Title	***LINAC Modulator Solid-State Switches***			
Project Requestor	Dave Bromberek			
Date	4/17/08			
Group Leader(s)	Ali Nassiri			
Machine or Sector Manager	Nick Sereno			
Category	Obsolescence/Spares			
Content ID*	APS_1256752	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)**	**3**

Objectives:

Procure, assemble, test and implement a solid state fast high-voltage/high current switch, capable of replacing the Linac modulator CX1836A Hydrogen thyratron switches.

Benefit:

Each of the six Linac modulators (five providing for beam, and one in the Test Stand) utilizes one Hydrogen filled thyratron CX1836A manufactured by E2V, a UK company. The thyratrons are triggered by a trigger units designed and manufactured by E2V, as well. Average lifetime of the thyratrons in the Linac modulators is about 17,000 hours. Since the modulators are in use during about 6,000 hours a year, about two thyratrons need to be replaced every year, with a replacement cost of $33,000 according to the latest (June, 2008) quotation. Also, each thyratron consumes as much as 560 Watts of electric power for its cathode and reservoir filament. Energy consumption of all 6 thyratrons during one year of operation exceeds 20,000 kWatt*hrs at a cost of over $2,000. Total cost of using the thyratrons approaches $40,000 per year when overhead is considered. Replacing the thyratrons with solid state switches, which if properly designed and maintained, will totally eliminate power consumption by the filaments and significantly reduce replacement cost, since solid state switches have much longer (theoretically unlimited) lifetime. Also, each switch is less expensive than the thyratron ($12,6k vs. $16.5k, according to the quote received in October, 2007 from Applied Pulsed Power, Inc.).

Risks of Project: See Note [2]

N/A

Consequences of Not Doing Project: See Note [3]

If this project is not undertaken, the APS will continue spending $40,000 a year on spare modulator thyratrons and filament power for them.

Cost/Benefit Analysis: See Note [4]

In addition to cost savings, longer component lifetime improves downtime and MTBF, with less transients affecting surrounding equipment.

Description:

A funding level of $110.6k over three years would assure a graduate replacement of the thyratrons and utilization of existing spares:
Year 1 – Purchase two switches and modification components
Year 2 – Purchase three switches
Year 3 – Purchase three switches

Funding Details

Cost: ($K)
Use FY08 dollars.

Year	AIP	Contingency
1	35	
2	37.8	
3	37.8	
4		
5		
6		
7		
8		
9		
Total	110.6	

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		0.1			0.1	0.1		0.3
2		0.1			0.1			0.2
3					0.1			0.1
4								0
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.)