Title	***SPX Accelerator System***			
Project Requestor	Alireza Nassiri, for SPX Team			
Date	September 12, 2008			
Group Leader(s)	Alireza Nassiri			
Machine or Sector Manager				
Category	Accelerator R&D			
Content ID*	APS_1271708	Rev.	1	8/18/08 12:00 AM

*This row is filled in automatically on check in to ICMS. See Note [1]

Description:

Start Year (FY)	**FY09**	**Duration (Yr)**	**4**

Objectives:

Study, design, prototype, and develop necessary accelerator system and components in support of the APS SPX utilizing superconducting rf technology to deliver few picoseconds x-ray pulses at APS.

Benefit:

The Short Pulse X-ray (SPX) Source at the Advanced Photon Source will extend time-resolved capabilities to the important 1-ps timescale while retaining the powerful characteristics of synchrotron radiation, user-controlled continuous tunability of energy, polarization and bandwidth combined with exquisite x-ray energy and pulse length stability over a wide energy range. The 1-ps stroboscopic images can freeze molecular rotations, capture photo-excited molecular transition states, stress/strain wave propagation, magnetic domain wall dynamics, phase transitions, energy relaxation, and the coupling between electron, phonon and spin degrees of freedom in condensed matter systems.

Risks of Project: See Note [2]

Medium

Consequences of Not Doing Project: See Note [3]

Lose a unique opportunity to be the first hard x-ray facility providing high average flux (~10^{13}/s) with high repetition rate excitation methods and year-round operation that will enable time-resolved studies with unprecedented precision – yielding joint resolution of picoseconds and picometers for a variety of atomic, molecular, chemical and material systems.

Cost/Benefit Analysis: See Note [4]

Involves staff time from many groups, including RF, OA, AP, DIA (ASD), CTL, MED (AES), and XSD. This project has also external collaborators from JLAB and LBL. Potential payoff is high. Overall, the scientific payoff and benefits favorably justify the cost.

Description:

1. Development of a suitable superconducting RF deflecting structure for CW operation.
2. Development of a suitable cavity system test setup for vertical cold tests and evaluation.
3. HOM/LOM damping
4. Development of a suitable cryomodule.
5. Lattice studies and beam dynamic analysis for longer straights
6. Development of a new LLRF control system to meet the amplitude and phase stability requirements of SPX accelerator system.
7. Modeling and analysis of an integrated LLRF control system including signal processing, noise analysis, phase stable distribution systems.
8. Thermal and stress analysis of the accelerator components.
9. Timing, synchronization, and precision phase reference and distribution.

Funding Details

Cost: ($K)
Use FY08 dollars.

Funding Details
FY 08 $

Cost ($k)

Year	AIP	Contingency
1	300	60
2	400	80
3	400	80
4	400	80
Total	1500	300

Contingency may be in dollars or percent. Enter figure for total project contingency.

Effort: (FTE)
The effort portion need not be filled out in detail by March 28

Year	Mechanical Engineer	Electrical Engineer	Physicist	Software Engineer	Tech	Designer	Post Doc	Total
1	0.3	0.3	0.3			0.2		1.1
2	0.3	0.4	0.3	0.2		0.2		1.4
3	0.3	0.4	0.2	0.2		0.2		1.3
4	0.2	0.4	0.2	0.2		0.2		1.2
5								0
6								0
7								0
8								0
9								0

Notes:

[1] **ICMS**. Check in first revision to ICMS as a *New Check In*. Subsequent revisions should be checked in as revisions to that document i.e. C*heck Out* the previous version and C*heck In* the new version. Be sure to complete the *Document Date* field on the check in screen.

[2] **Risk Assessment.** Advise of the potential impact to the facility or operations that may result as a consequence of performing the proposed activity. Example: If the proposed project is undertaken then other systems impacted by the work
include ... (If no assessment is appropriate then enter NA.)

[3] **Consequence Assessment.** Advise of the potential consequences to the facility or to operations if the proposal is not executed. Example: If the proposed project is not undertaken then ____ may happen to the facility. (If no assessment is appropriate then enter NA.)

[4] **Cost Benefit Analysis.** Describe cost efficiencies or value of the risk mitigated by the expenditure. Example: Failure to complete this maintenance project will result in increased total costs to the APS for emergency repairs and this investment of ___ will also result in improved reliability of ____. (If no assessment is appropriate then enter NA.)