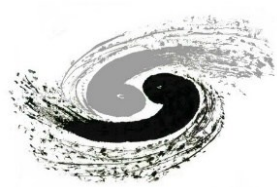


Latest updates on the Geant4 simulation of a single crystal bar

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CEPC Calorimeter Software Meeting



Overview

- Geant4 full simulation

- Adapted from a short crystal bar (single-end readout)

- Geometry

- A 40cm long crystal bar, 1x1 cm² transverse size
- Read out by two SiPMs at both ends

- Properties

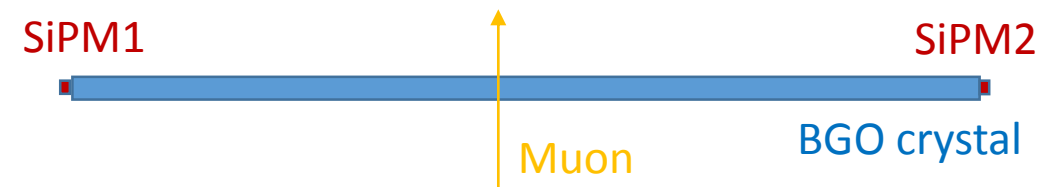
- BGO: light yield, decay times (fast and slow), refractive index, transmission (absorption length)
 - Assumed fast rise time
- Wrapping: ESR foil (~99% reflectivity) with air gaps (total reflections)
- SiPM: 6x6 mm² sensitive area, Photon Detection Efficiency (PDE), realistic SMD package

- Primary particle

- 1GeV muon for MIP calibration

- Optical photon processes:

- Scintillation, Cherenkov, absorption, refraction/reflection at boundaries





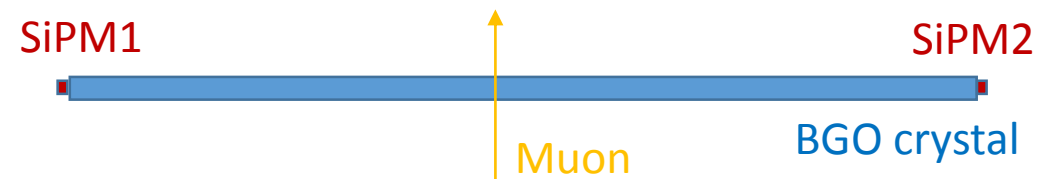
Overview

- Information extracted from G4

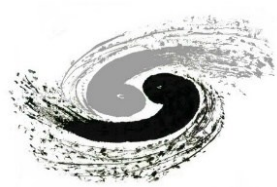
- Energy deposition: mean ~ 10 MeV/MIP, determined by crystal thickness
- #scintillation photons
- #detected photons at either SiPM
- Time stamp of each detected photon
 - T0: shooting of the primary particle (muon)
 - Including: scintillation time (\sim hundreds ns), propagation time (a few ns) within the crystal bar
 - Excluding: timing uncertainties from SiPMs and electronics
- MC samples: 30 events per run (~ 90 s/event)

- (Simple) Analysis on timing

- Choose the time stamp of the 1st photon detected at each SiPM

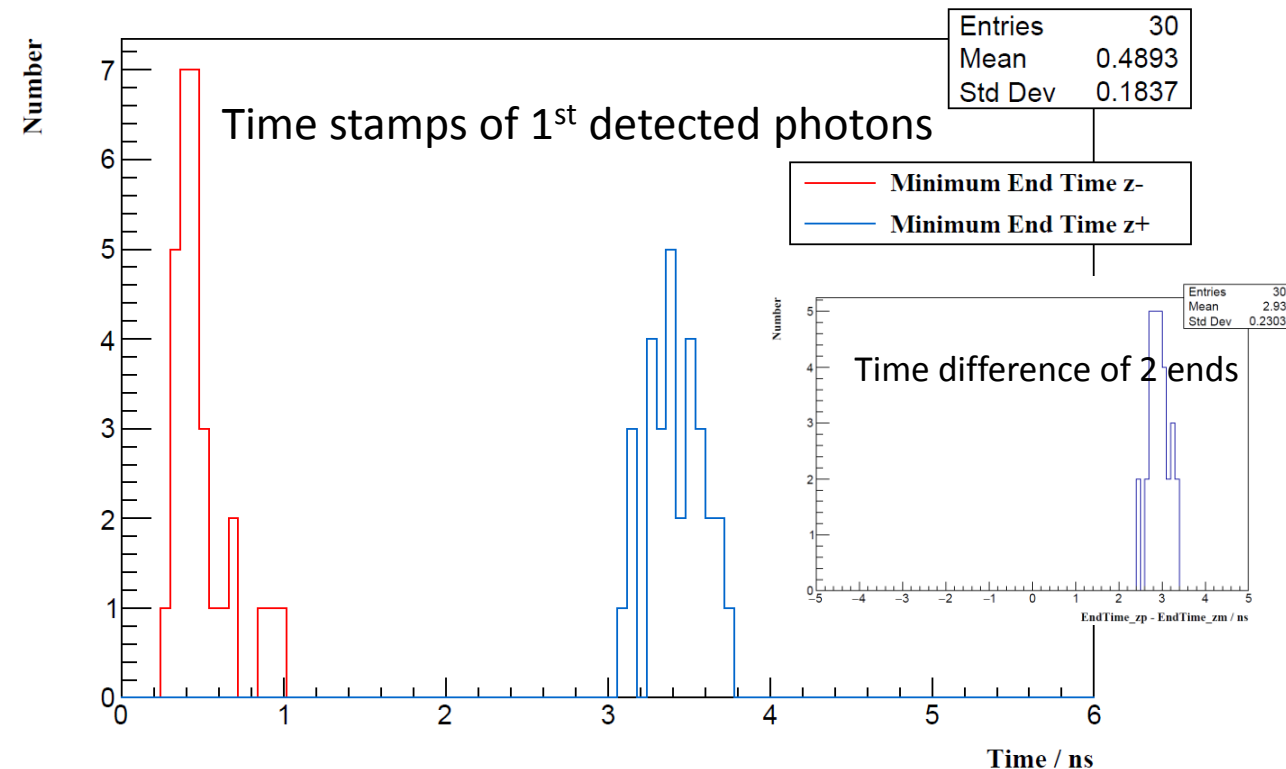
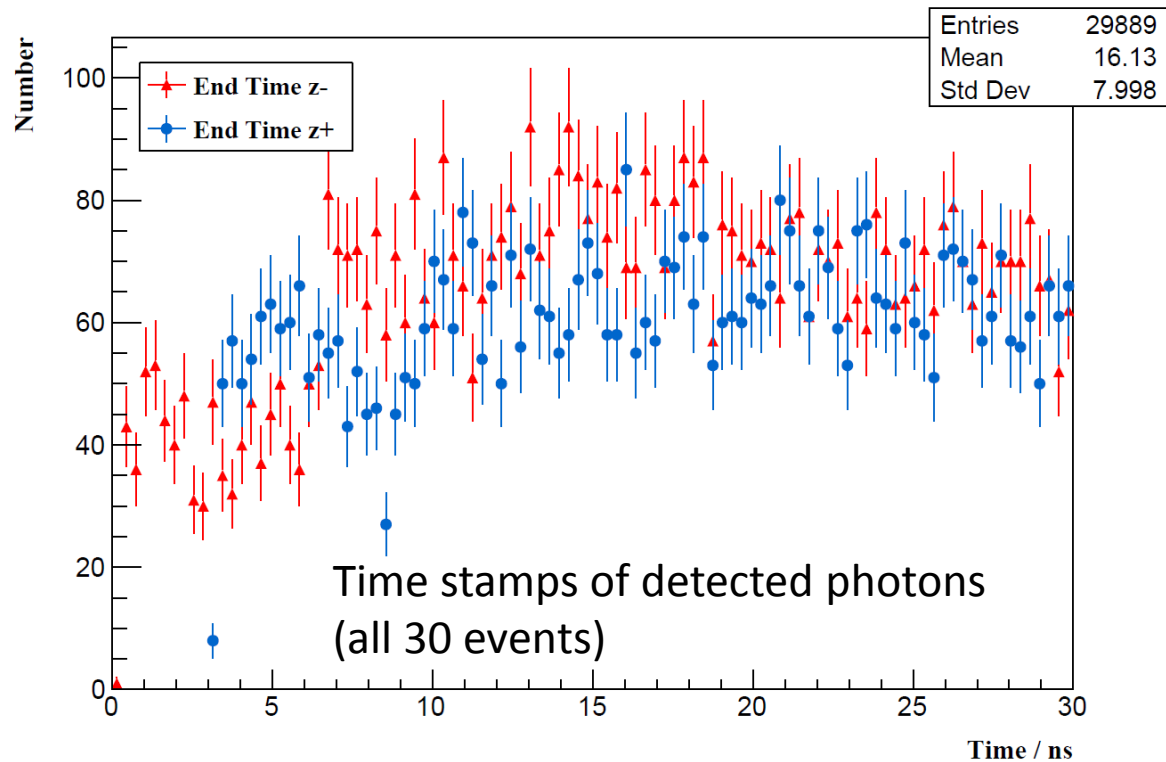


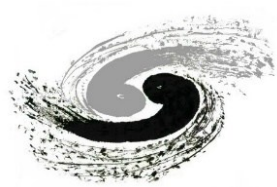
Fresh results from last few days (trying to understand better), thanks to Baohua's efforts



Simulation results: preliminary

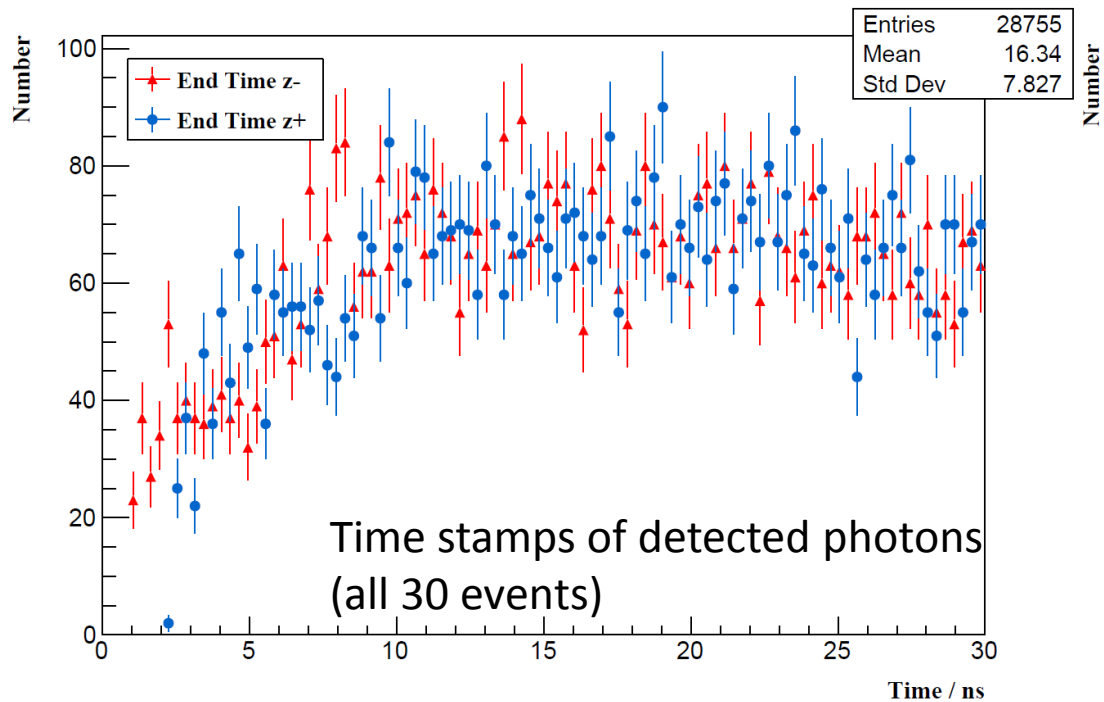
- Scenario 1: close to one end
 - 1cm away from one SiPM
 - Only focus on the rising edge of signals



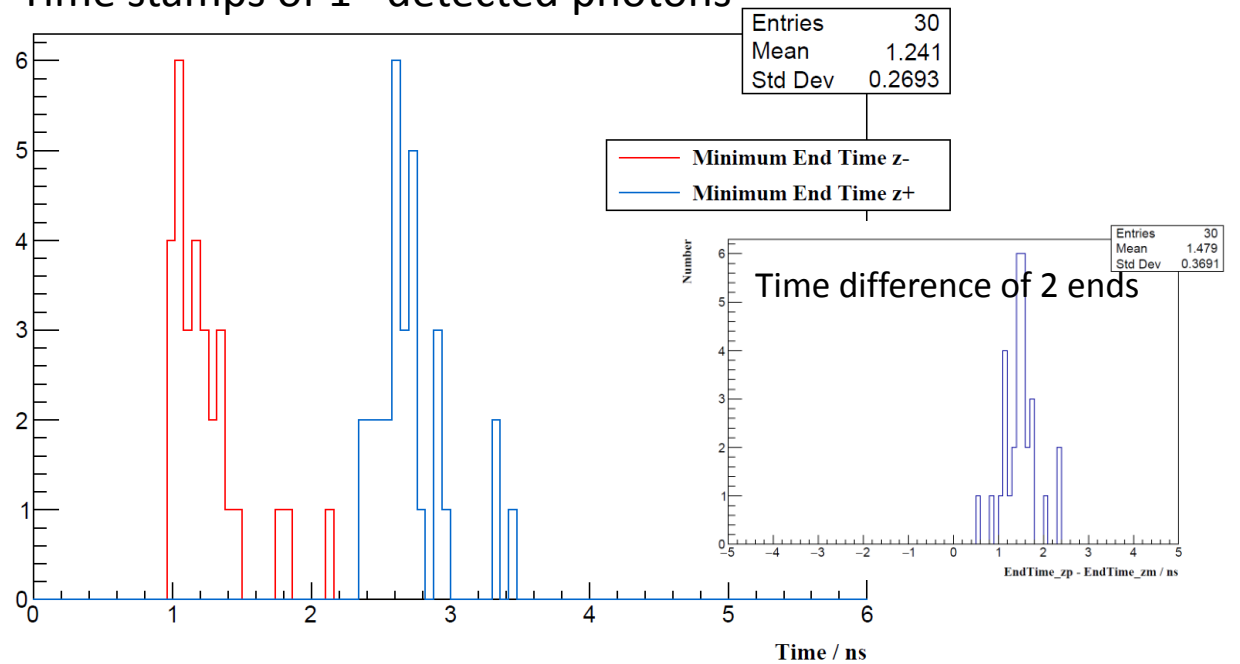


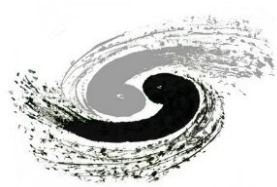
Simulation results: preliminary

- Scenario 2: in one quarter along the bar
 - 10cm away from one SiPM
 - Only focus on the rising edge of signals



Time stamps of 1st detected photons





Simulation results: preliminary

- Scenario 3: in the middle of the bar
 - 20cm away from one SiPM
 - Only focus on the rising edge of signals

