Subject: Pion Measurement Asymmetry in GEANT3
Posted by Andreas Herten on Mon, 27 Apr 2015 14:20:56 GMT
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Writing my thesis, I noticed that D mesons with negative charge were reconstructed more frequently than those of positive charge.

I backtraced the problem to the following: In GEANT 3, pions with positive charge sometimes don't produce hits in layer 3 of the MVD barrel. Switching from GEANT 3 to GEANT4 leads to more even distributions for positively and negatively charged pions (but there's a notable change when using scrut14 and mar15, see below).

For my thesis I produced the following plots. The PandaRoot version is scrut14 with the beam pipe geometry file in version beampipe_201112.root

The data shown is from a box generator simulating events with two positively charged pions and two negatively charged pions. The theta angle is fixed to 60°. For GEANT 3, about 92 %

hits are counted using an ideal MC track finder and following the FairLinks back to the MVDPoint.

There's no apparent reason why this pion should not generate a hit in layer 3.
(You can find the full description of the findings in my thesis on our documents server, in Section 5.3.2 / page 156 (PDF page 164).)

For this post, I reproduced the plots with the current PandaRoot / Fair* setup (mar15*). The beam pipe geometry file is beampipe_201309.root, in addition I had to update my tools to match the new structure of the FairLinks.
The two frequency plots from above now look like this.

The particles are absorbed there. That is somewhat expected, from what I hear from other people. But: This effect does not seem to be present in the scrut14 PandaRoot version. So: Why? Is it due to the new beam pipe geometry file? Is it correct now or before? If it's correct now, it does, probably, influence all analyses done before the geometry file change...

Let's say an excess in positively charged pions is expected, still the layer 3 asymmetry in GEANT 3 remains, also after updates; still in this layer, a lot more negatively charged pions can produce hits.

I created a minimal example so that you can reproduce the results. The zip file is attached (rawfiles.zip), you can download it here, or take a look at my development folder for the individual files.
The run.sh scripts calls the files in the appropriate order and creates two ROOT files with hit counts for the different layers and particle species; one for GEANT 3, one for GEANT 4. To run the script, you need to 1) add a reference to the folder with the zip contents to your PandaRoot CMakeLists.txt and 2) add the new MC Match ("PndMCMatchNewLinks") to your PandaRoot CMakeLists.txt.

You can directly download the two ROOT files here. The macro for producing the plots, genHistos.C, can then directly be used without any further compilation (see also the TBrowser for more histograms).
In the archive, the sim.C is the current macro/run/sim.C macro with modifications for FairLinks, the eventDisplay, and the BoxGenerator. digi.C has not been changed. hitcount.C invokes my PndMcHitCount.cxx, which extracts the number of hits per sub-detector and MVD layer based on the FairLinks. Finally, genHistos.C takes the hitcount.C output to produce histograms, of which to most important one is painted to the screen.

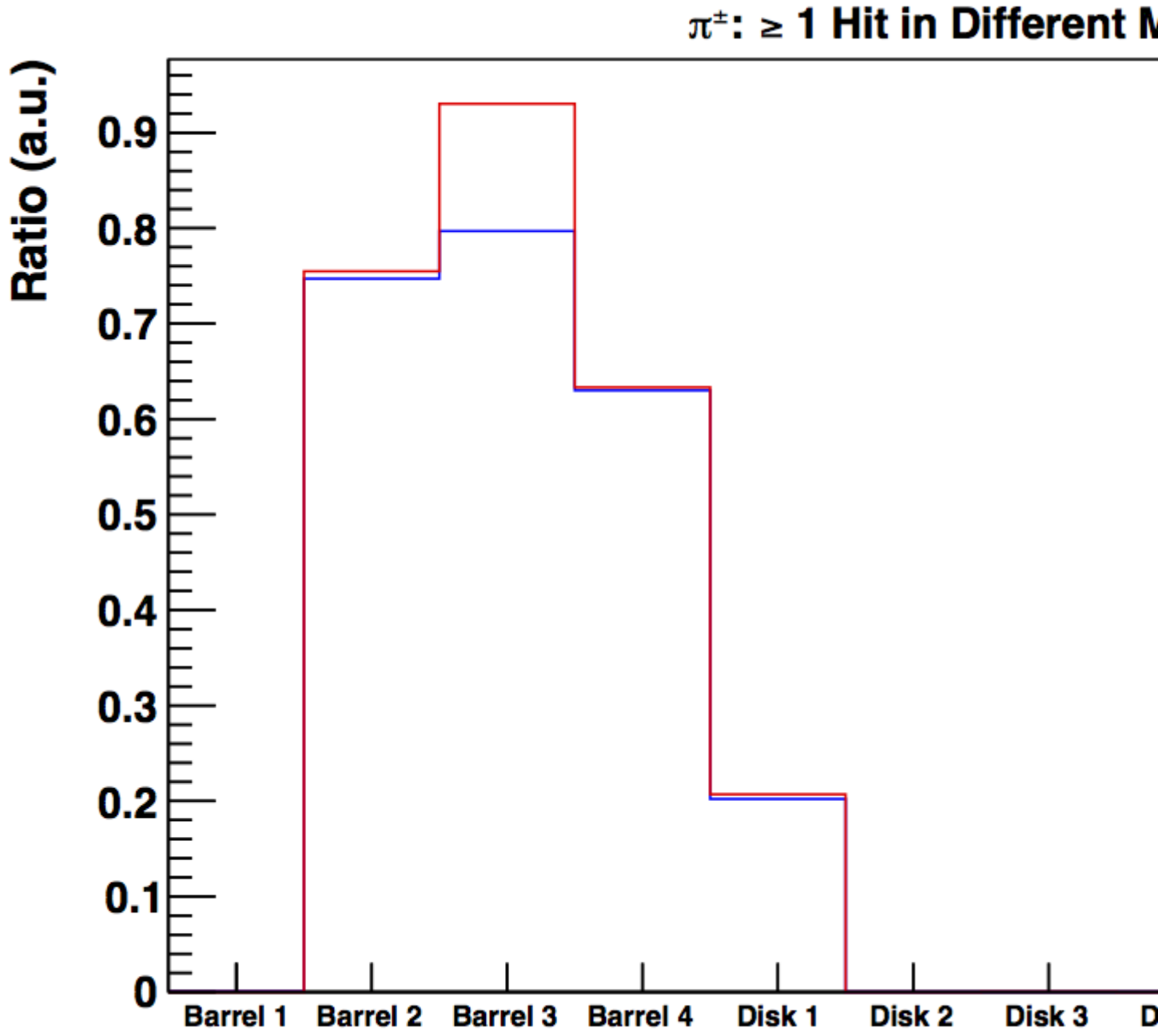
Any ideas? If there are questions, I can surely answer them here or tomorrow during the PandaRoot online meeting.

Edit (28.4., 9:30): *: Actually, I needed to take PandaRoot's trunk version, since in mar15 something of the FairLinks was not working (I don't remember exactly what).

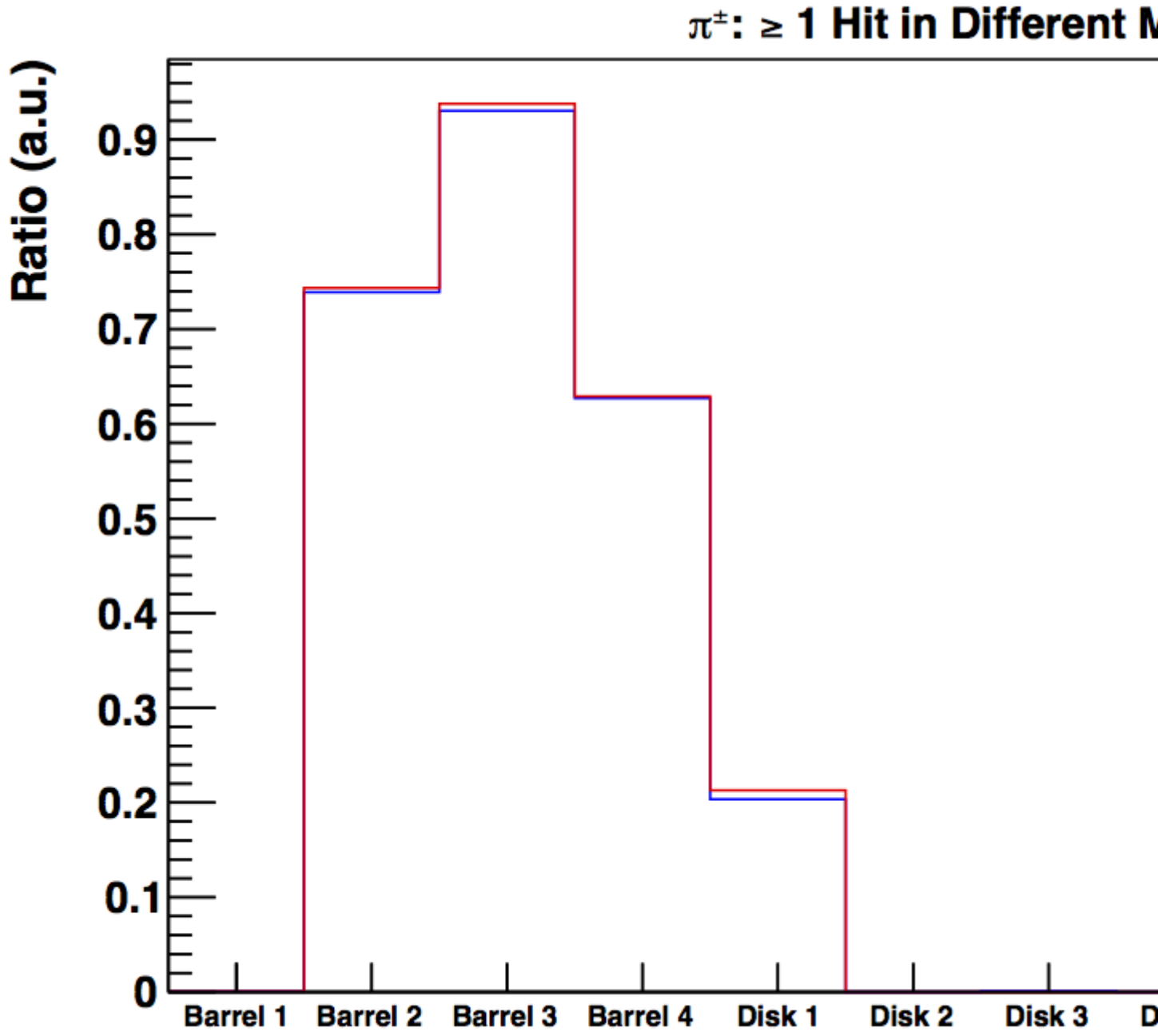
PS: It would be really cool if the forum would allow HTML code, or another method of resizing inserted images. The BBcode method does not work.

File Attachments

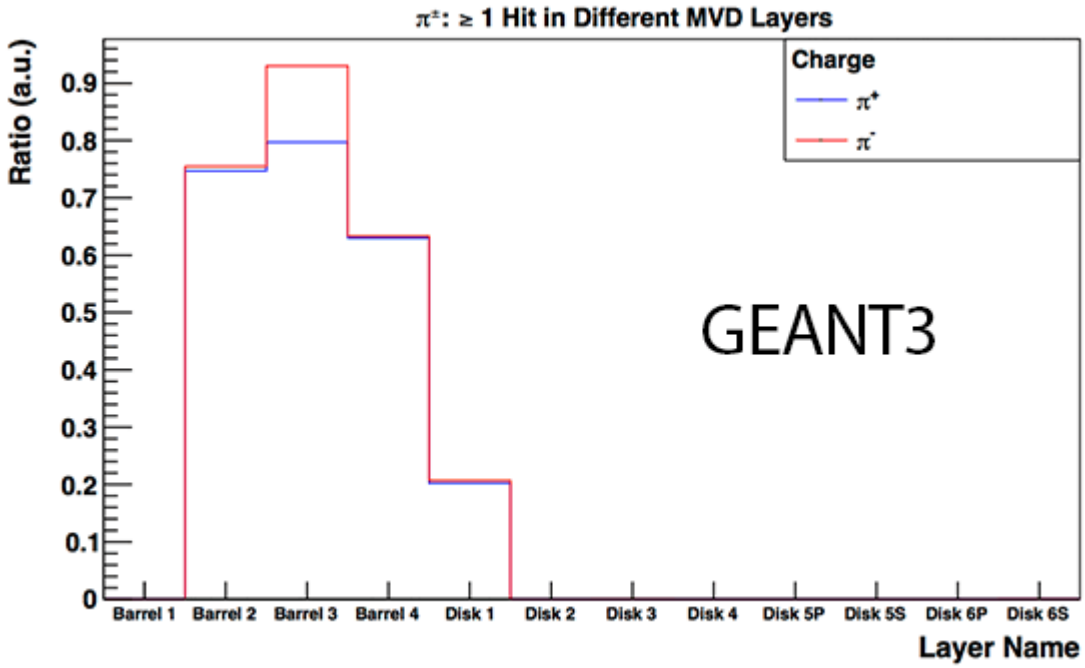
1) Hit_Count_Asymmetry_in_Layers-G3.png, downloaded 990 times

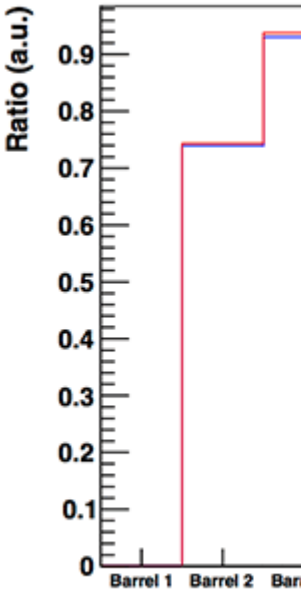


2) Hit_Count_Asymmetry_in_Layers-G4.png, downloaded 998 times

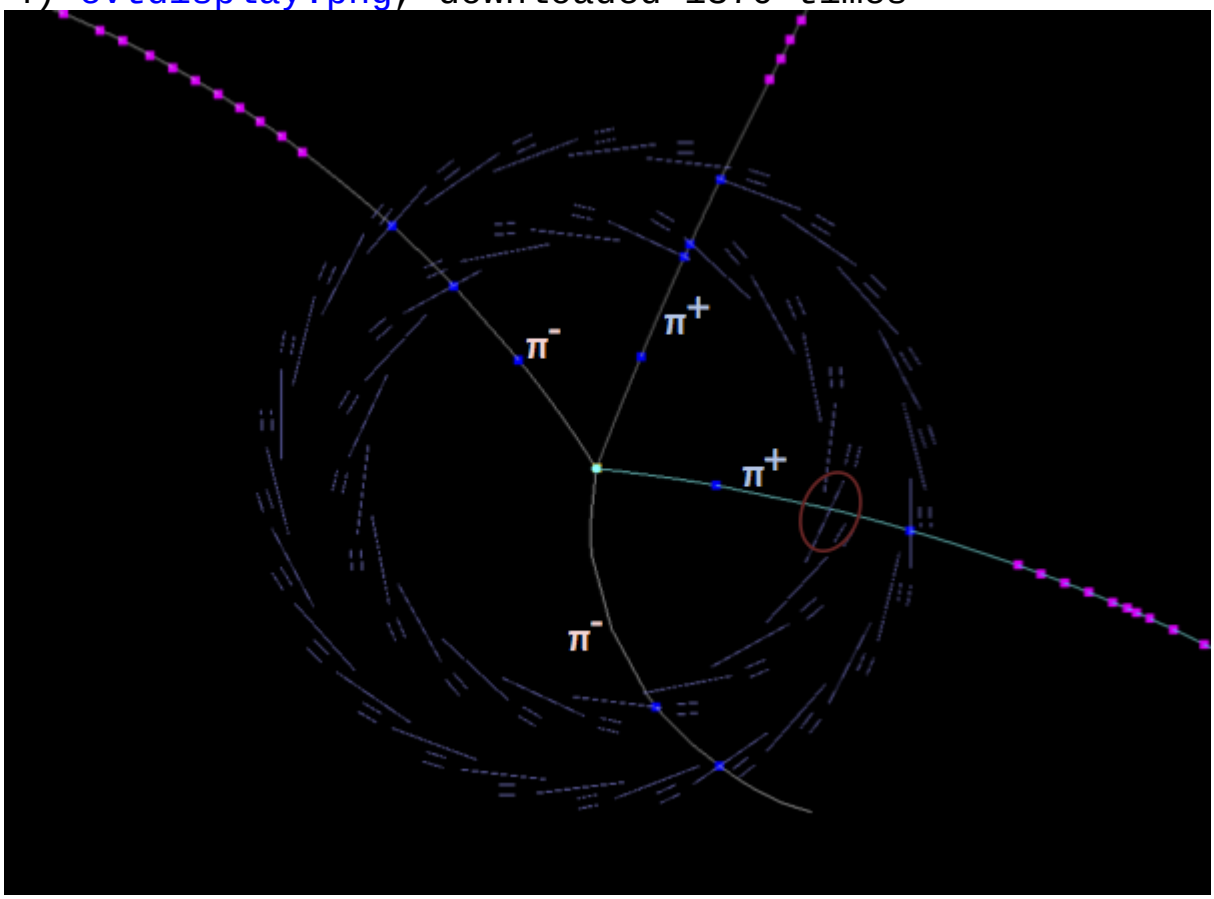


3) Hit_Count_Asymmetry_in_Layers-G34.png, downloaded 1284 times

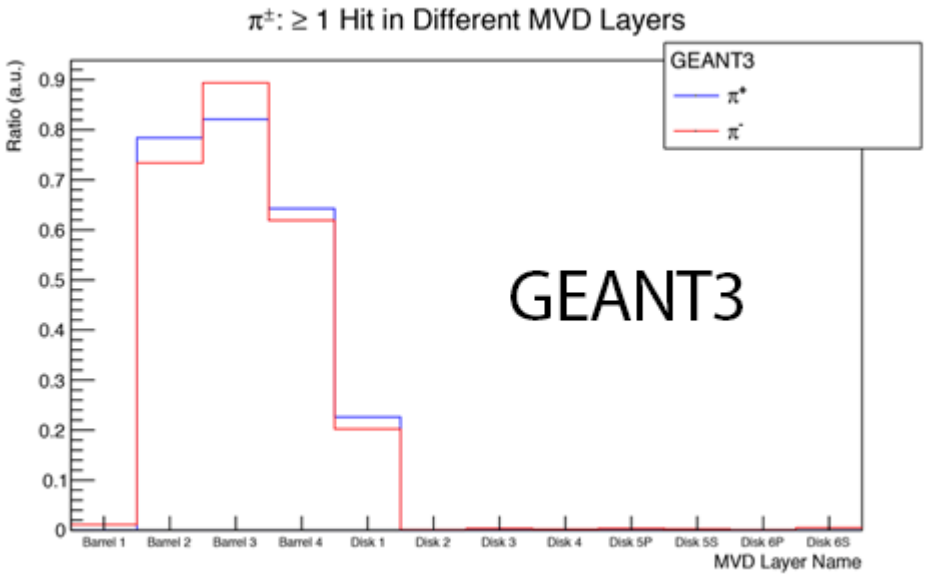


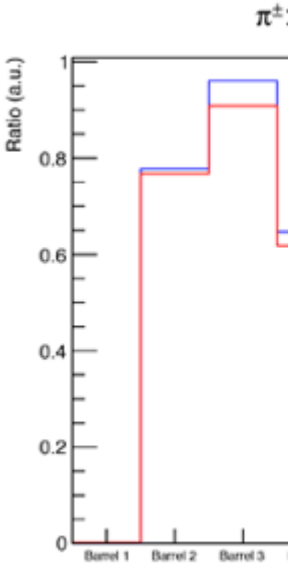


4) evtdisplay.png, downloaded 1370 times



5) pion_asymmetry_GEANT34.png, downloaded 1241 times





6) rawfiles.zip, downloaded 417 times