Analysis of check source observations in the ALMA QA2 procedure

Todd Hunter (NRAO), Crystal Brogan (NRAO), Ed Fomalont (NRAO/JAO)

Check source observations

- A check source is a quasar with a high-quality (VLBI) position that is close to the science target and the phase calibrator. The brightness threshold is somewhat less than that of the phase calibrator.

- A check source is inserted into all science observations with a synthesized beam of less than 0.25 arcsec, and in all high frequency observations (Band 8-10).

- The specification on cycle time given to the OT (SCIREQ-260) for 12m BLC array observations is the larger of:
  - 3 times the phase calibrator repeat interval
  - 1/3 the total on-source time

- Purpose of check source is to assess the quality of the phase transfer:
  - Assess the coherence of the calibrated data
 - Assess the astrometric accuracy of the calibrated data

Check source analysis

- Script developed by Crystal and me has been added to the manual QA2 report generator as of February 9, 2016 (SCOPS-2351) and has been offered to the pipeline (CAS-7730).

- Produces images of the phase calibrator and check source (calibrated like a science target using 'inf' solution). Runs imfit on both images to do the following:
  - Computes coherence by comparing peak intensity to fitted flux density
  - Computes percentage difference in fluxscale (fitted flux density vs. 'int' fluxscale produced by the calibration script)
  - For check source only: computes angular offset from catalog position and the deconvolved "size"

- No statistics have been compiled yet (ask DRMs?).

- Future improvement: also self-calibrate the check source ('int' solution), image it, and determine if it has any non-point-like component.
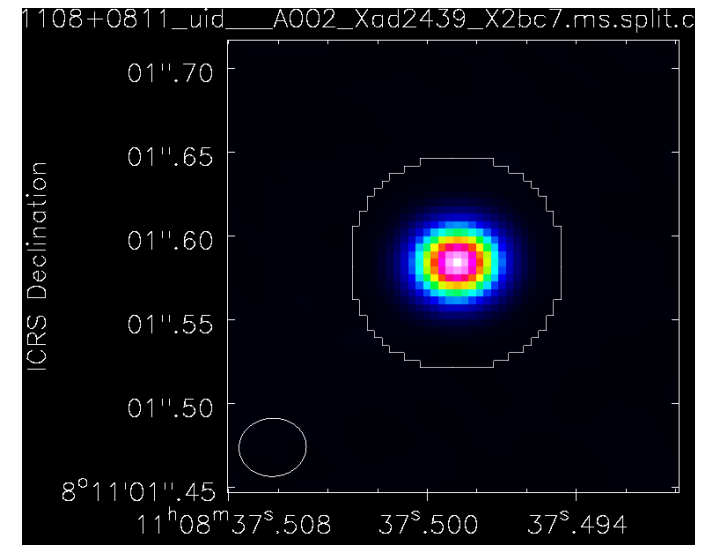
Phase calibrator
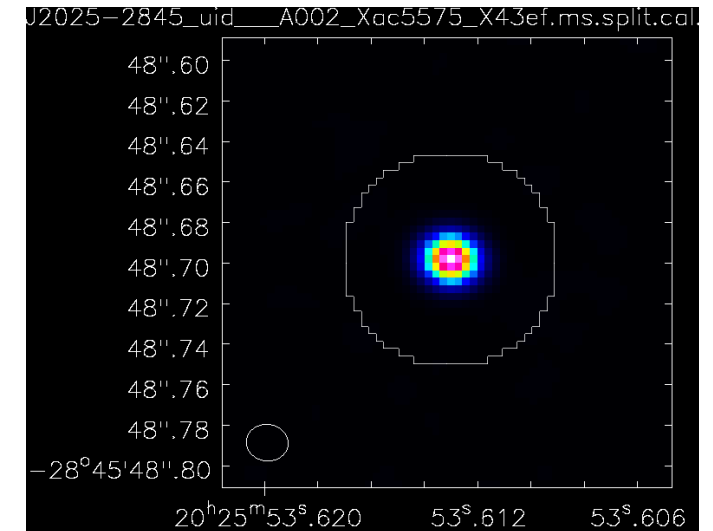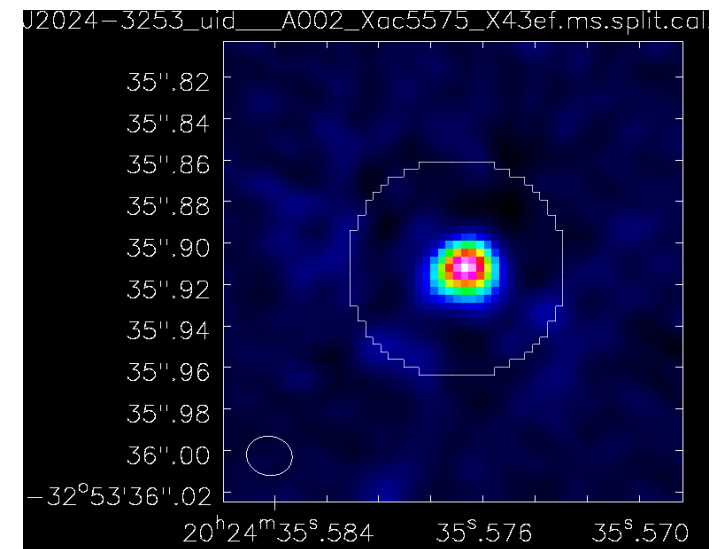
Check source

Example report from LBC 2015

Phase calibrator

CHECK_SOURCE IMAGE ANALYSIS REPORT (version 1.10)

Phasecal J1108+0811: Position difference = 0.0000 arcsec = 0.0000 synth.beam,
   Flux % difference = 5.51
   coherence = peakIntensity/fittedFluxDensity = 99.4%

Checksource J1116+0829: Position difference = 0.0105 arcsec = 0.273 synth.beam,
   Flux % difference = 20.2
   coherence = peakIntensity/fittedFluxDensity = 75.6%
   beam size = 0.0414 x 0.0353 arcsec
   apparent deconvolved size = 0.024 x 0.023 arcsec = 0.37 synth.beam area
   angular separation of phasecal to checksource = 1.89 degree
   angular separation of phasecal to only science field (3) = 5.51 degree
   angular separation of checksource to only science field (3) = 4.43 degree

Check source