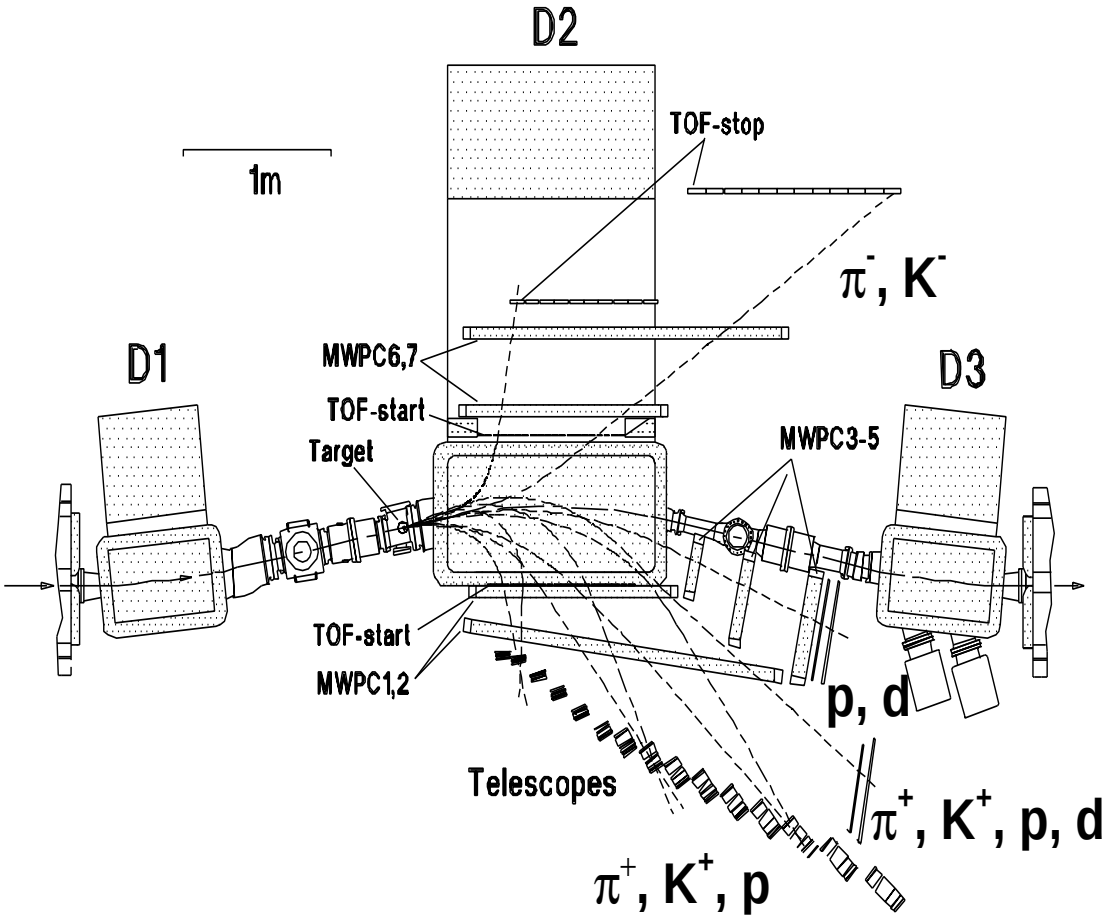
(Λp) masses from $pp \to K^+ p\Lambda(1116)$ reaction

V.Koptev PNPI



Three possibilities to study (Λp) system in the reaction $pp \to pK^+\Lambda$ at ANKE:

1. K^+ mesons are detected in telescopes and Side Wall (pages 2–8),
2. K^+ mesons are detected in Forward Detector, new for ANKE (pages 9–15),
3. K^+ mesons are **not** detected as it has been done during the pentaquark studies (pages 16–37).

Kaons are in telescopes and Side Wall

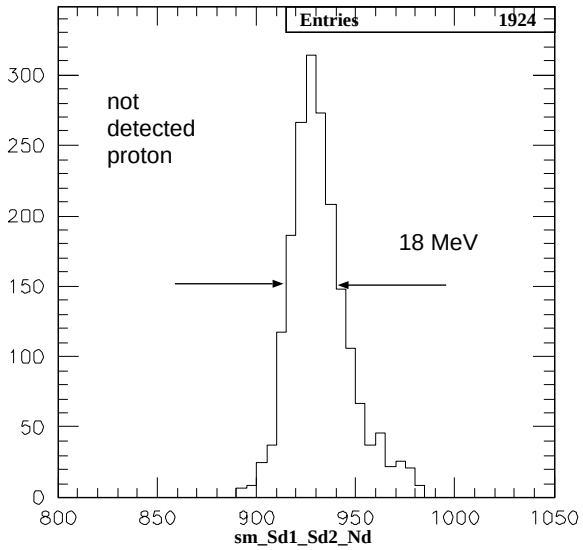
3-fold coinsidences are sufficient to make a conclusion about the ANKE possibility to study low Λp mass region. Two possinilities can be considered.

1. $K^+\pi^-p$ coinsidences when one of the protons is detected either in telescopes and Side Wall or in Forward Detector. Another proton (as $M_{miss}(K^+\pi^-p)$) and $\Lambda(1116)$ (as $M_{inv}(\pi^-p)$) are selected from kinematics. January 2004 data (T_p =2.65 GeV, fast trigger K^+&Nd) are used in this analysis. Data measured at T_p =2.83 GeV in February 2002 and in March 2005 were analysed about 2 years ago and gave the same answer.

2. K^+pp correlationd when π^- (as $M_{miss}(K^+pp)$) and $\Lambda_{Sd}(1116)$ or $\Lambda_{Fd}(1116)$ (as $M_{miss}(K^+p_{Sd})$ or $M_{miss}(K^+p_{Fd})$) were selected from kinematics. Only data from February 2002 can be use for this analysis (fast trigger: K^+&Fd)

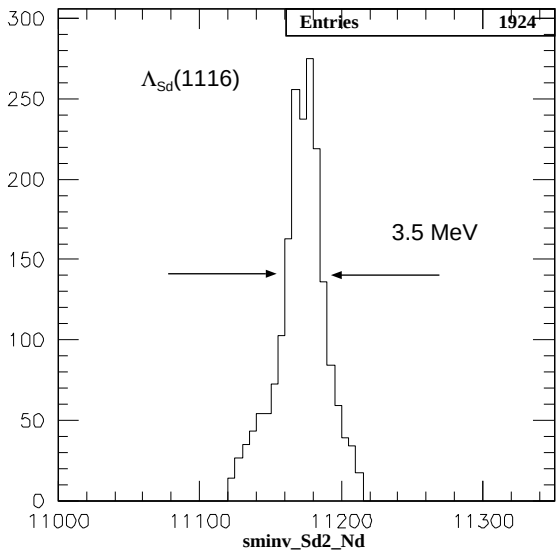
pp-K+.P.PI- (X=P)

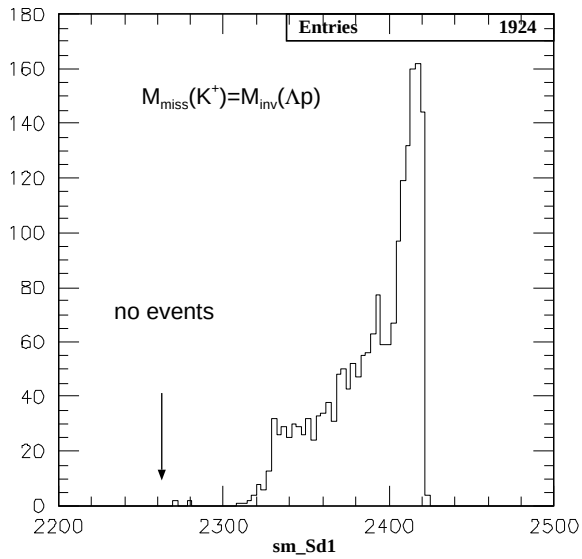
jan04.kaSD-pSD-ND.tapes8-23.Lsd1112-1121.Mp890-980



Momentum by Runge Kutta

Sd1 Particle(Tel.4-15 SW.1-4) =Kaon
Sd2 Particle =Proton
Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3463





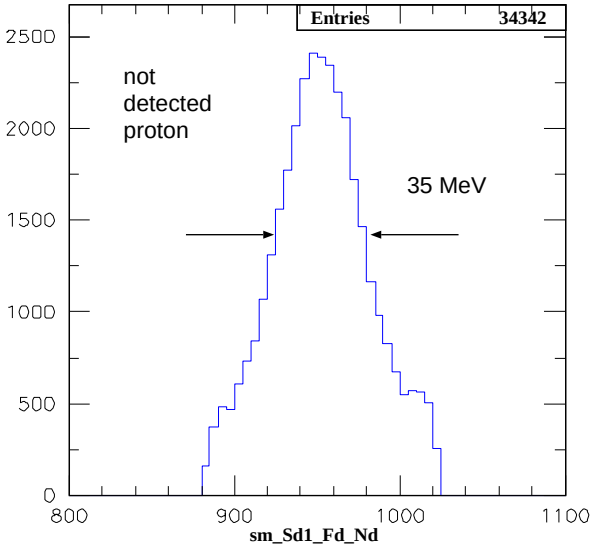
Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 1 2
ONOFF-nd-CorrMX

vTrigger = -1 0 0 0 0 9 0
nTrigger = 2 2 -1

Data from January 2004. Fast trigger K^+&Nd. One proton is in Telescopes and Side Wall. Not detected second proton and $\Lambda \to \pi^- p_{Sd}$ are reconstructed from kinematics. No events in the low Λp mass region.

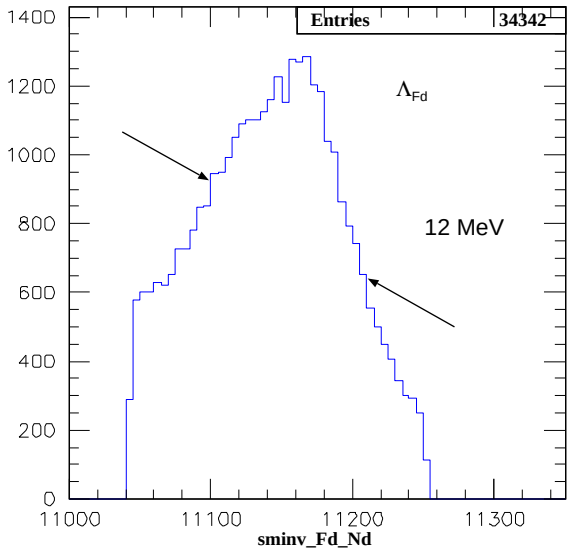
pp-K+.P.PI- (X=P)

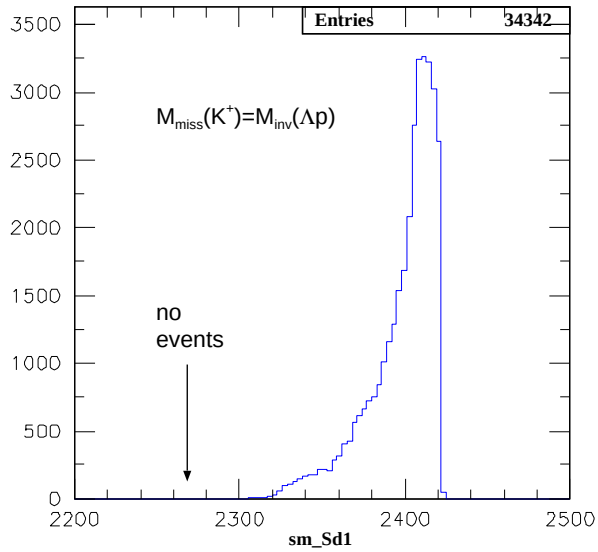
jan04.kaSD-ND-FD.tapes8-23.Lfd1104-1125.Mp880-1020



Momentum by Runge Kutta
Fd Particle=Proton
Sd1 Particle(Tel.4-15 SW.1-4) =Kaon

Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3463





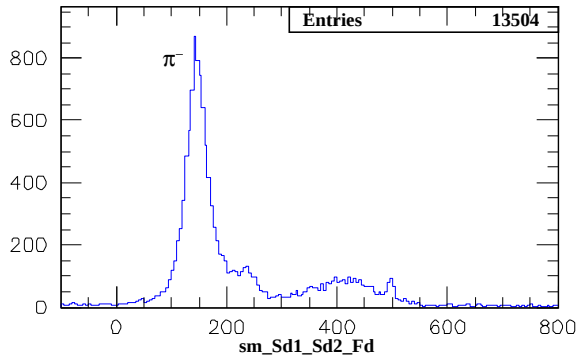
Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 1 1
ONOFF-nd-CorrMX

vTrigger = 1 1 0 1 1 2 0
nTrigger = 2 2 -1

Data from January 2004. Fast trigger K^+&Nd. $\Lambda \to \pi^- p_{Fd}$ and not detected another proton are reconstructed from kinematics. No events in the low Λp mass region.

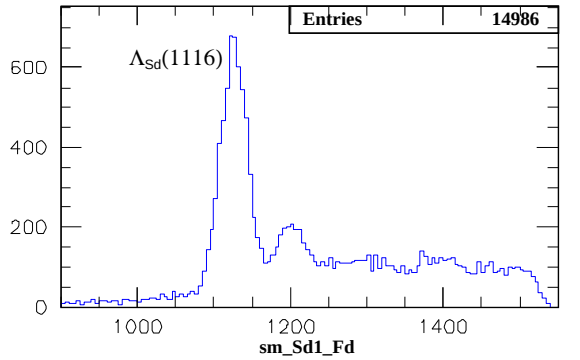
pp-K+.P.P (X=PI-)

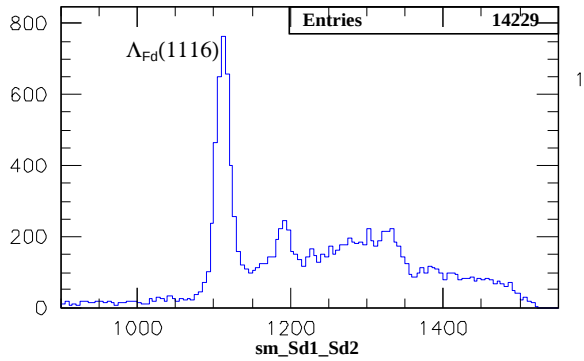
Run4468-710_ka-TEI20-SW25.MWPC-p.SW1-ka.SW2-MWPC.Fd-MWPC.trg1.no-cuts

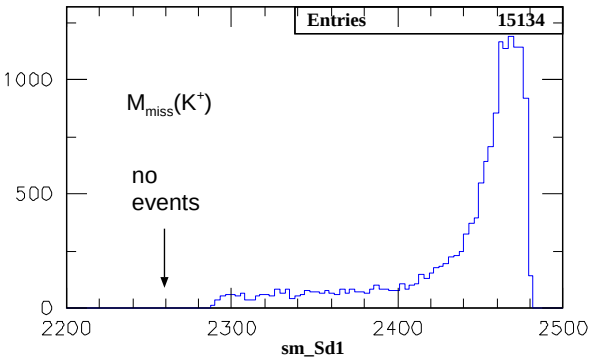


Momentum by Runge Kutta
Fd Particle=Proton
Sd1 Particle(Tel.1-15 SW.1-6) =Kaon
Sd2 Particle =Proton

Target=Proton
Proton Beam Momentum, MeV/c= 3650







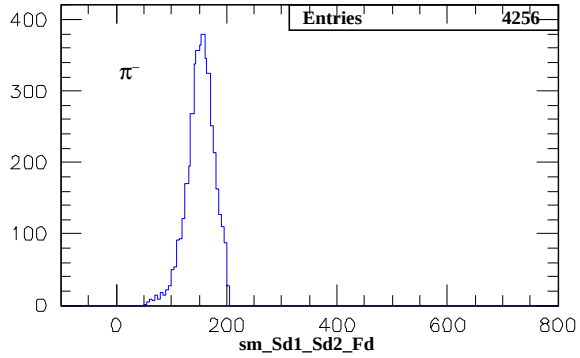
Trigger = 2 2 0 0 0 2 0 -1 1 3 1 2 0 1 2
ONOFF-nd-CorrMX

vTrigger = 1 1 0 0 1 2 0
nTrigger = -1 -1 -1

Data from February 2002. Fast trigger K^+&Fd. One proton is in Fd, another proton in Telescopes and Side Wall, π^- mesons are in Nd. From kinematics π^- $(M_{miss}(K^+p_{Sd}p_{Fd}))$, Λ_{Sd} as $M_{miss}(K^+p_{Fd})$ and Λ_{Fd} as $M_{miss}(K^+p_{Sd})$ are reconstructed. This is a raw analysis: without cuts on π^-, Λ_{Sd} and Λ_{Fd}. No events in the low Λp mass region.

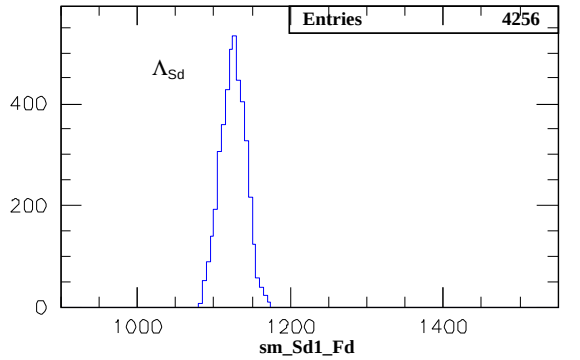
pp-K+.P.P (X=PI-)

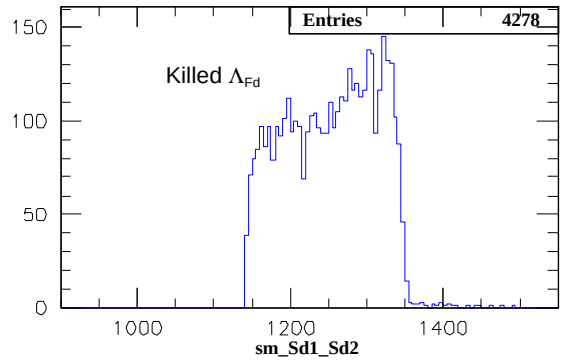
Run4468-710_ka-TEI20-SW25.MWPC-p.SW1-ka.SW2-MWPC.Fd-MWPC.trg1.Lsd-cut

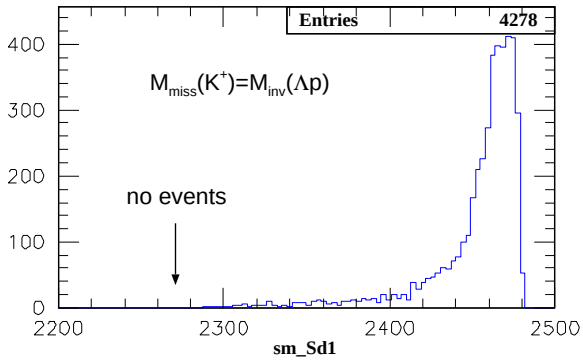


Momentum by Runge Kutta
Fd Particle=Proton
Sd1 Particle(Tel.1-15 SW.1-6) =Kaon
Sd2 Particle =Proton

Target=Proton
Proton Beam Momentum, MeV/c= 3650







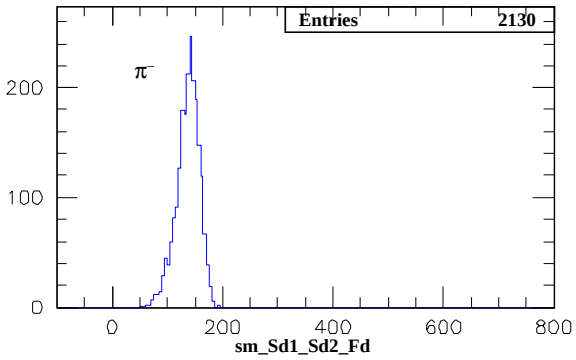
Trigger = 2 2 0 0 0 2 0 -1 1 3 1 2 0 1 2
ONOFF-nd-CorrMX

vTrigger = 1 1 0 0 1 2 0
nTrigger = -1 -1 -1

After Λ_{Sd} and π^- selection for data shown on page 5.

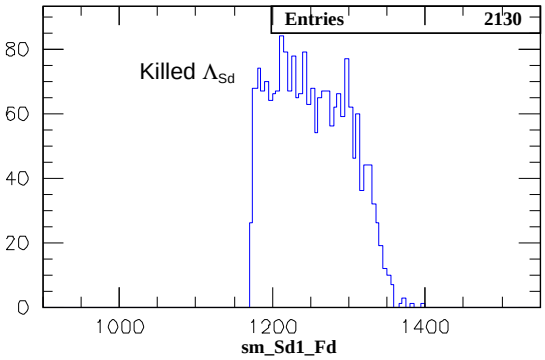
pp-K+.P.P (X=PI-)

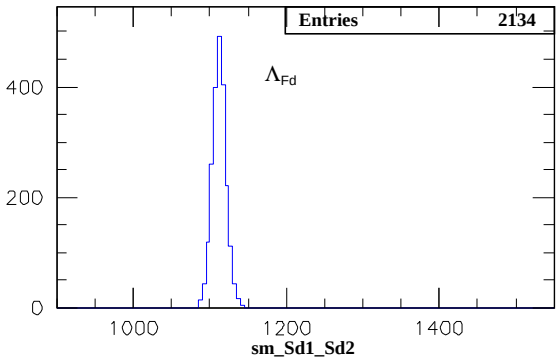
Run4468-710_ka-TEI20-SW25.MWPC-p.SW1-ka.SW2-MWPC.Fd-MWPC.trg1.Lfd-cut

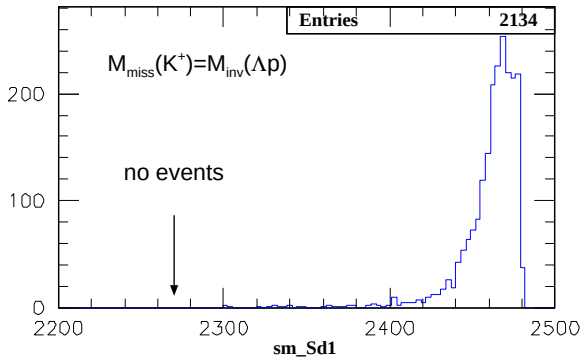


Momentum by Runge Kutta
Fd Particle=Proton
Sd1 Particle(Tel.1-15 SW.1-6) =Kaon
Sd2 Particle =Proton

Target=Proton
Proton Beam Momentum, MeV/c= 3650







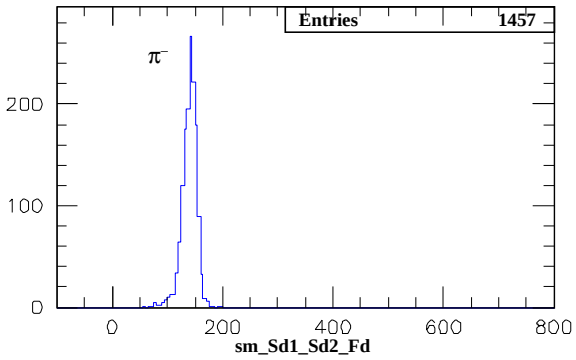
Trigger = 2 2 0 0 0 2 0 -1 1 3 1 2 0 1 2
ONOFF-nd-CorrMX

vTrigger = 1 1 0 0 1 2 0
nTrigger = -1 -1 -1

After Λ_{Fd} and π^- selection for data shown on page 5.

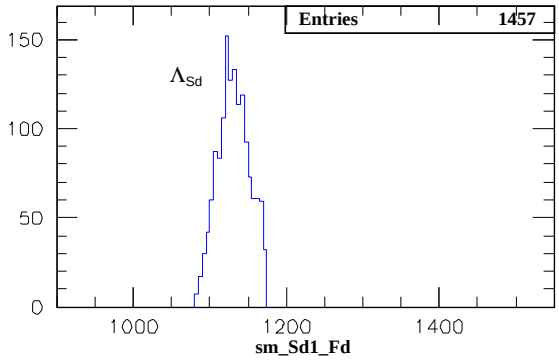
pp-K+.P.P (X=PI-)

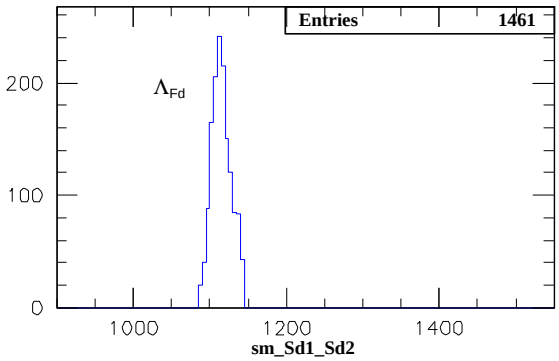
Run4468-710_ka-TEI20-SW25.MWPC-p.SW1-ka.SW2-MWPC.Fd-MWPC.trg1.Lsd-lfd-cuts

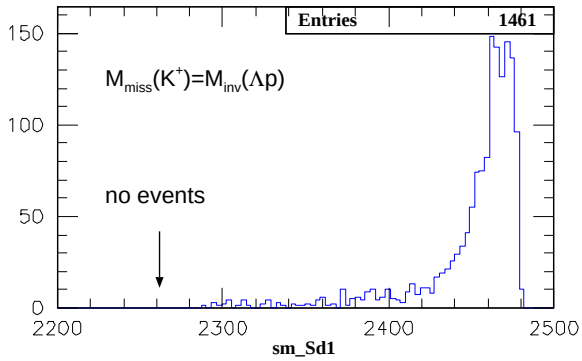


Momentum by Runge Kutta
Fd Particle=Proton
Sd1 Particle(Tel.1-15 SW.1-6) =Kaon
Sd2 Particle =Proton

Target=Proton
Proton Beam Momentum, MeV/c= 3650







Trigger = 2 2 0 0 0 2 0 -1 1 3 1 2 0 1 2
ONOFF-nd-CorrMX

vTrigger = 1 1 0 0 1 2 0
nTrigger = -1 -1 -1

After crossed over Λ_{Sd} and Λ_{Fd} selection from data shown on page 5.

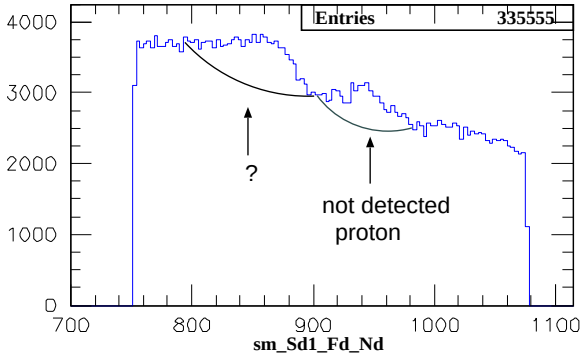
Conclusions from results shown on pages 2–8: if K^+-mesons are detected in Telescopes and Side Wall, then the low Λp mass region (2250 ± 100 MeV) is not observable at ANKE.

Kaons are in Forard detector

3-fold coinsidences must be used: Sd&Fd&Nd with kaons in Fd, protons in Telescopes and Side Wall and π^- in Nd. Since Δt_{K^+p} between the target and Fd hoposcope is about 0.9 – 1.0 ns, the TOF (Nd-Fd) can be used to separate (at least partly) kaons from protons in Fd. In the frame of this analysis it was naively considered that all the particles in Fd are kaon. There were kinematically selected either $\Lambda_{Sd} \rightarrow \pi^- p_{Sd}$ or Λ_{Fd} from $M_{miss}(K^+ p_{Sd})$ and the second proton from $M_{miss}(K^+ \pi^- p_{Sd})$. For this analysis only six runs (9276, 9277, 9278, 9279, 9283, 9287) can be used. These were calibration runs measured during 6.5 hours in March 2005 with open trigger in Sd.

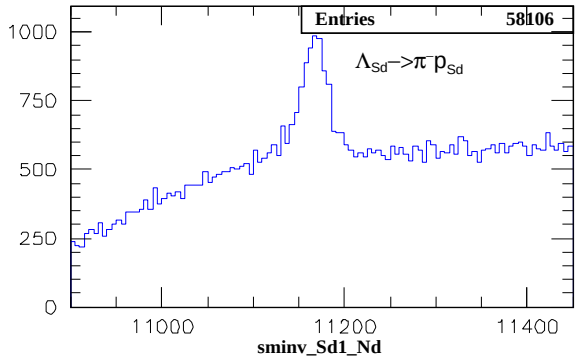
pp-PI-.P.P.(X=K+)

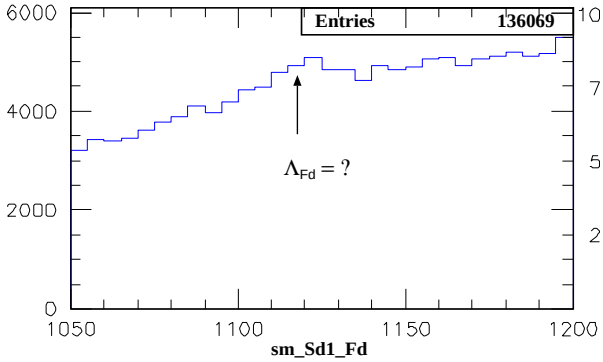
runs9276-87.SD-p.kaon-in-FD.Mp750-1076.Vert15

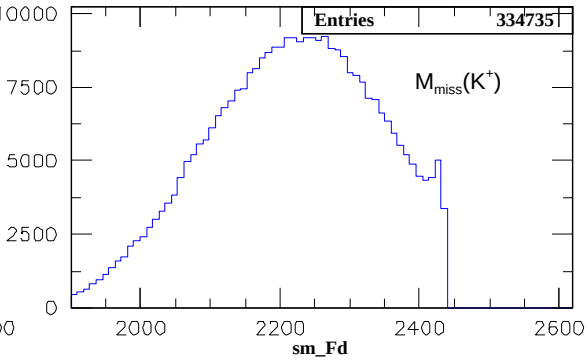


Momentum by Runge Kutta
Fd Particle=Kaon
Sd1 Particle =Proton

Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3650







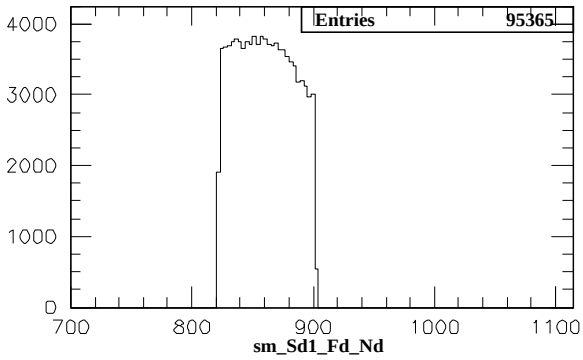
Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 1 1
ONOFF-nd-CorrMX

vTrigger = 1 1 0 1 1 1 0 2 1
nTrigger = 2 2 -1

A strong Λ_{Sd} peak is seen in $M_{inv}(\pi^- p_{Sd})$ after a mild cut on $M_{miss}(K^+\pi^- p_{Sd})$. A hint on Λ_{Fd} is also seen in $M_{miss}(K^+ p_{Sd})$. Looks like, two peaks are seen in $M_{miss}(K^+\pi^- p_{Sd})$: one of them corresponds to not detected protons from $pp \to pK^+\Lambda$, the second peak is???

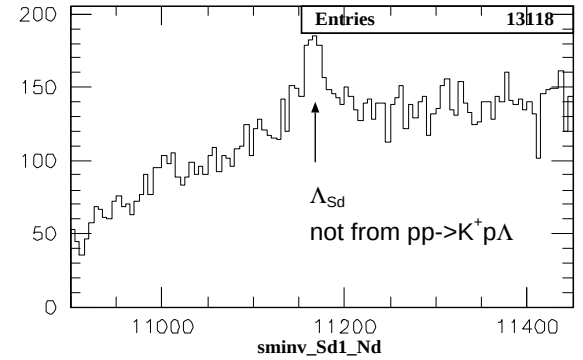
pp-PI-.P.P.(X=K+)

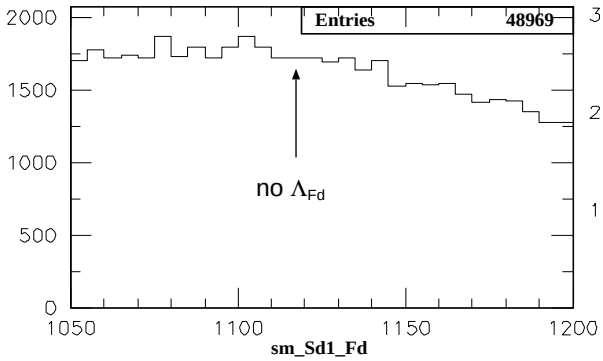
runs9276-87.SD-p.kaon-in-FD.Mp820-900.Vert15

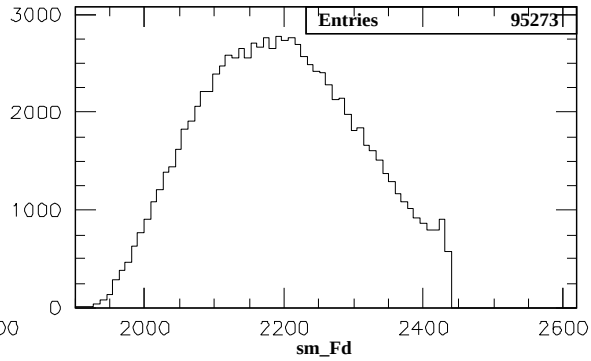


Momentum by Runge Kutta
Fd Particle=Kaon
Sd1 Particle =Proton

Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3650





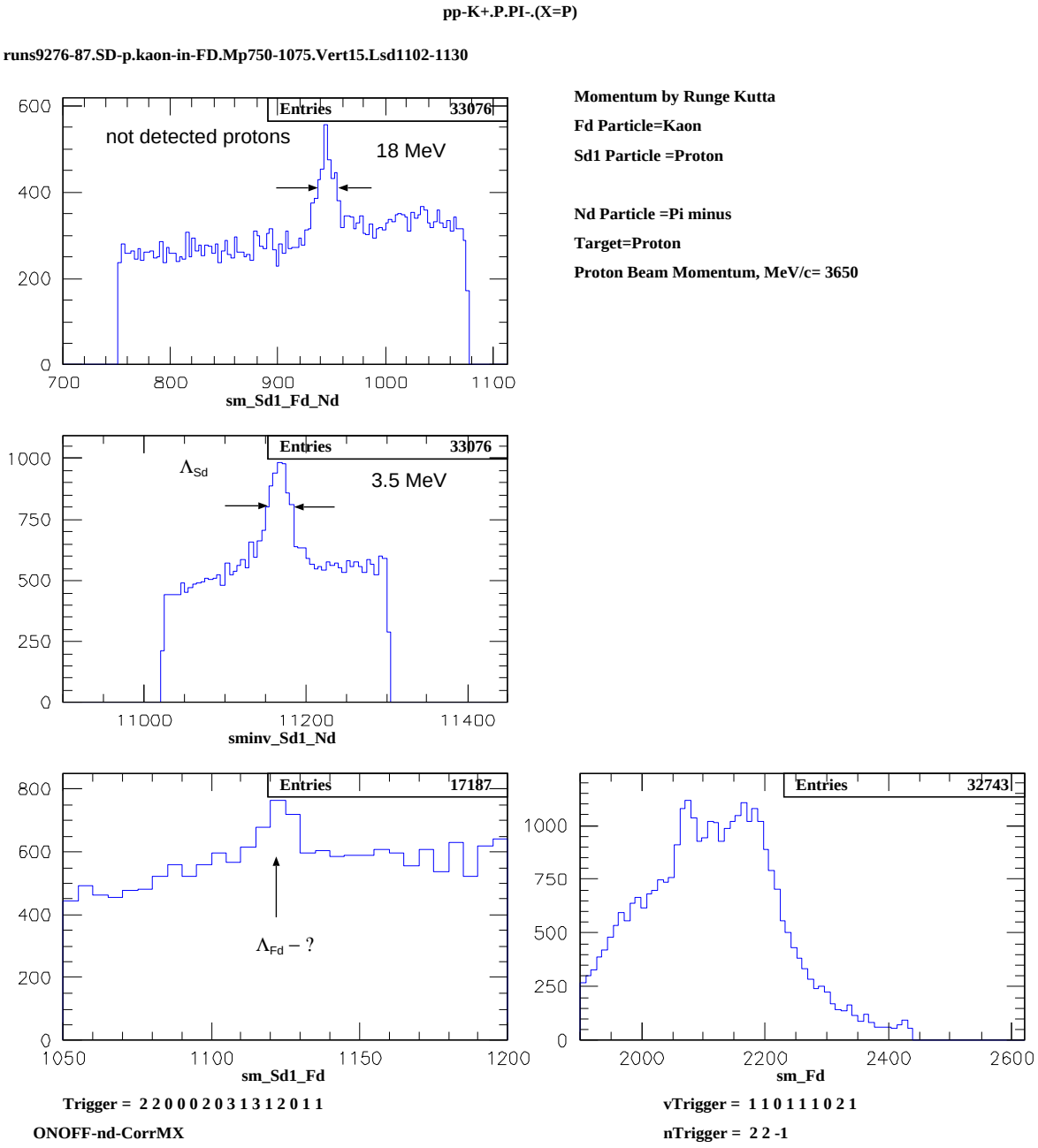


Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 1 1
ONOFF-nd-CorrMX

vTrigger = 1 1 0 1 1 1 0 2 1
nTrigger = 2 2 -1

The mass region of the second enhancement is selected ($M_{miss}(K^+\pi^-p_{Sd}) = 860\pm40$ MeV):

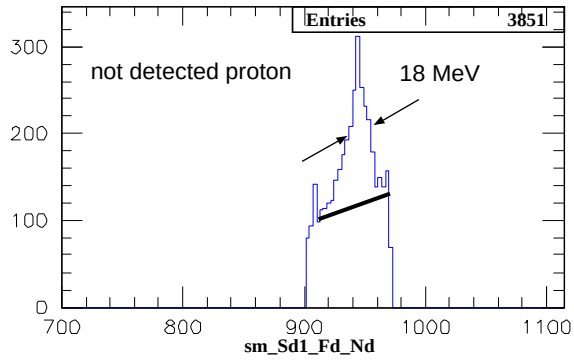
1. no indications on Λ_{Fd} peak in $M_{miss}(K^+p_{Fd})$,
2. Λ_{Sd} peak is still seen in $M_{inv}(\pi^-p_{Sd})$. It is not from $pp \to K^+p\Lambda$ but from $pp \to pK^+\Lambda(n\pi)$ or $pp \to pK^+\Sigma(n\pi)$ reactions because the invariant mass distribution are not dependent on kinematics of reactions.



Mild $M_{inv}(\pi^- p_{Sd}) = 1116 \pm 13\,\mathrm{MeV}$ cut kills the second peak. Selected: $N_{\Lambda(Sd)}$ ≈2990 events, N_p ≈1300 events. Not detected protons are selected according to kinematics of $pp \to K^+ p\Lambda$ reaction. Λ_{Sd} is selected as $M_{inv}(\pi^- p_{Sd})$ independent on the reaction. The large $N_{\Lambda(Sd)}$-N_p defference confirms the presence of large physics background from $pp \to K^+ p\Lambda(n\pi)$ or $pp \to K^+ p\Sigma$ reactions.

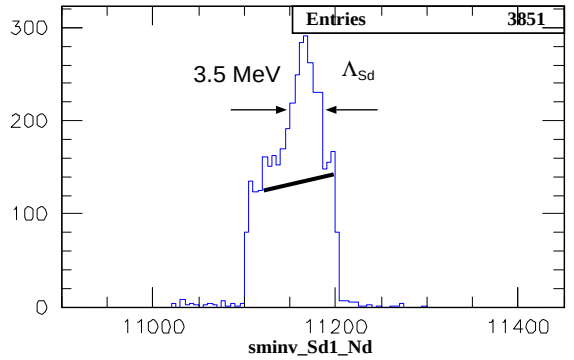
pp-K+.P.PI-.(X=P)

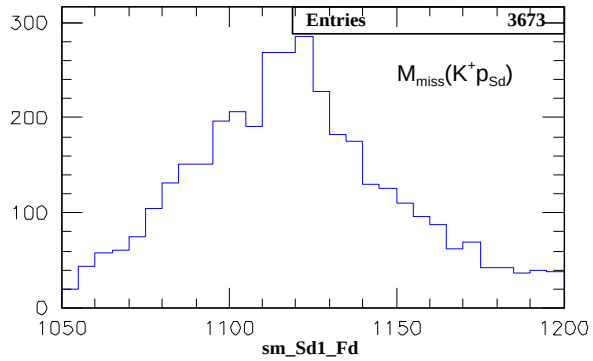
runs9276-87.SD-p.kaon-in-FD.Mp900-970.Vert15.Lsd1110-1120

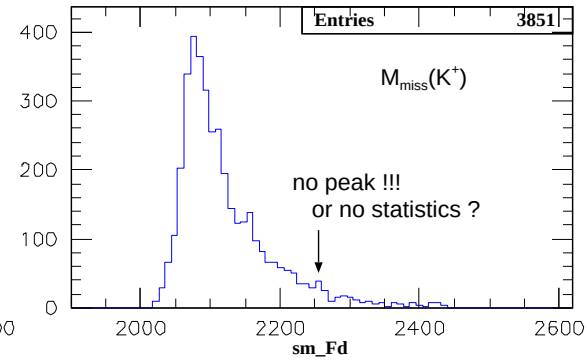


Momentum by Runge Kutta
Fd Particle=Kaon
Sd1 Particle =Proton

Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3650







Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 1 1
ONOFF-nd-CorrMX

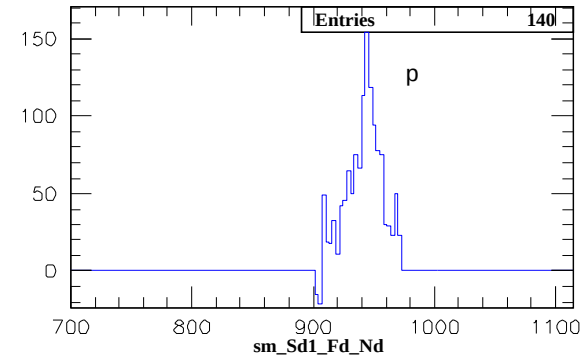
vTrigger = 1 1 0 1 1 1 0 2 1
nTrigger = 2 2 -1

Strong cut on Λ_{Sd} (1115±5 MeV):

1. $M_{miss}(K^+p_{Sd})$ shows a broad peak but (unhappily) with maximum at around 1116 MeV.
2. $M_{miss}(K^+)$ does not show a significant peak at 2250 MeV. Statistics must be increased (?).
3. Narrow peaks of notdetected protons ($N_p \approx 800$ events) and of Λ_{Sd} ($N_{\Lambda_{Sd}} \approx 900$ events) with nearly equal number of events. Seems it is mostly $pp \to K^+p\Lambda$.
4. High background under the peak is connected with K^+ missidentification in Fd. TOF(π^-K^+) must be used to reduce these background.

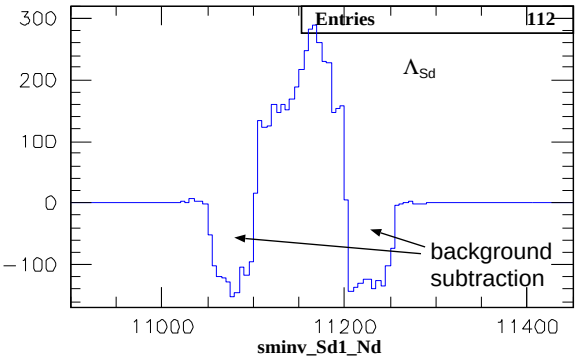
pp-K+.P.PI-.(X=P)

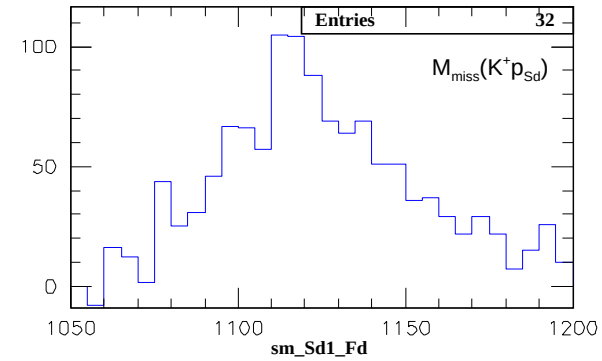
runs9276-87.SD-p.kaon-in-FD.Mp900-970.Vert15.Lsd1110-1120

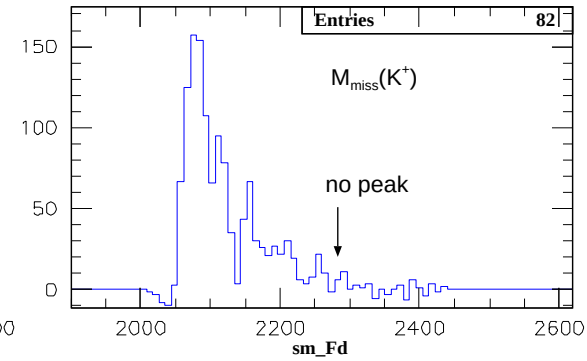


Momentum by Runge Kutta
Fd Particle=Kaon
Sd1 Particle =Proton

Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3650







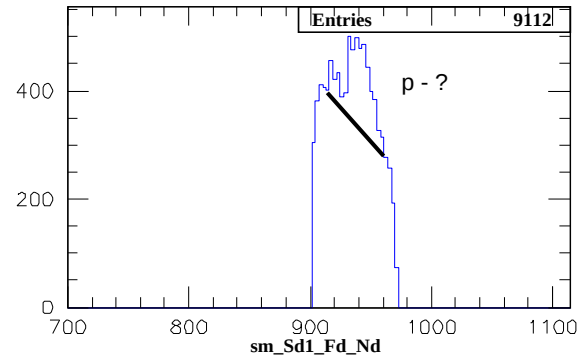
Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 -1 1
ONOFF-nd-CorrMX

vTrigger = 1 1 0 1 1 1 0 2 1
nTrigger = 2 2 -1

If the background under proton and Λ_{Sd} peaks is connected with K^+ missidentification then this way of the background subtruction is reasonable.

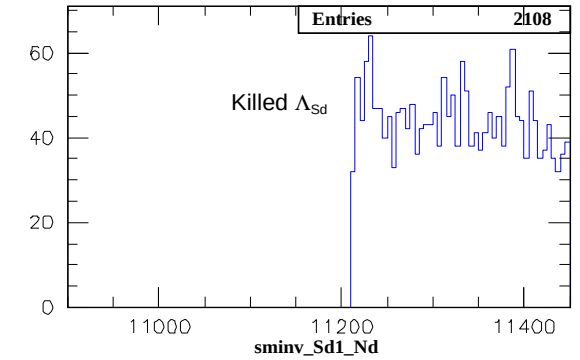
pp-K+.P.PI-.(X=P)

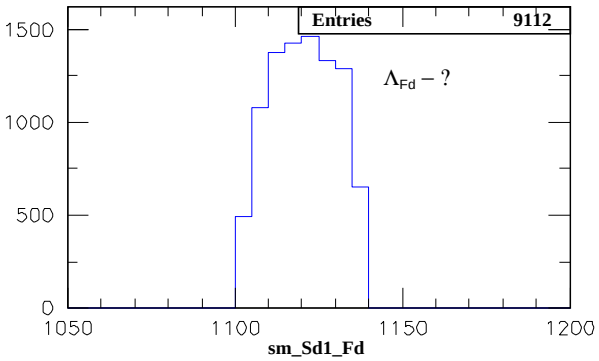
runs9276-87.SD-p.kaon-in-FD.Mp900-970.Vert15.Lfd1100-1135

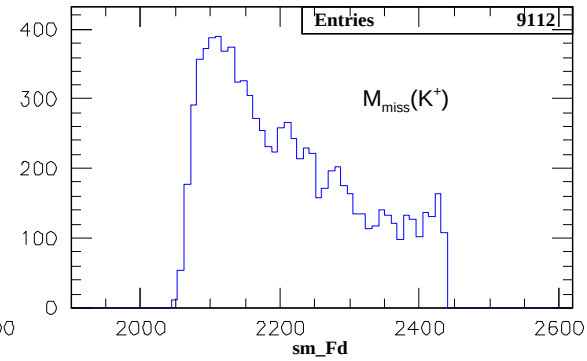


Momentum by Runge Kutta
Fd Particle=Kaon
Sd1 Particle =Proton

Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3650







Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 1 1
ONOFF-nd-CorrMX

vTrigger = 1 1 0 1 1 1 0 2 1
nTrigger = 2 2 -1

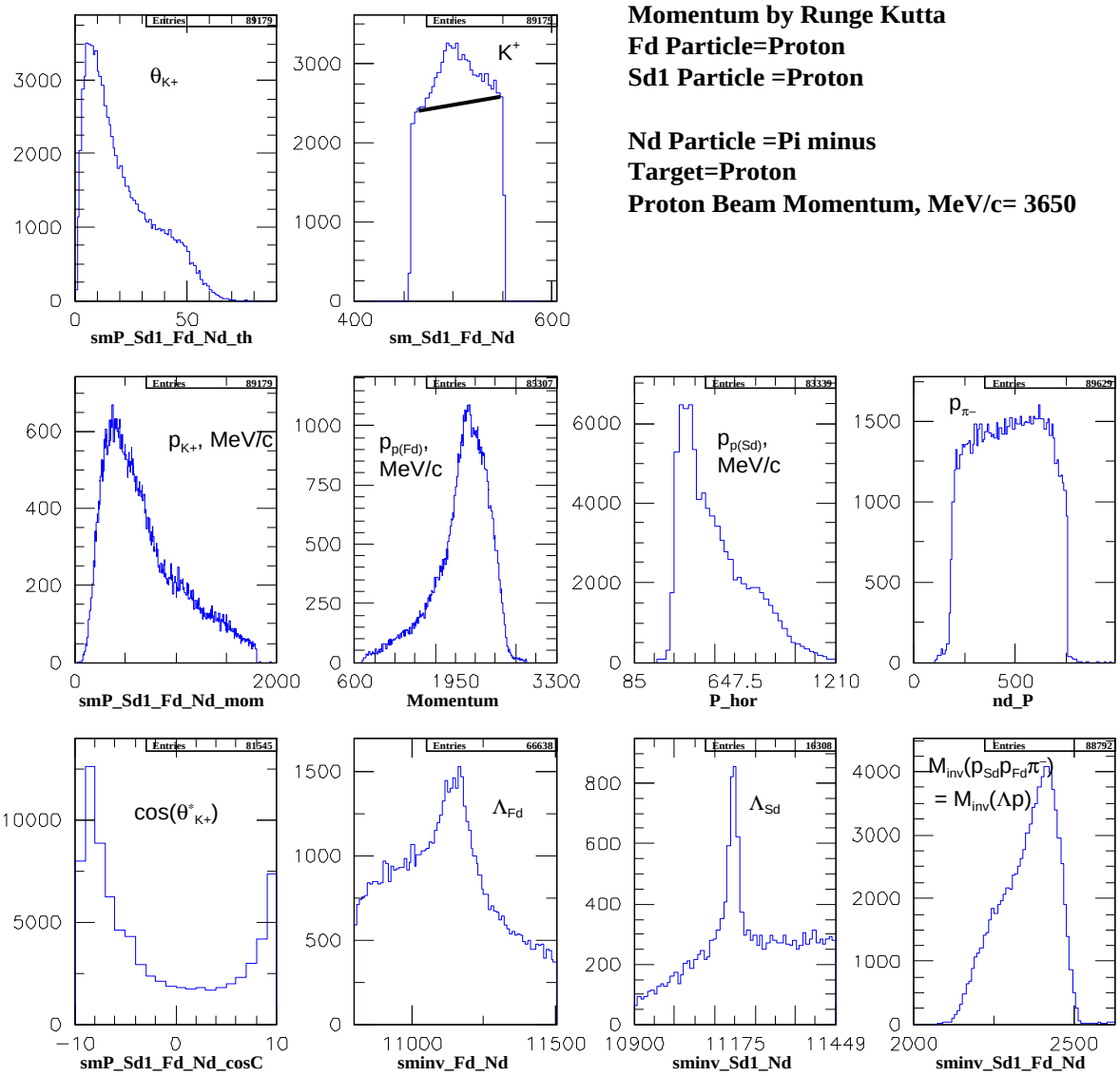
Strong $M_{miss}(K^+p_{Sd})$ cut in the mass region of Λ_{Fd} from $pp \to K^+p\Lambda$. A proton peak (?) of about 800 events is seen in the $M_{miss}(K^+\pi^-p_{Sd})$ with the 10 times higher background and not clear conclusion about $M_{miss}(K^+)$. May be the background can be reduced applying kaon identification from TOF(π^-K^+) distributions.

Kaons are not detected

3-fold $p_{Sd}\&p_{Fd}\&\pi^-$ correlations are selected from 6 calibration runs measured in March 2005. $\Lambda_{Sd} \rightarrow \pi^- p_{Sd}$ or $\Lambda_{Fd} \rightarrow \pi^- p_{Fd}$ are selected from $M_{inv}(\pi^- p_{Sd})$ or $M_{inv}(\pi^- p_{Fd})$ distribution. K^+-mesons are kinematically selected from $M_{miss}(p_{Fd}p_{Sd}\pi^-)$. An informaion about $M(p\Lambda)$ is obtained from $M_{inv}(p_{Fd}p_{Sd}\pi^-)$ distribution. Very important that in this method one can see (page 9) the complete kaon momentum spectrum ($100 \leq |\vec{p}_{K^+}| \leq 1900\,\mathrm{MeV/c}$), rather large kaon angular acceptance ($\theta_{K^+} \leq 60^o$) and both backward and forward kaons in CM ($-1.0 \leq \cos\theta^*_{K^+} \leq 1.0$). Disadvantage: very high background under the K^+ peak in $M_{miss}(\pi^- p_{Sd}p_{Fd})$. This is the physics background coming from multipion production reactions $pp \rightarrow pp(n\pi)$. The only way to reduce this background is to improve $M_{miss}(\pi^- p_{Sd}p_{Fd})$ resolution.

pp-PI-.P.P (X=K+)

runs9276-77-78-79-83-87.mK455-540.ps



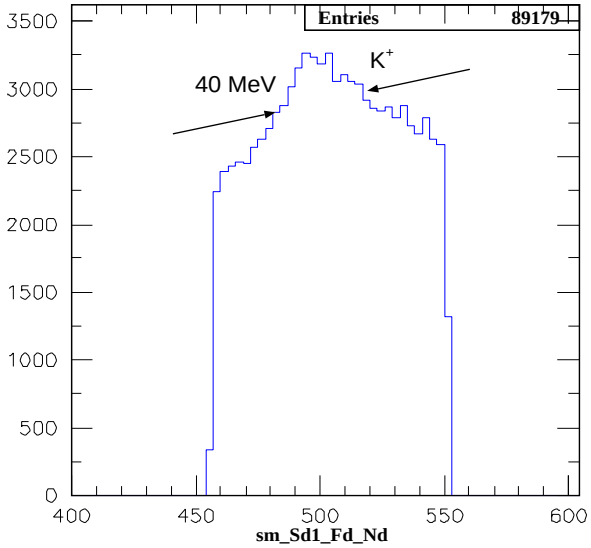
Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 1 1 **vTrigger = 1 1 0 1 1 2 0 2 1**

ONOFF-nd-CorrMX **nTrigger = 2 2 -1**

March 2005 data measured at 2.85 GeV during calibration runs. In Telescopes and Side Wall open trigger was used: practically uncorrelated π^+ or K^+ or p. For this analysis only p were selected on correlation with p in Fd and π^- in Nd. In $M_{miss}(p_{Sd}p_{Fd}\pi^-)$ a broad peak of K^+ from $pp \to K^+p\Lambda$ is seen as well as both $\Lambda_{Sd} \to \pi^- p_{Sd}$ and $\Lambda_{Fd} \to \pi^- p_{Fd}$.

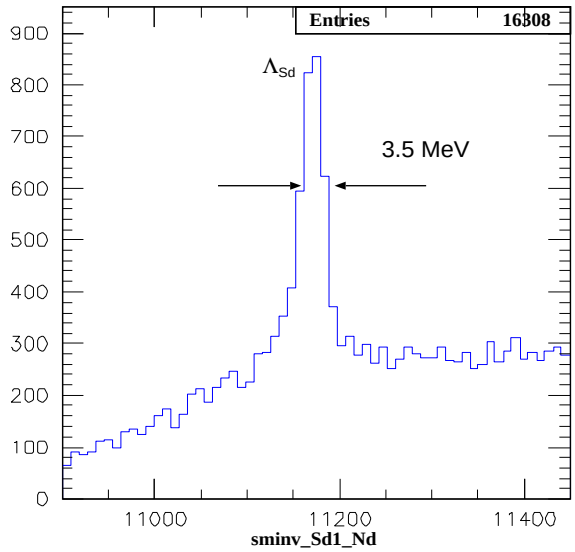
pp-PI-.P.P.(X=K+)

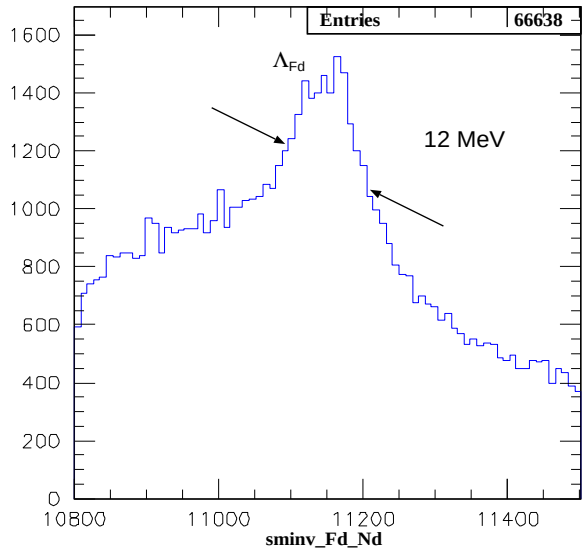
runs9276-77-78-79-83-87.mK455-540.3.ps



Momentum by Runge Kutta
Fd Particle=Proton
Sd1 Particle =Proton

Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3650





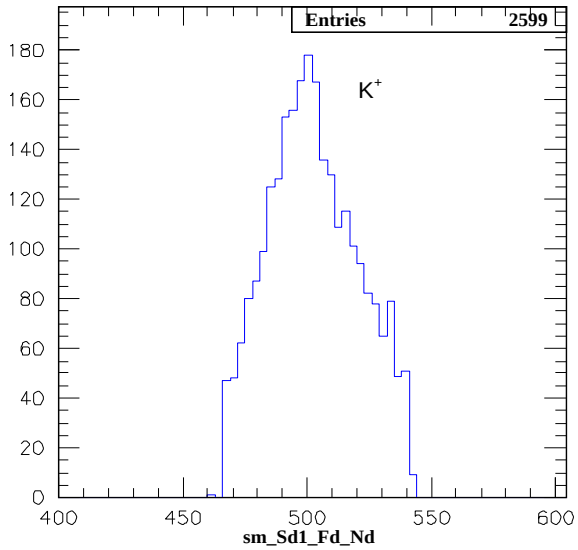
Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 1 1
ONOFF-nd-CorrMX

vTrigger = 1 1 0 1 1 2 0 2 1
nTrigger = 2 2 -1

Fraction of spectra from previous page.

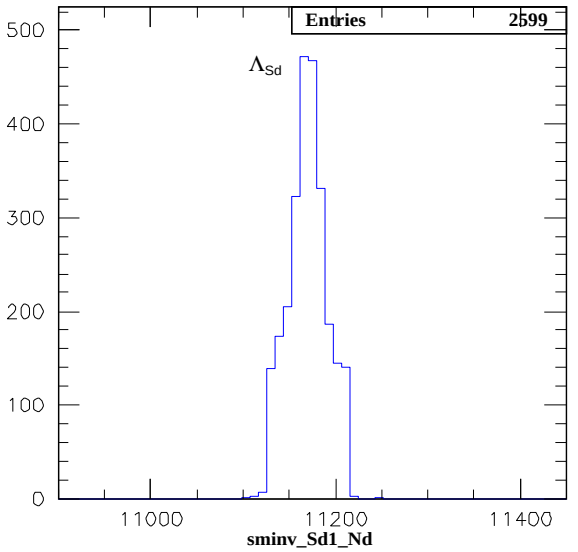
pp-PI-.P.P.(X=K+)

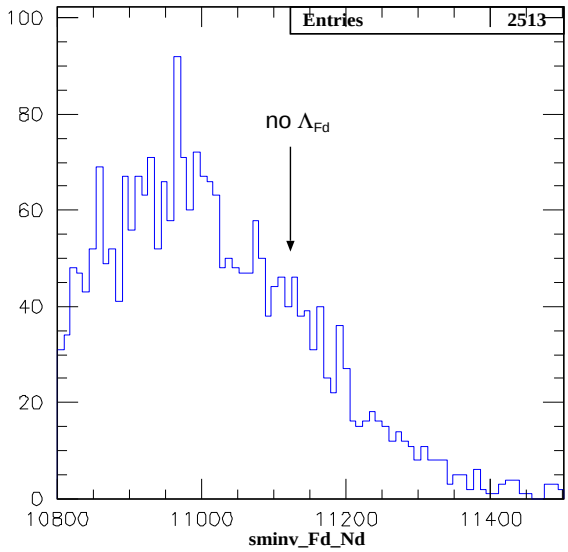
runs9276-77-78-79-83-87.mK455-540.Pnd30-750.Lsd1112-1121.ps



Momentum by Runge Kutta
Fd Particle=Proton
Sd1 Particle =Proton

Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3650





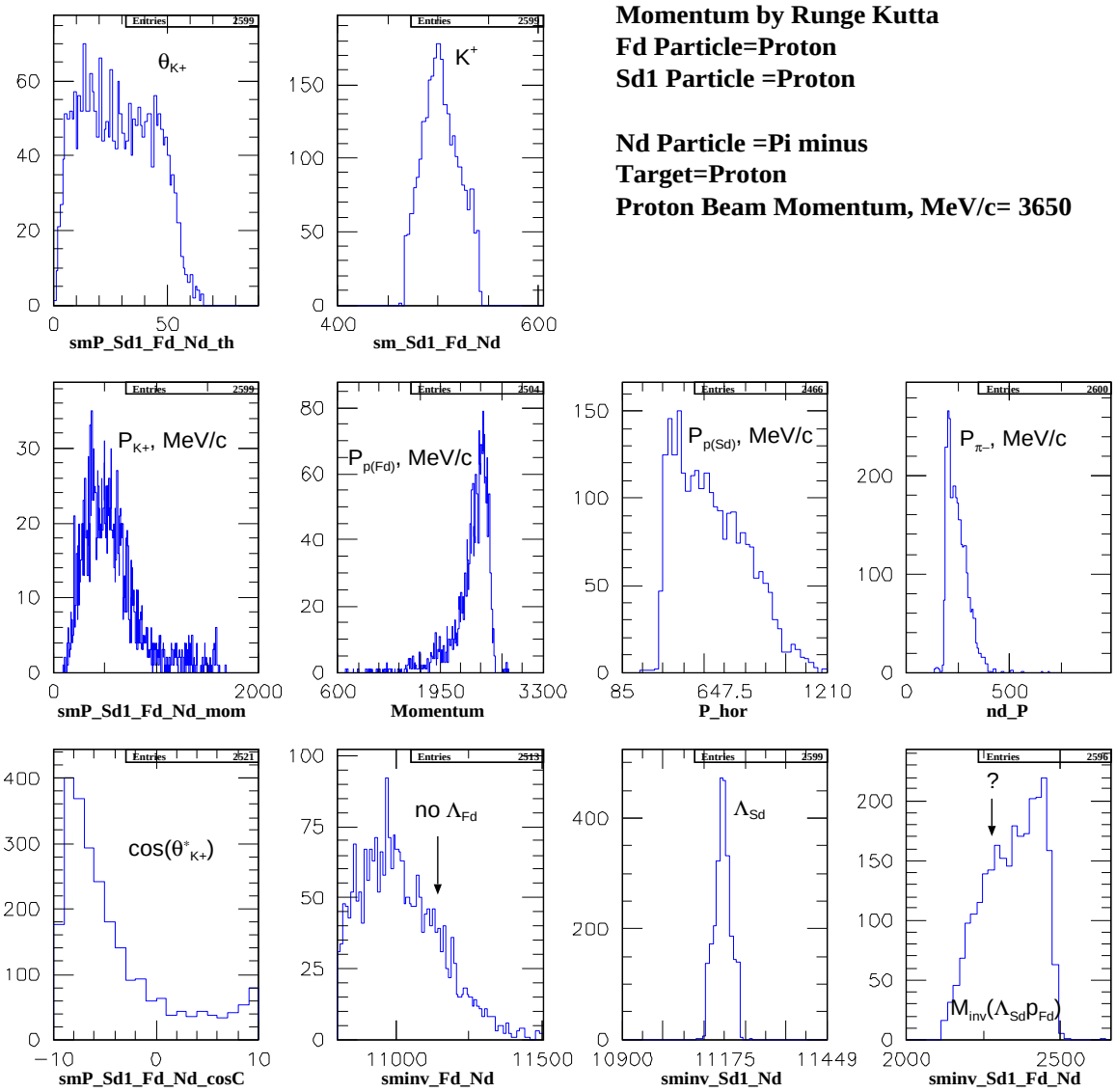
Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 1 1
ONOFF-nd-CorrMX

vTrigger = 1 1 0 1 1 2 0 2 1
nTrigger = 2 2 -1

After K^+ and Λ_{Sd} selection there is practically no Λ_{Fd}. Background is about 40%. The only way to reduce it is to improve $M_{miss}(p_{Sd}p_{Fd}\pi^-)$ resolution.

pp-PI-.P.P (X=K+)

runs9276-77-78-79-83-87.mK455-540.Pnd30-750.Lsd1112-1121.ps



Momentum by Runge Kutta
Fd Particle=Proton
Sd1 Particle =Proton

Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3650

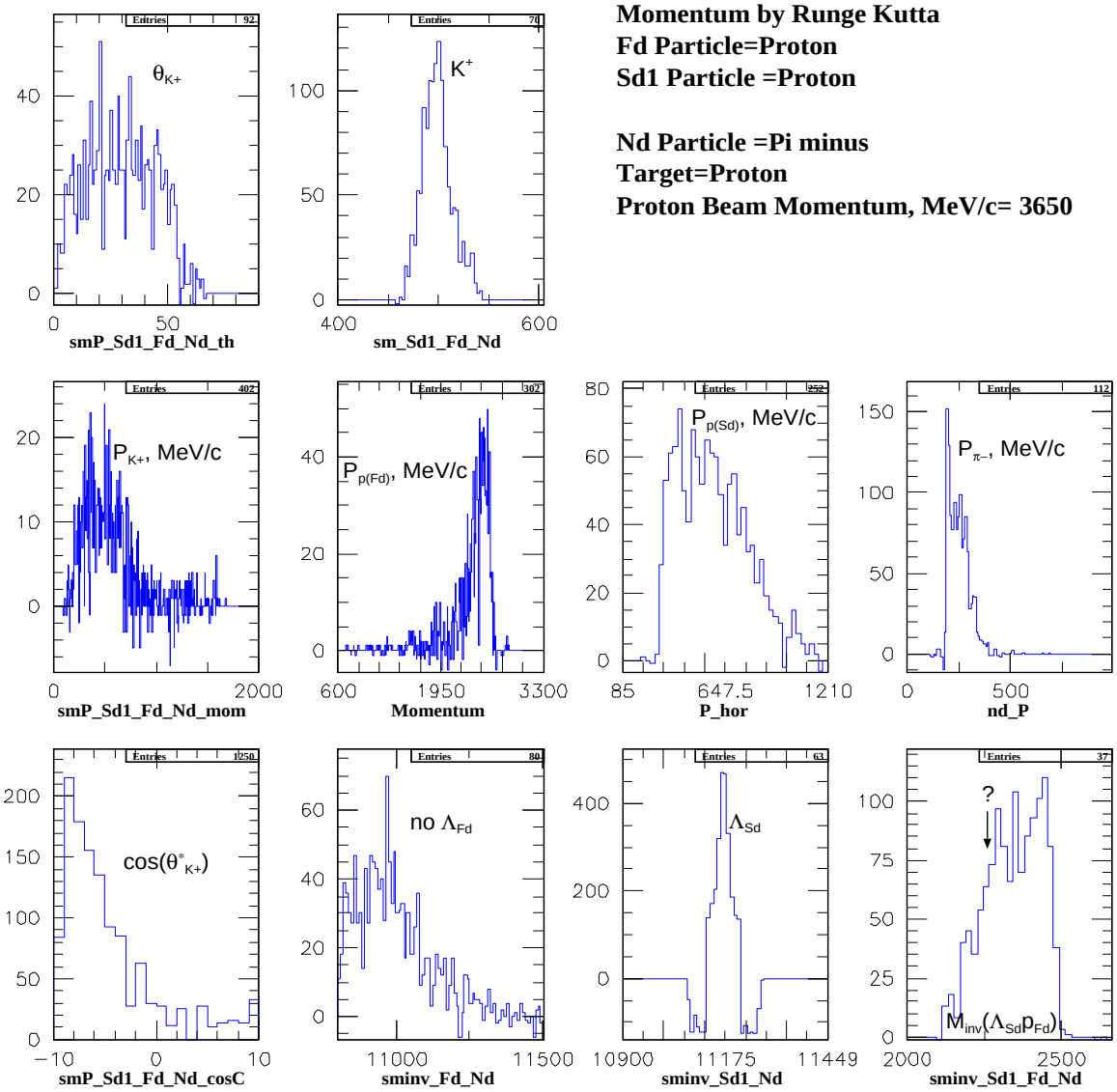
Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 1 1
ONOFF-nd-CorrMX

vTrigger = 1 1 0 1 1 2 0 2 1
nTrigger = 2 2 -1

$M(K^+)$ =497±42 MeV. Λ_{Sd} selection ($M(\Lambda_{Sd})$ = 1116±4 MeV) provides flat angular (θ_{K^+} =0–60^o) and rather narrow momentum ($|\vec{p}_{K^+}| \leq$1000 MeV/c) distributions of K^+-mesons mostly CM backward ($\cos\theta^*_{K^+} \leq 0$). π^--mesons have low momenta ($|\vec{p}_{\pi^-}| \leq$400 MeV/c).

pp-PI-.P.P (X=K+)

runs9276-77-78-79-83-87.mK455-540.Pnd30-750.Lsd1112-1121.n0-Lsd-bg.ps



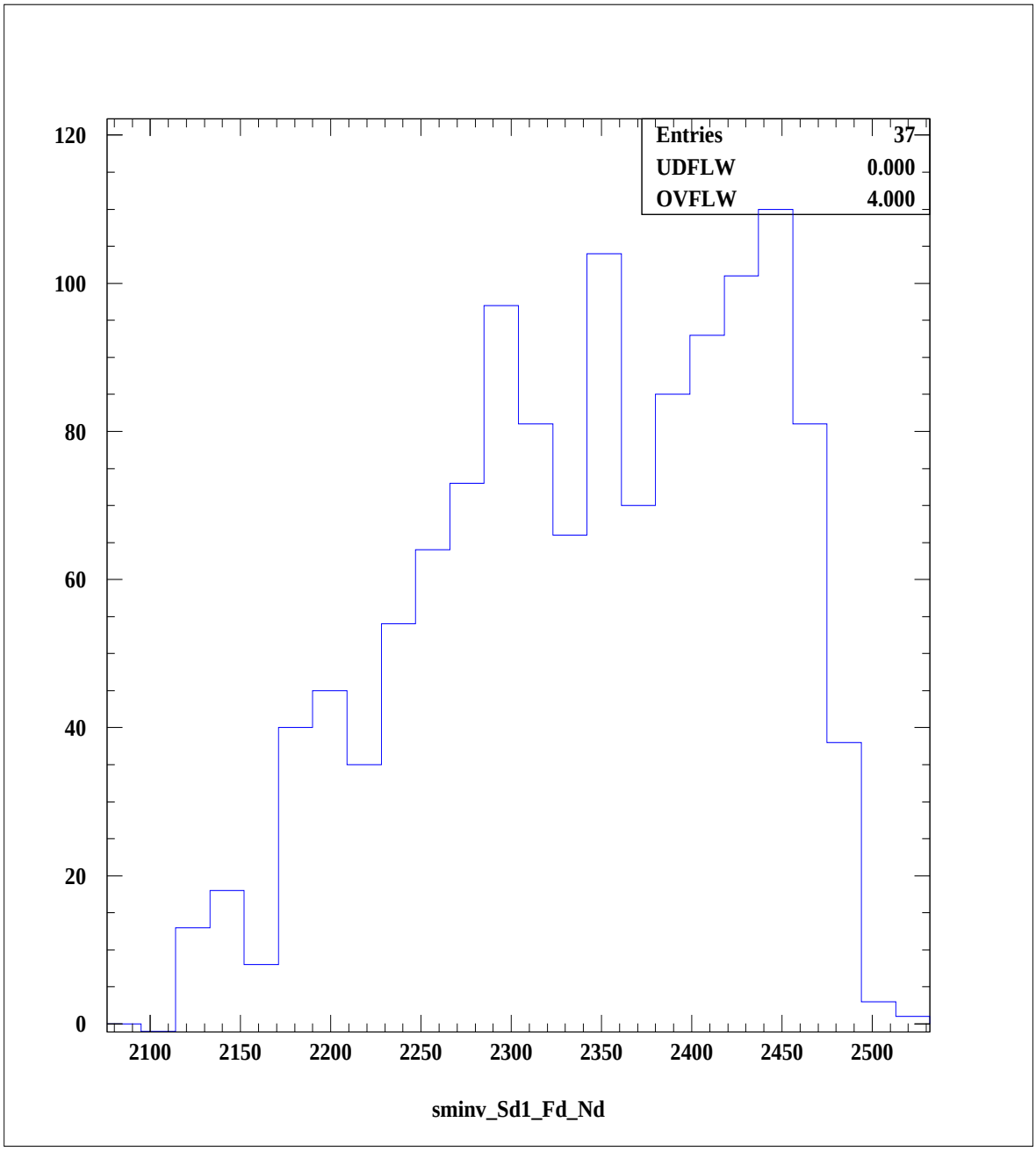
Momentum by Runge Kutta
Fd Particle=Proton
Sd1 Particle =Proton

Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3650

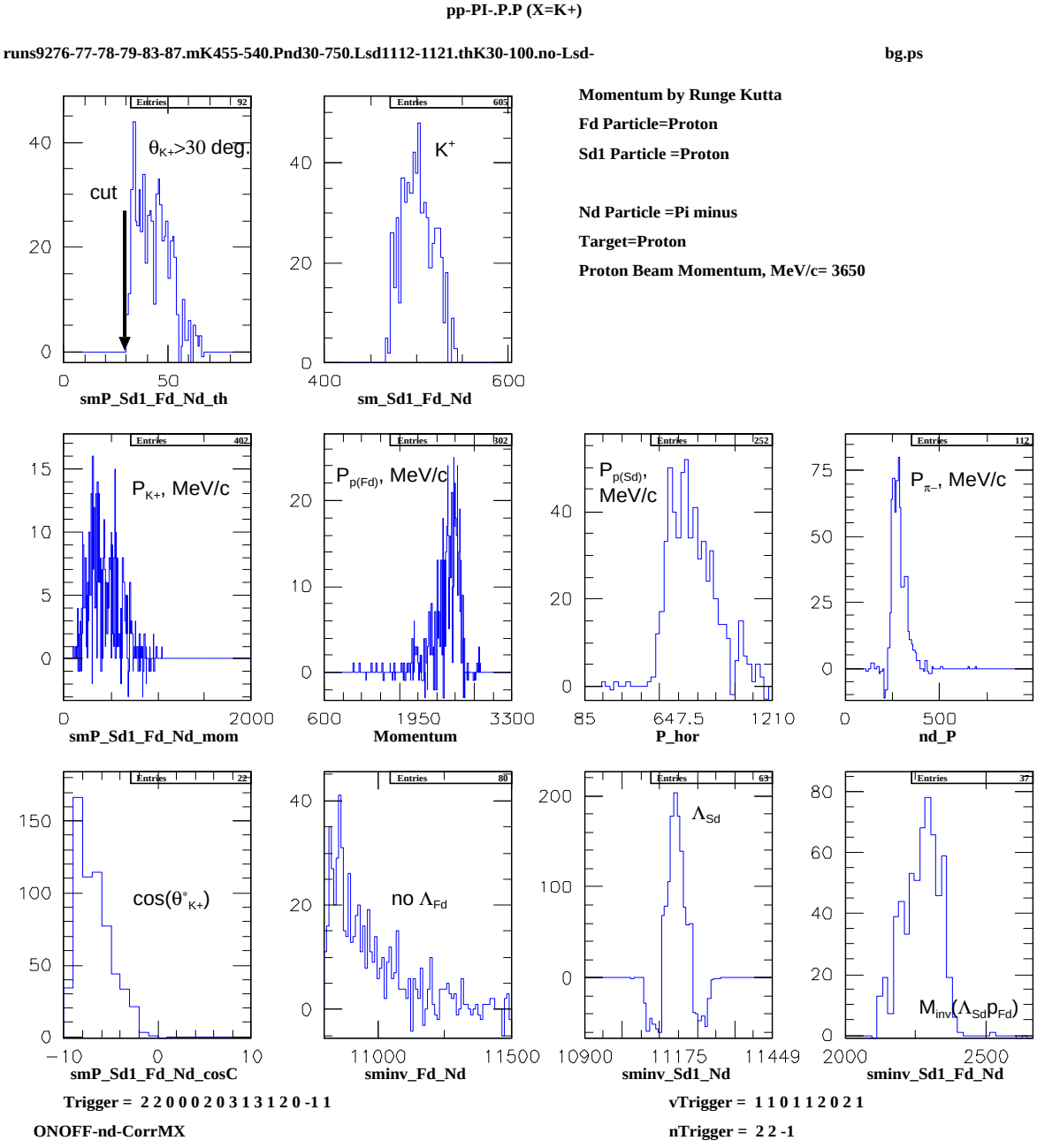
Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 -1 1
ONOFF-nd-CorrMX

vTrigger = 1 1 0 1 1 2 0 2 1
nTrigger = 2 2 -1

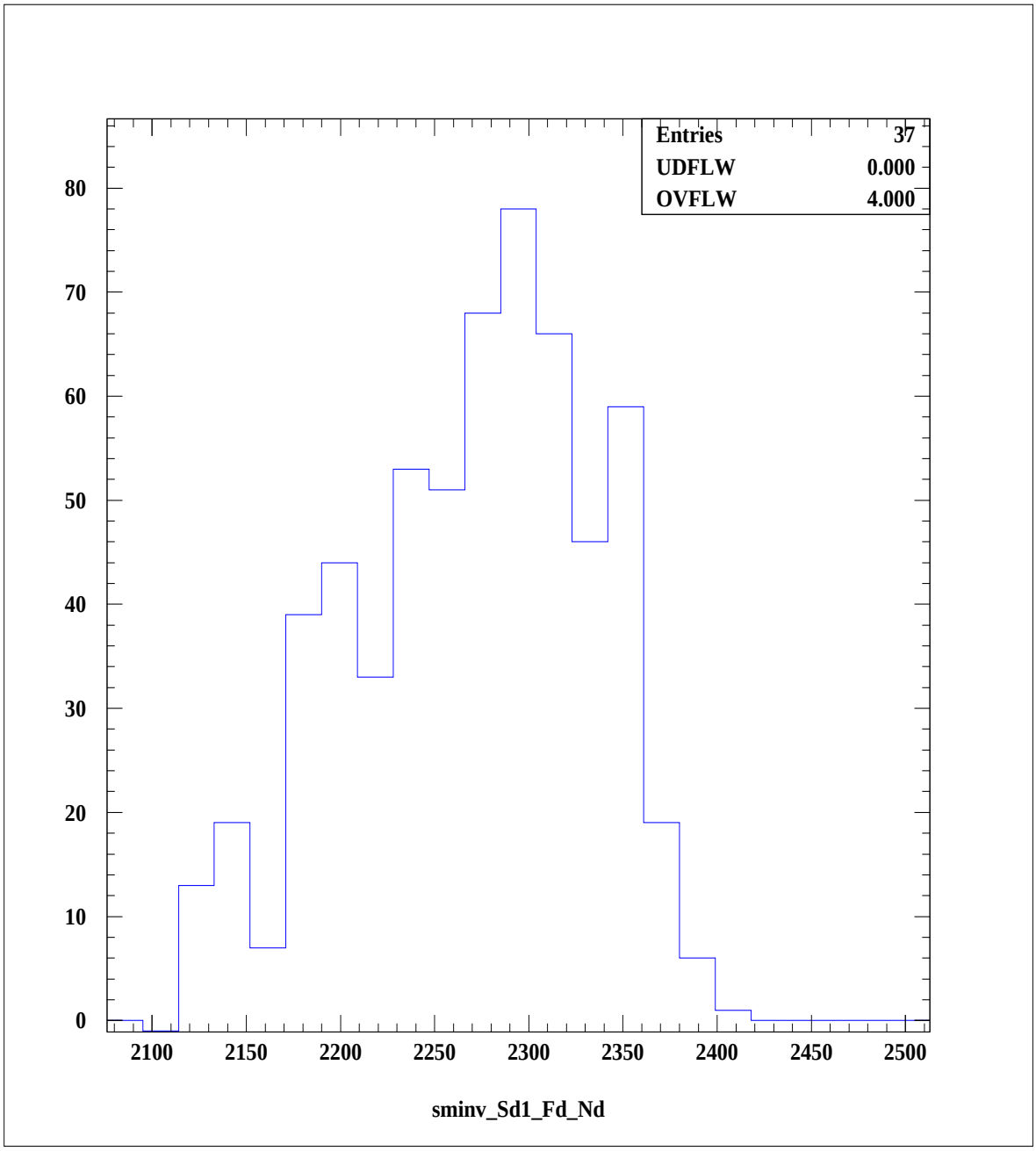
$M(K^+)$ =497±42 MeV. After Λ_{Sd} background subtraction practically clean K^+ peak is seen. $M(\Lambda_{Sd}, p_{Fd})$ spectrum is shown on the next page.



$M_(\Lambda_{Sd}, p_{Fd})$=$M_{inv}(p_{Sd}, p_{Fd}\pi^-)$
Low statistics but seems nothing is at 2260 MeV?



Selected kaons with $\theta_{K^+} > 30$ deg.

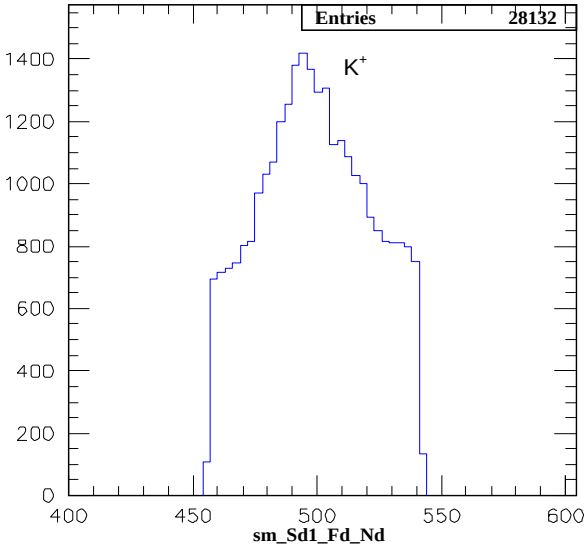


$M_(\Lambda_{Sd}, p_{Fd})$=$M_{inv}(p_{Sd}, p_{Fd}\pi^-)$ Cuts $M(K^+)$ =497±42 MeV, θ_{K^+} >30 deg., $M(\Lambda_{Sd})$ = 1116±4 MeV.

As it is seen, selecting larger K^+-mesons angles one makes $M_(\Lambda_{Sd}, p_{Fd})$ narrower with the maximum shifting to low masses!!!

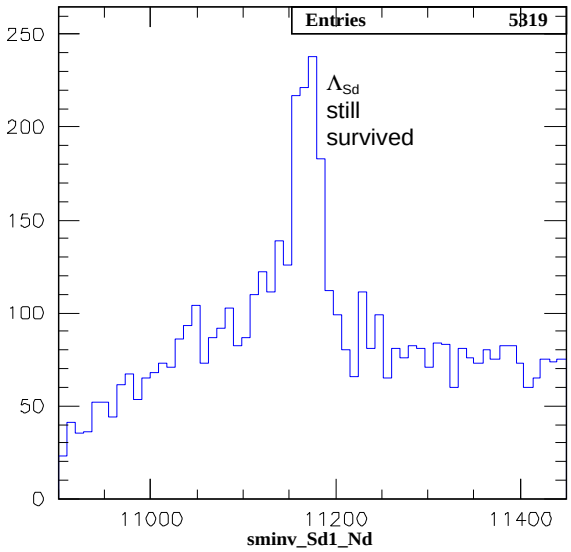
pp-PI-.P.P.(X=K+)

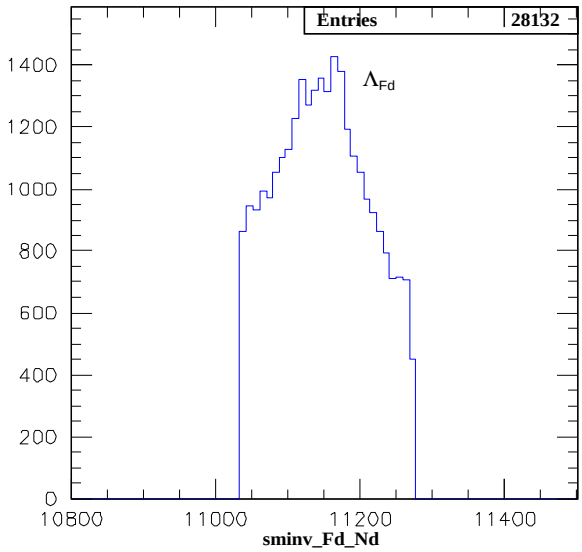
runs9276-77-78-79-83-87.mK455-540.Pnd30-750.Lf1103-1127.ps



Momentum by Runge Kutta
Fd Particle=Proton
Sd1 Particle =Proton

Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3650





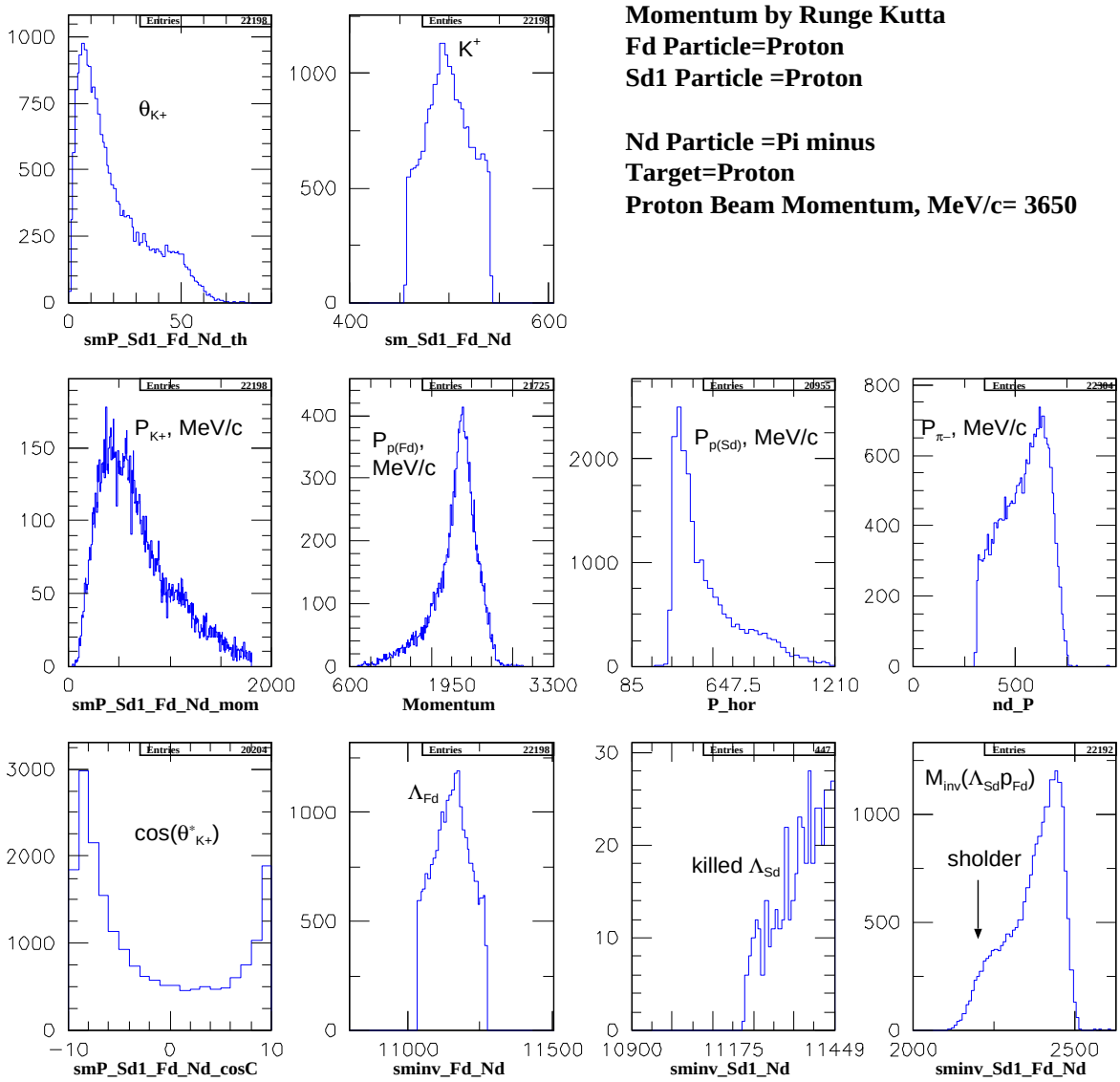
Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 1 1
ONOFF-nd-CorrMX

vTrigger = 1 1 0 1 1 2 0 2 1
nTrigger = 2 2 -1

$M(K^+)$ =497±42 MeV, $M_{inv}(p_{Fd}\pi^-)$ = 1115±12 MeV. $M(\Lambda_{Fd})$-peak is 3 times wider than $M(\Lambda_{Sd})$-peak. This is the reason why for $M(\Lambda_{Fd})$-cuts the background under the kaon peak is larger (see page 20). Wider $(\Lambda_{Fd}, \Lambda_{Sd})$ crossed over region makes survived Λ_{Sd} peak rather strong after Λ_{Fd} selection.

pp-PI-.P.P (X=K+)

runs9276-77-78-79-83-87.mK455-540.Pnd300-700.Lf1103-1127.no-Lsd.ps



Momentum by Runge Kutta
Fd Particle=Proton
Sd1 Particle =Proton

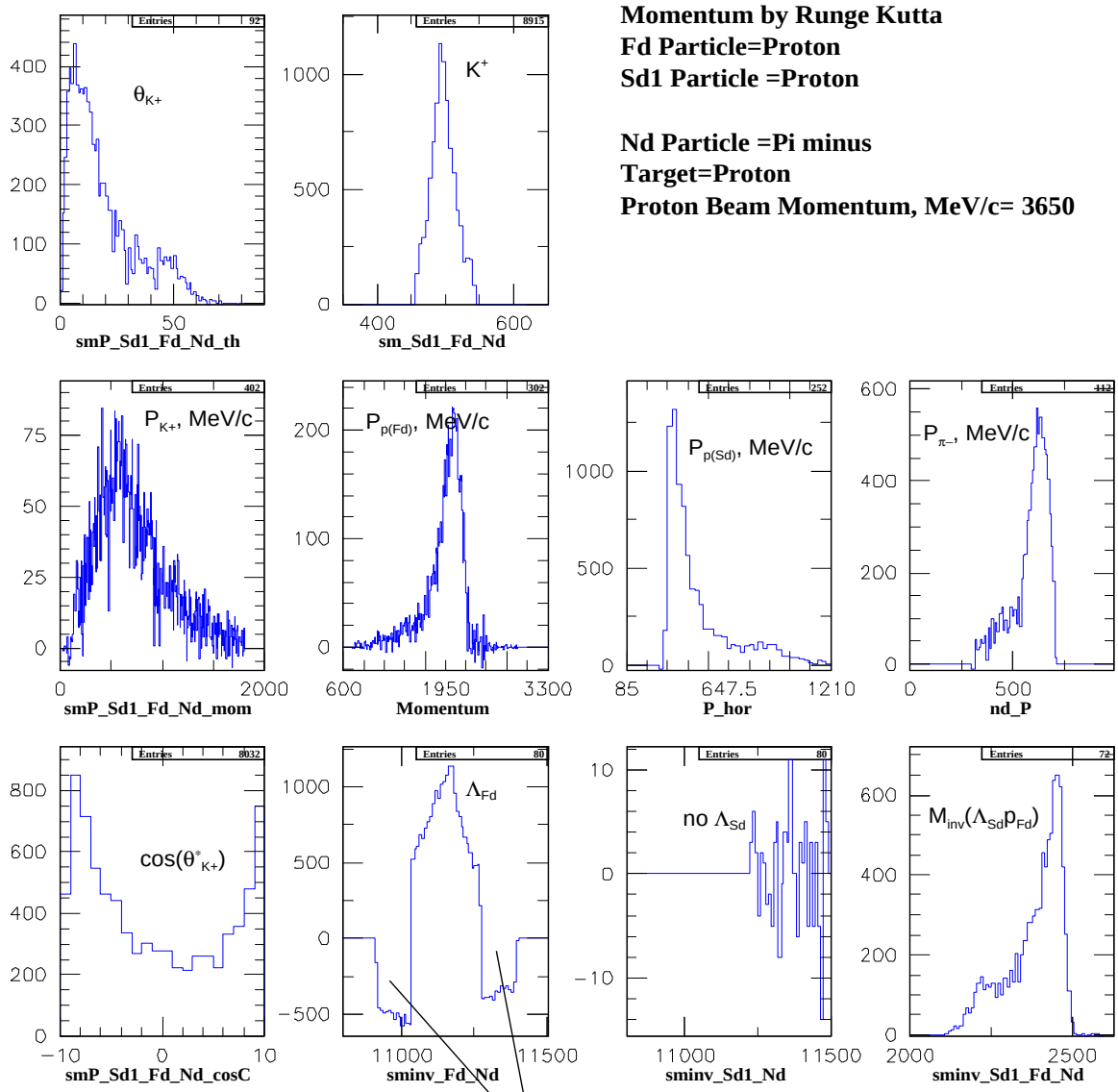
Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3650

Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 1 1 **vTrigger = 1 1 0 1 1 2 0 2 1**
ONOFF-nd-CorrMX **nTrigger = 2 2 -1**

$M(K^+)$ =497±42 MeV, $M_{inv}(p_{Fd}\pi^-)$ = 1115±12 MeV and additional cuts: $|\vec{p}_{\pi^-}|$ >300 MeV/c and $M_{inv}(p_{Sd}\pi^-)$ >1120 MeV.
A sholder is seen in $M_{inv}(p_{Sd}p_{Fd}\pi^-)$ at 2250 MeV.

pp-PI-.P.P (X=K+)

runs9276-77-78-79-83-87.mK455-540.Pnd300-700.Lf1103-1127.no-Lsd.n0-Lfd-bg



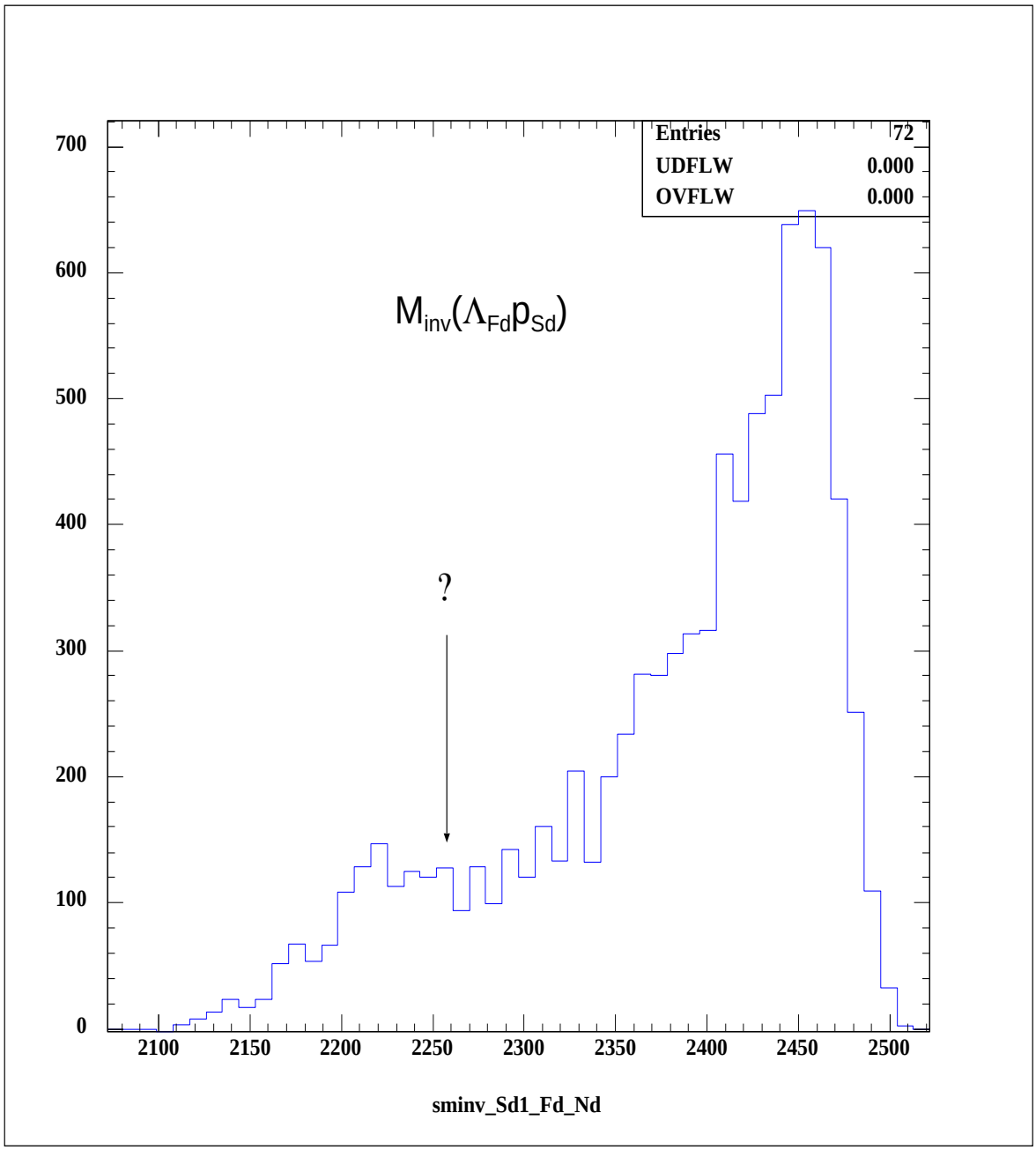
Momentum by Runge Kutta
Fd Particle=Proton
Sd1 Particle =Proton

Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3650

Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 -1 1 background subtraction **vTrigger = 1 1 0 1 1 2 0 2 1**

ONOFF-nd-CorrMX **nTrigger = 2 2 -1**

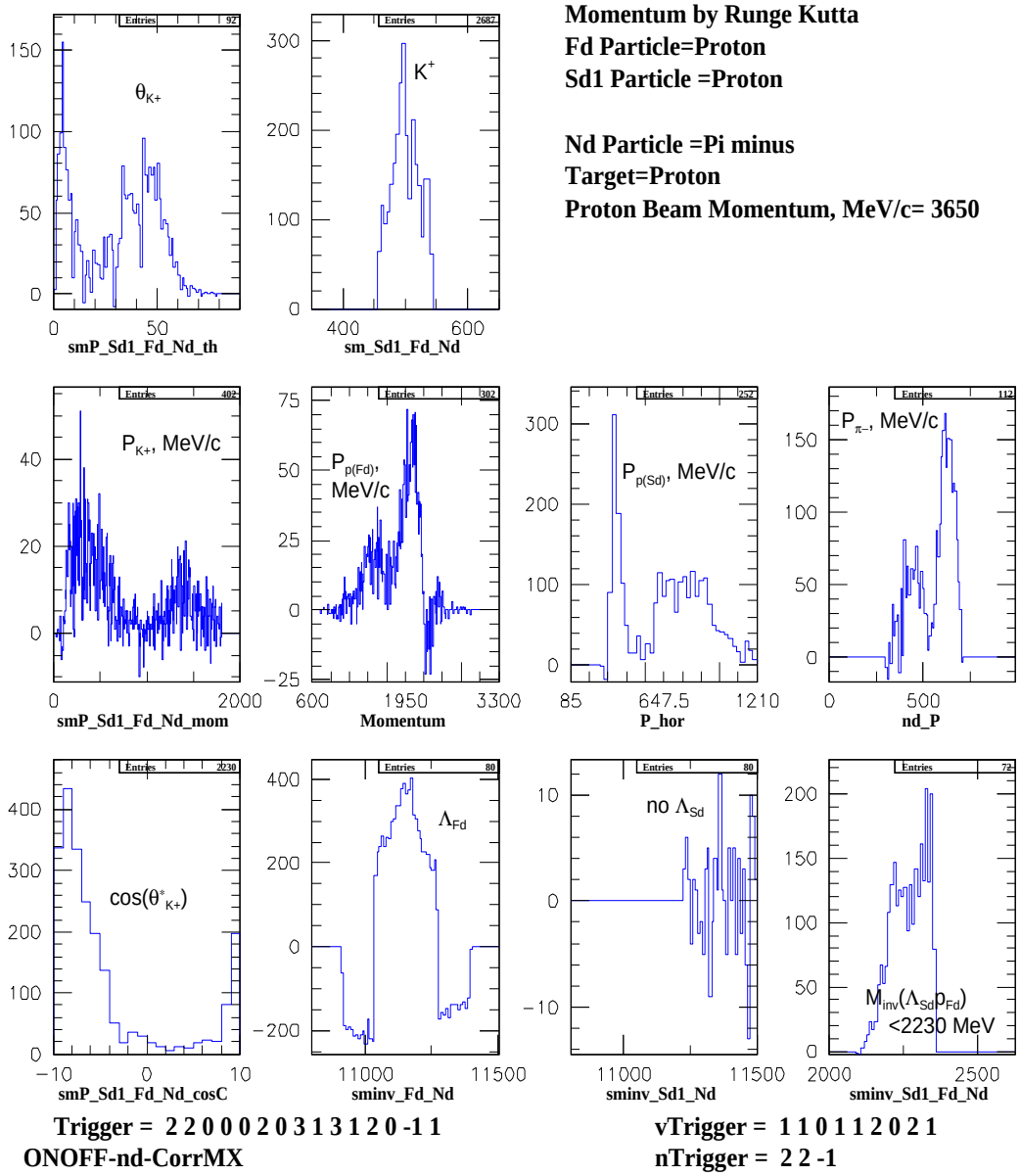
After the Λ_{Fd}-background subtraction (compare with page 27) the background under the kaon peak is practically killed.
$M_(\Lambda_{Fd}, p_{Fd})$=$M_{inv}(p_{Sd}, p_{Fd}\pi^-)$ is shown on the next page.



$M(\Lambda_{Fd}, p_{Sd})$=$M_{inv}(p_{Sd}, p_{Fd}\pi^-)$.
Cuts: $M(K^+)$ =497±42 MeV, $M_{inv}(p_{Fd}\pi^-)$ = 1115±12 MeV, Λ_{Sd} is killed, Λ_{Fd} — background is substracted.
Is it really a wide peak in the (Λ_{Fd}, p_{Sd})-mass region or is it a game of not quite correctly subtracted background?? Must not be excluded also that a correct model of K^+-production in $pp \to K^+p\Lambda$ reaction gives the same result without any additional $(p\Lambda)$-resonant productions.

pp-PI-.P.P (X=K+)

runs9276-77-78-79-83-87.mK455-540.Pnd300-700.Lf1103-1127.no-Lsd.n0-Lfd-bg. nvPIPP2100-2350.no-Lfd-bg



Momentum by Runge Kutta
Fd Particle=Proton
Sd1 Particle =Proton

Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3650

Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 -1 1
ONOFF-nd-CorrMX

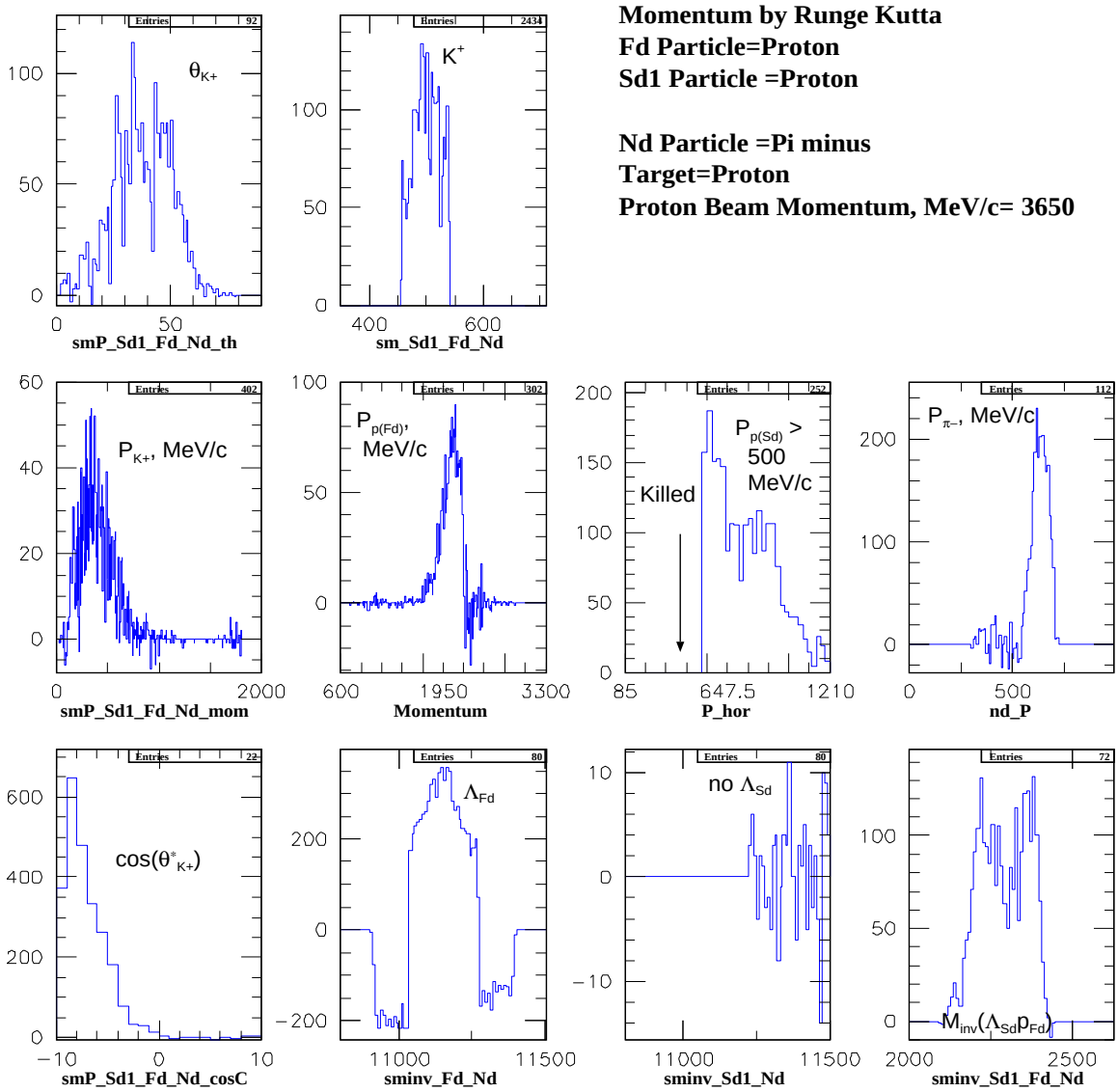
vTrigger = 1 1 0 1 1 2 0 2 1
nTrigger = 2 2 -1

In addition to the criteria used before (see page 28) the low $M(\Lambda_{Fd}, p_{Sd})$ region is selected as $M_{inv}(p_{Fd}p_{Sd}\pi^-) \leq 2350\,\mathrm{MeV}$.

Conclusion: to enrich the low $(p\Lambda)$-mass region is qute sufficient to select kaons at large angles ($\theta_{K^+} > 20\,\mathrm{deg.}$) or to select high momenta of Sd-protons $|\vec{p}_{p_{Sd}}| > 500\,\mathrm{MeV/c}$.

pp-PI-.P.P (X=K+)

runs9276-77-78-79-83-87.mK455-540.Pnd300-700.Lf1103-1127.no-Lsd.Psd500-200 0.no-Lfd-bgps



Momentum by Runge Kutta
Fd Particle=Proton
Sd1 Particle =Proton

Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3650

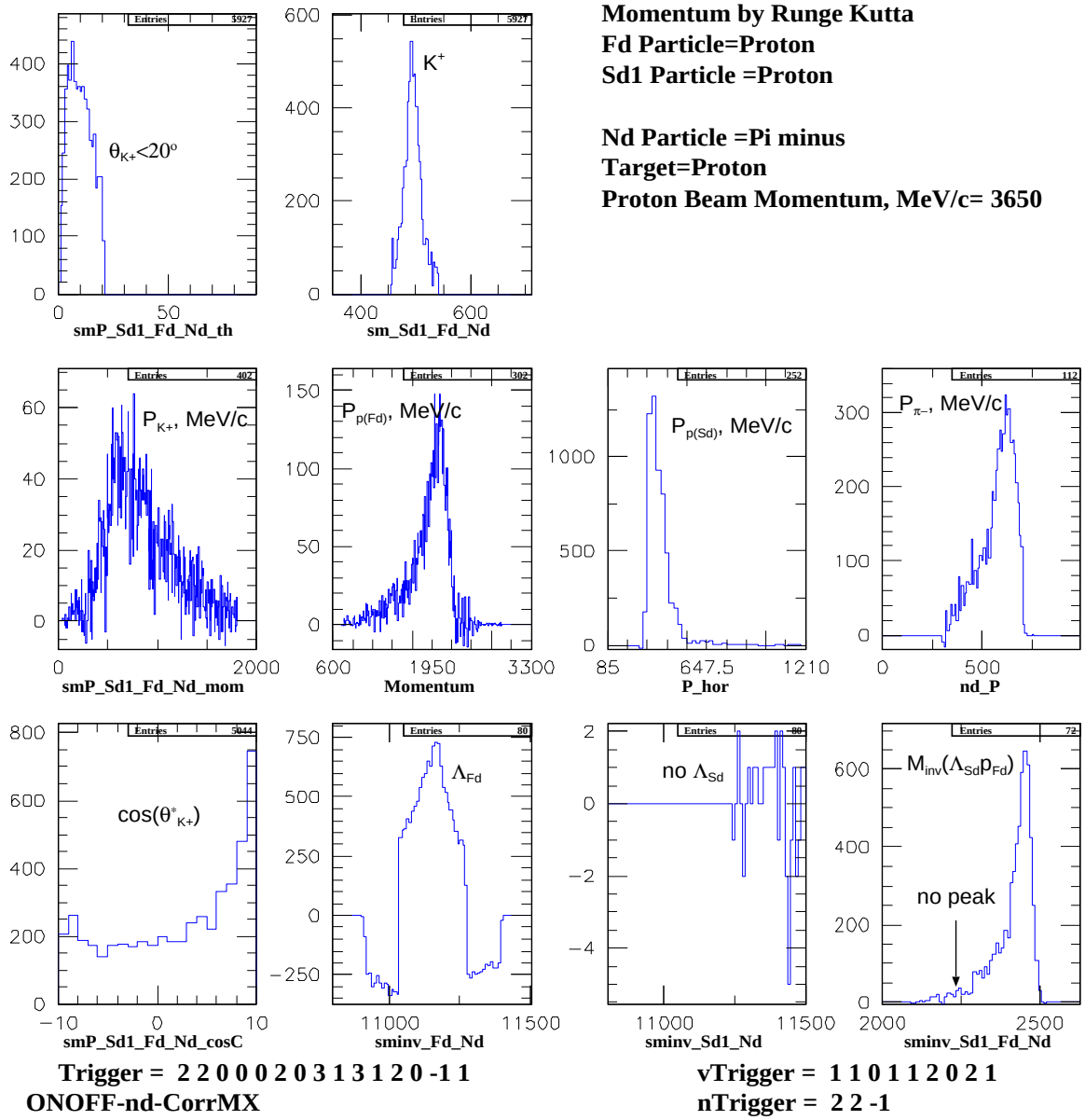
Trigger = 2 2 0 0 0 2 0 3 211 3 1 2 0 -1 1
ONOFF-nd-CorrMX

vTrigger = 1 1 0 1 1 2 0 2 1
nTrigger = 2 2 -1

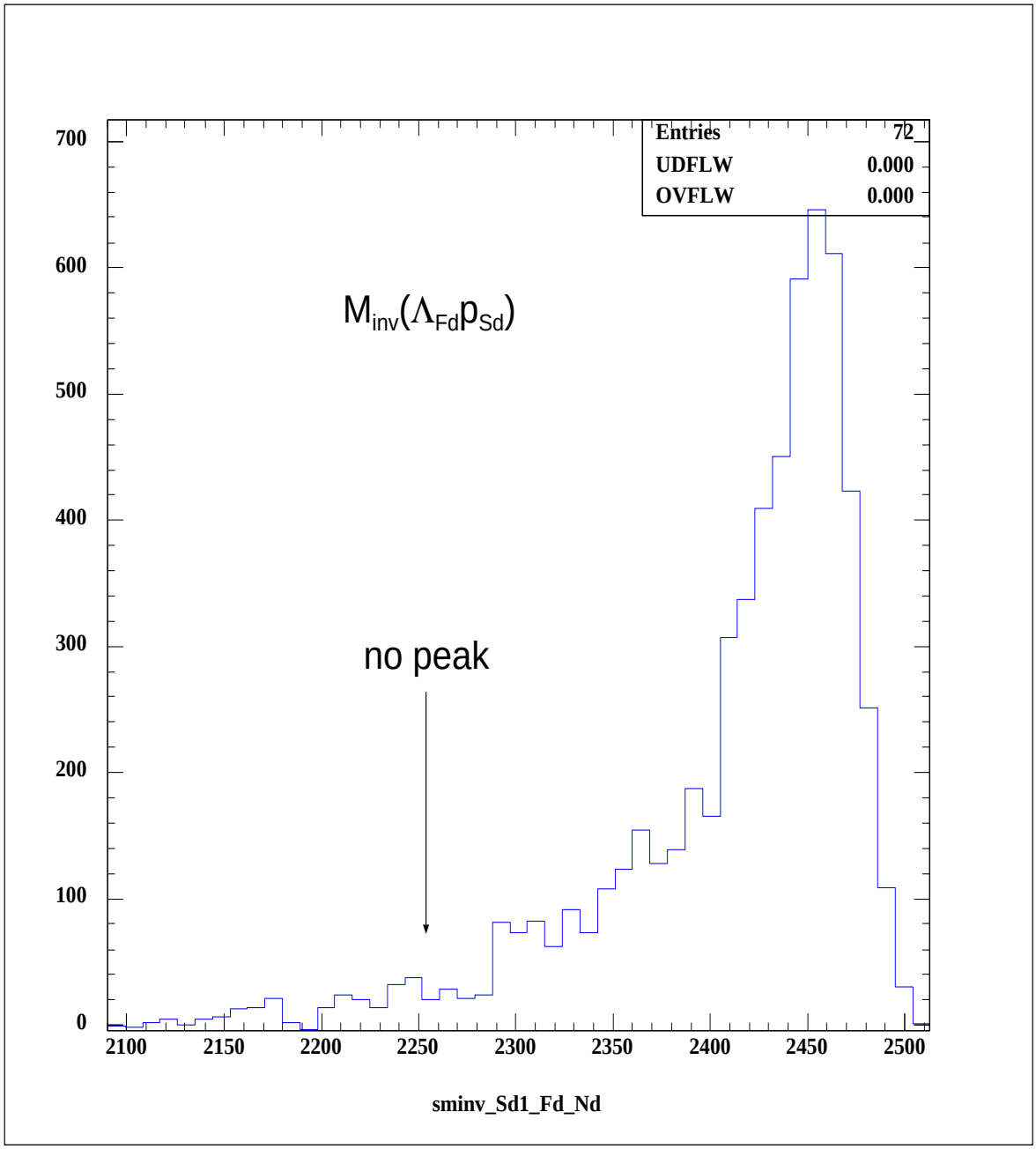
In addition to the criteria shown on the page 28 the high moments Sd protons are selected: $|\vec{p}_{pSd}| > 500\,\mathrm{MeV/c}$.
In March 2005 only 4 sidewall counters were used. The peak in $M_{inv}(p_{Fd}p_{Sd}\pi^-) = M(\Lambda_{Fd}p_{Sd})$ will be stronger if SW5 and SW6 counter are used in the future.

pp-PI-.P.P (X=K+)

runs9276-77-78-79-83-87.mK455-540.Pnd300-700.Lf1103-1127.no-Lsd.thK0-20.no -Lfd-bg.ps



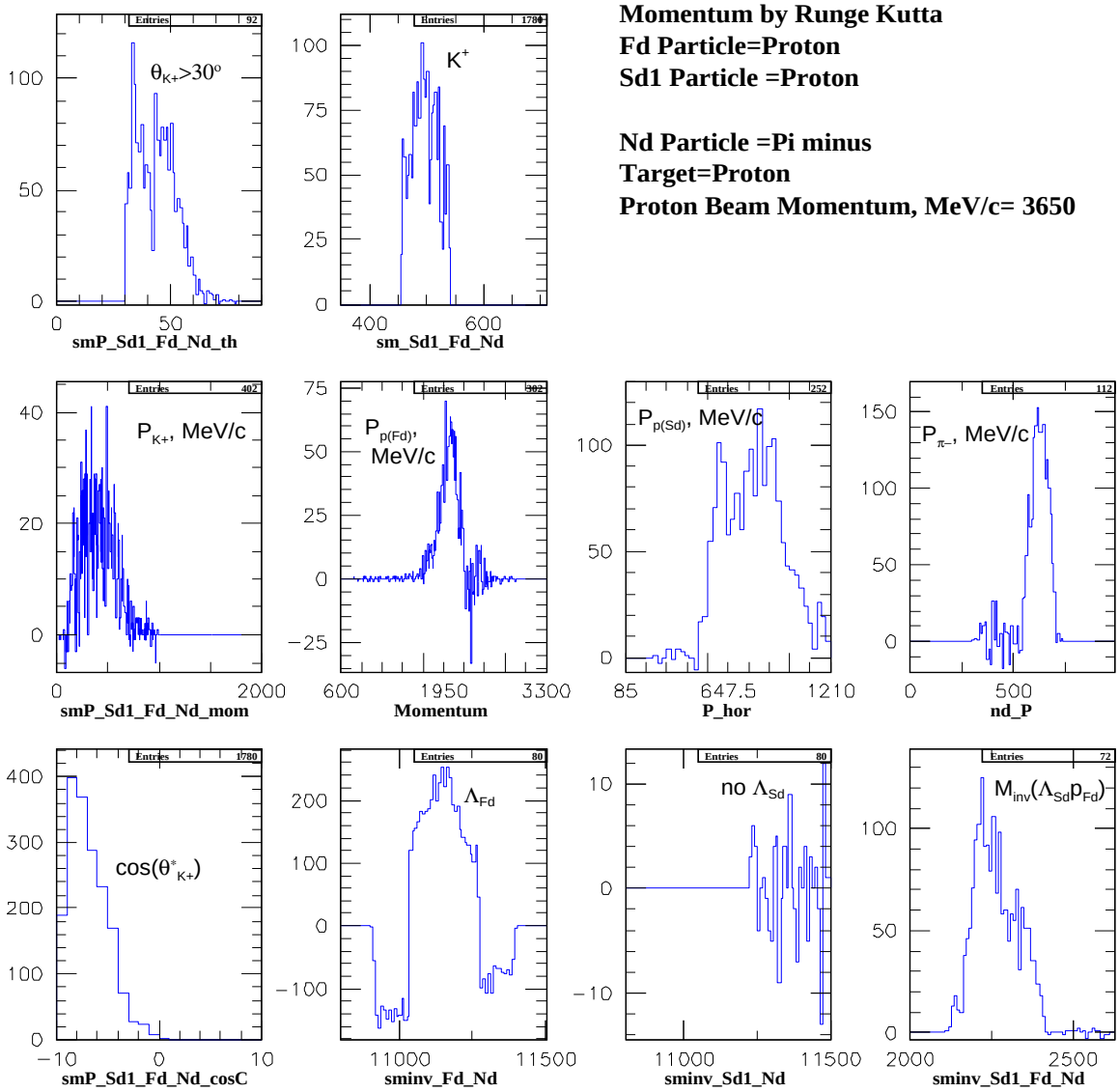
Kaons with θ_{K^+} <20 deg. are selected. This is the condition of the case when kaons are detected in Telescopes and SW (page 2–8). The enhancement at 2250 MeV dissappeared in$M_{inv}(p_{Fd}p_{Sd}\pi^-)$, see next page.



$M(K^+)$ =497±42 MeV, $M_{inv}(p_{Fd}\pi^-)$ = 1115±12 MeV. Λ_{Sd} – are killed, Λ_{Fd} – background is subtracted, θ_{K^+} <20 deg.

pp-PI-.P.P (X=K+)

runs9276-77-78-79-83-87.mK455-540.Pnd300-700.Lf1103-1127.no-Lsd.thK30-100. ps



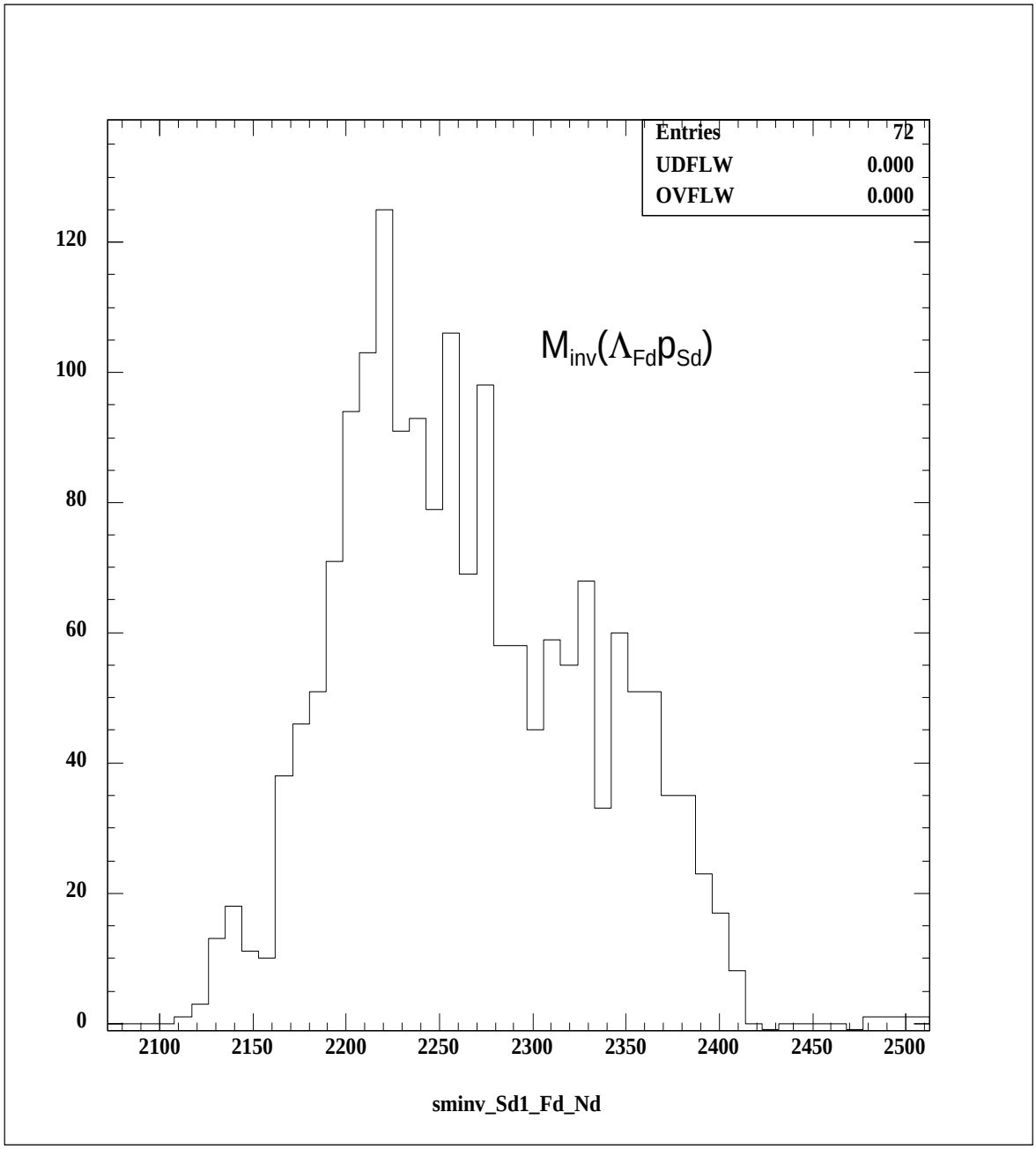
Momentum by Runge Kutta
Fd Particle=Proton
Sd1 Particle =Proton

Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3650

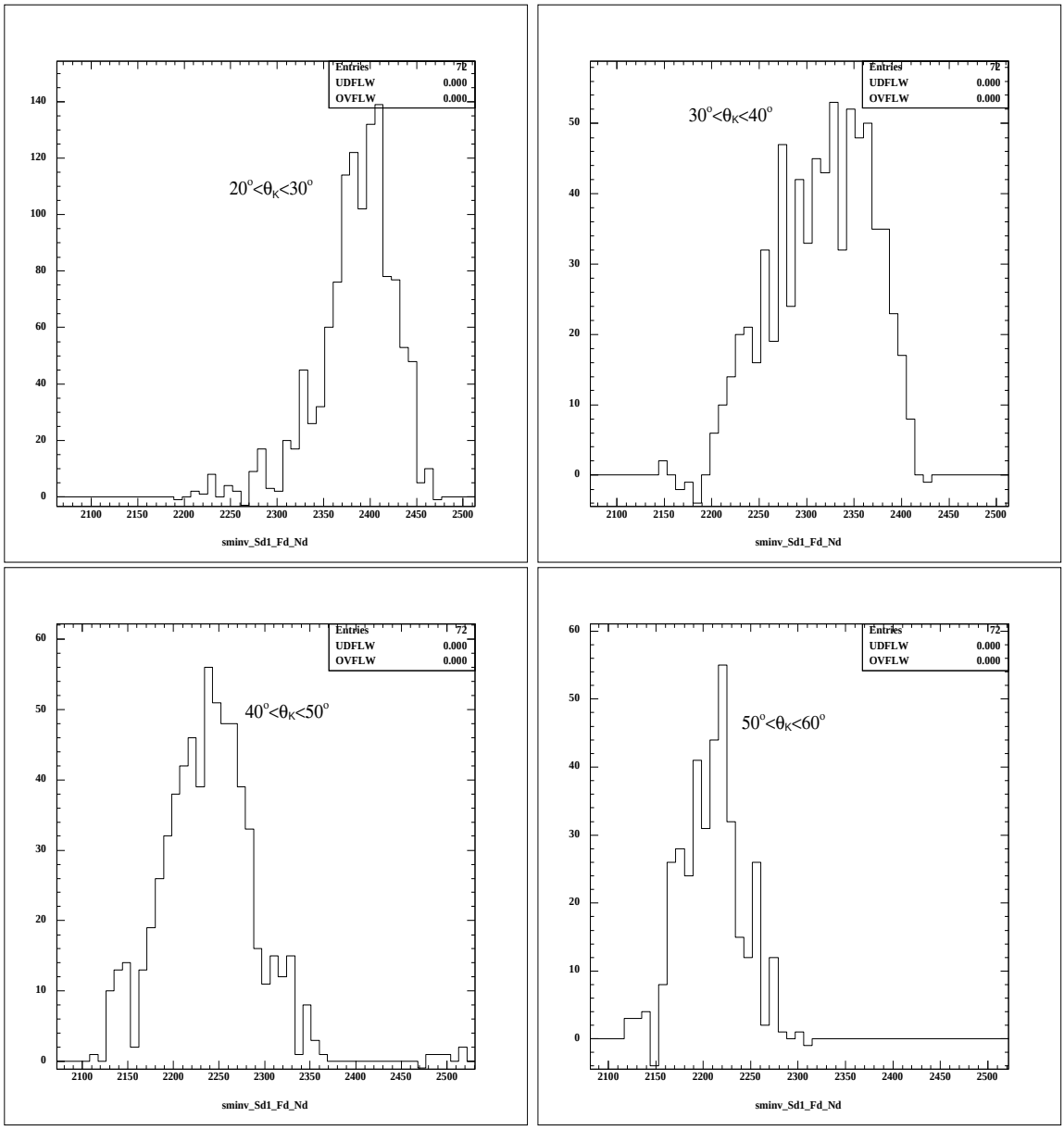
Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 -1 1
ONOFF-nd-CorrMX

vTrigger = 1 1 0 1 1 2 0 2 1
nTrigger = 2 2 -1

Kaon at large angles are selected θ_{K^+} >30 deg. → strong peak at 2250 MeV in $M(\Lambda_{Fd}, p_{Sd}) = M_{inv}(p_{Sd}p_{Fd}\pi^-)$, see next page.



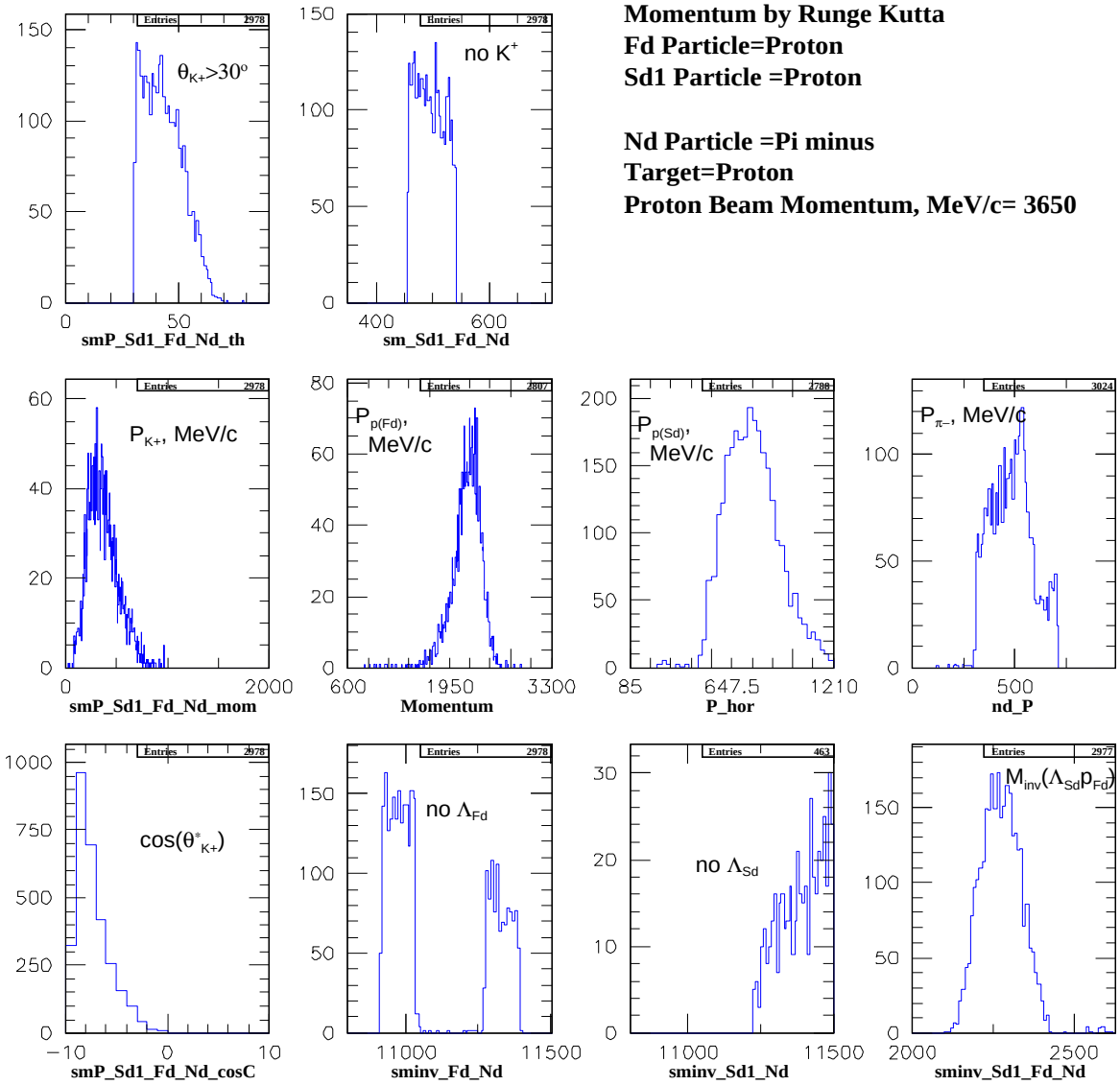
$\theta_{K^+} > 30\,\mathrm{deg.}$



Making different angular cut for K^+-mesons it is possible to have a peak of any width and at any mass in maximum!!!

pp-PI-.P.P (X=K+)

runs9276-77-78-79-83-87.no-Lambda-no-kaons



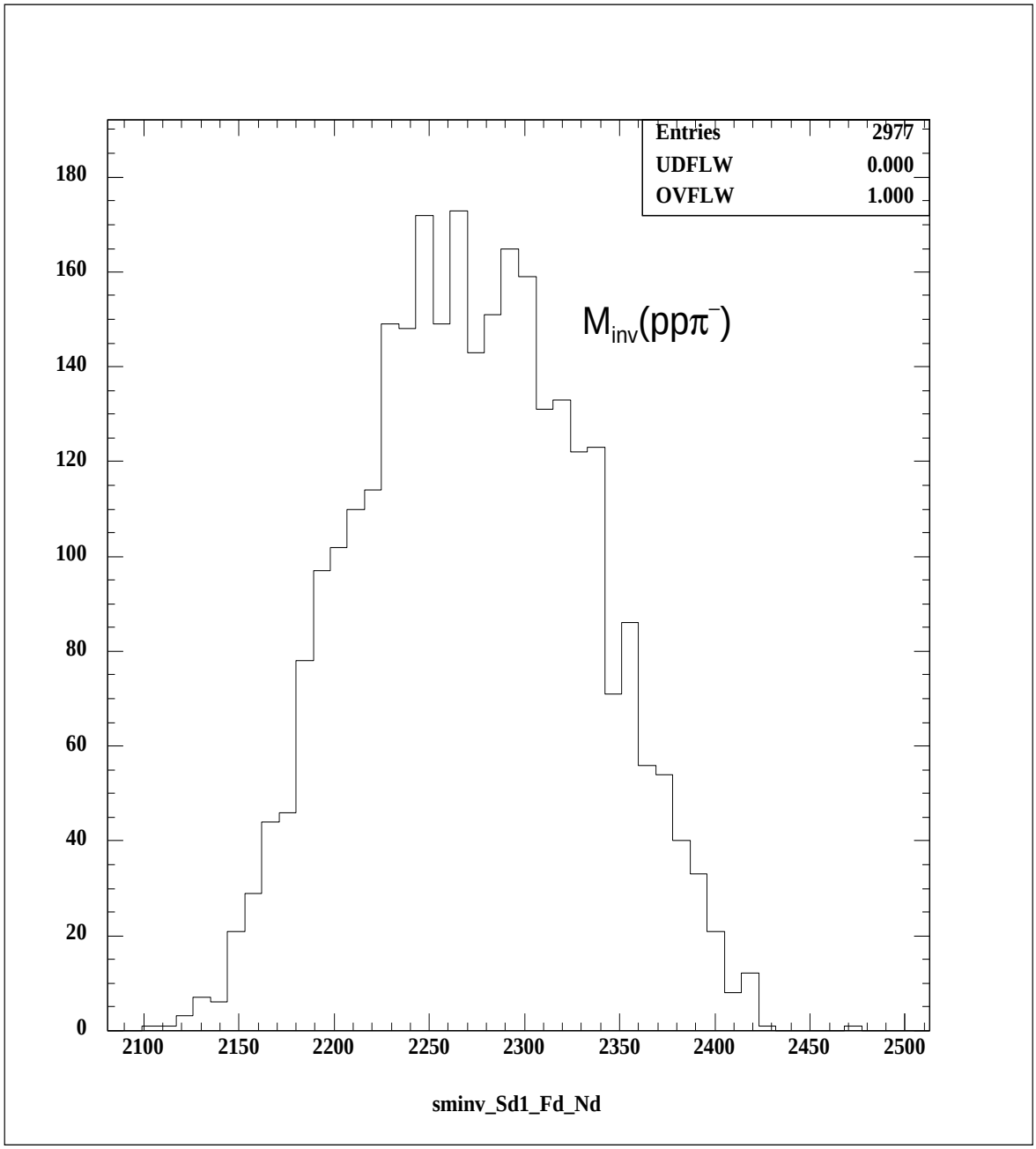
Momentum by Runge Kutta
Fd Particle=Proton
Sd1 Particle =Proton

Nd Particle =Pi minus
Target=Proton
Proton Beam Momentum, MeV/c= 3650

Trigger = 2 2 0 0 0 2 0 3 1 3 1 2 0 1 1
ONOFF-nd-CorrMX

vTrigger = 1 1 0 1 1 2 0 2 1
nTrigger = 2 2 -1

Let's take the events, which were used for Λ_{Fd} background subtraction, and select " as if kaons" at large angles $\theta_{"K"} > 30$ deg.
No kaons, no Λ_{Fd}, Λ_{Sd}, but a strong peak is seen in $M_{inv}(pp\pi^-)$ at 2260 MeV with the width of about 100 MeV .
Looks like the DISTO result. See next page.



No kaons, no Λ_{Fd}, Λ_{Sd}. Peak $M_{inv}(pp\pi^-)$ =2260 MeV, ΔM ≈100 MeV (FWHM).

Conclusion

1. Detection of K^+-meson is useless to study low (Λp)-mass region at ANKE.
2. Without kaon detection ($pp\pi^-$ coinsidences) the complete (Λp)-mass region can be seen but:
   - huge physics background,
   - not clear how correct is the procedure of this background subtraction,
   - any angular or momentum cuts are very dangerous, because a proper peak in $M_{miss}(\Lambda p)$ can be obtained even from backgound events.
3. More interesting is kaon detection in FD if the non physics background can be killed applying TOF($\pi^- K^+$) to separate kaons from protons in FD.