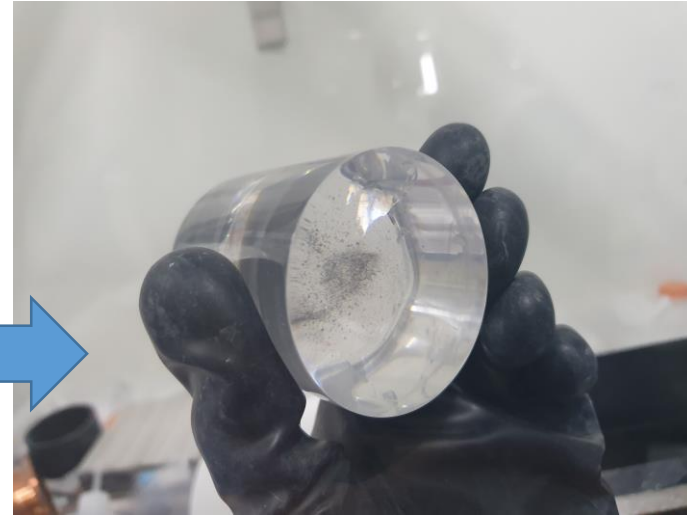
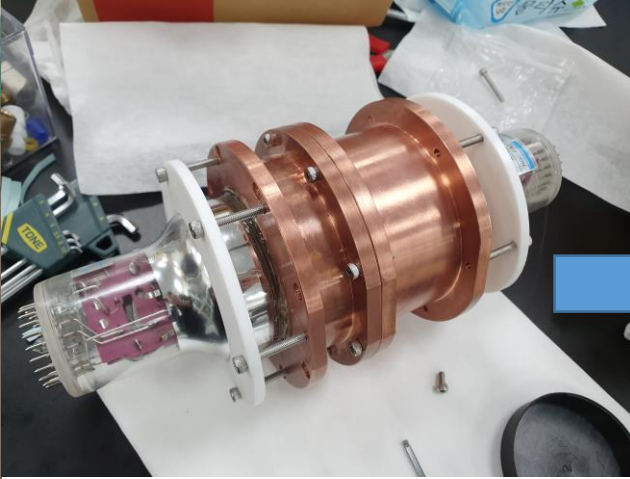


Nal-034(R&D)

2019/12/06
Jae Jin Choi



Nal-034 machining & encapsulation

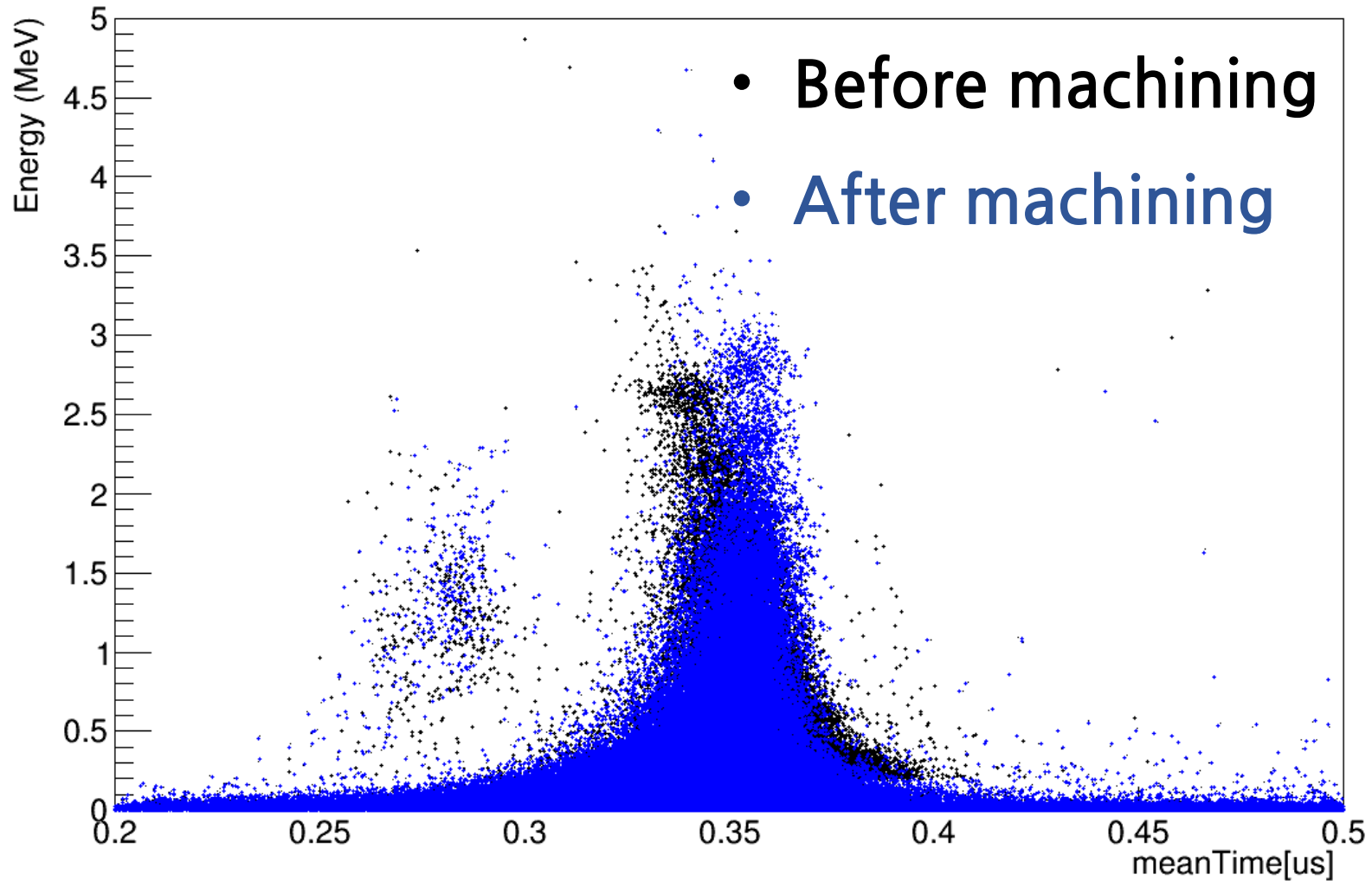


- Before machining

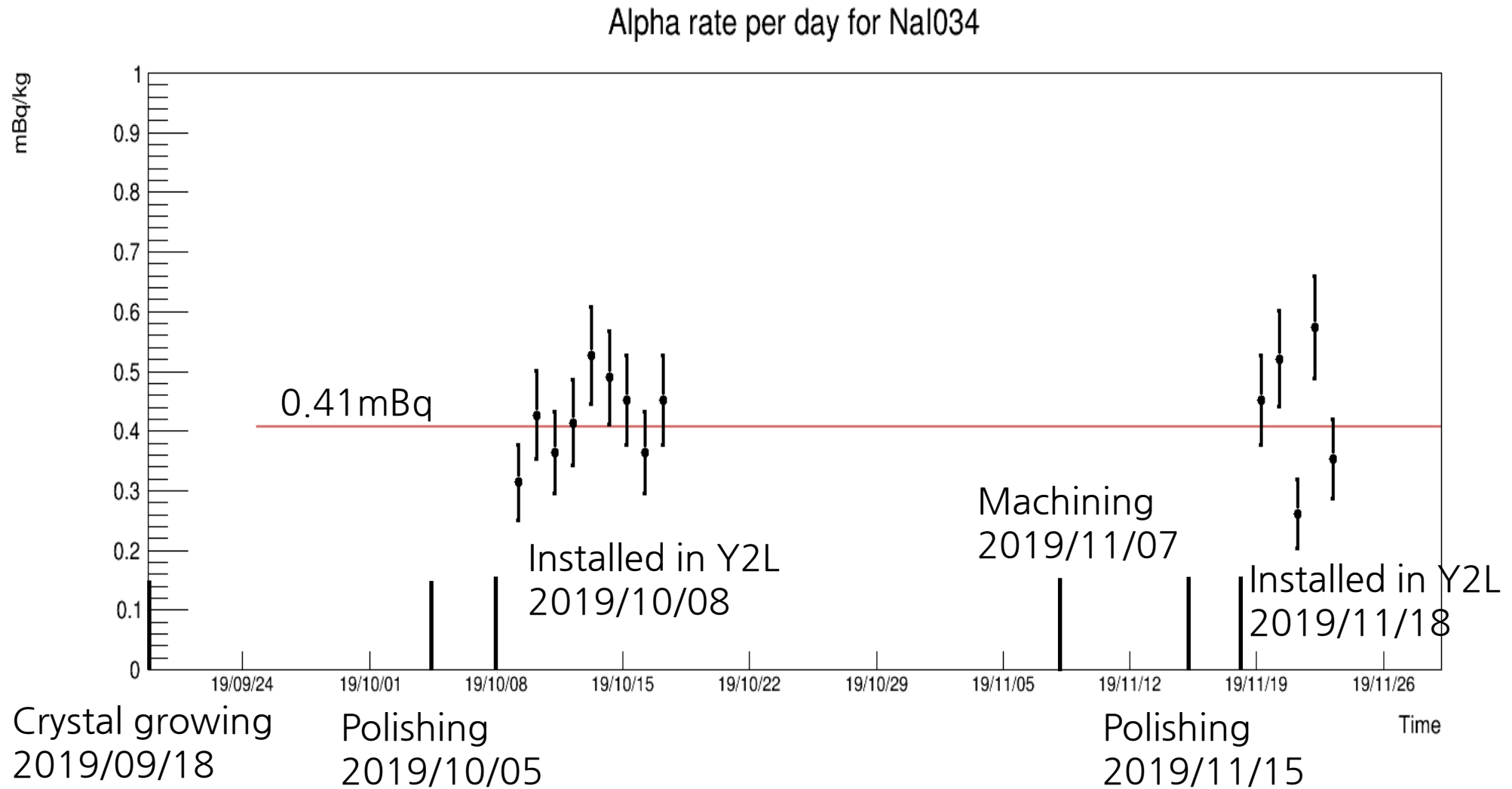
- After machining(cylinder)

NaI-034 alpha

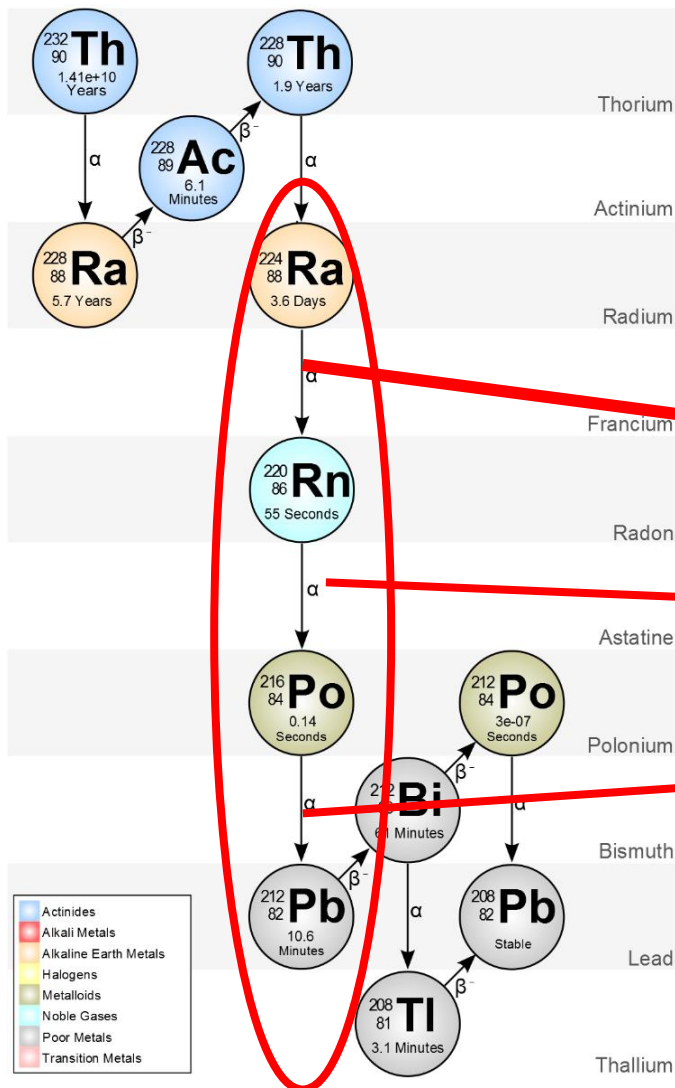
- Voltage changed 1100 V ,1280 V - > 1050 V, 1150 V



Nal-034 alpha rate



NaI034(Th-232 contamination)

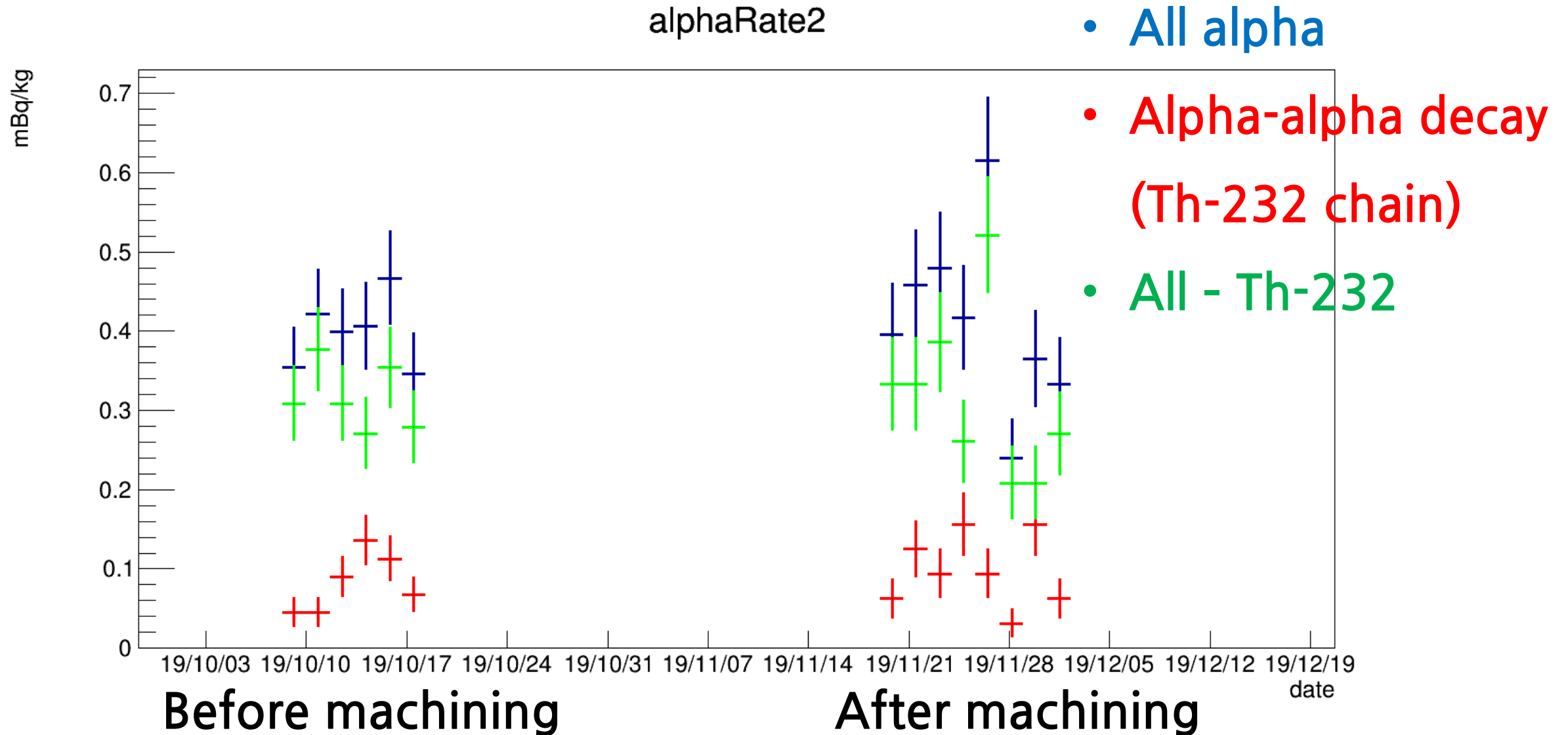


	Half life	Q value(Me V)
Th-228	1.91y	5.520
Ra-224	3.66d	5.789
Rn-220	55.6s	6.405
Po-216	0.145s	6.906

subrun	:	42		
time difference	:	32.6 s	before energy : 1.339	after energy : 1.561
time difference	:	0.02 s	before energy : 1.561	after energy : 1.787
subrun	:	43		
time difference	:	12.84 s	before energy : 0.747	after energy : 0.8847
time difference	:	0.2616 s	before energy : 0.8847	after energy : 0.7816

~ 30% alpha events from Th-232 alpha-alpha-alpha decay

Nal-034 alpha rate



NaI-034 alpha-alpha-alpha events(Th-232)

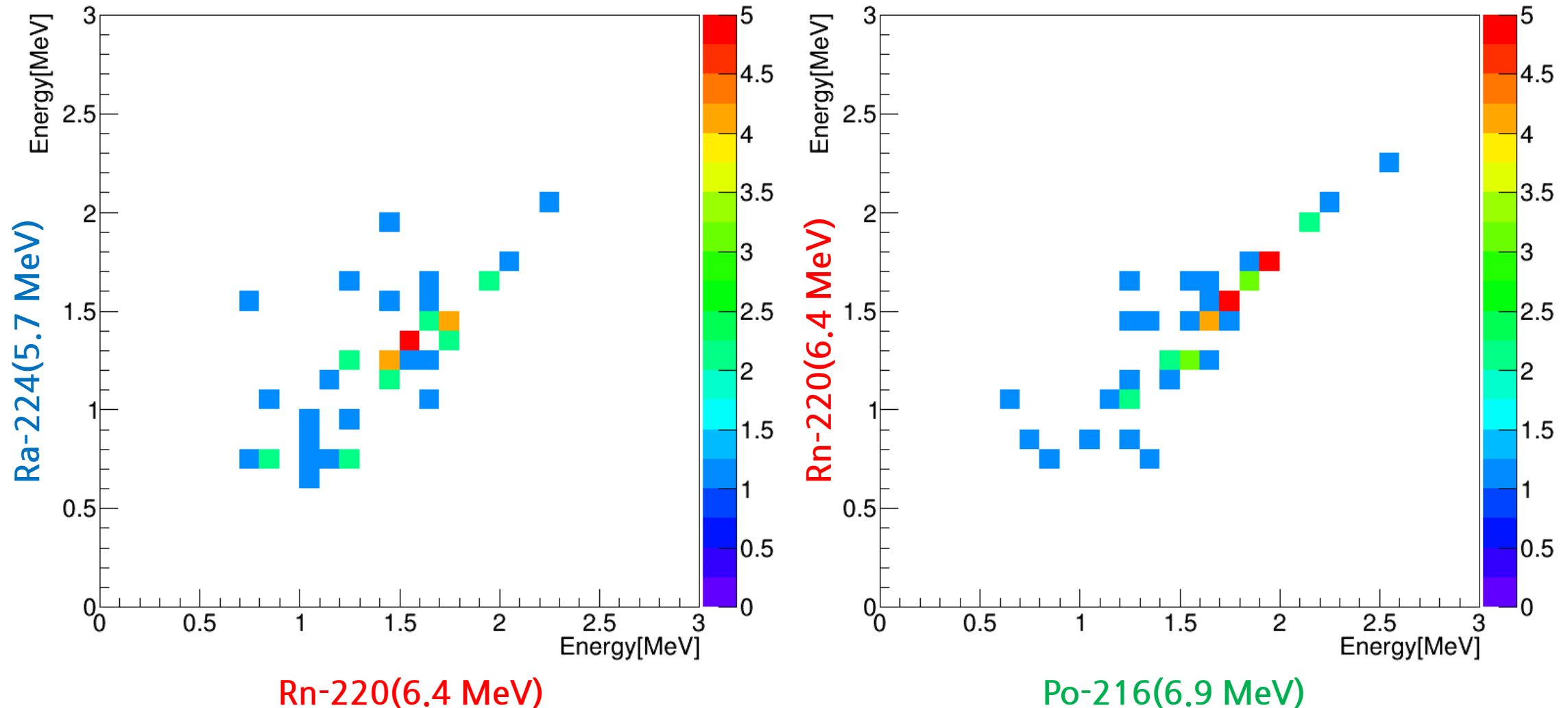
			Ra-224(5.7 MeV)	Rn-220(6.4 MeV)	Po-216(6.9 MeV)
subrun	:	20			
time difference	:	0.2503 s	time difference between 3 alpha :	207.6 s	
			before2 energy :	1.437	before energy : 1.7
					after energy : 1.912
subrun	:	38			
time difference	:	0.0486 s	time difference between 3 alpha :	34.47 s	
			before2 energy :	1.481	before energy : 1.739
					after energy : 1.981
subrun	:	42			
time difference	:	0.02 s	time difference between 3 alpha :	32.62 s	
			before2 energy :	1.339	before energy : 1.561
					after energy : 1.787
subrun	:	43			
time difference	:	0.2616 s	time difference between 3 alpha :	13.1 s	
			before2 energy :	0.747	before energy : 0.8847
					after energy : 0.7816
subrun	:	28			
time difference	:	0.2141 s	time difference between 3 alpha :	263.4 s	
			before2 energy :	1.293	before energy : 1.409
					after energy : 1.628
subrun	:	42			
time difference	:	0.1505 s	time difference between 3 alpha :	160 s	
			before2 energy :	0.7308	before energy : 0.7338
					after energy : 0.8285
subrun	:	46			
time difference	:	0.06316 s	time difference between 3 alpha :	153.9 s	
			before2 energy :	1.79	before energy : 2.078
					after energy : 2.279

- Quenching factors are similar if there are from same Th-232 origin
- Quenching factors are different by Th-232 origin like two peak alpha events which are from COSINE crystals



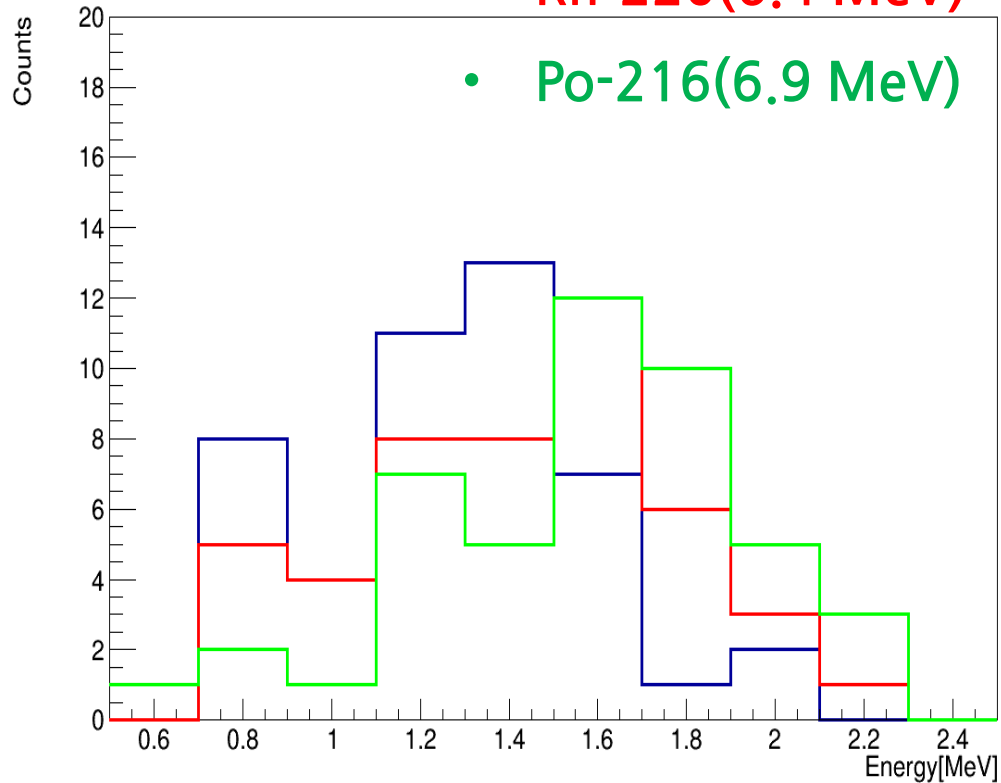
Quenching factors have position dependence

Nal-034 distribution(alpha-alpha energy comparison)



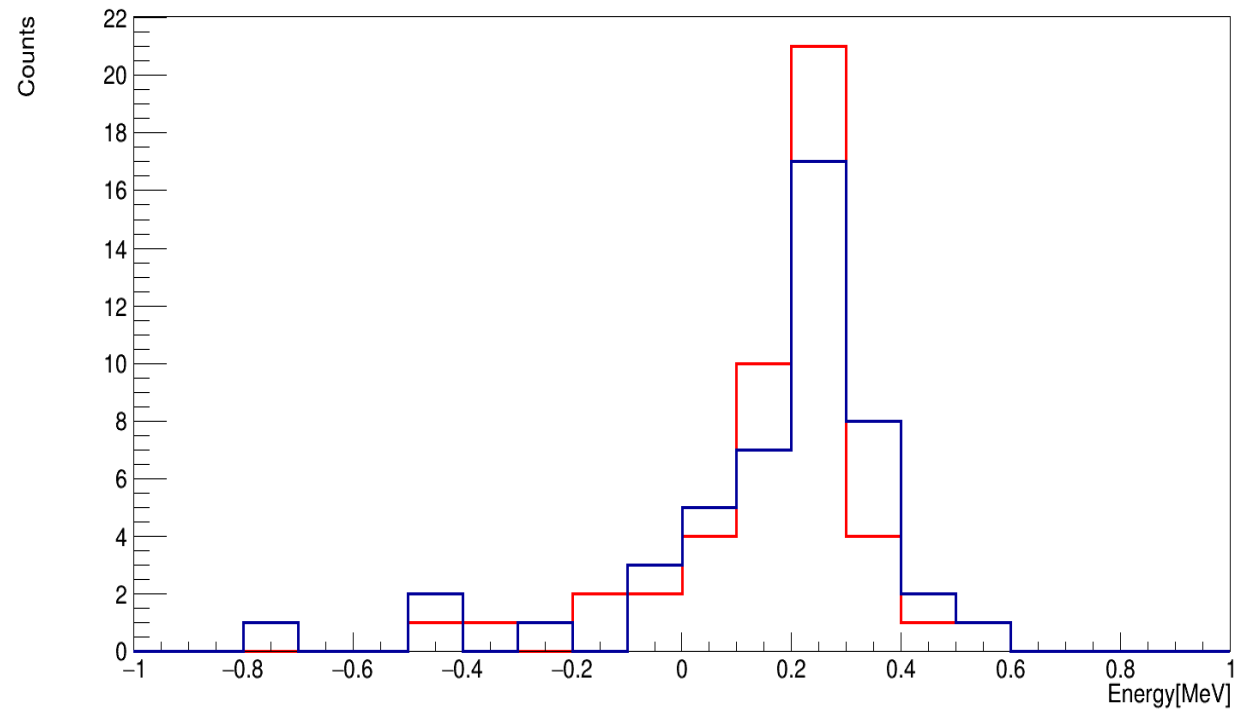
NaI-034 distribution

- Ra-224(5.7 MeV)
- Rn-220(6.4 MeV)
- Po-216(6.9 MeV)



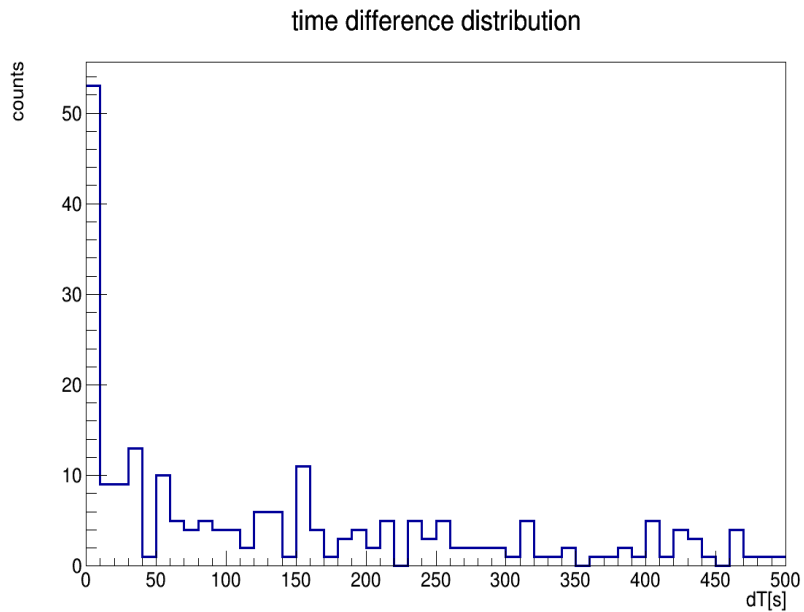
Alpha energy distribution

- Rn-220(6.4 MeV) - Ra-224(5.7 MeV)
- Po-216(6.9 MeV) - Rn-220(6.4 MeV)

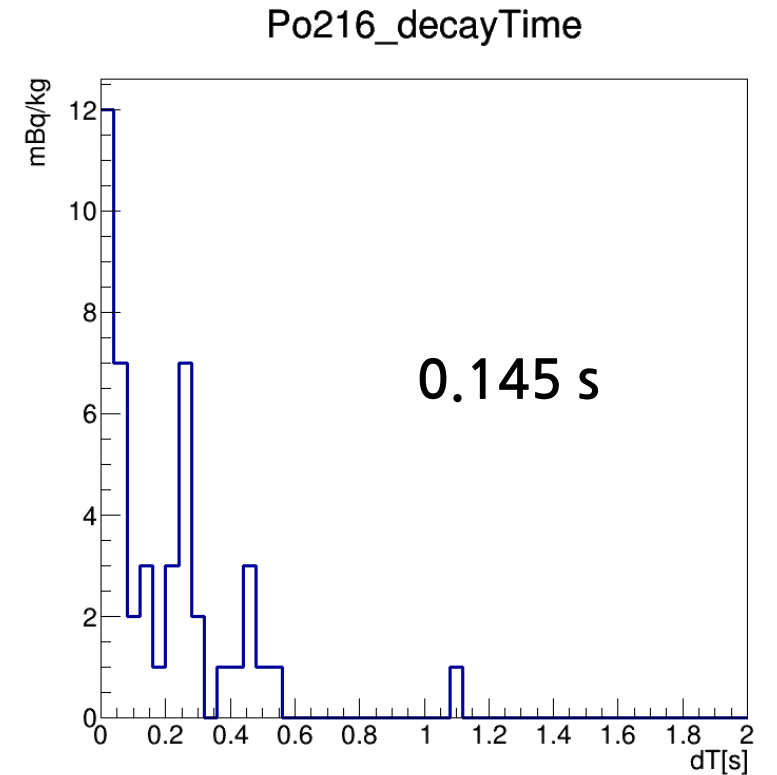
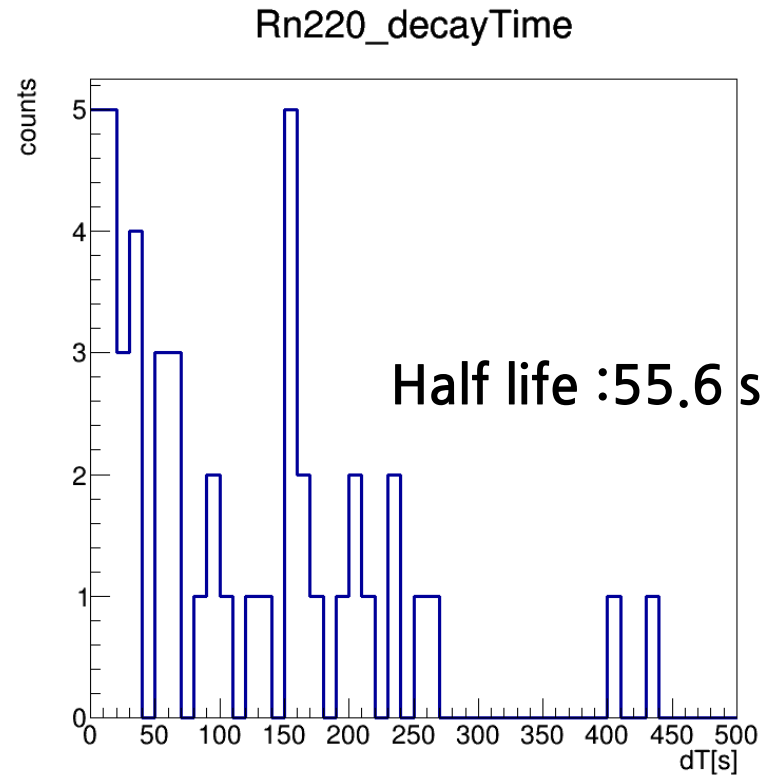


Alpha-alpha energy difference distribution

NaI-034 alpha decay time



Time difference distribution



Summary

- Alpha rate looks stable except Th-232 chain alpha(~ 0.3 mBq/kg)
- According to Th-232 chain alpha distribution, it looks correlated with Q-value
 - Poor resolution(various quenching factor)
 - Low quenching factor
- Quenching factors have position dependence
- U-238 contamination?(There still remain Th-232 chain alphas)

Backup