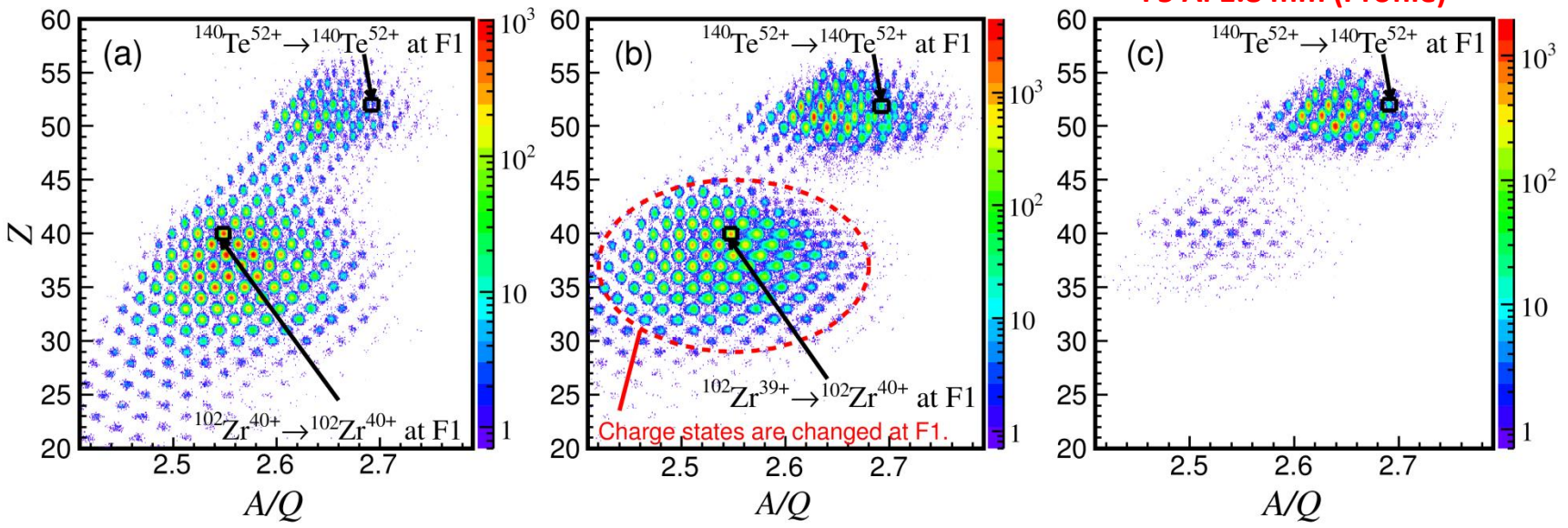
Prescription for background of charge state and secondary reaction at F1 degrader

- Two-stage separation I: Removal of reaction products produced at F1 degrader
- Two-stage separation II: Removal of contaminants due to charge-state change

Two-stage separation: Contaminants due to charge-state change

^{238}U 345 MeV/u + Pb 1.5 mm, $B\rho$ = 7.3940 Tm
F1 slit +-63 mm, F2 slit +-15 mm, F7 slit +-50 mm, Tuned for ^{140}Te^{52+}

No degrader | **F1 Al 3 mm (Wedge)** | **F1 Al 3 mm (Wedge) F5 Al 1.8 mm (Profile)**

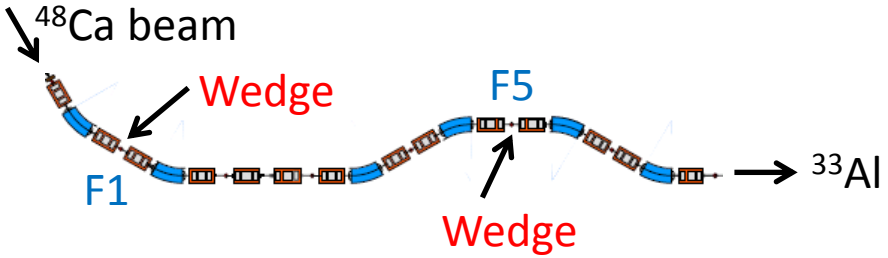


These isotopes reach F3 and F5. **These isotopes reach F7.**

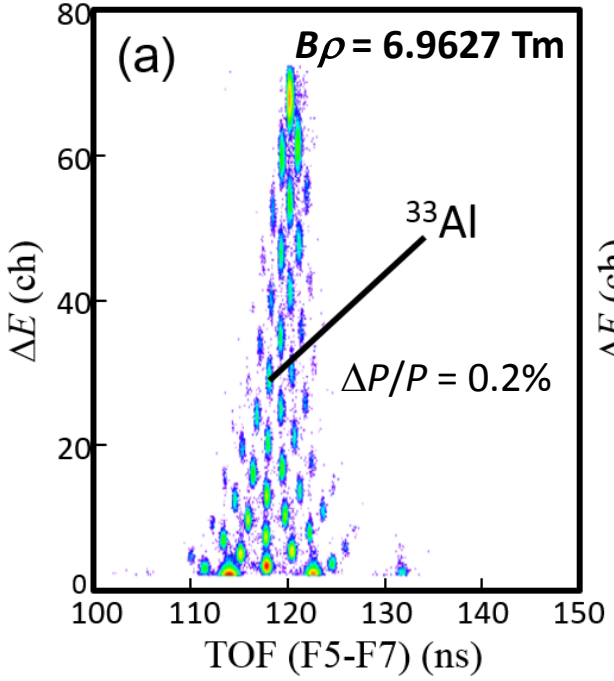
Two-stage separation is effective to remove the contaminant before F7.
But rates at F3 and F5 are still high!

Two-stage separation: Reaction products produced at F1 degrader

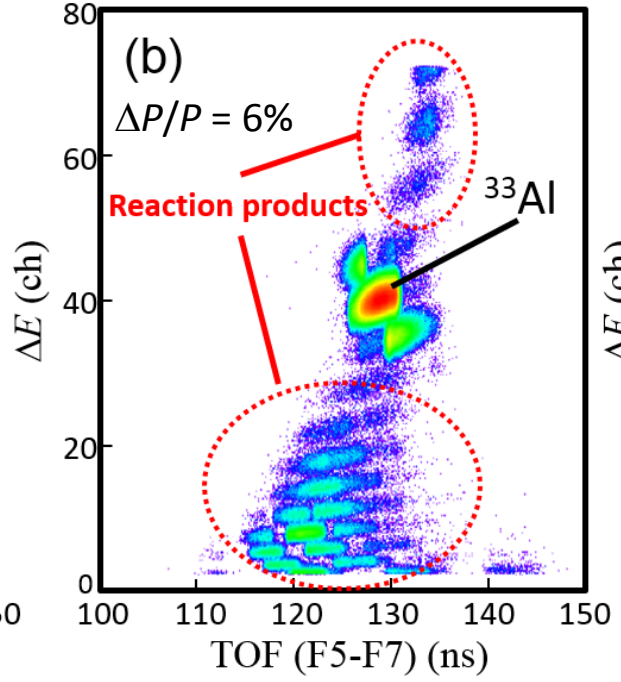
Example: Production of ^{33}Al using a ^{48}Ca beam at 345 MeV/u (with a 10-mm Be target)



Without degraders



Wedge degrader at F1
F1: Al 15 mm



Wedge degrader at F1 and F5
F1: Al 15 mm, F5 Al 10 mm