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Subject: Separation of photon and electron  
Posted by [donghee](#) on Sat, 09 May 2009 19:04:49 GMT  
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Dear EMC experts,

I have a question about the PID of photon and electron with EMC.  
I found a good article for electron PID based on the EMC information in the panda physics report.  
but there are only electron, hadrons and muon separation with MLP training and Zernike moments.

E1/E9 or E9/E25 should be important variables for this purpose.  
Could you teach me which values are relevant for photon PID or electron PID case?

Is there a global tracking class for photon or electron using only EMC?

Thank you in advance.  
Donghee Kang

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Subject: Re: Separation of photon and electron  
Posted by [Bertram Kopf](#) on Mon, 11 May 2009 12:43:57 GMT  
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Dear Donghee,  
Quote

I have a question about the PID of photon and electron with EMC.  
I found a good article for electron PID based on the EMC information in the panda physics report.  
but there are only electron, hadrons and muon separation with MLP training and Zernike moments.

the particle identification of electrons and photons are in principle two different things. Namely, before one should start with the EMC specific particle identification the matching of charged particle tracks with the EMC clusters/bumps has to be done. Those clusters which can be associated with charged tracks are assumed to be originated either from electrons, from charged hadrons or from muons. The EMC PID is described in the Panda PB exactly for this scenario. BTW: The most important info is  $E/p$  (the energy deposit of the cluster over the momentum of the charged particle).

For our PB studies we have assumed that all non-matched clusters are originated from a photons. And this was sufficient for our benchmark studies. But in principle you are right that a proper photon identification is needed. Such clusters can also originate from neutrons,  $\pi^0$ 's, electromagnetic or hadronic split-offs. The shower shape informations are also here helpful properties for the distinctions between these (faked) particles.

Quote

E1/E9 or E9/E25 should be important variables for this purpose.  
Could you teach me which values are relevant for photon PID or electron PID case?

There is a correlation between the Zernike-moments and E1/E9 and E9/E25. We trained the MLP with 10 different input properties. The advantage of using such a neural network is that it's not necessary to know how the properties are correlated.

Quote

Is there a global tracking class for photon or electron using only EMC?

For the PB studies we have defined a EmcCand object which has a reference to the cluster/bump object and to the track object (for the matched scenario). The PID has been done with PID specific packages.

Best regards,  
Bertram.

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Subject: Re: Separation of photon and electron  
Posted by [donghee](#) on Mon, 11 May 2009 13:56:28 GMT  
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Dear Bertram,

Thank you for your nice explanation.  
May I use such kind of EmcCand PID class based on the MLP, right now?  
If yes, then where can I find it?

Best wishes,  
Donghee

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Subject: Re: Separation of photon and electron  
Posted by [Bertram Kopf](#) on Mon, 11 May 2009 15:21:24 GMT  
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Hi Donghee,

donghee wrote on Mon, 11 May 2009 15:56  
Thank you for your nice explanation.  
May I use such kind of EmcCand PID class based on the MLP, right now?  
If yes, then where can I find it?

What is explained in my last posting has been realized in the software code used for most of the PB benchmark studies. In PandaRoot the detector specific and global PID are still under

development. I think that the PandaRoot experts for PID can better explain what you can use for your purposes right now.

Cheers,  
Bertram.

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Subject: Re: Separation of photon and electron  
Posted by [donghee](#) on Mon, 11 May 2009 18:58:04 GMT  
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Dear Bertram,

I understand well that the global PID is now not ready to use.  
I have introduced lhetrack and EMC part in my analysis stuff for electron proton identification. Electrons as a charged particle can be relatively easy to detect in the lhetrack class. But for photon I think that EMC expert can only help for that in any case.

Quote: I think that the PandaRoot experts for PID can better explain what you can use for your purposes right now.

If I choose only maximum cluster energy, that is suggested in EMC macro/emc, the reconstruction efficiency is simply not enough in the range from 0.1 to 4.5 GeV energy.

Thank you for your comment and help.  
Donghee Kang

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Subject: Re: Separation of photon and electron  
Posted by [M.Babai](#) on Tue, 12 May 2009 08:48:16 GMT  
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Dear Donghee,

At this moment we are developing the global PID tools for PANDA and it is not finished yet. The task is partially implemented and one can use it, if you know how to train the different classifiers. Concerning the algorithms (MLP, KNN, BDT, ...) that are available, please have a look in the gpID directory.

Currently (until the global data structure is ready to use) we are storing the output of classifiers in a self-made object ("PndPidCand") that will disappear once the global one is available.

cheers,

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