Track-based Alignment for the Muon Chambers (just starting!)

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What this talk is NOT

I don't intend to present an overview of track-based alignment.

Here are some references for that

- ▶ CMS NOTE 2006/016: **Muon System alignment with tracks**
- ▶ CMS NOTE 2006/017: Influence of Misalignment Scenarios on Muon Reconstruction

- ▶ CMS NOTE 2006/011: Software Alignment of the CMS Tracker using **MILLEPEDE II**
- ▶ CMS NOTE 2006/018: The **HIP Algorithm** for Track Based Alignment and its Application to the CMS Pixel Detector
- ▶ CMS NOTE 2006/022: A **Kalman Filter** for Track-based Alignment

We (Texas A&M) are newcomers to this project.

This talk is about our plans for getting involved

Objective: develop a track-based muon alignment package
for CMSSW

Method: extend existing tracker alignment tools to muon
detector

Short-term (this talk): get up to speed on muon software
infrastructure

Strategy

1. Obtain a sample with DT & CSC hits and standalone or global muon tracks $\sqrt{}$

2. Plot global positions of DT & CSC hits $\sqrt{}$

3. Apply a misalignment and observe a shift in hit positions

4. Start writing/porting/linking to an alignment algorithm

5. Obtain large, realistic $Z \to \mu\mu$ and $W \to \mu\nu$ samples to study performance

Step 1 (get a sample): DONE

Found a $H \rightarrow ZZ \rightarrow \mu\mu\mu\mu$ physics validation sample with muon hits and global fits

https://twiki.cern.ch/twiki/bin/view/CMS/RelValSamples

We filtered out all branches except reco::Tracks, reco::TrackExtras, and TrackingRecHits, to make it like AlCaRECO.

~~(The LPC $Z \rightarrow \mu\mu$ samples have no muon hits.)~~
On Wednesday, Sergei Gleyzer pointed me to CMSSW_1_0_1 samples. (I haven't checked them yet.)

Official AlCaRECO with muons is coming in CMSSW_1_0_4.

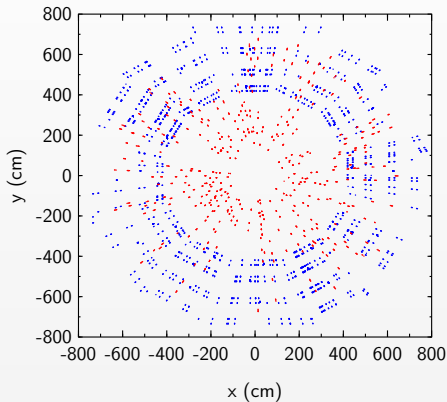# Step 2 (plot global hit positions): DONE

extracted
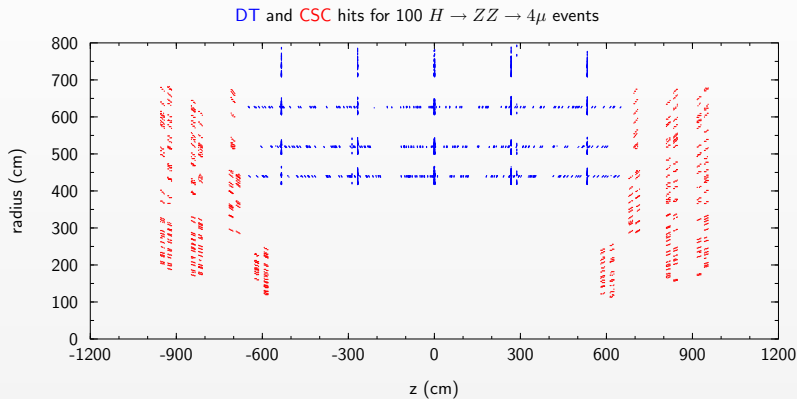ESHandle<DTGeometry>
and ESHandle<CSCGeometry>
from MuonGeometryRecord to
transform localCoordinates into
globalCoordinates

DT and CSC hits for 100 $H \rightarrow ZZ \rightarrow 4\mu$ events

Step 2 (plot global hit positions): DONE

DT and CSC hits for 100 $H \to ZZ \to 4\mu$ events

Step 3 (apply a misalignment): not working

I tried to apply it, but nothing moves (CMSSW_1_0_1)

Perfect Alignment

include "Geometry/CMSCommonData/data/CMSIdealGeometryXML.cfi"
include "Geometry/DTGeometry/data/dtGeometry.cfi"
include "Geometry/CSCGeometry/data/cscGeometry.cfi"

Misaligned

include "Geometry/CMSCommonData/data/CMSIdealGeometryXML.cfi"
include "Alignment/MuonAlignment/data/Scenarios.cff"
es_module MisalignedMuon = MisalignedMuonESProducer {using
                                                    MuonExampleScenario}
                              also tried MuonSurveyOnlyScenario...

(Other combinations of commenting things out didn't
cmsRun. I need to talk to Andre Sznajder, the author.)

Steps 4 and 5 (use framework/realistic dataset)

Oliver Buchmueller (Friday):

> *Andre Sznajder and Frederic Ronga have just a few*
> *days ago committed in 1_0_2 (and 1_0_3) the full*
> *muon alignment geometry interface to the DB.*

We also got in touch with Francisco Matorras, who is working on a similar project in Santander, Spain. His group has calculated residuals and written to the database, two things we'll need to do also.

We'll get together and figure out how to collaborate.

Summary

We're past the CMSSW start-up issues, ready for
muon/alignment specifics.

Now we only need to
a) misalign the detector (MisalignedMuonESProducer),
b) move it back (AlignableMuonModifier), and
c) write an algorithm to do so automatically
   (CMS NOTES/talk to Francisco/look at tracker
   implementation).