

# ALMA and the Czech ARC node

---

**Miroslav Bárta & the ARC-node team**

barta@asu.cas.cz



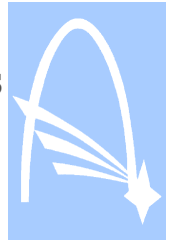
**EUROPEAN ARC**

ALMA Regional Centre || Czech



**Astronomical Institute  
of Academy of Sciences  
of the Czech Republic**

**CZ-25165 Ondřejov**



## What is ALMA?

- ▶ ALMA = **A**taacama **L**arge **M**illimeter/submillimeter **A**rray  
The largest project of contemporary ground-based observational facility in astronomy built in a world-wide international cooperation in Chile
- ▶ The key partners are **ESO**, NRAO and NAOJ
- ▶ System of fifty 12m high-precision antennas + twelve 7m (ACA) phased as an interferometer, + four 12m single-dish (TP)

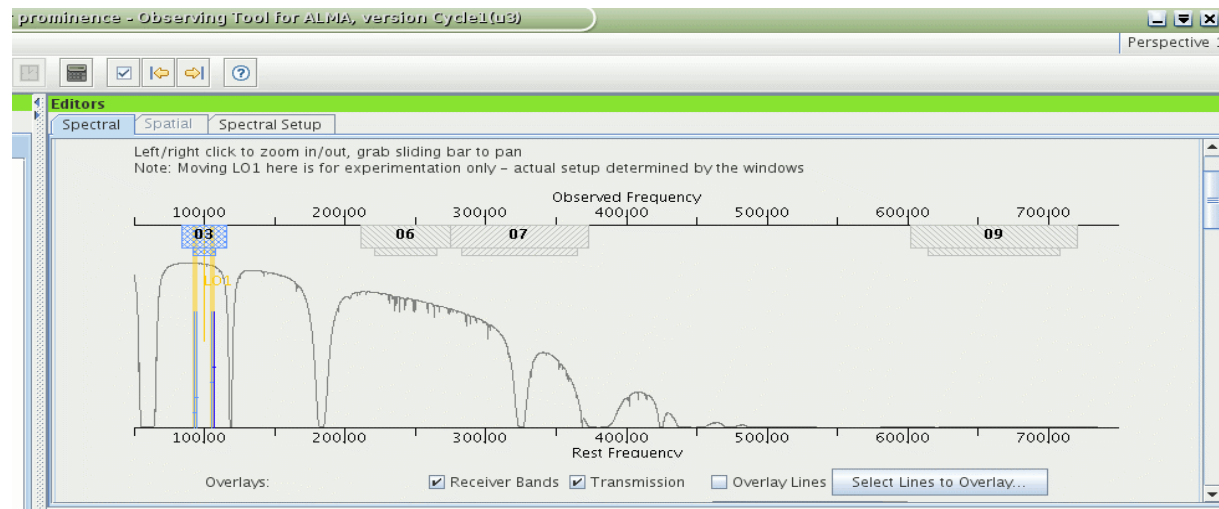
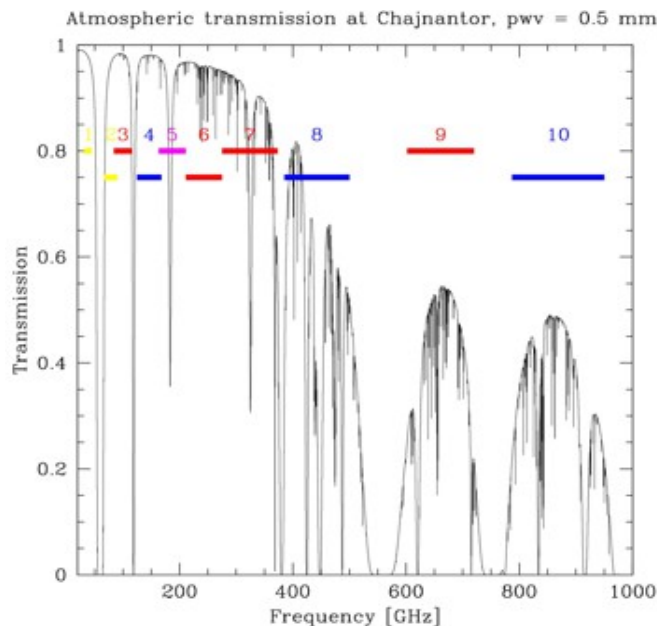


# What is ALMA?

For the first time we (will) have

- ▶ Very high spatial resolution (up to 0.005" in extended configuration @ 1THz)
- ▶ Extremely high spectral resolution – up to 30kHz
- ▶ Temporal resolution for very bright sources (e.g. the Sun) ~ 1s
- ▶ Very high sensitivity

at the same moment in a broad range of frequencies from 30GHz up to more than 1 THz



# Science with ALMA

1. Cosmology and the high redshift universe
2. Galaxies and galactic nuclei
3. ISM, star formation and astrochemistry
4. Circumstellar disks, exoplanets and the solar system
5. Stellar evolution and the Sun

<http://almascience.eso.org>

**Atacama Large Millimeter/submillimeter Array**  
In search of our Cosmic Origins

ESO NRAO NAOJ

Log in | Register | Reset Password | Forgot Account

**About**  
Science  
Proposing  
Observing  
Data  
Documents & Tools  
Knowledgebase/FAQ

You are here: Home

**Welcome to the Science Portal at ESO**

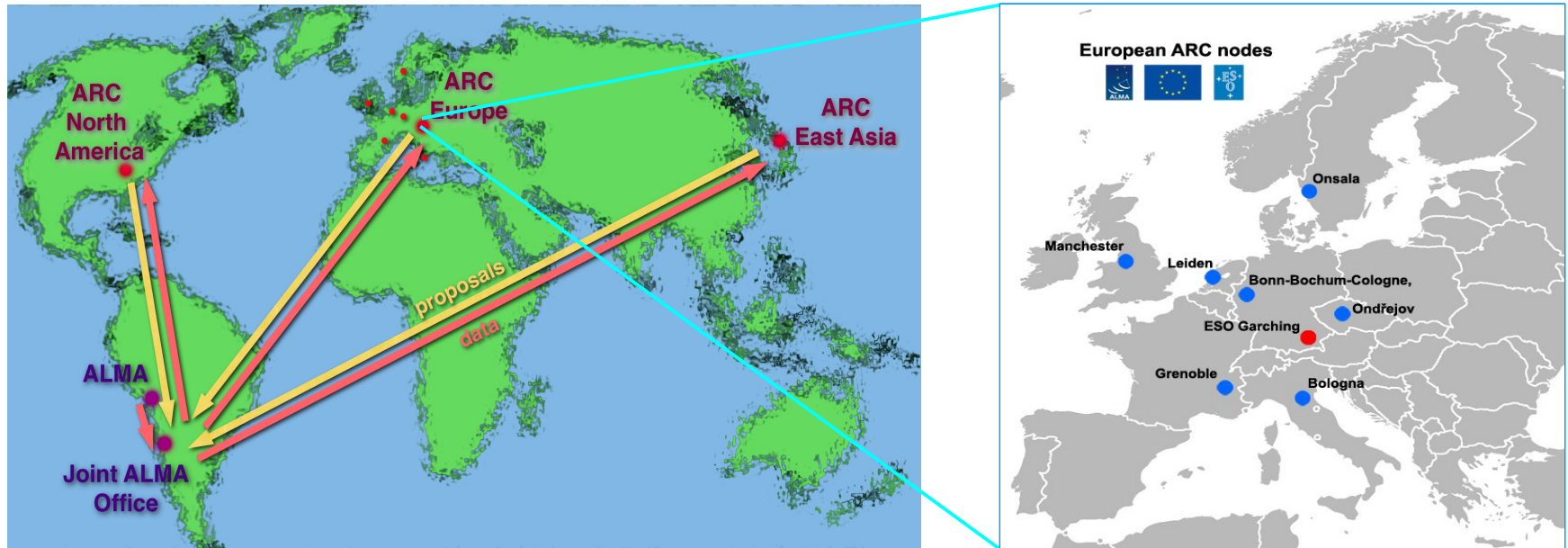
**General News**  
ALMA Status Report: March 2014  
Mar 12, 2014  
ALMA Cycle 2 Call for Proposals closure  
Dec 19, 2013  
Urgent: Cycle 2 Observing Tool Update  
Nov 15, 2013  
ALMA Cycle 2 Call for

## ARCs – user / ALMA interfaces



- ▶ ALMA is very expensive project → high expectations for excellent science
- ▶ Need to address as broad scientific community world-wide as possible
- ▶ The system is very complex at the same moment – not everyone with bright scientific ideas can cope with it.
  - Need to establish a contact network between scientific community and ALMA
    - ALMA regional centers – ARCs

# European ARC and the ARC nodes



## Structure of the European ARC:

- ▶ Head in ESO Garching
- ▶ Seven nodes across Europe
  - ▶ One in Ondřejov

### **Towards user community:**

- ▶ Face-to-face (F2F )support of users in all stages of their ALMA-oriented projects.
- ▶ ALMA-system knowledge dissemination
- ▶ Spreading awareness of ALMA among scientific community

### **Towards ALMA observatory and ALMA-system developers:**

- ▶ Help to the developers of ALMA user software:  
testing of CASA, ALMA OT, ALMA Helpdesk system,  
suggestions for improvement

### **Connecting users ↔ ALMA developers:**

- ▶ Definition of new modes of observation – based on scientific community requests:  
→ use-case studies, simulations, test observations (CSV),  
assembling requirements for system update => suggestions to ALMA observatory and developers.

## F2F user support

### The clients/users are assigned to a node based on:

1. Match between the project and the scientific expertise of the node
2. Geographical locality
3. Client's preference

#### Ondřejov

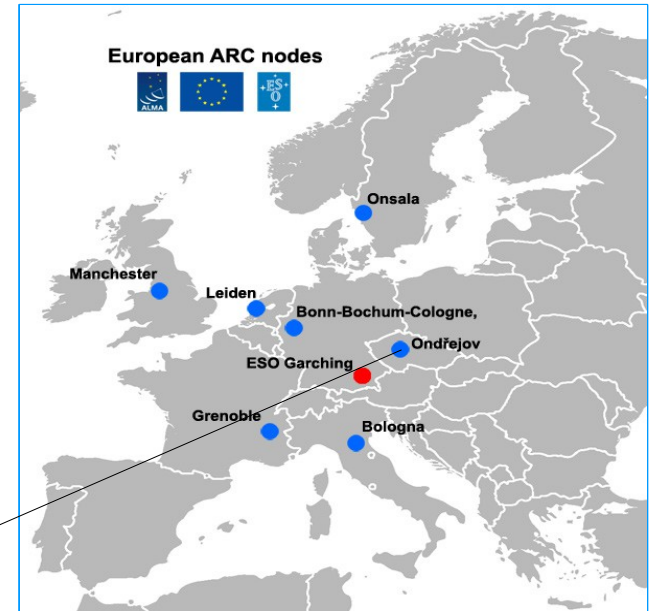
*Countries:* Czech Republic

*Contact person:* M. Karlický

*Staff:* 2 staff astronomers, 2 postdocs, 1 IT support

*Expertise:* Solar and (extra)galactic astrophysics, Laboratory measurements of molecular spectral lines, Observation planning, Data quality check, Data storage and processing, Data reduction using CASA

[Local web pages](#)

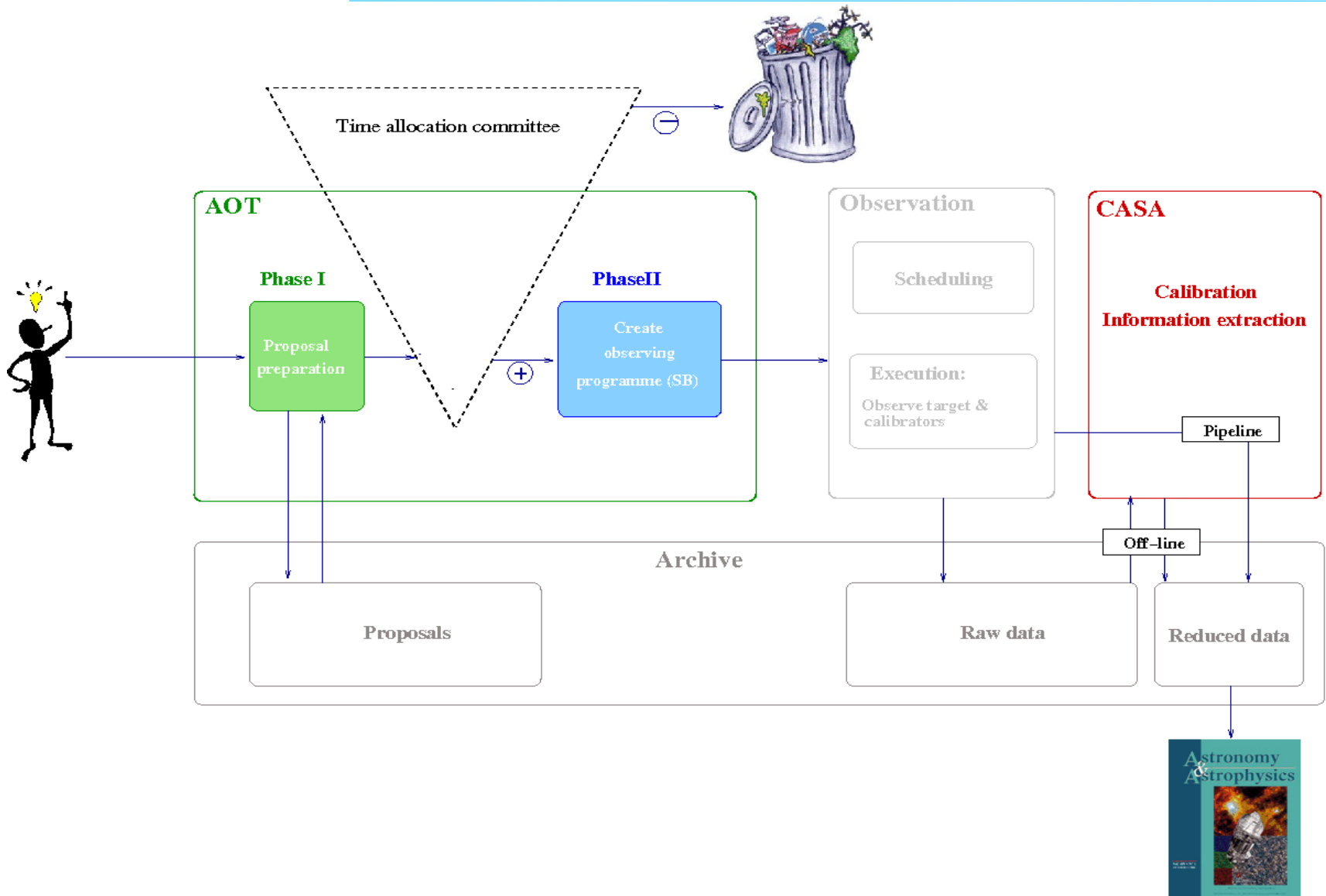


### CZ ARC node Personnel:

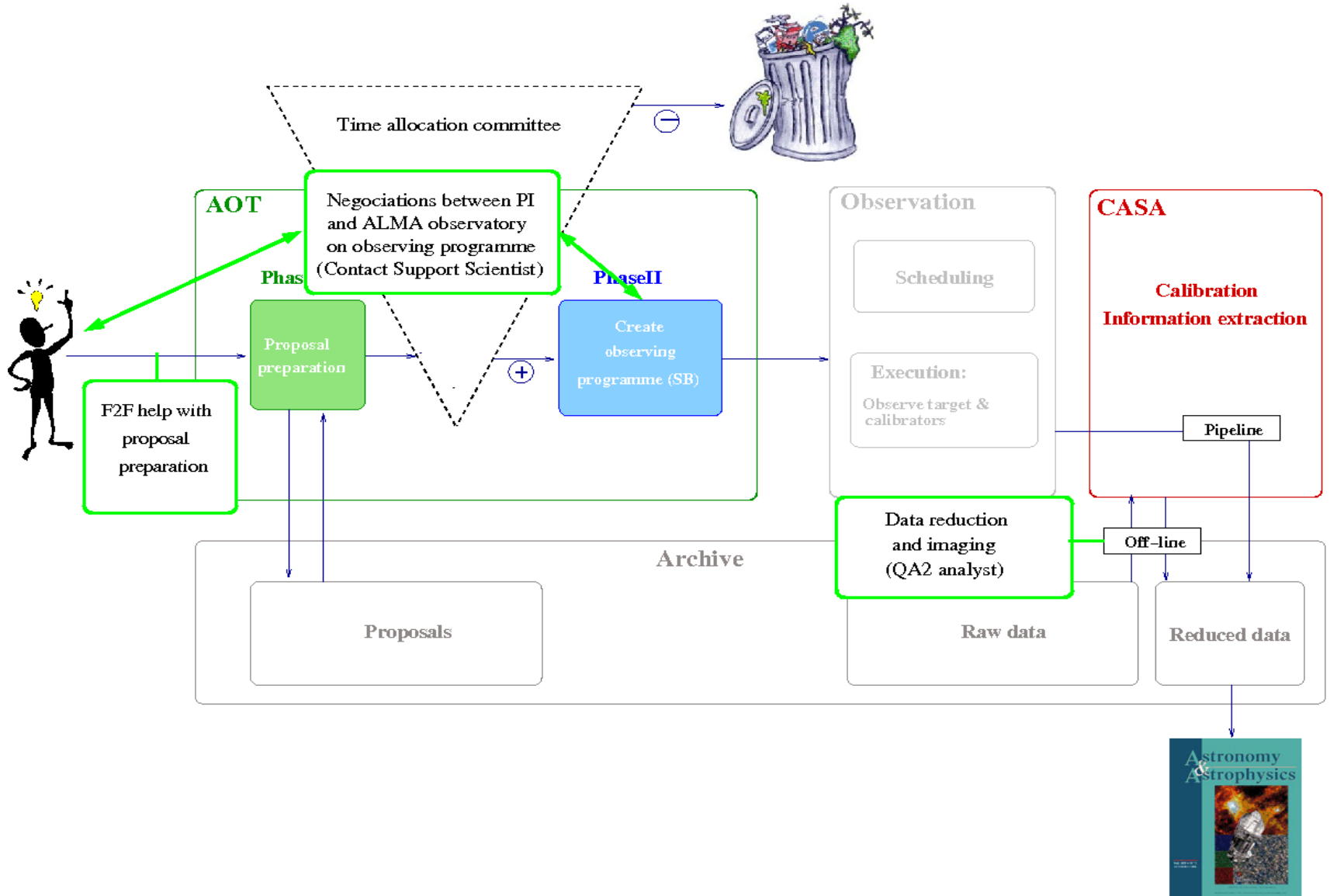
M. Bárta, M. Karlický, B. Dabrowski, P. Jáchym, R. Brajša (Uni Zagreb, HR), S. Štefl (ESO), D. Kunneriath, M. Kraus, Š. Urban (VŠCHT Praha), G. Mann (AIP Potsdam, DE), Ch. Vocks (AIP Potsdam, DE), J. Polách (IT support)



# F2F user support



# F2F user support



### Contribution of the CZ ARC node

- ▶ Share on proposal preparation: P. Jáchym (Cycles 1,2), M. Bárta (Cycle 2)
- ▶ Contact Support Scientist: M. Bárta (Cycle 0), B. Dabrowski (Cycle 1)
- ▶ QA2 – data analysis and information extraction: B. Dabrowski and M. Bárta (Cycle1 data)



## F2F user support

### CZ ARC node visitor room in Ondřejov



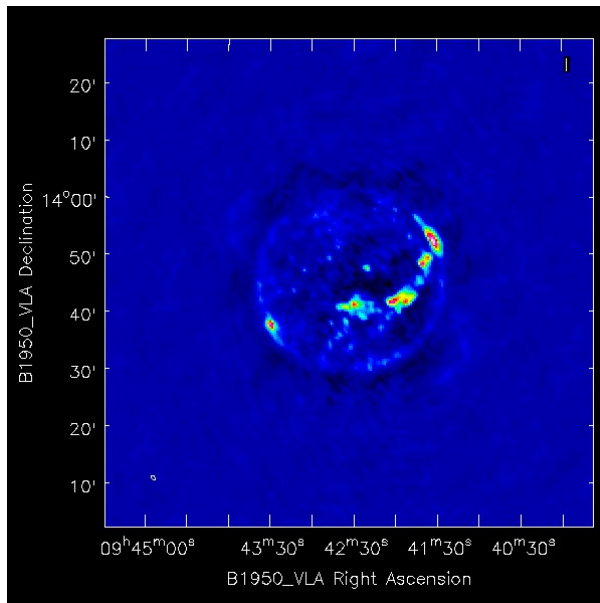
## Knowledge transfer to community

- ▶ ALMA Winter School, Prague, February 2012
- ▶ 2nd Solar ALMA Workshop, Prague, June 2013
- ▶ CESRA Workshop 2013 – special session on ALMA
- ▶ Solar ALMA Wiki pages – <http://wave.asu.cas.cz/SolarAlmaWiki>
- ▶ Papers, lectures

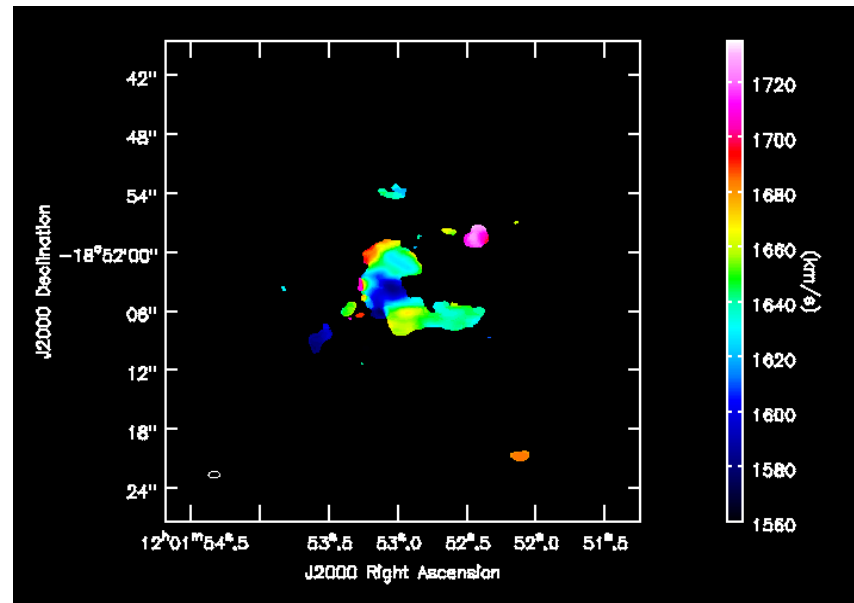


## User software tests

- ▶ CASA: User test 1 (2010), EU ALMA Imaging Group (EACIG - 2011-14), CASA 3.4 test, CASA Sit-together – solar data session (M. Bárta)
- ▶ ALMA OT: AOT user tests (B. Dabrowski, M. Bárta), AOT integrated tests (P. Jáchym, B. Dabrowski, M. Bárta)
- ▶ Helpdesk system: User test (B. Dabrowski)



CASA Sit-together: Solar data from VLA



EACIG: Antennae galaxies in ALMA

## Community-driven ALMA upgrades: Solar observing mode

- ▶ Less than 1% of total observing time was planned for solar observations in the original ALMA Design Reference Science Plan (DRSP)
- ▶ View changed later substantially: Daytime observations of weak (extra) galactical sources difficult/impossible (water vapour, enhanced atmospheric turbulence)
- ▶ Can be somewhat corrected for the Sun (WVR or direct measurement of WV absorption line)
- ▶ Technical arrangements at ALMA site: Appropriate roughness of the dishes, radio flux attenuator
- ▶ Increasing interest of ALMA community in solar observations
- ▶ **CZ ARC Node** plays coordination role in this activities: Solar ALMA Wiki, Solar ALMA Workshop, **ESO project “Solar Research with ALMA”**

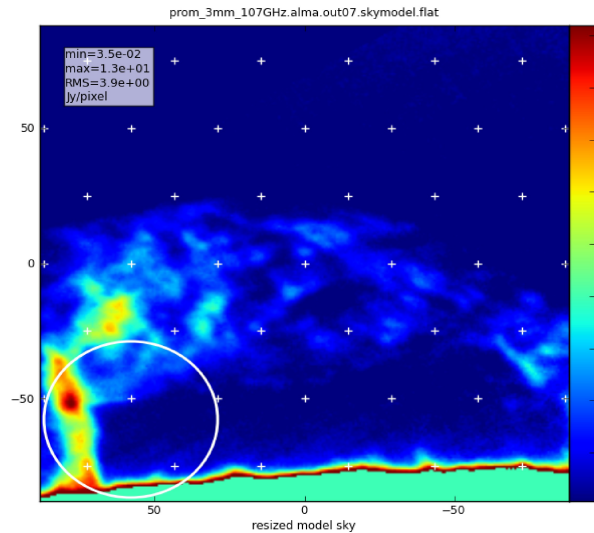
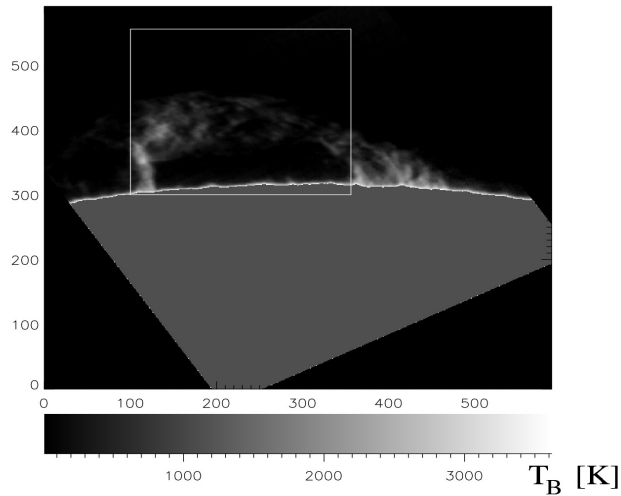
## ESO-granted project “Solar Research with ALMA”

- ▶ PI: R. Brajša (affiliated with the node), bidders for the ARC node: M. Karlický, M. Bárta
- ▶ 70 kEUR for 24-30 months
- ▶ Expected start: May 1st, 2014 (we are about to sign a contract)
  
- ▶ 3 main working packages:
  - ▶ WP1: Use cases for solar research with ALMA
    - Develop a set of detailed use cases for solar observing with ALMA
  - ▶ WP2: Solar Observing Modes and Calibration
    - Define new solar observing modes and analyse calibration requirements
  - ▶ WP3: Software Requirements
    - Produce requirements for observing preparation, execution and reduction
  
- ▶ Project team:
  - ▶ Core: R. Brajša, M. Bárta, B. Dabrowski, M. Karlický, P. Heinzel + a new postdoc 100% paid from the project
  - ▶ External collaborators: A. Hanslmeier, M. Temmer (Uni Graz, AT), A. Benz (FNHW Windisch, CH), E. Kontar (Uni Glasgow, UK), S. White (US Air Force Research Lab, Albuquerque, US), T. Bastian (NRAO, Charlottesville, US), M. Loukicheva (Uni St. Petersburg, RU)



# ESO-granted project "Solar Research with ALMA"

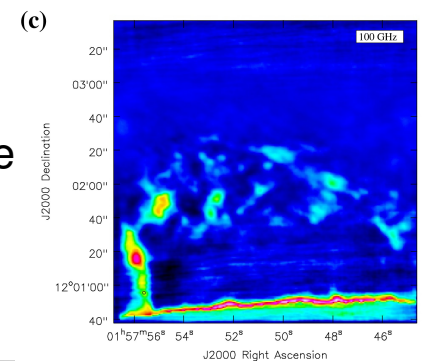
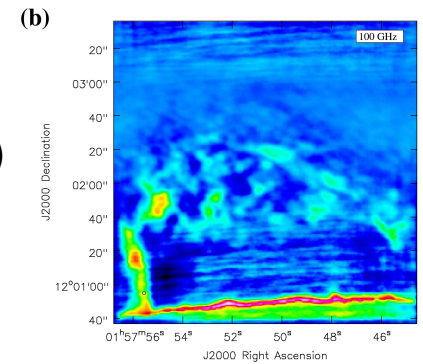
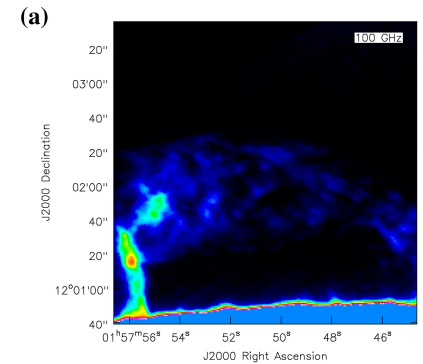
Simulation using `CASA::simobserve()`, imaging using `CASA::clean()`



Model data

Single continuum (1 SPW)

4 SPWs – better u-v coverage



- ▶ ARCs and ARC nodes (in Europe) provide interface between the ALMA observatory and scientific community
- ▶ The main tasks of ARC nodes are
  - ▶ Serve with direct support to users throughout their ALMA projects
  - ▶ Help the ALMA SW developers to test the user software packages
  - ▶ Help the user community to promote new observing modes
- ▶ One of the seven European ARC nodes is located in Ondřejov
  - ▶ In spite it belongs to the smallest one in the network, it provides (to some extent) all standard services to the user community and ALMA SW developers
  - ▶ Promotes (based on contract with ESO) a new ALMA observing mode: solar observations

**Thank you for your attention!**

**Questions?**