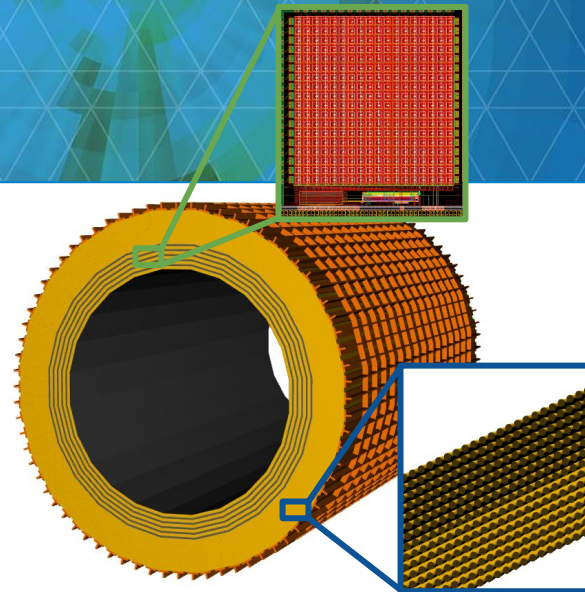


TIC Meeting,  
Dec 11, 2023

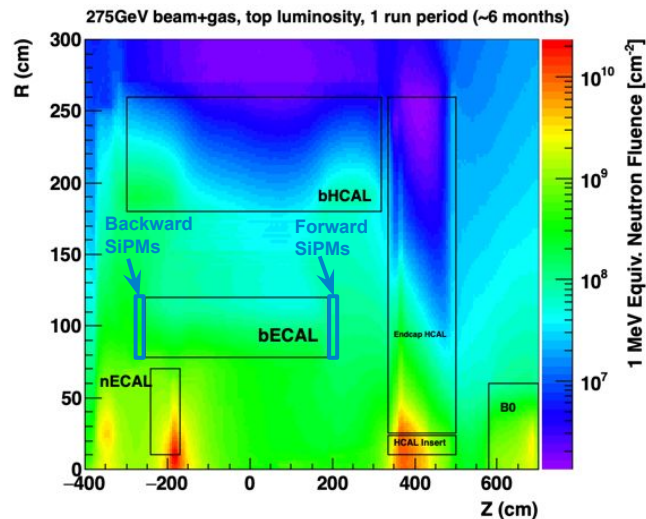
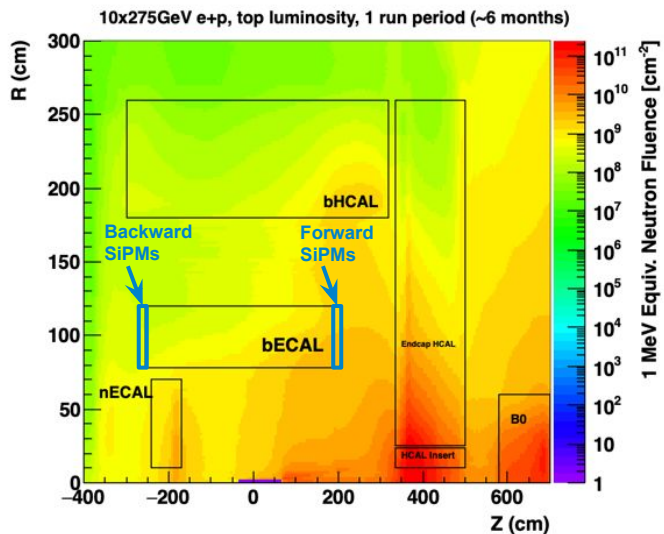
## Barrel Imaging Calorimeter (BIC) Irradiation Plans



Maria Źurek  
PHY, Argonne National Laboratory

# Radiation dose at the Barrel ECal SiPMs

[https://wiki.bnl.gov/EPIC/index.php?title=Radiation\\_Doses](https://wiki.bnl.gov/EPIC/index.php?title=Radiation_Doses)

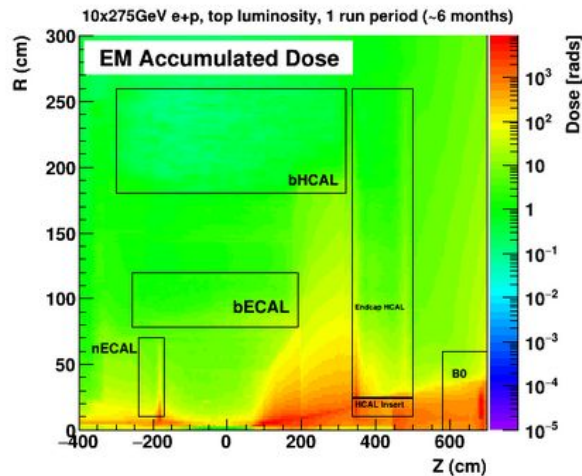
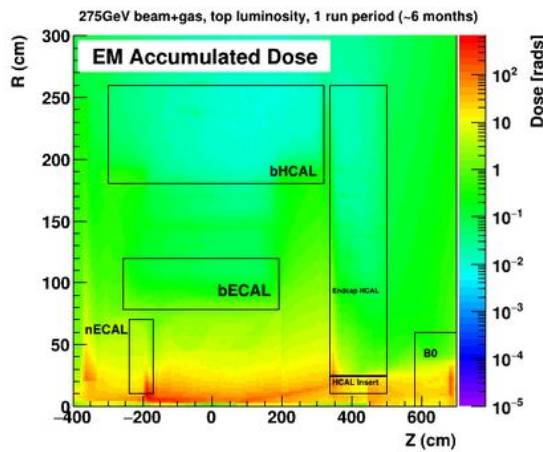


	Forward SiPMs (+z)	Backward SiPMs (-z)
Dose from physics*	$\sim 3 \times 10^{10} / \text{cm}^2$	$\sim 6 \times 10^9 / \text{cm}^2$
Dose from beam + gas*	$\sim 9 \times 10^9 / \text{cm}^2$	$\sim 5 \times 10^9 / \text{cm}^2$

\*In 1 MeV neutron equivalent fluence for 10 year of running

# Radiation dose at the Barrel ECal SiPMs

[https://wiki.bnl.gov/EPIC/index.php?title=Radiation\\_Doses](https://wiki.bnl.gov/EPIC/index.php?title=Radiation_Doses)



	Max dose
Dose from physics*	30 rads
Dose from beam + gas*	400 rads

Hadronic radiation doses give overall factor of 2 to the numbers in the table

\* per 10 running periods

# Barrel Ecal: needs for radiation hardness studies

1. **Need to study radiation hardness of:** SiPMs, front-end electronics, AstroPix chips
2. **Doses based on** [https://wiki.bnl.gov/EPIC/index.php?title=Radiation\\_Doses](https://wiki.bnl.gov/EPIC/index.php?title=Radiation_Doses):  
1 MeV neutron equivalent neutron flux for 10 year of running:  $\max \sim 4 \times 10^{10} / \text{cm}^2$   
EM Accumulated dose:  $\sim 1 \text{ kRad}$
3. **Timeline:**
  - a. AstroPix (v3, v2) sensors tested in FNAL MTA Facility in FY23 (passive, FY24 active irradiations planned)
  - b. SiPMs (S14161-6050-04, S14161-6050, S13360-6050) in FY24 at FNAL (some tests done for Insert in LBNL, FY23, from what we understand)
  - c. Front-end electronics for SciFi - FY24/25 (Coordinated test for HGCROC?)
  - d. End-of-stave card for AstroPix - FY24/25
4. **Facilities:** FNAL ITA (low-energy proton, FY23/24), EM irradiation: JLab, LEAF at ANL, ...

# Snapshots from the Sensor Irradiations

400 MeV protons

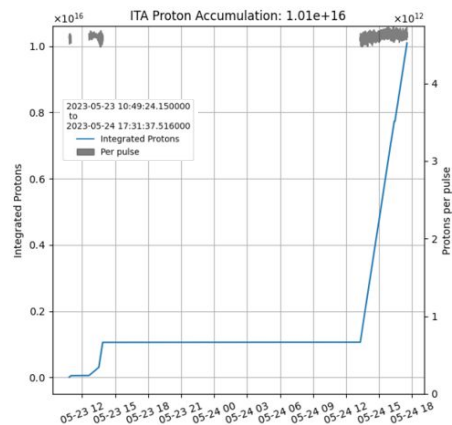
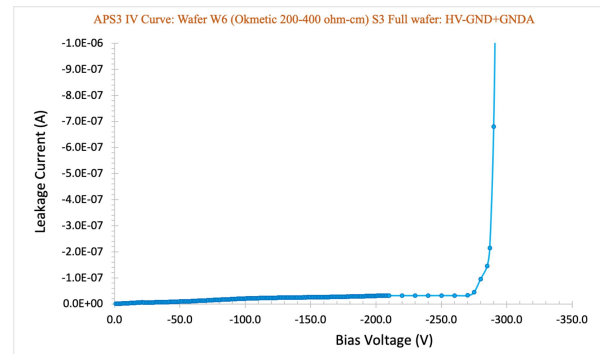
- 9 samples of AstroPix v2 chips prepared for the passive irradiation in the FNAL MTA Facility
  - IV and CV measurements performed for the v2 and v3 chips before irradiations
    - Same measurements will be repeated post irradiation

## V2 Irradiation

Nb of samples	Doses (400 MeV protons)
3	4.50E+13
3	1.08E+15
2	1.01E+16
1	5.02E+16

## V3 Irradiation (low and high ResChips)

Nb of samples	Doses (400 MeV protons)
2	4.50E+13
1	5.04E+15



## 1-MeV neutron equivalent fluences at EIC

