Preparation to define global muon-tracker alignment for cosmic 2010

Alexander Spiridonov (DESY)

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What new

- Standalone muon and tracker segments of global muons are used to define relative alignment of the muon and tracker systems
- Now it is possible to refit separately muon and tracker segments before the procedure of cross alignment evaluation

Study with MC and cosmics10

- We made a study for mc/Summer09/InclusiveMu15/ALCARECO/MC_31X_V3_StreamMuAlCalIsolatedMu-v2/0005
- Real events from cosmics 2010
- Track and muon segments are refitted

Results for barrel+endcup on MC

- We used GlobalPosRcd with shifts and rotations,
  d = (3000μm, 4000μm, 5000μm)
  α = (0.1mrad, 0.2mrad, 0.3mrad)
- Fitted parameters for global muons

Statistic	dx	dy	dz
60K	3007+/-29μm	4131+/-29μm	5012+/-65μm
	α_x	α_y	α_z
	0.089+/-0.006mrad	0.21+/-006mrad	0.34+/-0.01mrad

Results for cosmics 2010

- We read GlobalPosRcd with shifts and rotations set 0
- Fitted parameters for global muons

Statistic	dx	dy	dz
87K	227+/-21μm	689+/-30μm	192+/-30μm
	α_x	α_y	α_z
	0.02+/-0.01mrad	0.07+/-01mrad	0.11+/-0.01mrad

Results for cosmics 2010

- We used default GlobalPosRcd with rotations =0 and shifts for tracker and muon systems both equal to: d = (-900μm, -1100μm, -1700μm)
- Fitted parameters for global muons

Statistic	dx	dy	dz
87K	223+/-21μm	678+/-30μm	211+/-30μm
	α_x	α_y	α_z
	0.02+/-0.01mrad	0.08+/-01mrad	0.11+/-0.01mrad

Results for another cosmics 2010

- We used default GlobalPosRcd with rotations =0 and shifts for tracker and muon systems both equal to: d = (-900μm, -1100μm, -1700μm)
- Fitted parameters for global muons

Statistic	dx	dy	dz
104K	219+/-19μm	626+/-29μm	367+/-28μm
	αx	αy	αz
	0.001+/-0.01mrad	0.09+/-01mrad	0.10+/-0.01mrad

Next steps

- Quoted statistical errors could be too optimistic for real data
- Try to estimate size of possible systematic
- Study with recent alignments for muon and tracker systems which we can read from SQLite files

Backup Slides

- 7 slides more

A model

- Inner tracker and muon detector are aligned in two Cartesian coordinate systems
- Standalone muon and tracker segments of global muons give as a possibility to validate relative alignment of the systems
- Minimal residuals for muon-tracker we can obtain by a propagation of the tracker segment to innermost hit of the muon segment.

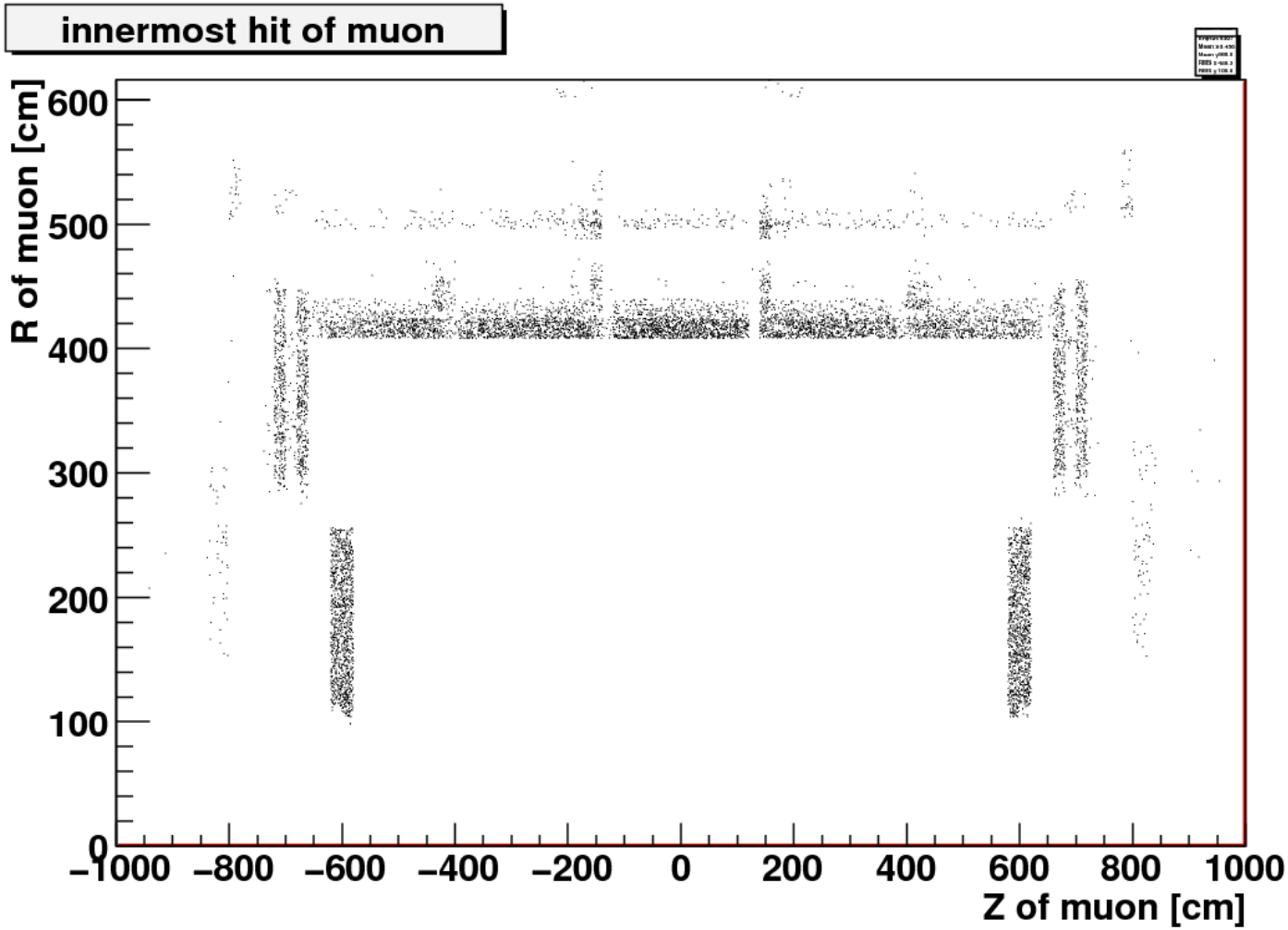
Search for the muon-tracker alignment

- Let's expect that muon cartesian system is shifted by a vector, $d = (d_x, d_y, d_z)$
- To obtain unbiased vector of track coordinates, Rt(d), we have to propagate track in addition to the shifted tangent plane of innermost muon hit
- An objective function for d is a sum over tracks:

  $1/2 \ \Sigma \ (Rm - Rt(d))\ W\ (Rm - Rt(d))^T \rightarrow \min$
- We use diagonal elements of the weight matrix, W
- For 200k of events in barrel we obtain for d=0: -105+/-55, -107+/-55, -60+/-51 μm , i,.e. unbiased

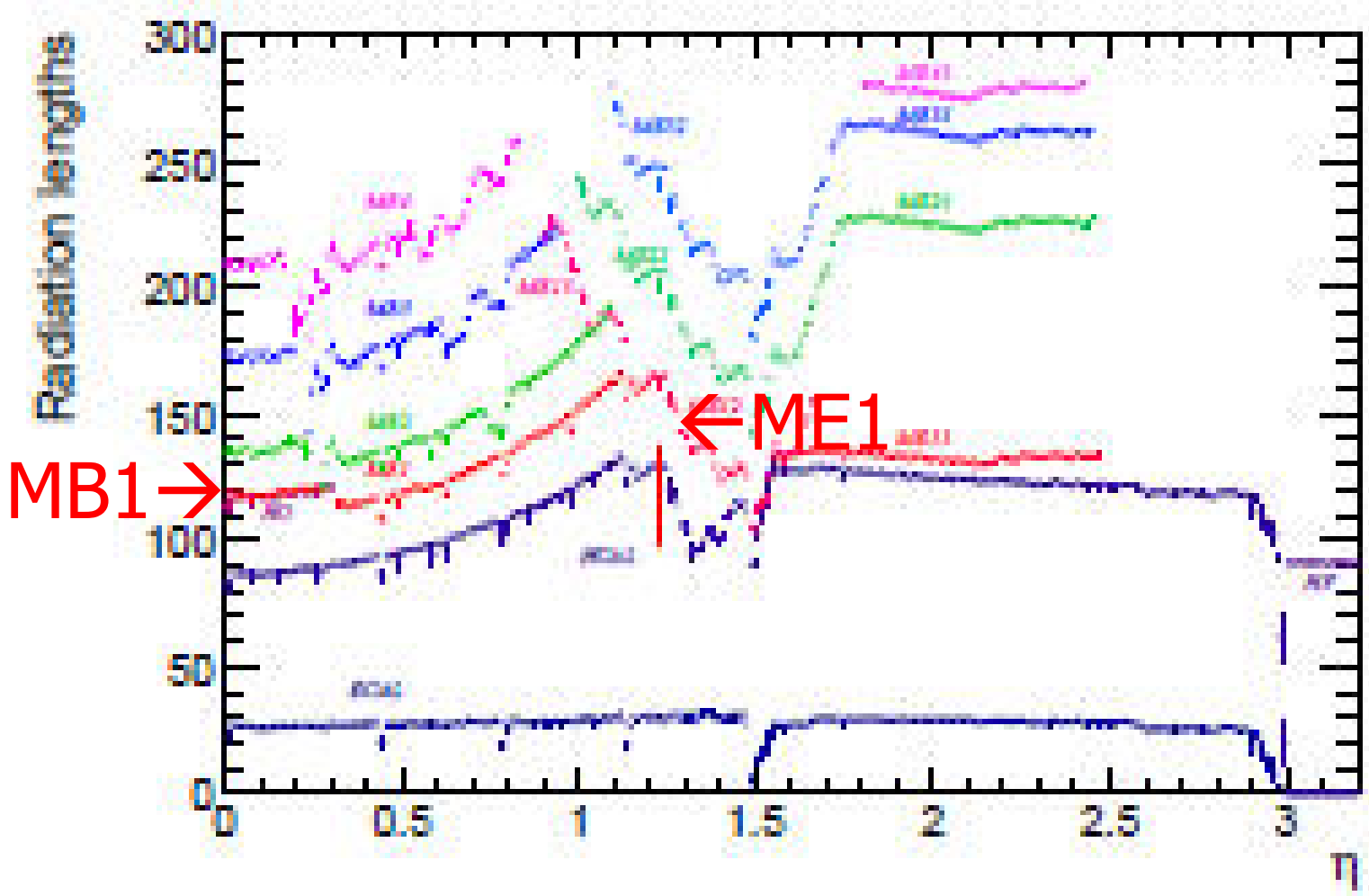
Innermost hit of muon segment

- We select 1st cylinder/plane , i.e. MB1/ME1



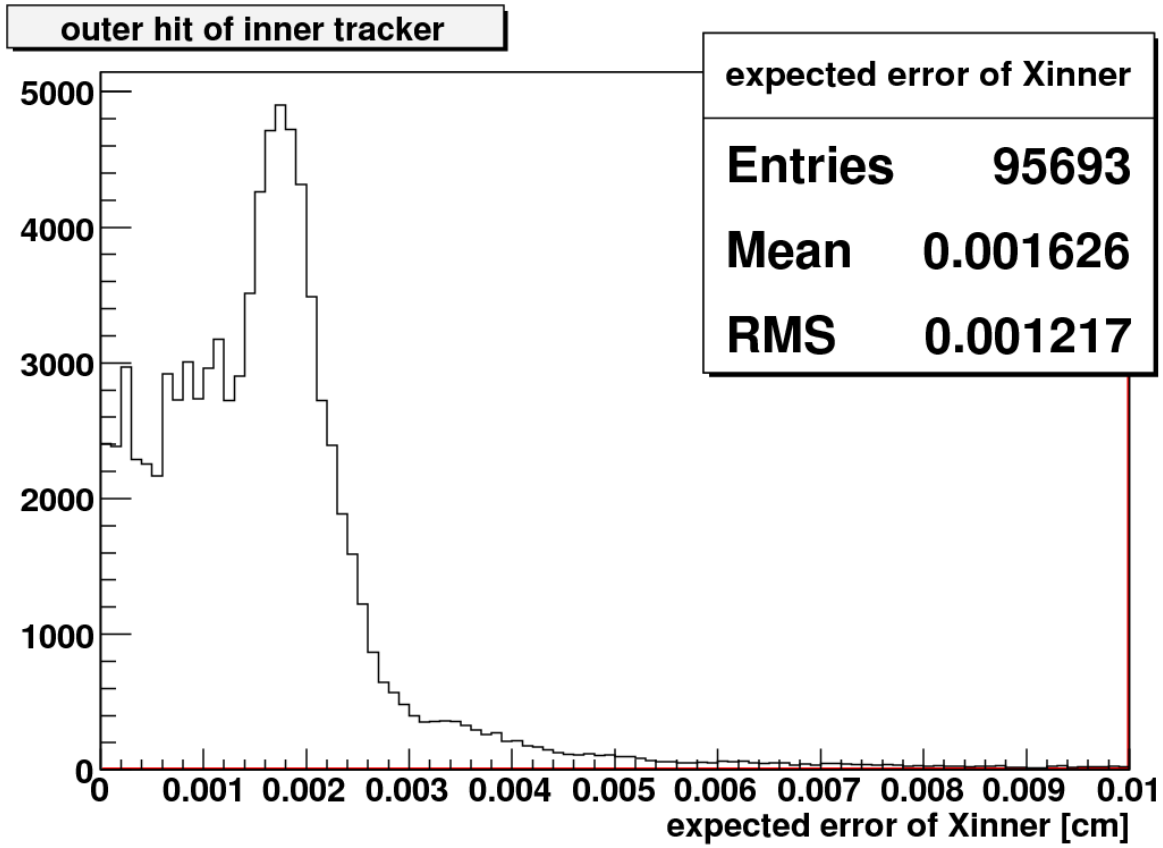
Material thickness in radiation lengths

- Multiple scattering contributes a lot in error



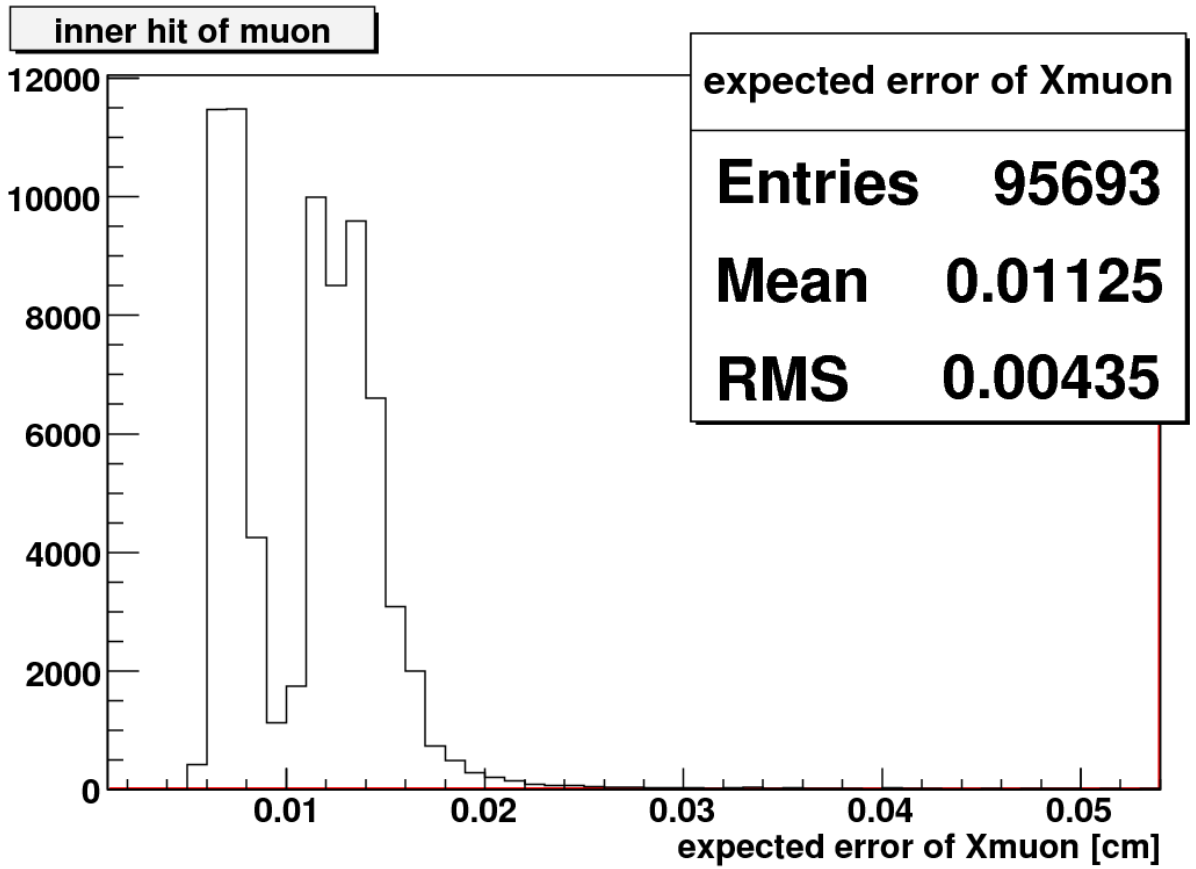
Expected error of X in inner tracker in barrel

- Expected error is about 16μm



Expected error of X in muon detector in barrel

- Expected error is about 112μm



Expected error of X for propagated track

- Expected propagation error is about 1.68cm
- Much larger than errors of 16μm and 110μm for inner track and muon segments, respectively