CoinTime Peak Stability

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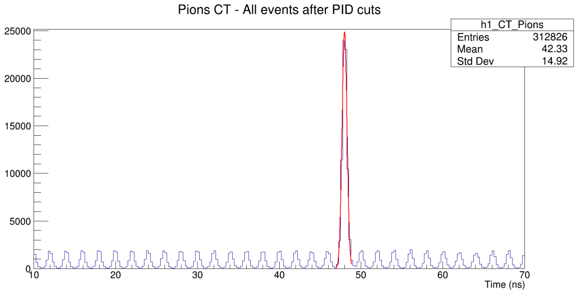
CoinTime Peak Stability

- As discussed in last full meeting, need to check stability of the cointime peak across runs
- Studied on a kinematic by kinematic basis (for now)
- Simple process, apply some standard acceptance/PID cuts to the data, save the resulting cointime histograms
  - δ cuts on HMS and SHMS
  - x'_{FP} and y'_{FP} cuts on HMS and SHMS
  - HGC, Aerogel and SHMS cal cuts
  - β cuts on SHMS
  - Cut values run dependent - see `https://github.com/sjdkay/UTIL_KAONLT/tree/offline/DB/PARAM` for relevant values
- Fit simple (but constrained) Gaussian to distribution to determine parameters of cointime peak

Peak Fitting Example - π

- Use the position, x_{max}, and number of entries, N_{max}, of the bin with most entries to guide constraints
  - Amplitude constrained to be between $N_{max}/2$ and $2N_{max}$
  - μ constrained to be $x_{max} \pm 0.5$
  - σ constrained to be $0.1 \leqslant \sigma \leqslant 2$
- Example plots are from run 6913 (Low Q^2, Winter 2018)



Peak Fitting Example - K

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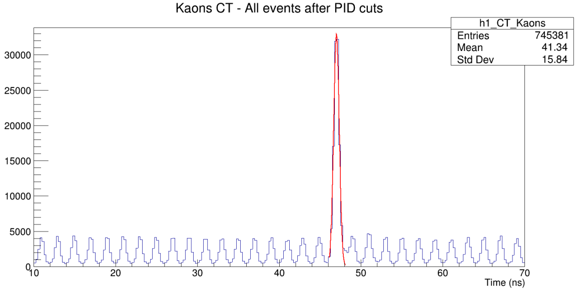

Peak Fitting Example - p

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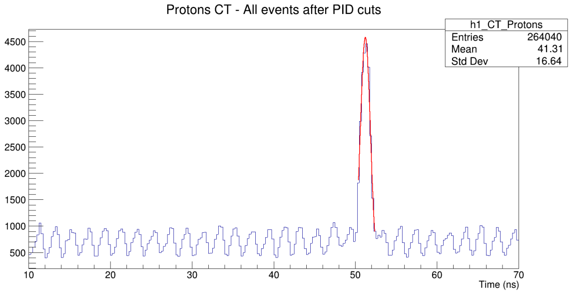
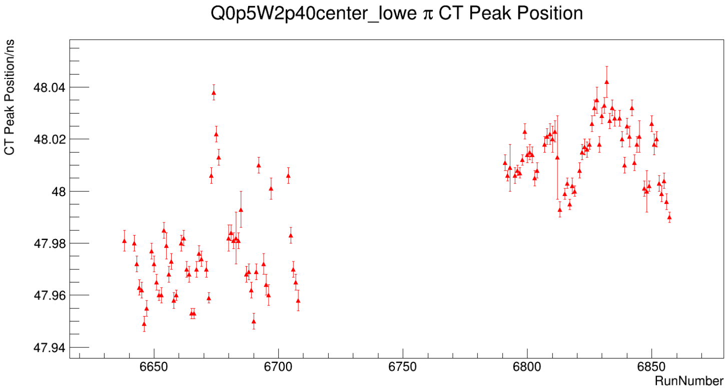


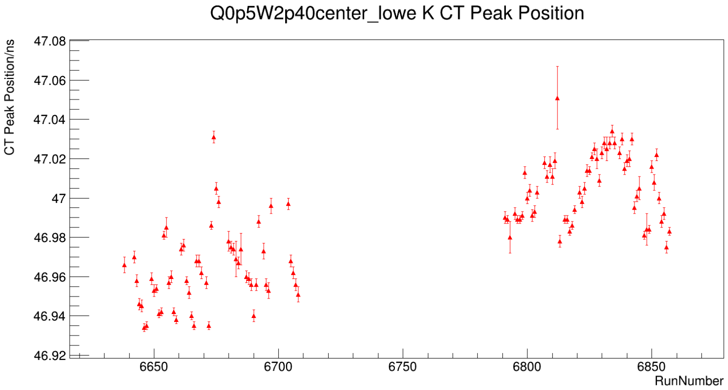
Next Steps

- μ and the FWHM ($\sim 2.355\sigma$) for each particle species are saved to a csv file
- Shell script runs over all runs in a kinematic, groups together parameters for a run in a single file and uses the data to create series of graphs in root
  - Further info on the process of running the relevant scripts is included at the end for completeness
- Plot both the peak position (μ) and the peak FWHM across all runs in a kinematic, for each particle species
- As an example, shown in the next few slides are this series of graphs for the $Q^2 = 0.5$, $W = 2.40$, ϵ_{low} central setting

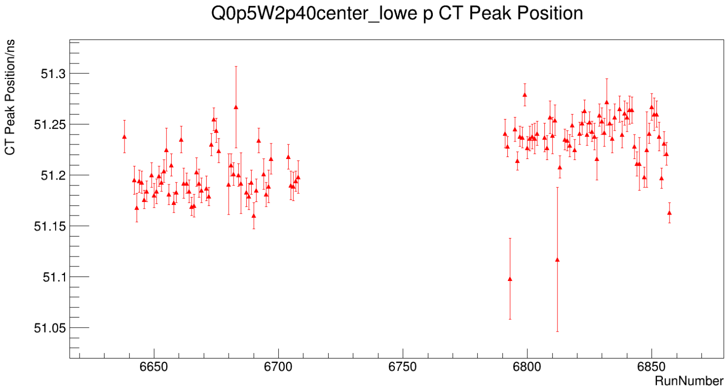
$Q^2 = 0.5$, $W = 2.40$, ϵ_{low} central setting - π Position



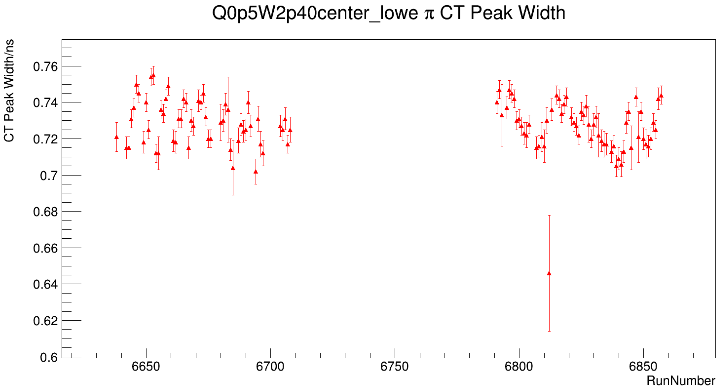
$Q^2 = 0.5$, $W = 2.40$, ϵ_{low} central setting - K Position



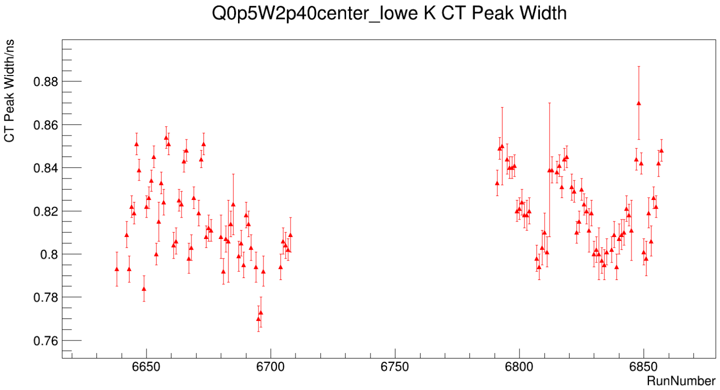
$Q^2 = 0.5$, $W = 2.40$, ϵ_{low} central setting - p Position



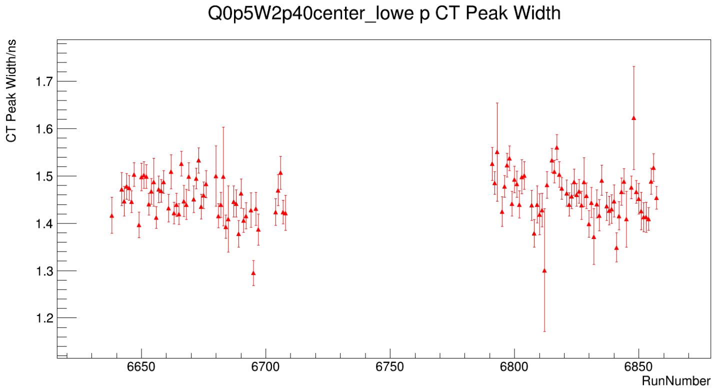
$Q^2 = 0.5$, $W = 2.40$, ϵ_{low} central setting - π Width



$Q^2 = 0.5$, $W = 2.40$, ϵ_{low} central setting - K Width



$Q^2 = 0.5$, $W = 2.40$, ϵ_{low} central setting - p Width



Comments

- General trend is the same for each particle species ✓
- Some outlier values on some plots
  - Likely due to fit hitting a constraint for this particular run
  - From investigation, doesn't look like a "real" effect
- Lower stats on p/K may also explain some shifts on the plot
- Some variation apparent regardless, but shifts are very small
- This is just one kinematic, what do others look like?
  - Generally similar, but trends vary a little, some have clear drift in a given direction
- Some stamp collections of other kinematics to examine this

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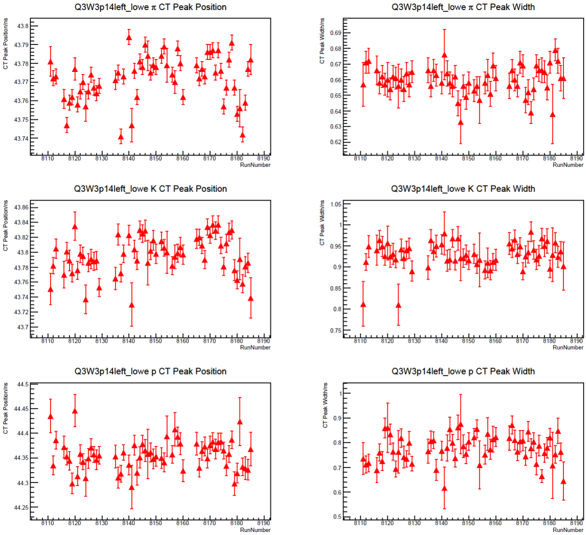
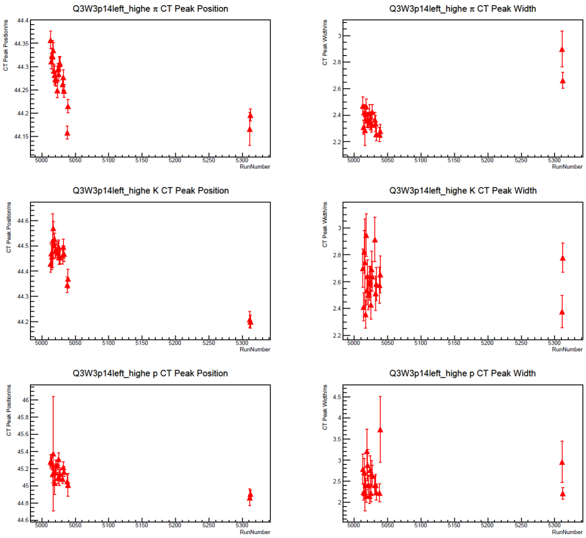
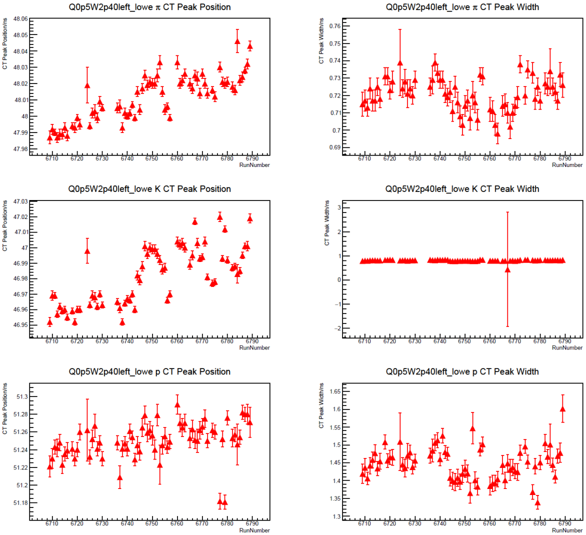
$Q^2 = 3$, $W = 3.14$, ϵ_{low} left setting



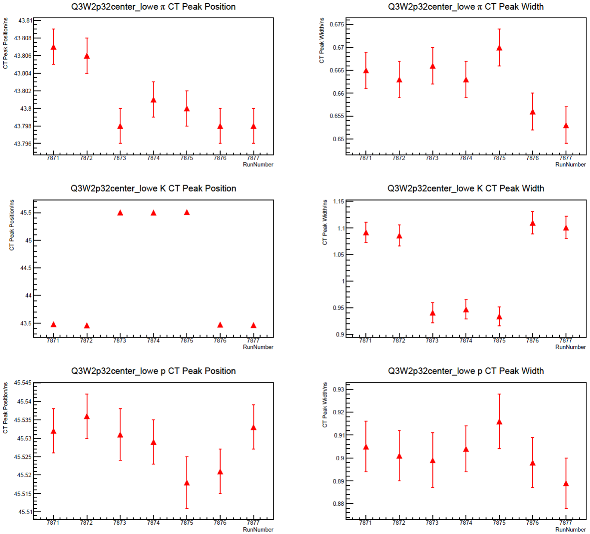
$Q^2 = 3, W = 3.14, \epsilon_{high}$ left setting



$Q^2 = 0.5$, $W = 2.40$, ϵ_{low} left setting



$Q^2 = 3$, $W = 2.32$, ϵ_{low} central setting



Summary and Next Steps

- Some trends and variation that we should account for
  - Split up kinematics in some cases with different peak positions in different blocks of runs
- Missing some kinematics
  - Some Kaon kinematics missing runs, re-running on farm
  - Pion kinematics analysed but not combined together yet $\rightarrow$ Later today
- Finally, want to check how all of the kinematics compare
  - Take weighted avg of peak position for each kinematic and plot
  - Need to write a quick script for this, should be relatively quick

Backup Zone

Running Info - 1 of 2

- Scripts all in `https://github.com/sjdkay/UTIL_KAONLT/tree/offline/scripts/CoinTimePeak`
- 3 steps to running the analysis
- 1. src/CoinTimePeak.py trims a replay file and leaves small rootfile with some trees showing cut info (if you want to check)
  - Relevant trees for fitting just include the CT info
- 2. PlotCoinPeak.C reads trimmed root file and does the fitting to the coin time peaks as described earlier
  - Outputs a set of plots as a pdf and root file and a .csv file with the fit parameters for further plotting
- 3. PlotKinematic.C reads in a csv with fitting info for a set of runs
  - Plots all of the runs in the csv as TGraphs

Running Info - 2 of 2

- AnalyseKinematic_CTPeak.sh automates all three steps, just feed it a kinematic
- If this script is *not* used, you have to manually combine all of the individual .csv files for every run into a single file (which is the input to the third script)
- The script also scans for missing runs and submits them to be processed as a farm job (if you ask it to)
- There's no README currently but I'll include one once I finish the last script