Reconstructing Hyperons with Kinematic Fitting at HADES

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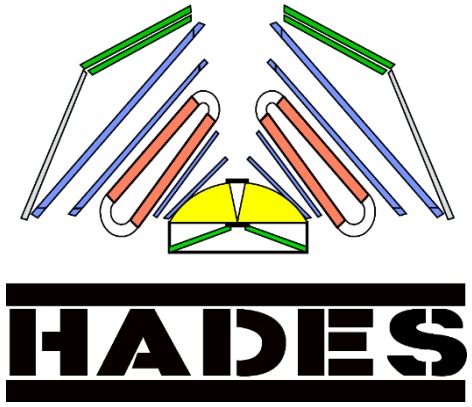
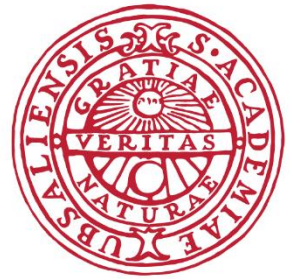
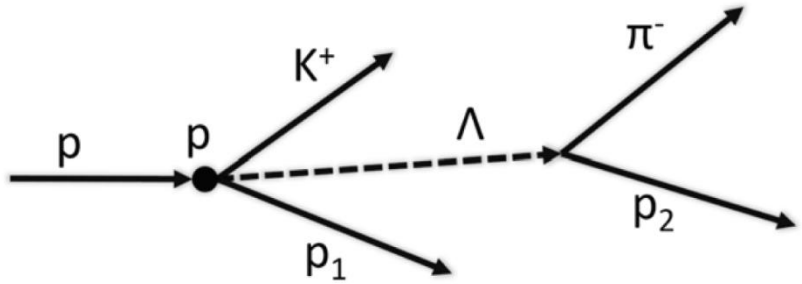




Kinematic Fitter at HADES

HADES at GSI

- Optimized for di-electron detection
- Has been upgraded with a forward tracker and a ToF detector
  - increase the acceptance for hyperon events



Kinematic fitter: Iterative fitting procedure based on Lagrange multipliers

$$\chi^2 = (y-\eta)^T V^{-1}(y-\eta) + 2\lambda^T f(\eta,\xi) = minimum$$

f- constraint function
η – set of measured quantities
y - set of estimated quantities
ξ – set of unmeasured quantities
λ – Lagrange multipliers

$$\vec{\eta} = (P_{\pi^-}, \theta_{\pi^-}, \varphi_{\pi^-}, P_{\mathrm{p}}, \theta_{\mathrm{p}}, \varphi_{\mathrm{p}}, \theta_{\Lambda}, \varphi_{\Lambda})$$

$$\vec{\xi} = (P_{\Lambda})$$

$$f_1 = -p_\Lambda sin\theta_\Lambda cos\varphi_\Lambda + p_{\pi^-} sin\theta_{\pi^-} cos\varphi_{\pi^-} + p_p sin\theta_p cos\varphi_p = 0 \quad (p_x)$$

$$f_2 = -p_\Lambda sin\theta_\Lambda sin\varphi_\Lambda + p_{\pi^-} sin\theta_{\pi^-} sin\varphi_{\pi^-} + p_p sin\theta_p sin\varphi_p = 0 \quad (p_y)$$

$$f_3 = -p_\Lambda cos\theta_\Lambda + p_{\pi^-} cos\theta_{\pi^-} + p_p cos\theta_p = 0 \quad (p_z)$$

$$f_4 = -\sqrt{p_\Lambda^2 + m_\Lambda^2} + \sqrt{p_{\pi^-}^2 + m_{\pi^-}^2} + \sqrt{p_p^2 + m_p^2} = 0 \quad (E).$$

Kinematic fitting library developed together with J. Rieger (Uppsala Universitet) and W. Esmail (GSI)

Analysis Procedure and Selected Results

- Identify Protons, pions and kaons
- Calculate a primary vertex and a decay vertex
- Compute the parameters (angles) of the neutral candidate
- Perform a fit with a 4-momentum constraint in the decay vertex
- Keep only the combination of particles that satisfy
  - Difference between in two consecutive iteractions,$\Delta\chi^2 < 1.0$
  - $p_{fit} > 10^{-4}$
  - Combination with best probability in the event