E/p studies @ high Pt

High pT egamma meeting

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Introduction/outline

- Updating E/p studies with 2011 data
- Include Rozmin's QCD background estimate
  - more statistics @ high pT
- Tried to derive data driven estimates of E/p cut behaviour w.r.t
  - pT
  - Eta

E/p -> MC/data comparison

- Samples

Data - period B + D (2011)

– Electrons from standard Z' selection as a signal data sample

– Used reverse Id QCD background templates as a background data sample

  - Switch to Rozmin's reverse ID -> used for m_{ee} >200 GeV for QCD estimation (Z')

MC

– MC10a Zee sample (106046)

– *MC10a Jet samples JX (105009-105015) -> not shown there*

- Reverse ID QCD template

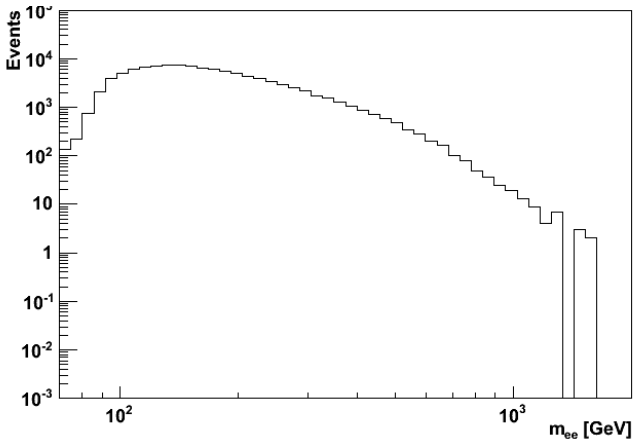
– trigger : e60_loose

– Ntrack p vertex >2, GRLs, OQ, $|\eta| < 2.47$ (no crack), cluster Etleading/subleading >65/25 GeV, blayer

– require loose !medium + failing strips

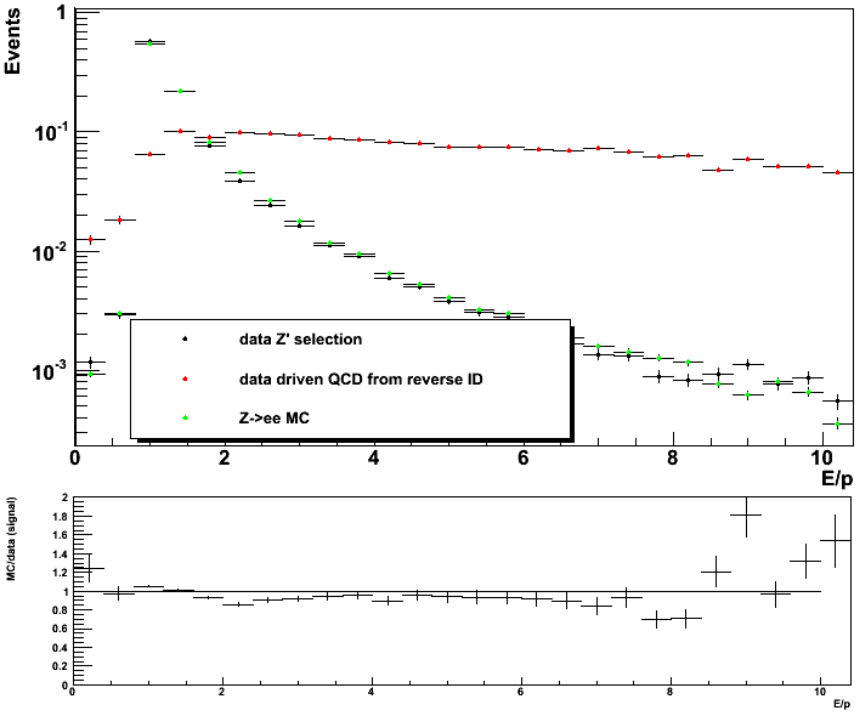
- Larger statistics at high m_{ee}

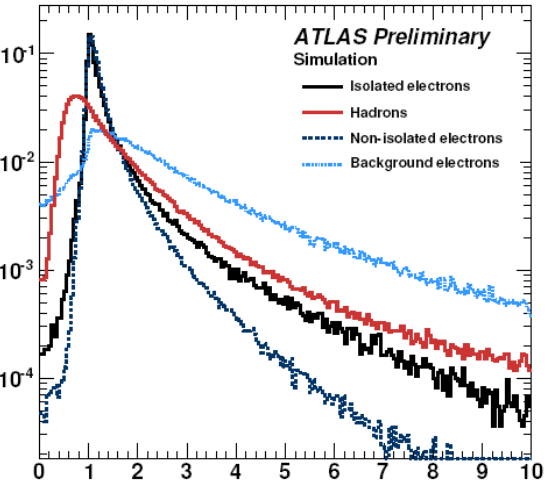
Reverse ID sample invariant mass



E/p -> MC/data comparison (2)

- Good agreement MC/data on signal
- QCD templates
  - Shape seems to indicate several components
  - To crosscheck with MC





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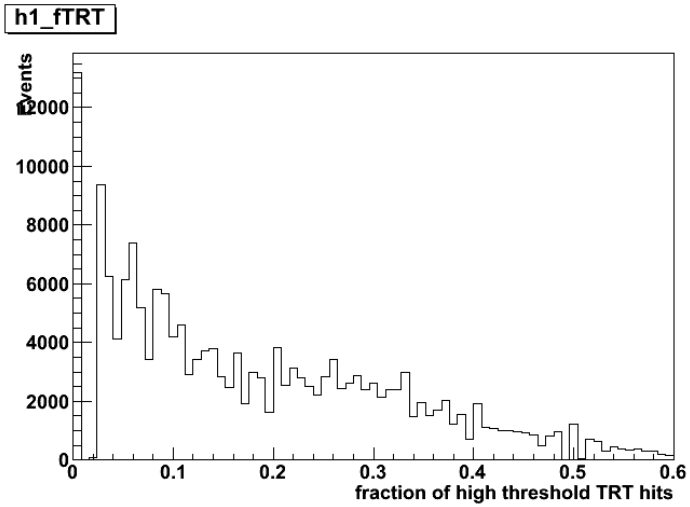
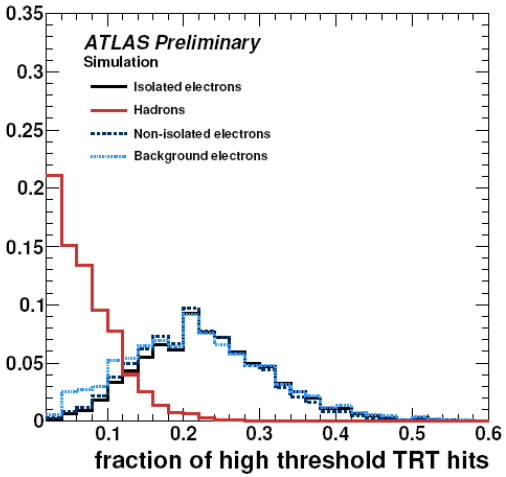
- High energy hit in TRT





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E/p cut - Signal vs background (pT)

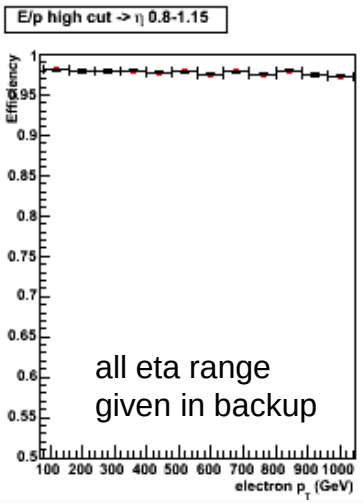
- Derived signal and background efficiencies for E/p cut from data
  - Tested stability of E/p cut with pT -> shown is E/p < 10

Single electron

pT range (GeV)->	80-120	120-160	160-200	> 200	All
Signal (%)	$98.2^{+0.5}_{-0.4}$	$97.3^{+1.0}_{-1.4}$	$94.6^{+2.5}_{-3.6}$	$95.3^{+2.6}_{-4.0}$	$97.8^{+0.4}_{-0.4}$
Background (%)	$60.9^{+0.2}_{-0.2}$	$53.5^{+0.4}_{-0.4}$	$47.8^{+0.7}_{-0.7}$	$44.3^{+0.8}_{-0.8}$	$57.7^{+0.2}_{-0.2}$
ε(S)/ε(B)	1.6	1.8	2.0	2.2	1.7

*only stat errors

  - Statistics rather low for signal (particularly for last pT bins) -> stable ?
    - MC studies would indicate such behaviour
    - Not enough data collected to have a data driven estimate
    - Background contamination not negligible at higher pt
      - Tendency of decreasing ε on background is rather sharp
  - On background -> **rejection improving with pT**
    - Sample size x2 + high pT « electrons »



* Trends for E/p < 10 are identical to the ones for other cuts

E/p cut - Signal vs background (eta)

- Derived signal and background efficiencies for E/p cut from data
  - Tested behaviour w.r.t |η| -> shown is E/p < 10
  - pT > 80 GeV

Single electron

|Eta| range ->	0 - 0.8	0.8 - 1.37	1.52 - 2.47
Signal (%)	$99.1^{+0.3}_{-0.4}$	$97.0^{+0.8}_{-1.0}$	$96.2^{+1.0}_{-1.2}$
Background (%)	$59.7^{+0.3}_{-0.3}$	$59.6^{+0.3}_{-0.3}$	$54.2^{+0.3}_{-0.3}$
ε(S)/ε(B)	1.7	1.6	1.8

  - Efficiency rather stable with eta for both background and signal
    - Slightly decrease @ large eta
    - Still a bit low statistic for signal

E/p cut - Signal vs background (cut values)

- Derived signal and background efficiencies for E/p cut from data
  - Added a few other cut to the one already presented E/p < 3 , 4 (considered for trigger rate reduction)
  - pT > 80 GeV

Single electron

Cut value ->	< 3	< 4	< 5	< 8	< 10	< 12	< 15
Signal (%)	$91.6^{+0.7}_{-0.8}$	$93.8^{+0.6}_{-0.7}$	$95.4^{+0.6}_{-0.6}$	$97.2^{+0.4}_{-0.5}$	$97.8^{+0.4}_{-0.4}$	$98.3^{+0.3}_{-0.4}$	$98.7^{+0.3}_{-0.3}$
Background (%)	$18.1^{+0.1}_{-0.1}$	$25.4^{+0.2}_{-0.1}$	$32.2^{+0.2}_{-0.2}$	$49.0^{+0.2}_{-0.2}$	$57.7^{+0.2}_{-0.2}$	$64.9^{+0.2}_{-0.2}$	$73.1^{+0.2}_{-0.2}$
ε(S)/ε(B)	4.9	3.7	3.0	2.0	1.7	1.5	1.4

  - Current cut @ E/p < 10 seems a bit loose
    - Preserve high efficiency
    - Drawback is that rejection power is rather loose too
    - As a reminder : old upper cut E/p < 5 -> may we finally go back to this one ?

Conclusion

- Main drawback of this study coming from lack of statistics
  - Background sample from reverse ID -> enough statistics (still a few things to understand)
  - Lacking of high pT « true » electrons candidates + contamination from background at high pT in this signal sample (see plots from S. Heim in backup)
- E/p rejection improvement with higher pT
- No strong eta dependance of E/p
- Old cut on E/p may be harmless for signal efficiency and ensure higher rejection of QCD background
  - Shall we go back to this one ?

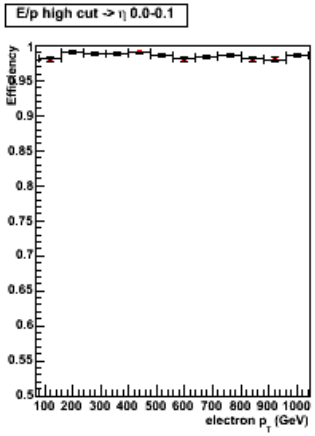
BACKUP

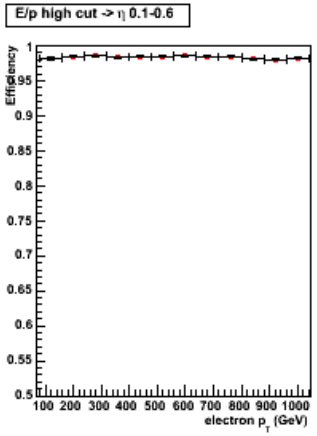
E/p efficiencies in MC

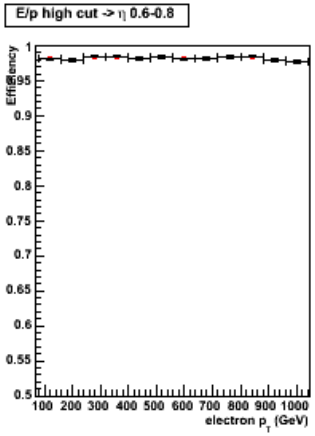
- E/p cut is flat in MC for the whole pT and eta range

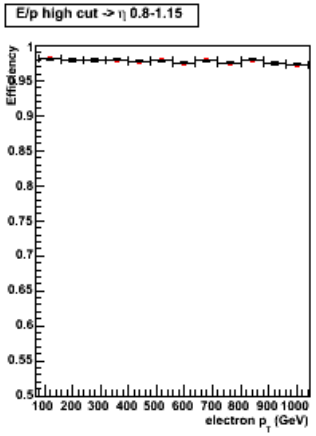
user.wanghill.mc10_7TeV.115494.Pythia_Zprime_ee.merge.AOD.e670_s933_s946_r2215_r2260_SMD3PD/

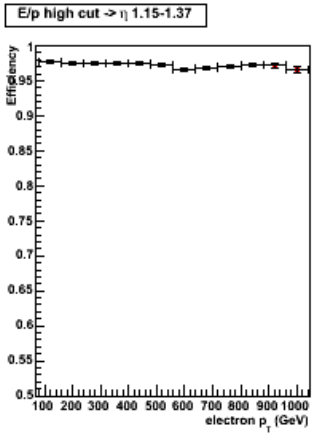
  - Z' preselection
  - See more on [our webpage]

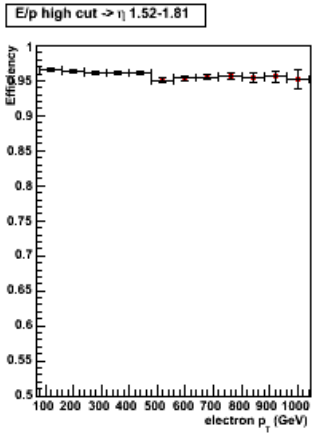


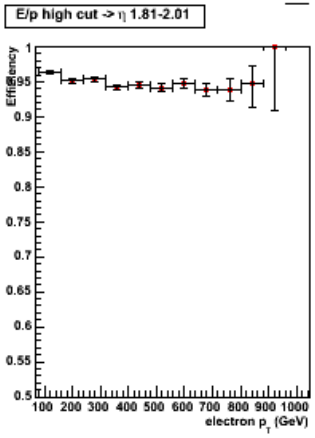


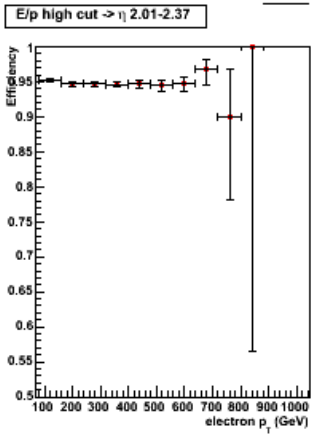


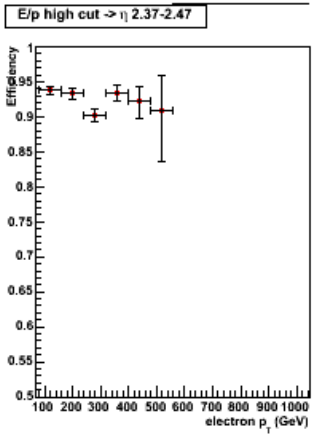












E_T distribution of selected electrons

- Data collected shows a potential non negligible background contribution at high E_T in the « signal » sample