PHY6860
Computational Physics
Final Project(s) Discussion

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Relativistic Resonance Decays
Monte Carlo Glauber
N-Body Problem(s)

Final Project(s)

1. Relativistic Resonance Decays (2-3 Groups)
2. Monte Carlo Glauber (M. Cordell)
3. N-Body Problem(s) (N. Elsey)
4. *Individual Projects (mainly for people not enrolled)*

Timeline:

- April 7th: Group forming
- April 9th: Short group presentation/discussion of the project
- Last week of Finals: Presentation (date TBD)

Final Projects: Goal

Goals:

All projects are intended to make use what we learned over the course; in particular all projects will require you to implement an "event-like" ROOT Class and usage of container classes of your own ROOT object classes (depends on the problem).

In particular the resonance problems (2-3 groups), since you should be able to analyze the resonance of the other group(s), requires that you discuss beforehand on a common event class interface. In principle you could implement it as you wish, but the interface should be in a generic way the you can use the resonance simulation data of the other group(s).

Relativistic Resonance Decay

Implement a relativistic resonance decay
Monte Carlo Simulation:

- Pick a resonance (will be assigned)

- Implement decay in resonance rest frame (isotropic decay)

- Boost in the center-of-mass frame of the collision

- Save this event (of course lots of them)

- Write an analysis macro: Invariant Mass calculation
(to identify/confirm the resonance)

- Additions:
i) You can implement gaussian smearing of
uncertainties in momentum (mimic detector resolution)
ii) Add uncorrelated background

Relativistic Resonance Decay Cont.

For Wed so discuss today:

What is needed and how do you want to store/generate? Track class, Event class, containers/trees ... ?

Prepare a short outline of what functionalities the classes need and a quick flow chart of the project itself! We will discuss then on Wed.!

Hints:

You clearly need a 4 mom. vector (look at TLorentzVector), but it would be beneficial to extend this by creating your own track class allowing to store further information like particle type ...

A good starting point for an event class we did in Lecture 10 ...

Other Projects

Monte Carlo Glauber (M. Cordell)

N-Body Problem(s) (N. Elsey)

Define the goals of the project and outline the classes and flow chart of the problem for Wed to discuss!

Remark

This project is intended for you to learn how to define and outline a more complex computing program and in addition how to organize and work with other people on such a problem (so using OO programing you can think about that you can, once an interface is defined, indeed split work).

It would be of course great if all projects will indeed be successful, but even if not, in the presentation you can discuss/point out the obstacles/problems and this is certainly part of the intended learning experience!