Weekly analysis meeting(BNL)
July 9, 2002
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1997 PNN2 Analysis.

- Finished processing all the 1997 Pass1 tapes. Pass3 ntuples for all the skims are sitting on /e949dsk/towb10/e787.

Kp2-scatter in RS

- Events were selected by tagging events with photons everywhere except in target region. All other target cuts were applied for event selection.

- The main cuts against this background : Range Stack quality cuts (RSDEDX and CHIRF)[collectively refered to as RSCT], box cut on PTOT, and the Photon Veto cut(PVCPNN2).

- 1/3 sample were analysed in this study..

- We assume that the 44 events that we have in the normalisation branch from the Kp2-scatter(in target) have a contribution from Kp2-scatter in the target as well as in Range stack; however, this background was not included in the photon veto study as the target cuts were reversed for photon veto study. The events which scatter in the range stack should be assigned the same photon veto rejection as in KP2BOX events since the pion didnot scatter in the target.

Cut	Rej. PBOX for kp2		Norm. $\overline{RSDEDX}$ or $\overline{CHIRF}$	
	KP2BOX	PNN2 R.E.BOX	KP2BOX	PNN2BOX
SETUP	8412	60	1274	18
UTCQUAL	8232	60	1243	18
RNGMOM	7934	60	1198	7
LAY14	7928	60	1197	7
COS3D	7368	51	1038	7
ZFRF	7007	51	941	7
ZUTOUT	6988	49	936	7
CHIRF	6207	34	NA	NA
RSDEDX	6052	12	NA	NA
TDCUT1	5610	12	854	6
PVCPNN2	65	2	21	0

- The SETUP cuts are RECOCUTS,PCUTS,TGCUTS,TGPVCUT and PBG cut. The second and third columns of the above table are prepared by selecting events in the Kpi2-momentum peak. The RSDEDX and CHIRF cuts were reversed in the normalisation branch.

- 6 events that surfaced in the Normalisation branch in the Kp2-scatter(RS) background study were studied using PAWPHOTO. Three events were found to have second pulse energies of about 1.4 Mev in the vertex fiber. Two events out of these three , had a gap (less than 1.5 cm) between pion fibers. The fourth event had a second pulse energy of 0.8 Mev in the vertex fiber at pion time. The fifth and the sixth events are seem to be the real pion scattering events in the Range stack. One of these events had a very large dip angle. The four events that had large second pulse energy deposition in vertex fiber are seem to be KPi2-scatter events in the target, but contaminating the reverse RSDEDX and CHIRF data sample because of the inefficiency of these cuts.
- $\epsilon_{RSCT} = 6052/6988 = 0.8661 \pm 0.004$
- $R_{RSCT} = 49/12 = 4.08 \pm 1.02$
- PV Rejection = =5610/65 = 86 ± 11
- Form two equations:

  $N_{tg} + N_{rs} = 44$

  $(1 - \epsilon_{RSCT}) \times N_{tg} + (R_{RSCT} - 1) \times N_{rs} = 6$

  $\Longrightarrow$

  $N_{rs} = 0.037 \pm 0.11$
- Therefore from the 1/3 sample the background from pion scattering in the range-stack is calculated to be:

  $N_{bck} = 3 \times (0.037 \pm 0.11)/(86 \pm 11) = 0.0013 \pm 0.0015$
- In 1996 PNN2 analysis the background from pion scattering in the range-stack was calculated to be:

  $N_{bck} = 0.007 \pm 0.006$

- Following George's suggestion, I moved the TDCUT position in the KPI2-scatter(RS) background study. However, as expected the muon contamination in this background sample is small; so there is not much change in the rejection of the RSCT cuts.

- Comment on the two events in the third column : These two events which are going to be rejected only by PNN2 momentum cut.Perhaps,these two events can be explained as the expected kpi2-scatter(in target) background events,since 1997 pnn2 analysis is expecting a 0.6083 of an event background from kpi2 scatter (in target) and putting emphasis on the fact that PNN2 momentum cut (140<Ptot<195) has a rejection of factor 2 on the tail events.However, a close examination of these two events by pawphoto didnot reveal (at least to me) that these are kpi2 scatter events. Some characteristics of the two events are:

  First event: Ptot= 207.9854Mev; ETOT=80.513 Mev; RTOT= 22.39 Tpi-Tk = 9.7 ns.

  Second event: PTOT=207.5458 Mev,ETOT=89.377 mev; rtot = 22.88 Tpi-Tk = 7.7 ns.

  One thing, I want to mention at this moment is that the first event had an extra energy of about 2.1 Mev in the kaon vertex fiber in the lowgain channel.However,for the High gain channel, we have a nice single pulse fit for this fiber.It looks like the extra energy we are seeing in the low gain channel is coming from a tail fluctuation of the CCD pulse fit(because of the bad fiber or bad fit),not from a actual second hit in that fiber.Except this , the two events look clean elsewhere.Looks like these two events are actually coming from Kpi2 decay with photon escaped detection;however,the understanding of the mechanism of the huge energy loss by these two events will be really helpful.

Cut	Rej. PBOX for kp2 KP2BOX	PNN2 R.E.BOX	PNN2 R.E.only	Norm. $\overline{RSDEDX}$ or $\overline{CHIRF}$ KP2BOX	PNN2BOX
SETUP	8412	60	206	1274	18
UTCQUAL	8232	60	199	1243	18
RNGMOM	7934	60	165	1198	7
LAY14	7928	60	165	1197	7
COS3D	7368	51	150	1038	7
ZFRF	7007	51	150	941	7
ZUTOUT	6988	49	145	936	7
TDCUT1	6464	48	105	854	6
CHIRF	5747	33	82	NA	NA
RSDEDX	5610	12	57	NA	NA
PVCPNN2	65	2	2	21	0

- $\epsilon_{RSCT} = 5610/6464 = 0.8679 \pm 0.004$
- $R_{RSCT} = 48/12 = 4.00 \pm 1.0$
- PV Rejection $= 5610/65 = 86 \pm 11$
- Form two equations:

  $N_{tg} + N_{rs} = 44$

  $(1 - \epsilon_{RSCT}) \times N_{tg} + (R_{RSCT} - 1) \times N_{rs} = 6$

  $\Longrightarrow$

  $N_{rs} = 0.0654 \pm 0.146$
- Therefore from the 1/3 sample the background from pion scattering in the range-stack is calculated to be:

  $N_{bck} = 3 \times (0.0654 \pm 0.146)/(86 \pm 11) = 0.0023 \pm 0.0022$
- In 1996 PNN2 analysis the background from pion scattering in the range-stack was calculated to be:

  $N_{bck} = 0.007 \pm 0.006$

1-beam Background..

- Single beam background can be either a kaon decay in flight or a beam pion scattering into the detector. This type of background is suppressed by requiring a delayed coincidence of the beam particle and the track particle and by high efficiency detection of beam particles in the Cerenkov Counter.

- The measurement of the rejection of the delayed coincidence was performed by tagging events in which pions entered the target and applying cuts to remove the 2-beam piscat contamination.

- Did not divide the 1 beam background in kaon entering type and pion entering type ; as 1-beam background is expected to be small.

	KP2 peak TOTAL	$> 6ns$	PNN2 box TOTAL	$> 6ns$	2 to 6ns
SKIM7 RECOCUTS TDCUT1 KCUTS PVCUTpnn1	13093		26632		
b4abm2<1.3	5501	125	15211	101	126
bw1trs	4849	24	13629	35	102
b4trs2	4727	17	13226	26	94
bhtrs	4349	16	12061	25	83
timcon	4313	10	11953	2	74
epitg	3628	10	10228	2	69
npitg	3433	10	9357	2	56
targf	3381	10	9216	0	51
dtgttp	3378	10	9207	0	50
rtdif	3358	10	9104	0	47
epimaxk	3358	10	9104	0	47
drp	3335	10	9018	0	45
phivtx	2677	9	7471	0	38
eic	2649	9	7366	0	35
tic	2649	9	7366	0	35
opsveto	2084	4	5794	0	26
tgedge	1940	4	5433	0	22
tgzfool	1620	4	4446	0	20

- Calculation of the rejection of the delayed coincidence cut at 6 ns.

- The 20 events in the 2 to 6ns window are very much clustered around the online 2ns delco cut.

1-beam background calculation..

- There are 0 events in the PNN2BOX in the normalization branch.

  The rejection of 6 ns delco is calculated to be 4445.

  $\Longrightarrow$

  The 1-beam background for the entire 1997 data set:

  $= 3 \times 1/4445 = 0.00067 \pm 0.00067$

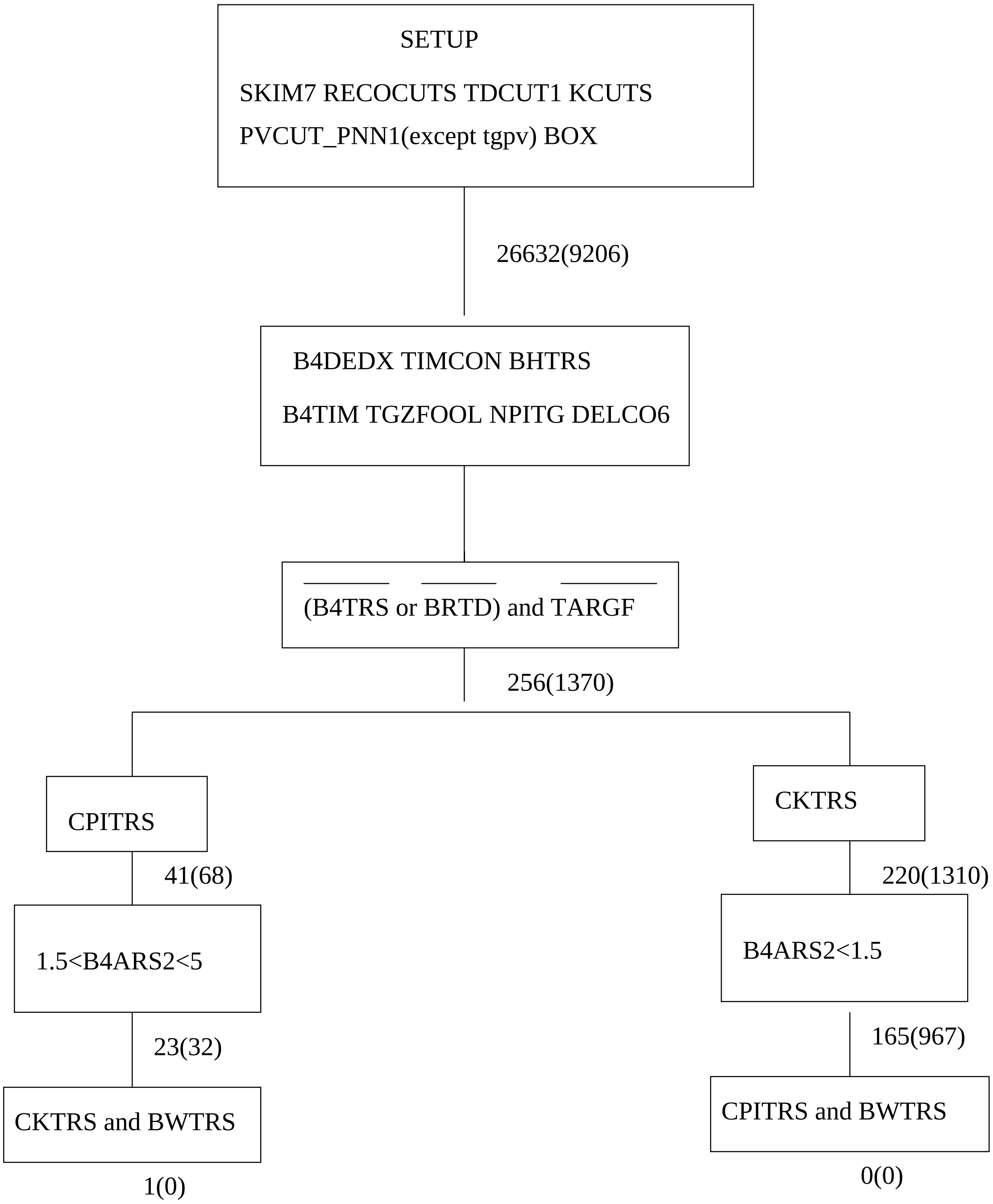
- 1996 1-beam background: 0.0009 ± 0.0009 based on 1/3
  0.0003 ± 0.0003 based on 2/3

	PNN2 BOX		KP2 box		All	
SETUP	5605	1.0000	3690	1.0000	18898	1.0000
PSCUT1	467	12.0021	1092	3.3791	2066	9.1471
B4DEDX	429	1.0886	1079	1.0120	1992	1.0371
BWTRS	412	1.0413	1066	1.0122	1937	1.0284
B4TRS	411	1.0024	1060	1.0057	1929	1.0041
B4TRS2	393	1.0458	1009	1.0505	1843	1.0467
CPITRS	388	1.0129	1006	1.0030	1831	1.0066
CKTRS	388	1.0000	1006	1.0000	1830	1.0005
BHTRS	388	1.0000	1006	1.0000	1830	1.0000
TIMCON1	386	1.0052	1002	1.0040	1808	1.0122
TIMCON2	384	1.0052	1000	1.0020	1803	1.0028
B4TIM	204	1.8824	943	1.0604	1490	1.2101
B4EKZ	65	3.1385	709	1.3300	974	1.5298
B4EKZ_IC	64	1.0156	705	1.0057	969	1.0052
TGZFOOL	63	1.0159	703	1.0028	966	1.0031
EPITG	37	1.7027	643	1.0933	816	1.1838
EPIMAXK	37	1.0000	643	1.0000	816	1.0000
TGER	37	1.0000	643	1.0000	816	1.0000
TARGF	34	1.0882	632	1.0174	794	1.0277
DTGTTP	34	1.0000	632	1.0000	794	1.0000
RTDIF	34	1.0000	626	1.0096	787	1.0089
DRP	33	1.0303	620	1.0097	776	1.0142
TGKTIM	33	1.0000	620	1.0000	776	1.0000
EIC	32	1.0312	619	1.0016	772	1.0052
TIC	32	1.0000	619	1.0000	772	1.0000
TGEDGE	31	1.0323	609	1.0164	759	1.0171
TGDEDX	27	1.1481	565	1.0779	697	1.0890
TGENR	24	1.1250	528	1.0701	643	1.0840
PIGAP	23	1.0435	528	1.0000	638	1.0078
TGLIKE	23	1.0000	528	1.0000	638	1.0000
TGB4	20	1.1500	503	1.0497	598	1.0669
PHIVTX	17	1.1765	482	1.0436	569	1.0510
OPSVETO	11	1.5455	353	1.3654	424	1.3420
CHI567	9	1.2222	281	1.2562	335	1.2657
NPITG	9	1.0000	281	1.0000	335	1.0000
VERRNG	6	1.5000	261	1.0766	312	1.0737
CHI5MAX	6	1.0000	253	1.0316	304	1.0263
ANGLI	6	1.0000	253	1.0000	304	1.0000
ALLKFIT	6	1.0000	252	1.0040	302	1.0066
TPICS	6	1.0000	252	1.0000	302	1.0000
KIC	6	1.0000	252	1.0000	302	1.0000
EPIONK	6	1.0000	246	1.0244	295	1.0237
PBG	5	1.2000	178	1.3820	214	1.3785
TGPVCUT	4	1.2500	142	1.2535	172	1.2442
B4TD	4	1.0000	141	1.0071	171	1.0058
CCDPUL	1	4.0000	93	1.5161	116	1.4741
TIMKF	0	1.0000	87	1.0000	108	1.0000

Table 1: Normalisation branch; The SETUP cuts are the final PV cuts except TGPVCUT and the reversed delayed coincidence cut of 6 ns; this is in addition to the setup cuts for the rejection

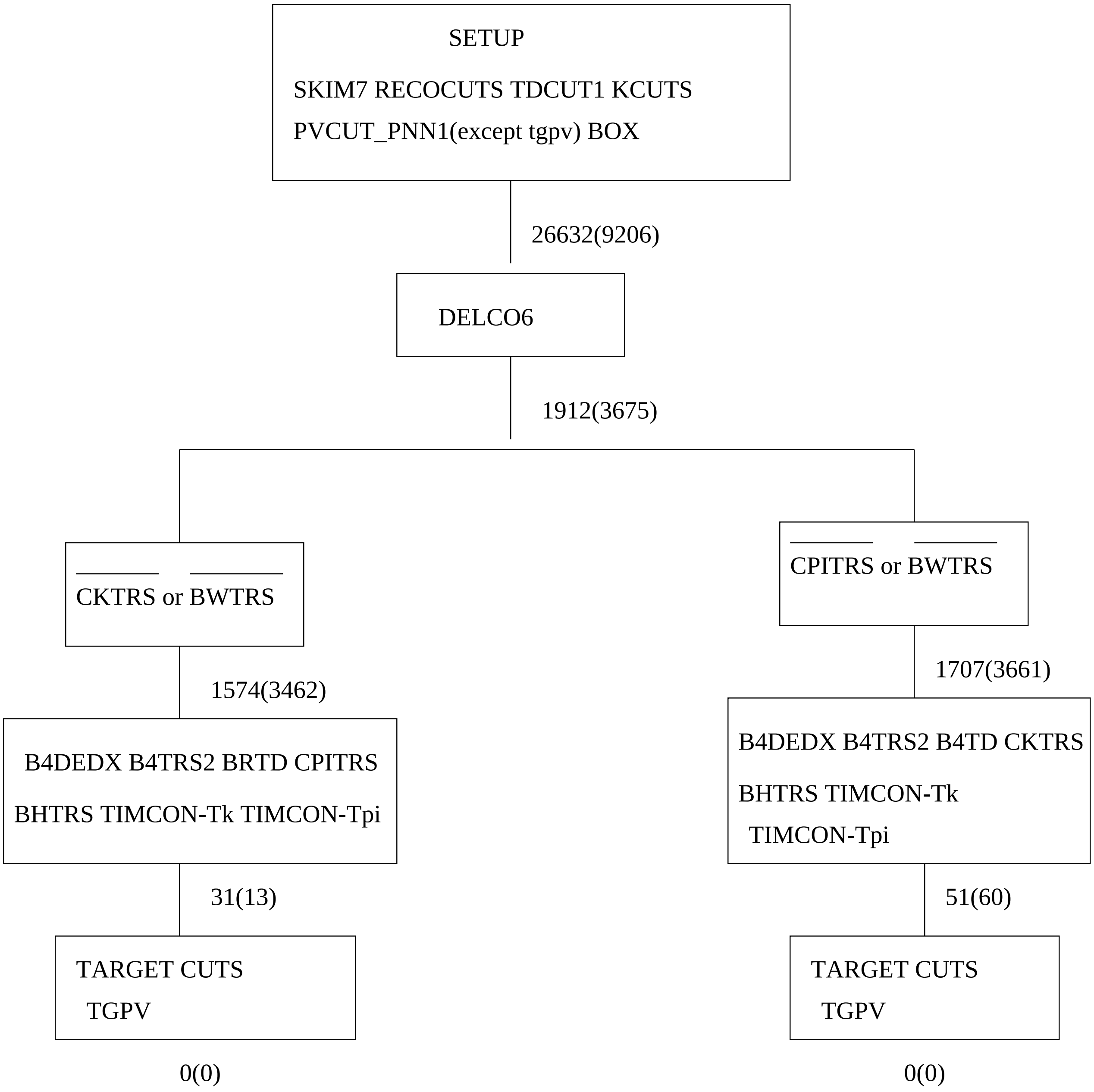
A)2 beam background study for PNN2(1997) analysis:(1/3 Sample)

1)Rejection Branch:



A)2 beam background study for PNN2(1997) analysis:(1/3 Sample)

1)Normalization Branch:



- The rejection of K-K branch = 23 (based on one event)

  The rejection of K-P branch = 165 (based on 0 event)

  No events were left in both the K-K and K-P normalisation branches. Therefore the 2-beam background is calculated to be:

  $N_{kk} = 3 \times (1/23) \times (0.569/0.82) = 0.091 \pm 0.091$

  $N_{kp} = 3 \times (1/165) \times (0.569/0.82) = 0.013 \pm 0.013$

- In this background estimate we used the PNN1 photon veto cuts (with an acceptance of 0.82), PNN2 photon veto cut is much tighter with an acceptance of 0.569.

- The above background estimate reveals that the 2-beam background (both K-K and K-P types) is a factor of 2 higher than it was calculated to be in 1996 PNN2 analysis. This could be due to statistics or a combined affect of statistics and rate(did we run in 1997 at higher rate as compared to 1996?)

- The one event that surfaced in the K-K rejection branch was examined with PAWPHOTO. A close examination of this event reveals that this is an I-counter decay and one of the non-vertex fiber recorded 0.4 Mev of extra energy at pion time.

Time required for CCDPULSE fitting:fitting only the K-fibers

- 6067 events were analysed from skim3 data (pass1) with both CCDPUL fit turn on and off. CCDPUL fit turn off means all the checks like checking for reliability of a fiber, checking for overflow, checking for timing (uncertainty in timing, too far from 0), reading tt shape files etc were turned off.

  With CCDPUL fit turn on:

  CPU time required to analyze 6067 events = 16523.18 sec.

  CPU time/event = 2.72 sec/event.

  With CCDPUL fit turn off:

  CPU time required to analyze 6067 events = 8080.44 sec.

  CPU time/event = 1.33 sec/event.

  $\Longrightarrow$ Time required to fit CCDPUL for an event = 1.4 sec. (assuming that we are fitting only the kaon fibers)