Nobeyama Perspective on Calibration and Some Comments

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1. What is calibration?

   To equalize electrical length from antenna feed to the entry point of the correlator for each component of the array antenna telescope.

2. Methods

   A. Use of point source as a calibrator, usually QUASAR. PSC

   B. Use of redundancy in antenna configuration. In other words, it is a self-calibration. SLFC

Method A is a standard in most cases in radio astronomy.

Method B is unique and applied only in Nobeyama Radioheliograph.

3. Merit and demerit

Mthd	Ant Conf	Data Gap	Accuracy	Lambda
A	Free	Inevitable	Absolute	cm, dm, m
B	Limited	None	Relative	~cm

Note: Method B uses the Sun as a calibrator.

Array configuration is restricted of grating type.

In method B the quiet Sun component is large relative to active region component at cm wavelength but not for longer wavelengths.

Method A requires a large antenna to calibrate small element antennas.

4. My choice and reasoning

A. Use of the standard calibration method is indispensable for FASR to attain accurate positioning of radio sources.

B. Then you need a 25-m telescope for small antenna calibration.

C. High temperature stability is required with respect to front-end boxes, transmission lines, back-end receivers. This consideration will increase calibration interval and is unique to solar studies.

D. Another consideration to reduce calibration time is highly desirable, which is also unique to solar work. This will increase chance to obtain good and interesting events.

E. Preferable values are 4 hours for CAL interval and 5 minutes CAL time.

5. Comments on data reduction

A Importance of real-time or quasi-real-time image processing, as well as off-line processing should be highly evaluated, and considered in system optimization.

B A couple of years ago, an electron flow event was found among hundreds of strong events image processed at Nobeyama, occurred in August 1999.

http://solar.nro.nao.ac.jp/norh/html/event/19990828_0056/norh19990828_0056.html

This is a large-sized event of 100 arcsec and strongly suggests existence of many small-sized events.

C If FASR attain 1 arcsec resolution, time resolution should be 1 arcsec / 100 kev velocity ~ 0.007 sec to movie an electron flow. Total data capacity has to be increased by 100 times than Nobeyama case.

6. Summary

A Use of the standard point source calibration method is essential to cover a wide wavelength range. A 25-m dish is necessary for CAL.

B Array configuration is, therefore, considered independent of CAL.

C High temperature stability is important along signal transmission lines to guarantee a long CAL interval and hence to catch interesting and good data

D In order to attain a high-space and high-time resolutions as well as wide-band coverage, capacity of image processing system is important.