Subject: Loss of efficiency for electrons at theta~22^deg, due to association failure in EMC
Posted by Ermias on Fri, 20 Feb 2015 16:10:26 GMT
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Dear all,

While doing simulations on electrons, I noticed a localized efficiency loss for electrons at around theta~22^deg. After
digging around a bit, I was able to pinpoint that it was due to electrons in this location not being associated to *any* cluster,
even though there is a valid reconstructed cluster sitting near the electron's projection. I first started to notice this problem
in oct.14 release. Even though the efficiency drop with oct.14 was localized in a relatively smaller zone (~1degree window),
the effect on the signal I was simulating was significant (~10%) because the electrons for this signal peak around 20^deg in theta.
However with the current development version (26841) the loss in efficiency is striking (see attached figure,
left panel, count of all electrons vs electrons with eid vs. theta). The efficiency loss is there for positrons too.

I looked at the change in the EMC association code and the only significant change that happened between apr.13 release
and current trunk is the addition of the following conditions before starting the cluster association:

```
  if ( (emcModule<3) && (helix->GetZ()>150.)  ) continue; // not consider tracks after emc barrel for BARREL
  if ( (emcModule==3) && (helix->GetZ()<165.) ) continue; // consider tracks only from last gem plane for FWD
  if ( (emcModule==4) && (helix->GetZ()>-30.) ) continue; // consider tracks only ending at the back of STT for BKW
```

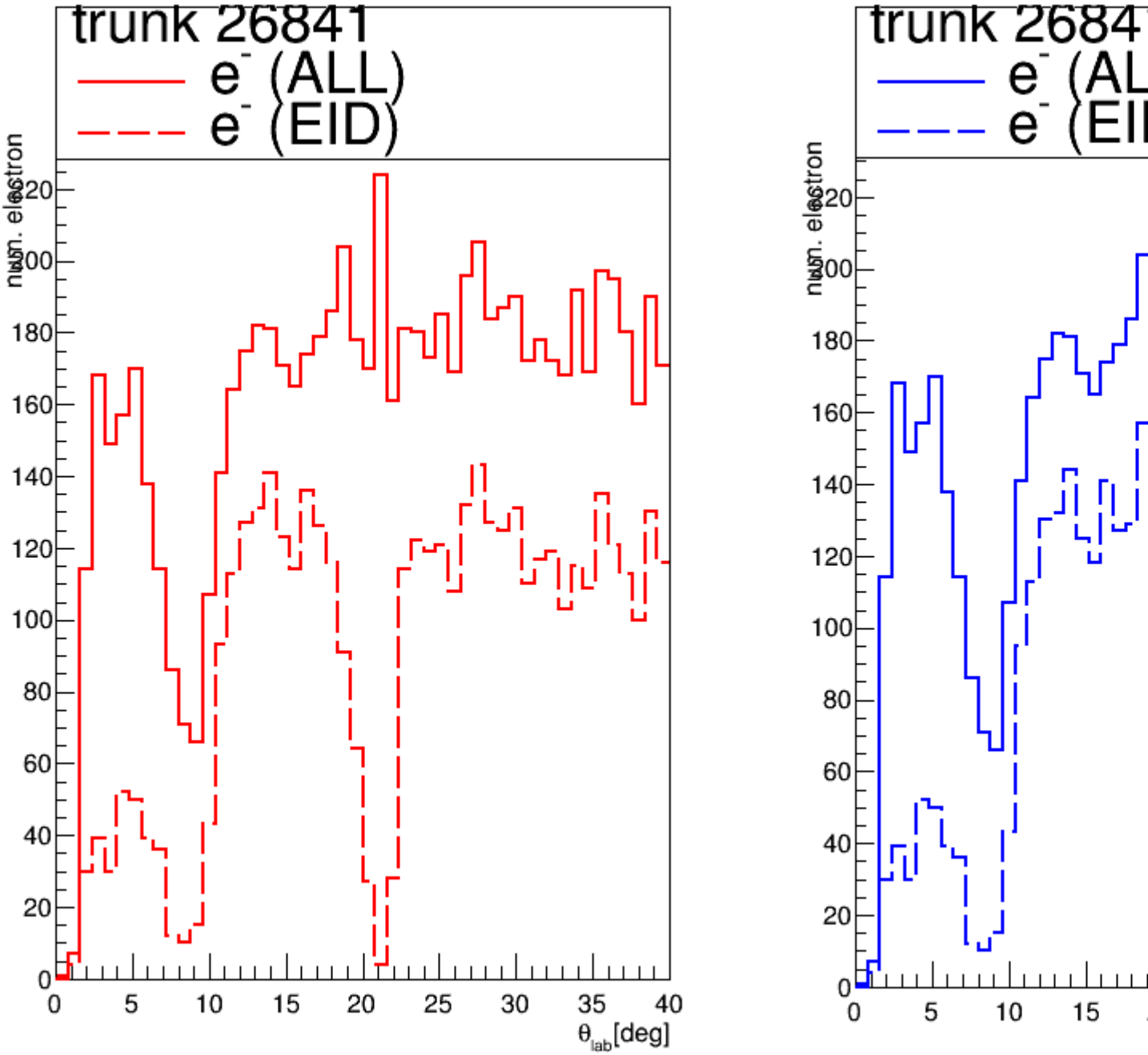
at L47 of PndPidEmcInfo.cxx. I assume these lines are there for a reason (would appreciate to hear from
EMC experts why...), but I was able to recover most of the loss in efficiency by commenting them out (right panel).
Could it be that the actual cut values are not correctly set?

What fix do EMC experts suggest? Maybe its a known issue and people are working on it, but for "mass" simulation,
would it be advisable to just go back and patch oct.14 version? or wait until a new release that includes fixes? What
would be the approximate time scale for the next release, if it is okay to ask?

Thanks in advance!

Ermias.

File Attachments
1) tc.png, downloaded 1049 times



Subject: Re: Loss of efficiency for electrons at theta~22^deg, due to association failure in EMC
Posted by StefanoSpataro on Fri, 20 Feb 2015 20:58:20 GMT
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Nobody of EMC has ever worked on the track-EMC correlation, you are asking to the wrong

guys.

```
  if ( (emcModule<3) && (helix->GetZ()>150.)  ) continue; // not consider tracks after emc barrel for BARREL
  if ( (emcModule==3) && (helix->GetZ()<165.) ) continue; // consider tracks only from last gem plane for FWD
  if ( (emcModule==4) && (helix->GetZ()>-30.) ) continue; // consider tracks only ending at the back of STT for BKW
```

The lines are well commented, and they explain why they were put there. helix is the track parameters at the last point of the track. Since these are geometrical selections, in theory they should work. Which is the EMC module which is suffering from that drop? A check with MC id could help (but you need to use recent trunk since in oct14 the MC for EMC was bugged).

Subject: Re: Loss of efficiency for electrons at theta~22^deg, due to association failure in EMC
Posted by Ermias on Fri, 20 Feb 2015 23:04:30 GMT
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Hi Stefano,

Sorry, I made the wrong assumption about who's working on that part of the code. I didn't mean to offend anyone and I should have known better to check...

For tracks that fail to get associated (emcIndex<0 after the loop over emcHits), I printed out the track MC index, its energy calculated from tracking using pion hypothesis together with the module number and energy of the emcHit with the closest energy to the track.

I only printed out a few hundred events, but It seems like module 3 is contributing to all of the unintended misses in the events I checked. Please let me know if I can provide any other useful feedback...

ps: Do you advise against using oct.14 for any simulation that uses the EMC?

Cheers,
Ermias.

```
pidCandMcIndex= 0    :   trackEnergy= 0.849534   Module= 3     emcHitEnergy= 0.740053
pidCandMcIndex= 0    :   trackEnergy= 4.03095    Module= 3     emcHitEnergy= 3.51169
pidCandMcIndex= 0    :   trackEnergy= 4.97663    Module= 3     emcHitEnergy= 4.8357
pidCandMcIndex= 0    :   trackEnergy= 3.74218    Module= 3     emcHitEnergy= 3.74057
pidCandMcIndex= 0    :   trackEnergy= 2.5047     Module= 3     emcHitEnergy= 2.40757
pidCandMcIndex= 0    :   trackEnergy= 0.405984   Module= 3     emcHitEnergy= 0.347898
pidCandMcIndex= 0    :   trackEnergy= 1.16359    Module= 3     emcHitEnergy= 1.08486
pidCandMcIndex= 0    :   trackEnergy= 2.81498    Module= 3     emcHitEnergy= 2.69472
pidCandMcIndex= 1084 :   trackEnergy= 0.22849    Module= 3     emcHitEnergy= 0.36478
pidCandMcIndex= 1083 :   trackEnergy= 0.428764   Module= 3     emcHitEnergy= 0.36478
pidCandMcIndex= 0    :   trackEnergy= 2.87692    Module= 3     emcHitEnergy= 2.68255
```

pidCandMcIndex= 0 : trackEnergy= 1.8808 Module= 3 emcHitEnergy= 1.69046
pidCandMcIndex= 0 : trackEnergy= 1.2923 Module= 3 emcHitEnergy= 1.2199
pidCandMcIndex= 0 : trackEnergy= 3.45425 Module= 3 emcHitEnergy= 3.62943
pidCandMcIndex= 0 : trackEnergy= 4.53307 Module= 3 emcHitEnergy= 3.92069
pidCandMcIndex= 0 : trackEnergy= 3.95271 Module= 3 emcHitEnergy= 3.83431
pidCandMcIndex= 0 : trackEnergy= 2.07854 Module= 3 emcHitEnergy= 3.70188
pidCandMcIndex= 0 : trackEnergy= 0.840579 Module= 3 emcHitEnergy= 0.816676
pidCandMcIndex= 0 : trackEnergy= 3.44526 Module= 3 emcHitEnergy= 3.43316
pidCandMcIndex= 0 : trackEnergy= 4.48627 Module= 3 emcHitEnergy= 4.15238
pidCandMcIndex= 0 : trackEnergy= 3.05255 Module= 3 emcHitEnergy= 3.01602
pidCandMcIndex= 0 : trackEnergy= 1.46736 Module= 3 emcHitEnergy= 0.845704
pidCandMcIndex= 0 : trackEnergy= 1.70518 Module= 3 emcHitEnergy= 1.62284
pidCandMcIndex= 0 : trackEnergy= 1.37598 Module= 3 emcHitEnergy= 1.33291
pidCandMcIndex= 0 : trackEnergy= 2.54198 Module= 3 emcHitEnergy= 3.89186
pidCandMcIndex= 0 : trackEnergy= 4.27216 Module= 3 emcHitEnergy= 4.15942
pidCandMcIndex= 0 : trackEnergy= 1.54658 Module= 3 emcHitEnergy= 1.48835
pidCandMcIndex= 0 : trackEnergy= 3.80585 Module= 3 emcHitEnergy= 3.40713
pidCandMcIndex= 0 : trackEnergy= 3.73259 Module= 3 emcHitEnergy= 3.56458
pidCandMcIndex= 0 : trackEnergy= 0.898616 Module= 3 emcHitEnergy= 0.949504
pidCandMcIndex= 0 : trackEnergy= 1.25923 Module= 3 emcHitEnergy= 0.920801
pidCandMcIndex= 0 : trackEnergy= 0.463938 Module= 3 emcHitEnergy= 0.0957954
pidCandMcIndex= 0 : trackEnergy= 2.92428 Module= 3 emcHitEnergy= 3.71379
pidCandMcIndex= 0 : trackEnergy= 0.611837 Module= 3 emcHitEnergy= 0.546316
pidCandMcIndex= 0 : trackEnergy= 4.05194 Module= 3 emcHitEnergy= 4.24035
pidCandMcIndex= 0 : trackEnergy= 0.40836 Module= 3 emcHitEnergy= 0.320374
pidCandMcIndex= 349 : trackEnergy= 0.262772 Module= 3 emcHitEnergy= 0.130423
pidCandMcIndex= 0 : trackEnergy= 4.78844 Module= 3 emcHitEnergy= 4.82905
pidCandMcIndex= 0 : trackEnergy= 0.384974 Module= 3 emcHitEnergy= 0.215389
pidCandMcIndex= 0 : trackEnergy= 1.66274 Module= 3 emcHitEnergy= 1.65131
pidCandMcIndex= 1 : trackEnergy= 0.212189 Module= 3 emcHitEnergy= 0.0214177

Subject: Re: Loss of efficiency for electrons at theta~22^deg, due to association failure in EMC
Posted by StefanoSpataro on Fri, 27 Feb 2015 11:04:55 GMT
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Oct14 suffers for a problem of MC truth for the neutrals, but apart from this the release is fine. All the lines you write come from geometrical considerations:

if ((emcModule<3) && (helix->GetZ()>150.)) continue; // not consider tracks after emc barrel for BARREL

If the position of the last hit is in the GEMS then most probably the will not hit the barrel, then skip this correlation

if ((emcModule==3) && (helix->GetZ()<165.)) continue; // consider tracks only from last gem plane for FWD

Consider only the tracks with are using the last GEM plane for the propagation to the forward endcap.

if ((emcModule==4) && (helix->GetZ()>-30.)) continue; // consider tracks only ending at the back of STT for BKW

If the last hit is not in the negative Z then it will not go to the backward endcap.

In theory, all these conditions make sense. BUT, maybe, if you suffer from a lack of counts for module 3, the 2nd command is somehow wrong, maybe not all the tracks hit the last plane of the GEM (problems in tracking). It could make sense to check the geometry of not GEMs and EMC to see how far we are in this "edge" region of 22°.
