

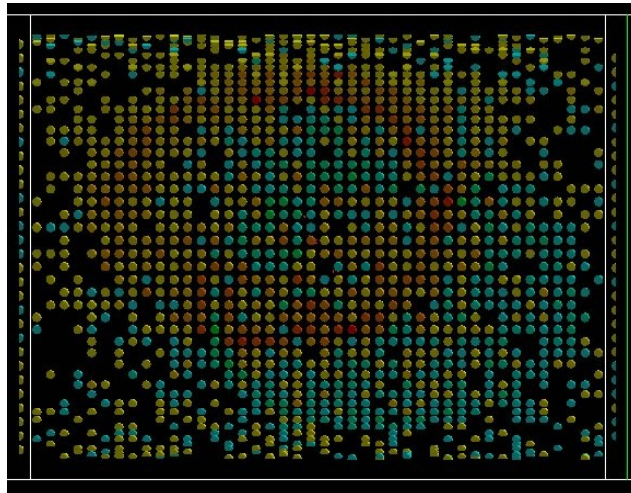
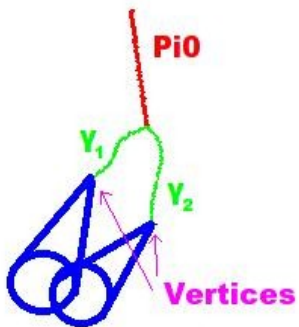


# **2km Pi0 Analysis Tools**

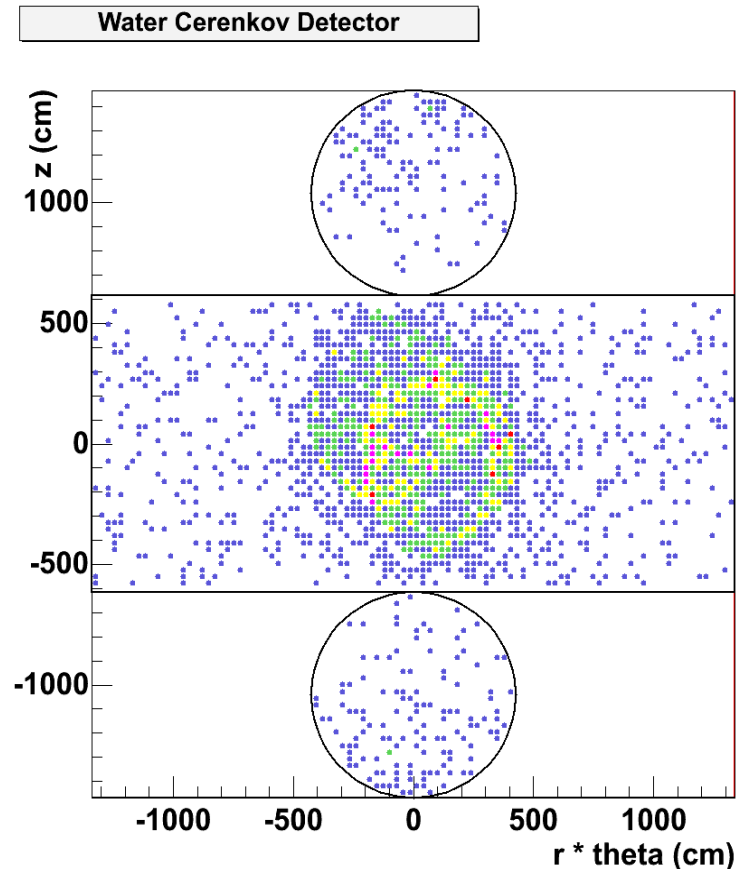
**By T.J. Corona**

# Tools

- **Extended G4 2km simulation**
  - **Each  $\gamma$  that hits a PMT knows what particle it originally came from**
  - **Records the position of where photons from a  $\text{Pi}^0$  converted**



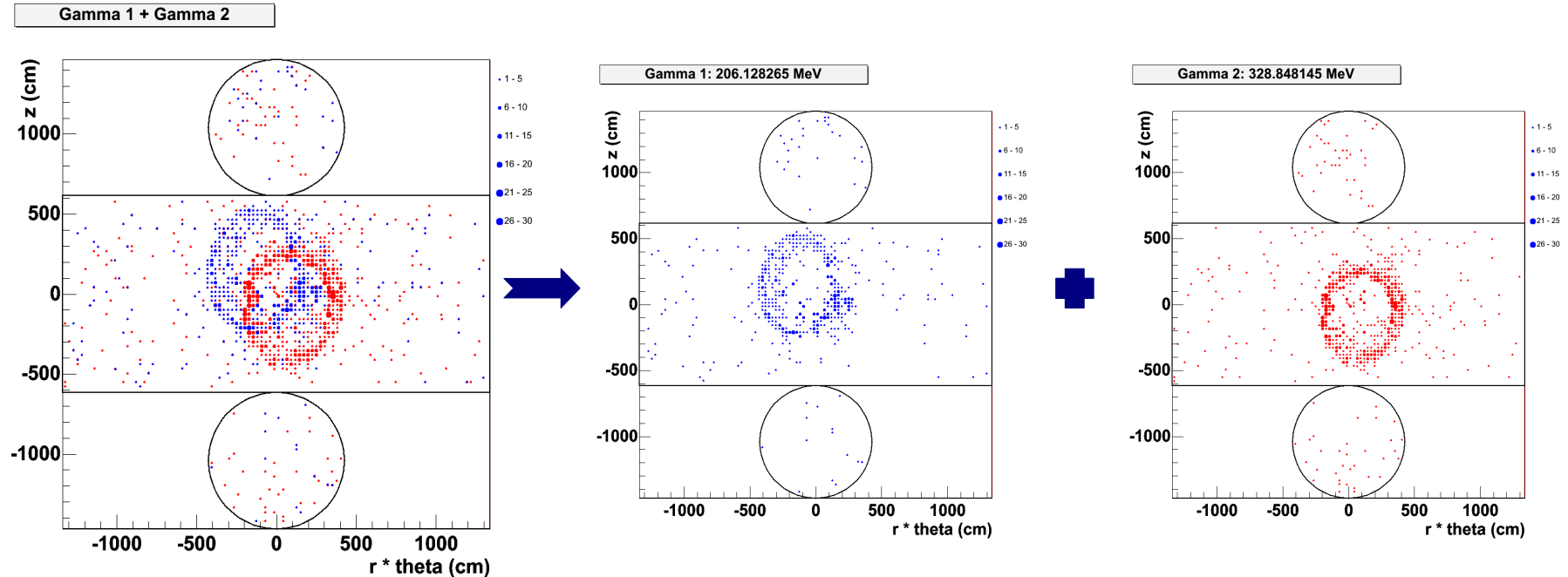
**Pi0 event in G4 display (one gamma is in red, the other in blue)**



**Same Pi0 event in Root display**

- **Customizable WC event display for Root**

# Tools



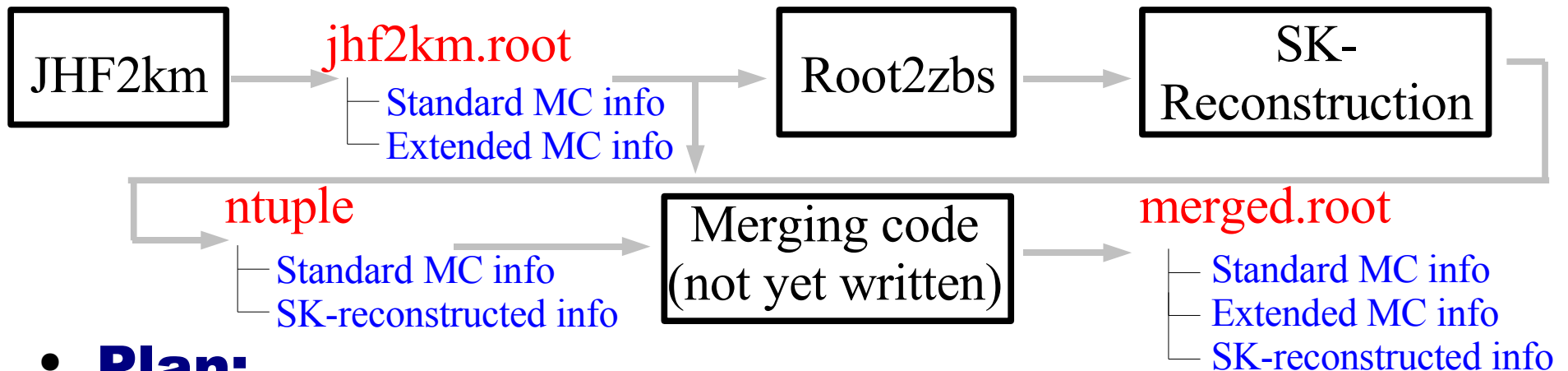
Same Pi0 event separated by parent  $\gamma$  in Root display ( $\gamma_1 = \text{blue}$ ,  $\gamma_2 = \text{red}$ )

## How to use these tools:

- Use modified 2km code with Root display to study T2K Pi0 background (Pi0s reconstructed as single e-like rings)
  - Information gained can be used to tune PolFit and possibly find new cuts

# Plan

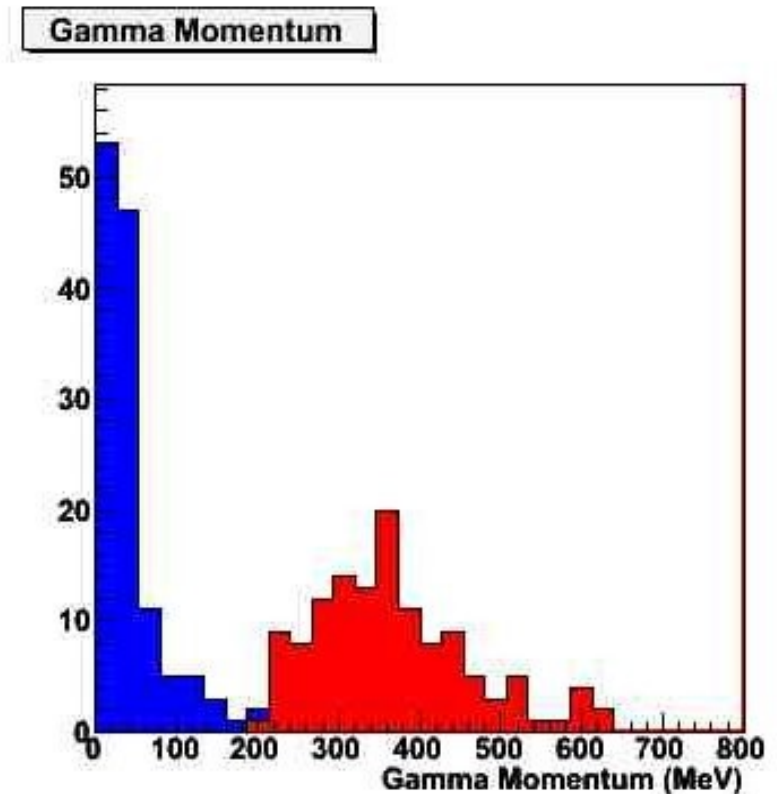
- **There is currently no way to combine SK reconstruction on 2km and still have access to extra root information**



- **Plan:**
  - **combine information from two files**
  - **Apply standard T2K cuts (ring counting, PolFit, etc)**
  - **Use tools to study charge, time distribution, and true vertices of these events**
  - **Can use to tune PolFit, find new cuts**

# True Momentum of Background Pi0 Gammas

- **Preliminary Background Pi0 Study**
  - **Study of gamma processes within Pi0 energy range (10-500 MeV)**
  - **Study of SK  $\nu_\mu$  Ntuple (no oscillation) background after standard cuts**
    - **Pi0 momentum**
    - **$\gamma$  momentum**
    - **Angle between  $\gamma$ s**



**SK  $\nu_\mu$  Ntuple (no oscillation) background Pi0s: momentum of decay gammas. Each Pi0 has a more energetic (red) and less energetic (blue) gamma**

# Conclusions & Plans

## Conclusions

- **Extended G4 to study true properties of background Pi0s**
  - **Each  $\gamma$  knows its parent particle**
  - **Pi0  $\gamma$  vertices recorded**
- **Made tool for Root-based displays**
- **Started studying properties of Pi0 background in T2K**

## Plans

- **Study properties of remaining Pi0s after cuts in G4 by combining reconstructed data and raw data**

## Goal

- **Better Pi0 rejection**
  - **Tune existing algorithms**
  - **Make new cuts (timing?)**