Using triple-pulse TD fit results

- FITPI4 pulse assignment algorithm
- TDFOOL
- Electron finding

Please see technote K-029 for the description of new pass2 ntuples variables produced by FITPI4.

Next page describes how FITPI4 makes assignment of the 'muon' pulse for triple-pulse fits.

Note that only stopping counter information is used.

Identification of 2 post-pion pulses for both ends:

Let dT = absolute value of minimum time difference of pulses satisfying muon area cuts.

dT'= absolute value of time difference of other pair of pulses

= 999. if other pair does not satisfy muon area cuts

Note that dT < dT' by construction

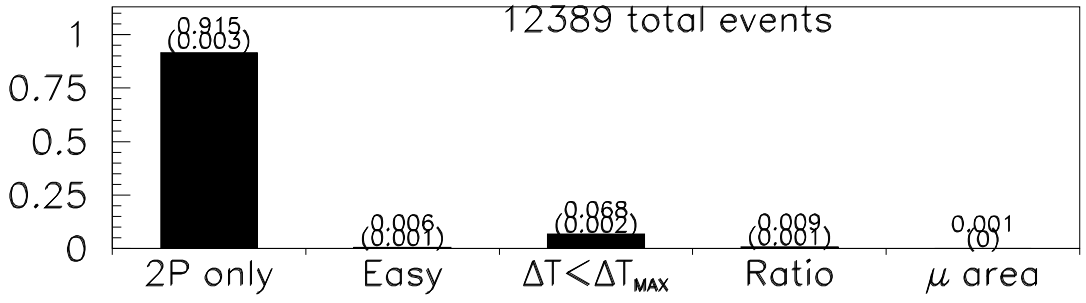
RFLAG

0	No double- or triple-pulse fit done
1	No triple-pulse fit done
2	Triple-pulse fit done: No resolution needed (there aren't two post-pion pulses for both ends)
3	dT' > dTmax ==> pair giving dT is muon
4	dT' < dTmax and both pairs pass average muon area cuts, the pair with area ratio matching pion area ratio is the muon
5	dT' < dTmax and one pair fails average muon area cuts, other pair is muon

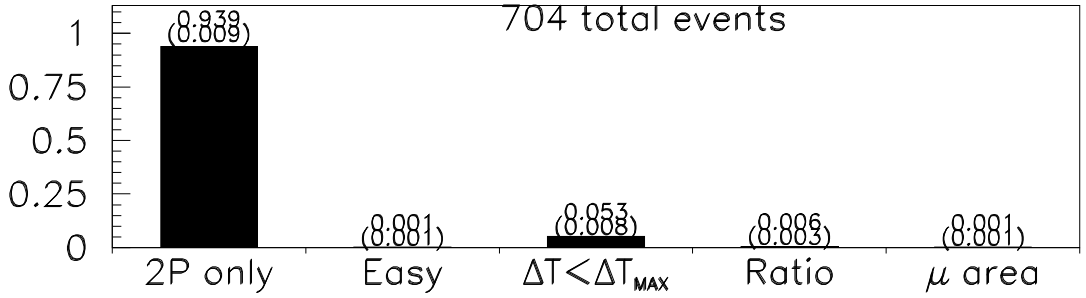
where dTmax = 6 ns.

Remaining pulse is assigned to be Random, of course.

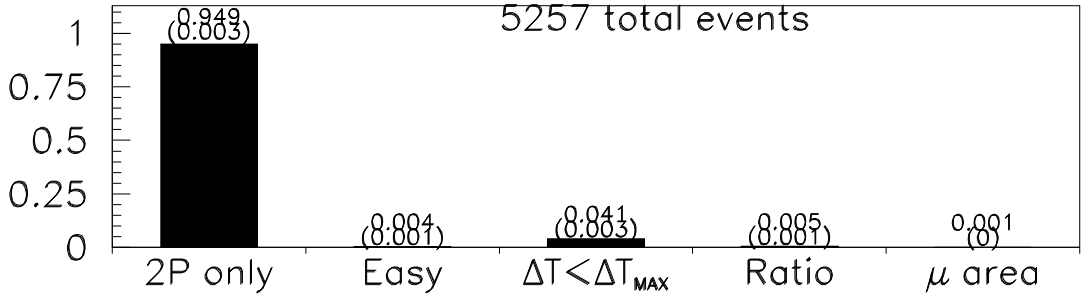
RFLAG distribution for runs 50141-9:
1=2Ponly, 2=Easy, 3=dT<dTmax, 4=Ratio, 5=μ area



FITPI4 μ assignment method for pnn1or2 events



FITPI4 μ assignment method for SKIM1 events



FITPI4 μ assignment method for SKIM3 events

Treating FITPI4 Triple-pulse assignments

$xyz \equiv T(x) < T(y) < T(z)$, $T \equiv$ time

$R \equiv$ 'Random' pulse (non-π and non-μ)

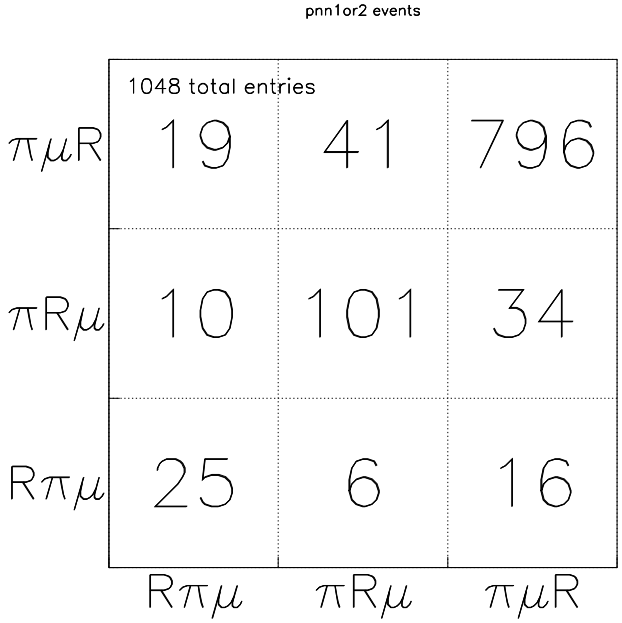
Currently no check is made to see if the muon assignment algorithm has found the 'best' muon candidate in 3P fits.

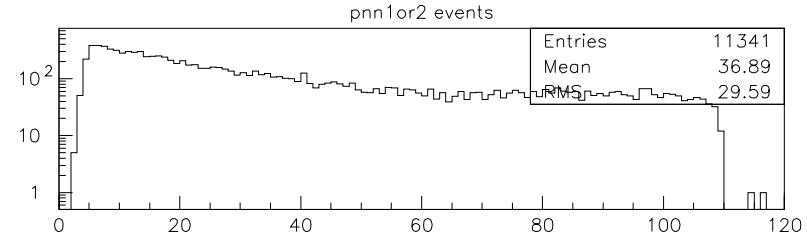
1. $R\pi\mu$: accept
2. $\pi R\mu$: reject
3. $\pi\mu R$: accept conditionally

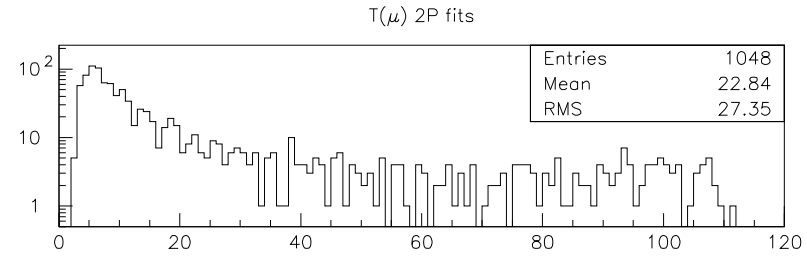
There is no explicit rejection of case 2, currently.

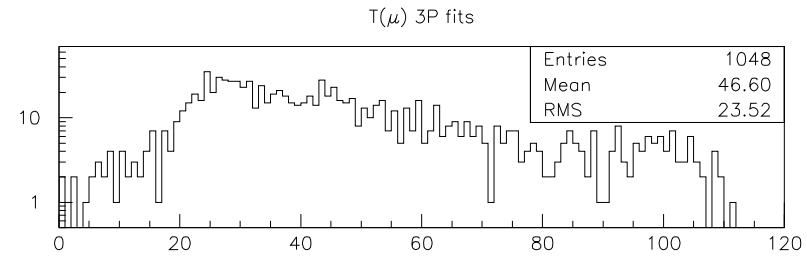
For case 3, R should be treated as an electron candidate by EV5.

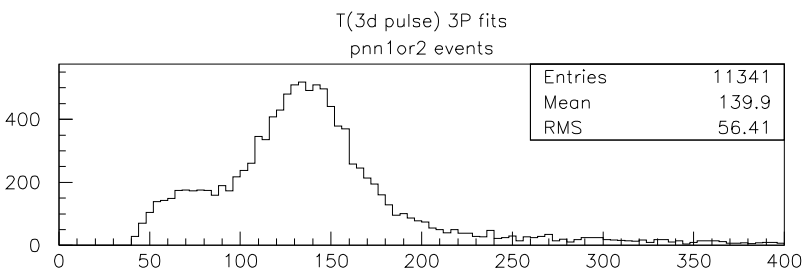
Pulse assignment US vs DS:

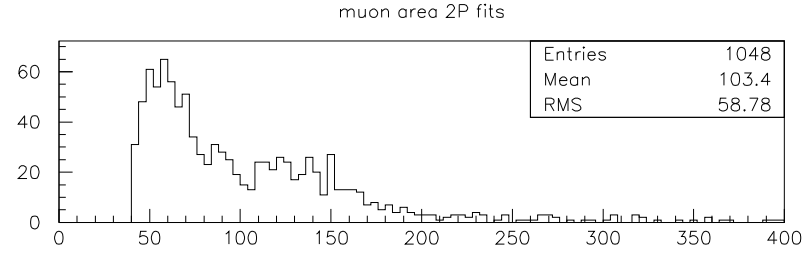


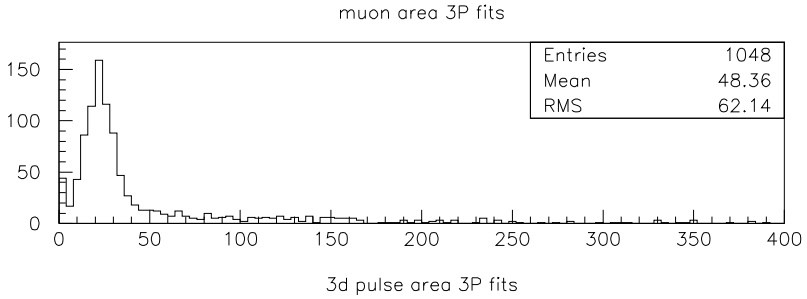

pnn1or2 events
Entries 11341
Mean 36.89
RMS 29.59


T(μ) 2P fits
Entries 1048
Mean 22.84
RMS 27.35


T(μ) 3P fits
Entries 1048
Mean 46.60
RMS 23.52


T(3d pulse) 3P fits
pnn1or2 events
Entries 11341
Mean 139.9
RMS 56.41


muon area 2P fits
Entries 1048
Mean 103.4
RMS 58.78


muon area 3P fits
Entries 1048
Mean 48.36
RMS 62.14
3d pulse area 3P fits

Electron finding, TDFOOL, ELVETO5

TDFOOL looks for an indication of activity at muon time (TMUAV) in 2 previous counters along track, presumably due to an early muon decay, where TMUAV is based on the muon assignment of FITPI4.

ELVETO5 searches entire RS for activity at the time of the apparent $\pi \to \mu\nu$ decay.

EV5 looks for electrons to positively identify $\pi \to \mu \to e$ decay chain.

Summary and recommendations

- Approximately 8% of pnn1or2 and 6% of SKIM1 and SKIM3 events required a triple-pulse fit
- For triple-pulse fit events:
  1. The muon pulse assignment should be checked and validated.
  2. $\pi R\mu$ events should be rejected.
  3. In $\pi\mu R$ events, the random pulse should be considered as an electron candidate.