Proposed ALCPG Tracking Group Priority List

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ALCPG – Tracking Group Priorities

A more comprehensive list has been generated by Dean Karlen (will be posted on Tracking Group Web Page)

I will distill this list, with some personal bias

The idea is to provoke discussion

Goals of Discussion:

- Establish consensus on direction and focus of group
- Discuss interim meeting format and schedule

Possible organizational tool:

http://karlen.freezope.org/zopetop/lincol/tracking

The Big Picture

Over the next few (?) years, we need to propose a tracking system that is

- Optimized for e^+e^- physics between 350 and 1,000 GeV
- Within cost constraints that will become concrete over time

Central Tracking

- Gaseous (TPC, DC, Silicon Assisted, ...)
- Solid State (Drift, Long or Short-shaping μstrip)

Forward Tracking

- Micro-strips
- Silicon pixels (active)
- Other?

How's a physicist to decide?

Job 1: Simulations

We might expect these systems to have vastly different capabilities regarding

- Pattern recognition in dense jets
- Background tolerance

NEED: Pattern recognition algorithms individually optimized for each system.

(Status: work underway)

NEED: Realistic background overlay

(Status: work underway)

Note: To make use of these algorithms in meaningful physics studies, need ancillary tools: Optimal fitter, analysis package (e.g. vertexing), etc. Much of this work is underway.

Simulations II: Momentum Resolution

Our current thinking places a lot of stock in improving momentum resolution. Is hardware R&D in this direction worth the time and money?

NEED: Probe physics processes requiring superb momentum resolution at high momentum for 'knee' in precision vs. resolution

(Status: underway for Higgstrahlung; other processes?)

NEED: Identify and probe physics processes requiring superb momentum resolution at low momentum

(Status: Not yet addressed)

Simulations III: The Forward Region

Can we get by with μstrips in the forward region, or do we need pixels or other? Where should the transition be?

NEED: Pattern recognition optimized for proposed variants of the forward tracking system

(Status: Work on TRF algorithm should address; independent approach?)

NEED: Again, realistic background overlay

(Status: work underway)

NEED: Identify and explore physics processes that establish requirements on coverage, resolution, and hermeticity

(Status: Some work on radiative Bhabhas, otherwise unexplored)

Detector Development I: TPC Studies

The following are perceived to be NEEDS in the optimization of the TPC approach for e^+e^- at 500+ GeV

- Understand tolerance for positive ion feedback
- Develop GEM/micromegas readout in view of point resolution, ion feedback, and track-separation resolution specs
- Spec and develop electronics with required granularity
- To what extent can performance be enhanced with intermediate, outer, and endcap silicon or fiber layers?

Detector Development II: Solid State Detectors

The following are perceived to be NEEDS in the optimization of solid state tracking for e^+e^- at 500+ GeV

- Demonstrate the principle of power cycling to eliminate need for active cooling in the detector volume
- Develop support structures commensurate with intrinsic sensor capabilities.
- Explore the effects of operating in up to 6T field
- Improve the point-resolution and per-layer thickness of the silicon drift (SDD) system.
- Develop long-shaping-time μstrip readout to eliminate electronics and servicing from active region
- Develop readout capable of spec'd precision in min-i region as well as particle ID in the $1/\beta^2$ region

Tracking/Calorimeter Interface

Some issues which may well have a major impact on tracker design

- Requirements on pointing resolution for interfacing with calorimetry

- Limits on material burden imposed by calorimetry

NEED: Sophisticated track/cluster matching algorithm

(Status: Limited progress so far (?))

Other (Lesser?) Priorities

- Physics simulation to determine need for min-i dE/dX (Si can't say much due to density effect)

- Are there any constraints posed by the need to match to vertex detector tracks?

- Relative ability to do kink and Vee finding, perhaps with the use of calorimetric information

- Limits on material burden imposed by calorimetry

- Calorimeter-aided kink and Vee finding