



# CASA DEVELOPMENTS AT NRAO

Nick Elias

2009 November 12



# CASA Management News

- ▣ I joined the project on 2009 September 21
  - two months before first public release (no pressure)
- ▣ We are still on schedule for the public release
  - 2009 December 1
  - final go or no go decision within ~ 7-10 days
- ▣ I am reorganizing CASA management (roadmap document) to:
  - streamline coding procedures
  - improving use of JIRA system (definitions, who/when/what, etc.)
  - implement long-term planning and coordinate it with cabal requirements
  - formally integrate regression testing
  - provide interfaces for external developers, testers, and users



# Plotting

- ▣ plotxy → plotms
  - plotxy: no new work, but will appear in release, it will eventually be removed from the package
  - plotms: faster, capabilities increasing
- ▣ plotms
  - Many flexible axis options
  - Averaging
  - Flagging
  - Data and meta-info caching
  - Threaded operation (for progress meters and interrupts)



# Calibration

- ▣ Standard gain and bandpass
  - Sampled/polynomial, flux density reference, auto-interpolation across flagged channels, etc.
  - Unique to CASA: amplitude only, channelized baseline-based solutions
- ▣ Polarization
  - Linearized instrumental polarization, source polarization
  - Unique to CASA: channelized solutions
- ▣ Additional features
  - Smoothing, interpolation, accumulation, solution plotting
  - Unique to CASA: solutions/applications over scan, field, spectral window
- ▣ Manual calibration task “gencal”
  - Amplitude, phase, delays, antenna positions
- ▣ WIDAR0: L band image, dynamic range  $\sim 230000:1$



# Mosaic

- ▣ Linear mosaic (image stitching) available in toolkit
- ▣ Mosaic and joint deconvolution
  - making joint dirty image in image plane
  - uv plane by using gridding convolution function
- ▣ Mosaic with gridding convolution allows “per baseline” correction
  - heterogeneous arrays can be processed and is available automatically in CLEAN task
- ▣ Single dish combination with mosaic
  - feather available as task
  - using SD image as starting model available in CLEAN
  - experimental "True Joint Deconvolution" available in toolkit (relative weighting unknown)



# Primary Beam Correction

- ▣ Azimuthally asymmetric PBs of az/el mount antennas lead to time-varying direction-dependent gains due to rotation WRT parallactic angle
  - Effects of the rotation on PB sidelobes occurs at a faster rate
- ▣ Imaging dynamic range of EVLA and ALMA will be limited by such time varying PB effects
  - Both arrays have enough sensitivity to require deconvolution of the sources in the first sidelobe of the PB
- ▣ Current plan is to use the A-Projection algorithm for full beam imaging (Bhatnagar et al. 2008, A&A 487, 419-429)
- ▣ A-Projection algorithm has been implemented in CASA and undergoing EVLA testing for
  - the correction of rotating azimuthally asymmetric PBs
  - the correction of PB polarization (e.g. EVLA squint correction)
  - the correction of frequency dependent PB effects
  - solving parameterized PBs: (Pointing SelfCal, EVLA Memo 84)



# External Developers

- We want CASA to become a powerful, flexible, and extendable interferometry package

Working model: features/improvements created and documented by external (non-CASA) developers and presented to CASA team

- “Light” (python-level) or “Heavy” (C++ level) development
- Example: Oxford HPC
  - Create algorithms
  - Modify code
  - Test algorithm
  - Write explanatory memo
  - Submit to CASA team



# Conclusion

- ▣ I have joined the CASA project at a very exciting time
  - New algorithms (calibration, imaging, HPC)
  - New telescopes
  - New world-wide software collaborations
  
- There is much work to do, and the CASA team will succeed