# $K^0_S$ analysis

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*Physics and MC meeting*
*25 January 2023*

# Event and track selection for the $V^0$ analysis

## Event sample

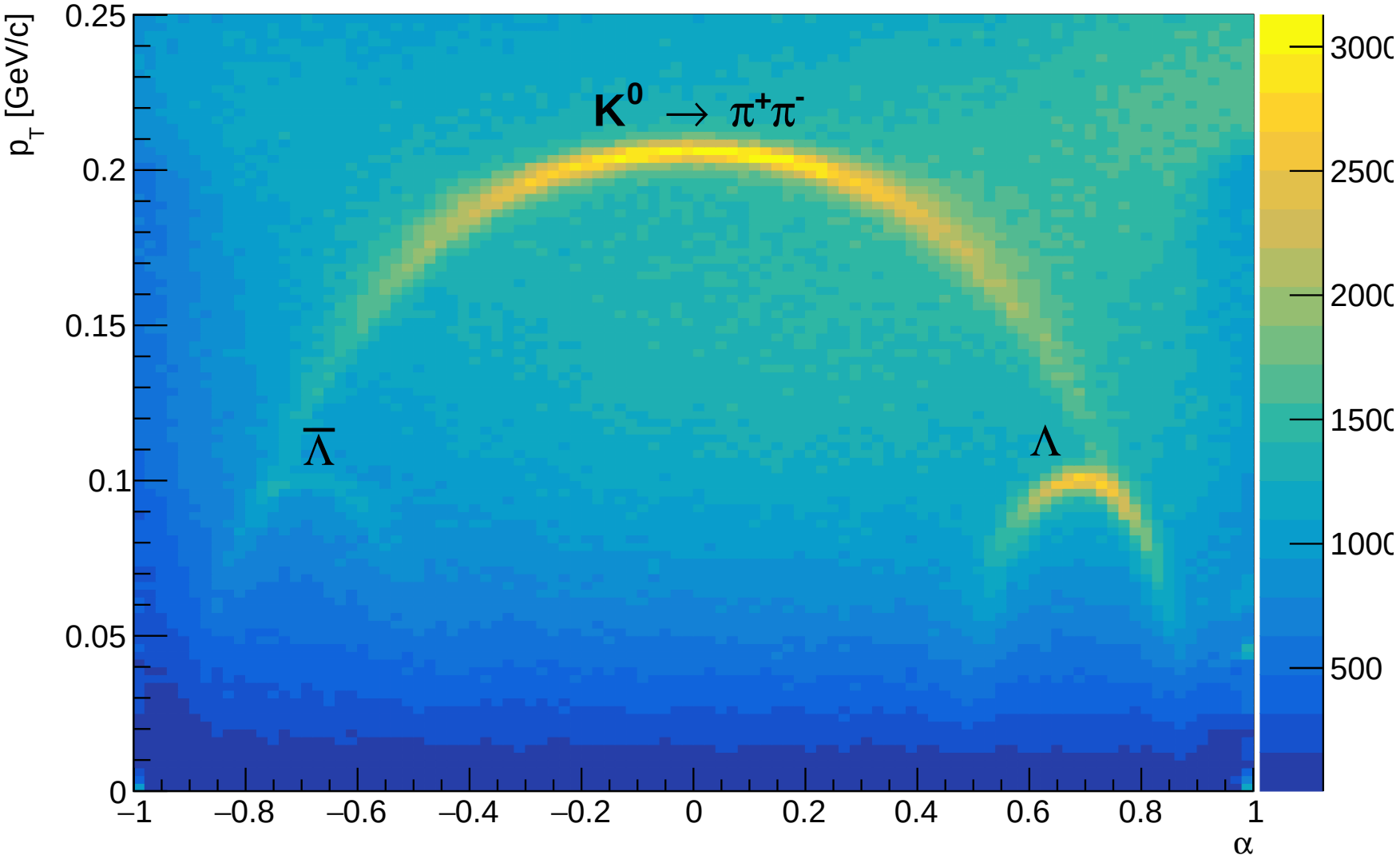
SpdRoot 4.1.4
Generation: Pythia 8, (p+p) at $\sqrt{S}$=27 GeV, SoftQCD(MB).
4 000 000 events (1 sec of data taking)

## V0 selection:

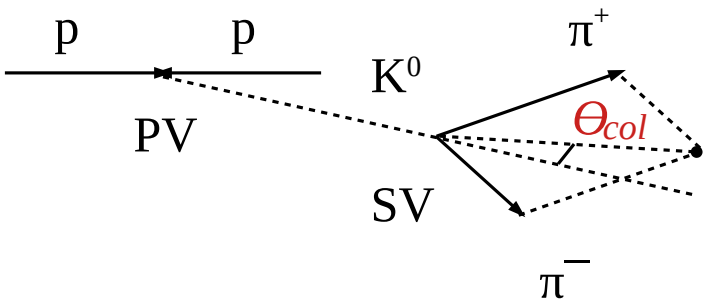
input parameters for SpdMCKFpartRCV0Finder:

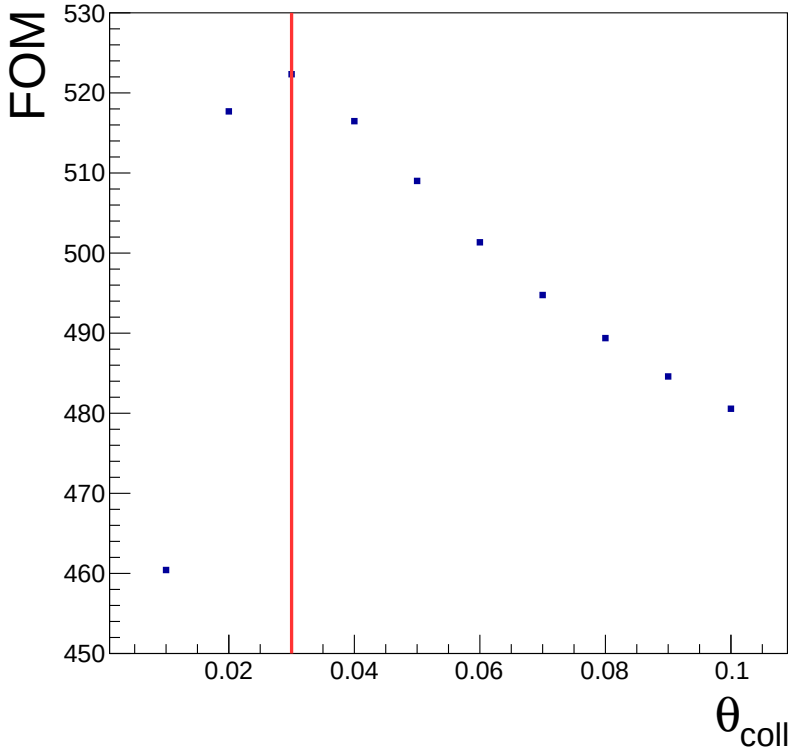
1. fMinItsHists = 3 - minimum Its hits for track selection
2. fDaughters = $K^0$(-211, 211),$\Lambda$(2212,-211),$\bar{\Lambda}$(-2212, 211);
   Bg = (321,-321), (-321,211), (321,-211).
3. fMinChi2PV = 2.0 - minimum chi2 track to PV (primary selection)
4. fMaxChi2Part = 2.0 - maximum chi2 between 2 tracks (primary selection)

# Distributions of the $V^0$ candidates in the Podolanski-Armenteros without selection cuts



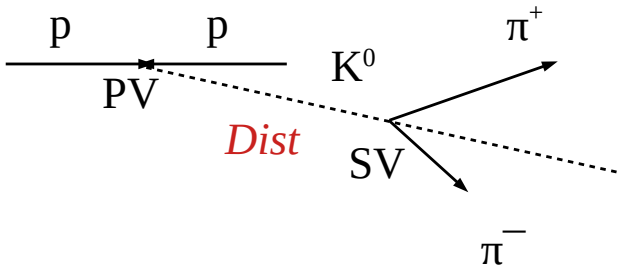
# The collinearity cut



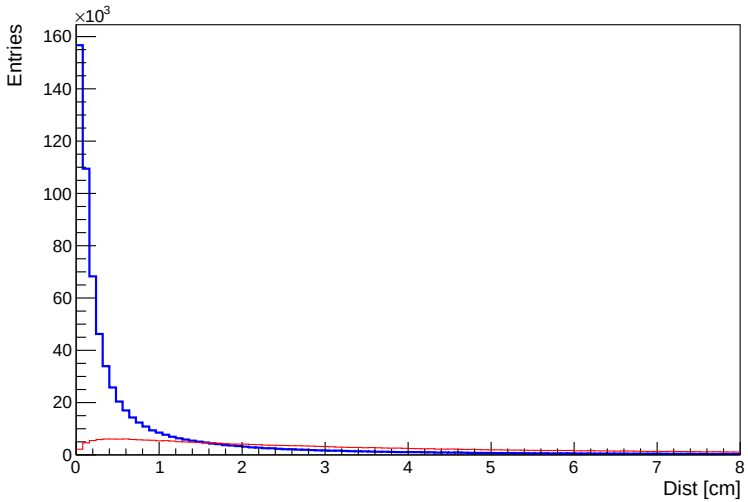



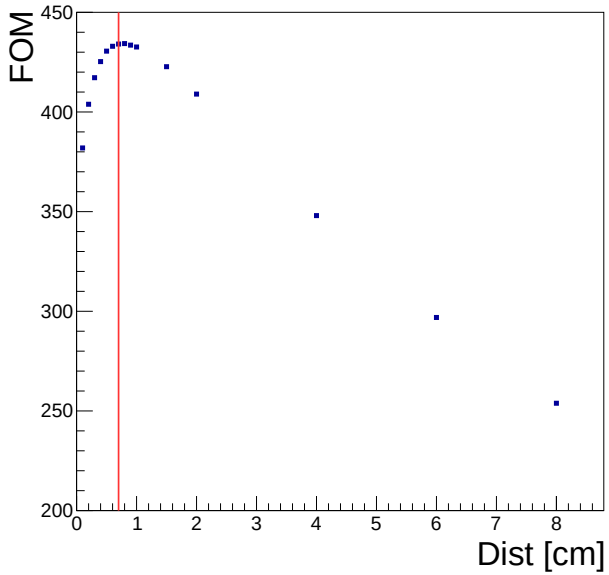

1. $FOM = \frac{N_{sig}}{\sqrt{N_{sig}+N_{bg}}}$;
2. This cut selects $V^0$ events the momentum looking at the PV. $\theta_{coll} < 0.03$ rad for $K^0$.

# Distance between PV and SV (V0 vertex)

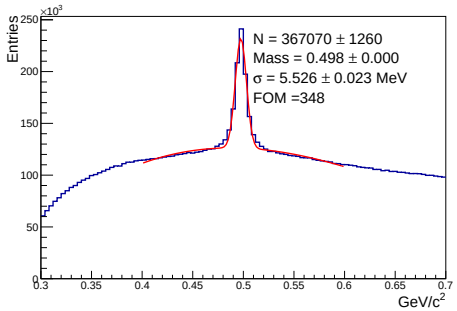



1. $Dist = \sqrt{(x_{SV} - x_{PV})^2 + (y_{SV} - y_{PV})^2 + (z_{SV} - z_{PV})^2}$;
2. This cut selects $V^0$ which decay close to PV.
   $Dist > 0.7$ cm for $K^0$.

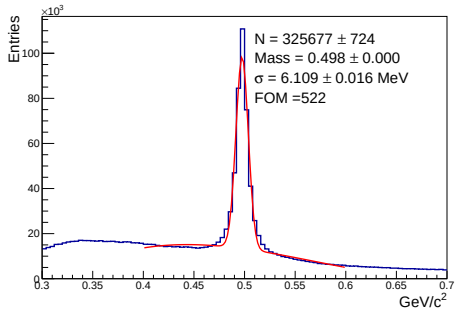


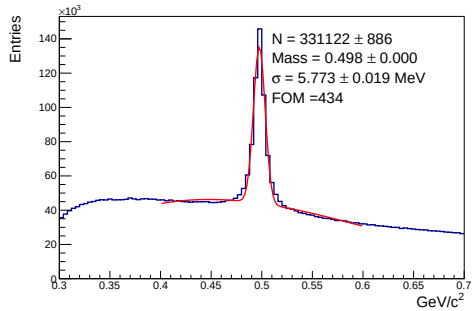
# Invariant mass of $K^0$ for different cuts



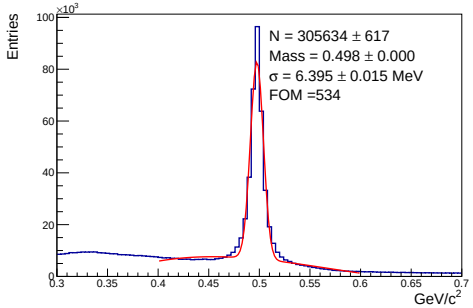

$\theta_{coll} < 0.03$



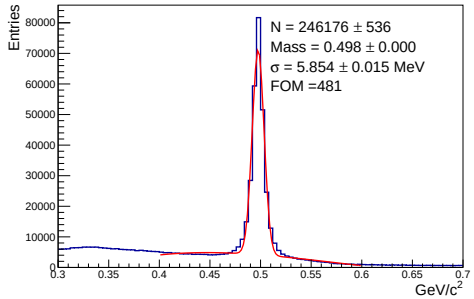

$Dist > 0.7$ cm



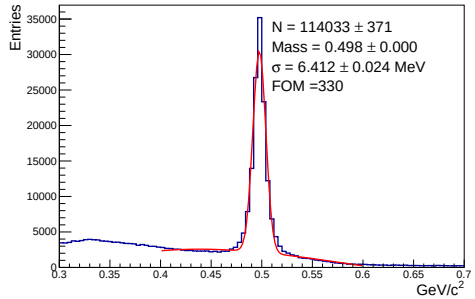

$\theta_{coll} < 0.03$ rad, $Dist > 0.7$ cm




$\theta_{coll} < 0.03$ rad, $Dist > 0.7$ cm, $\chi^2/ndf$ <10




previous cuts, isgood

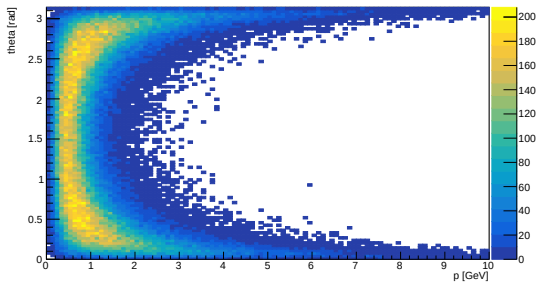


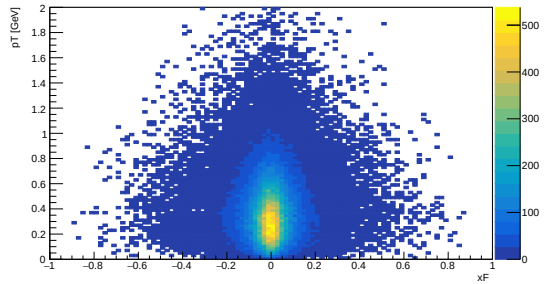

| | no cuts | $\theta_{coll} < 0.03$ rad | $Dist > 0.7$ cm | $\theta_{coll} < 0.03$ rad, $Dist > 0.7$ cm |
|---|---|---|---|---|
| $FOM$ ($\pm 2\sigma$): | 348 | 522 | 434 | 534 |
| N($K^0$): | 367 070 | 325677 | 331122 | 305634 |

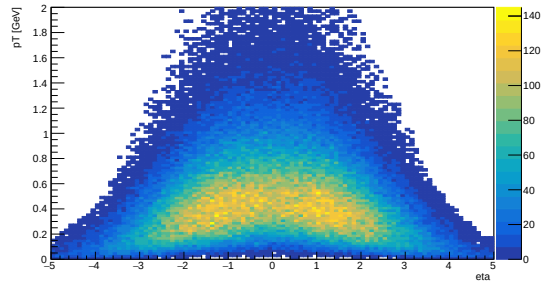
| $\theta_{coll} < 0.03$ rad, $Dist > 0.7$ cm, $\chi^2/ndf$ <10 | $\theta_{coll} < 0.03$ rad, $Dist > 0.7$ cm, $\chi^2/ndf$ <10, isgood |
|---|---|
| 481 | 330 |
| 246176 | 114033 |

# The selected $V^0$ candidates are plated in (p,$\theta$), ($p_T$, $x_F$) and ($p_T$, $\eta$) phase space

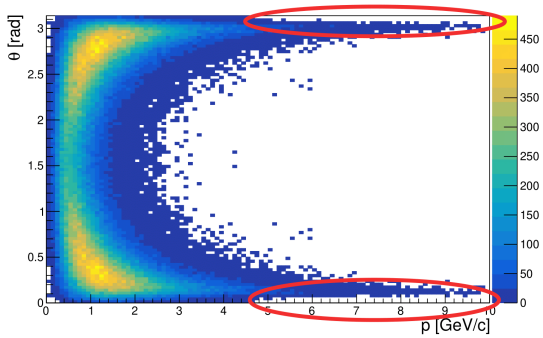
Pure Pythia 8, $K^0$

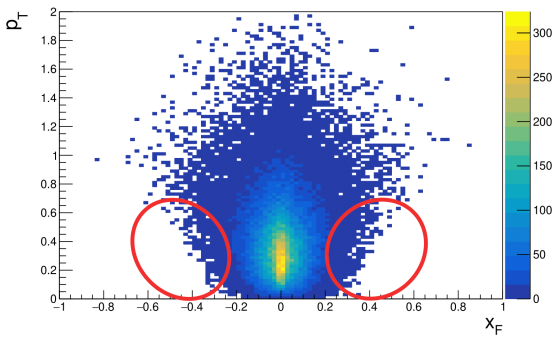


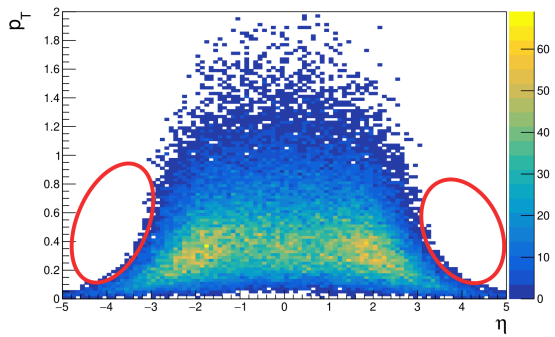



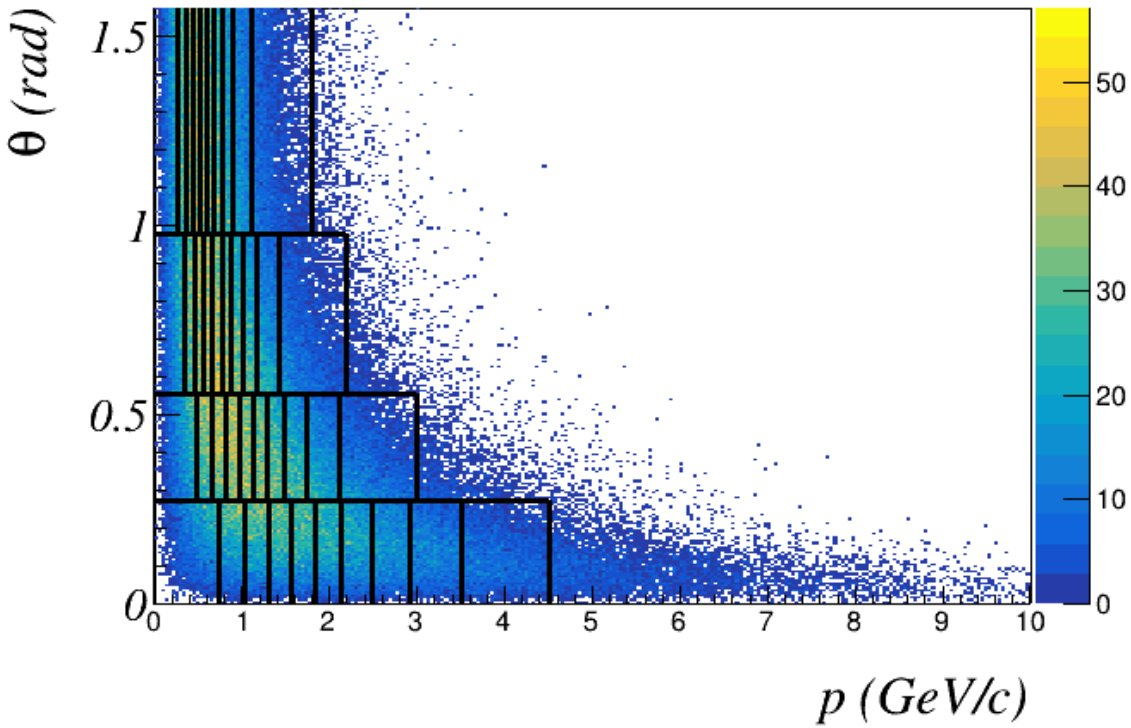

Reconstruction data, cuts: $K^0$ $\pm 2\sigma$, $\theta_{coll} < 0.03$ rad and $Dist > 0.7$ cm.



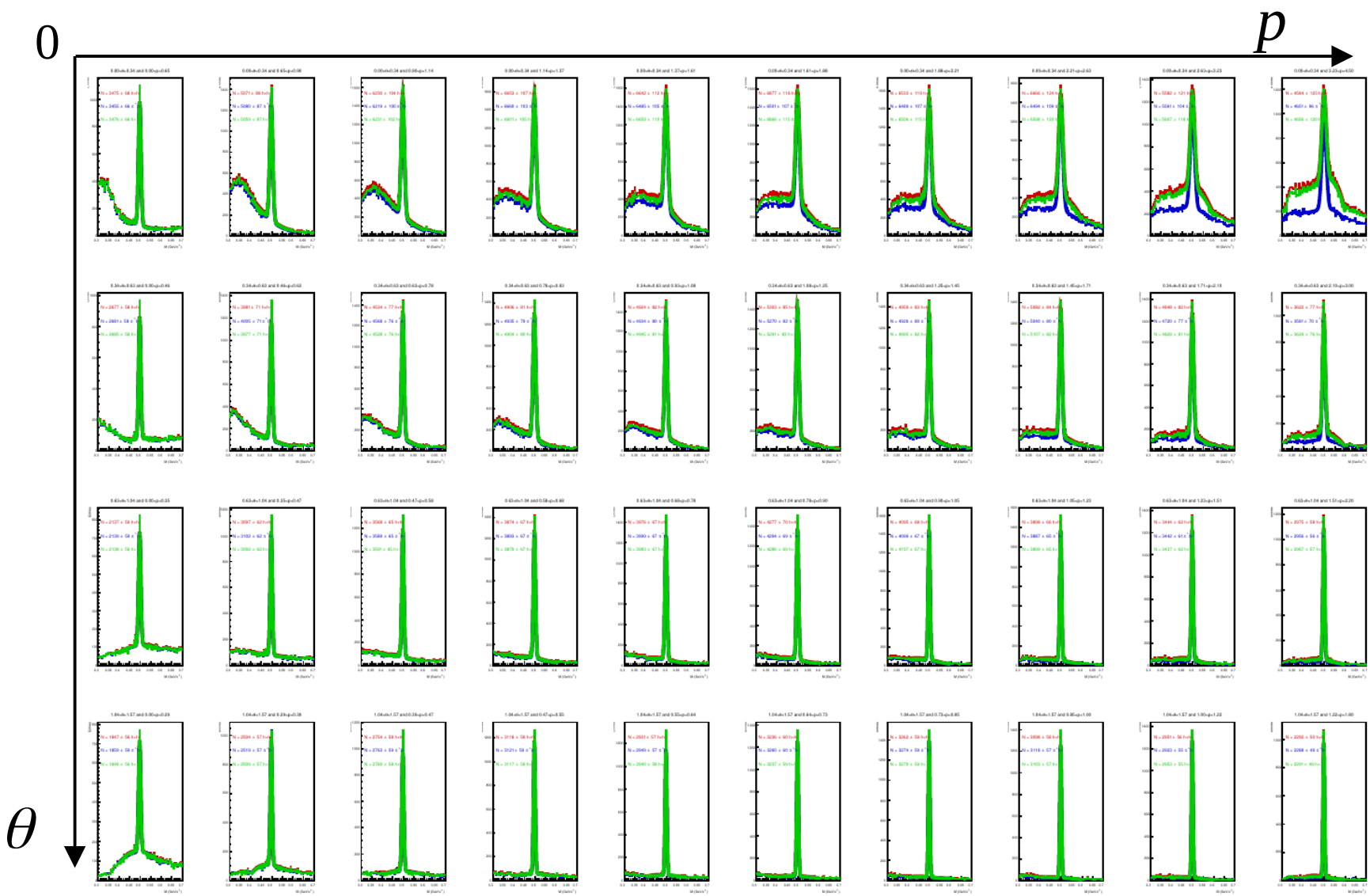



# Binning

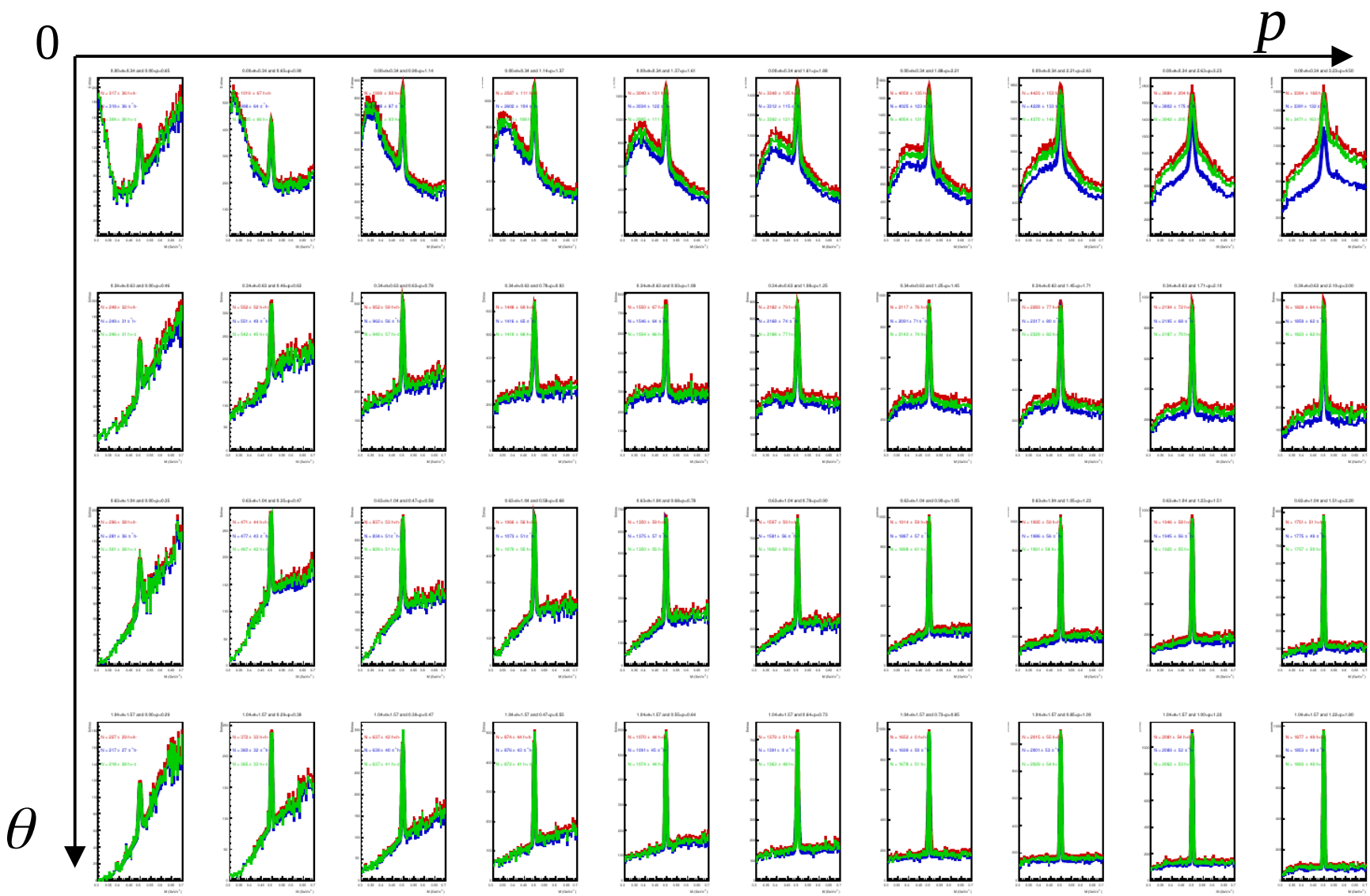



The choice of the binning scheme is obtained from distribution of $K^0$ simulated in Pythia 8. It was done to have the similar number of $K^0$ in bins ($n^{\theta}_{bin} = 4, n^{p}_{bin} = 10$).

# Distributions of the $K^0$ candidates with cut $\theta_{coll} < 0.03$ and $Dist > 0.7$ cm

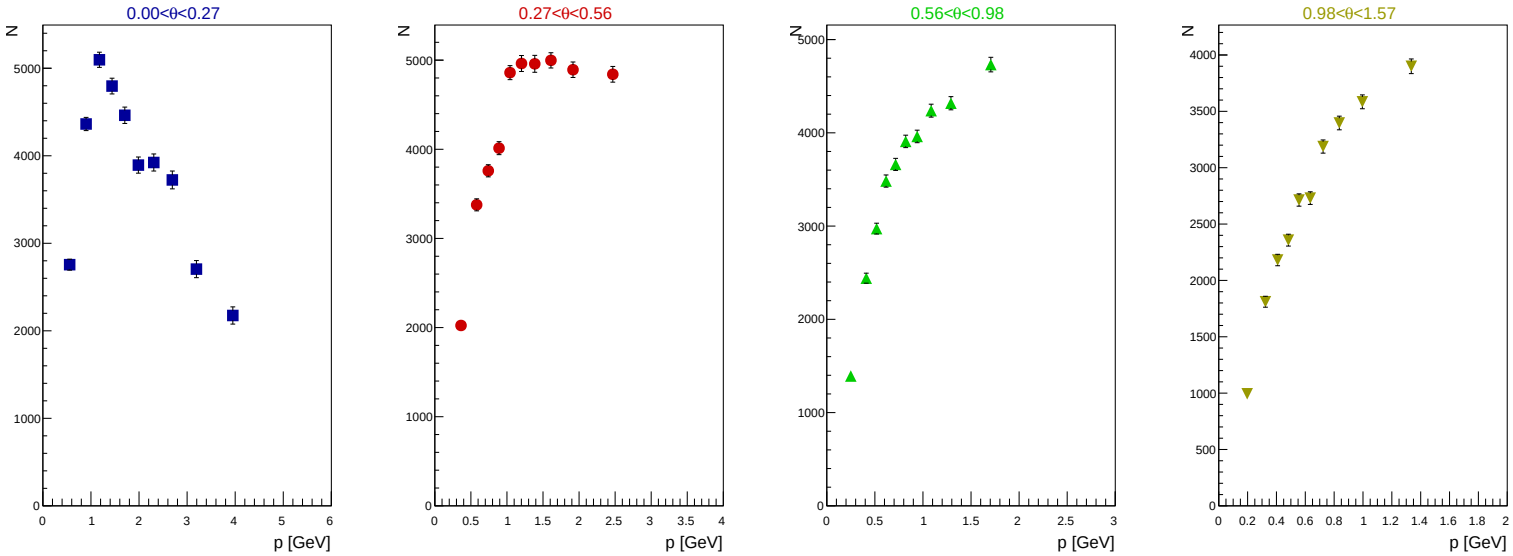


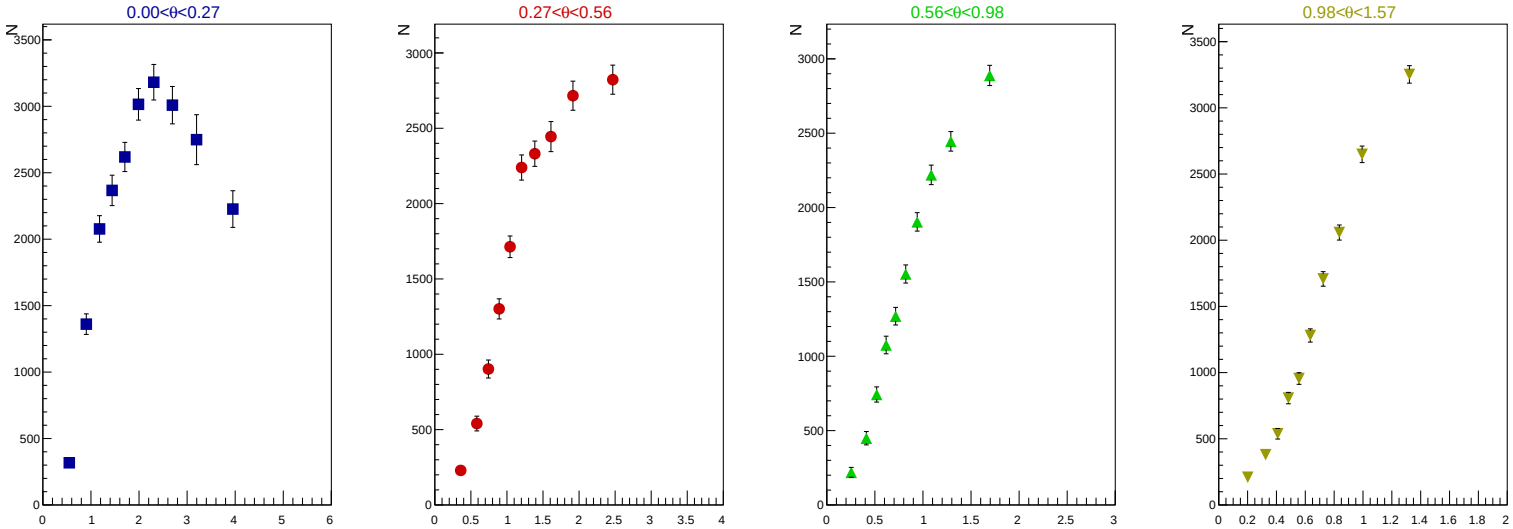
# Distributions of the $K^0$ candidates with cuts $\chi^2/ndf$ <10 and isgood



# Result of the fit (number of $K^0$ in $p$ for fixed $\theta$ interval)

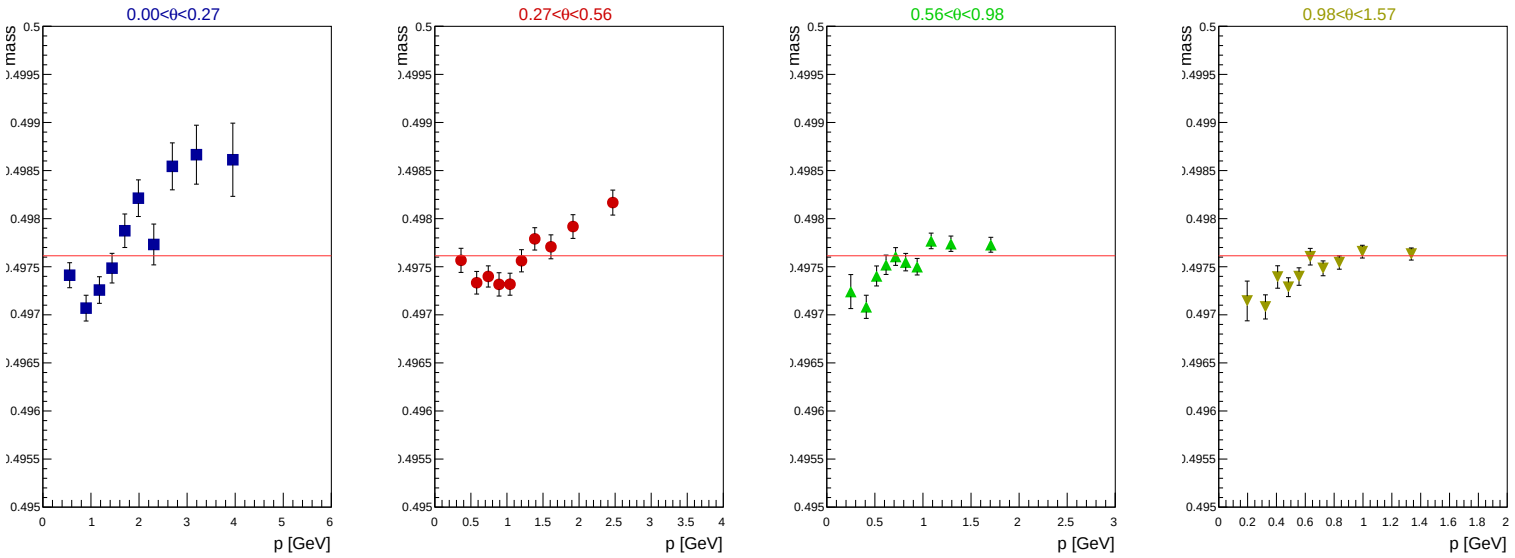
$\theta_{coll} < 0.03$rad.
$Dist > 0.7$ cm



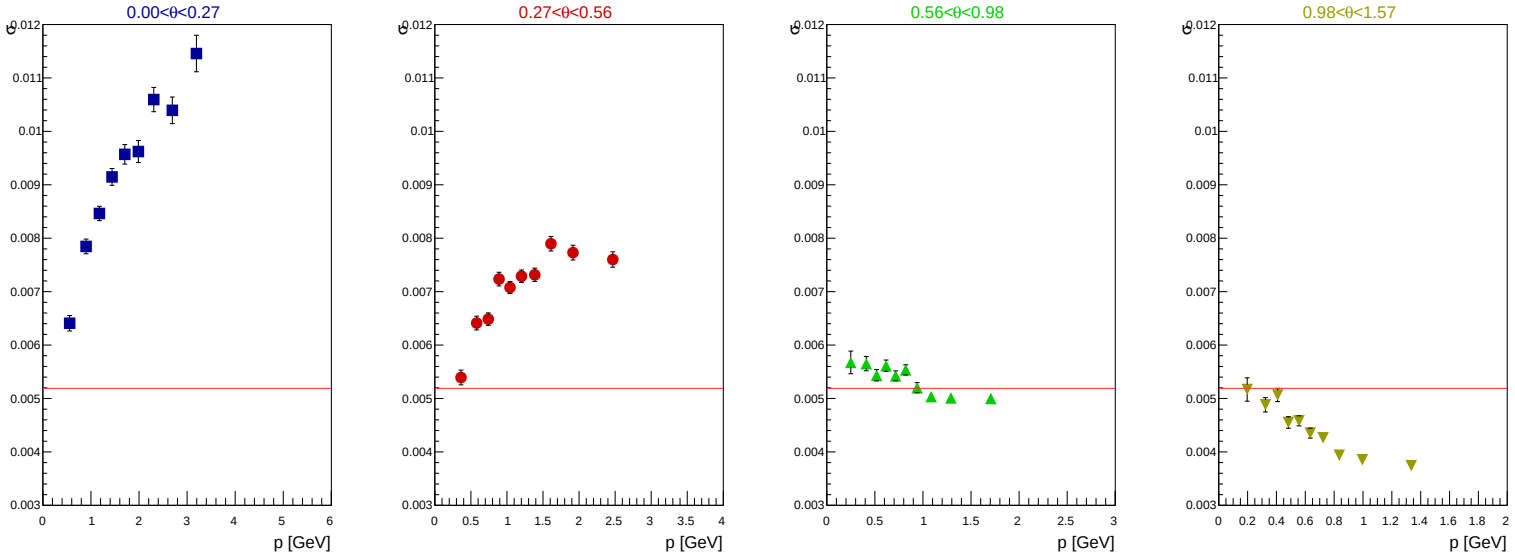




$\chi^2/ndf < 10$
isgood

# Mean mass and sigma of $K^0$ (in $p$ for fixed $\theta$ interval)

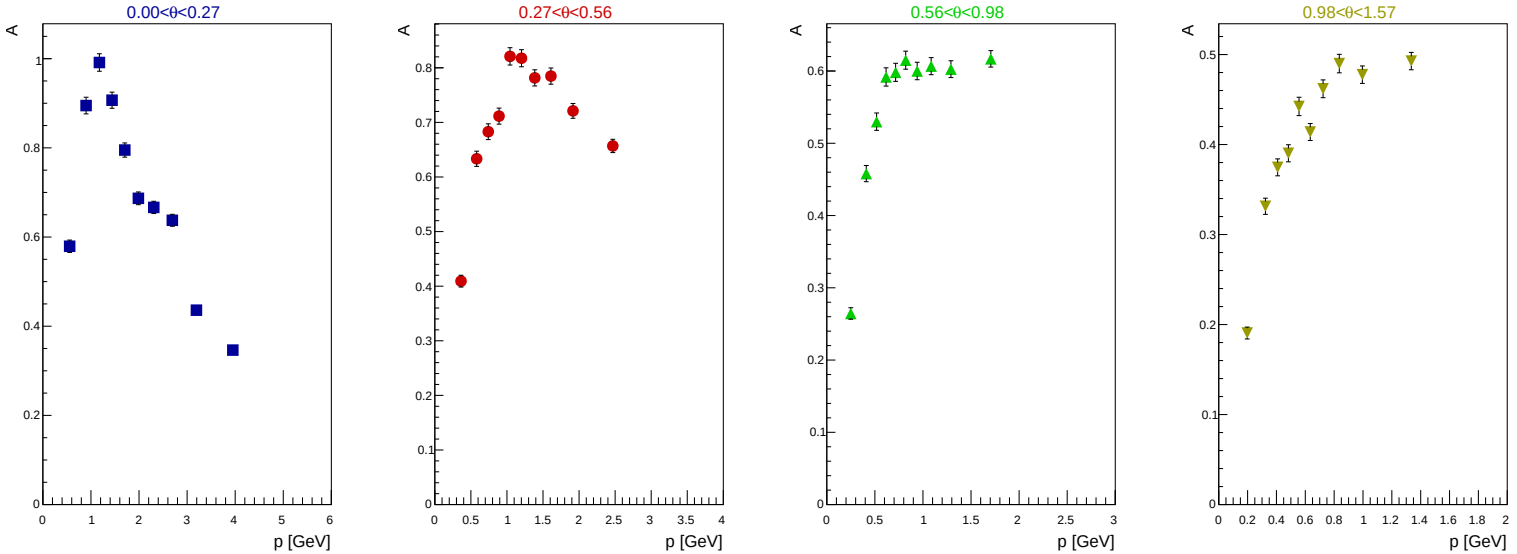



red line shows m(PDG) = 0.497 GeV

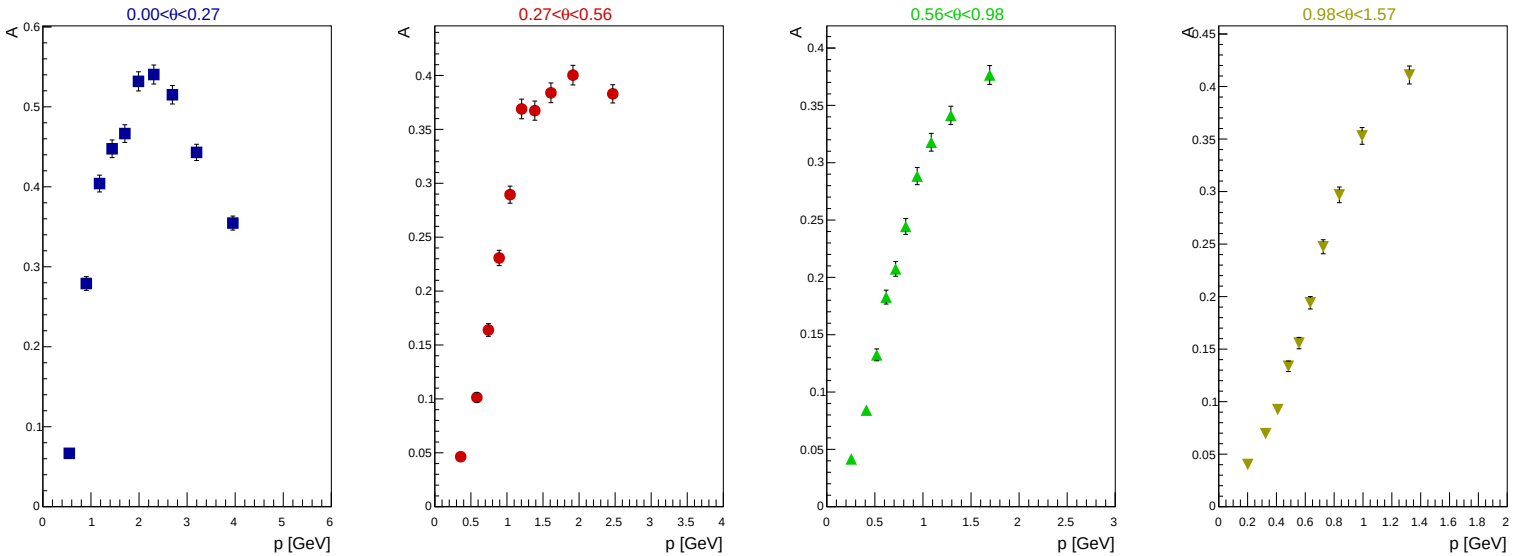



red line shows the sigma of the $K^0$ fit using full data sample

# $K^0$ reconstruction efficiency with all corrections included (A=$N^{MC}_{Rec}/N^{MC}_{pythia}$)




$\theta_{coll} < 0.03$rad.
$Dist > 0.7$ cm




$\chi^2/ndf$ <10
isgood

# Conclusion and TODO

1. Analysis of various factors affecting the $K_S^0$ reconstruction efficiency was performed.
2. $K_S^0$ reconstruction efficiency depends on $p$ and $\theta$ and in general is about 70%.
3. Criterium isgood rejects many signal events. Particularly for low momentum (p=0-1.5 GeV).
4. Spatial resolution along X, Y, Z axes and decay length for the secondary vertex of the $K^0 \to \pi^+\pi^-$ decay.

# Backup slides

Length− >GetLength(); LengthErr− >GetLengthErr();