


Muon Alignment Workflow with the HIP Algorithm

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Muon-HIP alignment procedures (in chronological order)

1. Cosmics/beam-halo alignment
   - Aligning chambers relative to wheel/disk, and maybe layers within chambers, depending on rate
   - Manually configured and operated, like an offline analysis
   - Data acquired before first collisions (trigger?)
   - Developer: Karoly Banicz
2. 1 pb^{-1} alignment
   - Aligning wheels/disks relative to tracker
   - Manually configured and operated, run on the CAF
   - Developer: Jim Pivarski
3. 10 pb^{-1} and 100 pb^{-1} alignments
   - Aligning chambers relative to the tracker
   - Automated and parallelized, run on the CAF
   - (More detail on following pages)

Workflow for 10 and 100 pb^{-1} alignments

- 9 passes, the first having 15 iterations, the rest 5 (total of 55)
  - First align wheels and disks, slow convergence
  - Next align innermost muon stations
  - Then fix innermost and align next, etc.
  - Then allow everything to float when close to optimum
- Data from $W + Z$ and muons from QCD, controlled by a p_T cut and an "outermost station residual" cut (new code)

For 100 pb^{-1}:

- Assuming all $W + Z$ and no QCD: 714,000 events
- 54 CPUs + 1 control job
- 11 min/iter $\rightarrow$ 10 hours wall time (3 min CPU time/iter. . .)
- 7 MB/iter output on *local* disk $\rightarrow$ 400 MB
- Typical max memory: 300 MB, max swap: 700 MB

Implementation details

- Single perl script creates all necessary directories and configuration files; easy to stop and restart a half-finished job
- One control job submits parallel sub-processes, waits for them to finish
  - If this runs on the CAF, a CPU spends most of its time sleeping
  - Recently (last two days), a job running on CAF cannot successfully submit jobs
- Muon geometry is passed from one iteration to the next via SQLite files: last one copied into database by hand
- Residuals monitoring through CommonAlignmentMonitor
- Alignment monitoring through MuonGeometryIntoNtuples
- For MC, combine datasets at the level of parameter matrices (individual subjobs run on pure samples)

Work to be done

Cosmics/beam-halo chambers-on-disk, layers-in-chambers:

- Understand pre-collisions trigger menu
- Develop procedure on MC (beam-halo rate is "factor-of-ten" uncertain: level of feasibility will not be fully known)
- Apply immediately to data as it becomes available (including MTCC/GRE*x* already available)
- Our first priority is CSC alignment with beam-halo

1 pb^{-1} wheel/disk alignment to tracker:

- Experience already shows this is feasible
- Open question: will we be able to connect with chambers-on-disk (above)? Will $\vec{B}$ be ramped in between?
- Study application of hardware alignment constraints using survey-constraint mechanism

Work to be done

10/100 pb^{-1} chambers to tracker:

- Run procedure (very close: only CAF problems)
- Submit new code, not strictly needed for 2_0_0 deadline, but we will aim for that
  - Should the track-filter become an optional AlCaReco switch? I will present an implementation
  - Alternate track-refitter (not part of baseline procedure, but we want to test its performance)
  - All configuration and plotting scripts
- Combine datasets, determine optimal cut and preferred parameters for AlCaReco producer
  (to be coordinated with MillePede muon alignment group)
- Systematics studies
  - Needs disk space! 400 MB $\times$ several configurations
  - Work in 1_6_7 with large data samples
- Layer alignment feasibility study

Conclusions

Requests:

- CAF/lxplus-accessible disk space (10 GB)
- Submitting-from-CAF issue
  (or "long-running, mostly-sleeping job" issue)
- Occasional overnight use of 50 CPUs

Very naïve question about CSA08:

- I don't think this is related to CSA08. . . should it be?

Status:

- Baseline 100 pb^{-1} procedure is almost in good shape:
  early tests show 300–800 μm, depending on station
- Need to do controlled study with full workflow on CAF
- Once that's in place, we focus attention on early alignment