Title	***R&D into Improved Collimation for the BTS and SR***			
Project Requestor	Michael Borland, Louis Emery			
Date	March 21, 2008			
Group Leader(s)	Borland, Harkay			
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 protect insertion devices and other accelerator components from suffering radiation damage due to electron beam losses.

Benefit:

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

Risks of Project: See Note [2]

Low. The primary risk is that the impedence of the ring will be changed. However, we have trusted simulation tools to prevent any deleterious increase. Indeed we would hope to improve the impedance.

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).

Beam collimation in the APS ring has been used to reduce the radiation dose to insertion devices resulting from Touschek scattering and beam dumps. We propose to improve this by designing a new scraper with both inside and outside jaws (presently there is only a single jaw) and improved impedance characteristics.

Using beam collimation to protect against injection losses may be difficult if we wish to preserve beam lifetime. An alternative is to collimate in the injection transport line. Ideally, the collimation will consist of several scrapers well upstream of the injection point,
to remove both tails and errant beam pulses. Some modeling has been done on this in the past, but without reaching a workable design. We propose to revisit this R&D, leading to a workable design.

The proposed work includes the following:

1. Study of collimation schemes used for LEP in order to determine their applicability to APS. Of particular interest is the use of multiple scrapers to localize the loss point.
2. For the storage ring
    1. Use modeling of Touschek scattering in ELEGANT to understand the dynamics of scattered particles and determine likely locations for effective collimation.
    2. Use of ELEGANT and SHOWER in combination to design and evaluate the collimation system in detail.
    3. Evaluate tolerances on scraper surfaces and angles.
3. For the BTS
    1. Perform modeling of the scraping beam tails on the septum and other apertures (e.g., quadrupoles inside the bump) to ascertain if losses at these locations can propagate to IDs. Modeling will use SHOWER and ELEGANT, and perhaps MARS or G4BEAMLINE.
    2. Design a multi-scraper collimation system (optics, choice of scraper materials) to scatter and then intercept beam tails.

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			0.4					0.4
2			0.4					0.4
3								0
4								0
5								0
6								0
7								0
8								0
9								0

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[1] **Notes:**

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.)