Muon Trigger Emulator

Ivan Mikulec
HEPHY Vienna

CMS trigger comissioning/emulator meeting
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Status of muon trigger emulators

- **RPC trigger emulator**
  - in CMSSW since 0.8.0
  - Depends on pattern files (since yesterday in cvs, go to 1.0.0)
- **CSC TPG emulator**
  - in CMSSW since 0.9.0
  - Default tunable parameters in a .cfi file
- **CSC TF emulator**
  - in CMSSW since 0.8.0
  - .cfi available with default params, can also read LUTs
- **DT TPG emulator**
  - in cvs, appears in 1.0.0
- **DT TF emulator**
  - in cvs but not tagged yet
  - Depends on LUTs (in cvs), path defined by env. var.

Status of the GMT emulator

- **Practically complete** (need to finalize MIP/ISO-bit data format from GCT, database…)
- **Since few days in the nightly** (in cvs since few months)**, scheduled for 1.1.0**
- **New features:**
  - **LUT generation implemented and tested**
  - **MessageLogger outputs implemented**
  - **Root tree producer (root tree similar to that in orca)**
  - **Some fixes at the inputs to adapt to particularities of regional trigger outputs**
- **All tunable parameters are specified in a .cfi file with their default values**

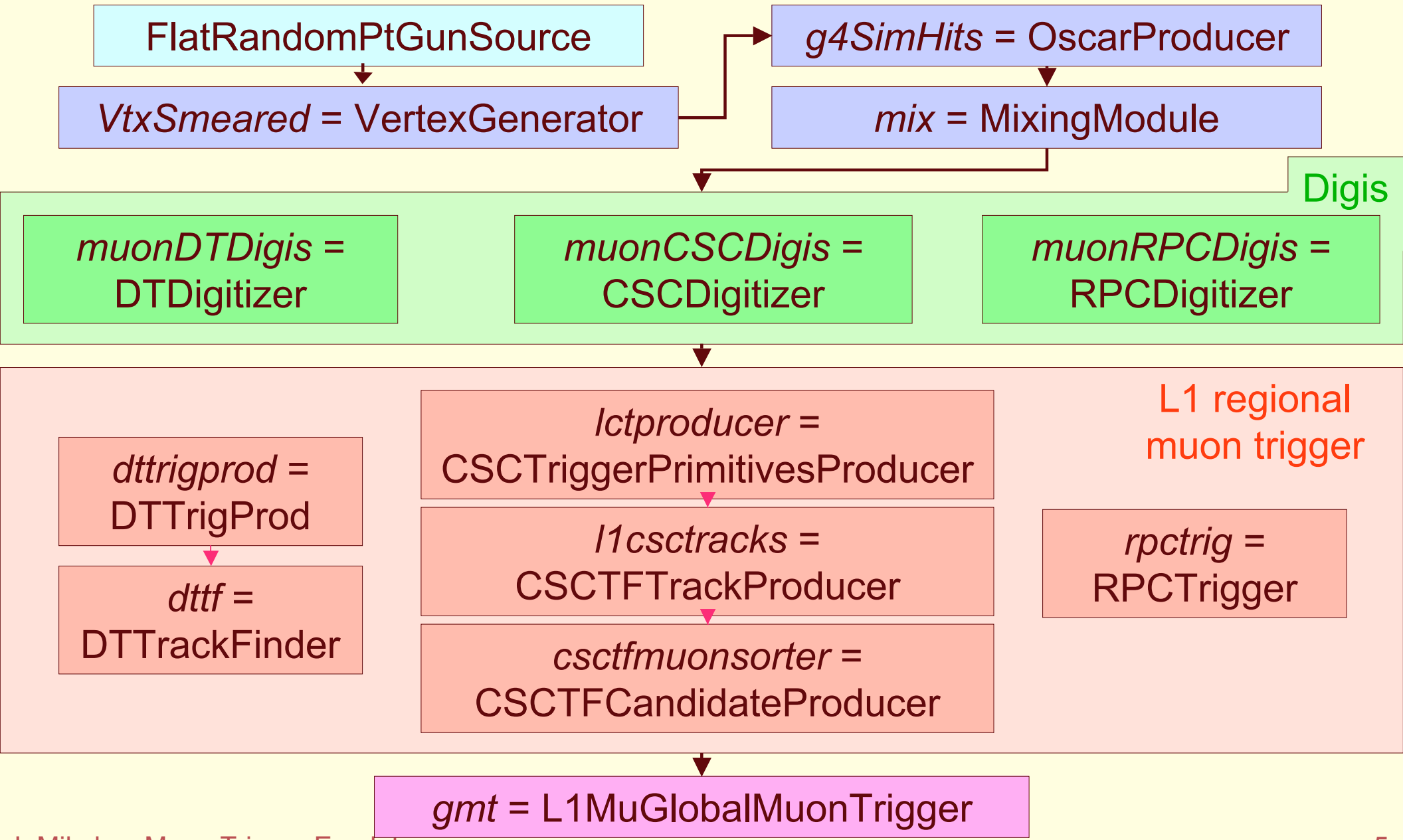
Test with the complete muon L1 emulator

- **Use CMSSW 0.9.1.**
- **Add compiled DTTrigger, DTTF and GMT emulators** (not in 0.9.1 taken from latest cvs)**.**
- **Generate 100k single muons with p_T=2-100GeV and run the complete path from source to GMT.**

First Problems:

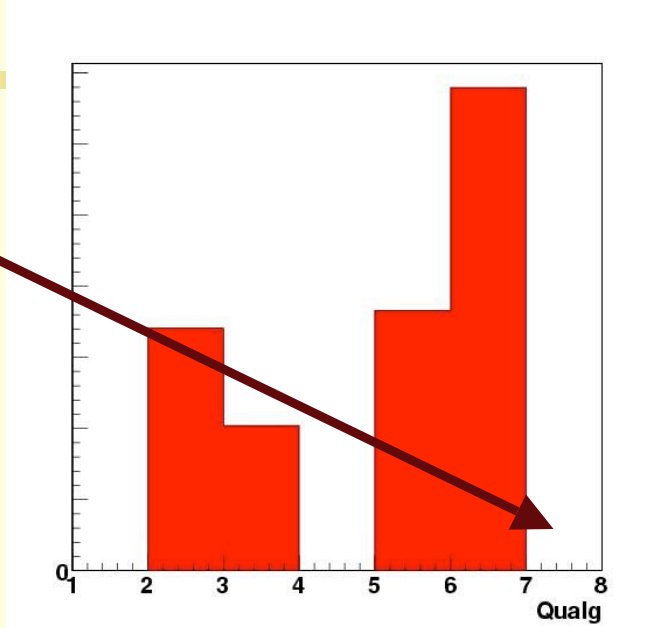
- **In order to get triggers from DT it was necessary to modify the default TOF offset in the DTDigitizer parameters** (promised to fix this soon)
- **A few details had to be adjusted at the GMT inputs to accept properly the incoming data** (bx number, instance name, empty candidates)**.**

Scheme of the CMSSW path from source to GMT

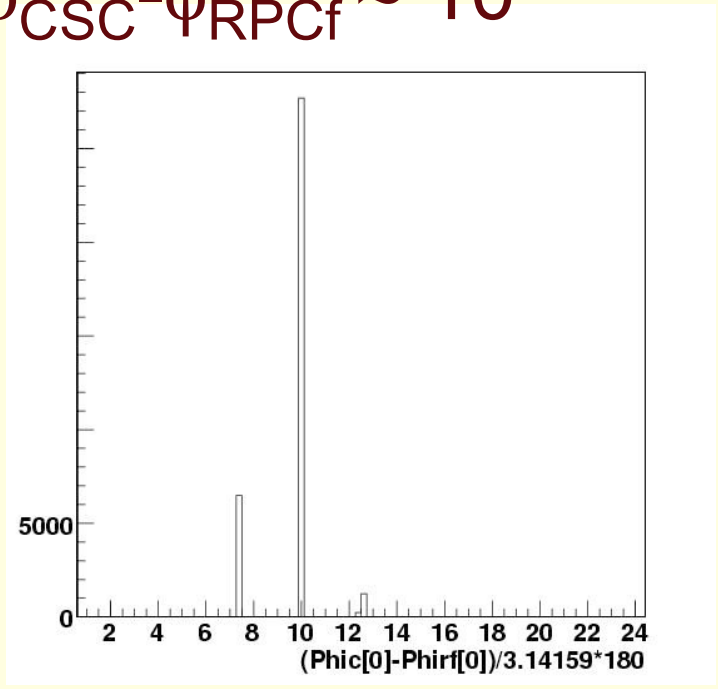


Phi adjustment

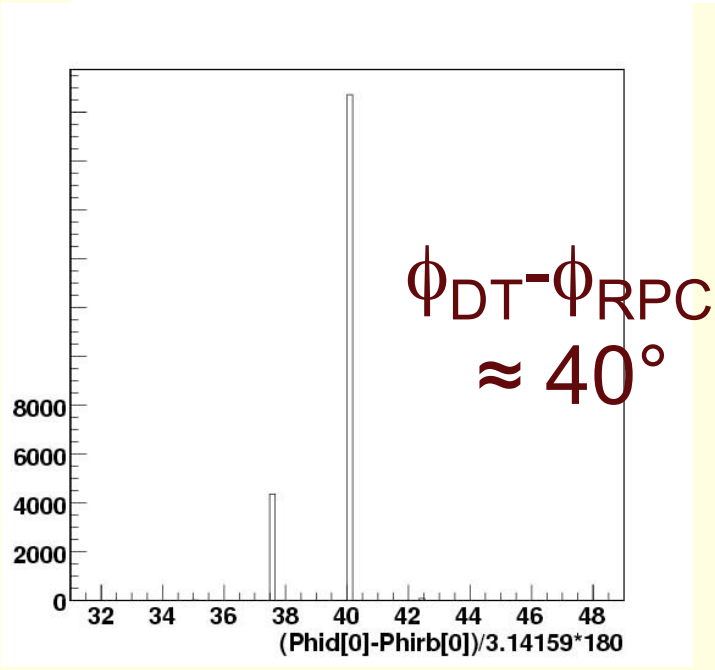
- **Next problem: GMT never produces quality=7 candidates**
(q=7 means DT/CSC candidates confirmed by RPC)



$\phi_{CSC}-\phi_{RPCf} \approx 10°$



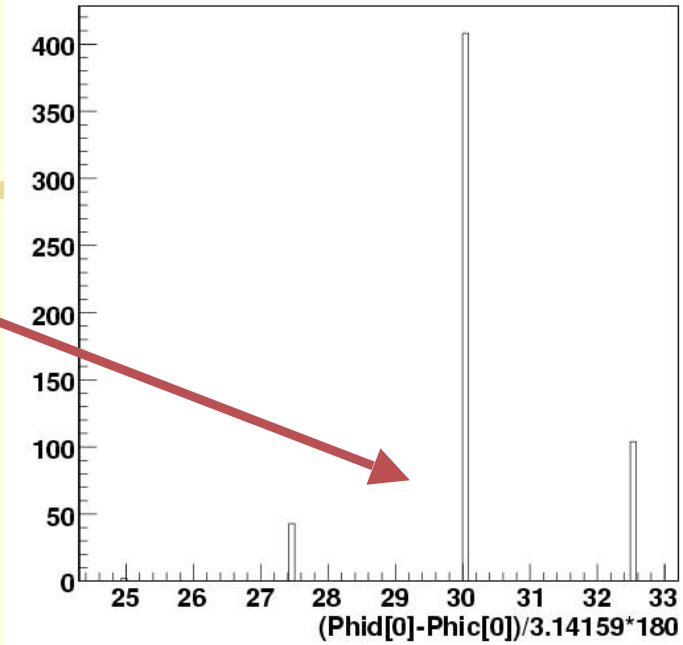
- **The reason is a mismatch in the phi coordinate**



$\phi_{DT}-\phi_{RPCb} \approx 40°$

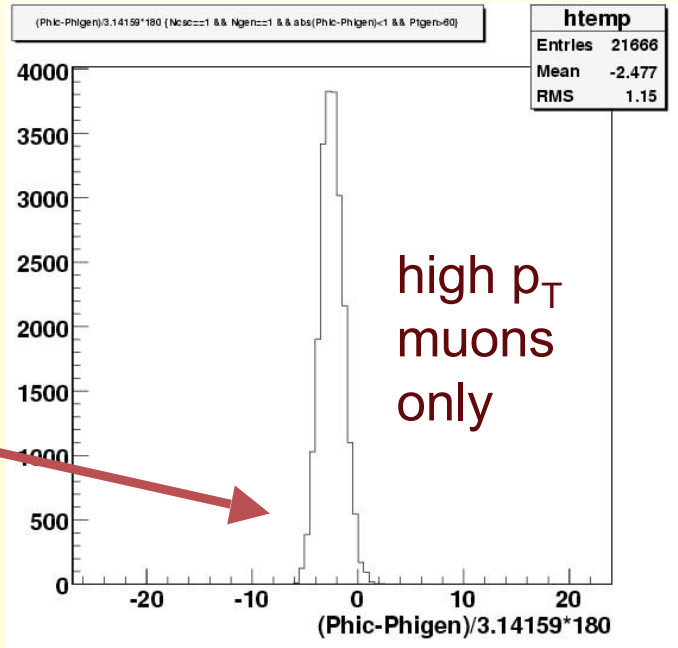
Phi adjustment

- **But also:** ϕ_{DT}-$\phi_{CSC} \approx 30°$

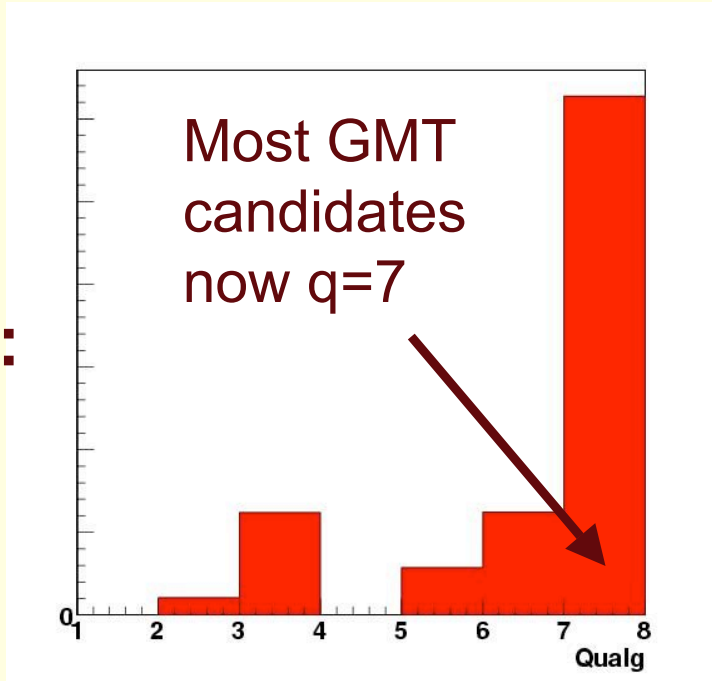


- **Closest to generated ϕ is CSC:**

ϕ_{CSC}-ϕ_{gen} ≈ -2.5°

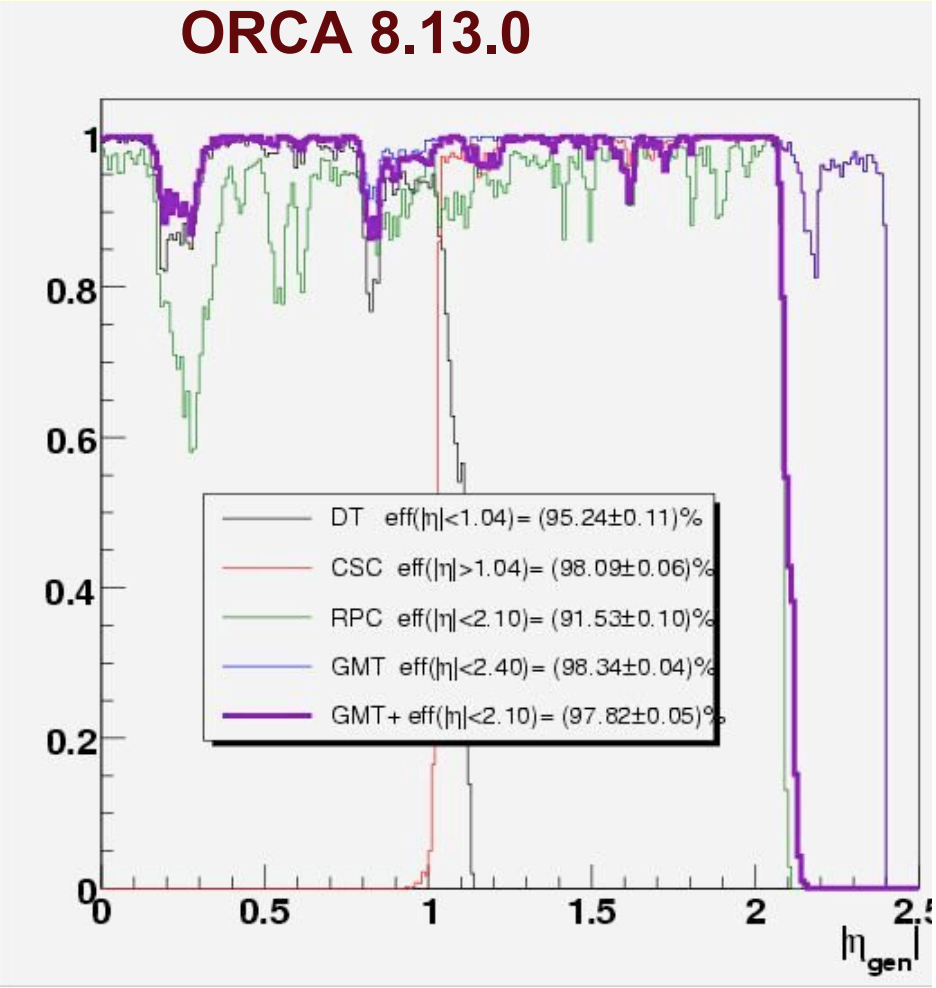


- **Temporary adjustments at GMT input:**
  - ϕ_{RPC} increased by 4 units (10°)
  - ϕ_{DT} decreased by 12 units (30°)

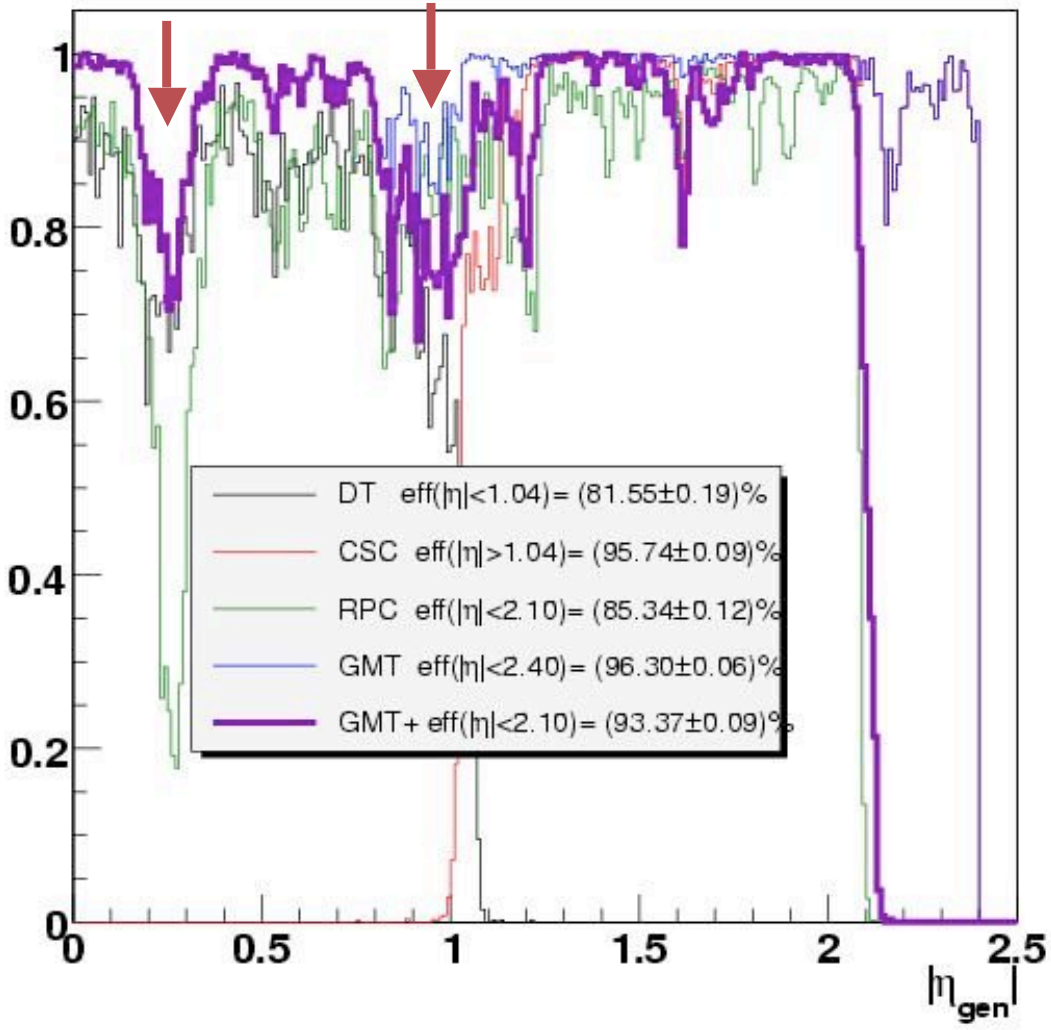


Efficiency vs. pseudorapidity

ORCA 8.13.0



CMSSW 0.9.1+

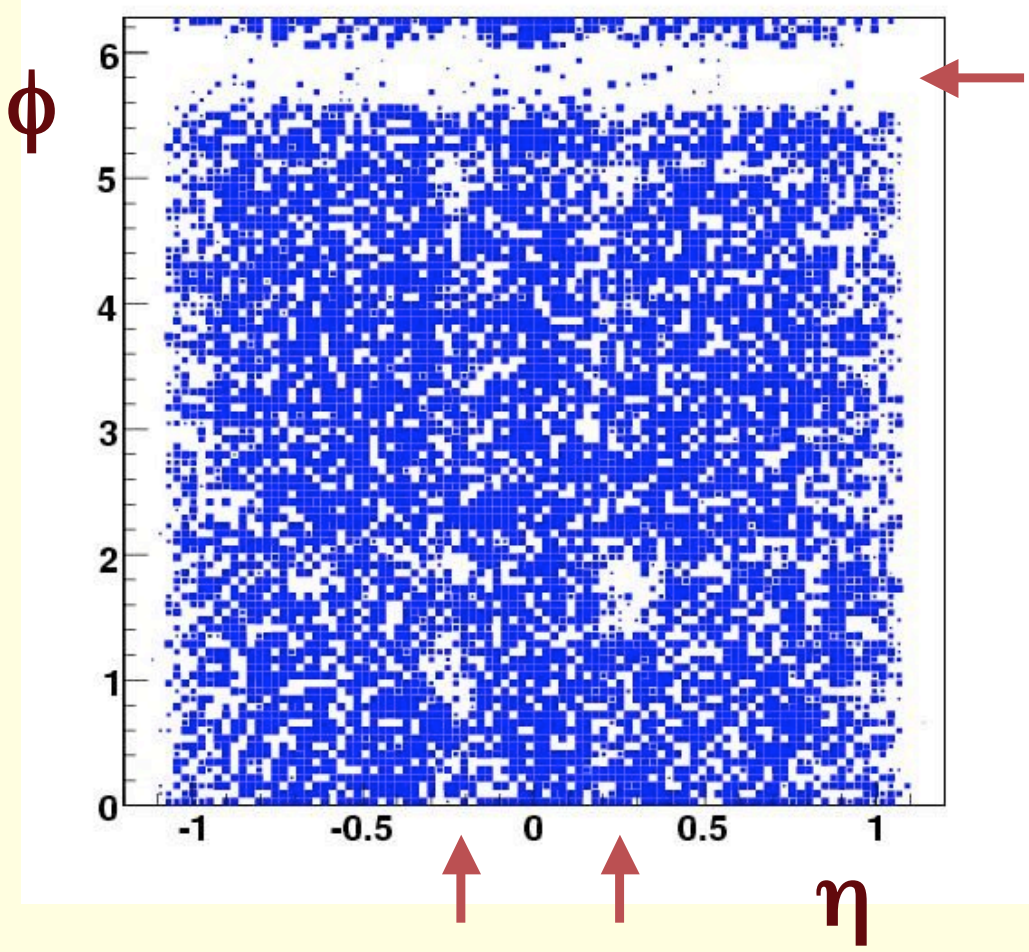


Larger inefficiencies in the central wheel crack and barrel/endcap overlap

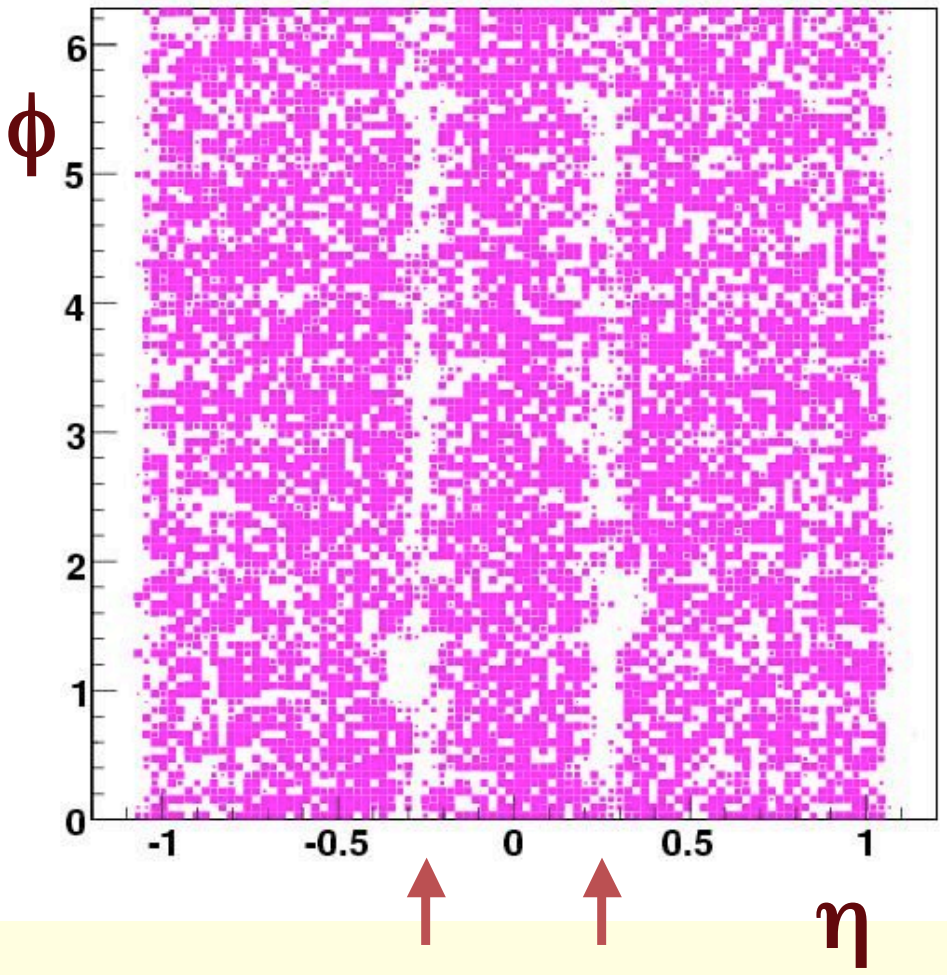
Barrel eff. vs eta and phi

CMSSW 0.9.1+

DTTF efficiency

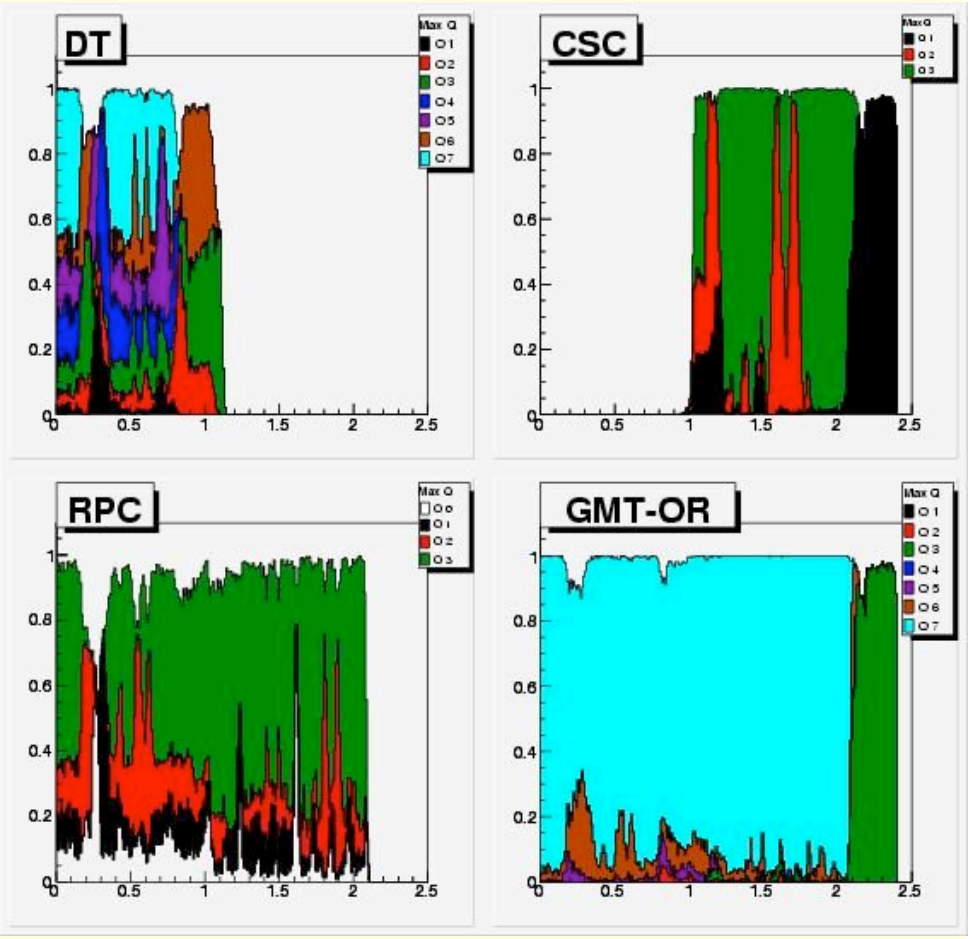


RPCb efficiency

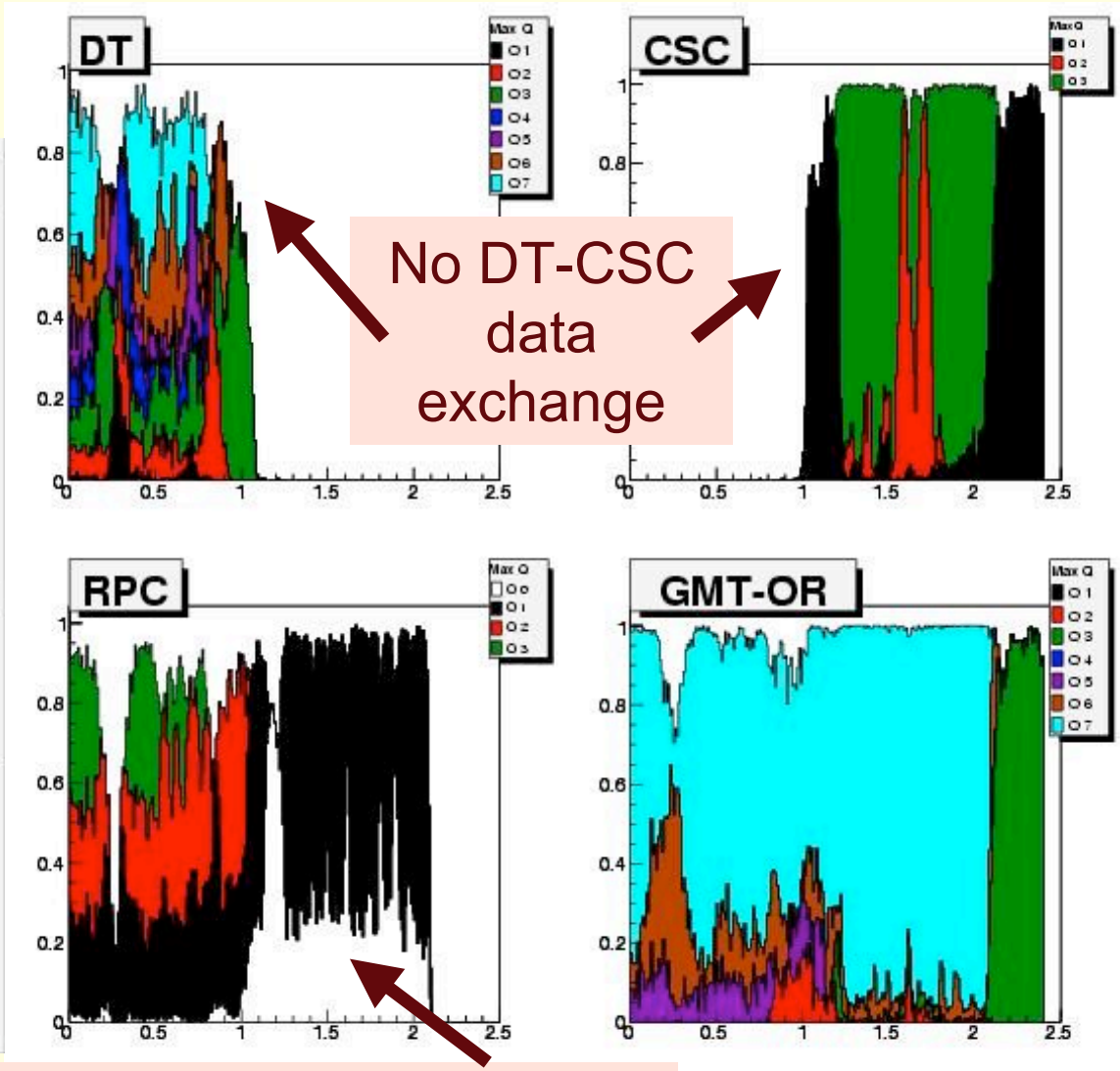


Quality bits vs. pseudorapidity

ORCA 8.13.0

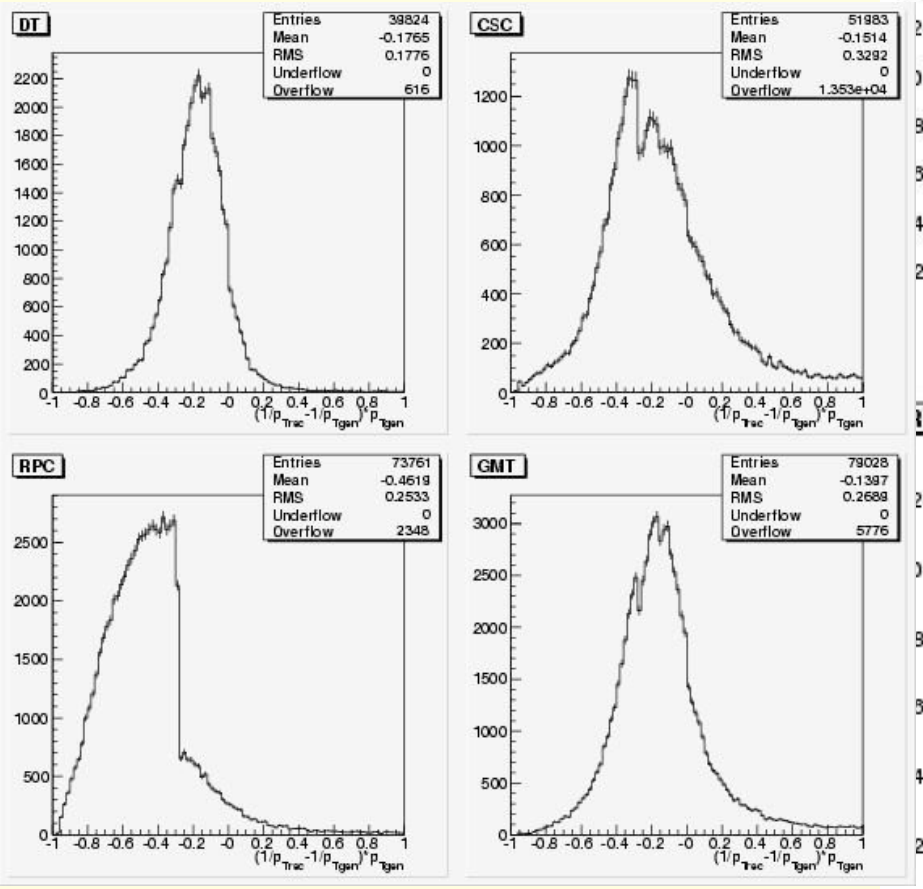


CMSSW 0.9.1+

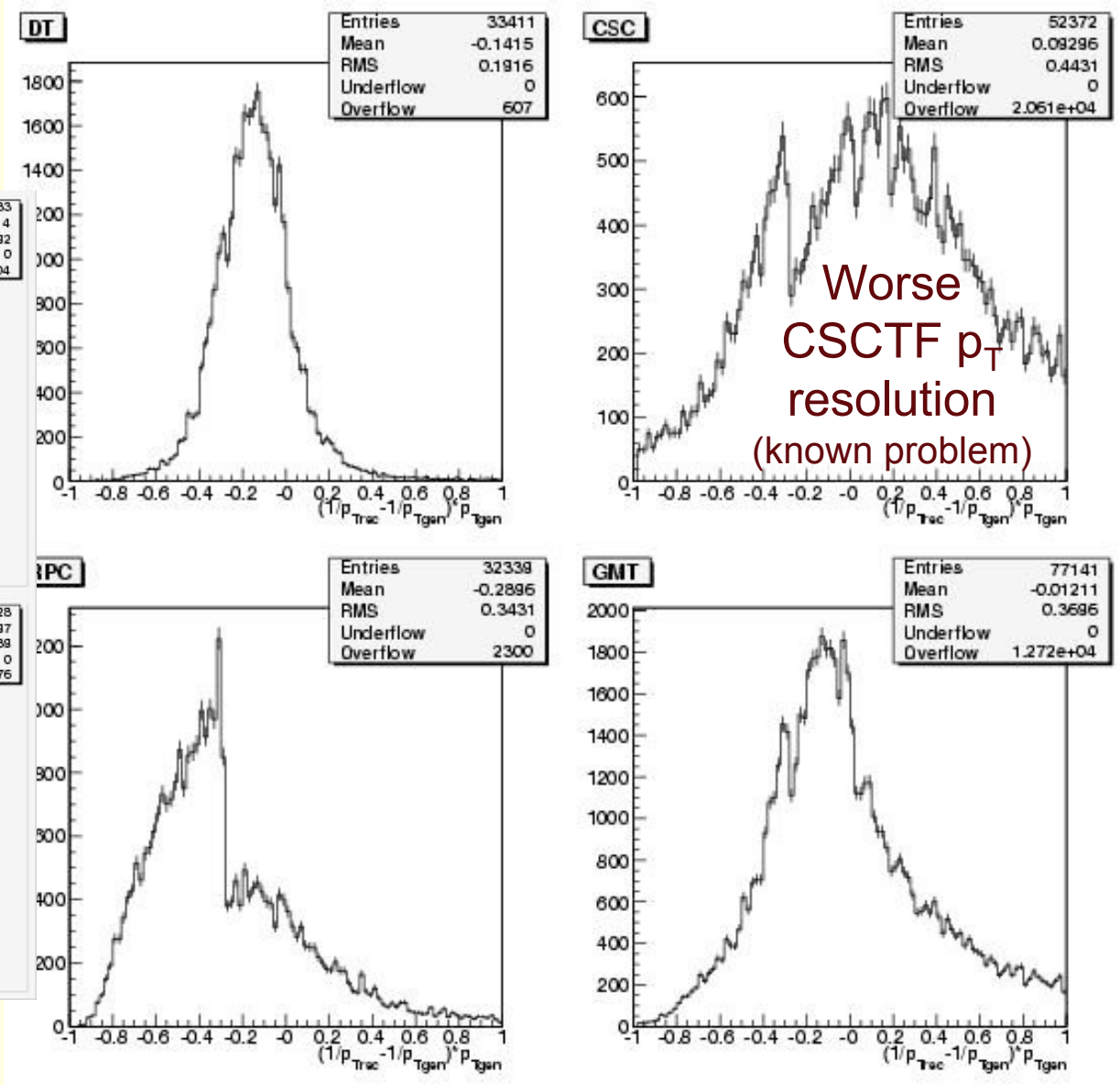


P_T resolution

ORCA 8.13.0

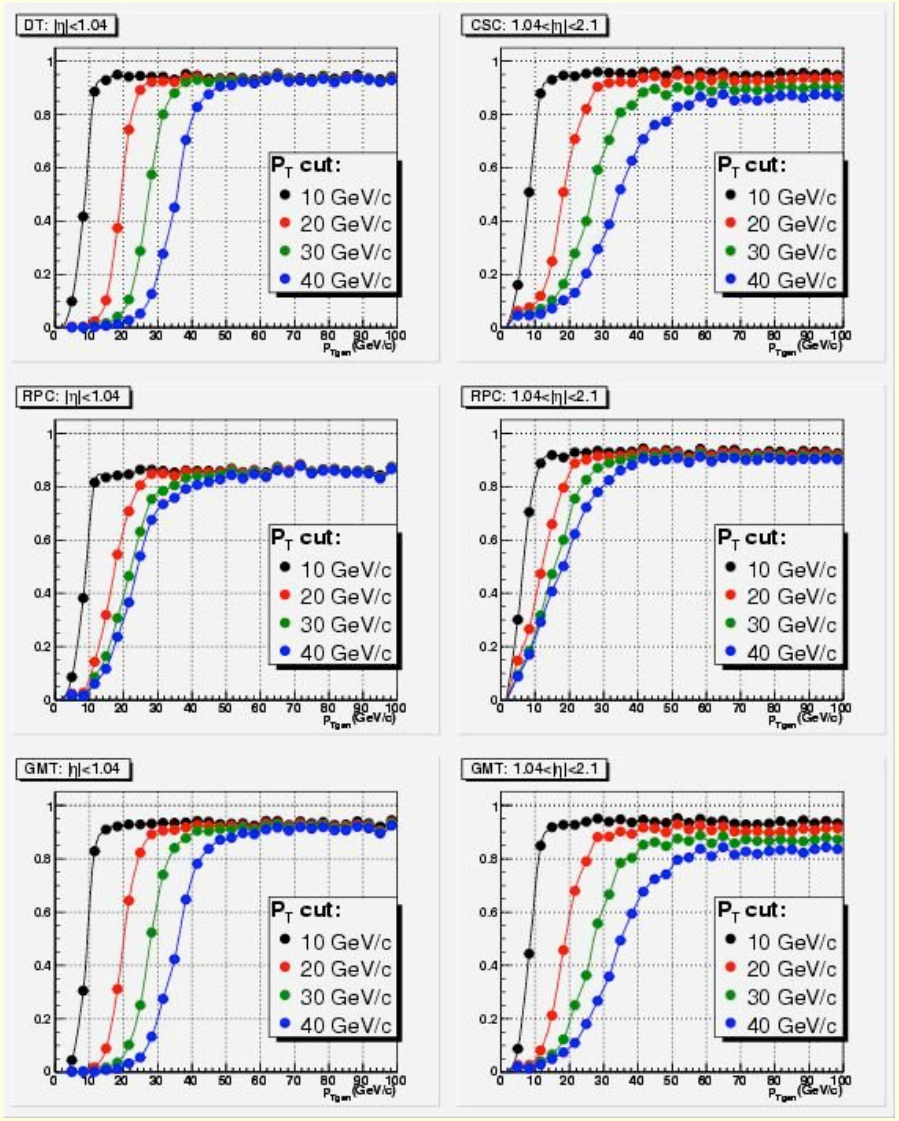


CMSSW 0.9.1+

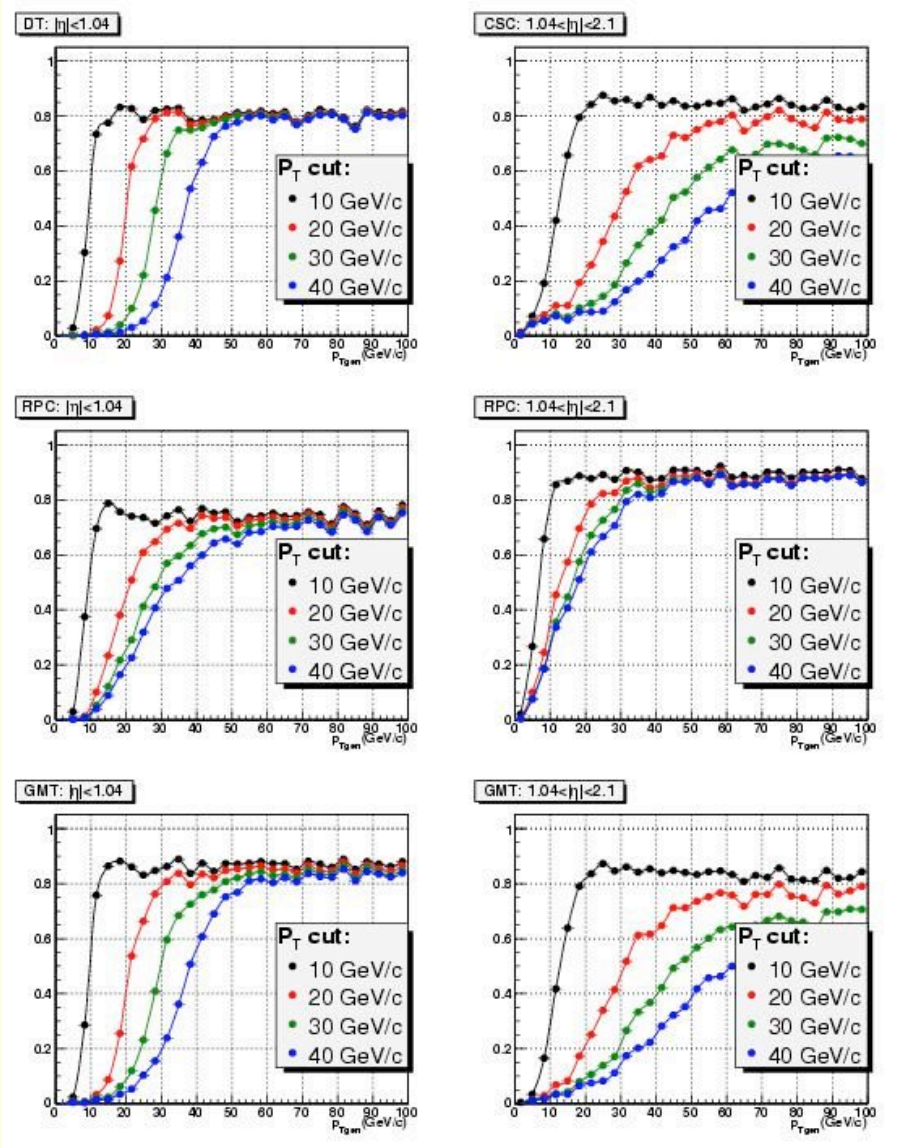


Turn-on curves

ORCA 8.13.0



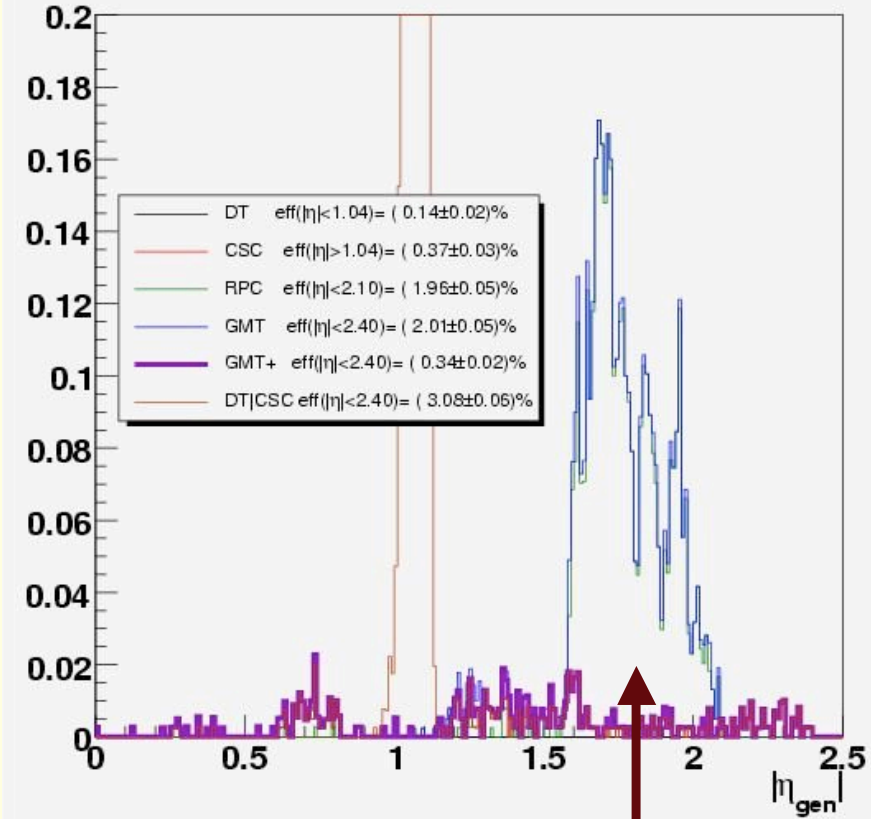
CMSSW 0.9.1+



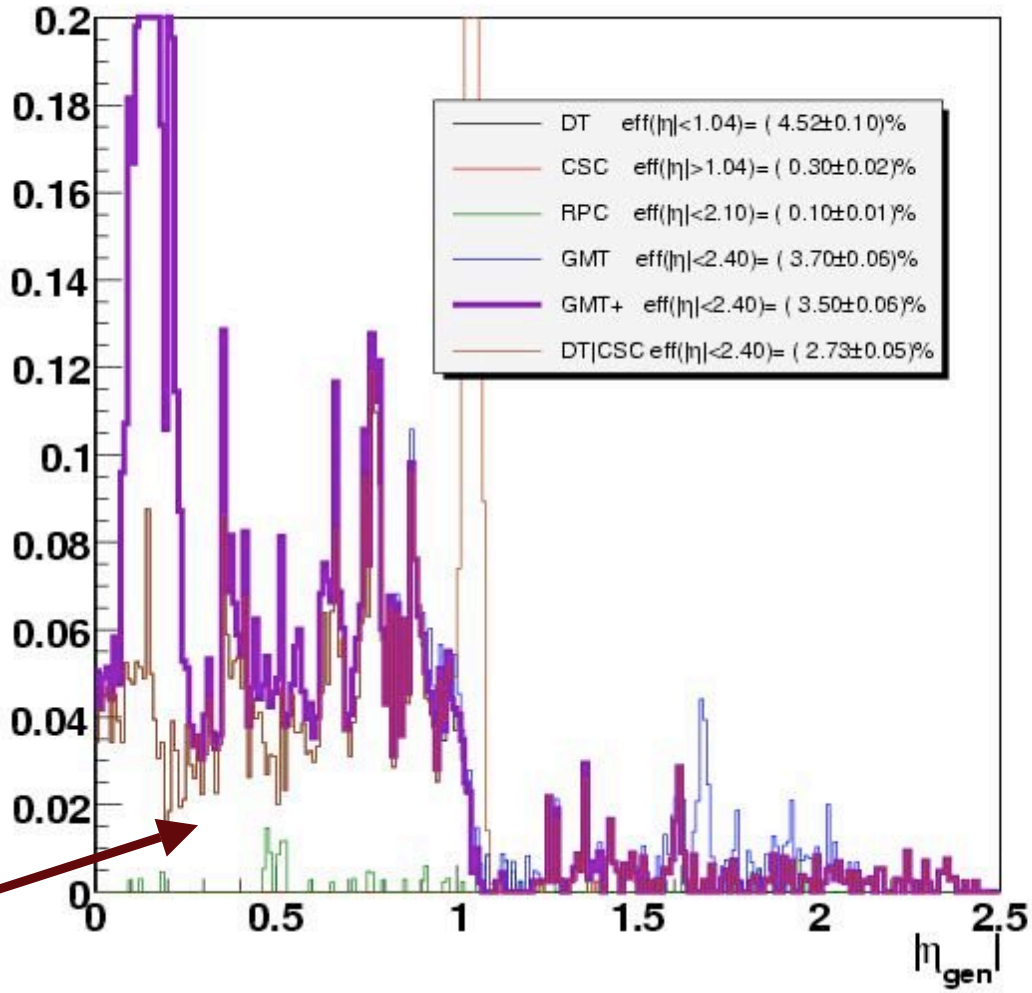
Reflects low eff. and p_T resolution

Ghost probability

ORCA 8.13.0



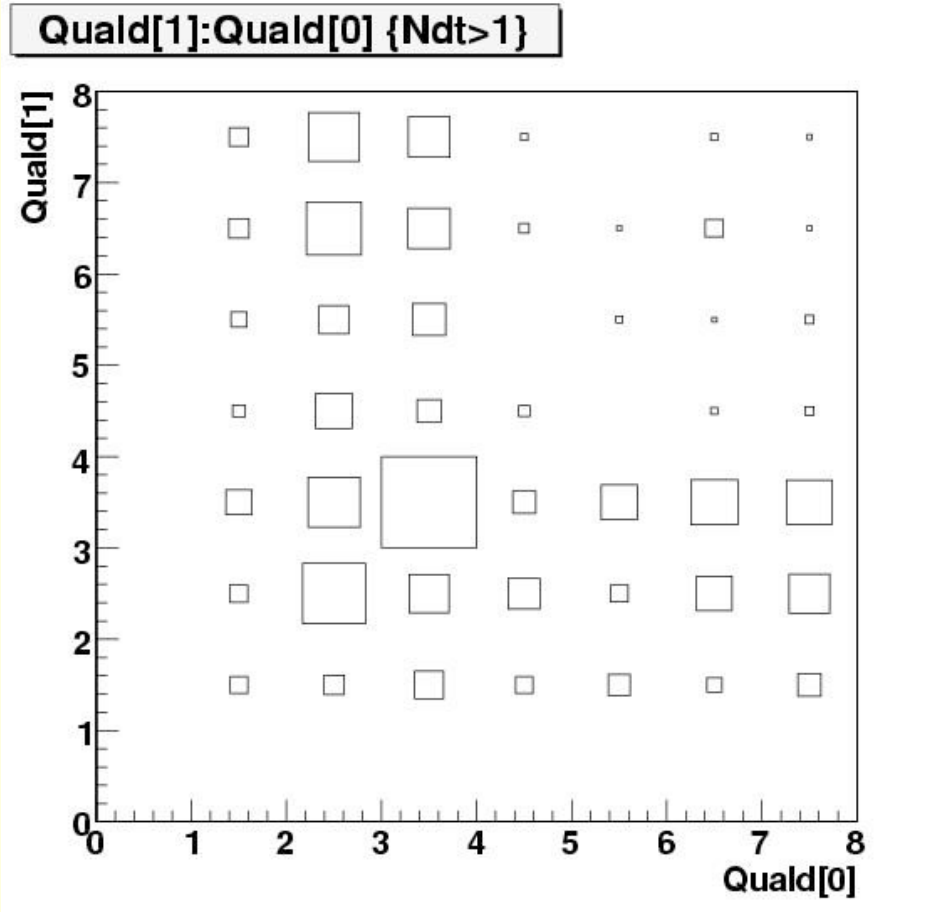
CMSSW 0.9.1+



- RPCf ghosts disappear
- DT ghosts appear

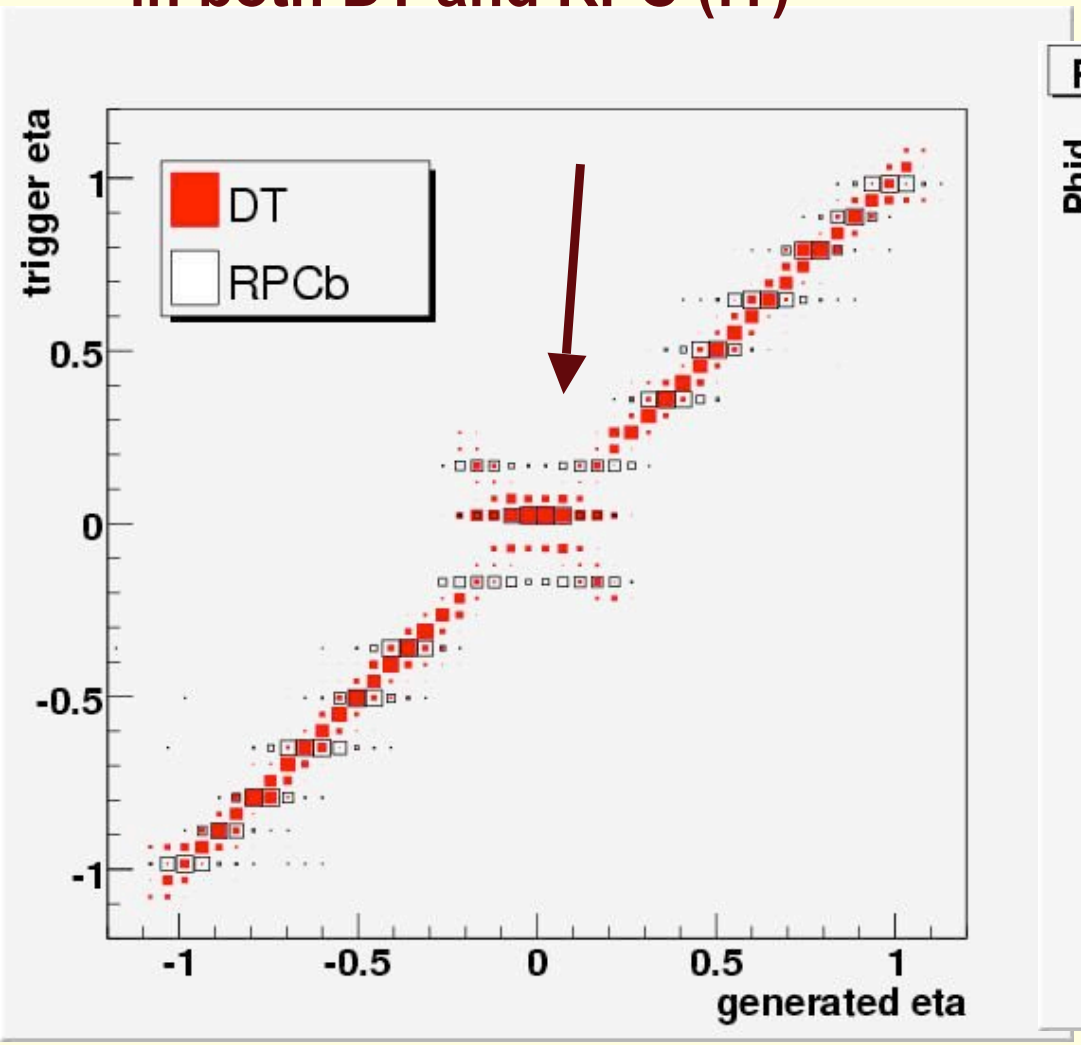
DT ghosts

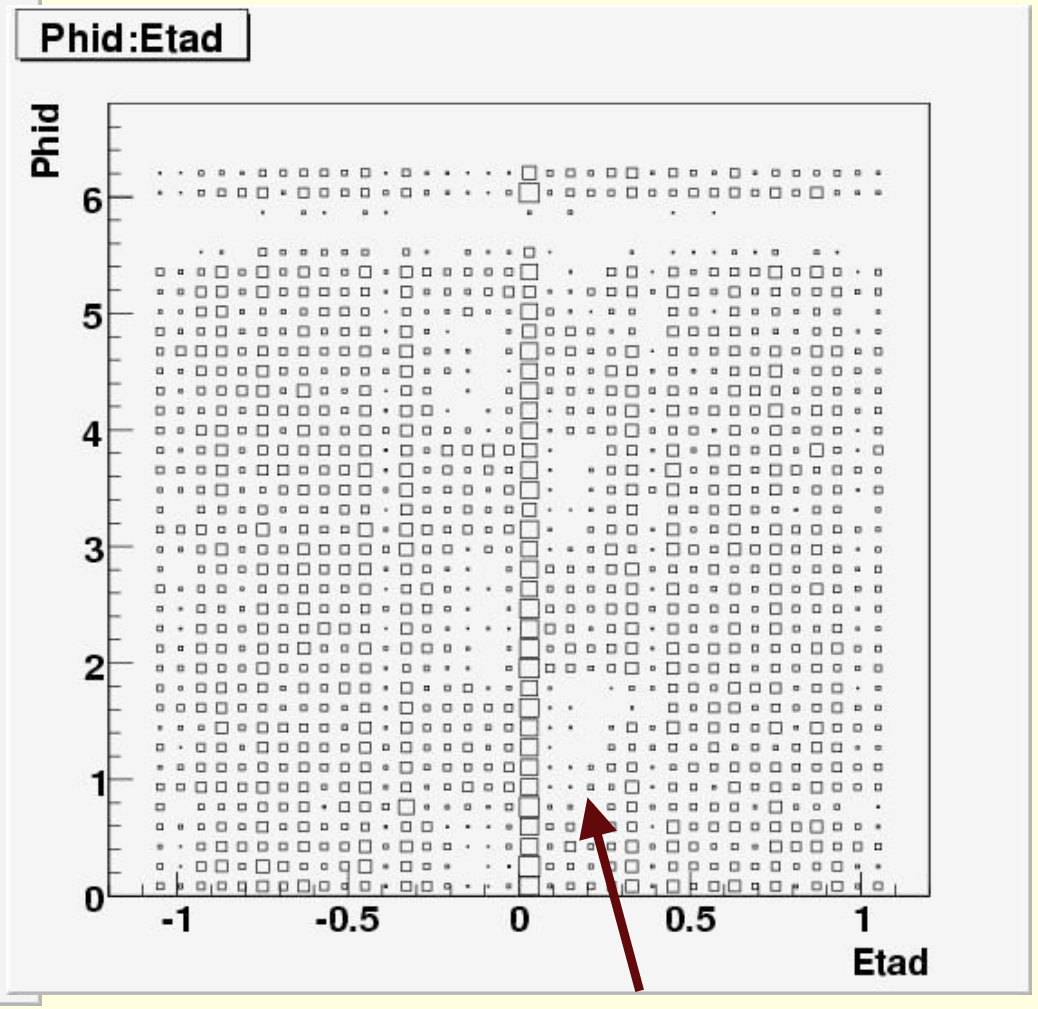
- DT ghosts have similar coordinates - real ghosts
- They have never both high quality - different fragments of the track



Problem at the central eta

- **Measured central eta values seem anti-correlated to generated ones in both DT and RPC (!?)**





some phi correlation visible

Summary

- **After few iterations/adjustments it was possible to run the whole muon part of the L1 trigger emulator in CMSSW.**
- **Despite of the very raw state of some parts, the performance on single muons is very encouraging!**
- **Some items:**
  - **phi measurement (DT)**
  - **central eta measurement (DT,RPC)**
  - **pT measurement (CSC)**
  - **charge measurement (CSC,RPC)** (not mentioned in the talk)
  - **ghosts (DT)** (could be related to ineff. in phi)
  - **DT-CSC data exchange**

  have to be finalized.
- **RPC has fixed the phi measurement and a few other minor items - will go to 1.0.0** (thanks to Tomek).
- **Of course, this was a first look - more studies needed to reach the ORCA quality and beyond.**

Further steps

- Need to work on databases and online-offline configuration/condition transfer
- Unpacking of raw data and comparison emulator - hardware with real data