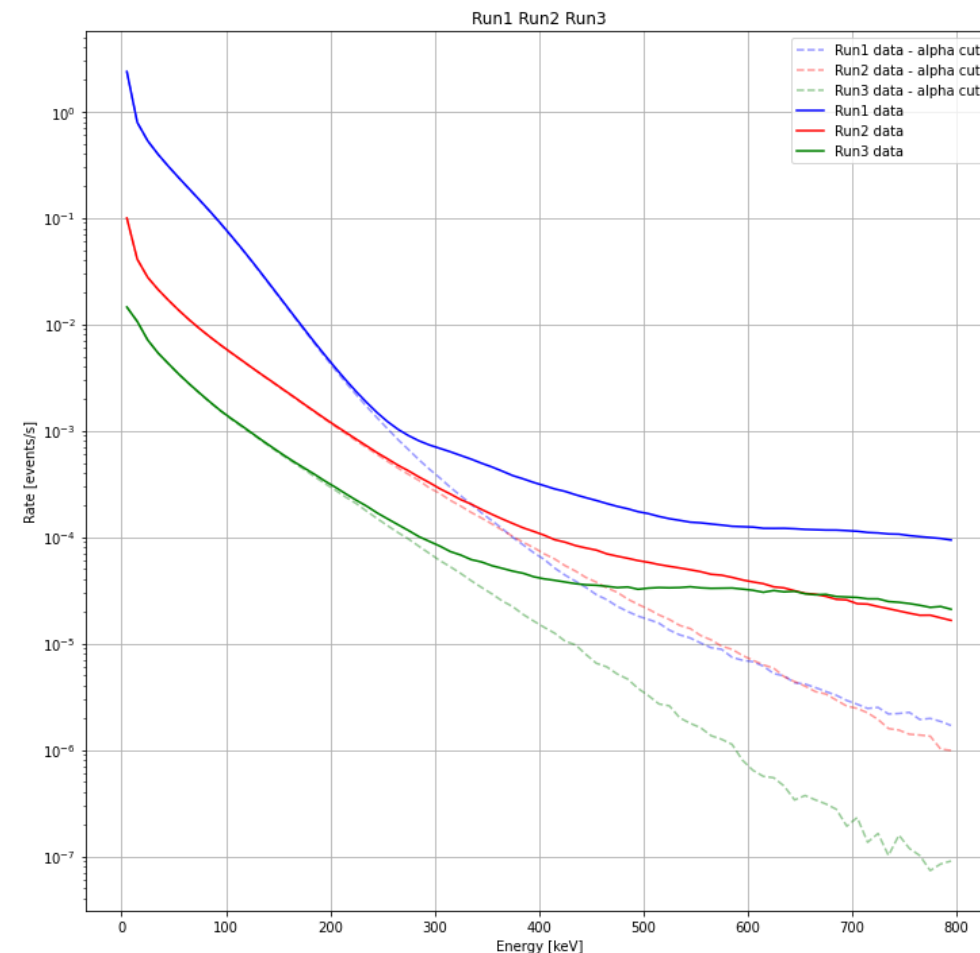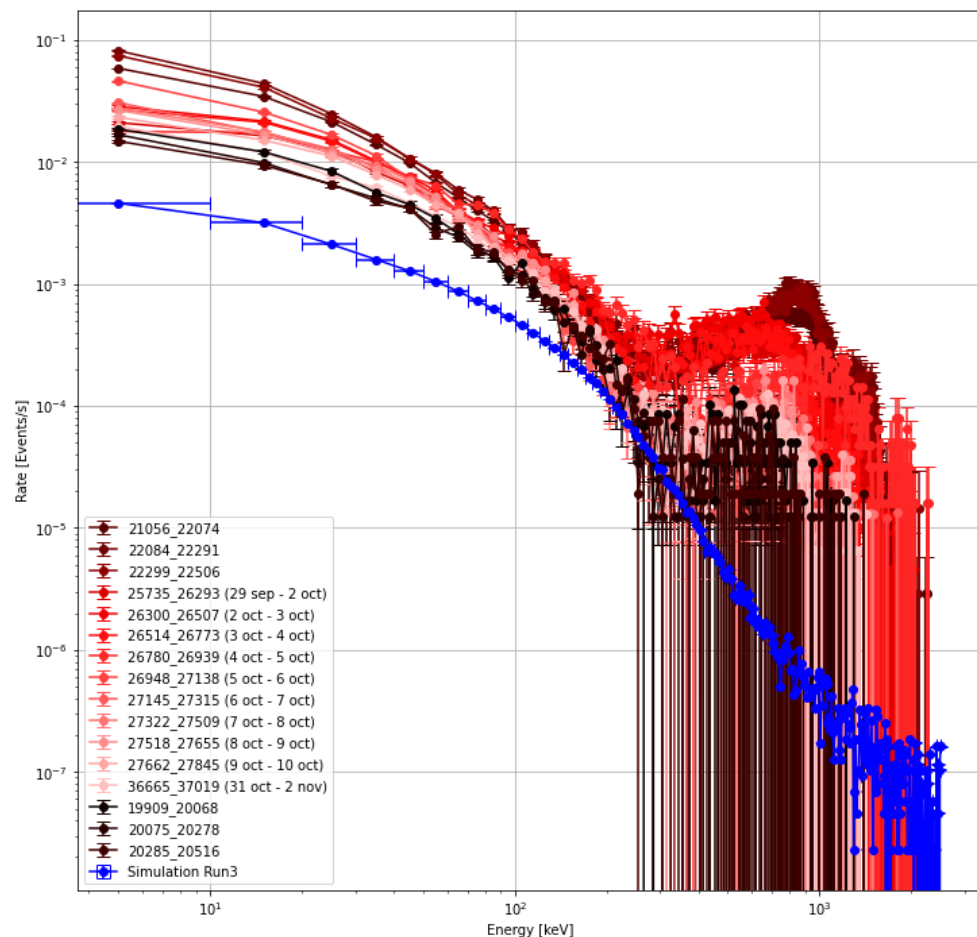# Alphas in LIME

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18/01/2024

We see an excess at high energy in all runs; the spectra all change slope around 300 keV (not present in MC)

They are alphas: cutting out delta>40 restores the slope

Partially expected: alphas from GEANT4 were NOT digitized for computational efficiency reasons

BUT in run3 we see a large variability of the total rate of these events, and a high alpha rate is associated with an excess at low energy also

They should not be at such low energy. Alpha energy is greatly saturated
Observation: the position of the main visible alpha peak is anti-correlated to the LY (low LY->low gain->low saturation)
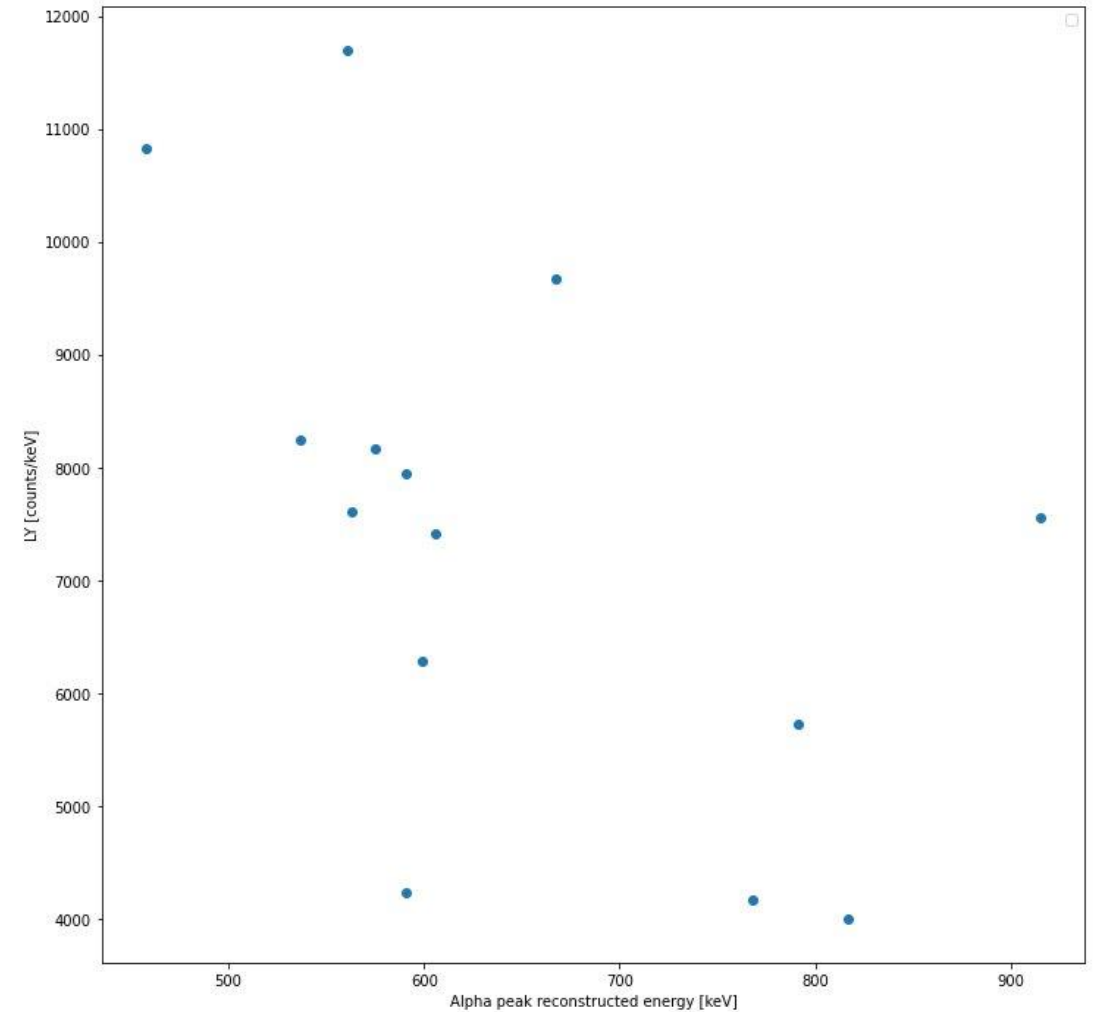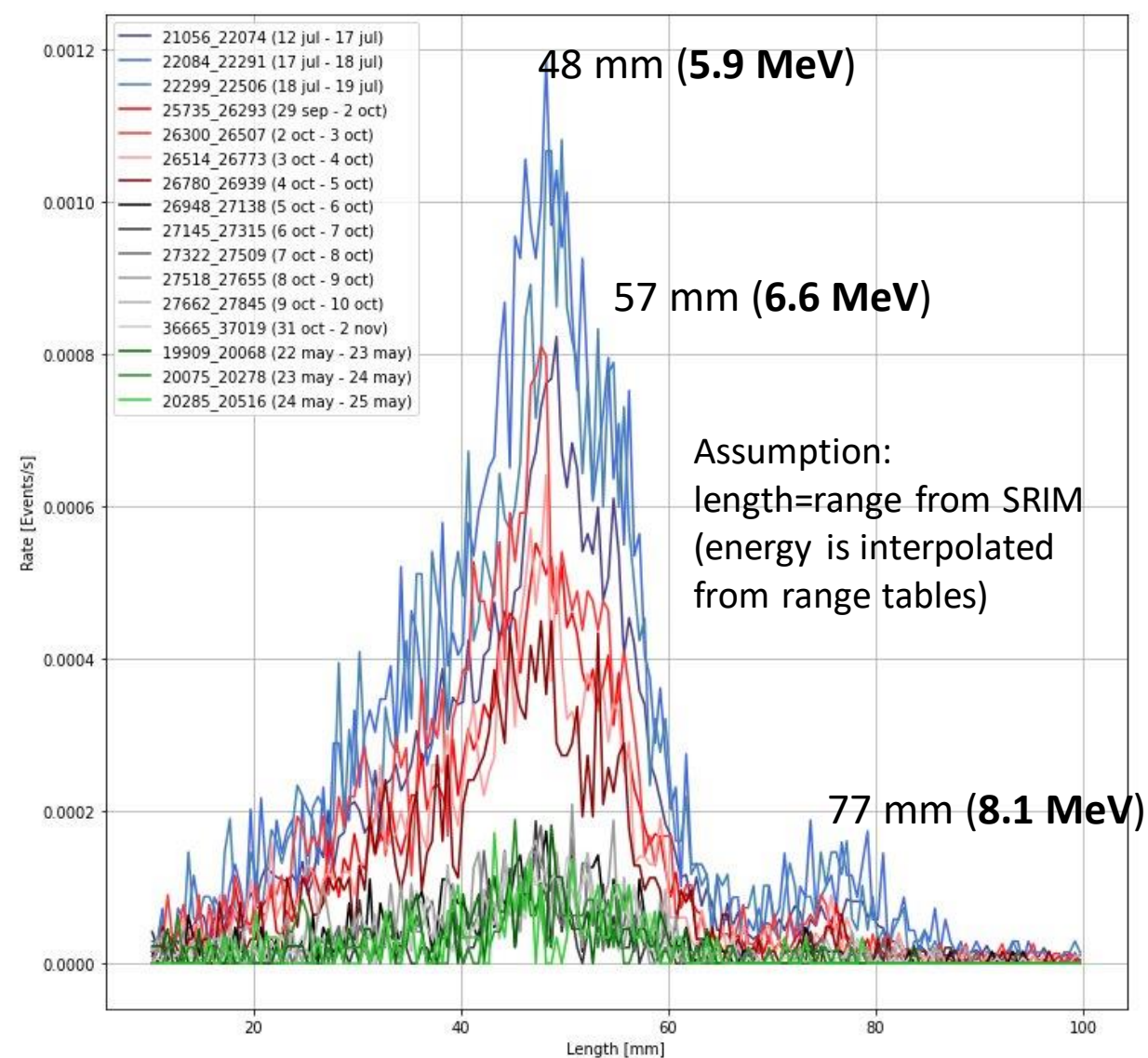
- Also the rate is correlated to the LY (common cause: contamination)

- -> It is also related to the filters:
- In may, no filters -> low rate
- July, line 2, filter from LNF -> high rate
- August (AmBe included), line 1, filter only used in LNGS -> low rate, increased over time
- October 5th, line 2, changed filter (still from LNF) -> low rate

- The filters might introduce radioactive contaminants, which not only increase this alpha rate, but also the rate at lower energy
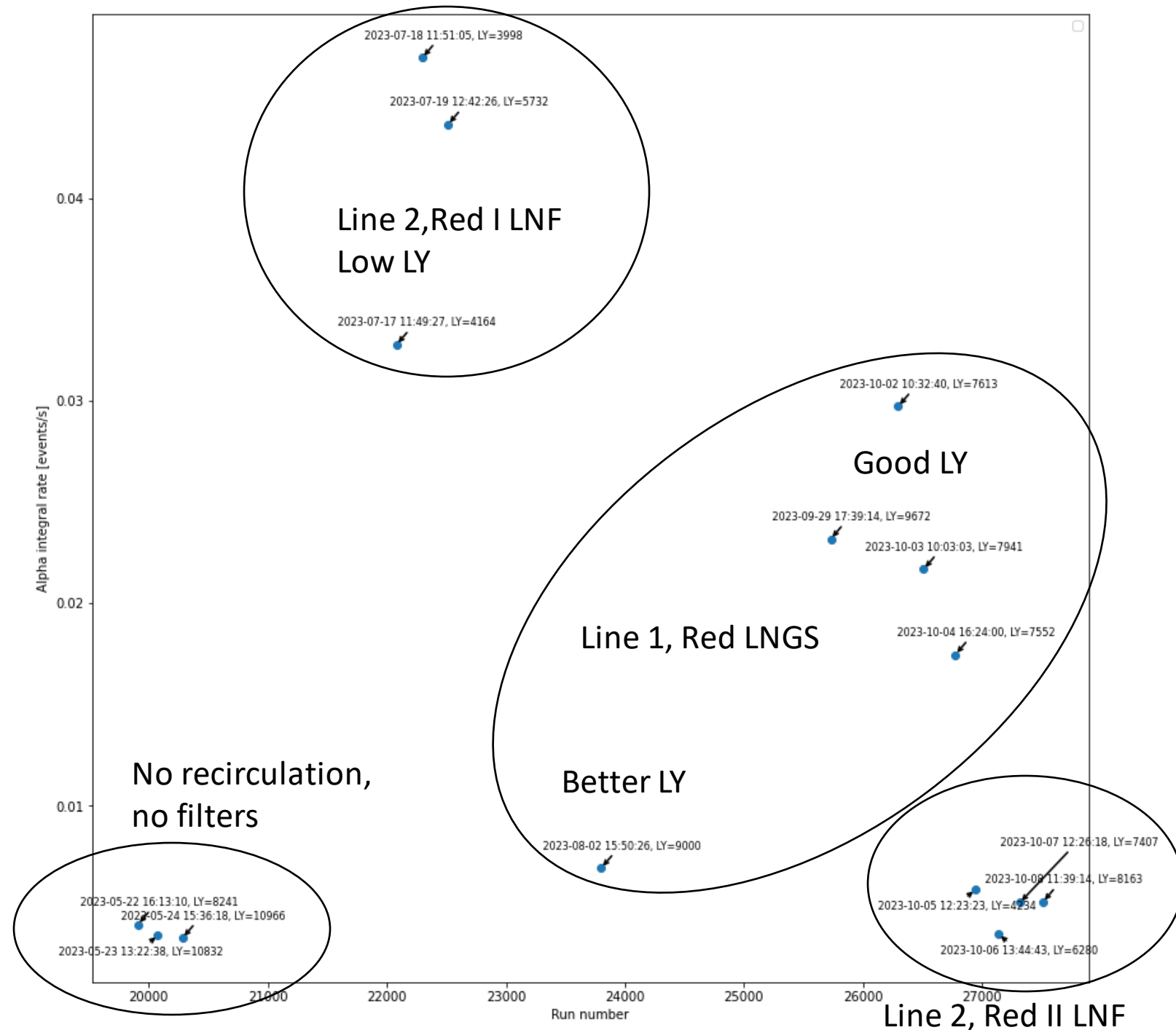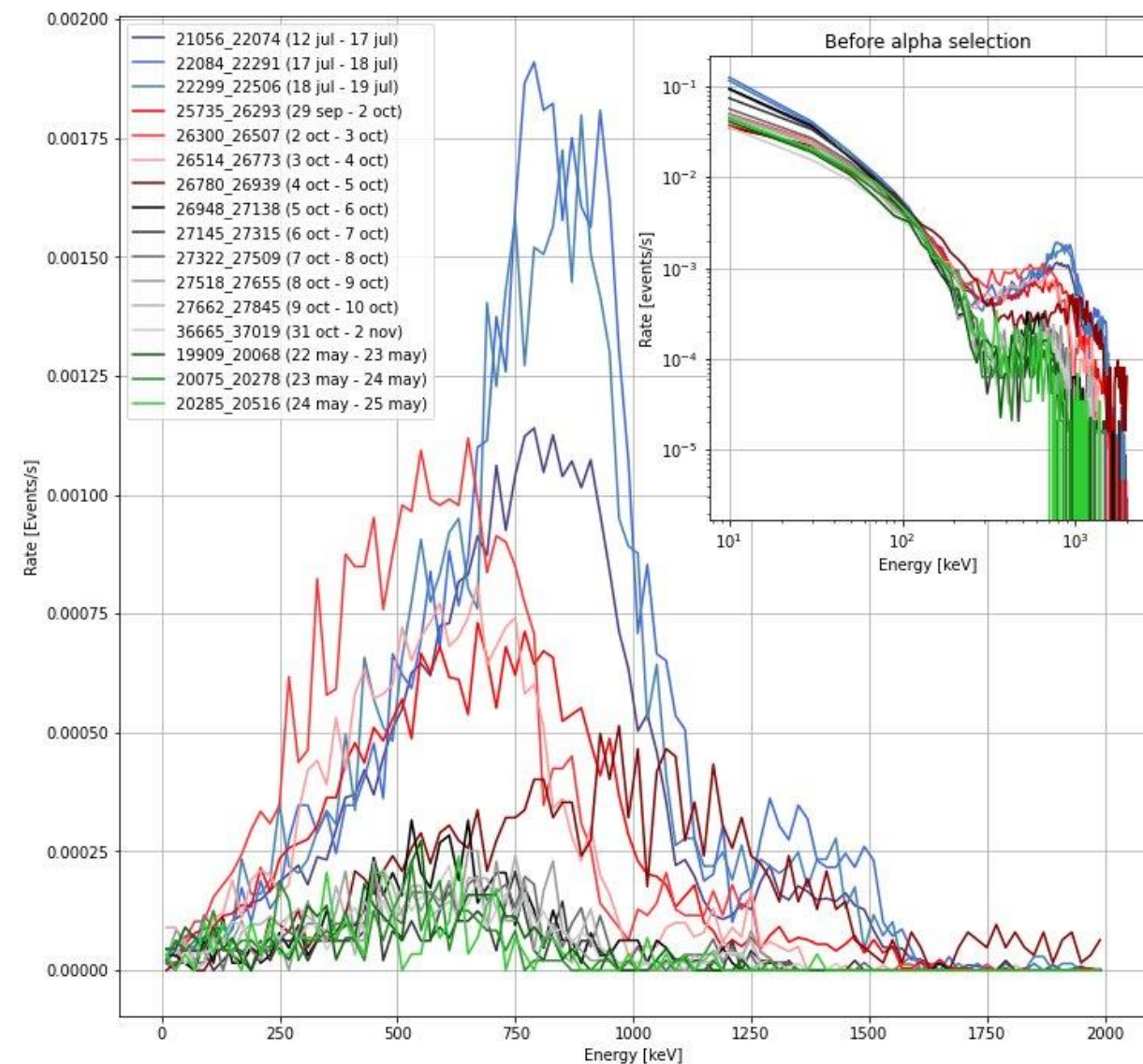
Alpha rate (just cut delta>40): 0.0034 s-1 (May) , 0.045 s-1 (July)
Subtracting the expected alphas from radioactivity (GEANT4 MC truth) -> 0.14 Bq/m3 (May), 1.81 Bq/m3 (July)

48 mm (**5.9 MeV**)

57 mm (**6.6 MeV**)

Assumption:
length=range from SRIM
(energy is interpolated
from range tables)

77 mm (**8.1 MeV**)

Expected alphas from radon chain:
Rn222: 5.59 MeV
Po218: 6.1 MeV
Po214: 7.8 MeV