Testing and Characterization of the SPS 200 Spectrometer

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Beamline(s): **U12IR**

Introduction: The two most important features of the new Science tech SPS 200 spectrometer at the U12IR beamline are the 10cm diameter optics and the 400mm path length of the moving mirror. The large size of the mirrors and the beamsplitter results allows for long wavelength operations, reaching from the far infrared, well into the microwave domain. The long path length results in high resolution, reaching or exceeding 0.01cm^{-1}. The goal of the present studies was to confirm these expectations, to characterize the operations of the spectrometer with a particular emphasis on comparing the synchrotron to the internal source in the long wavelength regime.

Methods and Materials: Most of the tests were done in the polarizing mode of the spectrometer, so that the main axis of polarization of the incident synchrotron light was parallel to the direction of the input polarizer. Two He cooled bolometer detectors were used, one of them pumped to 1.2K. The detectors had built-in cold filters, and the upper cut off frequency was sometimes further reduced by room temperature filters (most often stycast, plexiglass, glass or flourgold).

Results: Low resolution (0.5cm^{-1}) spectra are shown in Figure 1. The synchrotron source has a factor of 50 intensity advantage in the frequency range of 5cm^{-1} to 50 cm^{-1}. Further comparisons between the two sources were made with the 1.2K detector, and with various apertures placed at the sample position. At higher resolution an interesting fringe pattern is observed in the synchrotron spectrum (Fig. 2). This pattern has been seen before at U12IR. Recent experiments proved that it is due to the interference between the light directly emitted by the electron bunch, and the light emitted at an earlier stage and reflected from the inside wall of the storage ring.

Conclusions: The tests confirmed the expected intensity advantage of the synchrotron source, and yielded results in agreement with most of the expected design parameters. An unexpected instability in the baseline of the spectrometer, that is under further investigation, has also been observed.

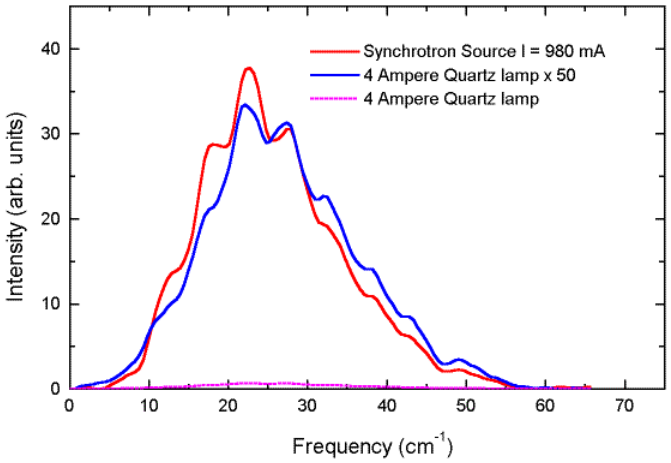

Figure 1. Comparison of the synchrotron and the internal Quartz lamp source. (Detector: 4.2K bolometer with fluorgold filter)

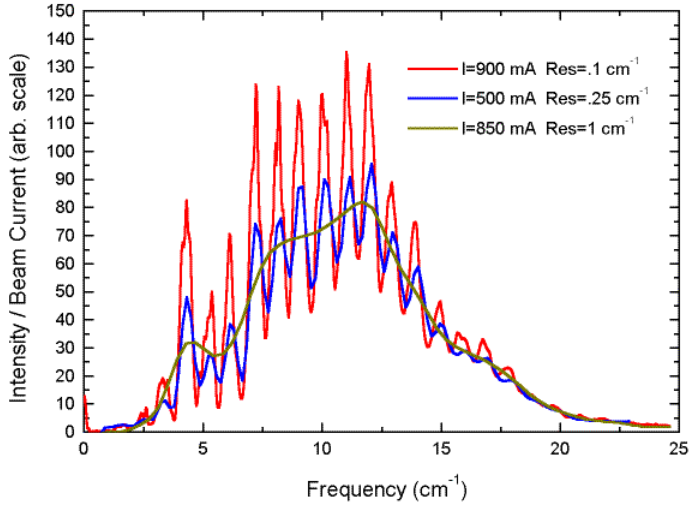

Figure 2. The synchrotron spectrum at various resolutions. (Detector: 1.2K bolometer with plexiglass filter.)

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References: Potential users may review many of the test results and other measurements at the U12IR WEB page, http://lsirg.nsls.bnl.gov/sps200/test/