

### Terminology:

- *xy-scatter*: an event with a pion that starts off at a  $\cos\theta_d$  within the acceptance, then scatters in the target to a direction also within the acceptance. It has a characteristic "kink" pattern in the *xy*-projection of the target.
- *z-scatter*: an event with a pion that starts off close to the beam direction, then scatters in the target to a direction within the acceptance. It may have a (less characteristic) "kink" pattern in the *xy*-projection of the target, i.e. the two categories overlap.

### To Be Done:

- Scattered Kp2 samples to measure PV on. This part of the analysis is similar to Bipul's 17 "classes" of TG-scattered events. We will have to eventually reproduce some or all of his classes. These need Tochio fitter quantities that should be available in latest ntuples.
  - kinks (found by Benji's kinkfinder): almost done, TGB4 left to be investigated. Up to now, this sample has not shown a higher offline PV rejection than the Kp2 peak, which might indicate that it is dominated by *xy*-scatters.
  - B4EKZ-inverted (not necessarily in kink sample): this sample is supposed to be *z*-scatter-rich.
  - Kp2 peak energy - PNN2 box range and momentum (kink sub-sample): this anomaly might also be indicative of *z*-scatters, as it shows a mismeasurement of the range (and subsequently of the range-corrected momentum), due to over/under-estimated *z*-position of the decay vertex. This sample will probably suffer from low statistics, but it's worth trying.
  - CCDPUL-inverted
- PV optimized on these samples: a formal optimization procedure will most probably not be allowed due to low statistics, but a tuning can be done "by eye". Also, few chosen elements could be optimized, with the others fixed. The sample could be increased by using the OR of some of the above classes.
- The AD does add some extra PV rejection. It still has to be baselined and reliably measured on
  - Kp2 peak
  - Kp2 scattered samples - optimized on it
  - Km2 - acceptance

For these samples, we need

- the AD  $E$  vs  $t$  (before and after all other PV)
  - to demonstrate which AD elements are useful: exclude the ones in the K path using TDC information, exclude them using the extrapolated K path from the BWCs, look for 2nd pulses in them...
  - to investigate the AD-EC correlation. By tuning the AD, CO and EC together, taking advantage of correlations, we might be able to gain some acceptance.
- Ultimately, the sample we will base our rejection measurement and background assessment on is the CCDPUL-inverted one. This is still waiting for the folks at TRIUMF to
    - debug
    - improve/tune
    - measure and optimize acceptance
  - Online PV: work has been already done in measuring this on the kink sample, and showed less rejection than the Kp2 peak. It has to be repeated on all the samples.