Λ° Polarization in the ALICE experiment

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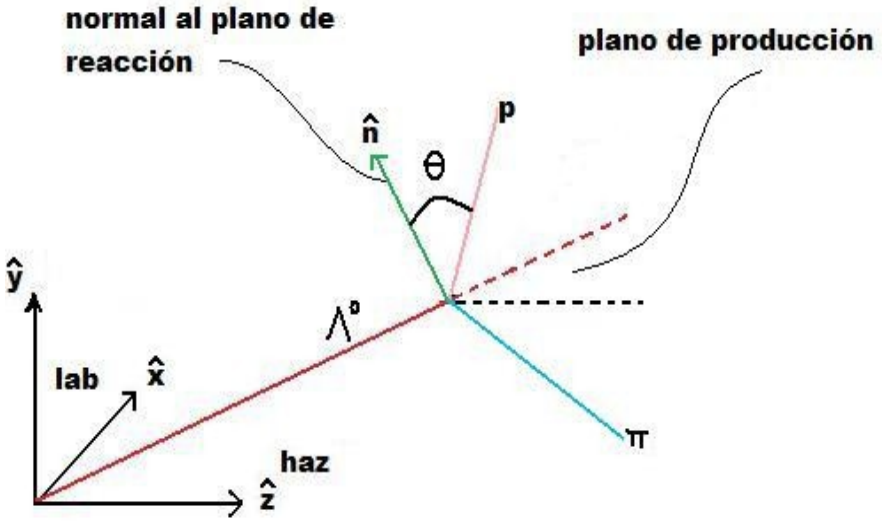
May 23th , 2012

Measuring the polarization

Polarization is calculated by Mearing the angular distribution of Decay products of Lambda.

$$\vec{P}'_p = \vec{P}_p + \frac{\gamma - 1}{\beta^2}\frac{\vec{P}_{\Lambda^0} \cdot \vec{P}_p}{E_{\Lambda^0}}\vec{\beta} - \gamma E_p \vec{\beta}$$

$$\hat{n} \equiv \frac{\vec{P_{beam}} \times \vec{P_{\Lambda^0}}}{\left|\vec{P_{beam}} \times \vec{P_{\Lambda^0}}\right|}$$



$$\frac{dN}{d\cos\theta} = A\left(\cos\theta\right)\left(1 - \alpha P \cos\theta\right)$$

V° identification

Identificated by its Decay topology:

$\Lambda^0 \rightarrow p^+ + \pi^-$ - 63.9 %

Find secondary vertex

↓

Every secondary track is combined with each opposite charged track

↓

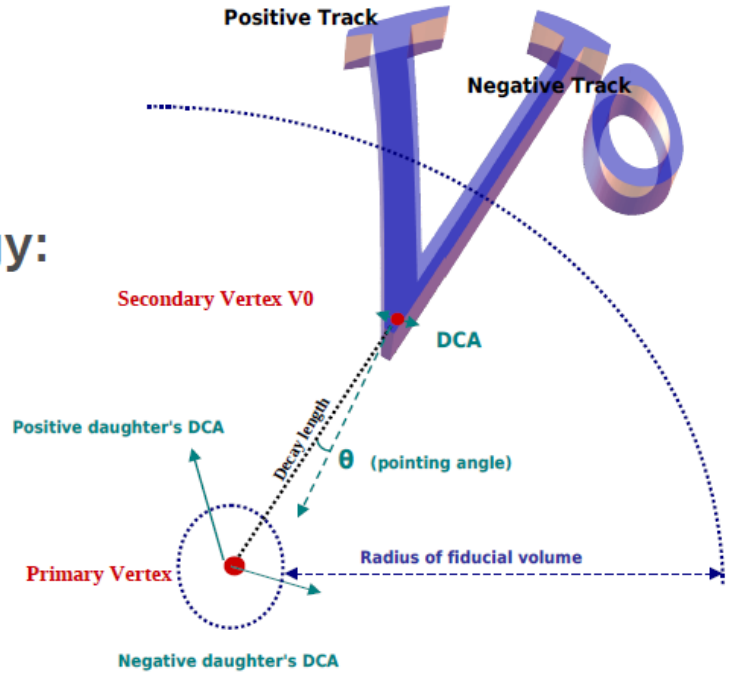
Mass hypothesis

↓

Cuts on topological variables

↓

Kinematic variables



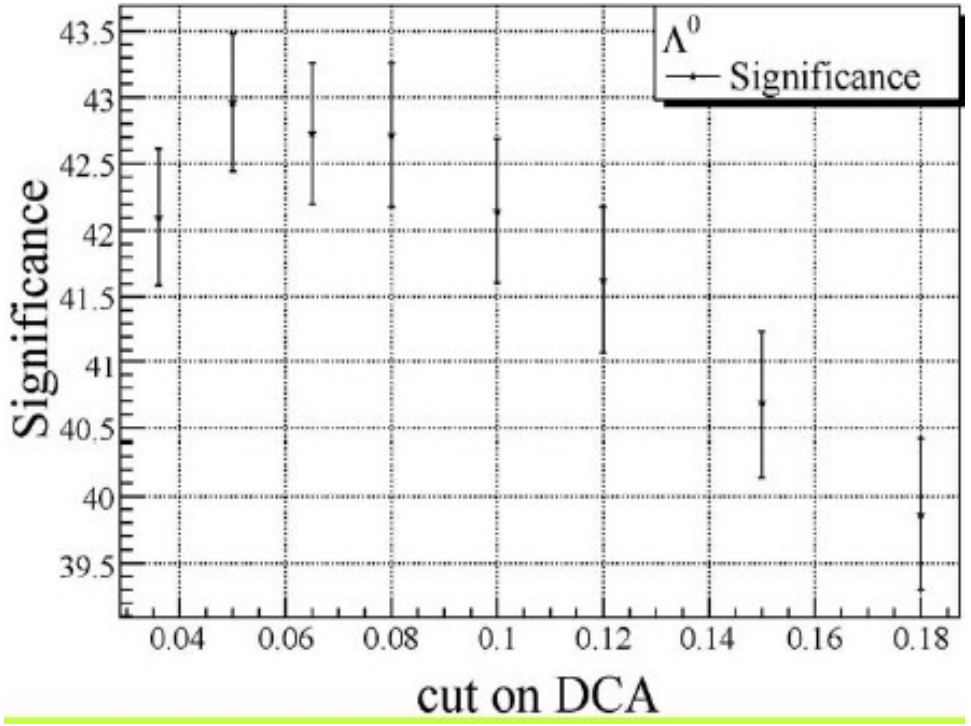
Topological variables:

DCA of negative daughter track
DCA of positive daughter track
DCA between V° daughters
Cosine of pointing angle

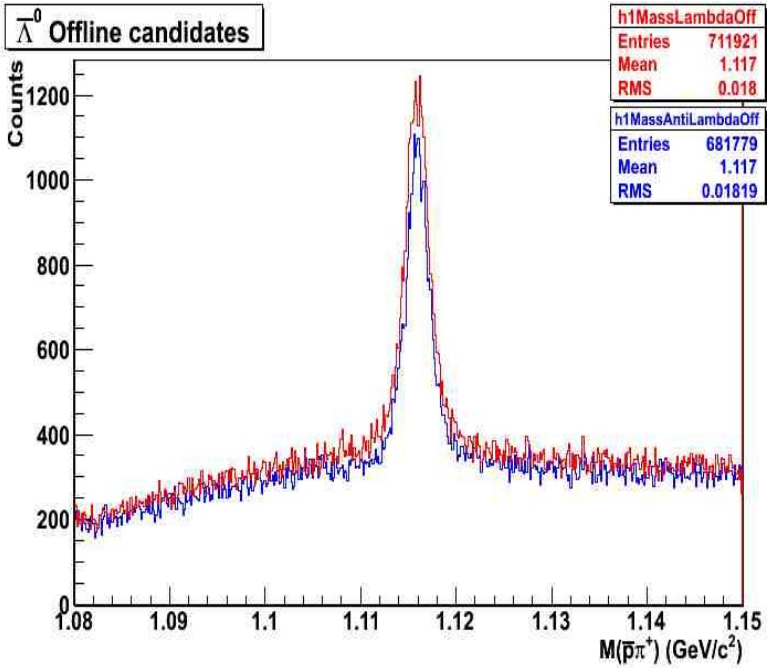
Kinematic Variables

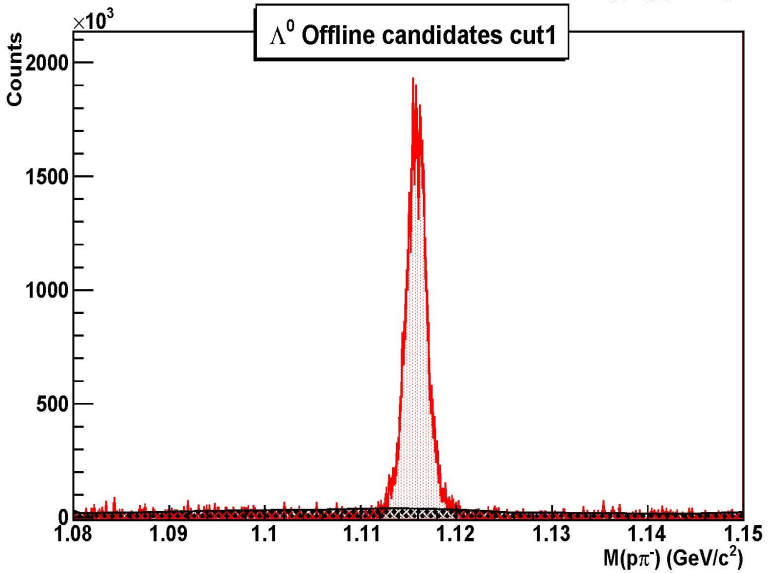
Radius of fiducial volume
Pt of daughters tracks

Optimization cuts (maximizing signal)



$$Significance = \frac{Signal}{\sqrt{(Signal + Background)}}$$





V° Cuts

Cuts c1 optimized for pp collisions with LHC09a4

Selection of Primary Vertex:
accept event only, if vertex is good and
is within fVertexZcut region (Primary vtx z < 10.0 cm)

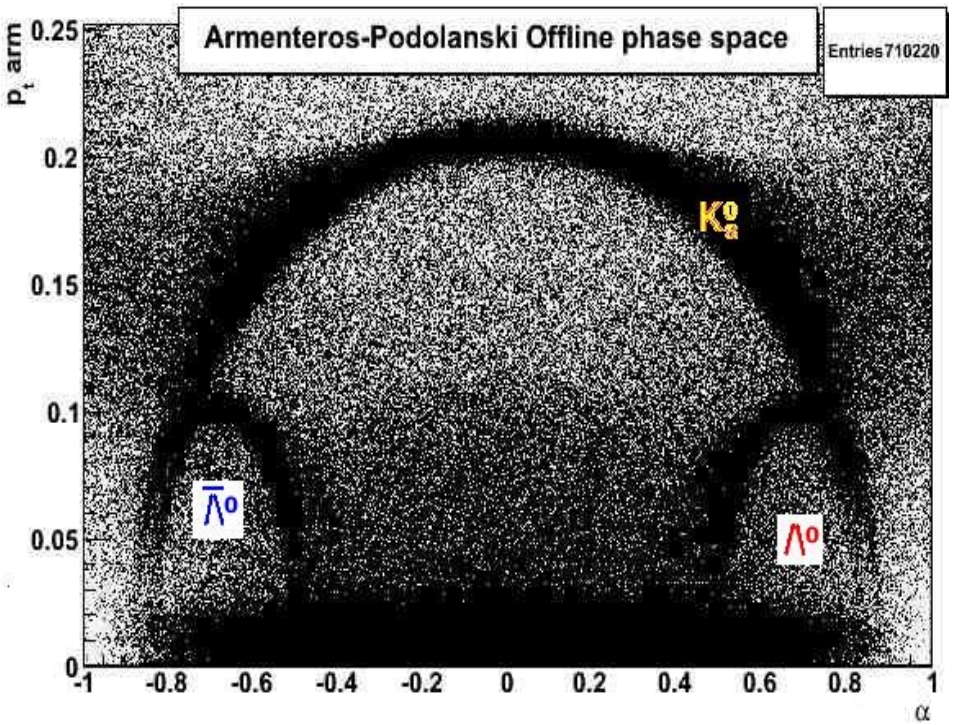
Track quality cuts of V° daughters:
TPCNcls > 80
TPCRefit
Pt > 0.16 GeV/c

|pz/pt| < 0.7
$|Pt_{(V°)}|$ > 0.6
Chi2 < 33

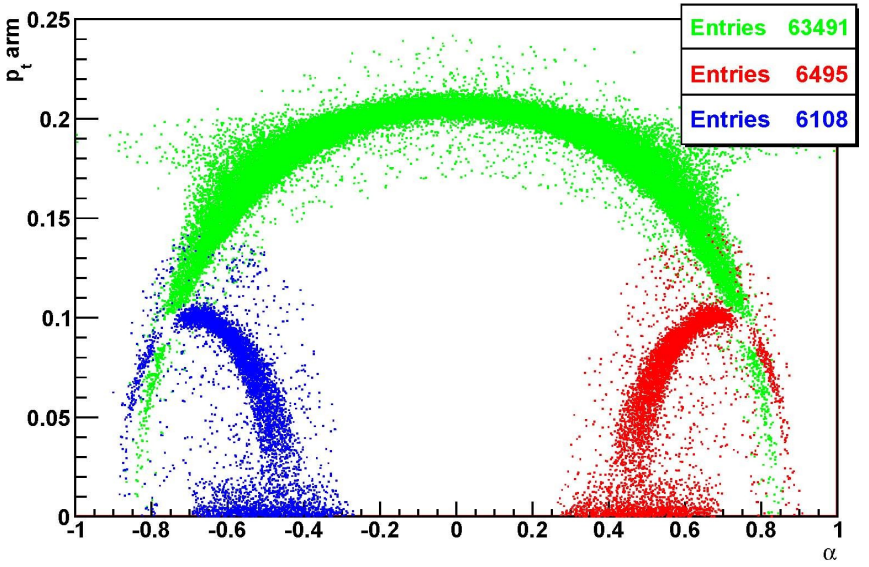
Selections for V0 particles	
DCA between V0 daughter tracks	$< 1\sigma$
IP for positive and negative daughters	> 0.1 cm
Cosine of V0 pointing angle	> 0.998
Radial boundaries of the fiducial volume	0.9 and 100 cm
Transverse momentum	> 160 MeV/c

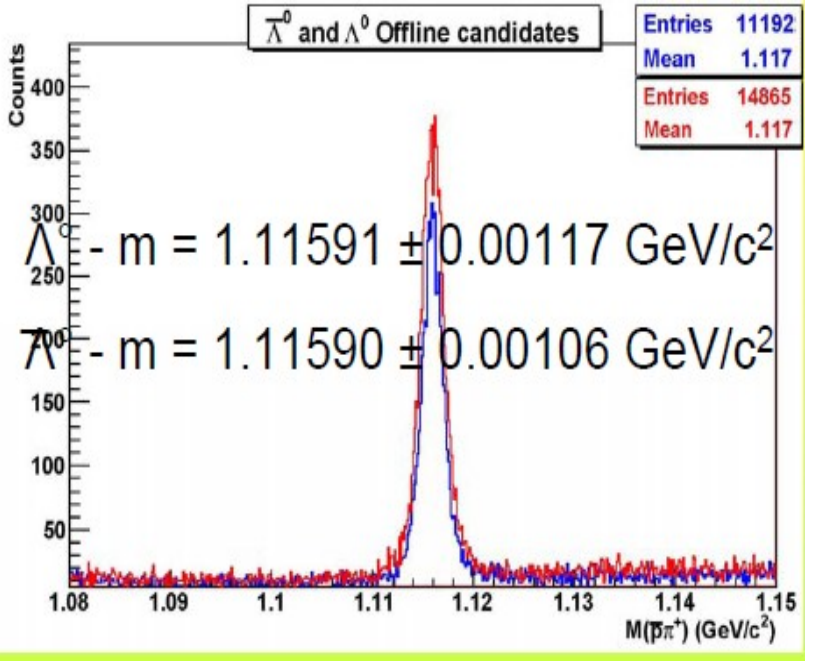
Set of Cuts		Pt pos	Pt Neg	DCA P To PV	DCA N To PV	DCA V0 d	Cos of PA	R of FV min	R of FV max	Pt arm V0	alpha
C1 → differs for each V°	Λ°	>0.54	>0.18	>0.05	>0.15	<0.3	>0.998	>1	<30	>0.02	>0
	Λ°	>0.18	>0.6	>0.1	>0.036	<0.1	>0.998	>1	<30	>0.02	>0
	K°_{s}	>0.16	>0.16	>0.036	>0.036	<0.3	>0.998	>1	<40	>0.2	----

Combinatorial background in Λ and K decays



Applying topological cuts

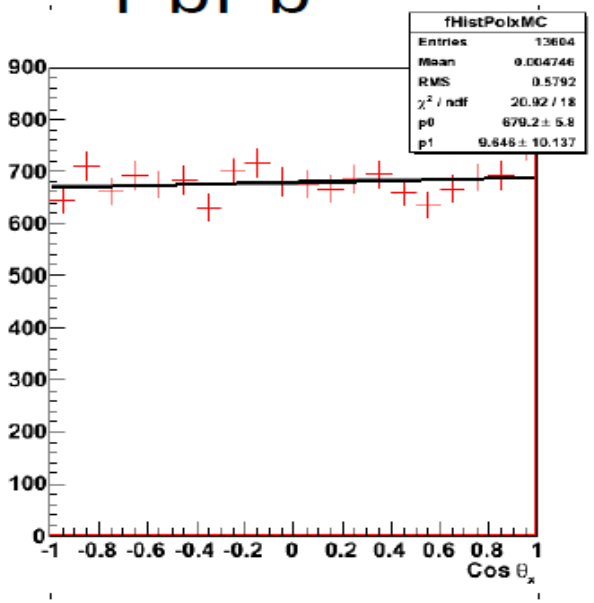


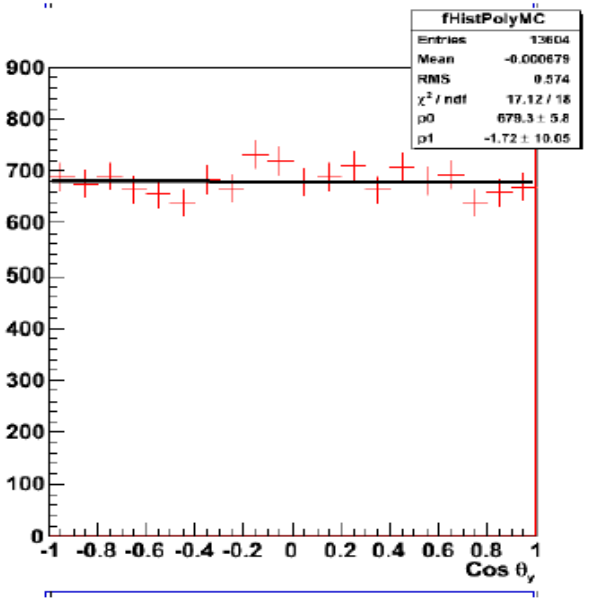


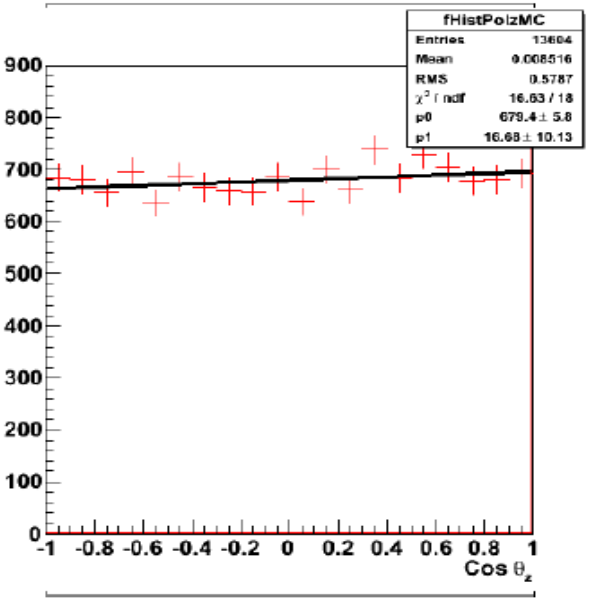
$$P_{tarm} \text{ vs } \alpha = \frac{P^{+}_{L} - P^{-}_{L}}{P^{+}_{L} + P^{-}_{L}}$$

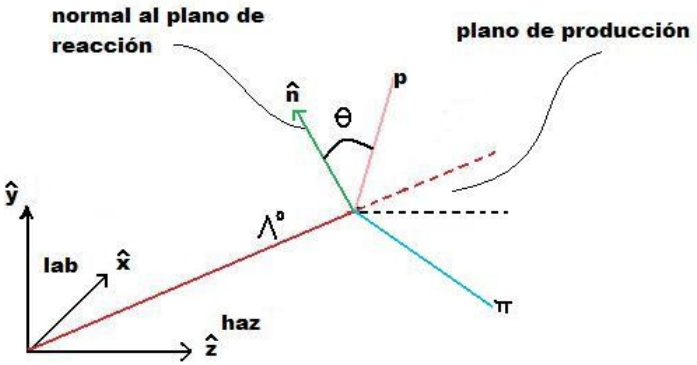
Proton-proton collisions at 10 TeV

- LHC09a 298400 events pp collisions at 10 TeV with |y|<0.75 running locally to compare with PbPb





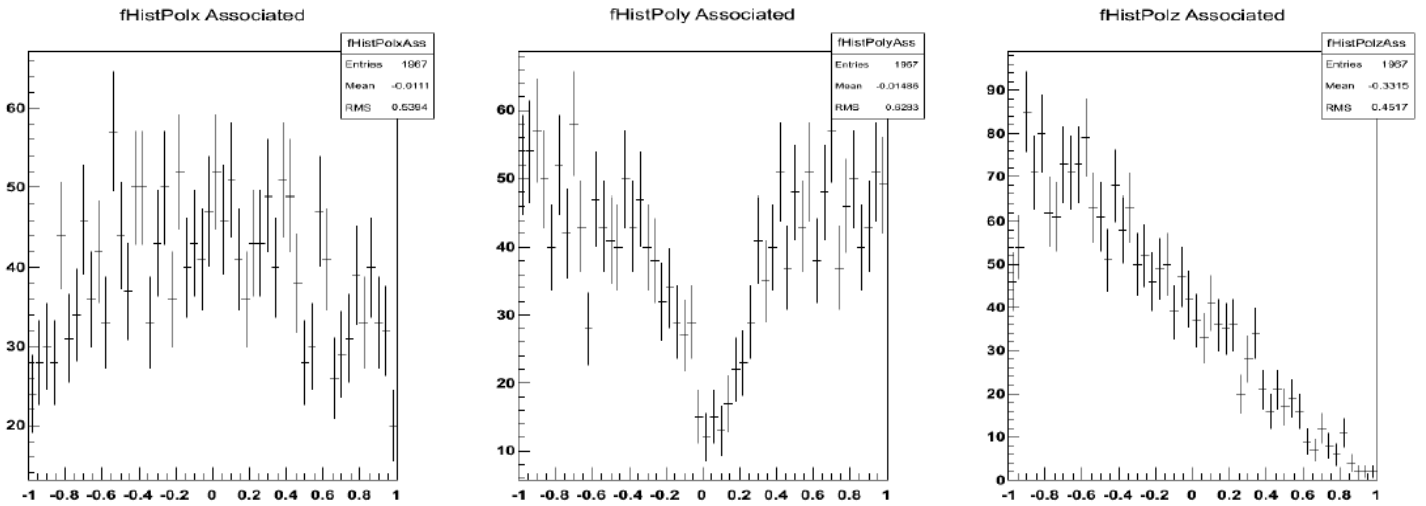




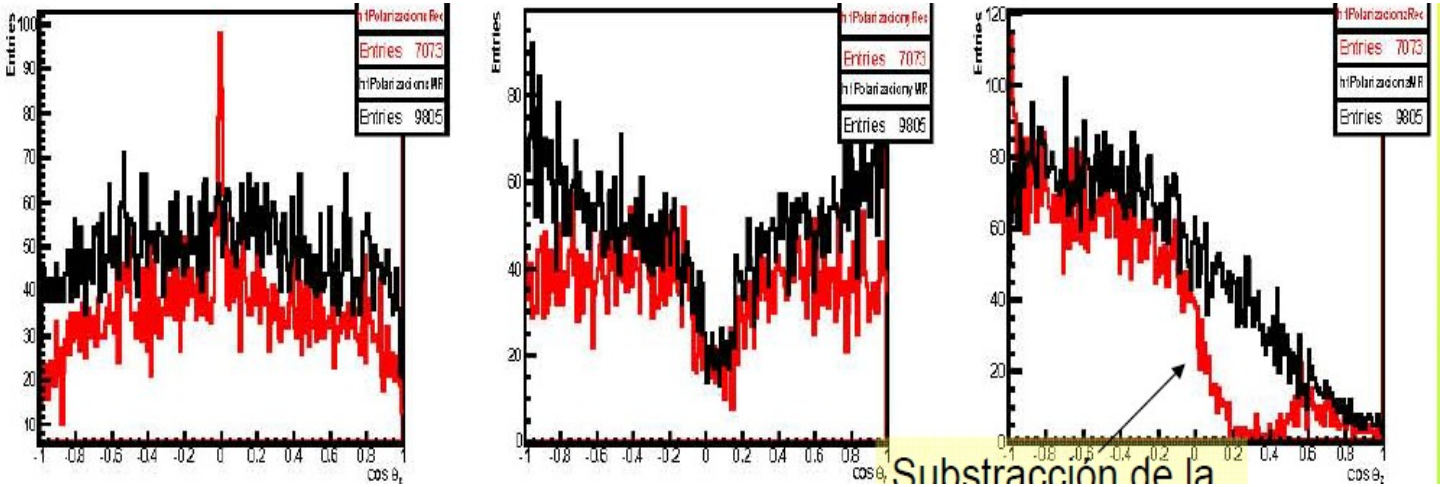
The parameter p1 of the fit is consistent with zero as we expect, however z projection shows a discrepancy

Reconstructed Angular Distribution

Primary associated Lambda distribution with |y|<0.75



We use this distribution to correct by acceptance



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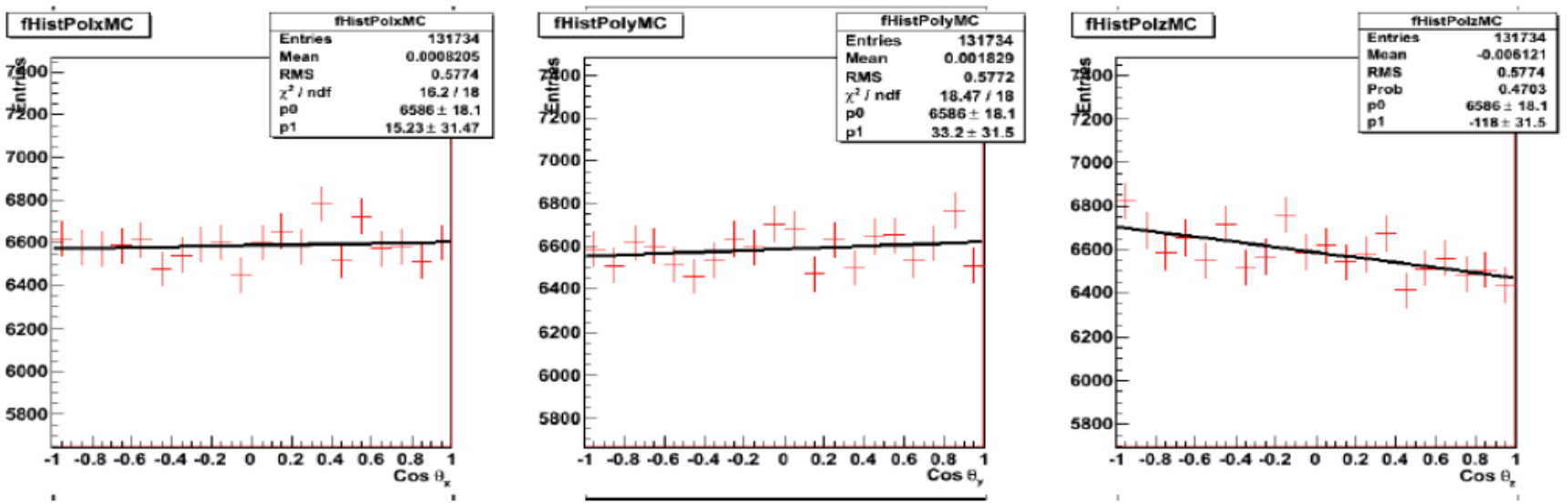
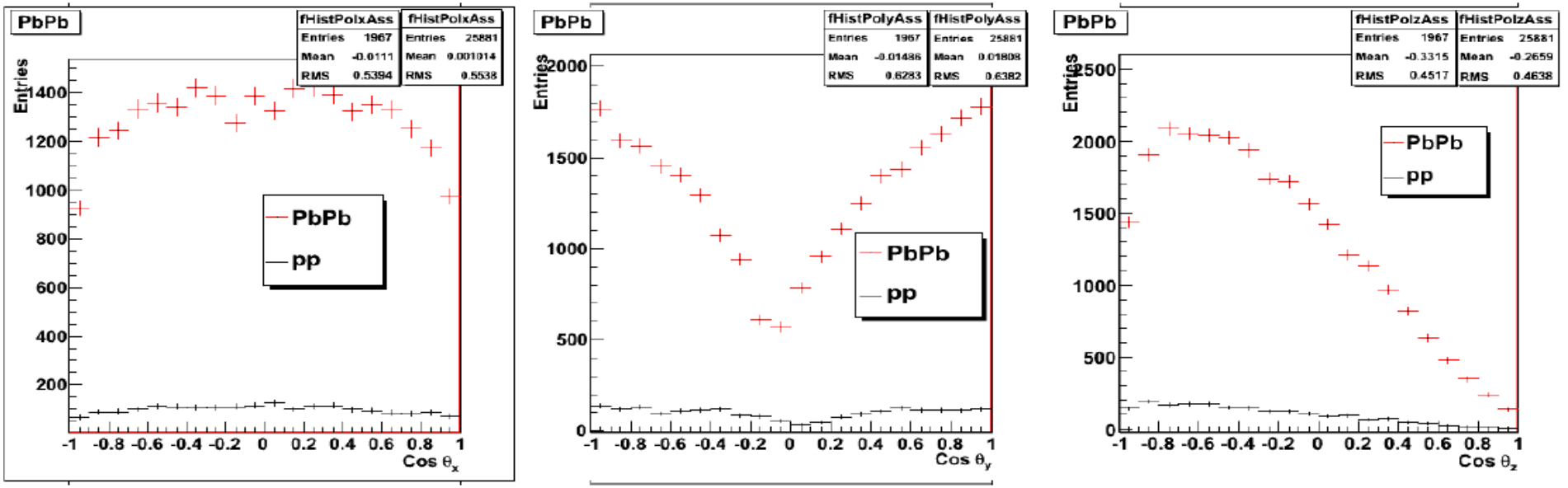
Lead-lead collisions at 2.76 TeV

LHC11a10a 76698 events PbPb collisions at 2.76 TeV with |y|<0.75



Generated angular proton distributions, we saw that for z axis is different to zero, as in the proton proton case.

Reconstructed angular distribution in PbPb



We show the comparison with pp, they have the same behaviour. This distributions are used to get the acceptance

Remarks:

First measurements of angular distribution of Lambda daughter shows:

At generation level (MC) everything looks fine

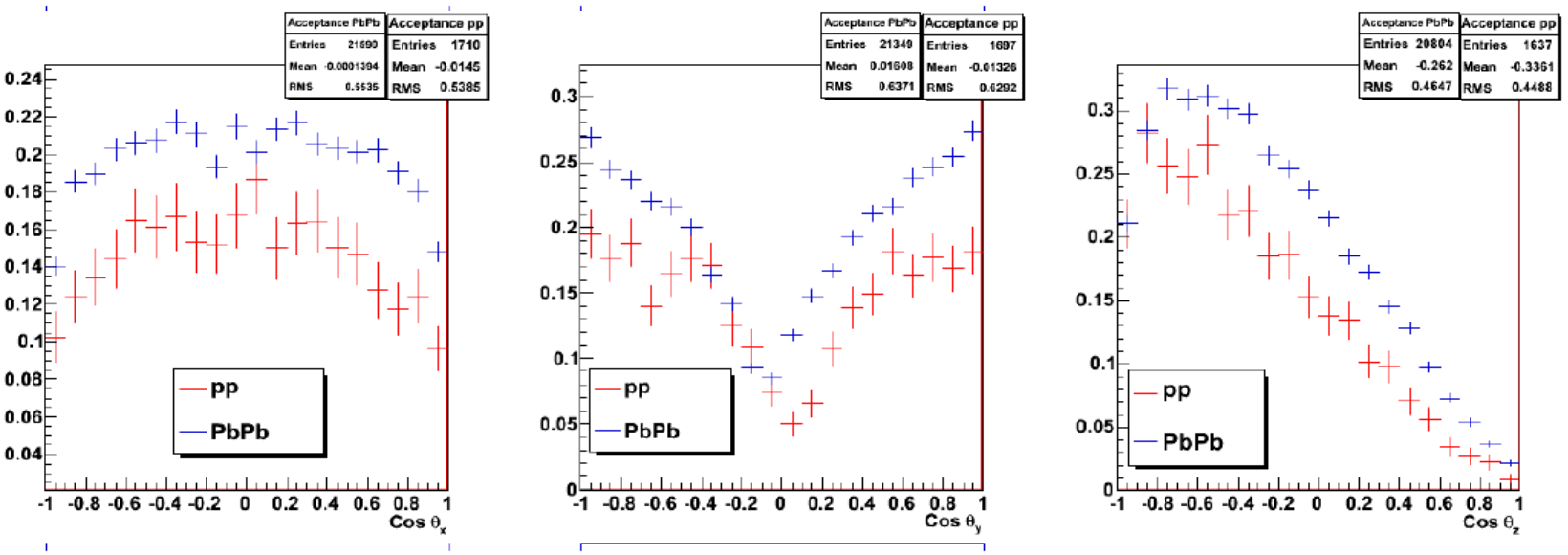
MC reconstructed present an asymmetry on z direction, which is not expected.

Possible explanation could be the wrong reconstruction of Lambda's. In other way, background is not completely eliminated.

Possible solutions:

Extraction of signal by different methods
Look different triggers,
..
..
..

Acceptance distributions



We use this factors to correct the angular distribution and get the distrbution-