Ultra-Fast Determination of the Primary Vertex at SPD

Advanced Computing — *C++ library VTX*

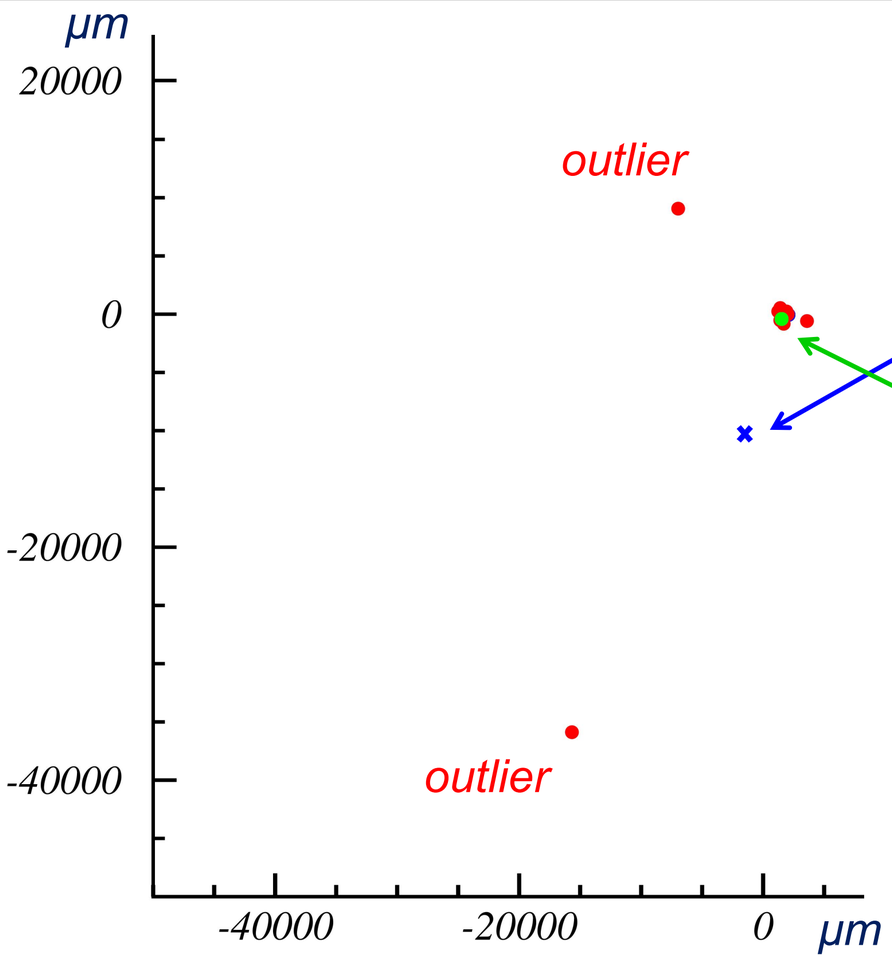
Maria Dima

Motivation: *Primary Vertex determination for online applications*

Idea: *- seed calculation & newDOCA*

- linear vertex using error ellipsoids

=> Flash-algorithm - non-iterative solution



SEED CALCULATION

Distance Of Closest Approach

Method 1: *v0 = avg(DOCA)*

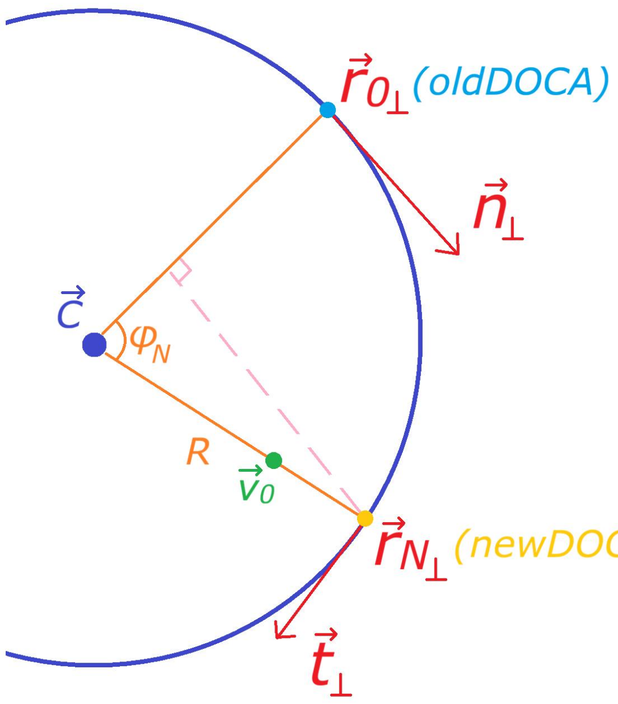
poor DOCA's => poor v0

Method 2 (seed):

$$w_i = \sum_{i \neq j} \left[\left\| d_i - d_j \right\|^2 + \mu^2 \right]^{-k}$$

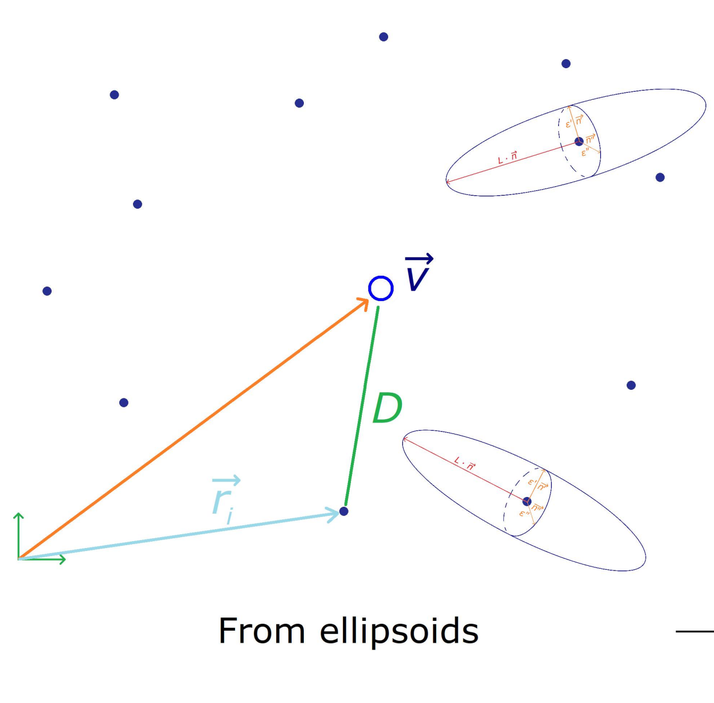
$$v0_{xy} = \sum_i w_i \cdot \vec{d}_i \Big/ \sum_i w_i$$

Radial acceptance cut: exclude DOCA points far from the local density maximum. Compute value as average of accepted points.



newDOCA

Swim tracks analytically the point of closest approach relative to v0 + re-parameterize locally + linearize



TRACK SELECTION

- *$DOCA_{xy}$ & $DOCA_z$ < 0.4 σ*
- *pT > 0.4 GeV/c*
- *χ^2/dof < 5 & no trks > 3*

VERTEXING

$$|v\rangle = \left(\overline{\sigma_D^{-2}} \right)^{-1} \overline{\sigma_D^{-2} |r_i\rangle}$$

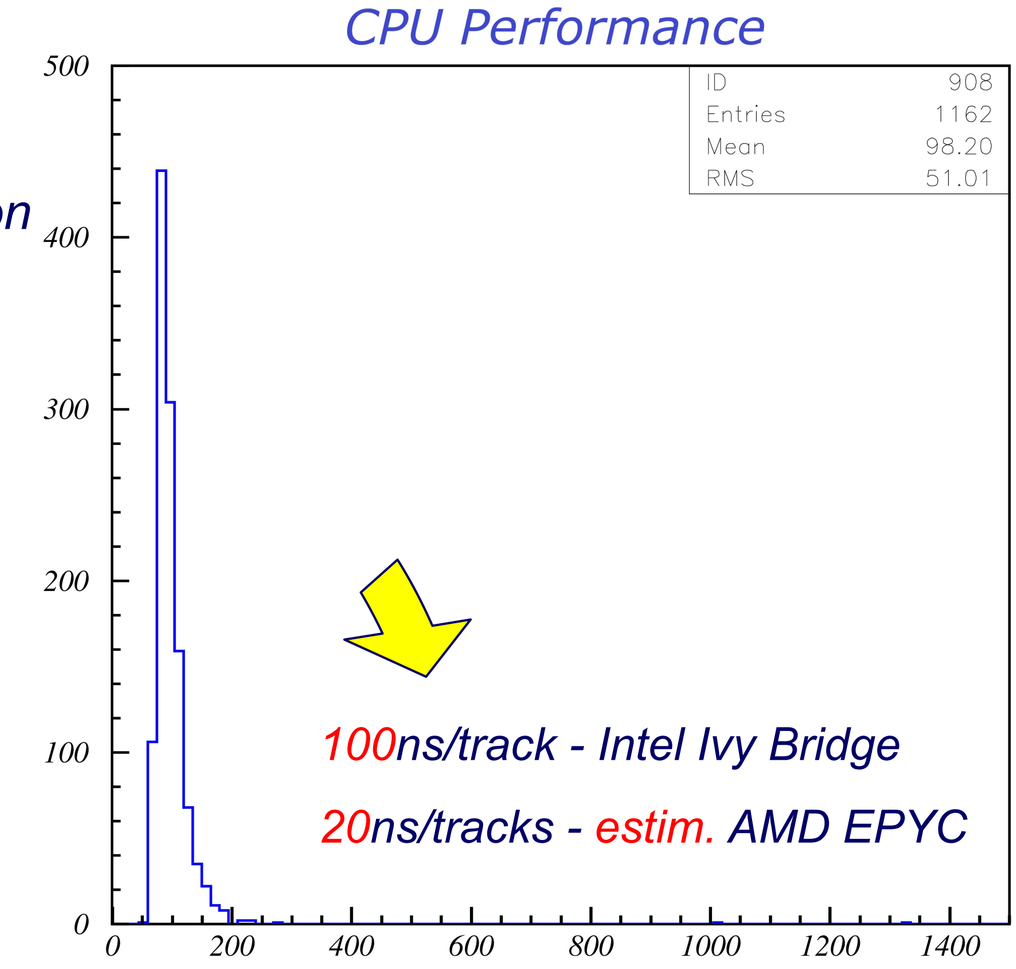
CONCLUSIONS

- *resolution: comparable to SPDroot reconstruction*

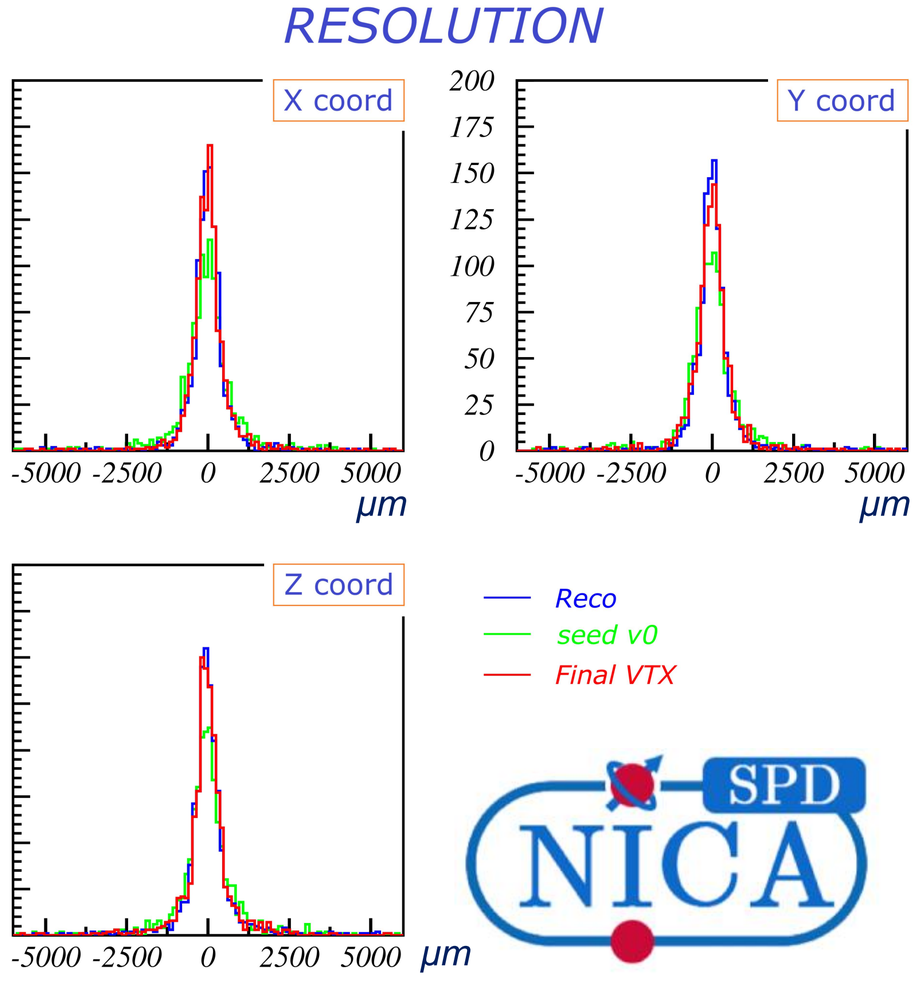
- *speed: 100ns/track*



CPU Performance



RESOLUTION



SPD NICA