Title: How to run a pointing session and a pointing model parameters fit
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General Note

The following notes indicate how to run a pointing session for the heterodyne receivers or the bolometer and how to generate the new pointing model parameters after the pointing session

It is recommended that the pointing session is performed at night time, at least one day after the antenna is running normal observations with good weather condition, no high wind and the antenna deicing off. We aim with this step to get the antenna and tower well stabilised in temperature

How to run a heterodyne pointing session

- The reference receiver for the heterodyne pointing model is the B100. Use any combination of receivers that includes the B100 tuned at 86 GHz LSB (although other frequency and/or DSB is valid too)

- Enter into the project *pointing* to run the pointing session (ask for the password to the operator or J. Peñalver)

- Start the program *xephem* (under the *pointing* account too) to know which pointing sources are visible during the pointing session. In the *Sky View* of the program load the catalog *monitoring2.edb*, at the right size of the sources name is indicated the approximated flux in Jansky, the white points representing the pointing sources have a size approx. proportional to the sources intensity. Use these facilities to find the more convenient pointing sources

- Start *pako*, then under the *PAKO* prompt load the script *lastbc.pako* to load a valid receiver configuration that includes the B100 receiver

- Before starting the pointing session move the antenna more than 60° in azimuth to update the inclinometer reading. To see that new inclinometer values are obtained check in any VME machine the last entrance of the file */home/penalver/INCLIN/p4p5yymm.prn* where *yy* indicates the year and *mm* the month

- Select in *PAKO* the beam switching mode for all the pointing session

- Do a *CALIBRATION*, *POINTING* and *FOCUS* scans to confirm the good receiver operation and the good starting corrections of pointing and focus

- Then carry out among 20 and 30 *POINTING* scans well spread in the sky to cover all the azimuth range and the elevation range between 20° and 75°. Update the pointing corrections

after each *POINTING* scan. Try to do all the *POINTING* scans in the shorter time to minimise the possible drift of the pointing parameters

- After, more or less, 10 POINTING scans do a FOCUS scan to update the focus correction. Use in *PAKO* the command *FOCUS 3* if the source is not strong enough to get a good fit

- After each valid pointing scan write down the antenna azimuth and elevation together with the correction in both coordinates. The information will be used later to fit the optimum pointing parameters.

How to run a bolometer pointing session

- Enter into any project of the bolometer pool to run the pointing session (check with the pool manager) and start *pako*

- Start the program *xephem* under the bolometer pool account to identify the more convenient sources for pointing

- Before starting the pointing session move the antenna more than 60° in azimuth to update the inclinometer information. To see that new inclinometer values are obtained check in any VME machine the last entrance of the file */home/penalver/INCLIN/p4p5yymm.prn* where *yy* indicates the year and *mm* the month.

- As usual with the bolometer observations use the wobbling switching mode

- Do a first *POINTING* and *FOCUS* scans to confirm the good bolometer operation and the good starting corrections for the pointing and focus

- Then carry out among 20 and 30 *POINTING* scans well spread in the sky to cover all the azimuth range and the elevation range between 20° and 75°. After each *POINTING* scan update the pointing corrections. Try to do all the *POINTING* scans in the shorter time to minimise the possible drift of the pointing parameters.

- After, more or less, 10 *POINTING* scans do a *FOCUS* scan to update the focus correction

- After each valid pointing scan write down the antenna azimuth and elevation together with the correction in both coordinates. The information will be used later to fit the optimum pointing parameters.

How to fit the pointing corrections from the pointing session

- It is strongly recommended that the pointing model parameters are changed by who knows the physical meaning of the changes. If necessary get the advice from A. Sievers or J. Peñalver. And finally keep informed of the modifications done to J. Peñalver

- In the computer *mrt-lx3*, under the account *pointing* change to the directory *fit* (path *mrt-lx1/vis/pointing/fit*)

- The pointing corrections from the pointing session must be entered in the file *FITIN.DAT*. This file keep the old structure used in the VAX computers, but the necessary information is entered

only in the columns 3 to 6, one line per valid pointing scan, with the antenna azimuth (degrees), elevation (degrees), correction in azimuth (arcsec) and correction in elevation (arcsec) respectively. A model of the file *FITIN.DAT* with only nine lines of nine pointing scans could be seen in the file *FITIN_model.DAT*

- In the file *FITDES.DAT* select the pointing model parameters to fit. The valid parameters to fit are P1 to P3 and P7 to P9, identified in the file as *VECT 1* to *VECT 3* and *VECT 7* to *VECT 9*. The way to enable the fit of any parameter is removing the exclamation character (!) at the starting of the line. The file *FITDES_model.DAT* shows how to prepare the file to fit only the pointing model parameters P2 (*VECT 2*) and P7 (*VECT 7*)

- To fit the selected pointing model parameters, first delete the file *FITOUT.DAT* (to create a new one later automatically), then run the program *./fit.exe* The result is shown in the terminal with the *Value* to correct and the *Error* of that parameter fitted. The information is also written in the file *FITOUT.DAT*

- Usually several combinations of pointing model parameters have to be selected and tested in *FITDES.DAT* until the optimum combination is chosen. Good corrections are for those parameters where *Value* is higher than three times *Error*. But once again, any pointing parameter represents some physical imperfection of the antenna, under that criteria consider if the correction to apply have sense or not

- You could see graphically with *greg* the result of the fit. Go to the directory *fit* and follow the steps:

```
$ gag_mar08
$ greg
GREG> @hu_ini
        ... answer the questions
GREG> COVERAGE          ! to display the pointing scans coverage in the sky
GREG> SCATTER           ! to display the scatter previous and after the fit
```

- Finally you can implement the new pointing model parameters modifying the file *pointing-heterodyne.30m* (for the heterodyne receivers) or *pointing-bolometer.30m* (for the bolometer). To do that enter in *mrt-lx1* as user *mrt* (ask the password to the operator) and follow the steps indicated in the wiki page
  https://mrt-lx1.iram.es/mainWiki/OperationNotesOperatorsHowToChangePointingModel