

# Updates on Secondary Vertex Resolution Using Vertex Detector

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# Need for the Update

- (Reco - MCtruth) histogram normalized, fitted with three Gaussians
- Effective resolution was **weighted average of the width** of the two narrowest/highest Gaussians since the third had negligible contribution
- Realized the weighting was wrong : should have been **weighted average of variance** and **not standard deviation**
- Corrected resolutions are presented below

# Those Gaussians!

- Weighted sum of two Gaussians :  
$$g(\mu, \sigma) = p.g1(\mu_1, \sigma_1) + (1 - p).g2(\mu_2, \sigma_2)$$
- Expectation value :  $\mu = p.\mu_1 + (1 - p).\mu_2$
- Variance :  $\sigma^2 = p.\sigma_1^2 + (1 - p).\sigma_2^2 + p.(1 - p).(\mu_1 - \mu_2)^2$
- Effective standard deviation :  $\sigma = \sqrt{p.\sigma_1^2 + (1 - p).\sigma_2^2}$ , for the trivial case of  $\mu = \mu_1 = \mu_2 = 0$

# Iterative Vertex Fit : x-dir

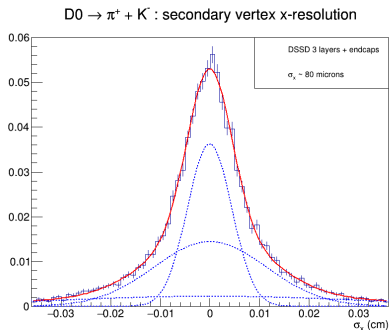


Figure 1: DSSD :  $\sigma_x \sim 80 \mu$

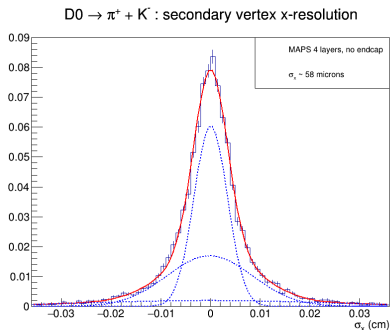


Figure 2: MAPS :  $\sigma_x \sim 58 \mu$

Multi-gaussian fits, effective resolution shown  
D0 decay-length  $\sim 120 \mu$

# Iterative Vertex Fit : z-dir

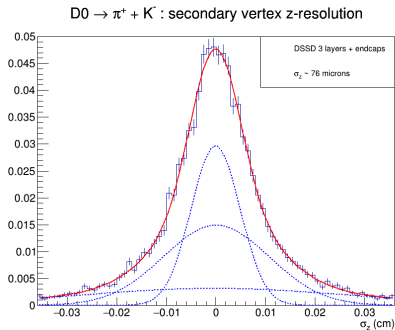


Figure 3: DSSD :  $\sigma_z \sim 76 \mu$

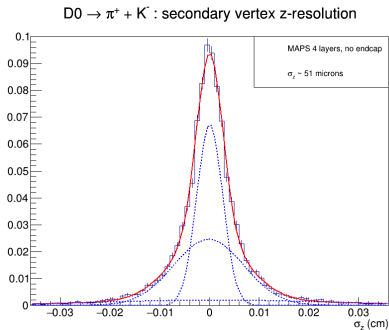


Figure 4: MAPS :  $\sigma_z \sim 51 \mu$

# KFParticle Reconstruction : z-dir

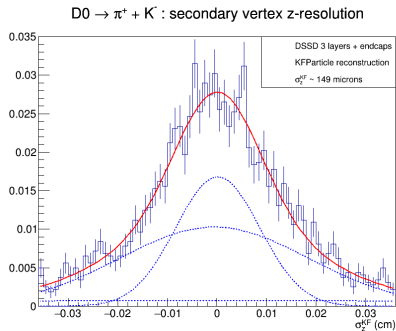


Figure 5: DSSD :  $\sigma_z \sim 149 \mu$

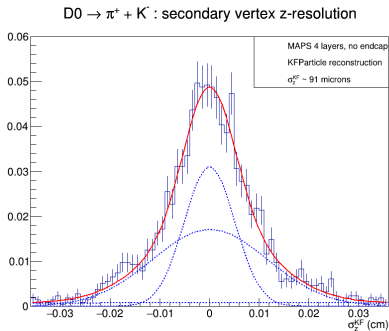


Figure 6: MAPS :  $\sigma_z \sim 91 \mu$

KFParticle reconstruction worse by a wide margin for both DSSD and MAPS

Moreover, DSSD resolution is worse than D0 decay-length

# Updated Vertex Detector Performance Plots for TDR

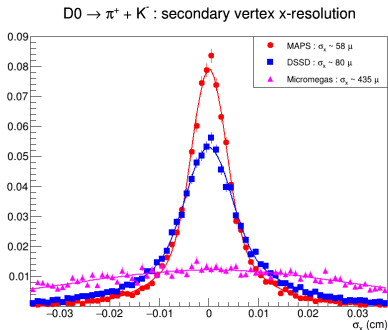


Figure 7: X-resolution

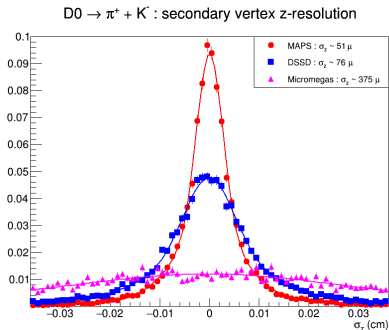


Figure 8: Z-resolution

comparison of Micromegas, DSSD and MAPS for x and z resolution of  $D^0$  secondary vertex reconstruction from daughter tracks

# Thank You