CASA/Pipeline Updates

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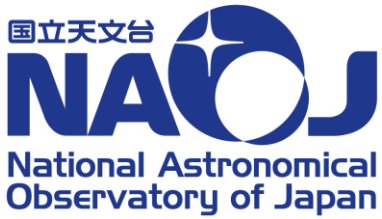
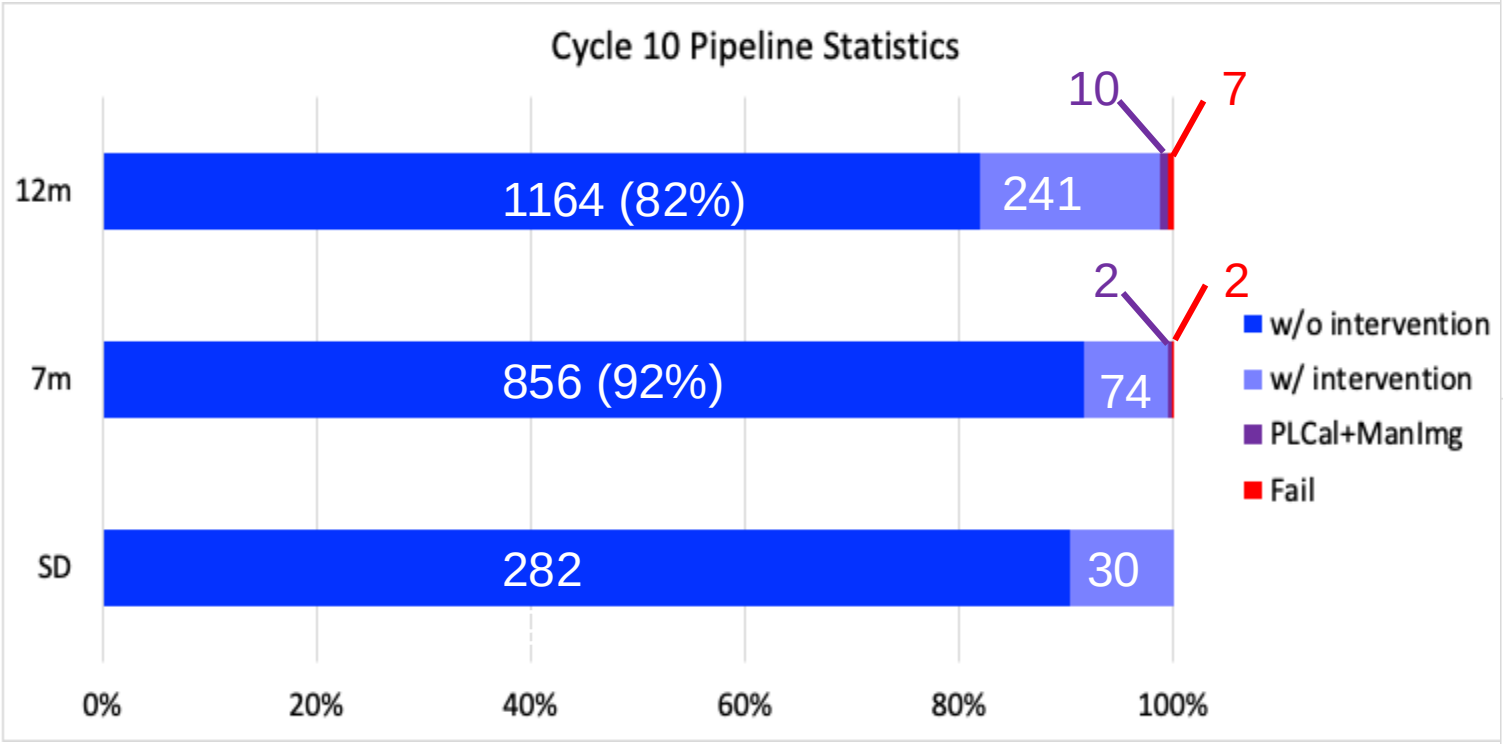
on behalf of CASA and Pipeline teams



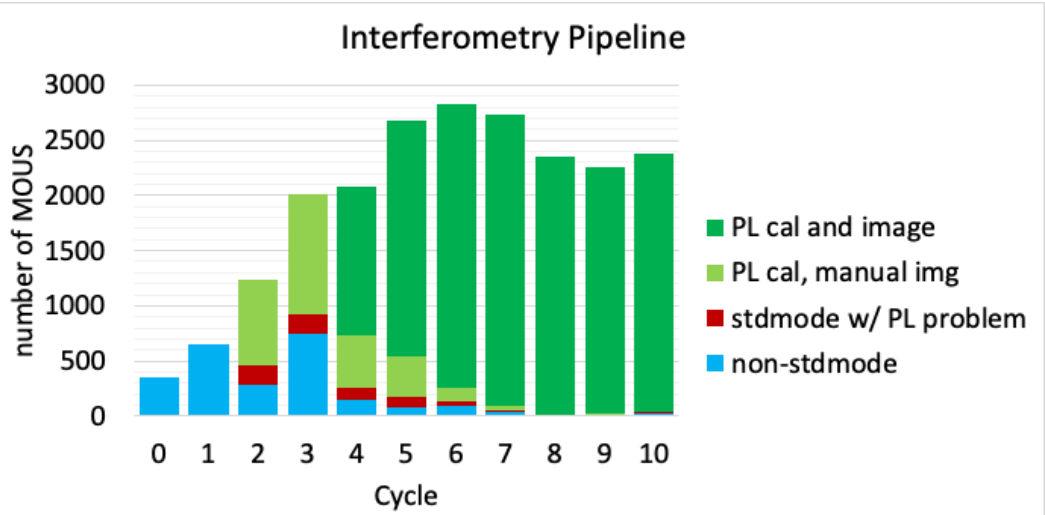
Operation of Cycle 10 Pipeline

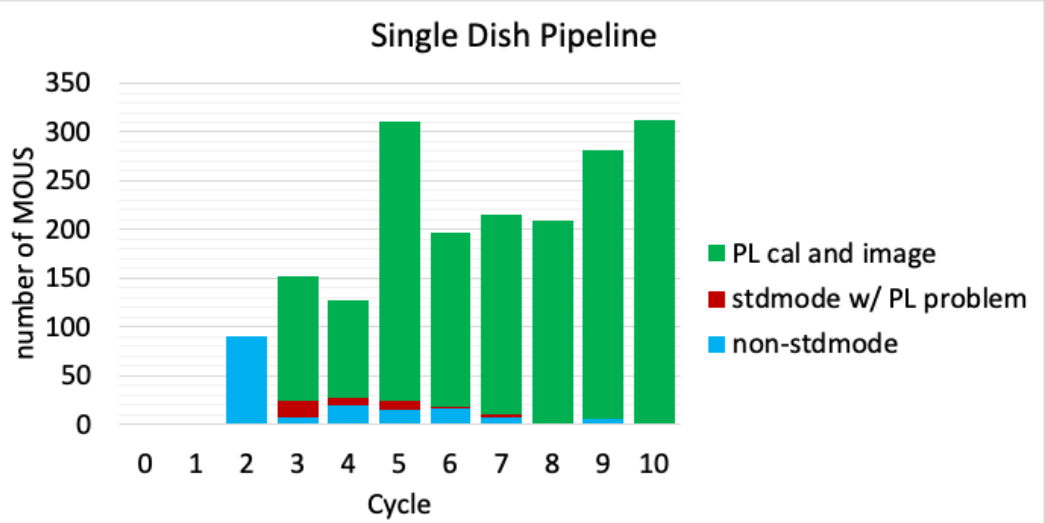
Data processing with pipeline goes very well



NOTE: This is preliminary result as data processing is still ongoing

(As of Dec. 12th 2024)





CASA and Pipeline Releases

CASA (https://casa.nrao.edu/casa_obtaining.shtml)

- Incremental release (every 2-3 months)
- Modular (pip wheels) and monolithic (tar-ball)
- CASA 6.6.3 (Feb. 2024), CASA 6.6.4 (Jun. 2024), CASA 6.6.5 (Sep. 2024)

Pipeline (https://almascience.nao.ac.jp/processing/science-pipeline)

- One release/year/project
- Packaged with CASA as a tar-ball
- **2024.1.0.8 + CASA 6.6.1.17 for ALMA Cycle 11, Nobeyama**, and VLA
- 2024.1.1 will support VLA and the new SRDP (Jan/Feb 2025)

Highlights of CASA Updates (1/3)

- Please see Release Information of casadocs for details
  - CASA 6.6.5
    https://casadocs.readthedocs.io/en/v6.6.5/

Infrastructure

- Update on platform support: see Compatibility Matrix for detail
  - **Python 3.8 is no longer supported** in the latest release, CASA 6.6.5
  - **Python 3.10 is the primary version for both modular and monolithic releases**
  - macOS ARM native build is available (Intel support might end soon)
- NB: casaviewer (including interactive CLEAN) is no longer included in macOS release
- CASA data has been managed by **casaconfig** module as of CASA 6.6.4 (see External Data section for detail)

Highlights of CASA Updates (2/3)

Interferometry

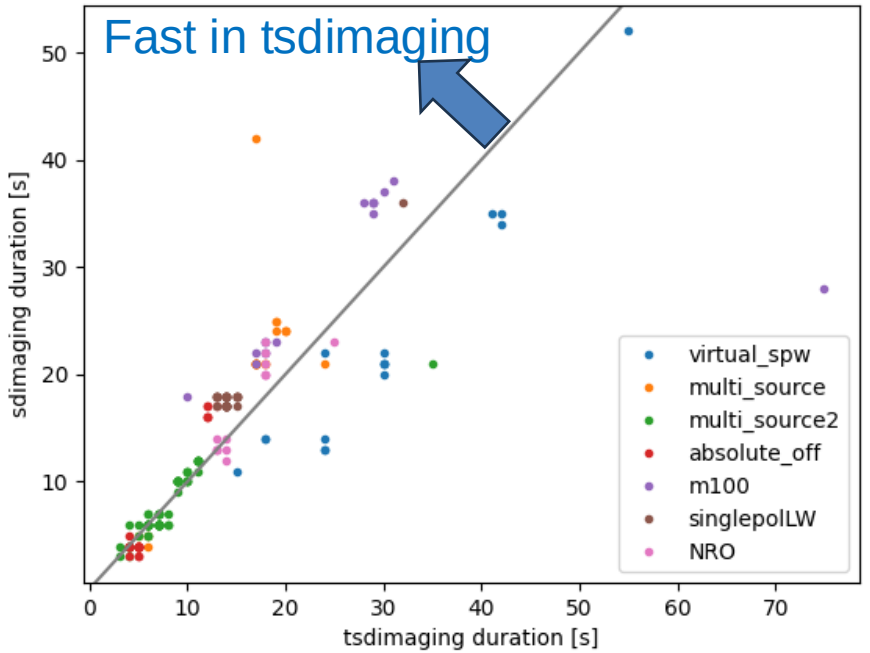
- **casaviewer:** the CASA viewer has been removed from MacOS packages; new exceptions have been added to *imview, msview,* and interactive modes of *tclean,* deconvolve and *sdintimaging;* the deprecated viewer taks is now removed (CASA 6.6.5)
- **CASA Docs:** new CASA Memo 13 - a guide towards achieving scalable parallelization for imaging large cubes. (CASA 6.6.5)
- **wvrgcal:** available in python 3.10 release, partially re-written to be compatible with python3.10. (CASA 6.6.5)
- **tclean/sdintimaging:** now sorts input list of MSes in chronological order. (CASA 6.6.3)
- **tclean/sdintimaging:** now checks for mismatches in column states when given multiple input MSs. (CASA 6.6.3)
- **getantposalma** – a new task to query ALMA antenna position web service and return list of antenna ITRF positions. *(CASA 6.6.4)*
- **msuvbin** - a new task to grid the visibility data onto a defined uniform grid (in the form of an ms) can be used to reduce data volume

* Information for "iclean" is available here

Highlights of CASA Updates (3/3)

Single-Dish

- Imaging task in SD
  - **sdimaging/tsdimaging:** added new parameter *'interpolation'* to specify the spectral interpolation rules. Default has been changed from 'nearest' to 'linear' *(CASA 6.6.5)*
  - **tsdimaging** now replace to sdimaging as the default imaging task
    - sdimaging will be deprecated in near future
    - tsdimaging's performance is almost comparable to the performance to the sdimaging for most of the observing cases
    - Solar TP image has ~30% time performance improvements with tsdimaging
- SD baseline fitting
  - Improvement for the sinusoidal function fitting
    - **sdbaseline**: per spectrum sinusoidal fitting for baseline subtraction *(CASA 6.6.5)*



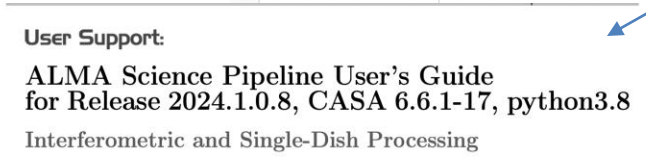
A direct comparison of sdimaging and tsdimaging runtime in CASA 6.6.0. Data points with different color present data obtained with different observing modes or from different telescopes. Grey line indicates the runtime of these tasks are equal.

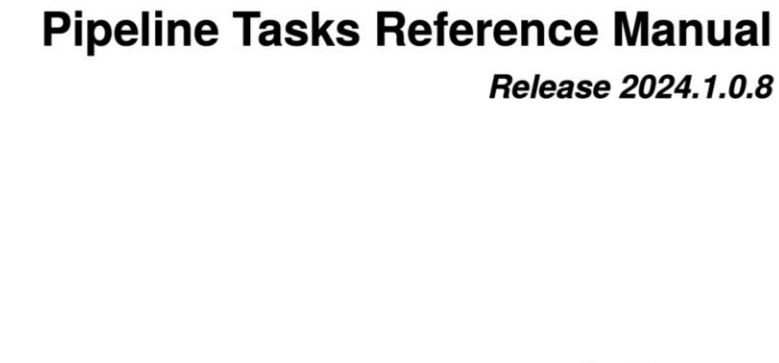
Highlights of Pipeline Updates (1/3)

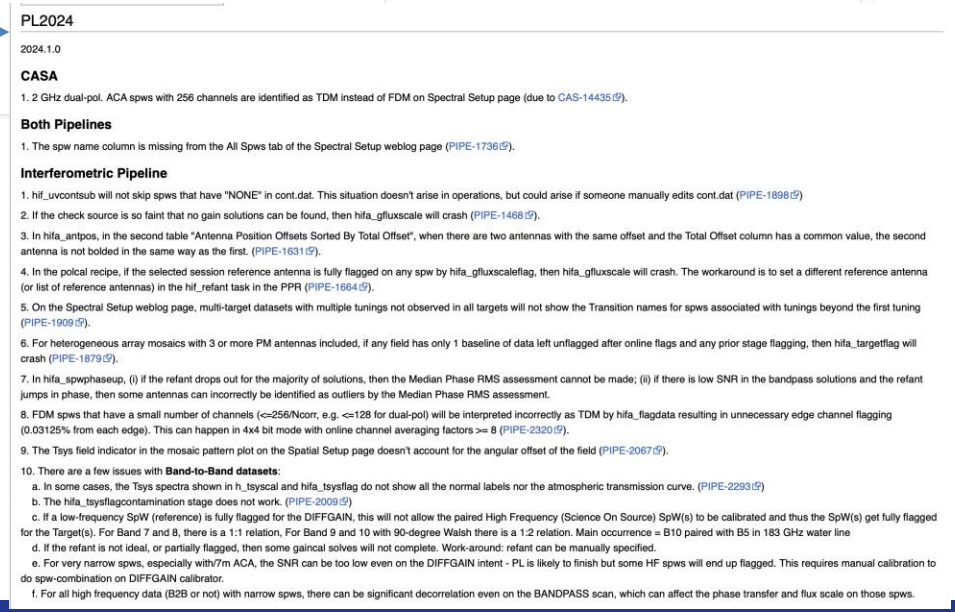
- Please see User's Guide for details of PL (https://almascience.nao.ac.jp/processing/science-pipeline)

CASA versions accepted for ALMA data processing:

CASA version	Pipeline branch and version	Pipeline Documentation	Description	used in operations	tarball for most modern OS available for each	versions that can be used to restore these data with scriptForPI.py
6.6.1.17	2024.1.0.8	User's Guide Reference Manual 2024 Pipeline 2024 known issues	Cycle 11	2024-09-30	casa-6.6.1-17-pipeline-2024.1.0.8-py3.8.el8.tar.xz casa-6.6.1-17-pipeline-2024.1.0.8-12.0-py38.dmg	most recent





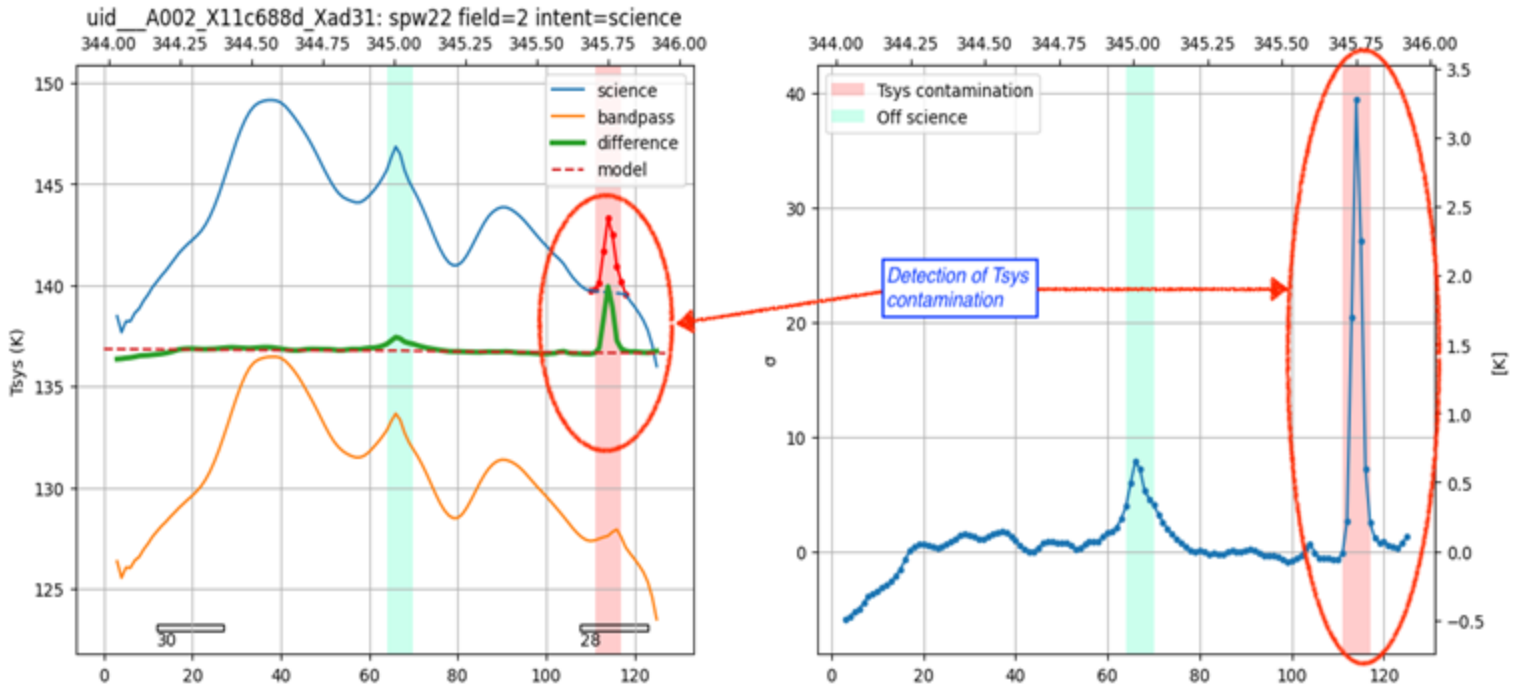


Highlights of Pipeline Updates (2/3)

Interferometry

- Implementation of Band-to-Band calibration
- Adding a new stage

"Tsys contamination flagging"



✓ If astronomical emission line is contaminated in the Tsys spectra, flag them

- Some improvements
  - ✓calibrated visibity flagging, self-calibration, findContiuum

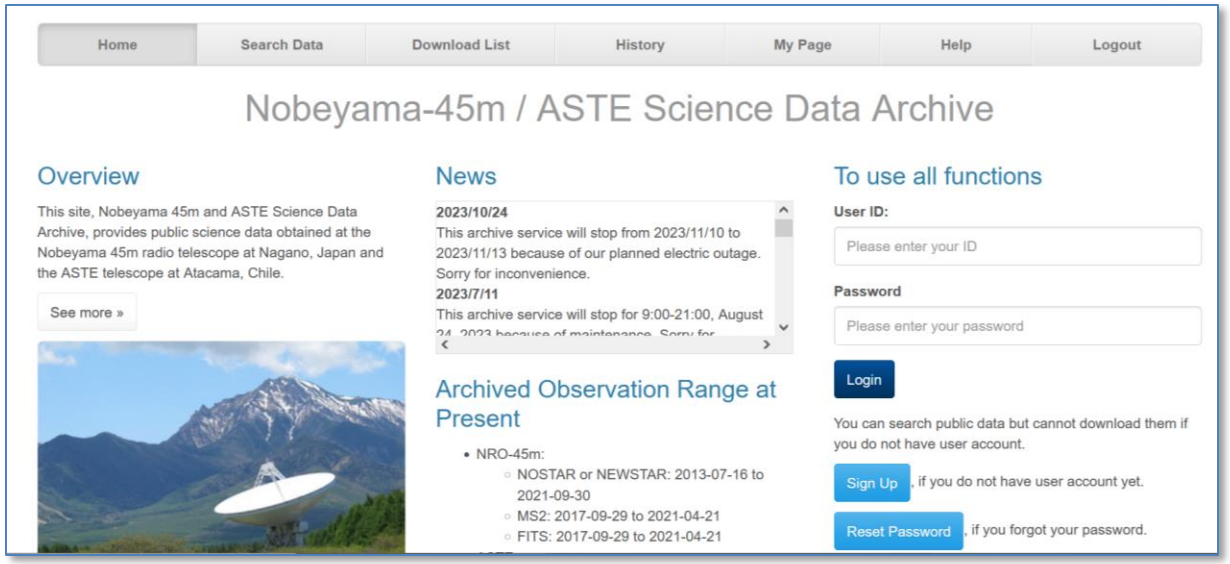
Highlights of Pipeline Updates (3/3)

Single-Dish

- Deprecation of sdimaging
  - ✓ Imaging operation has been replaced with more versatile imaging task, tsdimaging
- Improvement of baseline subtraction
- Improvement of visualization
- Implementation of polynomial fitting function
- Improvement of the QA scoring
  - ✓increasing overall (observations & data deliver) efficiencies

Nobeyama Pipeline and Science Data Archive

- https://nobeyama-archive.nao.ac.jp/ (since 2017/8/21)
- NRO SAM45 data and ASTE MAC/WHSF data
- 61562 raw data (nostar or newstar format, 2013 - 2024)
- For 5857 NRO OTF data (2017-2023), MS2 format data and FITS format data (made by Nobeyama-pipeline)
- 317 users
- Server machine was replaced and all observation data until May 2024 are stored.

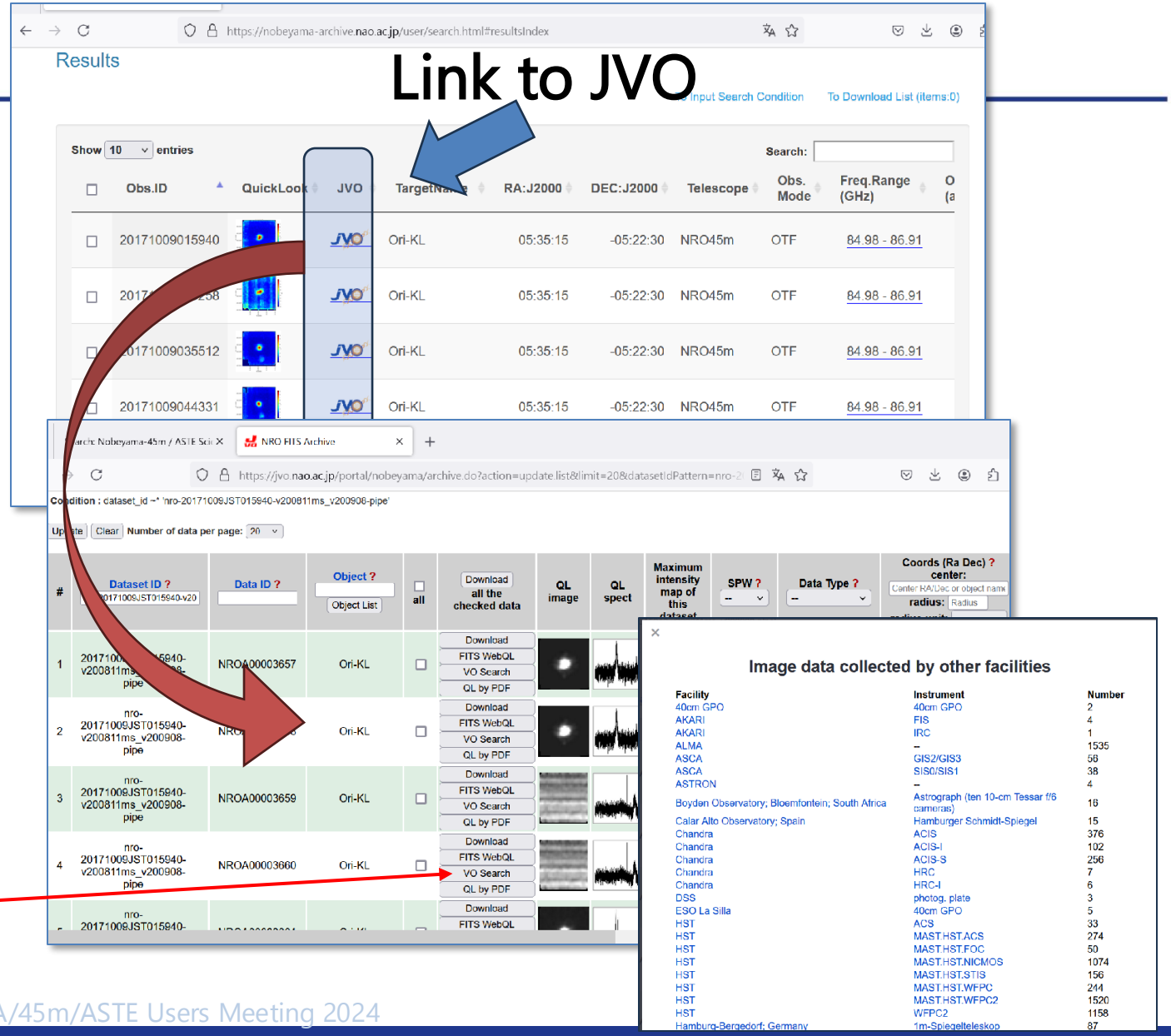


(*As of December 12, 2024)

New JVO Service

- A new column linking to JVO (Japan Virtual Observatory; http://jvo.nao.ac.jp) for FITS data (pipeline-processed)

- JVO
  - download FITS data
  - operate “WebQL” (online tool to analyze FITS)
  - search other images taken by various telescopes via “VO search”



Plans of Pipeline and CASA releases in 2025

CASA 6.7

- ***getantposalma*** - to get absolute antenna positions from online database
- ***tclean -*** new interactive clean, improvements to tclean reffreq calculation
- ***phaseshift*** - ability to specify multiple fields
- Establish E2E /Stakeholder's test for the single-dish mode
- ***sdbaseline*** - Further functionality improvements regarding the sinusoidal fitting
- Deprecate ***sdimaging***
- Bug fixes and user facing issues

Pipeline 2025

- Improve the QA scoring accuracy for efficient observations and data delivers (automation)

No new development is planned for the legacy CASA and pipeline, rather efforts move to RADPS-ALMA toward the ALMA Wideband Sensitivity Upgrade (WSU) and ngVLA

RADPS

= Radio Astronomy Data Processing System

Primary Objective:

Develop a data processing system that supports production and use of high-level data products for ALMA-WSU and the ngVLA

Secondary Objective:

Support the continued evolution of radio astronomy data processing through a widely accessible package enabling specialization and innovation at facilities and universities

*For more information, please see the following link; https://safe.nrao.edu/wiki/bin/view/Software/CASA/DUCUsersCommittee2024

Thank you for your attention