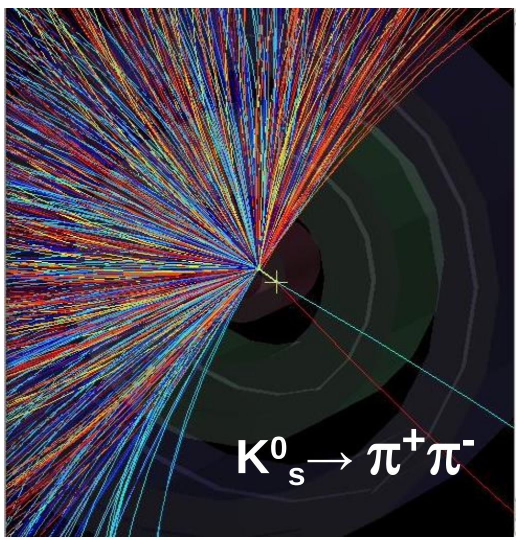
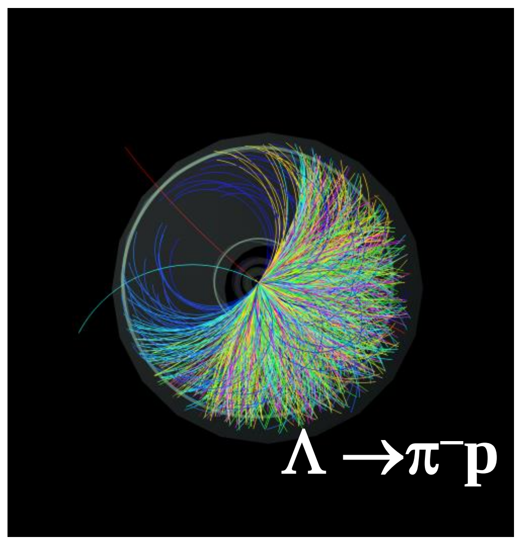
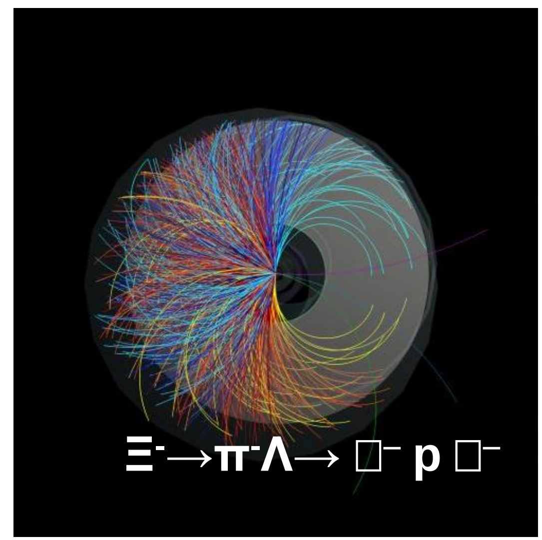
elearning

Looking for strange particles in ALICE

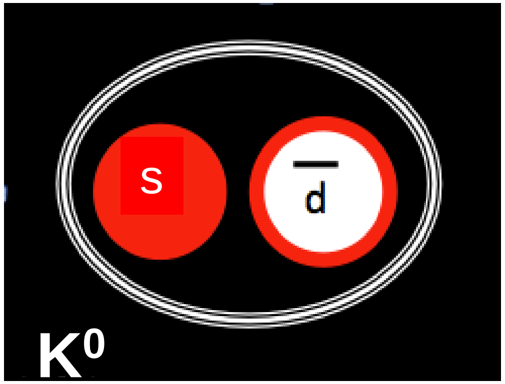






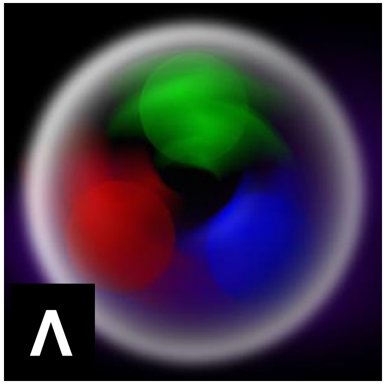
What are strange particles ?

meson



$d\bar{s}$, $\bar{d}s$

baryon



uds

hadrons (baryons or mesons) containing at least one strange (s) quark

We will be looking for neutral strange particles, which travel some distance (mm or cm) from the point of production (collision point) before they decay into two oppositely charged particles

$K^0_s \rightarrow \pi^+\pi^-$

$\tau = 0.89 \times 10^{-10}$ s

$c\tau = 3 \times 10^{10}$ cm $s^{-1} \times 8.9 \times 10^{-11}$ s

2.67 cm from the point of interaction

$\Lambda \rightarrow \pi^- p$

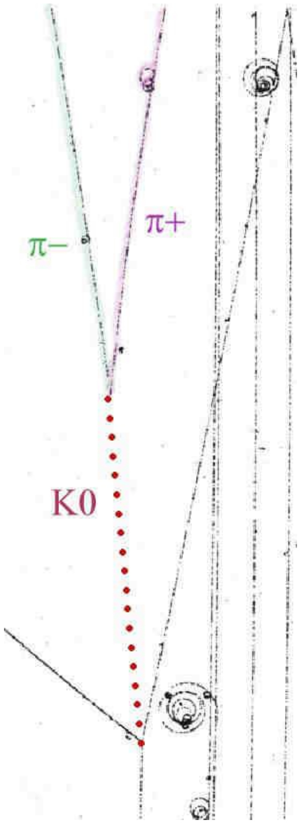
$\bar{\Lambda} \rightarrow \pi^+ \bar{p}$

$\tau = 2.6 \times 10^{-10}$ s

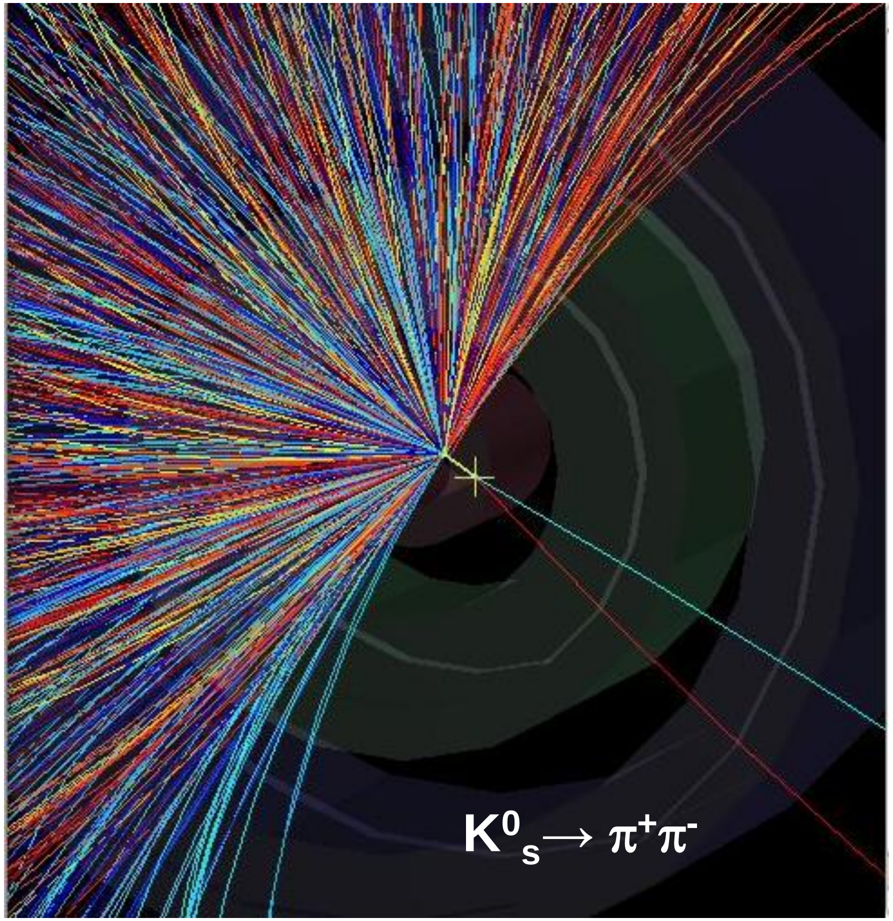
$c\tau = 3 \times 10^{10}$ cm $s^{-1} \times 2.6 \times 10^{-10}$ s

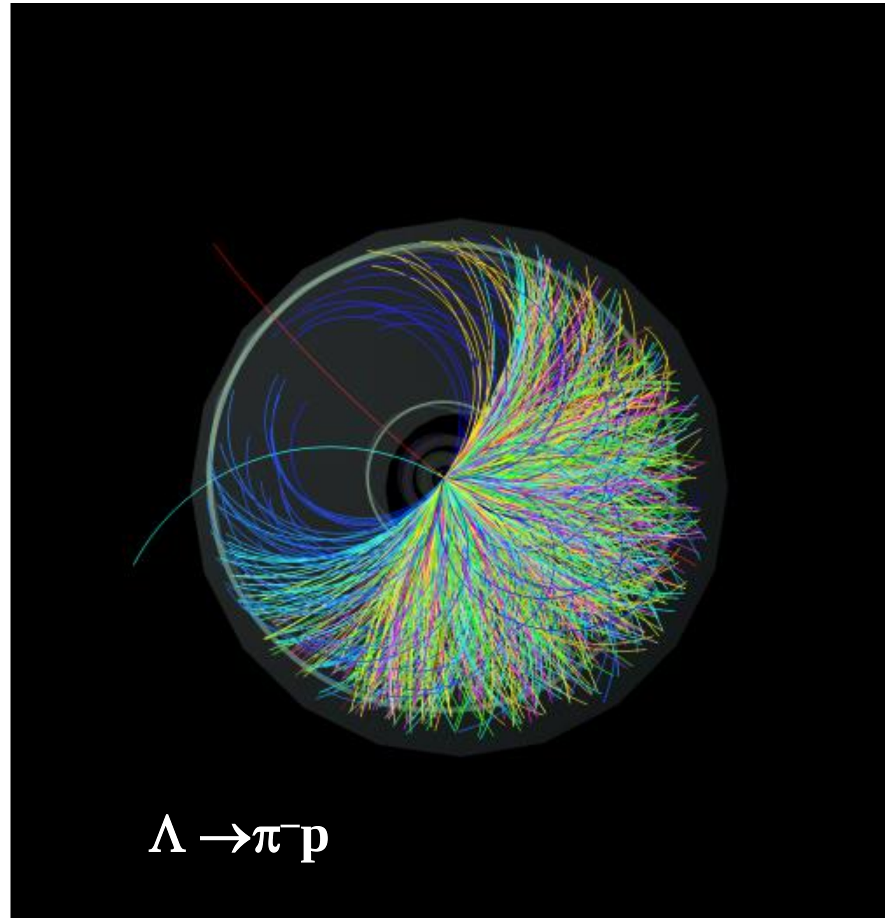
7.2 cm distance from the point of interaction

Weak decays : strangeness is not conserved



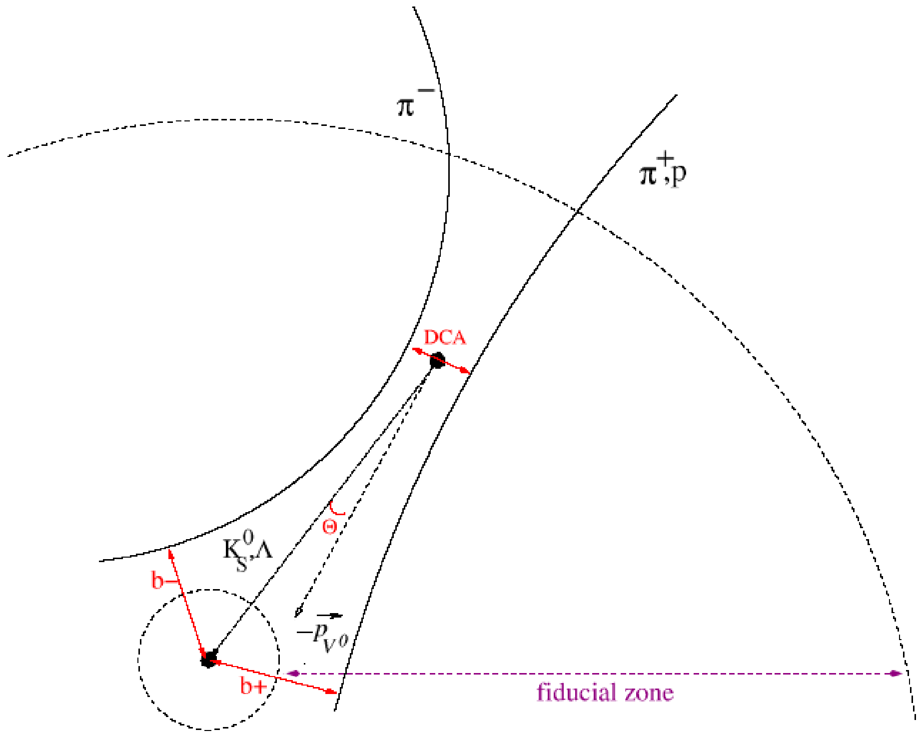
How do we find V0s ?





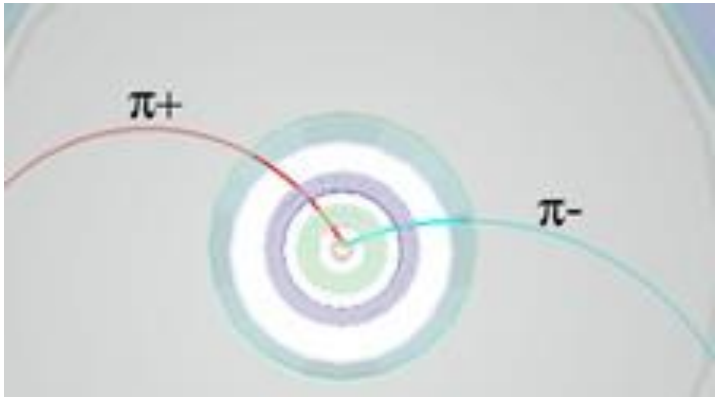
We look for two opposite tracks, having the same origin, which is not the interaction (collision) point

How do we find V0s ?



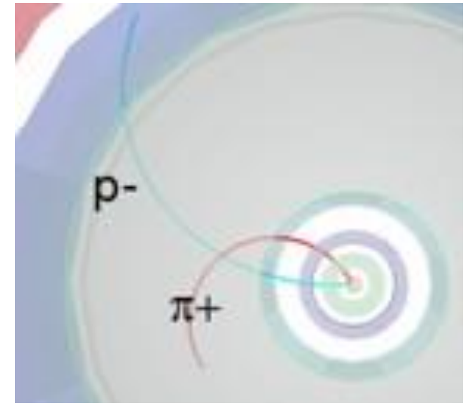
We look for two opposite tracks, having the same origin, which is not the interaction (collision) point

How do we identify each V0?



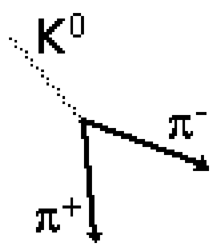
$K^0_s \rightarrow \pi^+\pi^-$

$\Lambda \rightarrow \pi^- p^+$



anti $\Lambda \rightarrow p^{-}\square^{+}$

$K^0 \rightarrow \pi^+ + \pi^-$



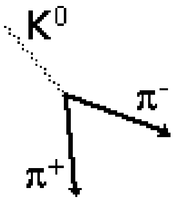
V0 decay :
a neutral particle (no track) gives suddenly two tracks

Identify V0s from the decay topology

$P = Q \cdot B \cdot R$
P momentum
Q electric charge
B magnetic field
R radius of curvature

How do we identify each V0?

$K^0 \rightarrow \pi^+ + \pi^-$



Calculate the (invariant) mass

Energy conservation $E = E_1 + E_2$

Momentum conservation $\mathbf{p} = \mathbf{p}_1 + \mathbf{p}_2$

Total energy $E^2 = p^2c^2 + m^2c^4$

c=1 $E^2 = p^2 + m^2$

$E = E_1 + E_2$ $E_1^2 = p_1^2 + m_1^2$ $E_2^2 = p_2^2 + m_2^2$

$E^2 = p^2 + m^2$ $m^2 = E^2 - p^2 = (E_1+E_2)^2 - (p_1+p_2)^2 = m_1^2 + m_2^2 + 2E_1E_2 - 2\,\mathbf{p}_1 . \mathbf{p}_2$

Calculate the mass of the initial particle from the values of the mass and the momentum of the final particles

Particle Identification (done by a number of PID detectors) $\Rightarrow$ m_1 m_2

Radius of curvature of the particle tracks due to magnetic field $\Rightarrow$ p_1 p_2

P=Q·B·R (P momentum, Q electric charge, R radius of curvature, B magnetic field)

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