Re-optimised electron IsEM cut/ID efficiencies @ high Pt (MC)

High Pt Egamma meeting

Emmanuel Laisné, Fabienne Ledroit – LPSC Grenoble

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Introduction/outline

- IsEM cuts re-optimisation based on 2010 data
  - Tightened :
    - Hadronic leakage, lateral shower shape in 2nd sampling ($R_\eta 37$), shower width in 2nd sampling
    - ΔE_{max} in sampling 1

loose medium tight

  - Relaxed/removed :
    - lower bound of E/p removed -> *previously*, efficiency dropping @ hight pT
    - Upper bound of E/p relaxed -> *previously*, efficiency stable w.r.t p_T but rather low
  - All cut values available here

- Updated high pT efficiencies study with new cuts
- Customed E/p upper bound
- Brief look at isolation requirement

- Towards an optimised Z' cutflow

Event selection

- Dataset used

group10.phys-sm.mc10_7TeV.115494.Pythia_Zprime_ee.recon.AOD.e670_s933_s946_r1831_tid243875_0.WZphys.101222.07.D3PD/

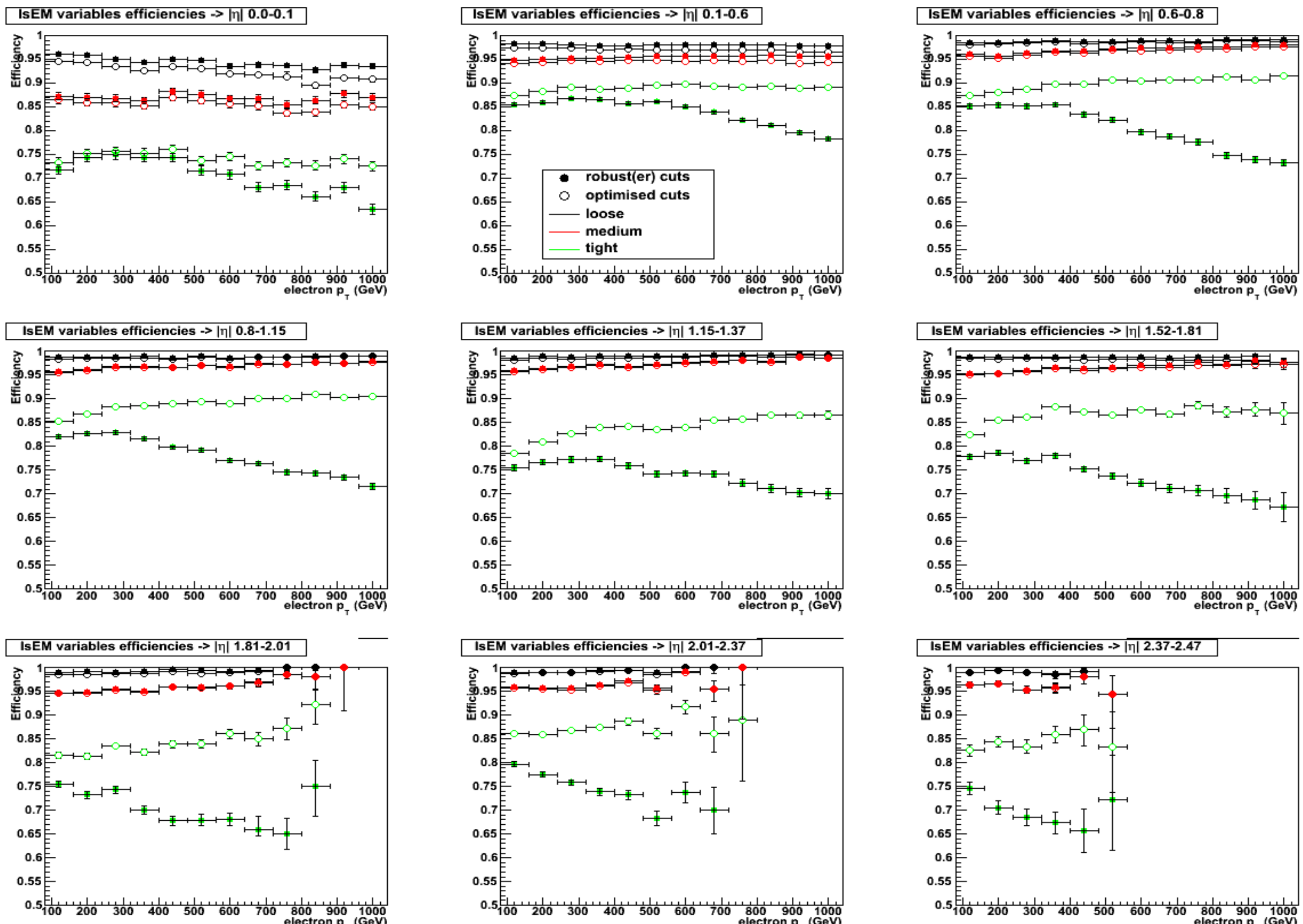
- Preselection :
  - Trigger: L1_EM14
  - N primary vertex >2
  - el author = 1 or 3
  - |η| < 2.47 + crack region (1.37<|η|<1.52) excluded
  - E_T cluster >25 GeV
  - Object quality (Otx maps)

  Efficiencies are computed from leading and subleading electron passing this preselection.

- Apply isEM ID criteria and determine efficiency vs p_T
  - 9 |η| slices reflecting isEM ones for calorimeter variables
  - *Loose, medium, tight ID efficiencies quoted w.r.t to preselection*
  - *IsEM variables efficiencies computed w.r.t preselected electrons passing previous ID (container,loose,medium)*
  - all results available on our webpage
  - reported are : changes concerning optimised variables + isolation + E/p optimisation

IsEM ID efficiencies - robust vs optimised

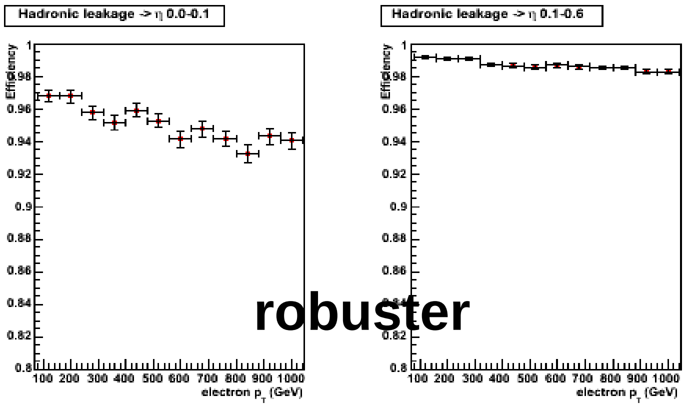
- Loose ID -> lower efficiency for optimised cuts @ |η| = 0-0.1 & 0.1-0.6
- Medium -> lower efficiency for optimised cuts @ |η| = 0-0.1 & 0.1-0.6
- Tight -> overall improvment with optimised cuts

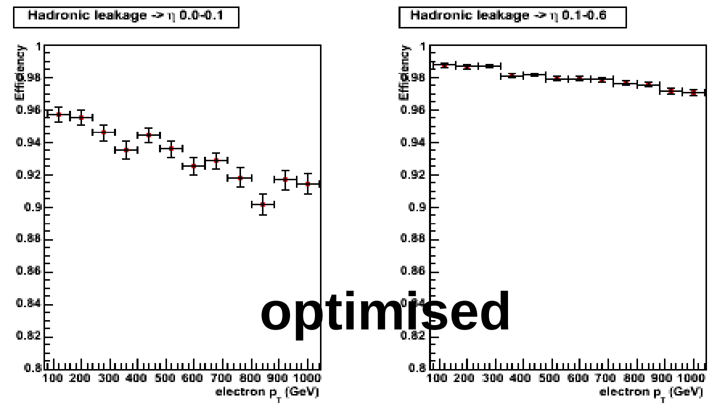


IsEM ID efficiencies - robust vs optimised

- Loose ID -> lower efficiency for optimised @ |η| = 0-0.1 & 0.1-0.6

  - main reason is tightened hadronic leakage





  - Other cuts stable
  - Loose « unefficiency » coming mafrom hadronic leakage and lateral shower shape in 2nd layer

- Medium -> lower efficiency coming from loose cuts (see backup)

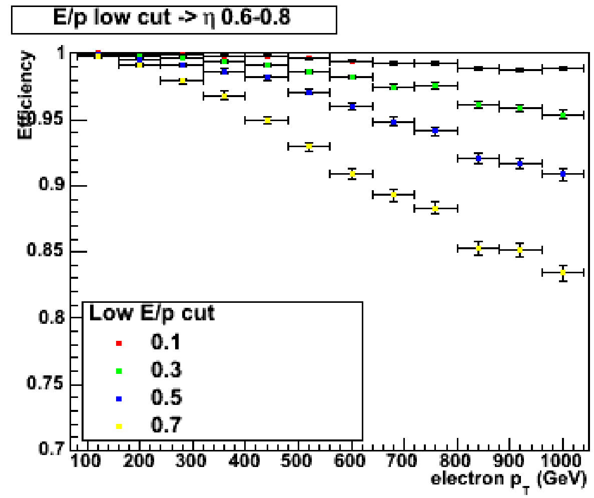
  - ΔE_{max} in sampling 1 cut stable though tightened

- Tight -> overall improvment

  - E/p hight cut changed -> from 5 to 10
  - E/p low cut removed ->previously 0.7
  - -> See details on next slides

Optimised/customed E/p (1)

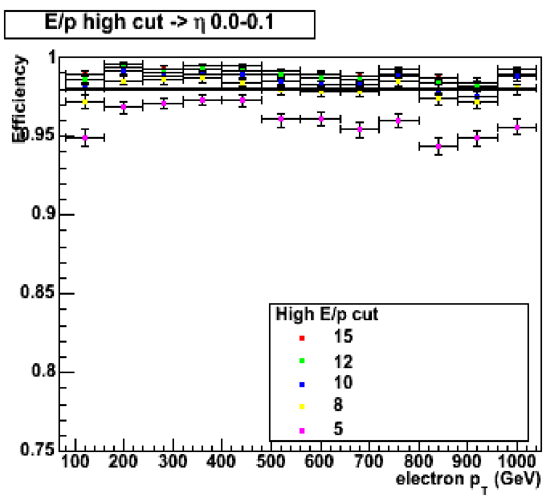
- Removed E/p lower bound
  - No clear optimisation possible @ high pT
  - Efficiency dropping @ high pT with « loosest » cuts

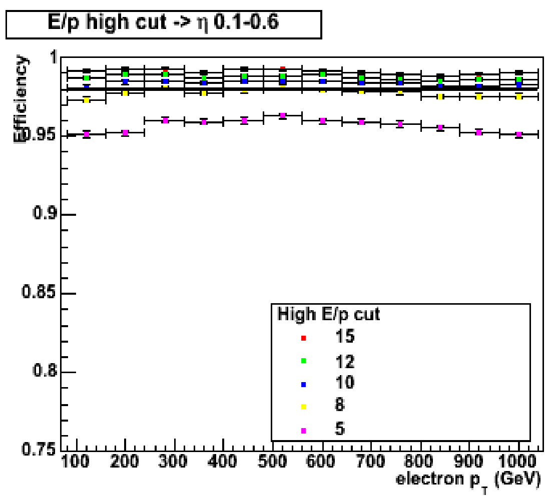


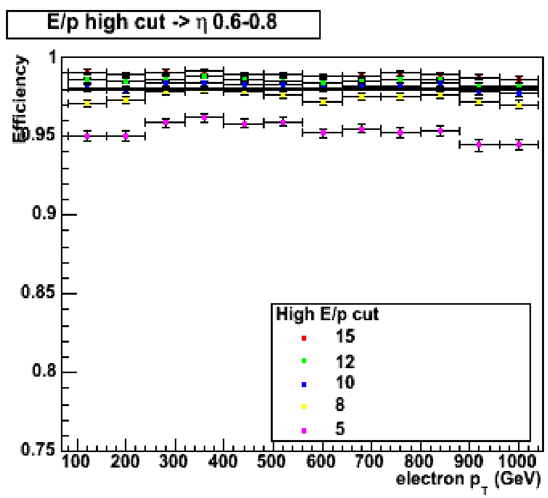
- First try of E/p upper bound optimisation
  - Baseline -> keep rather constant efficiency w.r.t η bins

  As much independent as possible of η distribution (Z / Z')*

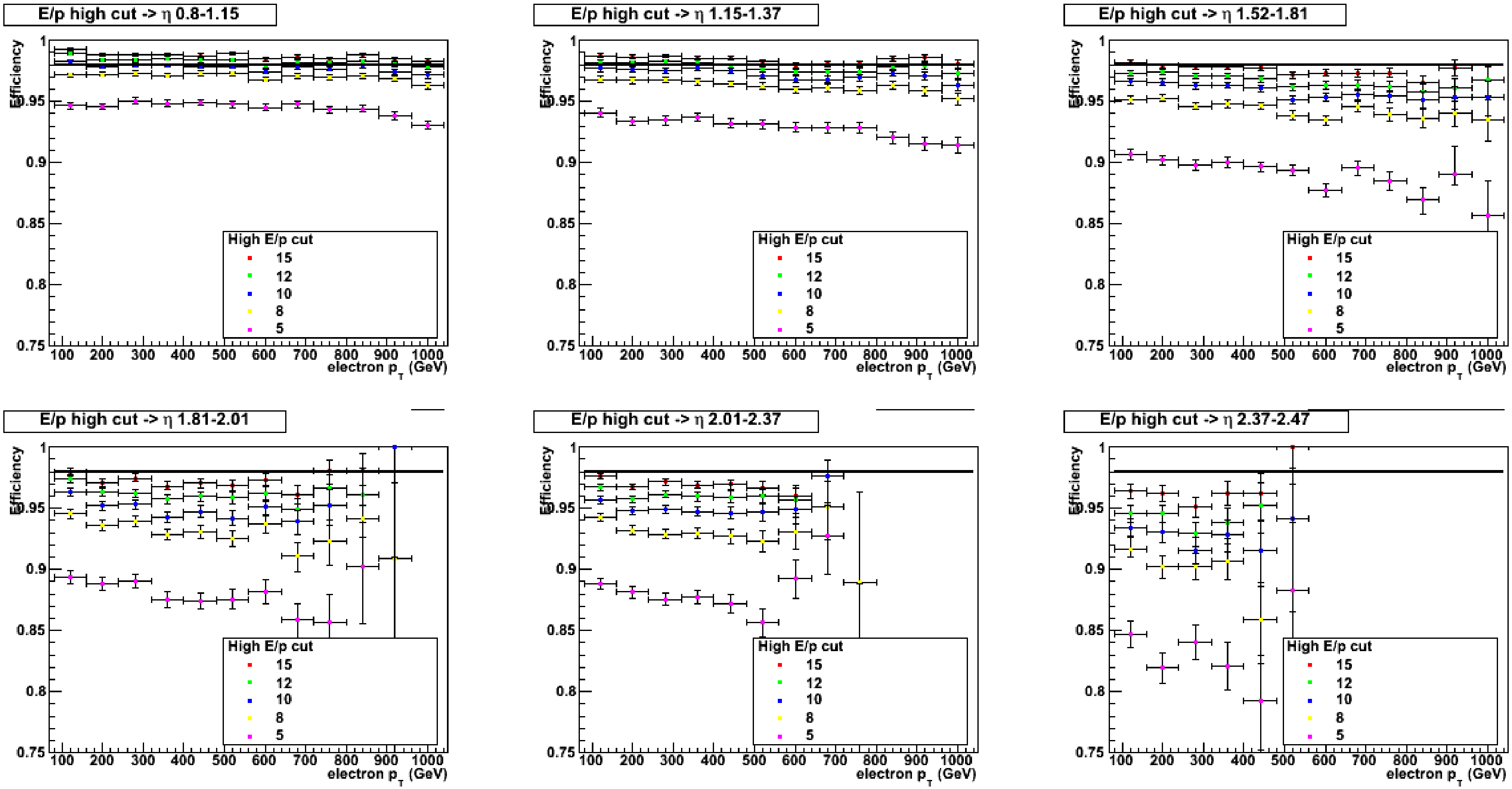
  - Arbitrary choice of 98% efficiency w.r.t medium ID





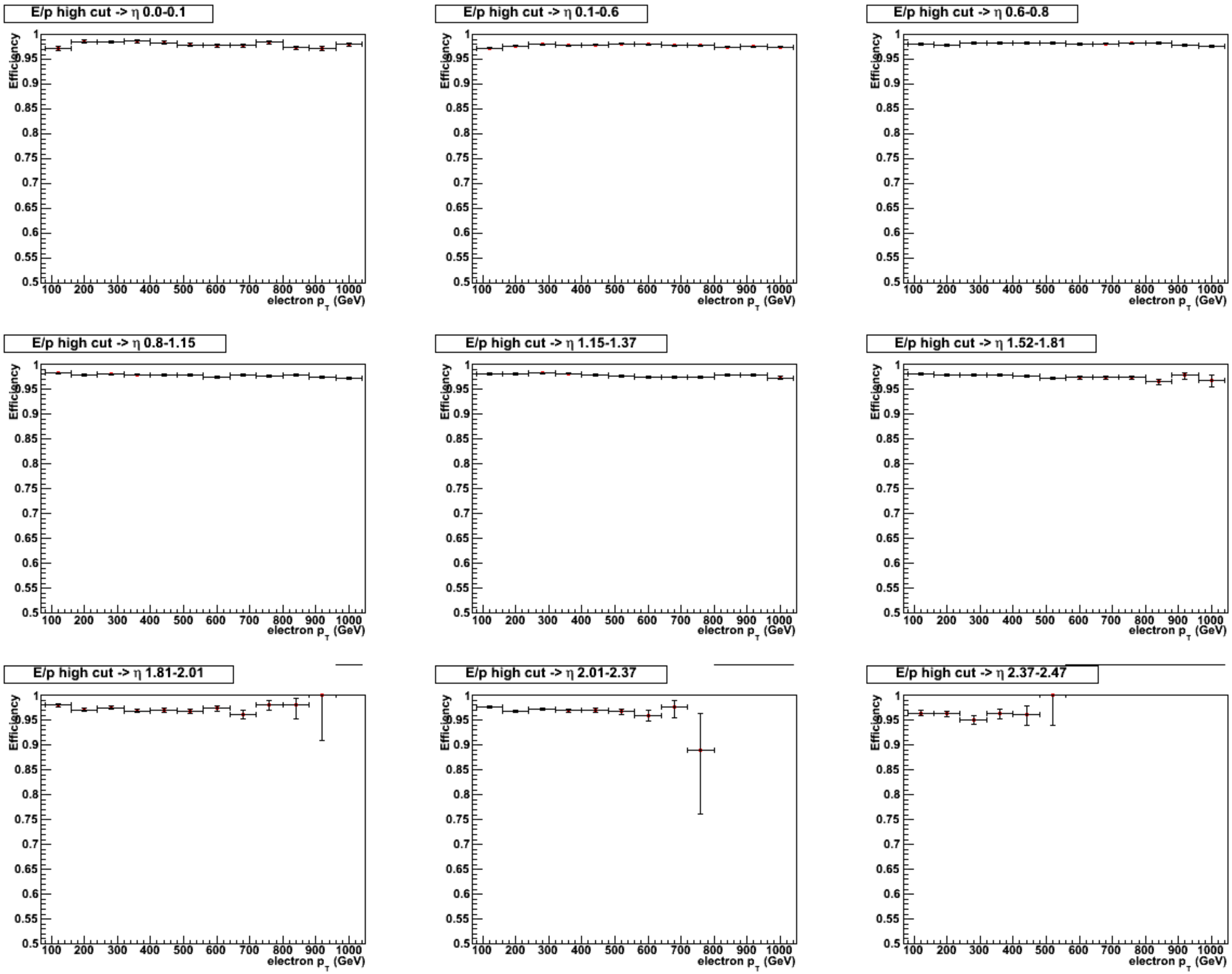


Optimised/customed E/p (2)



- Efficiency dropping with eta for a fixed cut value
- Defined an optimised set of cuts
  - [8.0 ; 8.0 ; 10.0 ; 10.0 ; 12.0 ; 15.0 ; 15.0 ; 15.0 ; 15.0 ; 15.0]

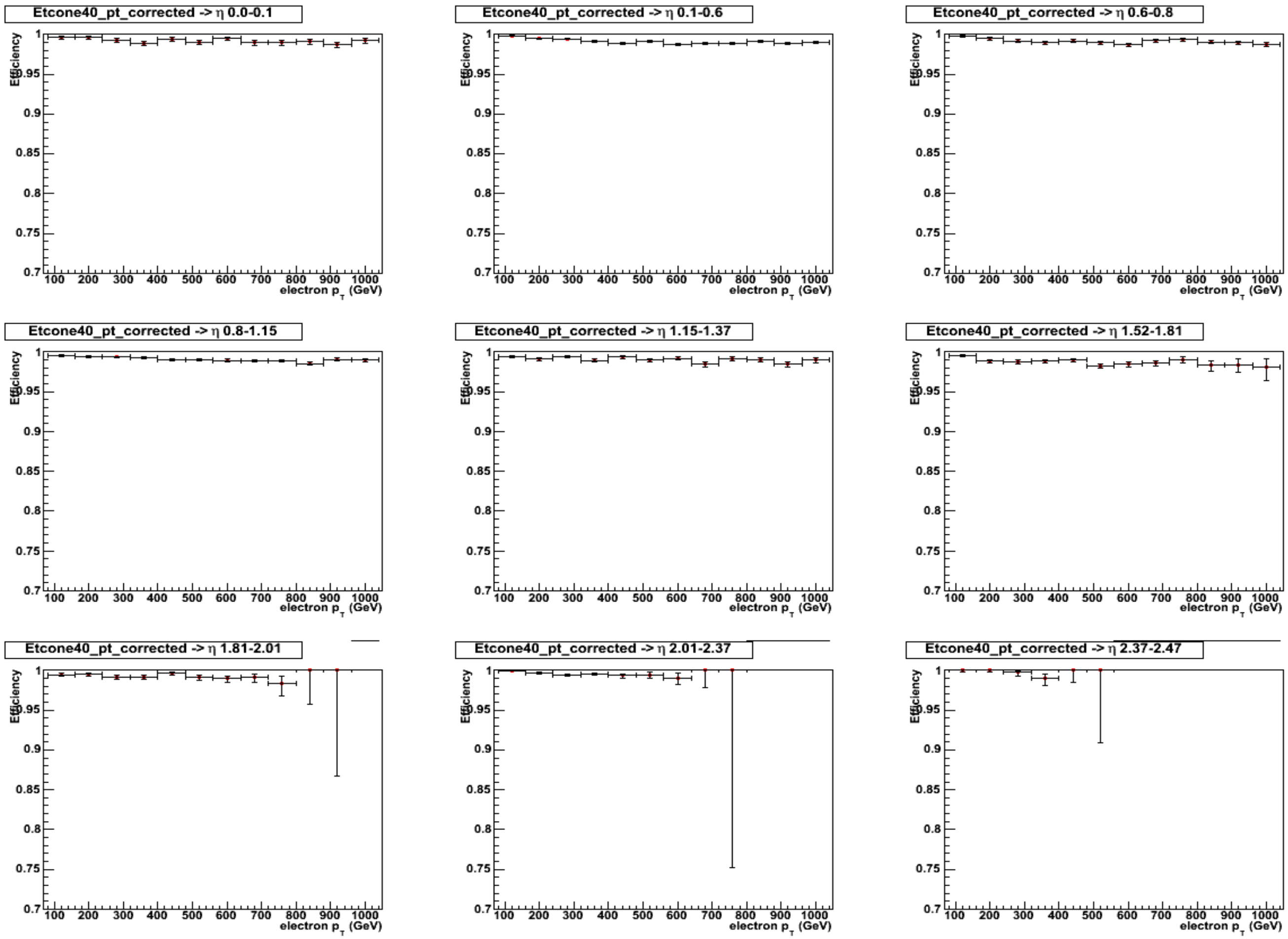
Optimised/customed E/p (3)



Brief look at isolation (1)

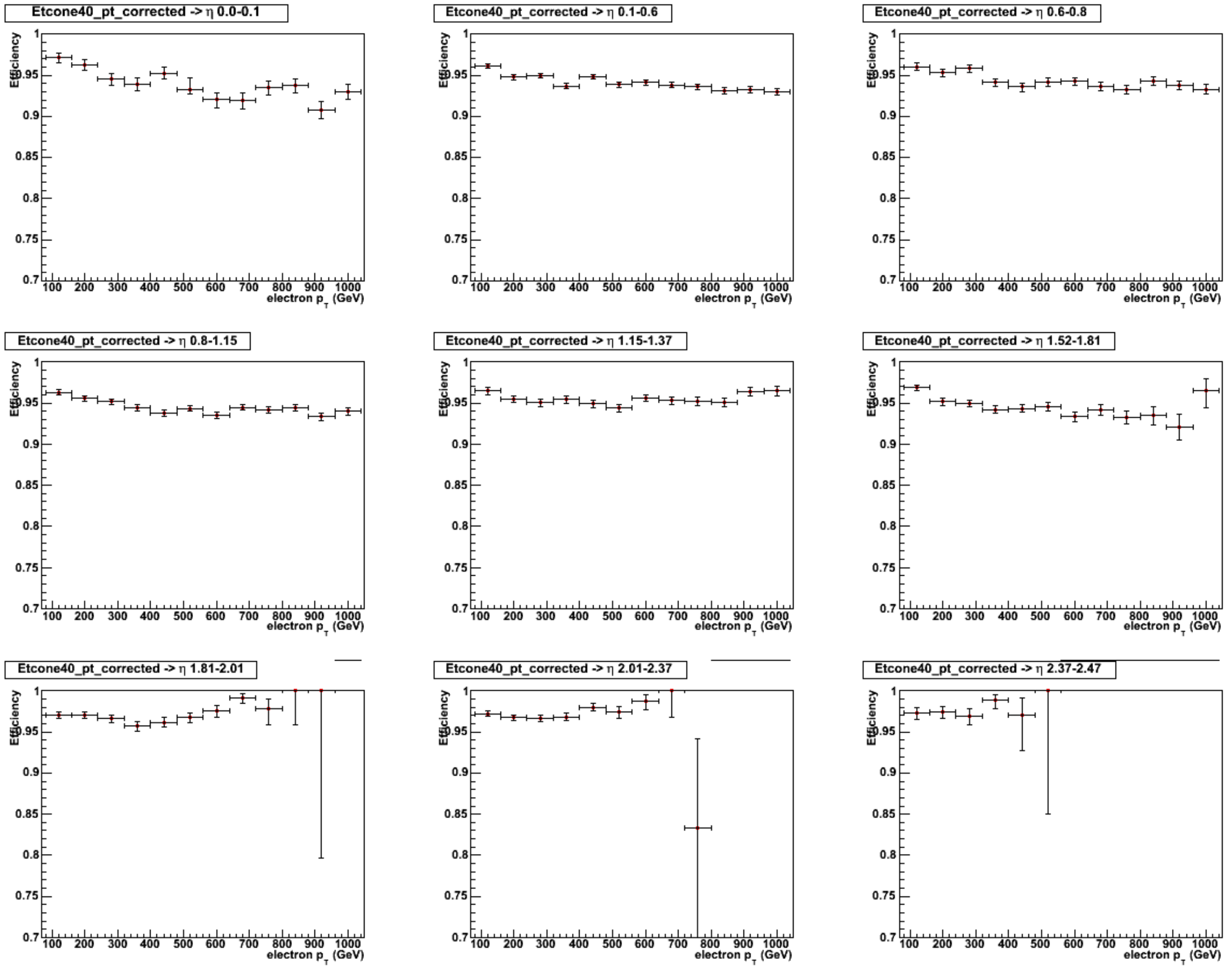
- Computed isolation cut efficiencies w.r.t optimised medium ID
  - Considered Etcone40_pt_corrected with flat cut : < 10 GeV
  - For more detailled study see Dominick Olivito’s talk last week

- Leading electron



Brief overview of isolation (2)

- Subleading electron



- Subleading always less isolated than leading
  - In agreement with Domick's conclusions

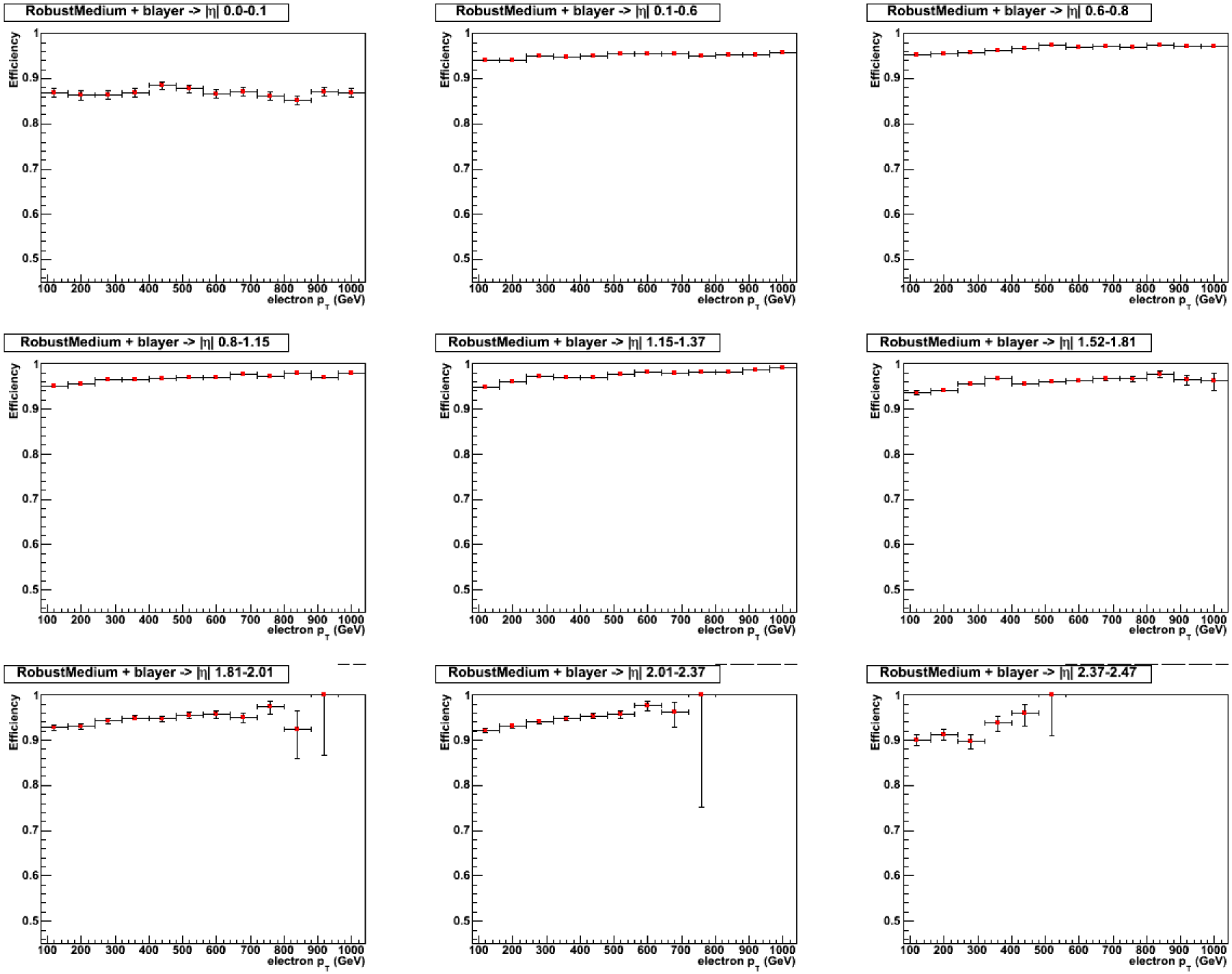
Towards optimised Z’ cutflow

- Considered adding E/p high cut and isolation to our standard cutflow
  - Avoid bad surprises when looking in detail at our high mass events

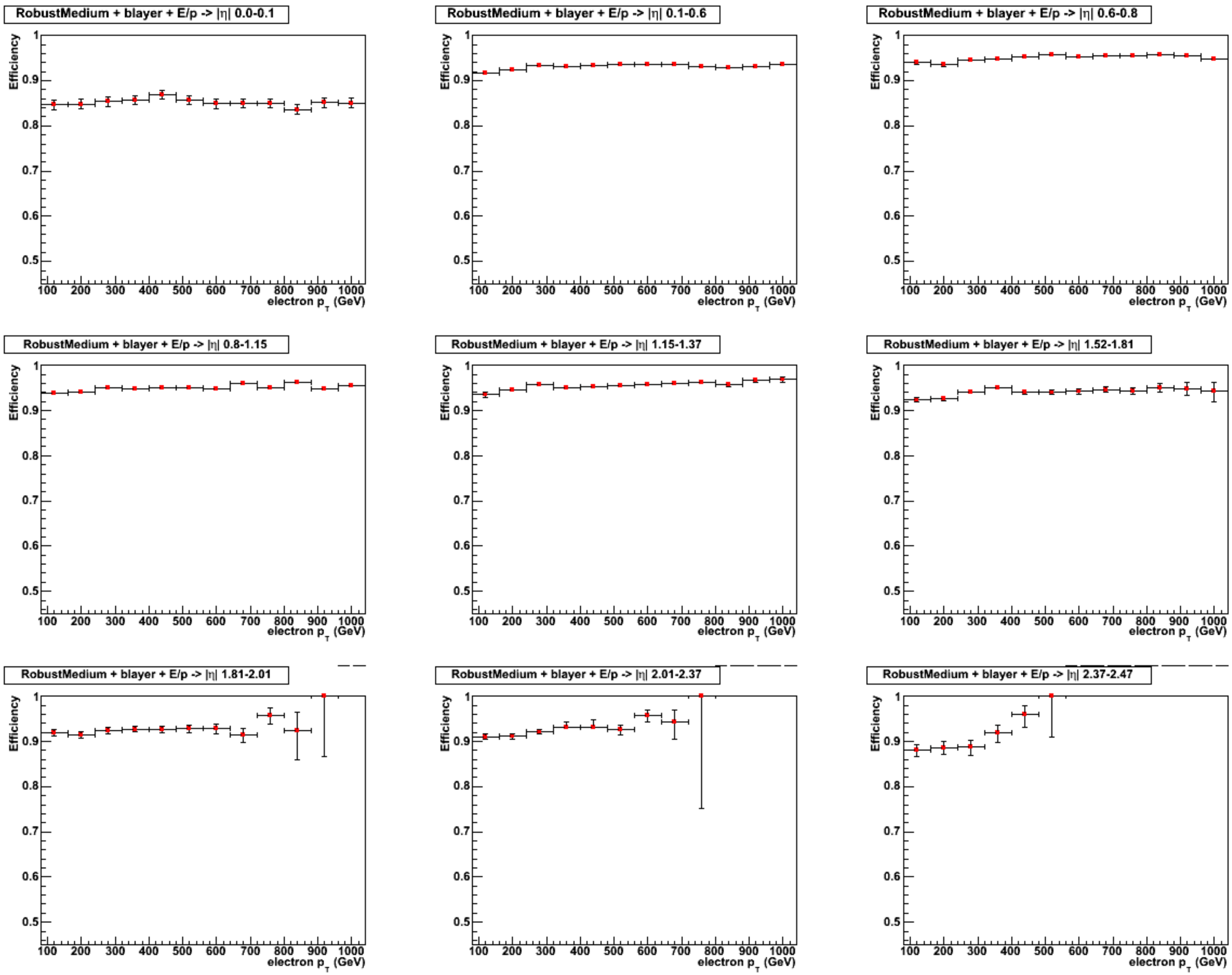
- Proposition would be all or part of the followings
  - Medium ID (both electrons)
  - Blayer requirement (both electrons)
  - **E/p (both electrons)**
  - **Isolation (leading electron)**

- Computed optimised medium + … selection efficiency vs pT on leading electron (w.r.t preselection)
  - Medium + blayer
  - Medium + blayer + E/p
  - Medium + blayer + isolation
  - Medium + blayer + isolation + E/p

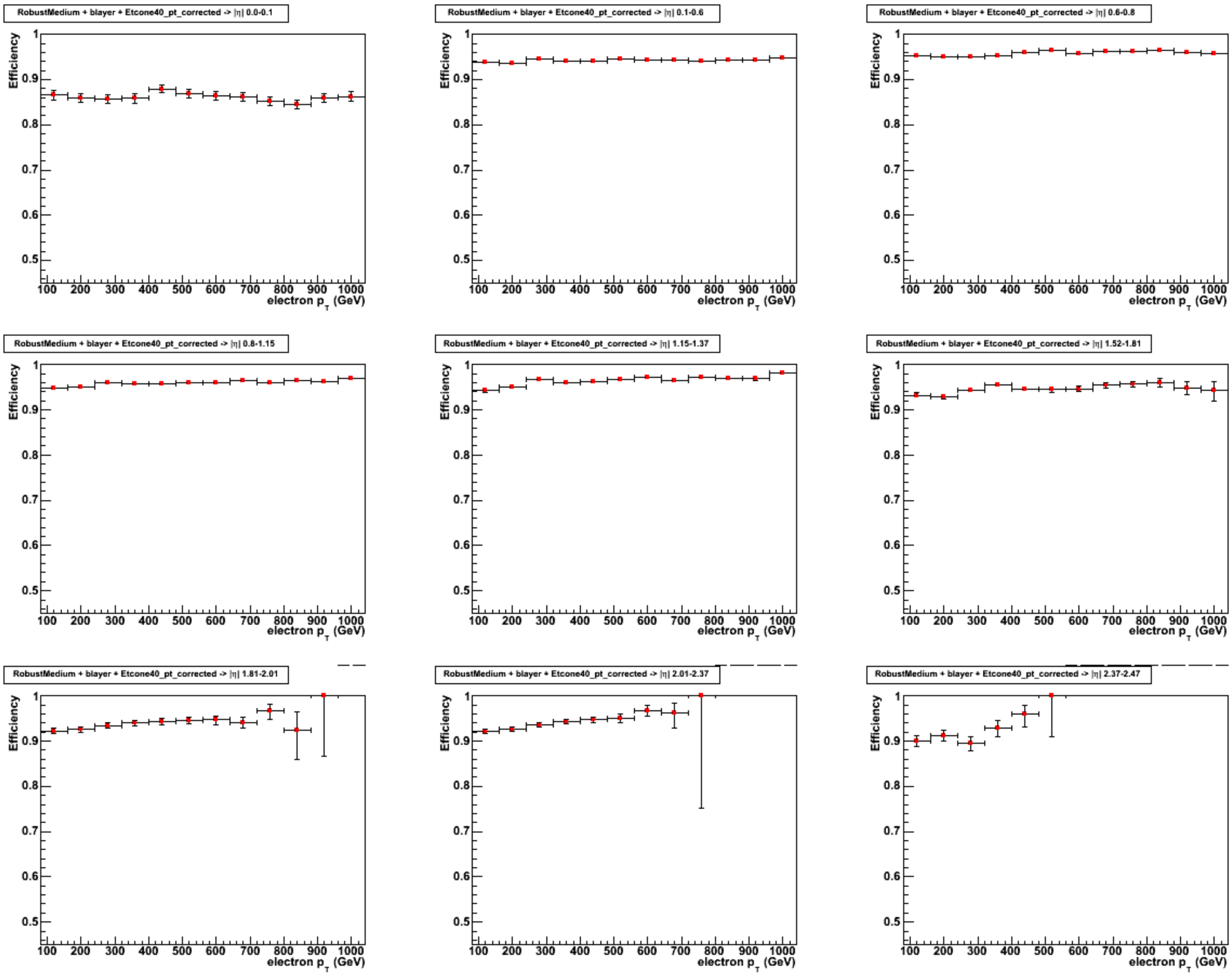
Medium + blayer (« standard »)



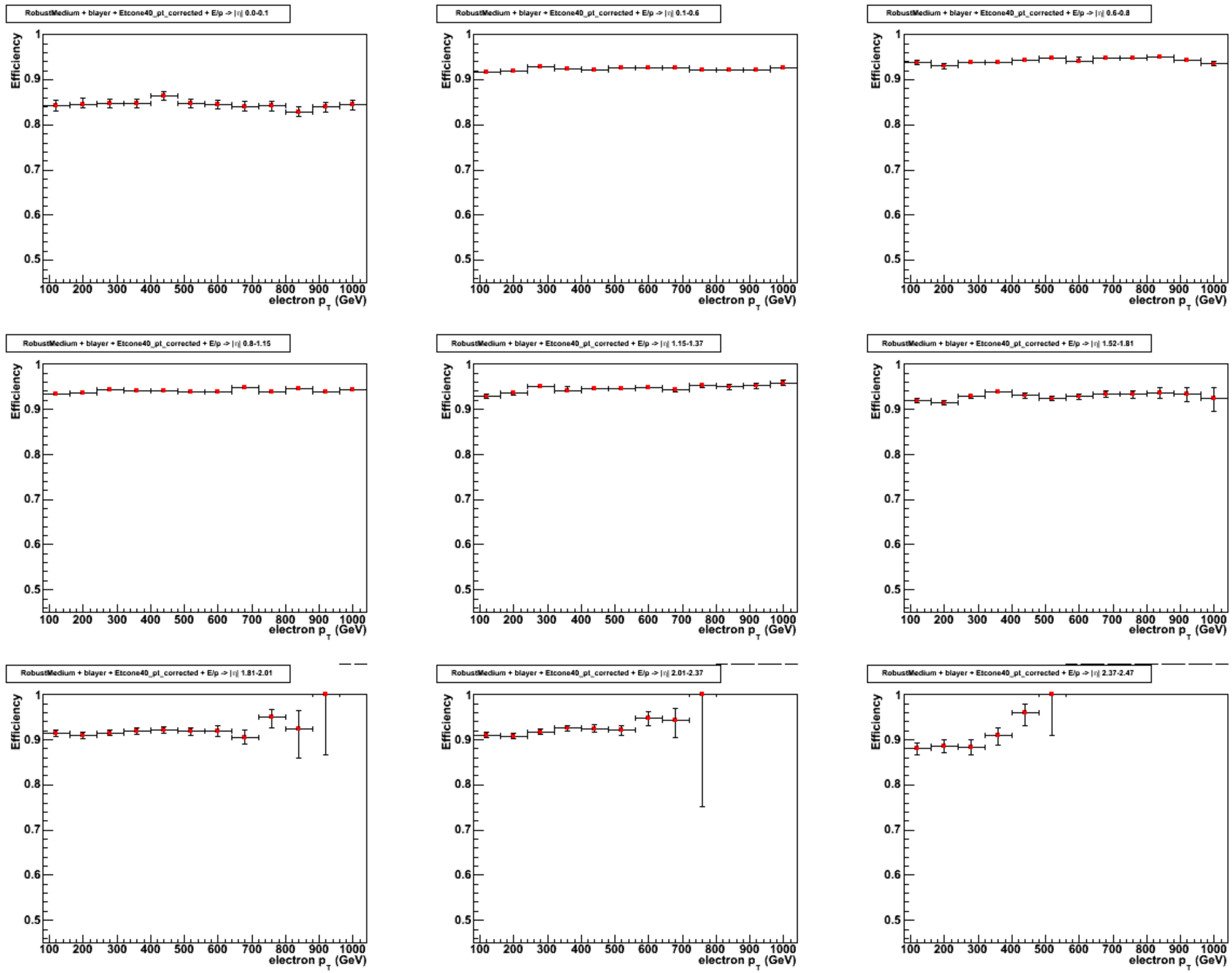
Medium + blayer + E/p



Medium + blayer + isolation



Medium + blayer + E/p + isolation



Conclusion

- Updated MC studies on IsEM variables and ID efficiencies with optimised cuts
  - Changes mainly affecting hadronic leakage and E/p
  - Medium efficiency extrapolation at high pT not affected as overall efficiency increasing with pT

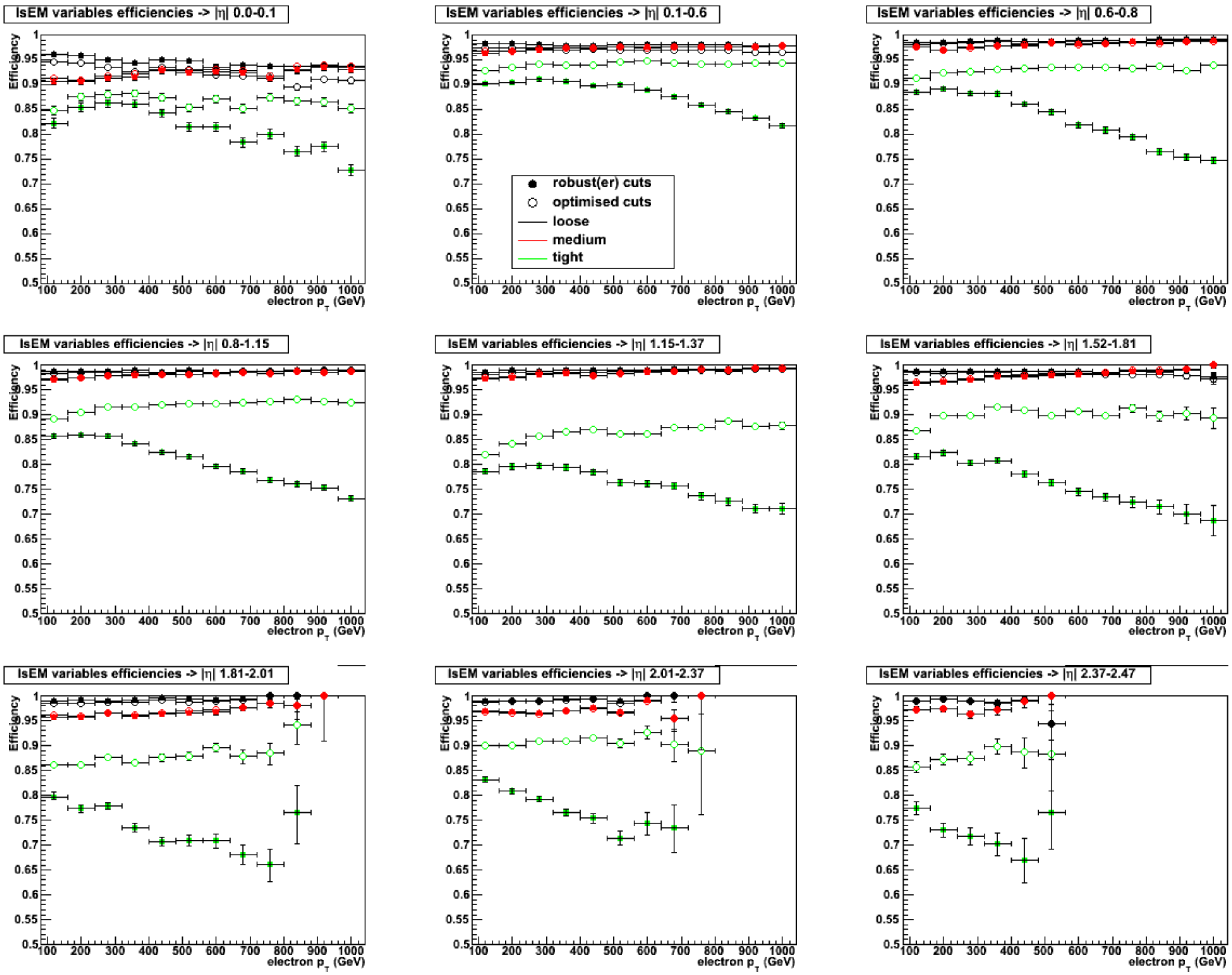
- Studied E/p selection
  - E/p cuts @ high pTrelaxed in optimised isEM
    - removed lower bound
    - relaxed upper bound
  - Proposed a rough optimisation of upper bound
    - Efficiency : ~98%
    - Stable behaviour vs pT

- Proposal for optimised cutflows -> E/p ; isolation
  - Adding them separately our together achieve similar performance regarding signal
  - Cost in term of efficiency not that high
  - Could avoid some bad surprises

BACKUP

IsEM ID efficiencies - robust vs optimised

- IsEM ID efficiencies vs pT w.r.t to **previous** ID selection
  - Optimised vs robust shows no change concerning medium ID



E/p lower bound efficiencies