Calibration of ALFA data in LiveData

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Abstract

The calibration factors to be entered into LiveData have been calculated, for the parameters used for the AGES and ZOA E-ALFA projects and a method is described for calculating these more generally. The AGES calibration has been checked against 38 fluxes in the literature and found to be consistent.

1 Calculation of the calibration factors

LiveData is one of the components of the AIPS++ pipeline developed initially for HIPASS and now used by the AGES, AUDS and ZOA E-ALFA projects at Arecibo. It is used to bandpass-subtract and calibrate the data prior to gridding using a second task (Gridzilla). LiveData includes an approximate calibration for ALFA using a gain of 10 Jy K^{-1} and a T_{cal} of 12 K. Calibration factors can also be input for each polarisation of each beam in order to refine this approximate calibration.

The correct calibration factors can be worked out from the gain and T_{cal} of the ALFA beams. These can be found using the Alfacal utility[1]. The gain, and thus the calibration, is dependent on zenith angle and both the gain the cal temperature are dependent on frequency. For this calibration, a central frequency of 1380 MHz and a bandwidth of 80 MHz were used along with the default ZA of 5°. The calibration factor for each beam and polarisation is given by $f = (T_{cal}/12) \times (10/\text{gain}) = T_{cal}/(1.2 \times \text{gain})$. This calibration should be reasonably accurate for data taken with central frequencies near 1380 MHz with a bandwidth of 100 MHz (i.e. standard E-ALFA WAPP setup), and with ZA $< 15°$. For the E-ALFA spectrometer, when commissioned, it will be necessary to calculate these values again with the appropriate bandwidth and central frequency for each IF. The calibration factors (Table 1) were entered into the Calibration window in LiveData (Fig. 1).

[1] http://www.naic.edu/~rminchin/alfacal.shtml

Table 1: Calibration factors. Note that the AIPS++ software numbers the beams 1 – 7 rather than following the 0 – 6 convention normal with ALFA.

	Polarization	
Beam	A	B
1	0.878	0.806
2	1.022	1.046
3	1.082	1.091
4	1.121	1.071
5	1.060	10.30
6	10.11	0.865
7	1.064	1.026

2 Testing the calibration

Three AGES cubes have so far been constructed using this calibration: the completed NGC 1156 and NGC 7332 cubes and the incomplete Abell 1367 cube. For the two NGC cubes, existing H I data was found in the Cornell Digital H I Archive (Springob et al. 2005) while for the Abell 1367 cube data was found from the studies of Gavazzi et al. (2003), Gavazzi et al. (2006) and Haynes et al. (1997). After extended objects (NGC 1156 and NGC 7339) were excluded and two objects badly affected by RFI in the AGES data were removed from the comparison, 4 galaxies were left in the NGC 7332 cube,

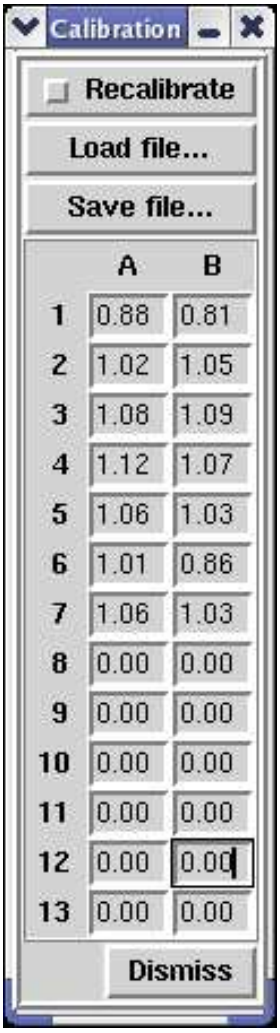

Figure 1: LiveData Calibration window

5 in the NGC 1156 cube and 29 in the Abell 1367 cube. Fig. 2 shows a comparison between the AGES and literature fluxes for the 38 sources.

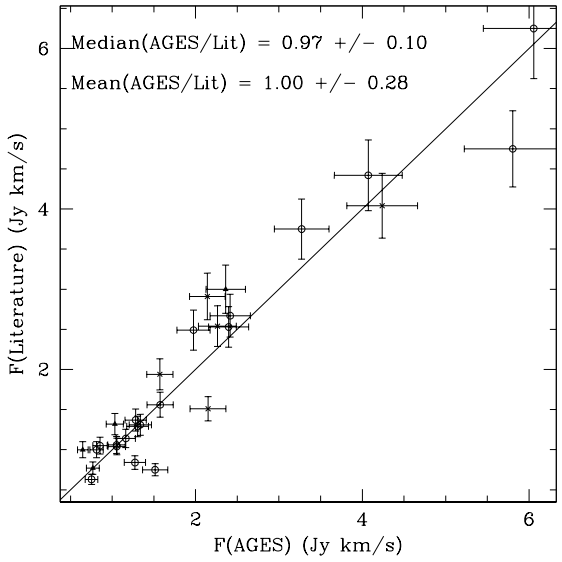

Figure 2: Comparion between the AGES and literature fluxes. Solid triangles represent sources from the NGC 7332 cube, crosses sources from the NGC 1156 cube and open circles sources from the Abell 1367 cube. Errorbars are indicative 10% errors rather than formal errors.

Comparing the samples statistically, the median of the ratio Ages flux/literature flux is 0.97 ± 0.10 and the mean of the ratio is 1.00 ± 0.28. Looking at the figure, it is clear that the fluxes match reasonably well. I therefore conclude that the calculated flux calibration is not inconsistent with the literature fluxes.

References

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