


Moving Muon Chambers in an Alignment Module

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Two Topics

1. Verifying Andre's tools

2. New Analyzer-based Framework for Alignment

Andre's Tools: Checklist

Test: can I move global hit positions?

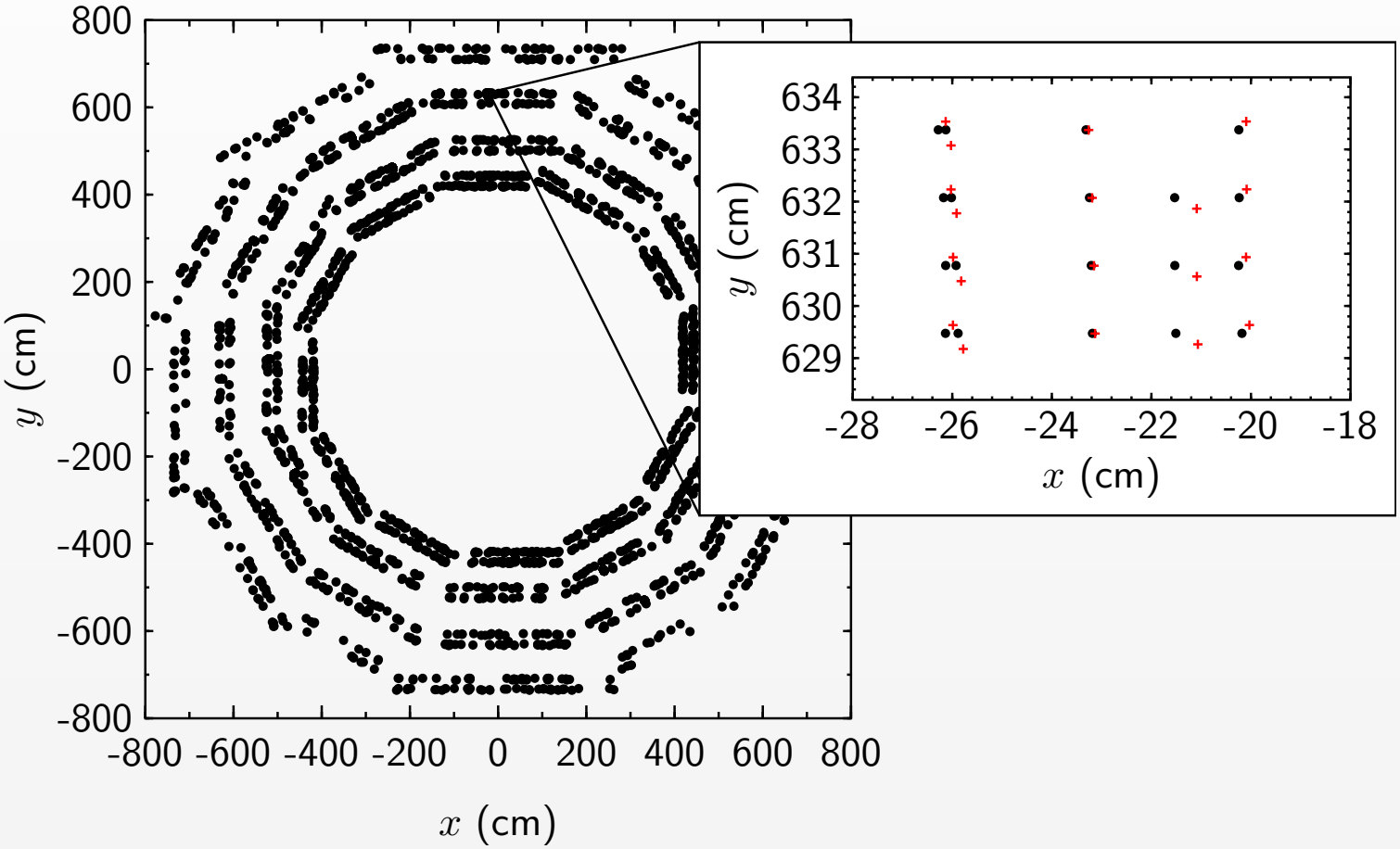
√ Read geometry from a remote database
(PoolDBESSource with connect = "frontier: ...")

√ Create a local file with randomly-generated misalignments
(MisalignedMuonESProducer and PoolDBOutputService)

√ Read geometry from local file
(PoolDBESSource with connect = "sqlite_file: ...")

√ Create a local file with user-controlled geometry
(MuonAlignment class with PoolDBOutputService)

Proof that it Works



- is ideal, + is misaligned ("ShortTermScenario")

New Muon Alignment Analyzer

MuonAlignmentAnalyzer reads an alignment, computes corrections, and writes a new alignment

maa_iteration0.cfg

MisalignedMuonESProducer → `maa_iteration0.db`

maa_iteration1.cfg

MuonAlignmentAnalyzer + data → `maa_iteration1.db`

maa_iteration2.cfg

MuonAlignmentAnalyzer + data → `maa_iteration2.db`

Structure of MuonAlignmentAnalyzer

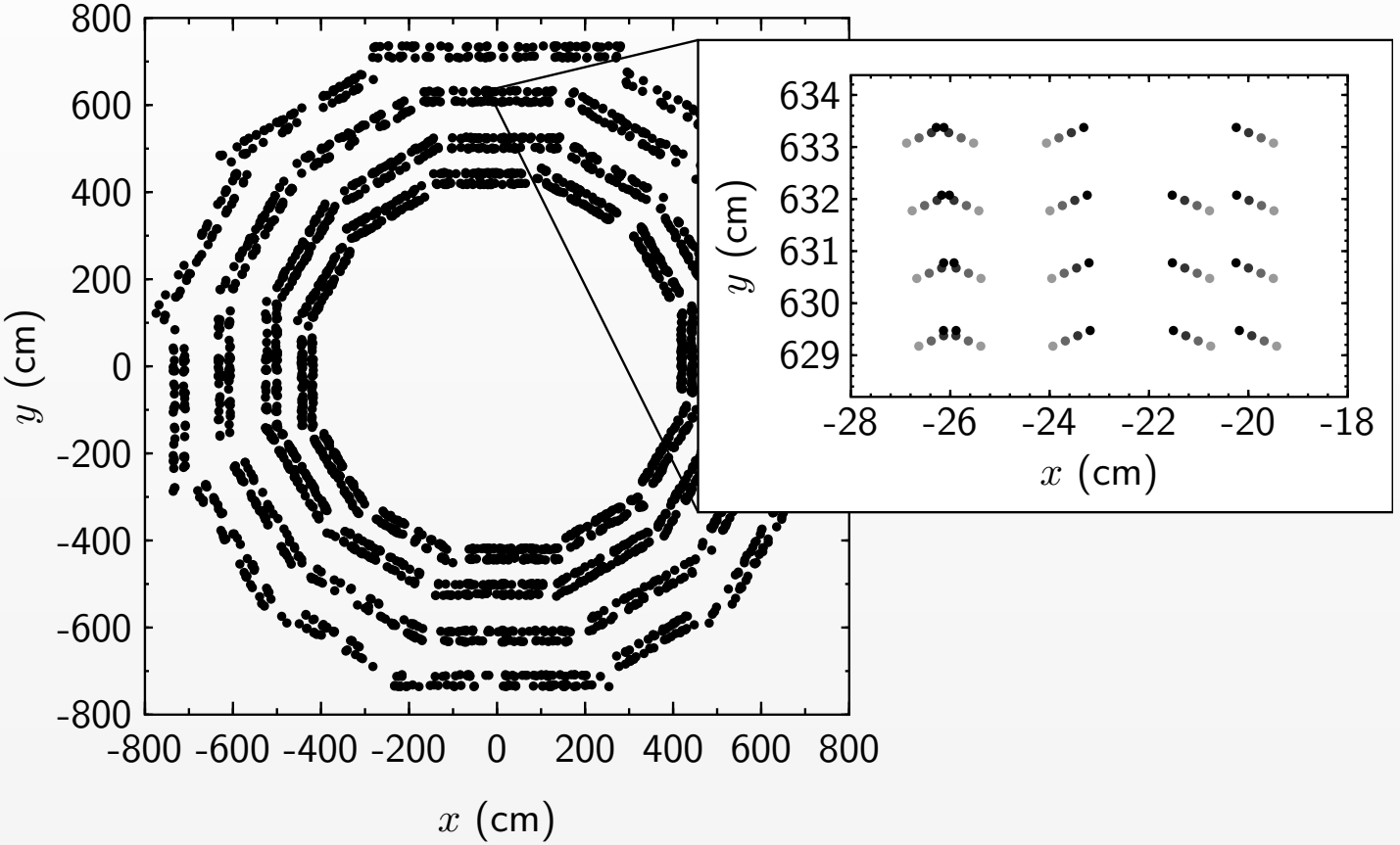
Generalized: Not Limited to One Algorithm

```
module analyzer = MuonAlignmentAnalyzer
{
    string algo = "dummy"

    string output = "maa_iteration1.root"
    string src = "globalMuons"
    uint32 events = 900
}
```

- MuonAlignmentAnalyzer points to a MuonAlignmentAlgo
- Sub-class MuonAlignmentAlgoDummy does the real work
- algo = "dummy" $\longrightarrow$ selects MuonAlignmentAlgoDummy

Test-Drive of MuonAlignmentAnalyzer



MuonAlignmentAlgoDummy moves every chamber with a hit $+0.25$ cm in x, $+0.10$ cm in z (4 iterations)

Awkward Feature

- We want to call MuonAlignment.saveToDB() at the end of the job
- but if we put this call in MuonAlignmentAnalyzer's destructor, it writes incorrectly (13k instead of 2.1MB)
- this is presumably because the structures necessary for database-writing were deleted before my analyzer
- For now, I stop after the 900th event and ignore the rest...

Do analyzers have a method that is called after all data-taking and before deletion?

Future Plans

1. Calculate track−hit residuals
   - talk to Jean-Roch Vlimant (UCSB)
   - and Francisco Matorras (Santander)

2. Dead-reckon alignment from trends in residuals plots (MuonAlignmentAlgoResiduals)
   - e.g. offset in x residual $\Rightarrow$ move x
   - linear trend in y residual $\Rightarrow$ rotate ϕ_z

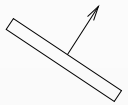
3. Incorporate Santander group's algorithm (MuonAlignmentAlgoMillipede)

4. Incorporate HIP, Kalman, CMS NOTE 2006/016...

Summary

- Thank you Andre! (and Frédéric!)
- We have a generalized framework for Muon Alignment

Extra slide: Surprises (to me)



direction away from IP is z in local coordinates, not y

$+z$ is toward the IP for some chambers, away for others

Wire DetIds $\neq$ detector DetIds

- need to recursively search detector for wire
- I made a map<long,long> to quickly match wire to detector