

LBNL

Low Background Facility



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National Laboratory



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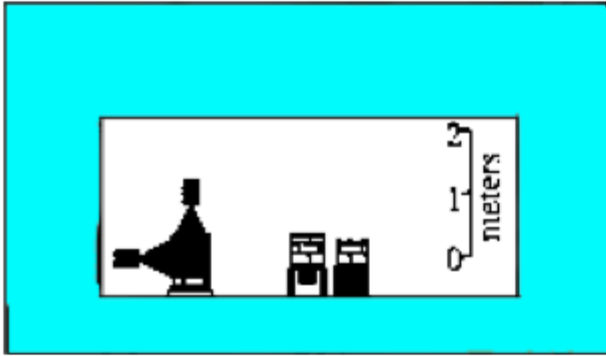
services and activities



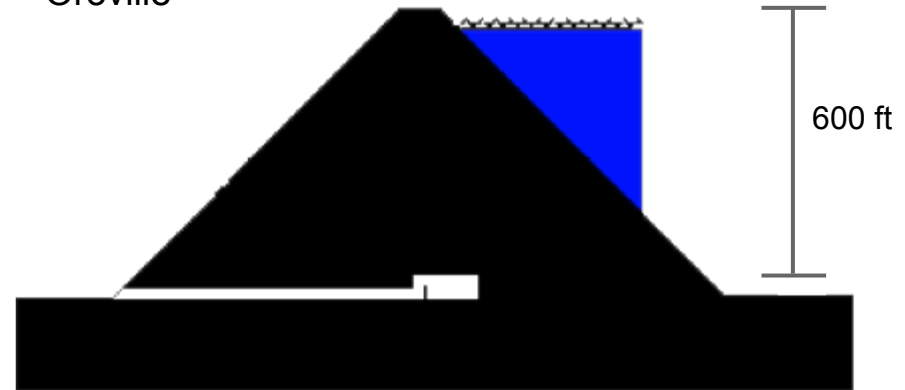
- HPGe gamma spectroscopy
115% n-type, 85% p-type, (+others)
 - passive assay of U, Th, K (and Co60, Cs137 etc.)
 - active assay via neutron activation analysis
 - Low activity NaI and BF3 counting also available, ICPMS via ESD
- Run by dedicated, expert staff at two facilities.
 - flexible scheduling, fast turn around
 - general procedure is for users to contact Al Smith prior to sending sample (arsmith@lbl.gov)
 - queue of at least ~several samples in rotation
- Long History of Low Background Counting
 - SNO, KamLAND, CUORE, DoubleCHOOZ, Daya Bay, Majorana, Katrin, Sanford Lab, LUX
- Other Activities:
 - LBNL EHS waste characterization
 - Environmental monitoring-- air, auto filters; rainwater (Fukushima)

Low Background Facilities

Berkeley



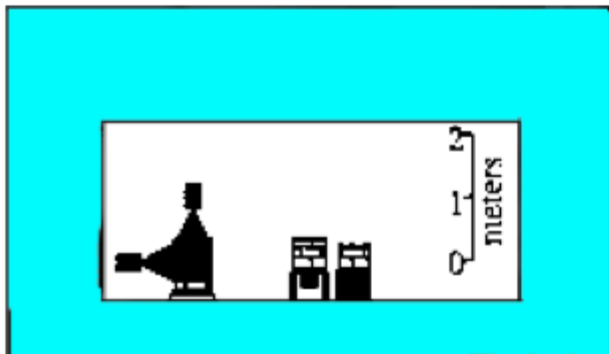
Oroville



- Low Activity Concrete Construction 1.5m minimum thickness
- Backgrounds dominated by cosmic rays
- HPGe, NaI, BF3 detectors 115% n-tpe
- reduction in cosmic rays by factor of 1000
- Backgrounds dominated by internal activity in detector, shielding
- HPGe detectors 85% p-type

Low Background Facilities

Berkeley



Counting Sensitivities	Berkeley Site	Oroville Site
U series	0.5 ppb	50 ppt
Th series	2.0 ppb	200 ppt
K	1.0 ppm	100 ppb
Co-60	0.04 pCi/kg	0.004 pCi/kg
INAA	<ppt-ppq>	

sample throughput



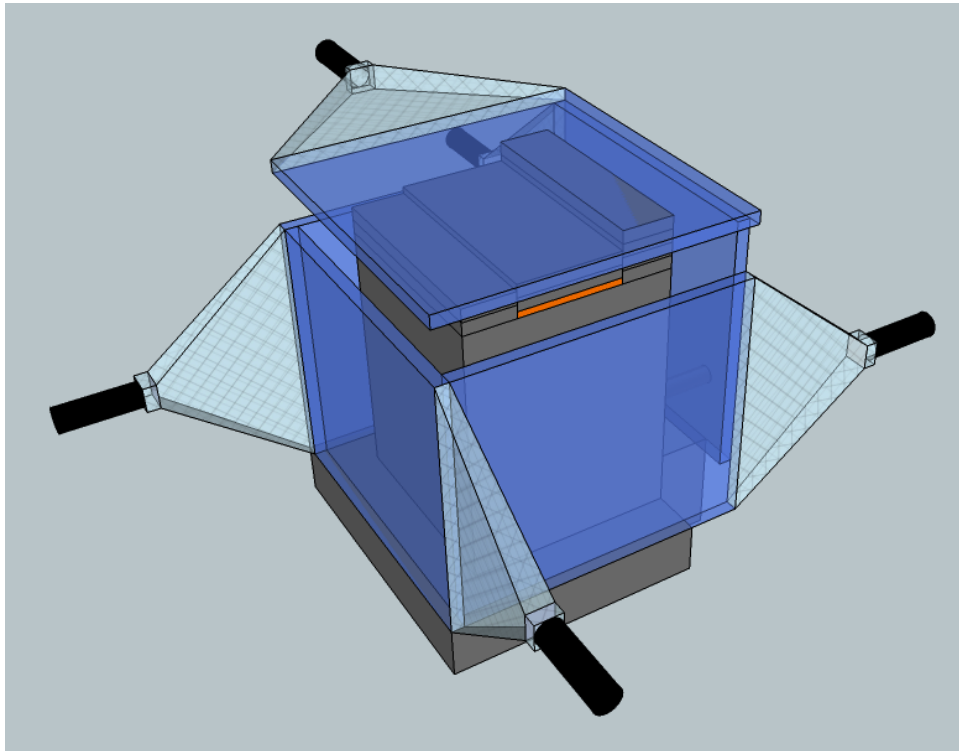
OROVILLE (one detector):

- Due to backlog, samples are generally limited to ~1 week counting periods.
- Generally, only samples benefitting from the lower background are sent here, after first counting at the Berkeley facility.
- This scheme accommodates 40-50 low activity samples per year
- Since early 2011, many samples related to the Fukushima disaster have been counted.
 - During 2011, 218 samples were counted
 - As of June 2012, a total of 100 samples have been counted this year.

BERKELEY (two detectors):

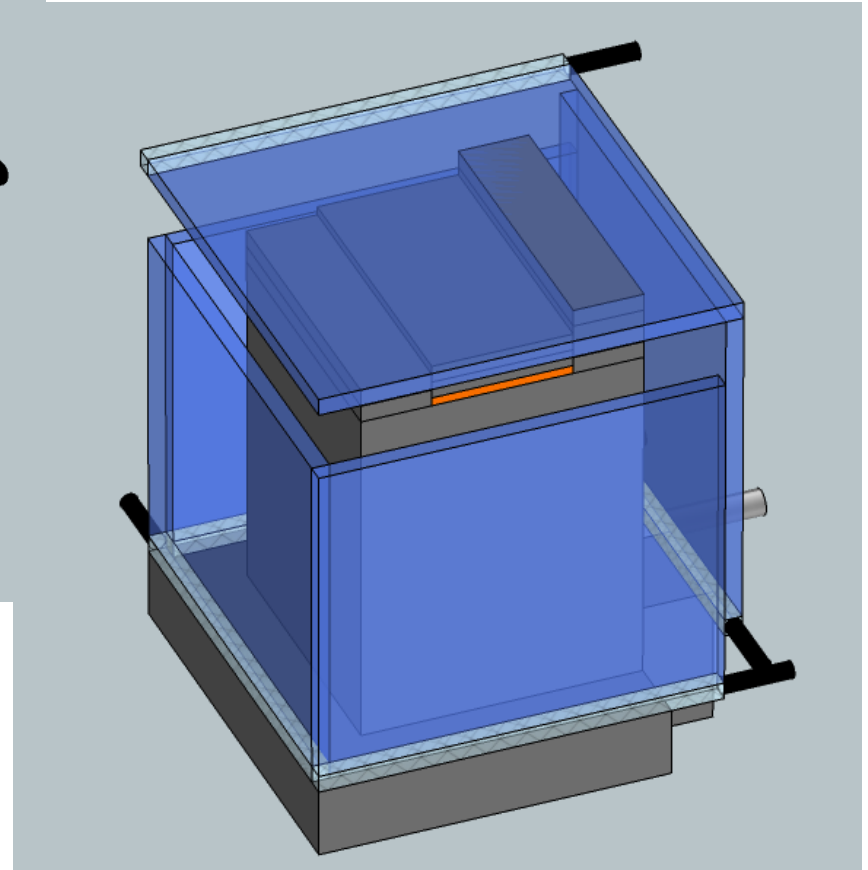
- In general, maximum counting time for a single sample is 2 to 3 days, although samples are occasionally counted for a week. Counting times range upwards from a few minutes to the range listed above.
- A typical counting time for environmental samples, including rocks, soils, air filters, car filters, etc., is one day.
- Annual throughput is in the range of 500 to 1000 samples, of which ~90 are UG related.

Muon Veto

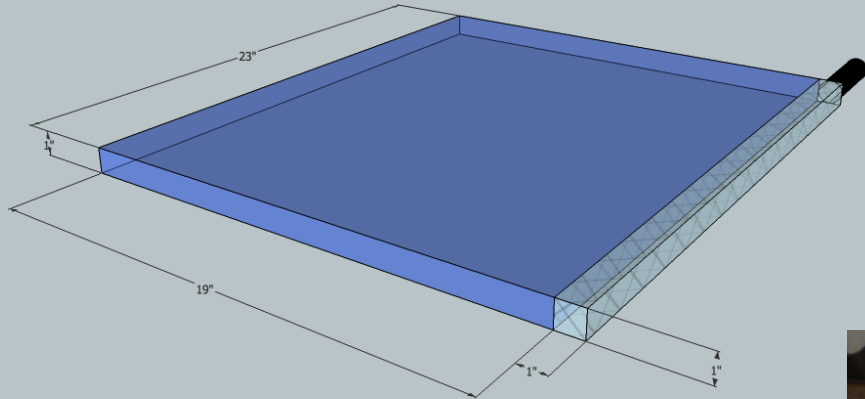


Design Criteria:

- convenient & non-cumbersome for daily use
- simple, stable operation



Muon Veto



First Test Panel (TOP)

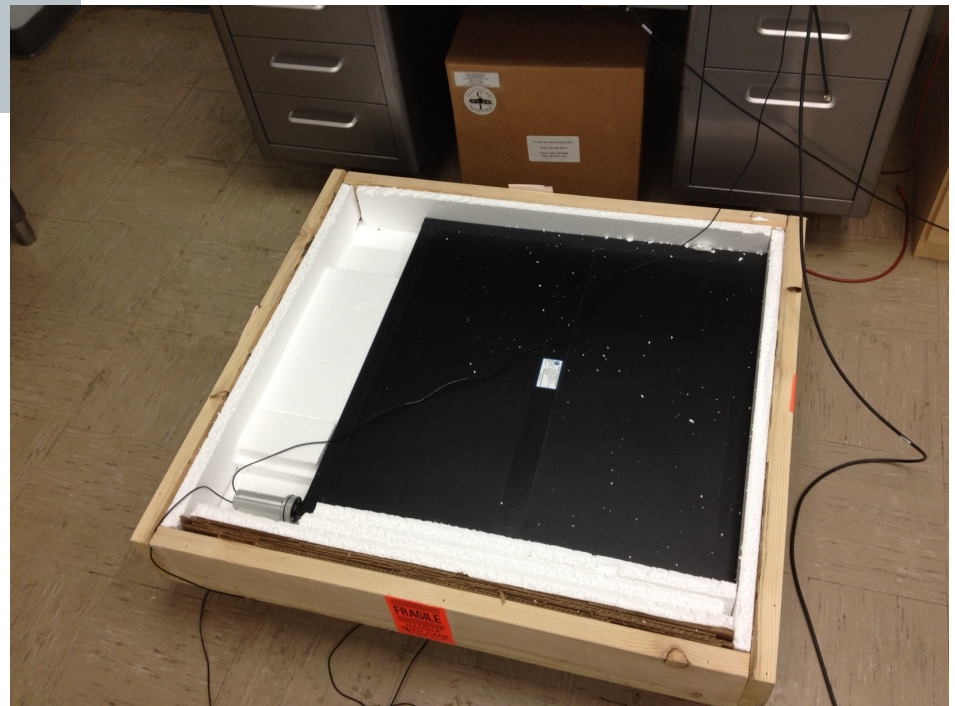
30 in x 30 in x 1 in thick

EJ200 scintillator

- front edge 'frosted' w/600 grit sand paper
- 0.25mm air gap between PS & WLS
- all other edges diamond milled

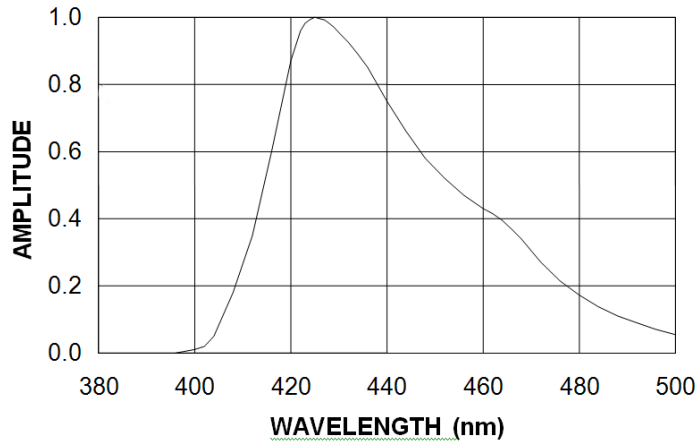
EJ280 wavelength shifting plastic

- re-emission in line of sight with 1" Hamamatsu PMT (1924A)



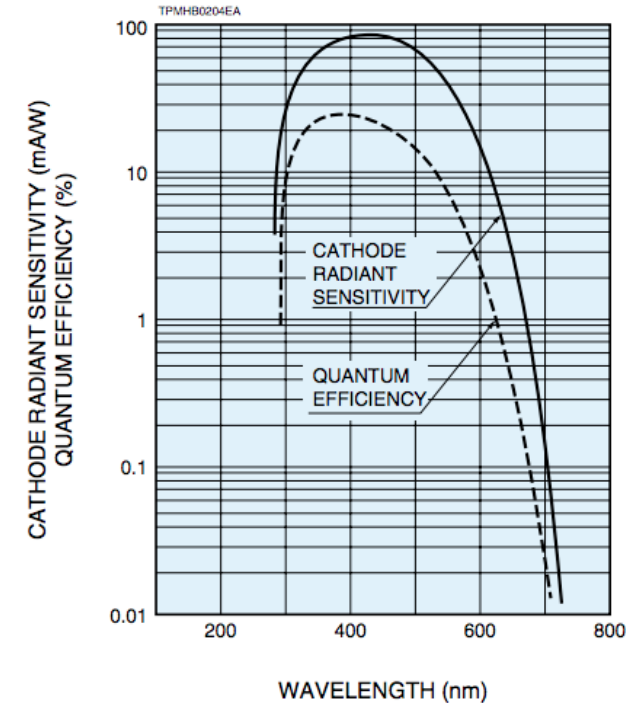
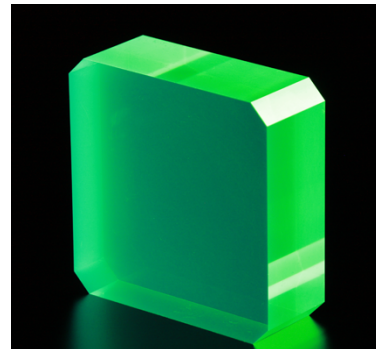
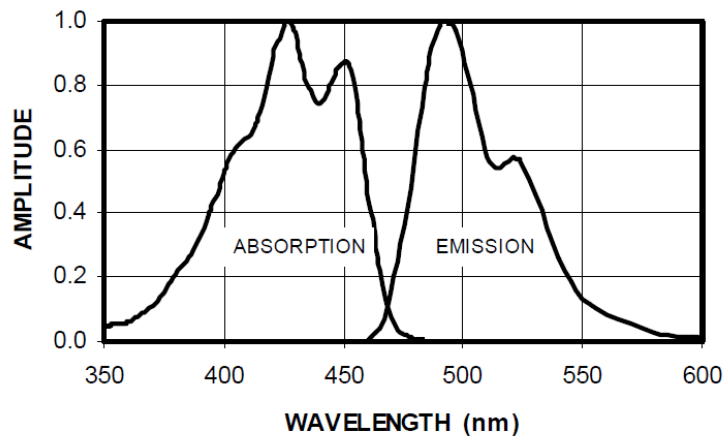
Muon Veto components

EJ-200 EMISSION SPECTRUM



Eljen Technology
Sweetwater TX

EJ-280 OPTICAL SPECTRA

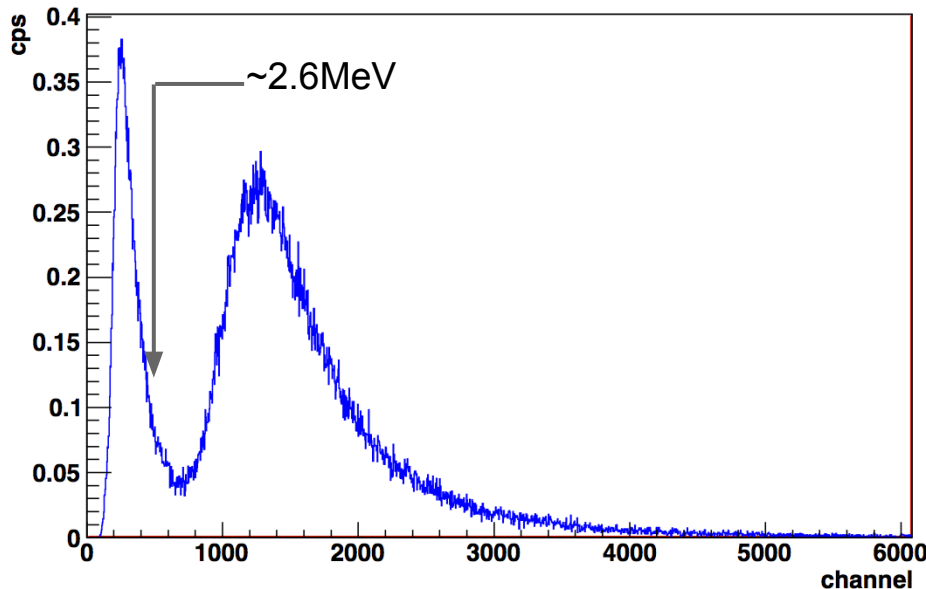


Hamamatsu 1924A 1" PMT



Muon Veto operation

VETO PANEL

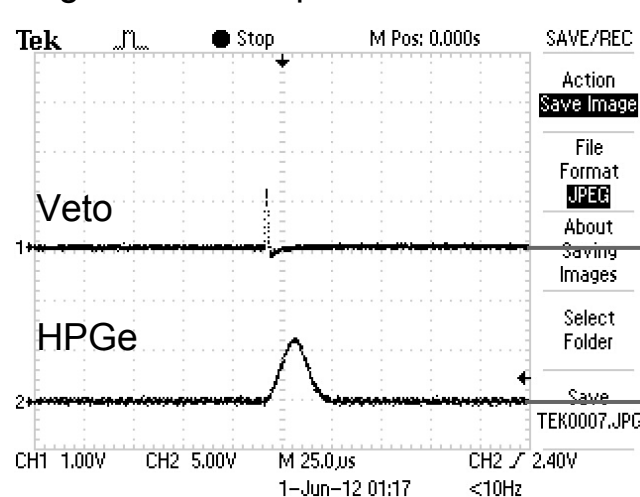


Threshold set by separation of gamma and muon spectra in scintillator singles.

Veto rate very stable regardless of threshold and gate length settings.

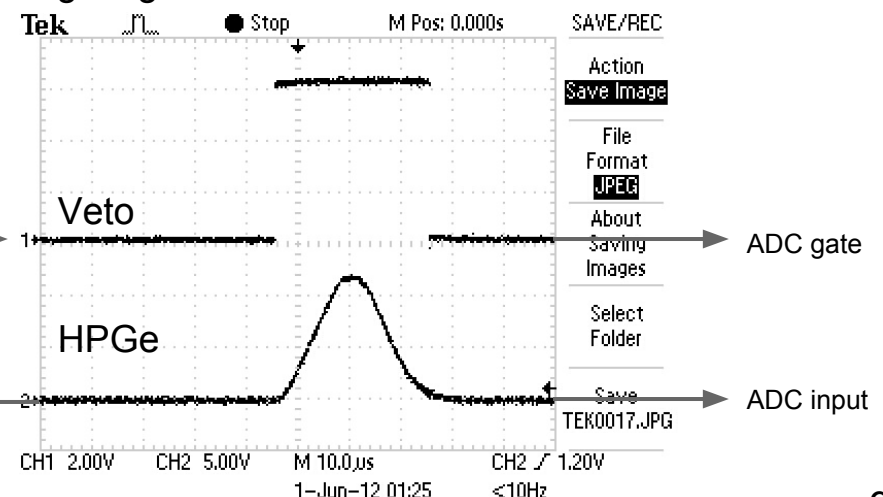
-- low external gamma background in LBF makes this very easy! False coincidences aren't an issue.

signals from amplifiers



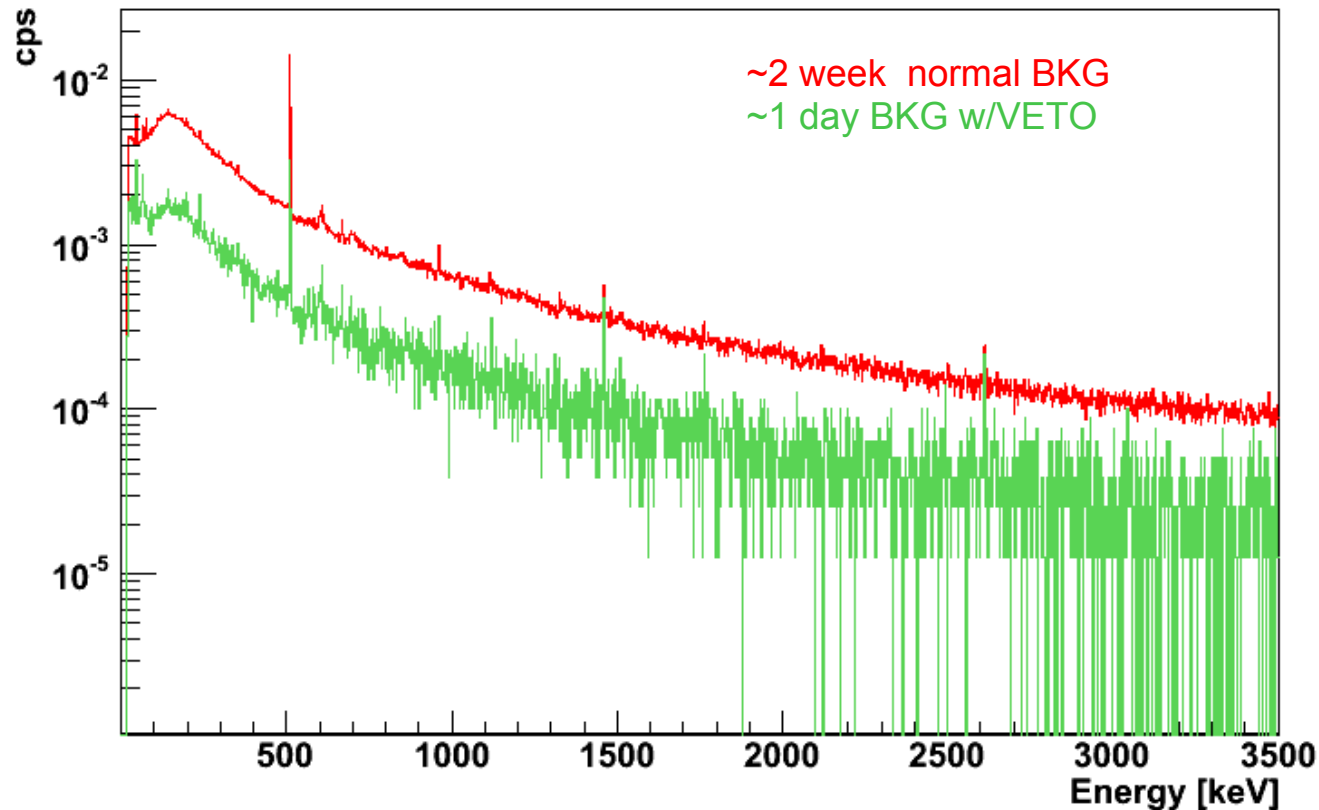
SCA
Gate & Delay

gating



Muon Veto installation

Merlin Background comparison



-A fairly uniform reduction in counting rates by a factor of 4 across the entire spectrum.

future plans



Additional Upgrades:

- Evaluate usefulness of the addition of side panels for veto system and proceed with additional panels.
- Upgrade Berkeley and Oroville shields with old Pb stock
 - requires re-smelting
- Establishment of internet connection to Oroville site for data transfer

Thank you!



backup slides



Muon Veto installation

Merlin Background comparison (linear scale)

