Recent progress in Λ^0-reconstruction with argon data

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Analysis meeting

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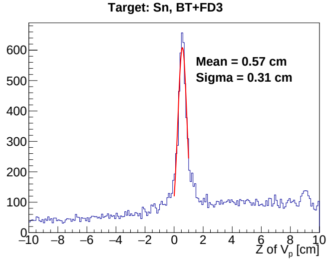
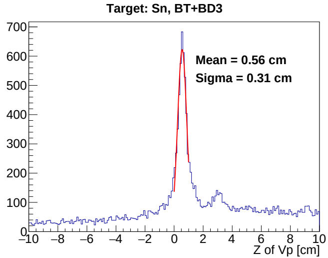
Some info on input data used ...

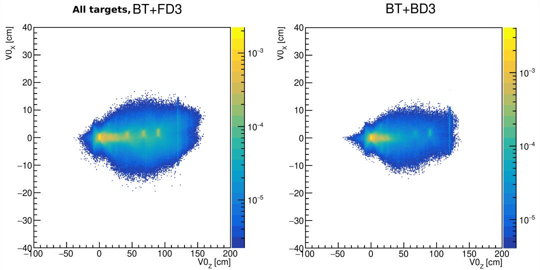
Input: DST's produced by L1-tracking for all targets and trigger conditions available for argon part of the last run and converted to the format already used for Λ^0 analysis before (I. Gabdrakhmanov)





Only events satisfying |Z of Vp| < 6 cm. are taken into account!

Reconstructed V0's



Different topology of V0's depending on trigger condition!

Optimization of cuts

Algorithm of cut optimization

Used cut values ("source”)

Cut	Used values	nValues
DCA0 [cm] (<)	0.5, 0.75, 1.0, 1.2, 1.4, 1.6	6
DCA1 [cm] (>)	0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5	9
DCA2 [cm] (>)	0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5	9
DCA12 [cm] (<)	0.5, 0.75, 1.0, 1.2, 1.4, 1.6	6
PATH [cm] (>)	6, 8, 10, 12, 14, 16	6
nPos (>)	2	1
nNeg (>)	2	1
Size of cut grid		17496

Main idea

- To search for a wide cut set ("source”) for each target aimed at giving max. signal value (with arbitrary background)
- Once the set is defined, to do a 1D optimization over each geom. cut ("improved”) to suppress the background with the minimal signal suppression.

0. «Source» cut value: (DCA12$_s$ DCA0$_s$ DCA1$_s$ DCA2$_s$ PATH$_s$)

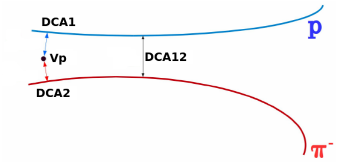
Cut window:
± 0.5 cm for DCA0, 1, 2, 12 around the «source» value (step = 0.1 cm), 5 + 5 checks
+ 10 cm for PATH around the «source» value (step = 2 cm), 5 checks

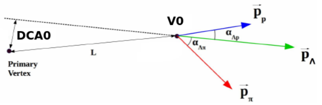
Optimization for each cut is done independently, «improved» value is considered to be chosen if the «improved» cut:
- **leads to background suppression**
- **suppresses signal smaller than background**

If the conditions not satisfied, the «improved» and «source» cuts are the same

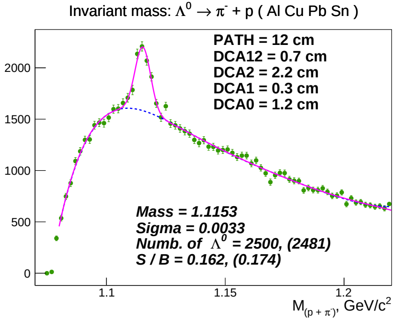
1. (DCA12$_s$ DCA0$_s$ DCA1$_s$ DCA2$_s$ PATH$_s$) → ((DCA12$_s$ + Δ) DCA0$_s$ DCA1$_s$ DCA2$_s$ PATH$_s$)
2. (DCA12$_i$ DCA0$_s$ DCA1$_s$ DCA2$_s$ PATH$_s$) → (DCA12$_i$ (DCA0$_s$ + Δ) DCA1$_s$ DCA2$_s$ PATH$_s$)
3. (DCA12$_i$ DCA0$_i$ DCA1$_s$ DCA2$_s$ PATH$_s$) → (DCA12$_i$ DCA0$_i$ (DCA1$_s$ + Δ) DCA2$_s$ PATH$_s$)
4. (DCA12$_i$ DCA0$_i$ DCA1$_i$ DCA2$_s$ PATH$_s$) → (DCA12$_i$ DCA0$_i$ DCA1$_i$ (DCA2$_s$ + Δ) PATH$_s$)
5. (DCA12$_i$ DCA0$_i$ DCA1$_i$ DCA2$_i$ PATH$_s$) → (DCA12$_i$ DCA0$_i$ DCA1$_i$ DCA2$_i$ (PATH$_s$ + Δ))

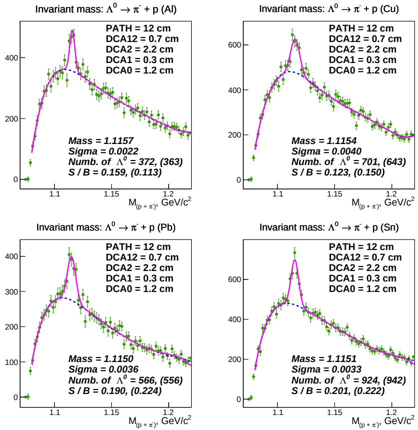
(DCA12$_i$ DCA0$_i$ DCA1$_i$ DCA2$_i$ PATH$_i$) is considered as optimal («improved»)





Result of optimization

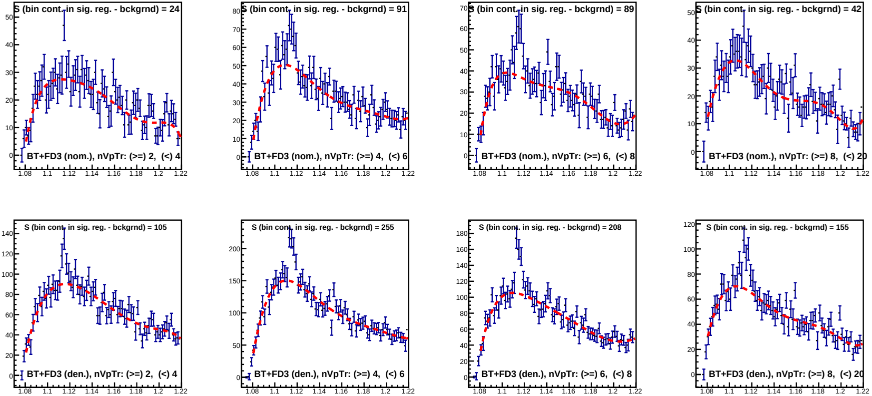




Performed optimization allowed one to get the same set of cuts (shown in figs.) for all targets and to see the signal for all targets as well as for each target

Estimation of trigger efficiency

Trigger efficiency (how to calculate?)

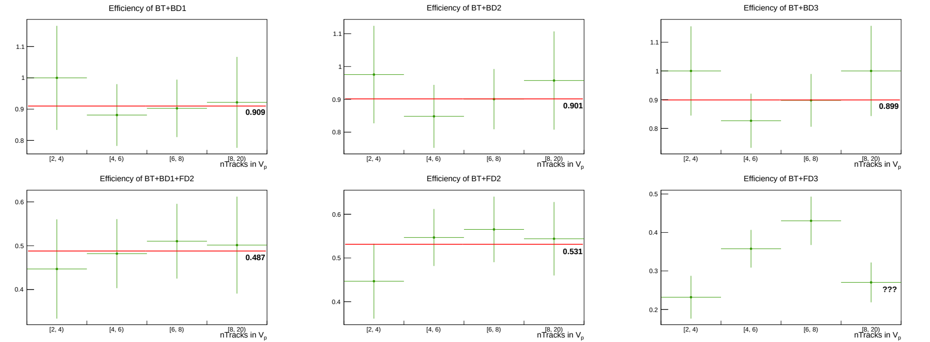


- **Done for all trigger conditions available**
- **A set of centrality bins is taken into account (number of tracks participated in V_p)**
- **Background is fitted with Chebyshev's orthogonal polynoms of 4-th order giving access to the fit covariance matrix (to be used for error estimations)**
- **Sig. is calculated via the back. subtraction in the signal region to avoid possible bias (not by fit!)**

$$\varepsilon_{TRIGGER} = \frac{N_{\Lambda^0}\ taken\ from\ nom.}{N_{\Lambda^0}\ taken\ from\ den.}$$

- **Nom. and den. contain data sets without trigger condition which efficiency is estimated**
- **In nom. is applied a cut for number of counts of trigger which efficiency is estimated (BD $>$ 2, FD $>$ 3 ...)**

Trigger efficiency (estimated by Λ^0 reconstruction)



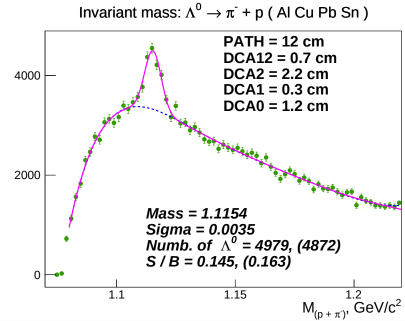
$$\varepsilon_{BT+BD1} = \frac{((BT+FD2)+(BT+FD3))|_{BD>1}}{(BT+FD2)+(BT+FD3)} \qquad \varepsilon_{BT+BD2} = \frac{((BT+FD2)+(BT+FD3))|_{BD>2}}{(BT+FD2)+(BT+FD3)} \qquad \varepsilon_{BT+BD3} = \frac{((BT+FD2)+(BT+FD3))|_{BD>3}}{(BT+FD2)+(BT+FD3)}$$

$$\varepsilon_{BT+BD1+FD2} = \varepsilon_{BT+BD1} \cdot \varepsilon_{BT+FD2} \qquad \varepsilon_{BT+FD2} = \frac{((BT+BD2)+(BT+BD3))|_{FD>2}}{(BT+BD2)+(BT+BD3)} \qquad \varepsilon_{BT+FD3} = \frac{((BT+BD2)+(BT+BD3))|_{FD>3}}{(BT+BD2)+(BT+BD3)}$$

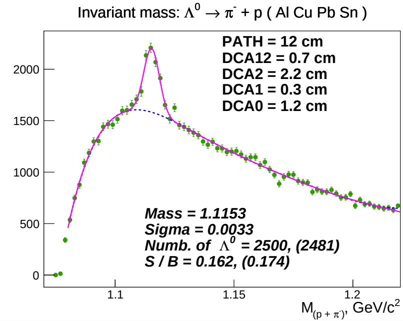
BT + BD(N) means beam trigger included and number of counts in barrel detector greater than N
BT + FD(N) means beam trigger included and number of counts in forward silicon detector greater than N
BT + BD(M) + FD(N) means beam trigger included and number of counts in barrel detector greater than M and in forward silicon detector greater than N

Taking into account obtained trigger efficiencies ...

With trigg. effs. used

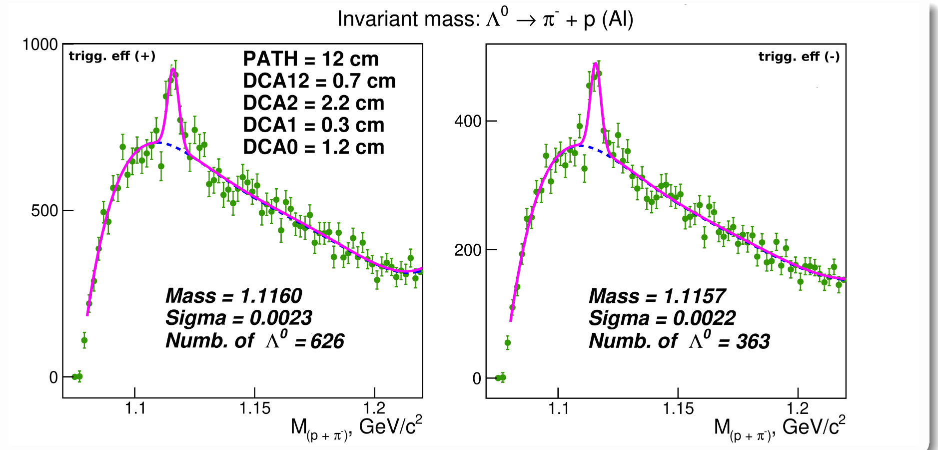


No trigg. eff. used



Trigger efficiencies taken into account allows one to increase number of Λ^0 by factor of two (for all targets)

Taking into account obtained trigger efficiencies ...



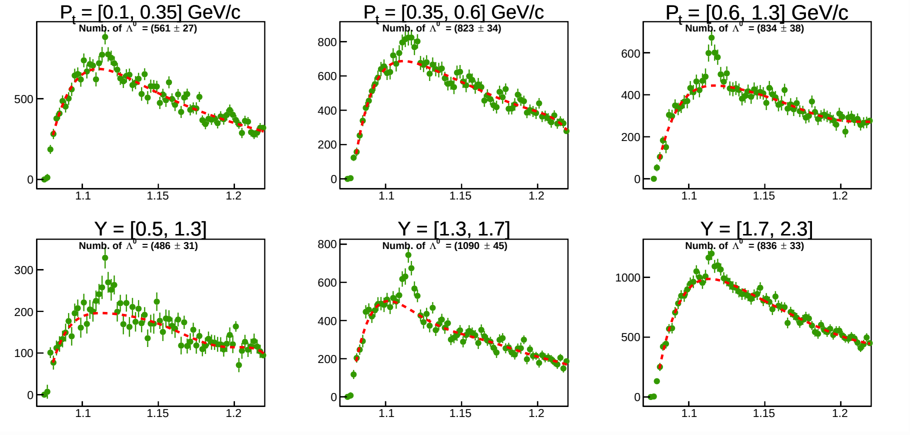
Target:	Al	Cu	Sn	Pb
N_{Λ^0} with (without)	626 (363)	1171 (643)	1912 (942)	1250 (556)
Inc. factor:	1.72	1.82	2.03	2.25

Reconstructed spectra in different P_t, Y bins

Looking at reconstructed Λ^0 in terms of PtY

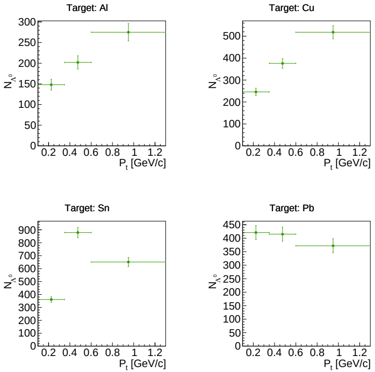
- Done for all targets
- Three chosen P_t bins: **(0.1, 0.35), (0.35, 0.6) and (0.6, 1.3) GeV/c**
- Three chosen Y bins: **(0.5, 1.3), (1.3, 1.7) and (1.7, 2.3)**
- Lower value of first bin and upper value of last bin were chosen not to suppress signal significantly (done when analyzing all targets)
- For each chosen bin **(S $\pm$ ΔS) is estimated**

Target: Sn

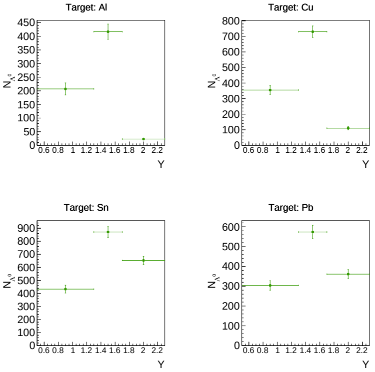


Looking at reconstructed Λ^0 in terms of PtY

P_t



Y



Target / P_t bins:	Al	Cu	Sn	Pb
0.1 ... 0.35	148 ± 13	246 ± 17	361 ± 22	421 ± 26
0.35 ... 0.6	202 ± 16	376 ± 22	879 ± 40	415 ± 26
0.6 ... 1.3	275 ± 21	518 ± 30	651 ± 35	372 ± 26

Target / Y bins:	Al	Cu	Sn	Pb
0.5 ... 1.3	207 ± 22	355 ± 28	433 ± 30	304 ± 24
1.3 ... 1.7	417 ± 28	730 ± 37	871 ± 41	574 ± 34
1.7 ... 2.3	23 ± 4	110 ± 10	653 ± 30	361 ± 23

Conclusion

- **Performed optimization allowed one to "elaborate" the same set of cuts applied to all targets to see the signal from Λ^0**
- **Estimated trigger efficiency w.r.t. Λ^0 reconstruction showed that triggers containing FD condition have less efficiency if compared with those ones having BD condition**
- **Produced Λ^0 spectra for different bins in (Y, P_t)-space with estimation of number of Λ^0 for each bin chosen.**

Thank you for your attention!