InterCAT Technical Working Group Meeting
October 21, 1999

Agenda Review and TWG Activity Summary: (Steve Heald)
Steve reviewed the meeting agenda and thanked Paul Zschack for his service as TWG chair. He also announced that Mark Beno (BESSRC-CAT) is the new TWG chair-elect.

Facility Reports

Facility Update/News: (Steve Davey)
Steve reviewed in detail a variety of FY 1998 and FY 1999 operational statistics. A question was asked about incorporating XFD-related failures (e.g., IOC reboots, loss of shutter permits, shutter malfunctions, etc.). It was recognized that some issues are not represented in the current sets of operational statistics but that these parameters should be tracked and studied to provide an even more detailed evaluation of machine performance.

Update on the LN2 system: (Bill Wesolowski)
Module A, which comprises sectors 1-9, has been completely installed, has liquid in the lines, and is being tested by three CATs. Bill thanked several CAT members for their assistance in evaluating the system's performance. A problem with the subcooler valves has been identified. Currently, the problem is being worked around in module A; the contractor will be coming out to evaluate. Bill explained the function of the subcooler and the nature of the problem (i.e., the valves aren't seating properly). Module B is expected to be completed the first week of November, module C two weeks later, and module D at the end of November.

Bill distributed diagrams of potential drop line setups and described some of the general engineering. He noted that some of the cryopumps have some inherent problems (e.g., the solenoids won't work at pressures greater than 35 psi). A possible solution is the use of a regulator valve/relief valve and vacuum-jacketed line either directly on the cryopump assembly or on a storage dewar. He reminded users that any parts purchased for these setups must be rated for cryogenic use. Users should contact Bill when other groups in sectors 1-9 are ready to begin to use the centralized LN2 system. The manual fill stations will continue to be available.

CAT Reports

Mirror design for polarization beamline 4-ID: (Ali Khounsary)
Ali reported to the group about mirror design considerations for beamline 4-ID. This sector four beamline has two undulators (for hard x-rays and intermediate x-rays): an APS undulator A (Und A) and an elliptically polarized undulator (EPU). Three kinds of polarized radiation can be produced by the EPU: linear horizontal, vertical linear, and circularly polarized. The task of mirror design for 4-ID had to focus on being able to look at various combinations of K_x and K_y. Ali presented data on the different types of polarization produced by the EPU and compared the horizontal profiles of the Und A and EPU beams. The primary question is what level of power from Und A contamination can be tolerated and still maintain the desired beam.

Ali showed graphical color representations of Und A contamination in the beam, noting that the Und A contribution is about ten degrees higher in temperature. Side (water) cooling is used on the mirrors, and Ali showed a graph of mirror displacement as the mirror initially heats up. Between the copper block and the silicon, interstitial material (either In or InGa) is used. In this case, InGa was chosen because it achieved steady-state temperature more rapidly and provided better overall mirror performance. The material was 25% In and 75% Ga (by volume). Mirror deformation can be greatly impacted if the In adheres to the mirror; Ali explained how the bonding process can occur.

Ali also discussed what would happen if a misteer resulted in the entire Und A beam hitting a mirror. Temperature, stress, and slope data were presented. The primary concerns are compressive and tensile stress. Thermocouples can be used to monitor mirror temperature and help to close the shutter rapidly before vacuum is lost. Ali indicated that anyone interested in detailed information about these side-cooled mirrors can contact him and request a copy of his paper (amk@aps.anl.gov).

Experience with x-ray phase retarders at SRI-CAT: (Jonathan Lang)
The polarization group in SRI-CAT has been using phase retarders to manipulate the polarization of the highly linear synchrotron beam by varying the relative phasing between the horizontal and vertical wave fields. This can be beneficial to the study of magnetic scattering. There are three kinds of phase retarders: Bragg reflection, Laue reflection, and thin-crystal transmission. Jonathan reviewed some dynamical diffraction theory to explain how thin-crystal transmission works. He indicated that this technique works well between 4-12 keV, offers rapid helicity reversal, and is insensitive to beam divergence.

Jonathan offered the group some insights on the use of such phase retarders, including the fact that transmitted intensity is asymmetric (so both the monitor and detector must be very linear) and that the absolute position of the phase retarder is critical for scattering experiments when working with circularly polarized x-rays. He showed some results of experiments. Low-z crystals, like diamond, LiF, and Be, make the best phase retarders; diamond is five times better than Si. Phase retarders work best at low energies and vary only slowly with wavelength; at higher energies (e.g., above 13 keV), they must be used very close to the Bragg condition. He showed a photo and beamline layout of an experimental set up at 1-ID. A series of results from dichroism experiments was shown, and Jonathan discussed various experiments, including diffuse magnetic reflectivity and magnetic reflectivity of a Gd/Fe multilayer.

Next Meeting
The meeting will be held Thursday, November 18, 1999, in conference room A1100.