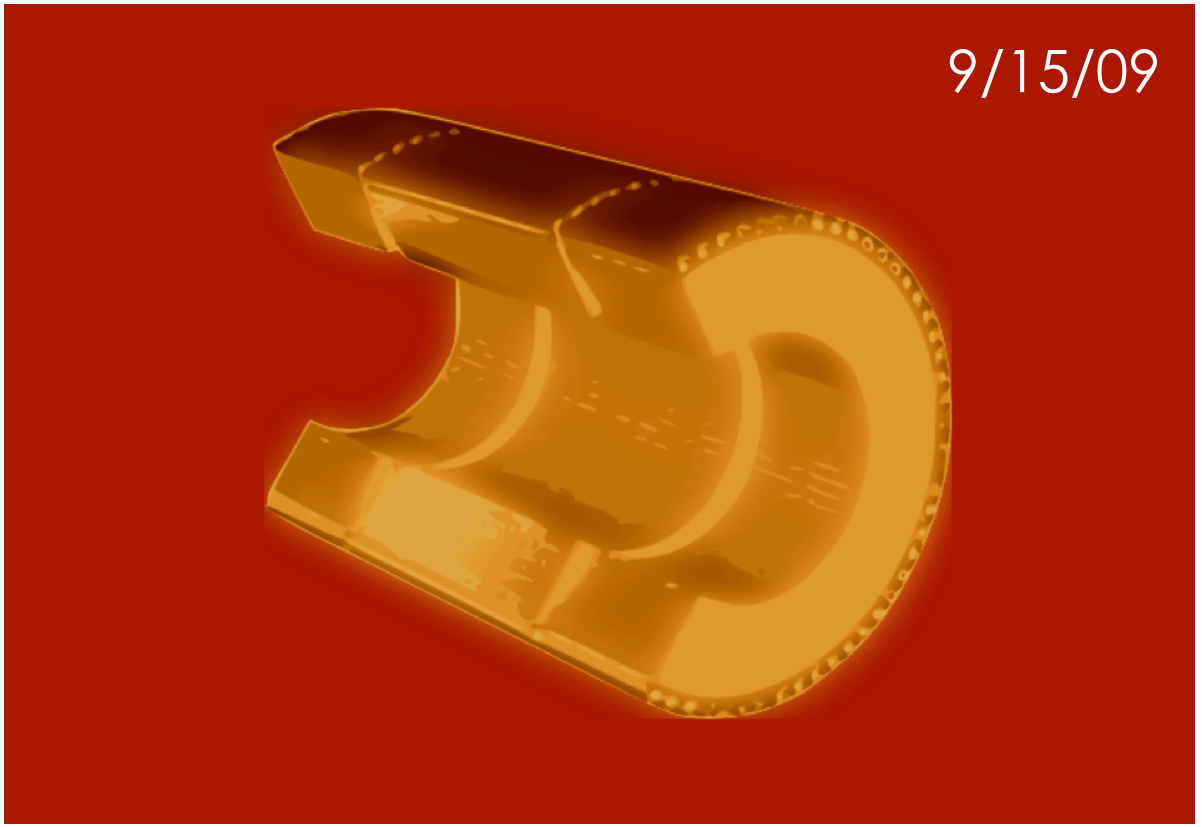
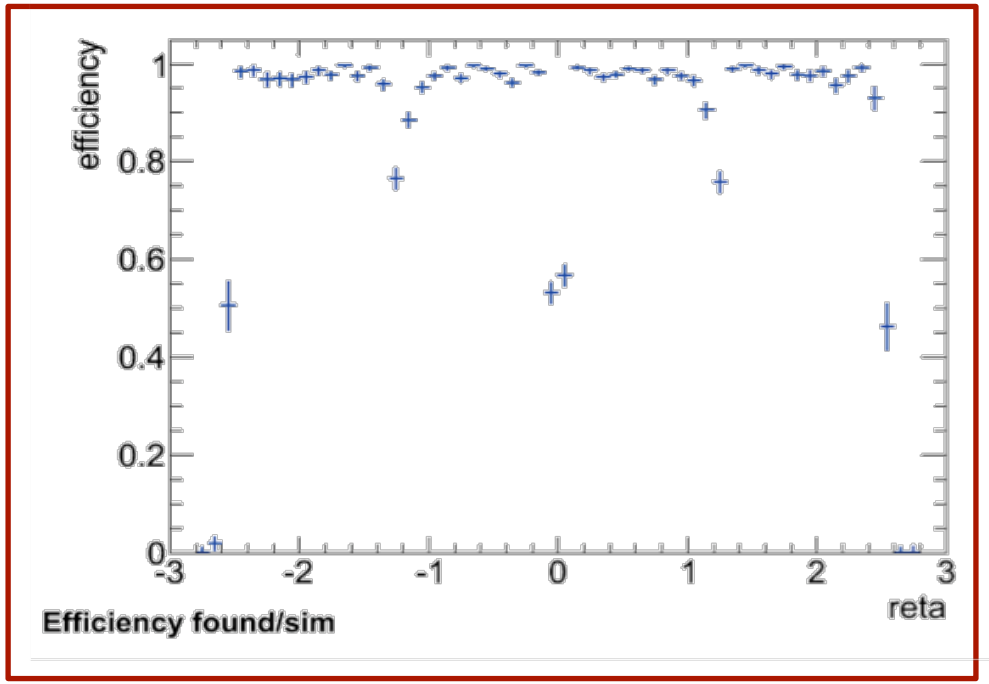


Muon identification in the Atlas calorimeters

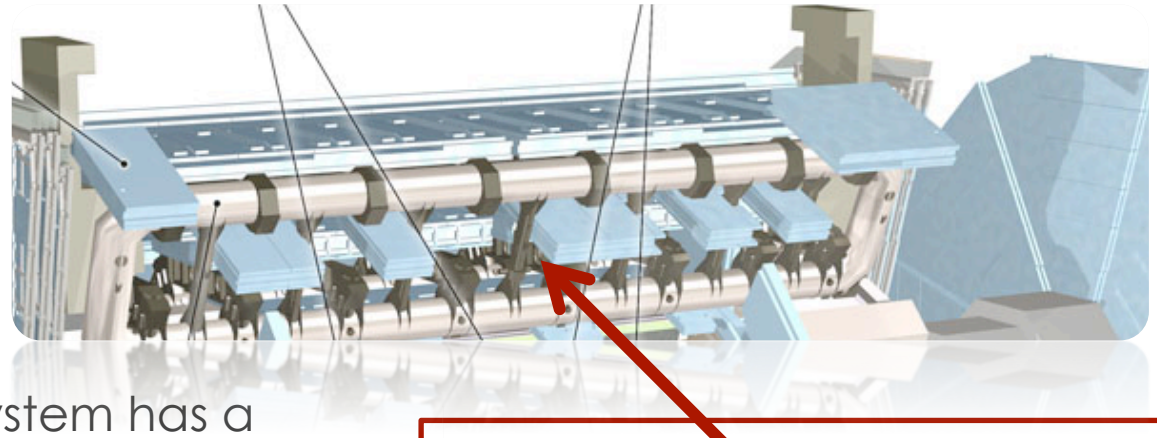
BND-school student talk

Why?

- ATLAS muon system has a gap at $\eta \sim 0$.
- Calorimeter has coverage there.
- Possibility to merge calorimeter muons with spectrometer muons to get better efficiency.
- Important for 4μ final states like H->4μ analysis.



Why?



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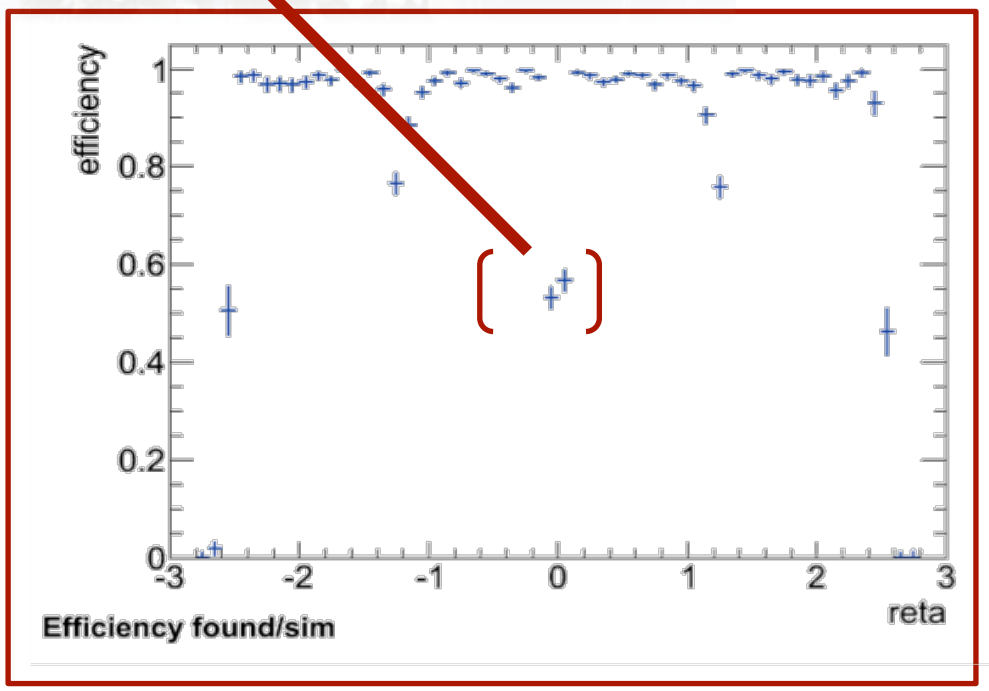
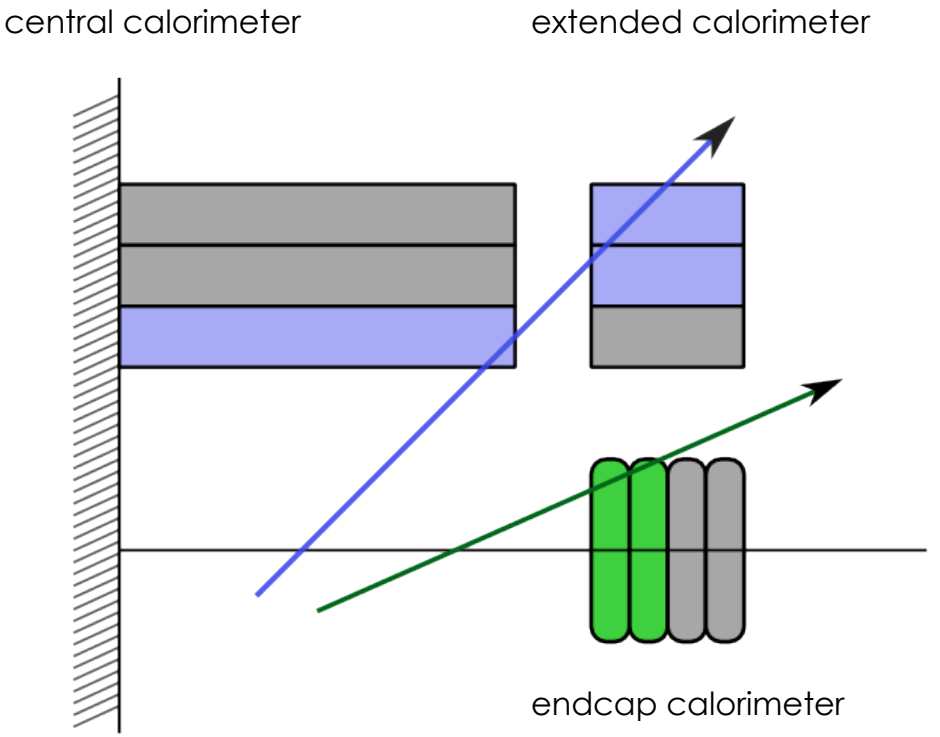
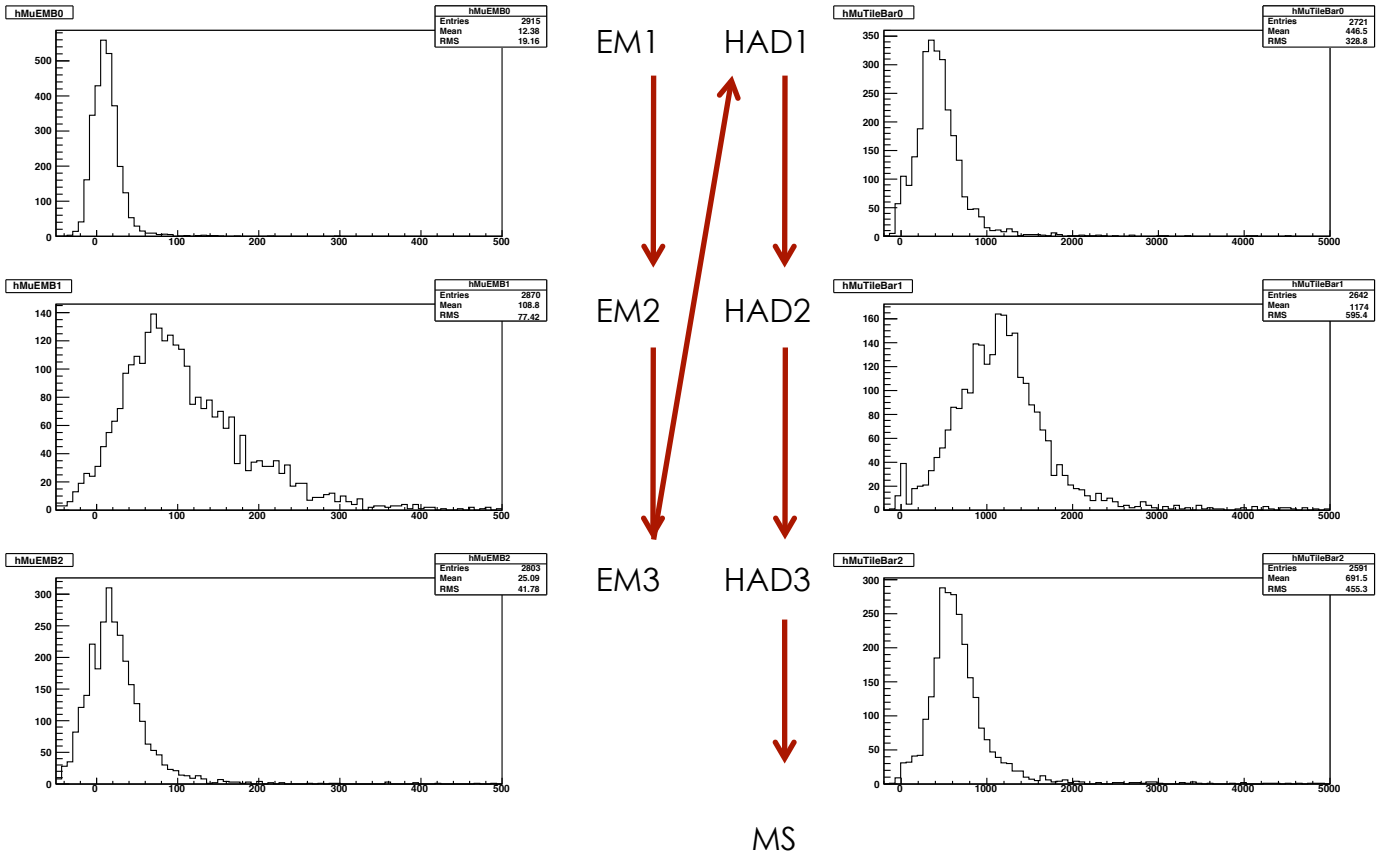


How?

- Take a track from the inner detector.
- Extrapolate to different calorimeter surfaces and gather the corresponding cells (deposits).
- Two ways to tag a muon:
  1. Define cuts on deposits.
  2. Construct likelihood ratio.
- Impose isolation criteria: this kills many fakes.

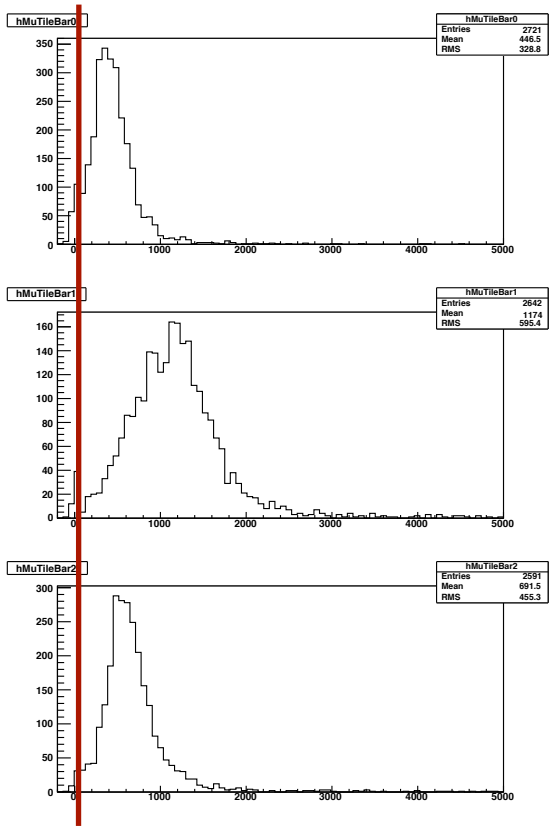


Muon deposits



Cut-based tagging

- First of all we should find a signal above some noise threshold. Veto on last layer that track passes through.



Cut-based tagging

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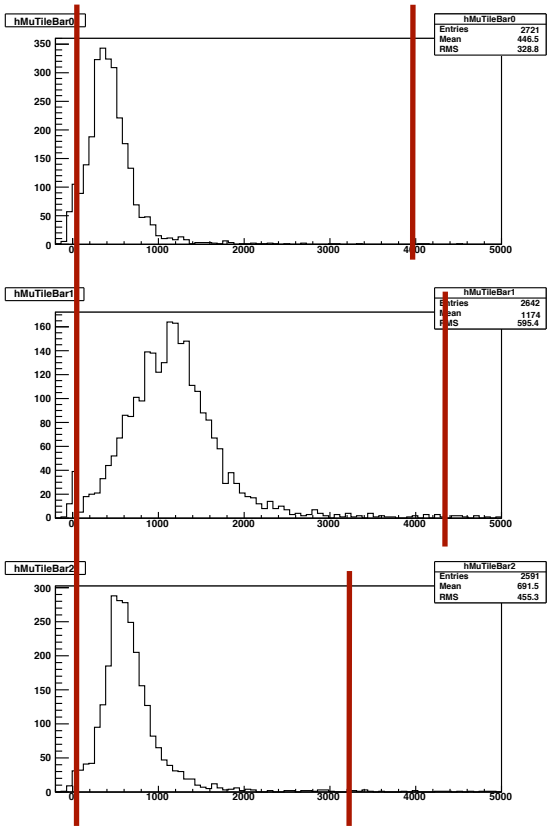
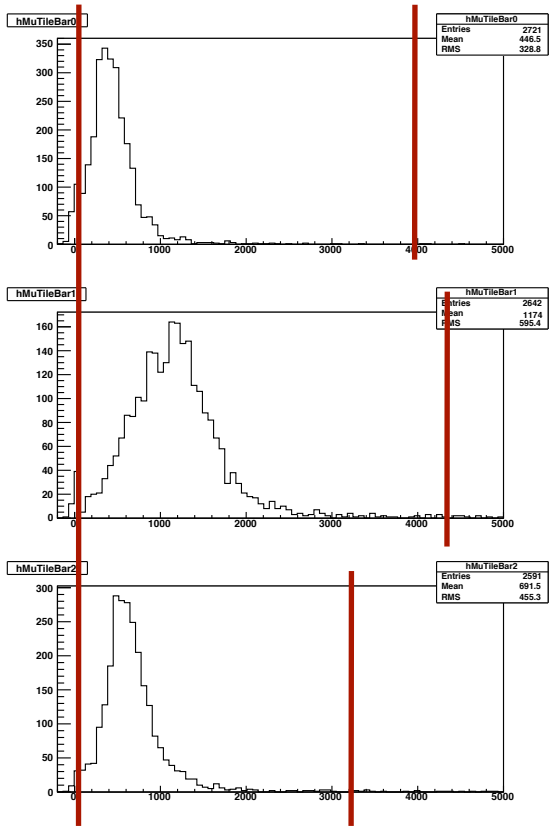
- The deposits must not exceed predefined cuts. These are optimized per layer.



Cut-based tagging

- First of all we should find a signal above some noise threshold. Veto on last layer that track passes through.
- The deposits must not exceed predefined cuts. These are optimized per layer.
- Upper cuts are also imposed on the electromagnetic calorimeter to kill punch through electrons.

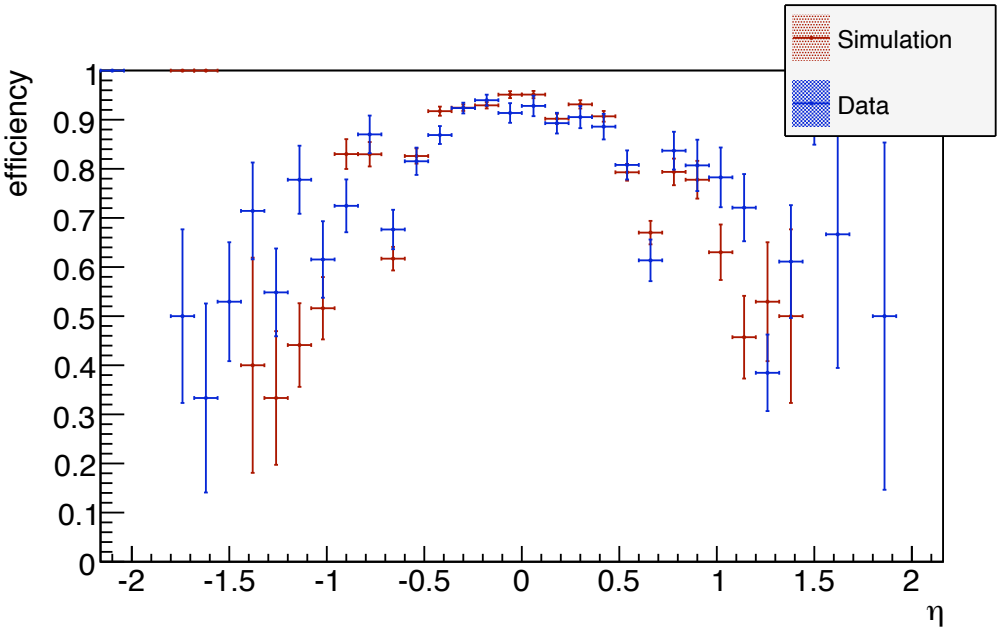


Other selection criteria

- Track quality is guaranteed by:
  - #SCT + pixel hits > 7,
  - Pt > 4 GeV,
  - $d_0/\sigma(d_0) < 7$ (w.r.t. primary vertex).
- Track isolation criteria:
  - $^{10}\log(p_t^{\mathrm{iso}}/p_t) < 0.7$
- Energy isolation:
  - $E_t^{\mathrm{iso}} < 15\,\mathrm{GeV}$
  - $^{10}\log(E_t^{\mathrm{iso}}/p_t) < 0.4$

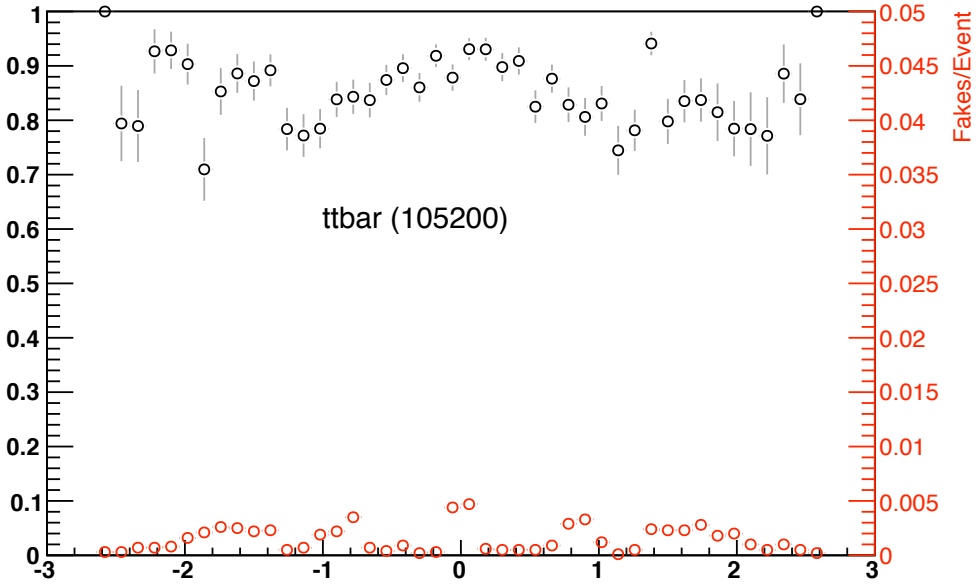
Results on cosmics

- Minimal track selection to assure two hits with η information.
- Lower efficiency at large η is an acceptance effect.



Results on MC

- Tagging efficiency:
  - Does not involve efficiency loss due to track selection criteria.



Outlook & conclusions

- Calorimeter-based muon tagging can recover muons otherwise lost due to gaps in the muon system.
- Ongoing work:
  - Dress muon with quality flag (../Loose/Medium/(Tight))
- When there's beam:
  - Will look for successful identifications.
  - Tune cuts, determine efficiency (although very physics channel dependent).