Spectroscopy observing modes in Effelsberg

Currently two basic observing techniques can be used in Effelsberg: **frequency switching** (aka FSWITCH or FSW) and **position switching** (PSWITCH, PSW). The aim of switching is to obtain a reference spectrum which can be used to remove the bandpass (i.e., frequency-dependent gain) from the data. This is achieved by dividing the ON by the OFF spectra. If you are completely un-familiar with these techniques we highly recommened to read Section 2 and the first parts of Section 3 and 4 in Winkel et al. 2012.

PSW and FSW can both be applied to **targeted observations** or maps of an area. In the latter case, one makes a distinction between so-called **RASTER** maps, which are just a number of targeted observations on a grid, and **On-the-fly** (OTF) maps, where the telescope is constantly steered in a zig-zag pattern on the sky. The latter is often better suited for large areas to be mapped but it is somewhat more difficult to reduce the data afterwards.

For any map it is very important to keep in mind Nyquist's theorem which means the spacing of the observed positions has to be smaller than half the beam width (FWHM/2) in each direction (i.e., for quadratic grid cells the spacing needs to be smaller than FWHM/2/sqrt(2)). Otherwise your map will suffer from aliasing!

In any case, spectroscopic observations should always be accompanied by so-called pointings and focus measurements, to ensure a proper pointing model for your session. Furthermore if one uses appropriate calibration sources as targets for the pointings, one can use the data to flux-calibrate the spectra later on!

Note that the automatic Class pipeline assumes the Tsys and Tcal to be flat over the complete bandpass, which is certainly not true. Therefore, if very accurate calibration is a must you may want to apply more sophisticated calibration methods (see Winkel et al. 2012 for details, or ask B. Winkel for help). Furthermore, the reduced Class pipeline spectra are in units of the Tcal, which means you have to use an absolute calibration source to perform the flux calibration. More post-processing is also required if you want to correct for the gain curve of the telescope (i.e., the change of antenna sensitivity with Elevation) and atmospheric opacity. Especially at shorter wavelength this is strongly recommended. Of course you may also ask local staff if you need help.