ALMA OT Demo

Case study: Gas and dust in local minor merger remnants

Based on demo by Kate Rowlands (Johns Hopkins University)

Atacama Large Millimeter/submillimeter Array
Expanded Very Large Array
Very Long Baseline Array

Downloading the ALMA OT

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

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Observing Tool

The ALMA Observing Tool (OT) is a Java application used for the preparation and submission of ALMA Phase 1 (observing proposal) and Phase 2 (telescope runfiles for accepted proposals) materials. It is also used for preparing and submitting Director's Discretionary Time (DDT) proposals. The current *Cycle 5* release of the OT is configured for the present capabilities of ALMA as described in the Cycle 5 Call For Proposals. Note that in order to submit proposals you will have to register with the ALMA Science Portal beforehand.

Note that preparation of Cycle 4 DDT proposals needs to be done using the Cycle 4 version of the Observing Tool. This version of the OT can be found in the DDT page, or the Phase 2 menu.

Download & Installation

The OT will run on most common operating systems, as long as a **64-bit version of Java 8** is installed (see the troubleshooting page if you are experiencing Java problems). The ALMA OT is available in two flavours: Web Start and tarball.

The **Web Start** application is the recommended way of using the OT. It has the advantage that the OT is automatically downloaded and installed on your computer and it will also automatically detect and install updates. There are some issues with Web Start, particularly that it does not work with the Open JDK versions of Java such as the "Iced Tea" flavour common on many modern Linux installations. The Oracle variant of Java should therefore be installed instead. If this is not possible, then the tarball installation of the OT is available.

The **tarball** version must be installed manually and will not automatically update itself, however there should be no installation issues. For Linux users, we also provide a download complete with a recommended version of the Java Runtime Environment. Please use this if you have any problems running the OT tarball with your default Java.

Webstart Tarball

Do not upgrade to Java 9!

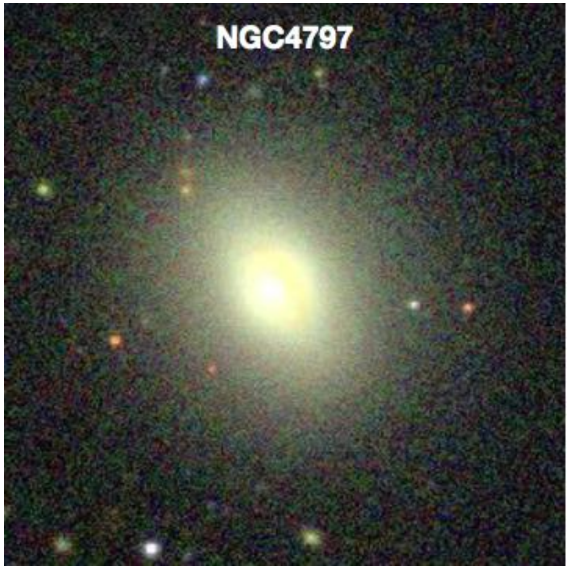
Documentation

Extensive documentation is available to help you work with the OT and optimally prepare your proposal:

Demo Overview

Science case - Minor mergers are an important process in galaxy evolution. While major mergers often enhance star-formation, minor mergers have been shown to suppress star-formation (Davis et al. 2015). We will use ALMA to determine the underlying physical cause of this intriguing effect.

Goal - This proposal aims to study the gas velocity and distribution in a minor merger remnant (NGC 4797), to distinguish between dynamical suppression, gravitational heating and AGN/starburst feedback. We will also map the dust continuum across the region to reveal the sources of dust heating, and to compare with optically obscuring dust.



Science Goals

Proposals consist of one or more "Science Goals" (SG)

Each SG has a specified observational properties (sensitivity, resolution, spectral setup, etc.) to be obtained for one or more sources or mosaics.

This demo will entail two SGs.

Science Goal 1

- Objective: spectrally resolve the 12CO 1-0 line.
- First task is to enter properties of the source (NGC 4797).
- Desired resolution is 1.5”. Important to have in mind because brightness is specified in flux density / beam.
- From previous detection of this line, we know the peak CO line flux is 4.60 mJy/beam and the line width is 450 km/s.
- We will also probe the continuum around this line. Its brightness is 0.304 mJy/beam (estimated from fitting a modified blackbody to fluxes at shorter wavelengths).
- Next step is to create a baseband with a spectral window centered on the line. Want to resolve with line with <10 km/s resolution.
- Setup remaining 3 basebands to observe continuum.
- CO line with be our “representative window”.

Science Goal 1

- Recall our desired resolution is 1.5″.
- Actual delivered resolution will be $\pm$20% of requested value.
- Set largest angular scale (LAS) = 2.0″ because in early-type galaxies such as NGC 4797 the gas is usually found within 0.5 effective radii (Davis et al. 2013).
- We want to detect line at SNR of 5. So set out desired sensitivity to 4.6/5 = 0.92 mJy/beam. You request sensitivity, not time!
- Set the "bandwidth used for sensitivity" to 10 km/s because we will spectrally average to this channel width during data reduction.
- Time estimate shows that this can be accomplished with one 12-m configuration.
- We can increase LAS to 20″ to see how 7-m array gets added.

Science Goal 1

- Note that sensitivity can be achieved in one “scheduling block” (SB).
  - A SB includes time on source and all required calibrations
  - Min (max) time on each source is 5 (50) minutes
  - Max length of a SB is 2 hours
  - Executed multiple times (not necessarily sequentially) until desired sensitivity is achieved
- Be sure to explain your choices in the “Technical Justification”
- Technical Justification also shows SNR for line and continuum.

Science Goal 2

- Objective: image the dust continuum in band 9 at high resolution to match the spatial resolution of existing optical data from HST.
- Desired resolution is 0.05”.
- Let’s say we know the source continuum brightness is 2.0 mJy/beam.
- For continuum-only observations, the OT will automatically setup the basebands in the optimal way.
- Note the mirrored spectral windows using 90-degree Walsh switching.
- Want SNR = 5, so request sensitivity of 0.4 mJy/beam.
- Desired LAS is 2.0”. Want to cover 10” x 10” region, so use a mosaic.
- Can see (and adjust) the mosaic size, orientation, and position in the viewer.

Finish the Proposal

- Tool → Display Project Time Summary
- Validate
- Submit!
- Can resubmit as often as needed, but server is busy right before the deadline!
- OT re-validates each science goal before submitting.
- All proposals subject to Technical Assessment by JAO and ARC experts.