Argon Emulation in the Simulation of the ATLAS Transition Radiation Tracker

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Content

Leaking in the TRT straws

$\Downarrow$

Losing Xenon : Expensive ☹

$\Downarrow$

New Gas mixtures : Argon

$\Downarrow$

Simulated samples take time & disk space

Implementation
How ?

Implementation of Emulation

- **❶ Introduce new gas types in the ATLAS simulation framework**
- **❷ Mimic the HT response of the gas we wish to emulate (Argon)**
- **❸ Scale the TR absorption efficiency during the digitization by a TR efficiency reduction factor (TRERF)**
  The TRERF is determined by comparing the HT probability versus straw layer (SL) for the gases (Argon Vs Xenon)

ATLAS Simulation

- ❶ Event generation
- ❷Simulation
  - output format: HITS
- ❸ Digitization
  - calculation of detector response to particles
  - output format: RDO
- ❹ Reconstruction
- ❺ Derivation
  - Adding / removing objects & variables
  - output format: AOD, xAOD

Implementation
Tools

Production

Athena Release : 21.0.30
Package : TRT_Degitization
GitLab link : Link

Validation

AnalysisBase/21.2.5
Package : TRTEmulation
GitLab link : Link

Implementation
Status

Summary of produced samples

Barrel	End Cap A	End Cap B
0.09	0.28	0.28
0.10	0.28	0.28
0.11	0.28	0.28
0.12	0.28	0.28
0.12	0.28	0.25
0.12	0.28	0.31
0.13	0.28	0.28
0.14	0.28	0.28
0.15	0.28	0.28
0.16	0.28	0.28
0.18	0.28	0.28
0.20	0.28	0.28

$20 < < \mu > < 23$

Use Muon Momentum Cut < 50 GeV

Electron pT >10 GeV

Muon pT >10 GeV

Track pT >2.5 GeV

|eta|<2.0

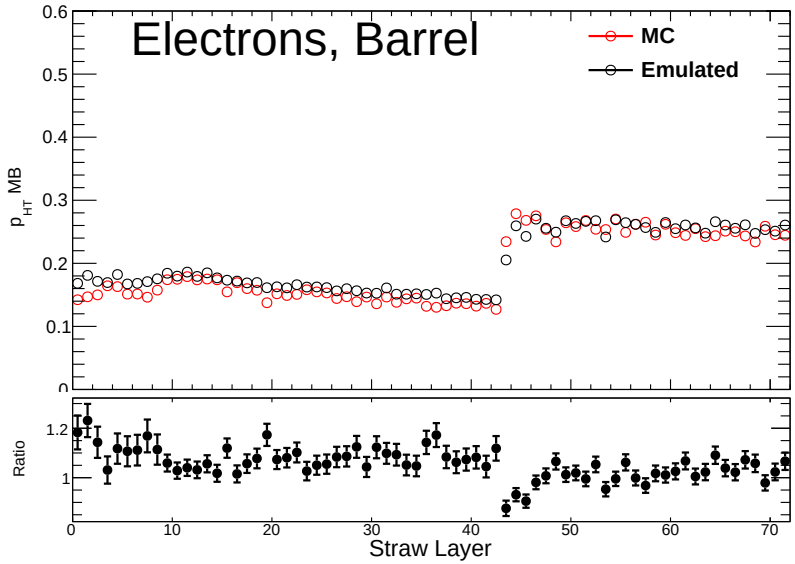
PixHits: 2

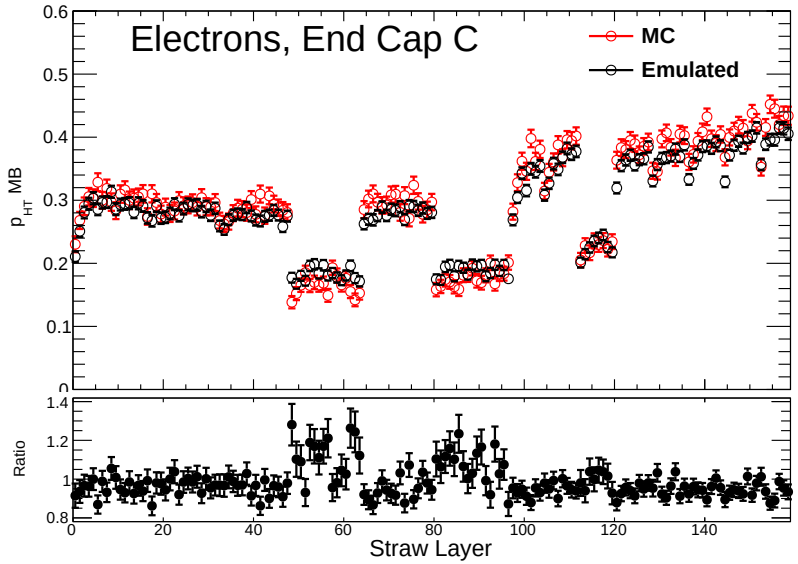
SiliconHits: 7

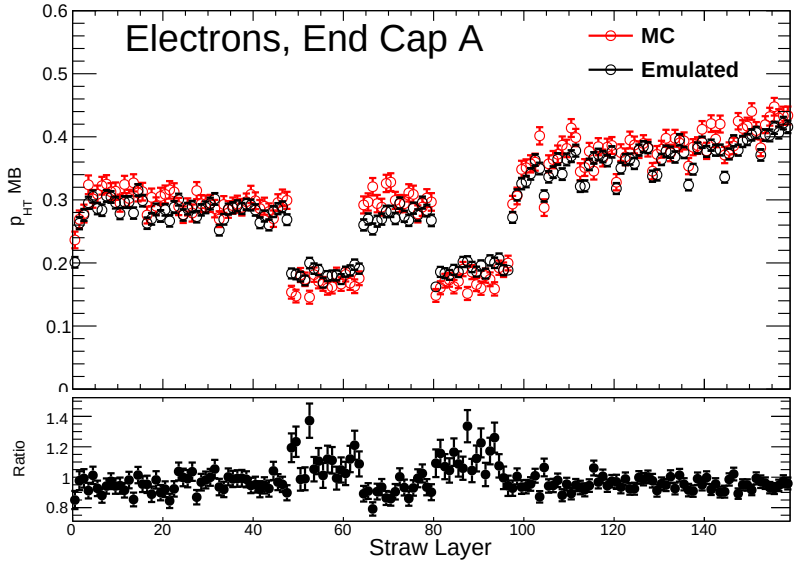
TRTHits: 15

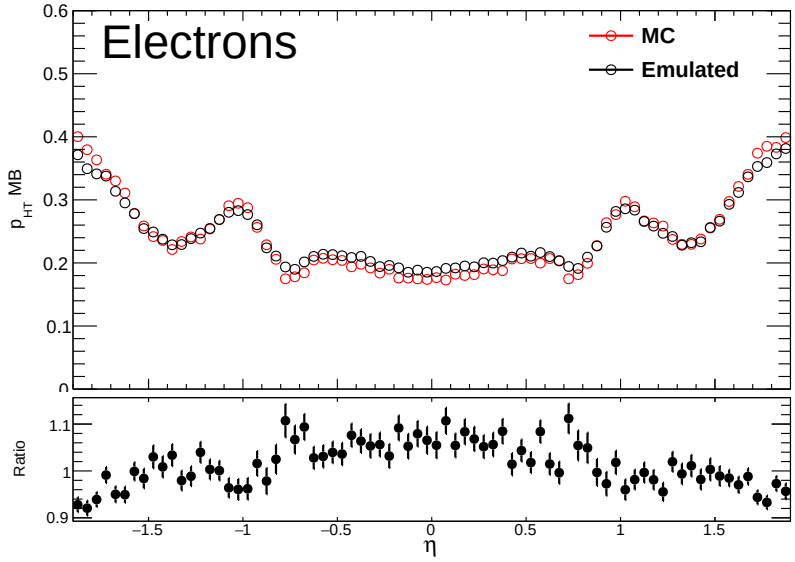
Results

Validation from pHTmb Vs SL and η









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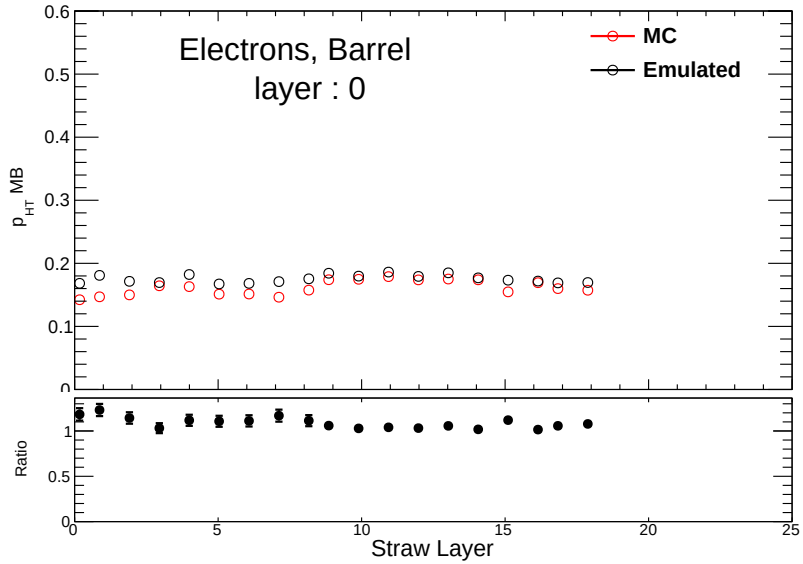

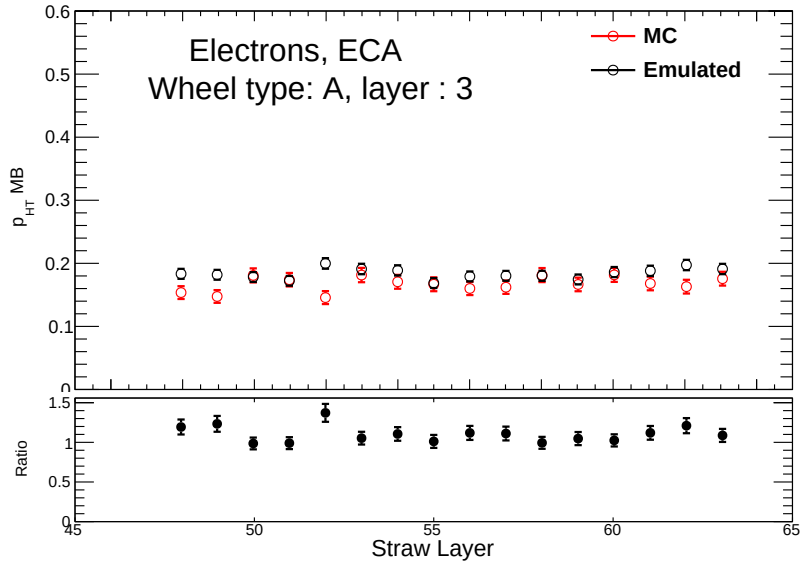

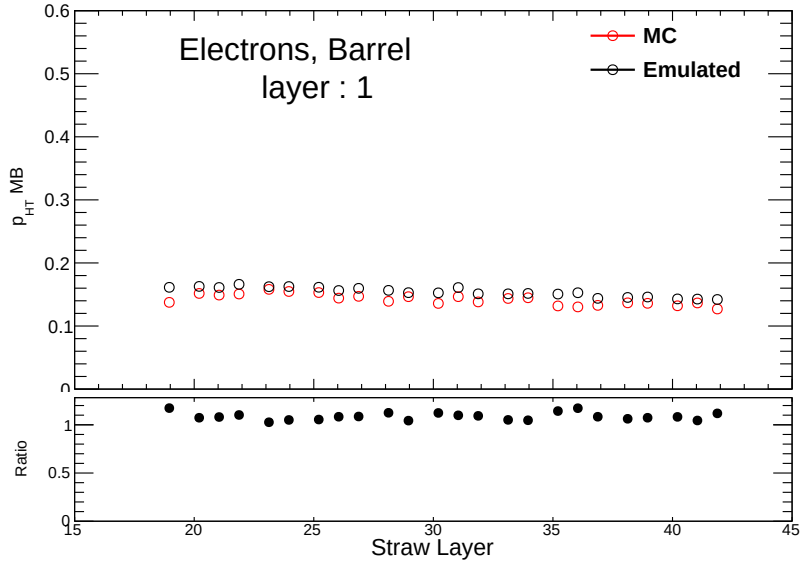

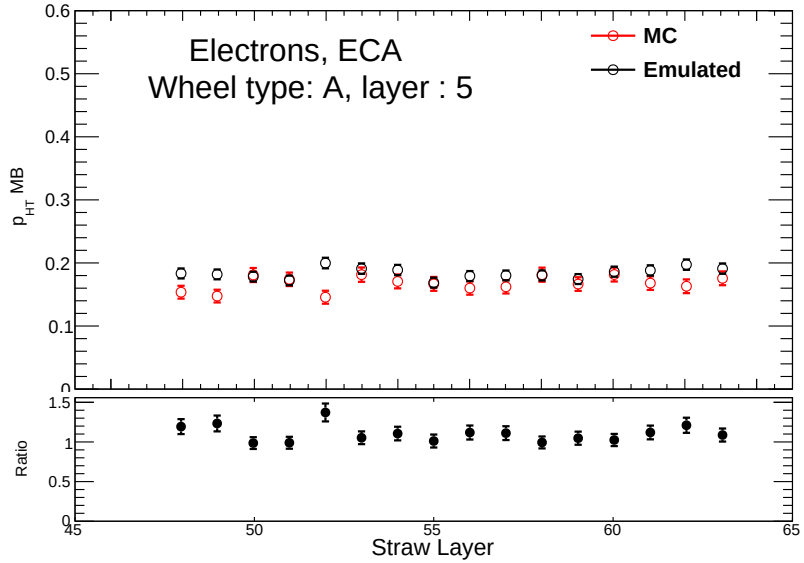

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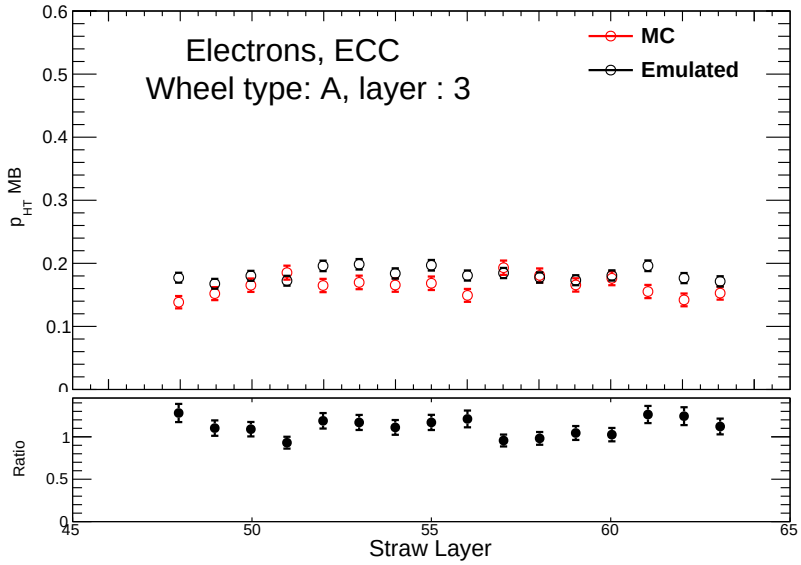

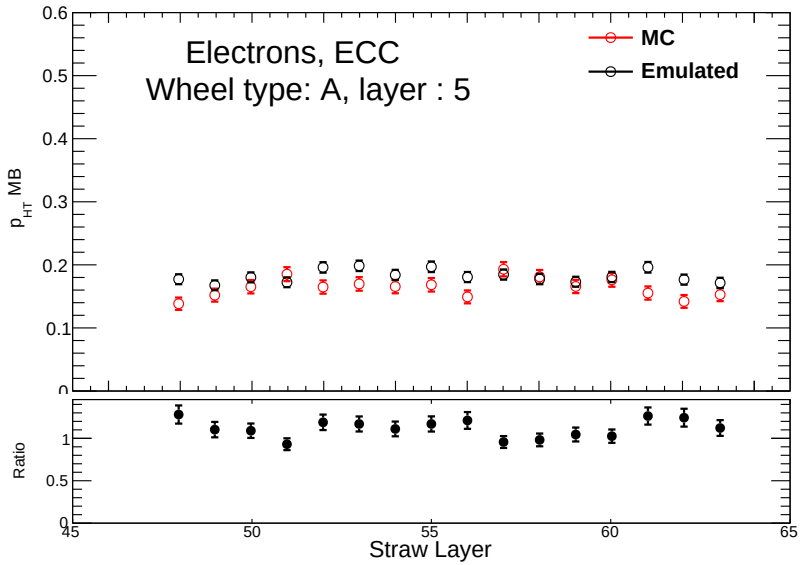

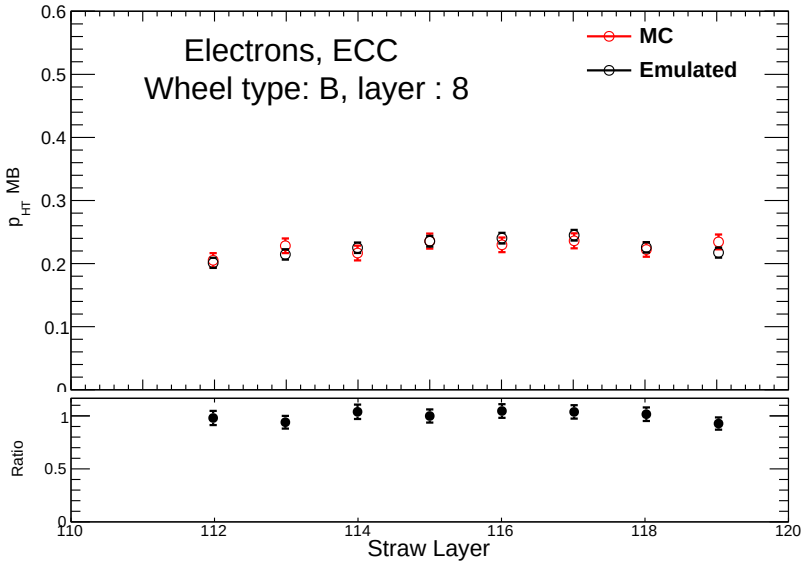

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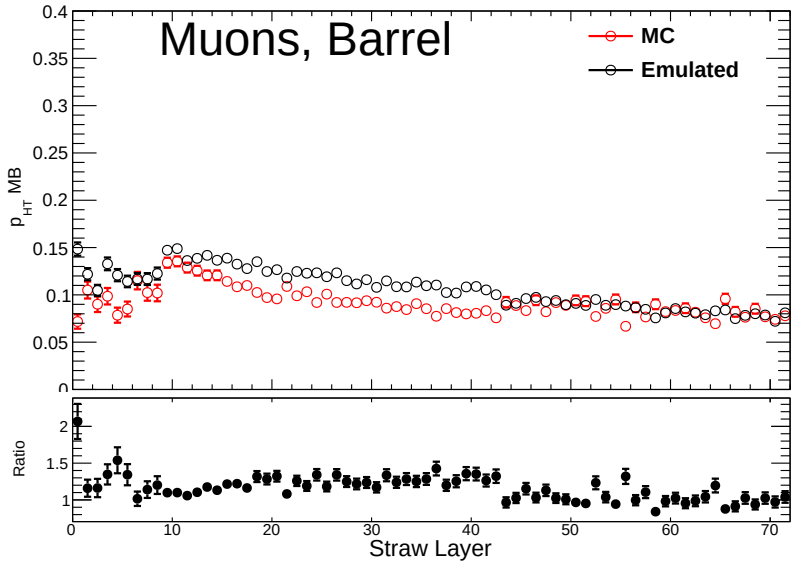

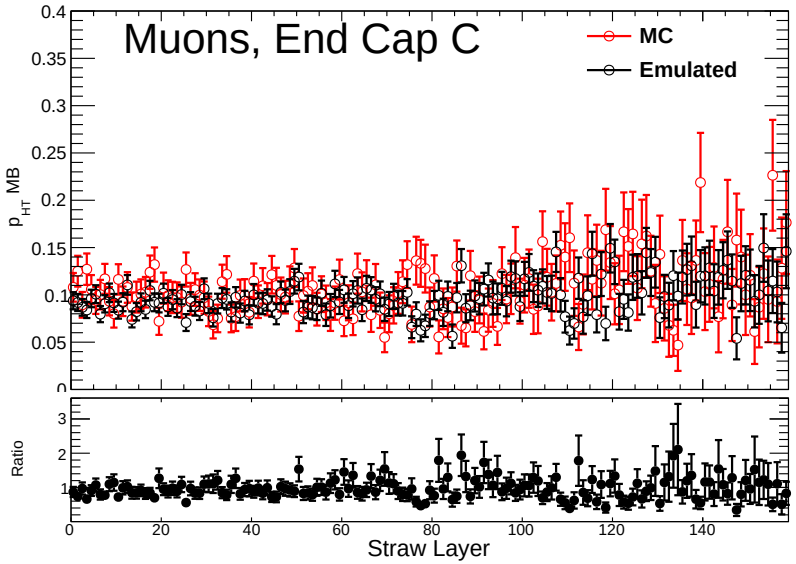

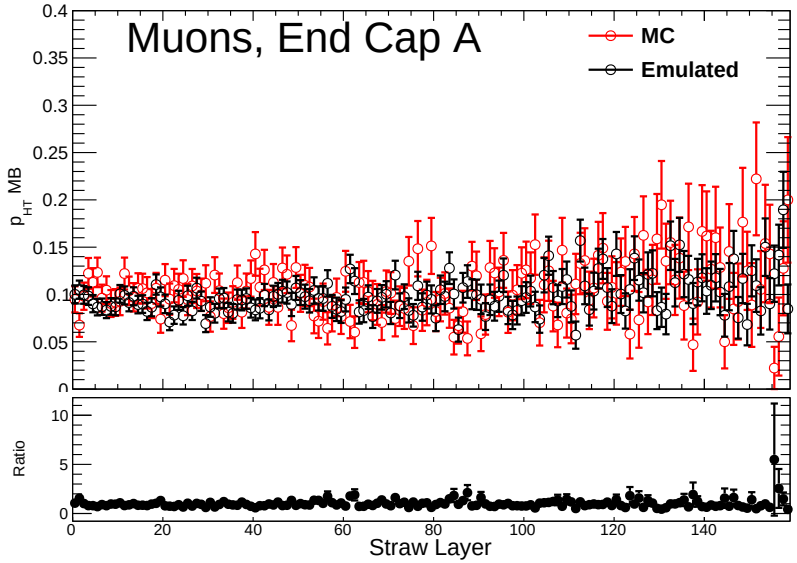

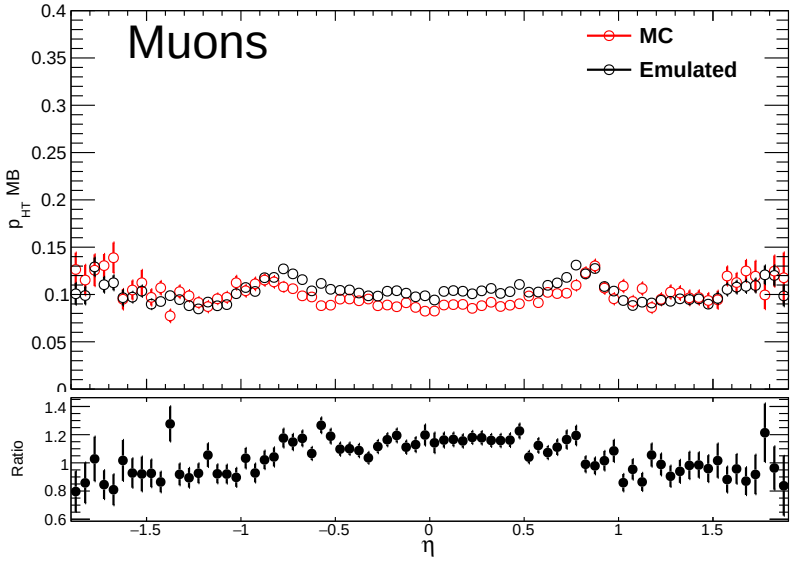

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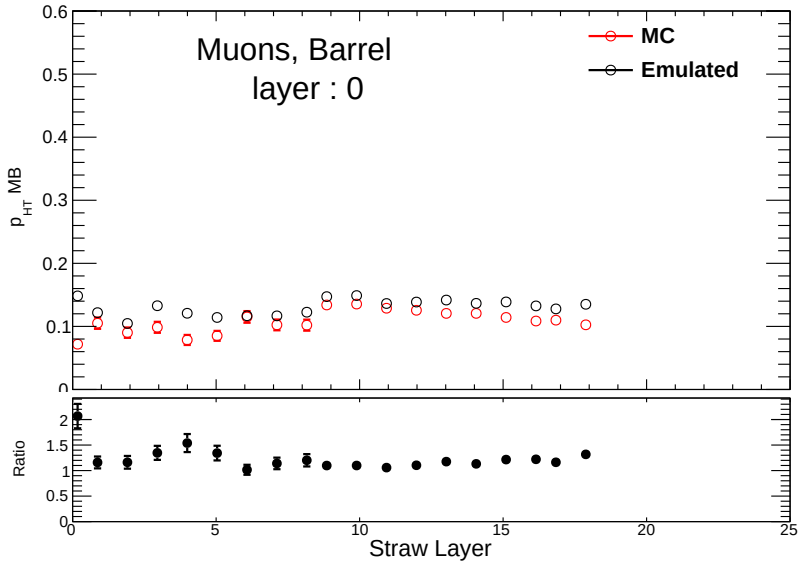

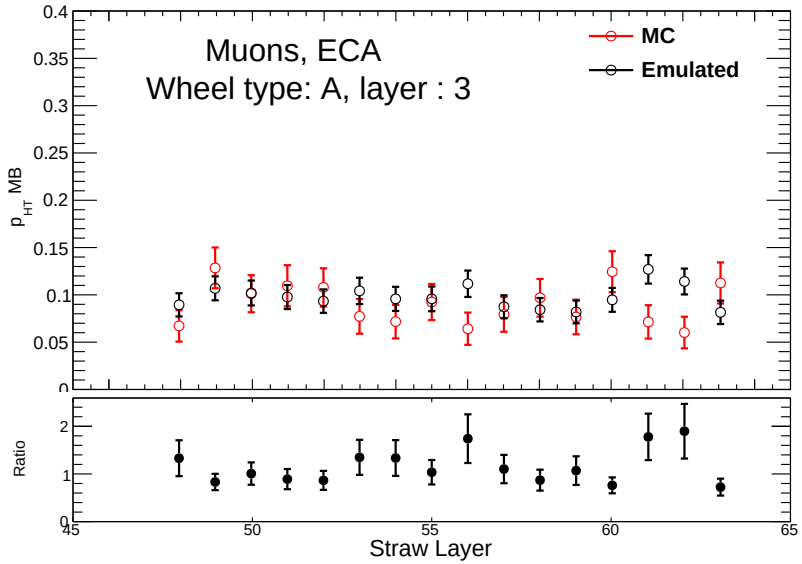

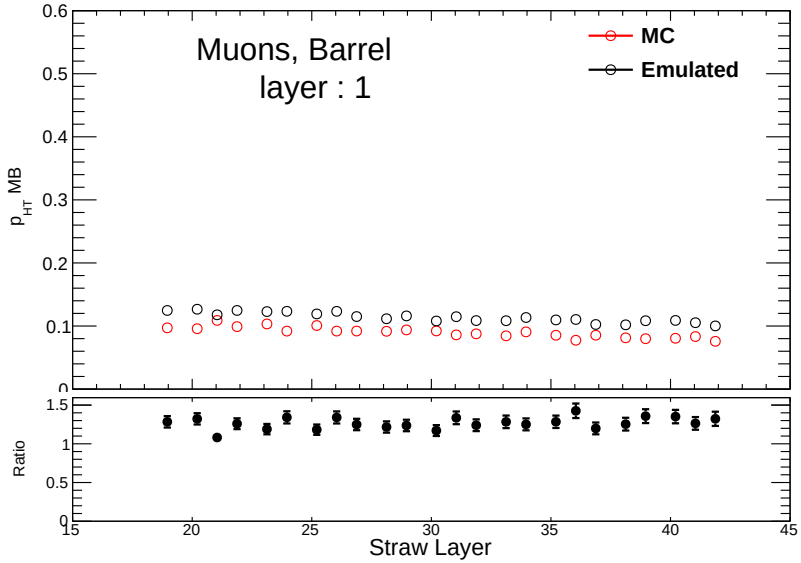

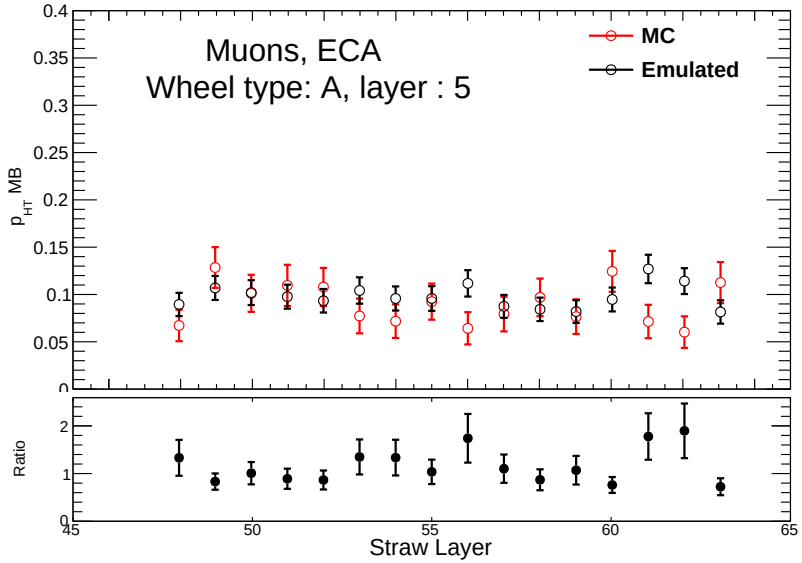

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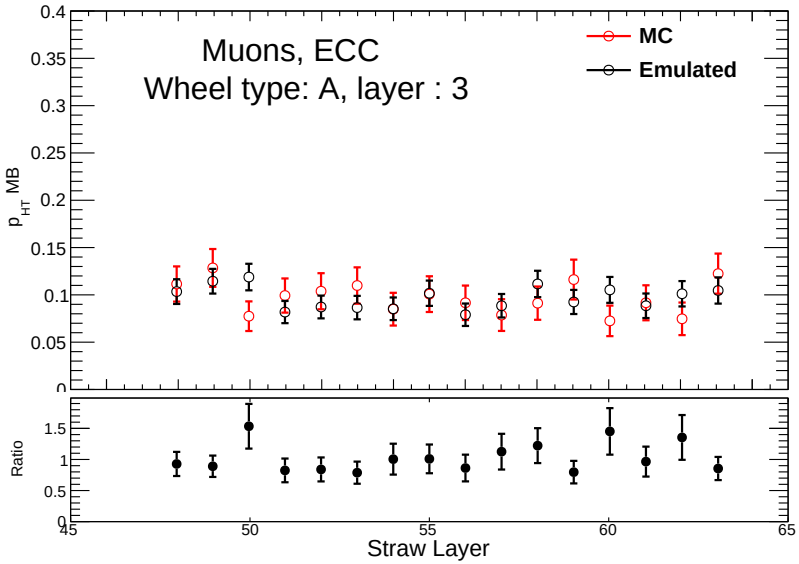
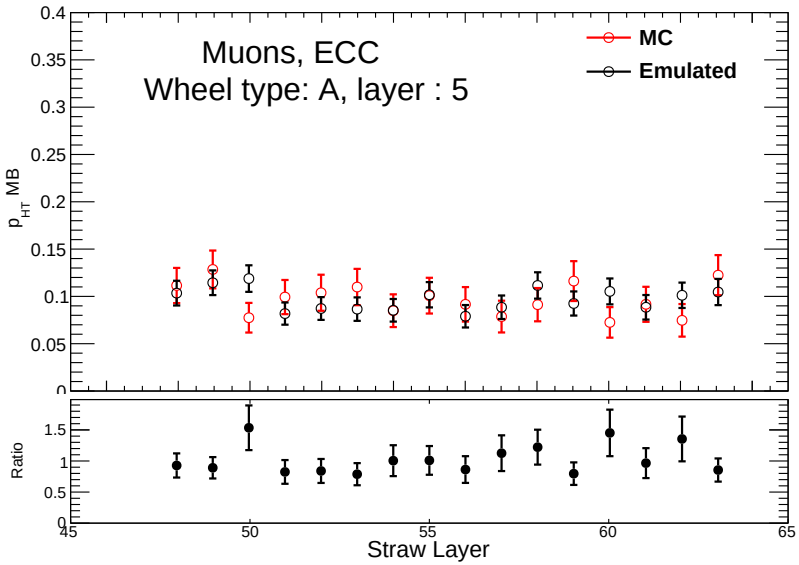
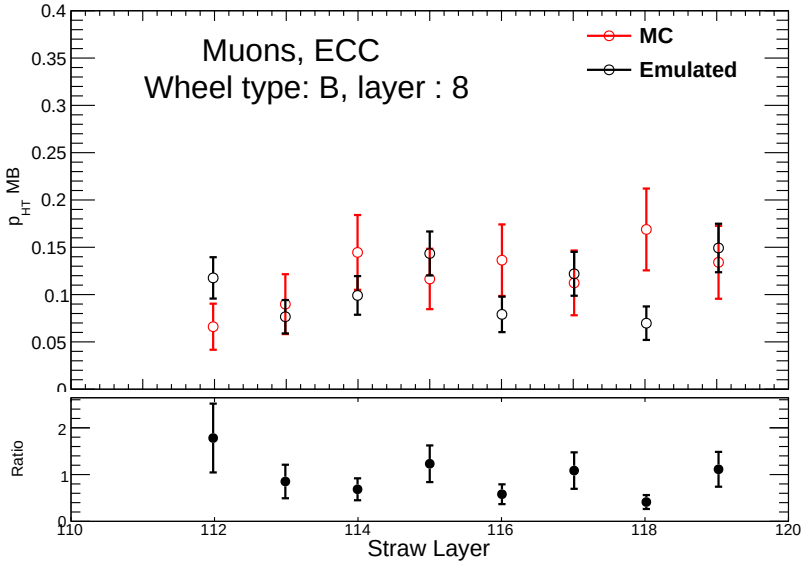
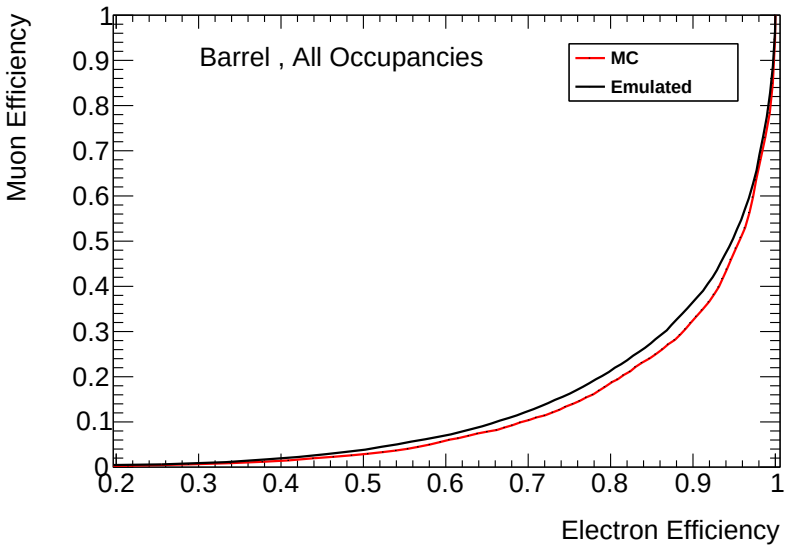


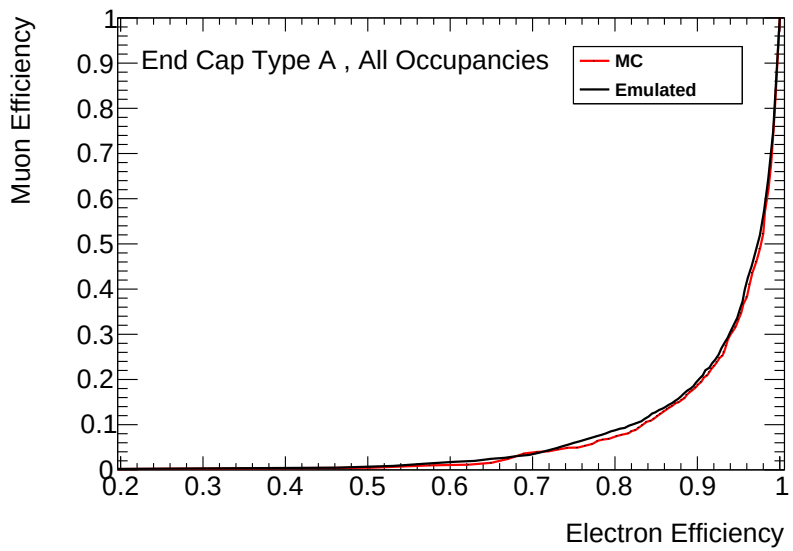


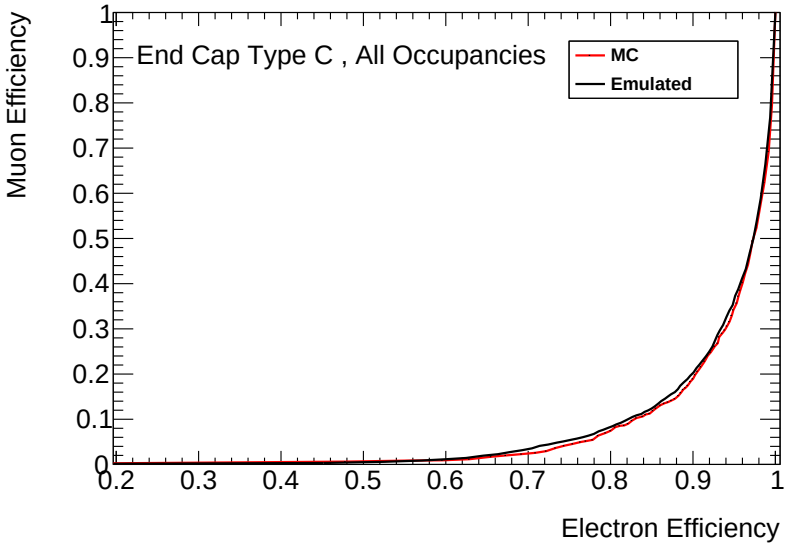


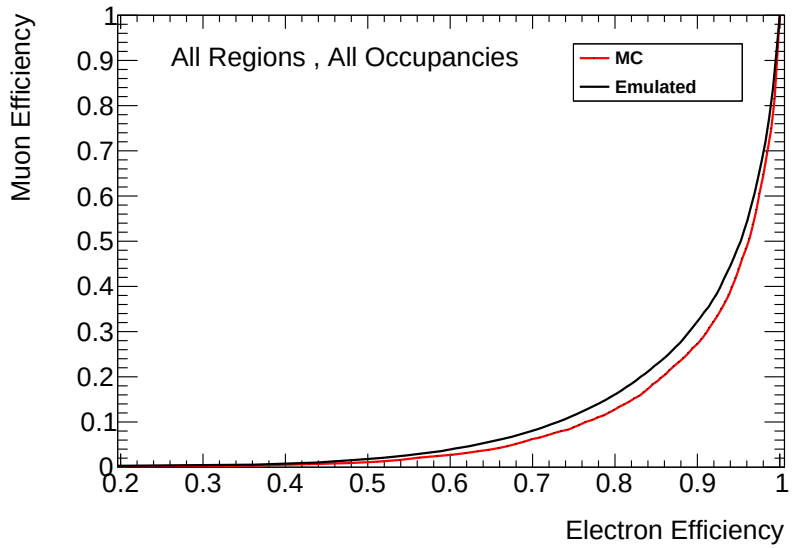
Results

Validation from Electron Probability (ROC Curves)










Thank you !