

SBN Progress – April 2019

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I. SBND PDS System Test Data Analysis

The data from the SBND Photon Detection System (PDS) Test are being analyzed and show that the PDS is working well. The System Test was performed in the CAPTAIN cryostat in December at the LANL Lujan Facility. The 120 8-inch detector PMTs were mounted on a support frame with 96 PMTs coated with TPB and 24 PMTs uncoated. The space between PMTs was covered by TPB-coated foils that increase the amount of light collected.

Figure 1 shows the individual pulse height distribution in ADC counts for all detector PMTs. The pedestal peaks at about 10 ADC counts, while the single photoelectron peak occurs at about 60 ADC counts. The end of the noise wall is given by the green vertical line. Figure 2 shows the dark rates for all 120 PMTs. The dark rates are typically in the 10-20 kHz range.

A preliminary analysis of the PDS System Test data is shown in Figure 3. The upper left plot shows the integrated pulse height (in photoelectrons) for beam-on data (black curve) and beam-off data (red-dashed curve). The events from beam-off data are mostly due to ^{39}Ar beta decays, which determine the light yield to be about 0.5 photoelectrons per keV of deposited electron energy. The beam-on data include events from neutron capture in addition to the events from ^{39}Ar beta decays. The upper right plot shows F90 (singlet to triplet light ratio) vs the integrated pulse height. The low F90 values confirm that the events from both beam-off and beam-on data are due to electrons and photons. The lower left plot shows the integrated pulse height vs the polar radius squared. For low pulse height (<100 photoelectrons), the beam-off data events are roughly flat over the squared radius, as expected for ^{39}Ar events. The lower right plot shows the reconstructed y position vs the x position (z is vertical).

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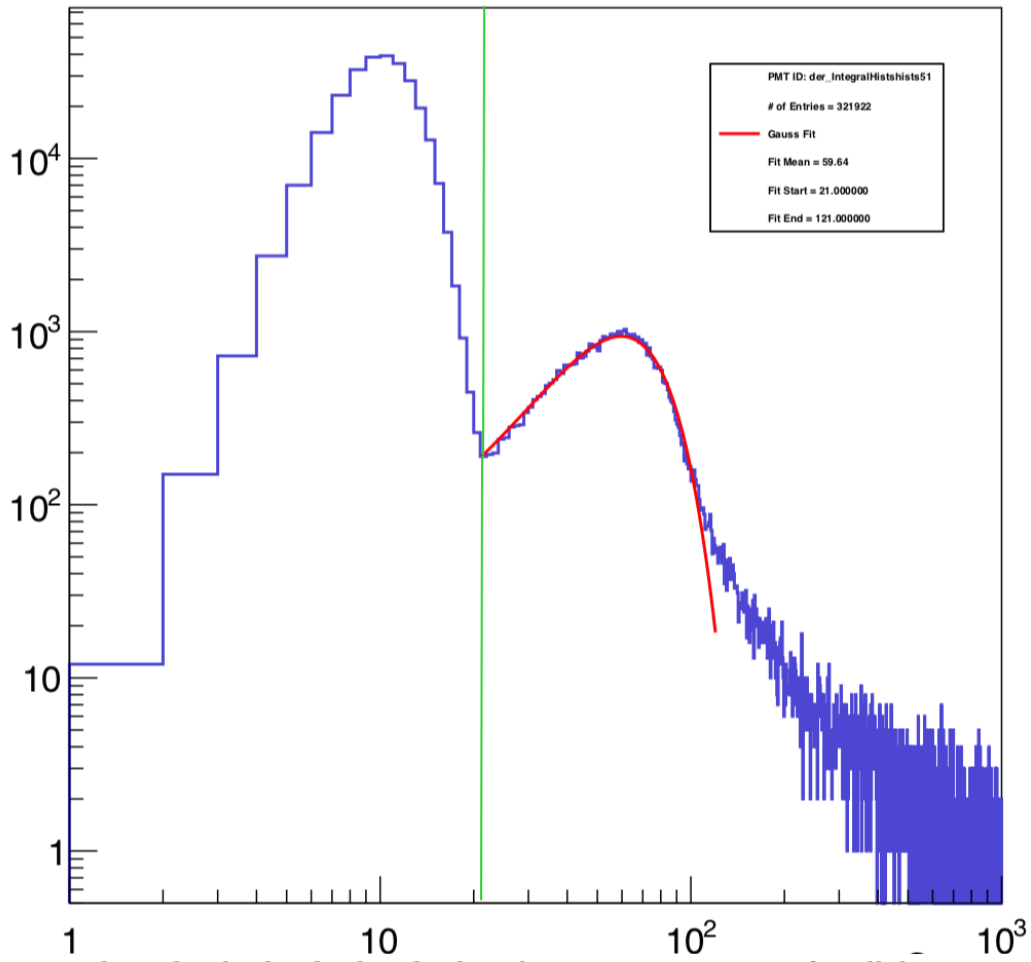


Figure 1: The individual pulse height distribution in ADC counts for all detector PMTs.

PMT Dark Rates, LED Top, Derivative PulseFinder, PulseWidth >= 16ns

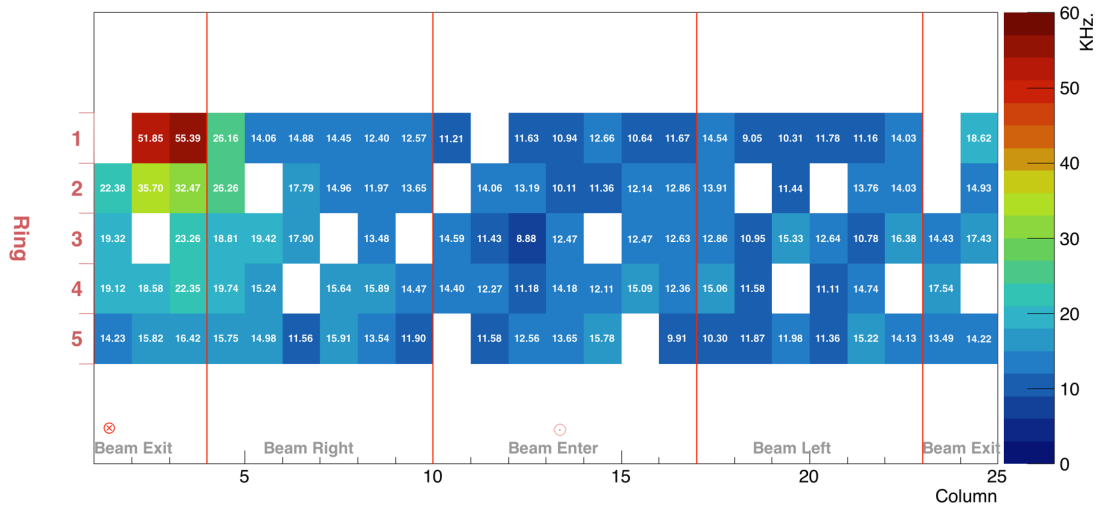


Figure 2: The dark rates are shown for all 120 PMTs. The dark rates are typically in the 10-20 kHz range.

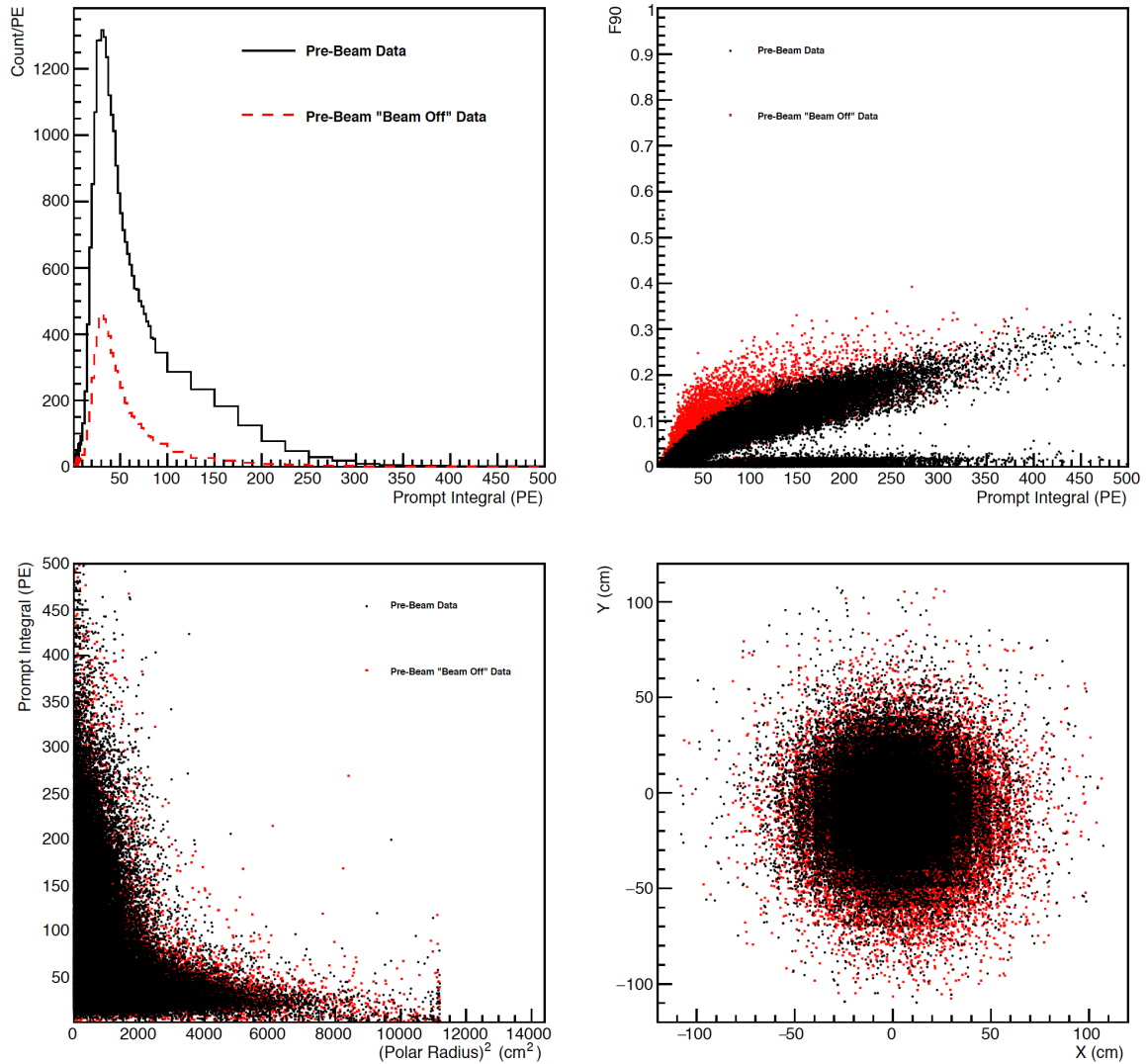


Figure 3: Analysis of data from the PDS System Test. The upper left plot shows the integrated pulse height (in photoelectrons) for beam-on data (black curve) and beam-off data (red-dashed curve). The upper right plot shows F90 (singlet to triplet light ratio) vs the integrated pulse height. The lower left plot shows the integrated pulse height vs the polar radius squared. The lower right plot shows the reconstructed y position vs the x position.