The Nordic Tools for advanced analysis of interferometry data

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The Nordic tools for Interferometry are a set of algorithms developed by the Nordic Node of the ALMA Regional Center (Nordic ARC) and its collaborators. These are tools specially designed for an advanced processing and analysis of astronomical interferometric observations. Here we present a subset of our tools and also give a list of tools currently being implemented. Please visit our website for more information:

http://nordic-alma.se/support/software-tools

Any comment, suggestion, and/or bug report can be sent to contact@nordic-alma.se

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UVMULTIFIT is a versatile tool for fitting generic source models to the visibilities. Any combination of model components, with a generic frequency dependence in any of their defining parameters, can be specified. Any algebraic relationship among the defining parameters of the model components can also be specified (see examples below). Fits to continuum and/or spectral lines are supported. Limited support also for mosaic observations.

See Marti-Vidal et al. 2014, A&A, 563, A136

(Also IMMULTIFIT, an extension working in the image domain).
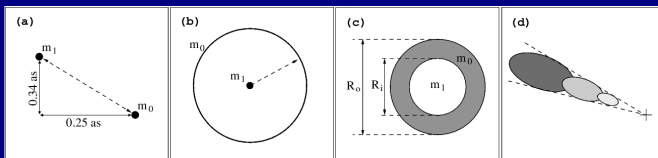
EXAMPLE SOURCES: (a) two points with fixed relative position, but free absolute position. (b) a disc plus a point at its center (the absolute position of the two sources and/or the disc size and intensity can also be set free). (c) a disc with a hole (built as another disc with negative intensity). (d) an optically-thick jet (i.e., with a core shift). In all these cases, the free model components can depend on any algebraic function of frequency and/or fitting parameters.

PRACTICAL (REAL) EXAMPLE: ALMA OBSERVATIONS OF THE LENSED BLAZAR PKS1830-211 AT 93 GHz
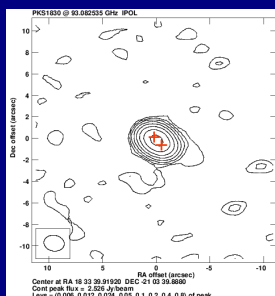
The two lensed images (each one with a different absorption-line spectrum) are fully blended in the image plane, due to the limited resolution.
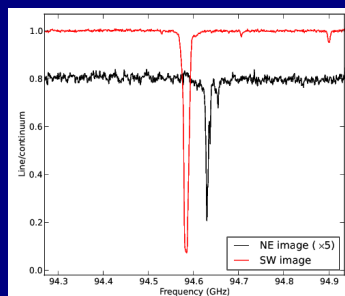
But UVMULTIFIT allows us to extract the spectrum of each image without blending, by fitting two sources with a known separation (but free absolute position!), i.e., example (a) in the figure above.

UV-STACKING, developed by L. Lindroos, is a tool to perform stacking of weak sources in the Fourier domain. This approach has many advantages, compared to the image-based stacking.

See Lindroos et al. MNRAS (submitted)
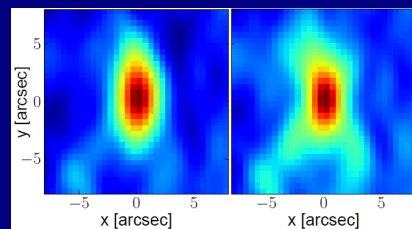
Example of a stacked source using UV-STACKING (left) and image-based stacking (right), on the same dataset.

CLOSURES generates diagnostic plots based on the statistics of amplitude and phase closures. This is useful to identify problematic antennas and/or bad frequency channels, even before the calibration.

Example plot of CLOSURES, showing a problematic antenna (ID 4) and ranges of problematic channels (from 0 to 1300).

CHANDRAFERMI, developed in collaboration with the German ARC Node (Bonn), allows the user to estimate magnetic fields from full-polarization images, using the Chandrasekhar-Fermi algorithm. Chandrasekhar, S., Fermi., E. 1953, ApJ 118, 113
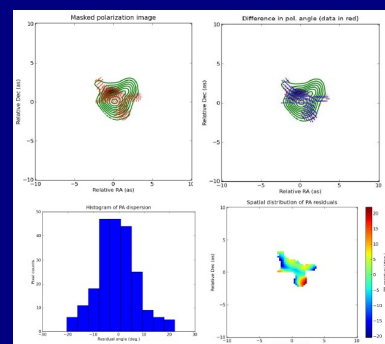
Example plot of ChandraFermi, generated from SMA observations of NGC1333. (from Girart et al., 2006, Science, 313, 812)

OTHER TOOLS (DEVELOPED OR BEING DEVELOPED):

FAKEOBS: Allows the user to substitute data from real observations with model visibilities, obtained from Fourier inversion of a FITS image (cube). This is useful for simulations, proposal preparation, tests, and even for data modelling (a rough alternative to UVMULTIFIT, if the user computes the Chi Square minimization by him/herself).

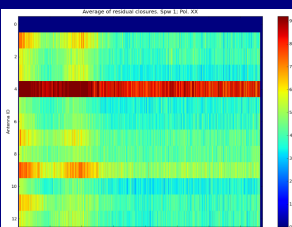CUBE-ANIMATE: A multimedia tool to make movies from data cubes.

… and others coming.   Note: ChandraFermi will be published soon in our website.