A closer look at background events in the FDIRC

Background/FullSim meeting, July 16th 2012

07/23: slides updated after bug fix

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Introduction

- Focus on the RadBhabha samples
  - ‘full’ and ‘Tungsten4.5cm_full’

- Goal: to go beyond the mean background rate / sector
  - See Alejandro’s recent talks, among which the Elba one

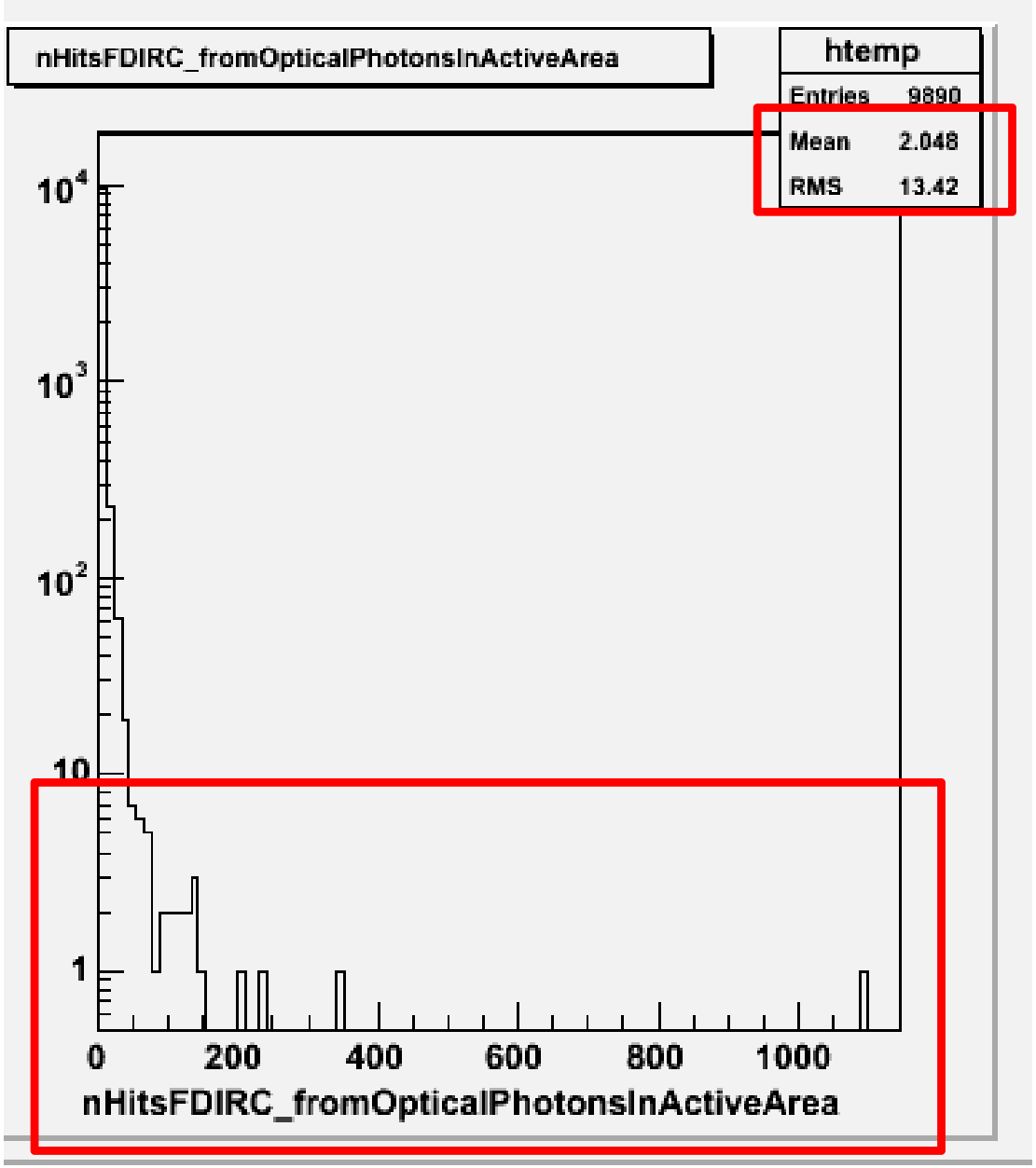
- Space and time structure of the background events
  - Uniform, burst-like, etc.

- The ultimate goal would be to be able to simulate realistic background events to test the degradation of the FDIRC performances with high background
  - Some studies were done in BaBar (~2006): no significant effect seen
  - Still a long road ahead for the SuperB FDIRC…

- 07/23 update
  - Bug in the previous version of the code: arrays too short to read correctly all the data coming from bc with very high number of hits in the FDIRC

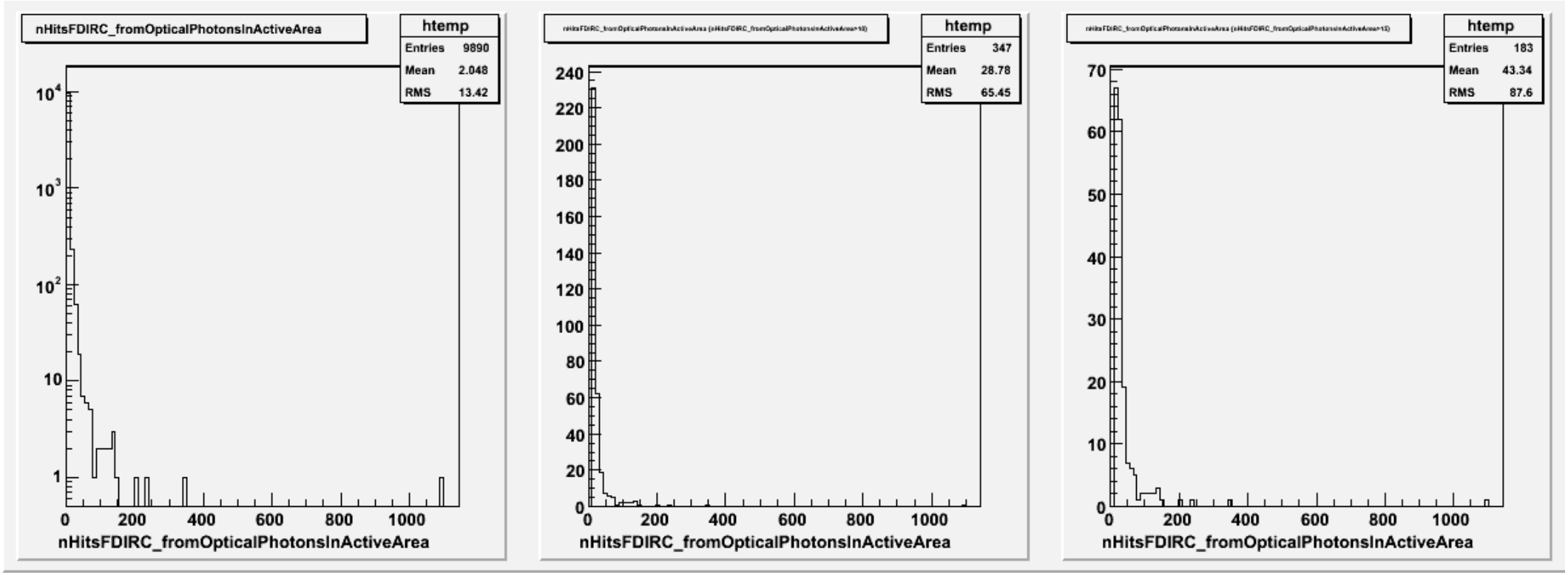
FDIRC hits per bunch crossing (bc)

- ‘Tungsten4.5cm_full’ sample
- Hits from optical photons
  in MaPMT active areas
  - Using ‘blindly’ Alejandro’s code
    to associate hits with FDIRC pixels
- In average about 2 hits / bc
  for the whole FDIRC!
  - bc frequency is making the rate!
- Tail extending up to 100’s of hits / bc
  - Origin!?
- 9890 bc total, ~20255 hits total
  - each event with ~100 hits accounts
    for 0.5% of the total background



Zoom on the tail

- Cut on the number of hits in the FDIRC



Same as previous page

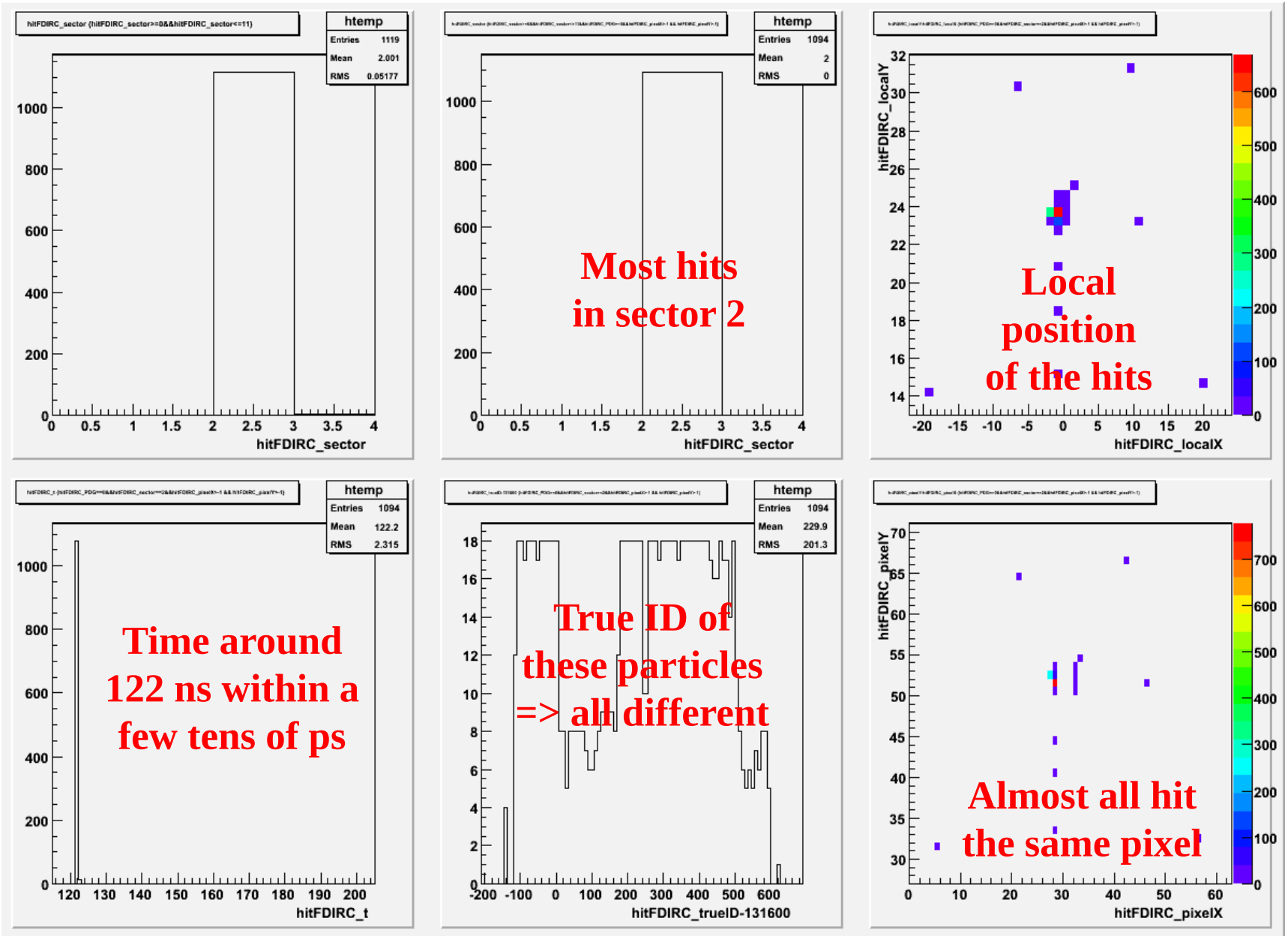
More than 10 hits
3.5% of the events
49% of the hits

More than 15 hits
1.9% of the events
39% of the hits

- Events with the highest number of hits are localized on a sector / on a pixel

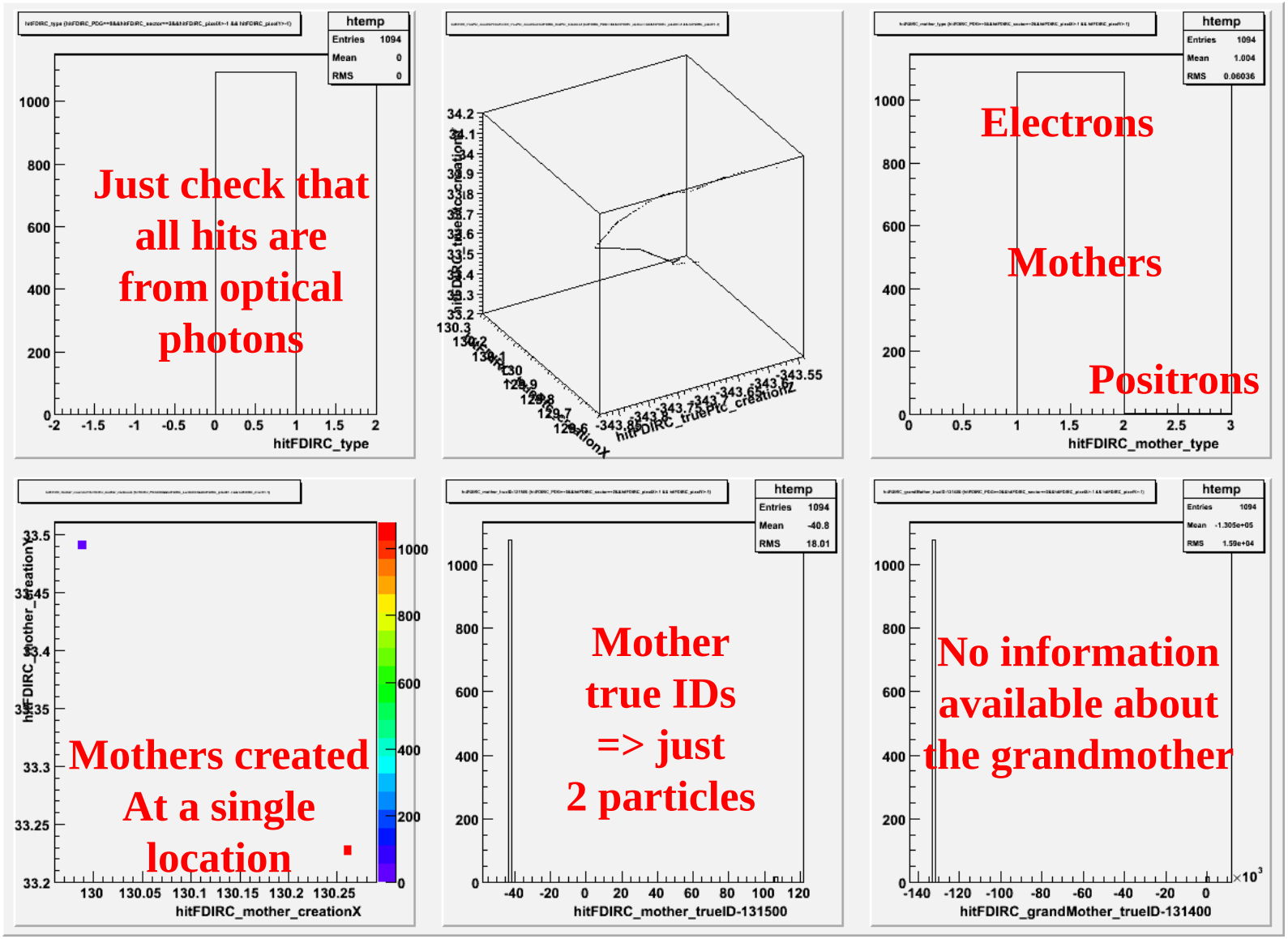
Looking at one event from the tails

Row	FullSimFi	EntryInFi	BunchCros	nHitsFDIR	nHitsFDIR	nHitsFDIR	nHitsFDIR
816	100193	6	817	1119	1101	1111	1094



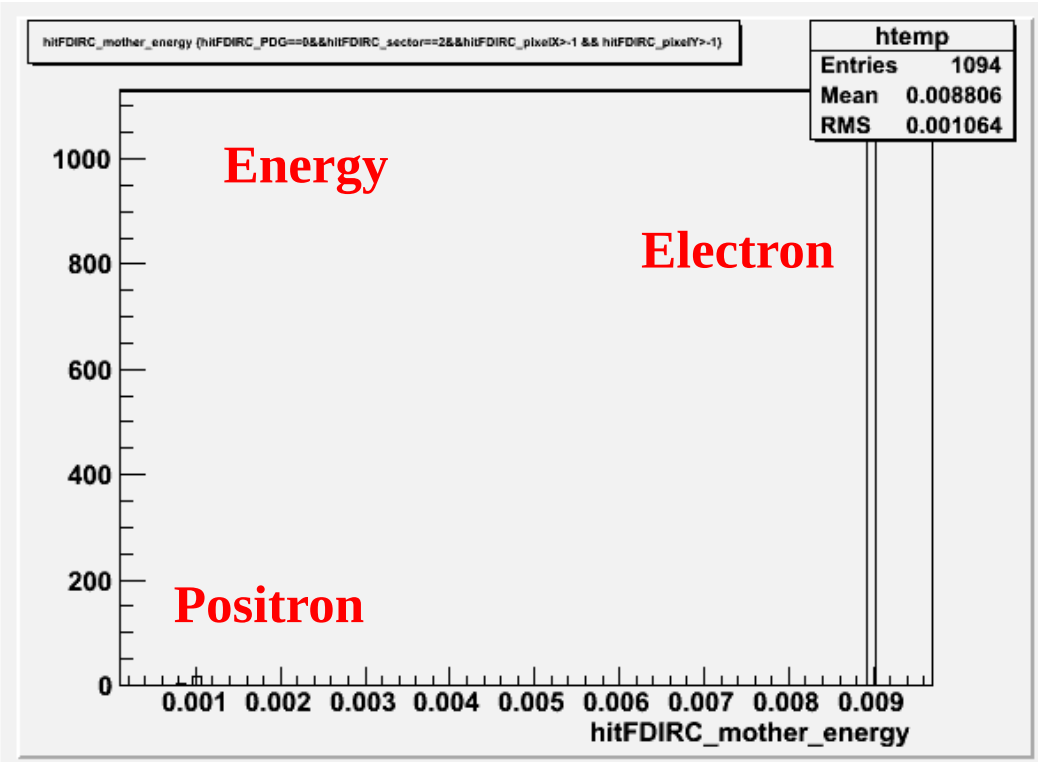
Looking at one event from the tails (cont'd)

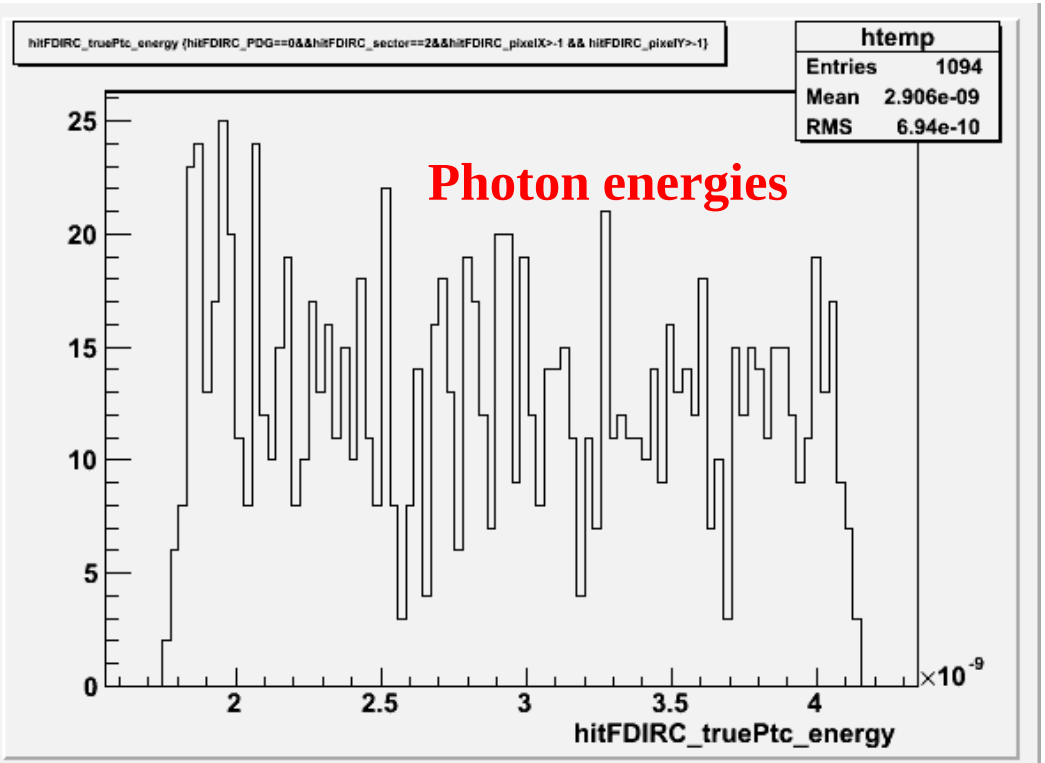
* Row	* FullSimFi	* EntryInFi	* BunchCros	* nHitsFDIR	* nHitsFDIR	* nHitsFDIR	* nHitsFDIR	* nHitsFDIR *
* 816	* 100193	* 6	* 817	* 1119	* 1101	* 1111	* 1094	*



Looking at one event from the tails (cont'd)

* Row	* FullSimFi	* EntryInFi	* BunchCros	* nHitsFDIR	* nHitsFDIR	* nHitsFDIR	* nHitsFDIR	* nHitsFDIR *
* 816	* 100193	* 6	* 817	* 1119	* 1101	* 1111	* 1094	*





- I would conclude that these photons are Cherenkov photons generated by low energy electron and positron created inside the FBLOCK

- Similar conclusions for an handful of events looked at in details

Next

- These events are likely responsible for the rate variations between sectors observed by Alejandro
  - Cutting them away ‘blindly’ makes the rate histogram much flatter

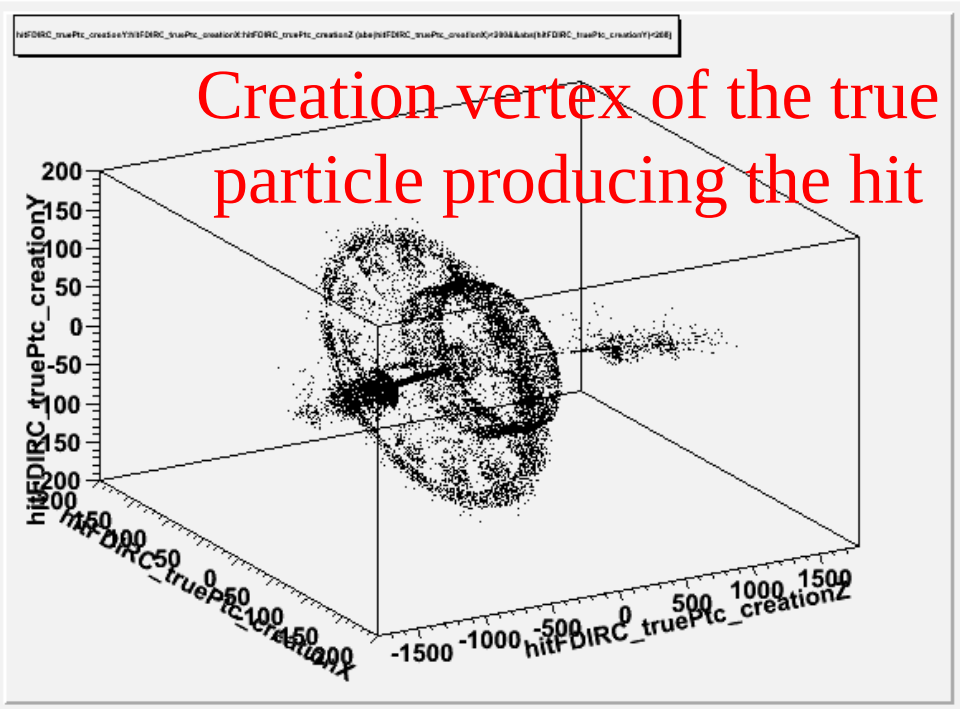
  → Do we expect any RadBhabha-related azimuthal dependence?
- Understand how the MaPMT and the front-end electronics (FEE) will react to these well-localized bursts of hits
- Superimpose individual bunch crossings separated by 4.2 ns each to see what a real background event looks like given the FEE acquisition window
- Look at other background samples
  - These events seem absent from the pair sample (TBC)
- Suggestions more than welcome…

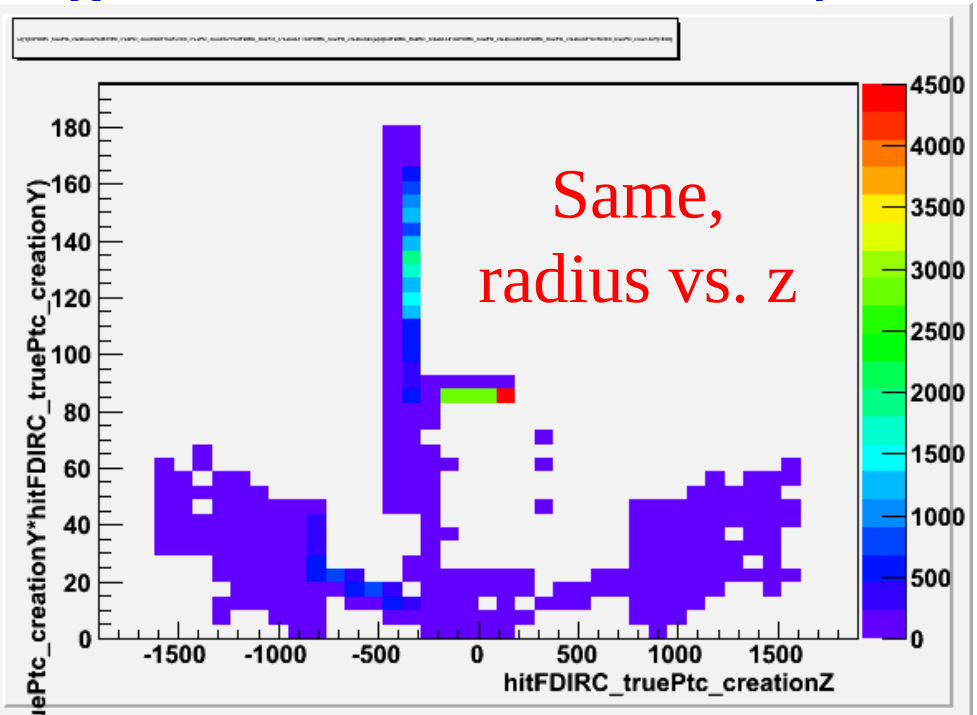
→ A few more plots based on the truth information

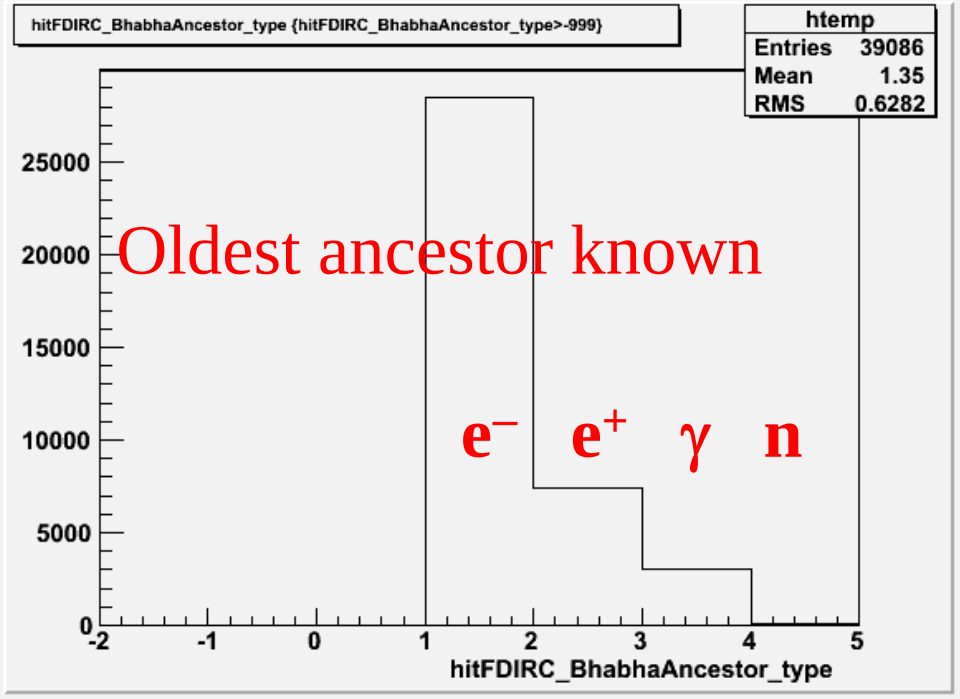
- The following slides have not been modifed.

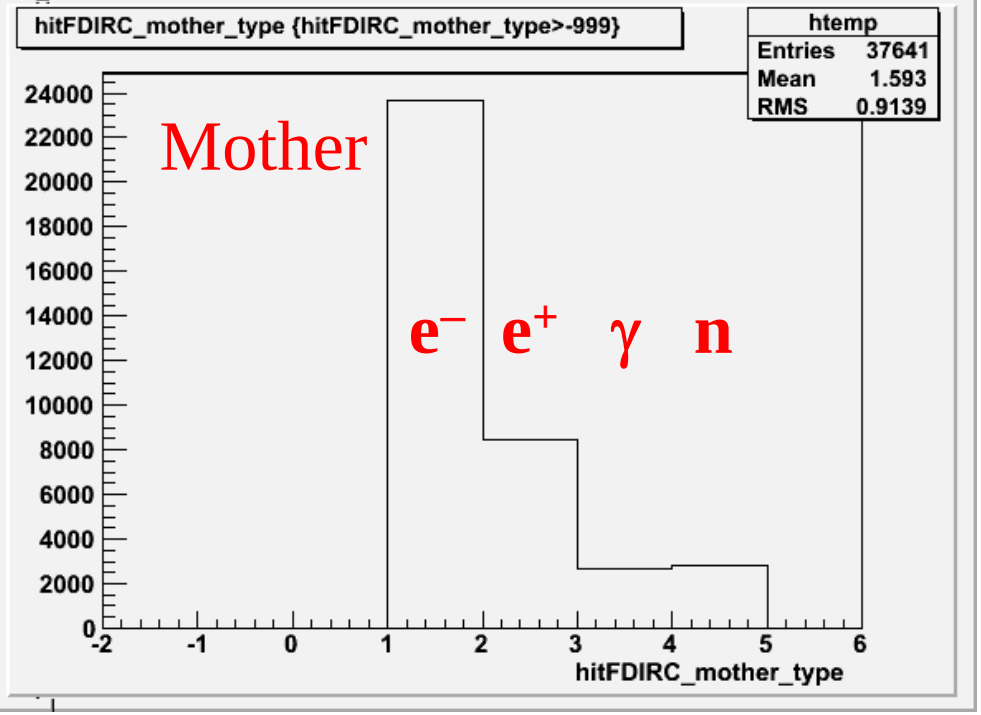
  → They may be partly affected by the bug which is now fixed
- Added on 07/23: ~3300 hits (~16%) come from particles which are created exactly (distance = 0) where the hit is detected. ??????

‘Genealogy’ of all particles hitting the FDIRC MaPMT plane

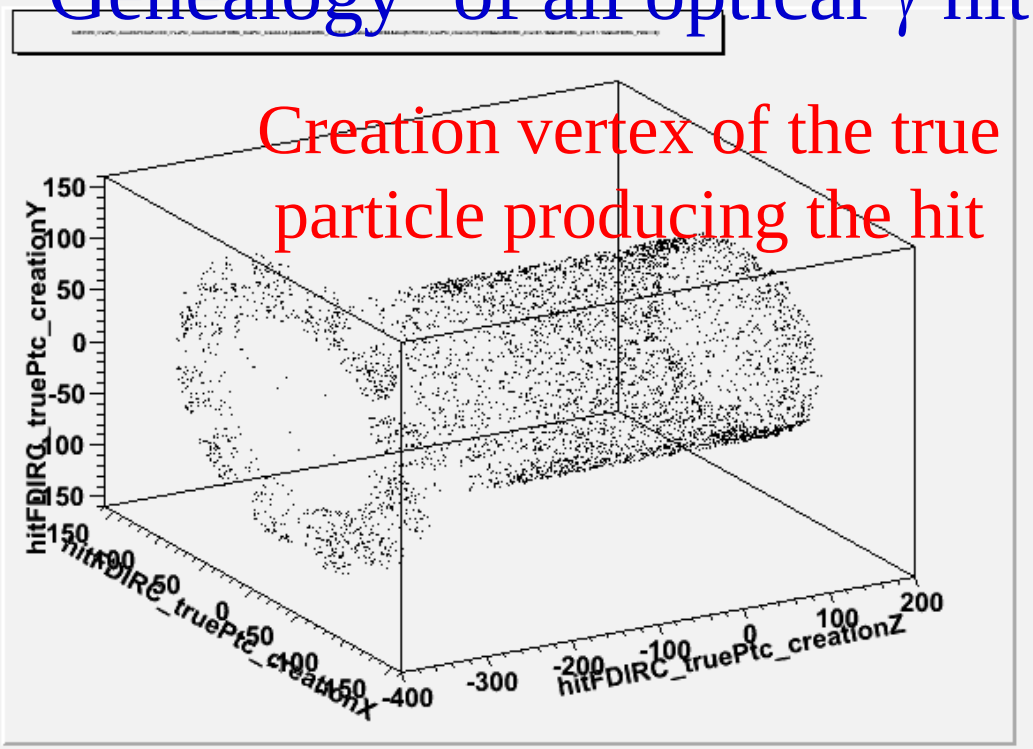


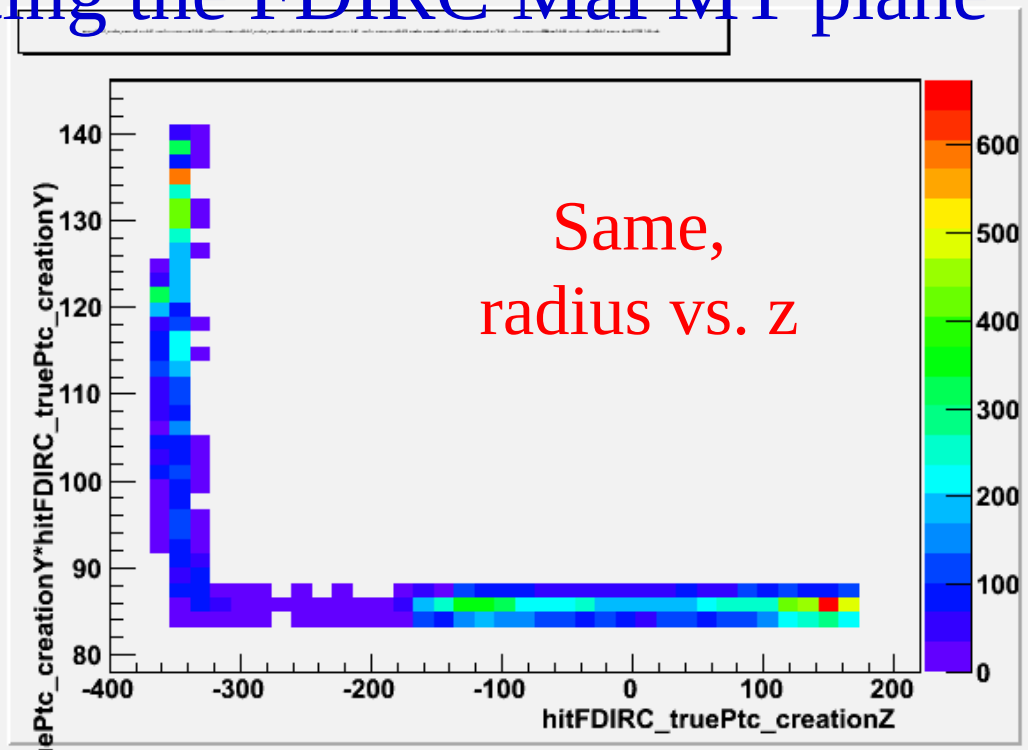


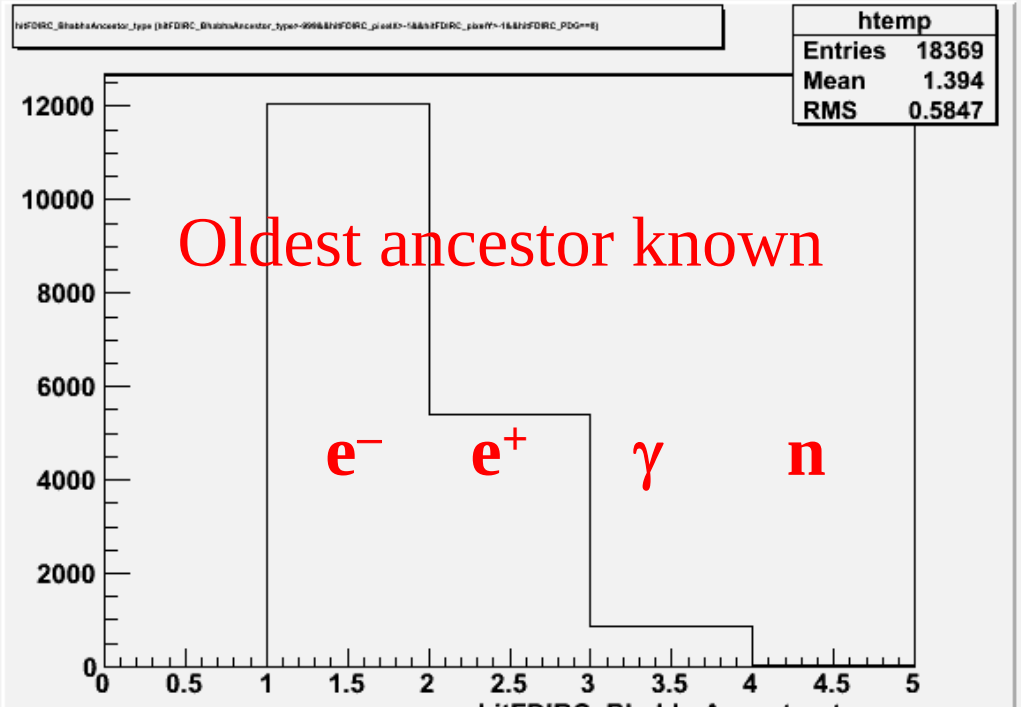


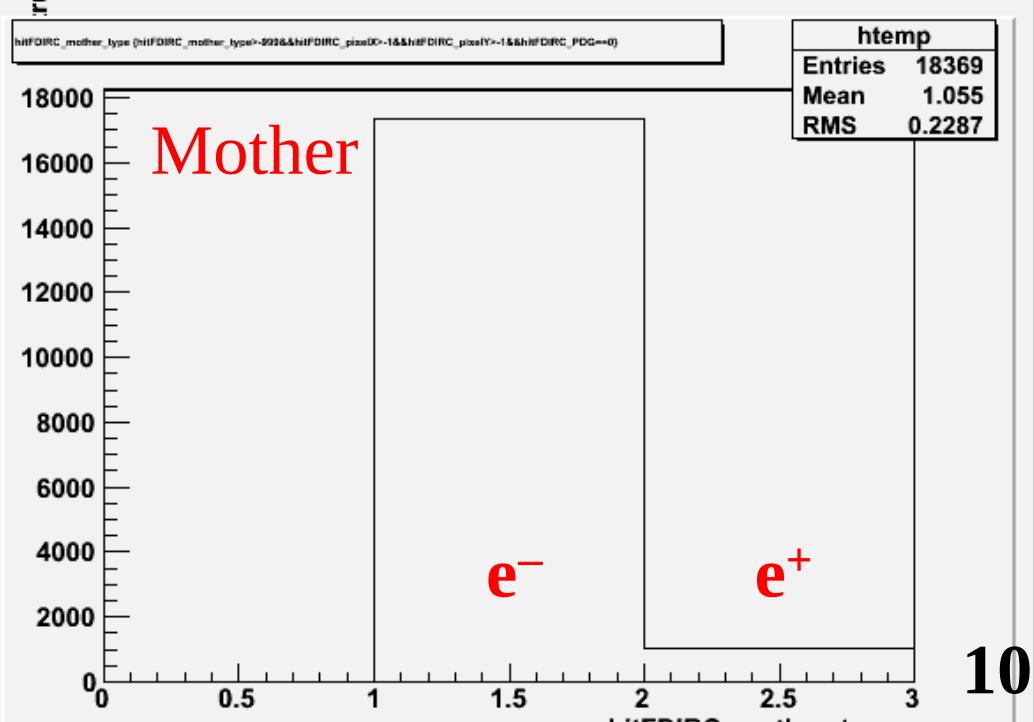


‘Genealogy’ of all optical γ hitting the FDIRC MaPMT plane



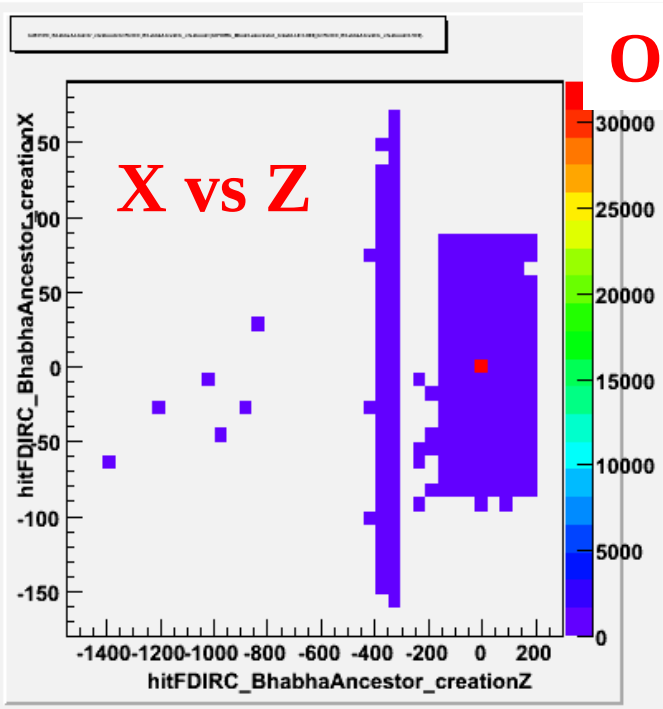


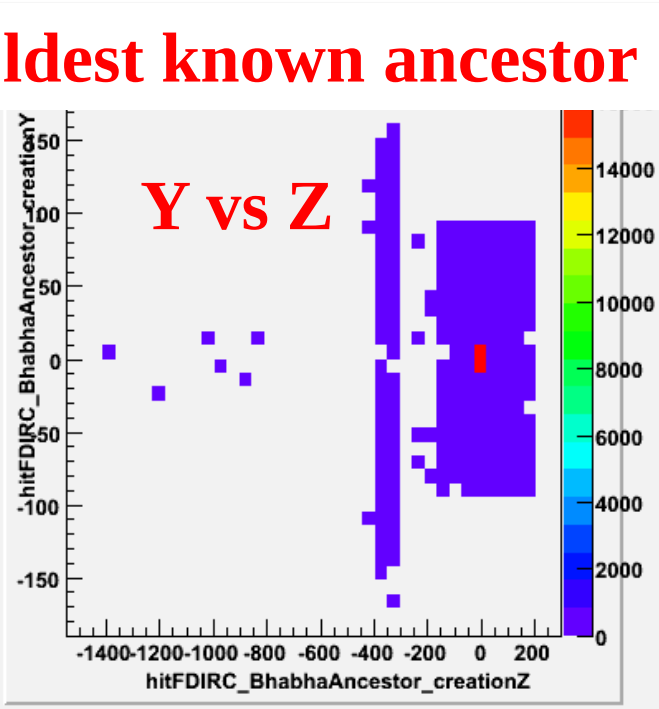


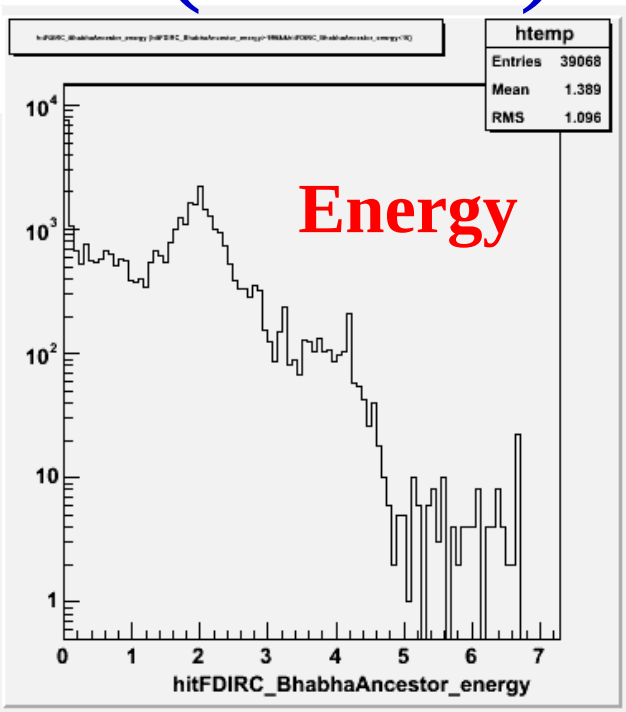


More on the creation vertices (all hits)

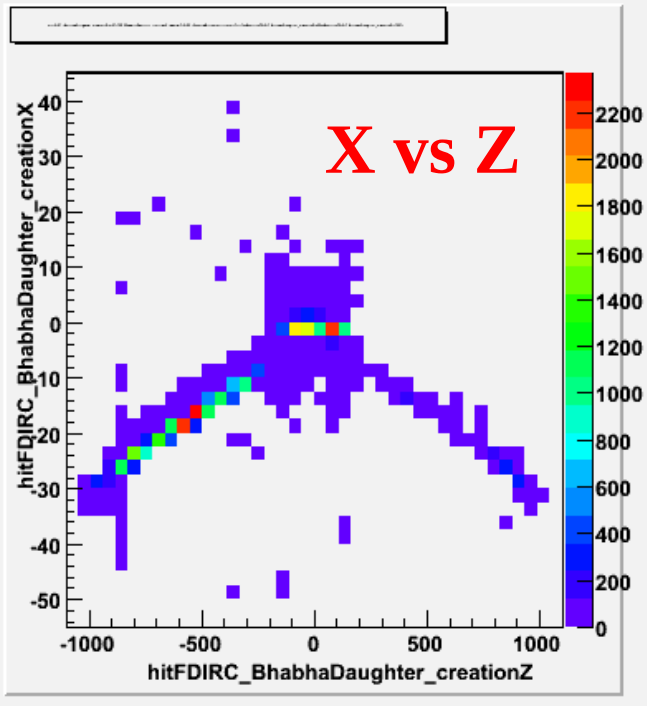
Oldest known ancestor

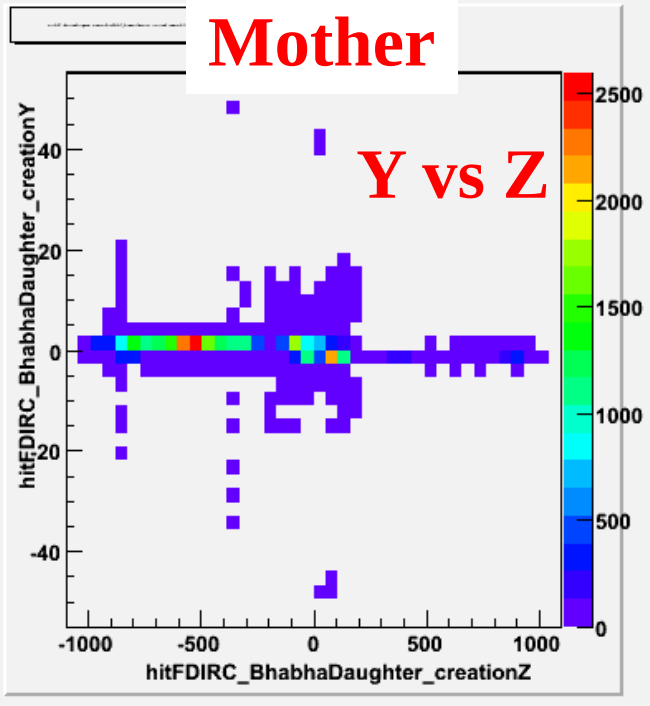


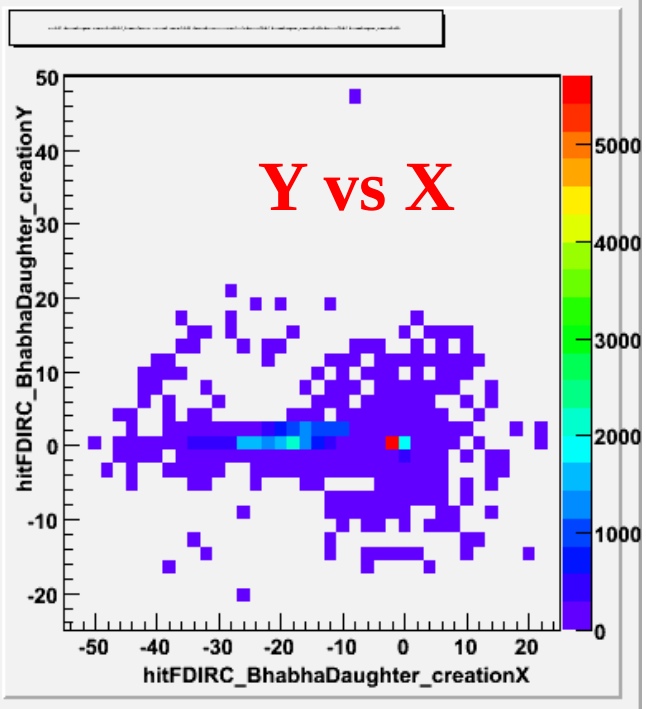




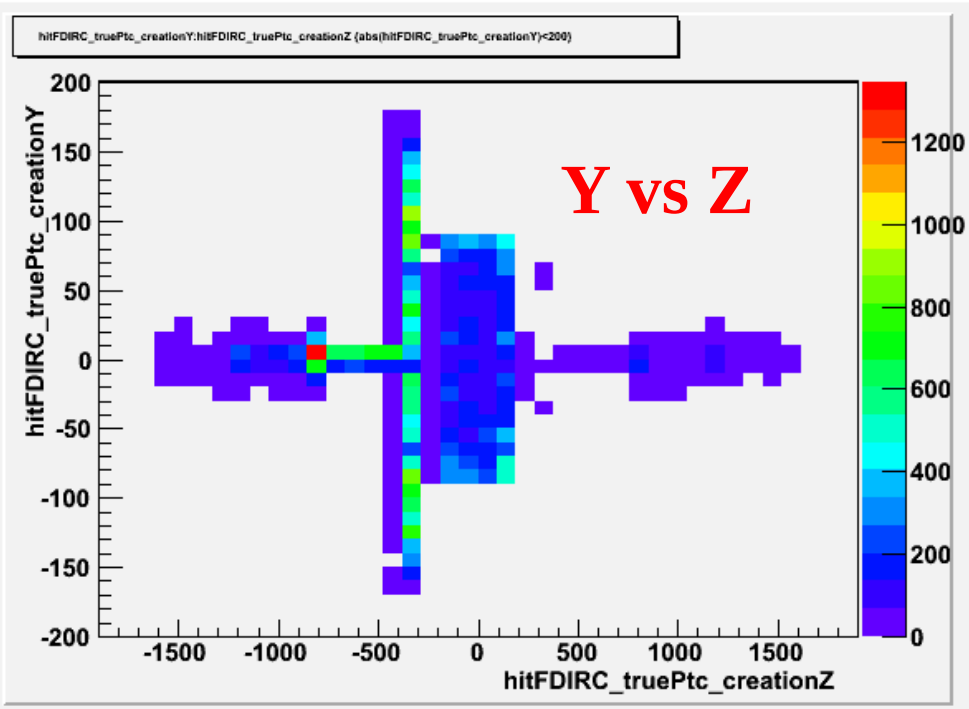
Mother

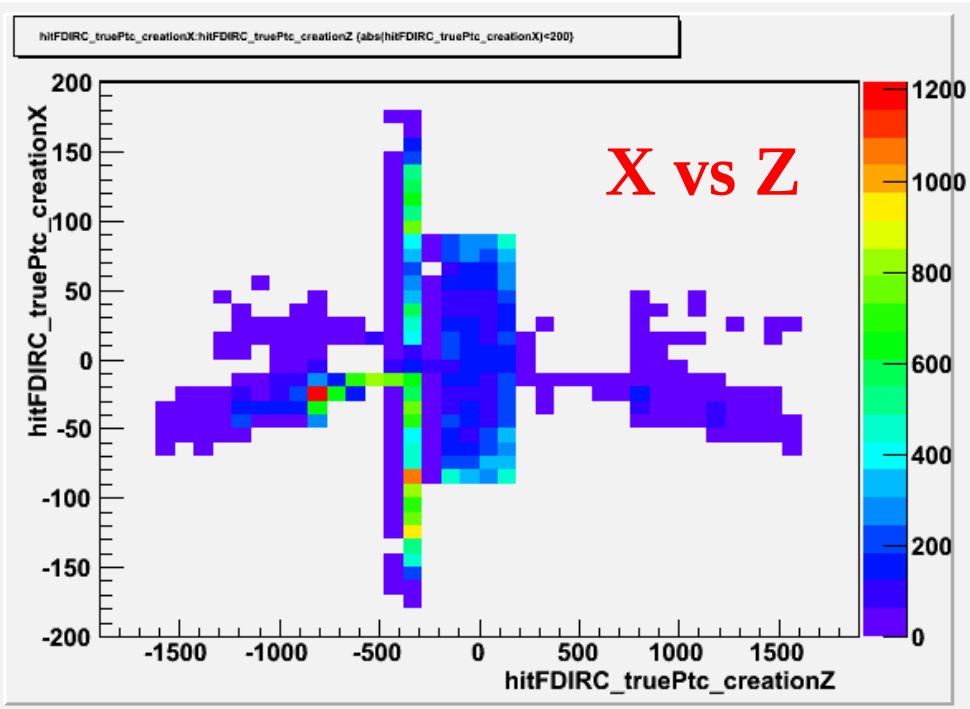


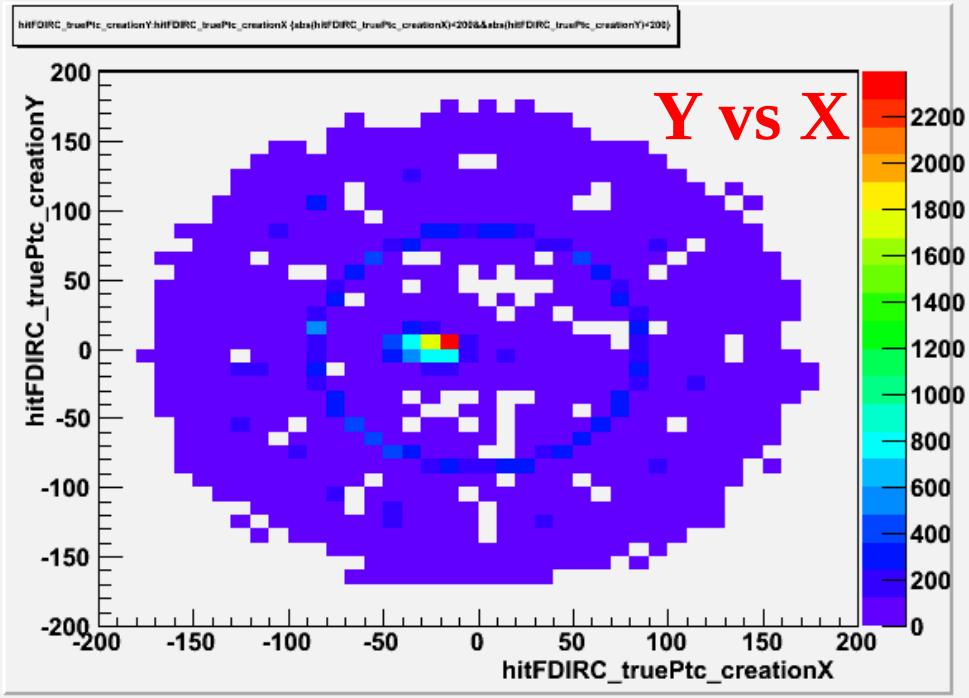


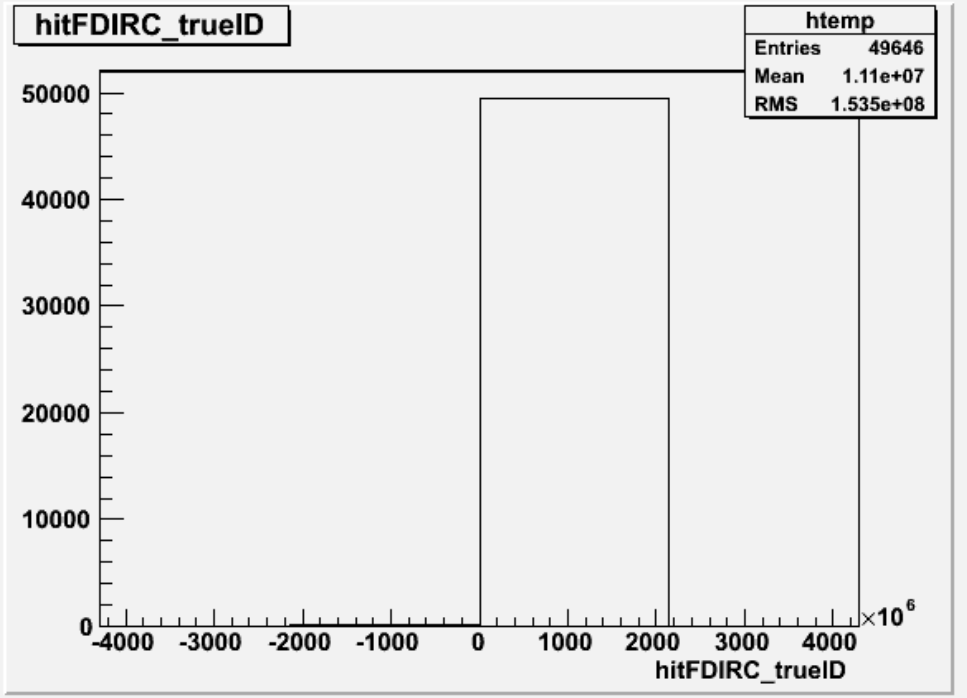


Creation vertices of the particles hitting the FDIRC

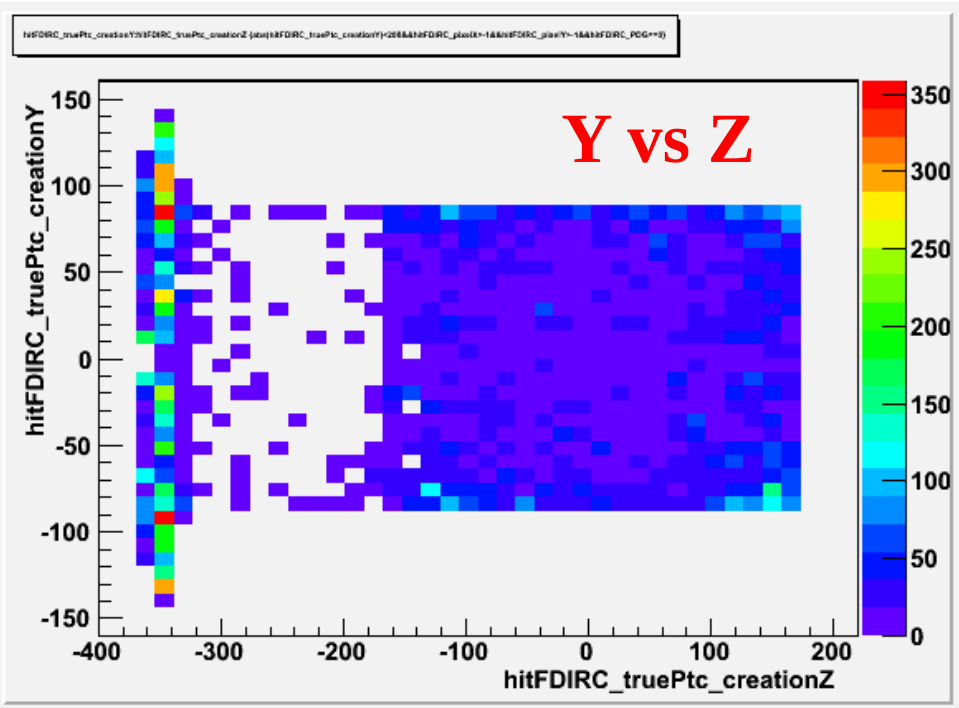


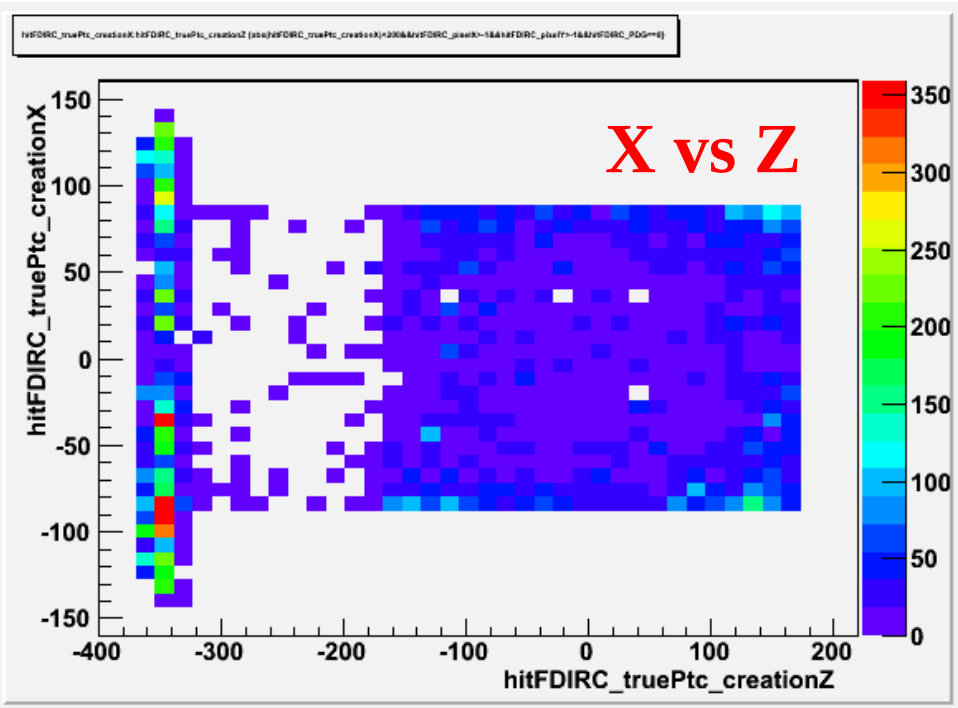


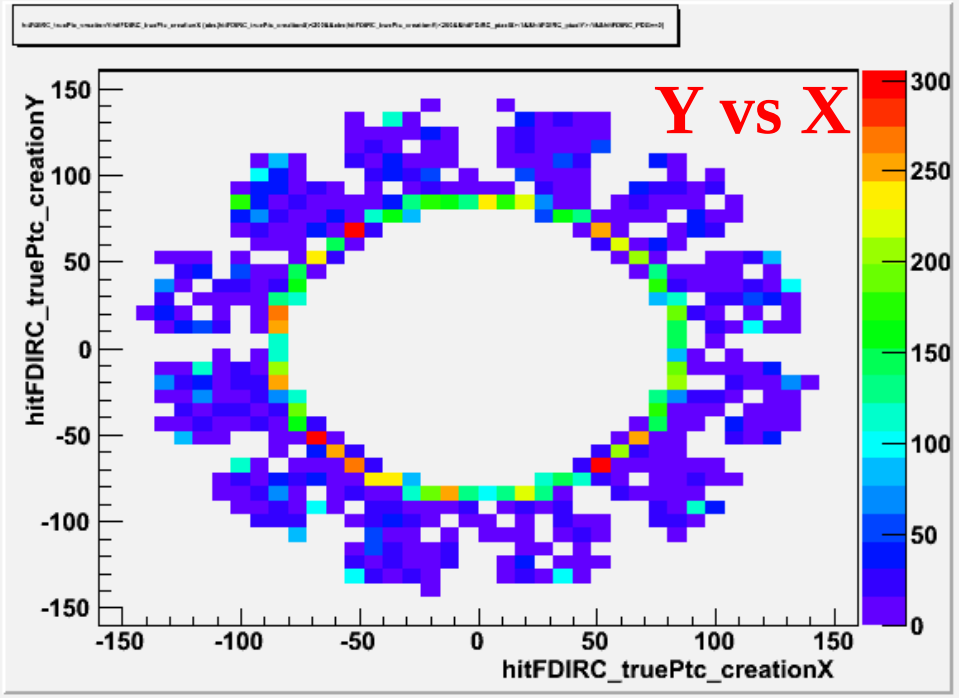


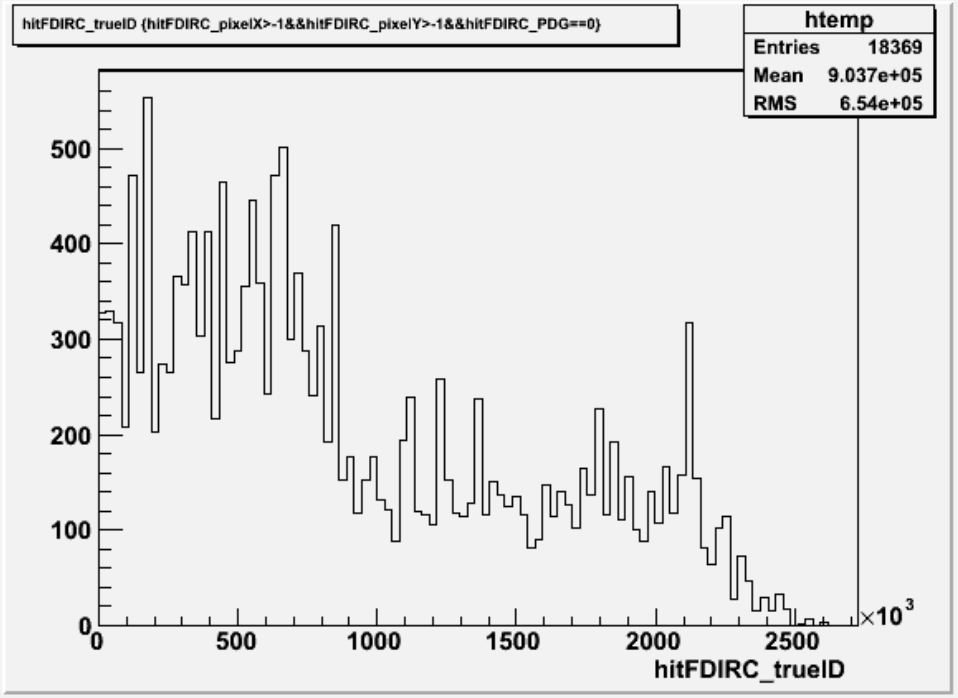


Creation vertices of the optical γ hitting the FDIRC









Hits on the FDIRC plane (sector averaged)