CASA/Pipeline Updates
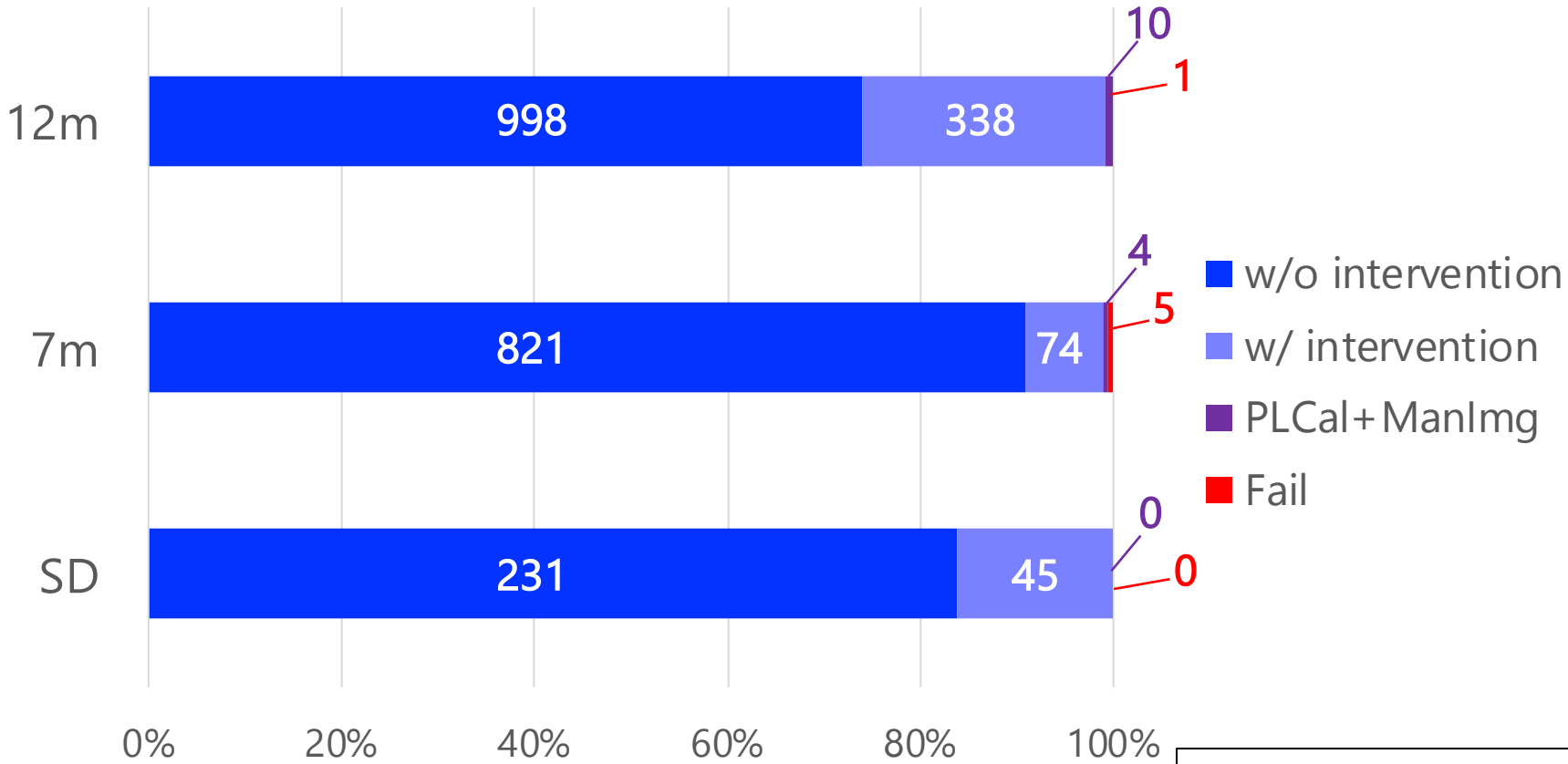
Takuma Izumi, Takeshi Nakazato, Kanako Sugimoto, and Satoko Takahashi (NAOJ)

on behalf of CASA and Pipeline teams
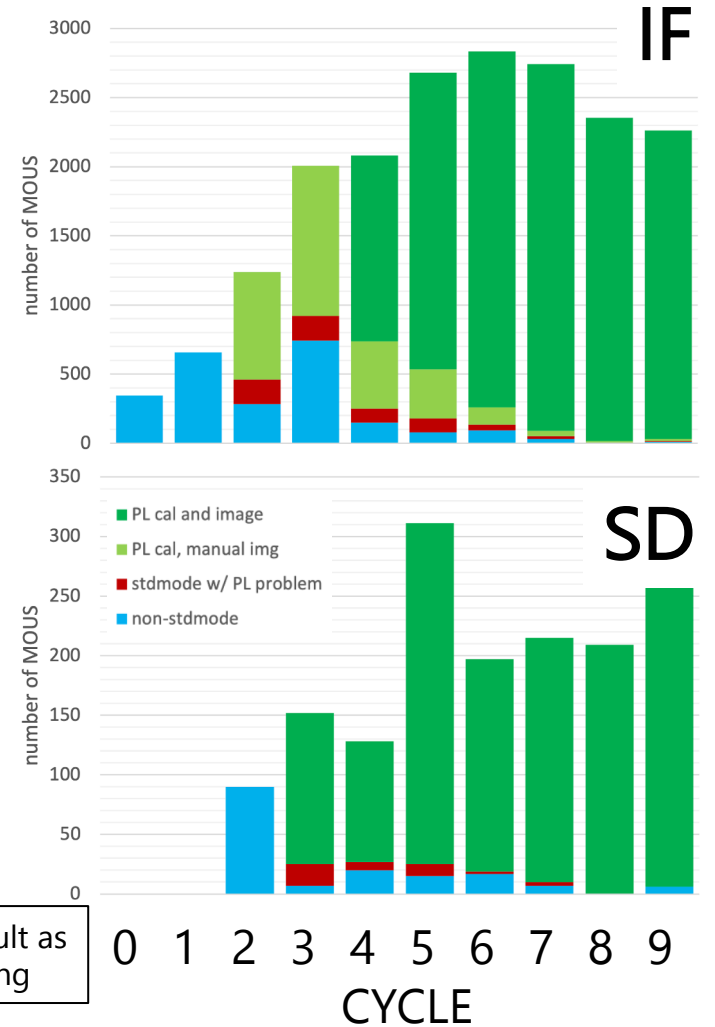
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Operation of Cycle 9 Pipeline

CASA and Pipeline Releases

CASA

- Incremental release (every 2-3 months)
- Modular (pip wheels) and monolithic (tar-ball)
- CASA 6.5.3 (Feb. 2023), CASA 6.5.5 (Apr. 2023), CASA 6.5.6 (Jul. 2023)
- CASA 6.6.0 (Oct. 2023)

Pipeline

- One release/year/project
- Packaged with CASA as a tar-ball
- **2023.1.0.124 + CASA 6.5.4 for ALMA Cycle 10, Nobeyama**, VLA, and NRAO SRDP
- 2023.1.1.7 + CASA 6.5.4 for VLASS

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Highlights of CASA Updates (1/3)

- Please see Release Information of casadocs for details
  - CASA 6.5.x
    https://casadocs.readthedocs.io/en/v6.5.6/notebooks/introduction.html
  - CASA 6.6.0
    https://casadocs.readthedocs.io/en/v6.6.0/notebooks/introduction.html

Infrastructure

- Update on platform support: see Compatibility Matrix for detail
  - **Python 3.6 is no longer supported** in recent releases
  - RHEL8 + py3.8 is the performance benchmark for developers
  - Added support for **Python 3.10 (modular release only)**, Python 3.11 in progress
  - Added support for macOS 13 ARM
- prototyping for next generation CASA for WSU- started initial development
- telemetry/crash reporter has been deprecated and removed as of 6.6.0
- clarified log message has been added for handling non-conformant multi-MS input

Highlights of CASA Updates (1/3)

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  - CASA 6.5.x
    https://casadocs.readthedocs.io/en/v6.5.6/notebooks/introduction.html
  - CASA 6.6.0
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NOTE:
There is a mistake in the compatibility matrix. There is no monolithic package based on Python 3.7 although the matrix says that there are such packages. Python 3.7 is supported only on modular release.

Highlights of CASA Updates (2/3)

Interferometry

- new **msuvbin** task (visibility gridding)

- new **uvcontsub** task implementation but yet w/o combination of spws → old version = uvcontsub_old (with combine = "spw")

- active development for VLBI calibration capability

- **tclean**: *gridder=awproject* was commissioned for *specmode=cube*

- prototyping for next generation CASA (ngCASA)
  - **AstroHack** - antenna holography data analysis package
  - **xradio** - data I/O
  - **graphviper** - HPC
  - **astroviper** - scientific algorithm development

Highlights of CASA Updates (3/3)

Single-Dish

- performance improvement of imaging tasks
  - added new parameter for efficient direction conversion to **sdimaging** (porting to **tsdimaging** is ongoing)
  - ~20% performance improvement (CASA 6.6.0) of **tsdimaging** for spectral line imaging

- fixed long-standing data selection bug in **sdimaging** (and possibly other tasks)

- prototyping for next generation CASA (ngCASA)
  - **xradio**: enable importing single-dish MS into new data format
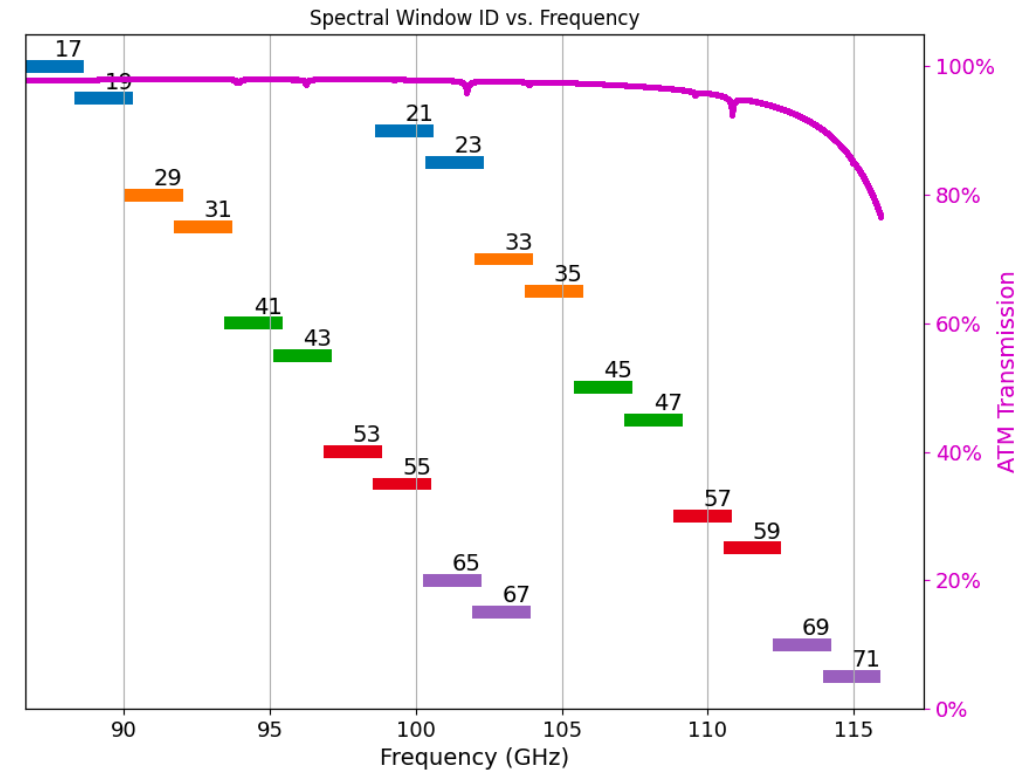 - **xradio**: proposal on Kubernetes (K8s) based cluster configuration

Highlights of Pipeline Updates (1/3)

- Please see User's Guide for details of PL
https://almascience.nao.ac.jp/documents-and-tools/cycle10/alma_pipeline_users_guide_2023

Infrastructure

- Weblog: A colorized plot of spw ID vs. frequency has been added.

Spectral Window ID vs. Frequency

Highlights of Pipeline Updates (2/3)

Interferometry

- **hifa_polcal** solves for the instrumental polarization and provides plots and QA in the WebLog

- **hif_selfcal** attempts to perform self-calibration for each source, using the aggregate continuum image
  (currently only for single-field, non-ephemeris)

- improved detection of general decorrelation in flagging tasks

- QA improvement for more efficient QA and data delivery
 → efficient auto-delivery

Single-Dish

- SDPL always produces **FITS cubes with positive frequency increment (CDELT3 > 0)** regardless of spw setting (USB/LSB)

- re-enabled online query to Jy/K REST API (after cyber-attack)

- **hsd_blflag**: flagging threshold values were doubled to avoid overflagging

- **hsd_baseline**: Improved baseline flatness evaluation

Nobeyama Pipeline and Science Data Archive

- Pipeline processing of last season's data (2022-2023) is pending due to a lack of disk space
  - We will process these data as soon as additional disk is ready

- Status of Nobeyama/ASTE Science Data Archive (as of 2023/12/21)
  - 52645 raw data (nostar or newstar format, from 2013 to 2022) are stored.
  - For 4777 NRO OTF data (2017-18, 2018-19, 2019-20, 2020-21 and 2021-22), MS2 format data and FITS format data (made by Nobeyama-pipeline) are stored.
  - 296 users are registered.
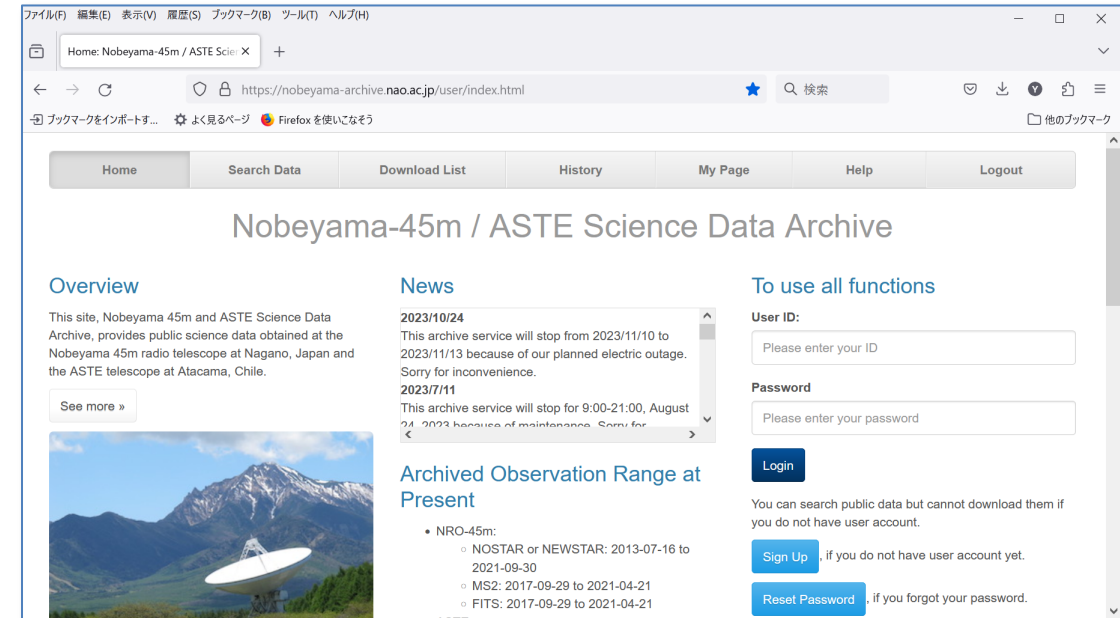
Plans of Pipeline and CASA releases in 2024

CASA 6.6, CASA 7

- next generation CASA prototyping for WSU
- Introduction of next generation CASA capabilities into CASA 6 -> CASA 7
- GPU gridder for wide-field imaging
- msuvbinflag - new flagging algorithm based on gridded visibility
- New Interactive CLEAN, deprecate viewer (continued)
- tsdimaging has comparable performance to sdimaging now, retirement of sdimaging ongoing

Pipeline 2024

- QA improvements for more efficient (or fully automated) QA and data delivery
- Band-to-band calibration for high frequency bands
- Per-EB parallelization of interferometry calibration tasks
- New line finding algorithm (SD)
- Migration from sdimaging to tsdimaging

Thank you for your attention