Subject: Mass calculation from vector<PndEmcDigi*> in EMC
Posted by donghee on Tue, 19 May 2009 11:51:17 GMT
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Dear all,

I have a question about Mass function in PndEmcCluster using the list of PndEmcDigi.
In this Function, a list of digitization in ONE cluster is called, and all stored digi iterate to build a momentum.
If I correctly understand now, a cluster has few digitization according certain space points, where is only covered region in one cluster. I cannot clearly understand why two or even more digitizations are needed to calculate momentum, how do they involve in one cluster?
Could you explain about that? I just want to know the functionality of this digi list.

Thank you for your help in advance
Donghee Kang.

Quote:Double_t PndEmcCluster::Mass() const
```
00216 {
00217       Double_t mass;
00218       TVector3 clusterMomentum(0,0,0);
00219       vector<PndEmcDigi*>::const_iterator digi_iter;
00220       TVector3 digiDirection;
00221       Double_t digiEnergy;
00222       for (digi_iter=fDigiList.begin();digi_iter!=fDigiList.end();++digi_iter)
00223       {
00224             digiDirection=(*digi_iter)->where().Unit();
00225             digiEnergy=(*digi_iter)->GetEnergy();
00226             clusterMomentum=clusterMomentum+digiDirection*digiEnergy;
00227       }
00228
00229       Double_t clEnergy=energy();
00230
00231       mass=sqrt(clEnergy*clEnergy-clusterMomentum.Mag2());
00232
00233       return mass;
00234 }
```

Subject: Re: Mass calculation from vector<PndEmcDigi*> in EMC
Posted by Bertram Kopf on Tue, 19 May 2009 15:18:03 GMT
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Dear Donghee,
the method "Double_t PndEmcCluster::Mass() const" is helpful for the distinction between real photons and faked photons (e.g. merged pions). It calculates the so-called "invariant shower mass" of the cluster which is in principle a specific property for the description of the shower shape. For this, each fired crystal will be assosiated with a four vector (mass=0) and

afterwards this function calculates the invariant mass of all theses four vectors. This is the reason for the iteration of the digis.
In case of a real photon one expects a shower mass around 0. For merged pi0's instead the shower mass is in general higher and expected to be close to the pi-mass.

Cheers,
Bertram.

Subject: Re: Mass calculation from vector<PndEmcDigi*> in EMC
Posted by donghee on Wed, 20 May 2009 06:53:40 GMT
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Dear Bertram,

I can clearly understand your explanation for the calculation of shower mass.
A question to what comes next is the mechanical construction of EMC. I think that a cluster is composed of few crystals, which connects with Front-End-Electronics. If it is correct, the concept of mass calculation can be easily understood.
Could you give me how is the EMC cluster built in current planning setup, in the level of crystals?

Second issue is the inconsistancy of mass function with comparing energy.
If I get the mass info from cluster, we need to correct the calculated mass as performed energy, as well.
Since deposit energy or energy loss can calibrate with GetEnergyCorrected() function, one has to apply same calibration to the mass calculation. But I think that is not considered.
I guess it is not possible to do with digi list.
After constructing the mass, the cluster mass will be corrected again.
If digi list can provide such process, than we need two different mass function with corrected energy and without correction.

Finally, I would like to show you a plot for electron, photon and proton event.
This plot shows a mass distribution of all EMC cluster.
You can see a electronic noise near 0 due to high energetic 15 GeV forward direction proton, second bump is exactly photon, and last bump is for electron. Because I have checked already last two bump corresponding photon and electron with comparing true MC info.
Unfortunately all electron is not located in the expected mass region.
I plot the mass with the unit in GeV scale, but I assume that the unit must be MeV, otherwise mass(e) = 0.511 MeV of electron cannot archive.
This is the reason why we need a correction for mass also.

Best wishes,
Donghee Kang

File Attachments

1) Cluster_mass.eps, downloaded 511 times

Subject: Re: Mass calculation from vector<PndEmcDigi*> in EMC
Posted by Dima Melnychuk on Wed, 20 May 2009 09:23:28 GMT
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Dear Donghee,

I can try to answer to your question but I hope that Bertram will correct me if I am wrong.

So first of all as I understand "invariant shower mass" should not give you a real mass of a particle but is just a property of the shower that allow you discriminate clusters from real photons and cluster which are created by two photons from pi0 decay.
From this point of view it does not make sense to apply the energy correction to calculate mass of the cluster. The energy correction does make sense if the particle if identified already as a photon.

Second, I want to add a comment what the clusters and digis are. The digi is in principle an energy deposited in single crystal, smeared somehow with electronic response. PndEmcMakeCluster task find a group of neighbor crystals and create from them a cluster and energy of the cluster is a sum of the energies of digis which it is made from.

May be you can look into my short presentation from the last EVO meeting (http://panda-wiki.gsi.de/pub/Computing/Minutes13May2009/D.MelnychukPndEm cCluster130509.pdf), where I summarized a little bit about EmcClusters, however this presentation was for slightly different purpose.

Best regards,
Dima

Subject: Re: Mass calculation from vector<PndEmcDigi*> in EMC
Posted by Bertram Kopf on Wed, 20 May 2009 09:58:18 GMT
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Dear Donghee,

thank you very much, Dima, for you explanation. Dima is right, it doesn't make sense to correct the invariant shower mass.

donghee wrote on Wed, 20 May 2009 08:53
Finally, I would like to show you a plot for electron, photon and proton event.
This plot shows a mass distribution of all EMC cluster.
You can see a electronic noise near 0 due to high energetic 15 GeV forward direction proton, second bump is exactly photon, and last bump is for electron. Because I have checked already last two bump corresponding photon and electron with comparing true MC info.
Unfortunately all electron is not located in the expected mass region.
I plot the mass with the unit in GeV scale, but I assume that the unit must be MeV, otherwise mass(e) = 0.511 MeV of electron cannot archive.

As Dima wrote, the invariant shower mass is a property which can be used to discriminate clusters from real photons and cluster which are created by two photons from pi0 decay. I think it doesn't make sense to distinguish photons, electrons and protons with a cut one the shower

mass. As I mentioned it in one of my last postings: The first step is to do a matching between clusters and charged tracks which allows to distinguish between neutral and charged particles. After that one can start with the PID of charged particles where also the shower shape informations of the cluster are helpful properties.

Best regards,
Bertram.

Subject: Re: Mass calculation from vector<PndEmcDigi*> in EMC
Posted by donghee on Wed, 20 May 2009 10:18:55 GMT
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Dear Betram and Dima,

Thank you for your time and kind teaching.
I have one more comment for cluster shape with mass in your comment
Quote:the invariant shower mass is a property which can be used to discriminate clusters from real photons and cluster which are created by two photons from pi0 decay.

I think that can be also used to separate electron and single photon.

Concerning geometry of EMC!
I have learn, current setup of EMC designed with missing region at 142 to 149 degree for theta angle in backward endcap.
I have heard actual design should be slightly different, this missing acceptance will be covered in the future, but it is not introduced just in the MC simulation.
How about the situation for the theta region 142 to 149?
Do you have plan to modify some acceptance for EMC in MC simulation?

Best wishes,
Donghee

Subject: Re: Mass calculation from vector<PndEmcDigi*> in EMC
Posted by Bertram Kopf on Wed, 20 May 2009 11:53:04 GMT
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Hi Donghee,

donghee wrote on Wed, 20 May 2009 12:18
I think that can be also used to separate electron and single photon.

I think, it is in not possible (at least not easy) to seperate electrons from single photons by using only shower shape informations. The shower will be produced in a very similar way via electromagnetic processes and also the complete energy will be deposited for both particles. Therefore the shower shapes look very similar. Hadrons instead lose only a certain fraction of the energy by ionization processes and thus the shape of the shower looks different.

donghee wrote on Wed, 20 May 2009 12:18
Concerning geometry of EMC!
I have learn, current setup of EMC designed with missing region at 142 to 149 degree for theta angle in backward endcap.
I have heard actual design should be slightly different, this missing acceptance will be covered in the future, but it is not introduced just in the MC simulation.
How about the situation for the theta region 142 to 149?
Do you have plan to modify some acceptance for EMC in MC simulation?

This is a question which could answer the relevant EMC hardware group. As far as I know, the design of the backward endcap is still not fixed. It's also not definitely clear how much space can be provided for the endcap. Therefore I think is not unrealistic to simulate with a gap between 142 to 149 degrees. Am I right?

Best regards,
Bertram.