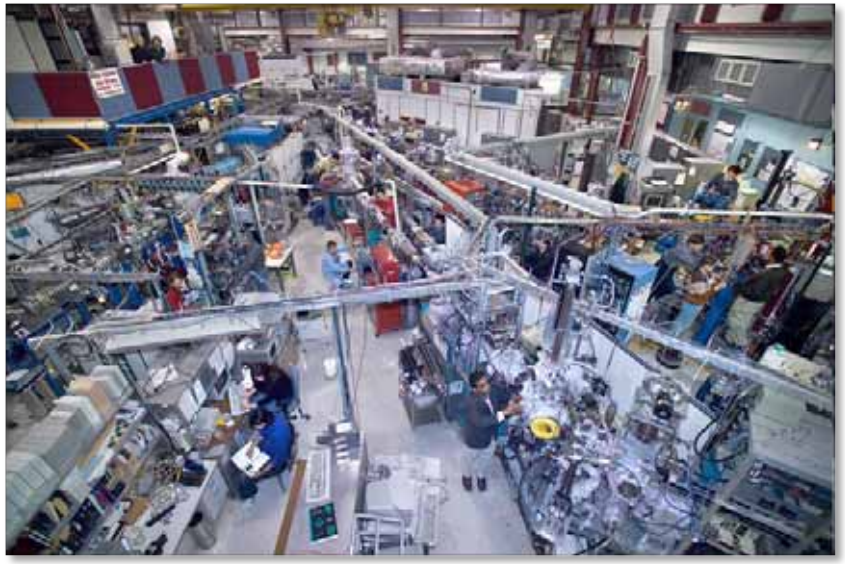
IN SynC

Introducing Synchrotrons into the Classroom

Starts	Ends	List of Speakers
3:30 PM	4:00 PM	Check-in as necessary at GUV Center Building 400, ~
4:00 PM		Group Photo, ~
4:00 PM	4:15 PM	Ken White, Brookhaven National Laboratory
		Welcome
4:15 PM	4:45 PM	Antonio Lanzirotti and Scott Bronson, University of Chicago and Brookhaven National Laboratory
		Overview of InSynC and Goals for the Workshop
4:45 PM	5:15 PM	Lisa Miller, Photon Science Directorate, Brookhaven National Laboratory
		Introduction to the NSLS & NSLS-II
5:15 PM	5:45 PM	Maria Brown, Sayville High School; Diana Soehl, Elwood-John Glenn High School; Mike Vaccariello, Sachem (East) High School; and Lucinda Hemmick, Longwood High School, ~
		Teacher Experience with InSynC
5:45 PM	6:15 PM	Light Dinner, ~
6:15 PM	6:45 PM	Scott Bronson, Brookhaven National Laboratory
		Internet Tools and Remote Access
6:45 PM	7:45 PM	Antonio Lanzirotti and Lisa Miller, University of Chicago and Brookhaven National Laboratory
		Tour of the NSLS Experimental Floor
		THURSDAY, May 26 - Conference Room A
4:00 PM	4:30 PM	Antonio Lanzirotti, University of Chicago
		Writing a Beamtime Proposal
4:30 PM	5:30 PM	Antonio Lanzirotti and Lisa Miller, University of Chicago and Brookhaven National Laboratory
		Beamline Activities (technique introduction) - Activity 1: X-Ray Fluorescence Microscopy; Activity 2: Fourier Transform Infrared Microspectroscopy; Activity 3: Macromolecular Crystallography
5:30 PM	6:00 PM	Light Dinner, ~
6:00 PM	7:45 PM	Antonio Lanzirotti and Lisa Miller, University of Chicago and Brookhaven National Laboratory
		Beamline Activities (hands-on) - Activity 1: X-Ray Fluorescence Microscopy; Activity 2: Fourier Transform Infrared Microspectroscopy; Activity 3: Macromolecular Crystallography

Office of Educational Programs

NSLS

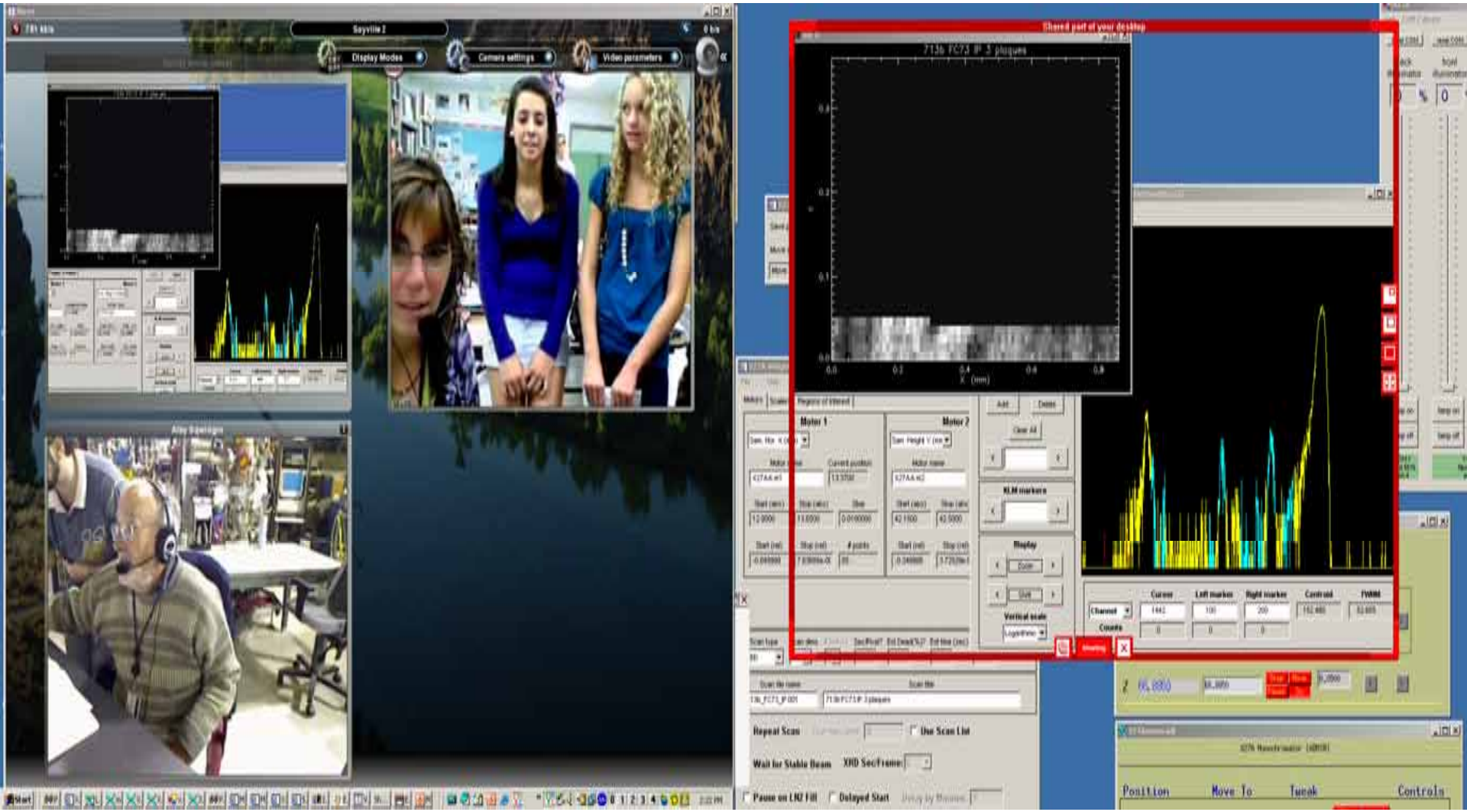


RHIC

NSLS-II

CFN

Cyber-enabled Remote Access



Bringing Big Science into the Classroom: BNL's NSLS and CFN
Monday, May 24, 2010

Over 100 Registered Attendees, over 50% were High School Teachers and Administrators

What is InSynC?

- A program to enable high school teachers and students to gain remote access to synchrotron beamtime through a competitive, peer-reviewed proposal process.
- The program will train both teachers and students to formulate a hypothesis-driven scientific problem and learn the skills of writing a competitive beamtime proposal.
- Supported and Funded the NSLS and DOE's Office of Workforce Development for Teachers and Scientists (WDTS) to enhance science education at the high school level.
- *http://insync.nsls.bnl.gov/*

Who Can Participate?

- This program has started with local Long Island high schools.
- Any high school science program can participate.
- We anticipate that in the future the program will be expanded to a nationwide competition and involve all US synchrotrons.

Implementation

3-Day Teacher Training Course

Teachers & Students formulate a hypothesis and experiment

July 2010

Teachers & Students submit proposal

Peer Review

Proposals receive 1-4 rating

Score too low for this cycle: Classroom Visit

Highest rated scheduled for beamtime

Where Are We Now?

- First set of proposals were submitted on October 22nd. We have had one additional round of proposals since then.
- For both rounds reviews were completed and proposals scored by a panel of synchrotron scientists worldwide with expertise in education and outreach.
- Proposal Examples: collection and analysis of micrometeorites, effectiveness of household water filters, chemistry of biofilms, structural biology
- Two proposals were allocated beamtime in December 2010 and two more in April 2011.

InSynC off and running with a Bang!

InSynC Introducing Synchrotrons into the Classroom

nsls IR UV X

What's Next?

Available Beamlines & Beamtime:

- Initially, approximately 1-2 days of beamtime per cycle will be allocated on 3 beamlines at the NSLS.
- These will include:
  - X-ray fluorescence microprobe beamline
  - Infrared microscopy beamline
  - Protein crystallography beamline
- As additional beamlines are outfitted, more beamlines will be made available.

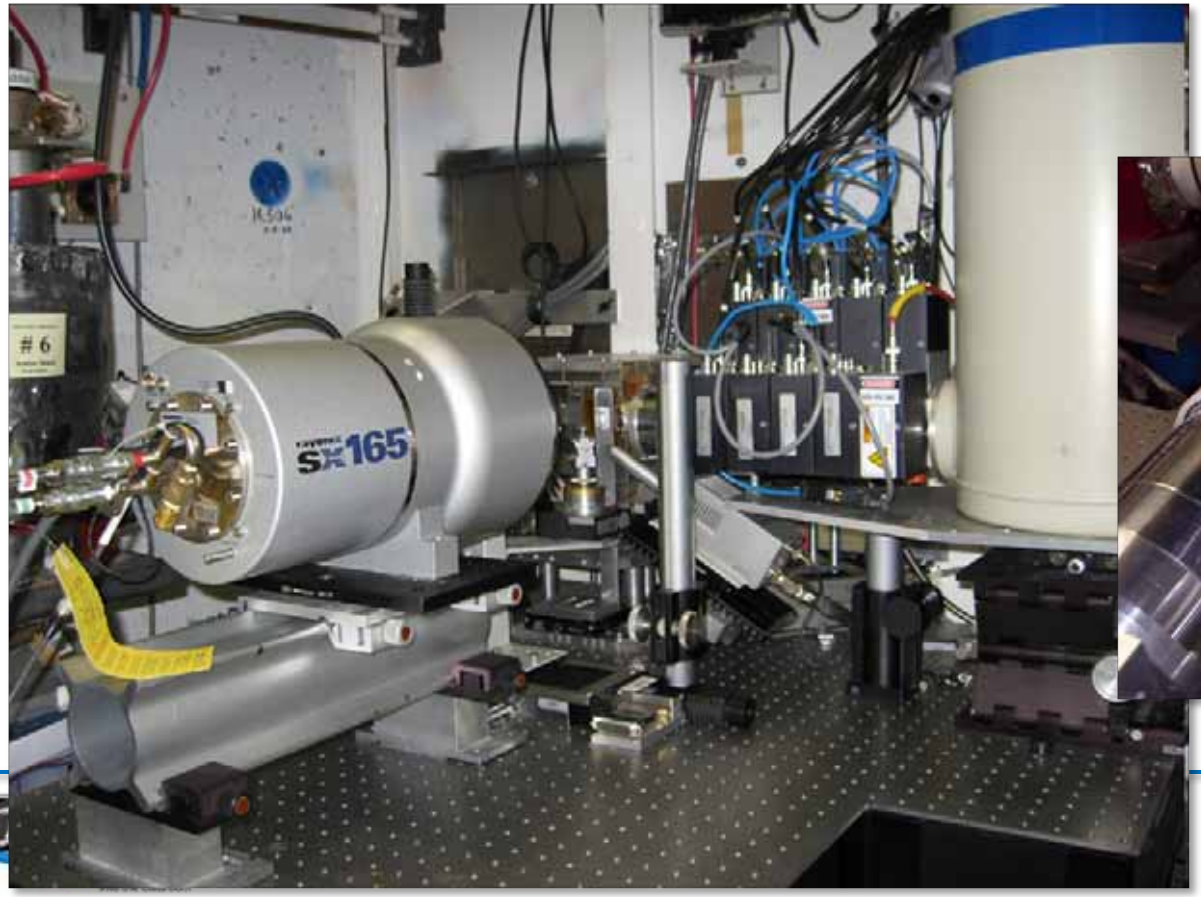
Infrared Microscopy Beamline

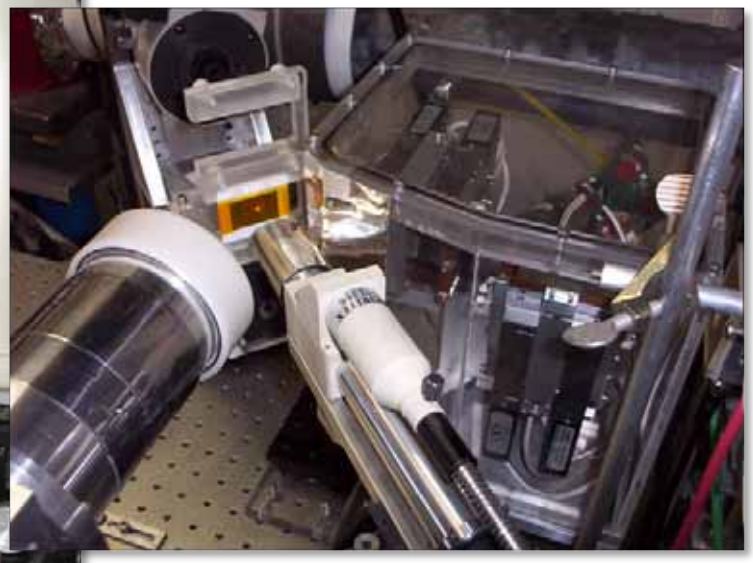
These beamlines focus bright beams of infrared light to a very small size (1/10 size of human hair) to image the organic makeup of materials

Examples: biological materials, plastics, fibers, soils

Synchrotron X-ray Microprobes

- These beamlines focus these bright X-ray beams to very small size (<10 µm …f.y.i human hair is ~100 µm diameter) to:
  - Examine the distribution of elements at micron scale with femtogram sensitivity (0.000 000 000 000 001 g)
  - Evaluate the molecular form of these elements in natural samples
  - Provide chemical information as an imaging experiment

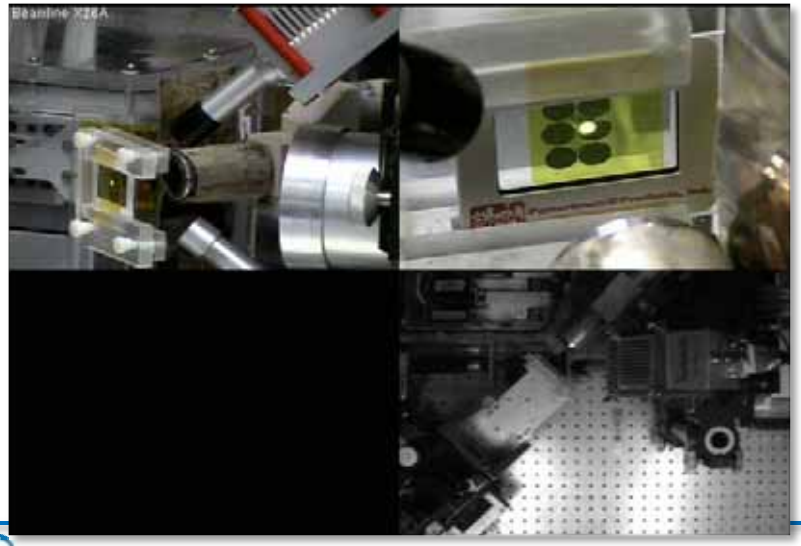




Macromolecular Crystallography

- These beamlines use synchrotron X-ray beams to determine the arrangement of atoms within a crystallized protein.
  - The beam of X-rays strikes the crystal and diffracts into many specific directions. From the angles and intensities of these diffracted beams, the researcher can produce a three-dimensional picture of the density of electrons within the crystal.
  - From this electron density, the mean positions of the atoms in the crystal can be determined, as well as their chemical bonds, their disorder and various other information.

Remote Access from the Classroom



InSynC Goals

InSynC…

- Engages high school teachers and students to formulate hypothesis-driven experiments
- Provides research experience to entire classrooms rather than individual students
- Addresses many of the key recommendations made by the National Academies in the National Curriculum Standards (i.e. inquiry based learning)
- Provides student access to the Nation's premier science facilities, the same facilities Nobel-prize winning researchers have used

2003 and 2009
Nobel Prizes in Chemistry

Rod MacKinnon

Venkatraman Ramakrishnan

Thomas Steitz

Goals for this workshop

Introduction to the NSLS & NSLS-II (Lisa Miller)

- What is a synchrotron and how does it work?
- What types of science are addressed at synchrotron facilities?
- How do scientists gain access?

Teacher Experience with InSynC so far (Maria Brown,…)

- Overview of types of experiments conducted so far
- Experiences writing proposals
- Lessons learned interfacing between the beamlines and the classroom
- Students and the synchrotron as a learning tool

Internet Tools and Remote Access of Synchrotron Experiments (Scott Bronson)

- History of remote access to NSLS
- Adobe Connect as an interface tool
- Lessons learned for enabling smooth and successful remote experiment

Tour of the NSLS Experimental Floor

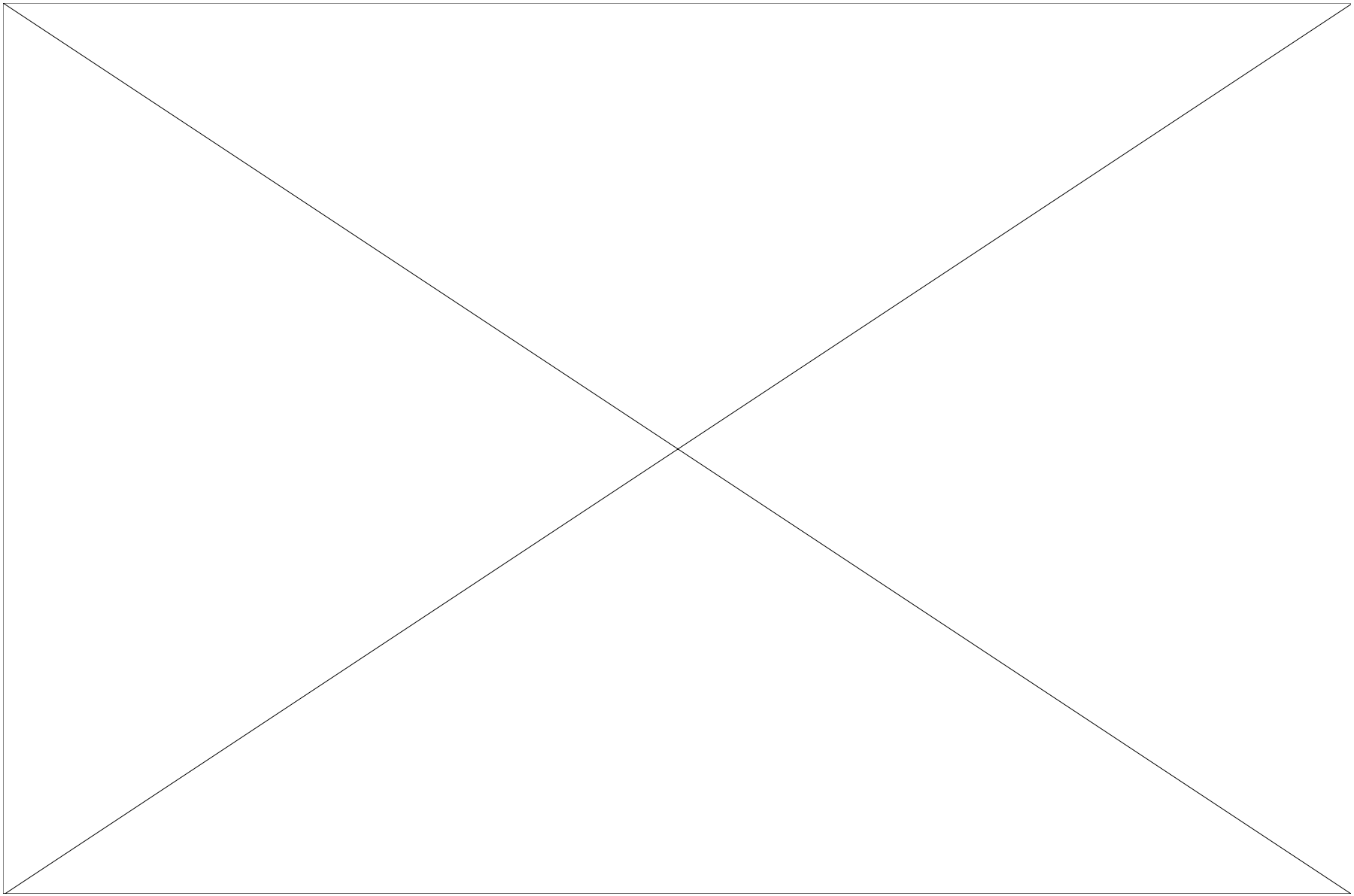
Goals for this workshop

How to write a Beamtime Proposal (Tony Lanzirotti)

- How the NSLS PASS system works
- The review criteria
- Scoring and beamtime allocation and scheduling
- What to expect if allocated beamtime

Activity 1: X-Ray Fluorescence Microscopy (Tony Lanzirotti)

Activity 2: Fourier Transform Infrared Microspectroscopy (Lisa Miller)

Activity 3: Macromolecular Crystallography (Alexei Soares)

- Introduction to the techniques and how they work
- Scientific Examples of how these techniques are used
- Practical aspects of sample preparation and analysis of data
- Tour and hands-on experience with the beamlines