EVLA Post-processing

Algorithm Development

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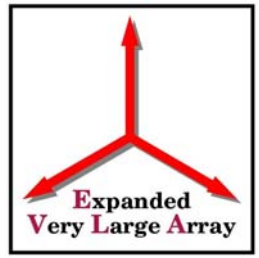
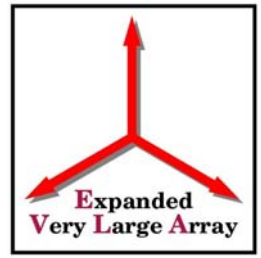
AIPS++/EVLA

Requirements



- Full beam imaging
  - Wide field imaging problem at L-band
- Full bandwidth continuum imaging
  - Multi-frequency Synthesis at 2:1 BWR
- Image plane corrections
  - Pointing offsets, Poln. PB corrections, non-isoplanatic phase correction
- Other stuff

Wide field imaging

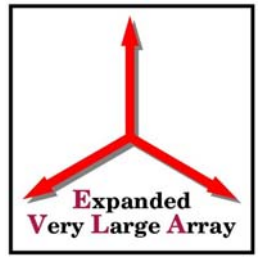


- Traditional approach (Faceted imaging)
  - Approximate the sky as smaller facets
  - Use 2D approximation within the facets
  - Stich the facets to make the final image
- Problems
  - Multiple gridding/de-gridding per major cycle
  - Edge effects
  - Extended emission across facets

W-projection

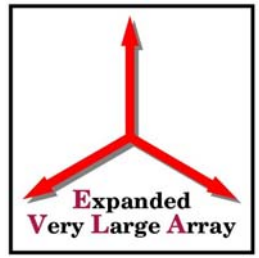
- Use Fresnel term during gridding (EVLA Memo #67)
  - Project w-axis onto w=0 plane during gridding.
  - Use average PSF during minor cycle.
- Advantages
  - Major cycle speeds up by ~10x.
  - No edge effects. User always sees 2D projection.
  - Component based imaging (MS-Clean, Asp-Clean) possible.

Wide band imaging



- Frequency sensitive deconvolution
  - Sky: Spectral Index effects
  - Primary Beam and UV-coverage scales with frequency
  - Time varing PB (asymmetries, beam squint)
- Possible solutions
  - Image plane MFS / Model fitting
  - Image plane effects in gridding (inspired by w-projection)

Plan

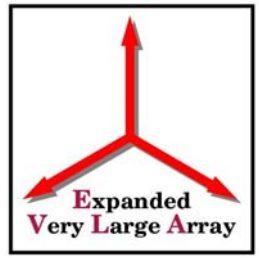


- W-projection implemented in AIPS++
  - Measured speed-up for VLA-A, L-Band: x10
- Implement component modeling in AIPS++
  - The code in C++ works – but as a Glish client
  - Extend it for frequency dependent components
- Extend w-projection (work in progress)
  (EVLA Memo #84)
  - PB application during gridding done (pointing selfcal)
  - Extend it for frequency dependent PB.

Imaging computing load

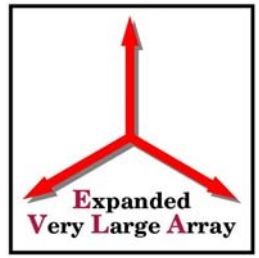
- Wide field imaging
  - 8h, VLA-A, LBand data processed in ~10h (20GB).
  - Corresponds to about 1% of the EVLA data.
- Major cycle: data prediction
  - For normal Clean, this is the most expensive step.
  - With w-projection, this is limited by the I/O speeds.
- Minor cycle: component search
  - Compute limited for component based imaging.

Parallel computing



- Parallel I/O
  - Parallelizing gridding by data partitioning
  - Use parallel file system to access data for other applications (viewer, etc.)
- Need to develop portable imaging and calibration software for clusters.
- Use AIPS++ code-base.
- Need to invest in a modest cluster now.

Plan

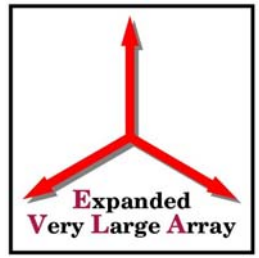


- Start work on parallelization in parallel with current algorithm development
- Collaborate with others (Xiao Qin @NMT)
  - Evaluate various schemes for parallelization
  - Explore Parallel File Systems and their interface to the AIPS++ Table system
  - Implement imaging/calibration algorithms on cluster machine

Other Stuff

- Other things needed, but not part of the focus for the coming year
  - RFI Removal (EVLA Memo #61, 86)
  - Data Visualization

References



- Removing RFI through astronomical image processsing, EVLA Memo #61, Perley & Cornwell (2003)
- RFI Excision in Synthesis Imaging without reference signal, EVLA Memo #86, Cornwell, Perley, Kolap, Bhatnagar (2004)
- W-projection: A new algorithm for non-coplanar baselines, EVLA Memo #67, Cornwell, Kolap, Bhatnagar (2004)
- Solving for antenna based pointing errors, EVLA Memo #84, Bhatnagar, Cornwell, Kolap (2004)