ASPRO 2

OIFITS data simulation

Libre / FOSS: https://github.com/JMMC-OpenDev/aspro

L. Bourgès

ESO & JMMC (VLTI) meeting

2021-10-14

ASPRO 2: Data simulation

- References:
  - JMMC-MEM-2800-0001 - Noise model for interferometric combiners (strehl, e(V2) for recombiners, other estimators)
  - Aspro2 data simulation, SPIE 2016: ASPRO2: get ready to 2nd generation instruments (GRAVITY and MATISSE)
  - Test report on MATISSE ETC / ASPRO 2 : comparaison ASPRO2 vs MATISSE ETC ~ OK in ASPRO2 21.06
  - Current ASPRO2 configuration : AO, FT, instrument & noise parameters
- Parameters:
  - object photometry (mag/jy in Aspro2, no spectra or SED)
  - atmosphere quality + AO parameters => strehl (seeing, t0)
  - atmosphere transmission : average ESO Paranal atmosphere profile (0.1 to 20 E-6 m)
  - Instrument mode (wavelength range, resolution)
  - Instrument noise parameters (global transmission, DIT, ron, pixels I/P ...)
  - Fringe tracker: basic model (longer integration time + mag limit + transmission loss)
  - Observation parameters: elevation (strehl) + Total integration time (s) on SCIENCE

ASPRO 2: Data simulation

- Approach:
  - theoretical estimation for e(V2) with / without photometry (for T3PHI/VISPHI)

  => complex visibility error => numeric error estimation on observables (sampling)

  - observables: VIS2, T3AMP / T3PHI, VISAMP / VISPHI (abs or diff) (+ NS_SQCORR_FLUX)
  - generate noisy observables (pick 1 sample) + add systematics (MATISSE instrument + calibration error)
- Possible improvements:
  - AO validation of NAOMI / CIAO / MACAO parameters
  - refine FT model : loss of contrast depending on seeing / atm conditions
  - Use advanced parameters for GRAVITY ? MATISSE tables for spectral channels, transmission, pixels...
  - How to simulate binning or exposure average (MATISSE: 4x1min) ?
  - How to handle specific estimators like VIS-PHI ? low-SNR estimations (non gaussian) ?

ASPRO 2 vs ESO ETC

- ASPRO2 is a generic tool, but a2p2 adapts OB to p2 (dit, ndit...)
- How to map ESO observing modes to ASPRO2 ?
- ASPRO2 considers ideal calibration (punct : V = 1)
  - how to calibrate properly OIFITS science with OIFITS calibrator ?
    - diameter (jsdc) ?
    - photometry offsets or biases in deltaT=30min, atmosphere losses
- Refine ASPRO2 transmission: global to composed : element by element (vlti, ao, ft, instrument ...)
- Make ESO documents public :
  - Commissioning & Performance reports (GRAVITY, MATISSE, NAOMI, CIAO... = all VLTI elements)
  - ETC formula / documents including concrete test cases (see ASPRO2 vs MATISSE ETC)
- TESTING concrete & precise cases = share ESO / JMMC test plan