Sharing Real Data Files for Common Analyses and First Look at the new Luminosity Run2

- What is the „neuro skim“ CDST? -> Data from Run1 -> Exp. 26

- Why do we want an additional „f“ line skim ?

- First Look at Lumi Data and Unbiased „f“ / „neuro skim“ trigger lines

Remark:
Due to problems in the CDC B2Link, the neuro trigger analysis programs could not run anymore (illegal addresses for some CDC wires -> seg fault)

Temporary solution: Remove trigger simulation
look only at TS/Wires delivered by the Neuro B2Link

„NeuroSkim“ CDST

„NeuroSkim“:
- subset of **all** data taken during luminosity (~5%)
- based on the RAW data files taken under lumi condition (-> ELOG),
- written out by the HLT **before** the HLT decision is taken, requirement: L1 trigger has fired (any!)
- the NeuroSkim files are run through full reconstruction, keeping also the RAW data (->CDST format).
- the CDST files are routinely produced by the DP group. The delay relative to RAW data is usually not more than a few days

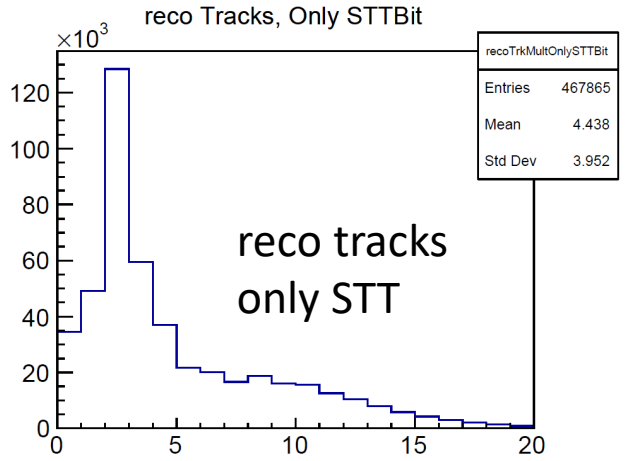
Purpose of the „NeuroSkim“:
- continuous monitor for the performance of the neuro trigger by detailed analysis (program written in C++)
- use these data to monitor the background
- use data to retrain our networks when needed

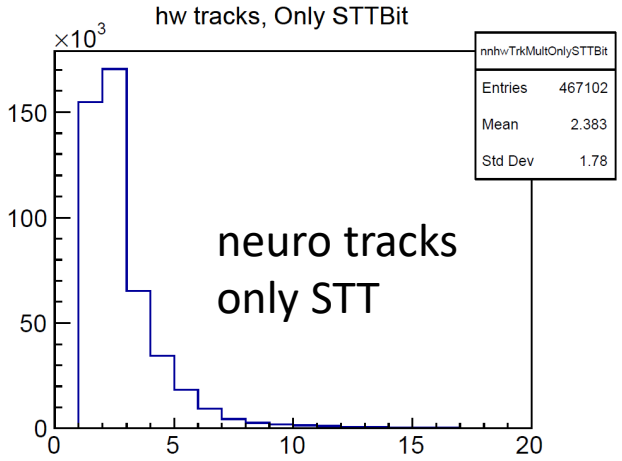
The NeuroSkim data exist since Exp. 16

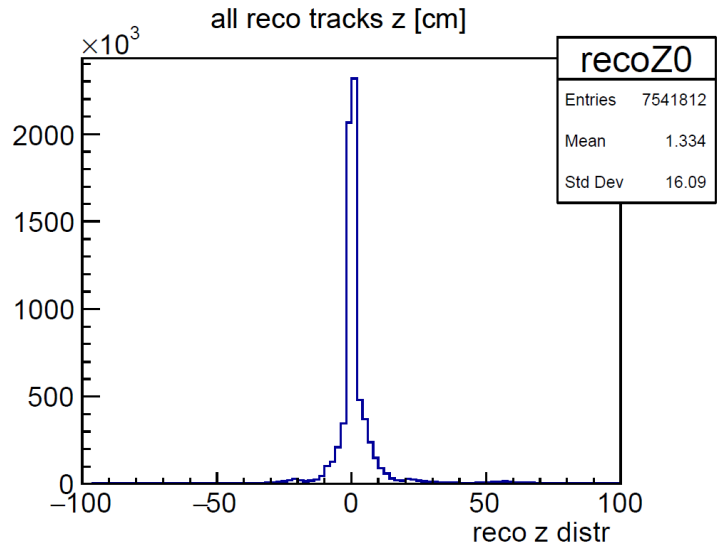
Location of the Exp. 26 data (taken in 2022):
/group/belle2/dataprod/Data/release-06-01-02/DB00000523/BIIDP-5264-NeuroTrigger-cDST/e0026/4S

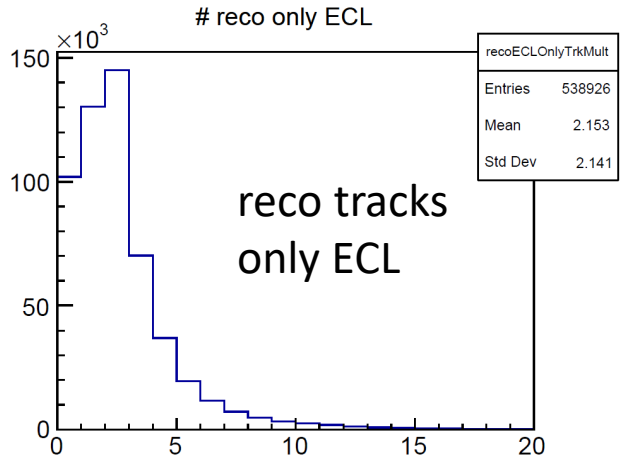
„NeuroSkim“ CDST: Analysis

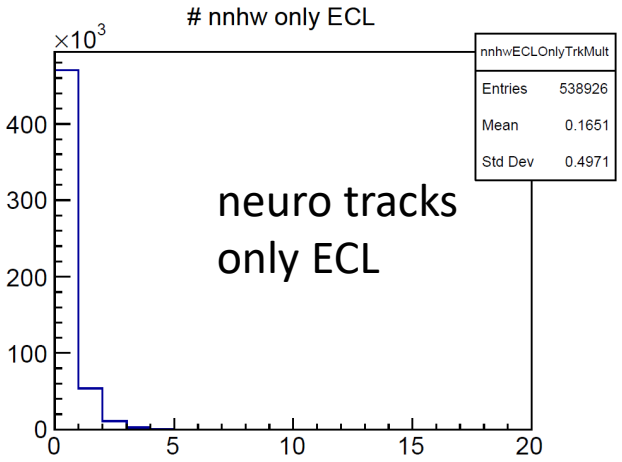
Examples of plots: Track Multiplicities for Exp. 26 runs 1700-end

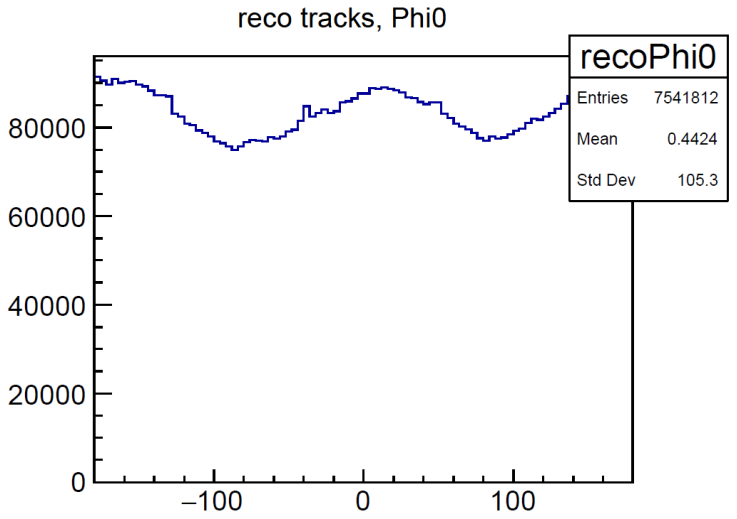






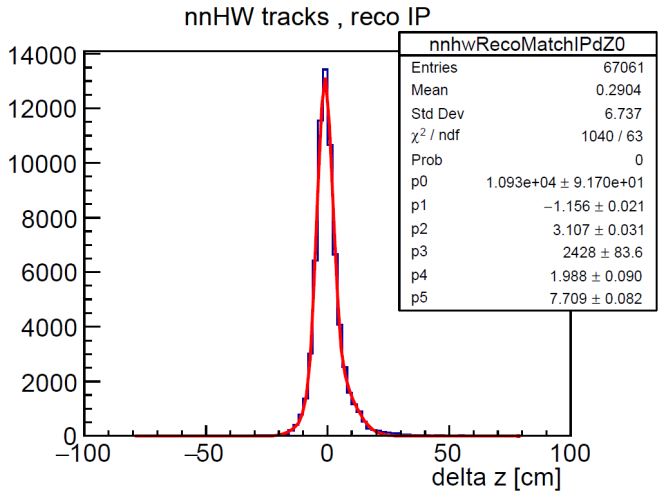


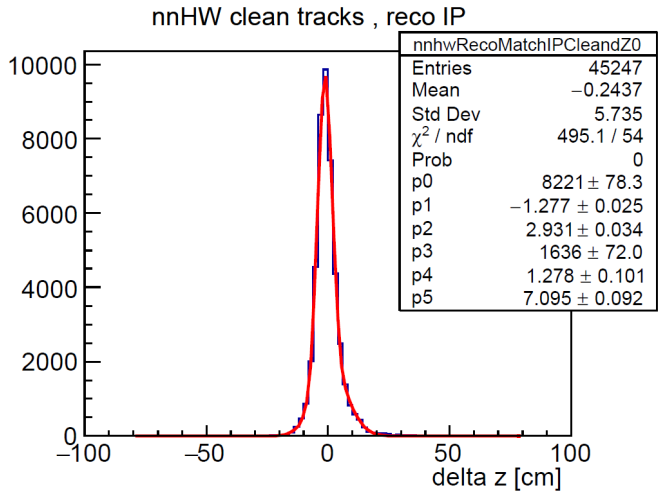


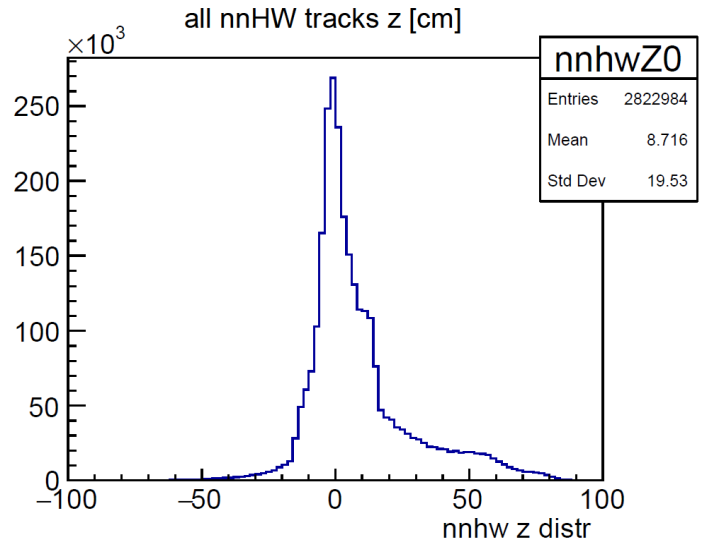


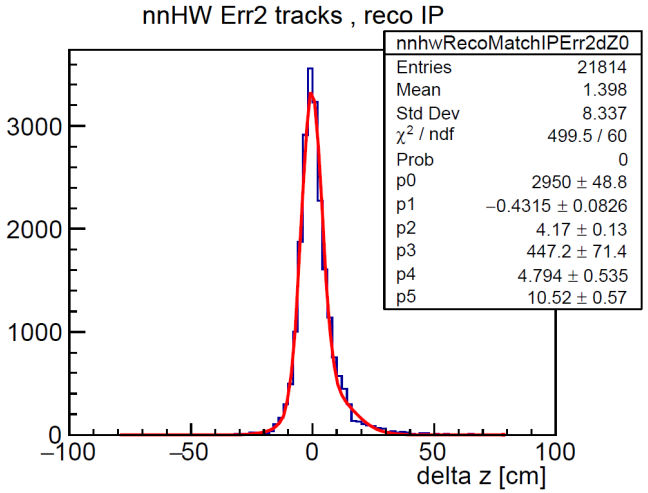
Exp 26, runs 1700-end |z| < 15 cm, STTactive 09/02/2023 8

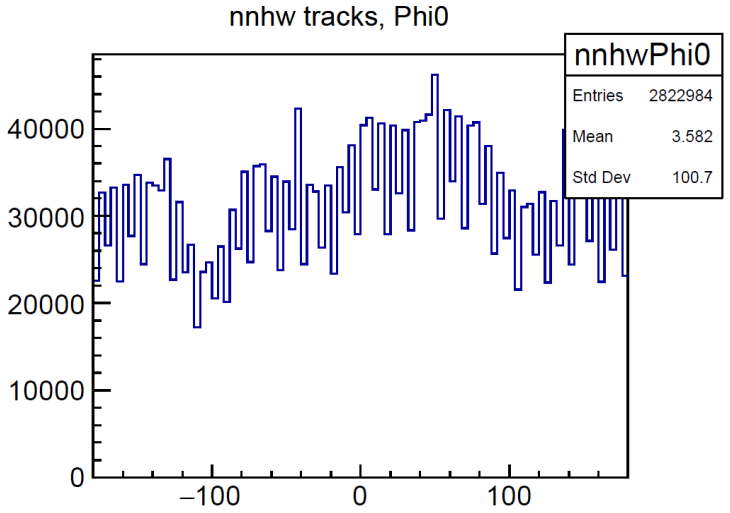
„NeuroSkim“ CDST: Analysis











Exp 26, runs 1700-end

|z| < 15 cm, STTactive

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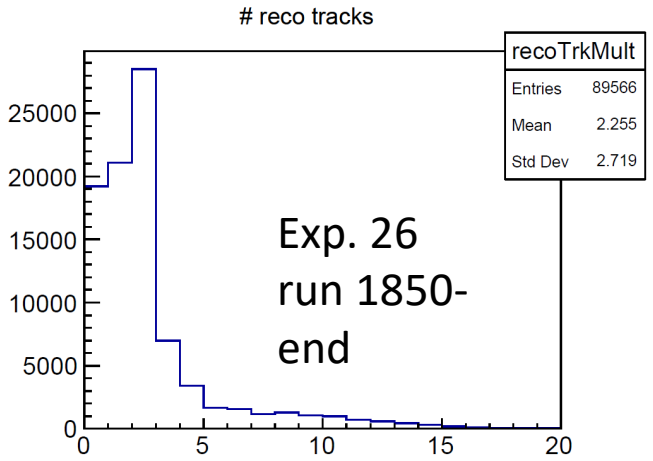
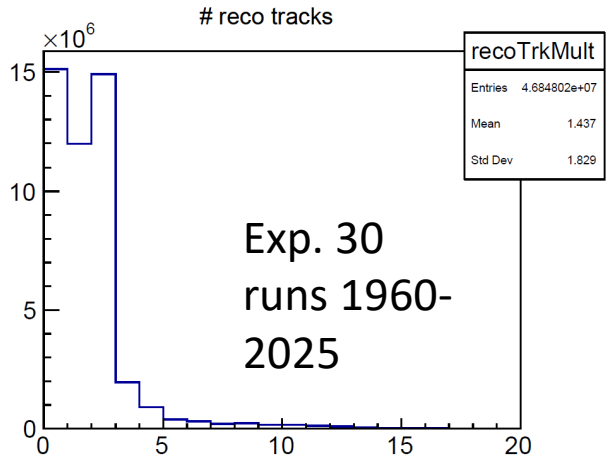
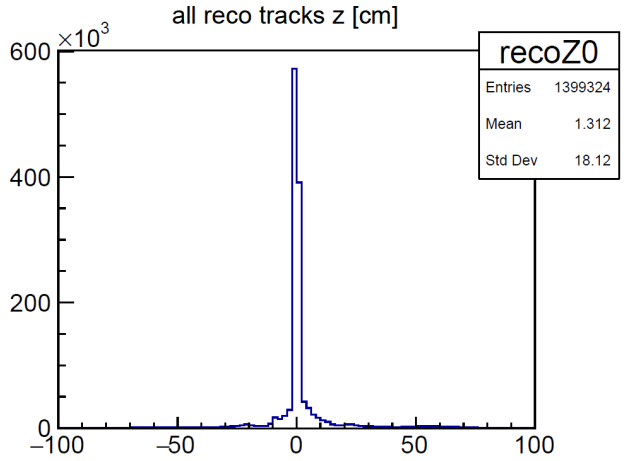
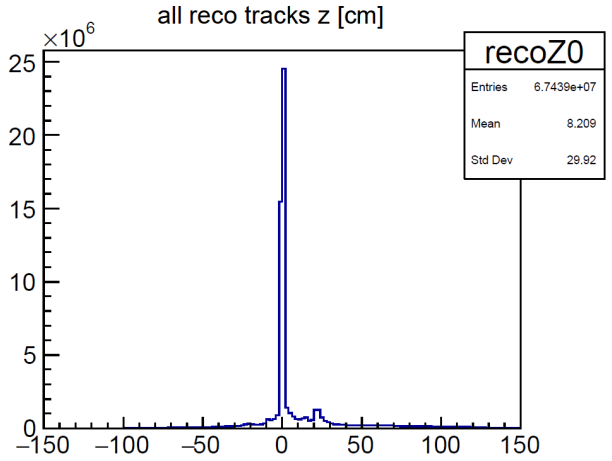
Exp 26, neuro skim CDST (left) vs Exp 30 RAW (right)









Exp 26, runs 1850-end (DST Skim)

Exp. 30, runs 1960-2025 (RAW)

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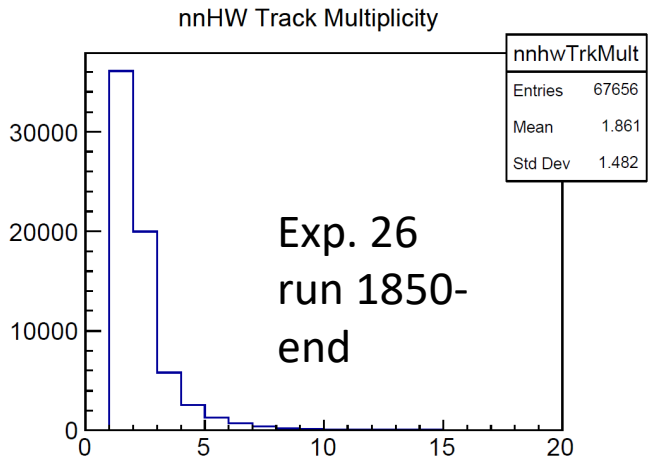
Lumi Data: all reco tracks

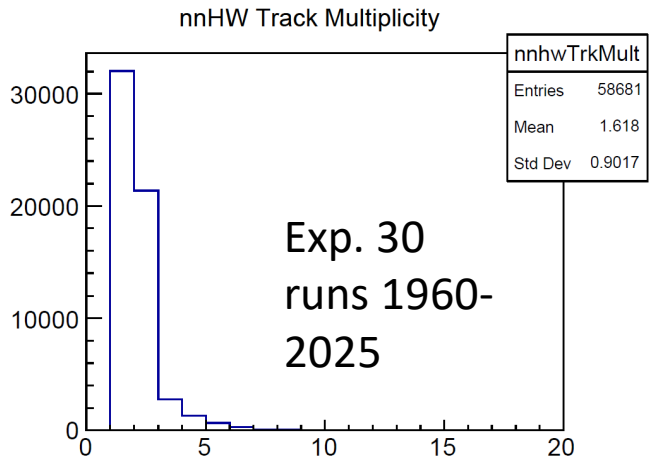
Exp 26: from neuro skim runs 1850-1968

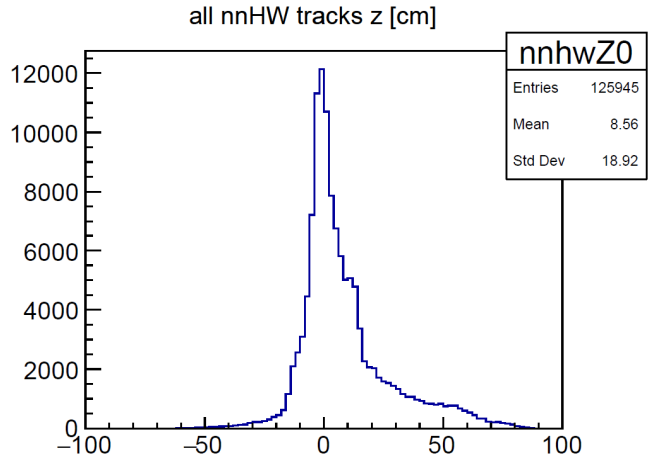
Exp 30, from RAW data runs 1960-2035

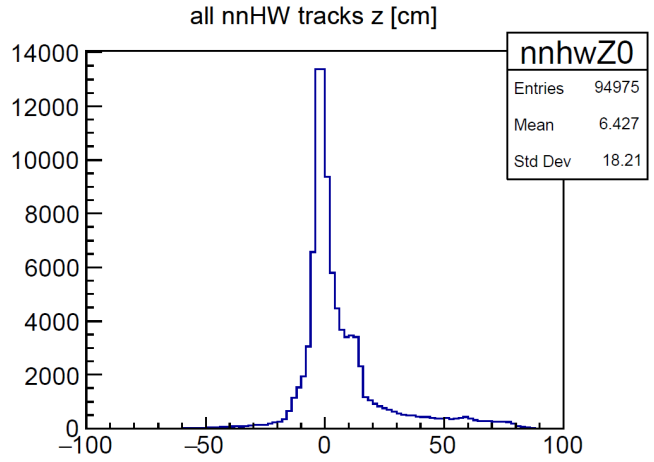
(small) differences due to different instant. luminosities

Exp 26, neuro skim CDST (left) vs Exp 30 RAW (right)









Exp 26, runs 1850-end (DST Skim) Exp. 30, runs 1960-2025 (RAW) 18/03/2024 page 2

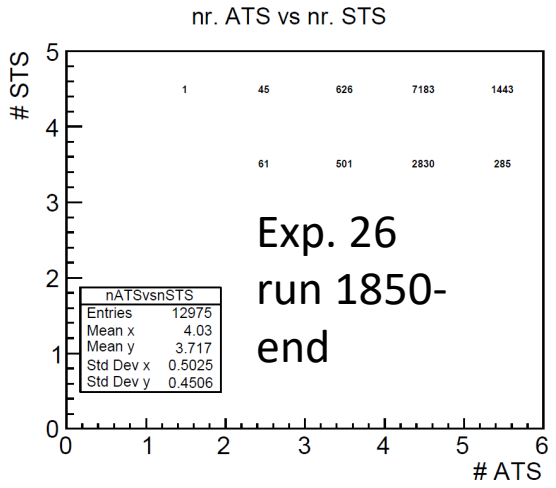
Lumi Data: all nnhw tracks

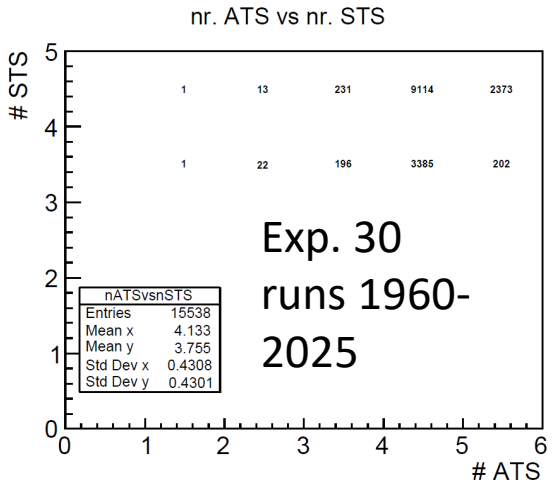
Exp 26: from neuro skim
runs 1850-1968

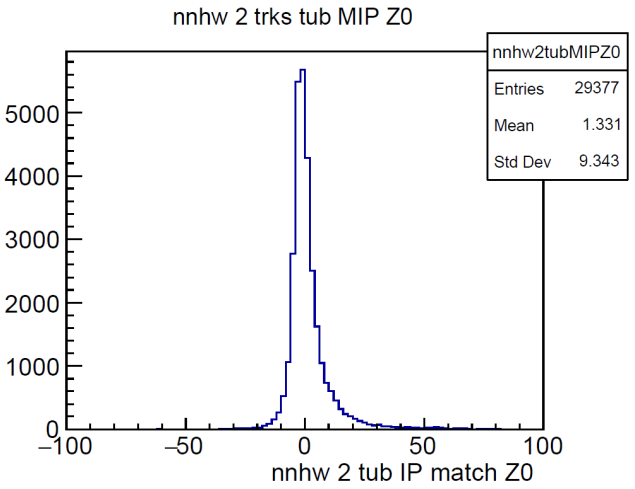
Exp 30, from RAW data
runs 1960-2035

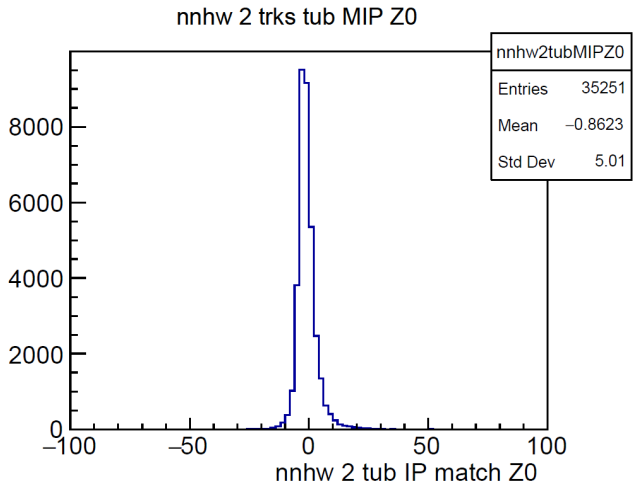
Exp. 30 has less background
still low lumi ~ 1 x 10^{34}

Exp 26, neuro skim CDST (left) vs Exp 30 RAW (right)









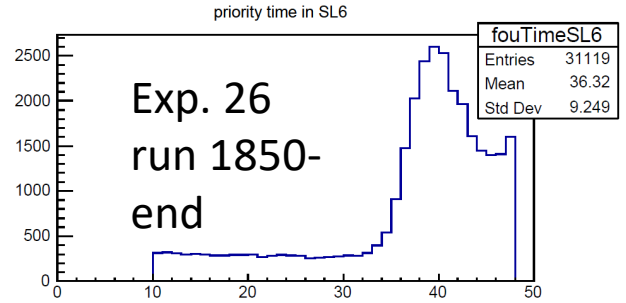
Lumi Data:
all nnhw tracks in tube from IP

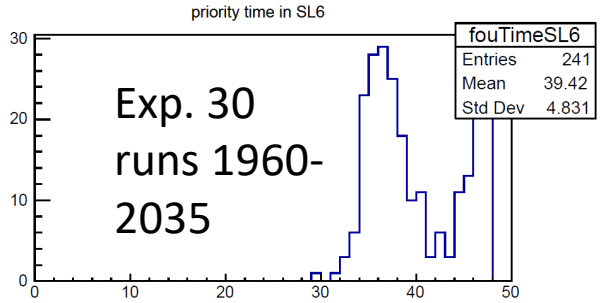
Exp 26: from neuro skim
runs 1850-1968

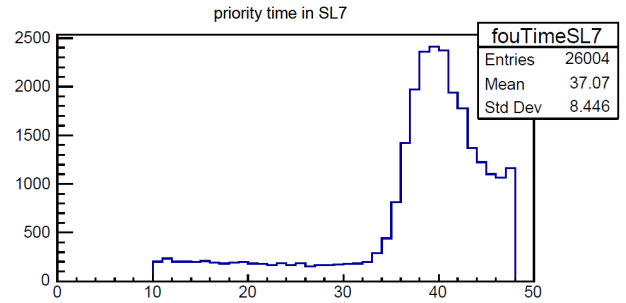
Exp 30, from RAW data
runs 1960-2035

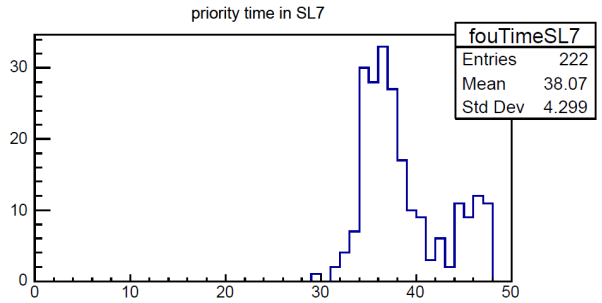
Exp. 30 has less background
still low lumi ~ 1 x 10^{34}

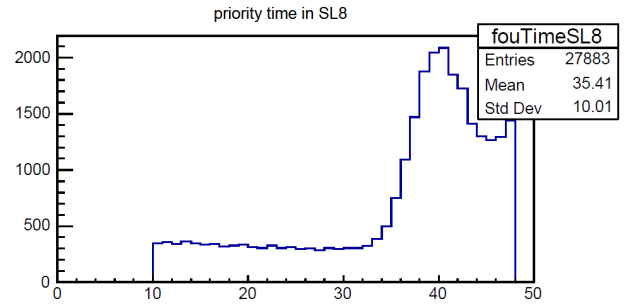
Exp 26, neuro skim CDST (left) vs Exp 30 RAW (right)

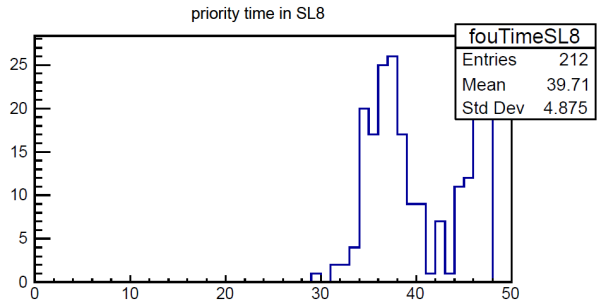












Exp 26, runs 1850-end (DST Skim)

Exp. 30, runs 1960-2025 (RAW)

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Lumi Data:
CLK counters for SLs 6-8

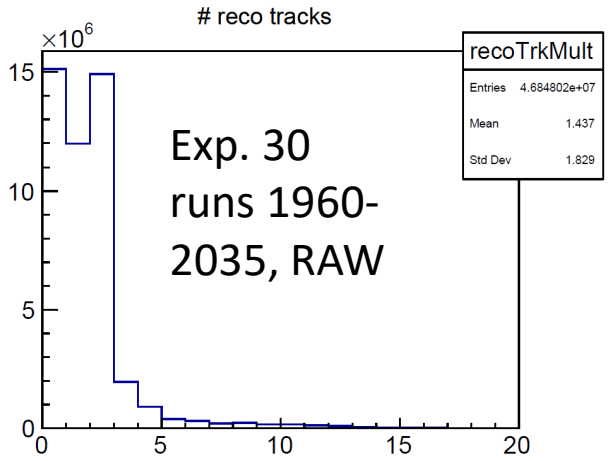
Exp 26: from neuro skim
runs 1850-1968

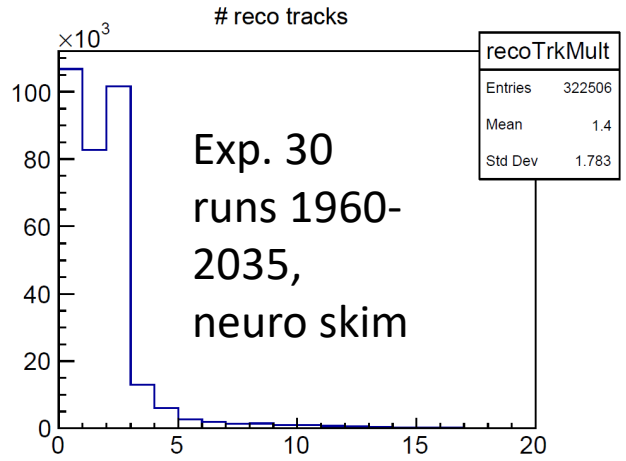
Exp 30, from RAW data
runs 1960-2035

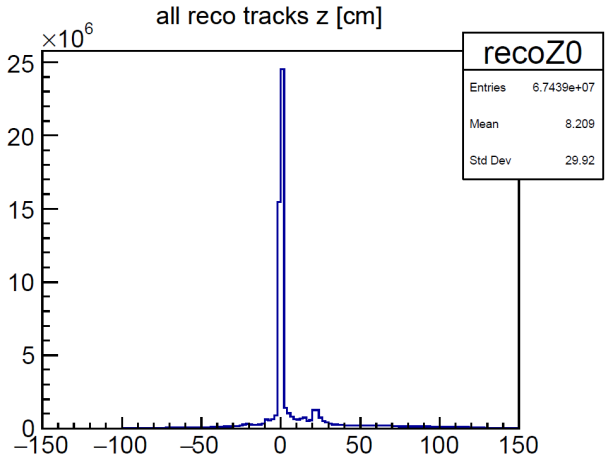
SLs 0-5 look very similar

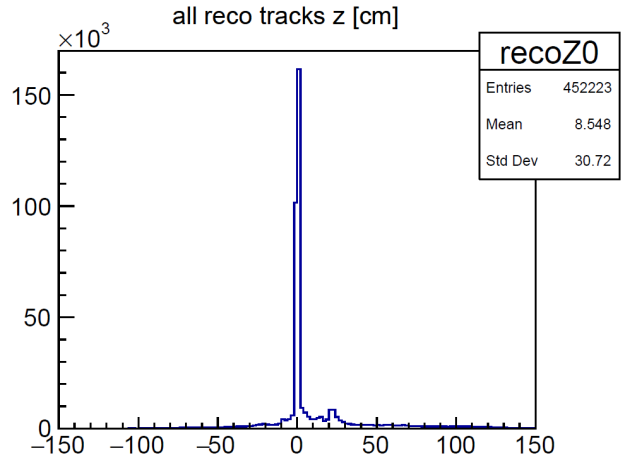
Timing really looks OK.
We have also observed differences during Exp. 26 running (!)

Exp 30 RAW (left) vs Exp 30, neuro skim (right)









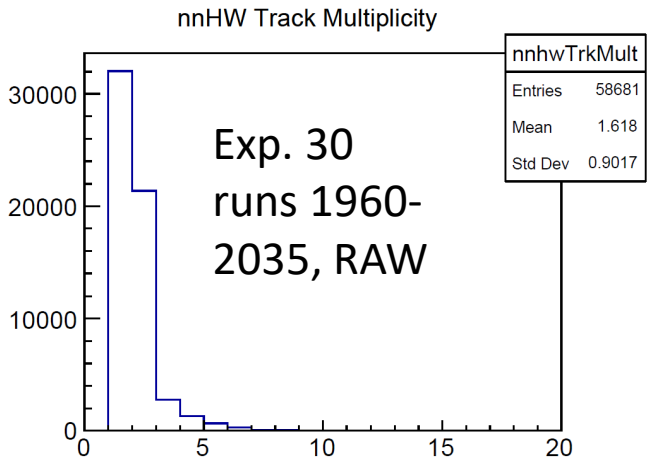
Neuro skim has recently been produced (still test mode)

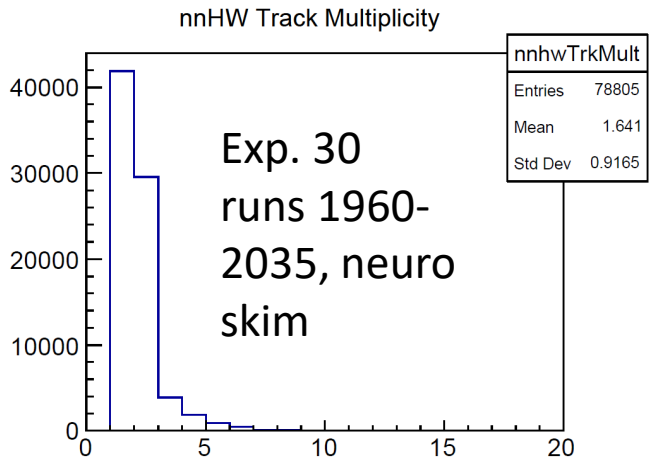
Seems OK,

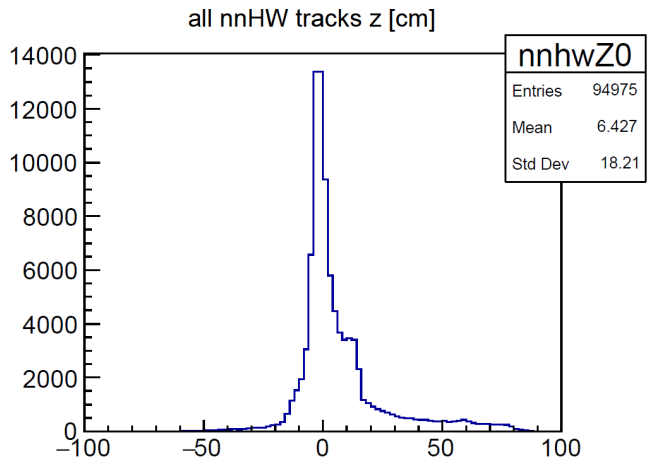
keep rate = 6.8 %

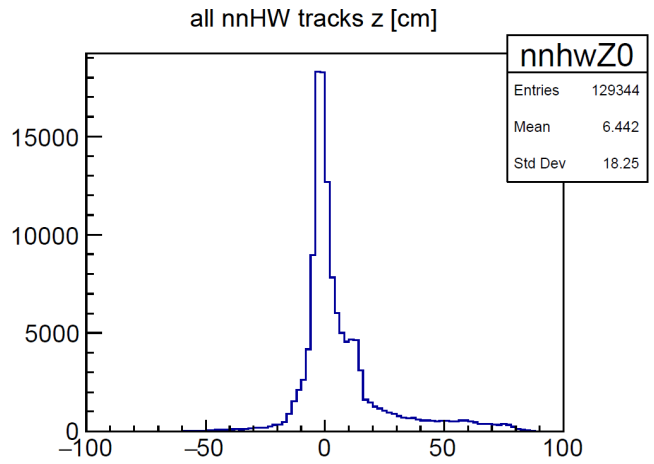
Exp 30, runs 1960-2035 (RAW) Exp. 30 runs 1960-2035 (hRAW neurotrigger) 18/03/2024 page 1

Exp 30 RAW (left) vs Exp 30, neuro skim (right)









Exp 30, runs 1960-2035 (RAW) Exp. 30 runs 1960-2035 (hRAW neurotrigger) 18/03/2024 page 2

Note: neuro skim is a subsample of the RAW triggered data

Seems OK,

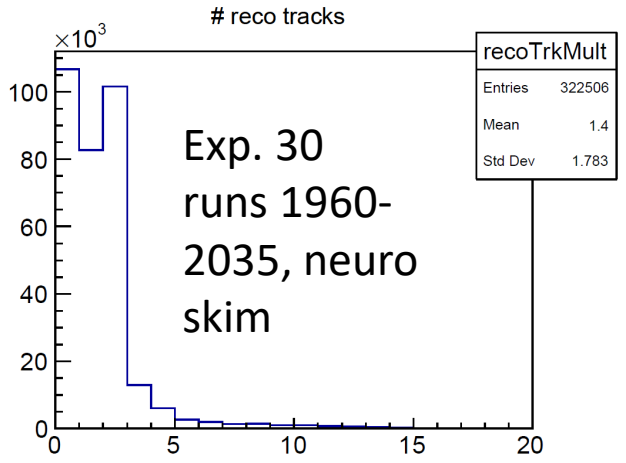
keep rate = 6.8 %

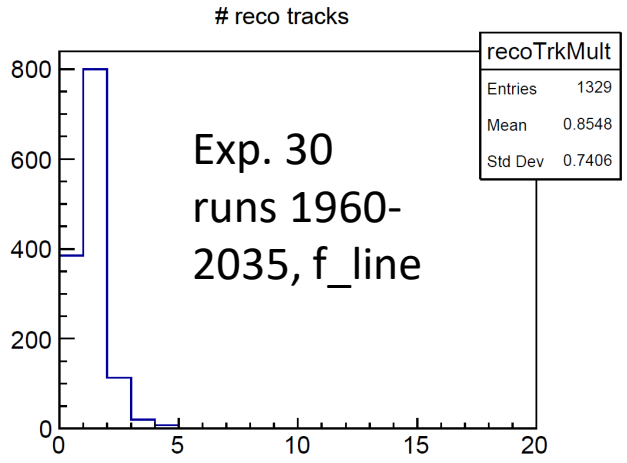
not so clear: more TRG info than on RAW data file ??

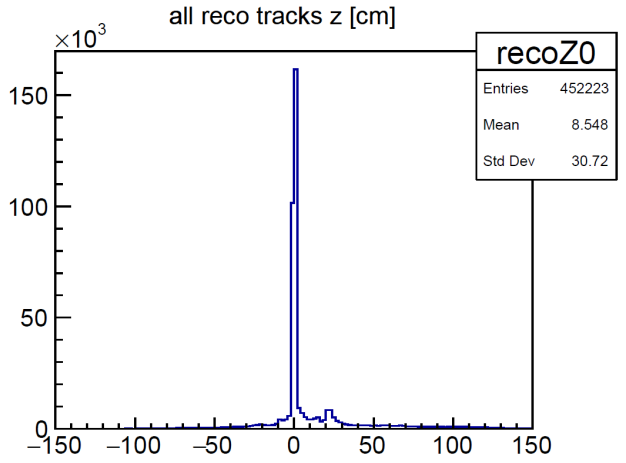
TRG info rate = 136.2 %

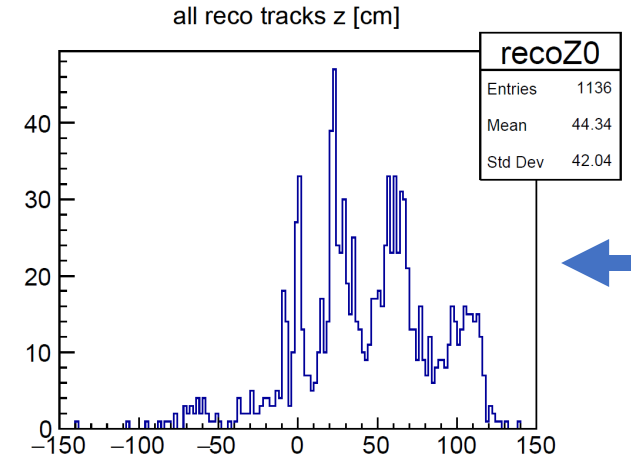
-> rate about 1 Hz @ 1 x 10^{34}

Exp 30 neuro skim (left) vs Exp 30, f line (right)









Note:
f_line requires only „f“ (>= 1 2D track),

L1 trigger NOT required

-> unbiased sample

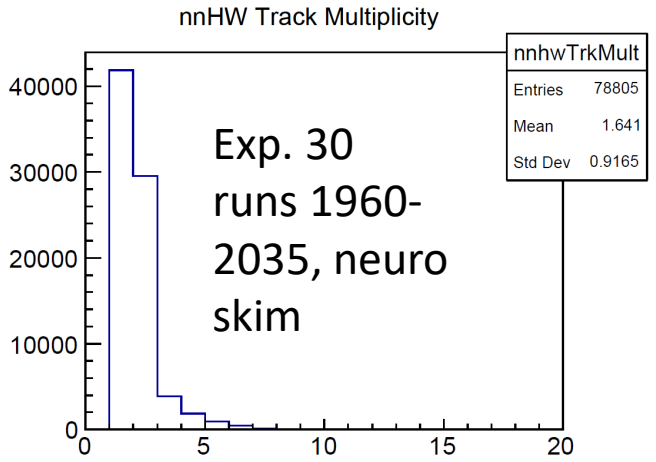
keep rate = 0.25 % of the neuro skim

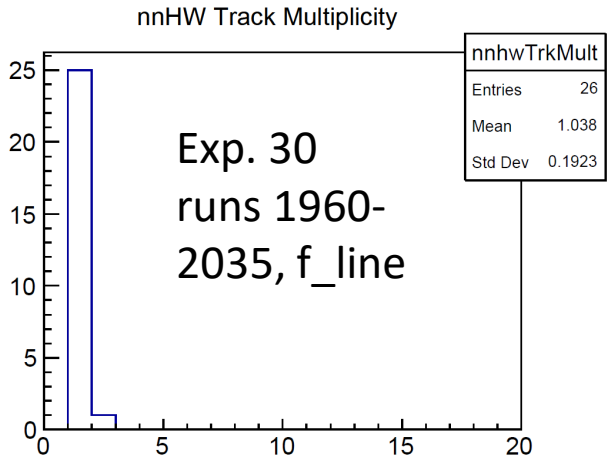
the marked difference is expected !!
(background neuro tracks)

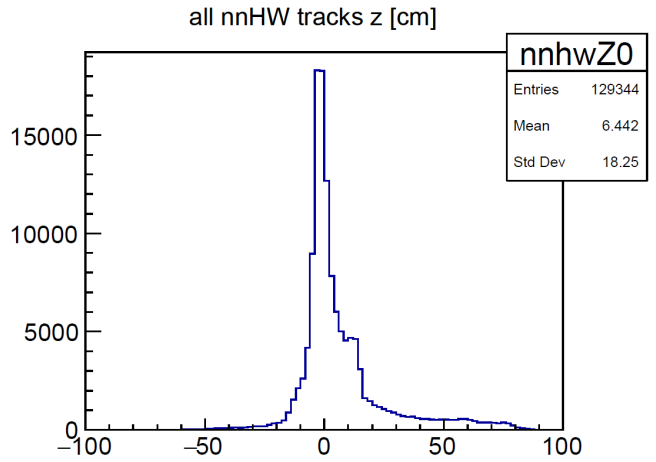
-> f_stream seems to work (in principle)

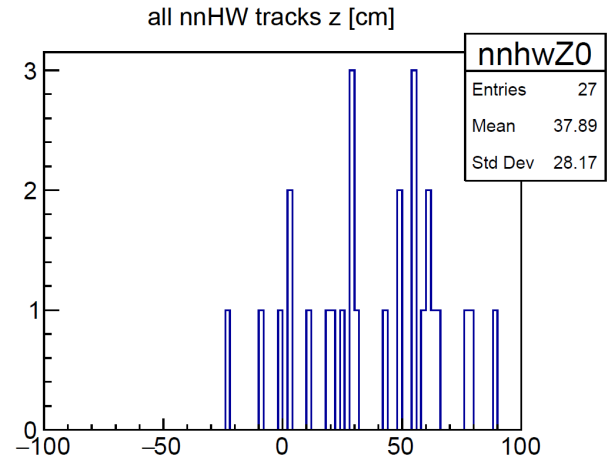
Exp 30, runs 1960-2035 (hRAW neurotrigger) Exp 30, runs 1960-2035 (hRAW fstream) 18/03/2024 page 1

Exp 26 (left) vs Exp 30, f_stream (right)









Exp 30, runs 1960-2035 (hRAW neurotrigger) Exp 30, runs 1960-2035 (hRAW fstream) 18/03/2024 page 2

Corresponding neuro tracks

fraction is exceedingly small
(in contrast to the neuro_skim)

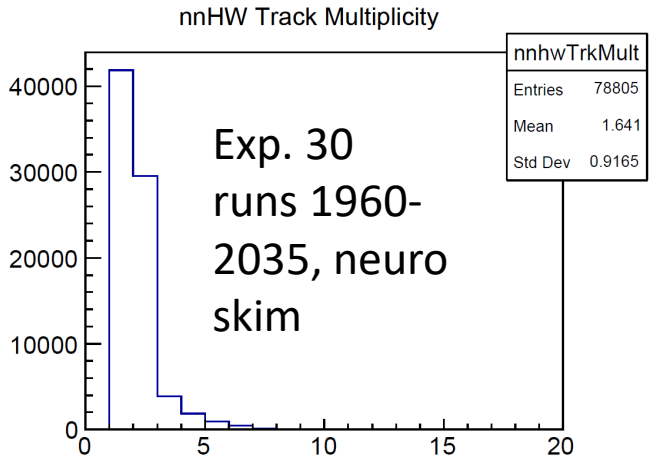
Discussion with HLT/L1 Trigger ongoing:
need more data/run

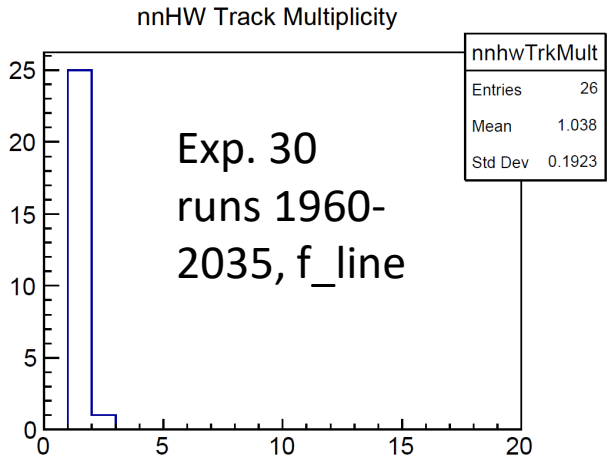
60 reco tracks selected, 27 with NN tracks seen within 22 hours of running

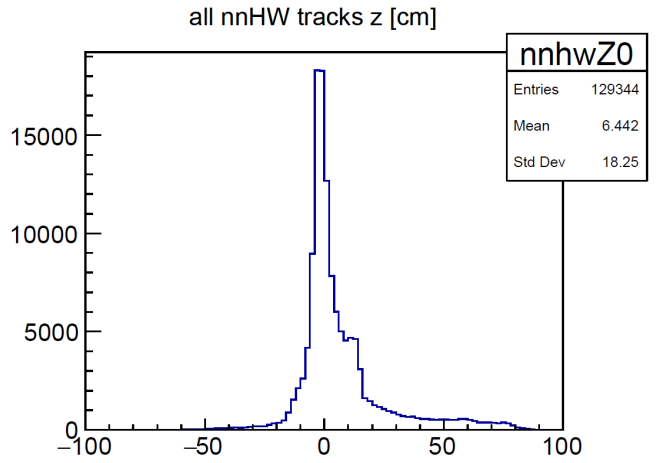
Assume 50% duty cycle:
~ 30 tracks in 40 hours

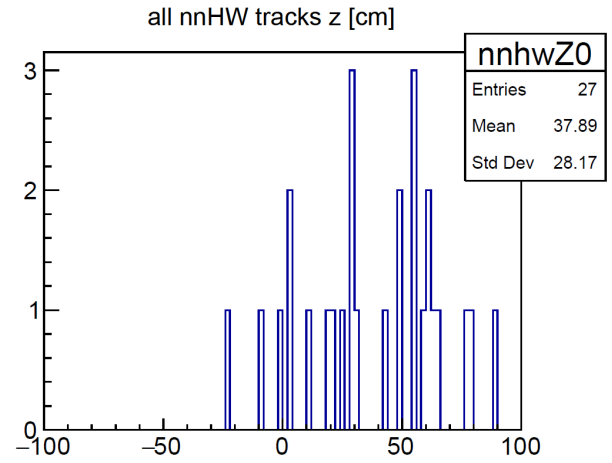
~ 120 tracks per week @ 1 x 10^{34}
-> much too small (by factor ~100)

Exp 26 (left) vs Exp 30, f_stream (right)









Check of trigger rate of the „f“ line:
9.5 kHZ @ 1 x 10^{34}

Present prescale : 20,000
-> trigger rate ~ 0.5 Hz

every 256th trigger has the full TRG info,
expect 7 „f“ triggers per hour.

Run time 21 h, elapse time 43 h (from ELOG)
-> duty cycle of 50%, 50% NN tracks

7*21/4 ~ 37 NN tracks expected, 27 seen
(order of magnitude estimate about OK)

only 1 f track for 4800 neuro skim tracks

Exp 30, runs 1960-2035 (hRAW neurotrigger) Exp 30, runs 1960-2035 (hRAW fstream) 18/03/2024 page 2