
Introduction to Detector Workshop 2005

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Outline of Talk

- History of this workshop
- Review 2000 Detector Workshop
- Overview of the workshop agenda
- Personal comments on development of detectors for synchrotron experiments
- Goals of workshop

Thanks to All Speakers for Coming

- The synchrotron community needs better detectors and your enthusiasm in coming to a workshop in the middle of winter in Chicago is really appreciated !!

This Workshop Was Planned for SRI2005 in Baton Rouge

- Sol Gruner was “sparkplug” for having this workshop
- Program committee has representatives from all U.S. synchrotrons.

ALS - Howard Padmore

APS - Dennis Mills

CAMD - John Scott

CHESS - Sol Gruner

NSLS - Peter Siddons

SRC - Ralph Wehlitz

SSRL - John Arthur

- Workshop is funded by NSF (Charles Bouldin)
- *Hurricane Katrina forced cancellation*

Story of 2000 Detector Workshop

- Workshop on Detectors for Synchrotron Radiation Research was held October 2000 in Washington with over 70 participants
- Had both Detector Scientists and Experimental Synchrotron scientists
- Working groups were formed in Crystallography, Imaging, Diffraction, Spectroscopy, IR, and Ultrafast
- Funded by the Office of Science of DOE
- Major goal was to lay groundwork for a more focused and integrated U.S. detector development program

Results of 2000 Detector Workshop

- White paper coordinated by Howard Padmore was written that proposed:
 1. New funds for beamline detector upgrades that use today's technology
 2. Creation of a road map for detector development
 3. Funding of long-range strategic research in key areas. Part of research would be producing detectors for use at all synchrotrons and/or technology transfer to industry

Unfortunately these proposals were not followed

Why Have a 2nd Workshop Now?

In past 5 years :

- Many beamlines are operational with optimized beamline optics
- Experimental requirements for state of the art experiments are now limited by detectors instead of raw x-ray flux
- New detector technologies are becoming available that could provide new capability
- U.S. will soon be behind Europe in having most advanced scientific capability

Agenda of First Day

- This morning is on detector needs for X-ray Science, FEL science, Soft X-ray/UV/IR science. Gareth will talk on Detector Research in Europe.
- Lunch at the Argonne Guest House
- This afternoon is on pixel detectors, drift detectors and CCD's
- Poster session on the 5th floor of APS
- snacks/no host bar
- No Host Dinner at Guest House with Gene Ice entertaining with his guitar/songs

Agenda of Second Day

- Morning session on superconducting detectors and What we can learn from High Energy Physics.
- Lunch at the Guest House
- Afternoon session of Si Arrays and Channelplate based detectors
- Discussion and writing session to produce a written summary document

Some Speakers Were Unable to Attend

- Jerry Hastings on Detector Needs and Plans for FEL Science (Peter Siddons)
- Christian Broennimann on the SLS pixel detector - Gareth will include about 5 slides from Christian about this detector
- Ralf Menk on Gas Detectors

Synchrotron Facilities in U.S.

- ALS - since 2000 many more beamlines
- APS - many new beamlines - routine operation in top-off mode at full energy
- CAMD - routine operation
- CHESS - dedicated synchrotron operation - research on a Energy Recovery ring
- NSLS - many insertion device beamlines - fully operational - proposal for NSLS2
- SSRL - new 3rd generation storage ring
- SRC - routine operation

Synchrotron-based Science Is An Important Part of U.S. Science

- ALS, APS, CAMD, CHESS, NSLS, SRC, and SSRL have a total of over 100 beamlines.
- Investment of over \$2 billion since 1990
- Support from NSF, DOE, NIH, DOD.
- There are 1000's of users from everywhere in the U.S and from many scientific disciplines.

Synchrotron Science is International

- Canada, Australia, UK, France, Spain, India, China, ...
- New machines are generally 3rd generation so they have “state of the art” capability
- The world’s best scientists go to the best facilities and they often push the technical limits in their research
- U.S. should be allocating funds to keep the U.S. at the technical cutting edge. Buying off the shelf hardware is shortsighted.

Development of LCLS at Stanford and ER at Cornell

- Pulsed nature of rings requires new detector technology needed
- UltraFast Timing Detectors with very large flux per pulse.

LCLS is like a High Energy Physics Accelerator
with a only a few beamlines

ER would provide new capability

How Is Advanced Technology Funded in U.S. Industry ?

Two Examples:

- U.S. automobile industry
 - individual companies develop independently
 - compete for a shrinking part of pie
- U.S. semiconductor industry
 - major players (Intel, AMD, TI,...) work with tool builders to make a 5-15 year “road map”
 - identify critical technology and arrange to collectively fund it

Helps the whole field but it gives the edge to advanced technology companies.

Trends in Synchrotron Science

- Computer hardware (PC farms) and software (Epics/Labview) are not a major experimental limitation.
- Available experimental flux is not growing dramatically
- Optics is producing 10-100 nm beams
- Quality of beams is improving (stability, monochromaticity, harmonics)
- Many experiments need higher throughput (crystallography has crystallization and sample handling robots (many xtals/shift), 3D tomography data sets (Gbytes/hr), micro-EXAFS in heterogeneous samples

New Detectors can increase data rates 10-100X

What is Needed

- Generating a detector development “road map” would give focus to detector needs of synchrotron community.
- Some long time horizon (3-7 year) detector projects should be funded to develop “seed corn” for next generation detectors.
- Mechanism is needed for beamline experimental groups to get funding to upgrade their detectors with “state of the art” detectors.

Goals of Workshop

Write a report which will:

- *Update experimental requirements*
- *Update the opportunities for advanced detectors that would enable dramatically improved experiments*
- *Highlight trends in advanced detectors*
- *Spark coordinated development of advanced detectors for the synchrotron community*

Questions and Discussion Are Encouraged

- I have asked all the speakers to allow time for questions - workshop not seminar.
- I have also asked them to project what could be developed rather than just reporting what is available.