
Subject: Loss of efficiency for electrons at $\theta \sim 22^\circ$, 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 $\theta \sim 22^\circ$. 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 ($\sim 1^\circ$ window), the effect on the signal I was simulating was significant ($\sim 10\%$) because the electrons for this signal peak around 20° in θ . 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. θ). 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?

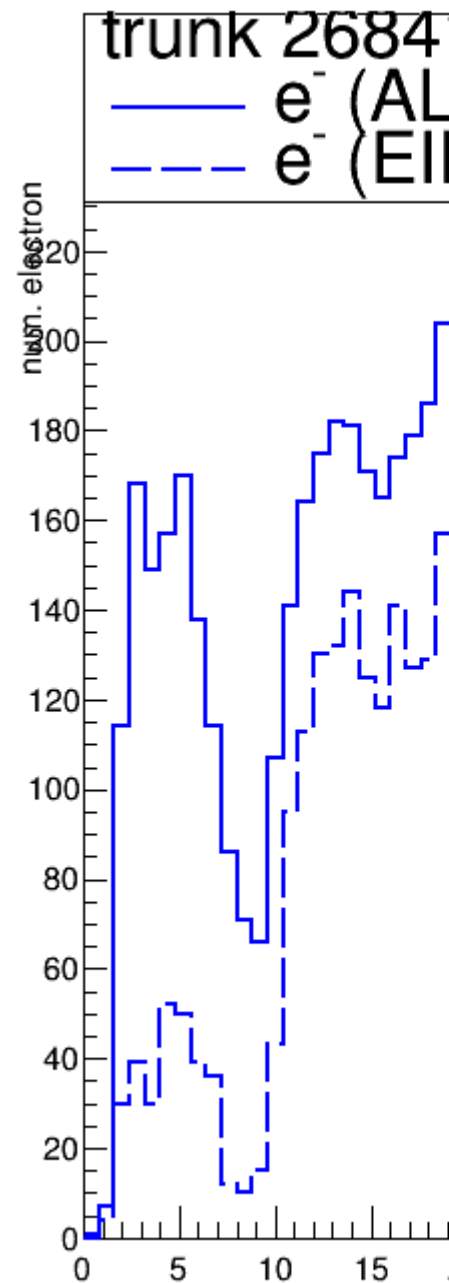
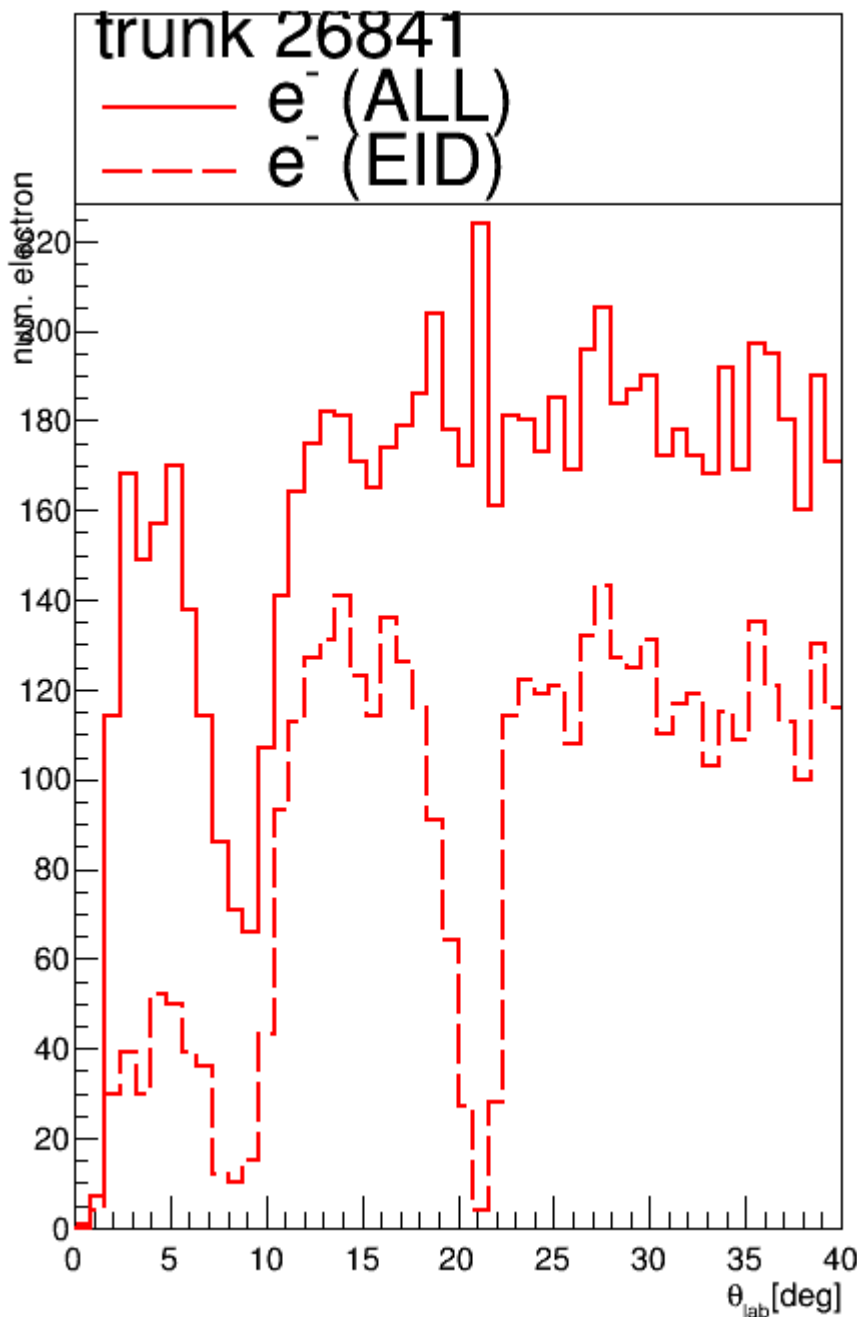
What fix do EMC experts suggest? Maybe its a known issue and people are working on it, but for "mass" simulation, would it be advisable to just go back and patch oct.14 version? or wait until a new release that includes fixes? What would be the approximate time scale for the next release, if it is okay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

Thanks in advance!

Ermias.

File Attachments

1) [tc.png](#), downloaded 903 times



Subject: Re: Loss of efficiency for electrons at $\theta \sim 22^\circ$, due to association failure in EMC

Posted by [Stefano Spataro](#) 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 $\theta \sim 22^\circ$, 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°.
