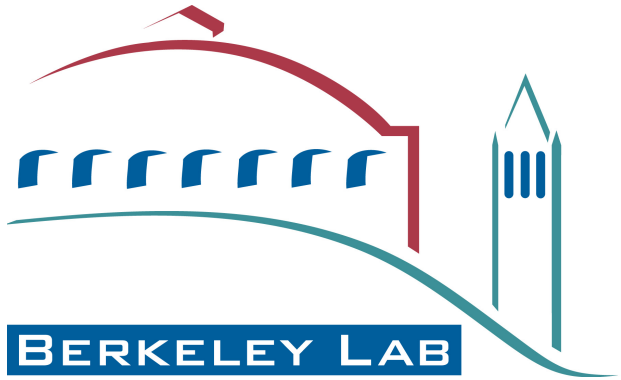
Deep Pion Analysis update with newer data

Ivan Chernyshev

December 19, 2017



Introduction

- Used Dr. Miguel Arratia's Deep Pion Efficiency analysis software, which uses both Dr. Yue Shi Lai's neural net and λ_0- based data analysis, and compares them.
- Data: 2013 pPb (e period, processed with the clusv2 algorithm)
- MC: 17g6a3_pthat2 (dijet Monte-Carlo, processed with the clusv2 algorithm
- Also compared the results for the same data sets from the clusv1 algorithm

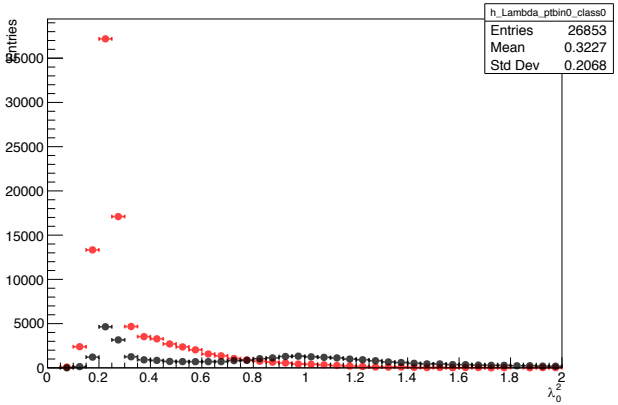
MC Normalized in NN > 0.85 and λ_0^2 > 0.27

10 GeV <$pT_{cluster}$ < 12 GeV

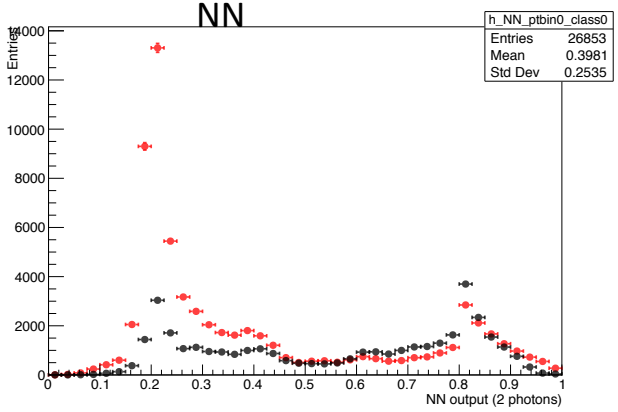
Legend

- Data
- MC

Lambda



NN



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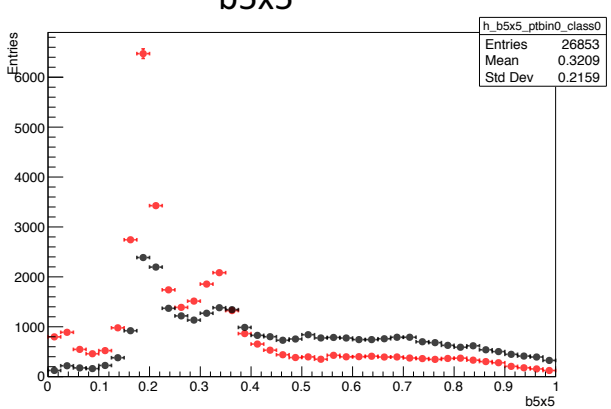
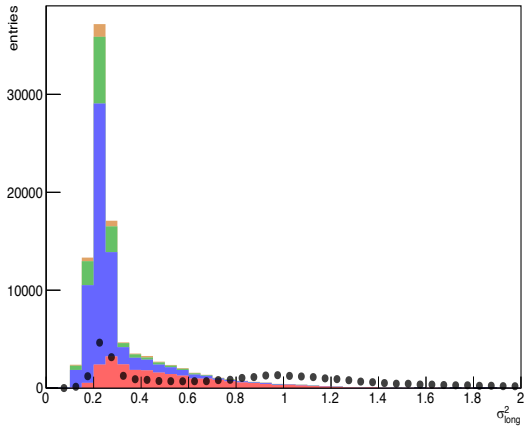
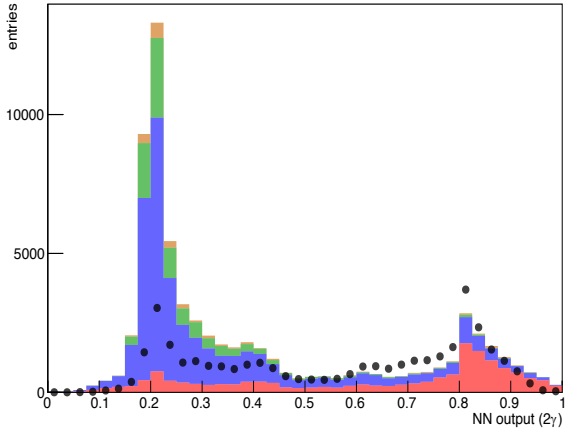
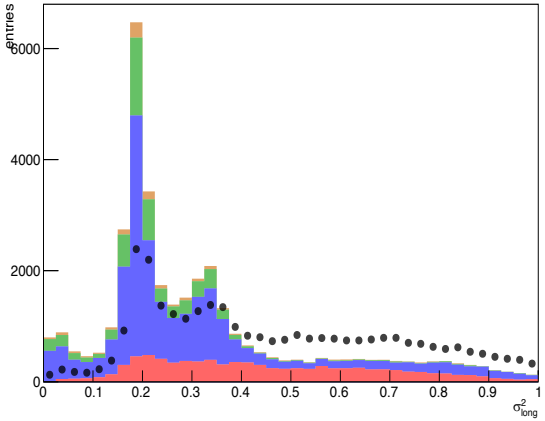


Legend

- data, pPb
- π^0 2 showers
- π^0 1 shower
- η BKG
- Other BKG







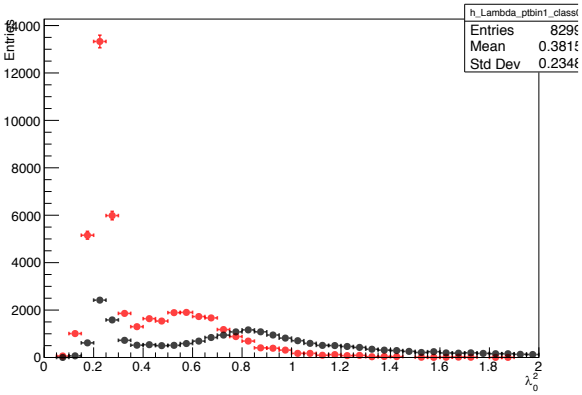
MC Normalized in NN > 0.85 and λ_0^2 > 0.27

12 GeV <$pT_{cluster}$ < 14 GeV

Legend

- Data
- MC

Lambda



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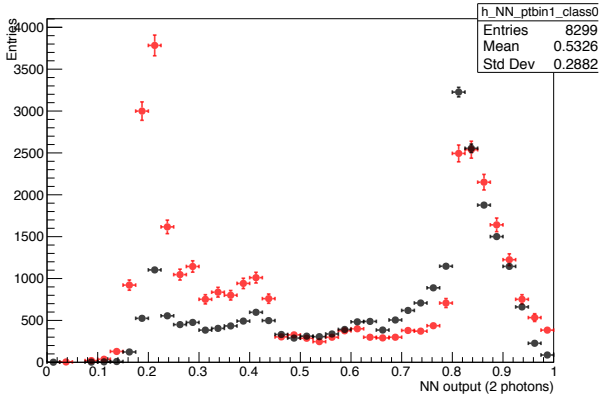

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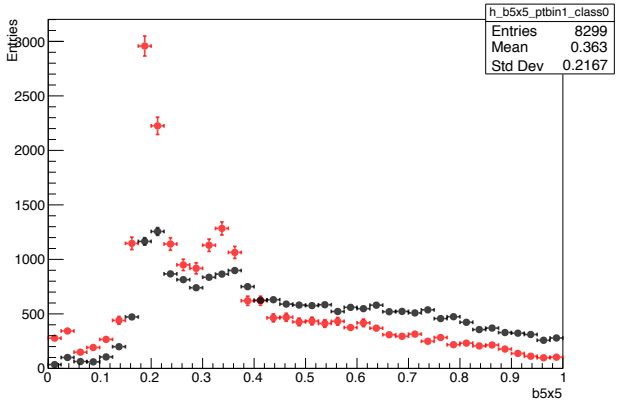

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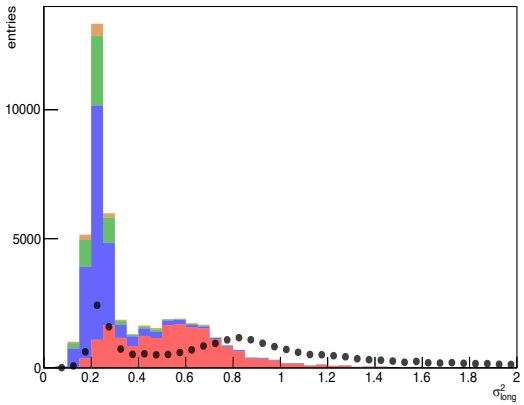
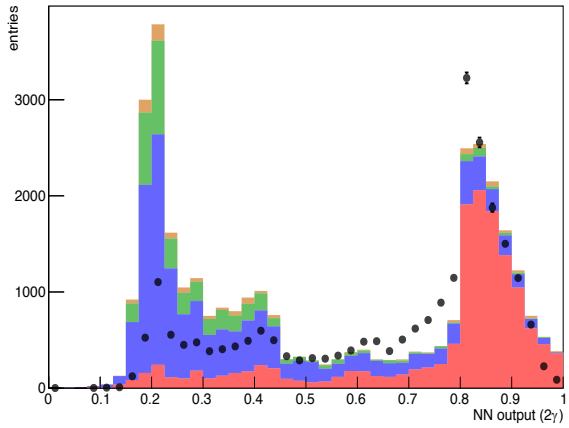
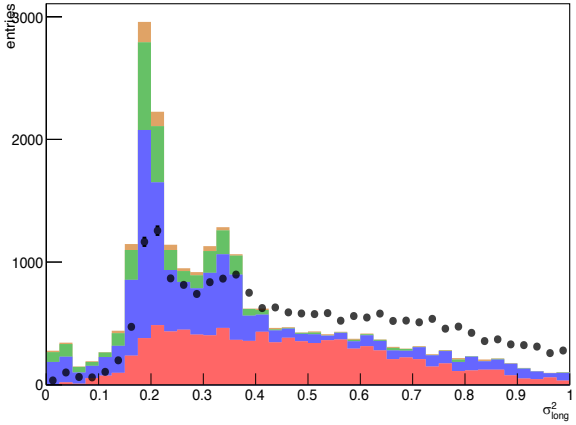






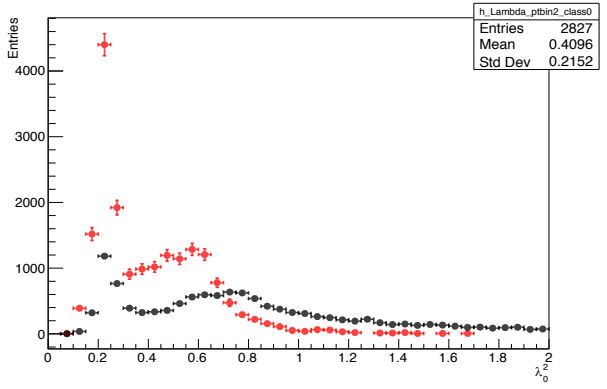
MC Normalized in NN > 0.85 and λ_0^2 > 0.27

14 GeV <$pT_{cluster}$ < 16 GeV

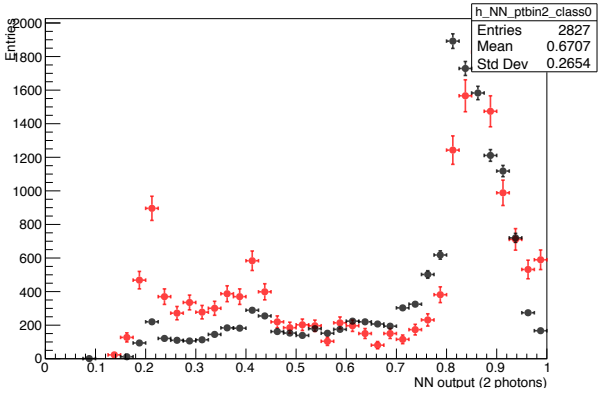
Legend

- Data
- MC

Lambda



NN



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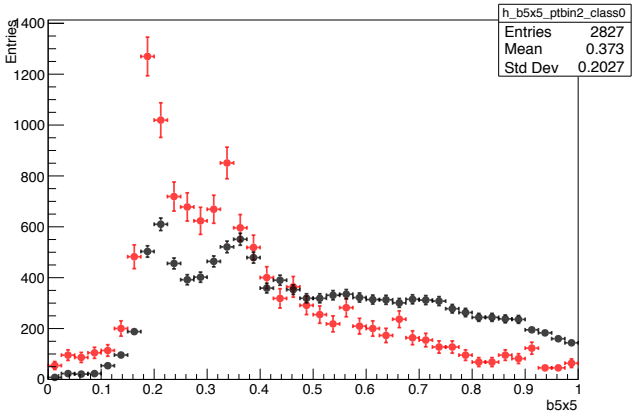

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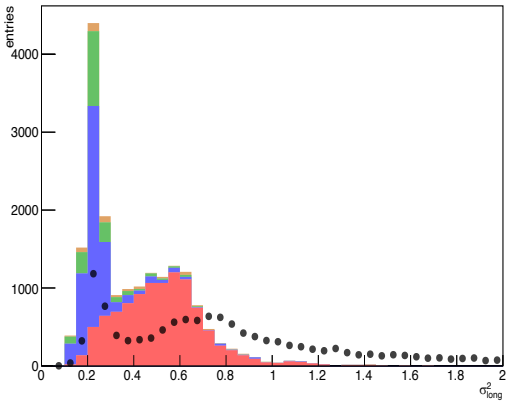
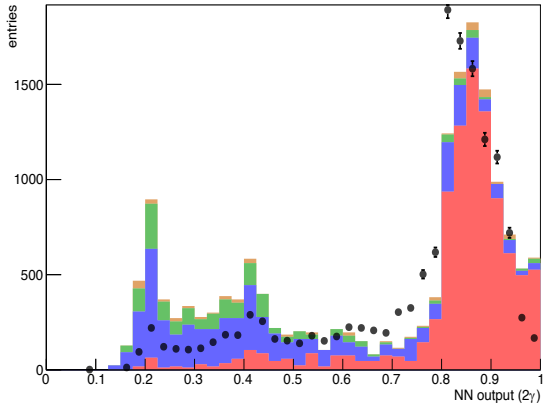
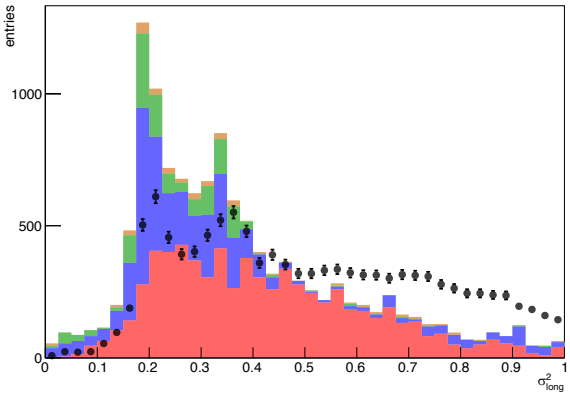






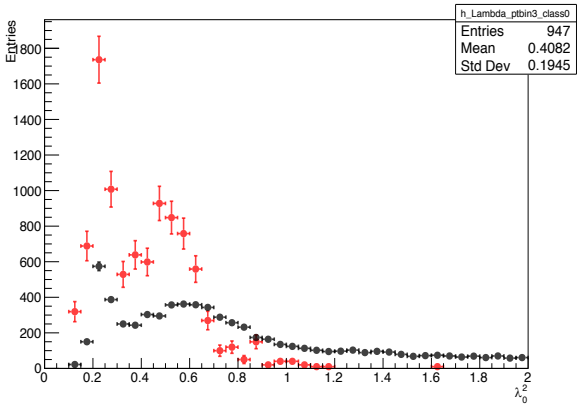
MC Normalized in NN > 0.85 and λ_0^2 > 0.27

16 GeV <$pT_{cluster}$ < 18 GeV

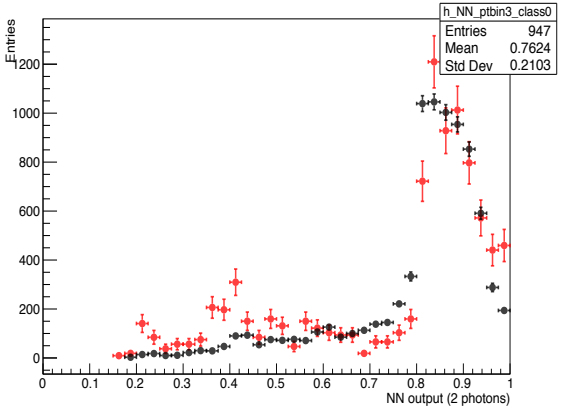
Legend

- Data
- MC

Lambda



NN



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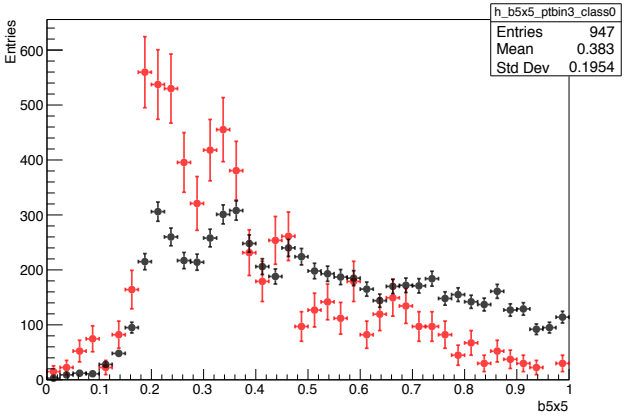
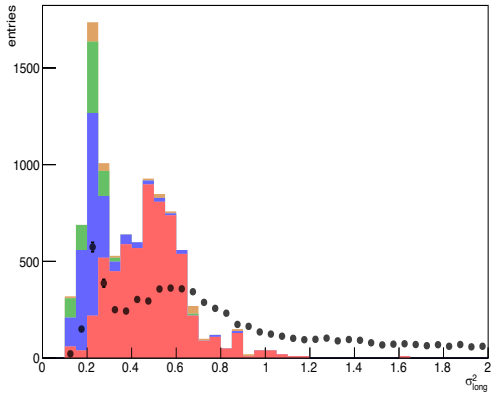
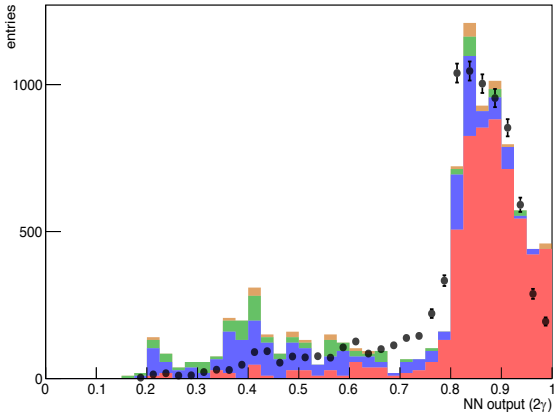
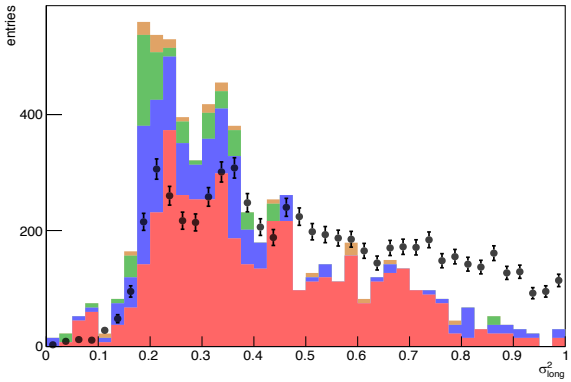


Legend

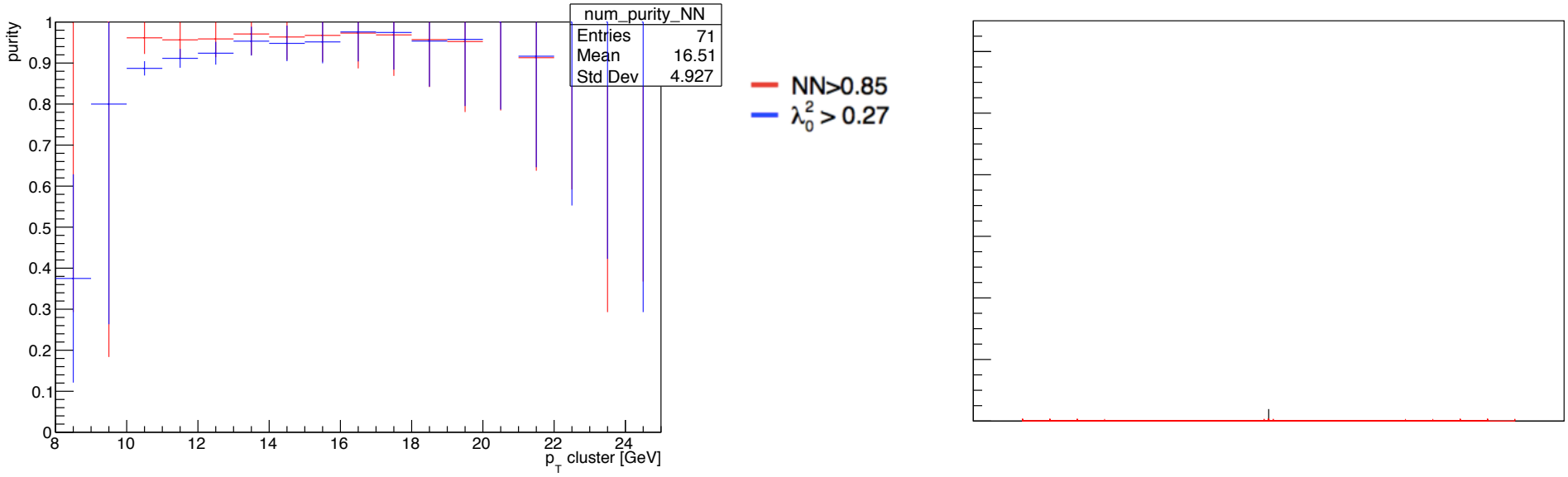
- data, pPb
- π^0 2 showers
- π^0 1 shower
- η BKG
- Other BKG





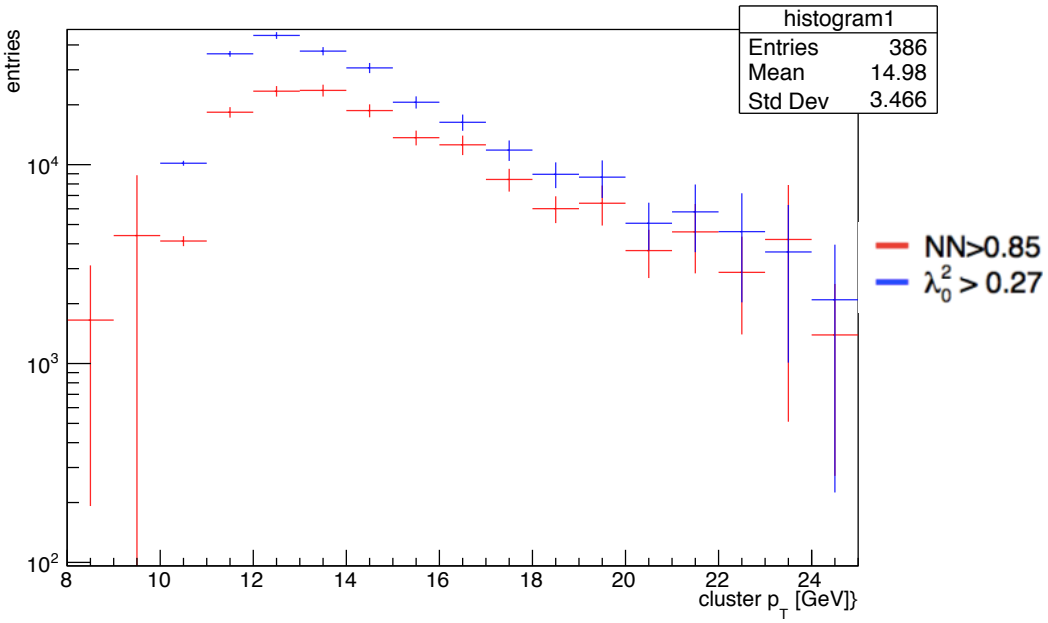


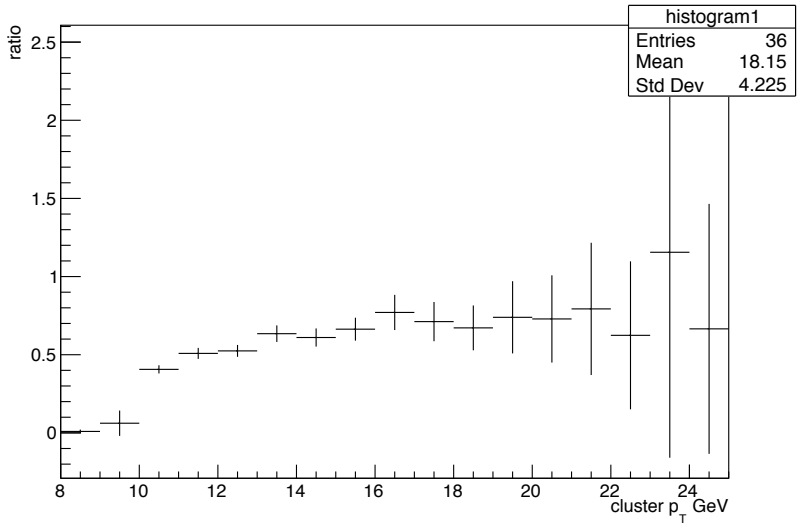
Purity and Efficiency



- In general, the purities seem to be within error of each other, except at 10 GeV < $pT_{cluster}$ < 13 GeV, where NN purity is higher It is important to note that at $pT_{cluster}$ less than 10 or greater than 20 GeV, the error bars become excessively large.
- Miguel's code failed to produce results for the efficiency

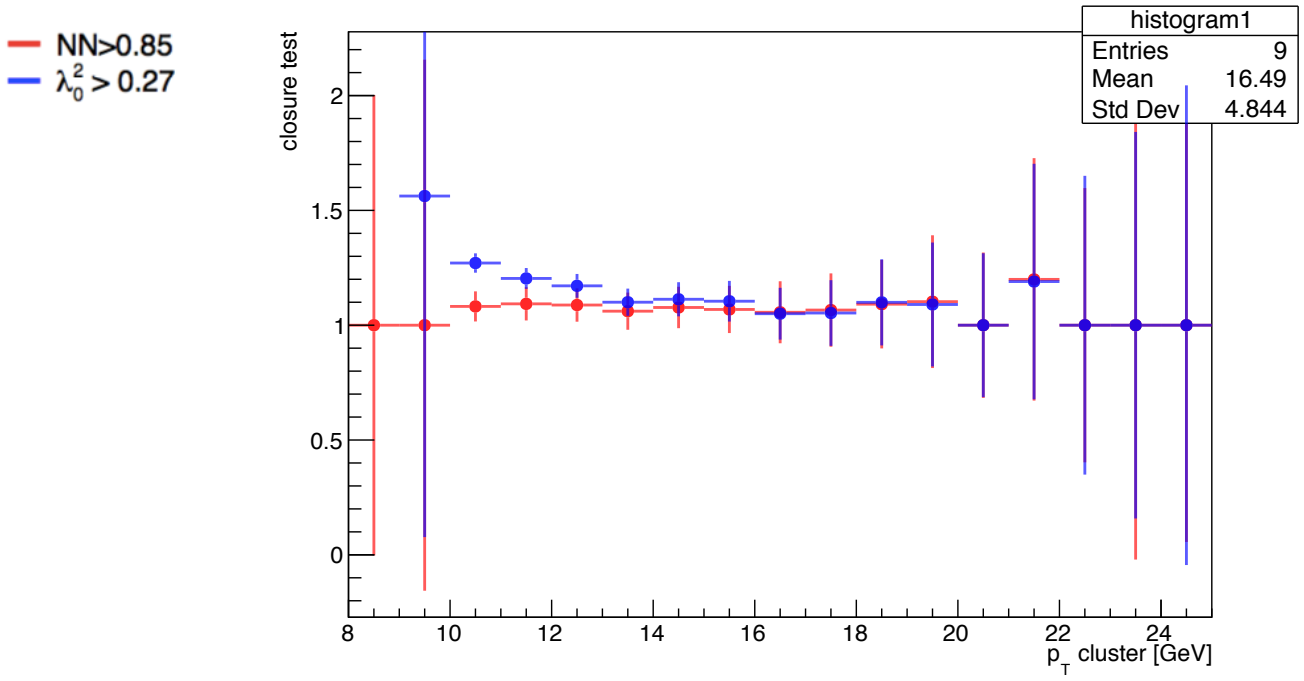
Purity-and-efficiency corrected spectrum and ratios





- No agreement, except where the error bars are far too large

Closure Test



Clusv1 Comparison

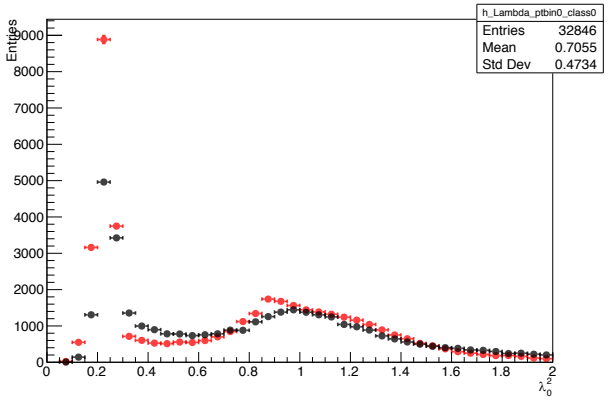
MC Normalized in NN > 0.85 and λ_0^2 > 0.27

10 GeV <$pT_{cluster}$ < 12 GeV

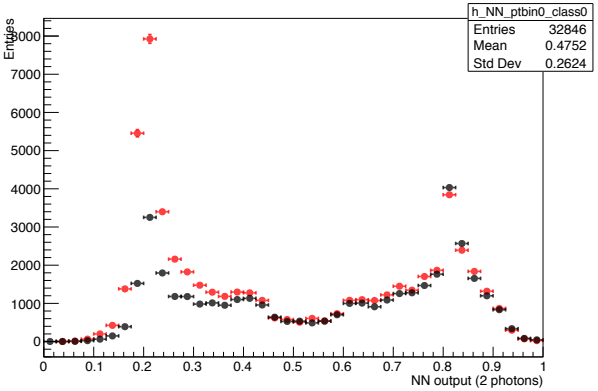
Legend

- Data
- MC

Lambda



NN



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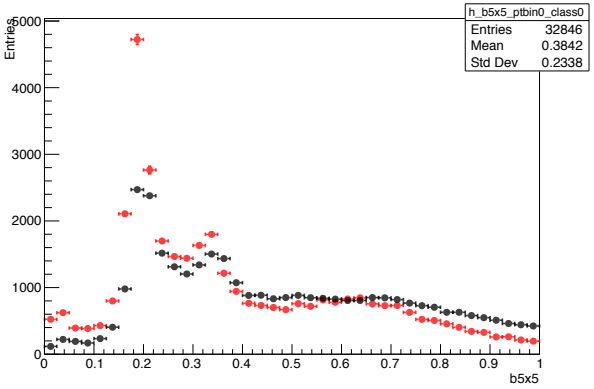
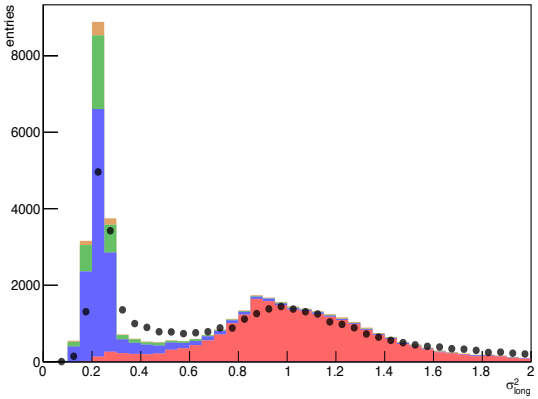
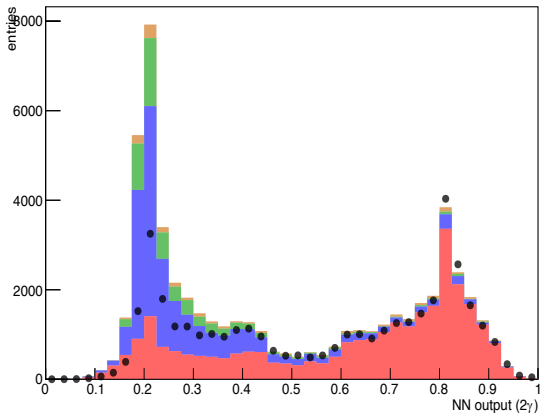
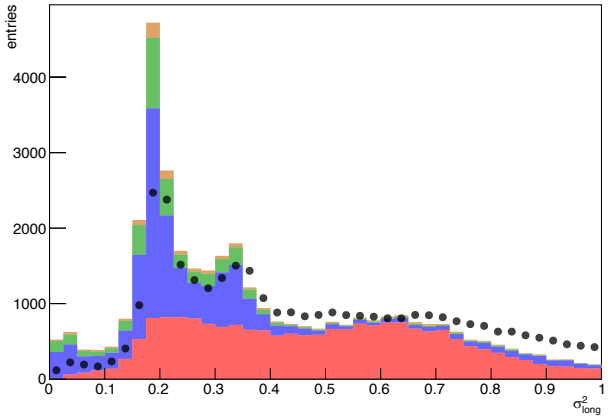


Legend

- data, pPb
- π^0 2 showers
- π^0 1 shower
- η BKG
- Other BKG







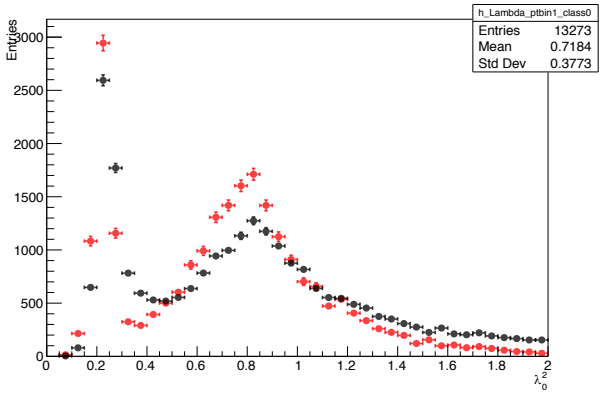
MC Normalized in NN > 0.85 and λ_0^2 > 0.27

12 GeV <$pT_{cluster}$ < 14 GeV

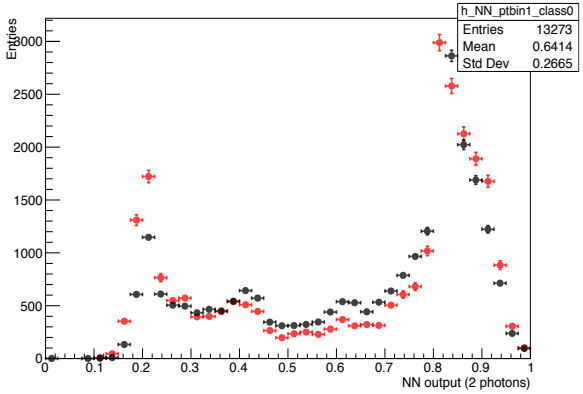
Legend

- Data
- MC

Lambda



NN



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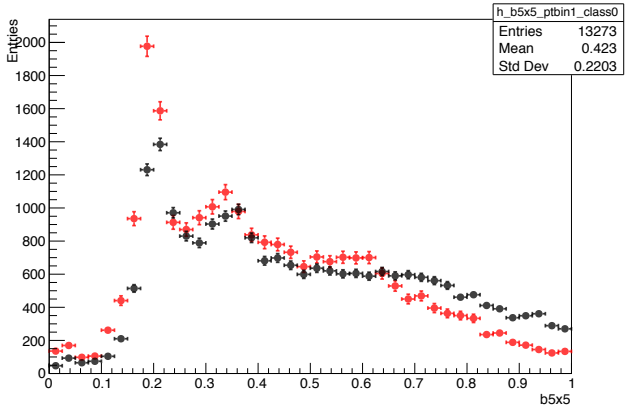

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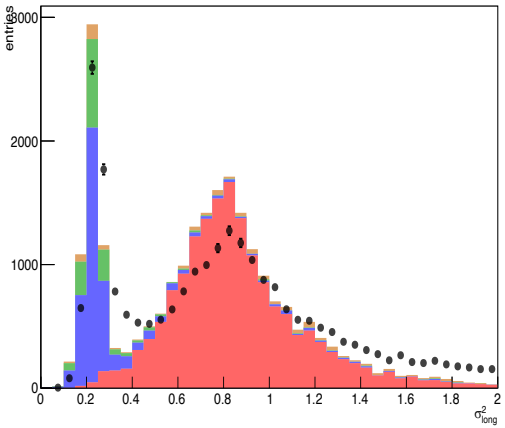
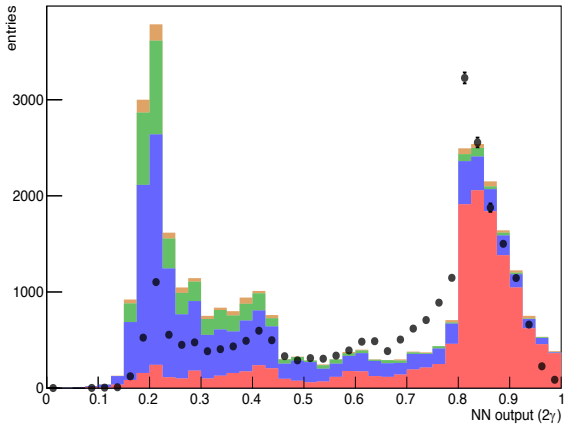
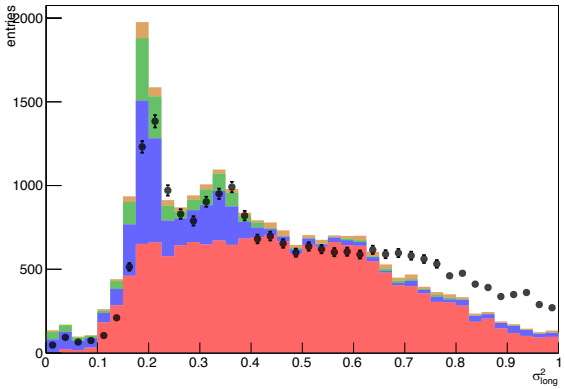






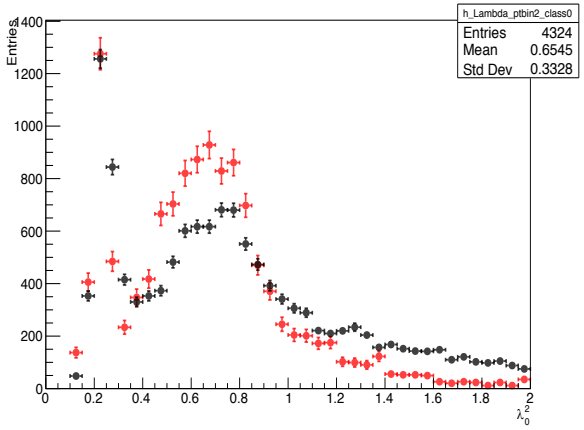
MC Normalized in NN > 0.85 and λ_0^2 > 0.27

14 GeV <$pT_{cluster}$ < 16 GeV

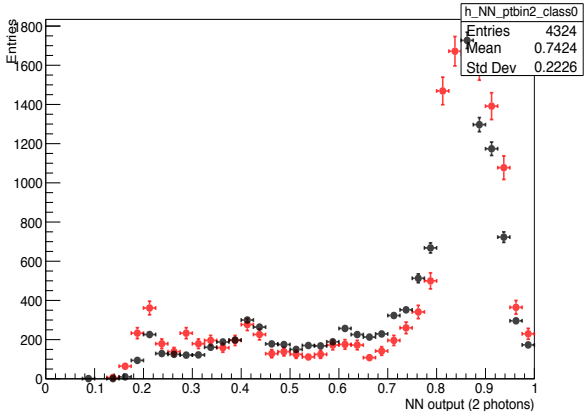
Legend

- Data
- MC

Lambda



NN



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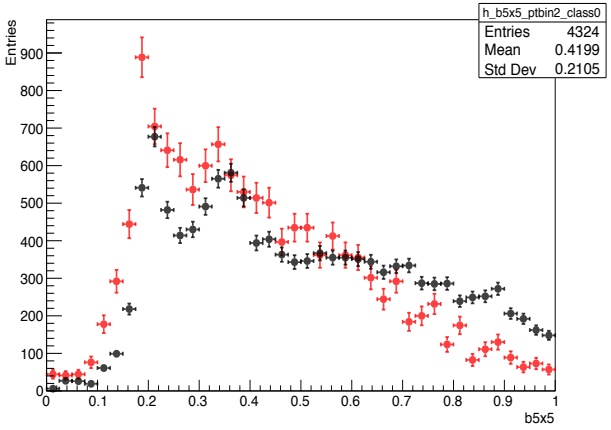

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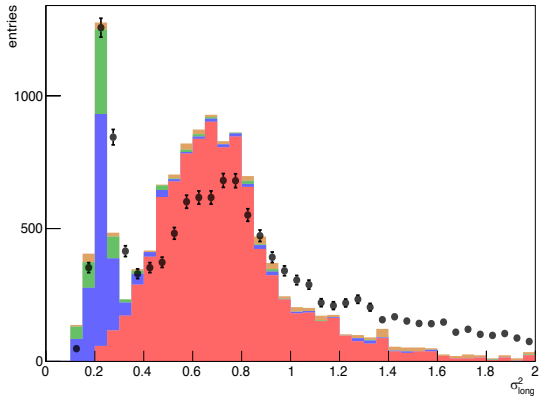
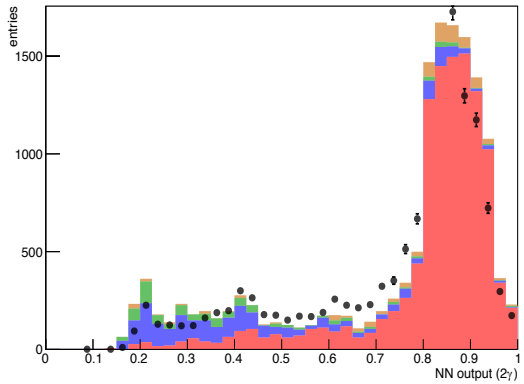
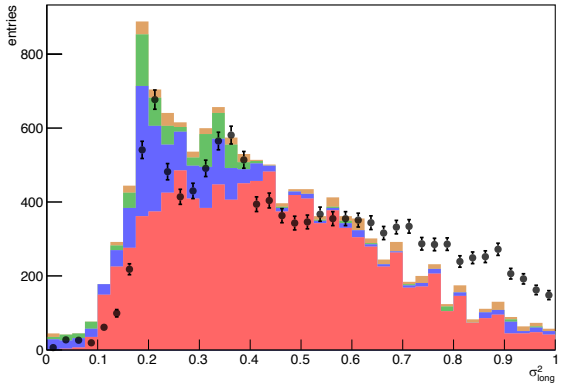






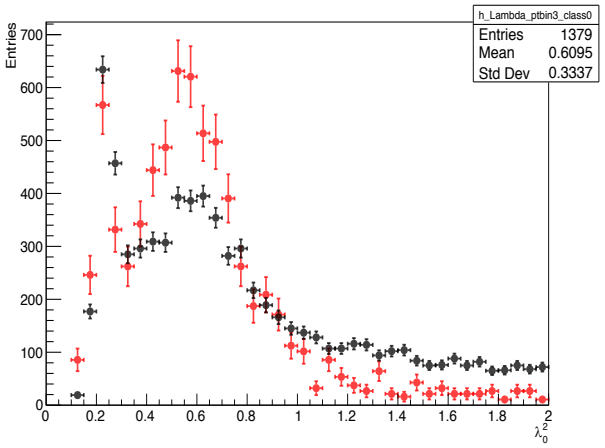
MC Normalized in NN > 0.85 and λ_0^2 > 0.27

16 GeV <$pT_{cluster}$ < 18 GeV

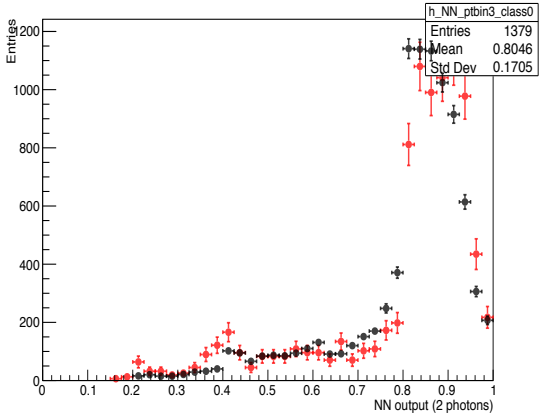
Legend

- Data
- MC

Lambda



NN



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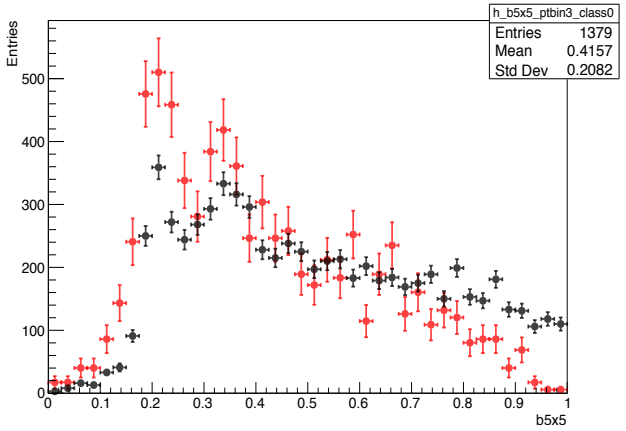

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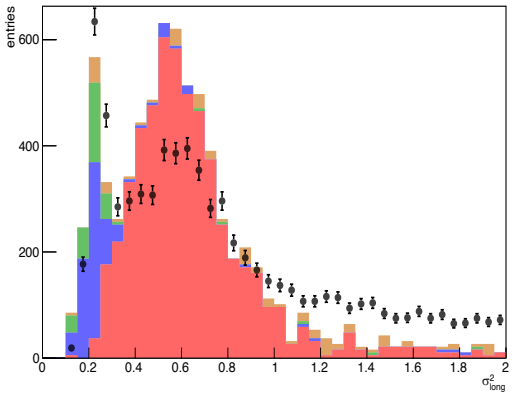
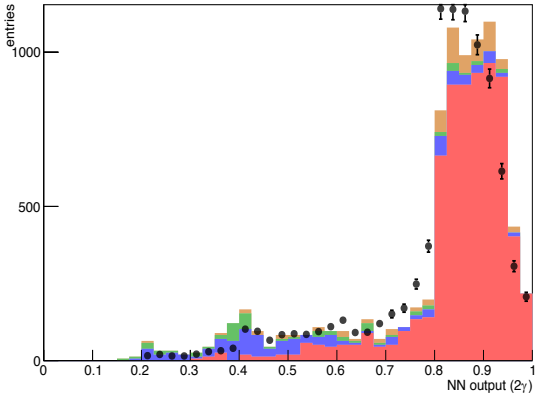
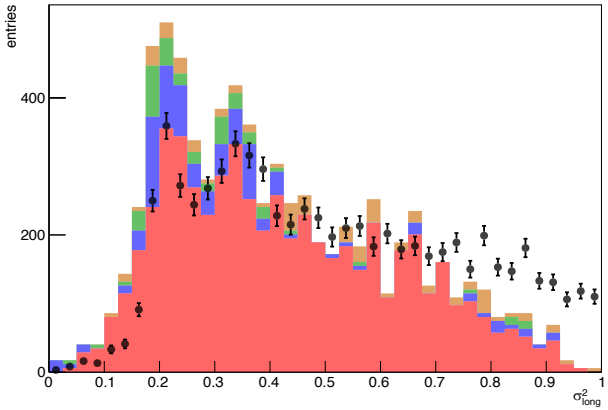
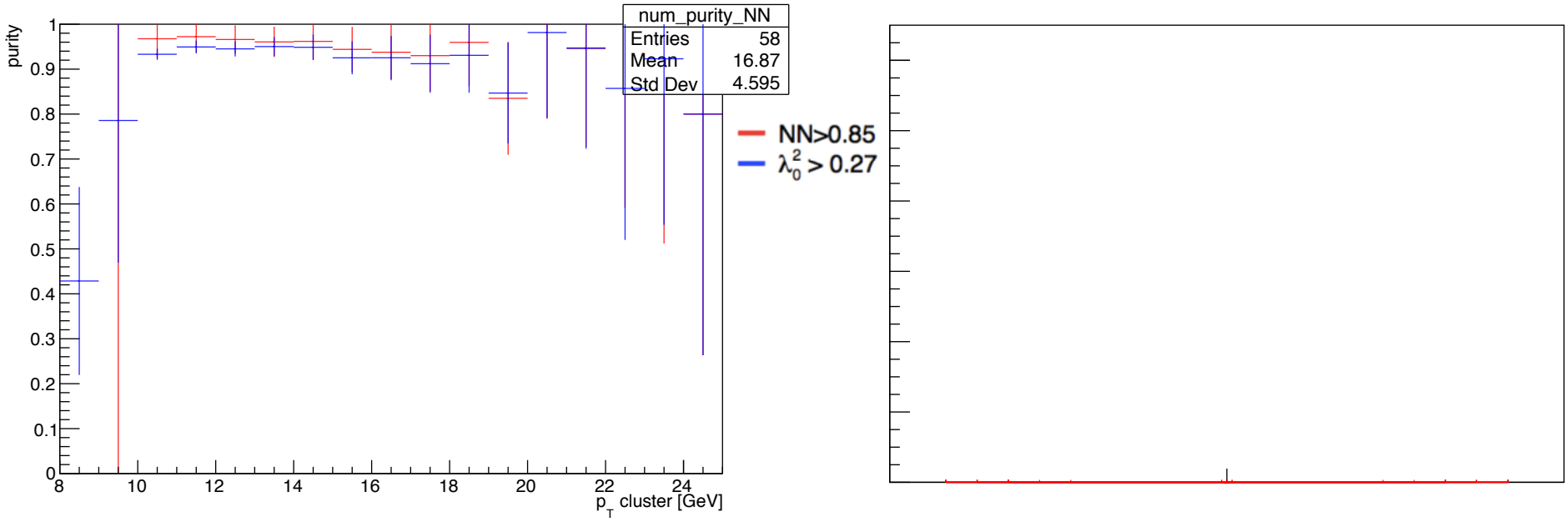




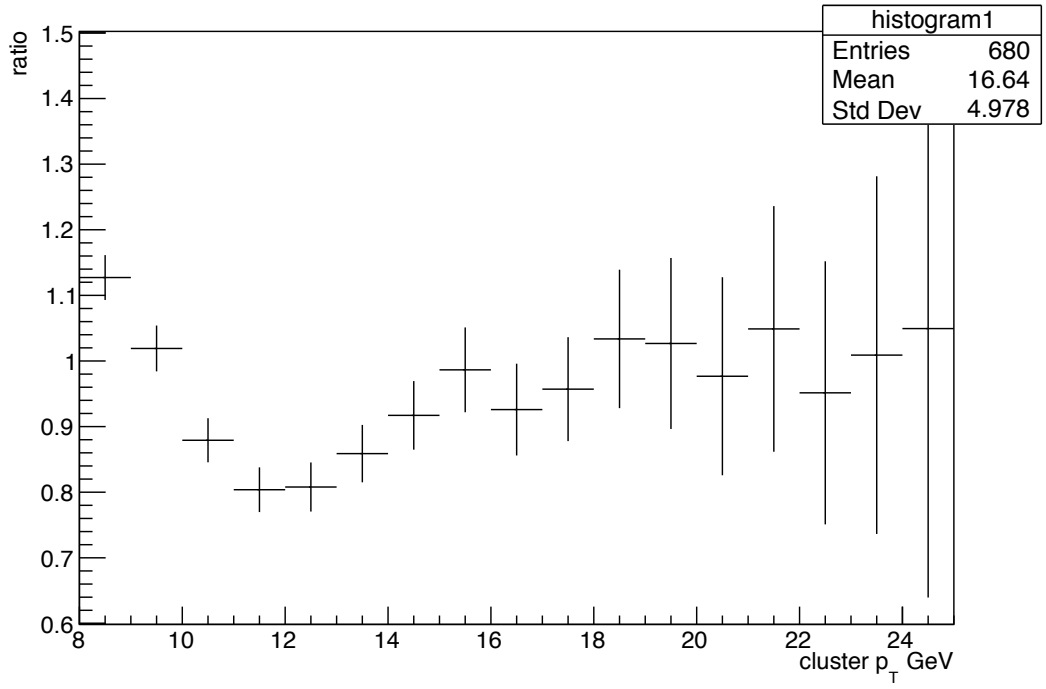


Purity and Efficiency



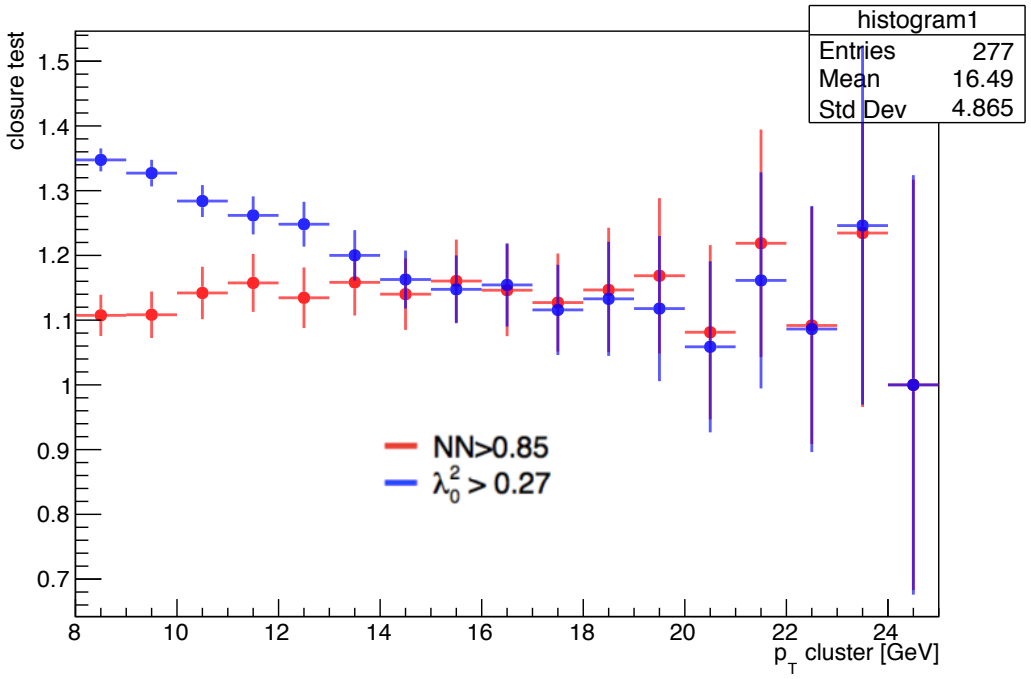
- In general, the purities are in agreement, though there is one cell where NN data is missing, at $pT_{cluster}$ near 8GeV and very high error bars at $pT_{cluster} > 22$ GeV and $pT_{cluster} < 10$ GeV
- Miguel's code failed to produce good results for the efficiency

Purity-and-efficiency corrected spectrum ratios



- Agreement at $pT_{cluster} \geq 15$ GeV

Closure Test



Conclusions

- Across the board, the NN produces more data-consistent MC readings than the lambda or the b5x5, though for cluster v2 the MC and data show significant differences even for NN
- b5x5 produces more data-consistent MC readings than lambda, and at low pTs, it sometimes rivals even NN
- For cluster v1, NN closure test is at around 15% from unity everywhere and lambda is at 15% for pT > 15 GeV and shoots up past 30% for lower pT; for cluster v2, NN closure is at around 10 % from unity everywhere, lambda at 15%
- For cluster v1, NN and lambda spectra match at pT > 15 GeV, while for cluster v2, they don't match anywhere
- For cluster v1, NN and lambda purities seem to match everywhere, but for cluster v2 this is not so for 10 GeV < pT <13 GeV