Final Report

DOE Grant #DE-FG02-04ER46106

In December of 2004, upon hearing of the DOE decision to terminate this grant, a no-cost extension was requested to allow us to expend residual funds from the 2004 calendar year. These funds have been used to support MR-CAT staff as we transition to other funding. As of this writing, the funds have been expended.

Over the past four years of DOE operations funding, MR-CAT has become one of the most productive sectors at the Advanced Photon Source. This report will list the overall accomplishments of the collaboration during the time of DOE funding.

Technical

Monochromator The MR-CAT monochromator has been an extremely reliable instrument, with failure only due to human error in the summer of 2004. Since that failure, the new crystal installed has improved thermal stabilty of the entire system. The overall noise has been reduced to less than 1%. We expect the monochromator to continue, with routine maintenance and parts replacement, to be reliable for all of our experiments.

Microfocusing The microfocusing system has been rebuilt and it functions to specifications. The demand for this instrument is continuing to grow and we expect to schedule about 1/3 of our time for microprobe and micro-EXAFS experiments.

Detector Our 13-element solid state detector has been upgraded to 19 elements. This will significantly improve the data quality on very dilute samples. The data readout overhead has been reduced by a factor of 5 and we expect to make even greater improvements as we move to the new software libraries. This detector is used up to 50% of the time during any scheduling period.

Control Software We are continuing to improve our current graphical user interfaces and develop new ones to better serve both CAT and General Users. At this time, we have a working GUI for the Lithography system (in its second revision) at the bending magnet line and we have begun testing a first version of an XAFS GUI on the insertion device line. The microfocus alignment GUI has been in use since the 2004-1 run and is in its second revision.

Scientific

Student Participation at MR-CAT Student training continues to be a significant aspect of MR-CAT activities. From the time of initial experiments, we have had over 80 graduate students at the beamline and at least 18 of them have received their degrees. MR-CAT has also continued to host undergraduate student interns over the summer. Over the past 4 years, we have had 7 such interns and we plan to continue this program through funds obtained from individual grants. The work done by these students has resulted in new beamline control software, the basis for a successful NSF proposal for a major instrument at MR-CAT and several publications.

Publications Below are listed the publications from the period of MR-CAT's operations funding from DOE. This includes the current grant and the one immediately previous to it. There are a number of publications currently in press or submitted which have not been listed. In particular, the proceedings of the 12^{th} International Conference on X-Ray Absorption Fine Structure held in 2003 has not yet been published and contains a number of papers from MR-CAT. The Editors believe that the papers will be published in early 2005.

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