Operations and Engineering Division

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Organization and Mission

The Operations and Engineering Division (OED) has three sections: Operations, which is led by Richard Heese; Electrical Systems, led by Richard Biscardi; and Mechanical Engineering, led by Ed Haas. To serve the NSLS user community, our mission falls into three main areas:

- Operating on of the NSLS 24 hours a day, seven days a week, an average of 44 weeks a year
- Designing, fabricating, and maintaining of the NSLS accelerators, infrastructure, and instruments, including upgrades, modifications, and proposal development
- Providing engineering and technical support for other NSLS divisions and the NSLS user community

The OED staff includes one scientist, 19 engineers, and 55 technicians, making it the largest of the NSLS divisions. In addition to its own staff, the division coordinates the activities of five full-time skilled tradesmen from the laboratory, as well as shops and trades assigned for specific jobs. The breadth of our mission is such that we need to draw on the capabilities of the other NSLS divisions for support, and in turn provide specialized support for their activities.

2005 Activities

Thankfully, this year was not punctuated by some of the major equipment failures that we have experienced in recent years. An overview of machine performance summarized for calendar year 2005 is provided in Section 6, “Facility Facts and Figures.” For Fiscal Year 2005, which is the DOE reporting period, overall reliability was 96% for the x-ray ring and 99% for the VUV ring. For a facility now into its third decade of operations, high reliability depends critically on an aggressive maintenance program as well as the skill of the staff operating the machine. Faults and operations disruptions are carefully monitored to extract trends and help us focus our efforts on the most fragile systems. A comparatively small number of disruptions over four hours in duration accounts for much of the down time. For FY 2005, roughly one-third of the downtime came from only six events on the x-ray ring and three on the VUV ring. This distribution is an indication of a mature operation with an effective preventive maintenance program.

Along with our maintenance program, a number of initiatives were undertaken this year aimed at improving the safety, performance, and reliability of the facility. After an extensive evaluation of hazards at the NSLS, our staff members located, identified, and labeled potential sources of stored energy that could cause injury to staff or visitors. Placing informational signs sounds like a mundane activity, but it was actually an important milestone in our program to enhance worker safety around the facility. During the spring shutdown, in addition to our equipment upgrade and preventative maintenance activities, NSLS staff members placed more than two thousand warning signs on equipment around the facility, much of it in use since the start of NSLS operations. This activity required a bottom-up assessment of the stewardship and hazards for all of the NSLS equipment, capturing the information in a systematic manner and providing suitable warning signs with information pointing to the correct procedures for servicing the equipment. This monumental investment of effort is worthwhile, since we anticipate continuing use and development of the facility for some years ahead.

Significant effort was also directed toward becoming compliant with various code requirements. Major investments were made to facilitate compliance with the National Fire Protection Association code on electrical safety (NFPA 70E) in a way that minimizes impact on operations. This included providing specialized personnel protective equipment (PPE) required by the code, providing training on its use, and, where possible, installing systems to verify that equipment that does not require the use of PPE is de-energized.

An Electrical Equipment Inspection (EEI) program has also been developed to assure that electrical equipment is free from reasonably foreseeable risk due to electrical hazards. This goal can be met when equipment is certified by a

Nationally Recognized Testing Laboratory (NRTL) or through further inspection through the EEI program. In either case, the equipment must be inspected and inventoried. Equipment that does not carry NRTL certification will be subject to further examination to ensure that it will be safe for its intended use. This work will be performed by a cadre of inspectors comprised of longtime members of the NSLS community with extensive experience as electrical technicians or engineers. This effort will be an ongoing program, and full inspection of all equipment is expected by DOE by 2009.

FY05 Summary Fault Analysis

Group Area/System	Number of Faults Total	X- DT	U- DT	Downtime [hr] X-ray	UV
Total Charges to Down Time					
Controls and Diagnostics	121	37	11	29.8	8.4
Power Systems	195	41	45	60.7	57.3
Utilities	95	47	26	54.3	10.7
Miscellaneous	136	86	8	36.1	1.6
	547	211	90	180.9	77.9
Significant Disruptions					
Ground Faults on XQB				22.5	
VUV RF System Intermittant Short					20.3
X-ray Sextupole overheating (XSD1)				13.1	
Trim system failures				8.1	
LIPA Switchover Power Dip				4.1	
VUV RF 100 W amplifier failure					4.3
XRF2 Contactor Replacement				3.6	
VUV Dipole PS Water Leak					3.7
				51.4	28.3
Balance to 'Routine' Faults					
				129.5	49.7

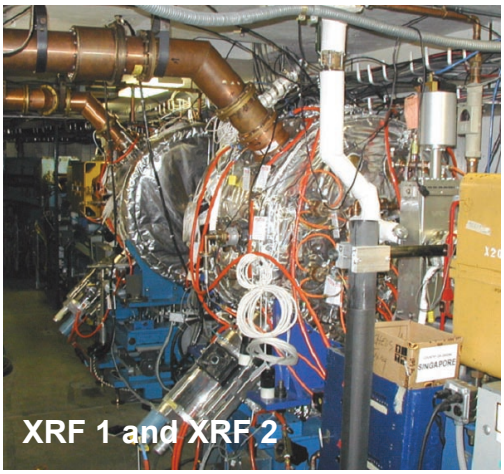
The spring shutdown also saw a complete rebuild and upgrade of the UV RF1 temperature control system, substantially improving its thermal response. This is important because the old system could not adjust quickly enough to keep up with the change in load from injection at maximum rate, and hence extended the minimum fill time for the VUV ring. After the shutdown, with the new system in place, one fill was completed from 0 to 1000 mA in less than two minutes. Of course, this also depended on the ability of the injector to rapidly supply charge to the machine.

Working with the Accelerator Division staff, this year the injection system was fitted with enhanced diagnostics to allow tracking of its performance. Wall current monitors were installed on existing ceramic breaks to follow current loss from the linac through the transport lines. Improved flags installed in key areas provide better imaging of the electron beam to help with machine tune-up. These upgrades are part of an ongoing effort to reduce lost charge and the radiation it produces around the facility. They also have the benefit of providing more user beam through reduced injection times.

Several other major activities underway in 2005, aimed at improving the capabilities of the facility, achieved significant milestones during the winter 2005 shutdown. The new undulator constructed for X25 was installed, providing a much brighter source for the X25 program. The construction, measurement, and testing of this novel device was a monumental and sustained undertaking for the whole department. The X25 mini-gap undulator (MGU) is described in detail by the Accelerator Division on page 5-4. This is only fitting, since their Magnetic Measurement Lab became a center of activity as the device came together for final assembly and testing starting in October.

The X25 MGU in the tunnel (not surrounded by the legion who built it; see Accelerator Division article for more information).

Another major program effort revolves around the creation of an insertion device based on a small angle x-ray scattering (SAXS) beamline to support research for the Center for Functional Nanomaterials. As it happens, the only available insertion device location in the x-ray ring is the RF straight, which feeds the X9 beamline, a slot already occupied by two very active beamlines that need to be relocated to make way for the new program. A suitable new home for the current Case Western X9 beamlines is the space at X3, although it was occupied by the Stony Brook University powder diffraction program. This program was relocated to X16C, which was refurbished for powder diffraction work. This cascade of moves is well underway, with the User Science Division coordinating and supporting the relocation of SBU program to X16C and dismantling the old beamline at X3 during 2005. This seemingly Byzantine series of moves was planned after careful consideration of many alternative sequences that would address the need to make a significant program change in a facility that is fully built out. Of the options considered it was easily the most cost effective way to free the space at X9 with minimal


XRF 1 and XRF 2

disruption for most of the user community.

To provide sufficient space within the x-ray ring for the insertion device that is to be located in the RF straight, the last of the new RF cavities was installed during the winter shutdown. Beyond making space for a new insertion device, as was done in the X29 RF straight, this last new cavity for the x-ray ring completes a long upgrade campaign. The new cavity design has improved thermal performance and eliminates weld joints that separated vacuum from water.

Further work is planned for the winter 2006 shutdown to install an insertion-device-capable exit chamber on the ring and to complete preparations of the RF straight such that it can receive an insertion device. The critical front-end components for the current X9 beamline will be relocated during the May 2006 shutdown, with relocation of the beamline to occur during the summer of 2006.

With the award of CD0 for NSLS-II in 2005, the whole NSLS community looks forward to bringing the exciting capabilities the proposal envisions into reality. In the meantime, the OED will continue to work with the other NSLS divisions to keep our user community on the existing facility — one of the most productive synchrotrons in the world.