Title	***R&D into Separation of Lifetime and Injection Optimization Using Time-Dependent Sextupoles***			
Project Requestor	Michael Borland, Louis Emery			
Date	March 21, 2008			
Group Leader(s)	Borland, Moog			
Machine or Sector Manager	Louis Emery			
Category	Accelerator Hardware and ID Upgrades			
Content ID*	APS_XXXXXX	Rev.	ICMS_Revision	ICMS Document Date

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

Description:

Start Year (FY)	**2009**	**Duration (Yr)**	**3**

Objectives:

To improve injection efficiency and lifetime, thus reducing radiation damage to accelerator components and IDs.

Benefit:

Reduction in radiation damage to insertion devices and other accelerator components.

Risks of Project: See Note [2]

Low.

Consequences of Not Doing Project: See Note [3]

Higher than necessary damage to IDs and accelerator components.

Cost/Benefit Analysis: See Note [4]

At this point this is an R&D project, so the cost/benefit remains to be quantified.

Description:

This is part of a multi-proposal initiative aimed at reducing radiation damage. (See Section 1 of OAG-TN-2008-008 for a full description and explanation of the linkage among the parts).

Presently, the sextupole configurations we use are developed using a method [OAG-TN-2007-040, OAG-TN-2007-029] that reaches a compromise between injection efficiency and beam lifetime. If our sextupole magnets could be adjusted "quickly" to different values just for injection, we could perhaps optimize injection and beam lifetime separately, thus possibly reducing radiation at IDs from both sources. This won't be possible unless we are steered quite close to the center of the sextupoles. We propose to perform R&D leading to use of time-varying sextupoles for separation of lifetime and injection optimization. Since the desired pulse duration is on the order of a few seconds, the required pulsing should be possible with the planned upgraded digital power supplies.

We may have issues with beam motion due to the asymmetric vacuum chamber, however. It is possible that we could use six power supplies on each fast corrector to provide two pulsed sextupoles in each sector. It remains to be determined whether we could have sufficient sextupole strength to perform the desired changes, or whether the locations are suitable for making the desired changes.

The proposed work includes the following:

1. Using simulation, optimize APS sextupoles to separately maximize momentum aperture (subject to sufficient dynamic aperture for retaining beam) and dynamic aperture only (subject to sufficient momentum aperture for retaining beam). Do this variously with all sextupoles, with two families only, and with sextupoles at the location of the fast correctors only.
2. Use tracking and (later) machine studies to assess, for each set (pair of sextupole configurations)
    1. Single bunch thresholds for both configurations
    2. Injection efficiency for the injection configuration
    3. Beam lifetime for both configurations
3. If results are positive, create specifications for magnet and power supply groups for implementation.

[1] **Notes:**

ICMS. Check in first revision to ICMS as a *New Check In*. Subsequent revisions should be

Funding Details
FY 08 $

Cost ($k)

Year	AIP	Contingency
1	0	
2	0	
3	0	
4		
5		
6		
7		
8		
9		
Total	0	

Contingency may be in dollars or Percent

The effort portion need not be filled out in detail by March 28

Effort (FTE)

Year	Mechanical Engineer	Electrical Engineer	Physicist	Software Engineer	Tech	Designer	Post Doc	Total
1			0.3					0.3
2			0.3					0.3
3								0
4								0
5								0
6								0
7								0
8								0
9								0