SIPM irradiation campaign at LBNL

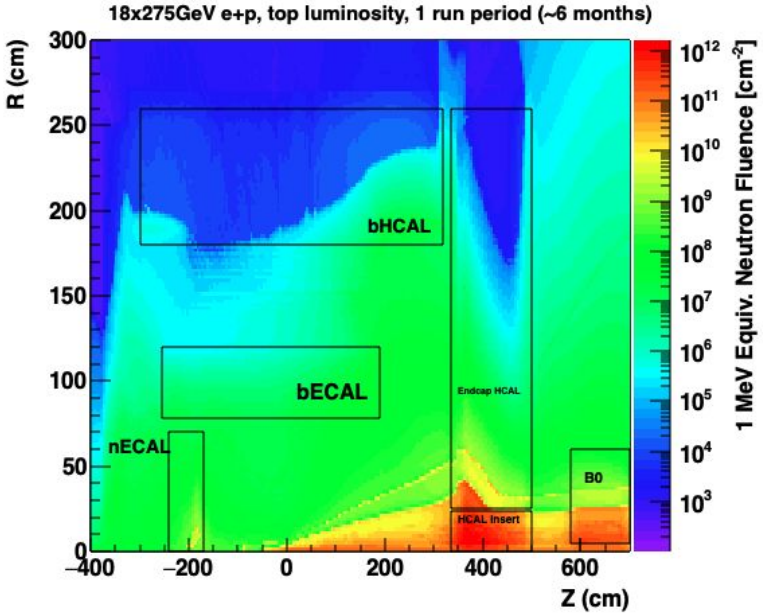
BERKELEY ACCELERATOR SPACE EFFECTS

CALIFORNIA EIC CONSORTIUM

We will use LBNL 88’ cyclotron 55 MeV beam to irradiate up to 1E12 1-MeV neutron equivalent.

Plan to measure 3 different fluences
(1E10, 1E11, 1E12)

Will characterize SiPM before and after irradiation, and after annealing

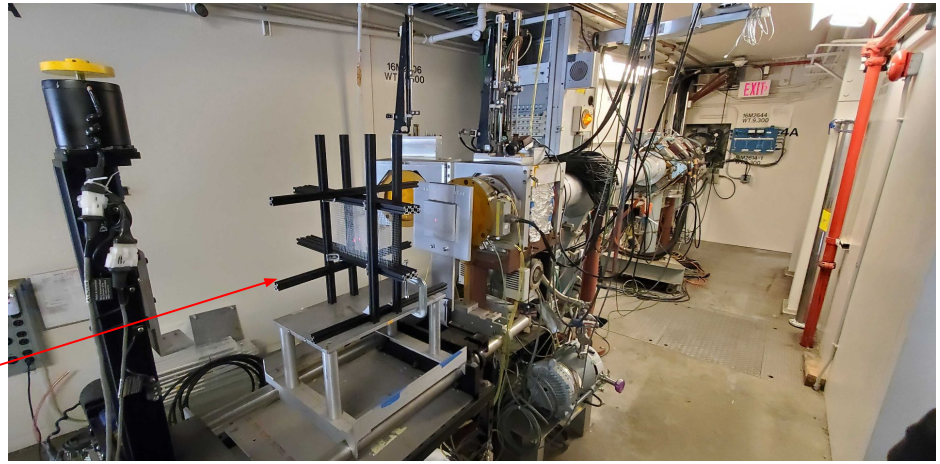


SiPMs to be irradiated

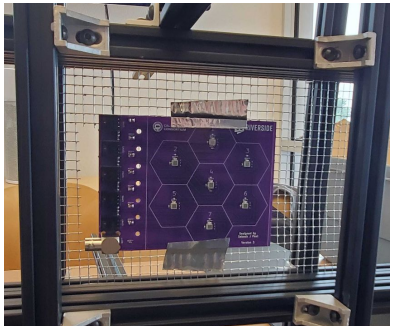
Model	Quantity
14160-6050	15
14160-3015	15 + 15
14160-1315	15 + 15
14160-6025 (from project)	8

LBNL SiPM irradiation status: preparing setup for beam scheduled tomorrow

Our SIPM mount



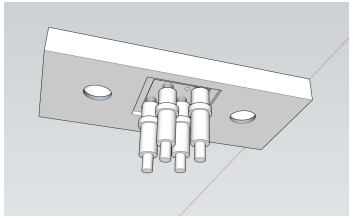
We will irradiate bare SiPMs and some SiPM in boards

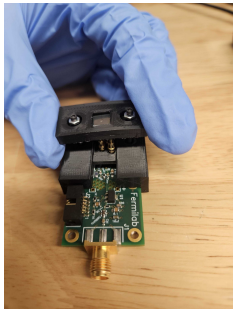


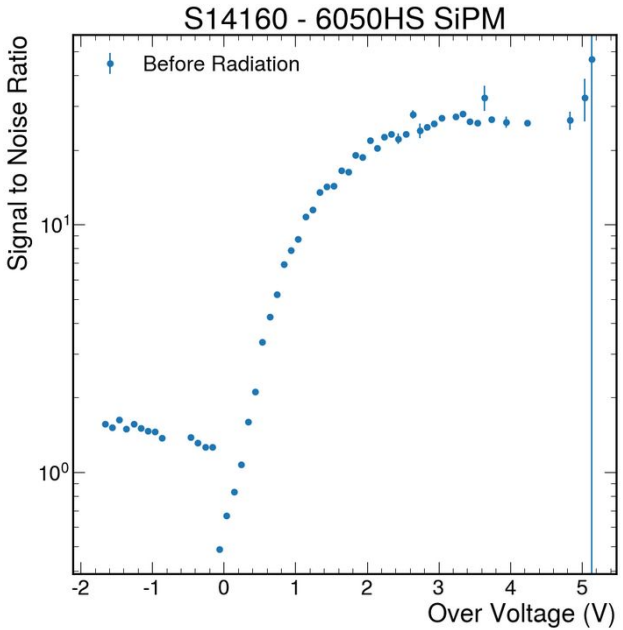
Planned tests

Plan to measure IV, dark rate, S/N with LED and cosmics.

See Jay's presentation for more comprehensive status report of unirradiated SiPM results https://indico.bnl.gov/event/19559/







Climate chamber for annealing

Rad damage comparison

Up to 5e13 1 MeV neutrons / cm2 over lifetime of experiment (TDR)	**Up to 1e12 1 MeV neutrons / cm2 Per year at top luminosity.**
Operating temperature: -30C (TDR)	**Operating temperature: room temperature** (Dark current at RT at 2V is ~30 higher than at -30C)

max neutron fluence in 1 year of EIC is similar to the maximum tolerable in CMS HGCAL design <u>over lifetime</u>

SiPM used: 1.3 mm and 2 mm, 15 microns	**SiPM used: 1.3 mm (or 3 mm?), 15 microns**
Dedicated irradiation campaign and beamtest 2022-2023	**Dedicated irradiation campaign :** June 15th 2023
Signal-to-noise ratio: S/N > 10 for 1 MIP (as per TDR) S/N ~2.5 for 1 MIP at highest dose (as per latest public result)	**Signal-to-noise ratio:** S/N > 5 at 1 MIP to be able to keep a 0.5 MIP threshold with 2.5 sigma suppression of noise
Mitigation measures (for higher dose region) - Larger SiPM (2 mm instead of 1.3 mm) - Casted scintillator, not injected molded scintillator - …	**Mitigation measures:** - Design to keep SiPM accessible for annealing after each run. - …