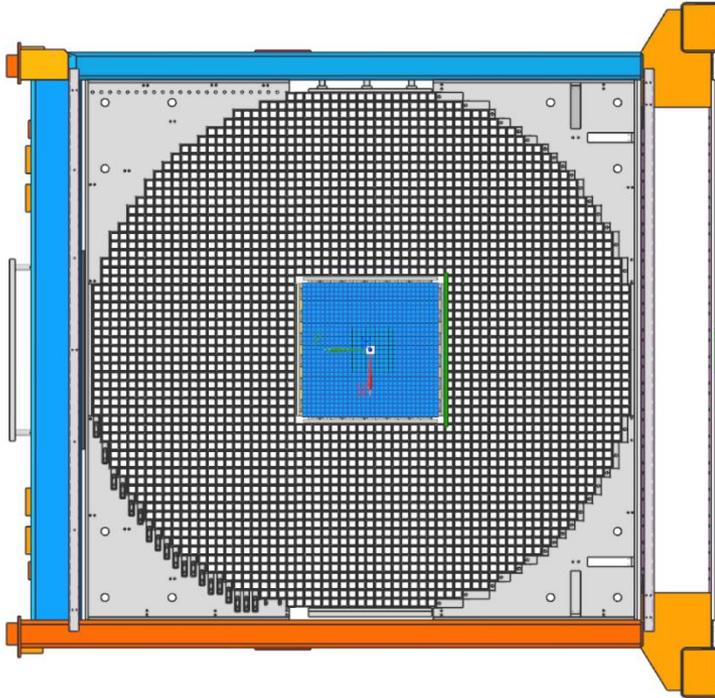


Proposal for FCAL-II Upgrade



A 32x32 matrix of PWO insert ($\sim 64 \times 64$ cm² in size, a total of 1024 PWO detector modules) with a 2x2 matrix ($\sim 4 \times 4$ cm²) beam hole to replace 247 channels of the Pb glass modules in the central region of the existing FCAL

Unit Price of a PWO Detector

Item	Cost per channel
PWO Crystal (2.05cmx2.05cmx18cm)	\$820
PMT	\$310
HV divider	\$50
PMT housing	\$50
Flash ADC	\$340
HV	\$310
HV cable	\$100
Signal cable	\$50
Total	\$2030

Estimated total cost

(Calorimeter with 32 x 32 modules = 1020 channels)

Item	Channels	Unit Cost	Cost
PWO crystal	1050	\$820	\$0.86M
PMT+base+house	1050	\$410	\$0.43M
Flash ADC	660 (reuse FCAL/CCAL)	\$340	\$0.22M
HV	910 (reuse CCAL)	\$310	\$0.28M
HV cables	910 (reuse CCAL)	\$100	\$0.09M
Signal cables	910 (reuse CCAL)	\$50	\$0.05M
Frame	1	\$150 k	\$0.15M
Chiller & control equipment	1	\$50 k	\$0.05M
VXS crate+electronics	3	\$34.5 k	\$0.1M
Light monitoring	1	\$30 k	\$0.03M
Total			\$2.26M
Contingency(20%)			\$0.47M
Total+Contingency			\$2.71M

FCAL II fabrication and Installation

Assemble 1050 CCAL modules: 6 months, 2 people

(time estimates are based on the CCAL fabrication experience)

FCAL restacking:

Unstack FCAL modules	- 2 months
Install new frame	- 2 months
Stack CCAL/FCAL modules	- 2.5 months
Attach PMTs/cables install LMS	- 1.5 months

Total time: 8 months

Note, some installation procedures can be done in parallel