Title	***HOM Dampers***			
Project Requestor	Doug Horan			
Date	8/14/08			
Group Leader(s)	Ali Nassiri			
Machine or Sector Manager				
Category				
Content ID*	APS_1269799	Rev.	3	8/15/08 12:00 AM

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

Description:

Start Year (FY)	**2009**	**Duration (Yr)**	**5**

Objectives:

Develop a design upgrade to the existing E-probe HOM dampers presently installed in the Sector 38 storage ring rf cavities, and install the upgraded dampers in all sixteen storage ring cavities. The upgraded dampers will be designed to reject the fundamental mode in order to damp only higher-order-modes (HOM's) with modal patterns potentially existing in high-field regions in the single-cell cavity. The dampers would be designed to dissipate intercepted HOM power in external rf loads so that outboard instrumentation can be used to analyze the HOM spectral and power data.

Benefit:

Avoiding known HOM instabilities has created parameter constraints on present storage ring operation, resulting in performance compromises. It is expected that the installation of E-probe HOM dampers in each storage ring rf cavity will increase the HOM instability threshold of the storage ring and therefore help ensure stable operating conditions to a maximum beam current of 300mA over a wide range of fill patterns.

Risks of Project: See Note [2]

The risks of the project are moderate due to the obvious connection to storage ring vacuum integrity should the dampers fail. However, these risks will be mitigated by thorough testing of both low and high-power prototypes and high-power conditioning of all production units of the proposed upgrade damper design in the 350-MHz RF Test Stand. Also, since the dampers may be removed (or electrically shorted) at any time after they are installed, the risk of introducing unforeseen and uncontrollable detrimental effects in storage ring rf system operation is also reduced. Additionally, multipacting issues would also be investigated at the fundamental frequency during the development phase to determine if that mechanism would be a limiting factor.

Consequences of Not Doing Project: See Note [3]

Specific known HOM’s periodically affect the present accelerator operations by causing instabilities resulting in lost beam or beam degradation. Present mitigation efforts involve adjustments to cavity temperature, cavity tuning, and total cavity gap voltage, all of which introduce compromises in system performance that limit the useful operating range of the machine. It is generally understood that uncontrolled HOM’s and related instabilities will limit the ability of the machine to achieve higher current operation.

Cost/Benefit Analysis: See Note [4]

The addition of HOM dampers to all sixteen rf cavities has the potential to improve the current performance of the storage ring, but the dampers will be essential if operation of the storage ring at currents higher than 150mA is required. The immediate benefits at present operating levels will likely include reduced thermal and multipacting stresses attributed to the presence of HOM’s, but either active or passive dampers will be necessary to permit higher beam current operation.

Description:

We propose to build a general-purpose damper that utilizes enhanced diagnostic capability to accurately characterize HOM’s that are interacting with the beam. The dampers are designed with a high-power rejection filter that enables the dampers to be located in cavity ports that will intercept HOM’s while not degrading the high Q cavity operation. Their performance has been shown empirically to match the performance of the dampers that are currently installed in S38 for the 540 MHz longitudinal HOM. However, the new damper design would enable the damping of modes that can not be damped by the current dampers, and at the same time, would offer enhanced diagnostics and little vacuum interaction since the new damper design uses external damper loads that are not resident in the cavity vacuum.

<u>Risk Matrix Evaluation:</u>
Impact 2 Likelihood 2 Risk 4

Funding Details

Cost: ($K)
Use FY08 dollars.

Year	AIP	Contingency
1	$170	
2	$170	
3	$311	
4	$311	
5	$311	
6		
7		
8		
9		
Total	$1,273	

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	0.2	0.2				0.05		0.45
2	0.2	0.2				0.05		0.45
3	0.1	0.1			0.2	0.05		0.45
4	0.1	0.1			0.2			0.4
5	0.1	0.1			0.2			0.4
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.)