The ALFA Fixed Azimuth Drift Observing Mode

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Several E-ALFA observers have been confused about the function of the Fixed Azimuth Drift Map mode and associated CIMA widgets, designed originally by Jeff Hagen in collaboration with the A1946 team, later adapted for A1963 purposes by Lyle Hoffman and further refined by Mikael Lerner for the A1961 and A1963 teams. Here we attempt to explain several points about the mode which may help to reduce future confusion.

The basic idea of Fixed Azimuth Drift Mapping is to position the telescope at a particular azimuth and zenith angle, with ALFA rotated to a particular angle, so that a source of given RA and Decl will transit exactly through Beam 0 at a predetermined time, yielding an ALFA beam configuration giving beams equally spaced in declination. Because of ALFA symmetry, there are several such configurations. All observations conducted by the A1946 and A1963 E-ALFA teams adopt a single configuration placing Beam 4 at the highest zenith angle, given by a rotation angle of $\sim+19^\circ$ for a source on the meridian (Az=0° or 180°).

The use of the term "Right Ascension" as an entry in the "Fixed Azimuth Drift" widget is apparently confusing to those not familiar with the strategy, since it implies that the telescope should point towards that position on the sky. Actually, the telescope needs to point at the appropriate azimuth and zenith angle so that a source of RA,Dec in Beam 0 will pass exactly though that Az, ZA at a designated time in the future. The data-taking begins at the instant that such source transits Beam 0. So when the telescope slews to point, it does **not** point at the entered RA, but rather a bit to the west, as given by the commanded azimuth, and then waits for the targetted RA to drift by. Observers need to understand this function in order to make sense of the sequence of events, positions and times, important both in the practical experience of observing and in the design of most efficient and effective observing schedules (such as those demanded by high precision programs like A1963; for practical examples, see *http://www.naic.edu/∼ngc2903*).

Once the special widgets, IF/LO Control and Backend Control parameters are set in CIMA, and the "Fixed Azimuth Drift Map" is selected in the "Spectral Line Observing" widget, it is this latter one which is relevant to the Fixed Azimuth Drift Map observing strategy. In particular, after the beginning of a night's run (when you may wish to start the telescope moving if a large slew is needed from where the telescope was last pointed by the previous observer), the "Pointing Control" widget should **NOT** be used to point the telescope or to rotate ALFA. Those are incorporated into the "Spectral Line Observing" widget when "Fixed Azimuth Drift Map" is selected, and the apparently similar commands in the "Pointing Control" window do not function identically. Once you start the telescope moving towards the first source, use the "Pointing Control" window **ONLY** to read positions from a source catalog – or, better yet, not at all (to avoid confusion). Simply, for a given RA,Decl., enter the desired azimuth and ALFA rotation angle in the "Spectral Line Observing Control" widget and hit "Observe" to start the telescope in motion. It will move to position and then wait for the proper time to begin integrating. For maximum efficiency, type in the new parameters before the end of the previous scan and hit "Observe" as soon as the trumpet flourish sounds the end of the previous observation. Keep in mind that the azimuth you enter must allow adequate time for the telescope to get to position and for ALFA to rotate, along with their associated not-insignificant overheads.

It should also be noted that most observers' calculations are performed in on-sky epoch J2000, but most of the telescope parameters that appear on the control monitors and practical timing considerations are apparent. Pointing model and even precession corrections from apparent to J2000 are considerable. Likewise, slew and ALFA angle rotation times are large and depend on δAz, δZA and δAngle, and overheads allowing for communication, acceleration, deceleration and settle times add up. Furthermore, while scramnet communications regarding positions occur every second, the rotation angle is sensed only every 10 seconds, so the dead time between command and action can vary by as much (depending on your luck).

It is very important that observers understand the intention and function of the fixed azimuth drift mode and its associated widget. Since CIMA control of ALFA is still evolving, care should be taken to make sure that the mode functions in the same way that it does at the time of this writing (04Dec06).