

Experiment 949-PNN2
Technical Note No. xxx Single Cut Failure Benji Lewis

Abstract

1 Introduction

2 Implantation

- Protect against observing inside of box.

Do test run(s) on a sample with an inverted cut (do not include the inverted cut in the cut list).

- Study will never include cuts that may be removed, such as *ev5*, *chi5max*.

Need to obtain this list.

- Initial study not consider cuts that have a high chance of being changed soon or later, such as *ccd pul*.

Need to obtain this list.

- Only consider the loosest cuts. i.e. Big & Small boxes.

TDNN

PNN2-Box

Photon-Veto

DELCO

CHI567

UTCqual

- Grouping highly correlated hits. i.e. an event fails only 3 highly correlated cuts then consider this as a 1 cut failure.

- Setup cuts

Bad_Run

SKIM(5) or SKIM(6) or SKIM(7) for 1/3 and SKIM(1) or SKIM(2) or SKIM(3) for 2/3 sample.

2.1 Cut List & Grouping of Cuts

Grouping cuts such that if any combination of a group will only count as a one cut failure will yield a larger set of one-cut failure events than a basic one-cut failure study, as was done in E787-PNN2. We have decided to group the cuts into 13 groups. 6 of these groups are single cuts (not grouped), 3 groups are groups of two or three cuts, the other groups are TD cuts, Kinematic cuts, Beam cuts, and Other cuts. The list of all cuts used are shown in the following tables.

Cut Groups	
Cut name	additional info
$PNN2Box_{loose}$	Loose version (E949 box)
PV(no AD, no TG)	Loose version
PV(AD)	
DELCO-3	Loose Version. delc+DELO3
B4EKZ	
TGZfool	
Extra Target Energy	see Table 2
Energy in Kaon fibers	see Table 2
Target/IC	see Table 2
TD cuts	see Table 3
Kinematics	see Table 4
Beam	see Table 5
Other	TG cuts, see Table 6

Table 1: Cut Groups used in 1 and 2 cut failure studies.

Small Groups	
Cut name	additional info
$TGPV_{loose}$ OPSveto	Extra energy in TG due to other particles
CCDPUL EPIONK TIMKF	Energy under the Kaon related.
TGCEO KIC	Pathological beam events entering thru IC.

Table 2: Cut Groups used in 1 and 2 cut failure studies.

TD cuts	
Cut name	additional info
IPIflg	
ELveto	
TDFool	
$TDVar_{nn_{loose}}$	
RSHEX	
RSHEX2	

Table 3: Note that *ev5* is not included in the loose version of TD cuts.

Kinematic Cuts	
Cut name	additional info
cos3d	
zfrf	
zutout	
UTCqual	
TIC	
EIC	
layv4	$5 \geq layv4 \geq 19$
icodel14	Found RSSC hit.
LAYER14	layv4.eq.14.and.dzutsc14 _i -99. (lay 14 stop and used z info in UTC).
RngMom	
prrf	prrf1,prrfz
RSdEdX	rsdedxcl,rsdedxmax,rslike

Table 4: Cut Groups used in 1 and 2 cut failure studies.

Beam Cuts	
Cut name	additional info
BWtrs	
CKtrs	
CKtail	
CPItrs	
CPItail	
B4dEdX	
B4trs	
B4ccd	
timcon	

Table 5: Cut Groups used in 1 and 2 cut failure studies.

Other TG cuts	
Cut name	additional info
TGqualt	
npitg	
epitg	
epimax	
TGer	
targf	
dtgttp	
rtdif	
drp	
TGKtim	
TGedge	
TGdEdX	rtghi,etghi,tgdedx1,tgdedx2
TGenr	
pigap	
TGlike	tglike1,tglike2
TGB4	tgdb4,tgdb4tip,tgdvxtip,tgdvxpi
PhiVtx	
chi567	Zhe's loose version
chi5max	
verrng	
angli	
TGfitallK	
tpics	PNN2, st.dev of energy weighted TG-fiber pion times
TGtcon	cut on Kaon timing (energy dependent)
B4etcon	ADC/CCD Energy and Time consistency.

Table 6: eic,tic not belong here?

Other pathological cuts?	
Cut name	additional info
upvtrs	
rvtrs	

PASS1 & Pass 2 Cuts	
Cut name	additional info
BADRUN	
TRIGGER	
Lev1.1	
Lev1.2	
RD_TRK	
TRKTIM	
TARGET	
PSCUT	
TGCUT	
STLAY	
UTC	
RDUTM	
BAD_STC	
FITPI	
PDC	
TDCUT	
PVCUT	

Table 7: Cut applied to all events as setup cuts

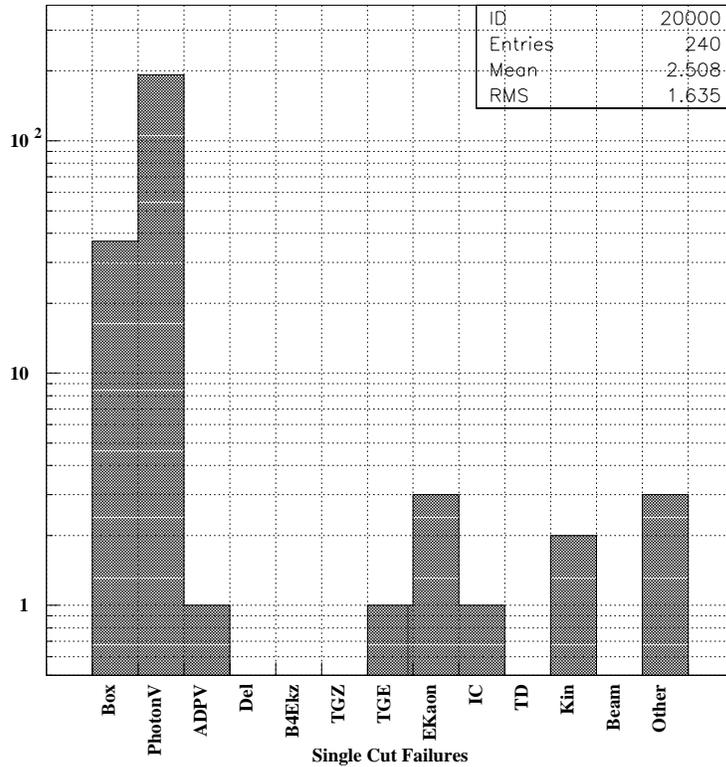


Figure 1: Distribution of single cut failures.

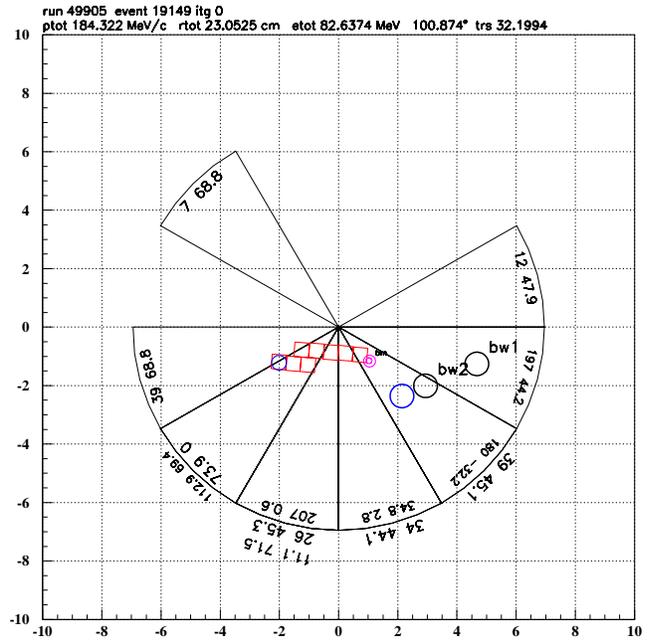
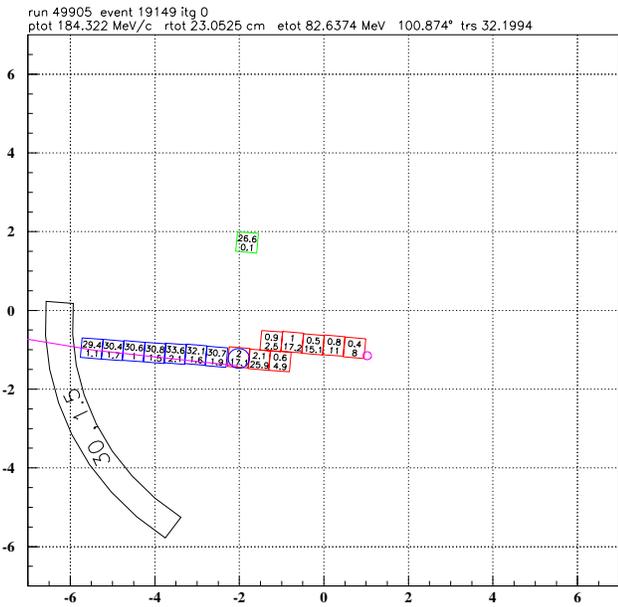
3 Results

There were 240 single cut failures observed in the 1/3 data (processed from skimmed data on disk), see Fig. 1. There are 11 events which fail groups other than Box and Photon-Veto.

4 ADPV event

Event 19149 from Run 49905 fails only the ADPV. It was determined that CCDPUL should have failed this event as there is a large second pulse in a kaon fiber, as shown in Fig. 2. The energy of the second pulse is at least half of the total energy in the fiber. Making the pion have an energy of ≈ 8 MeV which is much larger than the CCPUL threshold. Therefore, this event is in fact a two cut failure.

Joss Ives analyzed why this event was not removed by CCPUL and ???



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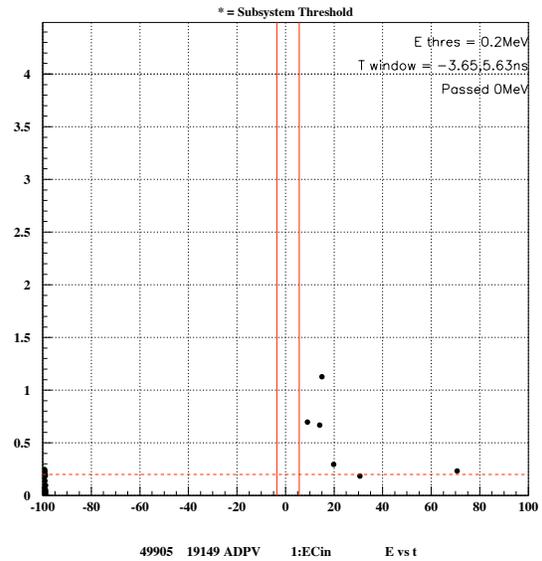
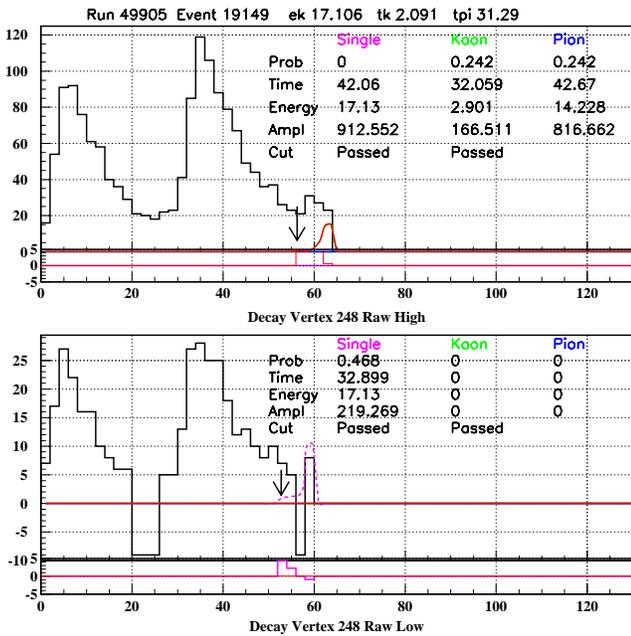


Figure 2: Event reconstruction of ADPV 1-cut failure. The CCD pulse fit in the decay vertex fiber is shown in the lower left. The EC inner-ring hits are shown in the lower right.

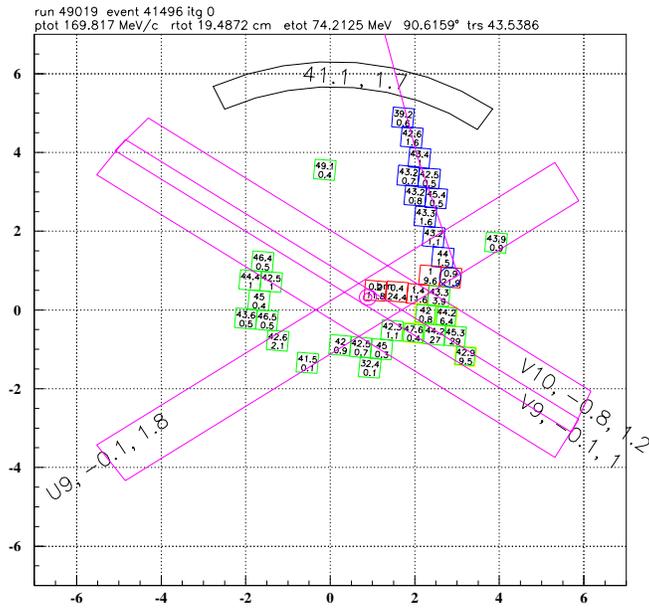


Figure 3: Reconstruction of the extra target energy event.

5 Extra Target Energy Event

Event 41496 from Run 49019 fails OPSVETO and TGPV from the extra target energy group. This is believed to be a K_{e4} event. There is 16.9 MeV of energy in fibers flagged as opposite side pions. From view of the Target, Fig. 3, there appears to be a negative charged track with $\approx 76 \text{ MeV}$ energy and a positive charged track with $\approx 10 \text{ MeV}$. Both extra tracks stop within the target radius. There does not appear to be any significant second pulses in the kaon target fibers.

6 Energy in Kaon Fiber Events

7 IC Event

8 Kinematic Events

9 Other Events

10 Kinematic Box Events

There are 37 Events which fail the Kinematic Box cut group.

11 Photon-Veto Events

There are 192 Events which fail the Photon-Veto cut group. Fig. ?? shows the kinematic distribution for the Photon-Veto single cut failures. They are evenly distributed throughout the signal box region and seems to have a similar

11.1 EC outer only events

There are 16 events which only failed the EC outer-ring PV subsystem.

11.1.1 Run 48377 Event 46575

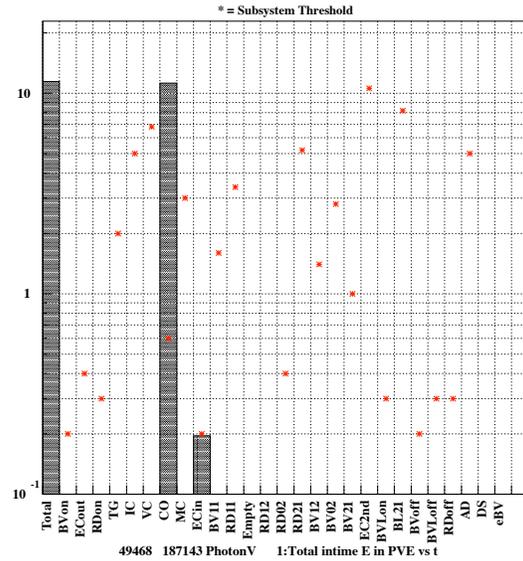
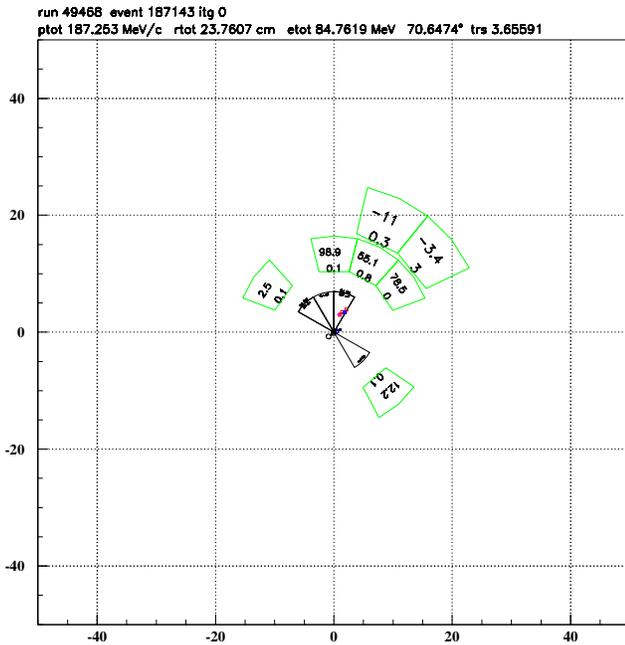
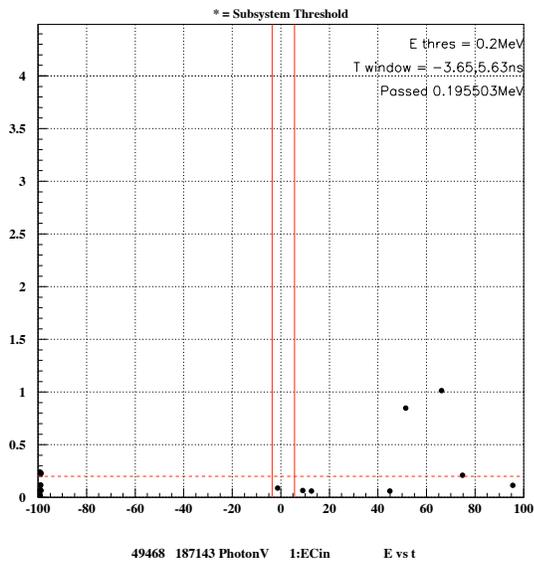


Figure 4: Left: EC reconstruction of Collar-PV 1-cut failure. Right: Intime energy for each subsystem. The red points are the 60% thresholds.

11.2 Collar Only Event

There is 1 event which only failed the Collar PV subsystem, event 187143 from run 49468. This event had greater than 10 MeV within the Collar where the energy threshold is only 0.6 MeV. As seen in EC-outer Energy vs Time plot, see Fig. 5, one hit is very close to the timing threshold and well above the total energy threshold and another hit is within the timing window and above the energy threshold. (I ASSUME???) The reason that this did not fail the EC-outer PV cut is because the hit did not fulfill the *hit_is_available* function applied to all hits within the subsystem.

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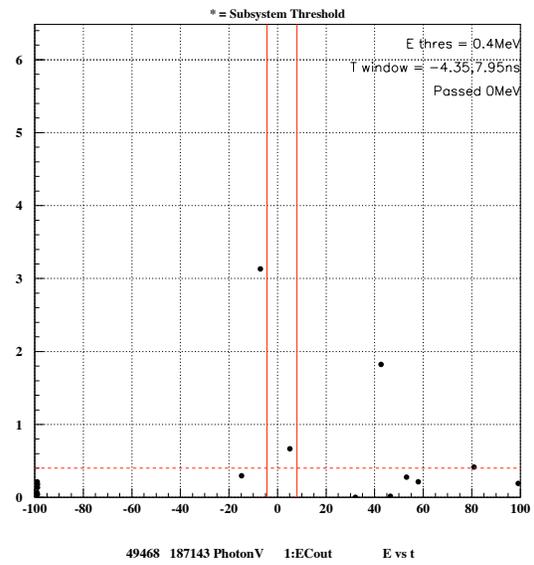


Figure 5: The EC inner-ring (outer-ring) hits are shown in the left (right) plot.

11.3 RS Only Events

There are 2 events which only failed the RS PV subsystem.

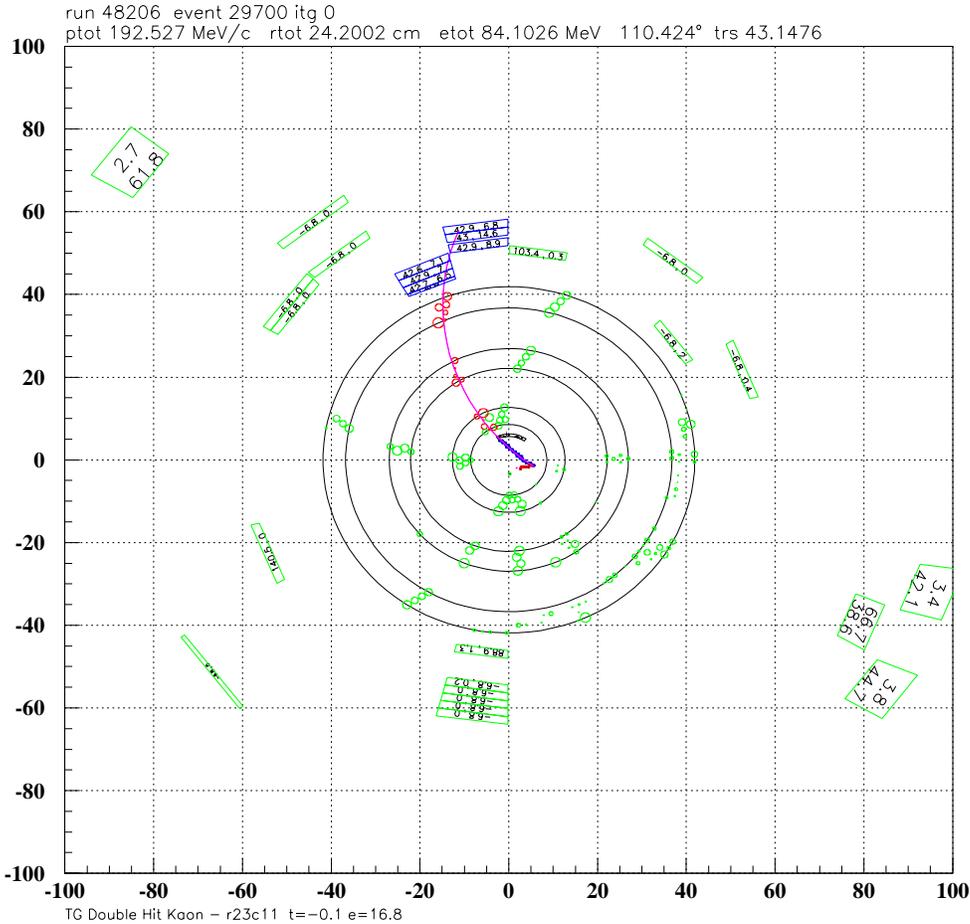


Figure 6: Event reconstruction of BV 1-cut failure. The hits which forced the event to fail are on the far right side toward the bottom

11.4 BV Only Events

There are 2 events which only failed the BV PV subsystem.

11.4.1 Run 48206 Event 29700

This event fails on the BV PV requirement. However, there is an hit with large energy (67 MeV) in the BVL detector, see Fig. 6 and Fig. 8, that is within 1 ns of the time window. The BVL hit is located back-to-back with the π^+ -track. There is also a hit within the Collar which has 9 MeV, well above threshold, but is fractionally outside the time window, see last plot in Fig. 8.

In Fig. 7, we observe a CCDPUL fit with a second pulse energy of 1.09 MeV in the low gain counter. ??? I'm not sure if this would fail if the second pulse energy with these probabilities exceeded the threshold of 1.25.

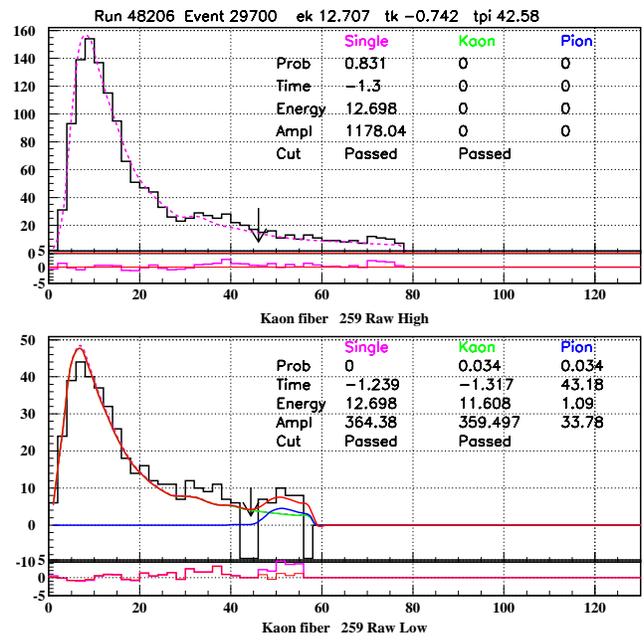
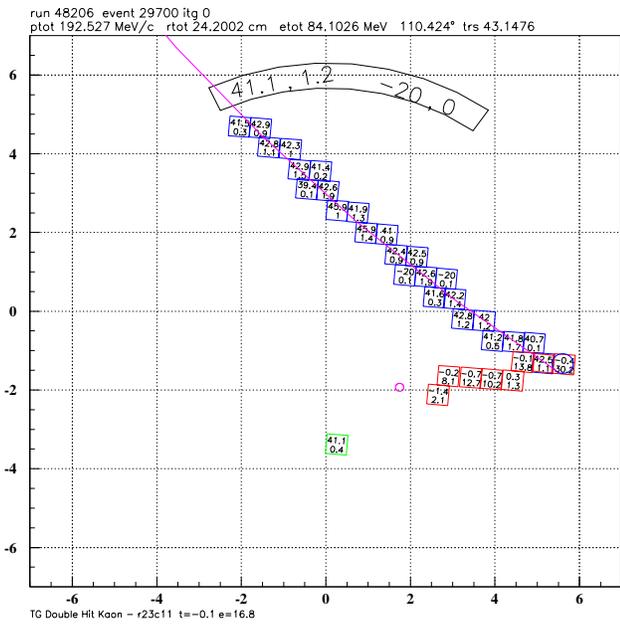
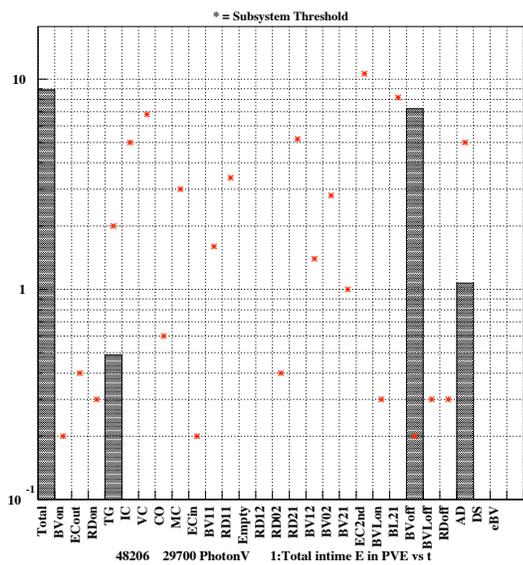
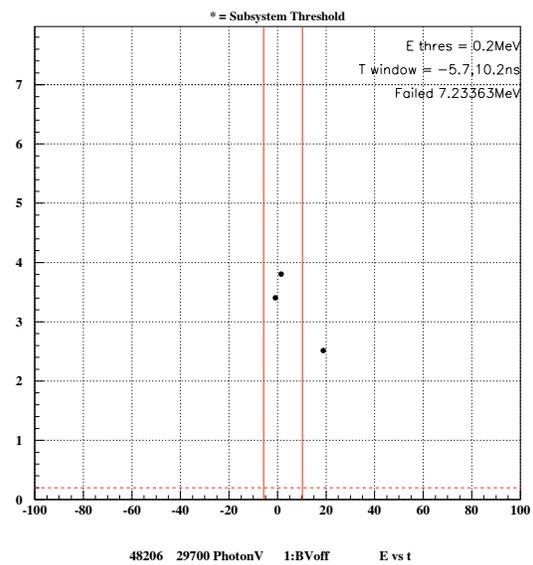


Figure 7: Left: TG reconstruction of BV 1-cut failure. Right: CCDPUL fit.

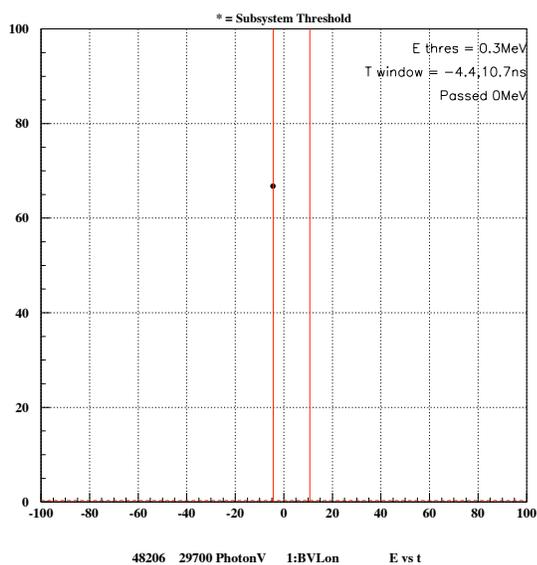
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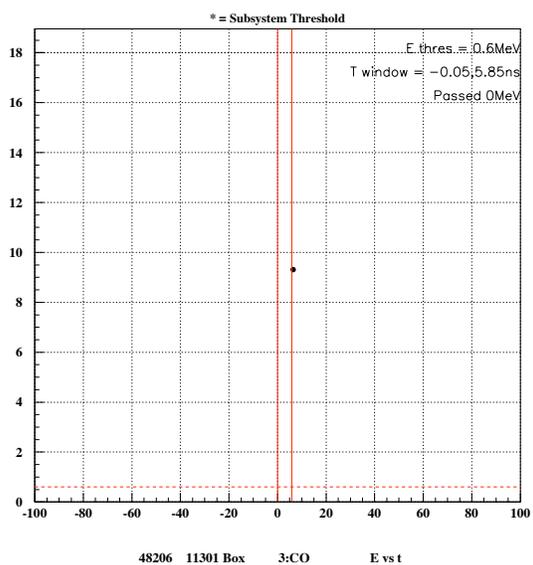


Figure 8: Energy vs Time plots of various PV detectors for BV 1-cut failure.

11.4.2 Run Event

11.5 Other PV Events

12 Conclusions

References

[1]