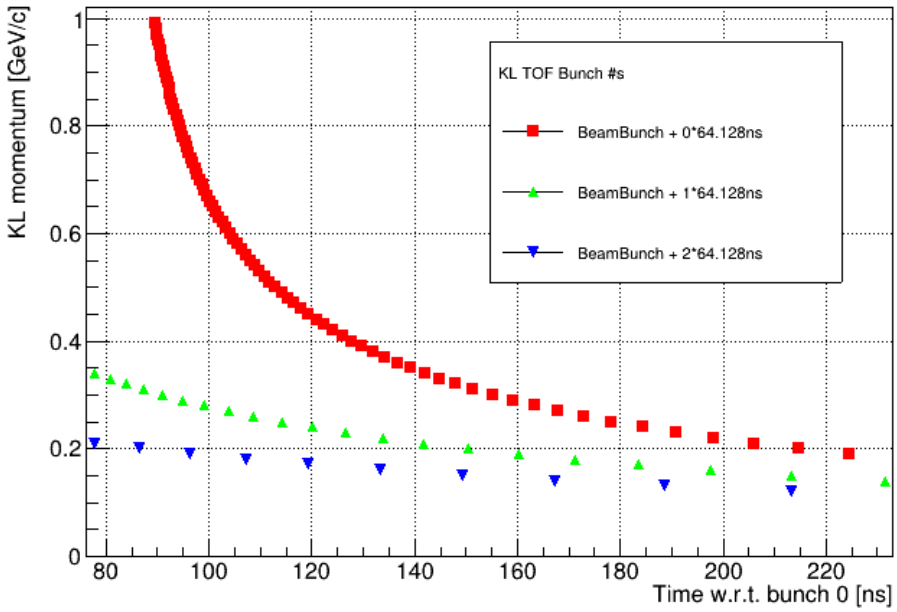
KLF Notes on beam properties

Cebaf machine frequency: 1497 MHz, results in bunch time of 0.668ns
KLF beam prescaling 1/96: this results in bunch times of 64.128ns
5 uA beam results in 3.125e13 electrons/s or 2.004e6 electrons/bunch or 0.32 pC/bunch

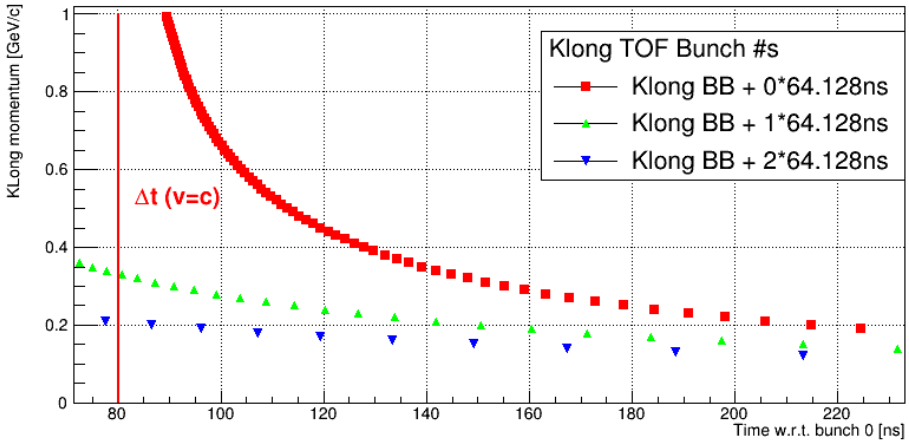
Assuming a flight distance of 24m from the center of Be production target to the center of LH experimental target the following relation between Klong momentum and time-of-flight can be determined with respect to the RF (64.128ns) The red curve illustrates the TOF w.r.t the reference bunch #0 while green and blue represent TOF from one and two bunches earlier in the sequence. So, for example, at t=120 = HitTime-RF there are 3 Klong momenta overlapping: 405MeV/c, 250MeV/c and 170MeV/c.

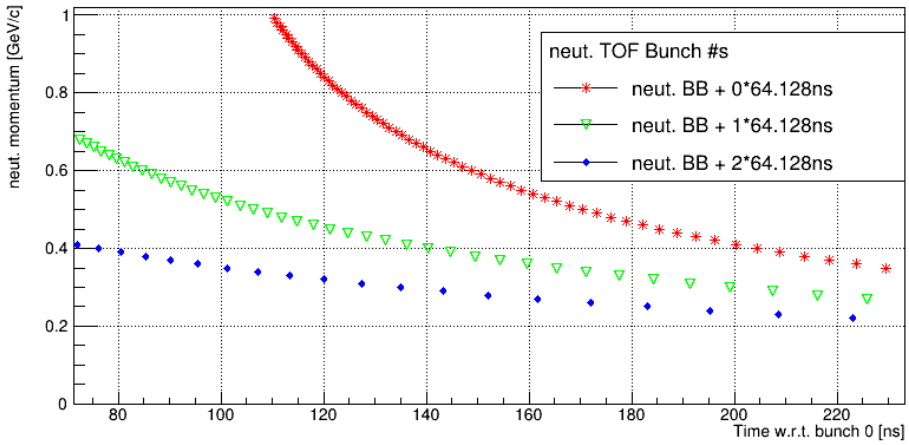


The table below illustrates this "overlap" in more detail where the first column shows the Klong momentum the second column its TOF over 24m with respect to its bunch. and the columns B+1, B+0, B-1, ... are the respective bunches considered regarding a potential overlap given in momentum GeV/c. B+0 is the reference bunch, B+1 is the bunch that will follow, B-1 is the previous bunch already passed the Be target and so on. For example, a 600MeV/c Klong has a flight time of 104.04ns for 24m and its flight time will overlap with a Klong of momentum 269MeV/c whose flight time will be longer by one bunch clock cycle of 64.128ns. The dp[%] and the dEkin[%] are the calculated uncertainty in momentum and kinetic energy respectively in units of [%] with the assumption that the uncertainty in the timing measurement is 0.5ns.

p[GeV/c]	TOF	B+1	dp[%]	B+0	dp[%](dEkin[%])	B-1	dp[%]	B-2	dp[%]	B-3	dp[%]
0.900	91.50	0.000	+/- 0.0	0.900	+/- 2.3 (3.3)	0.299	+/- 0.4	0.195	+/- 0.3	0.146	+/- 0.2
0.850	92.79	0.000	+/- 0.0	0.850	+/- 2.1 (3.1)	0.295	+/- 0.4	0.193	+/- 0.3	0.146	+/- 0.2
0.800	94.31	0.000	+/- 0.0	0.800	+/- 1.9 (2.8)	0.291	+/- 0.4	0.192	+/- 0.3	0.145	+/- 0.2
0.750	96.10	0.000	+/- 0.0	0.750	+/- 1.7 (2.6)	0.287	+/- 0.4	0.190	+/- 0.3	0.144	+/- 0.2
0.700	98.25	0.000	+/- 0.0	0.700	+/- 1.5 (2.3)	0.282	+/- 0.4	0.188	+/- 0.3	0.143	+/- 0.2
0.650	100.85	0.000	+/- 0.0	0.650	+/- 1.3 (2.1)	0.276	+/- 0.4	0.186	+/- 0.2	0.141	+/- 0.2
0.600	104.04	0.000	+/- 0.0	0.600	+/- 1.2 (1.9)	0.269	+/- 0.4	0.183	+/- 0.2	0.140	+/- 0.2
0.550	107.99	0.000	+/- 0.0	0.550	+/- 1.0 (1.7)	0.262	+/- 0.4	0.179	+/- 0.2	0.138	+/- 0.2
0.500	112.98	0.000	+/- 0.0	0.500	+/- 0.9 (1.5)	0.252	+/- 0.4	0.175	+/- 0.2	0.135	+/- 0.2
0.450	119.39	0.000	+/- 0.0	0.450	+/- 0.8 (1.3)	0.241	+/- 0.3	0.170	+/- 0.2	0.132	+/- 0.2
0.400	127.82	0.000	+/- 0.0	0.400	+/- 0.6 (1.1)	0.228	+/- 0.3	0.164	+/- 0.2	0.129	+/- 0.2
0.350	139.19	0.000	+/- 0.0	0.350	+/- 0.5 (1.0)	0.213	+/- 0.3	0.156	+/- 0.2	0.124	+/- 0.2
0.300	155.10	0.923	+/- 2.4	0.300	+/- 0.4 (0.8)	0.195	+/- 0.3	0.147	+/- 0.2	0.118	+/- 0.2
0.250	178.38	0.489	+/- 0.9	0.250	+/- 0.3 (0.7)	0.174	+/- 0.2	0.135	+/- 0.2	0.110	+/- 0.1
0.200	214.73	0.312	+/- 0.5	0.200	+/- 0.3 (0.5)	0.149	+/- 0.2	0.119	+/- 0.2	0.100	+/- 0.1
0.150	277.46	0.202	+/- 0.3	0.150	+/- 0.2 (0.4)	0.120	+/- 0.2	0.100	+/- 0.1	0.086	+/- 0.1
0.100	406.45	0.120	+/- 0.2	0.100	+/- 0.1 (0.3)	0.086	+/- 0.1	0.075	+/- 0.1	0.067	+/- 0.1
0.050	800.97	0.054	+/- 0.1	0.050	+/- 0.1 (0.1)	0.046	+/- 0.1	0.043	+/- 0.1	0.040	+/- 0.1

Since there are also neutrons produced and part of the beam the following plot shows the TOF of these particles as well in relation to Kaons.





This shows that for a measured TOF of 120ns the expected Kaon momenta are 450MeV/c, 250MeV/c and 180MeV/c while the neutron momenta are 850MeV/c, 450MeV/c and 300MeV/c.
Note that at a momentum of 450MeV/c both a Kaon from the prompt bunck (red) and a neutron from the previous bunch (green) are possible candidates for the trigger.