Practice Work Session P3 (1.5h)

Preparation of observation

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Abstract

This Practice work applies the knowledge of the two previous practice sessions to the preparation of an observation. Here we will use ASPRO to simulate the data that could be taken on the the object during real observations, and estimate how accurately we could fit a model in the observations.

1 The Source Model

We plan to observe Achernar, for which spectroscopic observations predict a large rotational velocity and hence an oblate ellipsoid shape. Interferometric observations of Achernar at VLTI with the VINCI instrument (2-telescopes) and small (35 cm) apertures have already been presented by Kervella in session S1.

We will use the full aspro interface.

We model the star with the first model described by Kervella in his presentation (see local website "http://192.168.8.150")

2 Source Position

Use CDS to retrieve the coordinates of Achernar[1].

3 Observatory

We want to observe Achernar with the VLTI, 3 Telescopes, around 1 to 2.2 microns (AMBER). (Why?)

4 Observation Period

Starding with today 7 June, find the best period of year to observe Achernar with the VLTI.

[1]In case of network problems, Achernar is EQ 2000.0 1:37:42.8466 -57:14:12.327, MV 0.5 MJ 0.790 MH 0.860 MK 0.880

5 Best Baseline Set

Now, we want to find the best baseline set (3 of the 4 Unit Telescopes of the VLT in our case) to explore the hypothetical peculiar structure of Achernar. Find the best coverage (or coverage/wavelength) that samples the regions of the fourier transform of the source's brightness distribution where the signature of the elliptical shape of the object is strongest.

6 Resulting visibilities

Now, let's restrict ourselves to 4 hours of observation (-2 to +2 hour angle); shorten the integration time from 90 min to 60 min since nowadays this is more representative of the speed of the VLTI+AMBER. Select the "fixed delay" of the 3rd delay line to avoid unobservable positions due limited delay line strokes[2].

Each time we create a new plot with "PLOT UV COVERAGE", the corresponding list of uv points, defining the spatial coverage of the full observation (super synthesis) is written in a file (named "oipt_psf.uvt" by default). This file will be further used as a "template table" to be filled with visibilities obtained from a model of the object.

Use the same model as before (values are alredy filled in) to populate a uv table (by default named "model", lets rename it as "model1"). This corresponds to the list of visibilities and other interferometric observables that would be produced by the real (however "perfect") interferometer.

We can explore the various columns of this table with the "UV EXPLORE" Panel. Look particulary to the variation of V^2 as a function of baseline length and baseline angle.

7 Model refinement

Use figure in slide 30 of Kervella's presentation to refine the model, and recompute the visibilities in a new file, "model2". "Explore" the UV table as before. Do we see differences?

8 Expected accuracy

At that point, we could add the expected "noise" introduced by the focal instrument (AMBER) depending on the observational mode selected (AMBER has 3 different spectral resolutions), and evaluate what precision we can expect on the model's parameters, with regards to the precision on the measurements obtained in the given observing time. However this is best done with the simpler interface of ASPRO dedicated to VLTI observations and will be done in P5.

9 The ESO observation preparation software

Have a look at the ESO observation preparation software VISCALC, available under the "exposure time calculators section" of the "Proposal Preparation and Submission" section at ESO website: *http://www.eso.org/observing/etc/*. The ESO product is targeted more closely on the VLTI instruments, and knows about delay line (DL) regions of shadowing (when for example the carry of one DL intersects the beam of another) , and about pointing limitations of each telescope due to shadowing by another, or by the UT domes.

Perform the same selections as with ASPRO with Achernar and compare results.

[2]This is automatically optimizes in the "simpler" version of ASPRO dedicated to VLTI, but must be taken into account in the general all-purpose version used here