InterCAT Technical Working Group Meeting
October 19, 2000

Agenda Review and TWG Activity Summary: (Mark Beno)
Mark called the meeting to order and reviewed the agenda.

APS Update

(Steve Davey)
Steve reported that the APS operating schedule through the end of July 2001 was now on the Web. The amount of top up operations in the new schedule and the possibility for an increase in top up operations during this run and in the future was mentioned. The status of changes in bending magnet positions to reduce ID x-ray BPM contamination was also discussed. This will be the topic for a future TWG presentation.

(Mohan Ramanathan)
Mohan solicited user feedback as to the appropriateness of the present timing signals for top up operations. At present these are 10 msec before and 20 msec after top up injection.

CAT Reports

Experimental Uncertainty Determination using QEXAFS: (John Quintana, DND-CAT)

John reported on a method for collecting EXAFS spectra that he has developed in DND-CAT. In contrast to using the traditional EXAFS counting chain, current amp, V-F and scalars, DND-CAT uses a fast A-D converter with a current amp. The advantages of this system are that it is cheaper, requires minimal engineering since commercial components are used, and is not time limited. The hardware used is a Stanford Research Systems SRS570 current amp, CyberResearch CYDAS 1602 16 bit A-D card, and a CyberResearch TDFIFO memory board. The system is capable of collecting 11 million data in the five minutes required for an EXAFS scan at DND-CAT. Since the monochromator used is very reproducible, multiple scans can be averaged to derive uncertainties in the absorption data. John gave an example at the Pt edge where thousands of data were recorded for each 1 eV energy change. Statistical analysis of binned data, which include multiple scans and oversampled data, provide an average absorption curve (μ) with derived uncertainties at each data point. A program written by Matt Newville, AUTOBK, was used to produce $K^3\chi$ data and uncertainties. The conclusions of John's talk were that this technique provides faster data acquisition, provides *in situ* monochromator diagnostics, and can provide uncertainties in EXAFS measurements.

Reference: J.P.G. Quintana, *Uncertainty Determination In QXAFS Measurements*, in Synchrotron Radiation Instrumentation SRI99: Eleventh US National Conference, ed. by P. Pianetta, J. Arthur, and S. Brennan, (American Institute of Physics, 2000) pp. 194-197.

Refractive Optics Development at MHATT-CAT: Search for new Materials: (Eric Dufresne, MHATT-CAT)

Eric presented results of experiments done at MHATT-CAT on Li-based compound refractive lenses (CRLs). He started his talk by presenting details of the MATT-CAT beamline design. In the 7-ID-D station, which has a femto second laser for timing experiments, horizontal focusing would be beneficial; the 7-ID-C diffraction station, vertical focusing is helpful. CRLs offer an inexpensive in-line optic with some drawbacks such as strong chromatic aberrations that can be beneficial by

rejecting higher orders like a mirror. For a single lens with a radius on the order of millimeters, the focal length is ~100 m; therefore, multiple lenses are used. Original references to this technique provided by Eric follow:

- B.X. Yang, *NIM* **A328**, 578–587 (1993).
- A. Snigirev, V. Kohn, I. Snigireva, and B. Lengeler, *Nature* **384**, 49–51 (1996).
- B. Lengeler, C. Schroer, J. Tümmler, B. Benner, M. Richwin, A. Snigirev, I. Snigireva, and M. Drakopoulos, *J. Synchrotron Rad.* **6**, 1153–1167(1999).

He then went on to give the results of some early experiments at MHATT-CAT using a sawtooth CRL based on a recently published paper.

- Cederstrom, R.N. Cahn, M. Danielsson, M. Lundqvist, and D.R. Nygren, *Nature* **404**, 951 (2000).

In this case, Li is used because its low density results in a low absorption. Also, as compared to beryllium or aluminum, the soft ductile nature of Li metal allows easy forming of these "sawtooth" CRLs. Lenses tested at MHATT-CAT were made by pressing a tap into the soft metal to form the CRL. Only one plate was used so in this case this is equivalent to half of the CRL reported in the *Nature* article. Eric showed data that demonstrated that these simple lenses focused the beam and produced significant gains over an unfocused beam. A focal length of ~16 meters was measured whereas the theoretical value was ~12 m. Improved designs for Li-based CRLs were shown. These new designs will be tested at MHATT-CAT in future experiments.

Next Meeting
The meeting will be held Thursday, November 16, 2000, in Building 401, room B4100.