CASA/Pipeline Updates

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on behalf of CASA and Pipeline teams

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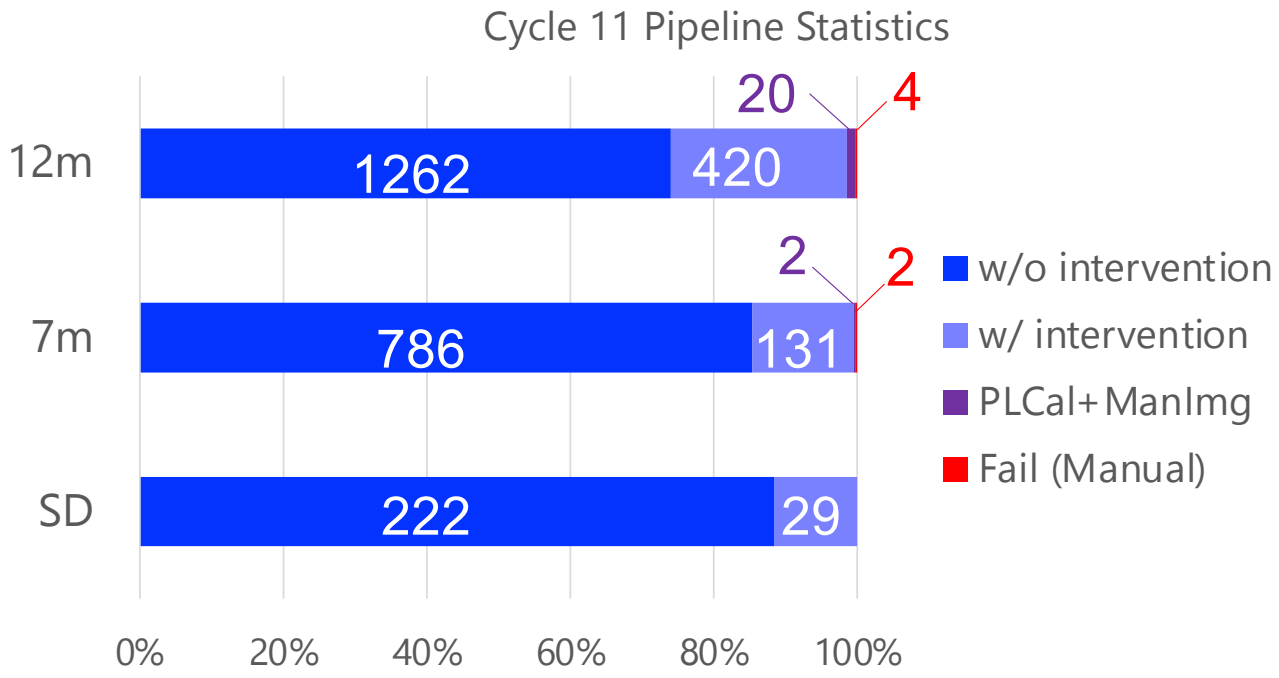
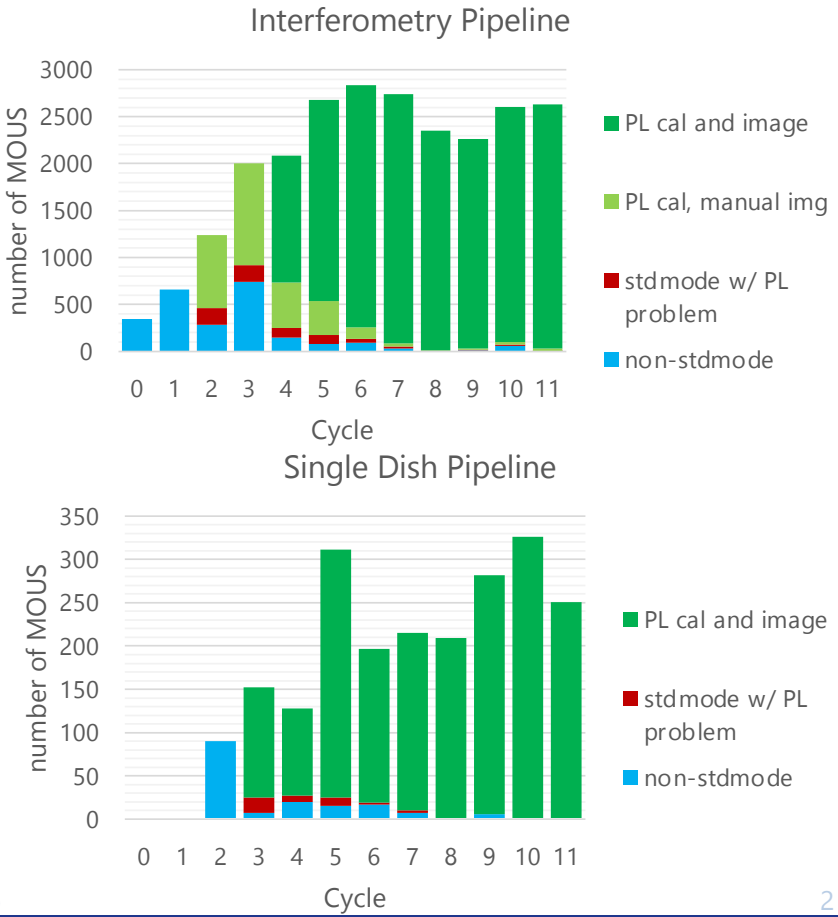
Operation of Cycle 11 Pipeline

Data processing with pipeline goes very well

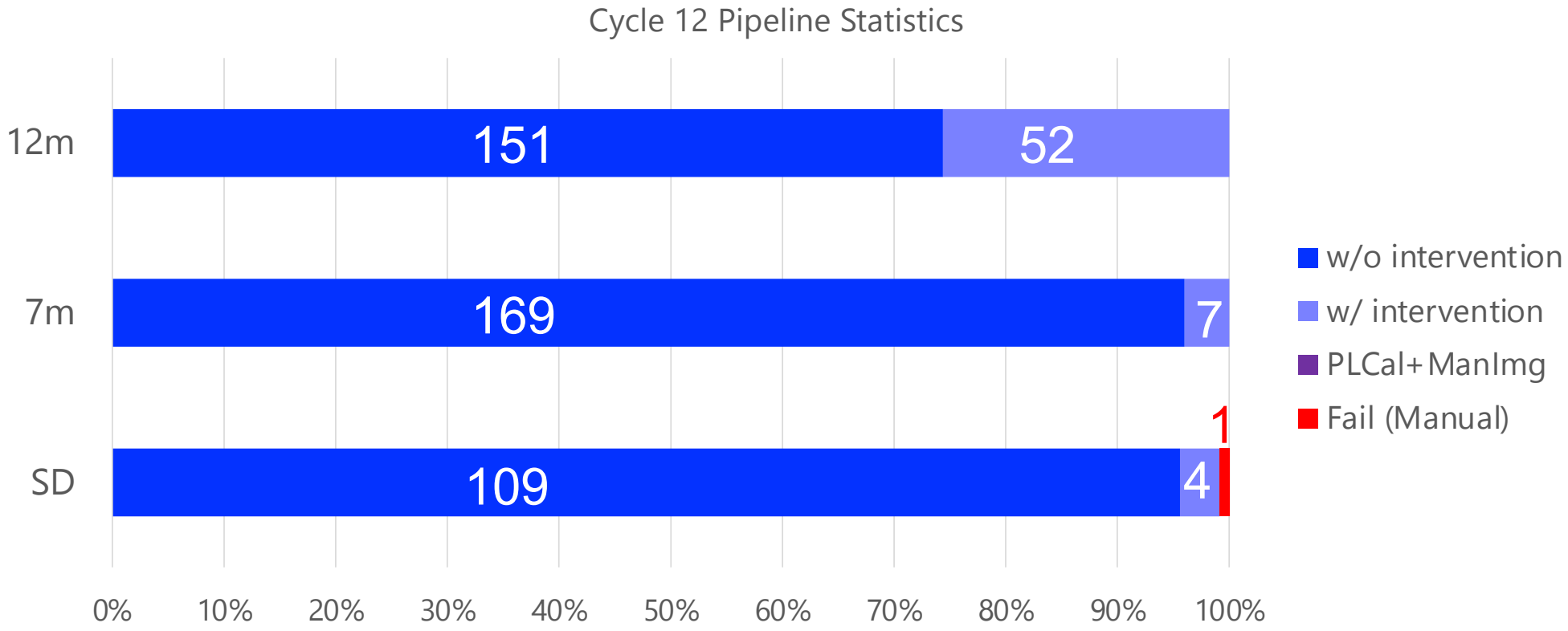


(As of Dec. 4 2025)



Operation of Cycle 12 Pipeline

Good start :) A new function (P12) works well to prevent crash the SDPL



(As of Dec. 4 2025)

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 6.7.0 (Feb. 2025), CASA 6.7.2 (Oct. 2025)

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

- One release/year/project
- Packaged with CASA as a tar-ball
- **2025.1.0.35 + CASA 6.6.6.17 for ALMA Cycle 12,** Nobeyama

Highlights of CASA Updates (1/3)

- Please see Release Information of casadocs for details
  - CASA 6.7.2
    https://casadocs.readthedocs.io/en/v6.7.2/notebooks/introduction.html

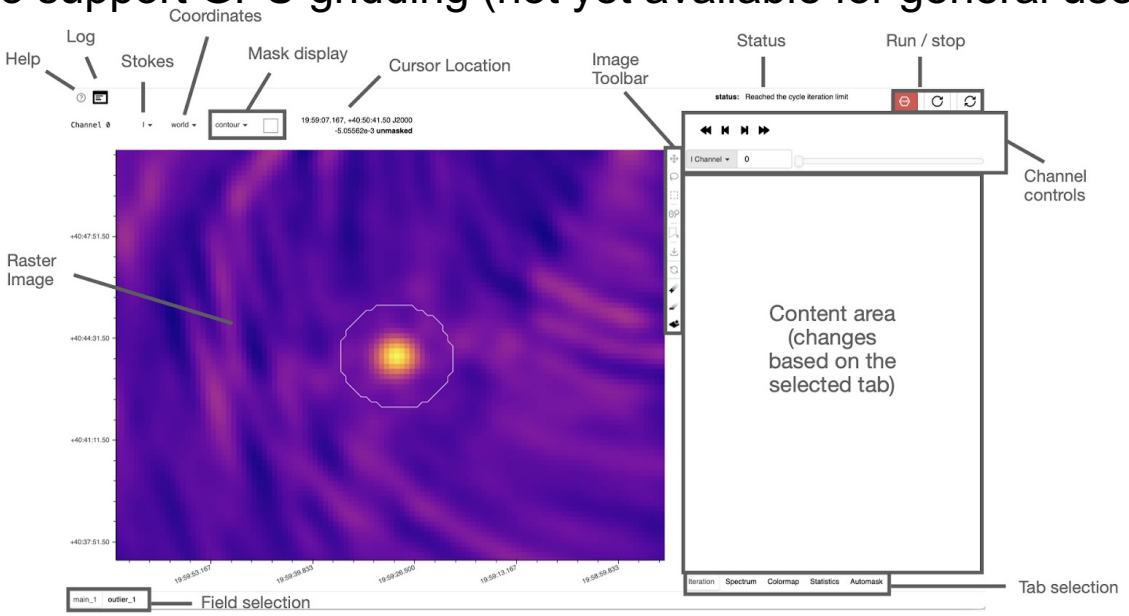
Infrastructure

- Update on platform support: see Compatibility / Testing page for detail
  - **Python 3.10 is no longer supported** in the latest release, CASA 6.7.2
  - **Python 3.12 is the primary version for both modular and monolithic releases**
  - macOS ARM native build is available, **dropped support of macOS Intel**
- iclean is available (https://casadocs.readthedocs.io/en/stable/notebooks/interactive_clean.html)
- ATM (atmosphere) library updated to ALMA Cycle 12

Highlights of CASA Updates (2/3)

Interferometry

- **iclean**: new interactive clean widget. (CASA 6.7.2)
- **msuvbinflag**: new experimental task to flag outliers in the UV plane. (CASA 6.7.2)
- **tclean**: initial work to support GPU gridding (not yet available for general use). (CASA 6.7.0)



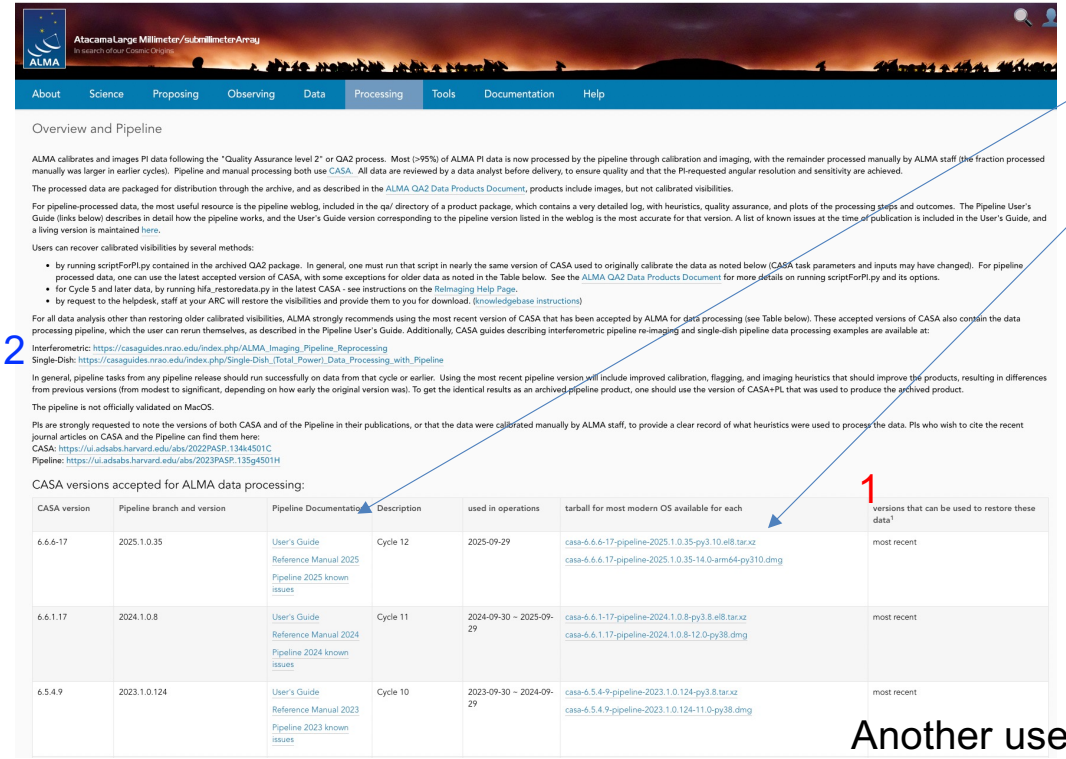
Highlights of CASA Updates (3/3)

Single-Dish

- Sinusoidal fitting has been fully implemented
  - Sinusoidal fitting has been fully implemented. It is now fully compatible with Pipeline usecase.
- Deprecating sdimaging is planned in the next CASA release (CASA ver. 6.7.3, expected in early Feb, 2026).
- End-to-end test for the development purpose
  - Calibration and imaging processes following manual procedure to check new functionality before each release.

Highlights of Pipeline Updates (1/3)

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



Documentation

Download

Updates since the last Users MTG

1. Summary of which PL/CASA can process for each cycle

2. Examples of data processing (TP is new)

Another useful documentation: ALMA QA2 Data Products for Cycle 12

Mirroring Package Provided by EA-ARC

Download will finish faster from the following URLs

CASA only (mac OS) : https://alma-dl.mtk.nao.ac.jp/ftp/casa/distro/casa/release/

CASA only (Linux) : https://alma-dl.mtk.nao.ac.jp/ftp/casa/distro/casa/release/rhel/

Pipeline : https://alma-dl.mtk.nao.ac.jp/ftp/casa/distro/casa-pipeline/release/linux/

Please select CASA packages corresponding your OS versions

Highlights of Pipeline Updates (2/3)

Interferometry

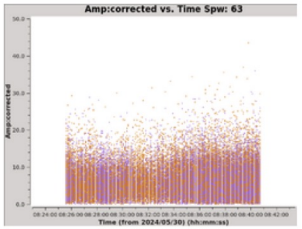
- Calibration improvements: The calibration of data with faint (low SNR) calibrator sources, including high frequency (HF), long baseline, and Band-to-Band (B2B), has been extended to handle more severe cases that previously failed to calibrate (next slide)
- Self-calibration; It covers mosaic targets, and its heuristics for long baseline data have been improved
- IQUV science target imaging capabilities have been introduced and added to the polarization recipes
- Some improvements, bug fix
  - ✓QAscores have been improved for hifa_bandpass and the Amp/Ph-Freq component of hif_applycal

Calibration improvements: HF/Long Baseline/B2B

low SNR refactor for BP/DGC

PL2024

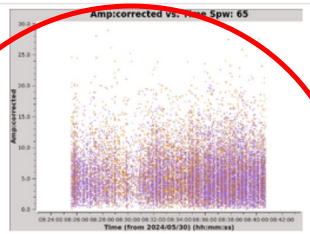
Missing solves, lost data at phase-up



Spectral Window 63

Intents: BANDPASS

Calibrated data before flagging.



Spectral Window 65

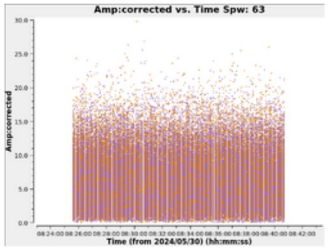
Intents: BANDPASS

Calibrated data before flagging.

Phase-up on bandpass calibrator

Measurement Set	Phase-up Solution Parameters	
	Type	Interval
uid___A002_X1181695_X437c.ms	Phase only	56.826s

PL2025



Spectral Window 63

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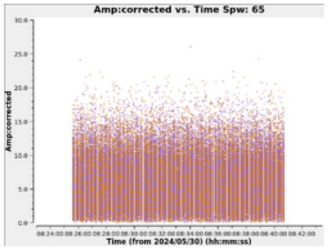
Calibrated data before flagging.



Spectral Window 65

Intents: BANDPASS

Calibrated data before flagging.

Spectral Window Phase Offsetting and Phase-up on the Bandpass Calibrator

Measurement Set	Phase-up Solution Parameters		
	Type	Interval	Combine
uid___A002_X1181695_X437c.ms	Phase only	Infinite	False
uid___A002_X1181695_X437c.ms	Phase only	18.144	True

```
uid___A002_X1181695_X437c.ms: computing optimal solint based on aggregate bandwidth.
Using combine='spw' and phaseup solint of '18.144' in MS uid___A002_X1181695_X437c.ms
```

Using aggregate BW, needs only 18s for SNR =20 phase-up

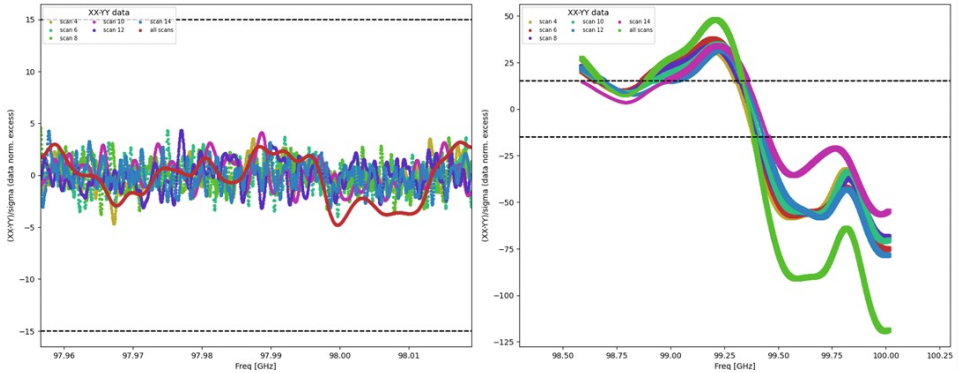
No data loss and better phase-up

Highlights of Pipeline Updates (3/3)

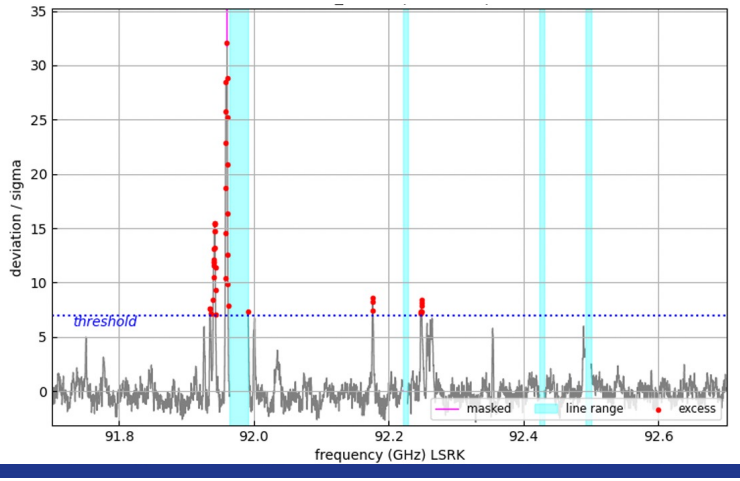
Single-Dish

- New QA scores; calibrated amplitude vs. time; residual emission in line-free channels of images
- New plots; Jy/K as a function of time; amplitude vs time
- **Allow per-spw specification of fitfunc and fitorder** (see details in CASA guide)
- Bug fix; calculation of theoretical rms etc.

Analysis of difference between two polarization

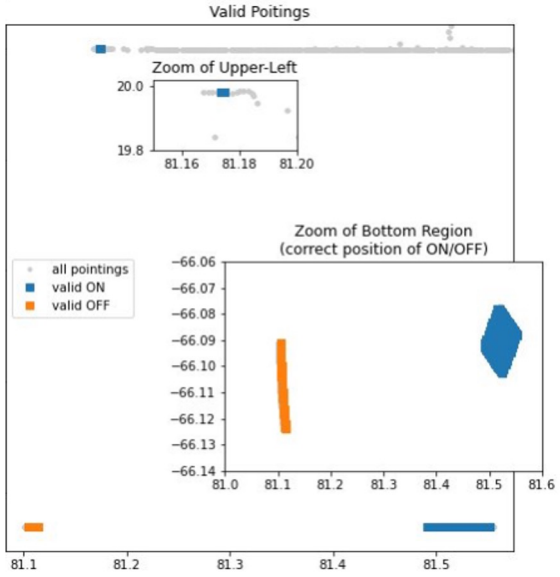


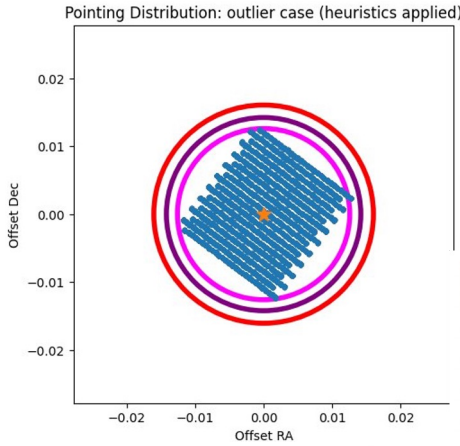
Diagnostic plot for possible missed line

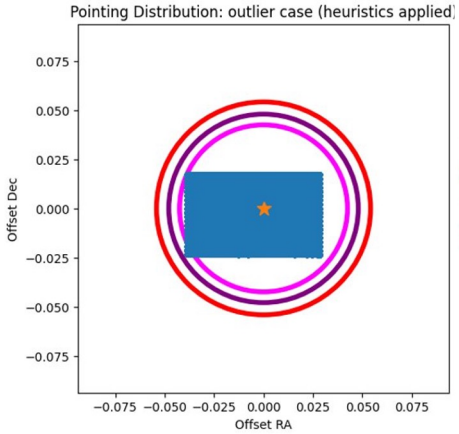


New function to flag outlier pointing data

PL try to create a large map and crashed







Outside of the red circles, data points would be flagged as outliers

inner circle: median_dist * sqrt(pi)
middle circle: median_dist * 2
outer circle: median_dist * sqrt(13 * pi / 8)

QA Score: 0.83 Pointing outliers detected in "uid___A002_Xfb5463_Xfc27.ms" , Field "LHA_120-N49", Antenna "PM03". Flagged time range is 2022/07/13/14:31:12.224000~2022/07/13/14:31:12.928000. Max separation from nominal field center is 86.07 deg. *All QA Scores (2 blue, 12 green)*

Score	Reason
0.89	10.79% data in uid___A002_Xfb5463_Xfc27.ms flagged by online, shadow, qa0, qa2, before and template flagging agents
0.83	Pointing outliers detected in "uid___A002_Xfb5463_Xfc27.ms" , Field "LHA_120-N49", Antenna "PM03". Flagged time range is 2022/07/13/14:31:12.224000~2022/07/13/14:31:12.928000. Max separation from nominal field center is 86.07 deg.
0.97	6.79% data in uid___A002_Xfa2f45_X19140.ms flagged by online, shadow, qa0, qa2, before and template flagging agents
1.00	No pointing outliers detected in "uid___A002_Xfa2f45_X19140.ms".
0.97	6.68% data in uid___A002_Xfb5463_X49ff.ms flagged by online, shadow, qa0, qa2, before and template flagging agents
1.00	No pointing outliers detected in "uid___A002_Xfb5463_X49ff.ms".

inner circle: median_dist * sqrt(pi)
middle circle: median_dist * 2
outer circle: median_dist * sqrt(13 * pi / 8)

Details will be presented by Nakazato-san in SPIE

Plans of Pipeline and CASA releases in 2026

CASA 6.7

- Bug fixes and user facing issues
- Stress testing toward WSU
- (IF) **simobserve**: users can choose correlator efficiency
- (SD) Setting a new task to retrieve Jy/K data from observatory hosted database, aiming to be ready for Pipeline 2026.

Pipeline 2026

- (IF) Imaging refactor
- (TP) Implementation of sinusoidal baseline fitting
- Improve the QA scoring accuracy for efficient observations and data delivers (automation)

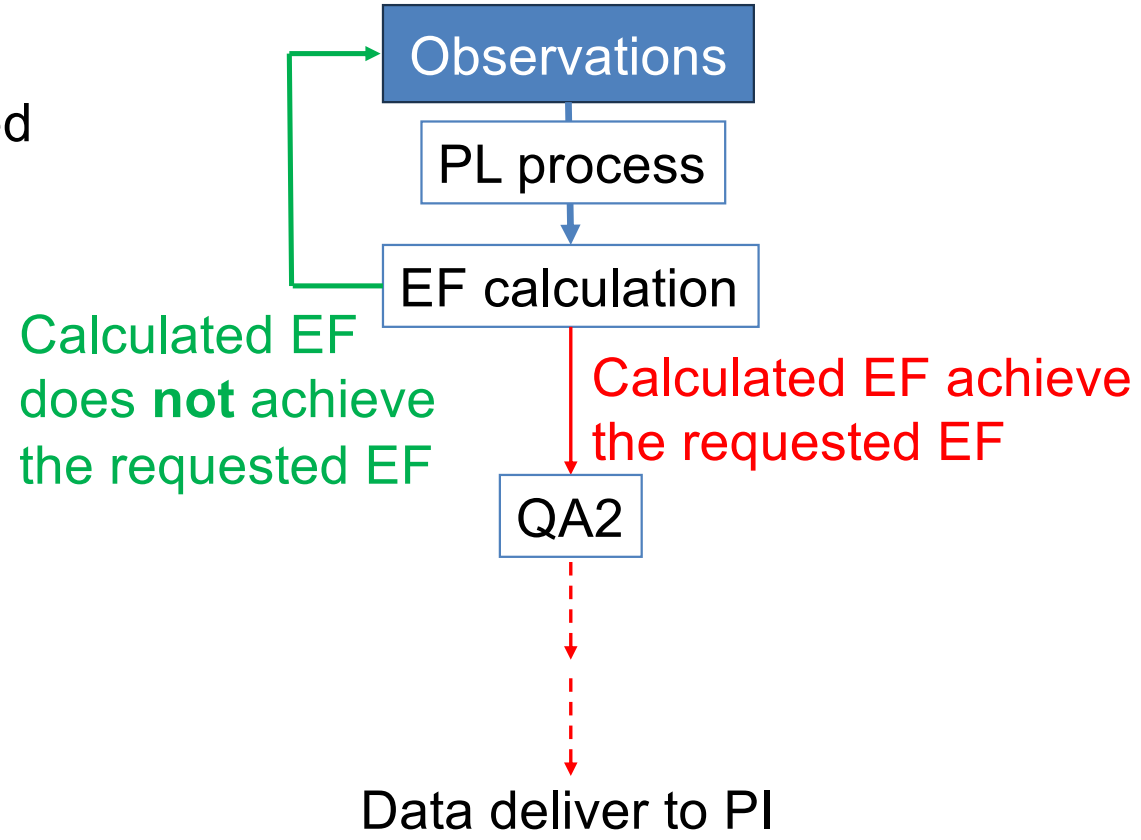
= Fast Feedback (FFB) project, Fast/Slow Lanes

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

Fast Feedback

- **Fast Feedback (FFB)**
  - ✓Execution Fraction (EF) is calculated using PL outputs
  - ✓Obtain more accurate EF than the former calculation method
  - ✓Possibility to request additional observations when current array configuration is still in place
  - ✓Judging of necessarily of additional observations becomes much faster

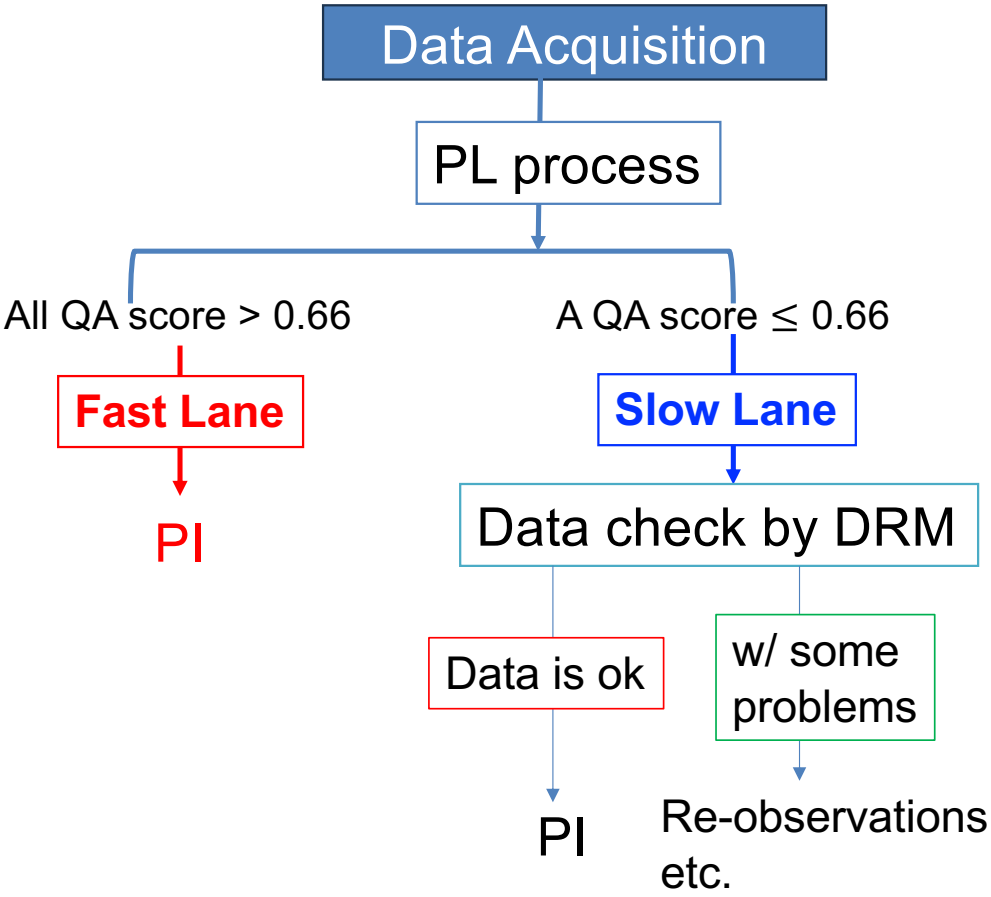
Under testing



Fast/Slow Lanes Projects

- **Fast Lane/Slow Lane**
  - ✓The data will be delivered to PI without checking by DRM, if all of the QA scores are enough high judged by PL; go to Fast lane
  - ✓If the data set has a low QA score, the data will be checked by DRM; go to Slow lane
  - ✓PI can get data sooner after observations

IF is starting
TP is under statistical studies



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

Progress:

- ✓ System Requirements Review was completed in Feb. 2025
- ✓ Prototyping is ongoing
- ✓ Preliminary Design Review is scheduled in July 2026

Thank you for your attention