Simulation Status

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for
Jet Task Force
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CDF Collaboration@UoF
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- MC Production
- Validation
- Passive Material
- Calorimeter Simulation
- Summary

MC Production (R. Tafirout)

- MC Physics–Group Representatives

Physics–Group	Representatives
Top	Un-ki Yang
QCD	Giuseppe Latino*
Bottom	Saverio D'Auria
Exotics	Sunil Sumalwar
Electroweak	Sunny Chuang

(*) New! Thanks to Rick Field

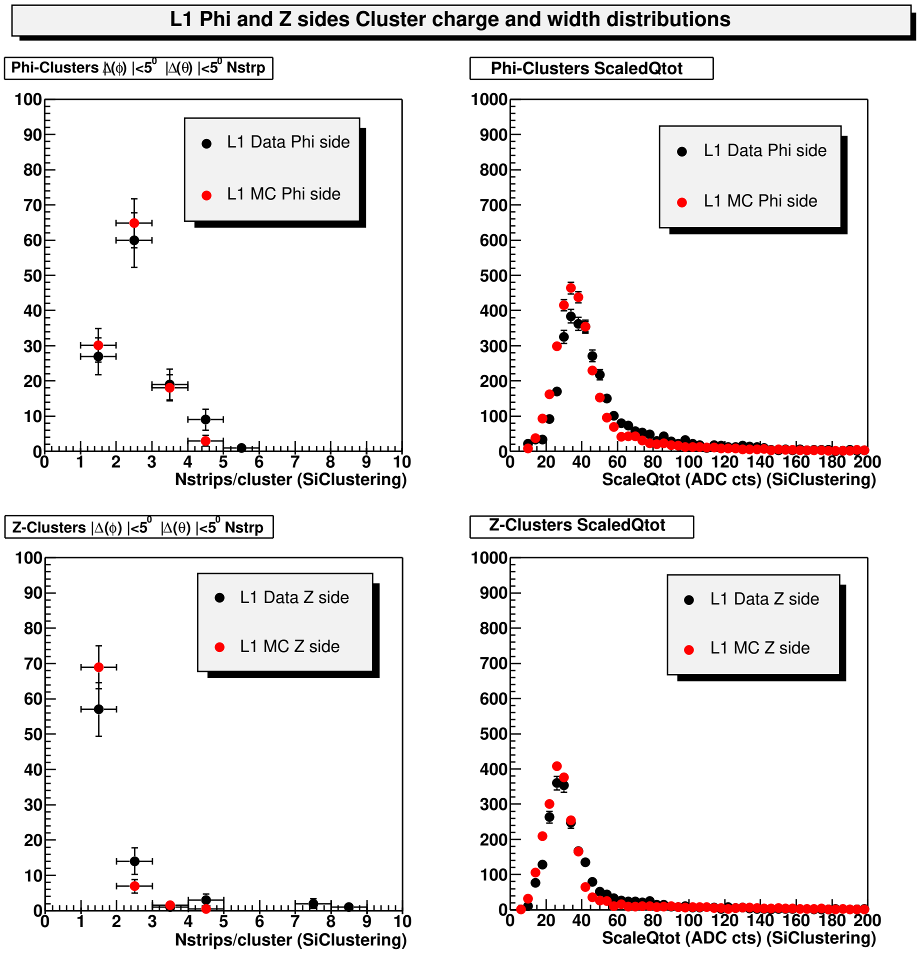
- Procedures for Official MC Production
  - Prioritized requests with your MC representatives
  - Physics groups do not have quotas!
  - For global MC request status, refer to
    http://hep.physics.utoronto.ca/RedaTafirout/mcprod
  - Produced samples are documented on www by the physics groups

- Evolution of runMC Package
  - Most requests to date still using 4.9.1
  - 4.9.1 $\rightarrow$ 5.3.x upgrade
    runMC replaced by cdfSim, ProductionExe
    Minbias inclusion feature (Pasha and Reda)
    Improve log file info for farm processing
    Plan to be ready on timescale of 5.3.1 release

Validation

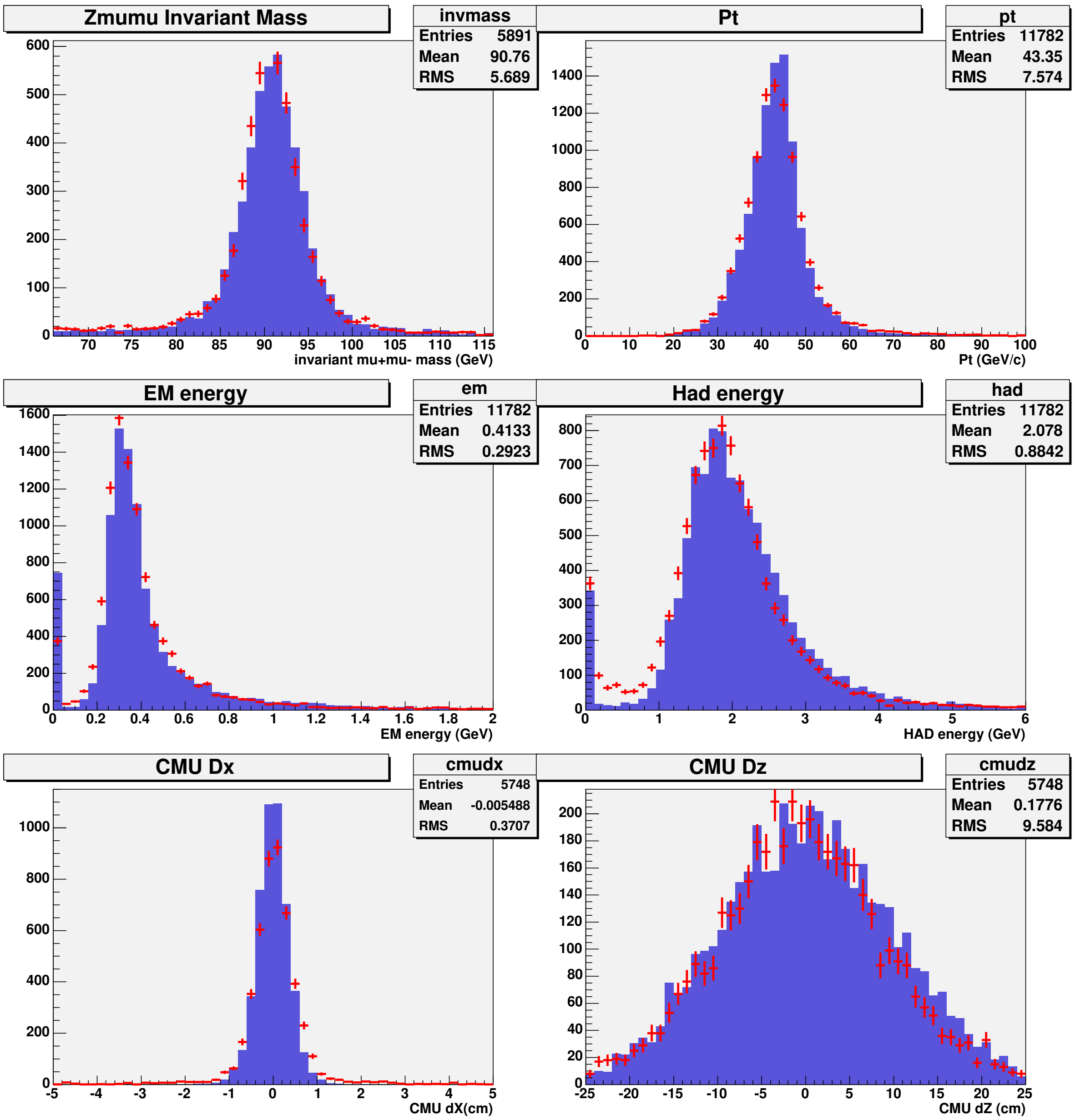
Silicon CDM (Sebastian Montero)

- Parametric Model is the Default CDM (5.x)



- Final Tune to Data (Cross talk, Gain, Noise)
  - Similar quality for all layers and ISL
- Tuned Hit position residual (centroid correction)
- http://www-cdf.fnal.gov/cdfsim/validation/silicon/siliconVal.html

$Z \to \mu\mu$ (Victoria Martin)

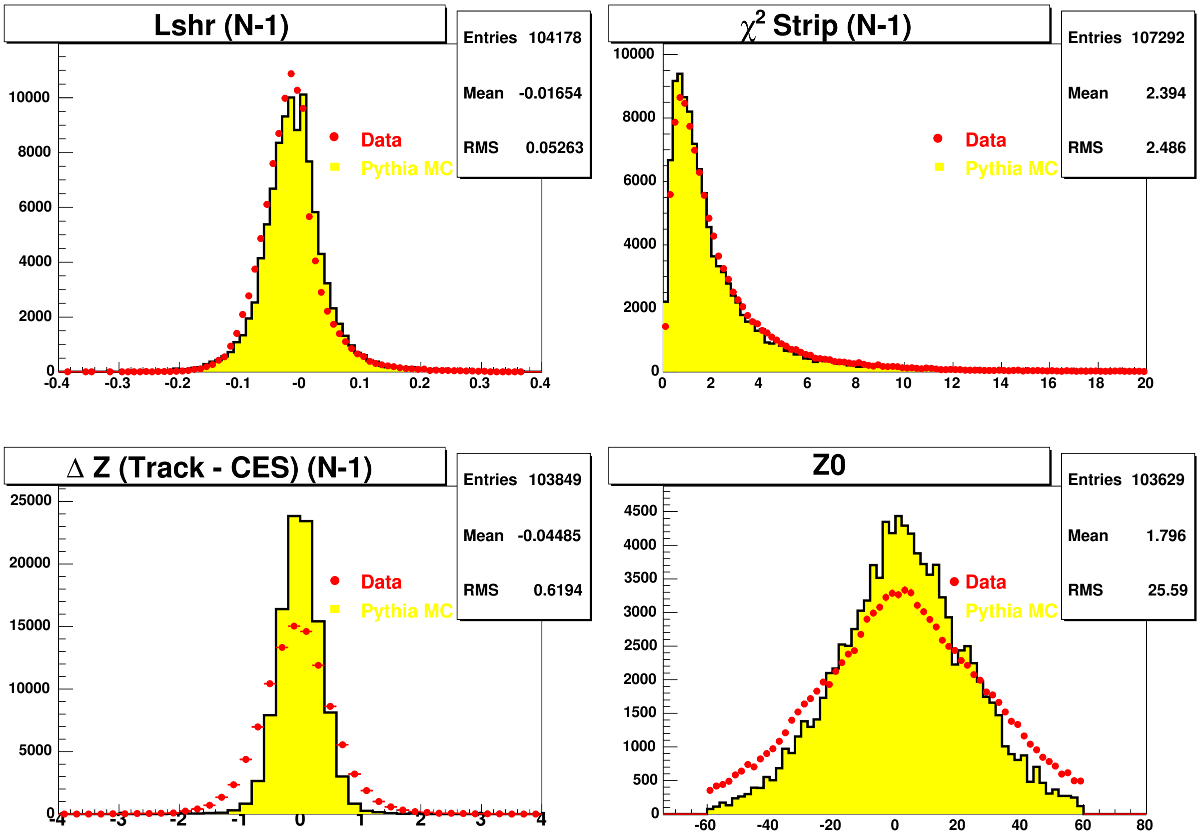


- 4.11.1 $Z \to \mu\mu$ Data vs. 5.3.0pre1
- Improvement in EM and HAD Energy
- Misalignment issue in data for dx

$W \to e\nu$ and $Z \to ee$

(Eva Halkiadakis, Giulia Manca,
Heather Gerberich and Aidan Robson)

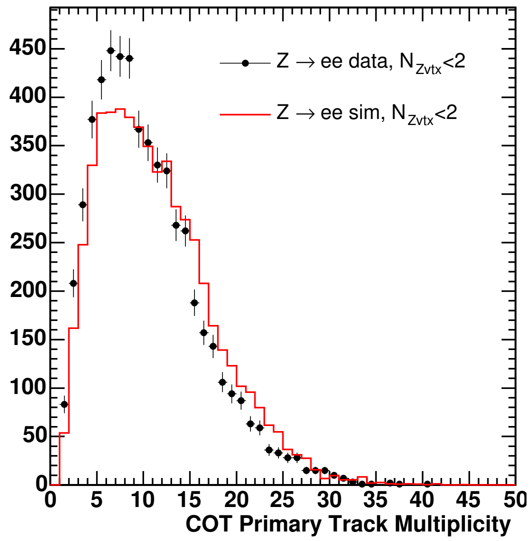
- Check both central and plug variables
- 4.11.1 $W \to e\nu$ Data vs. 5.3.0pre1

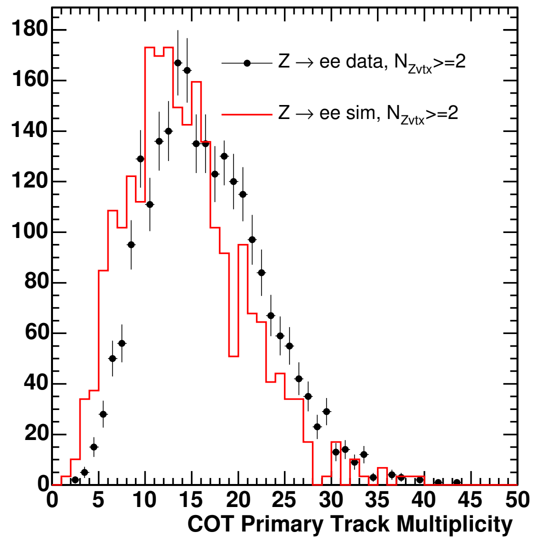


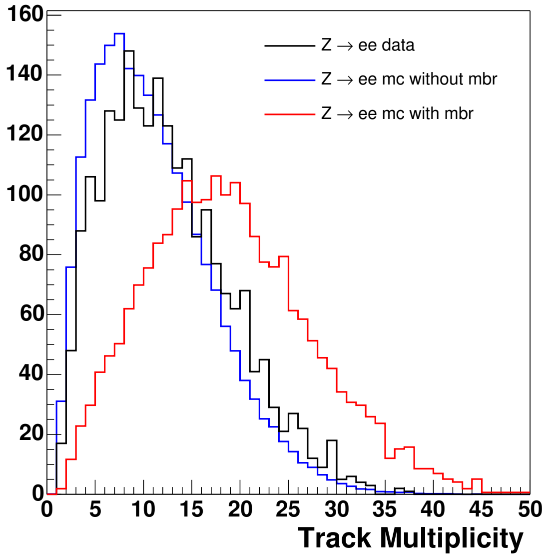
- Improvement in Lshr and Strip χ^2
- Problems reported for ΔZ and track $z0$
  - $z0$ width can be easily tuned with tcl parameter in the new β^*-function
  - need 5.1.x data for ΔZ (tracking improved)

COT Track Multiplicity (Heather G.)

- 4.11.1 $Z \to ee$ vs. 5.3.0pre1+PYTHIA_A



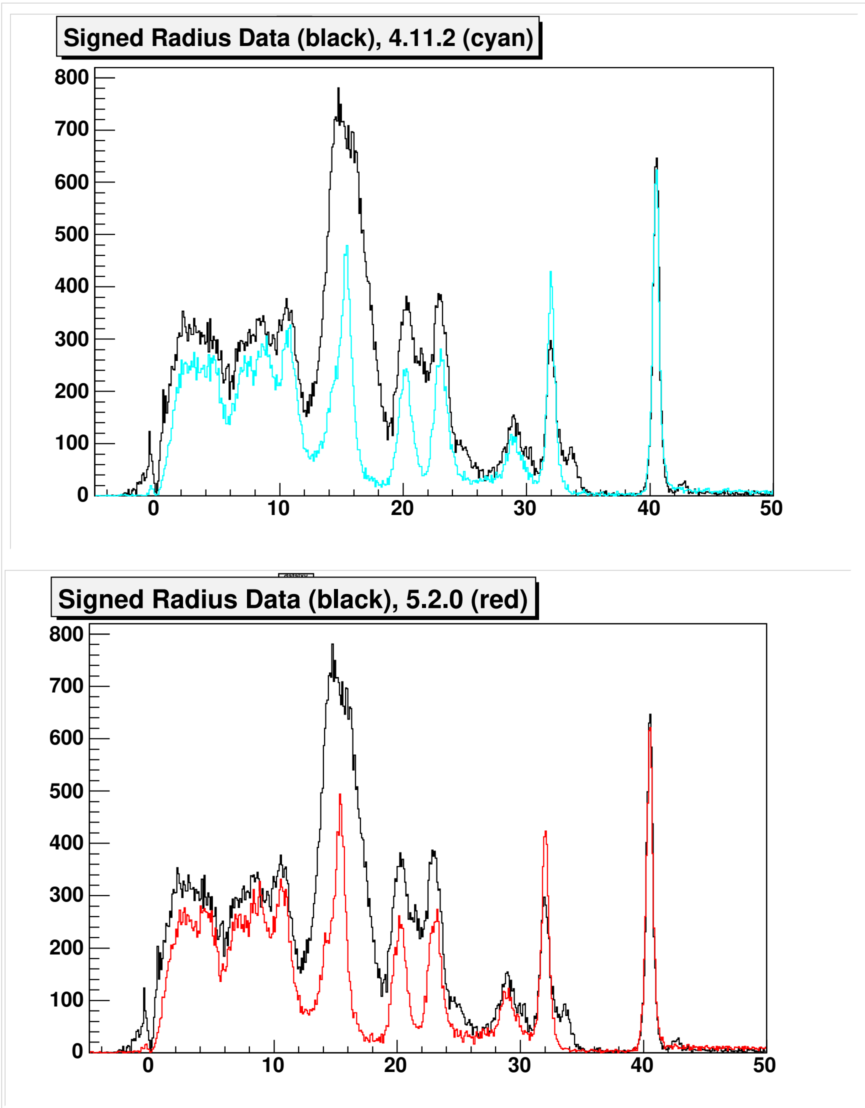




- COT track multiplicity is a reasonable measure of extra interactions
- Need extra 0.25 interaction in MC

Passive Material (Vivek Tiwari)

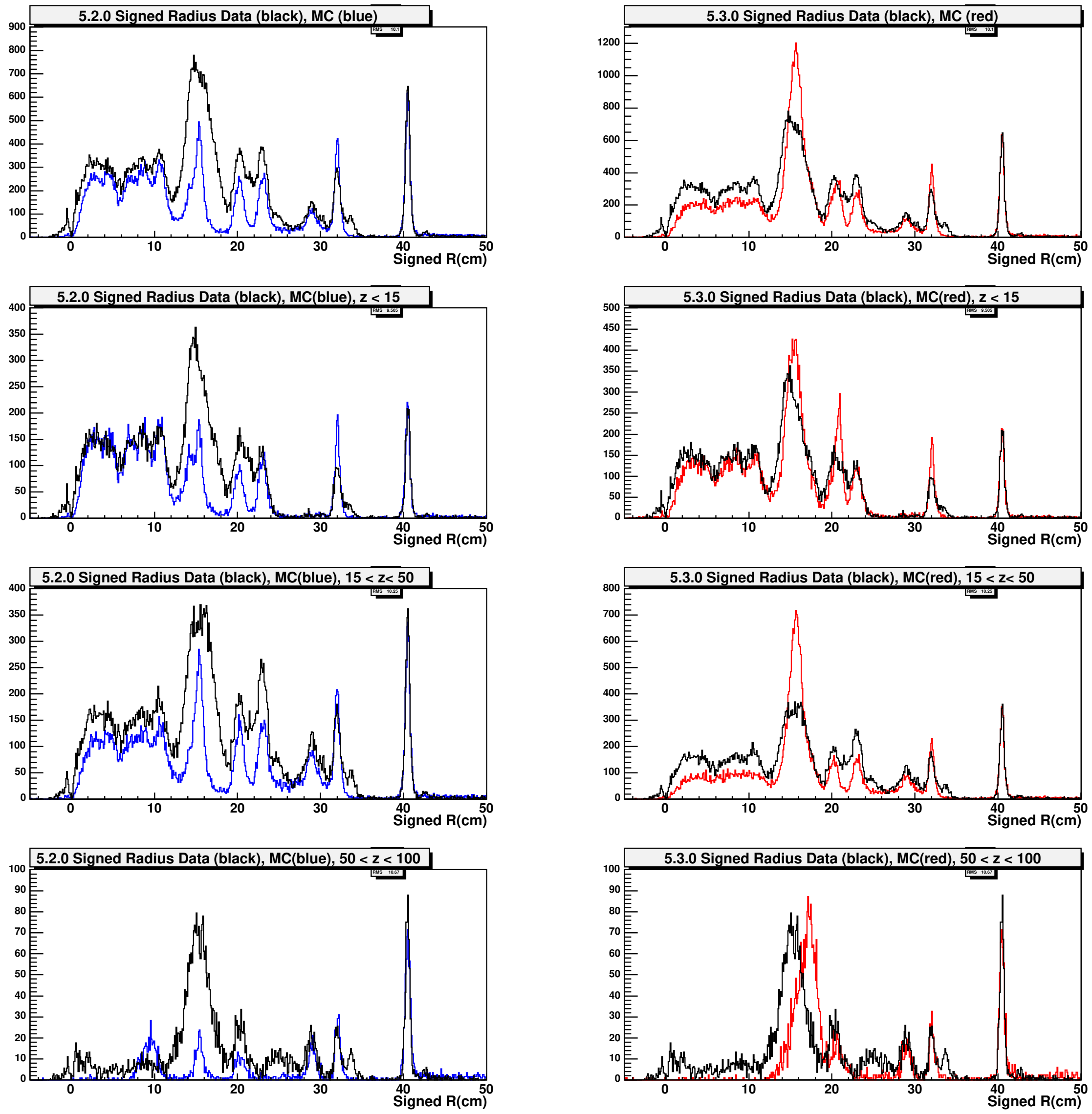
- Use conversions to compare material
- Improvement of material in PC region
- New cable structure (12-fold bundles)
- 4.9.1hpt3 Data vs. 4.11.2 vs. 5.2.0



- Fixes and rearrangement of Phantom Layers (Laurent Vacavant)

Passive Material (Manfred Paulini)

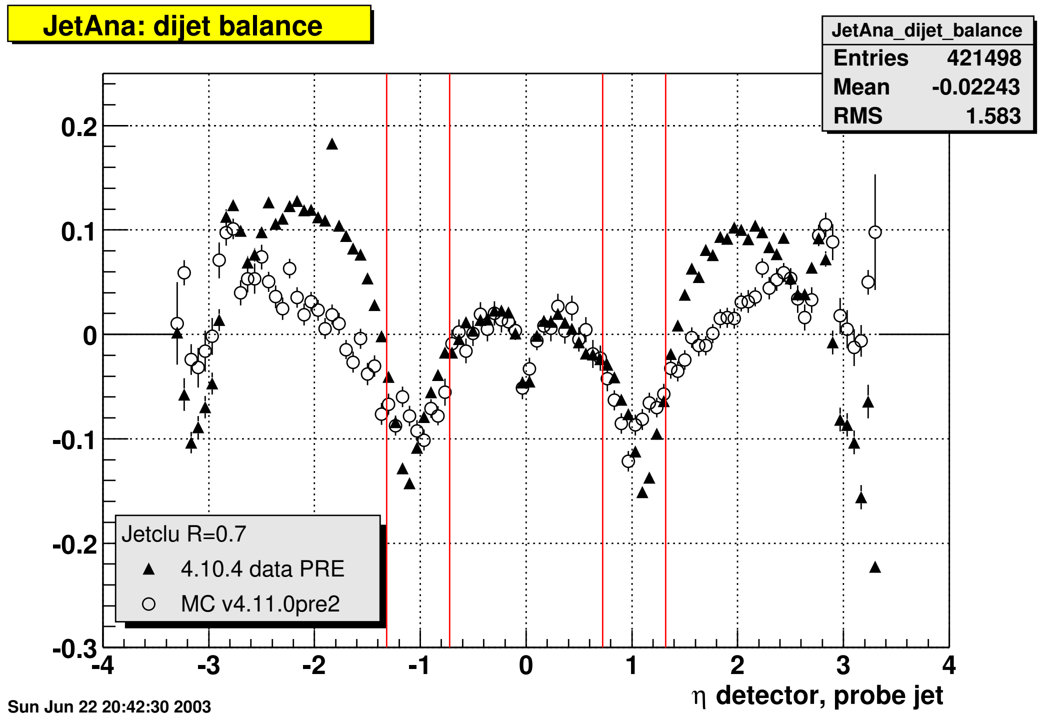
- Attempt to tune Phantom Layers
- 4.9.1hpt3 Data vs. 5.2.0 vs. 5.3.0



- good material map for $|z| < 15$cm, but need more material for $15 < |z| < 50$cm (where?)
- need feedback from J/Ψ mass and the E/P tail

Colorimeter Simulation (Task Force)

- Central/Plug Calorimeter Tuned
  - to test beam data (central/plug $p > 8$)
  - to minbias data (central $|\eta| < 0.6$ and $p < 5$)
- Problem Definition (C. Currat)



  - large discrepancies seen in dijet balance
  - balance is sensitive to low-p response (Jet20)
  - best guessed plug-parameterization implemented for $p < 8$ (worked for the balance at the plug)

Jet Calibration/Simulation Task Force

- Joint Working Group
  of TopMass/Jet Correction/Simulation
- Formed Jul-03 for Tasks
  - tune plug E-scale using isolated single tracks
  - tower basis correction around the 30^o-crack
  - tune lateral hadronic shower profile
  - refine central responses
- Task Force
  co–Leader: D. Ambrose and S.Y. Jun
  Force: A. Metha, C. Currat, A. Galtieri, A Bhatti, B. Hienemann, D. Hoffman, Y.K. Kim, P. Murat, D. Ryan, K. Yorita, K. Ebina, Y.S. Chung, Y. Shon, G. Latino, I. Shreyber, R. Tafirout
- Data sets and Ground works
  - 9.2M minbias (gmbs0b with 5.1.0pre9)
  - 0.5M STT (gjtc08 with 4.10.4)
  - PYTHIA: minbias and dijet (various releases)
  - plug-extrapolator
  - stand-alone track efficiency/resolution
  - track and cluster isolation
  - signal/background definition
  - re–confirm central energy scale

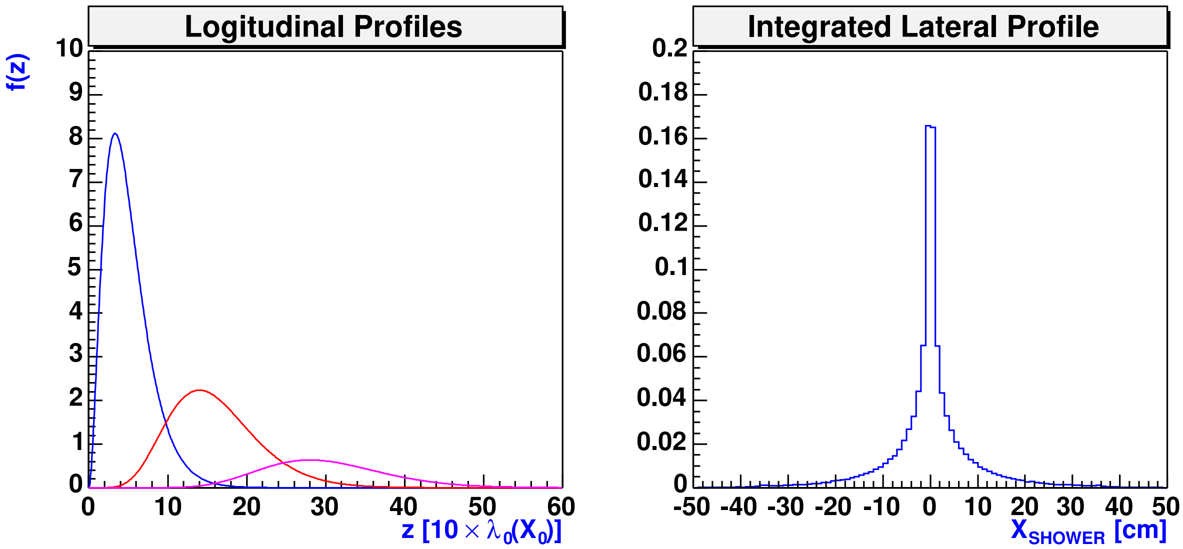
GflashSim

- Gflash takes over GEANT at the first inelastic interaction point (faster!)
- Relative Sampling Fraction to MIP

$$dE_{vs}(\vec{r}) = E_{dp}\hat{m}\sum_{k=e,h}\frac{\hat{k}}{\hat{m}}c_k f_k(\vec{r})dV$$

- Parameterize the spacial distribution of energy taking into account correlation and fluctuation $\rightarrow$ longitudinal and lateral shower profile

$$dE_{dp}(\vec{r}) = \frac{E_{dp}}{2\pi}f(z)dzf(r)dr$$

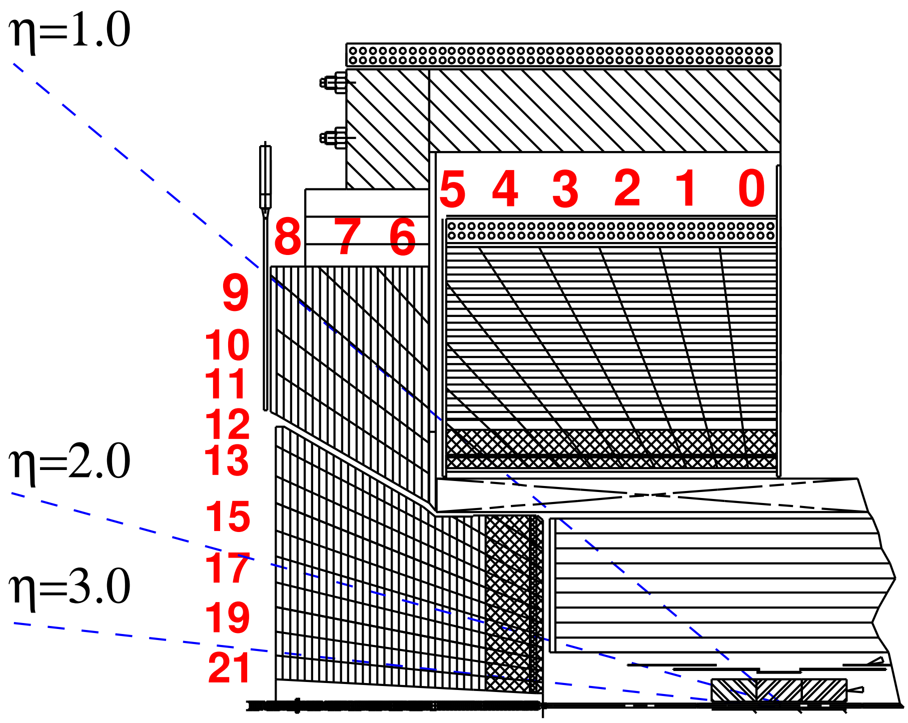


- Port spot energies into CalTower $\rightarrow$ CalData

Calorimeter Scan

- Region Convention

iD	Name	Tower	ieta (West)	ieta(East)
0	90^o	0	25	26
1	Central	1,2,3,4,5	20,21,22,23,24	27,28,29,30,31
2	Wall	6,7,8,9	16,17,18,19	32,33,34,35
3	Crack	10,11	14,15	36,37
4	Plug	12,13,14,15,16	9,10,11,12,13	38,39,40,41,42
5	Beam	17,18,19,20,21	4,5,6,7,8	43,44,45,46,47

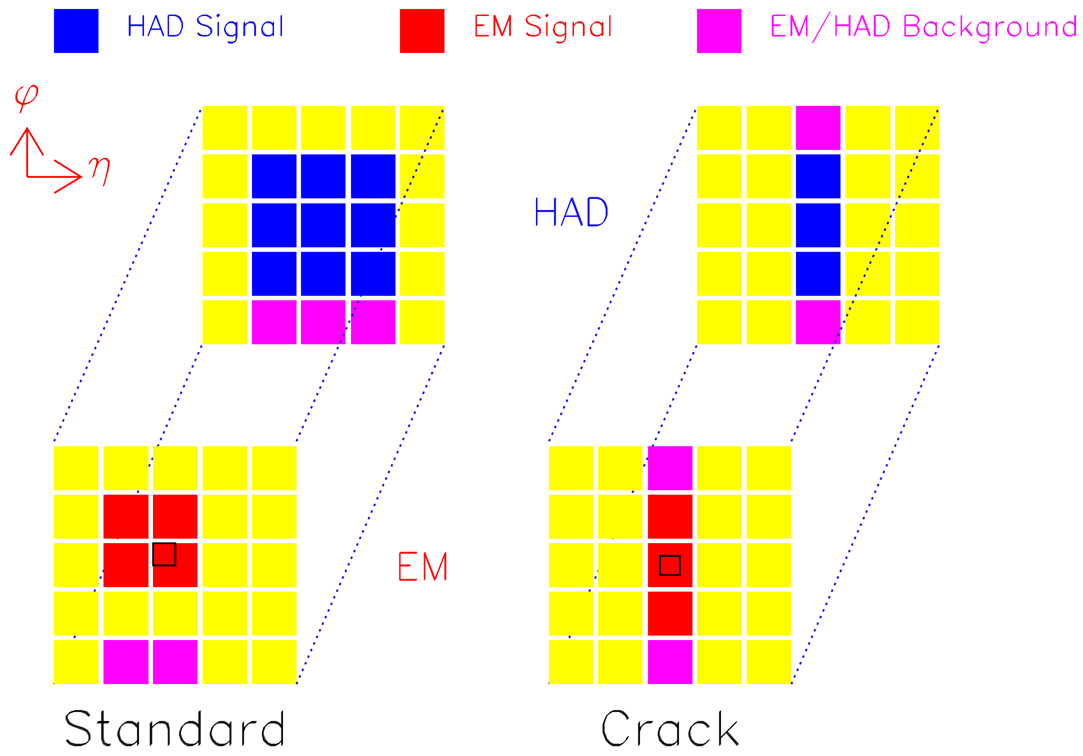


- Mainly focus on Plug and Crack, but also scan the rest of regions for completeness

Measure E/P

- Isolated Single Track in 7x7 tower block
- Signal and Background definition

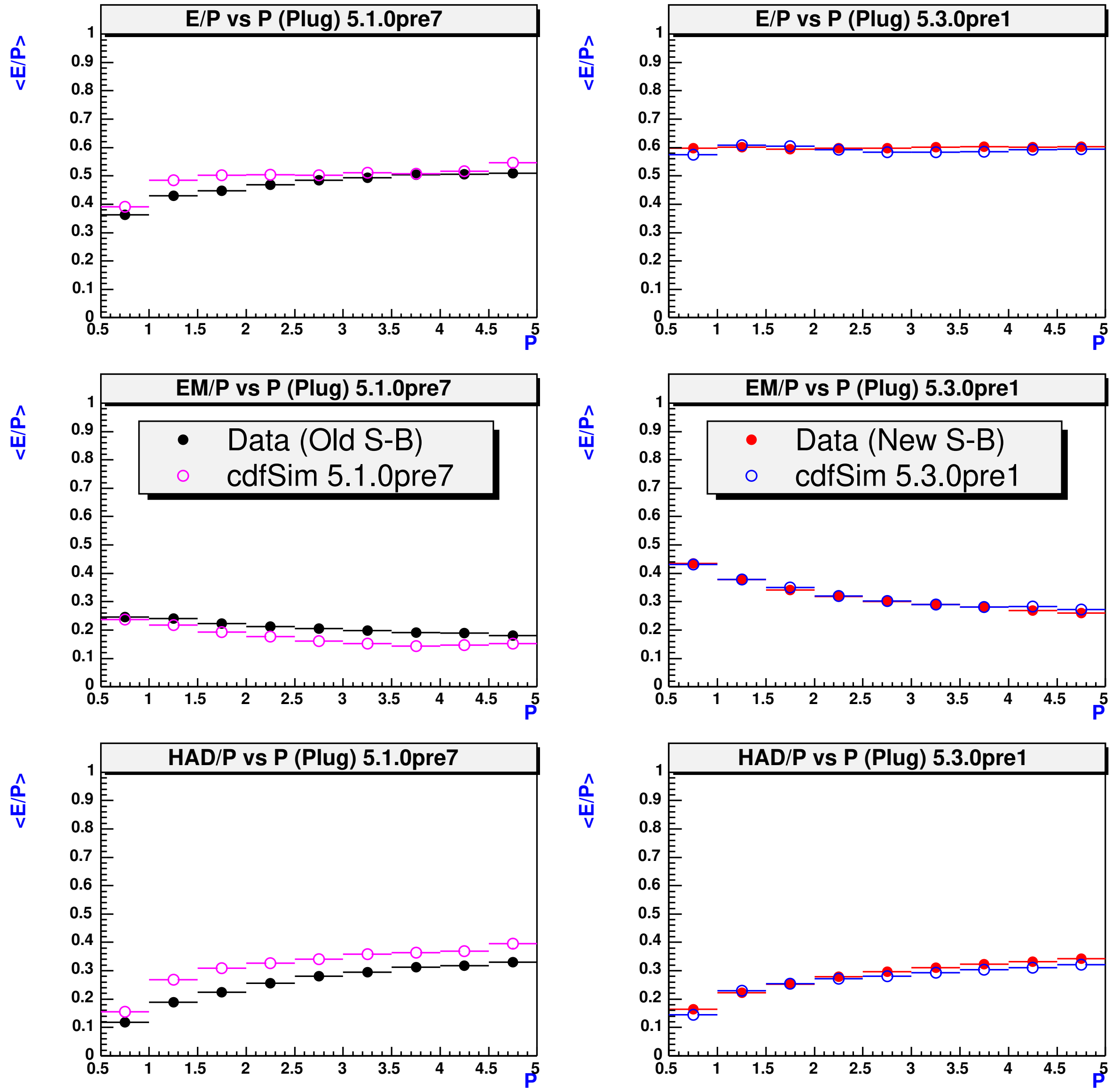
	Standard	Crack
EM Signal	Closest 2x2	1x3 (η-ϕ towers)
HAD Signal	Closest 3x3	1x3 (η-ϕ towers)
EM/HAD Back	Away side ϕ towers	both sides ϕ towers
Constraint	$\lvert\Delta\eta_r\rvert,\ \lvert\Delta\phi_r\rvert < 0.9$	$\lvert\Delta\eta_r\rvert,\ \lvert\Delta\phi_r\rvert < 0.6$



- A good choice based on Data/MC studies

Track $\langle E/P \rangle$ of Plug

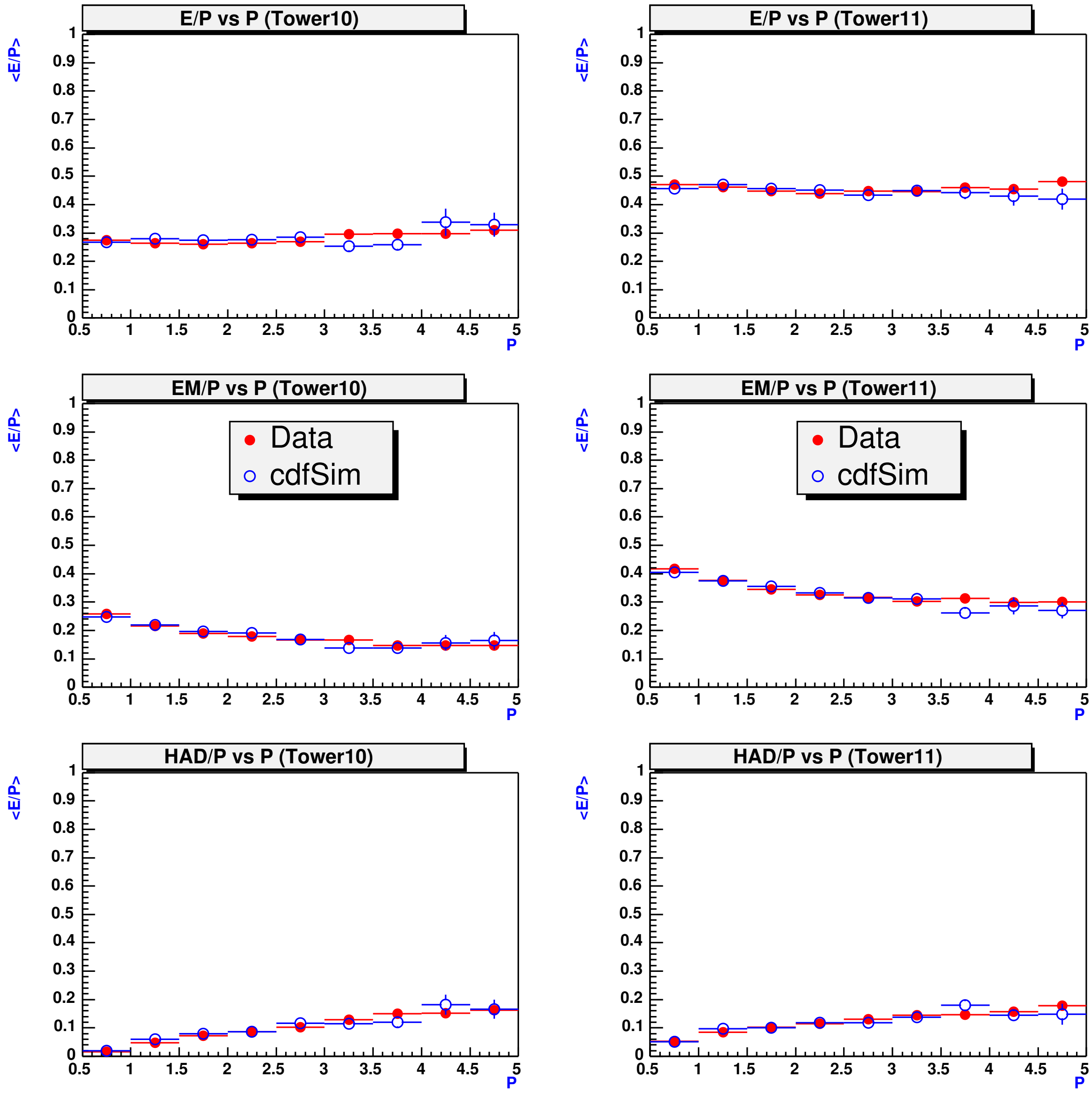
- 5.1.0pre7 (Magenta) vs. 5.3.0pre1



- Introduce new fraction of deposited energy
- Change PEM/PHA relative sampling fraction

Tuned Crack Response

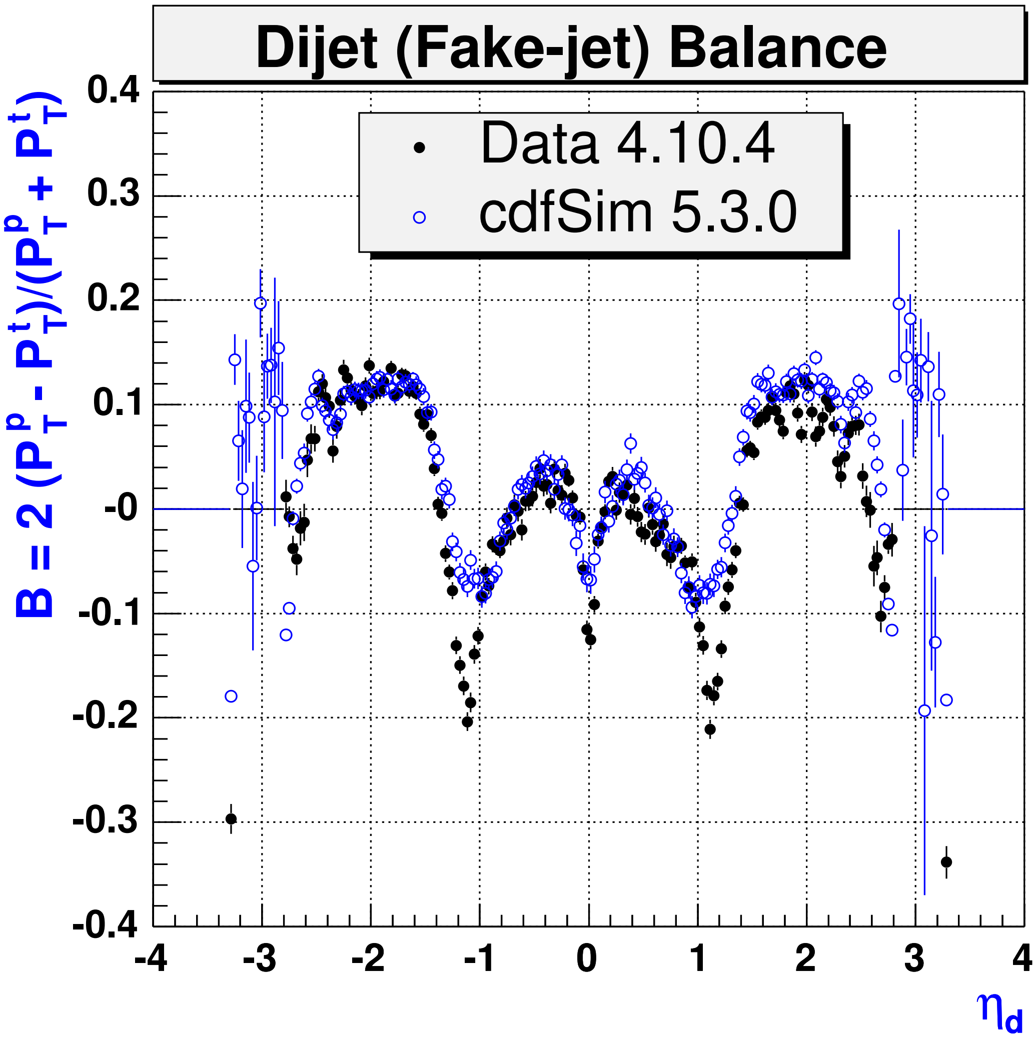
- Tower Basis Crack Correction for Tower10/11



- p-independent scaling on E-spots (PEM/PHA/WHA) for Tower10 and Tower11
- Relative-η dependence correction inside Tower10

Dijet Balance

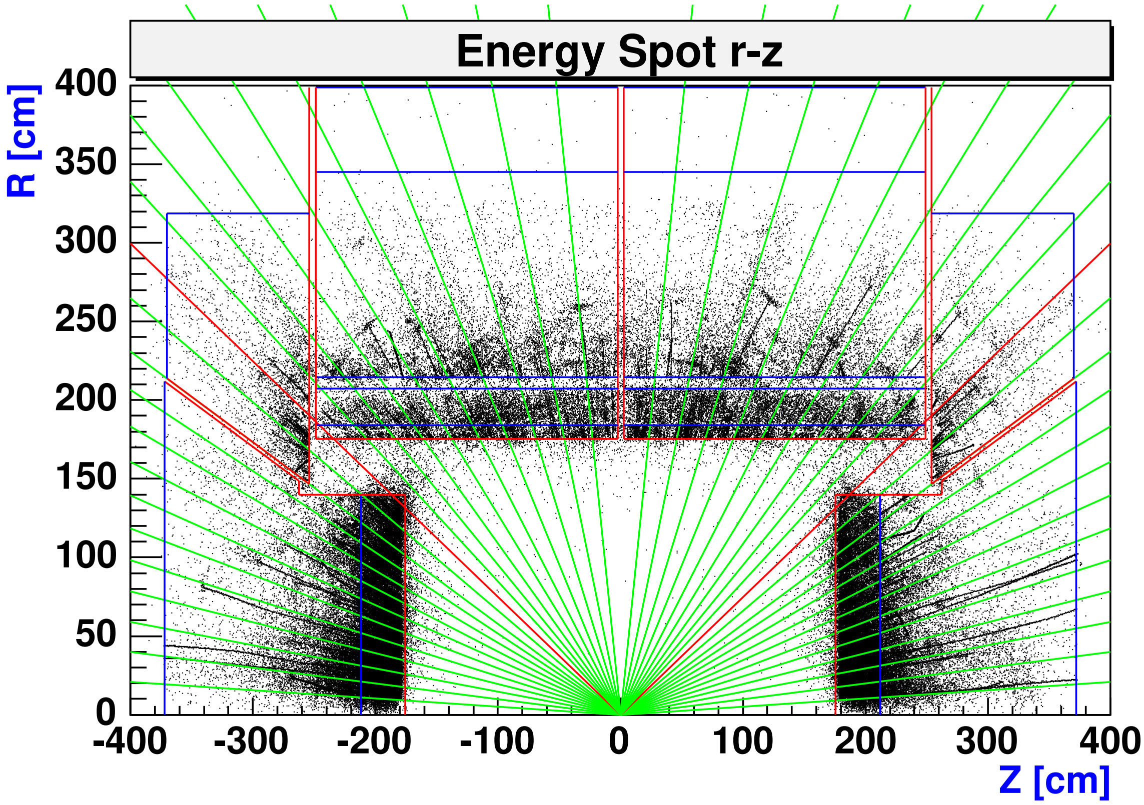
- Plug/Crack single track response into 5.3.0
- Single Tower scan is in great shape
- High-level cross check: Dijet Balance



- What went wrong around the 30^o-crack ?

Geometry Effect

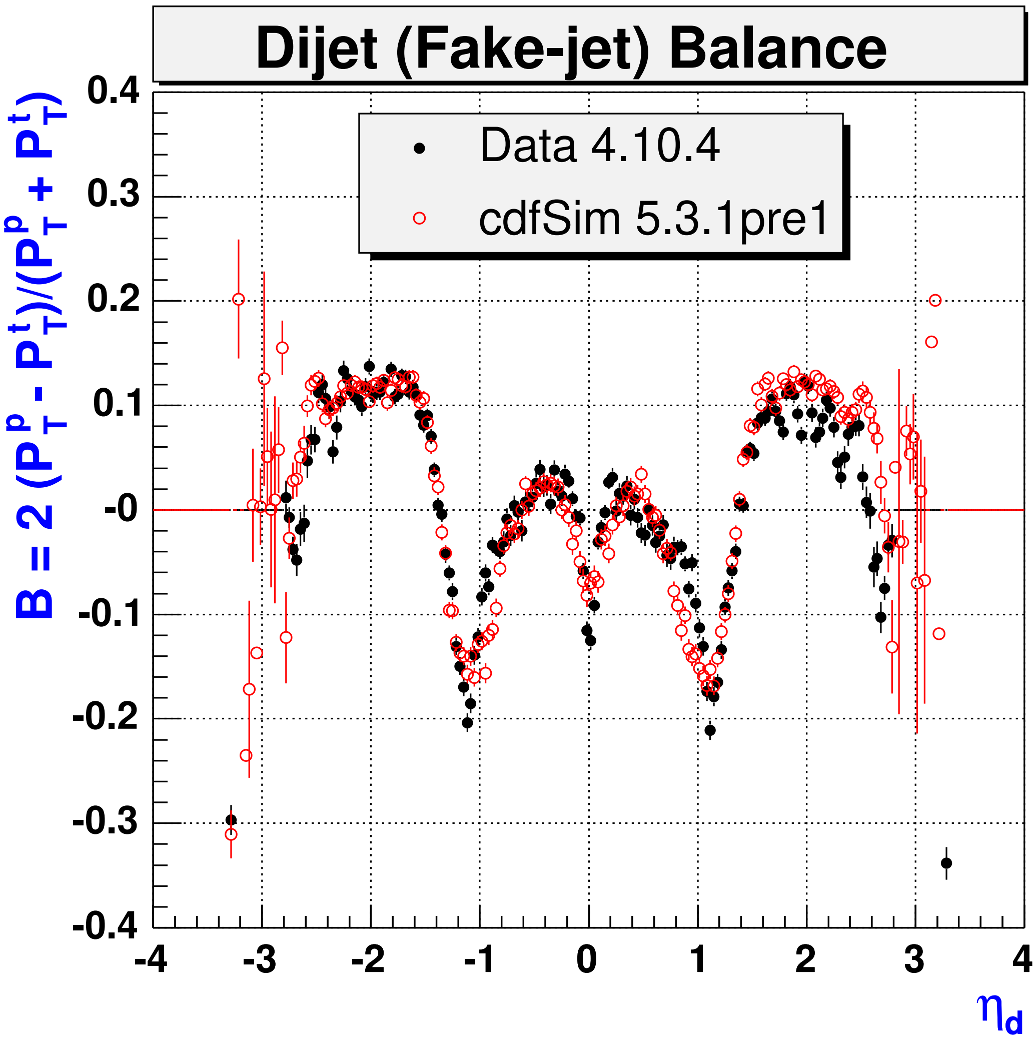
- Gflash treats a calorimeter module as one single effective medium assuming repetitive sampling structure



- Spacial energy distribution converted to E–spots
- E–spots outside calorimeters are due to the lateral spread of shower w.r.t the interaction point
- Removing E–spot outside volume "around the crack" is the better option (ex: shower developed at the edge of PEM10)

Toward 5.3.1

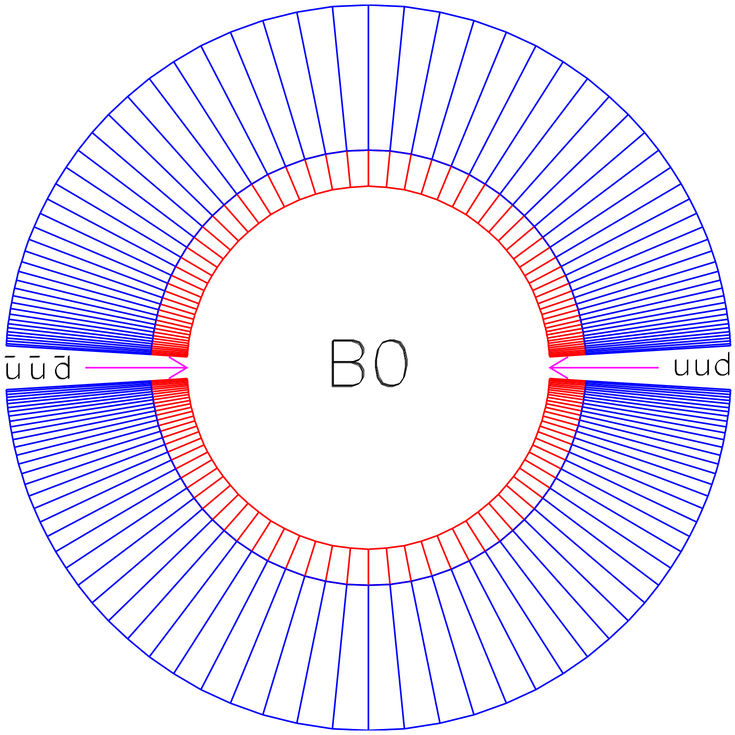
- Implement a calorimeter volume cut on E-spots



- Need to re-confirm with PYTHIA dijet sample
- Closure of Crack/Plug task!
- Move to lateral tuning and one remaining puzzle

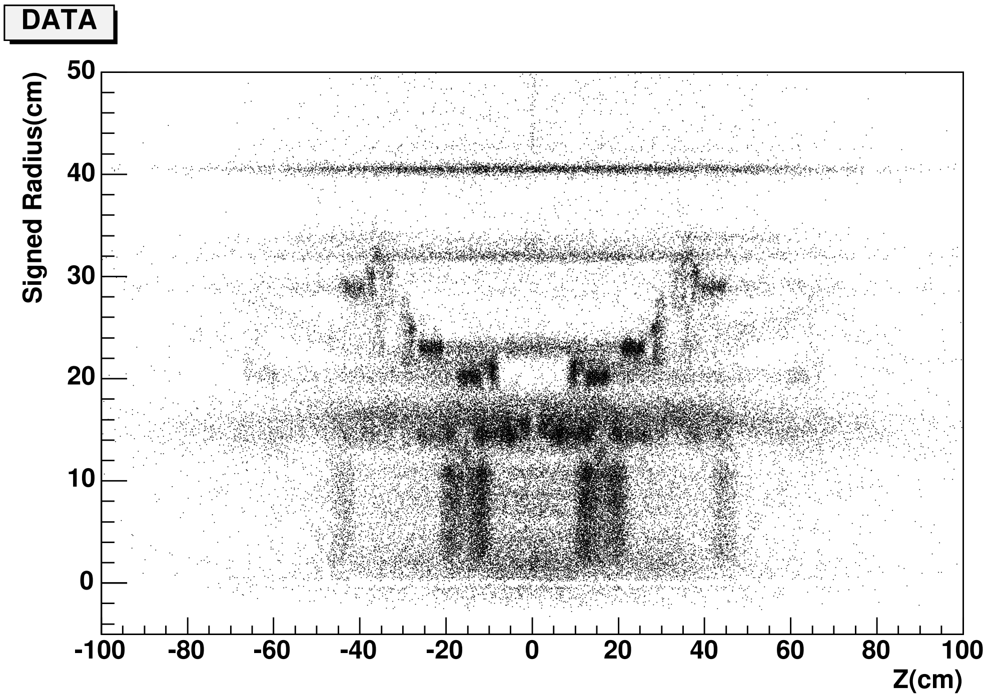
Summary

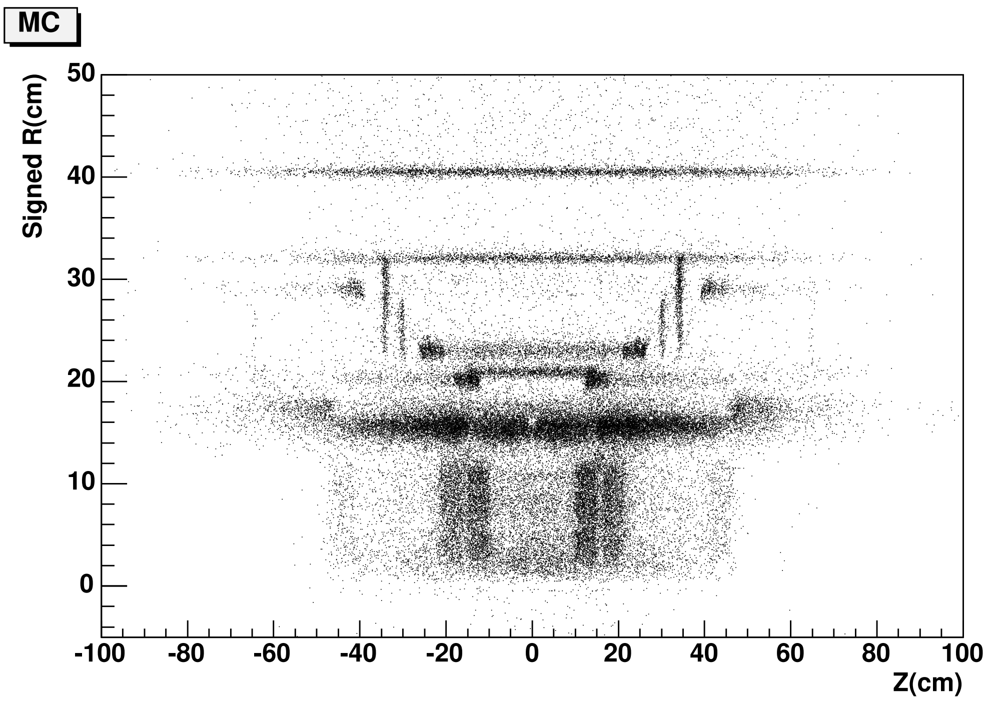
- 5.3.1 cdfSim ready to on the fly
- Need exclusive comparison with 5.x data
- Improved material map, but need cross checks for the better description
- Tuned low-p single track responses for plug/crack region
- Run IIb CDF Calorimeter



Conversion Map (backup)

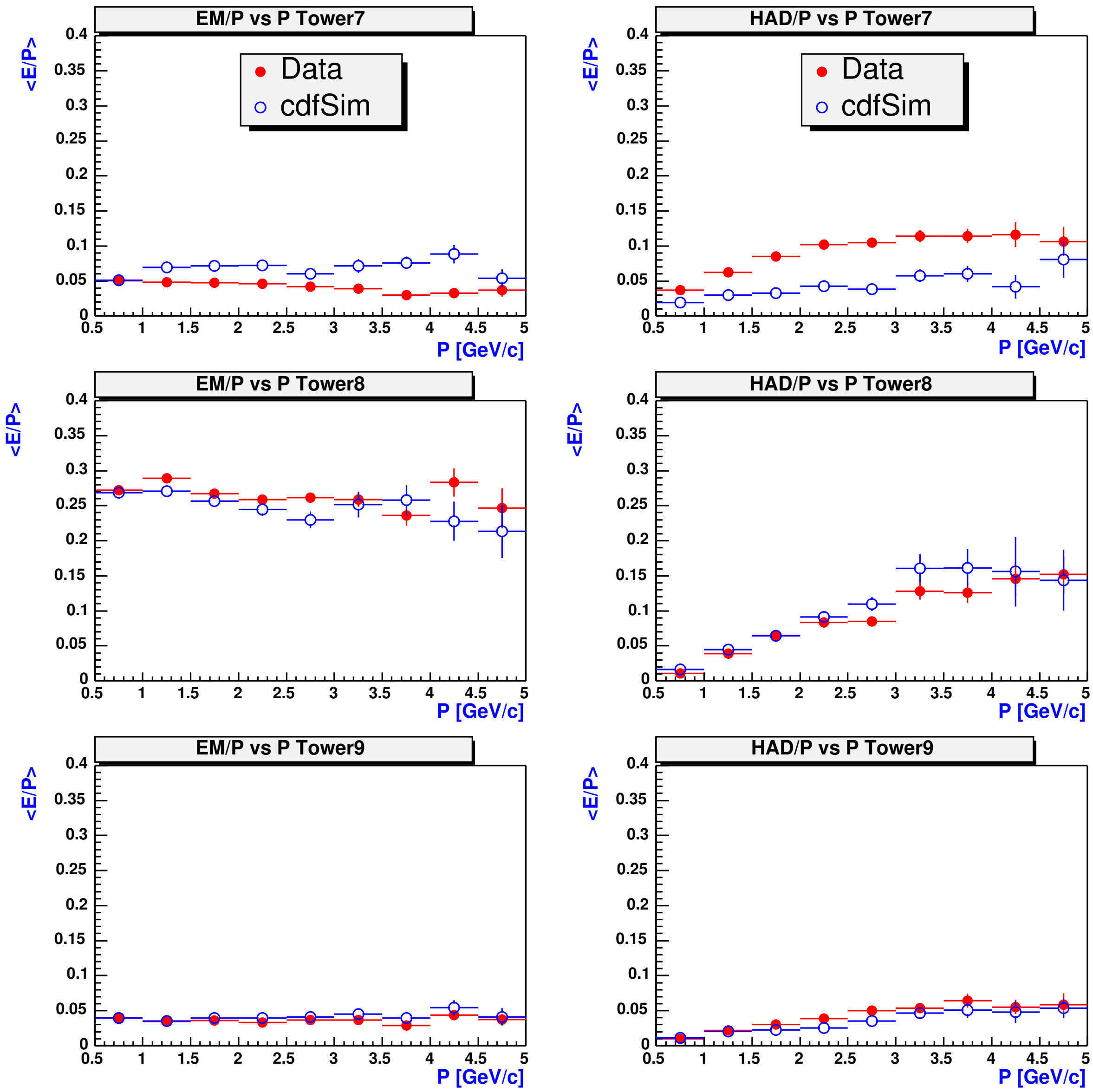
- Conversion Vertex R-z





Tower8 (backup)

- Track entering the center of tower8



- Nominal tower8(7,9) response is reasonable
- Asymmetric response in adjacent towers
- Need asymmetric lateral shower toward tower7?