

Workshop on Emerging Scientific Opportunities Using X-ray Imaging

Welcome and Summary of Charge to Participants

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WORKSHOP ON EMERGING SCIENTIFIC OPPORTUNITIES USING X-RAY IMAGING

Is a part of a study to explore future scientific directions for the Advanced Photon Source (APS)

Chair: Gopal Shenoy (APS/ANL)

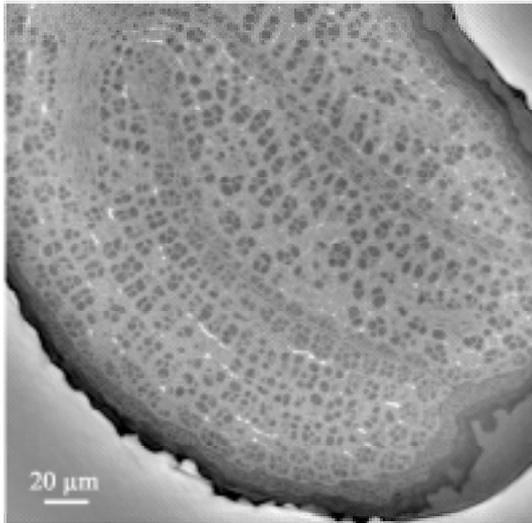
Co-Chair: Sunil Sinha (UCSB/LANL)

August 29 – September 1, 2004, The Abbey, Fontana, Lake Geneva Area, WI

Workshop Focus

- Full field hard (> 5 keV) x-ray imaging
- Scientific applications - present & potential
- Cover broad and diverse disciplines

Sensitivity



Dec 22, 1895. Mrs.
Roentgen's hand



Spatial Resolution



Time resolution

QuickTime™ and a
DV/DVCPRO - NTSC decompressor
are needed to see this picture.



Tomography

Acknowledgements: Cloetens (ESRF), Spence(ASU), Fezzaa, DeCarlo

APS Collaborative Access Teams by Sector & Discipline

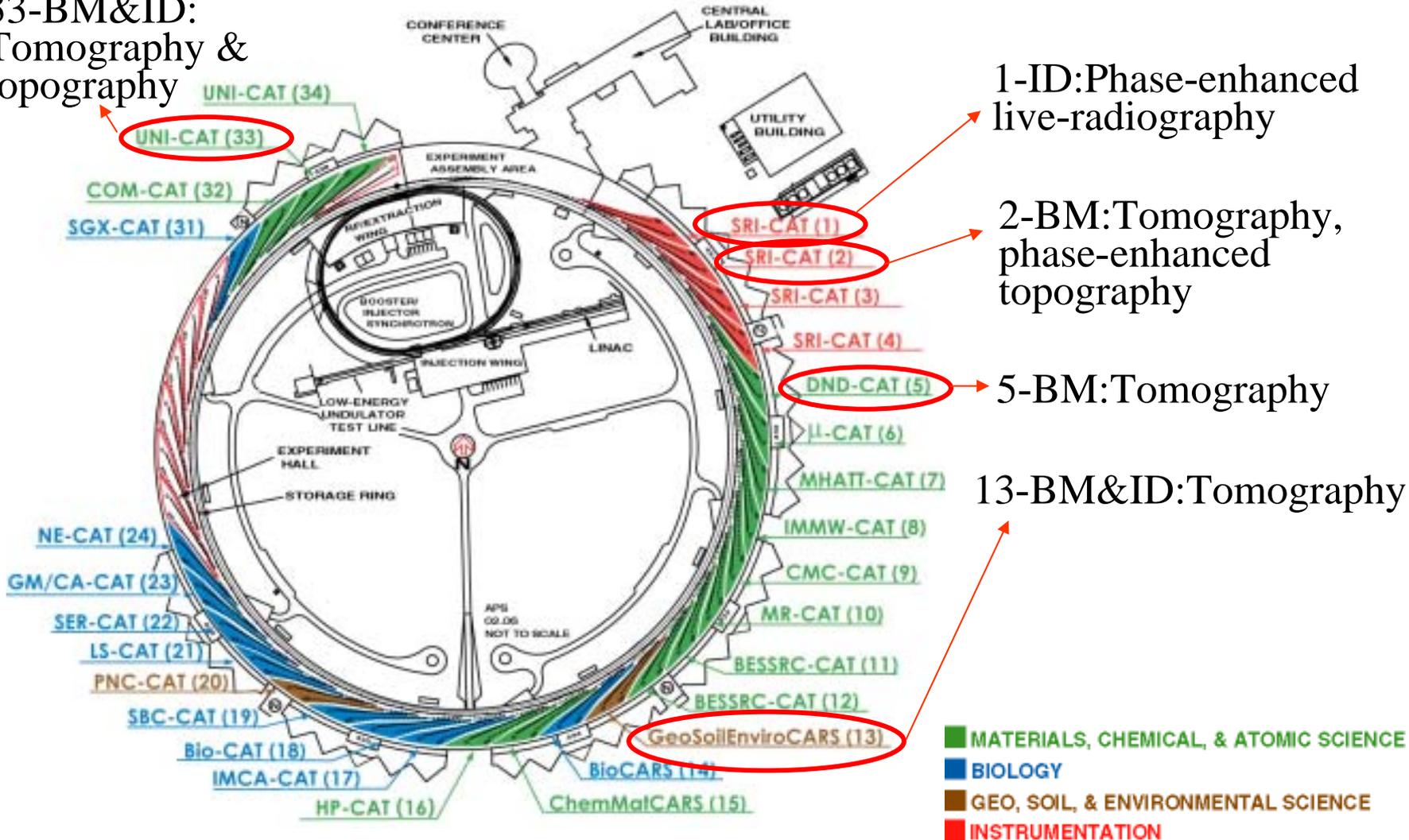
33-BM&ID:
Tomography &
topography

1-ID:Phase-enhanced
live-radiography

2-BM:Tomography,
phase-enhanced
topography

5-BM:Tomography

13-BM&ID:Tomography



Only on 2-BM is imaging > 50% of beamtime.

Practical Challenges

- Better 2D detectors - bigger and more efficient. Perpetual pursuit!
- Meeting the needs of a broad and diverse community - different imaging techniques and energies.
- Data storage - large amounts of data. Goes as N^3 for tomography.
- Data mining - how to extract useful **quantitative** information.
- Developing a user community.
- Need for dedicated beamlines and instrumentation.

Scientific Program Advisory Committee

- Jose Baruchel (*European Synchrotron Radiation Facility, Grenoble*)
- Howard Birnbaum (*University of Illinois , Urbana-Champaign and Member of APS Scientific Advisory Committee*)
- Dean Haeffner (*Advanced Photon Source*)
- Peter Ingram (*Duke University and Member of APS Scientific Advisory Committee*)
- Ian Robinson (*University of Illinois , Urbana-Champaign*)
- Yoshio Suzuki (*SPring-8, Japan*)
- Bill Thomlinson (*Canadian Light Source*)
- Ersan Üstündag (*Caltech*)
- Steve Wilkins (*CSIRO, Australia*)

Draft Workshop Objectives

1. Explore the breadth of science covered by the workshop topics, *not* limiting to synchrotron techniques alone.
2. Identify opportunities for continued scientific discovery and impact using the x-ray imaging at the APS during the next 5-10 years in the multi-disciplinary areas of science.
3. Identify new scientific proposals/programs specific to the emerging areas using x-ray imaging that the participants will bring to the APS during next 5 to 10 years. Also evaluate the capital and operational requirements for these proposals/programs.

Draft Workshop Objectives

4. In addition to available beamline capabilities at the APS, identify future needs to support research in this area of science and technology.
5. Address detector R&D that will enhance the capabilities of the APS x-ray imaging.
6. Address the need and support for developing imaging methodologies and image processing.
7. Prepare a summary document for the archival literature to serve as a roadmap for the time domain research using x-rays at the APS Source and suggest the role of the Advanced Photon Source towards this objective.

Charge to the Participants

Provide roadmap for APS on future of x-ray imaging

- Identify the grand challenge Scientific/Engineering problems in various disciplines that synchrotron x-ray imaging should address - now *and* 5-10 years from now.
- Identify the challenges and requirements needed to successfully answer these questions
 - New instrumentation and techniques needed
 - Need for dedicated beamlines and instrumentation
- Identify short and long-term R&D needed to achieve above - such as detectors, tomographic data mining, optics and sample environment

Workshop scope

- Perspectives - ESRF, APS, Spring-8
- New technique: Coherent diffraction imaging
- Science

<i>Life Sciences</i>	<i>Materials/Complex Systems</i>
Biology - physiology	Physics
Biology - plants	Energy
Biology - evolution	Material Science
Paleontology	Geology
Medical	Industry

Workshop Report

- The summaries and slides provided by the speakers of the talks can be accessed directly by clicking the 'summary' or 'slides' in the 'program' on the workshop website.

[http:// www.future.aps.anl.gov/Future/Workshops/Using_Xray_Imaging/program.htm](http://www.future.aps.anl.gov/Future/Workshops/Using_Xray_Imaging/program.htm)

- You can continually input your thoughts using the 'Swiki' software linked to the lap-top using Wi-Fi Input can be made even after the workshop.

<http://swiki.anlgh.org/Imaging>

Login Name: image

Password: pretty

- Address the applicable objectives in each of the topics in the scope of the workshop after each talk and make recommendations to the APS

APS Strategic Planning Meeting

"Future Scientific Directions" September 2 & 3, Fontana, Wisconsin
www.future.aps.anl.gov/Future/Strategic_Planning_Meeting/home.htm

	Thursday Sept. 2, 2004	Friday Sept. 3, 2004
8:00 am	Introduction & Charge	
8:30 am	Report on Time Domain Workshop	Report on Nanomagnetism Workshop
9:30 am	Report on Inelastic Scattering Workshop	Report on Big Magnet
10:00 am	Break	Break
10:30 am	Report on Imaging Techniques Workshop	Report on High-Energy X-rays Workshop
11:30 am	Report on Meso/Nanoscope Workshop	Report on Biological Crystallography Workshop
12:30 pm	Lunch Break	Lunch Break
2:00 pm	Report on Membrane Science Workshop	Discussion and Wrap-Up
3:00 pm	Report on BES-Funded Sectors Science	
3:30 pm	Break	
4:00 pm	Report on Environmental Workshop	Adjourn
5:00 pm	Report on Soft X-rays Workshop	
6:30 pm	Dinner	

Welcome.

Thank you for participating.

Your input is critical to the success of this workshop!