Subject: PID combiner with different detector
Posted by donghee on Mon, 04 Nov 2013 21:02:28 GMT
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Hi all,

I have a fundamental question about PID combiner.
In our analysis we are using PID combiner, which combines the probability values from different detectors.

Let assume a simple situation.
I want to identify electron from EMC+MUO+STT+DRC combination.
In some cases, I assume that the probability from MUO should be zero due to absorbing the electron already in EMCalorimeter.
In practice, MUO doesn't contribute electron PID.
If I multiply P(EMC)XP(MUO), then total probability should be zero because of P(MUO)=0 and will be set as 0.2 which is an eqaul probability of 5 hypothesis.

So effective way to identify the electron should be EMC+STT+DRC combination without MUO.
This means that one need to define best combination for 5 different particles.

Is there some study on this issue? or can we recommend simply EMC+STT+DRC+MUO+DISC+MVD combination for each particle hypothesis in practice at PID analysis?

Best regards,
Donghee

Subject: Re: PID combiner with different detector
Posted by Ronald Kunne on Mon, 04 Nov 2013 21:32:15 GMT
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> In practice, MUO doesn't contribute electron PID.

Why not ?
The fact that MUO doesn't give a signal *is* information.

But in PandaRoot by convention "no signal" results in P=0.2 for all five particles. As a result Pe(EMC) * Pe(MUO) will be equal to Pe(EMC).

Greetings,
Ronald Kunne

Subject: Re: PID combiner with different detector
Posted by StefanoSpataro on Mon, 04 Nov 2013 22:16:57 GMT
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In particular, if there is no MUO signal, the probability should be 0 to be muon and 0.25 to be pion kaon electron proton.

Subject: Re: PID combiner with different detector
Posted by donghee on Tue, 05 Nov 2013 10:05:24 GMT
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Dear Ronald,

Now I am clear for the eqaul probability for absent PID info in certain detector.

If I use EMC and MUO, and an electron will identify with a single piece of detector as like
Pe(EMC) = 0.9 (90% probability at EMC)
Pe(MUO) = 0 (no infomation at MUO)

For other particles with EMC,
Pmu(EMC) = 0.1
Ppi,k,p(EMC) = 0.5

And for MUO detector, the probabilities will be reset as 0.2 even for all other particles.
Pe(MUO) = 0.2
Pmu,pi,k,p(MUO) = 0.2

Then will calculate a global probability as like
Pe(EMC,MUO) = Pe(EMC) *Pe(MUO) = 0.9*0.2 = 0.18
Pmu(EMC,MUO) = Pmu(EMC)*Pmu(MUO) = 0.1*0.2 = 0.02
Ppi(EMC,MUO) = Ppi(EMC)*Ppi(MUO) = 0.5*0.2 = 0.1
Pka(EMC,MUO) = Pka(EMC)*Pka(MUO) = 0.5*0.2 = 0.1
Ppr(EMC,MUO) = Ppr(EMC)*Ppr(MUO) = 0.5*0.2 = 0.1
and so on.
After that will be normalized with
Pe(EMC,MUO) + Pmu(EMC,MUO) + Ppi(EMC,MUO) + Pka(EMC,MUO) + Ppr(EMC,MUO) = 0.5

So finally I can have normalized global PID probabilities
Pe(EMC,MUO) = 0.18/0.5 = 0.36
Pmu(EMC,MUO) = 0.02/0.5 = 0.04
Ppi(EMC,MUO) = 0.1/0.5 = 0.20
Pka(EMC,MUO) = 0.1/0.5 = 0.20
Ppr(EMC,MUO) = 0.1/0.5 = 0.20

This is a story of PID!
If I am wrong, correct me again.

Thanks,
Donghee

Subject: Re: PID combiner with different detector
Posted by donghee on Tue, 05 Nov 2013 10:26:30 GMT
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Dear Ronald and stefano,

If I see a band at 0.2 in PID with usage of global probability and many detector types, that means
there are very poor information from all detector or
are most likely ghost tracks and low energetic electrons.

(see attached plot from Klaus Gotzen)

Best wishes,
Donghee

File Attachments

1) Screenshot from 2013-11-05 11:23:49.png, downloaded 290 times

Subject: Re: PID combiner with different detector
Posted by StefanoSpataro on Tue, 05 Nov 2013 10:29:39 GMT
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This means that most probably some information was missing in the candidate, i.e. the track was not correlated to EMC DRC etc. Most probably they will be forward tracks, where no PID info is present.

Subject: Re: PID combiner with different detector
Posted by donghee on Tue, 05 Nov 2013 10:31:21 GMT
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Thanks to all teachers.

close session!

Subject: Re: PID combiner with different detector
Posted by Ronald Kunne on Tue, 05 Nov 2013 10:39:20 GMT
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Your example is a bit off, as all the probas should add up to 1.

p(EMC) = 0.9 for electron, 0.025 for each of the others
p(MUO) = 0.2 for all particle.

Then we have:
p(EMC)*p(MUO) = 0.9 * 0.2 =0.18 for the electron
p(EMC)*p(MUO) = 0.025 * 0.2 =0.005 for the others
This adds up to 0.2, so the final result is

p(EMC)*p(MUO) = 0.18/0.2 = 0.9 for the electron,
0.005/0.2 = 0.025 for each of the others, as expected.

Quote:If I see a band at 0.2 in PID with usage of global probability and many detector types, that means
there are very poor information from all detector or
are most likely ghost tracks and low energetic electrons.

Or particles falling outside the acceptance of the detector, or outside the momentum range 0.2 < p < 5 GeV/c for which the calculation was made.