

**Trigger workshop
Caltech
December 2, 2004**

L3 DCH

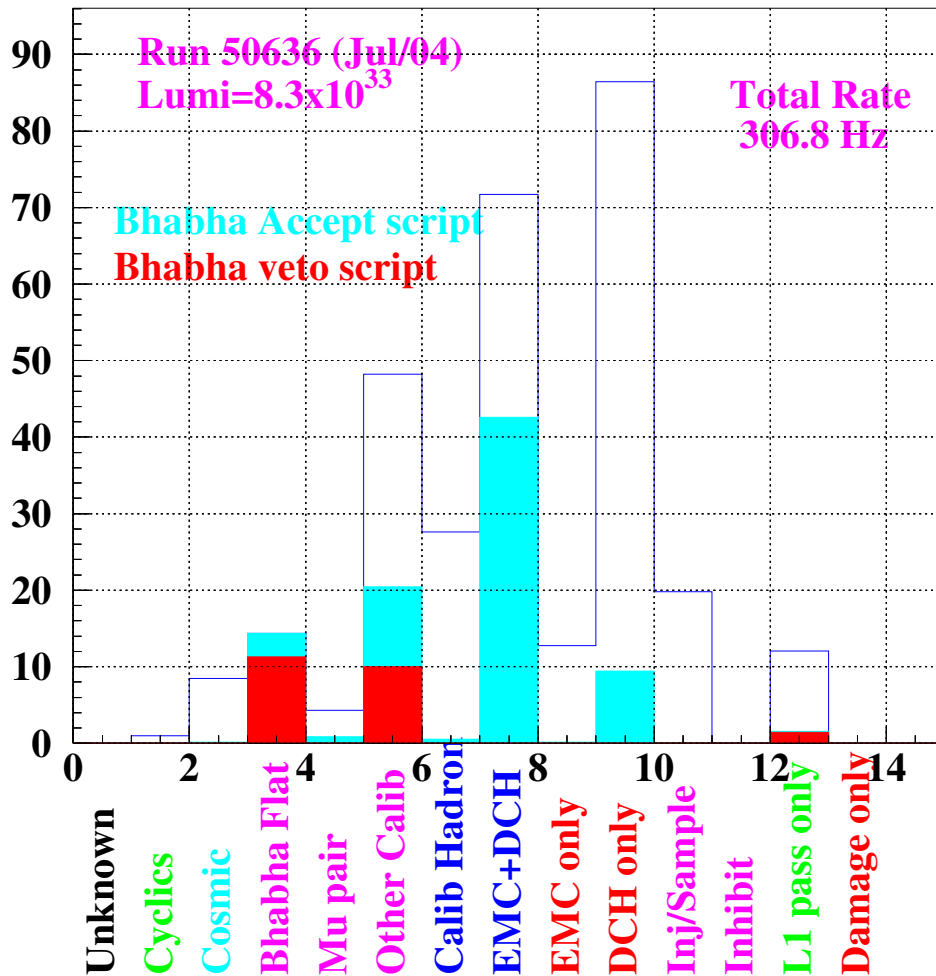
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University of Colorado**

- **Rates and background**
- **L3 tracking**
- **Possible solutions (discussion)**

Based on BAD 301 and discussions with Su Dong and Rainer Bartoldus.

L3 Rate

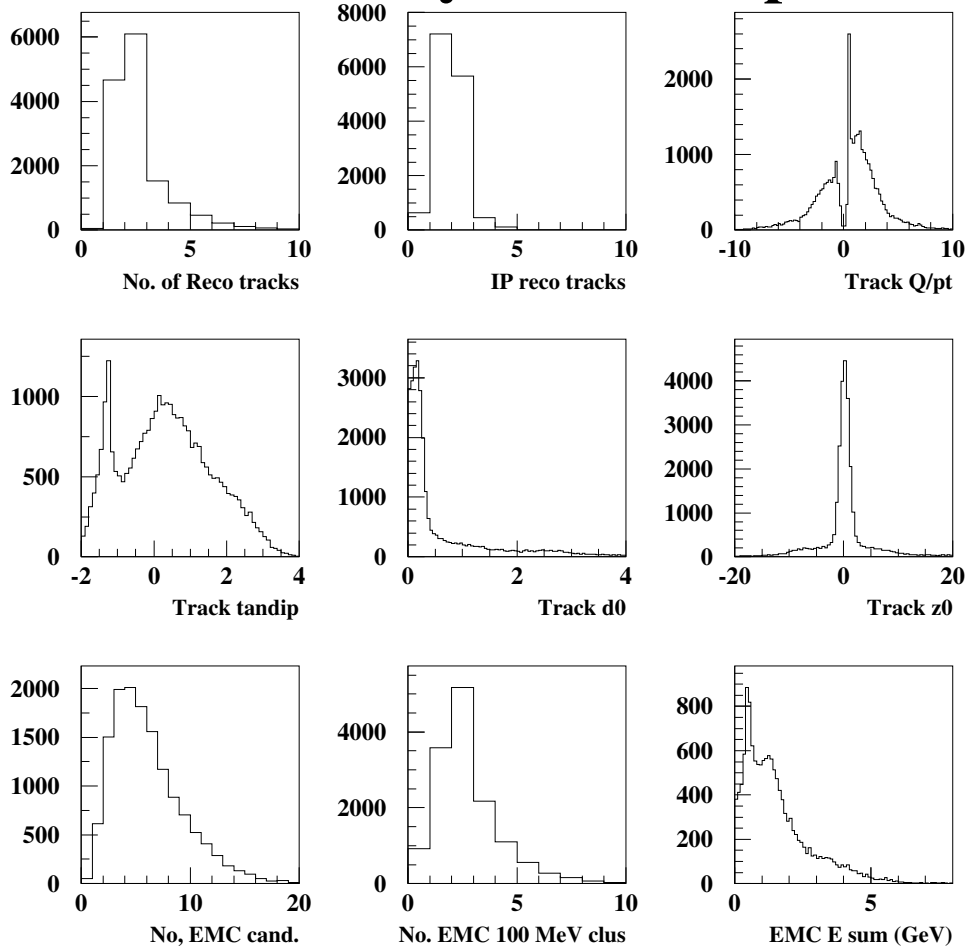
L3 Rate (Hz) by Event Class



High rate (85 Hz) of DCH-only events consisting mainly of background events.

A reduction of this large sample of background events will save a lot of time and money and is essential for future operation at high luminosity

L3 DCH Only Event Properties

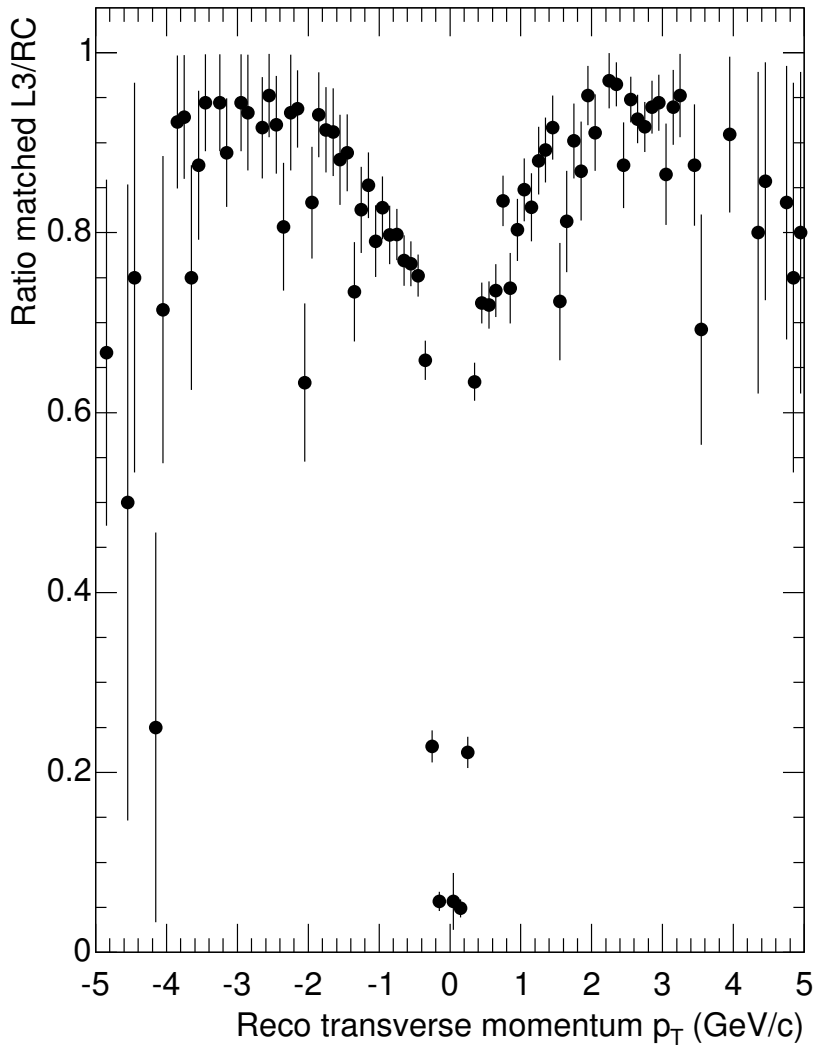


DCH only events

- Many of the DCH-only events are a single electron tracks, nothing else in the event.
- E/P 1; min $\cos(\text{clus-track})$ peak at 1 means just 1 significant cluster matched to track.
- The electron tracks have too low energy to be vetoed as a normal Bhabha event.
- Possibly radiative Bhabha events and other unwanted QED events.
- More study is necessary to identify other possible background sources.
- **Possible solution: reduce background by using at least two L3 tracks for a DCH tag.**

The problem

Low efficiency at low p_T causes ?? % of the physics events are tagged by a single L3 track.

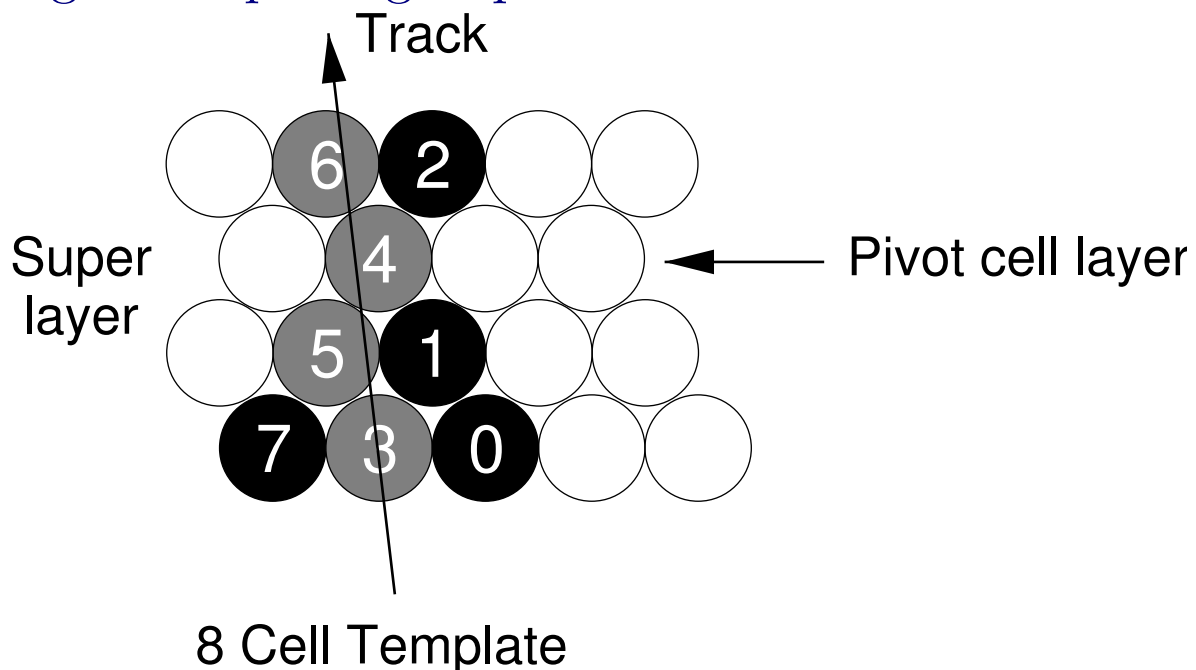


Solution: Improve L3 tracking algorithm to have better efficiency in reconstructing low p_T tracks.

The current algorithm

Track Segment Finder (TSF)

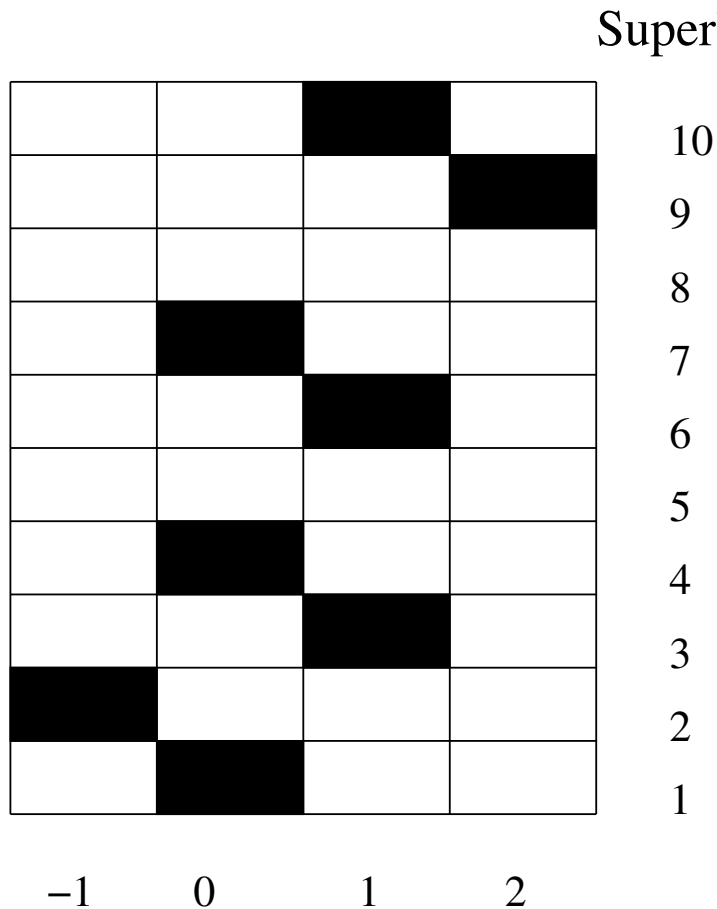
The DCH is divided into 1776 overlapping eight-cell pivot groups.



The pivot group shape is such that only reasonably straight tracks originating from the IP can produce a valid segment.

Track pattern finding

Each super layer is divided into 120 cells in ϕ to produce a 10×120 hit map.

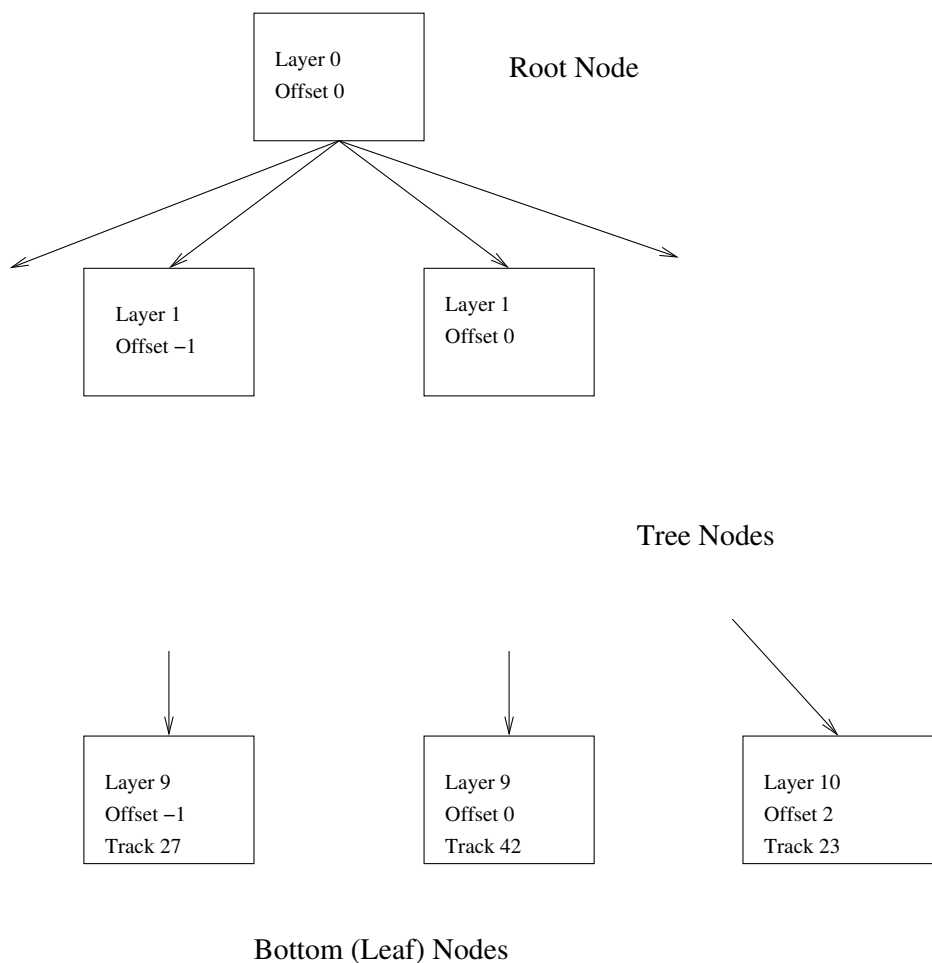


Cell Offset

A sequence of hit cells in different super layers produces a pattern. Due to ϕ asymmetry only relative offsets of the cells in different super layers are important.

A cell is considered hit if it contains at least one **TSF** segment.

Search tree

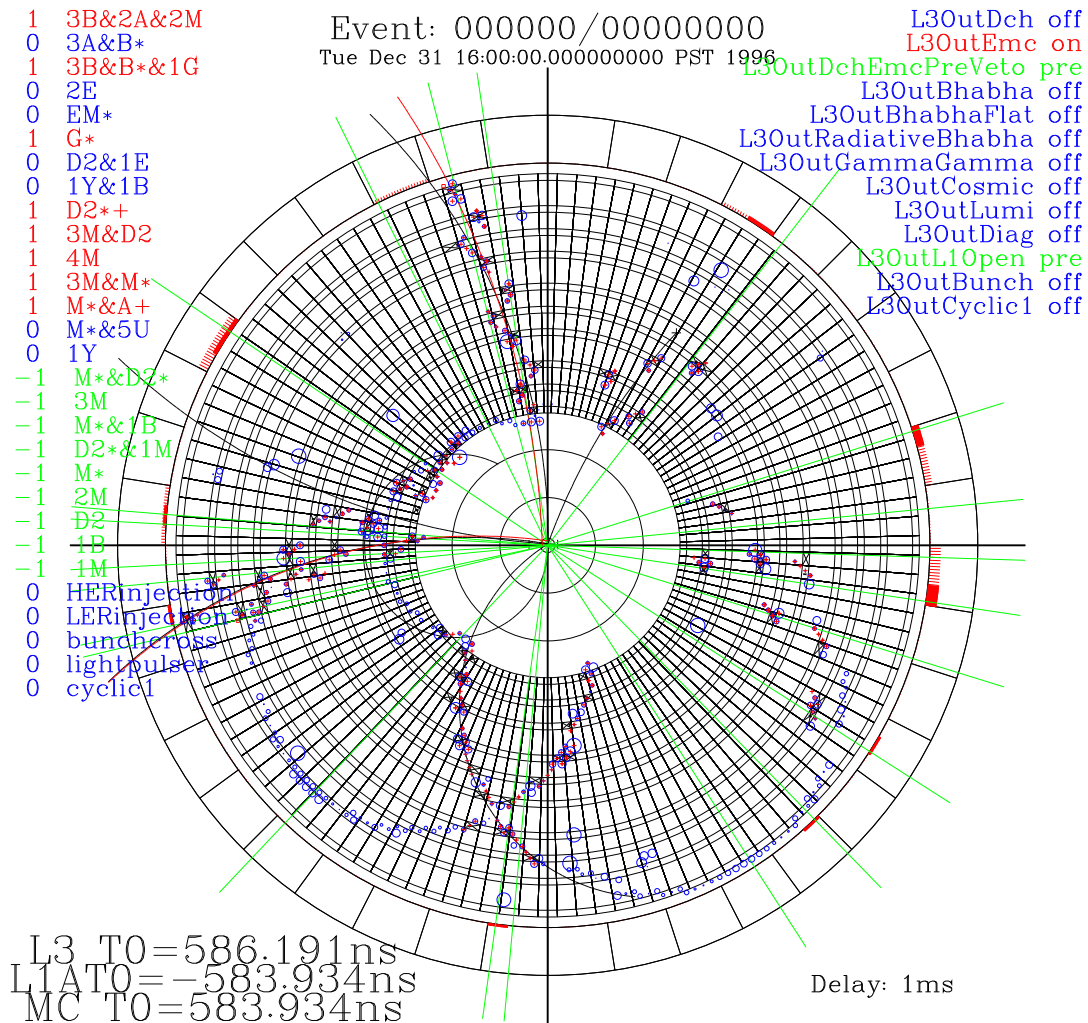


Possible valid track pattern produced by seed tracks have been precalculated by MC. These patterns are looked for in the hit map. Long tracks are allowed to have hits in 8 super layers out of 10, short tracks are allowed to have hits in 5 super layers out of 7. Search orders are used to specify which two super layers can be ignored and to build a search tree.

t_0 and track fitting

- The initial t_0 is obtained by subtracting 220 ns from the drift time average of the wires in the tracks TSF segments. t_0 estimates are only calculated for TSF segments in which all four wires (2,3,4,5) or (4,5,6,7) are hit.
- If no track patterns have been found, 500 ns is used as initial guess.
- Seed tree parameters are used for the initial fit.
- Four more five parameter (helix) fits are done iteratively improving on the previous.

Example event



For low p_T tracks, no TSF segments are found in the outer super layers.

Possible solution: require wire hits for outer super layers instead of TSF segments.