PID current and future foreseen computing activities for the TDR

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The first step – MC simulation of PID "geometrical" efficiency for B-meson tagging with full reconstruction

- The aim – to make the first look at detector PID efficiency increase with additional forward and backward PID systems.
- Packages used – EvtGen, GEANT4. For charged particles the first cross of PID system was calculated, all other crosses and the secondary particles were ignored. For neutrals the cross of the calorimeter = the solid angle of the calorimeter.
- 18 decay modes of B-meson were simulated.
- The conclusion – Depending on the modes of B and D decays forward PID increases the efficiency of full B reconstruction by 10-30 %. Forward + backward PID increases the efficiency by 15-50 %.
- The next step in understanding – fast MC of the SuperB detector taking into account a realistic representation of the subsystems geometry and performance.

What specific stand-alone programs we have and use now

- Geant 4 simulation of the barrel focusing DIRC prototype used in SLAC beam tests (SLAC)
- Full Geant4 simulation of the forward RICH, together with the reconstruction (i.e., likelihood calculation for individual hypotheses for a track with given parameters), ready to be integrated in a full spectrometer MC (KEK)
- Fast simulation of the forward RICH response (simplified but reasonably accurate likelihood calculation for individual hypotheses for a track with given parameters (KEK)
- Focusing Aerogel RICH simplified Geant 4 simulation for fast comparison of different geometrical configurations, aerogel radiators, photo detector types. (Novosibirsk)
- Geant 4 “geometrical” simulation of PID systems (Novosibirsk)

PID computing needs (short term)

- We need a general MC tool to answer the questions:
  - Do we employ a TOF device inth e forward end cap region, or an aerogel RICH, or no PID device at all ?
  - Do we need some PIDi n the backward region?
- To answer these questions we need a fast MC that generates B-B, tau-tau events in a realistic representation of SuperB detector:
  - realistic materials in the detector
  - realistic response from detector subsystems (in PID case the tag and mis-tag efficiensis)
  - there must be the possibility to change configuration of the detector subsystems (with or without forward and backward PID, TOF or FARICH) with the corresponding change in systems geometry and response.
- When fast MC will be generally available, our group would regard it as our job to come up with a sub-system parameterization of the PID system performance.

PID computing needs (long term)

- We would hope to have a full GEANT simulation of the SuperB detector, where each sub-system would have detailed simulation of its performance. The question about manpower is opened, we need help with this urgent and important task.
- We would, however, expect to play a role in coordinating the PID aspect of porting BaBar simulations forward to a complete SuperB implementation – again with help from others.

PID computing tasks (long term)

The tasks that we see need to be done for PID with software tools:

- The Barrel PID system
  - 1. MC study, detector level: Simulation of physics and background.
  - 2. MC study, subsystem level: Stand-alone Geant 4 simulation of optics of the full upgrade, and comparison with baseline. Simulation of final geometry, pixilization, etc
- The End Cap TOF system
  - 1. MC study, detector level: Simulation of physics and background. (some of that will be de facto included in the DIRC study)
  - 2. MC study, subsystem level: Simulation of timing resolution, radiator thickness, electronics, noise, systematic effects such effects of start time, tracking, etc
- The End Cap RICH system
  - 1. MC study, detector level: Simulation of physics and background. Additional possibilities for pi/mu identification, momentum measurement.
  - 2. MC study, subsystem level: Simulation of final velosity resolution, tag and mis-tag efficiences, radiator thickness, electronics, noise, etc

Conclusion

- The need in detector fast MC and full MC is very strong. We are ready to participate in this work introdusing PID systems into the SuperB detector.
- The question with manpower for this work is opened. This is a good opportunity for new groups to enter the SuperB Project.

"Even a journey of a thousand miles starts with a single step" (Chinese saying).

We are very pleased that this work has started.