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APS Renewal and Beyond: Plotting Out a Course of Action

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User Week 2008

May 4-8, 2008

The APS Renewal - Why?

- We need to develop a medium term plan that lays out how we will invest in the APS beamlines (optics, detectors, etc.) and source over the next 5 years, so that we stay a vital and internationally-competitive facility.

- Many beamlines are 10 or more years old and are in desperate need of rejuvenation.

- There is still considerable untapped potential at the APS that can be made available to the user community (3 unused straight sections, 18 unused BM sources, an increase in capabilities through canted IDs, optimized IDs, better detectors, etc.)

- The development of a 5-year plan was strongly recommended by the Review Committee for the 2007 DOE Facilities Review of the APS.

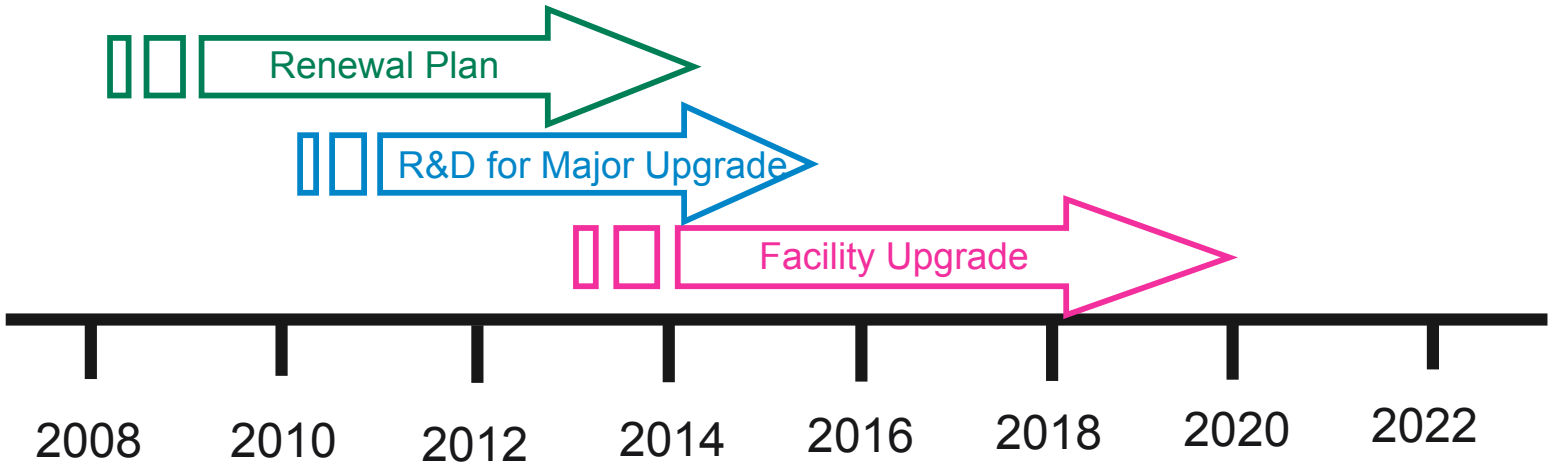
- If the renewal plan is well designed and the resources made available for implementation, all these things put together can make a significant impact on the scientific output of the APS.

- On the other hand, without a substantial investment, the APS will not simply stay where we are, but will begin to fall behind other facilities.

Long-term Plans for APS (APS 2020) - How the Renewal Plan Fits In

- The APS 2020 Plan is an high-priority component of the ANL 2020 Plan, recently submitted to DOE, that (among other things) describes the Laboratory's major activities over the next 5-10 years.

- The APS 2020 Plan has several components:
  - APS Renewal Plan - a 5 year science-driven investment plan that will focus on beamlines, optics, detectors, and source improvements
  - R&D for Major Upgrade - a plan that focused on the R&D required for a major facility upgrade that will build on the Renewal Plan that will take SR sources to the next level
  - Facility Upgrade - a project that, once defined and approved by funding agencies, would keep the synchrotron radiation facilities at ANL at the state-of-the-art to 2020 and beyond.



Background Information on the Renewal Plan

- To arrive at this point, APS has had many internal discussions and exchanges with the SAC and APSUO/PUC regarding what should be included in a medium-term renewal plan.

- In Feb 2008 we got things rolling by sending out an e-mail to:
  - CAT Directors,
  - XOR Group Leaders, and
  - Beamline Managers and/or Lead Scientists

  requesting that they develop ***beamline renewal proposals*** for the medium term (next 5 years). Beamline Advisory Committees (BAGs) for the XOR beamlines have already been or will be asked to help out here to.

- We currently have several ***Letters of Intent for new beamlines/sectors*** (e.g., imaging, surface and interfaces, bio-nanoprobe) that have already been approved by the SAC and they will be included in the renewal plan as well.

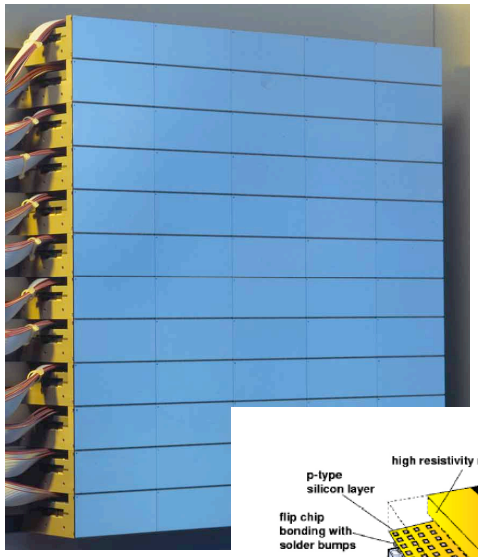
- At the same time, Rod Gerig had been tasked with requesting and organizing ***source renewal proposals*** from the accelerator side, that address obsolescence, reliability/spares, improved performance, and facility infrastructure.

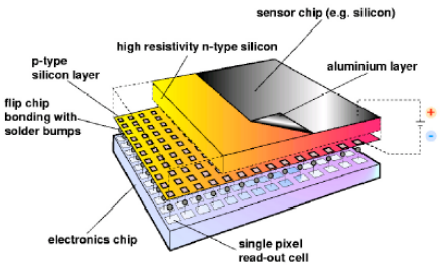
To go further, we need input and help from the User Community.

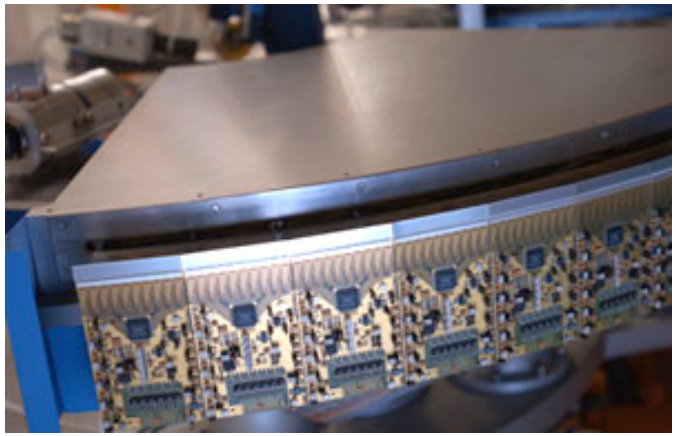
Beamline Renewal Proposal Example from the MX CATs

- Beamline renewal proposals covered a wide range of requests, from support of a piece of equipment to an entire beamline.

- Detectors were a frequently mentioned item.



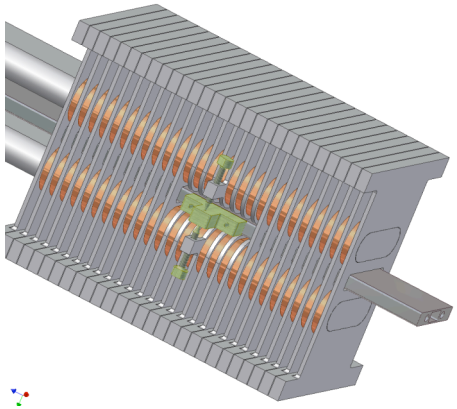




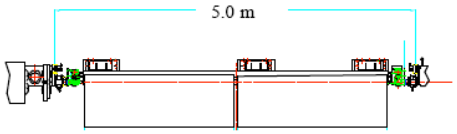
- Support for Pixel Array Detectors (from the MX CATs)
  - Since beamlines at the APS would like to move towards pixel array detectors (PADs), ***this proposal requests that the APS define and fund a group to support PAD operations*** at the APS
  - APS should ***train staff for diagnostics and repair of PADs*** and consider the acquisition of a spare PAD modules for enable rapid repair of faulty PAD detectors

Example of a Beamline Renewal Proposal from XOR Staff

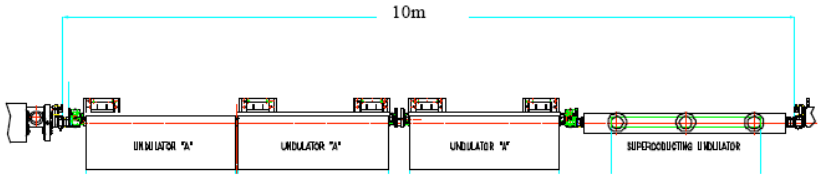
- A dedicated high-energy x-ray beamline for the study of mechanical properties
  - High-energy x-ray scattering techniques can be applied in a variety of ways to study the mechanical properties of materials
  - This proposal will allow us to ***explore time scales and spatial resolutions that are currently not possible at the APS - or anywhere else***.
  - Need long straight-section and IDs optimized for 45- 120 keV range
  - Area detectors



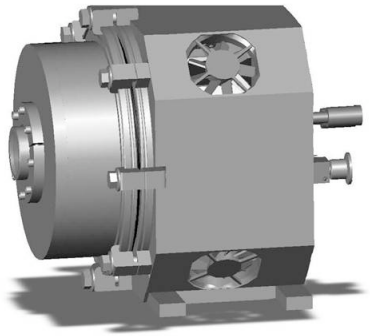
Conceptual design for the Nb_3Sn 1.5-cm-period SCU and cryo-system.



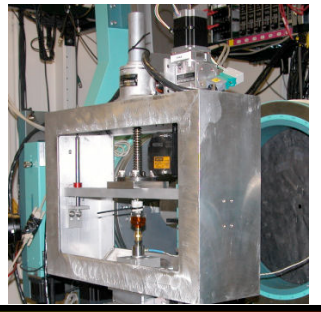
CURRENT STRAIGHT SECTION



PROPOSED EXTENDED STRAIGHT SECTION



Fast CCD collaboration with LBNL



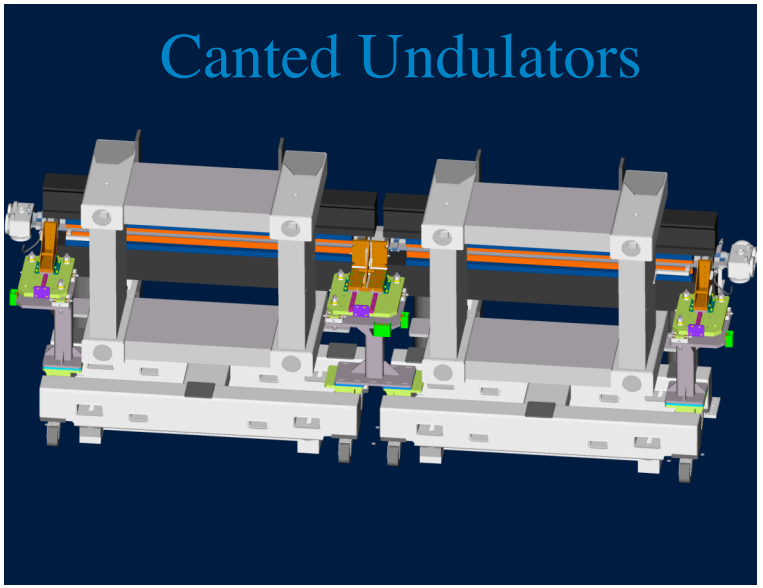
Current Sector 1 deformation rig

Example Renewal Proposal from HP CAT staff

- 10 years experience have revealed clear directions for the future

- At the same time the existing facilities are aging and face steep competition from new facilities in Europe and Asia

- Request:
  - Canted IDs
  - Optimized submicron beam
  - Instrumentation for TR, inelastic, and high resolution diffraction



- This proposed upgrade will:
  - Permit advancement to the next generation of HP synchrotron science
  - Optimize the current (mainstream) techniques and develop new ones
  - Help to mitigate the beamtime shortages

Accelerator System Renewal Proposals

- 60 proposals were received for accelerator systems renewal.
- Proposals were submitted in one of six categories, with each category having a coordinator:
  - Obsolescence/Spares/Hardware Upgrades — John Quintana/Michael Borland
  - Insertion Device Upgrades* — Efim Gluskin
  - Beam Stability — Glenn Decker
  - Accelerator R&D — Rod Gerig
  - Facilities and Infrastructure — John Maclean
  - X-ray science enablers — Denny Mills

* ID upgrades will be driven by requests from the beamline renewal proposals. Part of the process between now and the October Retreat will be to look at the beamline proposals and extract a list of desired IDs or desired properties.

- We are in the process of "repackaging" some of the proposals into larger ones to better cover/coordinate a particular accelerator area or system for renewal.

All proposals will be posted on the APS website - stay tuned

Examples of Accelerator Systems Proposals

- APS Water Systems (Obsolescence/Spares)
  - Maintain reliability by replacing aging/obsolescent components
  - Present controllers have not been manufactured for 7 years
  - Refurbishment of controllers available through 3rd party but no guarantee how long with will last

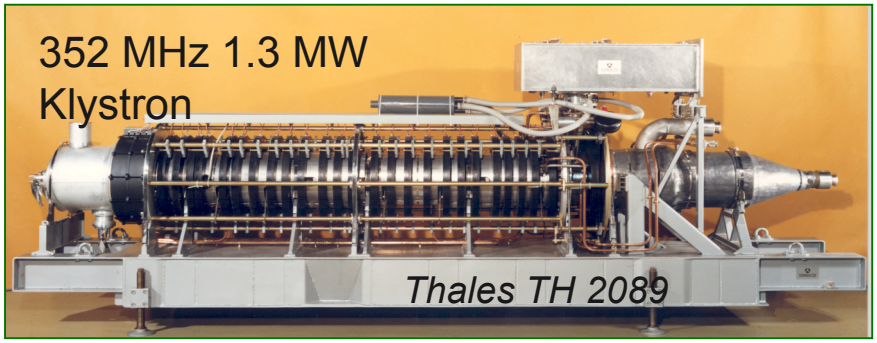
Upgrade monitoring of DI water polishing system

Connect Beamlines to APS water

Replace obsolete Johnson Controls temp controllers

Bringing the APS RF Transmitters into the 21st Century

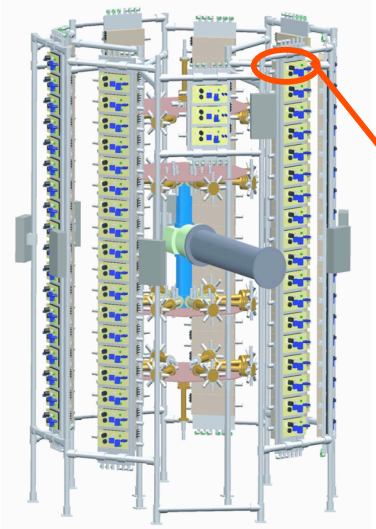
Present APS RF Transmitter



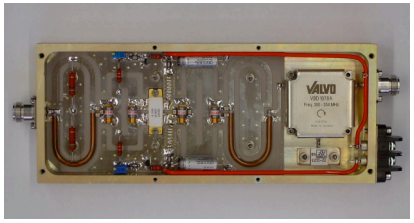
- Solid-State RF Amplifier Development (R&D)
  - Present system subject to instabilities
  - Not optimized for light sources
  - Long-term supply issue and expensive

Proposed APS Renewal/2020 RF Transmitter

200 kW tower

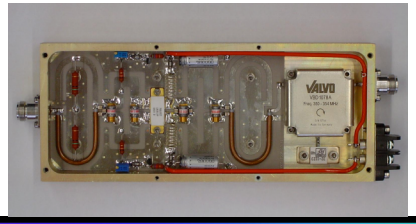


352MHz 330 W Module

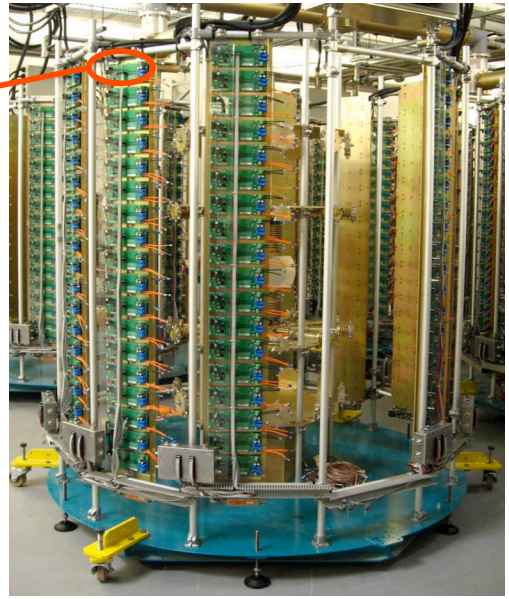


R&D

352MHz 1 kW Module



SOLEIL 50 kW tower in operation

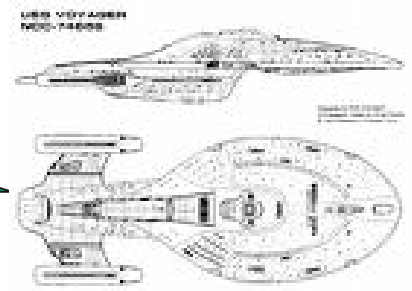


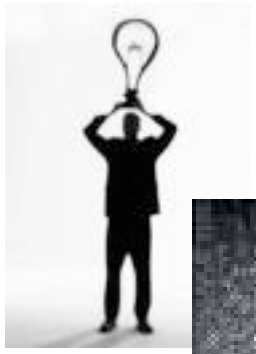
Where Are We Going?

- Our goal is to ***develop a document describing the scientific case*** driving the plan for renewal of the beamlines and source over the next 5-10 years.

How do we proceed from ideas, thoughts, notes….

to a plan?





The ESRF's "Purple Book" - a programme to upgrade Europe's strategic centre for science and technology research

That's what this talk is about.

Building the Science Case

- We need to build a strong ***science case*** for the renewal plan.
- We will build on our planning of the last few years, especially the many science workshops that have been held, to frame our Renewal plan.
- To get things rolling, we propose to start the process by building the science case around the following scientific disciplines:
  - Macromolecular Crystallography (MX)
  - Geological, Environmental, and Planetary Sciences
  - Atomic, Optical, Molecular, and Chemical Science
  - Surfaces, Interfaces, and/or Thin Films
  - Polymers, Soft Materials, and/or Biology (excluding MX)
  - Condensed Matter and Materials Physics (includes magnetism, superconductivity, and emergent materials)
  - Materials Science and Technology (includes photonics, semiconductors, nanomaterials, and liquid crystals)
  - Engineering Applications/Applied Science (includes deformation, cements and mortars, shape memory alloys, superalloys, liquid sprays)
- ***We may need to add more disciplines if important areas of science are underrepresented or missing.***

A Proposal to Move Forward: Science Discipline Working Group Leader/Members and Technique Coordinators

- We will assemble, for each science discipline, ***working groups of inside and outside users*****,** (Science Discipline Working Groups) who will work to develop the case for their respective discipline.
  - *There will be an opportunity for new proposals to be submitted or even new science groups to be created as we move forward*

- Science Discipline Working Group
  - Develop the science case
  - Select, consolidate and optimize the proposals
  - Develop/call for new proposals (if necessary)
  - Outline how the renewal and possible eventual upgrade will position APS to enable revolutionary new science of importance in this area

- Technique Coordinators
  - Help identify which techniques are important to each scientific discipline
  - Develop a list of (both current and future) instruments that are required to enable the various disciplines

- Then, with additional input from the user community, we will coalesce these disciplines into 5 (or so) of the most compelling ***scientific themes***.

Steering Committee

- The whole process will be shepherded along by a steering committee comprised of:
  - APS Staff
    - *Rod Gerig*
    - *John Maclean*
    - *George Srajer*
    - *DM*
  - User Representatives
    - *APSUO Chair or other representative*
    - *APS PUC Chair or other representative*
    - *Life Sciences Council Chair or other representative*
  - Member(s) of the SAC.
- An important responsibility of the steering committee will be to develop and assemble the ***final document*** describing the APS renewal plan.

APS Renewal Document

- Section I
  - will identify a limited number of scientific themes which the community feels has the greatest potential for scientific impact (breadth and depth)
  - will outline how the renewal (and possible follow-on facility upgrade) will position APS to enable innovative and bold new science of importance to our stakeholders.
- Section II
  - will cut across these science areas through enabling techniques and source capabilities
  - will reveal how a concerted set of beamline and source improvements would enable the scientific vision of the first section
  - will contain a part on support framework/infrastructure which enables everything described
- Section III
  - will summarize a prioritized strategy, costs, and timelines for making progress on our renewal goals.

How Will the Prioritization Process Work?

- The primary criterion for prioritization will be the same that is described in the mission of APS, namely to ***deliver world-class science and technology by operating an outstanding synchrotron radiation research facility accessible to a broad spectrum of researchers***.
  - Highest priority items are those which will maximize the scientific impact of our x-ray source.
  - Stay focused on those techniques that are best suited to APS, matched to the needs of our general user and partner user community.
  - Request that the science working groups, along with the technical coordinators, pull together the highest priority proposals to make their cases.
- We will seek input from the user community to assist in setting the priorities for the accelerator proposals.
- In addition to assisting in the selection of the submitted accelerator proposals, we will ask the science and technique working groups to incorporate in their planning possible ***revolutionary upgrades to the source*** in the future, e.g., energy recovery linacs, x-ray free electron laser oscillators.
- We will utilize the APS scientific advisory committee to help us make priority choices.

How Do You Get Involved?

- Volunteer to be on one of the scientific discipline working groups.

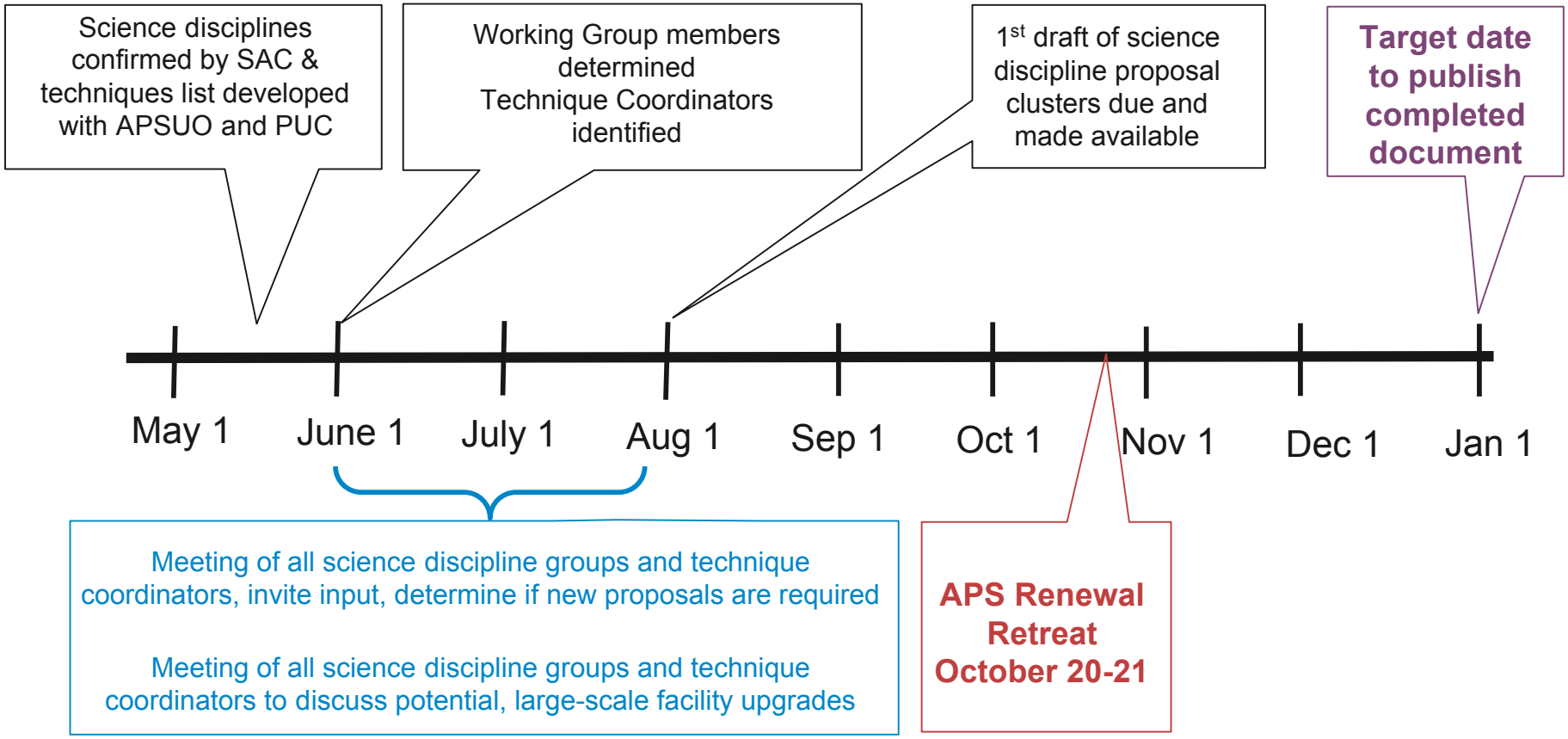
- Communicate your thoughts through a:
  - science working group member
  - technical coordinator
  - steering committee member
  - APSUO Steering Committee member
  - Partner User Council member

  } Both groups meeting later this week!

  - Beamline Advisory Group (BAG) member
  - Scientific Interest Group (SIG) member (www.aps.anl.gov/Users/Scientific_Interest_Groups/)

- Participate in the October 20-21 Renewal Retreat

Tentative Timeline



Summary

- We are beginning the process to develop a critically important document detailing our ***plan for investment in the APS over the next 5 years*** to remain a vital, internationally competitive facility.

- We have a very aggressive goal to complete this document in the ***beginning of 2009***.

- We need ***input from our user community*** on all aspects of this plan, including the process itself, science drivers and the necessary beamline and/or source improvements that will allow researchers using the APS to make significant impacts in those scientific areas.

- We see this as the first step in a larger plan, ***APS 2020***, that will lay the foundation and provide a path that will ensure that the APS facility remains at the state-of-the-art well into the future.