

Gamma Conversion at BESIII

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Gamma conversion in materials

- a photon having enough energy convert into an electron positron pair in the electromagnetic field of nucleus..
- For photons with energy above 10 MeV, pair conversion is the dominant interaction process
- A Nobel Prize level discovery in history

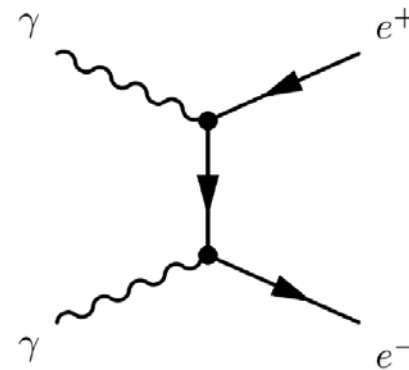
The Nobel Prize in Physics 1948



Patrick Maynard
Stuart Blackett
Prize share: 1/1

The Nobel Prize in Physics 1948 was awarded to Patrick M.S. Blackett *"for his development of the Wilson cloud chamber method, and his discoveries therewith in the fields of nuclear physics and cosmic radiation"*.

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quiz:

- why need a nucleus?

gamma conversion at BESIII — — signatures

- is two tracks with a zero opening angle \rightarrow try to think the reason
- originates in the material of the detector,

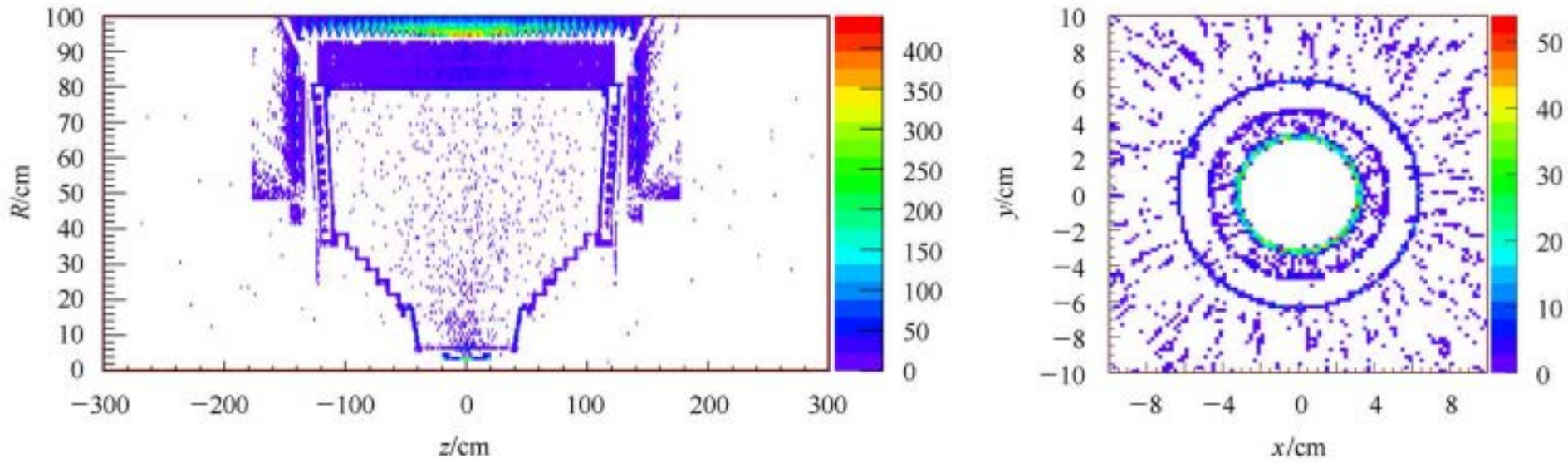
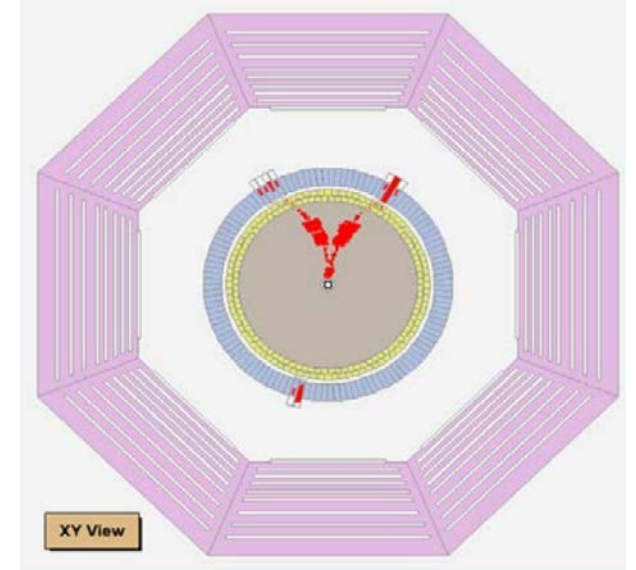


Fig. 1. Mapping of the BESIII detector using photon conversion (Monte Carlo true information).

Gamma conversion at BESIII

- In normal physics analysis at BESIII, gamma conversion is a contribution of background.
- as shown on right plots, gamma conversion mainly happens in beam pipe and inner MDC wall
- could be removed by requiring the vertex of e^+e^- is consistent with IP

Observation of the Dalitz decay $\eta' \rightarrow \gamma e^+ e^-$

M. Ablikim *et al.* (BESIII Collaboration)
Phys. Rev. D **92**, 012001 – Published 1 July 2015

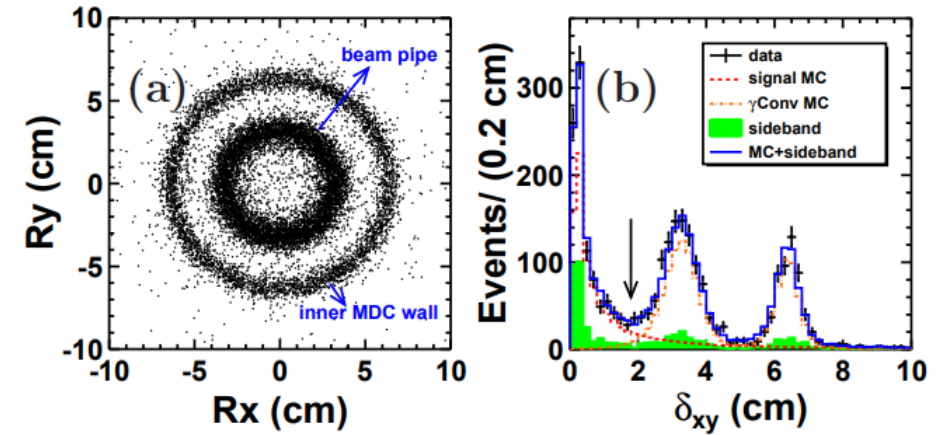


Figure 1. Electron-positron vertex position distribution: (a) scatter plot of R_y versus R_x for MC-simulated $J/\psi \rightarrow \gamma\eta'$, $\eta' \rightarrow \gamma\gamma$ events. (b) δ_{xy} distributions. The (black) crosses are data. The (red) dashed line shows the MC-simulated $J/\psi \rightarrow \gamma\eta'$, $\eta' \rightarrow \gamma e^+ e^-$ signal events. The (orange) dotted-dashed histogram shows the background from γ -conversion events. The (green) shaded area is estimated from the η' mass sideband. The (blue) line is the sum of MC and the sideband estimate. In (b), the solid arrow indicates the requirement on δ_{xy} .

one man's poison is another's meat

4.2 The branching fraction of $J/\psi \rightarrow \gamma\eta'$

The photon conversion finder is used to study the η' signal in J/ψ radiative decays. If the photon converts, it will have two extra charged tracks. We reconstruct the photon based on these two tracks using PCF. Fig. 8 is the photon recoil mass spectra. Clear η' signal is shown in the recoil mass spectra of reconstructed photons.

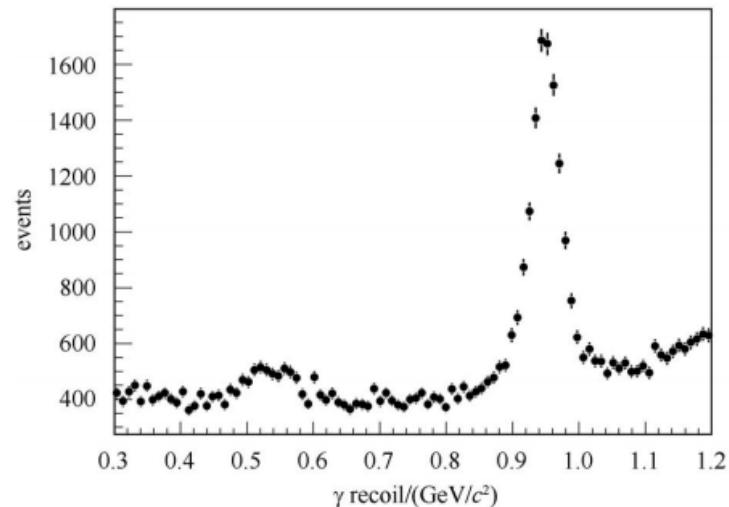


Fig. 8. Recoil mass spectra of the reconstructed converted photon.

A photon conversion finder at BESIII*

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Abstract: A photon conversion finder (PCF) based on track information from the main drift chamber (MDC) of the Beijing Spectrometer (BESIII) at the Beijing Electron Positron Collider (BEPCII) is developed. The validation of the PCF is done by reconstructing π^0 and measuring the branching fraction of $J/\psi \rightarrow \gamma\eta'$. Using the developed PCF tool, we mapped the materials from the interaction point through the BEPCII beam pipe up to the inner wall of the MDC.

- the charged tracks could be used to reconstruct signal.
- the background one work is signal in another.
- may be used in chicJ work.