

EMCal - DCal cluster spectra discrepancy

Follow up of

- [EMCal meeting 21/01/22 presentation](#)
- [EMCal meeting 28/01/22 presentation](#)
- [EMCal meeting 04/02/22 presentation](#)
- [PWG-JE meeting 14/02/22 presentation](#) (Pb-Pb checks)
- [EMCal meeting 18/02/22 presentation](#)

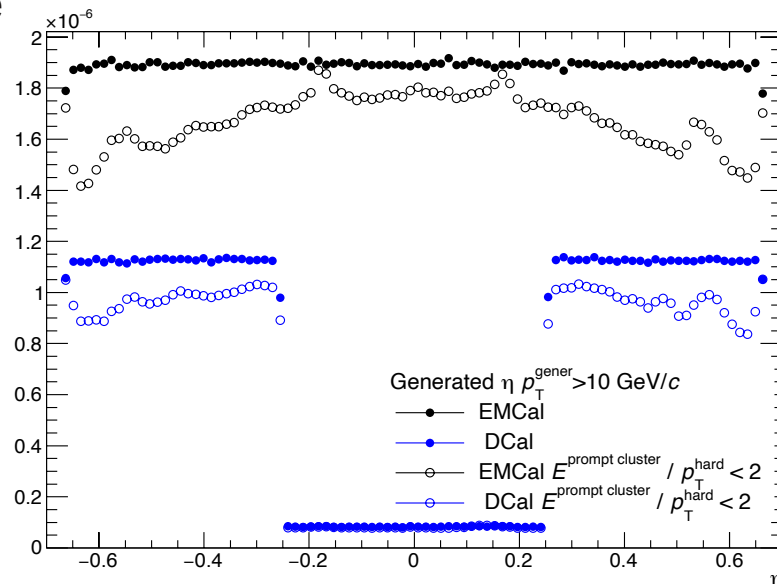
Gustavo Conesa Balbastre

- Long standing issue:
 - ◆ Discrepancy between EMCal and DCal isolated photon spectrum of ~20% in pp but also observed in Pb-Pb
 - ◆ While checking it, I observed that the spectra differ in central and outer eta of the calorimeter

- Different issues spotted in the last weeks:
 - ◆ Pt-hard bin outlier cut on Gamma-Jet MC events was biasing the eta distribution
 - Avoid using $E_{cluster}^{prompt}/p_T^{\text{hard}} > 2$ to reject events
 - ◆ Larger “cross-talk” in central rapidity
 - A new cross-talk parametrization with larger effect in central eta provided
 - ◆ Calibration/non linearity settings in yaml file not up to date or in sync with the analysis tagged version
 - Trains run during last week updating the settings

- The different behavior in the of narrow shower shape ($0.1 < \sigma_{\text{long}}^2 < 0.3$) cluster p_T spectra depending pseudo-rapidity region **is only due to the outlier event cut** on the γ -jet MC events

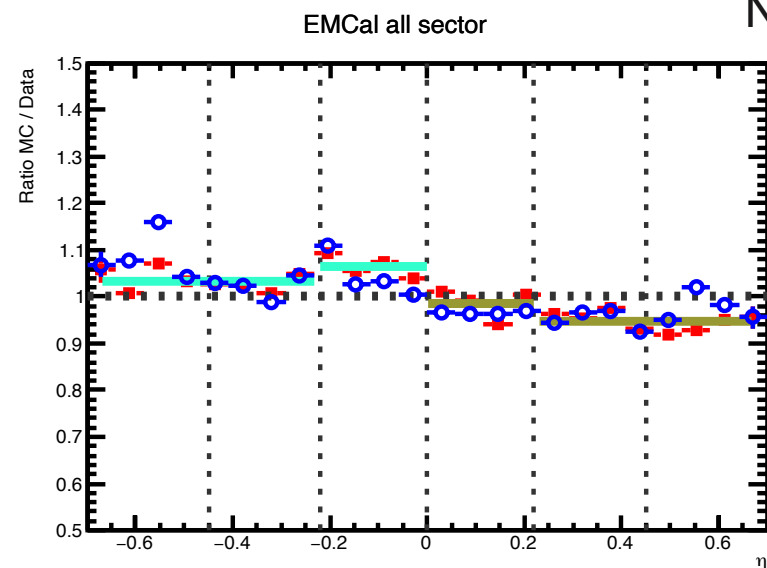
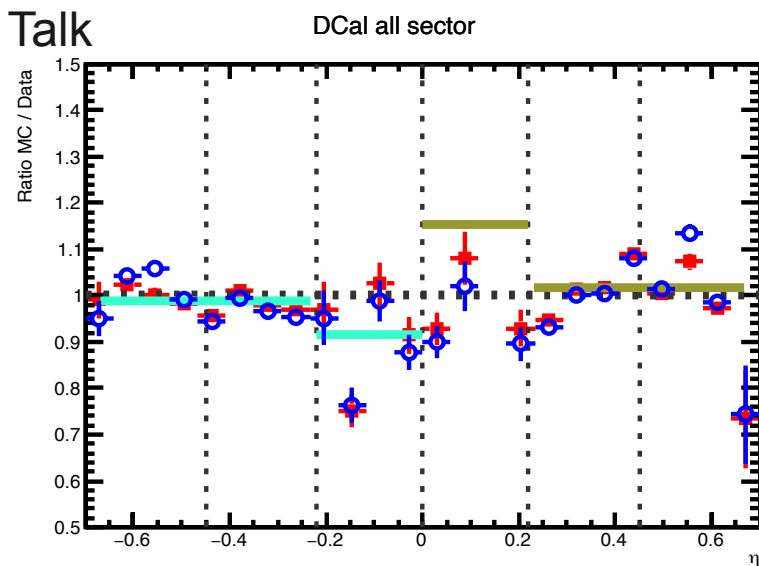
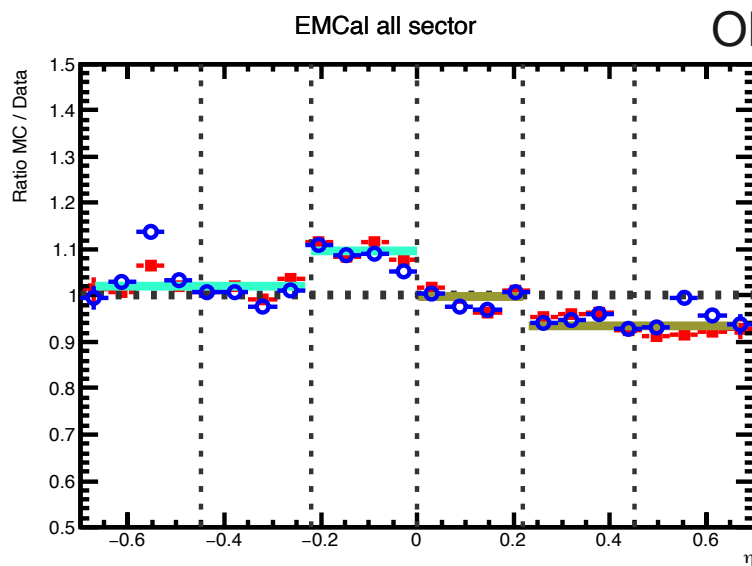
- Avoid using $E_{\text{cluster}}^{\text{prompt}} / p_T^{\text{hard}} > 2$ to reject events
- This affects significantly the efficiency but the correction goes in the same direction for EMCal and DCal and does not affect the corrected spectra ratios
- After fix, there is **no obvious problem between central, mid and outer η in p_T spectra**



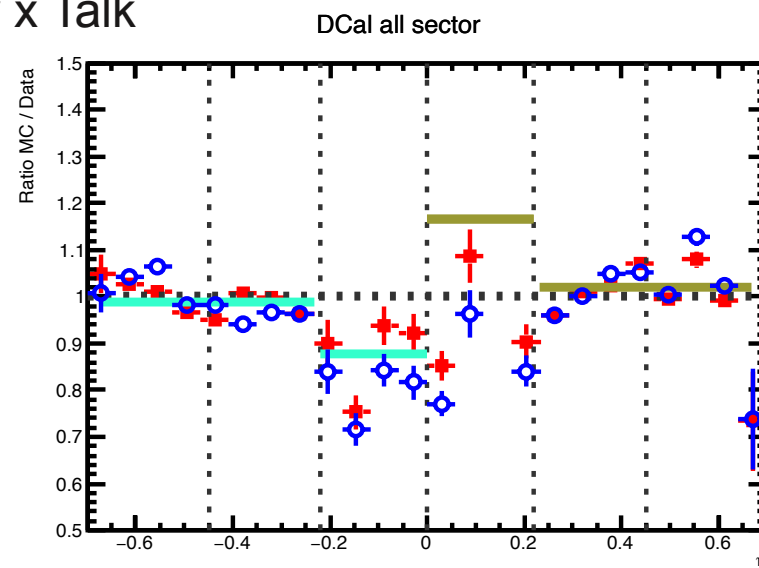
- Even if the **cluster shower shape is larger in central η** producing a bump in central narrow cluster η distribution, **the effect is rather small in the final p_T spectrum**
 - ◆ The new cross-talk parametrization tends to correct the bump in the cluster η distribution
- The updated calibration/non linearity settings in data tend to cure the problem

pp@13 TeV
 $p_T > 5$ GeV/c, MB EMCal & DCal

— GJ / Data
— (JJ+GJ) / Data



New x Talk

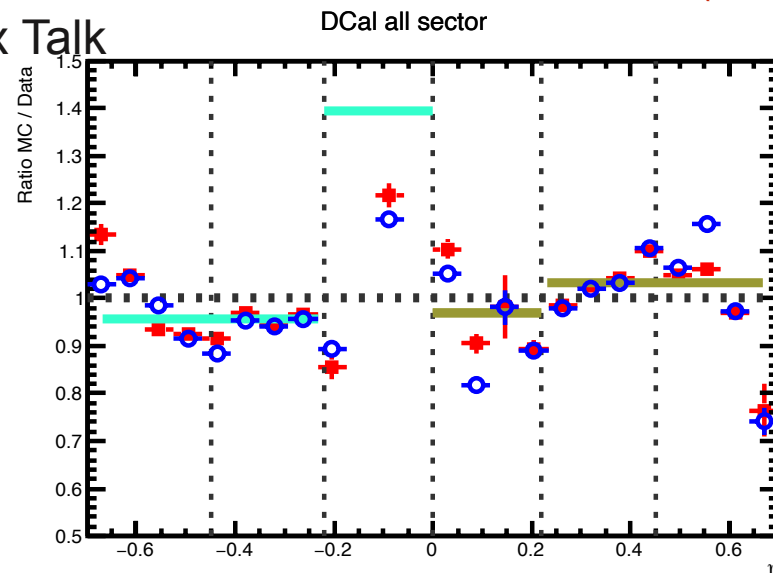
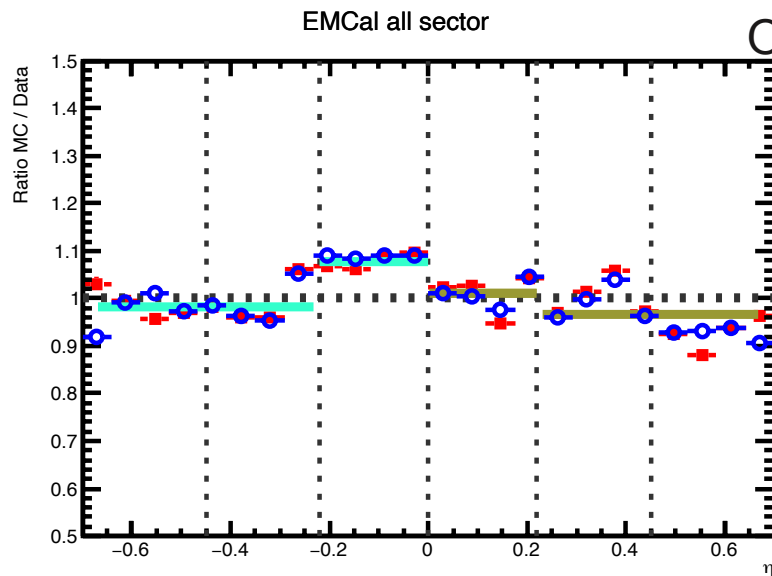


Improvement, with new cross talk, not perfect

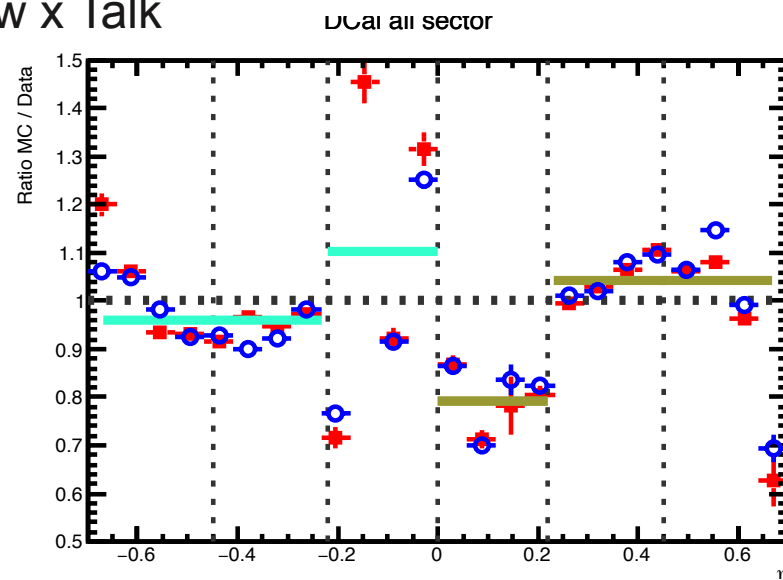
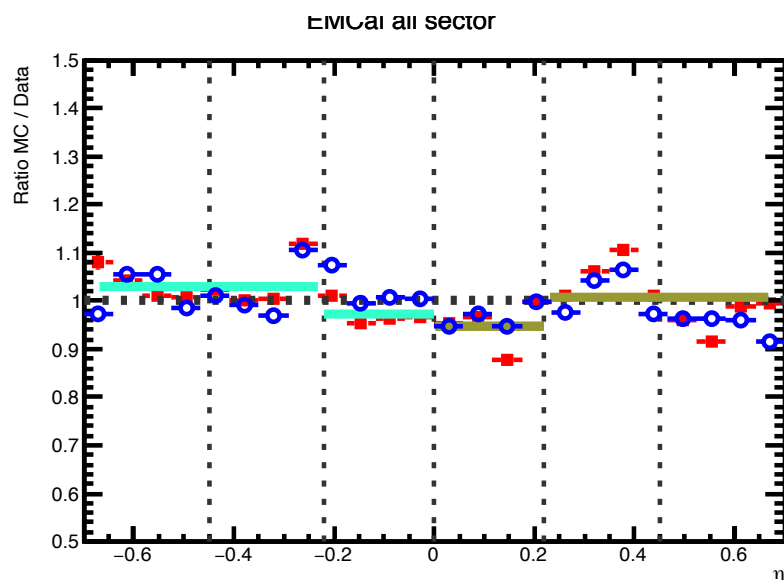
pp@13 TeV
 $p_T > 10$ GeV/c, L1 EMCal & DCal

— GJ / Data
— (JJ+GJ) / Data

Old x Talk



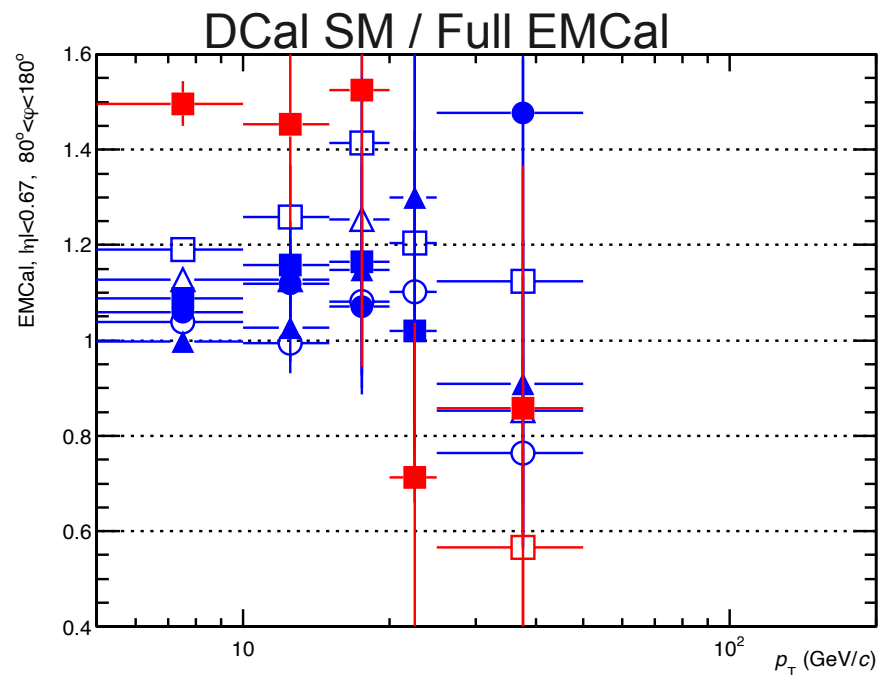
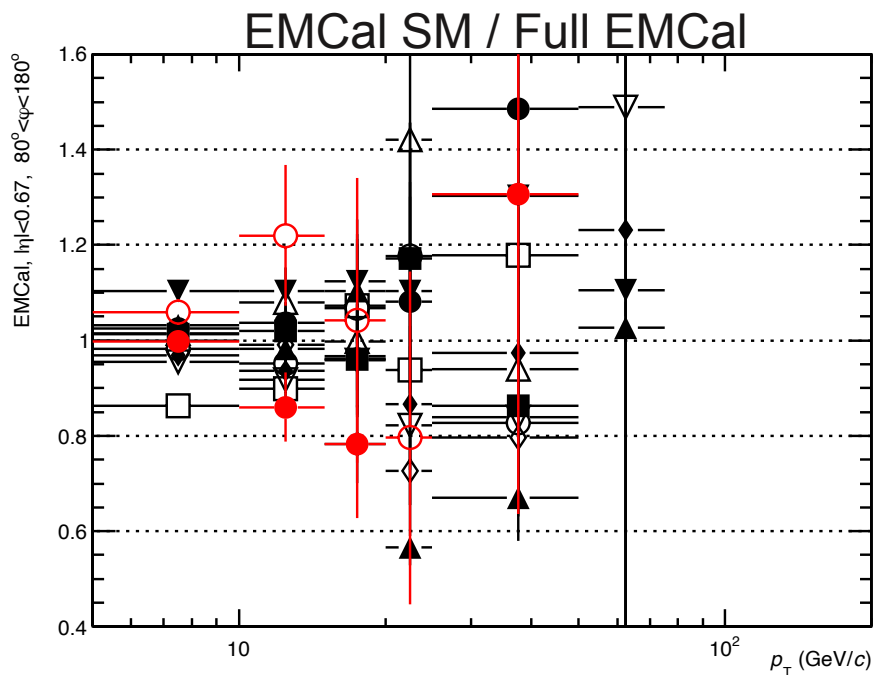
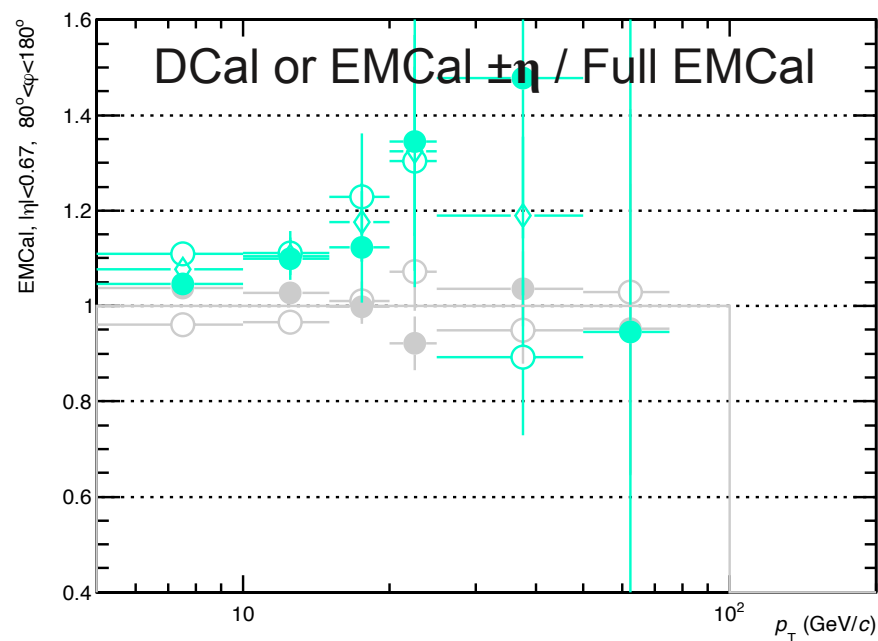
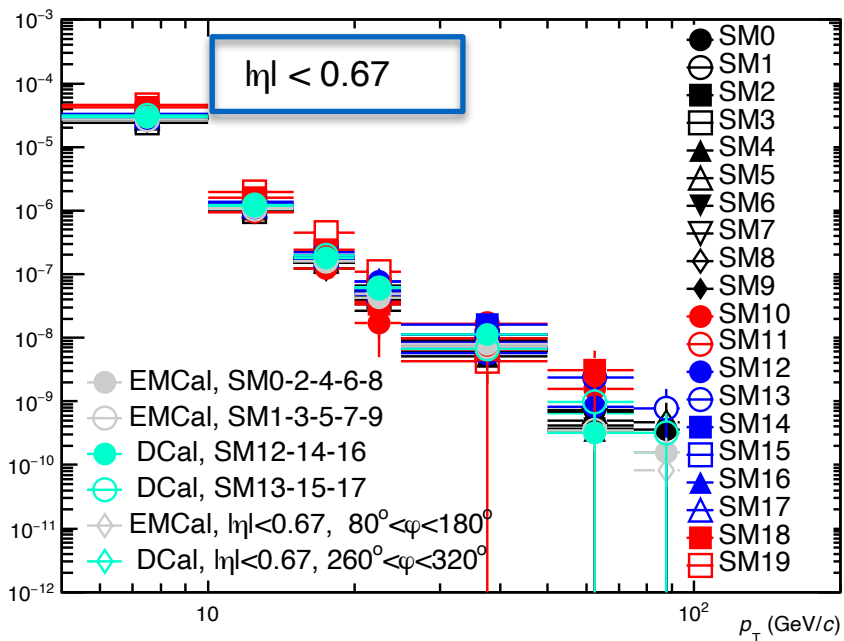
New x Talk



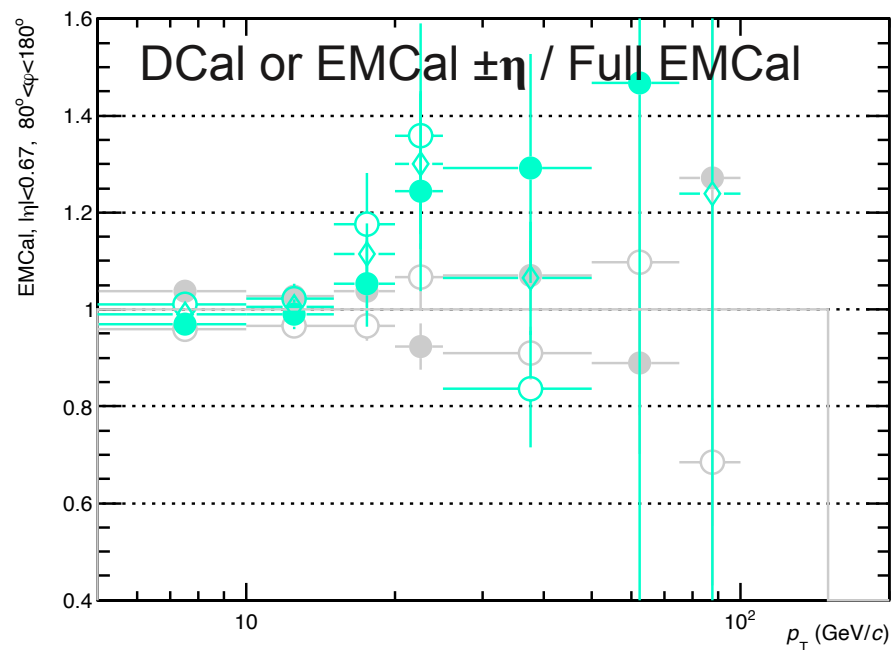
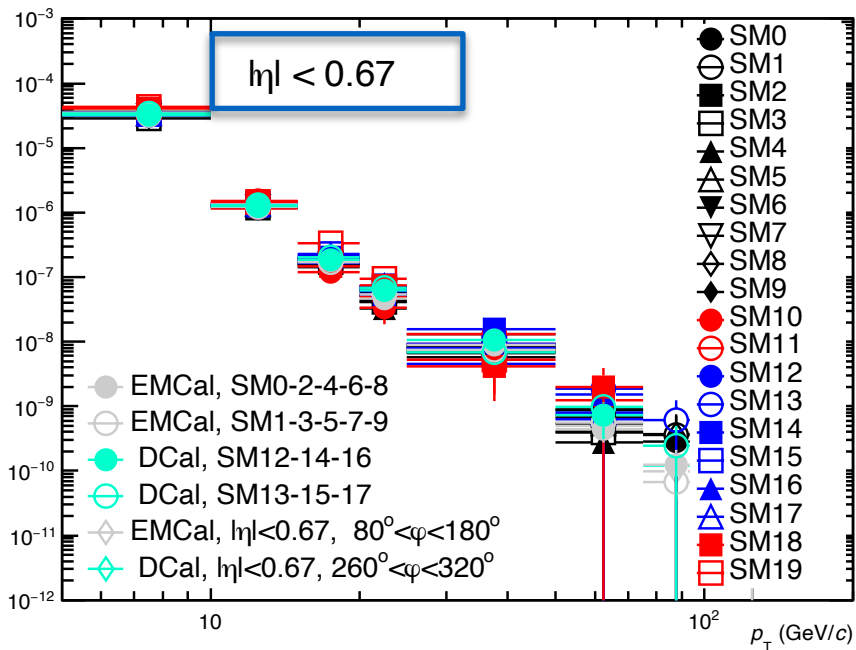
Improvement, with new cross talk, not perfect

- Narrow cluster p_T spectra semi-corrected by prompt photon efficiency
- Data is pp@13 TeV in 2016/7/8 with different triggers
- MC with new cross talk (more cross talk in central η) and no event cut on γ -jet MC
- No isolation is applied
- Ratios of spectra in different SM divided to full EMCal

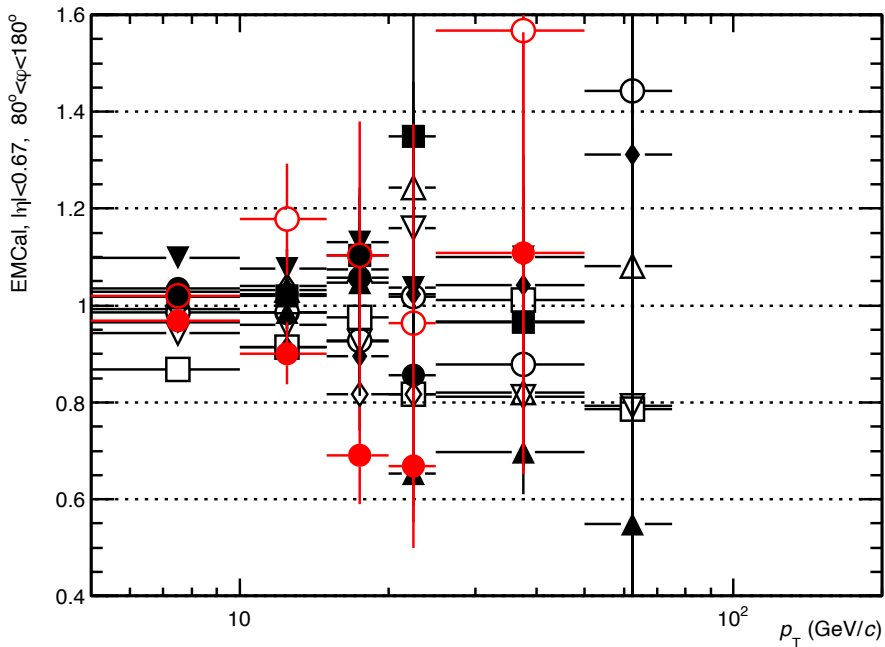
Narrow clusters, MB, Full SM — Old calibration



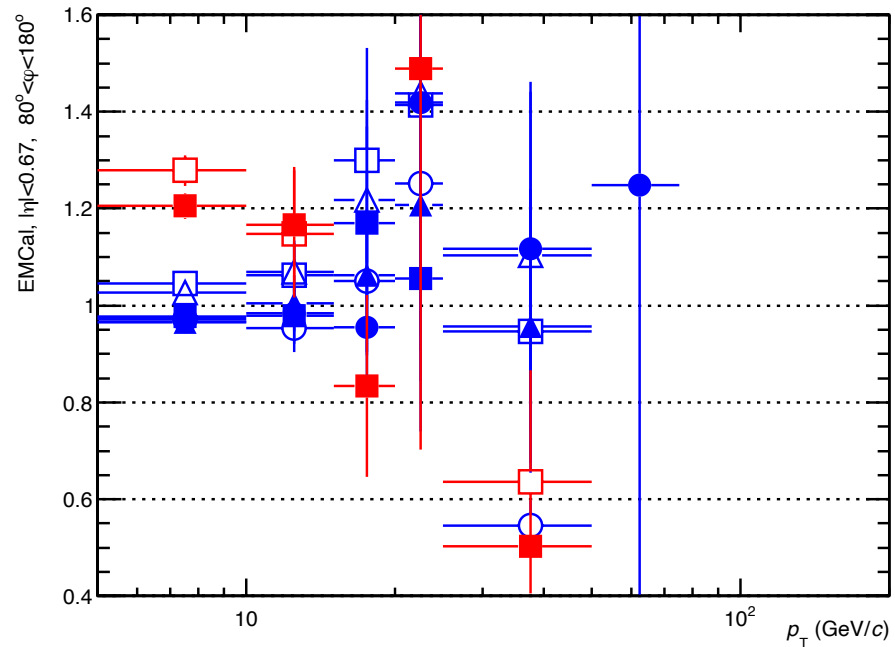
Narrow clusters, MB, Full SM — New calibration



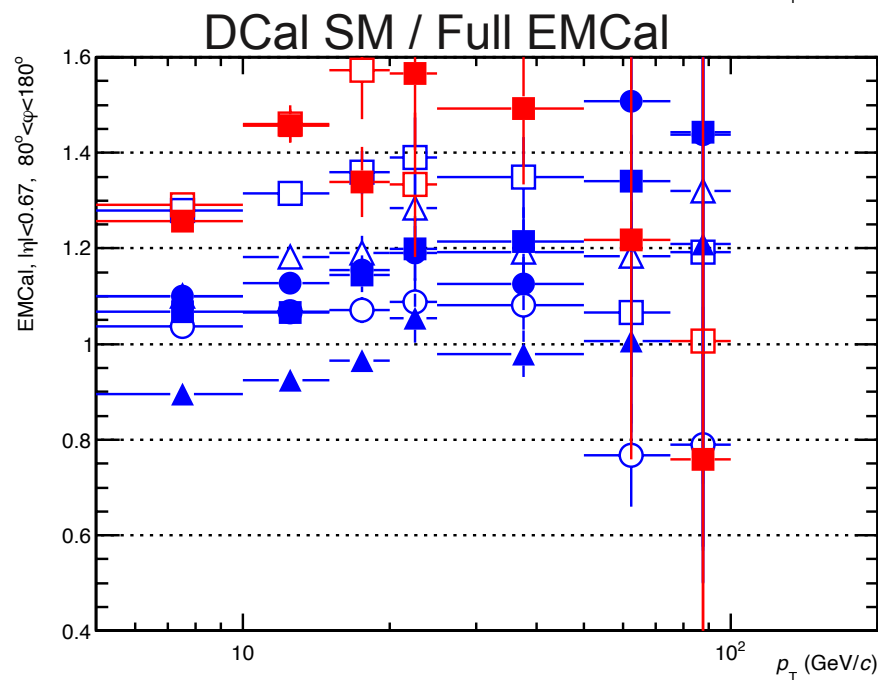
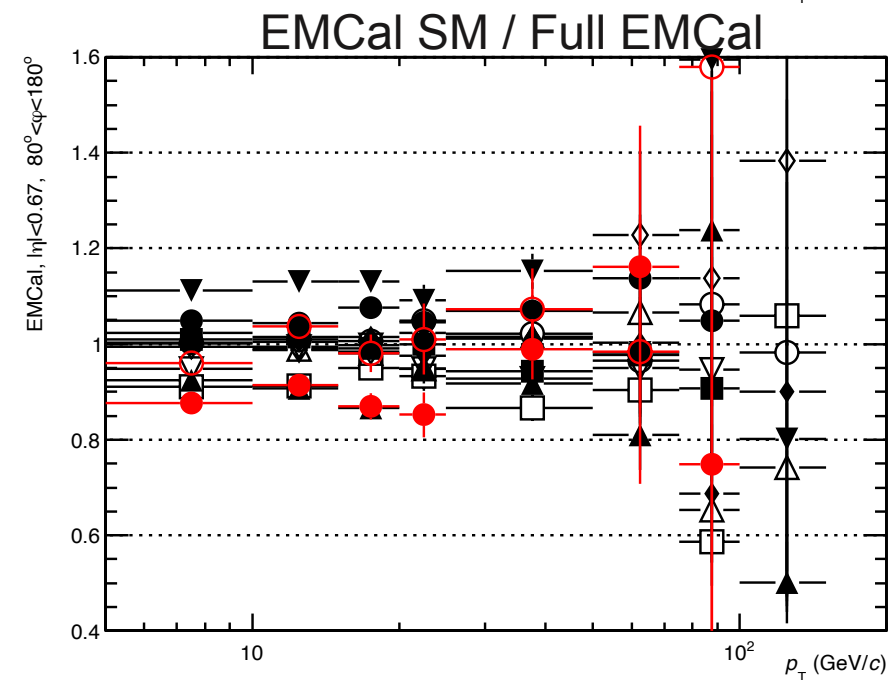
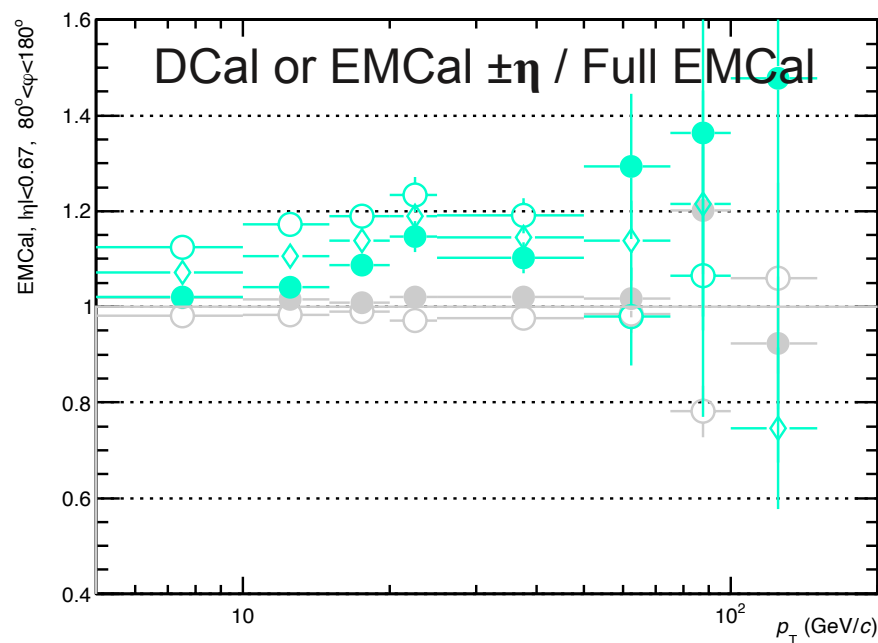
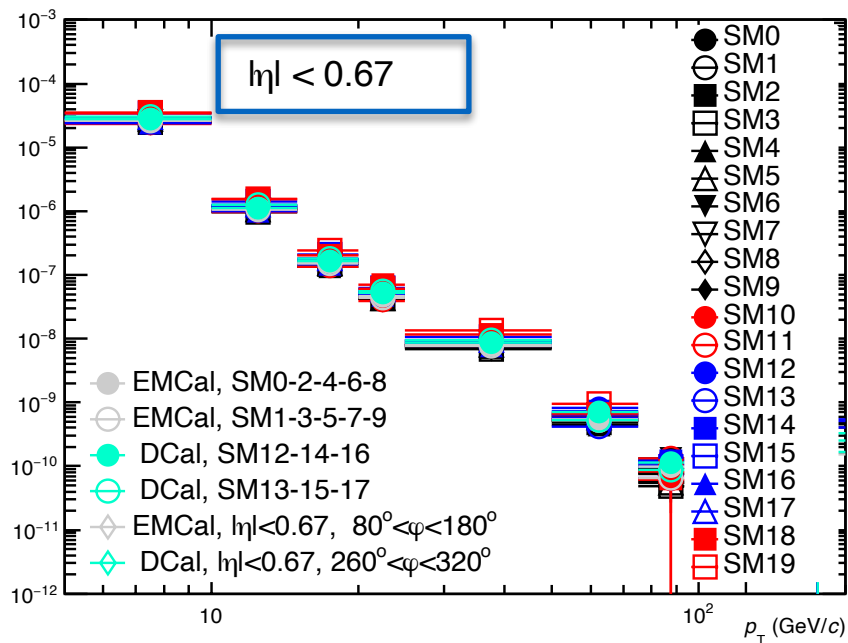
EMCal SM / Full EMCal



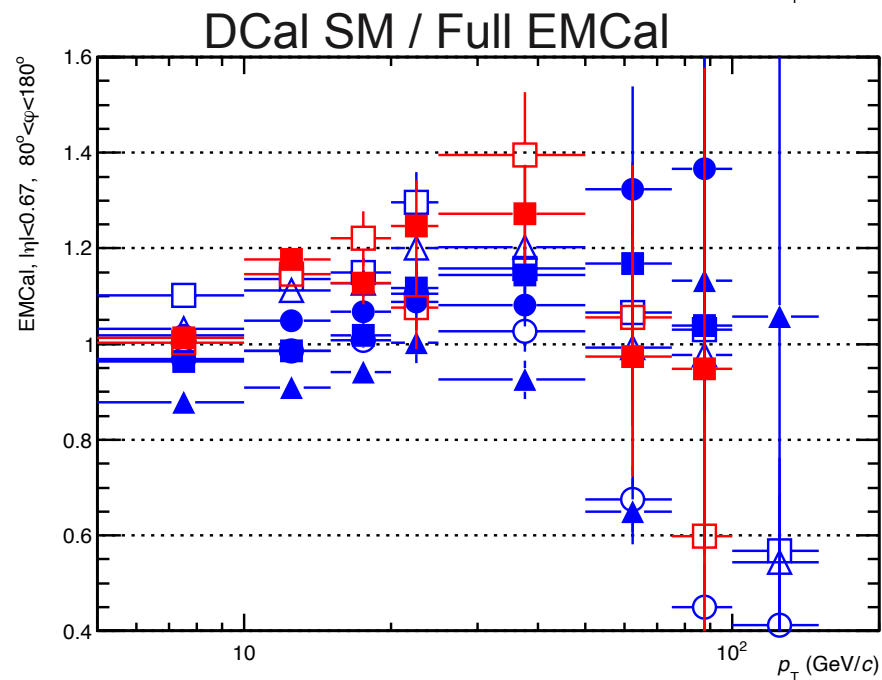
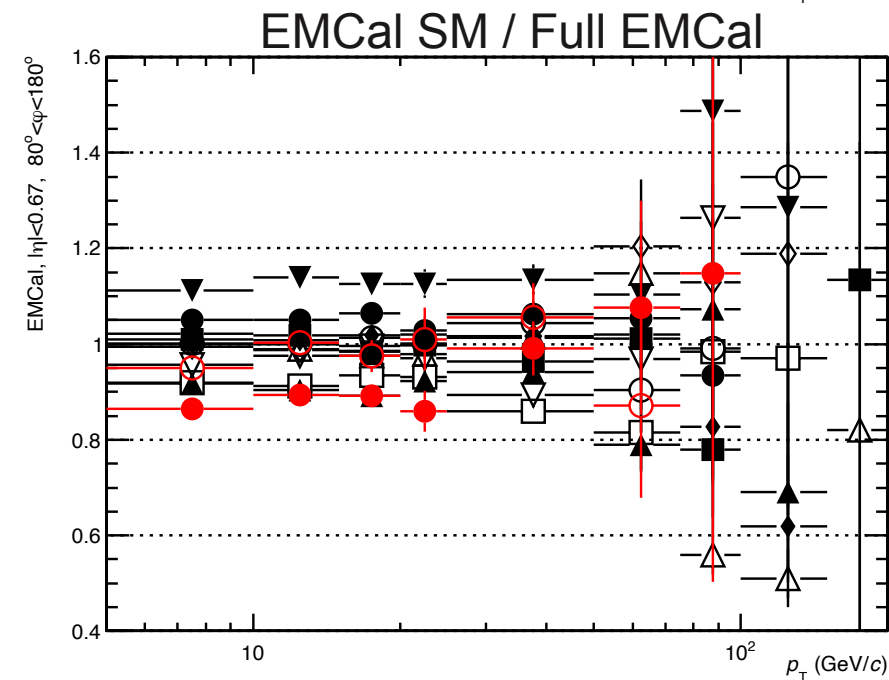
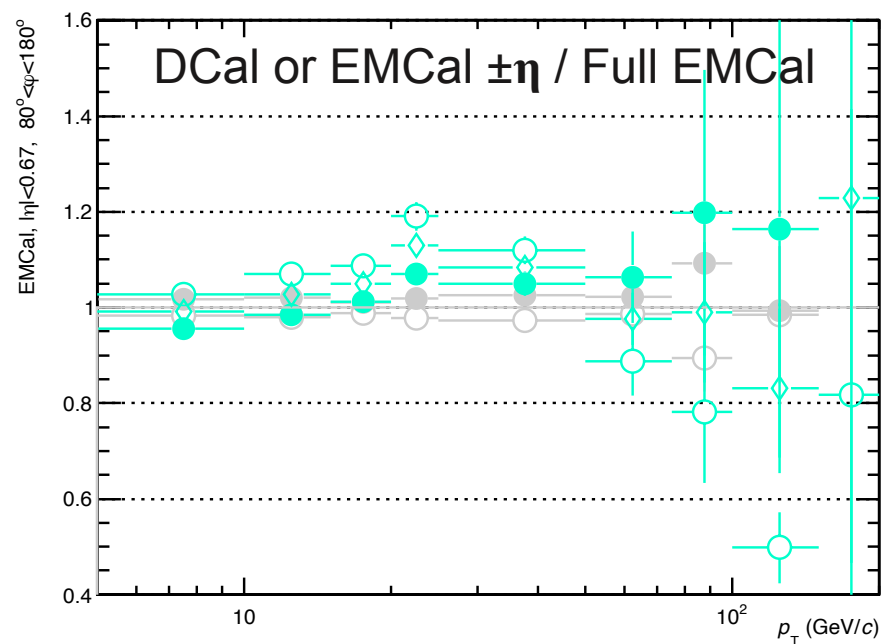
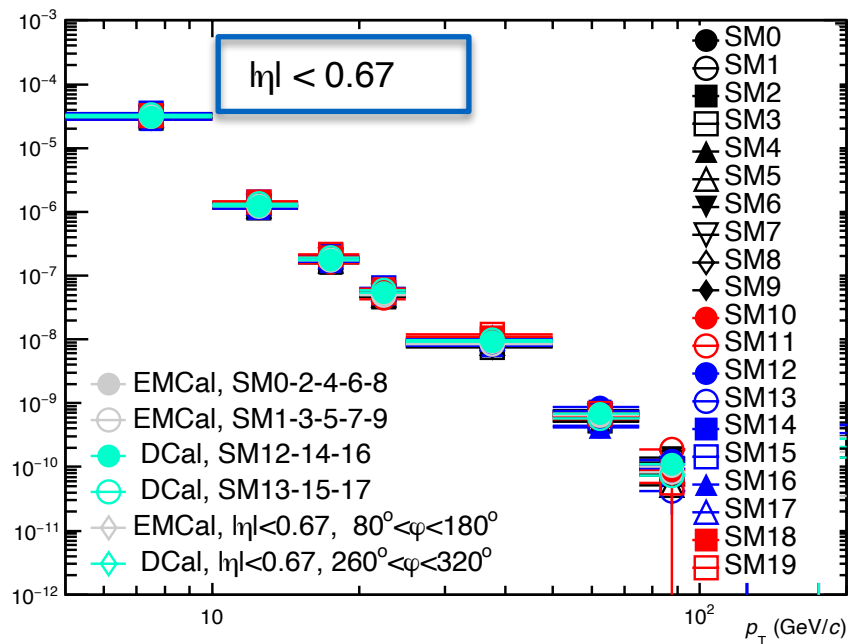
DCal SM / Full EMCal



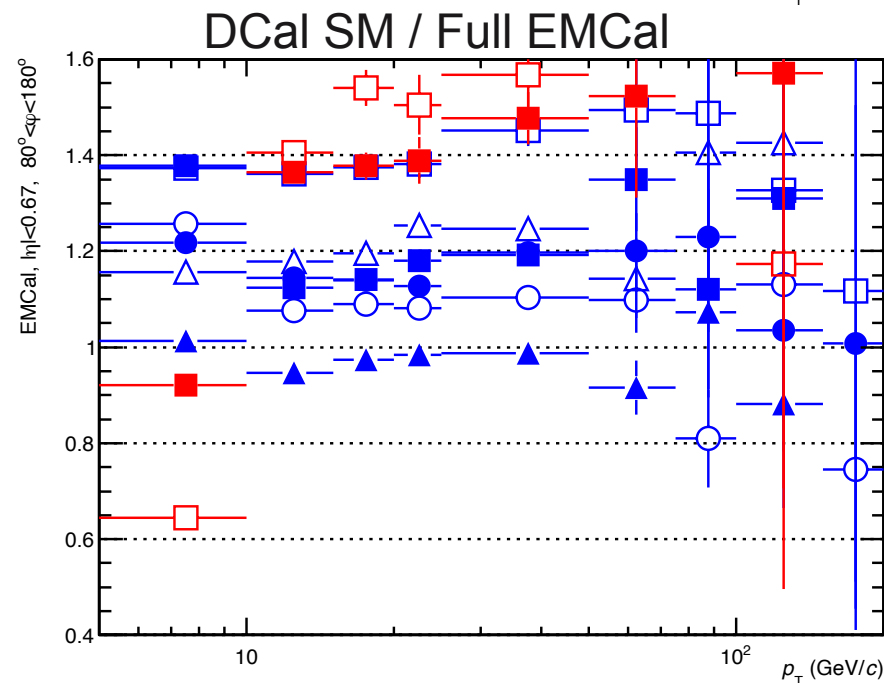
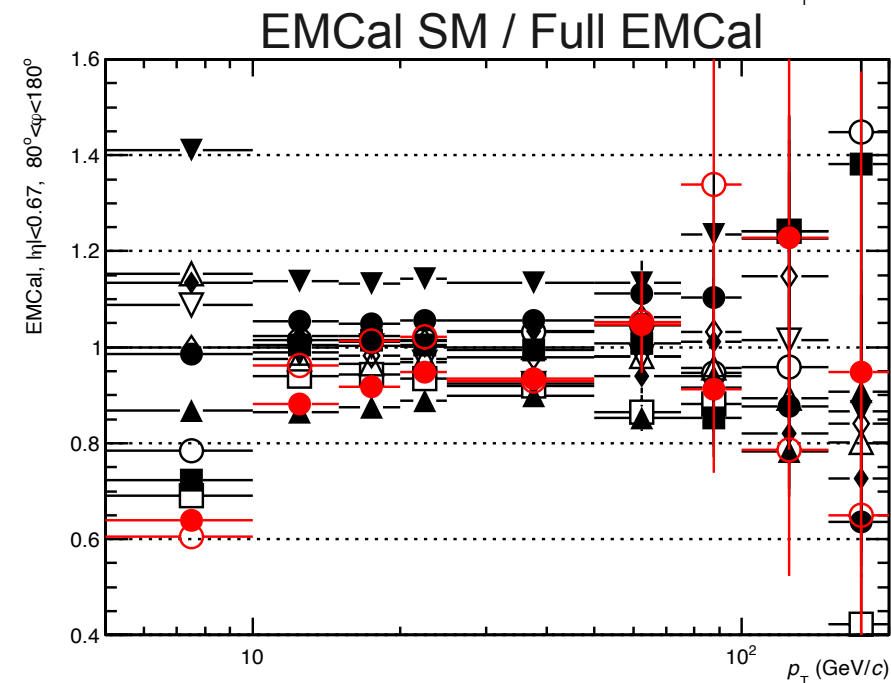
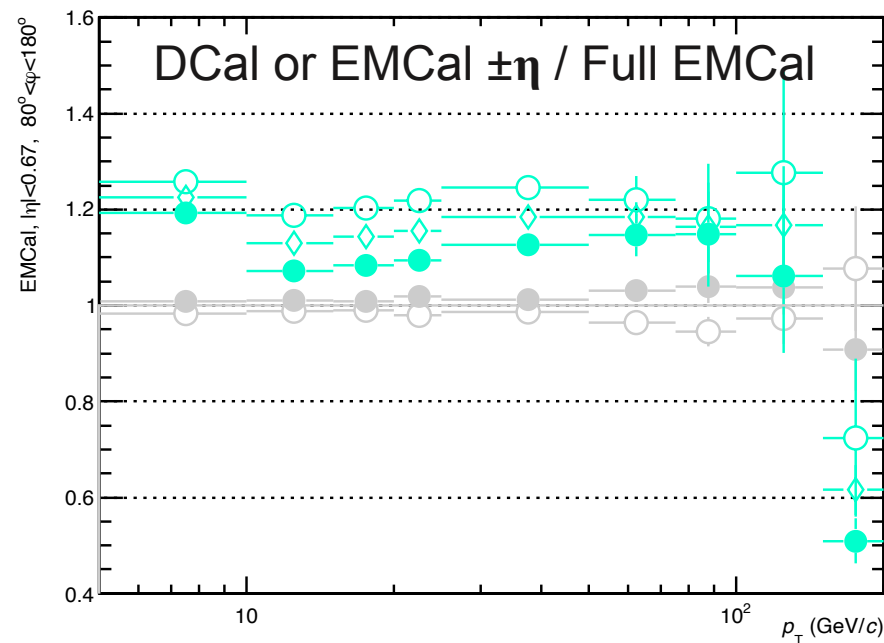
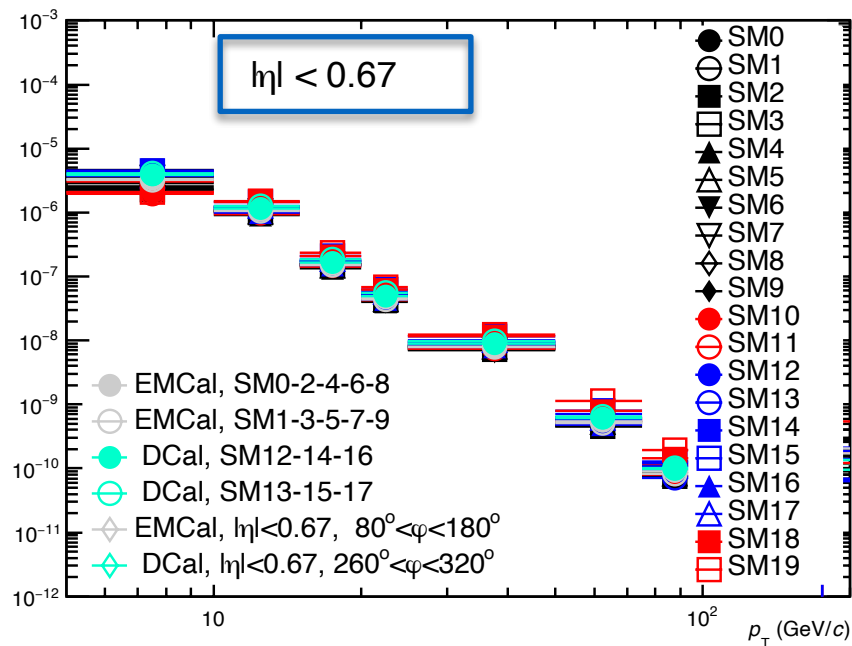
Narrow clusters, E/DG2, Full SM - Old calibration



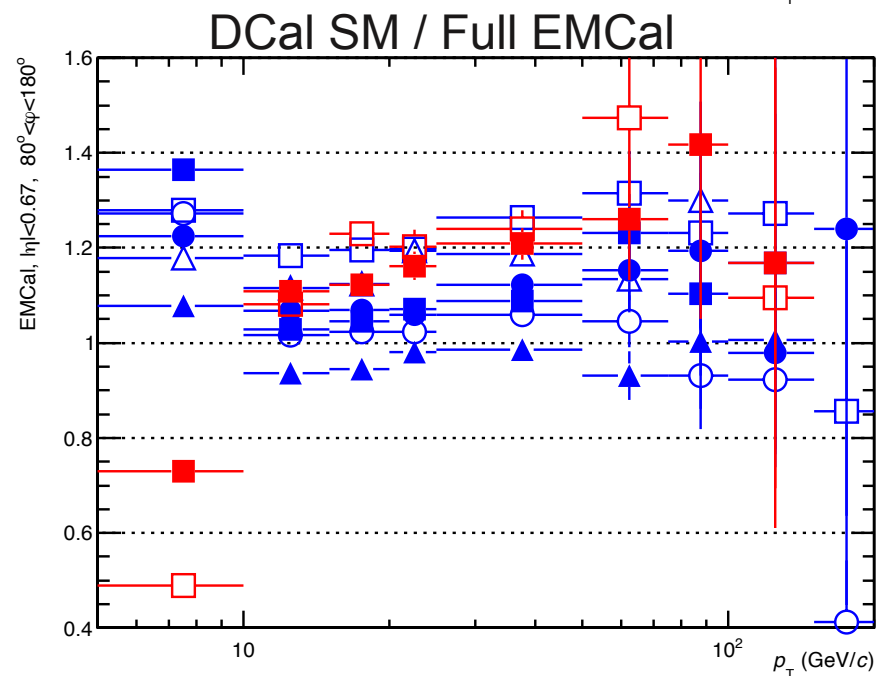
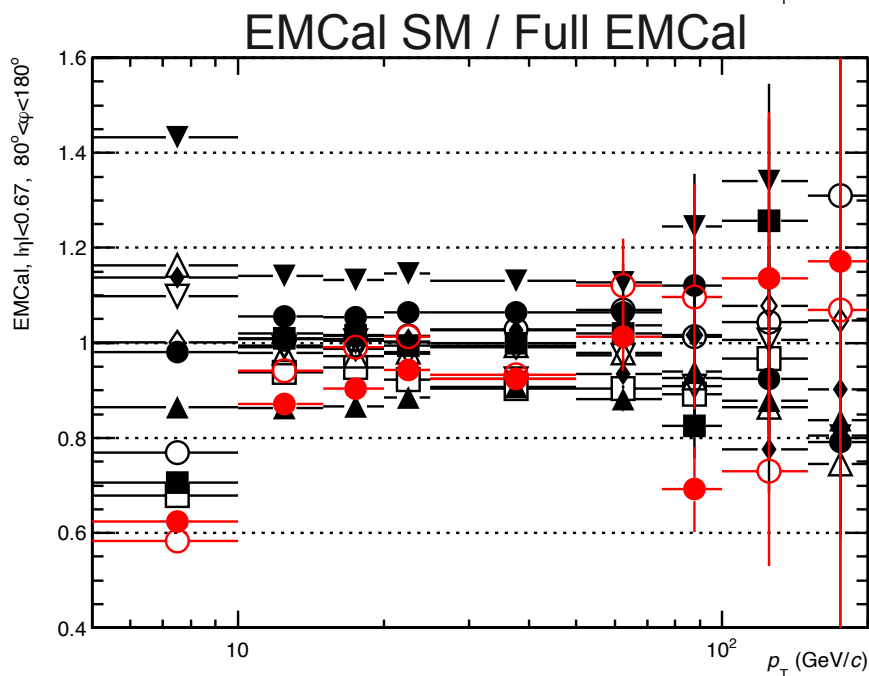
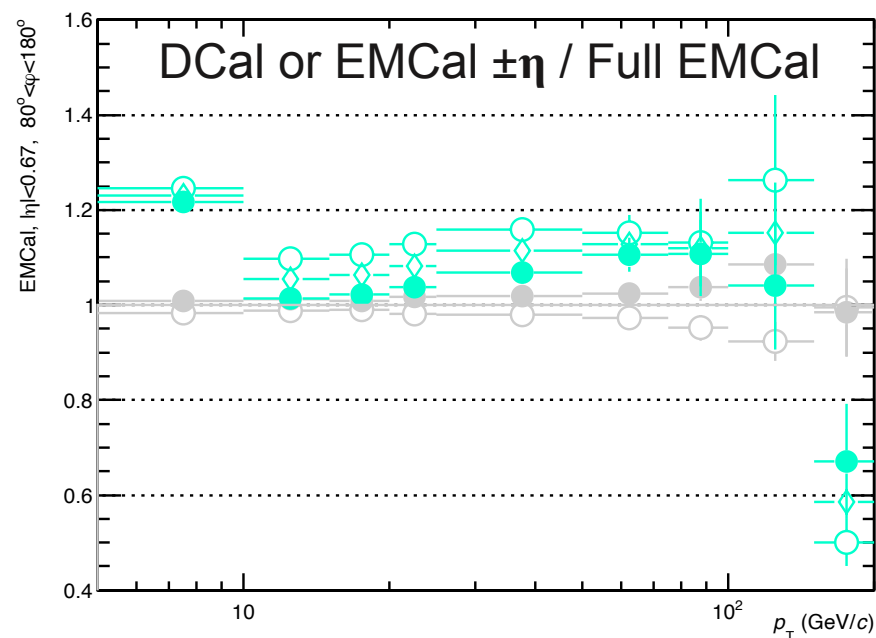
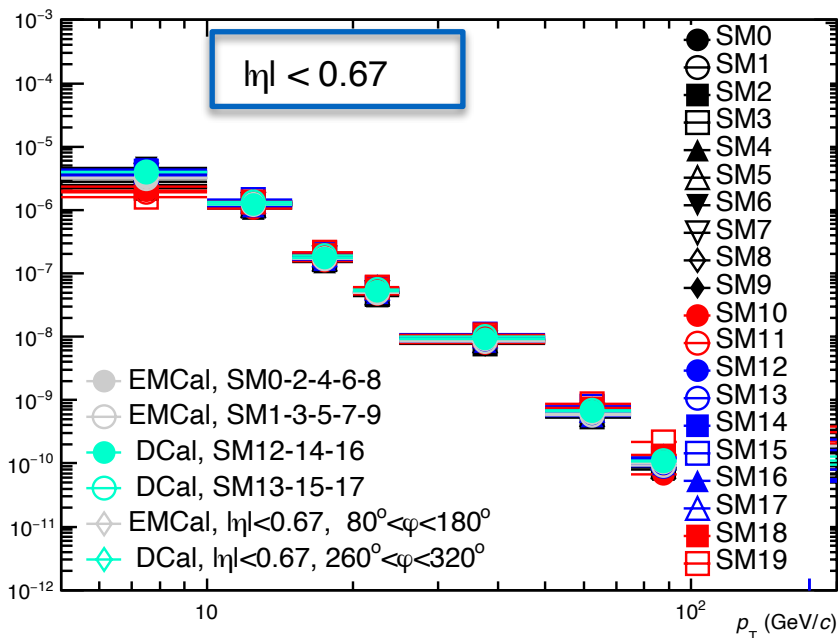
Narrow clusters, E/DG2, Full SM - New calibration



Narrow clusters, E/DG1, Full SM - Old calibration

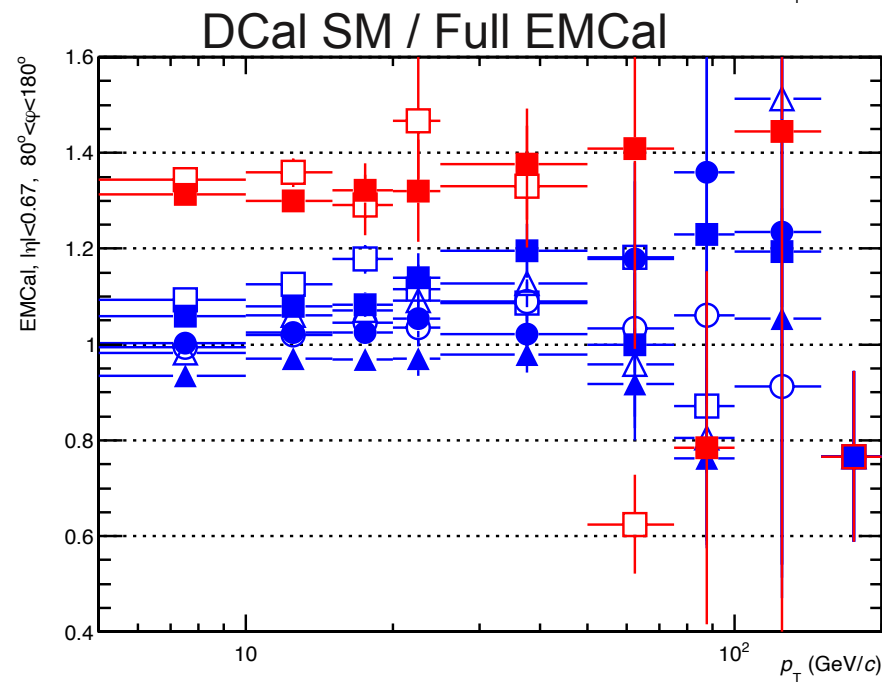
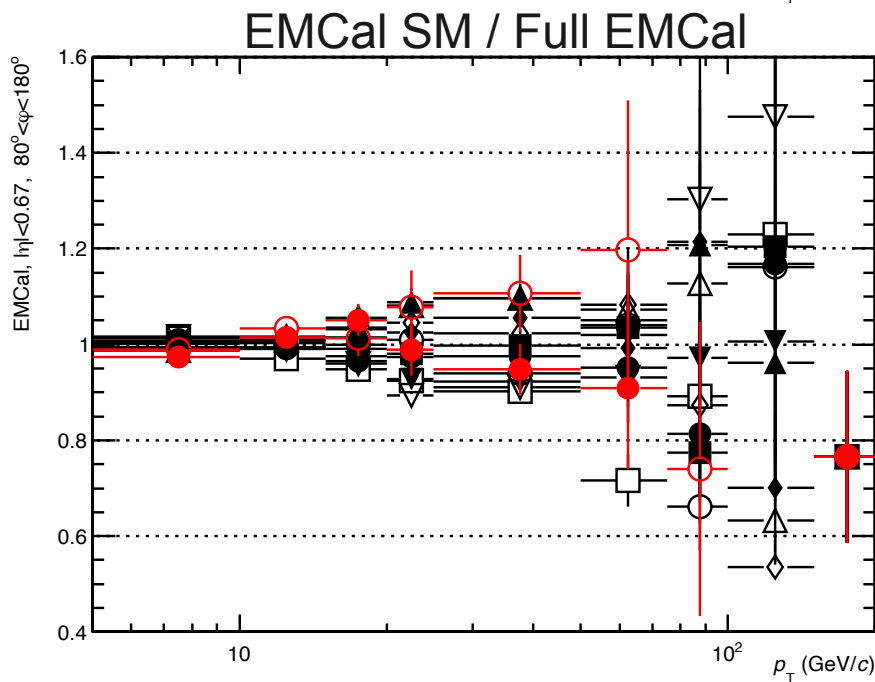
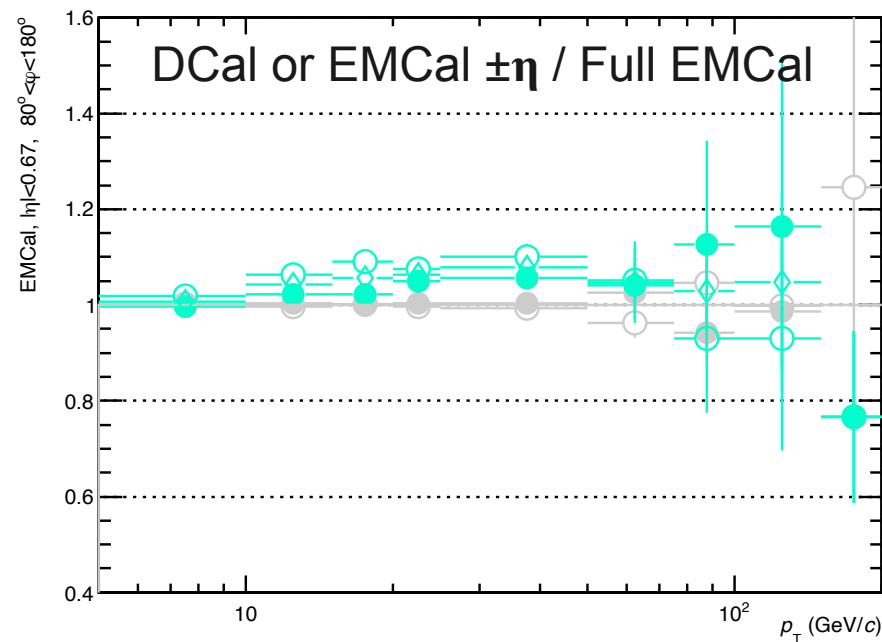
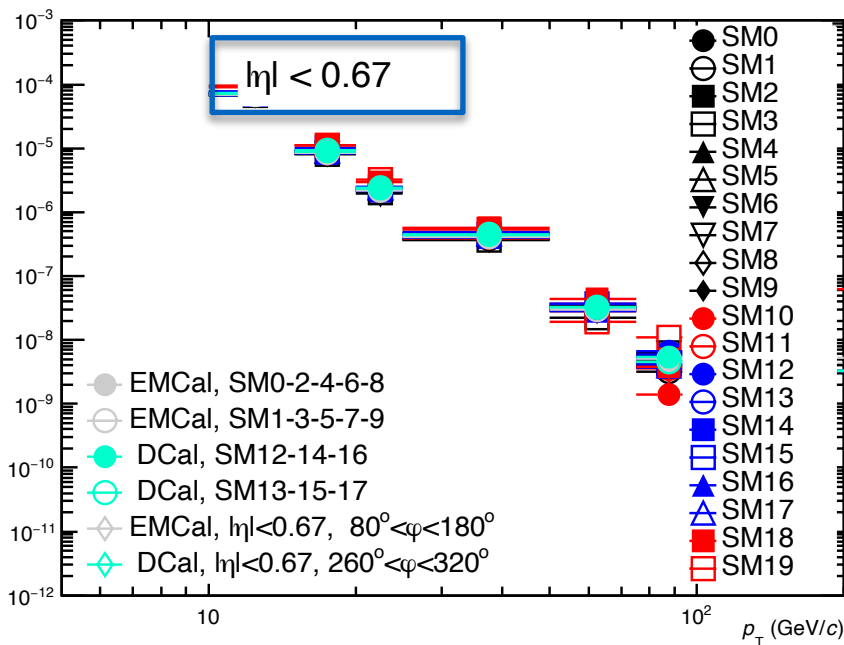


Narrow clusters, E/DG1, Full SM - New calibration

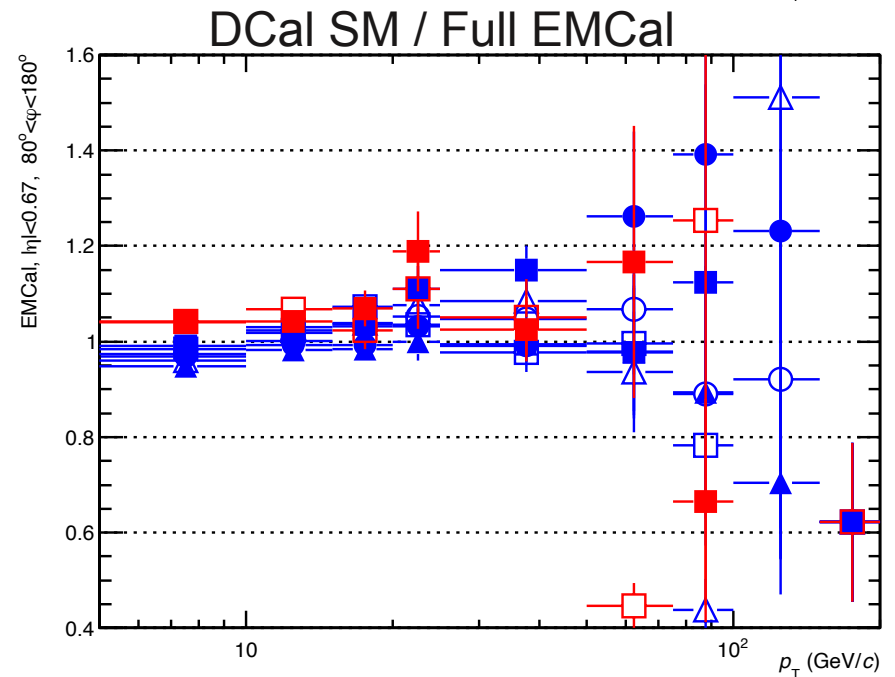
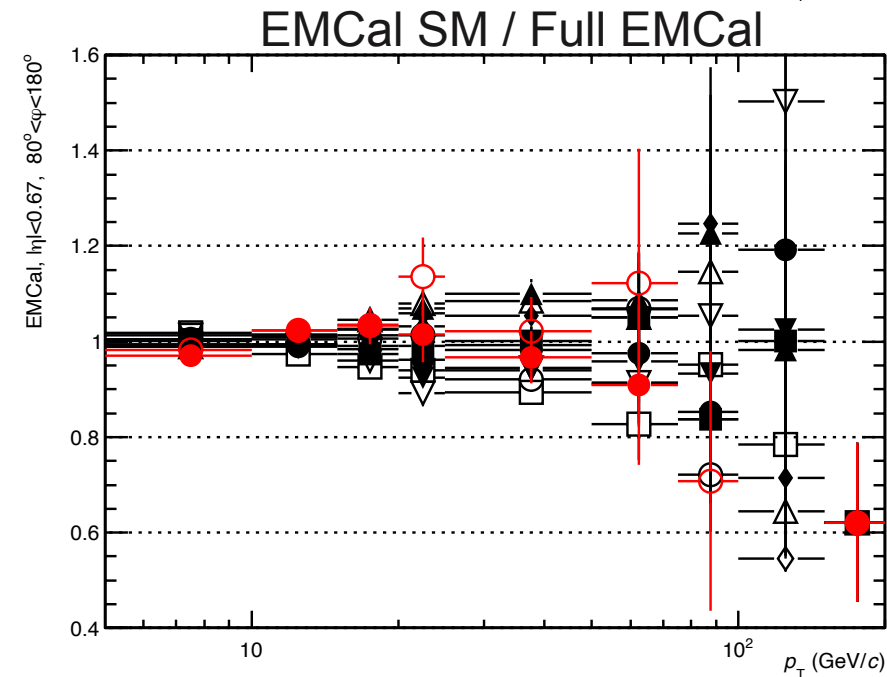
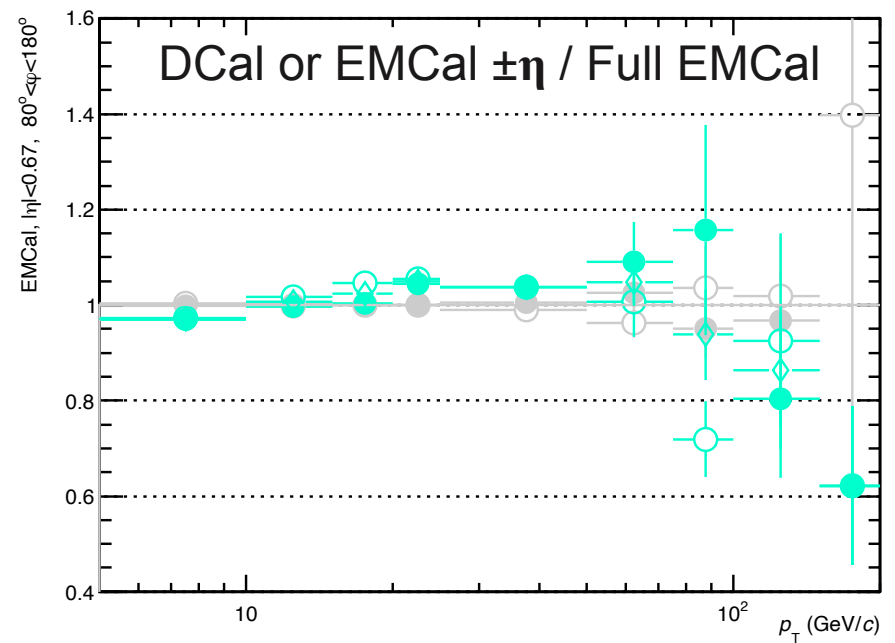
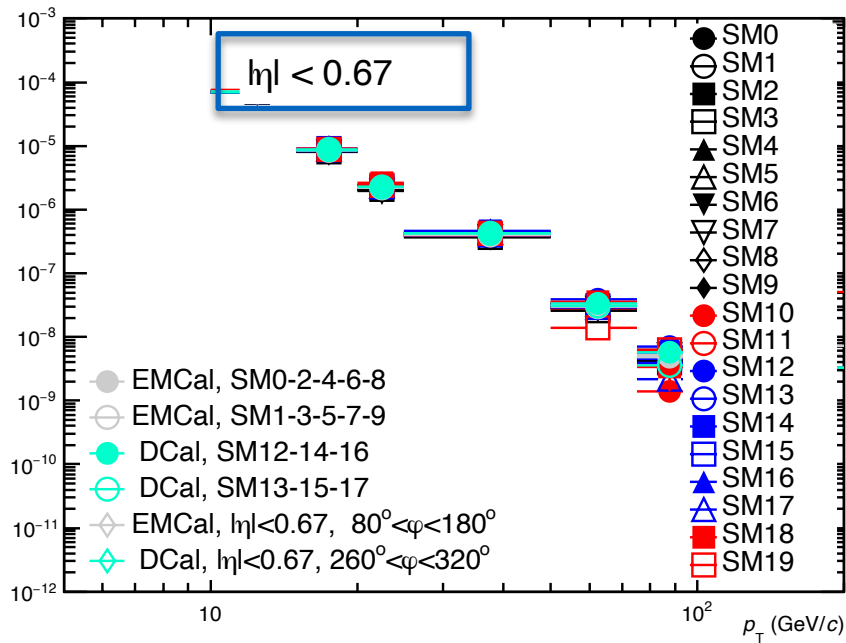


Narrow clusters, MC JJ low+GJ, Full SM, Old calibration

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Narrow clusters, MC JJ low+GJ, Full SM, New calibration 14 / 15

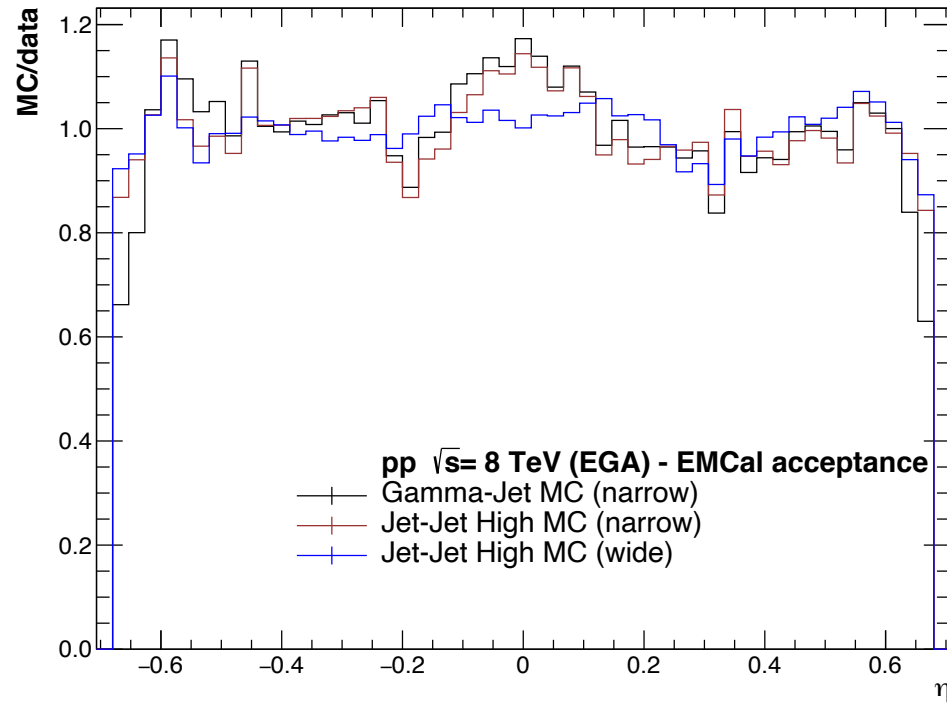
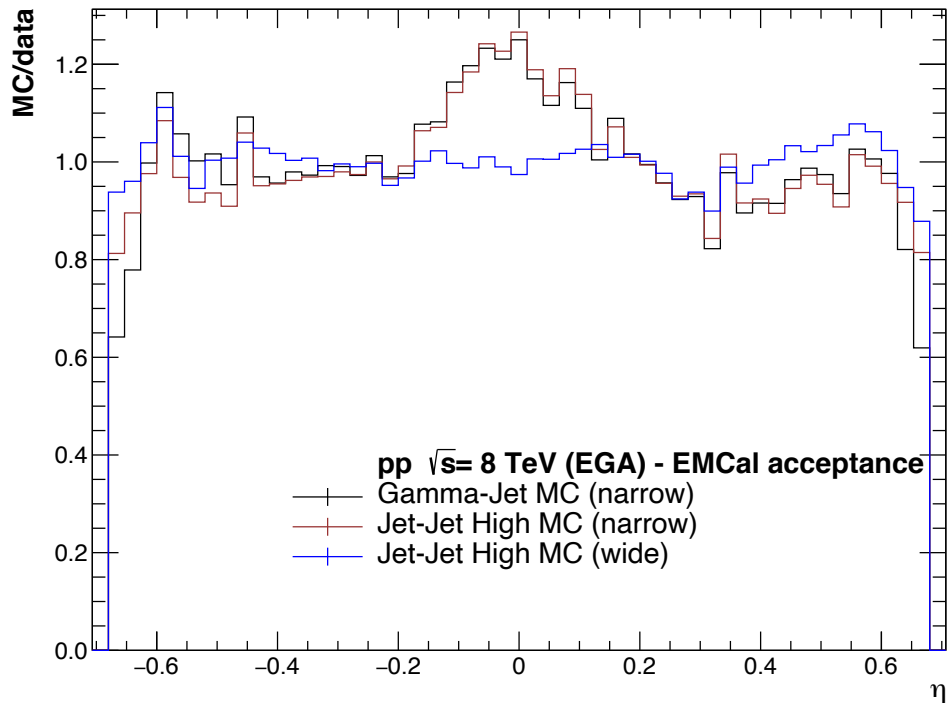


- We have spotted different issues and most of the difference between calorimeters is gone,
 - ▶ Although a significant spread between SM remains
- The main source was the non-linearity/calibration settings. How do we treat remaining discrepancies?
 - ▶ In the 7 TeV paper a 3.3% systematic error was assigned to the “energy scale”

Florian, pp@8 TeV
 $p_T > 12$ GeV/c, EMCal

Old x Talk

New x Talk



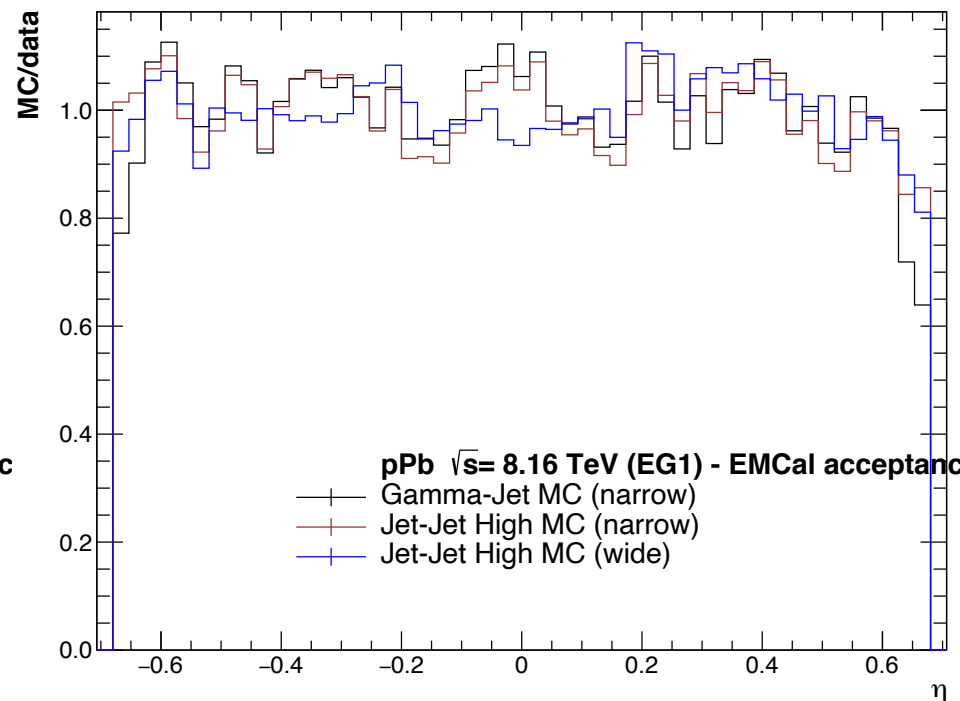
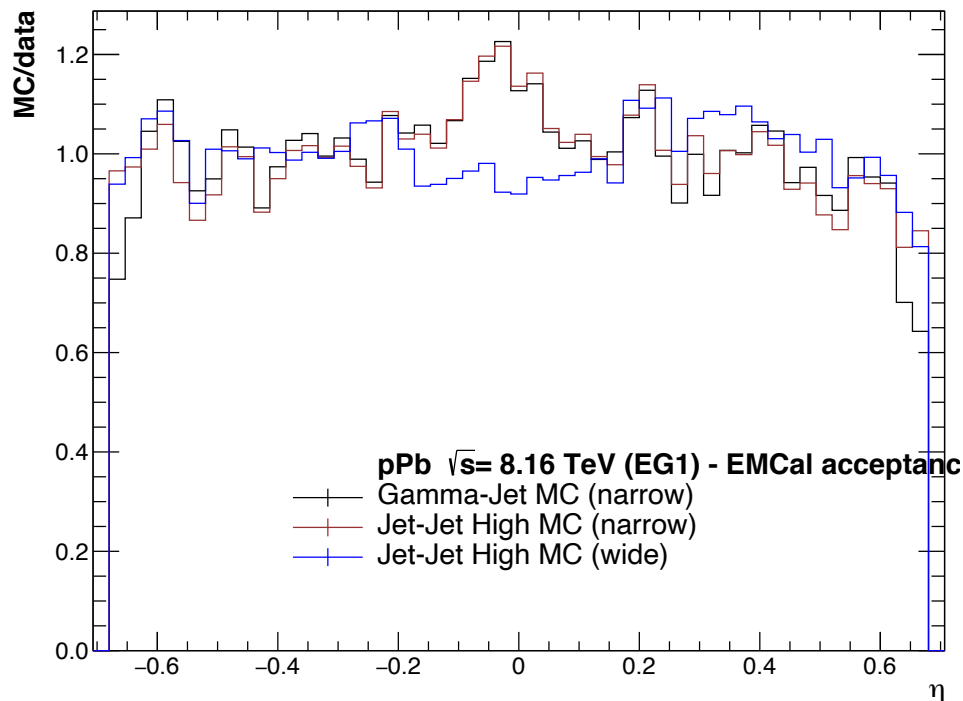
Improvement, with new cross talk, not perfect

Florian, pPb@8.16 TeV

$p_T > 12$ GeV/c, EMCal

Old x Talk

New x Talk

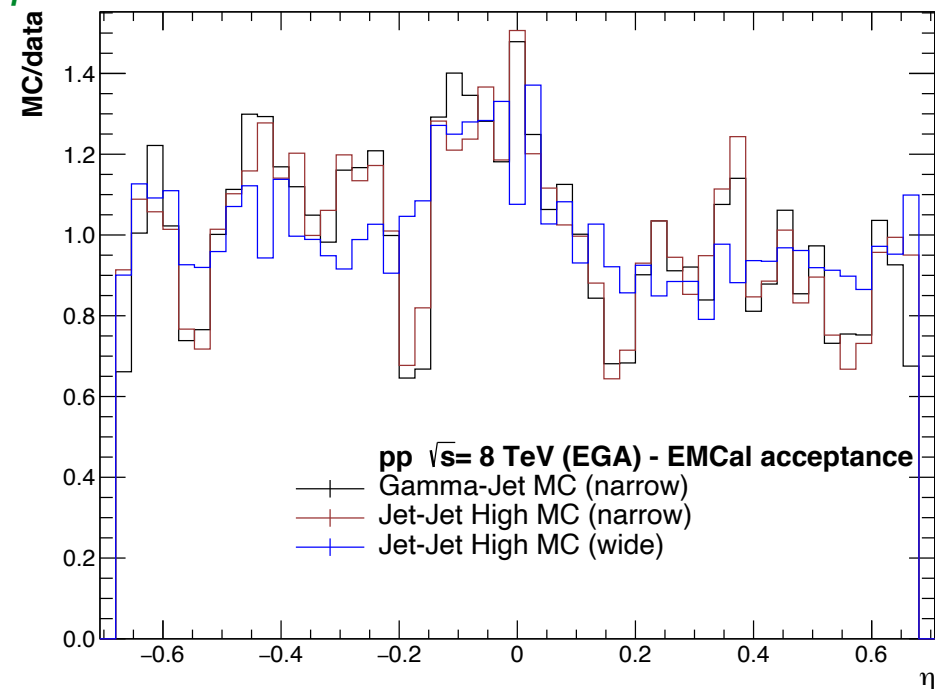
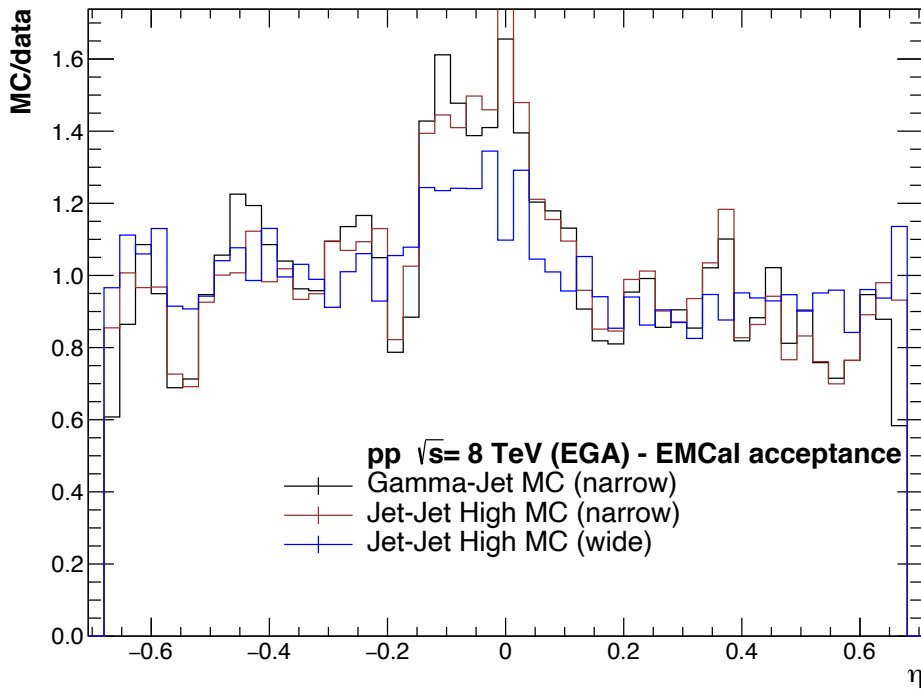


Improvement, with new cross talk, not perfect

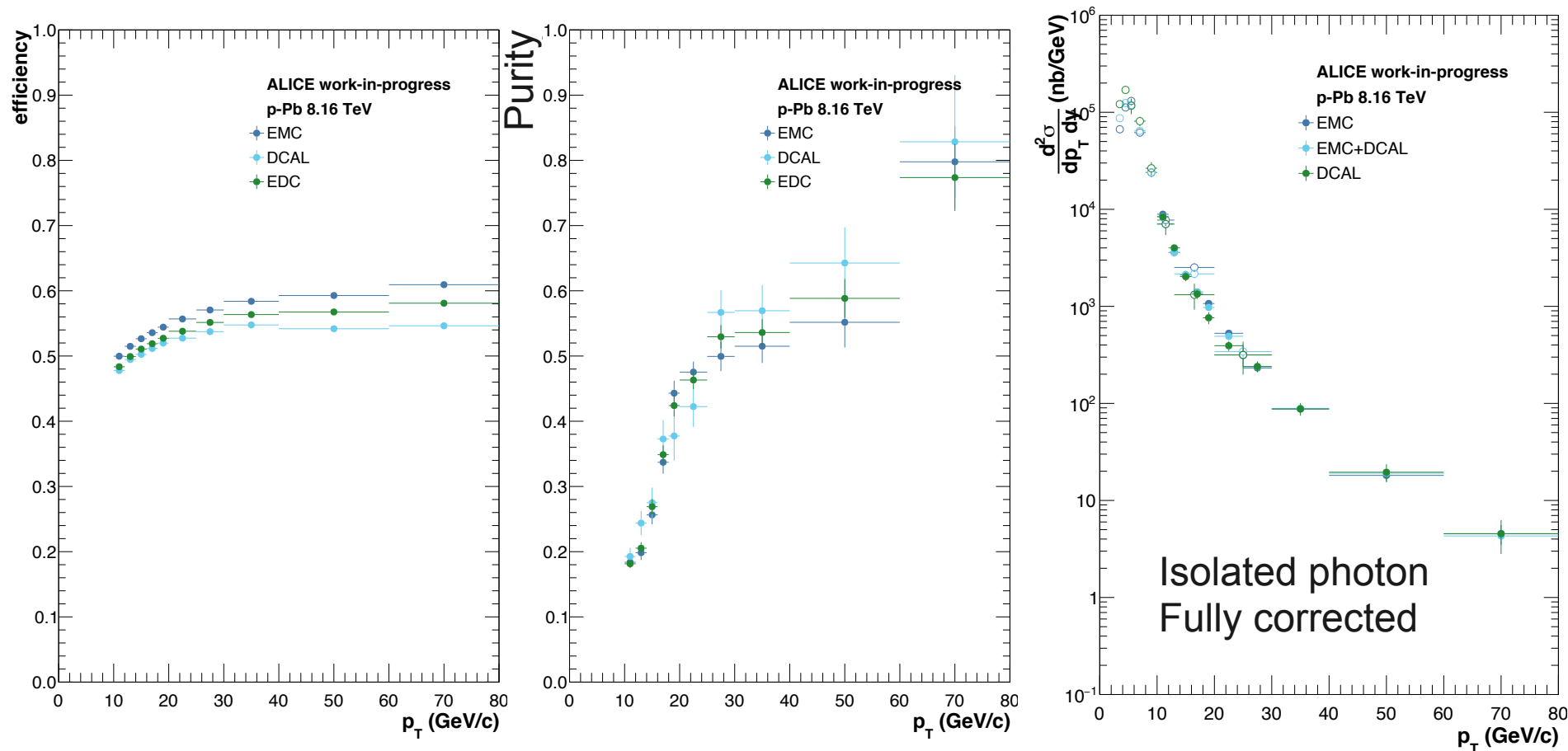
Florian, pp@8 TeV
 $p_T > 12$ GeV/c, EMCal
 $0.8 < E/p < 1.2$

Old x Talk

New x Talk

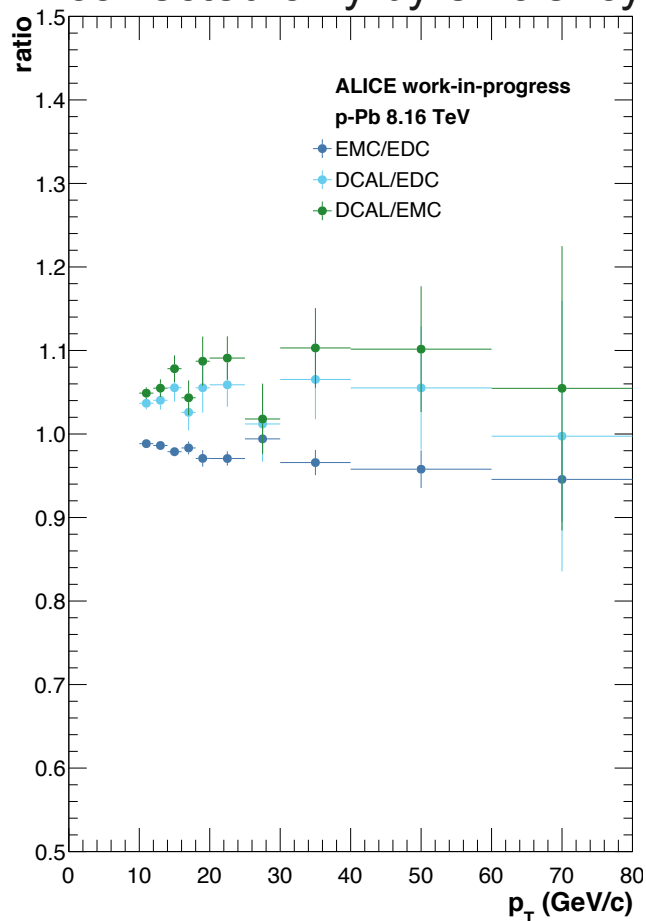


Also present for electron like clusters, possibly even larger effect
Improvement, with new cross talk, not perfect

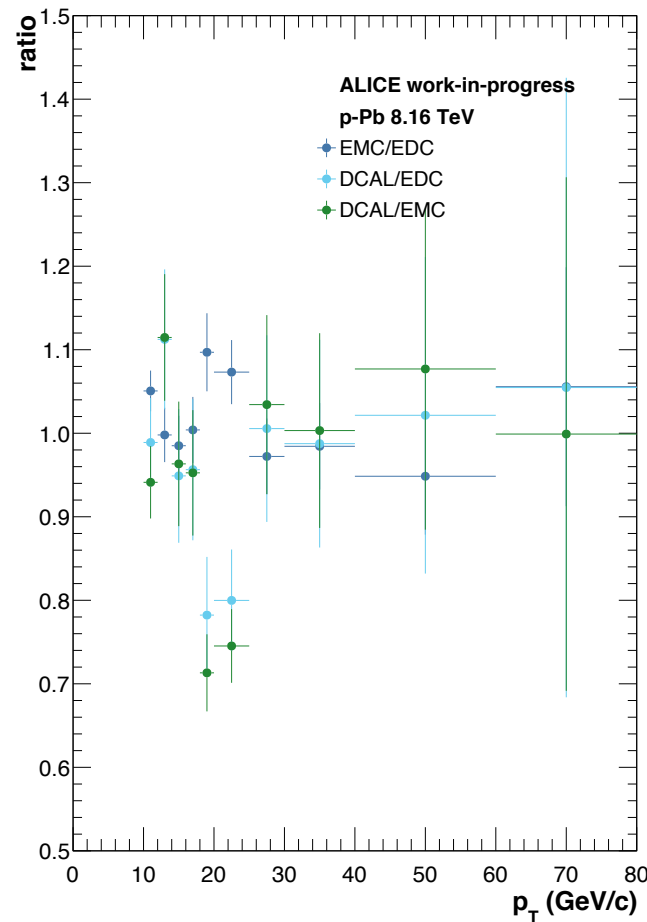


Different purity for EMCal and DCal, but within statistical error

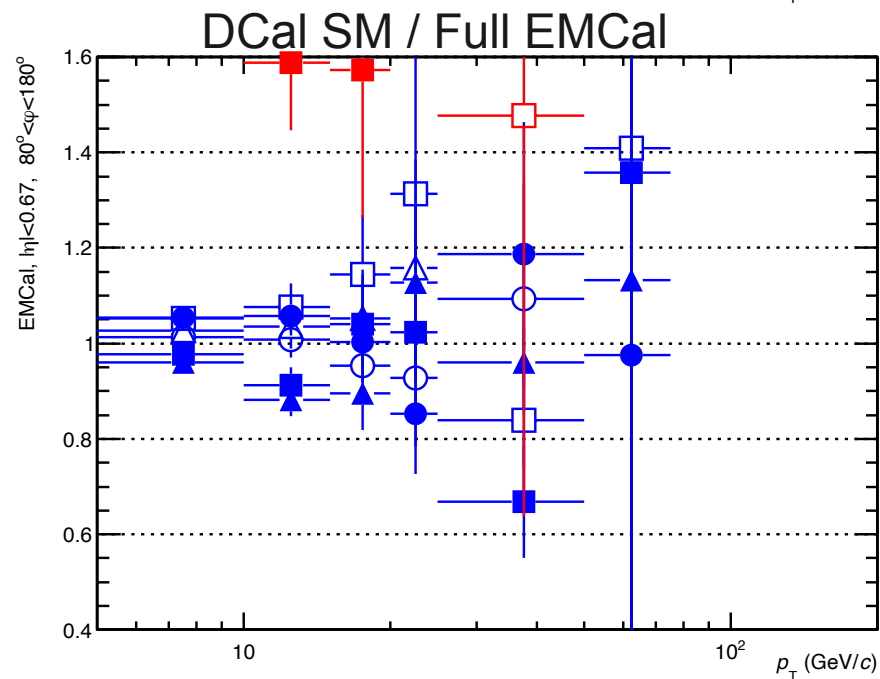
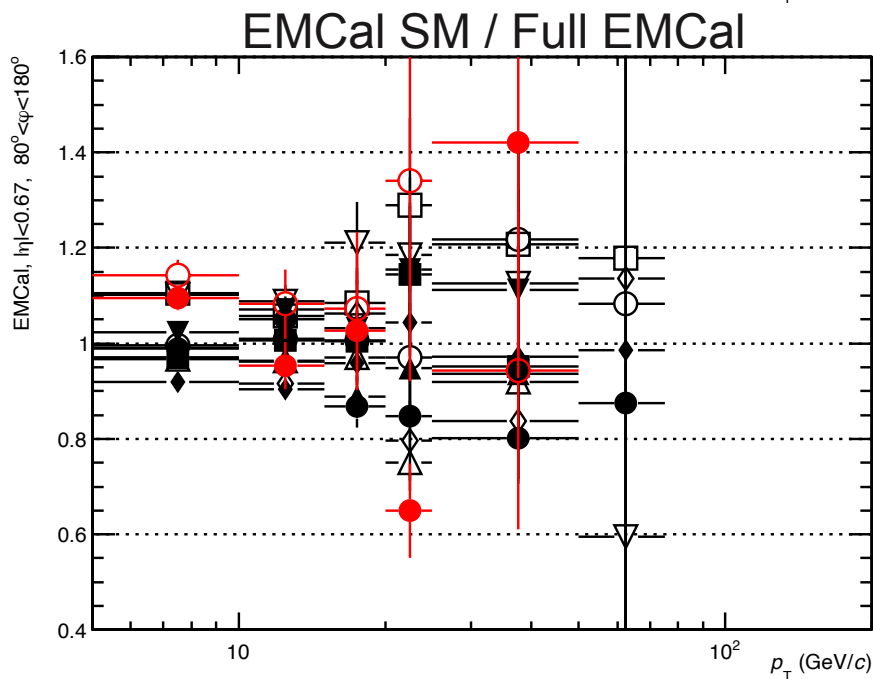
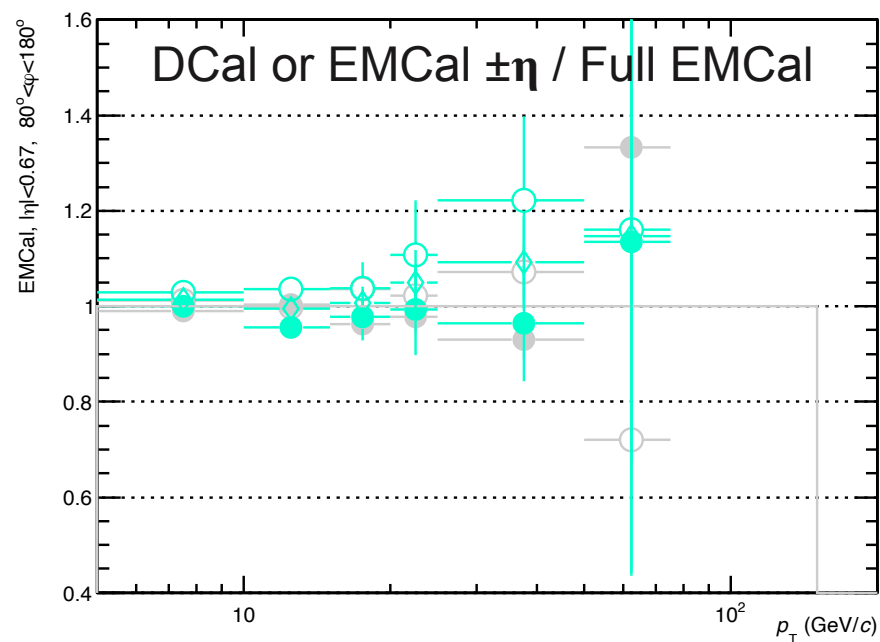
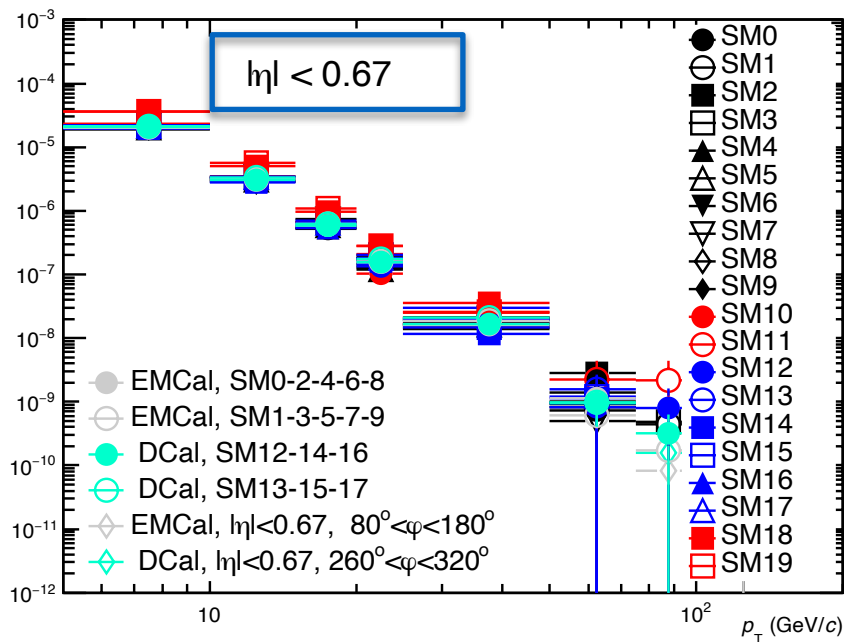
Not isolated,
corrected only by efficiency

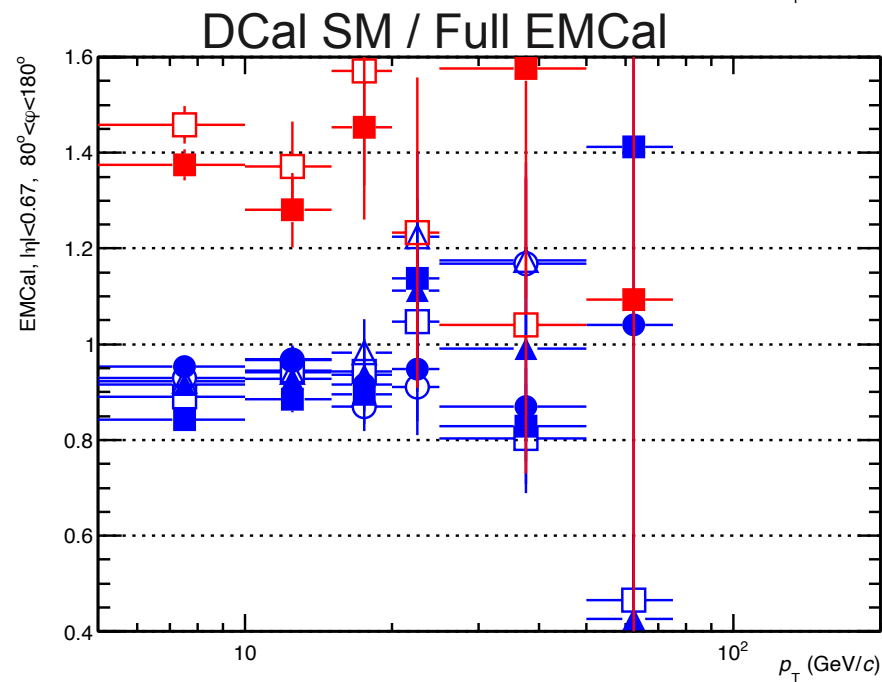
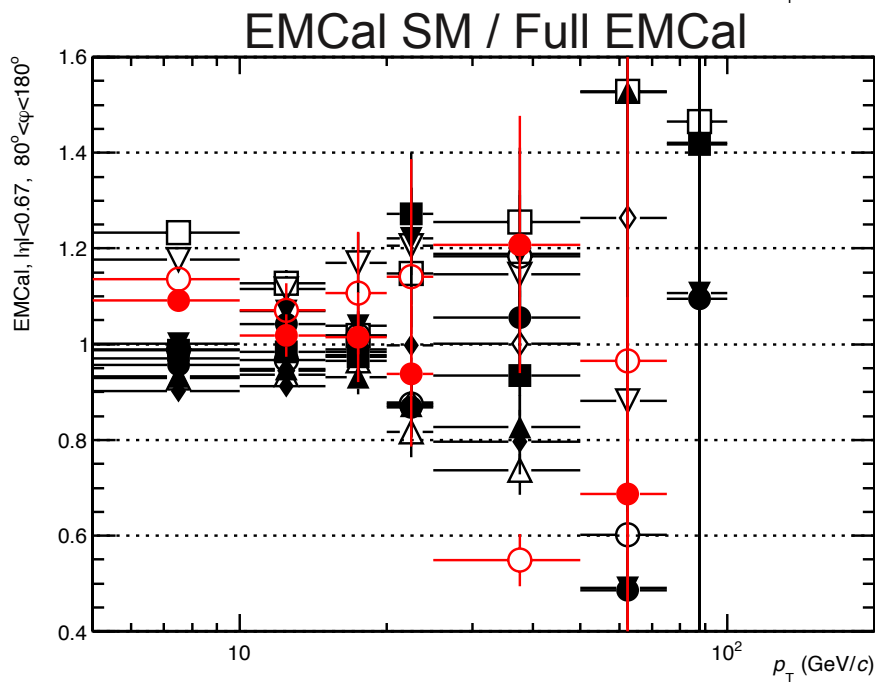
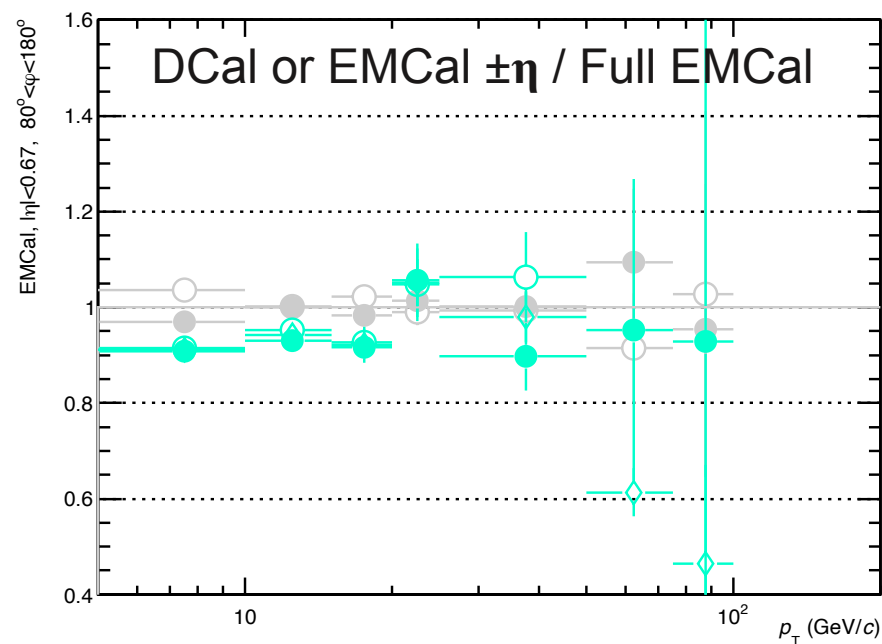
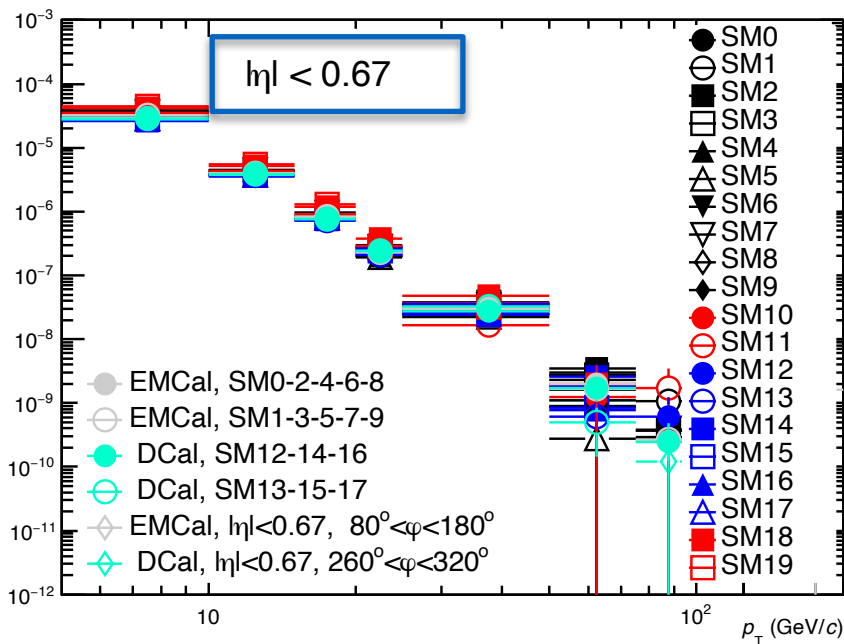


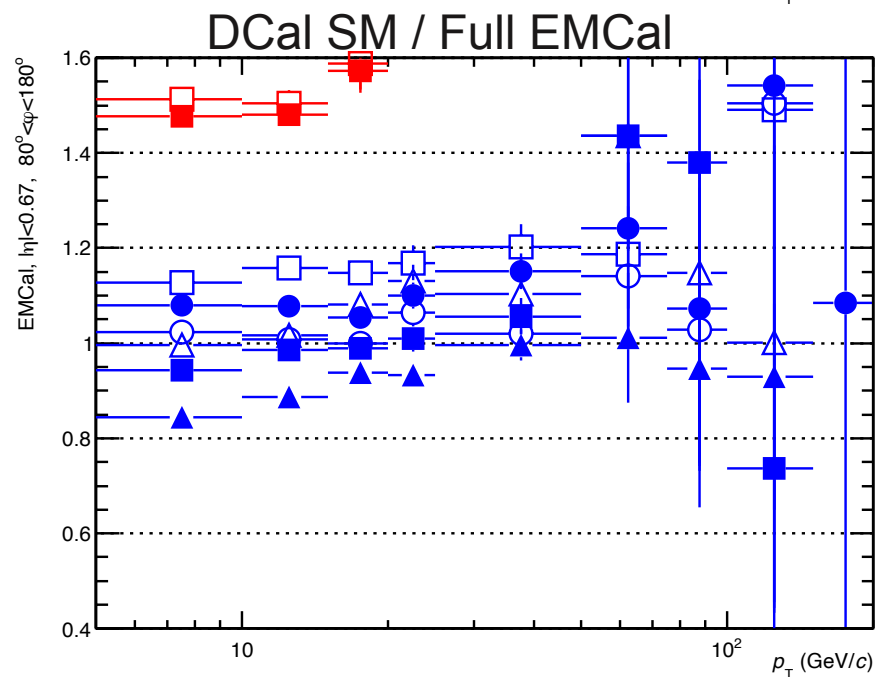
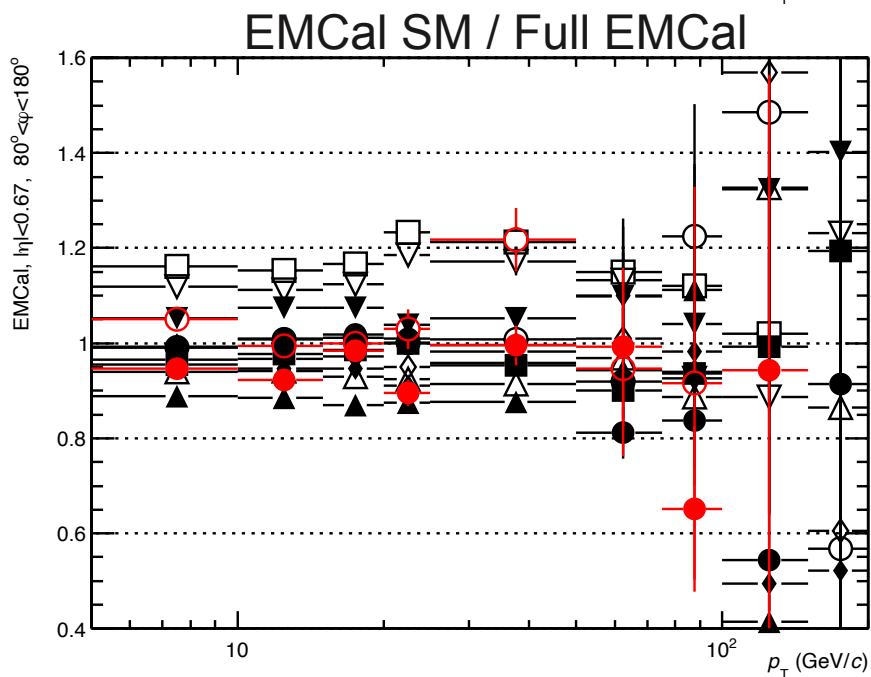
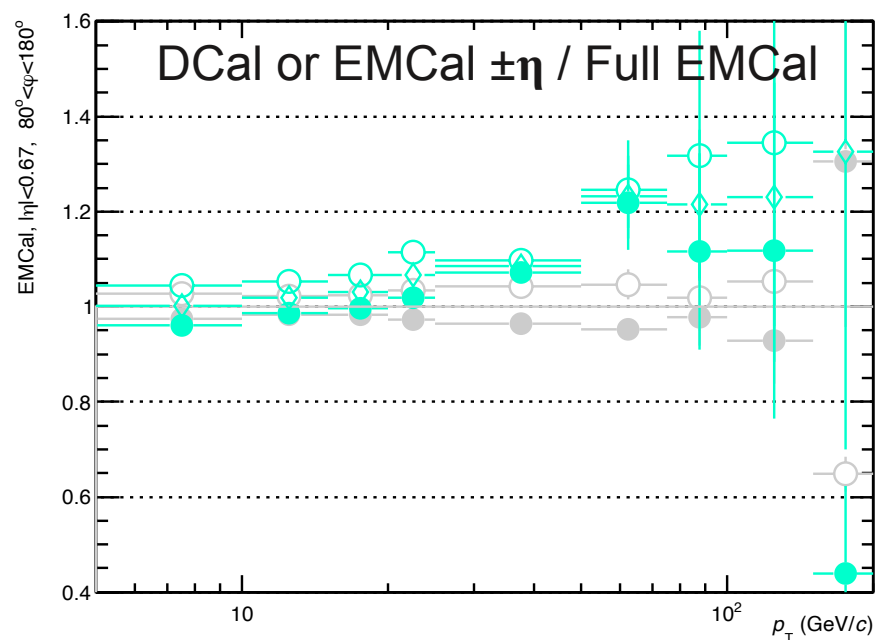
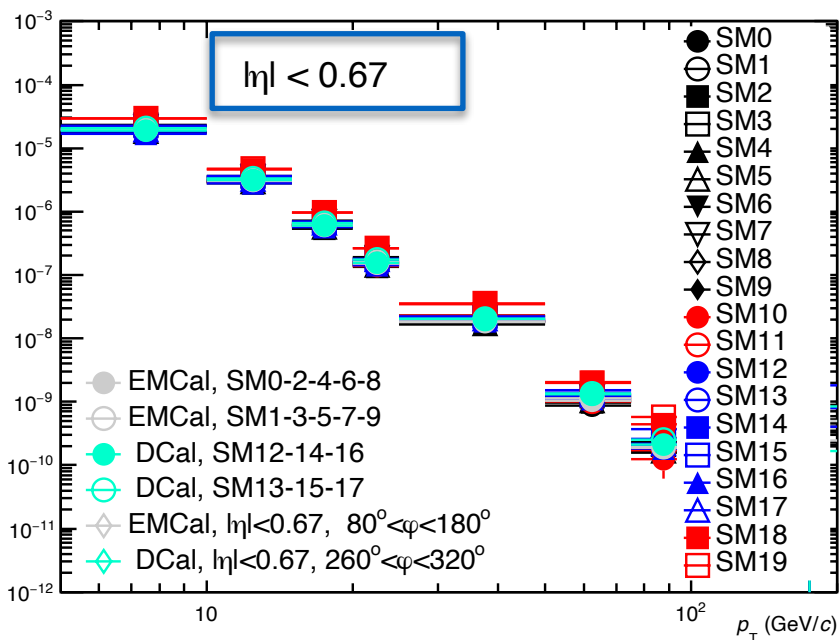
Isolated, fully corrected
(from previous slide)

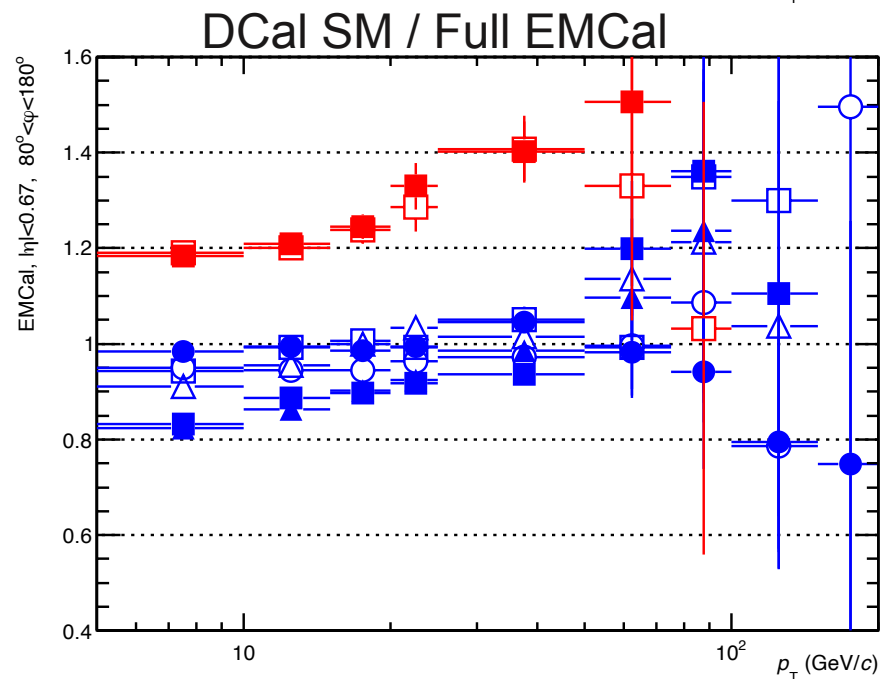
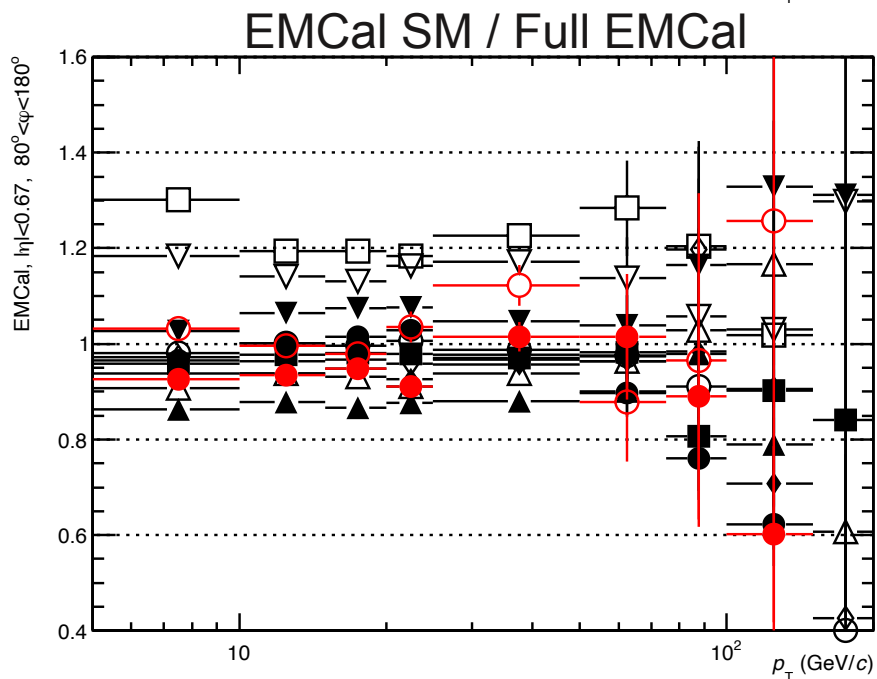
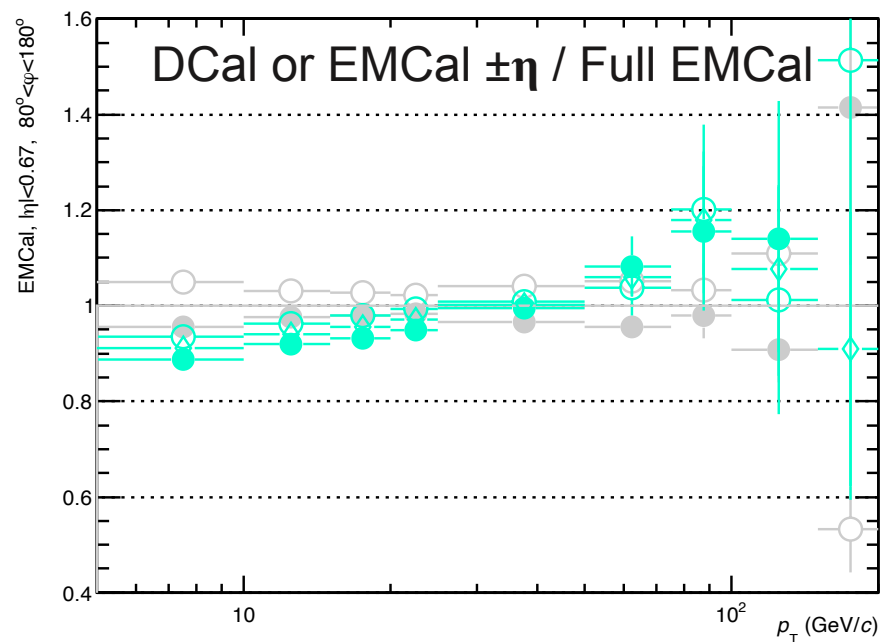
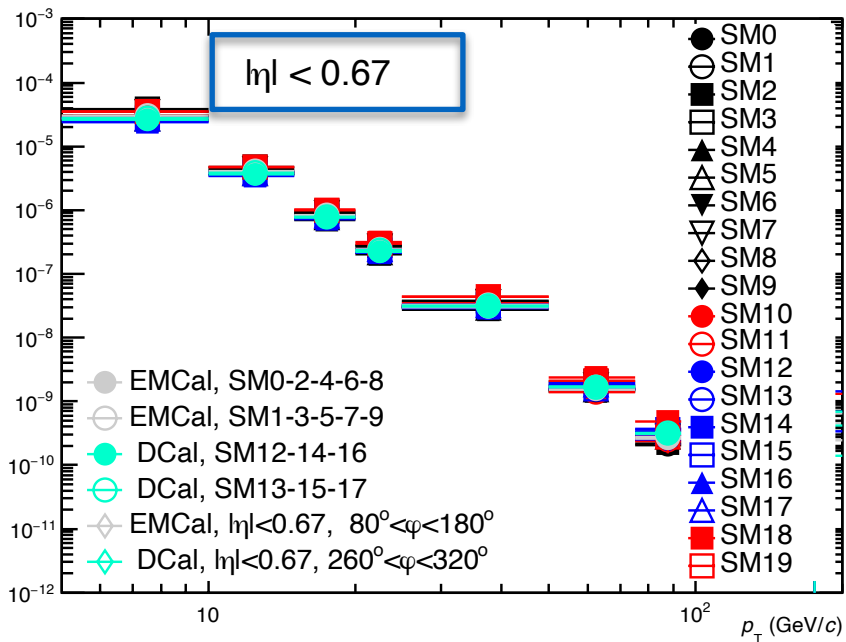


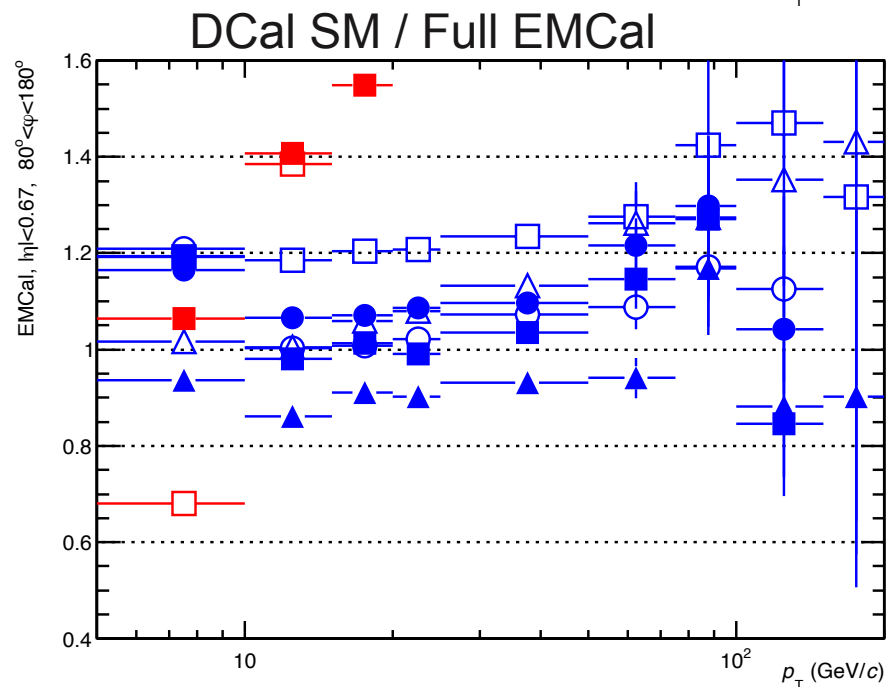
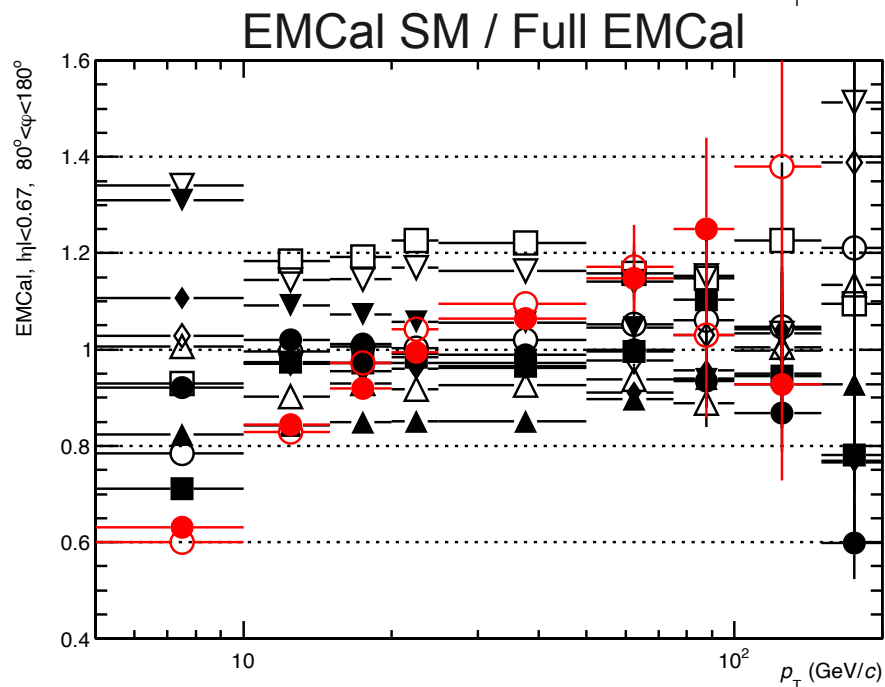
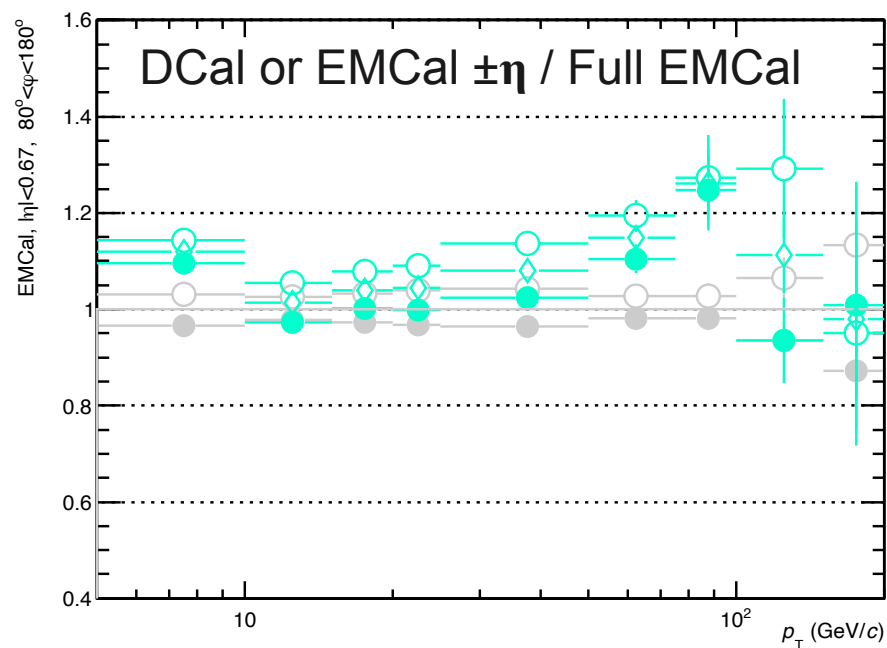
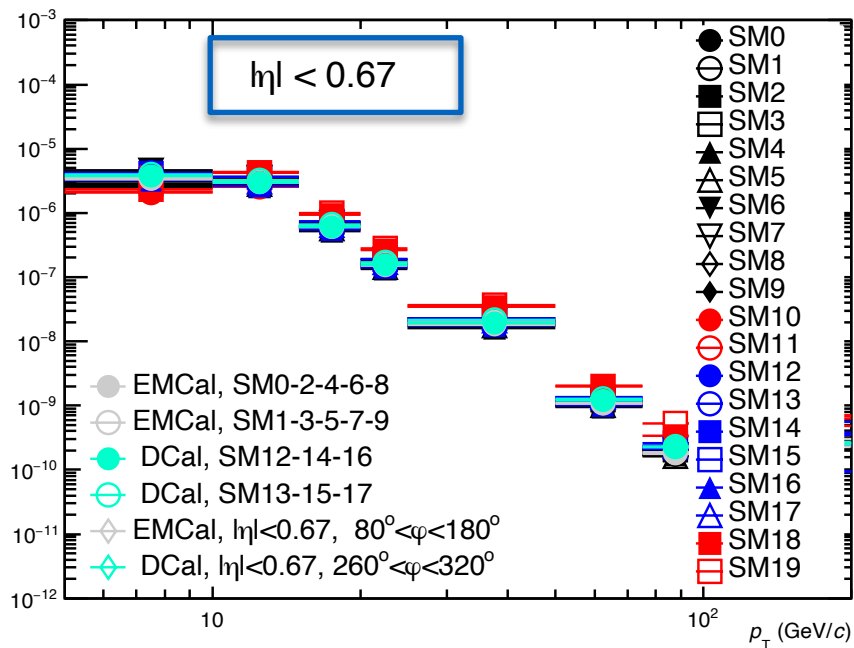
Fully corrected spectra seem compatible.
Not isolated spectra similar to previous slides.

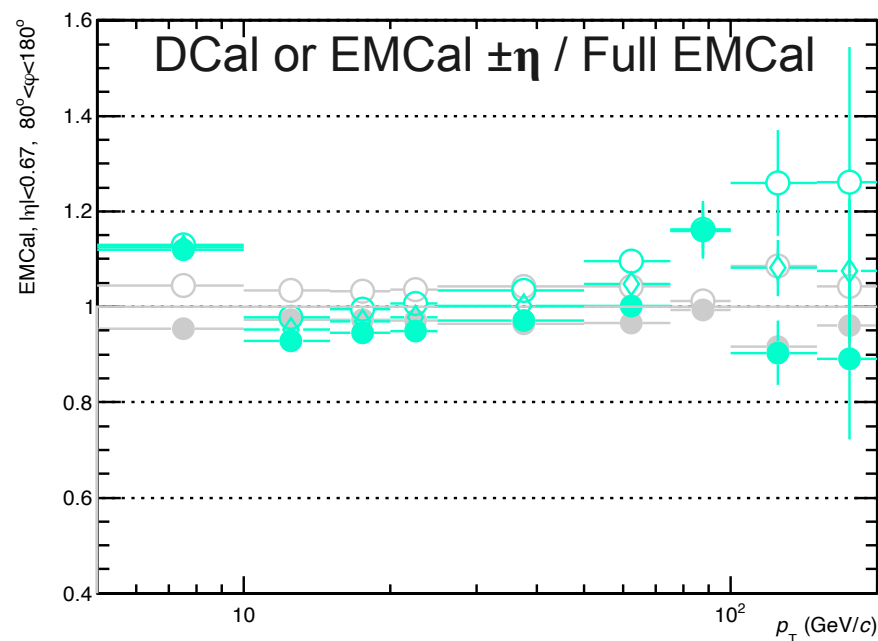
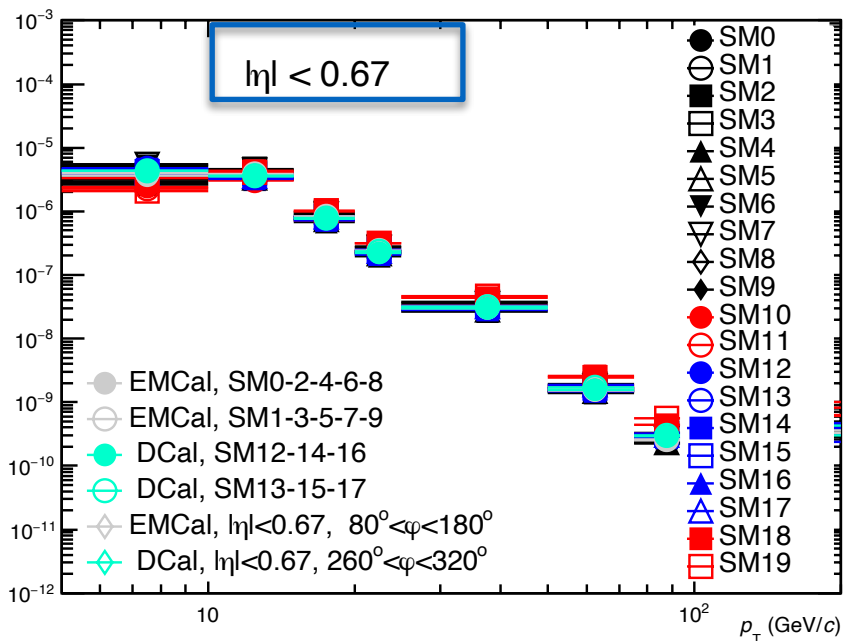




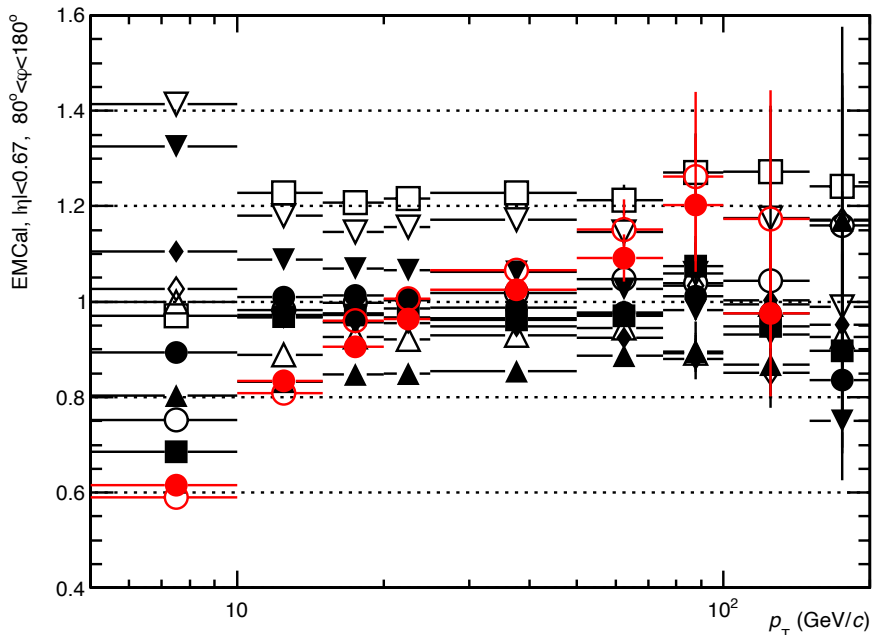








EMCal SM / Full EMCal



DCal SM / Full EMCal

