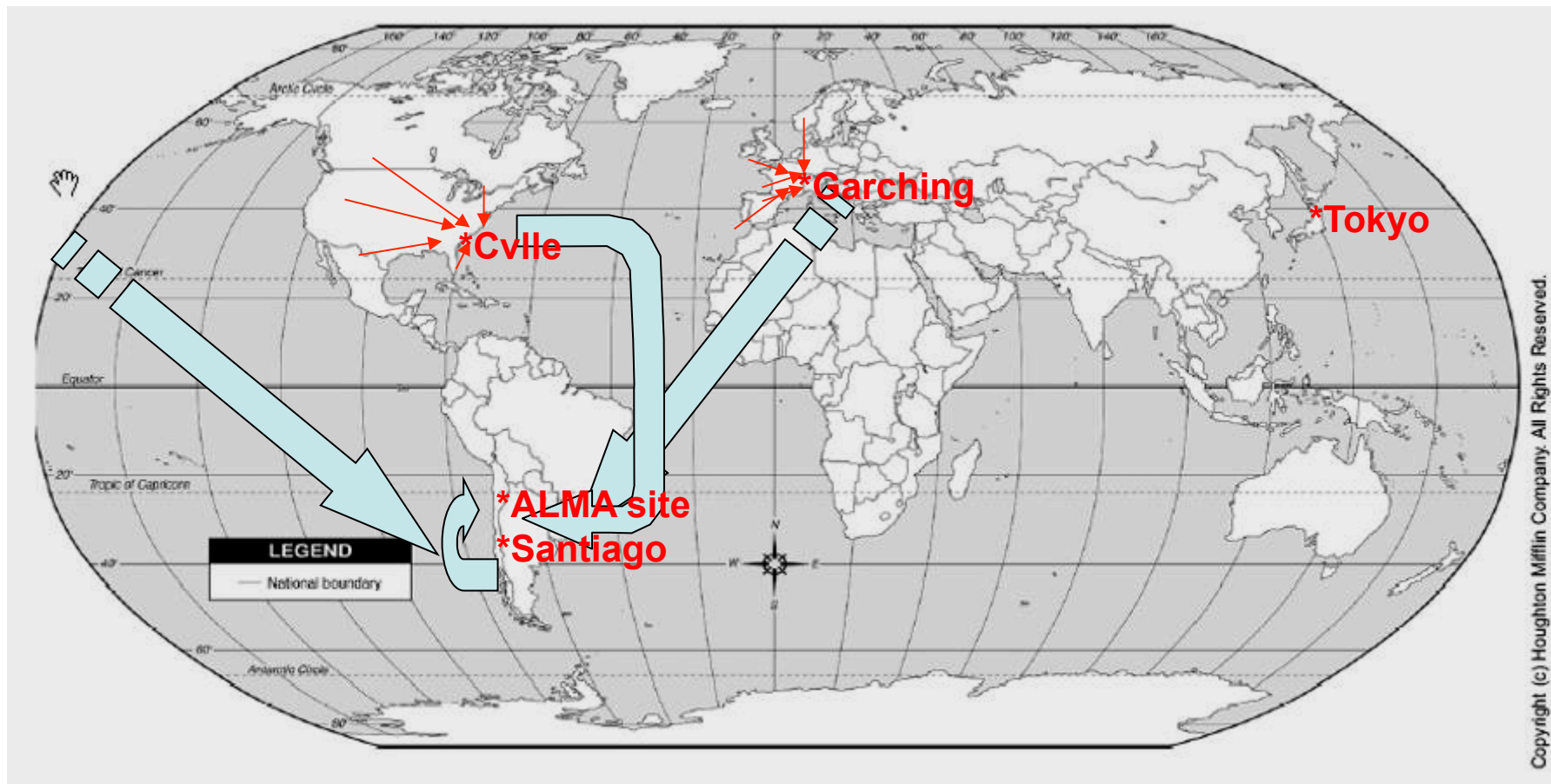
ALMA community days, Garching April 6-7 2011

# High-level concepts for Science Operations

- Observations **only** in service observing mode with flexible (dynamic) scheduling.
- Observations 24h/day interrupted by maintenance periods.
- All observations executed in the form of **scheduling blocks (SBs)**.
- Default output: 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.



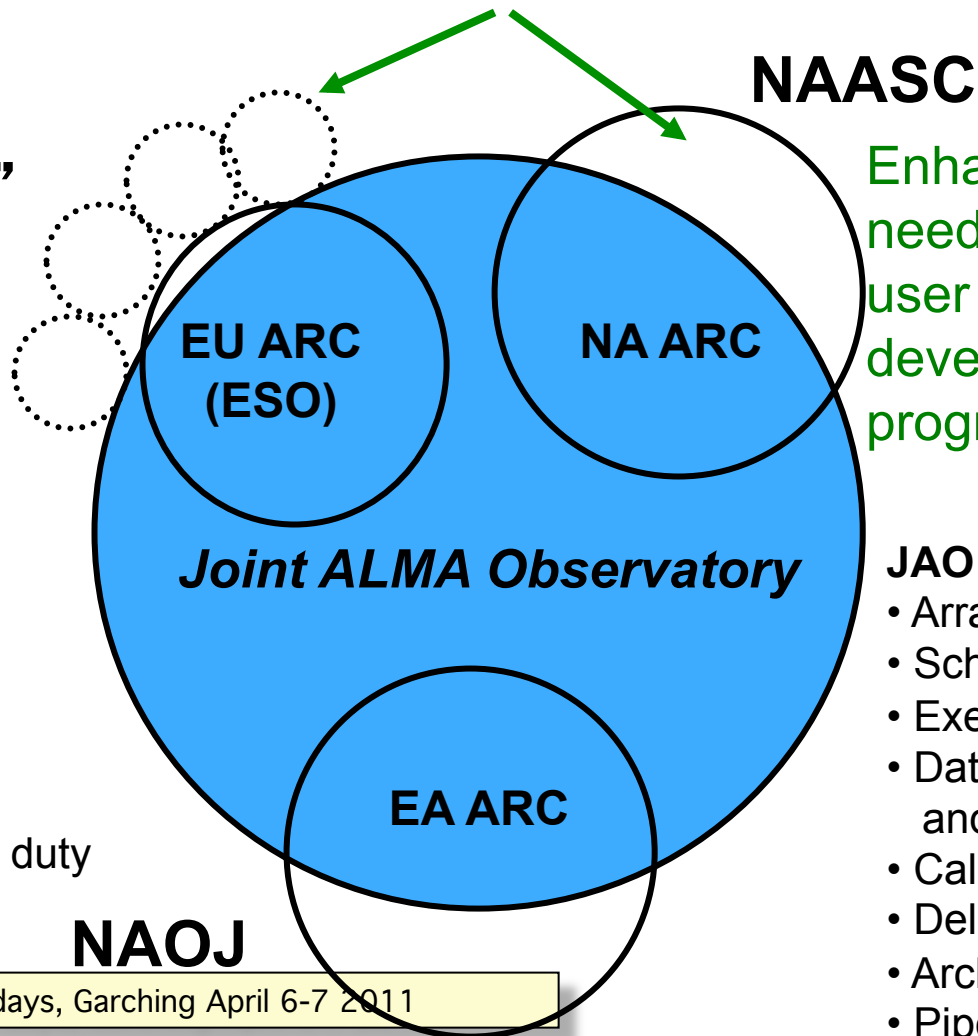
# ALMA Science Operations sites OSF, Santiago and the ARCs



# ALMA Operations: Three ALMA Regional Centres - ARCs

## Enhanced User Services

**“Satellite”  
EU ARCs**



**NAASC**

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

ARCs provide  
user interface,  
archive,  
software tools  
data delivery  
Astronomers on duty

**JAO (Science Operations) 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

**NAOJ**



# ARC in Europe

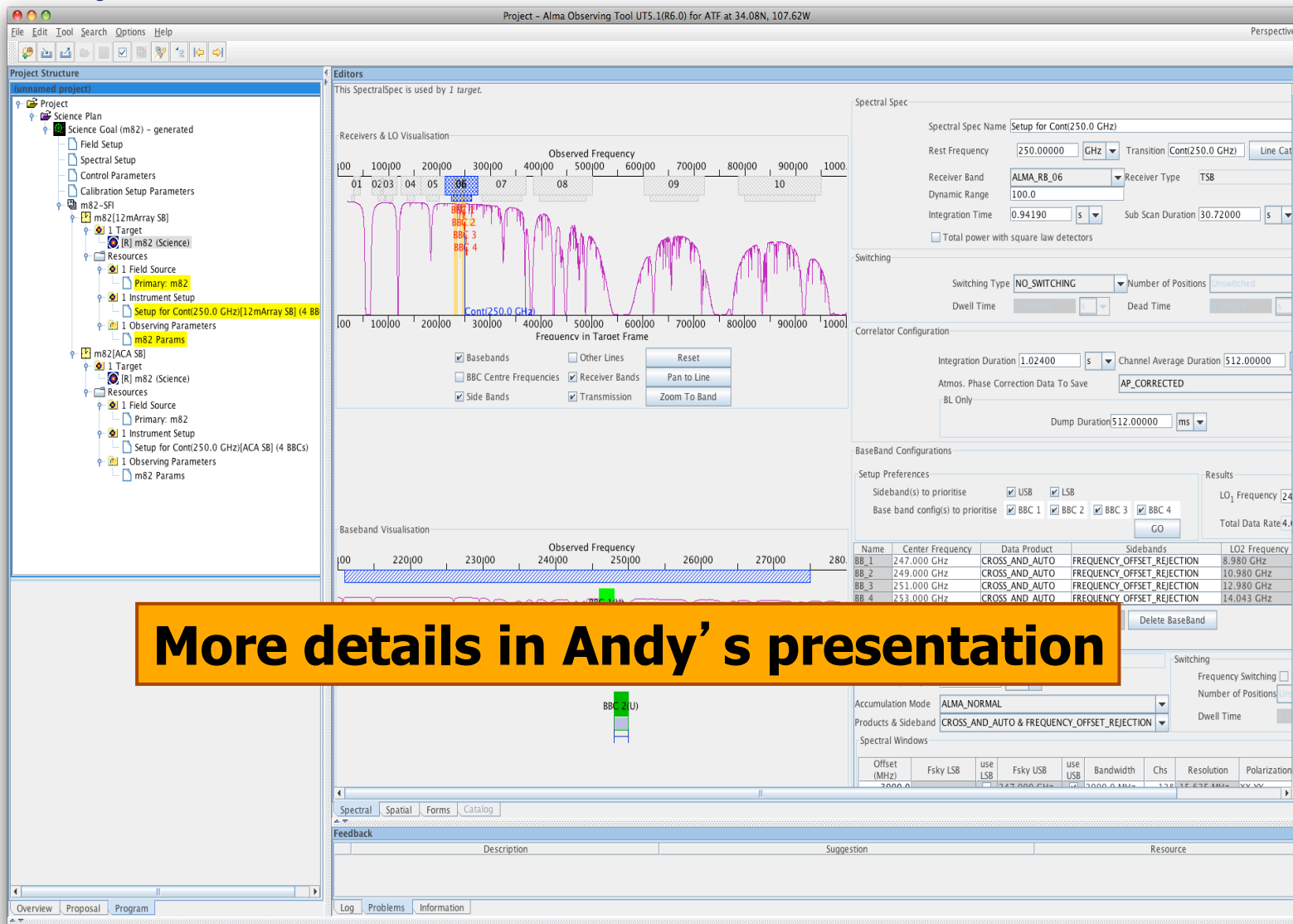
## European ARC nodes





EUROPEAN ARC  
ALMA Regional Centre

# The ALMA observing tool



ALMA community days, Garching April 6-7 2011



# ALMA Early Science

## ◆ When?

- Call released last week
- Deadline 30 June 2011
- Observations Fall 2011

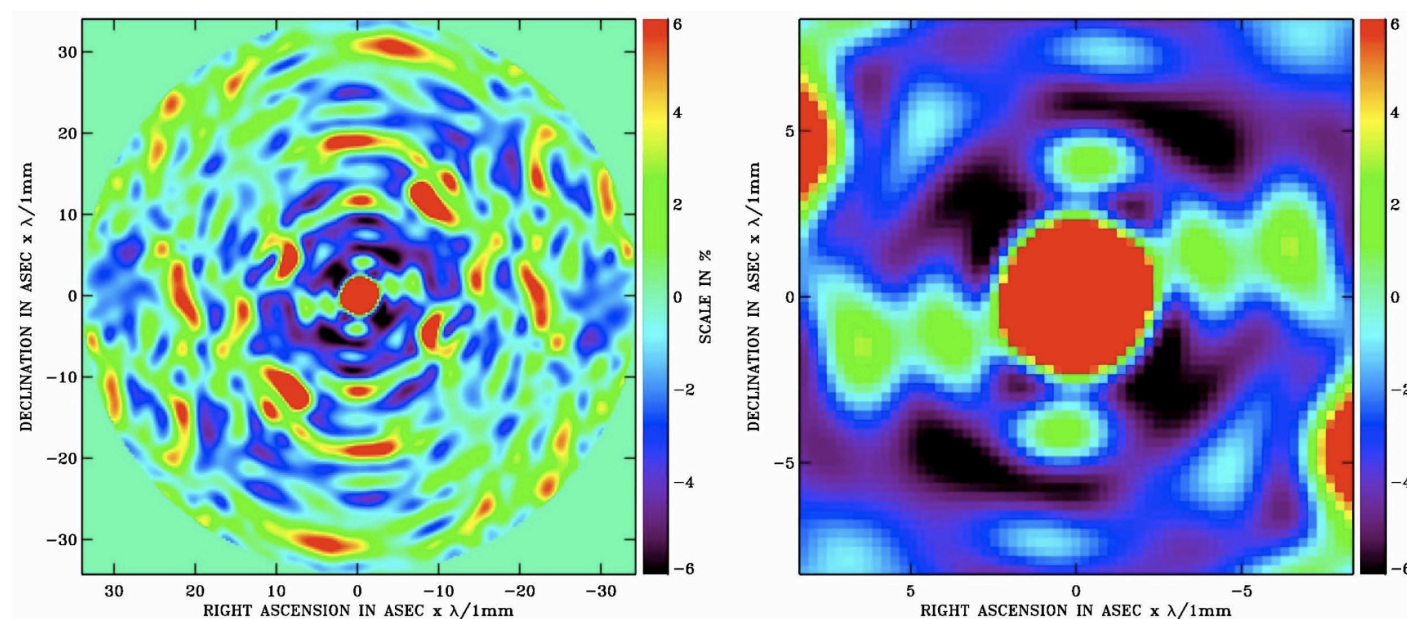
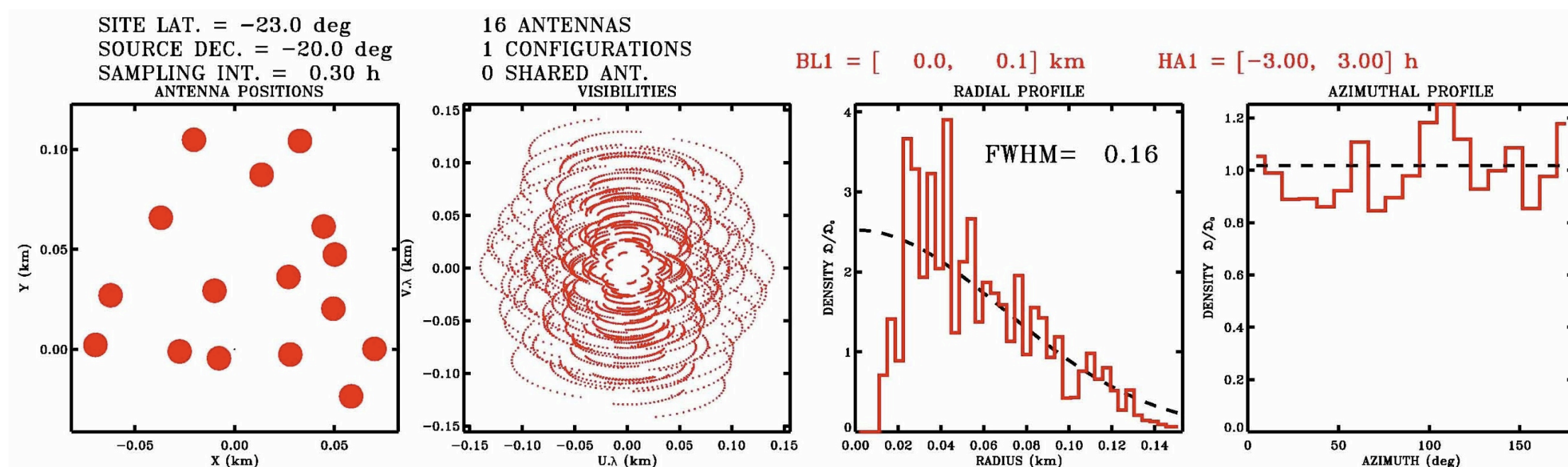
## ◆ What?

- 16 antennas
- Configurations from compact (125m) to moderately extended (400m)
- single field interferometry plus pointed mosaics with up to 50 pointings
- Bands 3, 6, 7 and 9 (3mm, 1mm, 0.85mm, 0.45mm)
- Several single spectral resolution modes
- 1 or 2 polarizations, no full polarization
- Amplitude calibration: 5% B3, 10% B6 and B7, 20% B9
- At most 30% of the available time for the first call (period Oct11-Jun12)
- No Solar observations

Leonardo Testi: Status of the ALMA project & Early Science, ALMA Days, 6 April 2011



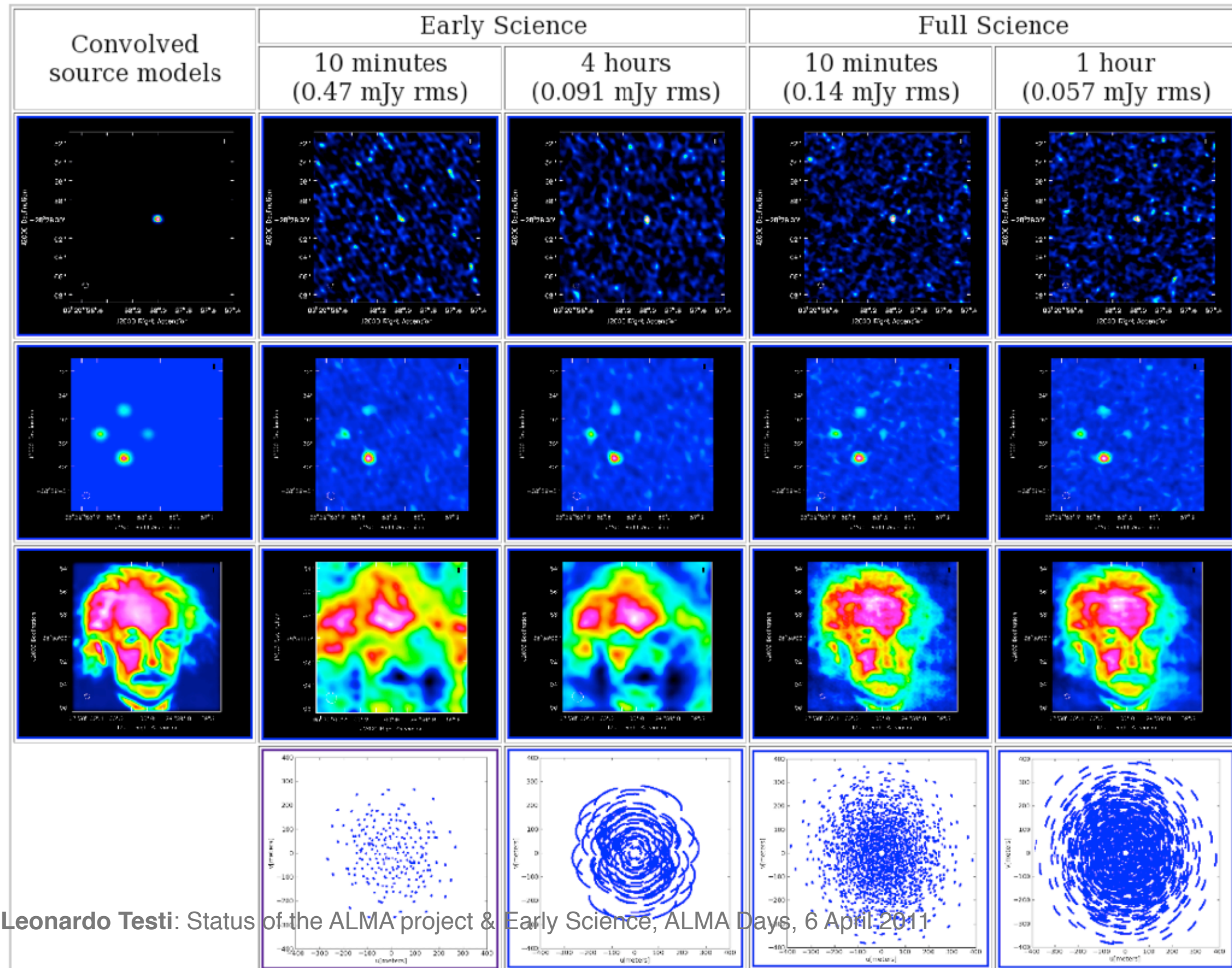
# Configurations for Cycle 0



♦ Two configurations with max baselines ~150 and ~400 meters



# Image Fidelity - Early Science



Leonardo Testi: Status of the ALMA project & Early Science, ALMA Days, 6 April 2011



# Spectral modes for Cycle 0

FDM modes		Resolution (kHz)→						
Band-width ↓	MHz	12	25	50	100	200	400	800
	7200							<b>2</b>
	3600						<b>2</b>	
	1800					<b>2</b>		
	900				<b>2</b>			
	450			<b>2</b>				
	225	<b>1</b>	<b>2</b>					

TDM modes		Resolution (MHz) →
Band-width	MHz	30
	8000 <del>7200</del>	<b>2</b>

The number in each cell shows the number of polarization products provided: 1 – single pol, 2 – both polarizations.

## General description of modes and performance in

« *The ALMA Correlators* » A. Baudry, ALMA Newsletter, Jan. 2011, No 7

<http://www.almaobservatory.org/en/outreach/newsletter/252-newsletter-no-7>

# Early Science Operations: key dates

- *31 March 2011:* Release of the Call for Proposals for ALMA Early Science Cycle 0 and release of offline Observing Tool.
- *29 April 2011:* Deadline for submission of Notice of Intent.
- *15 May 2011:* Release of Cycle 0 Technical Handbook and intended schedule of compact and extended configuration availability.
- *1 June 2011:* Opening of archive for proposal submission and release of the online version of the Observing Tool.
- *30 June 2011:* Proposal submission deadline.
- *September 2011:* Feedback to proposers on the results from the proposal review process.
- *30 September 2011:* Start of ALMA Cycle 0 observing.
- *February 2012:* One month engineering shutdown during the 2012 Altiplanic winter.
- *30 June 2012:* End of ALMA Cycle 0