SECONDARY FOCUS BASELINE RIPPLES AT 1.3 CM

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This report describes a test performed to measure the amplitude of baseline ripples in spectra obtained with secondary focus receivers. For this goal, the 1.3 cm secondary focus receiver (21.7–24.4 GHz) was employed during the night of Feb. 23 to 24, 2005. Weather conditions were excellent, with a humidity of 85% and a temperature of –8° Celsius. Wind speeds were low (<5 m/s).

The amplitude of baseline ripples toward the strong continuum source 3C273 was determined without and with $\lambda/8$ defocusing. The frequency chosen was that of the water line at 22.23508 GHz. This permitted a check of the performance of the AK 90 autocorrelator system prior to the test. Initially preferring split mode 'NSPLIT 27', i.e. eight backends with 160 MHz bandwidth and 128 channels each, it turned out that 'NSPLIT 26' with eight backends and 80 MHz and 256 channels was more suitable. 'NSPLIT 26' provided not only better baselines (baselines also tend to be slightly degraded at 160 MHz bandwidth when using primary focus receivers), but also a frequency resolution that permits to identify and to spectroscopically resolve individual baseline ripples.

The eight AK 90 spectrometers were set to the same frequency and velocity. Spectrometer 3 did not function and was thus not included in the data reduction. Spectrometer 4 is known to show baselines that are not flat. Thus six of the eight spectrometers, modules 1, 2, 5, 6, 7, and 8 were used in the data reduction process, applying the software package CLASS.

Fig. 1 shows the average continuum of 3C273 in units of the calibration signal from the noise-diode of the receiver system. Averaged are four pointing scans, each of them containing two subscans in elevation and two in azimuth. Pointing quality was reasonably good with pointing offsets of 5–10″, yielding an averaged full width to half power of 38″. This should be compared with the telescope beam of ∼35–36″.

Fig. 2 and 3 show the spectra (also in units of the calibration signal) obtained without $\lambda/8$ defocusing. Fig. 2 shows the average of spectrometers 2, 6, and 8, Fig. 3 those of 1, 5, and 7. The data were split into two parts because in the latter three spectrometers adjacent channels were not independent from each other and had to get smoothed ('SMOOTH BOX 2' in CLASS). The amplitude is approximately 2.5% (±0.3%) of the continuum flux. The frequency of the ripple is 5.6±0.1 MHz.

Fig. 4 shows the spectrum obtained with $\lambda/8$ defocusing. No baseline ripple is seen and it's amplitude is <1% of the continuum level. There is quite a pronounced bump at the redshifted side of the spectrum. This is a feature also encountered when observing with the primary focus 1.3 or 1.0 cm HEMT receivers toward continuum sources, but it is weaker here.

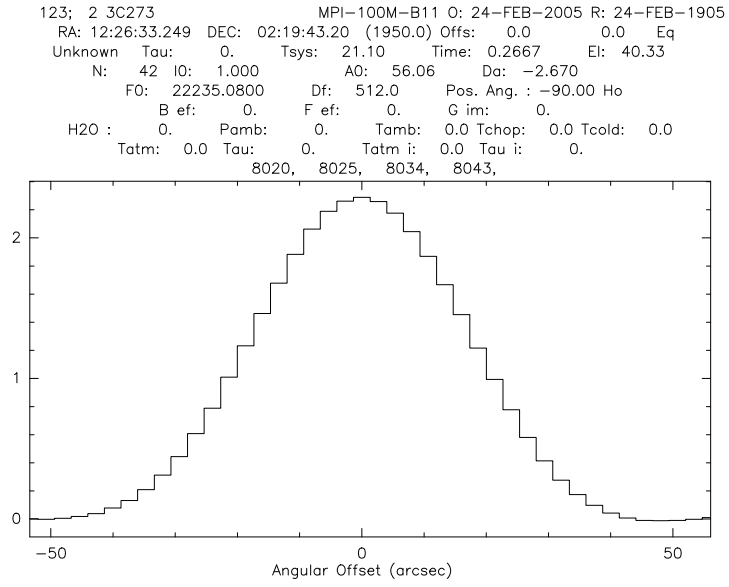


Figure 1: Averaged continuum scans toward 3C273

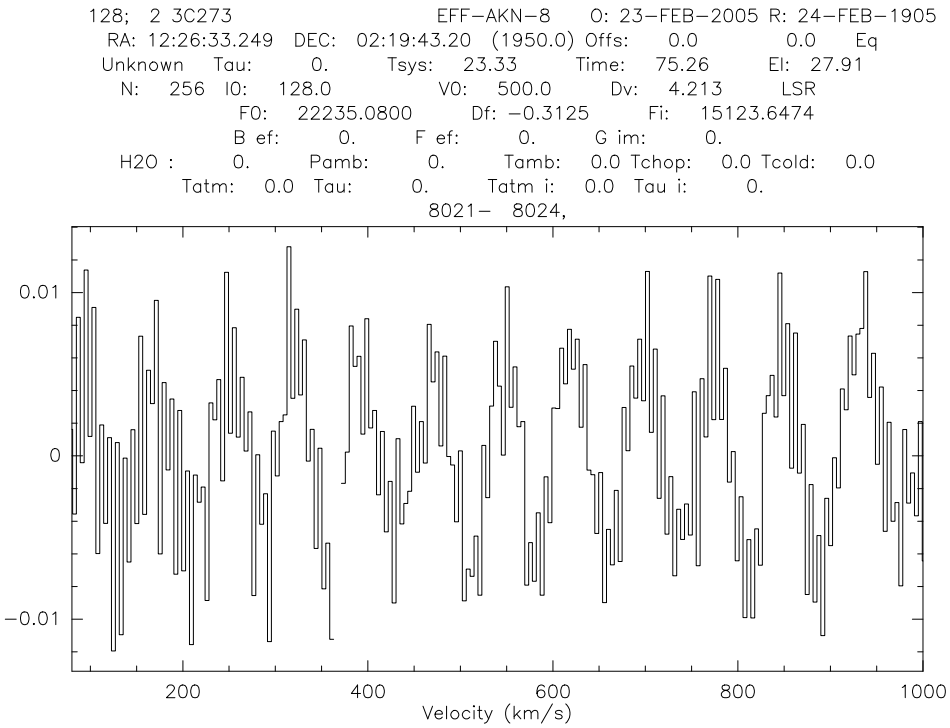
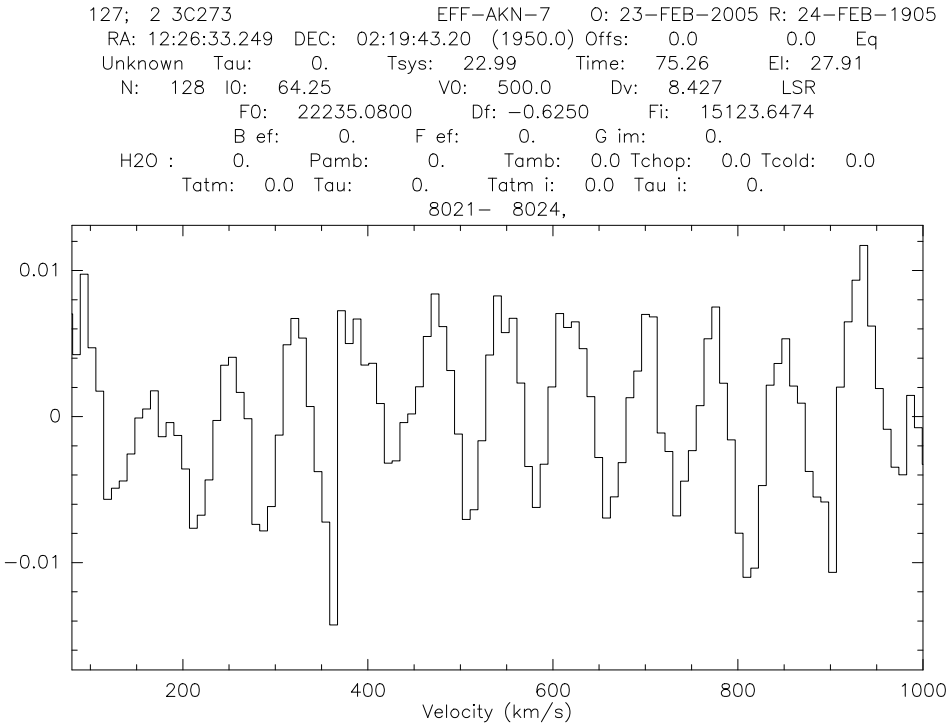


Figure 2: Baseline ripples without defocusing: Average of spectrometers 2, 6, and 8 after a third order baseline subtraction

Figure 3: Baseline ripples without defocusing: Average of spectrometers 1, 5, and 7 after a third order baseline subtraction



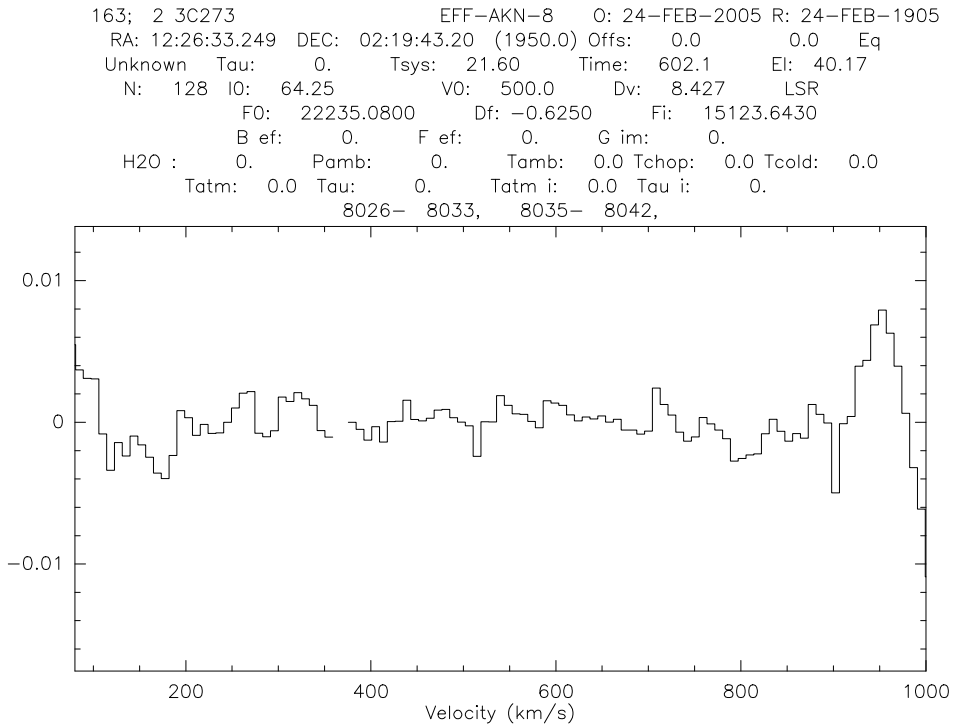


Figure 4: Spectrum with defocusing: Average of spectrometers 1, 2, 5, 6, 7, and 8 after a third order baseline subtraction