Kaon LT Status Update

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How am I finding my yields?

- Current is calculated per event with a threshold current of 2.5 uA for BCM4B [See Sangwa's Talk]
- I have not incorporated non-scaler EDTM based calculations so no electronic livetime included
- Yield is calculated by

$$\mathrm{Y} = \frac{N \times PS}{Q \times \varepsilon \times (cpuLT)} \pm \frac{\sqrt{N}}{N}\ \mathrm{Y}$$

  - N is number of reconstructed events passing cuts, PS is the prescale value, and ε are tracking efficiencies

Number of Events

- Two types of event selection
  - Using the event type leaf fEvtHdr.fEvtTyp where EvtType = 1 or 3 is a SHMS event and EvtType= 2 or 3 is a HMS event (previously used method)
  - Applying proper cuts to the TDC leaves to get the SHMS (3of4 in T.coin.pTRIG1_ROC2.tdcTime) and HMS (elreal in T.coin.pTRIG3_ROC1.tdcTime) event selection (more on this later)
  - In the end, these should result in the same event selection as long as fEvtHdr.fEvtTyp leaf is properly selecting events
- A number of cuts were applied as well
  - SHMS cuts: P_cal_etotnorm > 0.05, P_hgcer_npeSum > 1.5, P_aero_npeSum > 1.5
  - HMS cuts: H_cal_etotnorm > 0.6, H_cal_etotnorm < 2.0, H_cer_npeSum > 2.0

CPU Livetime

- Originally this was calculated through purely scalers
  - cpuLT = L1Acc/[(ptrig1/ps1)+(ptrig3/ps3)]
- To improve this beyond the level one accepts the TDC leaves (described above) were used
  - The same cuts as the event selection were applied
  - cpuLT = (TDC_trig1cut+TDC_trig3cut)/[(ptrig1-EDTM/ps1)+(ptrig3-EDTM/ps3)]
- The latest improvement was to separate the HMS cpuLT and SHMS cpuLT and calculate them separately
  - cpuLT_HMS = TDC_trig3cut/[(ptrig3-EDTM)/ps3]
  - cpuLT_SHMS = TDC_trig1cut/[(ptrig1-EDTM)/ps1]

Tracking Efficiencies

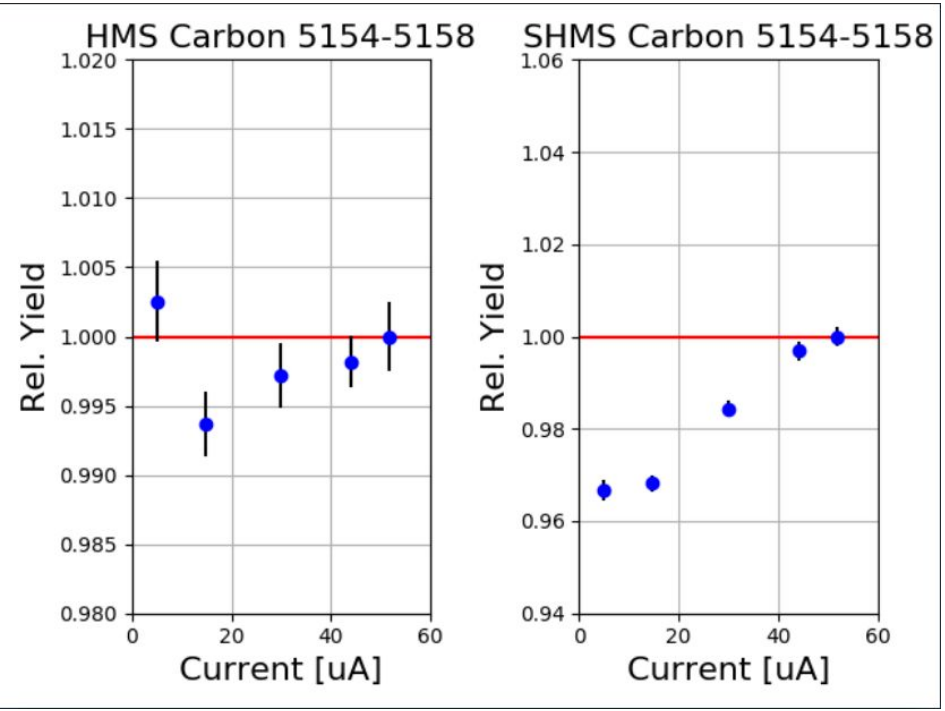
- The runs that I looked at had electrons in the HMS and pions in the SHMS
  - P_{HMS}=-3.266, Θ_{HMS}=12.50, P_{SHMS}=+6.842,Θ_{SHMS}=6.55
  - P_{HMS}=-4.204, Θ_{HMS}=14.51 P_{SHMS}=+6.053,Θ_{SHMS}=6.55
- HMS tracking was found by applying cuts to H.dc.ntrack
- SHMS tracking was found by applying cuts to P.dc.ntrack
- The HMS used the electron tracking efficiency while the SHMS used the pion tracking efficiency (note that originally the SHMS used the hadron tracking efficiency but there was little change going to pion tracking)

Tracking Efficiencies (con't)

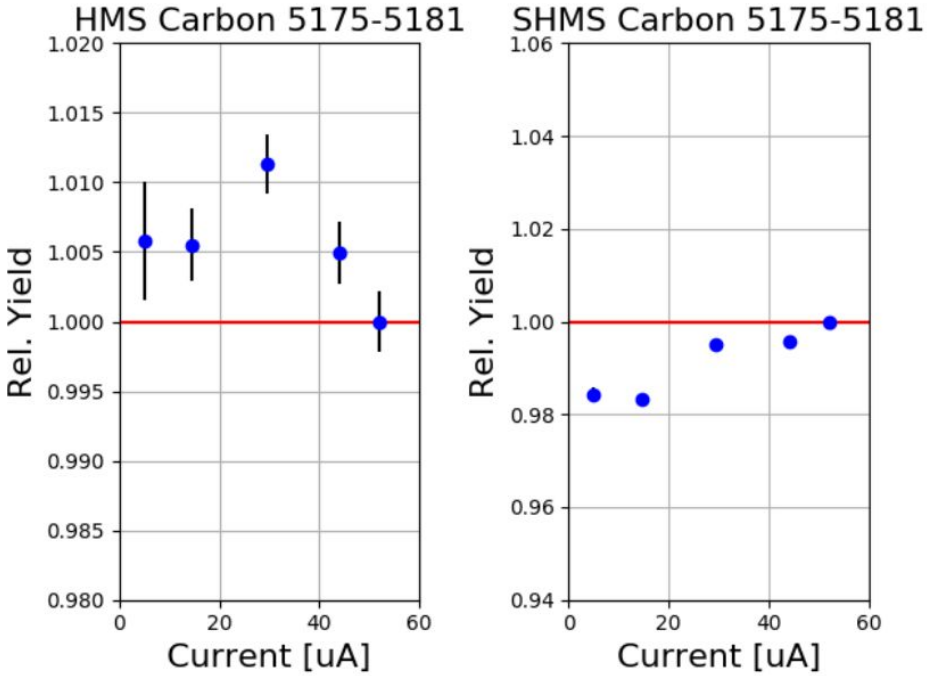
- Electron tracking efficiency cuts -> H_hod_goodscinhit == 1 & H_hod_betanotrack > 0.8 & H_hod_betanotrack < 1.3 & (H_dc_1x1_nhit + H_dc_1u2_nhit + H_dc_1u1_nhit + H_dc_1v1_nhit + H_dc_1x2_nhit + H_dc_1v2_nhit) < 20 & (H_dc_2x1_nhit + H_dc_2u2_nhit + H_dc_2u1_nhit + H_dc_2v1_nhit + H_dc_2x2_nhit + H_dc_2v2_nhit) < 20 & H_cer_npeSum > 0.5 & H_cal_etotnorm > 0.6 & H_cal_etotnorm < 2.0
- Pion tracking efficiency cuts ->P_hod_goodscinhit == 1 & P_hod_betanotrack > 0.5 & P_hod_betanotrack < 1.4 & (P_dc_1x1_nhit + P_dc_1u2_nhit + P_dc_1u1_nhit + P_dc_1v1_nhit + P_dc_1x2_nhit + P_dc_1v2_nhit) < 20 &(P_dc_2x1_nhit + P_dc_2u2_nhit + P_dc_2u1_nhit + P_dc_2v1_nhit + P_dc_2x2_nhit + P_dc_2v2_nhit) < 20 & P_cal_etotnorm > 0.05 & P_cal_etotnorm <= 0.6 & P_hgcer_npeSum > 10 & P_aero_npeSum > 3
- Hadron tracking efficiency cuts ->P_hod_goodscinhit == 1 & P_hod_betanotrack > 0.5 & P_hod_betanotrack < 1.4 & (P_dc_1x1_nhit + P_dc_1u2_nhit + P_dc_1u1_nhit + P_dc_1v1_nhit + P_dc_1x2_nhit + P_dc_1v2_nhit) < 20 &(P_dc_2x1_nhit + P_dc_2u2_nhit + P_dc_2u1_nhit + P_dc_2v1_nhit + P_dc_2x2_nhit + P_dc_2v2_nhit) < 20 & P_cal_etotnorm > 0.05 & P_cal_etotnorm <= 0.6

Most up to date plots (Carbon)

P_{HMS}=-3.266, Θ_{HMS}=12.50 P_{SHMS}=+6.842,Θ_{SHMS}=6.55

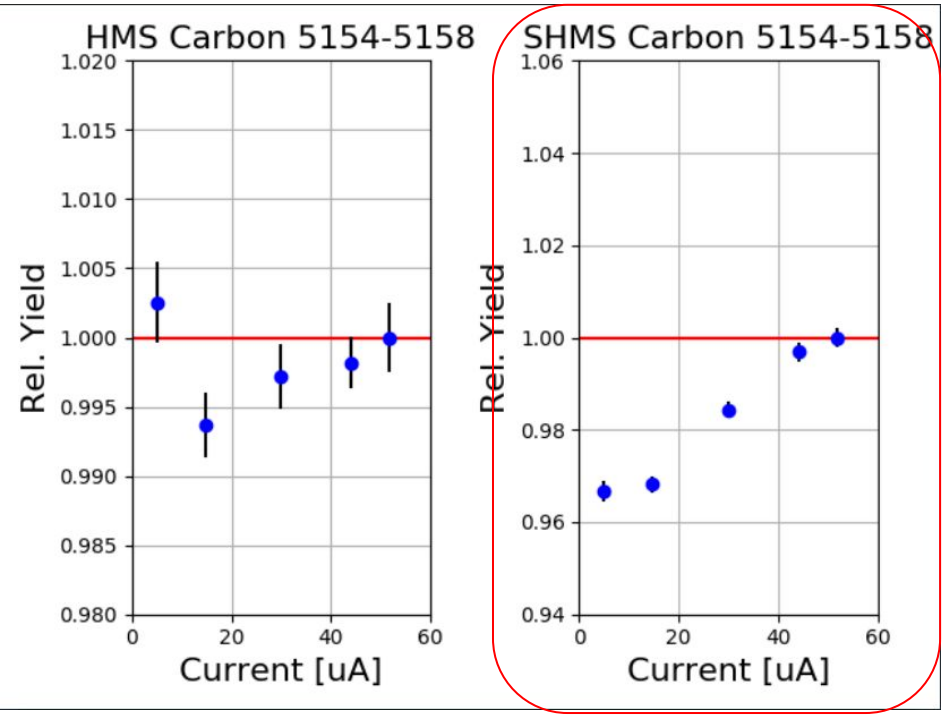


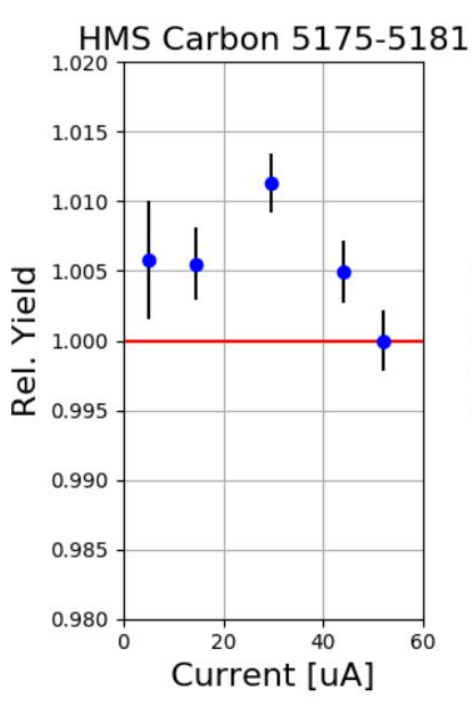
P_{HMS}=-4.204, Θ_{HMS}=14.51 P_{SHMS}=+6.053,Θ_{SHMS}=6.55

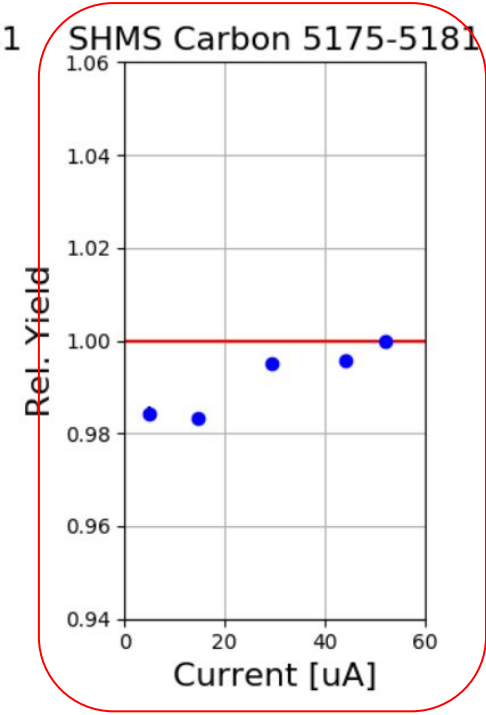


Looking back at carbon plots

Something's not quite right







TDC cuts vs Event type; really the same event selection?

- As stated before, applying proper cuts to the TDC leaves to get the SHMS (3of4 in T.coin.pTRIG1_ROC2.tdcTime) and HMS (elreal in T.coin.pTRIG3_ROC1.tdcTime) event selection. Using the event type should result in the same event selection, but is this true?
- Brad and Eric have made it clear how complex this can get so they suggested to begin at the basics.
- Well they were correct. It turns out physics is hard, especially when trying to correct for errors of 1% or less. To simplify things and try to gain a better understanding of the underlying physics, I have been looking at the singles runs we took during kaonLT
  - Runs: 5151, 5152, 5153, 5164, 5165
- There are still some issues I am working through, but getting there

Things to do before March

- Finish up TDC cuts so we can have them properly implemented for replays
  - EDTM cuts are also being applied, but further talks with Eric and Brad will need to be had before full implementation
- Update the redmine and status page for the next physics settings and any lingering updates from fall run
- Merge any changes that Stephen and Vijay have to the hallc_replay_kaonlt with my own changes to assure things are set up properly
  - Any updates to kaon yield script?
  - This includes updates to calibrations and replay changes
- Review detector and trigger checkout to assure they are comparable to the fall

Objectives during March run and beyond

- Get our data!
- Fix kaon yields
- Move beyond luminosity scans to begin elastic studies
  - This will begin once TDC/EDTM cuts are completed
  - I will need to have a long discussion with Carlos at some point.
- Organize and gain a deeper understanding of Bill’s scripts