Design Philosophy

- To reconstruct final states in terms of fundamental particles: quarks, leptons, and gauge bosons, so as to visualize underlying Feynman diagrams as much as possible.
  - Reconstruction of heavy partons such as top, W, and Z via the jet invariant mass method (Particle Flow). This implies measurements of their spin vectors.
  - Separation of charm and bottom form lighter quarks and gluons (High Resolution Vertexing).
  - Indirect detection of invisible particles such as neutrinos as missing momenta (Hermeticity).
- To select participating Feynman diagrams with beam polarization.

Requirements for the LC Detector

1. Recoil mass resolution for $e^+e^- \rightarrow ZH(Z \rightarrow l^+l^-)$ is determined by beam energy spread.
2. Jet invariant mass resolution that allows separation of W and Z decaying into two jets.
3. Vertex resolution capable of identifying charm jets as well as cascade decays of bottom quarks.
4. Hermeticity down to less than a few tens of mrad.
5. Robustness against various beam-induced backgrounds.

Requirements for the Central Tracker

- Momentum Resolution

$$\sigma_{p_T}/p_T \lesssim (1 \times 10^{-4}) \cdot p_T[\mathrm{GeV}]$$

- Two-Hit Separation

$$\Delta_{\mathrm{2hit}} \lesssim 2[\mathrm{mm}]$$

- Track-Cluster Matching (extrapolation error to CAL)

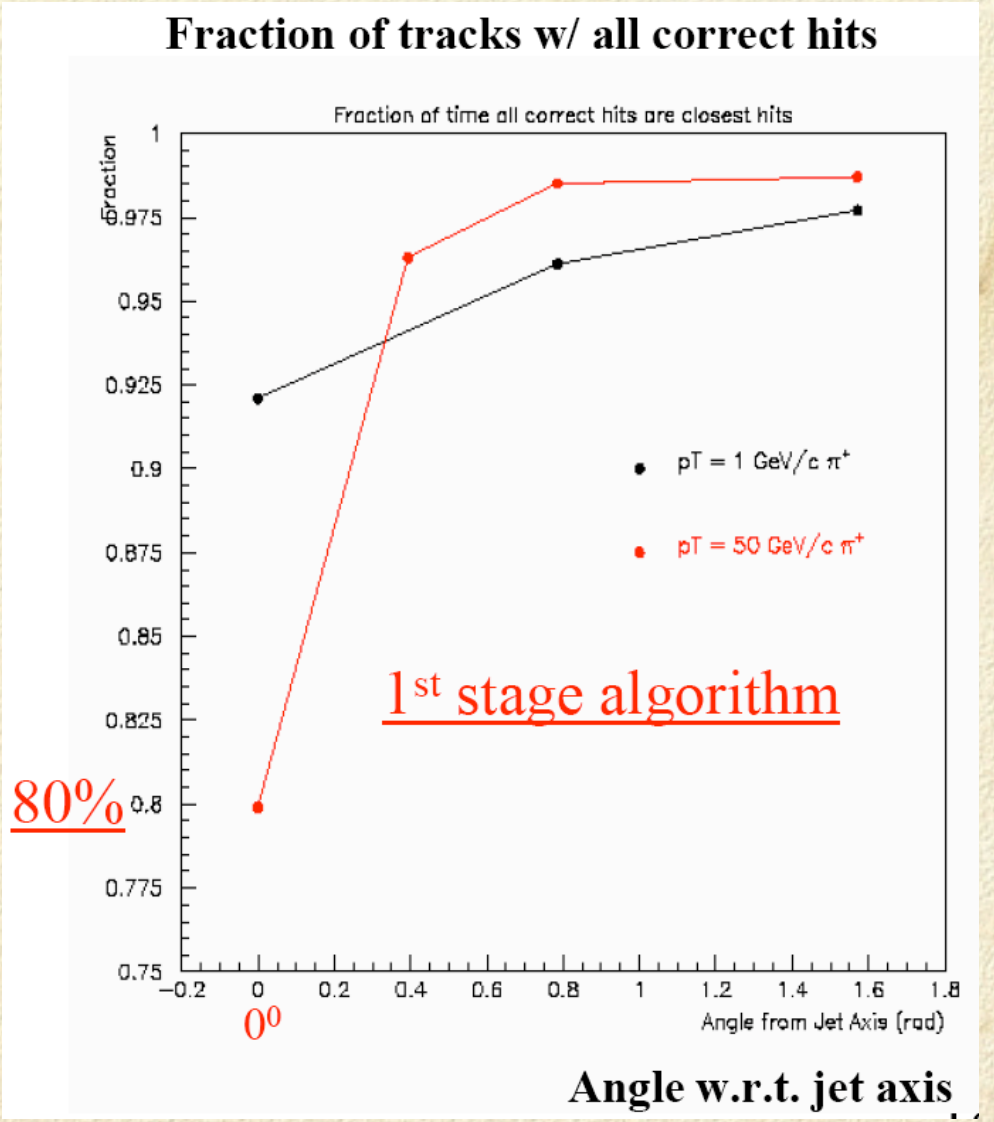
$$\Delta r\phi, Z \lesssim 1[\mathrm{mm}]$$

- Time Stamping Resolution

$$\sigma_{T_0} \lesssim 1.4[\mathrm{ns}]$$

Possible Options: Gas v.s. Solid

Solid	Gas
compact but CAL dominates the detector size anyway	large
too little redundancy	many sampling points
Thick	Thin
operational under high BG.	?



CDC v.s. TPC

	CDC	TPC (MWPC)	TPC (MPGD)
Spatial Resolution	$\sigma_{xy} \lesssim 100\mu$m $\sigma_z \lesssim 1$mm(stereo)	$\sigma_{xy} \lesssim 200\mu$m $\sigma_z \lesssim 0.5$mm	$\sigma_{xy} \lesssim 100\mu$m? $\sigma_z \lesssim 0.5$mm
Two-Hit Separation	$\Delta_{r\phi} \lesssim 2$mm $\Delta_z = N.A.$	$\Delta_{r\phi} \gtrsim 10$mm $\Delta_z \simeq 10$mm	$\Delta_{r\phi} \lesssim 2$mm? $\Delta_z \simeq 10$mm
Angular Coverage	limited by wire length $<$	limited by diffusion/HV $=$	limited by diffusion/HV
Sampling Points	$n < 100$	$n \gtrsim 100$	$n \gtrsim 200$
Sector Boundary	none	thick	practically none?
Time Stamping	$\sigma_{T_0} \lesssim 2$ns	N.A. if TPC alone	N.A. if TPC alone