Summary of Muon Studies Yoke Discussion

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Talk Conclusions and Outlook

- New geometry of the coil and the muon system for ILD introduced in MOKKA and tested
- Muon reconstruction in the ILD detector:
  - $\delta(1/pt) = 2.3\ 10\text{-}5$ GeV-1
  - $\delta(D0) = 2.5\ \mu m$
- Muon identification and μ/π separation:
  - ~95% μ-identification efficiency and correspondingly about 99% π· rejection at energy >4 GeV
  - Lower pion rejection for muon energy < 4GeV. Needs dedicated analysis
- Muon system for hadronic processes:
  - Endcap region equipment of muon system as tail catcher reasonable
  - Performance of barrel region limited by the large coil
  - For high energy jets useful to improve performance, especially resolution
- Detailed simulation of element of muon system
- All tools now ready for detailed studies

Talk Prel. Conclusions for Yoke Design

Tail-catcher

- Improves energy resolution. In particular at high energies
- Full thickness of yoke important for pion rejection
  (Also needed for achieving low stray field)
- Instrumentation of outer (thick) layers is useful for pion rejection.
  Much better than just one muon chamber layer on the very outside.
  In addition, one very thick instead of three outer iron layers (each about 100tons) would be much more difficult to deal with (manufacturing, transportation and assembly)
- Increasing iron plate thickness from 10 to 20cm probably fine at low energies (low statistics so far), but significant degradation at high energies

Instrumented coil

- Small improvement of energy resolution
- Might be useful for low energy hadrons and muons

Summary of Discussion

- Very useful study of muon system/tail catcher and impact on yoke design
- Question about transfer of magnetic forces from EC to barrel
  - Have looked into stress at hard stops. Should be fine
  - Question whether increasing thickness of 1st barrel iron plate from 10 to 20cm would harm the muon system/tail catcher performance
    - Probably not a good idea
- H.V. still asking whether number of muon layers/thickness of plates could be reduced/increased. Developing better muon ID algorithm using HCAL.
  - So far muon ID and pi misidentification mainly studied for single particles.
  - Will be more challenging in high energetic jets
  - Independent muon id important. Can use HCAL or muon system to determine efficiency. Otherwise have to rely on Monte Carlo.

Summary of Discussion

- Question concerning length of detector
  - Length determines available space when detector opened
  - Thickness of yoke mainly determined by stray field
  - Main stray field limit in radial direction
  - Should look into reducing number of thick end-cap iron plates from 2 to 1. In principle, no hard limits for accelerator. Might be different in real live.
- A.H. still has concerns about radial EC structure. Prefers horizontal block design as proposed by H.Gerwig
  - Previously, did some compressions
  - Both designs should work
  - Both have pros and cons
  - Don’t have man power to do a detailed (mechanical and physics performance) comparison
  - Final design not needed at this point
  - Propose to wait and see how CLIC detector yoke design develops