

Backward Hadronic Calorimeter

SiPM noise update

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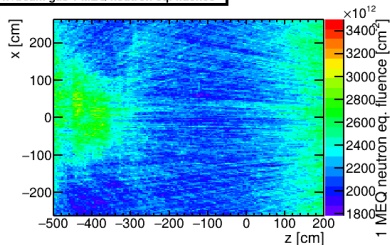


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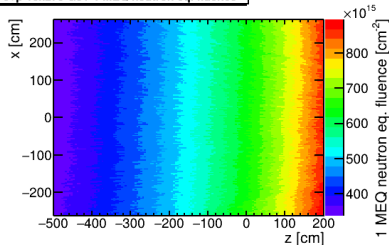
- 1 Radiation
- 2 Dark current
- 3 Signal characteristics
- 4 Other updates
- 5 Summary

Radiation - neutrons

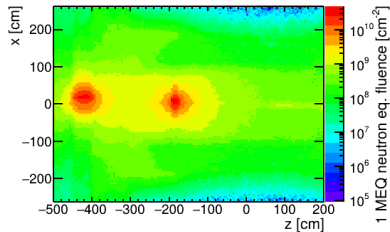
h+beam gas 1 MEQ neutron eq. fluence



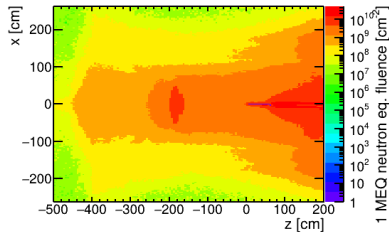
e+p 18x275 GeV 1 MEQ neutron eq. fluence



h+beam gas 1 MEQ neutron eq. fluence -1.5<y<1.5 cm

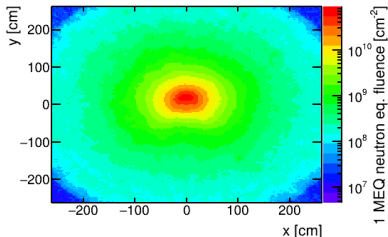


e+p 18x275 GeV 1 MEQ neutron eq. fluence -1.5<y<1.5 cm

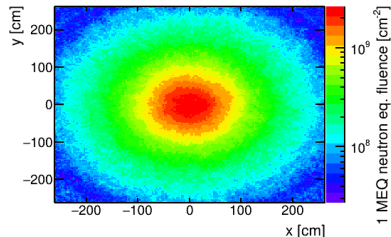


- Neutron fluence taken from updated files:
https://wiki.bnl.gov/EPIC/index.php?title=Radiation_Doses
- Slices and integrated distributions correspond to 100 fb⁻¹
- Some areas close to the beam are exceeding 10¹⁰ cm⁻²
 - may affect SiPMs dark current

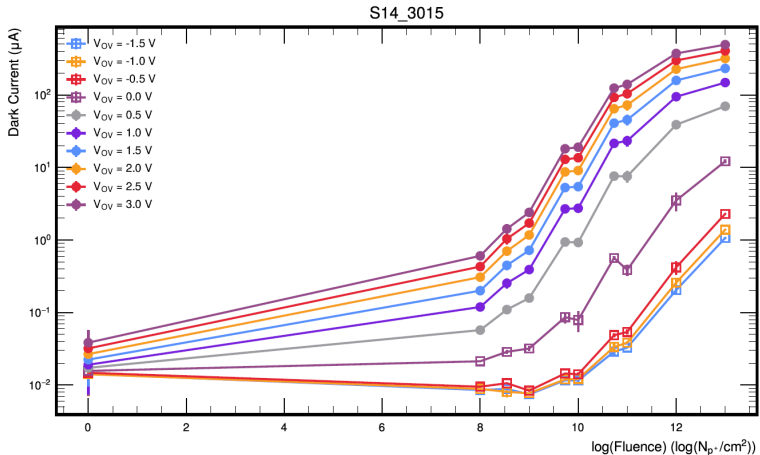
h+beam gas 1 MEQ neutron eq. fluence -440<z<-395 cm



e+p 18x275 GeV 1 MEQ neutron eq. fluence -440<z<-395 cm



- Neutron fluence taken from updated files:
https://wiki.bnl.gov/EPIC/index.php?title=Radiation_Doses
- Slices and integrated distributions correspond to 100 fb^{-1}
- Total fluence for nHCal is integrated within $-440 < z < -395 \text{ cm}$



- Taken from <https://indico.bnl.gov/event/24087/#17-further-rad-hard-studies-an>
- Dark current starts to increase above 10^{10} cm^{-2}

- Taken from <https://indico.bnl.gov/event/19751/#2-lfhcal-tile-sipm-testing> and numbers assumed in eicrecon (take with grain of salt, to be updated)
- ≈ 10 photons for MIP $dE = 0.75$ MeV, $\approx 13.3k$ GeV^{-1} photons
- Readout threshold $\approx 3\text{pixels} = 0.1875$ MeV = 41ADC
- Noise: pedestal $10 \pm 2\text{ADC}$

- Using StainlessSteel as a non-magnetic steel in simulation
 - But density seems too high! 8.3 g/cm^3 . Should we correct?
- Performed geometry optimization for neutron detection efficiency (update soon!)
- Performed sampling fraction study (update soon!)

Listing: Materials.xml

```
<material name="Steel235">
  <D value="7.85" unit="g/cm3"/>
  <fraction n="0.998" ref="Fe"/>
  <fraction n=".002" ref="C"/>
</material>

<material name="StainlessSteel">
  <D type="density" value="8.3" unit="g / cm3"/>
  <fraction n="0.74" ref="Fe"/>
  <fraction n="0.18" ref="Cr"/>
  <fraction n="0.08" ref="Ni"/>
</material>
```

Conclusions

- Discussed noise, radiation and updates

BACKUP