Digital SiPM Light Occupancy Study

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SLAC + TTU 5D Calorimetry Meeting

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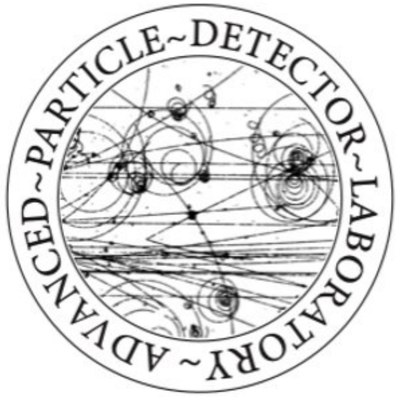

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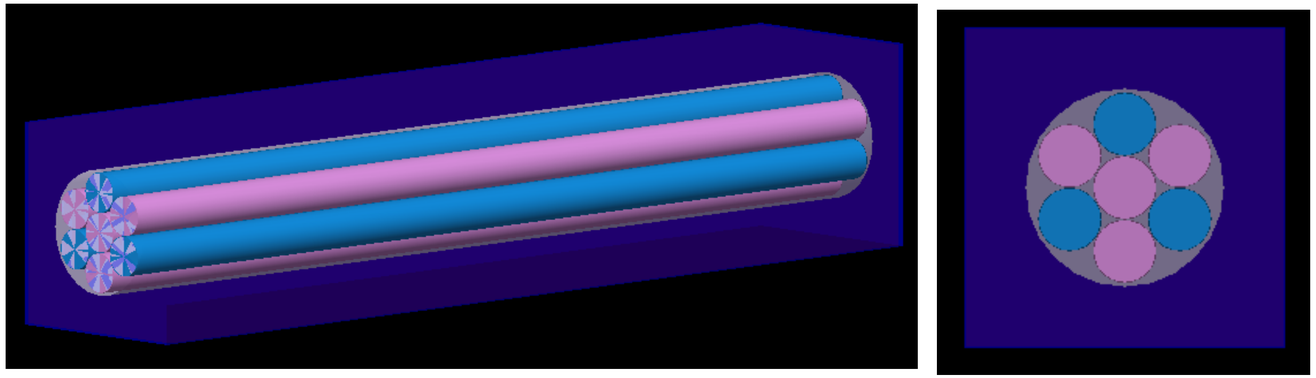
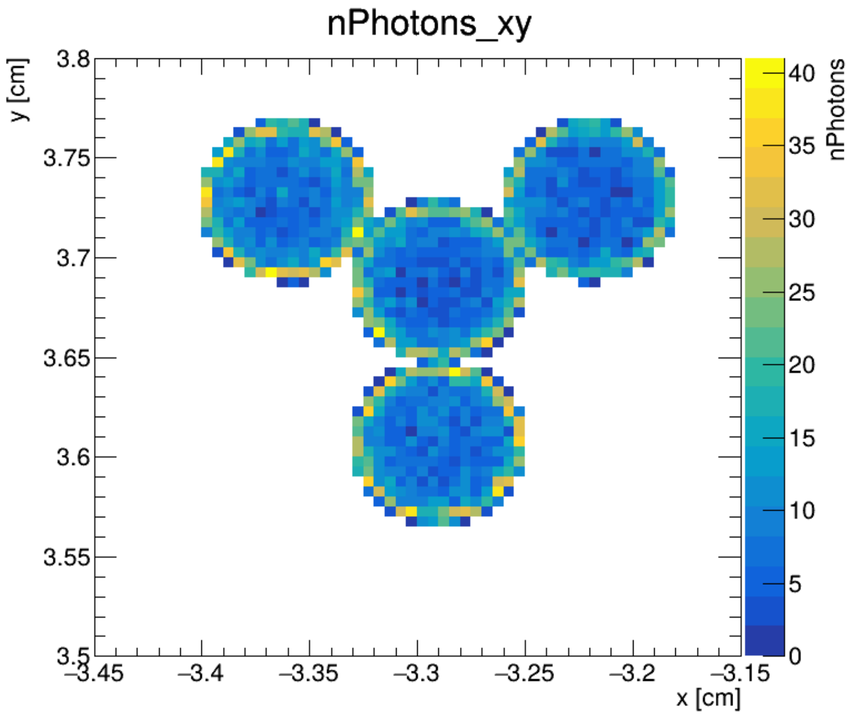
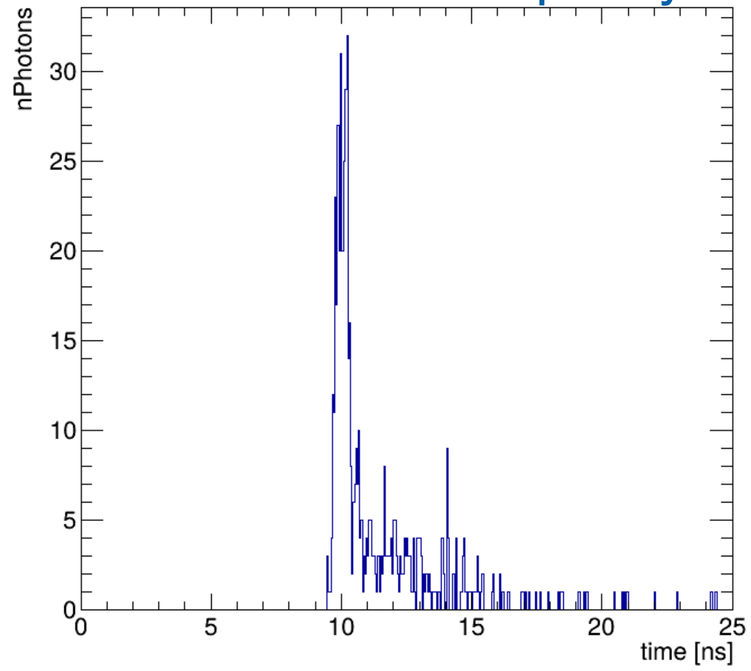
Light Occupancy Study

- Take the light occupancy from GEANT4 and determine expected number of photons
  - Location dependence from fiber
  - Timing dependence
- Assume nothing about SiPM
  - Purely occupancy study
- Time is segmented into 50 ps bins
- 1 rod, 4 Cherenkov fibers positioned over a 3x3mm^2 area
- Expected light from a 100 GeV positron





1 Channel occupancy



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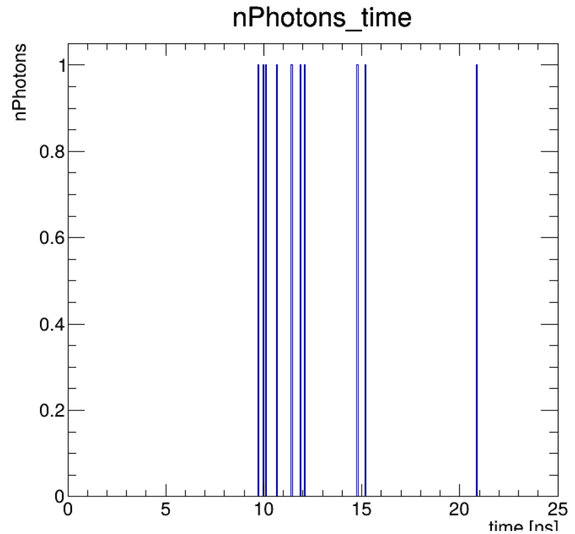
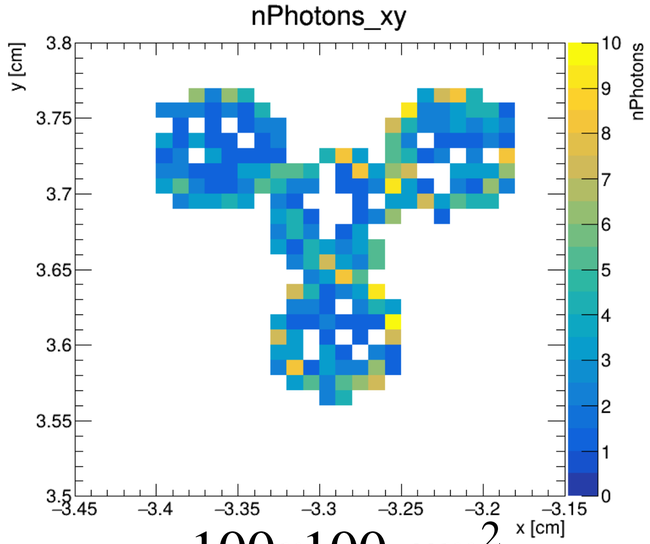
Channel Size Dependence: 1 event

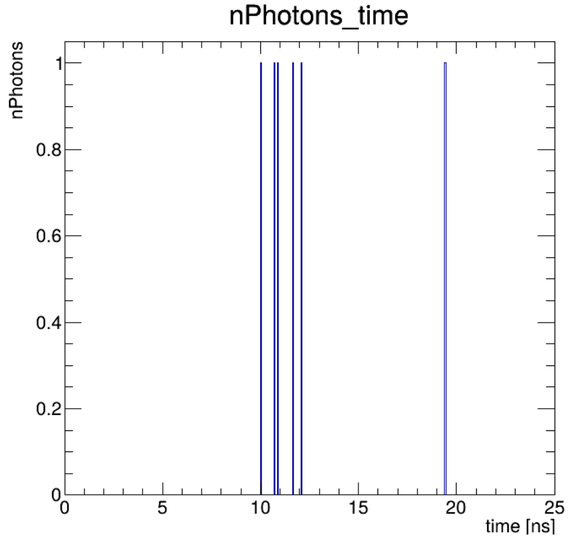
- Max occupancy channel timing distribution
- Overall position distribution

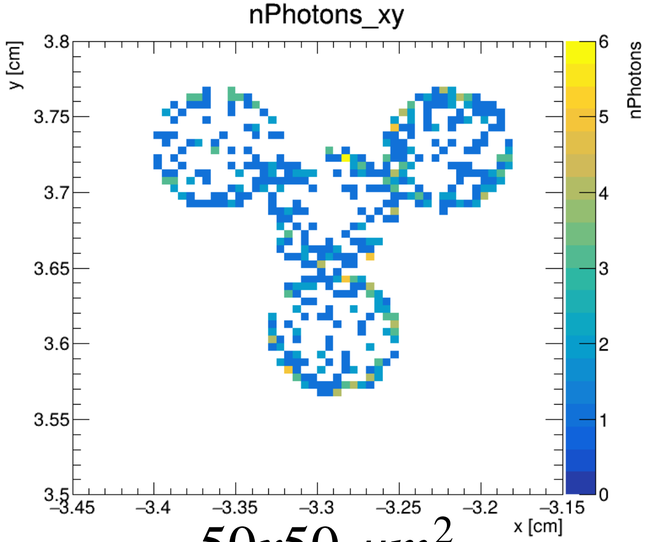




$100x100\ \mu m^2$

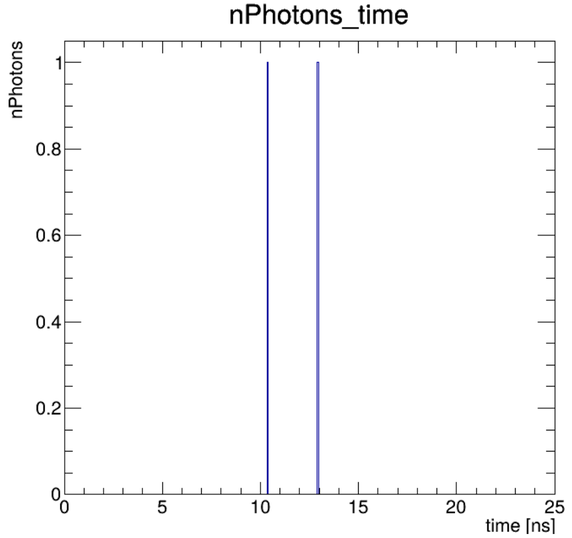
Channel area

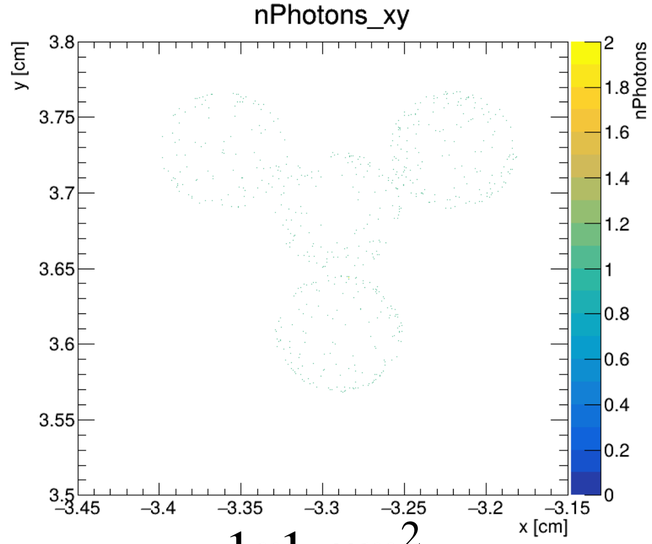




$50x50\ \mu m^2$

Channel area





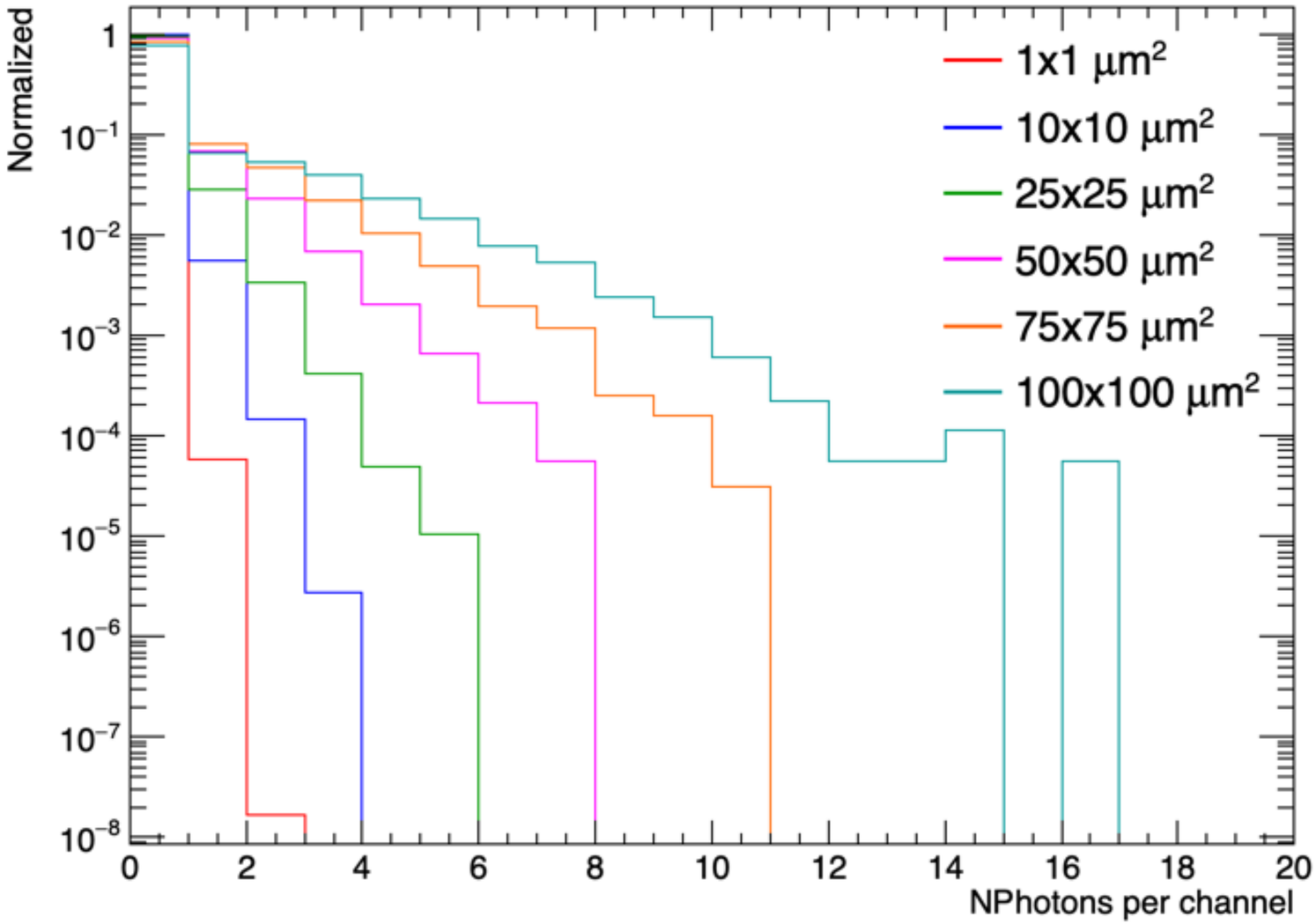
$1x1\ \mu m^2$

Channel area

Channel Size Dependence

- Scanning over a range of channel sizes
- Looking at photons from 20 events

- Next steps:
  - Generate more events
  - Study different showers (pions)
  - Include more rods



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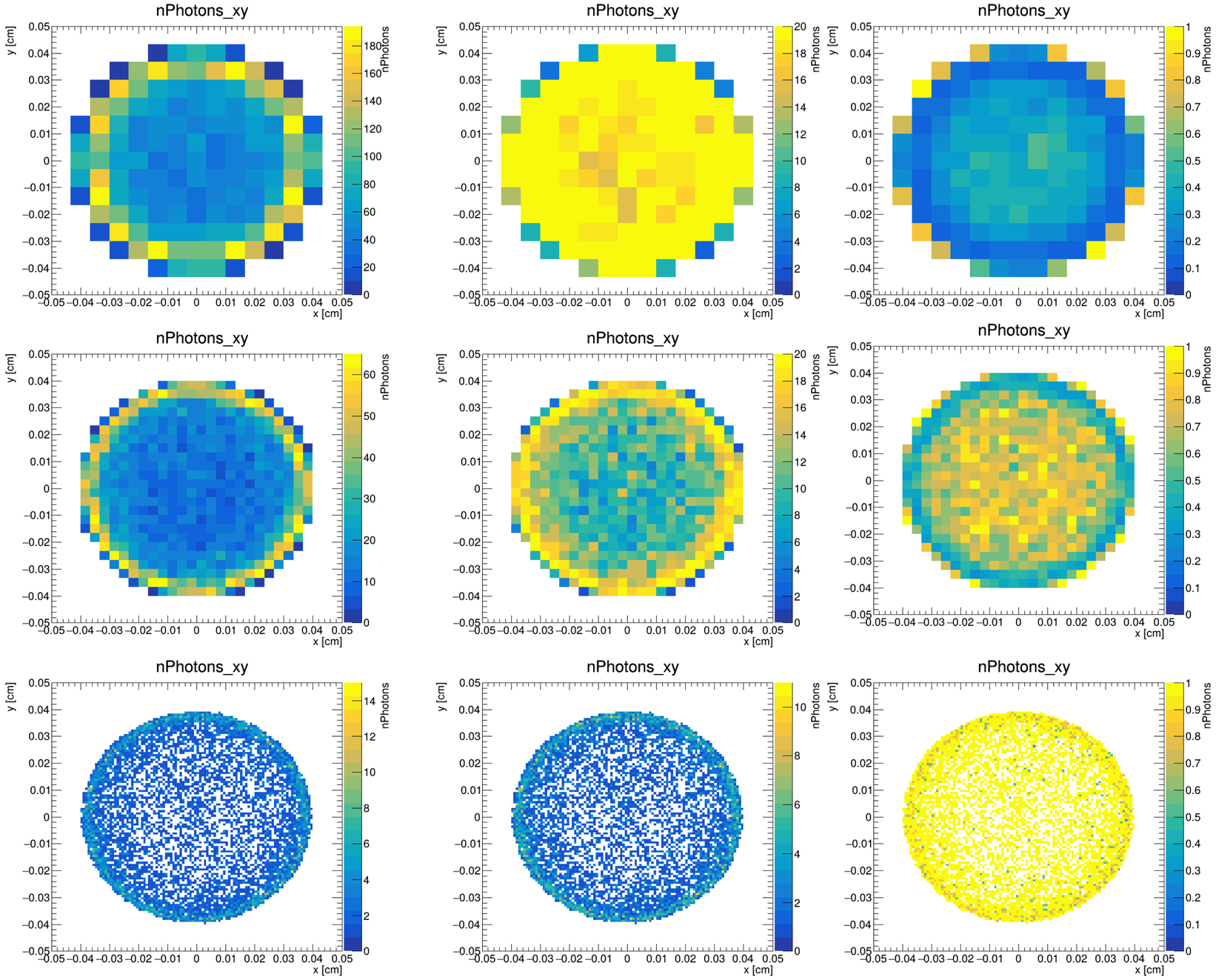
Including Dead Time

- Showing the proton counting eff.
  - Worse case scenario
  - When one photon hits a channel it is not usable until the next event
- Showing results for 20 events from a single Cherenkov fiber
  - Top row: $200x200\ \mu m^2$
  - Middle row: $100x100\ \mu m^2$
  - Bottom row: $25x25\ \mu m^2$



No dead time **Using dead time** **Efficiency**