Vertexing Tools

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Overview

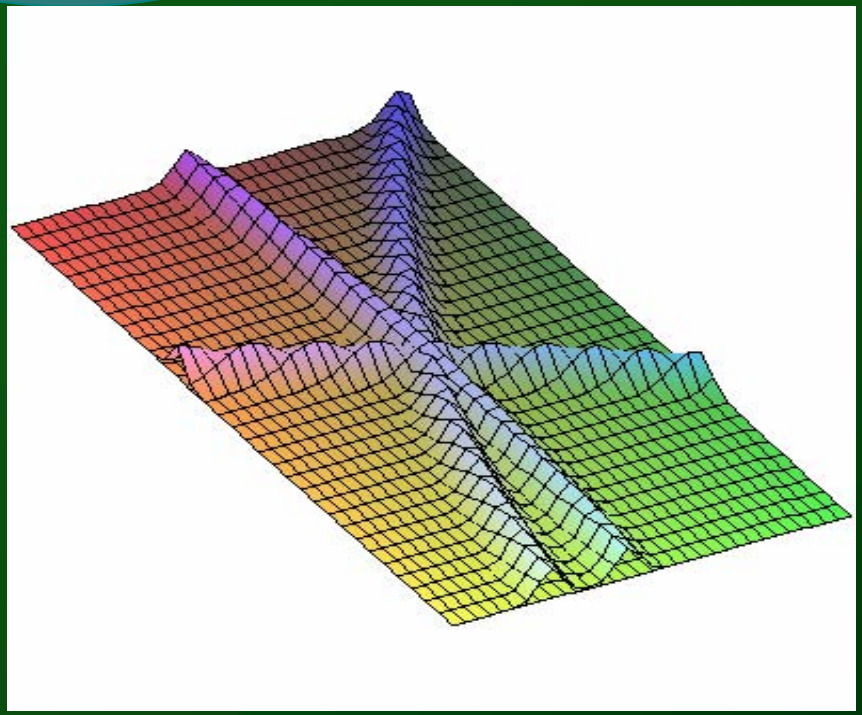
- Introduction
- The Algorithm – ZvTop
- Implementation in hep.lcd
- Introducing org.lcsim
- Present Status
- Summary and Outlook

The Algorithm – ZvTop

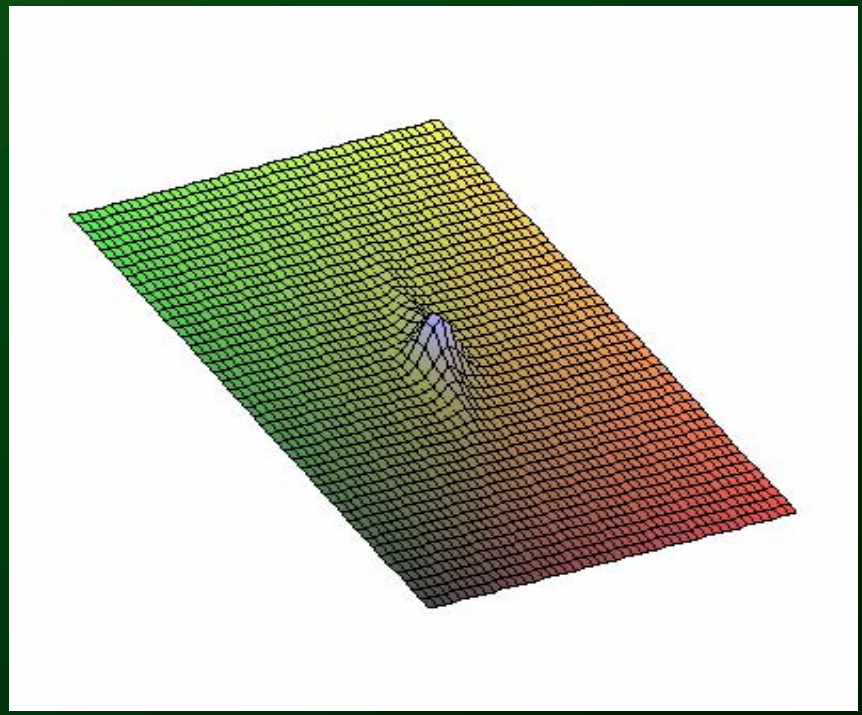
D. Jackson, NIM A388:247-253, 1997

- Topological Vertex Finding
- Looks for overlap of Track probabilities in the Jet
- Resolves ambiguities with a resolution criterion
- Tracks are fitted to the point of highest overlap

ZvTop at work

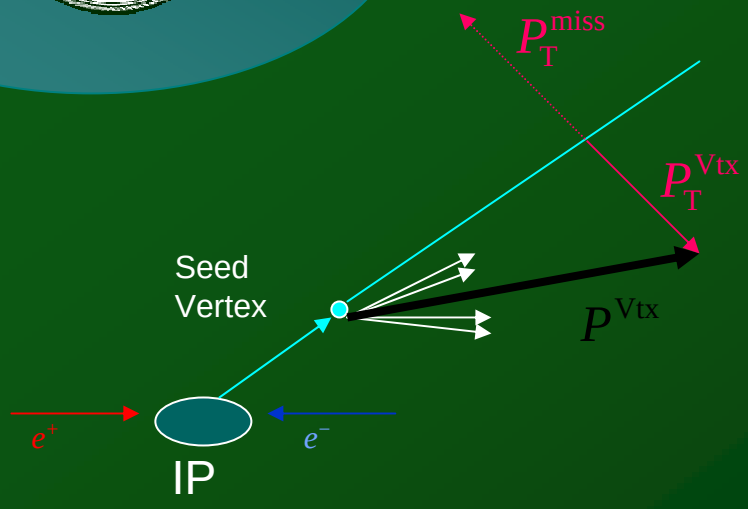


Tracks are assigned Gaussian Tubes



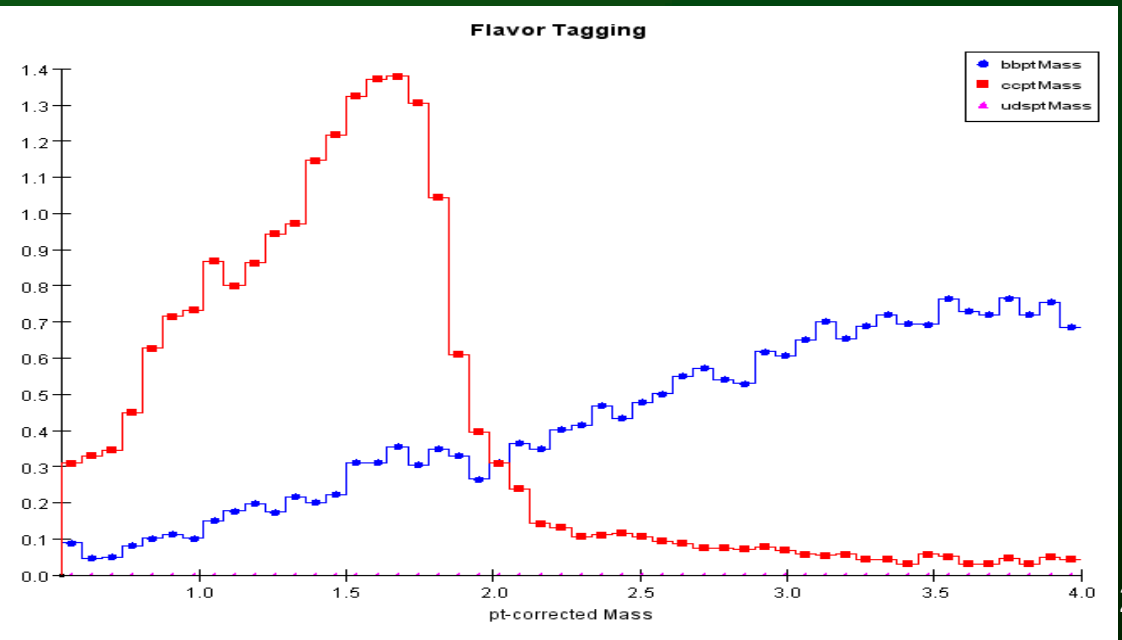
The maximum overlap is calculated

P_T-corrected Mass for Flavor Tagging



$$m_{P_T} = \sqrt{\left(\sum_{tracks} m_{\pi^\pm}\right)^2 + \left|P_T^{Vtx}\right|^2} + \left|P_T^{Vtx}\right|$$

- The P_T-corrected Mass already by itself gives quite reasonable results
- But you can see the contamination of B events in the D sample



ZvTop in hep.lcd

- ZvTop was successfully used in SLD analyses
- The Fortran code was ported to hep.lcd by W. Walkowiak and presented here in 2001
- Has been used successfully in studies to extend the algorithm
- The code is available and ready to use
- Cannot read LCIO files

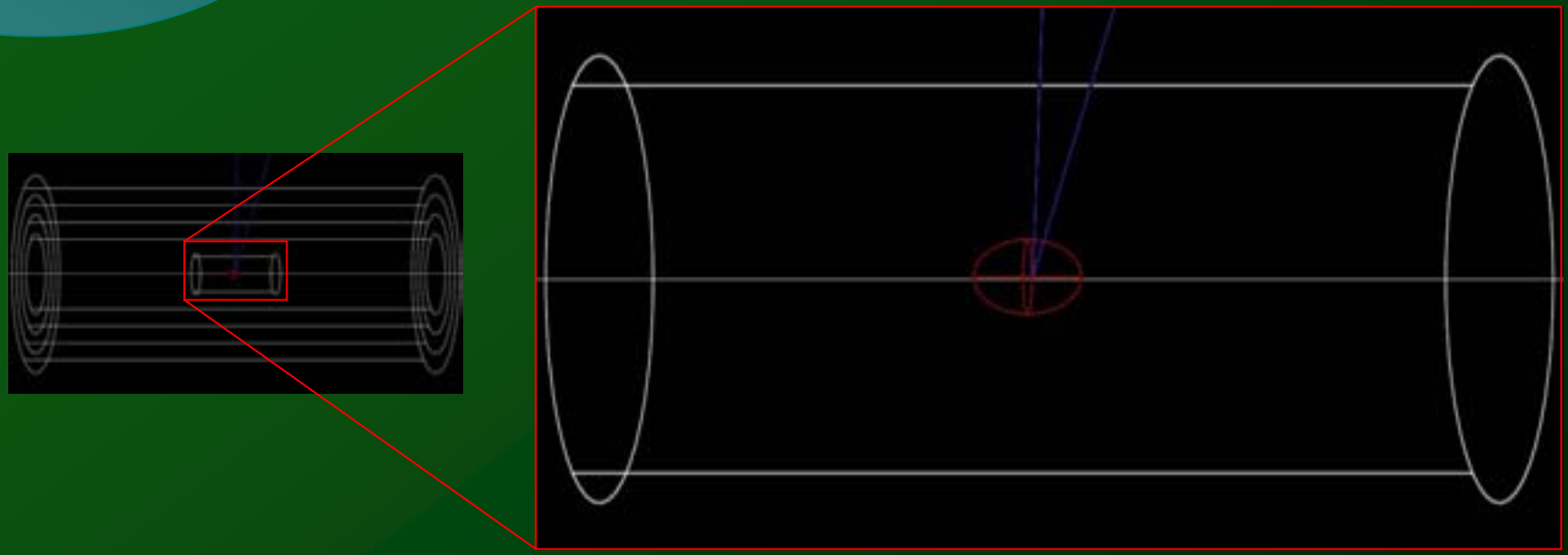
Introducing org.lscim

- Concept-independent framework
  - Call for contributions !!!
- Platform-independent implementation
  - Runs everywhere Java 1.5 runs
- Collaboration-independent persistence
  - LCIO format is the new global standard
- Experience-independent learning curve
  - Pick up a CD and start doing an analysis
  - Additional tutorials may be offered upon request

Under Construction

- Code being ported to org.lcsim
  - Better integration into framework
  - Making the code more modular
    - Vertex fitting and vertex finding should be decoupled
- The code is available. I would call it an early alpha.
  - A snapshot is distributed with every org.lcsim release
  - More recent versions available in CVS

Additional Functionality



This is an actual screenshot from WIRED4 in JAS3 of a J/Psi->mu mu event.

The position is the one found by the algorithm, but the tracks are not fitted.

The dimensions are just 1, 2, 3 mm in x, y, z, because functionality not yet implemented.

This was implemented early to help with debugging.

Work that still can be done

- Again, the framework is design-independent !
- Associating the vertex with additional neutrals can and should be a natural extension to the PFA that everybody is working on.
- Studies by Oregon (J. S. and J. Early, Victoria, 2004) and Oxford (S. Hillert, LCWS 2004) show that flavor tagging can be greatly improved by trying to associate neutrals to the vertex.

Summary

- Topological Vertex Finding is an important tool for many analyses.
- Proven Algorithm
- Existing tools allow studies of how to improve the algorithm
  - Has been shown that an extension is useful and important
- Efforts are underway to make tools available to a broader collaboration