


Effect of Realistic Alignment Scenarios on TeV Di-muons

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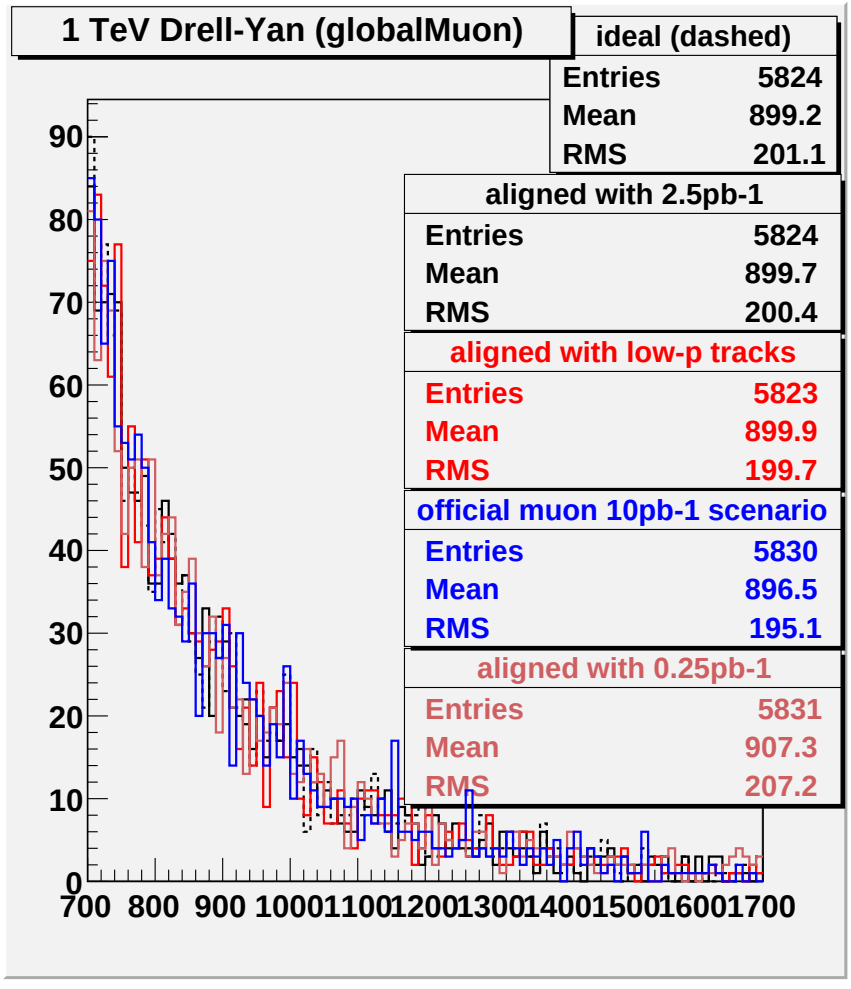
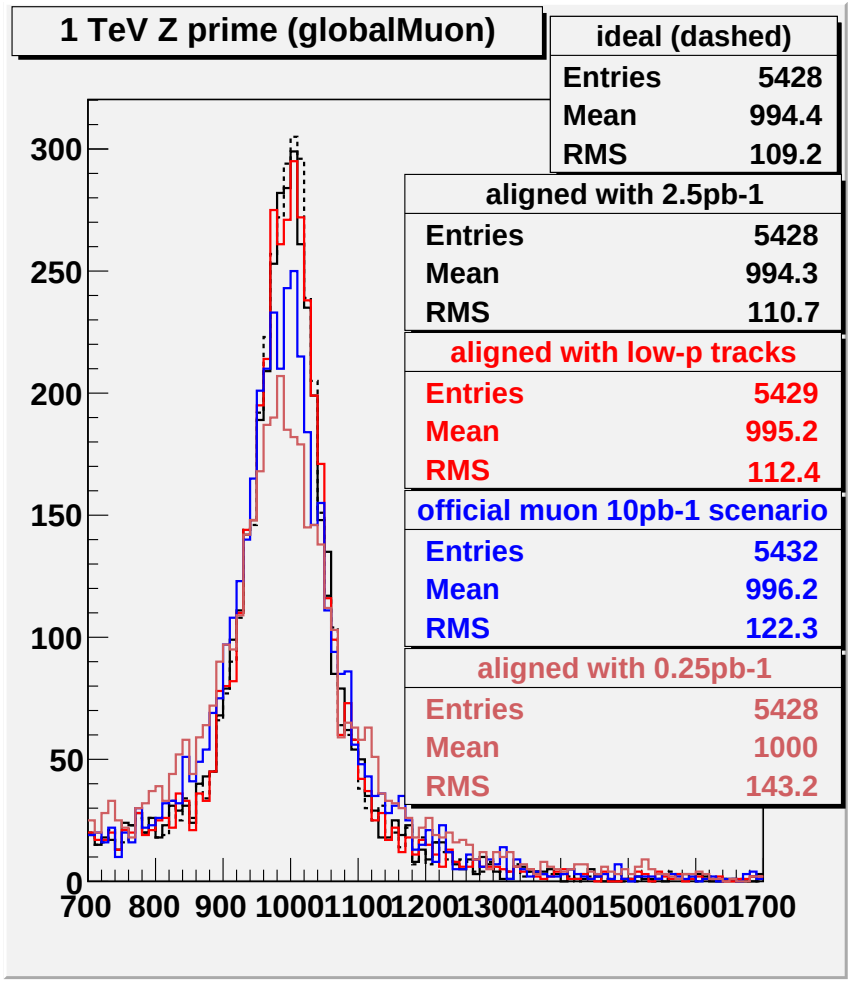
What I've been up to

- Developing a track-based muon alignment procedure
  - Align barrel and endcap in one procedure
  - Based on simple HIP algorithm
  - Two approaches: (a) stand-alone muons and (b) globalMuons (prefer (b), though it introduces tracker $\longrightarrow$ muon systematics)
  - Currently checking systematic errors; CMS note in production
- Recently applied results of realistically simulated alignments to TeV di-muons (see yesterday's CSC DPG)
- We'd like to contribute to TeV di-muon analysis effort
- The rest of this pdf file is all plots (gray is backup)
  - Page 3-6: overlays of misaligned di-muon spectra
  - Page 7-8: event-by-event ratio method for quantifying broadening due to misalignment only
  - Page 9-10: applied to individual track momenta, rather than di-muon mass

Overlay of 1 TeV Drell-Yan and Z' resonance

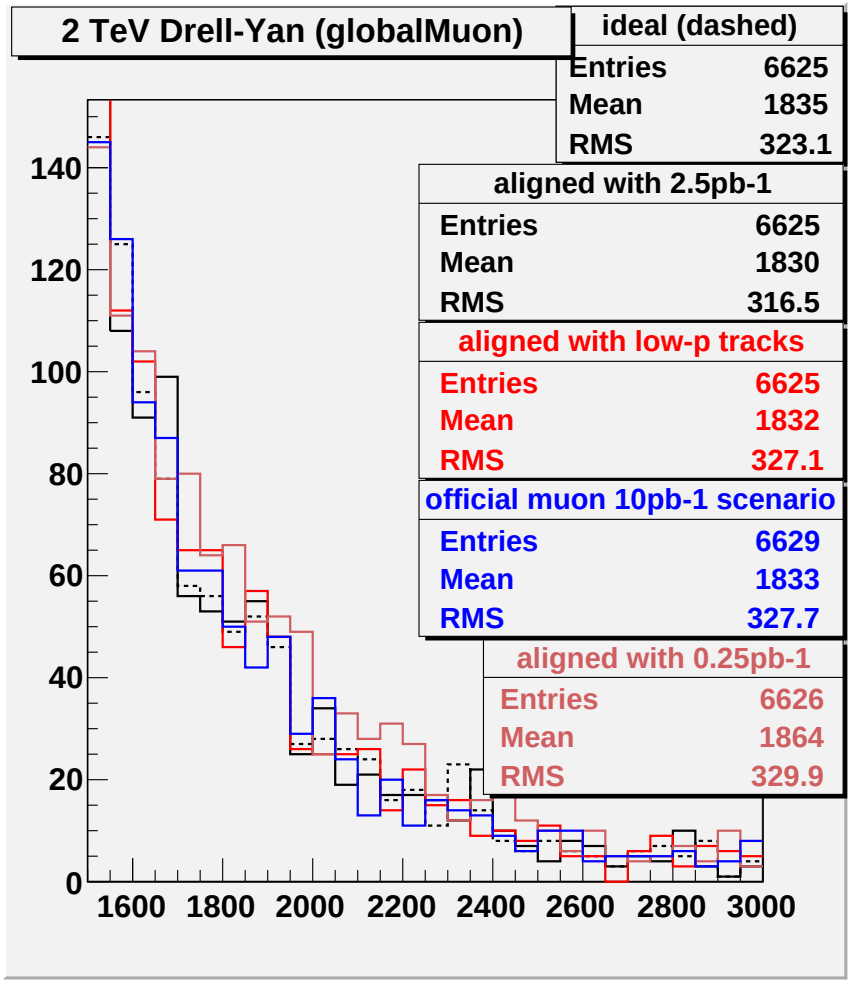


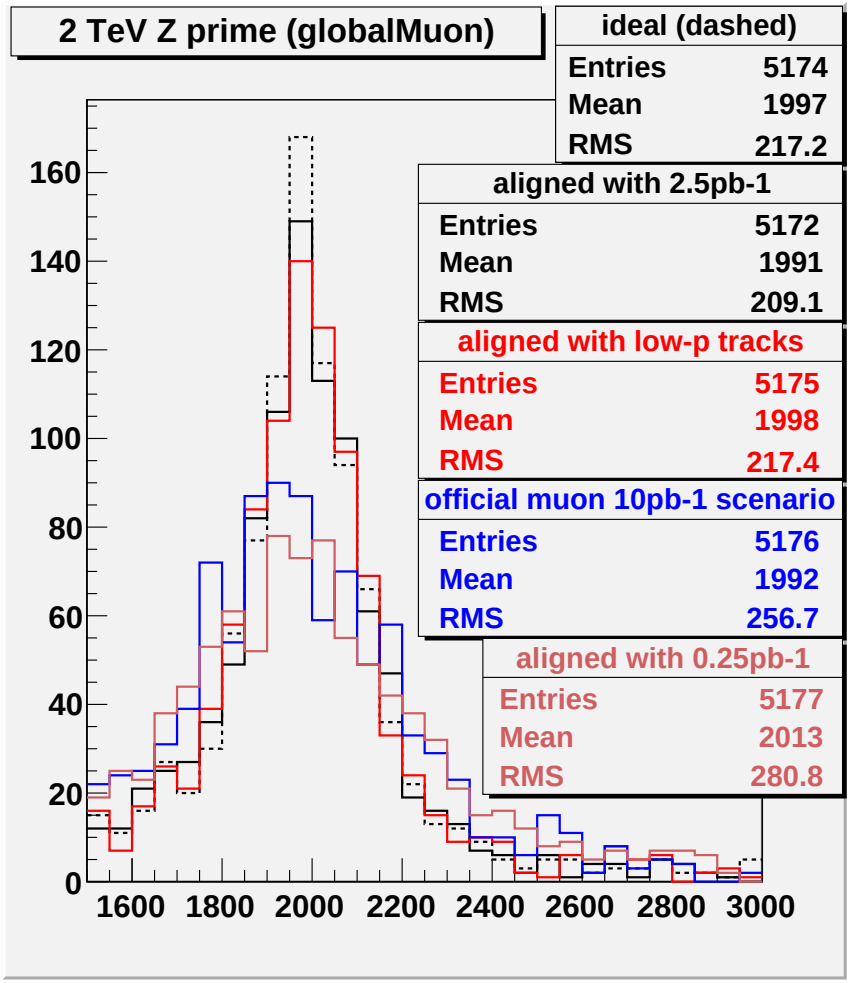


"low-p" means 20-60 GeV $Z \to \mu\mu$

official 10 pb^{-1} scenario is pessimistic

Overlay of 2 TeV Drell-Yan and Z' resonance





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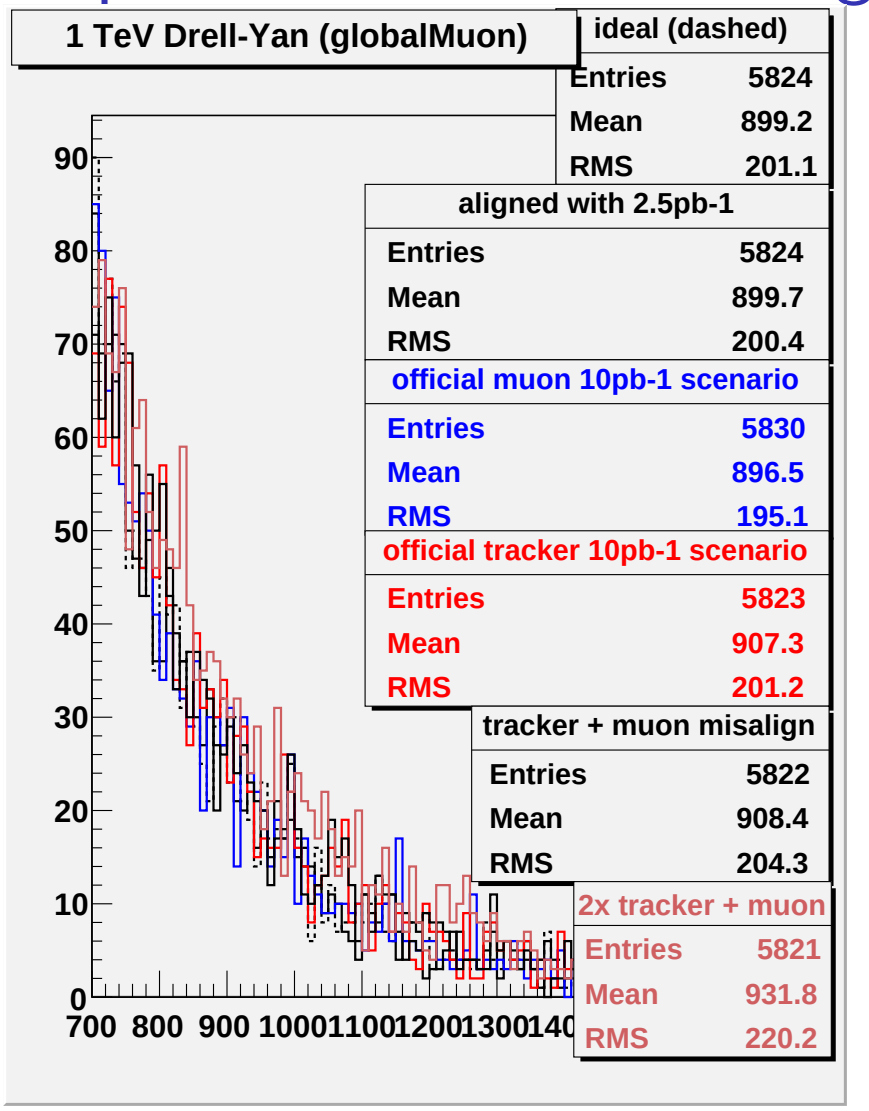
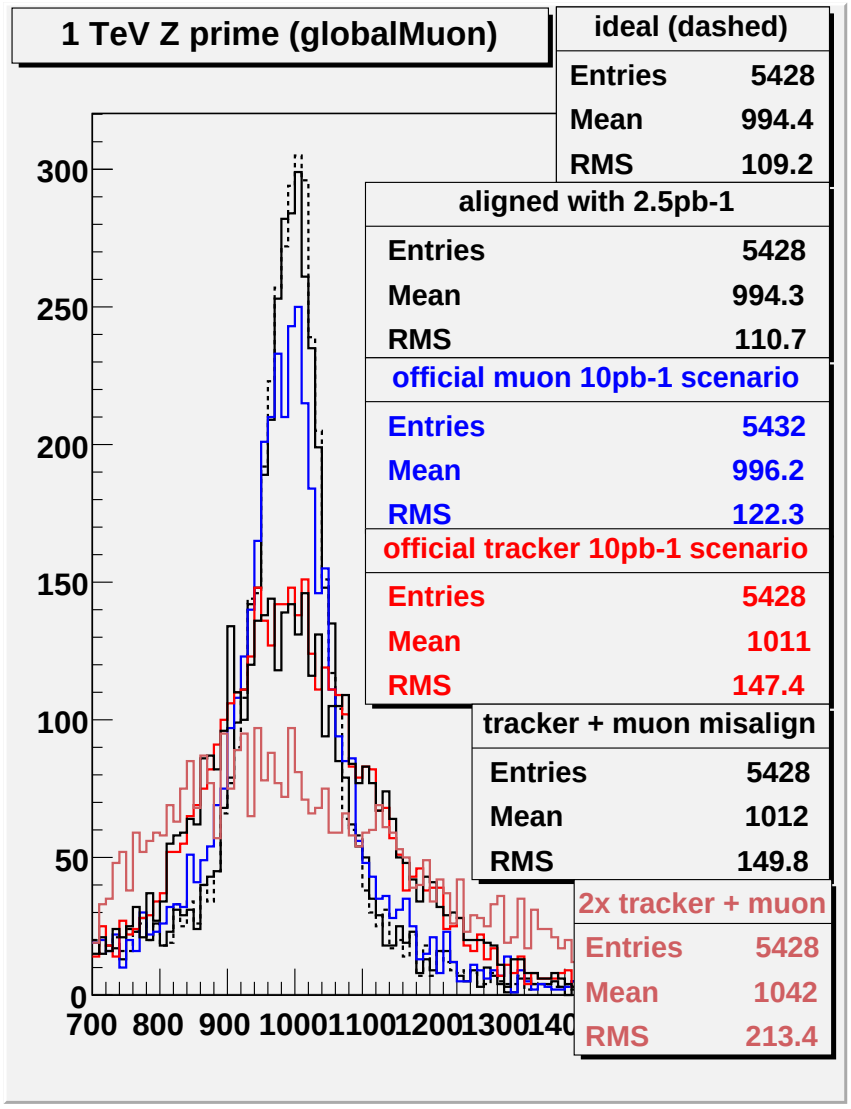
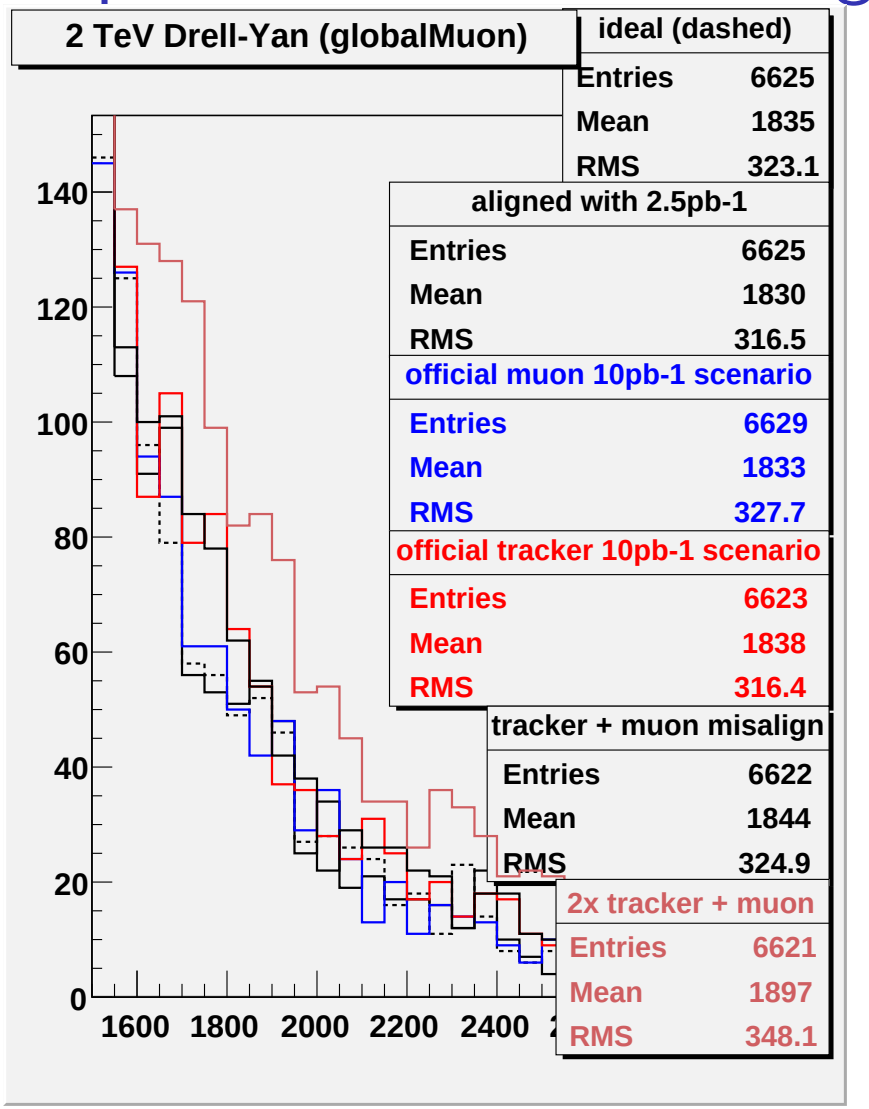
Comparison with tracker alignment scenario

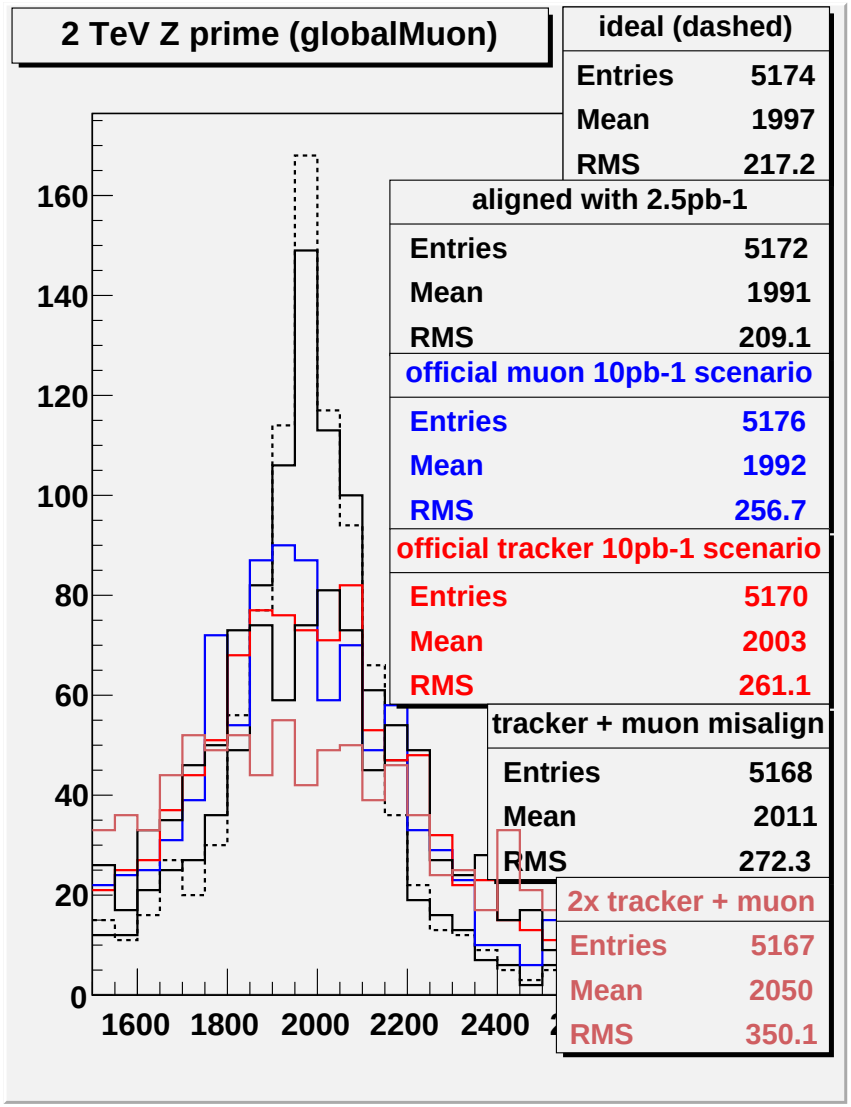




Careful! Tracker alignment scenario might be pessimistic, too

Comparison with tracker alignment scenario





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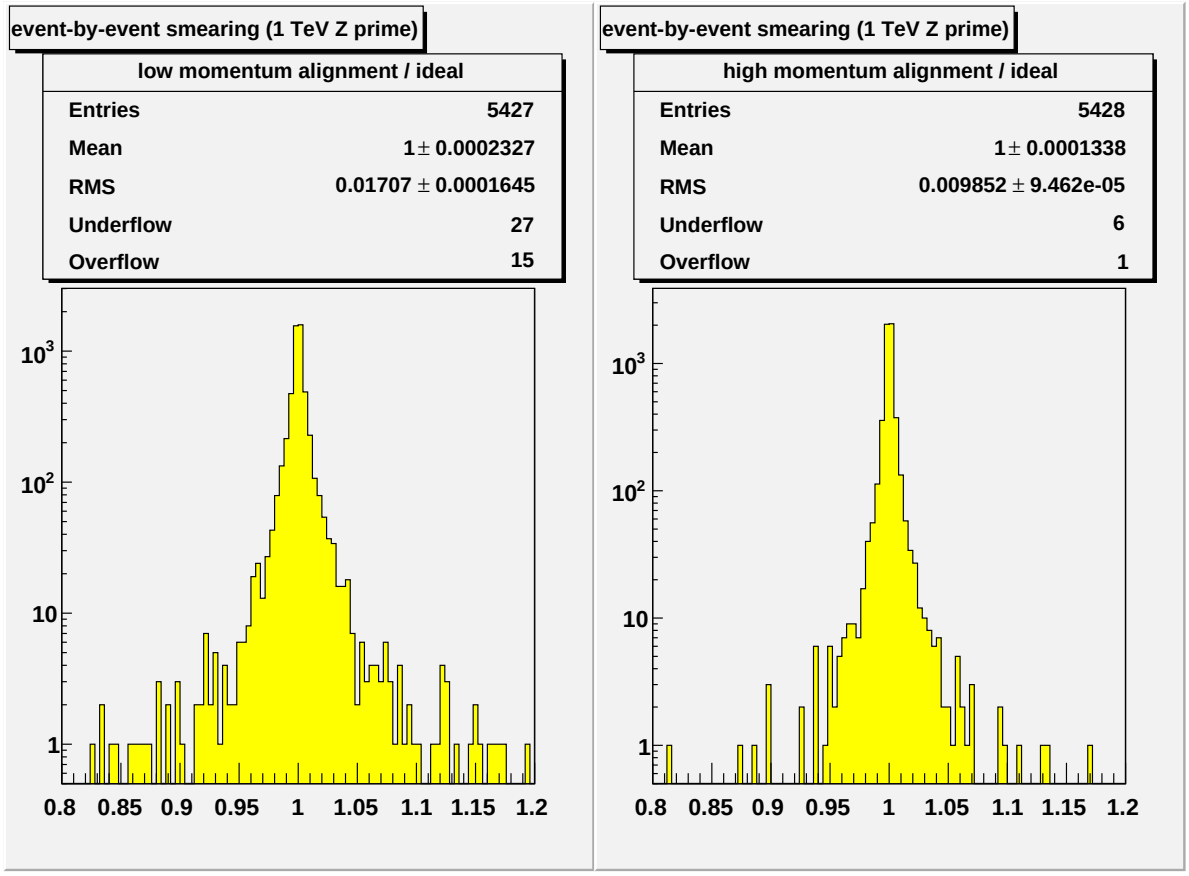
How much does a misalignment broaden di-muon mass?

$$\text{RMS of event-by-event } \frac{\text{misaligned di-muon mass}}{\text{ideal di-muon mass}} - 1$$



aligned with: $20 < |\vec{p}| < 60$ GeV $\qquad |\vec{p}| > 60$ GeV

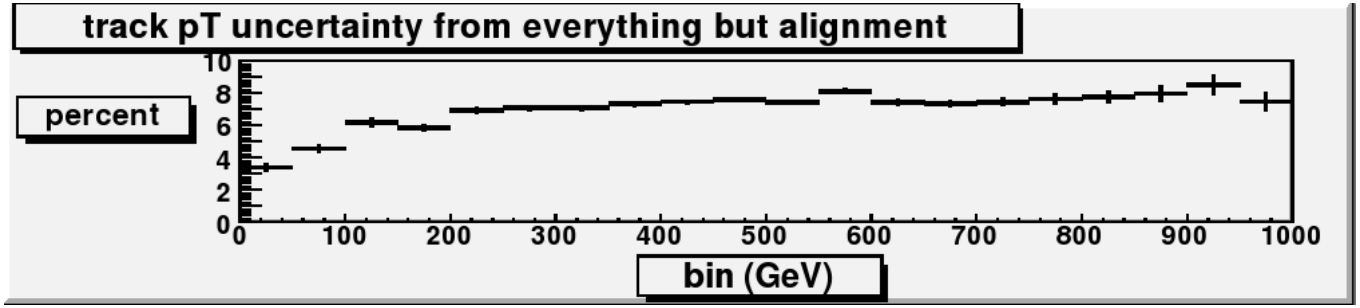
Comparison of alignment scenarios

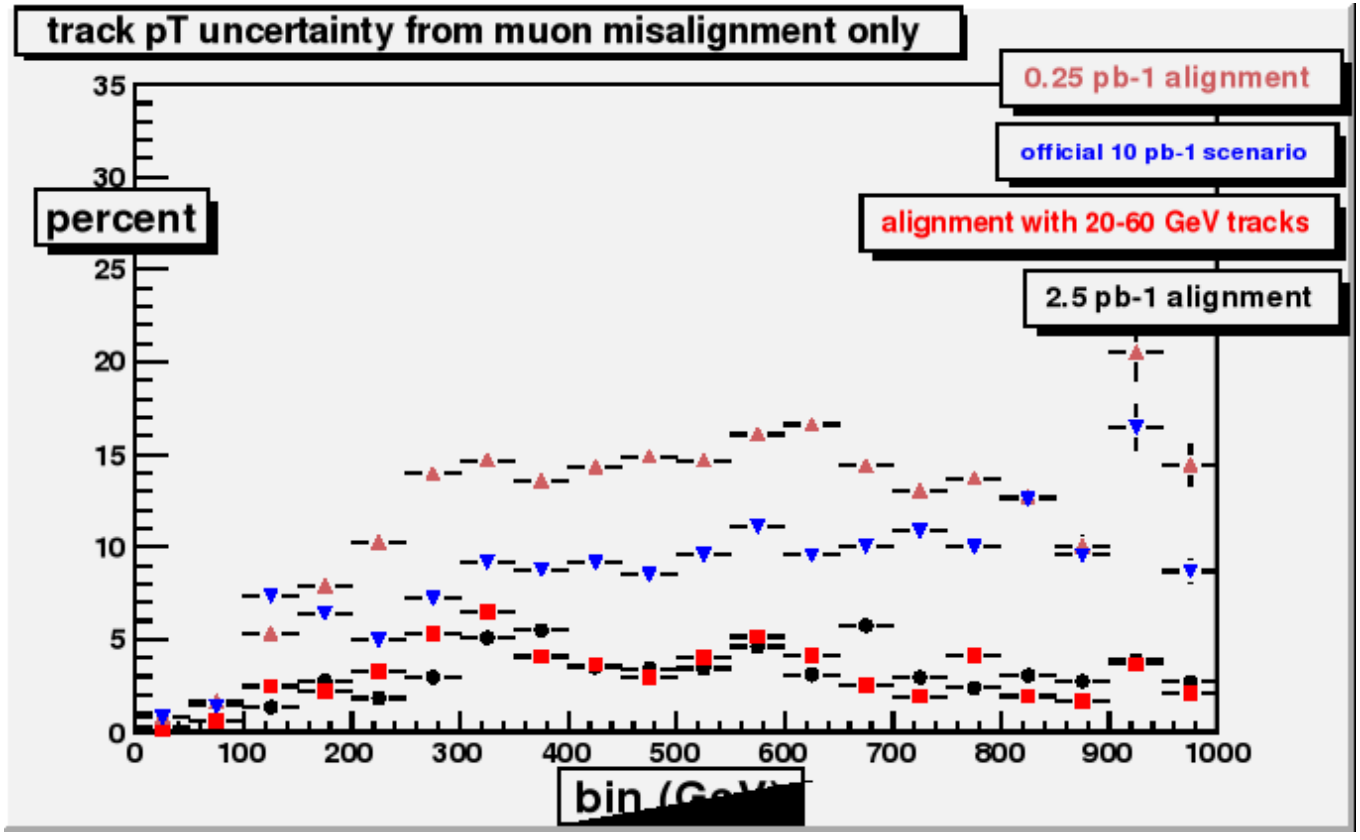
$$\text{RMS of event-by-event } \frac{\text{misaligned di-muon mass}}{\text{ideal di-muon mass}} - 1$$

Source of alignment	$Z'(1000)$	$Z'(2000)$	DY(1000)	DY(2000)
1k μ (0.25 pb^{-1})	6.0%	5.5%	4.8%	6.6%
10k μ (2.5 pb^{-1})	1.8%	1.7%	1.6%	2.1%
100k μ (25 pb^{-1})	1.2%	1.1%	1.0%	1.3%
325k μ (82 pb^{-1})	1.0%	1.0%	0.7%	1.2%
$\lvert\vec{p}\rvert > 60$ GeV	1.0%	1.0%	0.8%	1.2%
$20 < \lvert\vec{p}\rvert < 60$ GeV	1.7%	1.7%	1.5%	2.1%

Does not include broadening of di-muon mass due to other detector effects (denominator is recontructed with ideal geometry, not generator-level di-muon mass)

Fractional widening of momentum distribution, binned





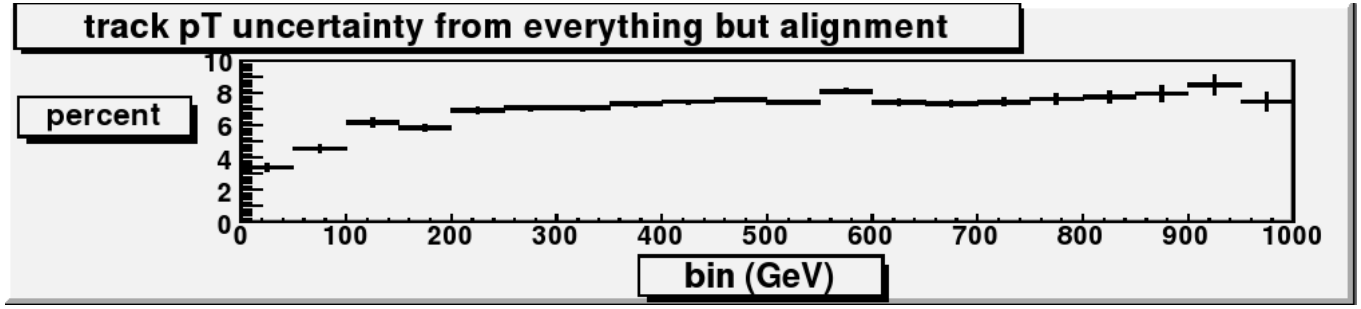
track-by-track RMS of $\frac{p_{T\,\text{ideal}}}{p_{T\,\text{generated}}} - 1$

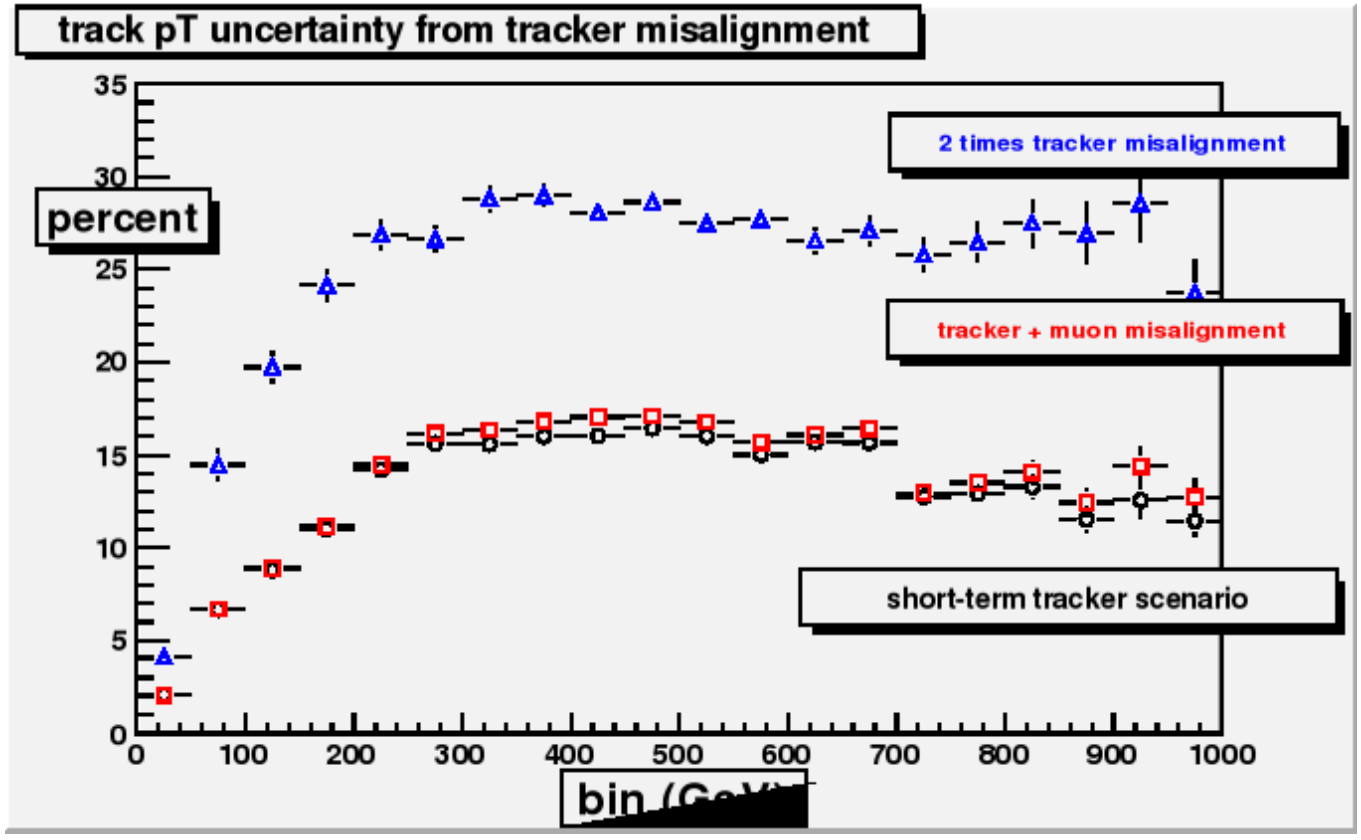
track-by-track RMS of $\frac{p_{T\,\text{misaligned}}}{p_{T\,\text{ideal}}} - 1$

$$\left(\frac{\sigma_{p_T}}{p_T}\right) = \left(\frac{\sigma_\kappa}{\kappa}\right)$$

= sum in quadrature of both uncertainties

Fractional widening of momentum distribution, binned





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