ECal report

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DOE 2015 Review recommendation

- The team should provide to DOE a report on the ECal annealing tests by February 16, 2016. This report should use the beam test data to validate the heat annealing model, and use the model to predict performance under expected operating conditions.
  - **Response:** *Report was sent to DOE in March 2016.*
- The Laboratory is urged to evaluate the ECal project including the technical feasibility of the annealing solution, and ECal project cost and schedule, by summer 2016.
  - Response: Working on report comparing 3 options

Three options

Option	Existing BIGCAL with UV curing	Existing BIGCAL with thermal annealing	BNL SPACAL
FOM	0.73	1.0	0.76
$\Delta E/E$	10%	5%	14%
Cost	\$54k	\$126K	\$142.5K

Shared cost of updated trigger and HV of \$100K.

- Written report comparing three options. Main consideration is difference in energy resolution and ECal trigger threshold of 90% of elastic max.
- Send out report on July 8th to three members of the SBS Annual review committee. Get response in one month.
- Send conclusions to DOE by August 15th.

Summary of technical cost and schedule risks

"BIGCAL with UV curing"		
Technical Risk	**HIGH**	1) Extrapolation by factor of 13 from GEp3 experience used to estimate rate of radiation damage. 2) Possible long-time constant radiation damage effects not seen in GEp3.
Cost Risk	**LOW**	The costs are understood.
Schedule Risk	**LOW**	The tasks are well understood.
"BIGCAL with thermal annealing"		
Technical Risk	**MEDIUM**	1) C200 work to test mechanical design for full scale implementation is ongoing. This risk will be mitigated when C200 test is complete. 2) Possible long-time constant radiation damage effects not addressed by the C16 test.
Cost Risk	**LOW**	The technology is standard.
Schedule Risk	**MEDIUM**	C200 work to test mechanical design for full scale implementation is ongoing and is expected to be done by August 2016. This risk will be mitigated when C200 test is complete.
"BNL SPACAL"		
Technical Risk	**LOW**	The SPACAL has been used previously and the modifications are straightforward.
Cost Risk	**LOW**	Quotes have been received from the vendors for parts and work.
Schedule Risk	**LOW**	The tasks are well understood.

Table 2: Summary of technical, cost and schedule risk

UV curing option
Budget and schedule

Item	Subitem	Cost ($K)
UV curing system		
	Osram UV lights	1
	Large housing to hold lights	25
	Labor for UV light fixture installation	8
Aluminum absorber		10
New legs for platform		10

Table 3: Budget for the UV curing option

Milestone	Date
Start preparing blocks	Sept 2016
Start preparing optical coupling cookies	Oct 2016
Complete wrapping of lead glass and cookies	Jan 2017
Design UV light fixture and aluminum absorber begins	Jan 2017
Lead glass installation started	Feb 2017
Order parts for light fixture	Mar 2017
Lead glass installation completed and cosmic tests started	May 2017
UV light fixture installed	July 2017
ECAL ready to install	Aug 2017

Table 4: Schedule for the UV curing option

Item	Group	Effort
New legs for platform	JLab engineers and designers	1 week engineer and 2 weeks designer
UV light box and aluminum absorber	JLab engineers and designers	3 weeks engineer and 5 weeks designer
Making optical cookies	One JLab staff	8 weeks at 25% time
Clean and wrapping lead glass	One JLab staff and postdoc	4 months at 50% time
Installation of lead glass	One JLab staff and postdoc	3 months at 50% time

Table 5: Workforce estimate for the UV curing option. The JLab staff and/or postdoc could be replaced by faculty user and/or university postdoc.

Thermal annealing option Budget and schedule

Item	Subitem	Cost ($K)
Oven		
	Thermalcouples and readout	2
	Foamglass insulation	6
	Heating elements	16
	9-block supermodule parts	35
Light guides	1200 (600 onhand)	12
BigCal Platform Modifications		
	New legs	10
	New enclosure	45

Table 6: Budget for the thermal annealing option

Milestone	Date
Conceptual design report for oven complete	Sept 2016
Order light guide rods	Sept 2016
Order the 9-block module parts	Oct 2016
Start gluing light guide rods to blocks	Dec 2016
Design of oven enclosure begins	Jan 2017
Receive the 9-block module parts	Feb 2017
Oven enclosure sent to procurement	May 2017
Completed gluing light guide rods to blocks	Aug 2017
Oven enclosure completed	Aug 2017
Installation of lead glass modules started	Sept 2017
Lead glass installation complete and cosmic tests started	April 2018
ECAL ready to install	May 2018

Table 7: Schedule for the thermal annealing option.

Item	Group	Effort
New legs for platform	JLab engineers and designers	1 week engineer and two weeks designer
New oven and enclosure	JLab engineers and designers	4 weeks engineer and 12 weeks designer
Assembly of oven	2 JLab technicians	2 weeks
Gluing light guide rods to blocks	1 JLab staff and 1 postdoc	8 months at 50%
Installation of lead glass modules	1 JLab staff and 1 postdoc	7 months at 50%

Table 8: Workforce estimate for the thermal annealing option. The JLab staff and/or postdoc could be replaced by faculty user and/or university postdoc.

BNL SPACAL option
Budget and schedule

Item	Subitem	Cost ($K)
BNL SPACAL modules		
	Shipping from BNL	5
	Cutting and polishing (quote from Vision)	6
Light guides		
	Material + machined and mechanical polished	83
	Holder	2.5
	Optical glue	1
BigCal Platform Modifications		
	New legs	10
	New enclosure	35

Table 9: Budget for the SPACAL option

Milestone	Date
Shipment of blocks from BNL to vendor	Sept 2016
Order light guides from vendor	Sept 2016
Order holders	Oct 2016
Start design of new enclosure and legs	Jan 2017
Vendor completes cutting and polishing blocks	Jan 2017
Holders completed	Feb 2017
Machining of light guides complete	April 2017
Begin assembly of light guides on modules	May 2017
New enclosure and legs sent to procurement	Mar 2017
Complete assembly of light guides on modules	Sept 2017
New enclosure and legs completed	Sept 2017
Installation of SPACAL started	Oct 2017
SPACAL installation compete and cosmic tests started	Mar 2018
ECAL ready to install	Apr 2018

Table 10: Schedule for the SPACAL option.

Item	Group	Effort
New legs for platform	JLab engineers and designers	1 week engineer and two weeks designer
New enclosure	JLab engineers and designers	3 weeks engineer and 5 weeks designer
Assembly of light guides on modules	1 JLab staff and 1 postdoc	4 months at 50%
Assembly of new enclosure	2 JLab technicians	1 week
Installation of modules	1 JLab staff and 1 postdoc	5 months at 50%

Table 11: Workforce estimate for the SPACAL option. The JLab staff and/or postdoc could be replaced by faculty user and/or university postdoc.

Shared costs for trigger and HV

Item	Subitem	Cost ($K)
Modified PMT bases and patch panels		
	2400 Connectors	17
	Patch Panels	5
Trigger electronics		
	31 4-channel linear FI/FO	40
	800 LEMO cables	24
Replacement HV cables and patch panels		
	40 patch panels	15

Table 13: Cost for the trigger and HV update.

Item	Group	Effort
PMT modified bases and patch panel	JLab technician	8 weeks
Replacement patch panels	JLab technician	6 weeks

Table 14: Workforce estimate for the updated trigger.