

A Second Look At Vertex Reconstruction

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Previous attempt at vertex reconstruction was
“bottom up”:

[1] Form all pairs of track crossings

[2] Cluster near-by crossings

* Weakness: produces many false positives

* Splits tracks from primary vertex

This attempt:

[1] Start by assuming all tracks come from same vertex

[2] Split tracks off that don't fit

* Too soon to know all its weaknesses

The algorithm

Works by process of deterministic annealing

[1] Pick seed vertex

[2] Compute weight of each track according to:

$$w_i = 1/(1+\exp[(r_i^2-rc^2)/(2T)])$$

[3] Vary vertex position to minimize statistic: $\sum_i^n \{w_i r_i^2\}$

w_i is weight of i th track, r_i is distance from i th track to vertex

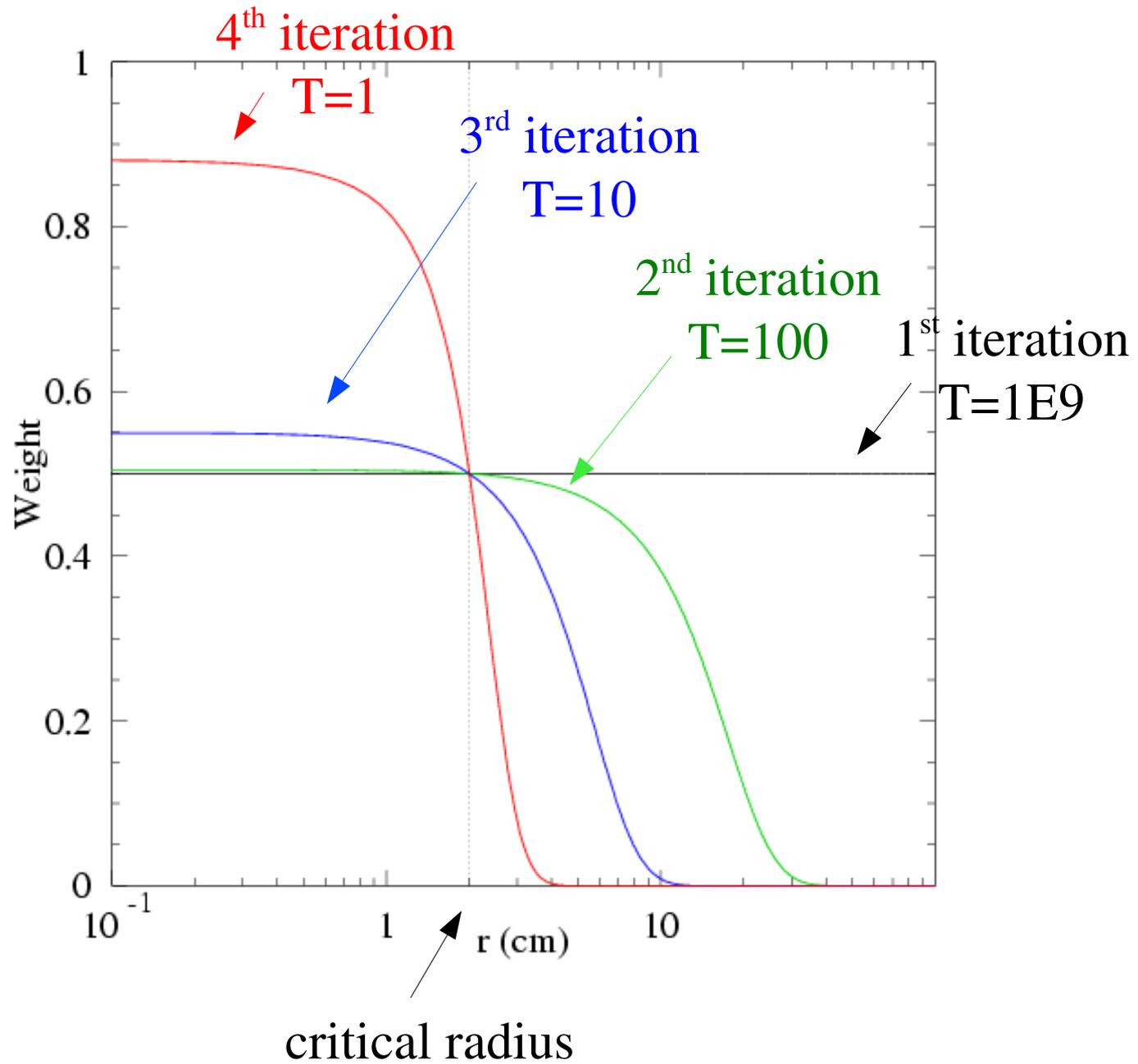
[4] Reduce temperature T and repeat

Critical radius is the largest distance from a track to a vertex for the track to be considered part of the vertex at $T=0$.

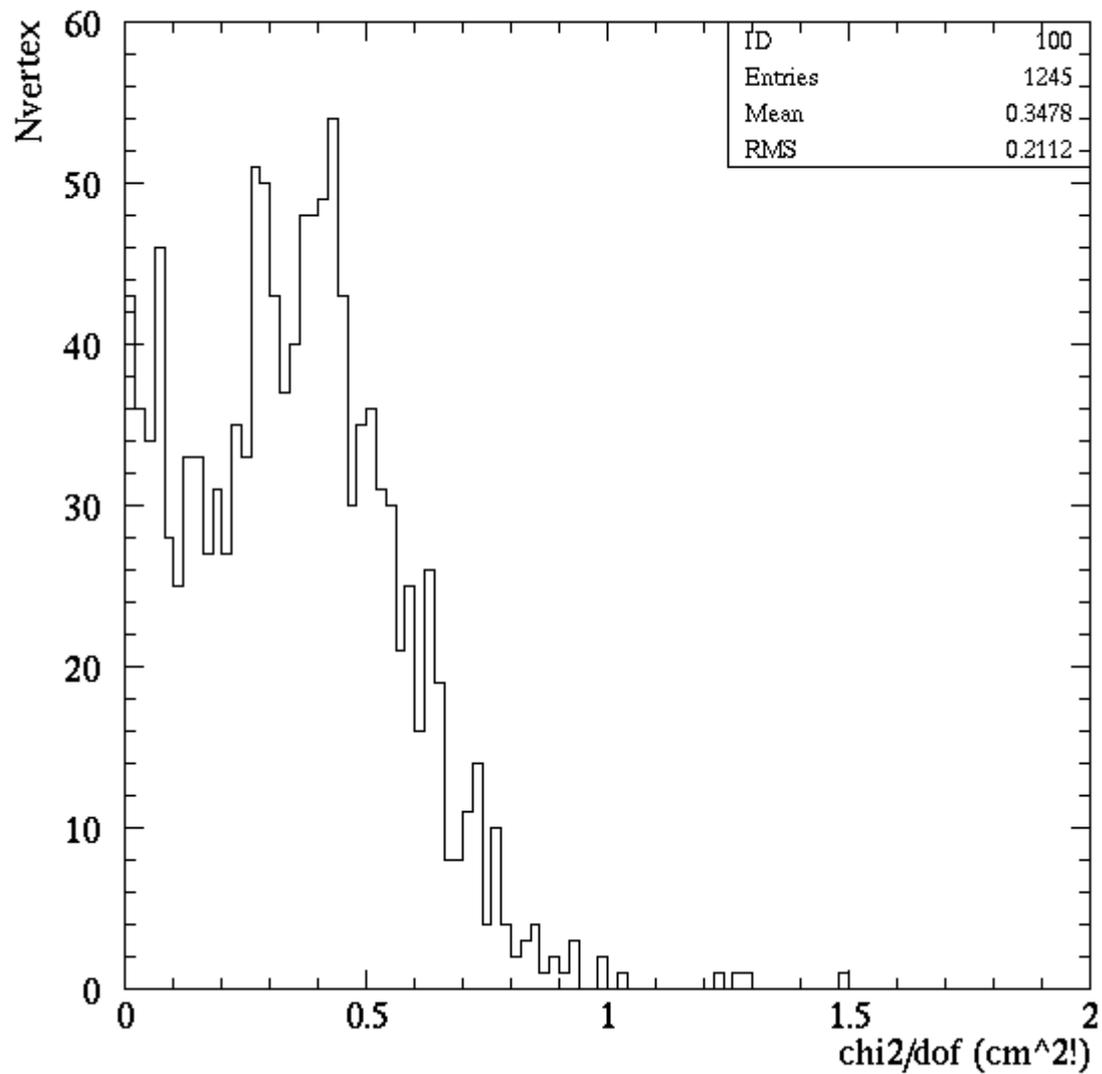
The temperature T is decreased from iteration to iteration.

This scheme is robust against outliers. They can be used in the fit, but their weight gets smaller and smaller while the weights of clustered tracks gets larger and larger. Convergence is possible using all tracks all the time.

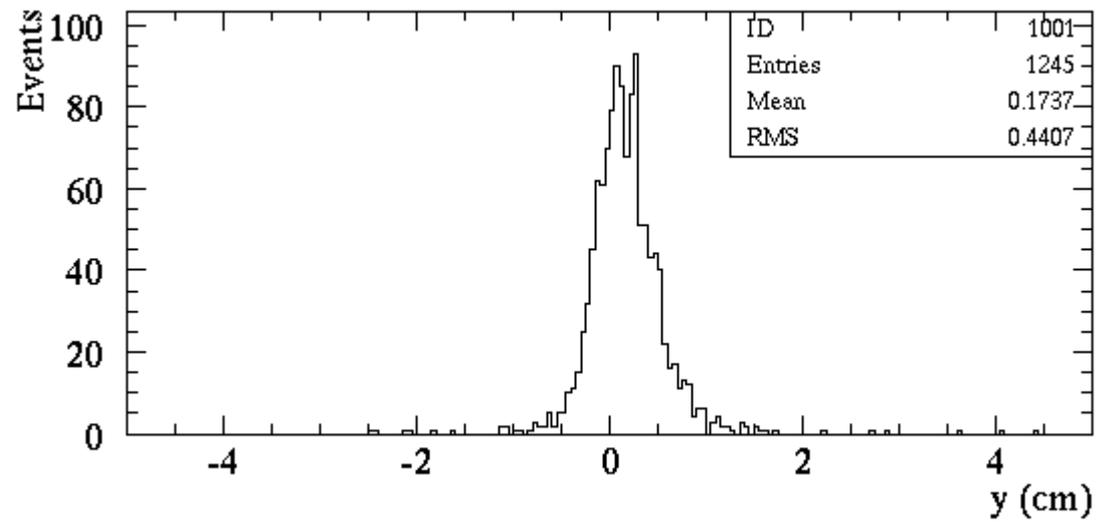
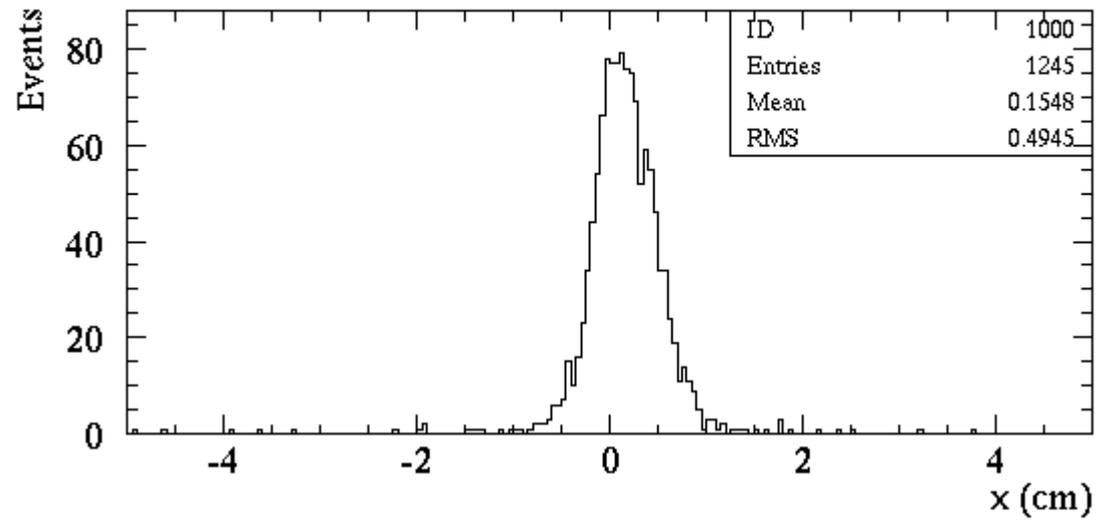
Track weights



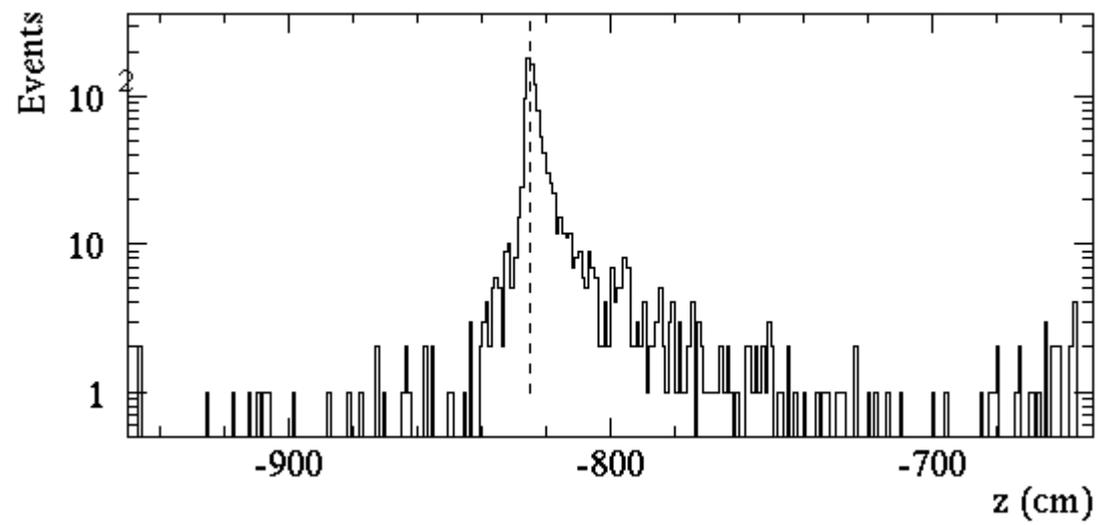
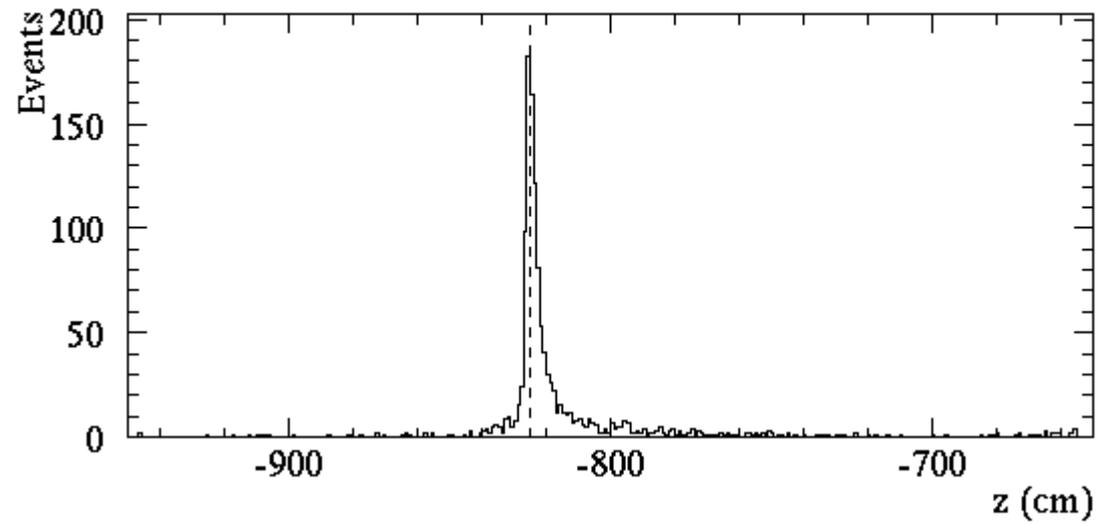
Average distance track-vertex squared



x and y distributions



Z distributions



Z distributions zoomed

