Subject: MC-truth match in a 7-photon final state
Posted by Christian Will on Fri, 28 Sep 2018 11:22:13 GMT
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Dear all,

I am doing simulations of a decay tree including a hybrid candidate which has 7 photons (and an e+e- pair) as final state. As you may know, in the current PandaRoot implementation there is quite a high probability that a photon interacts (compton-scattering, pair-production, ...) before it creates an electromagnetic shower in the EMC. As a result, in my channel only in a tiny fraction of events none of the seven photons have interacted before showering. This is problematic for me because when I check my reconstructed hybrid candidate for Monte-Carlo truth matches, the number of MC-matches is very low. I currently assume(!) that the low number of MC-matches is caused by the fact that when one of the photons interacts before showering, the reconstructed decay tree does not match the decay tree for my hybrid candidate and the MC-match returns "false". This leads to the problem that I can't optimize my parameters because I can't determine what is signal and what is background properly.

Has anyone experienced similar issues and found a workaround or can at least confirm my assumption about the MC-matching?

Cheers,
Christian
(Giessen University, Germany)

Subject: Re: MC-truth match in a 7-photon final state
Posted by Ralf Kliemt on Mon, 01 Oct 2018 09:06:38 GMT
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Dear Christian,

I suggest you do the MC matching not only with the directly derived MC particle, but iterate through the mother/daughter relations until you find the proper match or a proper mismatch.

Cheers!
Ralf

Subject: Re: MC-truth match in a 7-photon final state
Posted by Tobias Stockmanns on Mon, 01 Oct 2018 09:12:39 GMT
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Dear Christian,
I support the statement of Ralf. The MC information in the EMC points to the particle which first entered the crystal but you have a lot of material in front of the EMC with a high probability that the photons make pair production.

Cheers,

Tobias

Subject: Re: MC-truth match in a 7-photon final state
Posted by Christian Will on Tue, 02 Oct 2018 11:11:20 GMT
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Okay, you mean iterating through the full decay tree as it is done in the tutorial (tut_ana_mclist.C) ?
But how can I distinguish between the two cases
1) a photon did pair production before hitting the EMC (no tracks of e+e-)
2) a photon did pair production as the first interaction when showering in the EMC ?

Subject: Re: MC-truth match in a 7-photon final state
Posted by Tobias Stockmanns on Tue, 02 Oct 2018 11:22:12 GMT
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One would have to check it but I assume, that the MC info for the photon doing pair production inside the EMC (case 2) is correct.
Only case 1 needs the iteration backward to the original mother particle.

Cheers,

Tobias

Subject: Re: MC-truth match in a 7-photon final state
Posted by Christian Will on Tue, 02 Oct 2018 12:05:42 GMT
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Ok, just to make sure I understand what you're saying:

If the MC-match of my particle of interest is not correct, I iterate through all 7 gammas and check if they are actually a e+ or e- according to MC. If yes, I walk the decay tree up starting from this particle and check if at some point a mother particle is a gamma of my original decay tree.

Also, a follow-up question which came to my mind: which MC-id does a candidate receive that is reconstructed as one particle but actually consists of two particles which cannot be resolved?
E.g. a gamma as reconstructed particle in the EMC which was actually a high-momentum e+e- pair (without tracks).

Thanks so far,
Christian

Subject: Re: MC-truth match in a 7-photon final state
Posted by Tobias Stockmanns on Tue, 02 Oct 2018 12:21:32 GMT
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Dear Christian,

your EMC clusters have FairLinks pointing to the MC track they were created from. If more than one particle contributed to your cluster you will have a list of FairLinks pointing to all initial particles which deposited energy in the cluster.

You would iterate through all your clusters and check the MC-Id if it matches with your primary photons. If they match you are done. If they do not match you have to take the MC track belonging to the MC Id and ask for its mother Id. You check if the mother is your photon, if not you continue until you either have a matching photon or not.

Cheers,

Tobias

Subject: Re: MC-truth match in a 7-photon final state
Posted by Christian Will on Wed, 10 Oct 2018 08:45:47 GMT
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Ok, given that this is working, do you have any suggestions/ideas on how to handle the pair-production issue from a analysis point of view or know people who have dealt with similar problems?

If I consider those cases in which the particle of interest was reconstructed but at least one photon did pair production as background, I lose a huge fraction of my signal.
If I consider those cases as signal, I certainly have a systematic error I have to correct for (maybe some sort of energy-correction based on the multiplicity in an event?)

Thanks for your help!
Christian
