

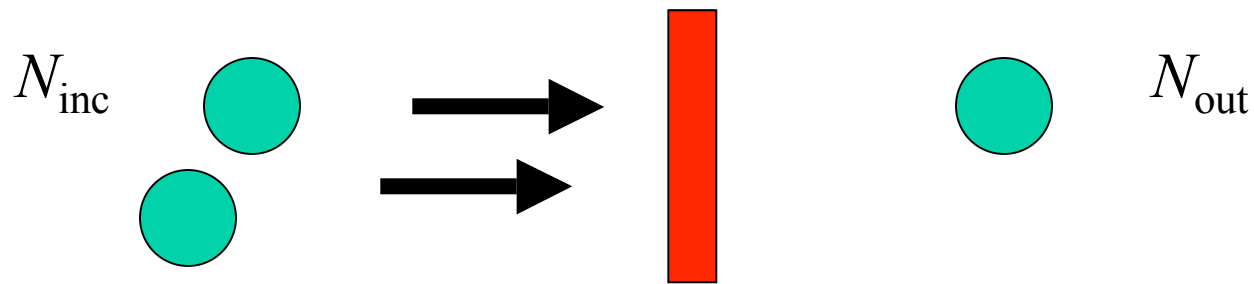
# 反応断面積の測定誤差 に関して(contaminationとtransmission)

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# 反応断面積測定

- transmission法

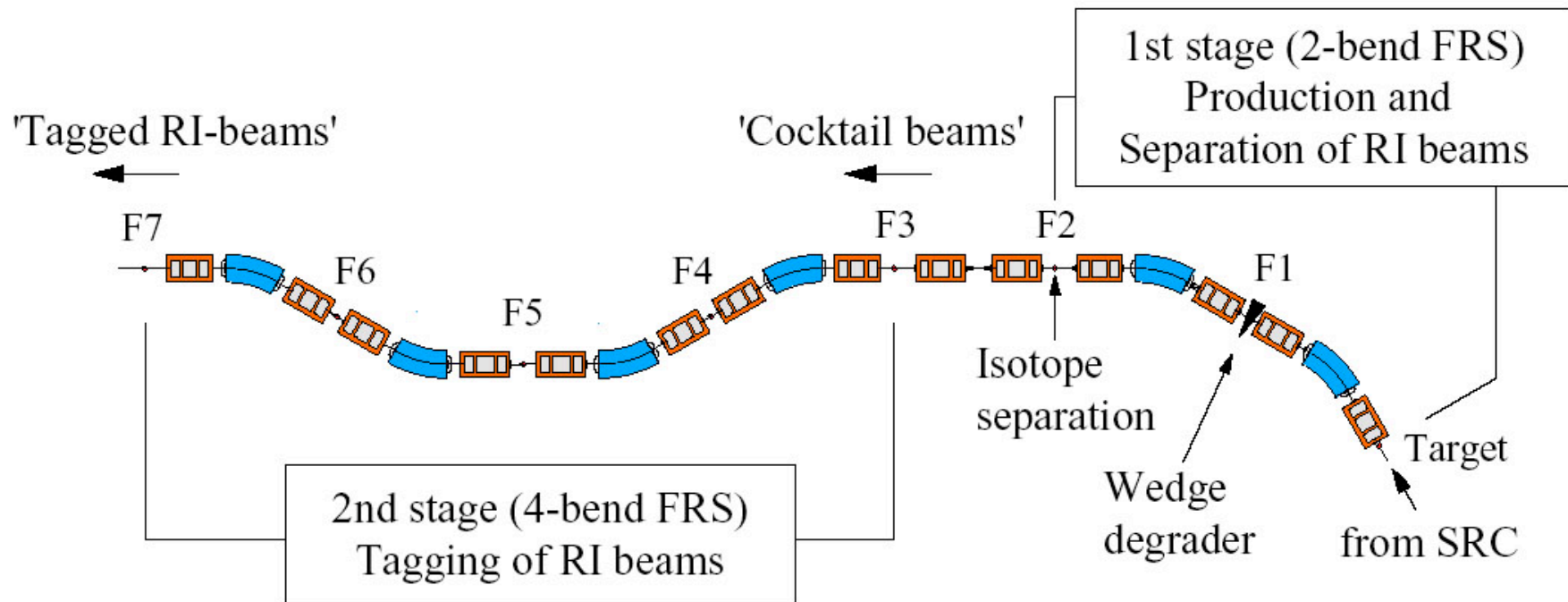


$$\sigma_I = \frac{A}{N_{At}} \ln\left(\frac{\gamma_0(1 - P_m)}{\gamma}\right) \quad \gamma = \frac{N_{out}}{N_{inc}}, \gamma_0 = \left(\frac{N_{out}}{N_{inc}}\right)_{\text{target out}}$$

$$\left(\frac{\Delta\sigma_I}{\sigma_I}\right) = \left\{ \frac{1-\gamma}{N_{inc}\gamma} + \frac{1-\gamma_0}{N_{0inc}\gamma_0} + \left[ \frac{\Delta\left(\frac{\gamma}{\gamma_0}\right)}{\left(\frac{\gamma}{\gamma_0}\right)} \right]^2 + \left[ \frac{\Delta(1-P_m)}{(1-P_m)} \right]^2 \right\} \left\{ \left(\frac{A}{\sigma_I N_{At}}\right)^2 + \left(\frac{\Delta t}{t}\right)^2 \right\}$$

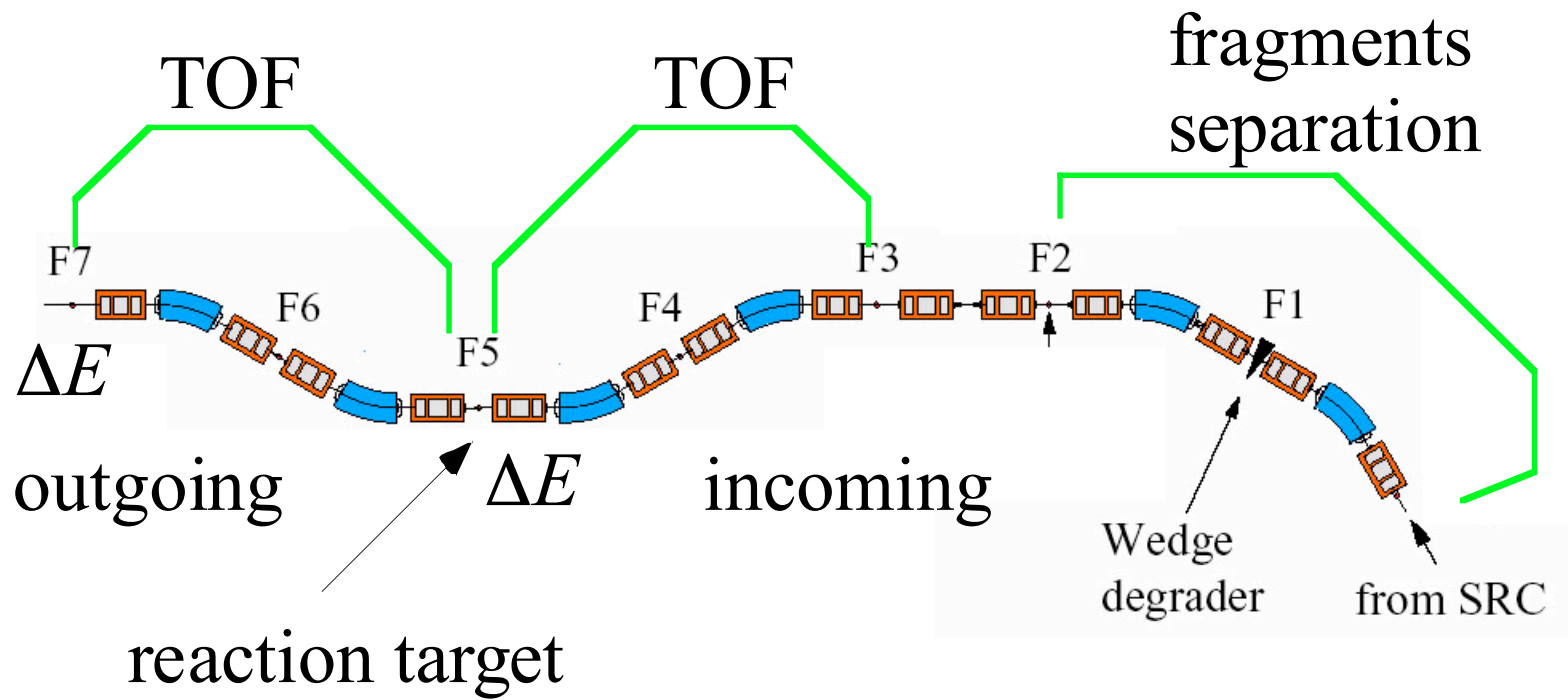
# BigRIPS

BigRIPS : Tandem (Two-stage) Separator



TOF,  $B\rho$ ,  $\Delta E \rightarrow Z, A/Q (A, Q), P$

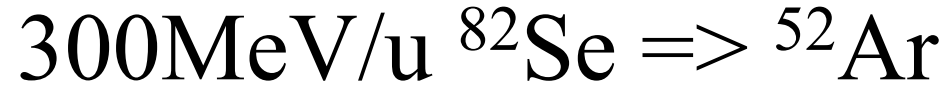
# 反応断面積測定



## estimation

- Beam condition
  - primary beam 300MeV/u
- F3 での contamination (rate)
- F5 target での contamination
  - target window
- transmission
  - IC window, F7 plastic

- Ar isotopes
  - $^{82}\text{Se}$  beam
- Ca isotopes
  - $^{70}\text{Zn}$  beam
- Ni isotopes
  - $^{86}\text{Kr}$  beam
- (Kr isotopes)



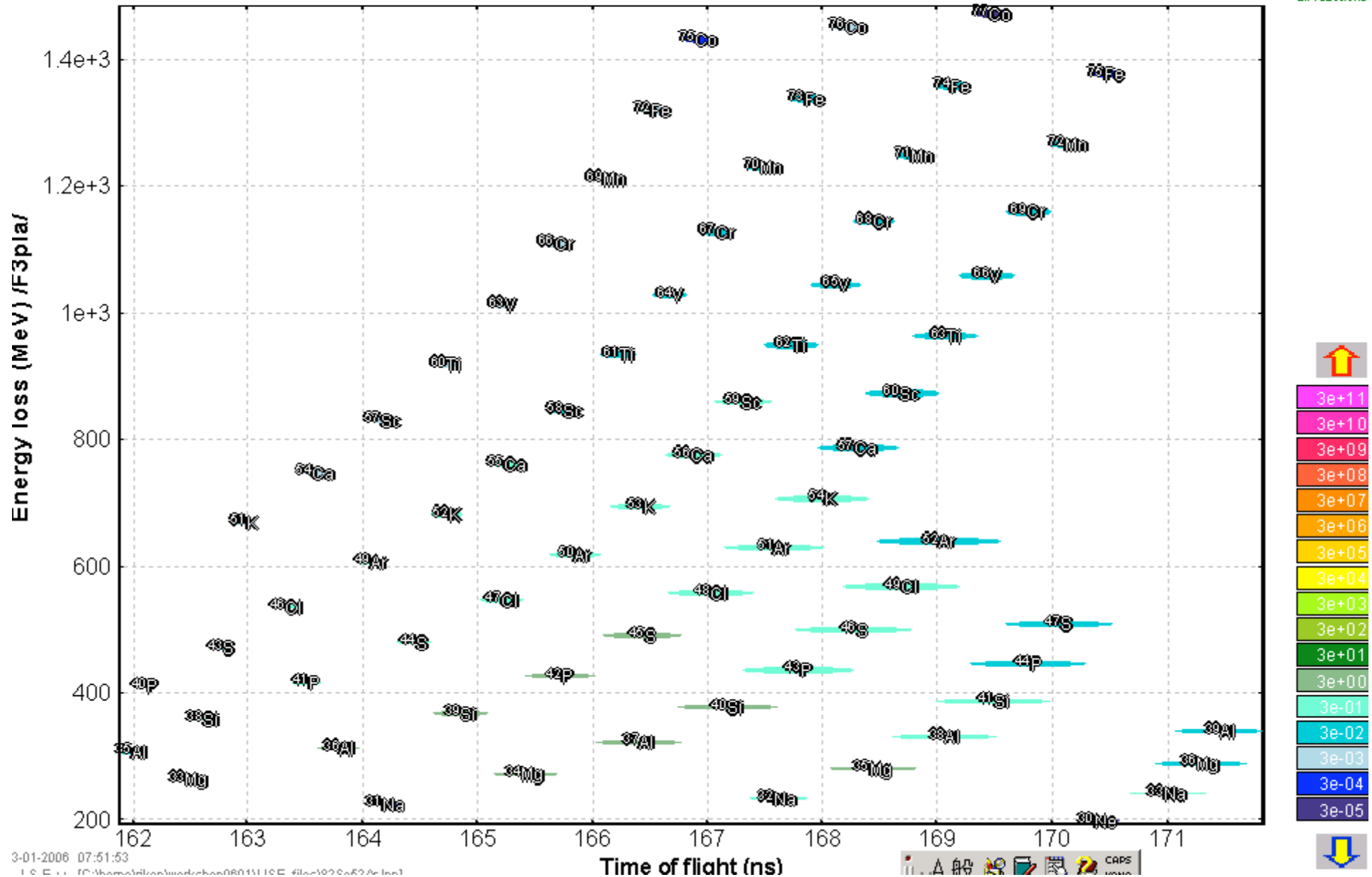
- slit at F1, F3
  - target  $0.5\text{g/cm}^2$  Be
  - 0.11 cps at F5
  - N/S at F3 = 290
- no slit at F1, F3
  - target  $2\text{ g/cm}^2$  Be (yield maximum)
  - contamination  $\times 10^3$ ,  $^{52}\text{Ar} \times 2$

# dE-TOF

Monte Carlo

$^{82}\text{Se}$  (300.0 MeV/u) + Be (500 mg/cm<sup>2</sup>); Settings on  $^{52}\text{Ar}$ ; Config: DSWDSMDDMMMDDMM  
dp/p=4.67%; Wedges: Al (1000 mg/cm<sup>2</sup>); Brho(Tm): 7.5394, 7.2621, 7.0725, 7.0725, 6.1957, 6.1957  
Start: Target; Stop: F3pla; ACQ\_start: Detector \*\* dE: F3pla - H10C9 (5 mm)

without charge  
all reactions

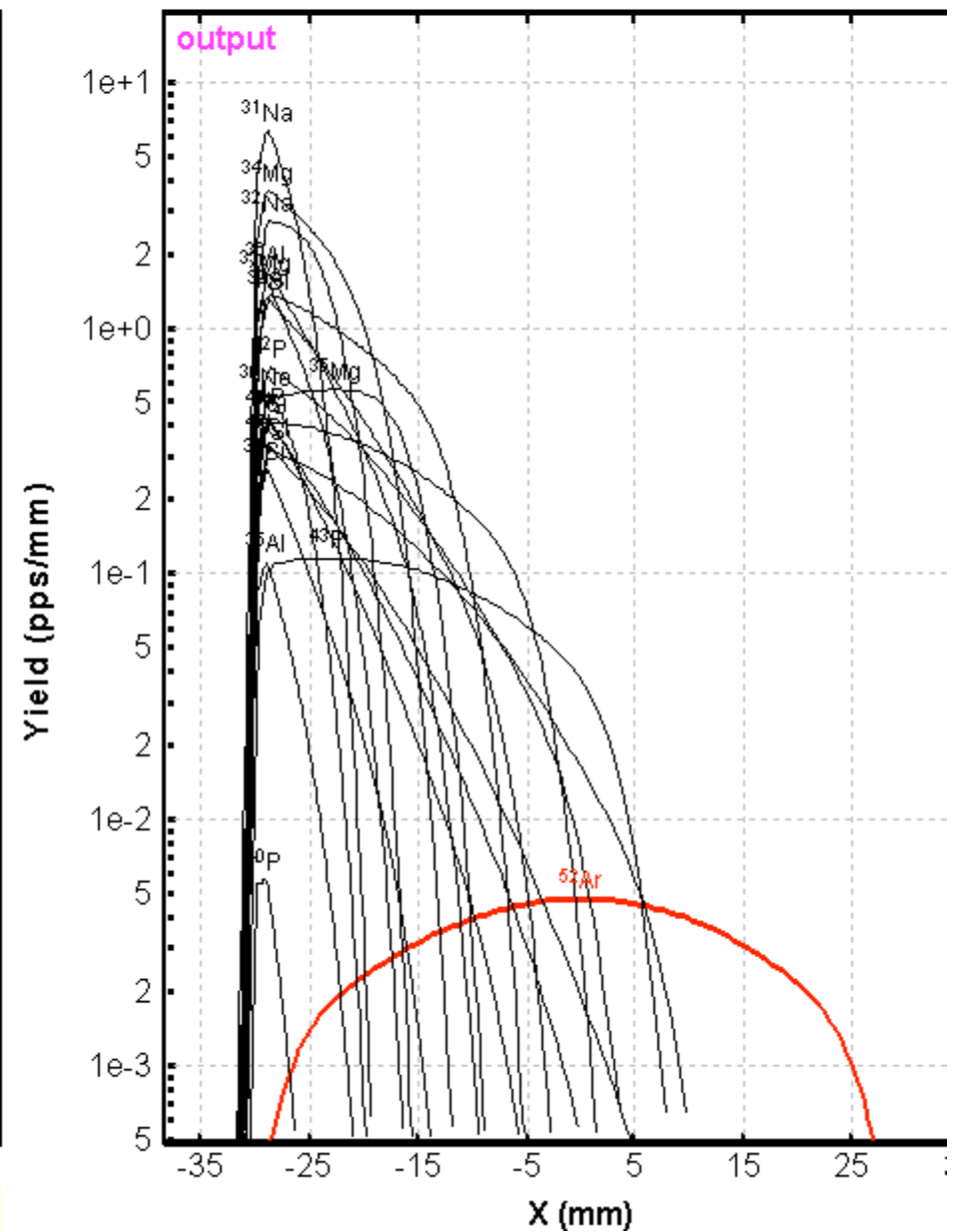
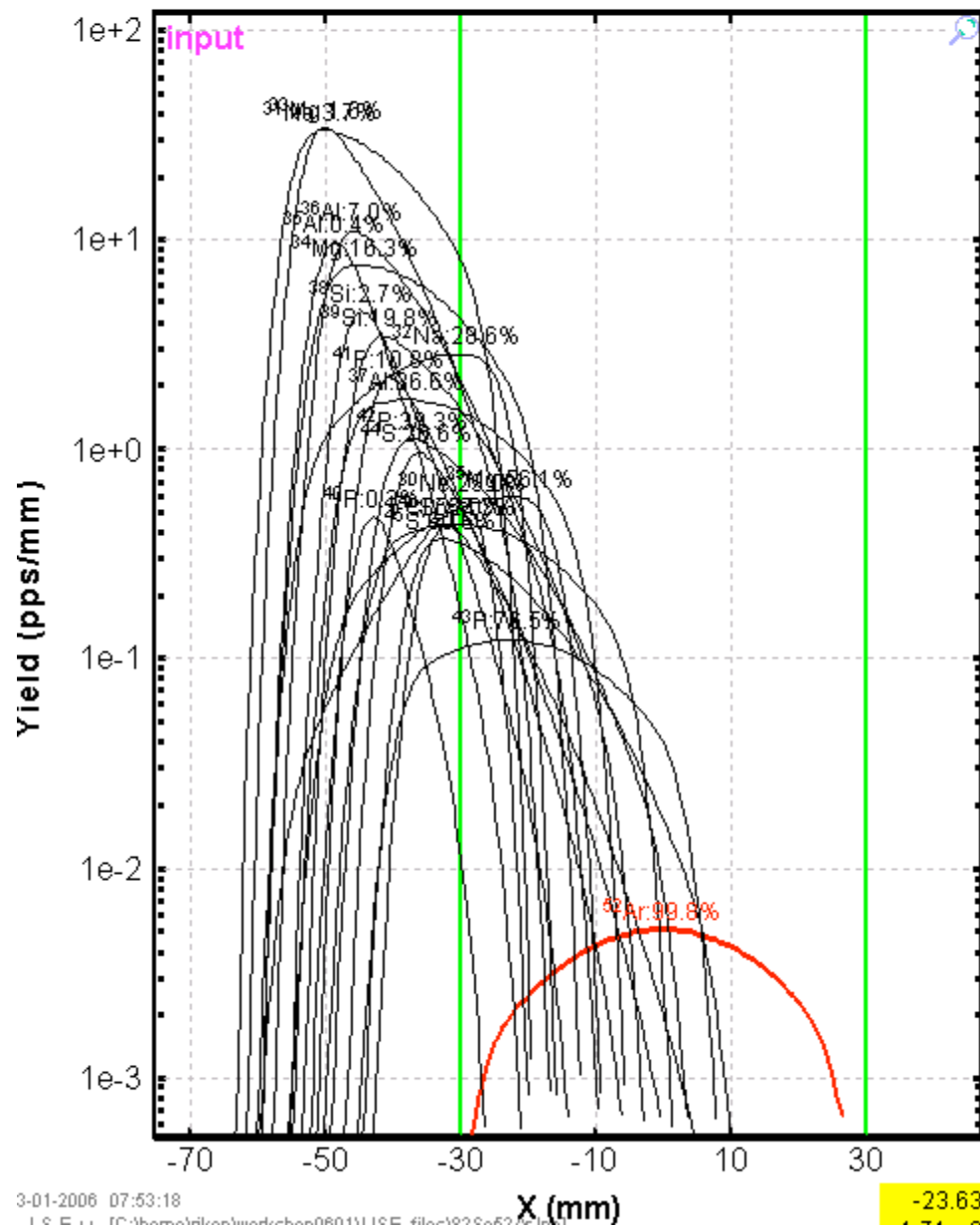




## F3pla-Xspace

$^{82}\text{Se}$  (300.0 MeV/u) + Be (500 mg/cm<sup>2</sup>); Settings on  $^{52}\text{Ar}$ ; Config: DSWDSMDDMMDDMM  
 dp/p=4.67%; Wedges: Al (1000 mg/cm<sup>2</sup>); Brho(Tm): 7.5394, 7.2621, 7.0725, 7.0725, 6.1957, 6.1957

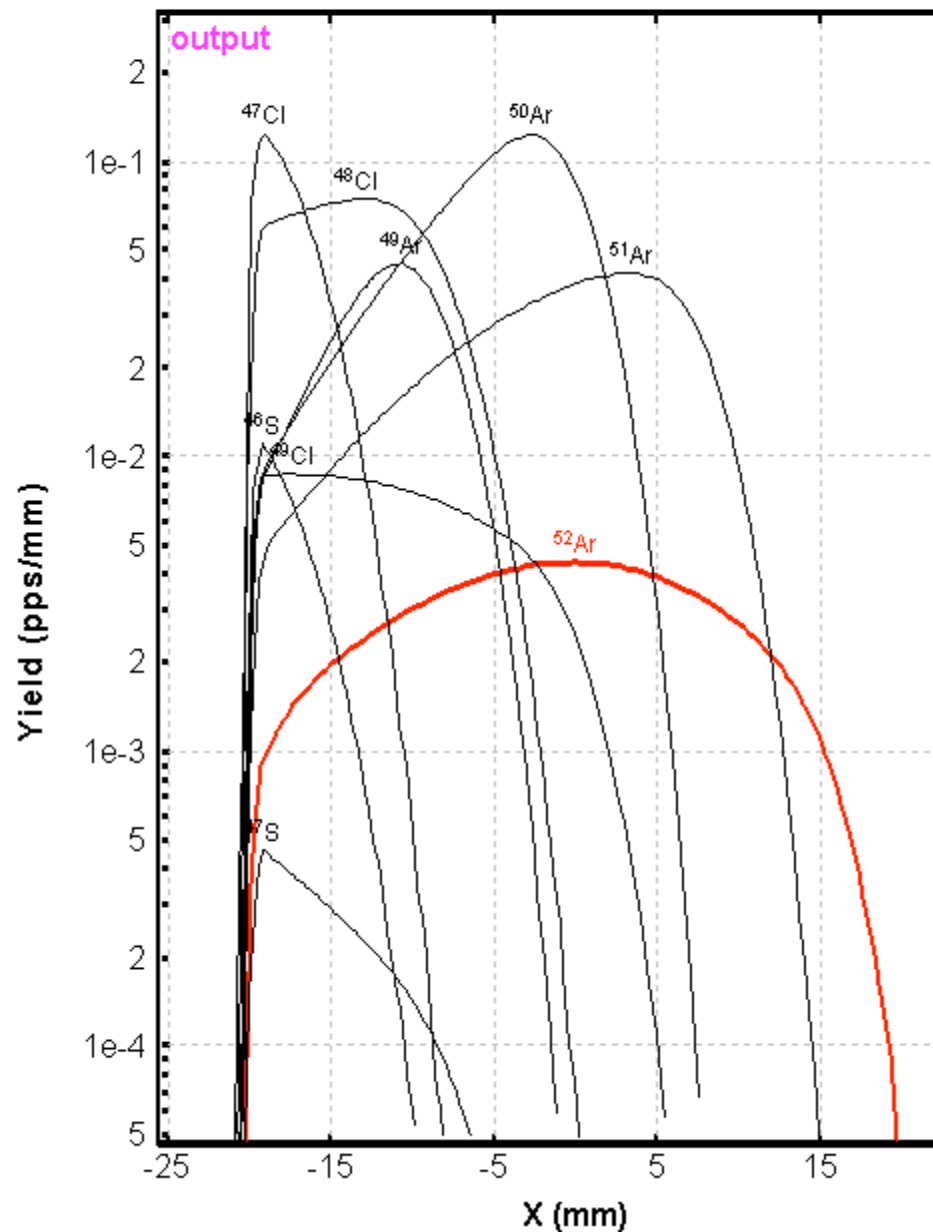
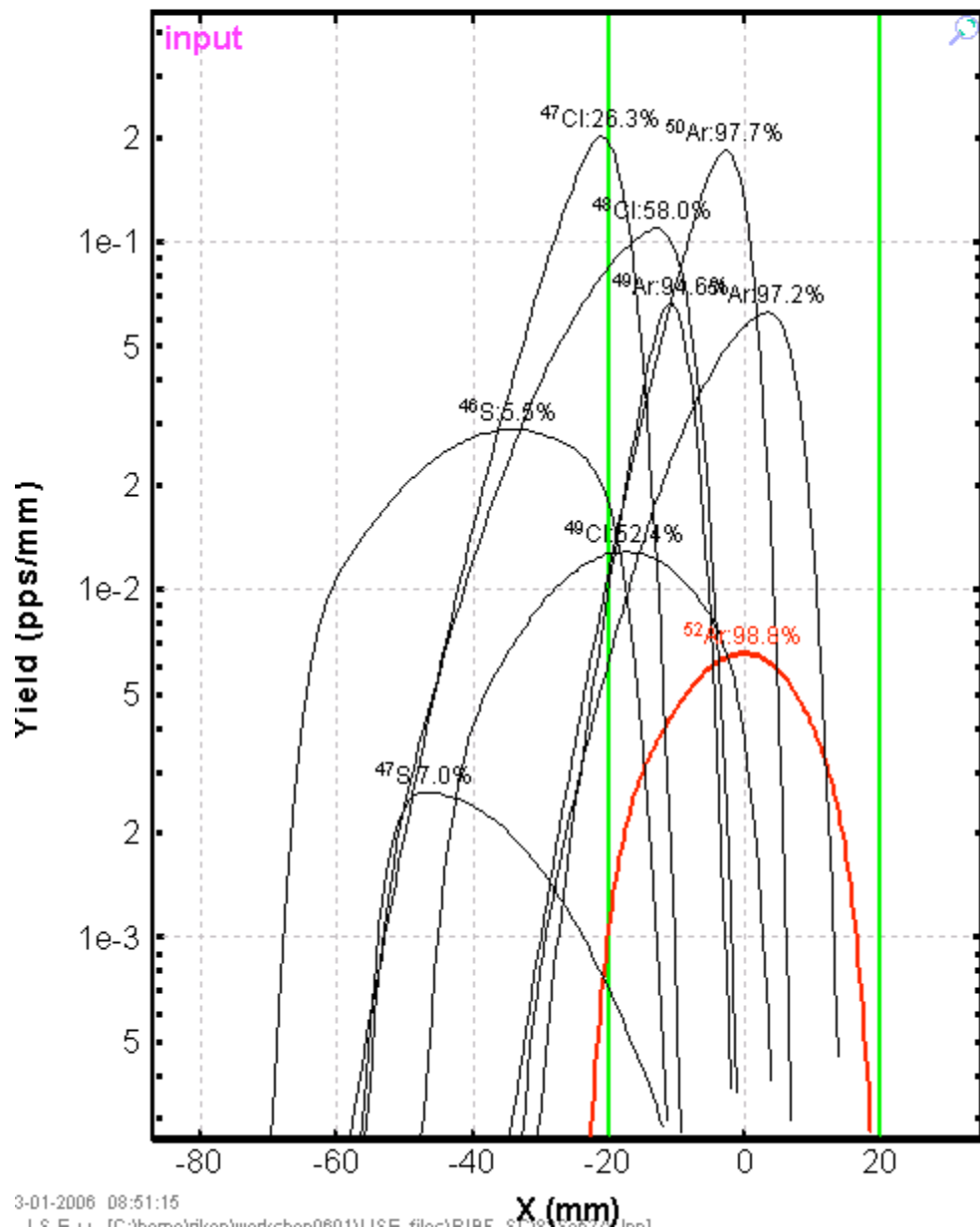
without charge  
 all reactions



## R-tgt-Xspace

$^{82}\text{Se}$  (300.0 MeV/u) + Be (500 mg/cm<sup>2</sup>); Settings on  $^{52}\text{Ar}$ ; Config: DSWDSMDDMMDDMM  
 dp/p=1.26% ; Wedges: Al (1000 mg/cm<sup>2</sup>); Brho(Tm): 7.5394, 7.2621, 7.0725, 7.0725, 6.1957, 6.1957

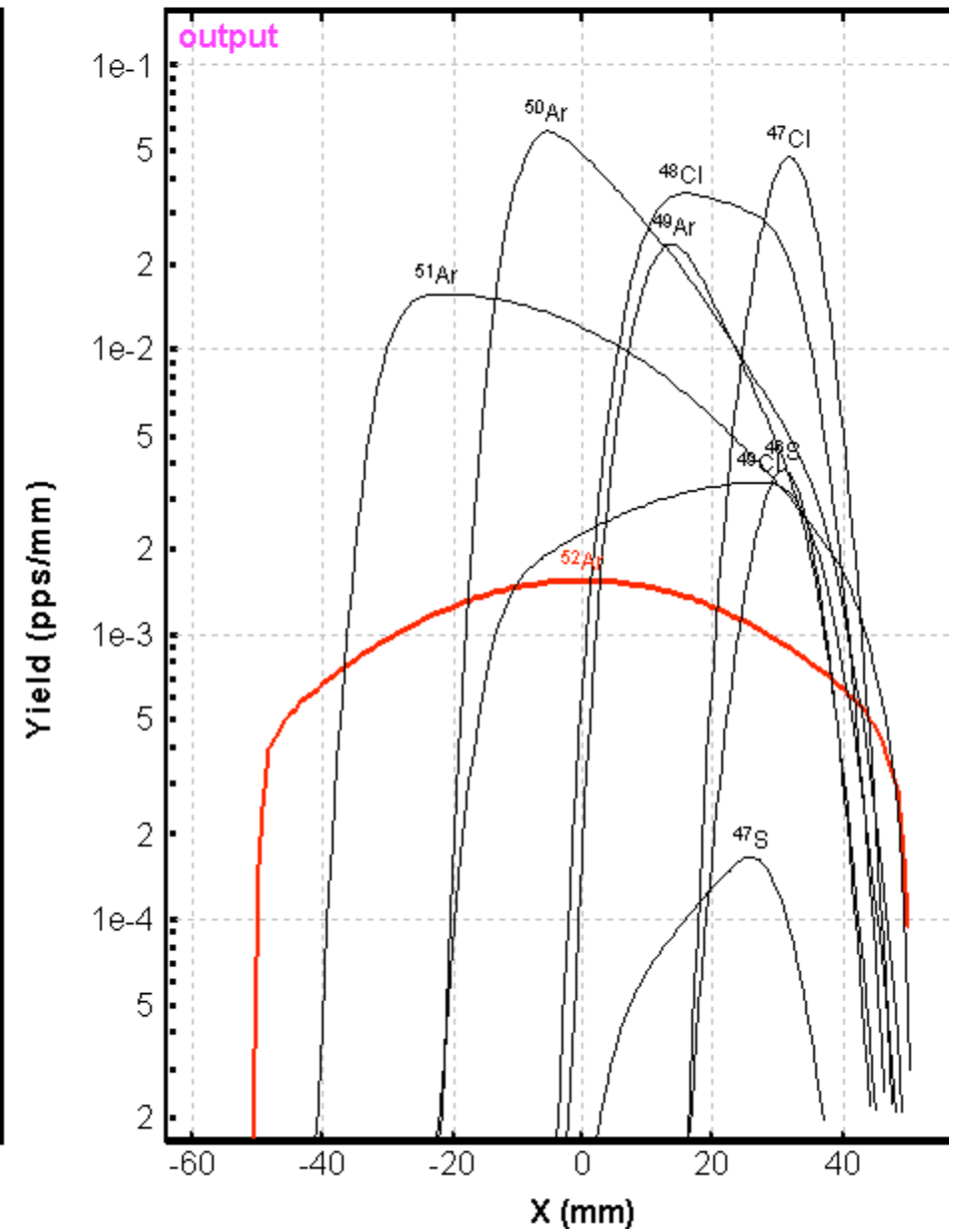
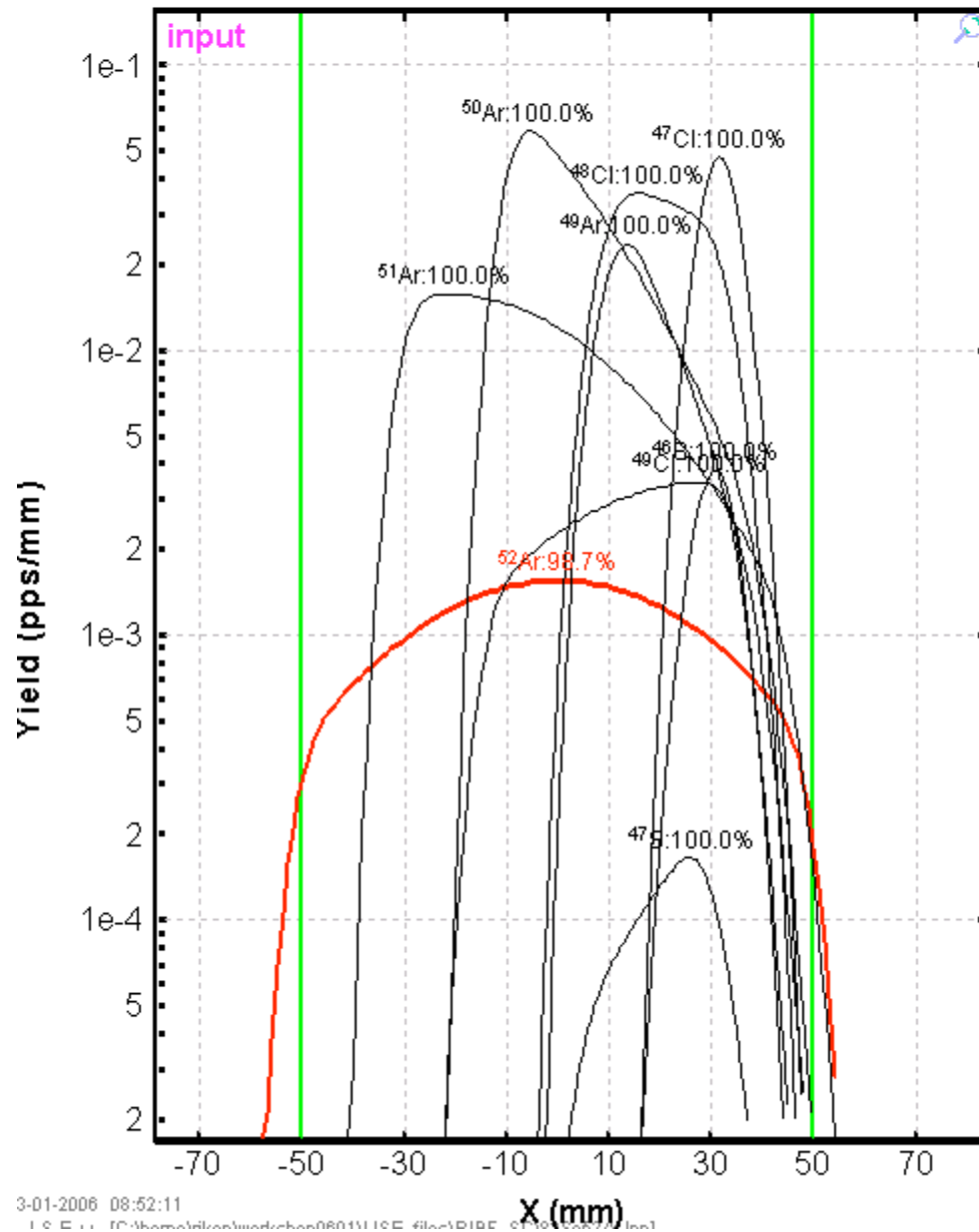
without charge  
 all reactions



## F7ic-Xspace

$^{82}\text{Se}$  (300.0 MeV/u) + Be (500 mg/cm<sup>2</sup>); Settings on  $^{52}\text{Ar}$ ; Config: DSWDSMDDMMMDDMM  
 dp/p=1.26% ; Wedges: Al (1000 mg/cm<sup>2</sup>); Brho(Tm): 7.5394, 7.2621, 7.0725, 7.0725, 6.1957, 6.1957

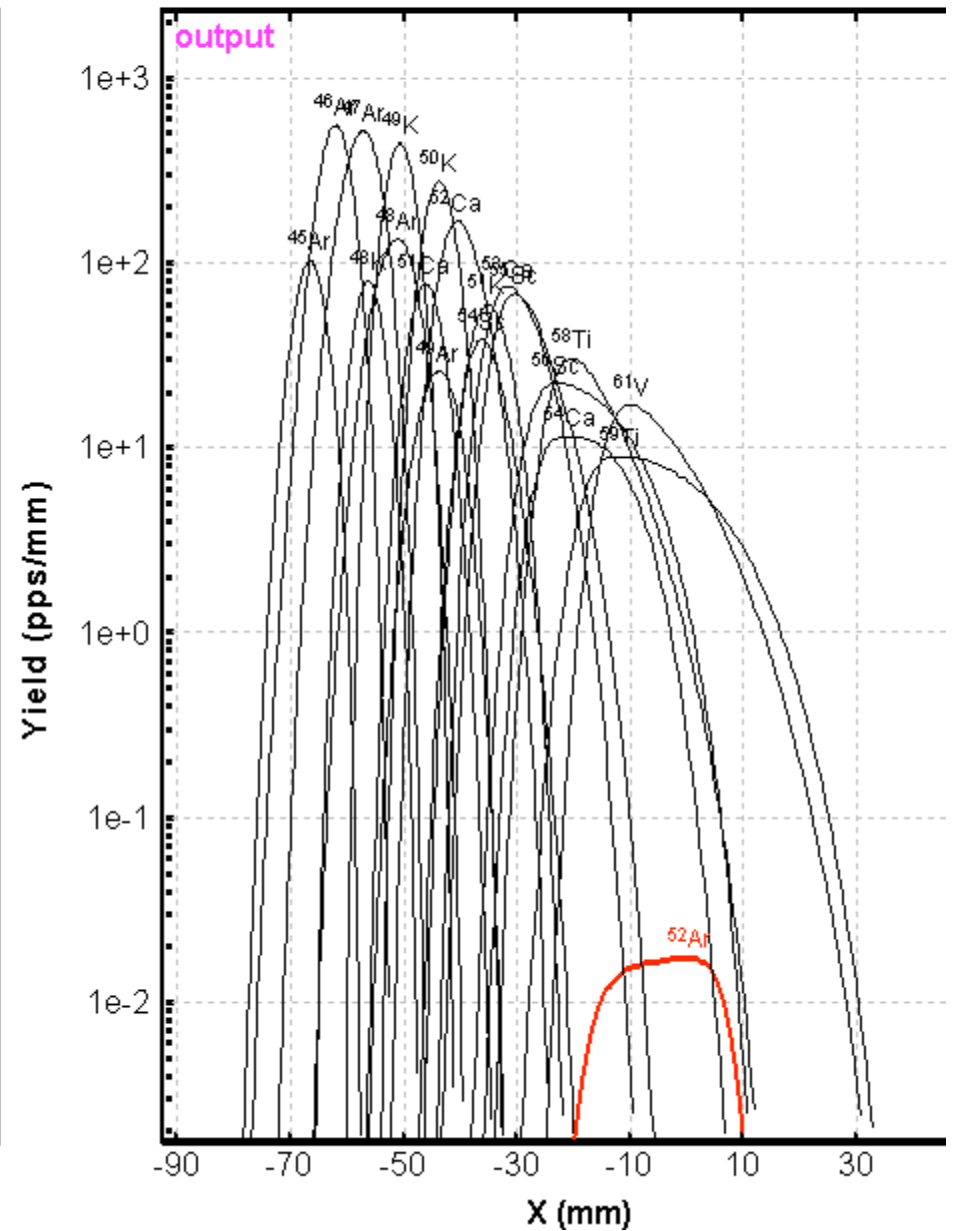
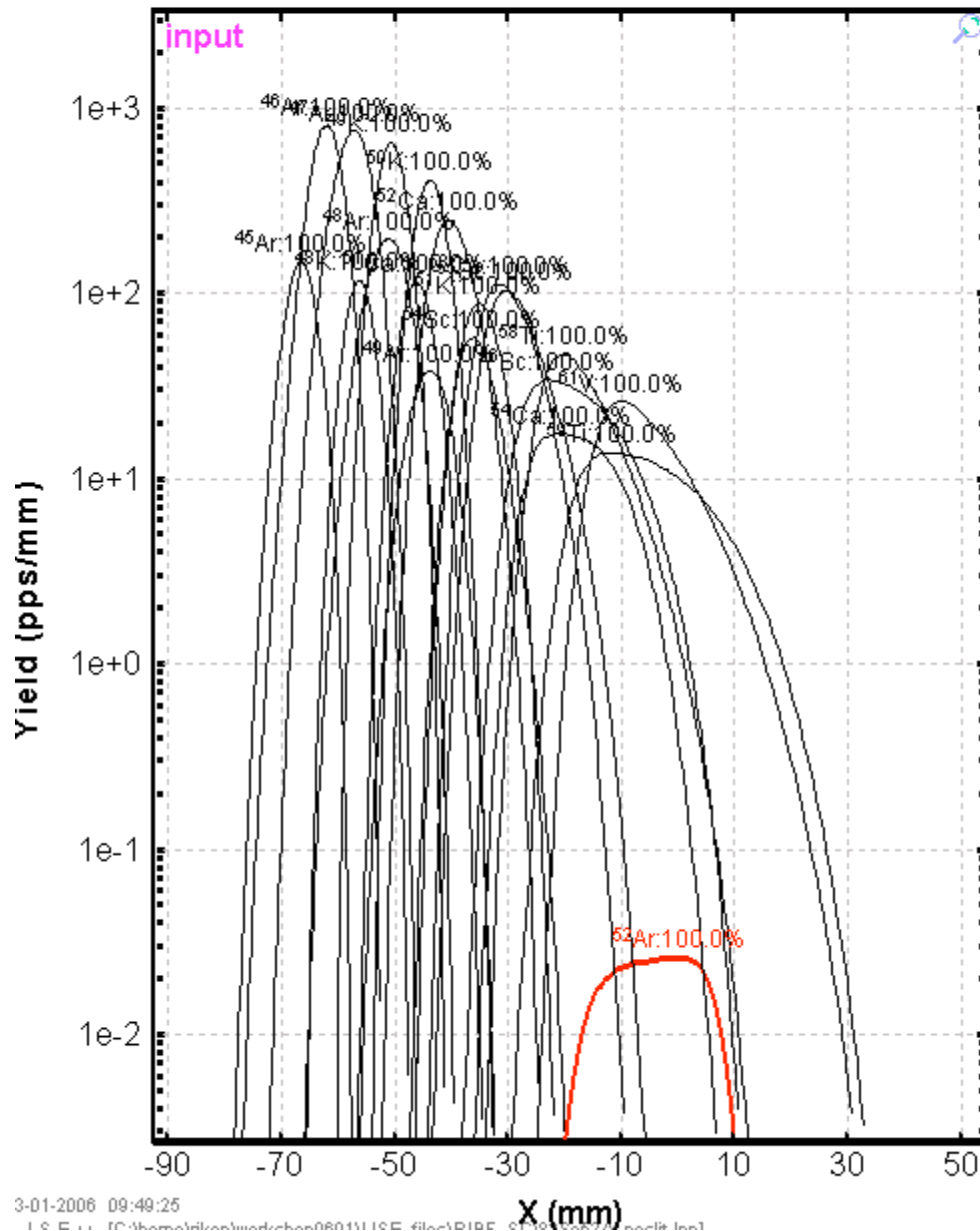
without charge  
all reactions



# R-tgt-Xspace

$^{82}\text{Se}$  (300.0 MeV/u) + Be (2000 mg/cm<sup>2</sup>); Settings on  $^{52}\text{Ar}$ ; Config: DSWDSMDDMMDDMM  
dp/p=8.84% ; Wedges: Al (1000 mg/cm<sup>2</sup>); Brho(Tm): 6.7925, 6.4594, 6.2249, 6.2249, 5.0352, 5.0352

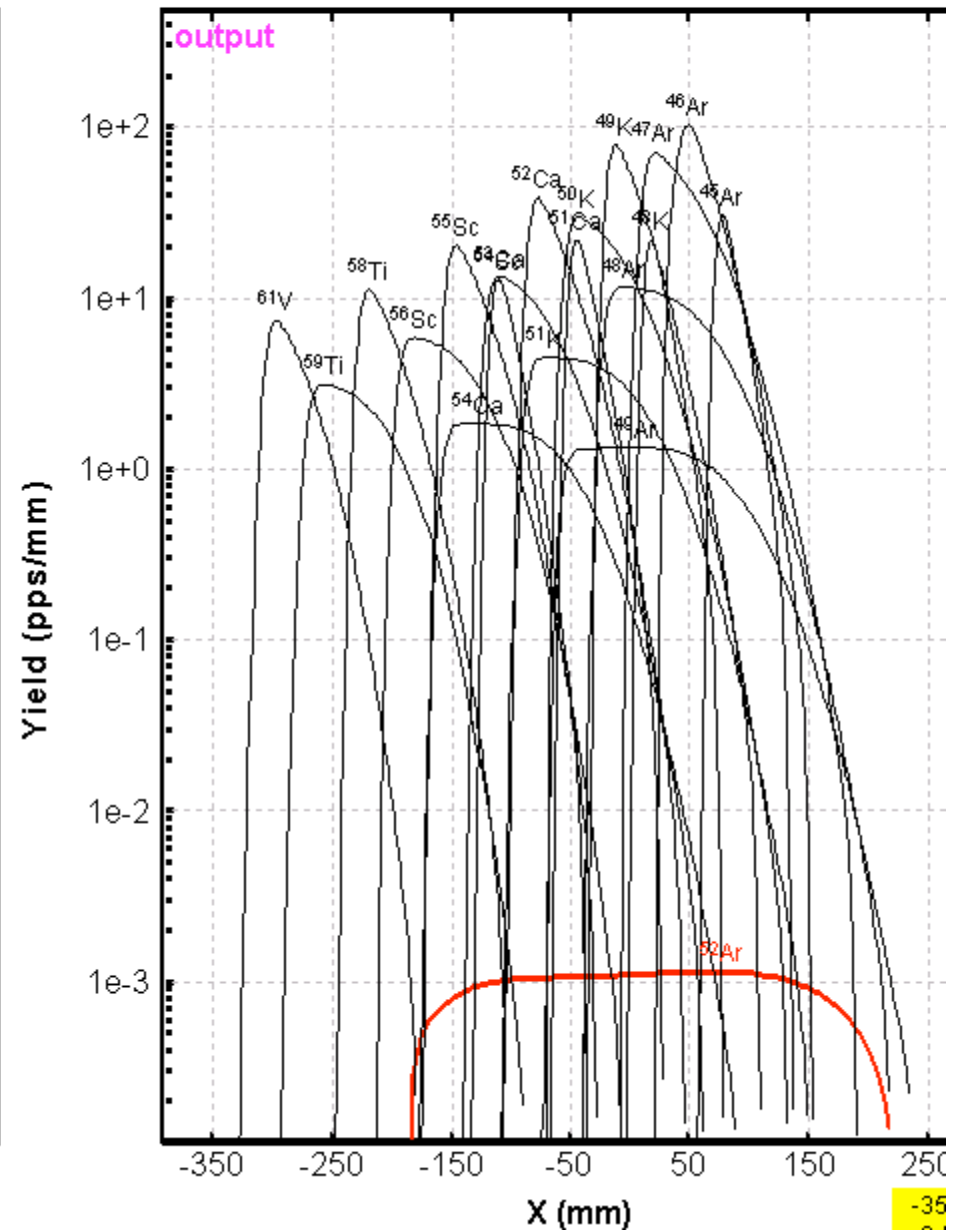
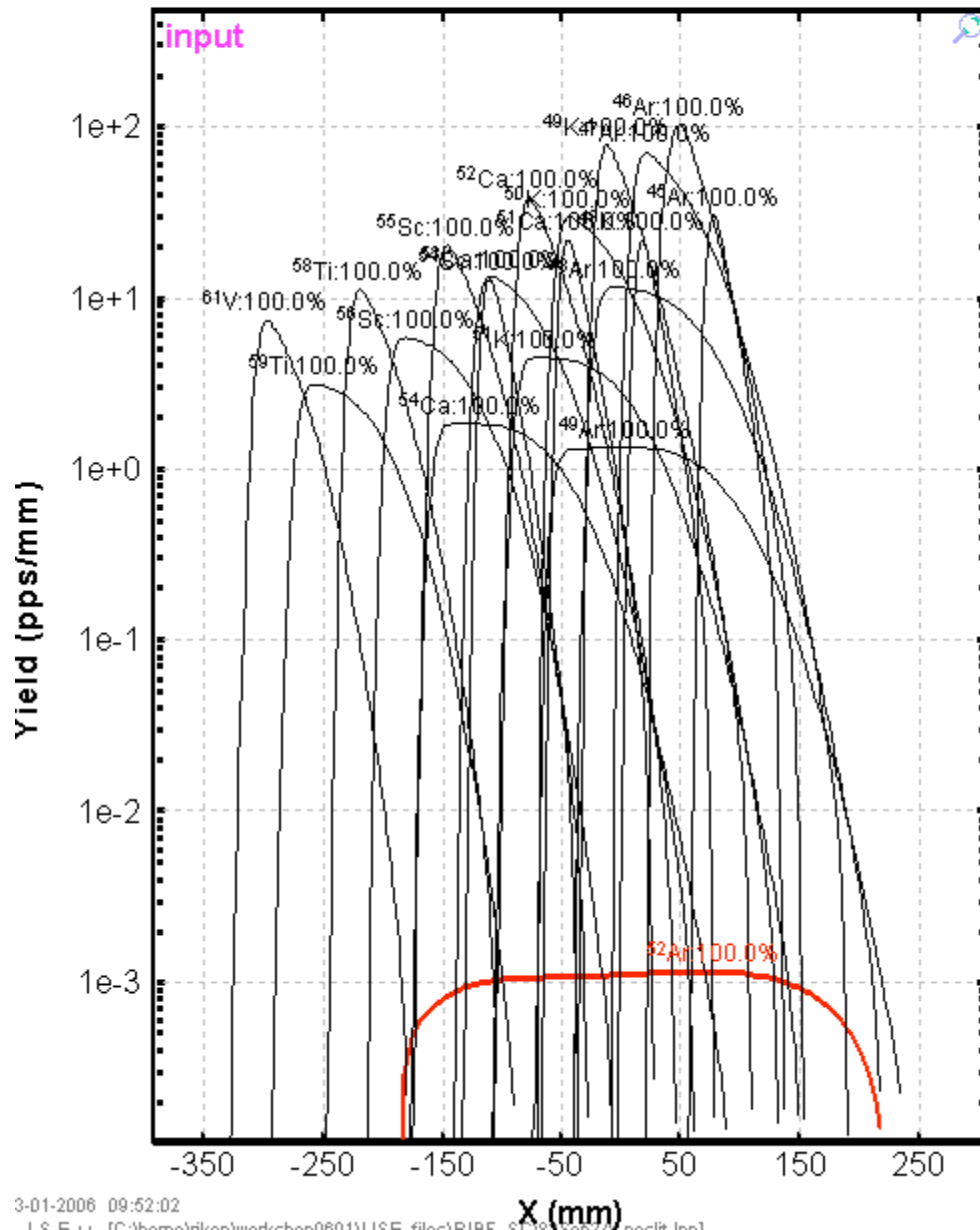
without charge  
all reactions



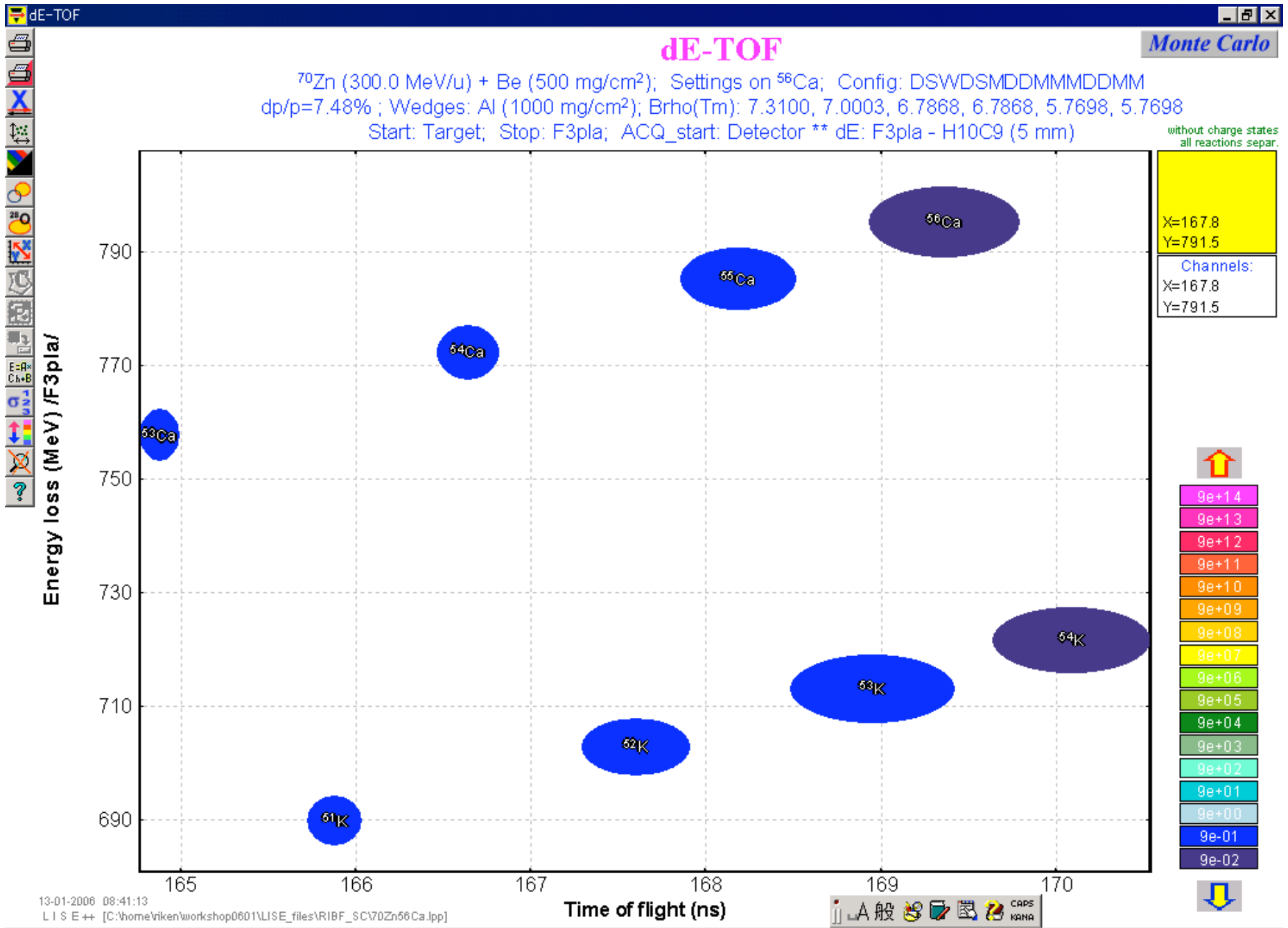
# F7ic-Xspace

$^{82}\text{Se}$  (300.0 MeV/u) + Be (2000 mg/cm<sup>2</sup>); Settings on  $^{52}\text{Ar}$ ; Config: DSWDSMDDMMDDMM  
dp/p=8.84% ; Wedges: Al (1000 mg/cm<sup>2</sup>); Brho(Tm): 6.7925, 6.4594, 6.2249, 6.2249, 5.0352, 5.0352

without charge  
all reactions



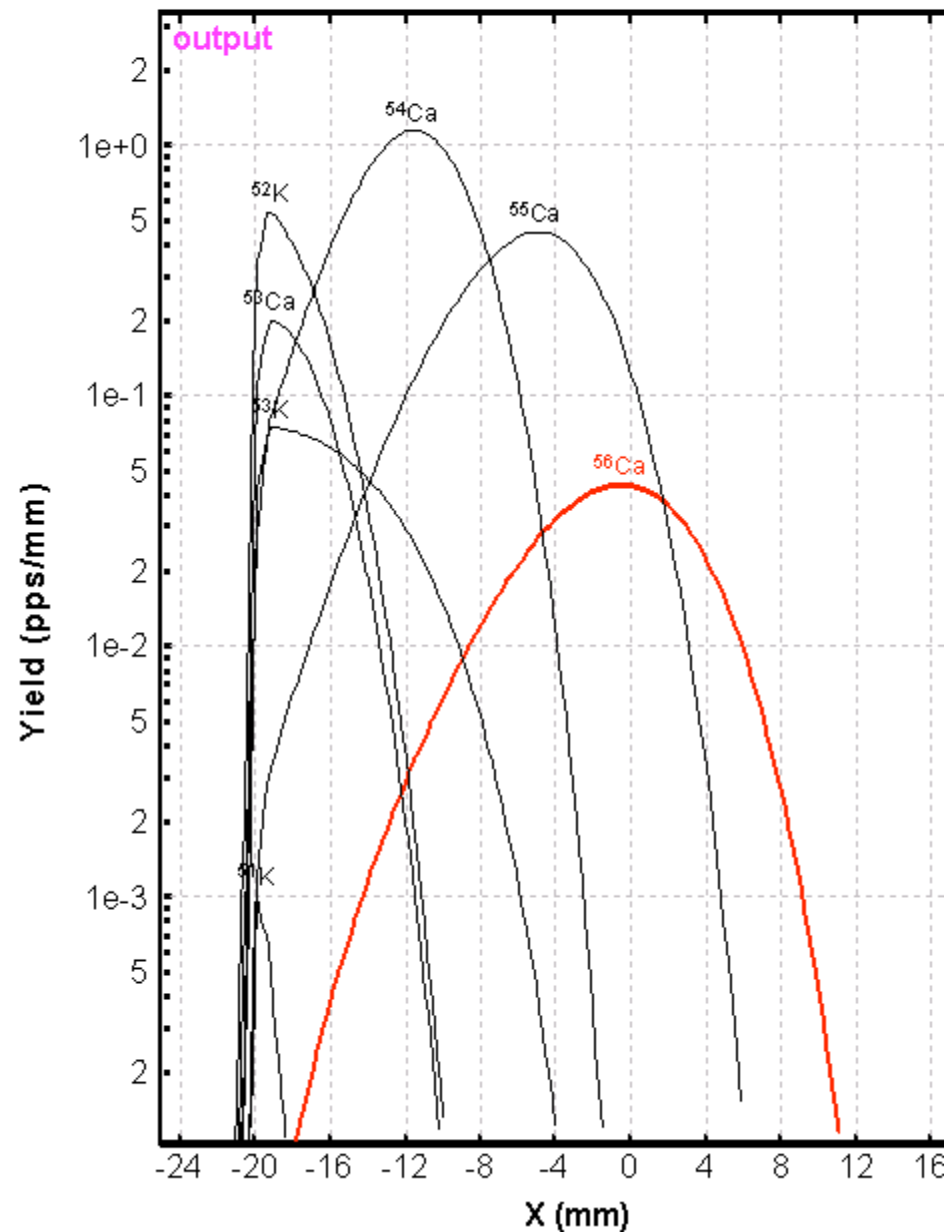
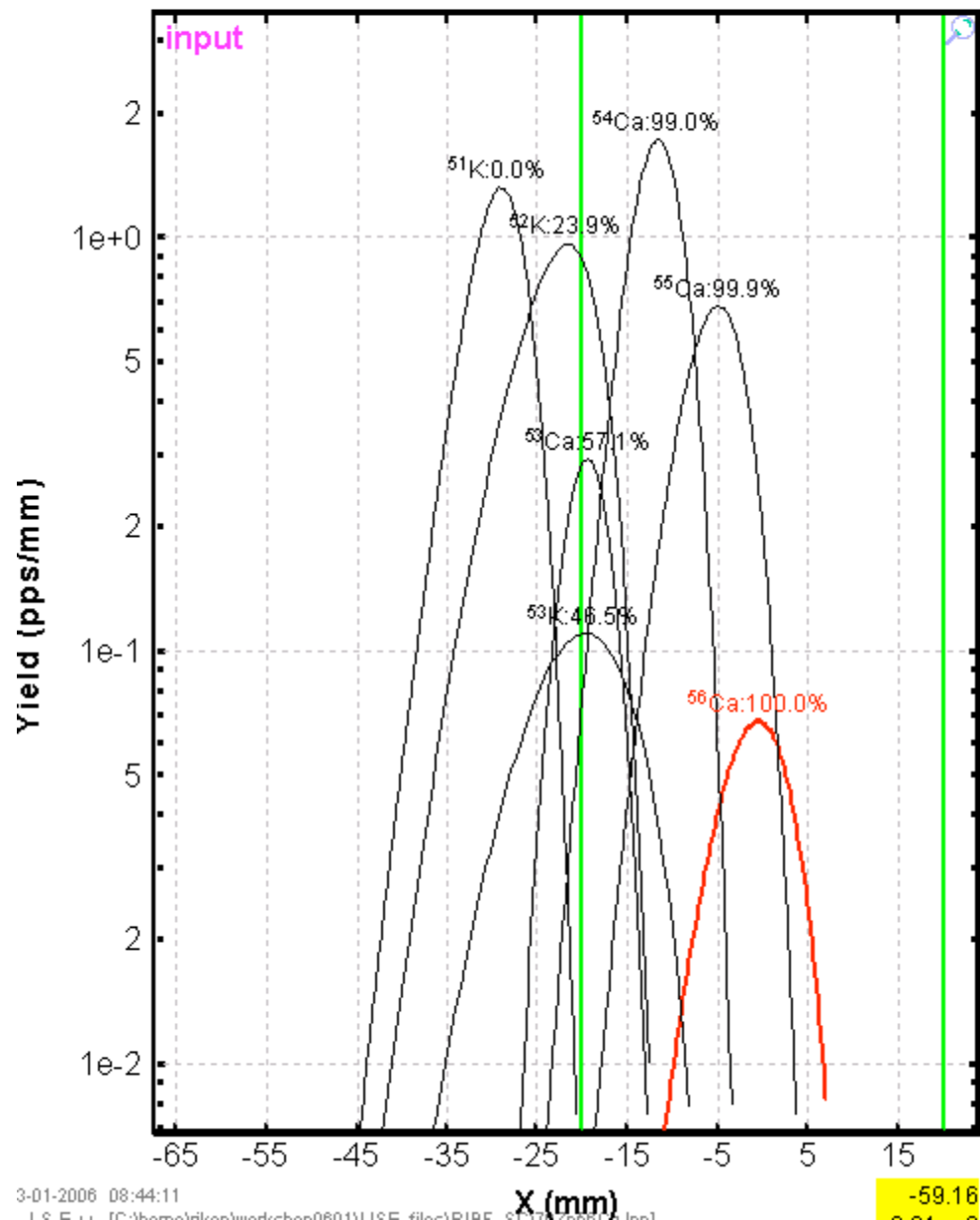
# 300MeV/u $^{70}\text{Zn} \Rightarrow ^{56}\text{Ca}$



## R-tgt-Xspace

$^{70}\text{Zn}$  (300.0 MeV/u) + Be (500 mg/cm<sup>2</sup>); Settings on  $^{56}\text{Ca}$ ; Config: DSWDSMDDMMDDMM  
 dp/p=1.26% ; Wedges: Al (1000 mg/cm<sup>2</sup>); Brho(Tm): 7.3100, 7.0003, 6.7868, 6.7868, 5.7698, 5.7698

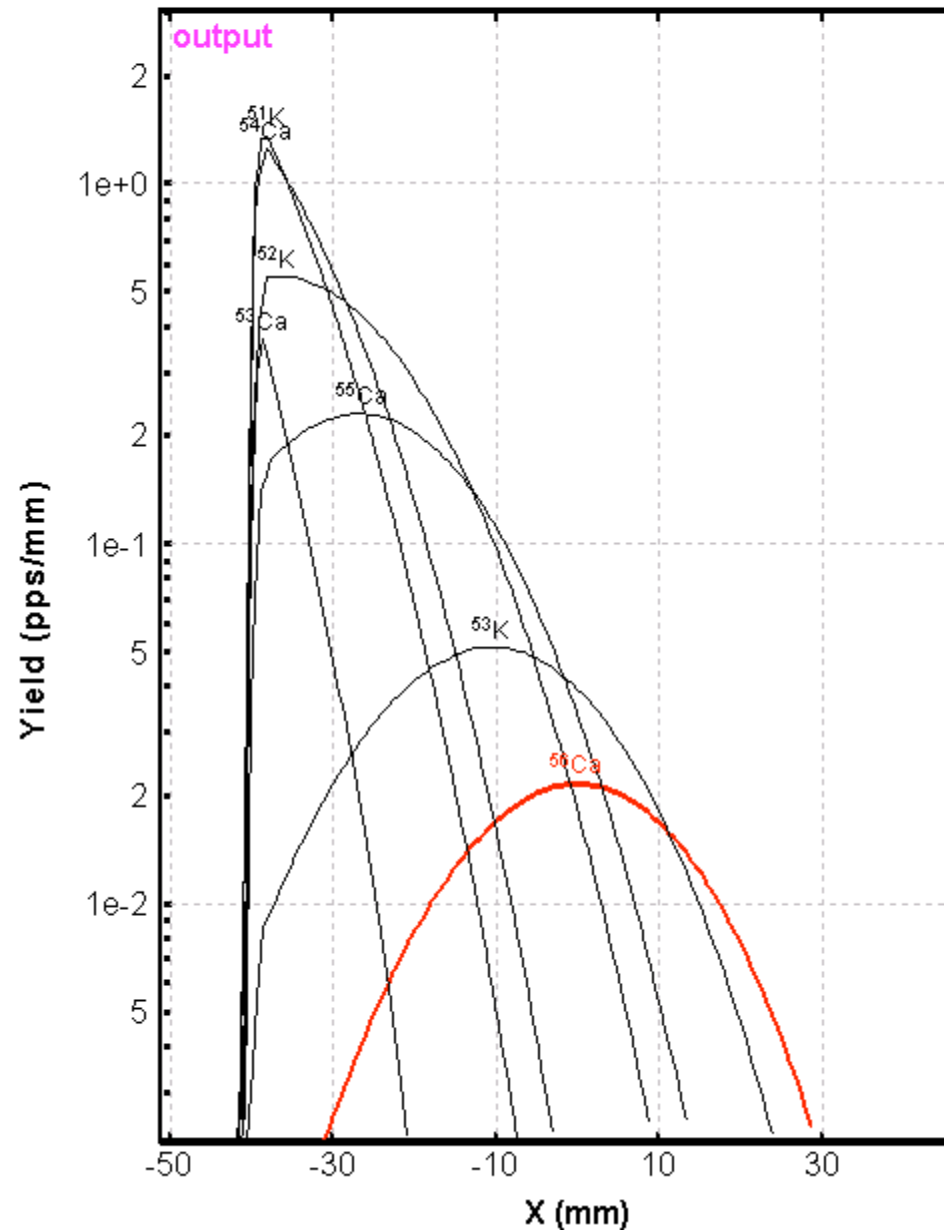
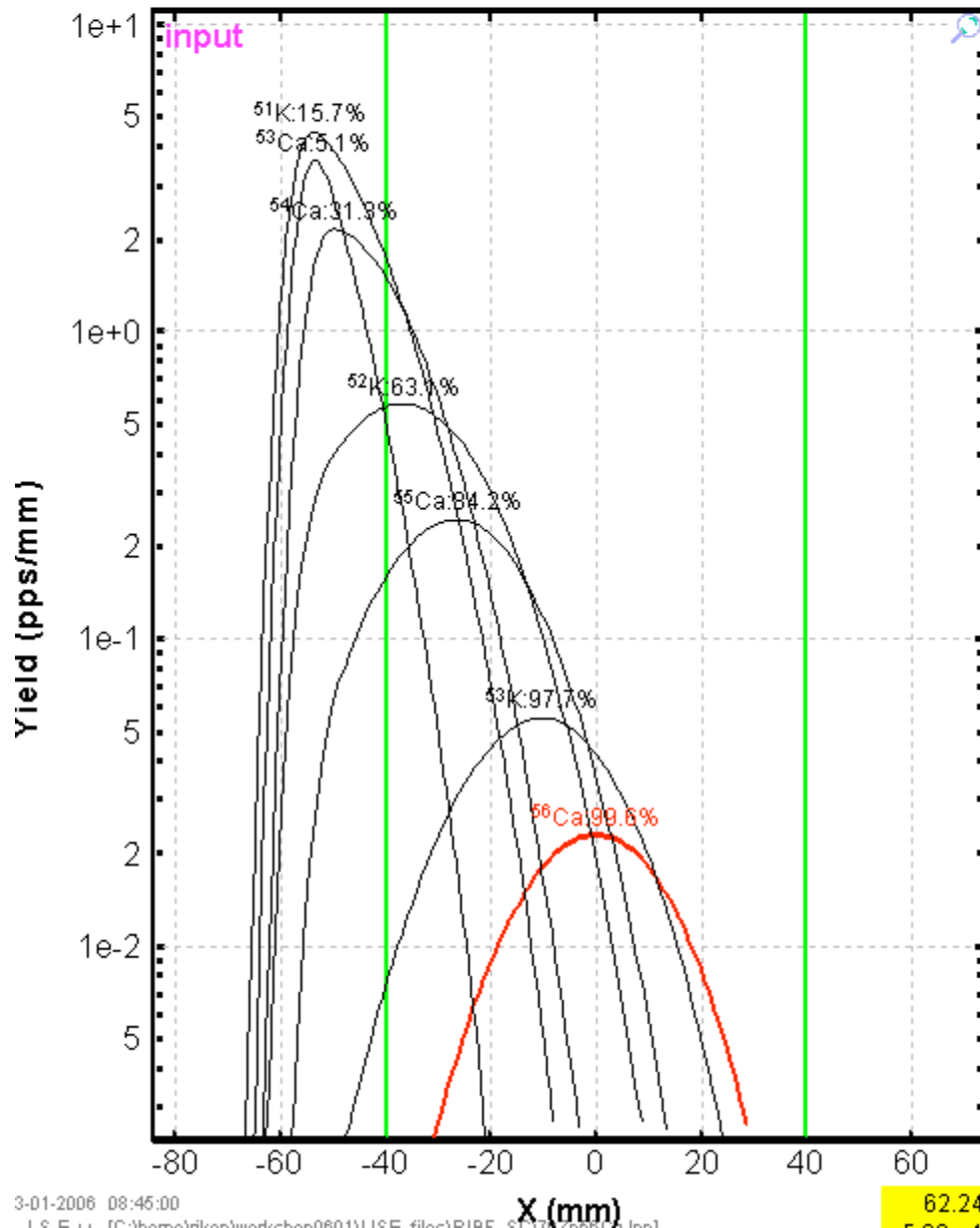
without charge  
 all reactions



# F3pla-Xspace

$^{70}\text{Zn}$  (300.0 MeV/u) + Be (500 mg/cm<sup>2</sup>); Settings on  $^{56}\text{Ca}$ ; Config: DSWDSMDDMMDDMM  
dp/p=1.26% ; Wedges: Al (1000 mg/cm<sup>2</sup>); Brho(Tm): 7.3100, 7.0003, 6.7868, 6.7868, 5.7698, 5.7698

without charge  
all reactions

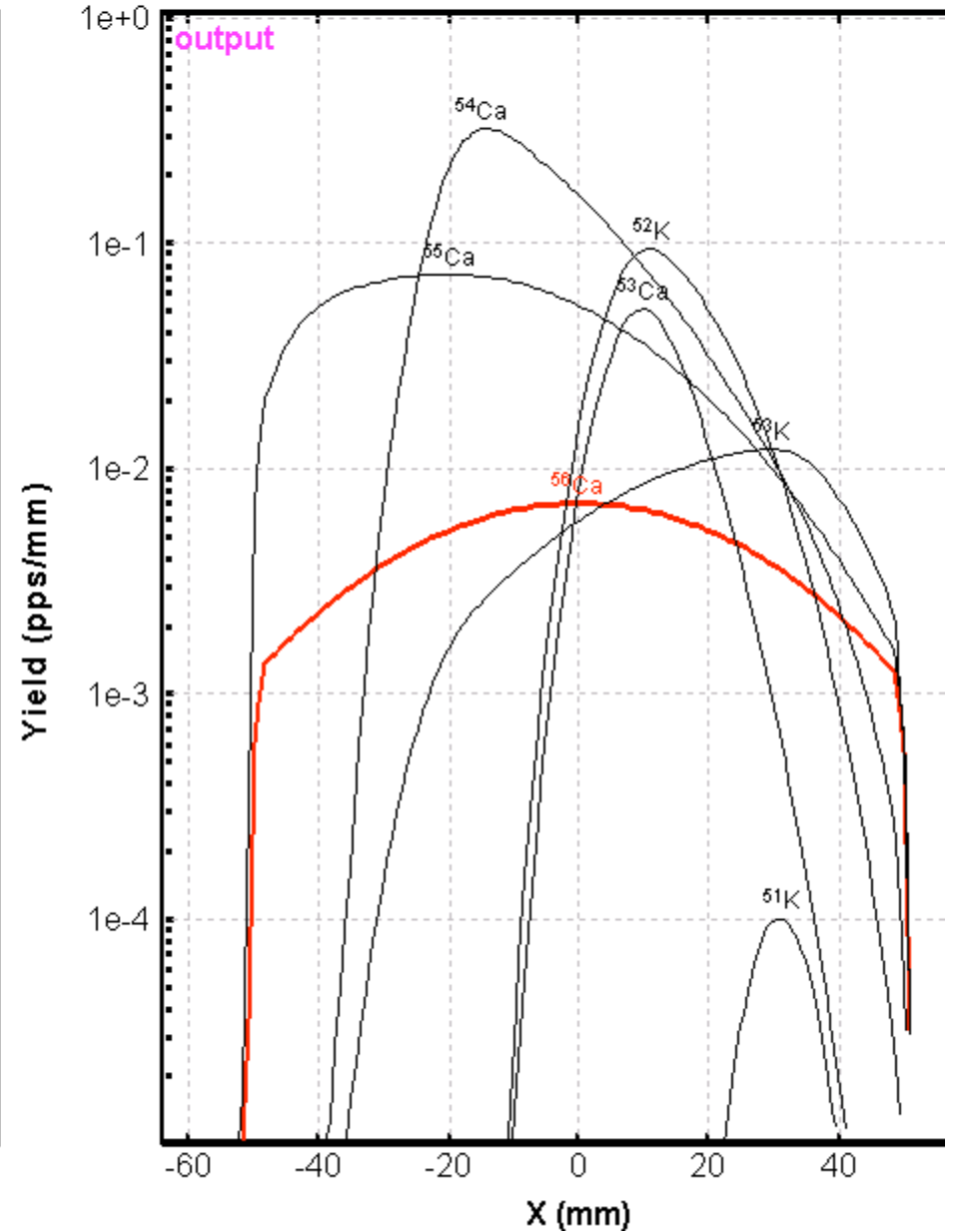
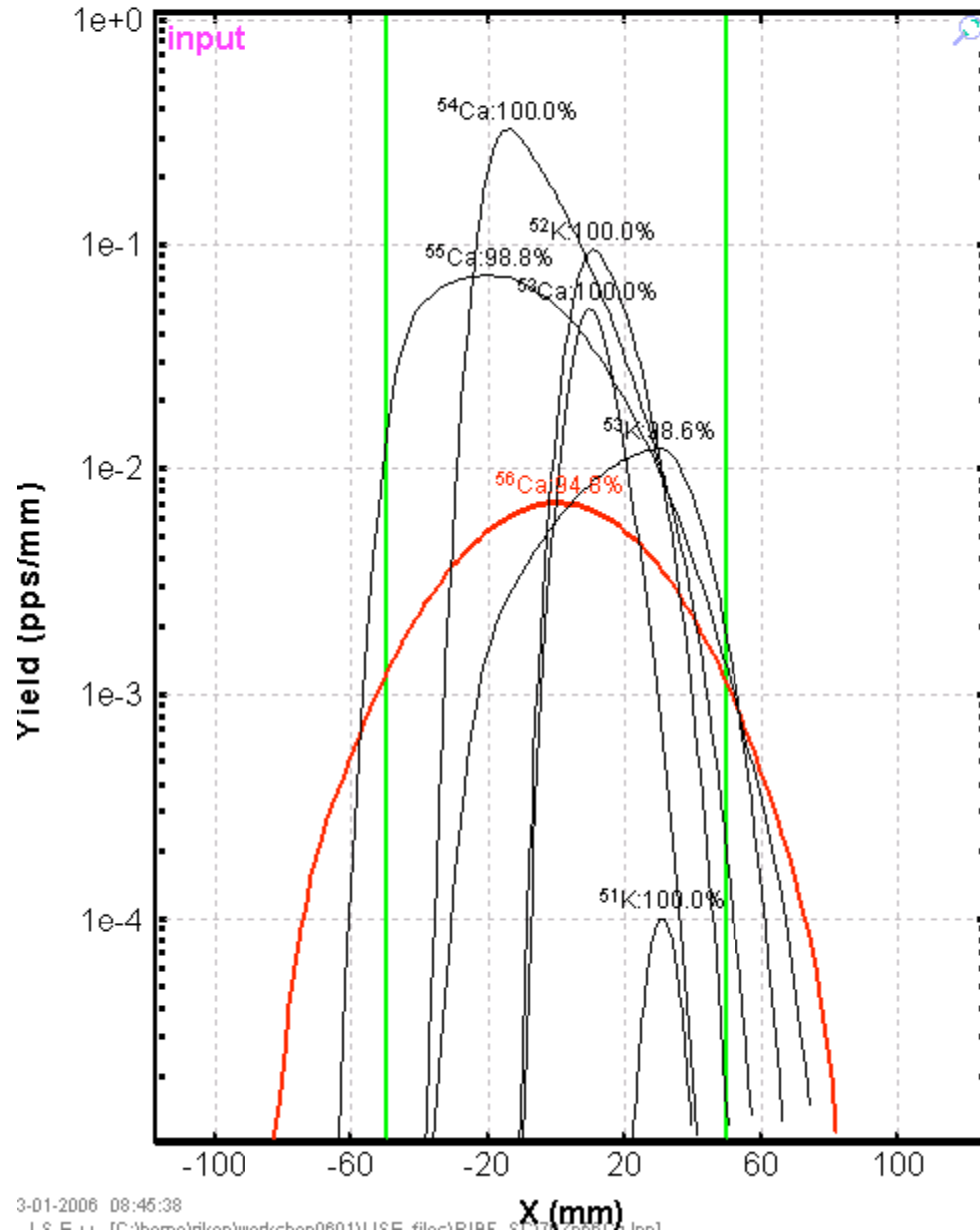




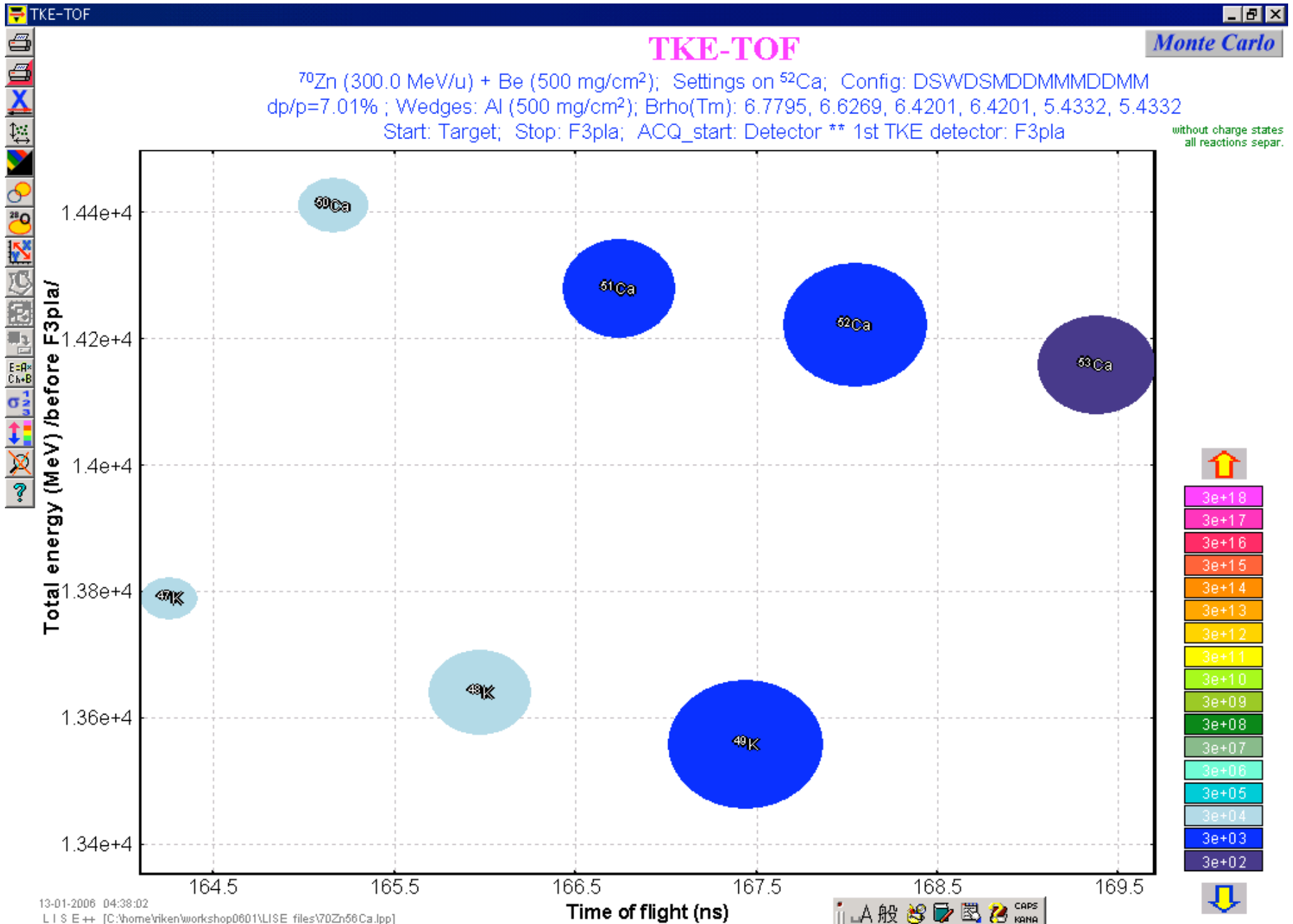
# F7ic-Xspace

$^{70}\text{Zn}$  (300.0 MeV/u) + Be (500 mg/cm<sup>2</sup>); Settings on  $^{56}\text{Ca}$ ; Config: DSWDSMDDMMDDMM  
dp/p=1.26%; Wedges: Al (1000 mg/cm<sup>2</sup>); Brho(Tm): 7.3100, 7.0003, 6.7868, 6.7868, 5.7698, 5.7698

without charge  
all reactions



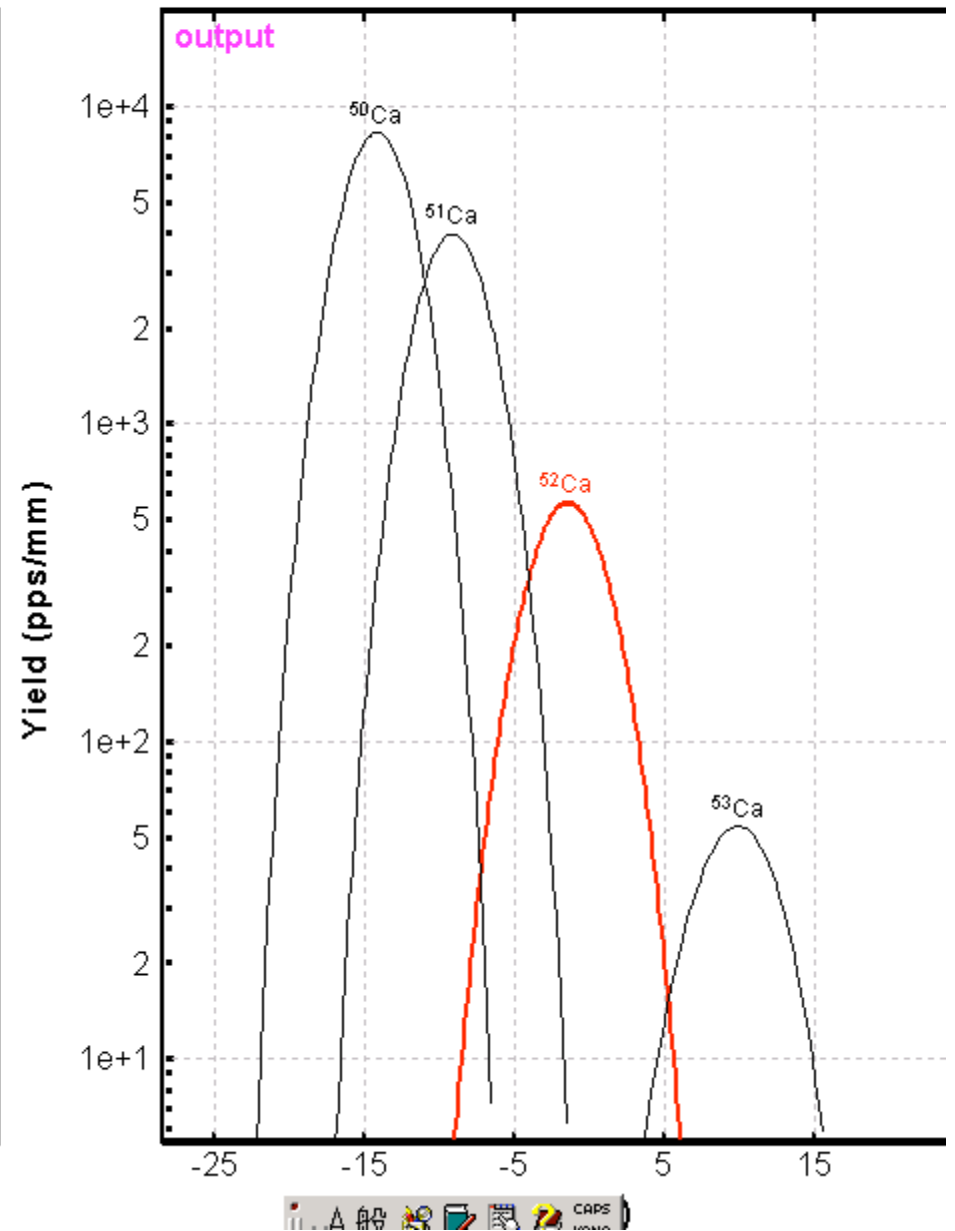
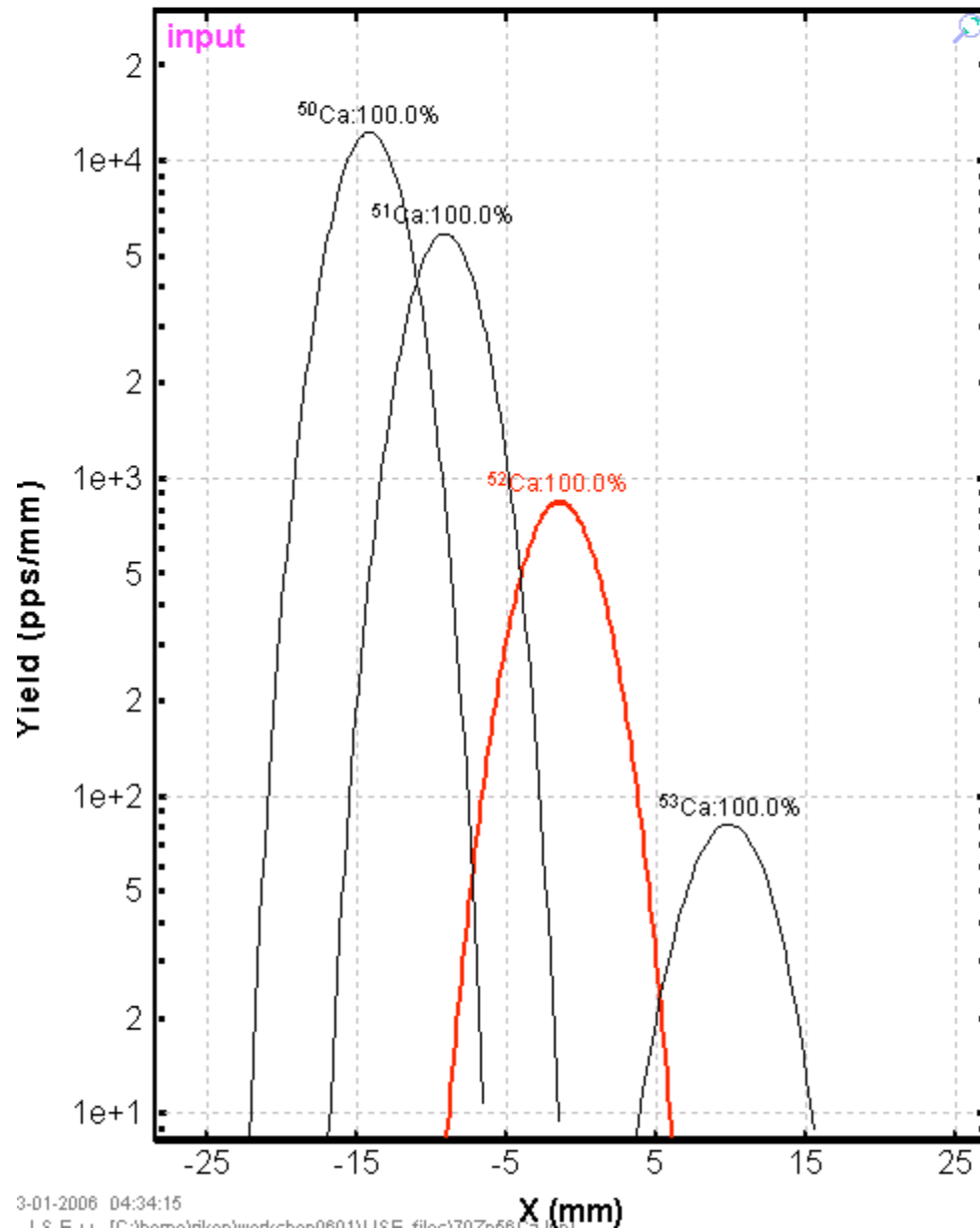
# 300MeV/u $^{70}\text{Zn} \Rightarrow ^{52}\text{Ca}$



# R-tgt-Xspace

$^{70}\text{Zn}$  (300.0 MeV/u) + Be (500 mg/cm<sup>2</sup>); Settings on  $^{52}\text{Ca}$ ; Config: DSWDSMDDMMDDMM  
dp/p=7.01% ; Wedges: Al (500 mg/cm<sup>2</sup>); Brho(Tm): 6.7795, 6.6269, 6.4201, 6.4201, 5.4332, 5.4332

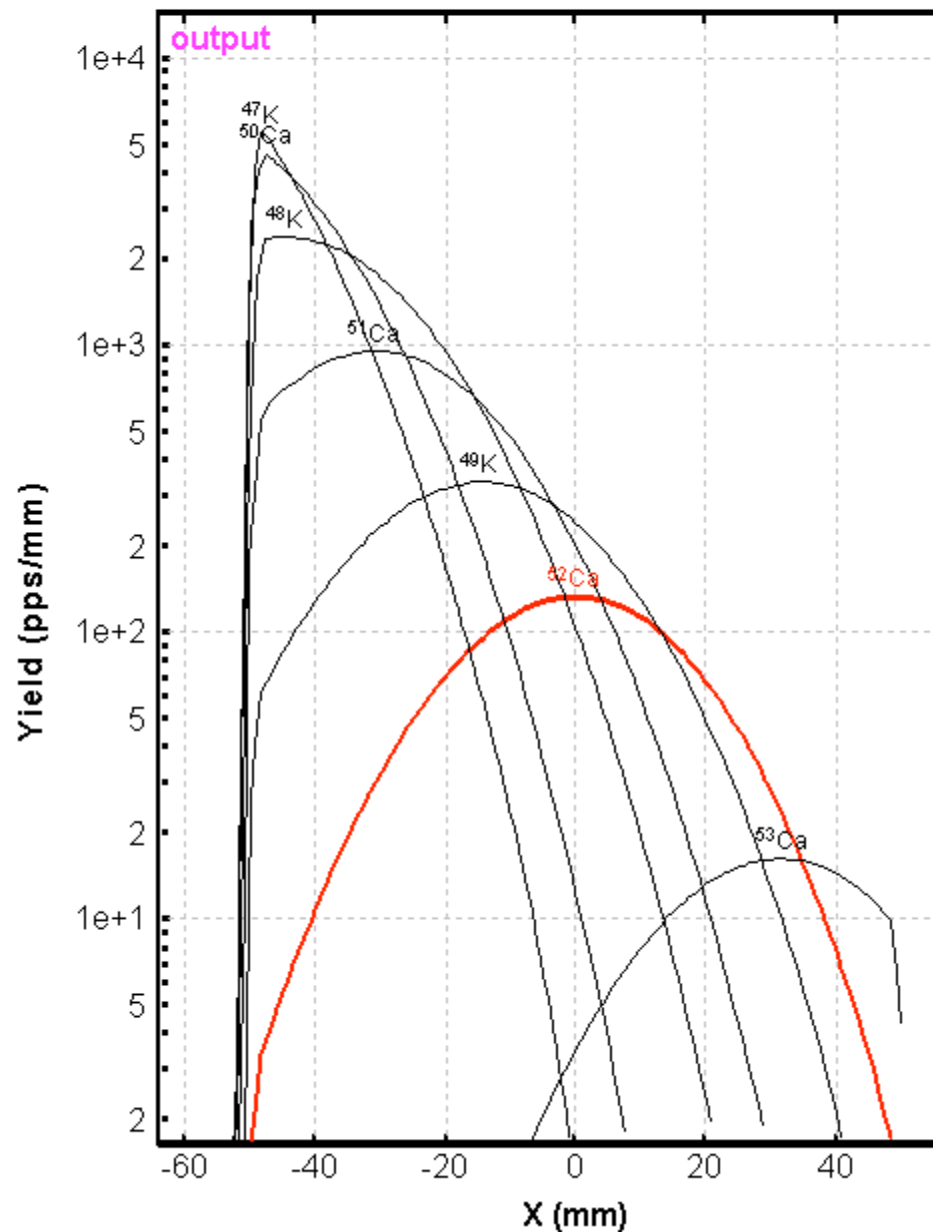
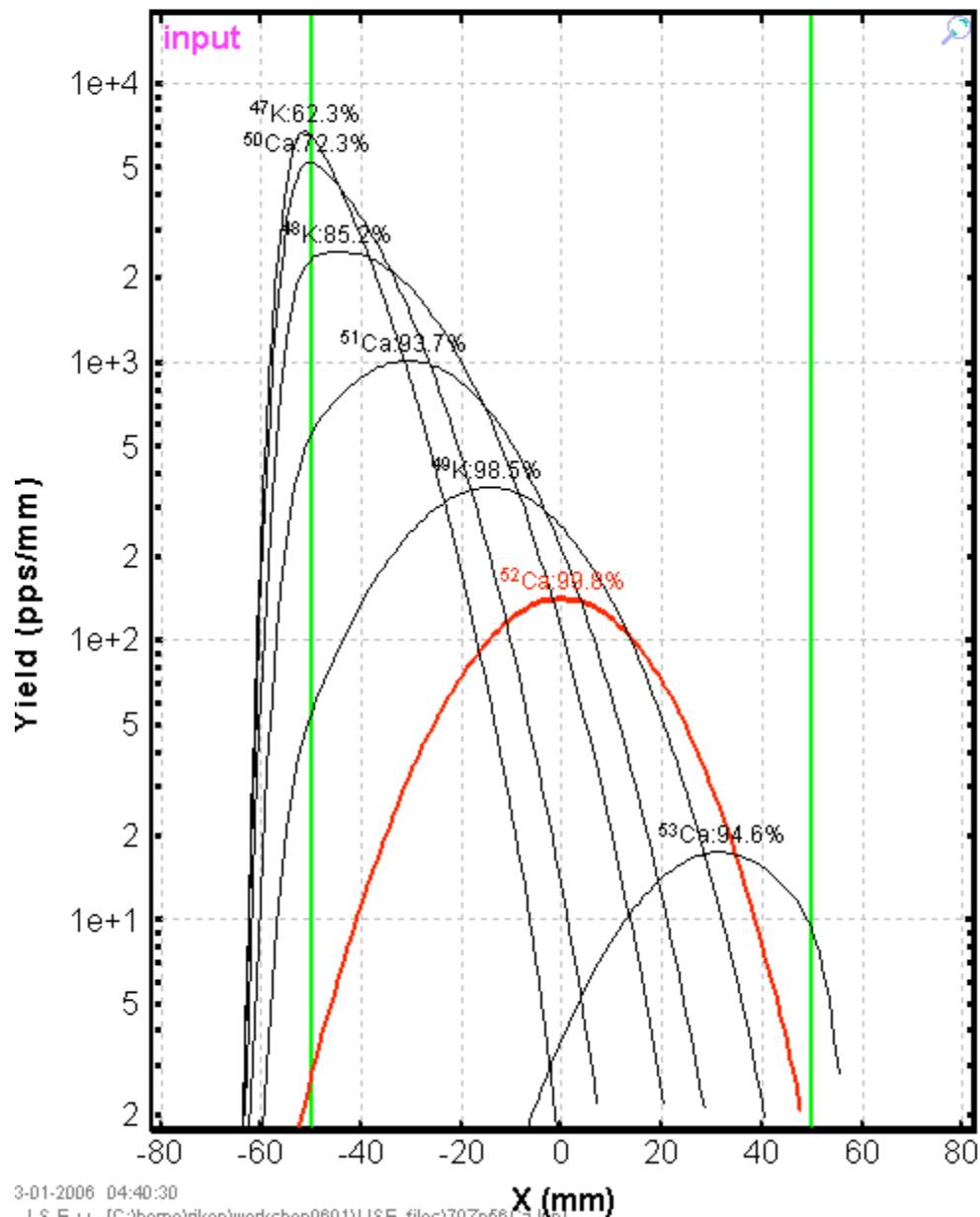
without charge  
all reactions



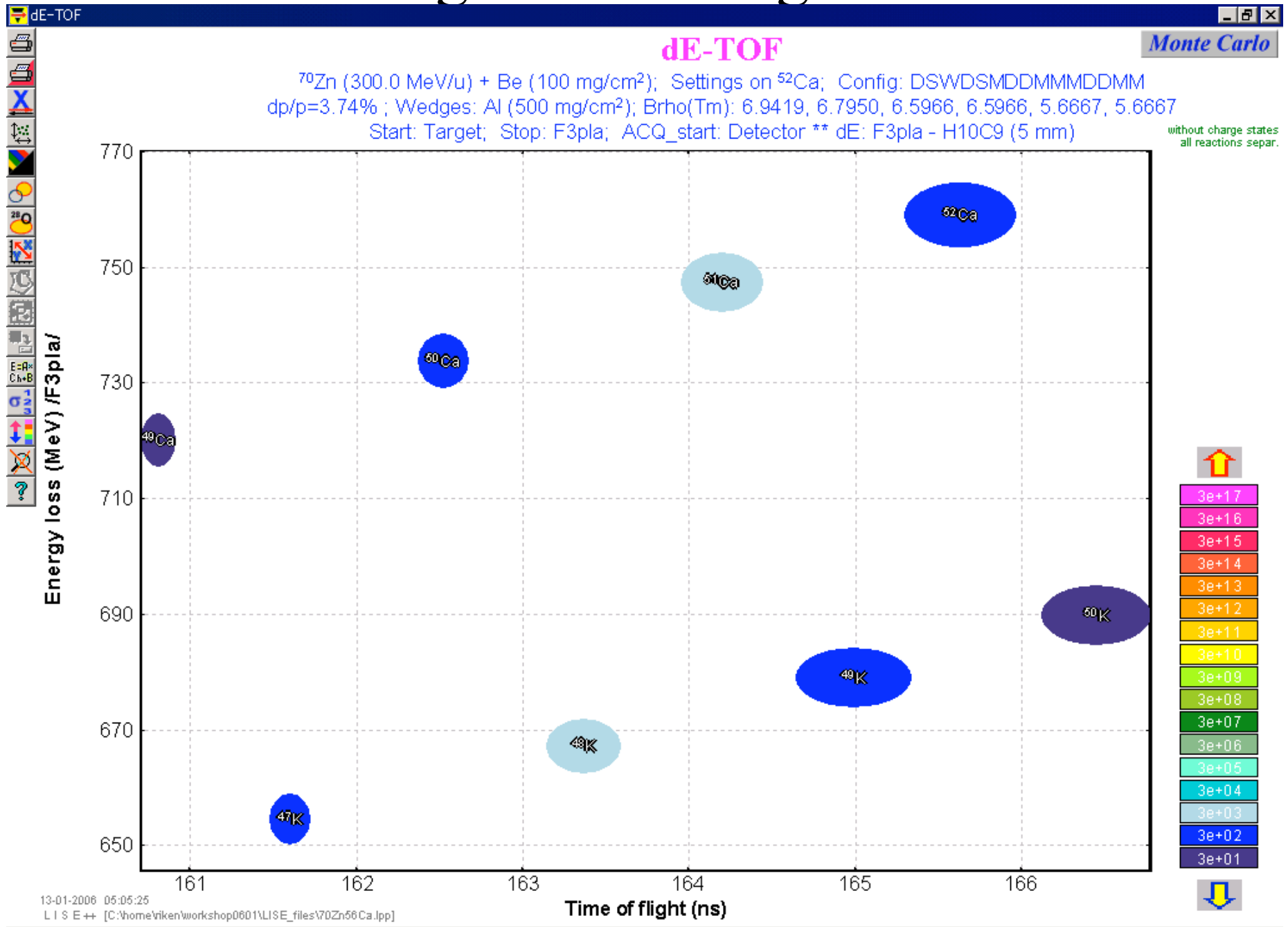
## F3pla-Xspace

$^{70}\text{Zn}$  (300.0 MeV/u) + Be (500 mg/cm<sup>2</sup>); Settings on  $^{52}\text{Ca}$ ; Config: DSWDSMDDMMDDMM  
 dp/p=7.01% ; Wedges: Al (500 mg/cm<sup>2</sup>); Brho(Tm): 6.7795, 6.6269, 6.4201, 6.4201, 5.4332, 5.4332

without charge  
 all reactions



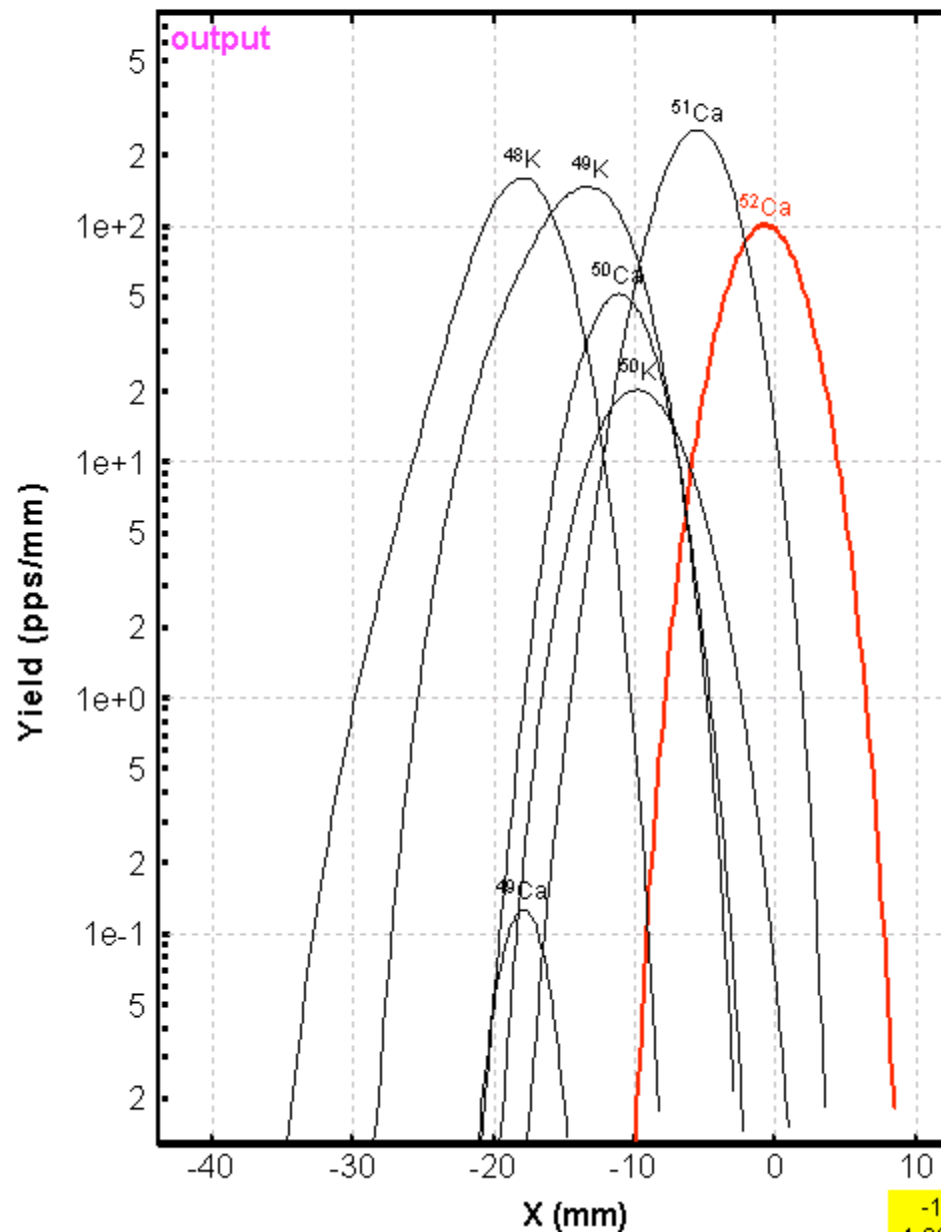
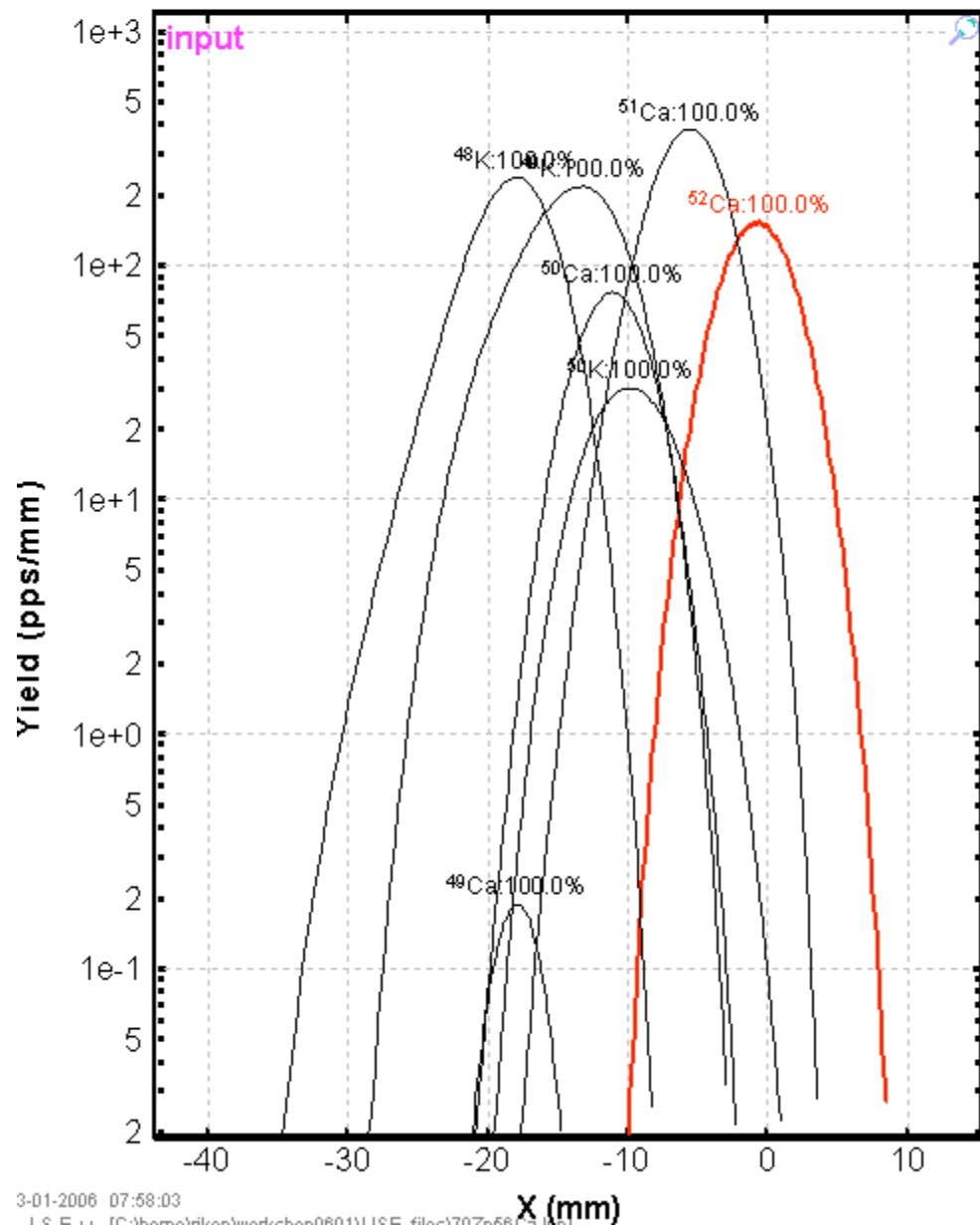
# target => 100mg/cm<sup>2</sup>



## R-tgt-Xspace

$^{70}\text{Zn}$  (300.0 MeV/u) + Be (100 mg/cm<sup>2</sup>); Settings on  $^{52}\text{Ca}$ ; Config: DSWDSMDDMMDDMM  
dp/p=3.74%; Wedges: Al (500 mg/cm<sup>2</sup>); Brho(Tm): 6.9419, 6.7950, 6.5966, 6.5966, 5.6667, 5.6667

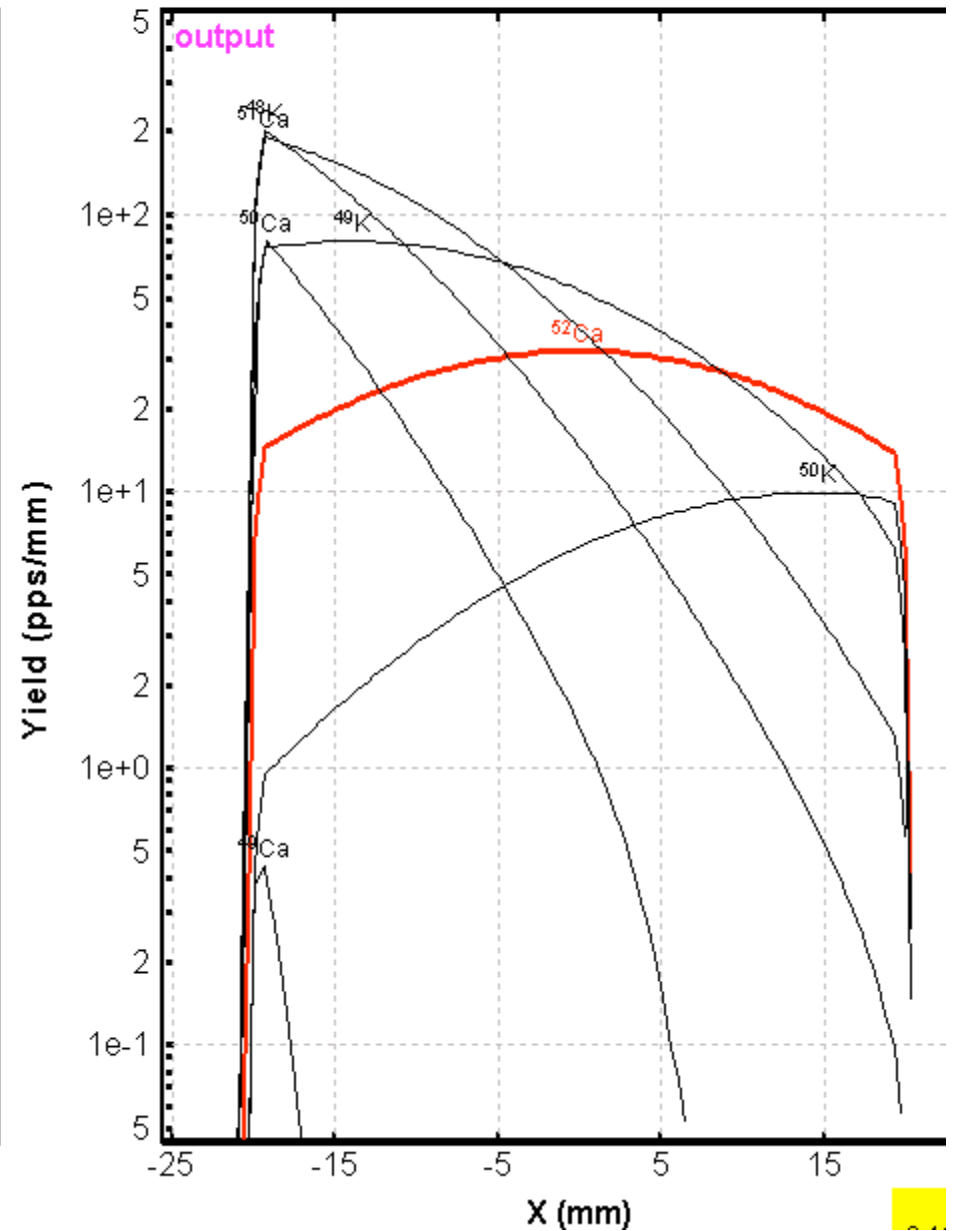
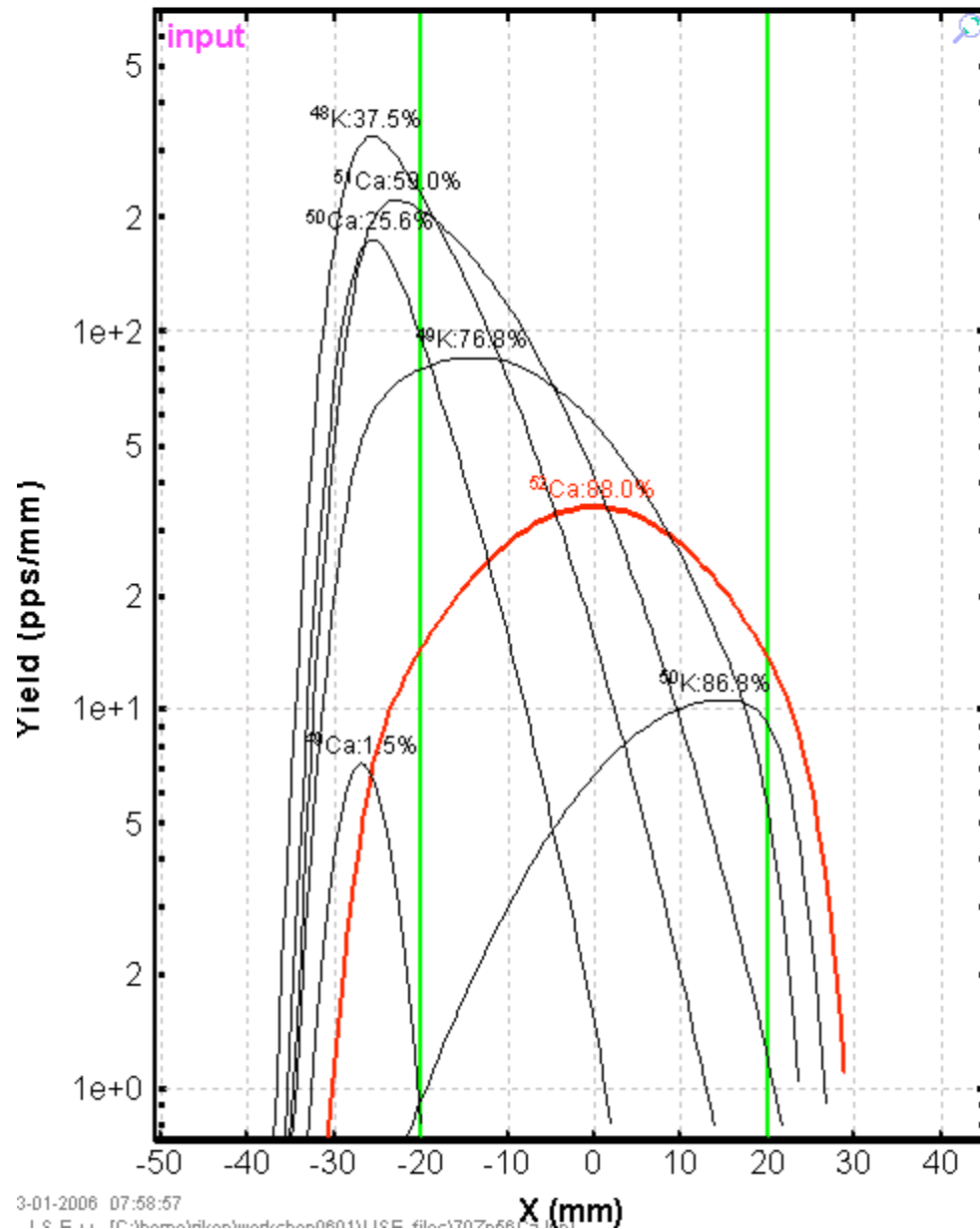
without charge  
all reactions

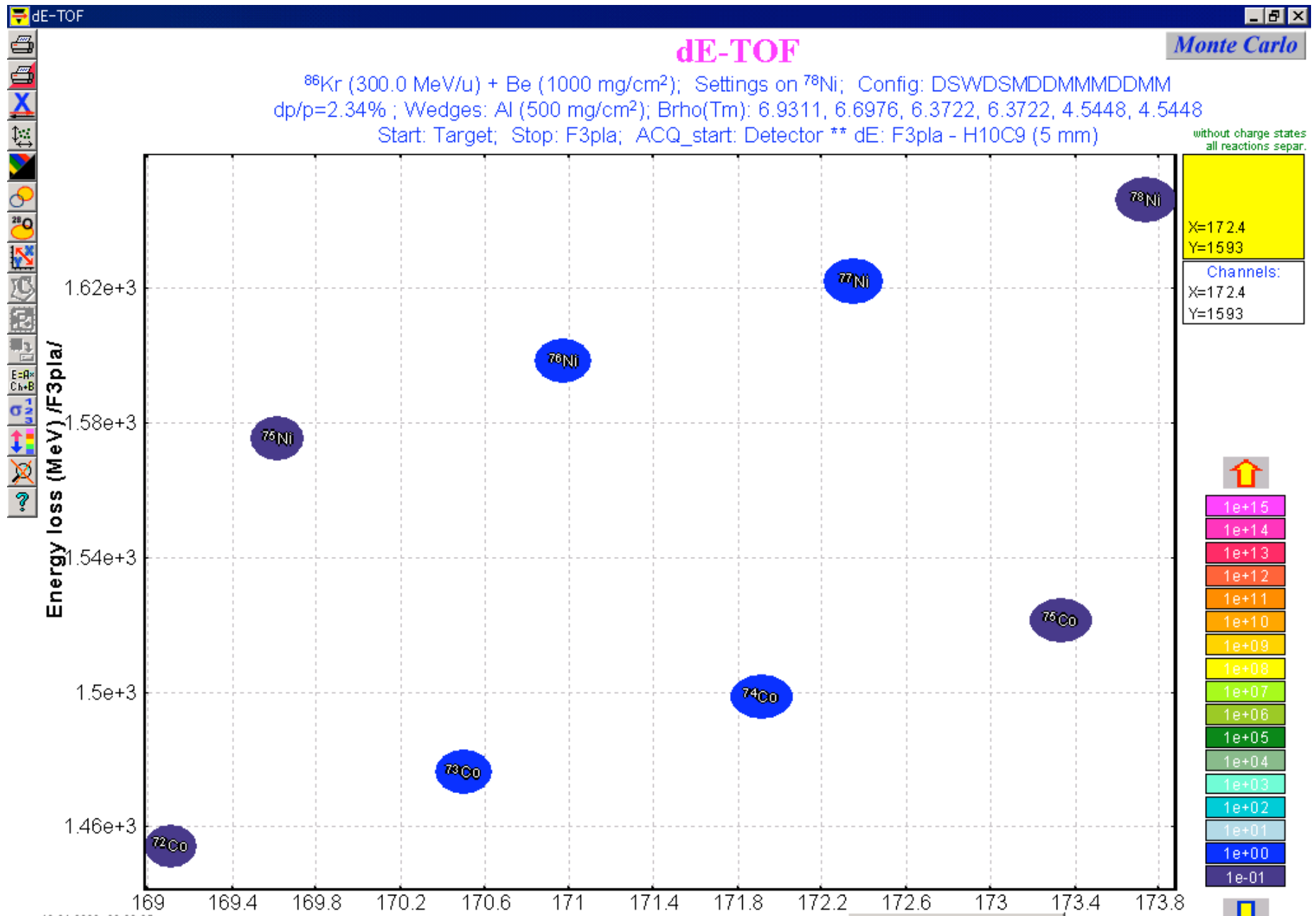


# F3pla-Xspace

$^{70}\text{Zn}$  (300.0 MeV/u) + Be (100 mg/cm<sup>2</sup>); Settings on  $^{52}\text{Ca}$ ; Config: DSWDSMDDMMDDMM  
dp/p=3.74% ; Wedges: Al (500 mg/cm<sup>2</sup>); Brho(Tm): 6.9419, 6.7950, 6.5966, 6.5966, 5.6667, 5.6667

without charge  
all reactions





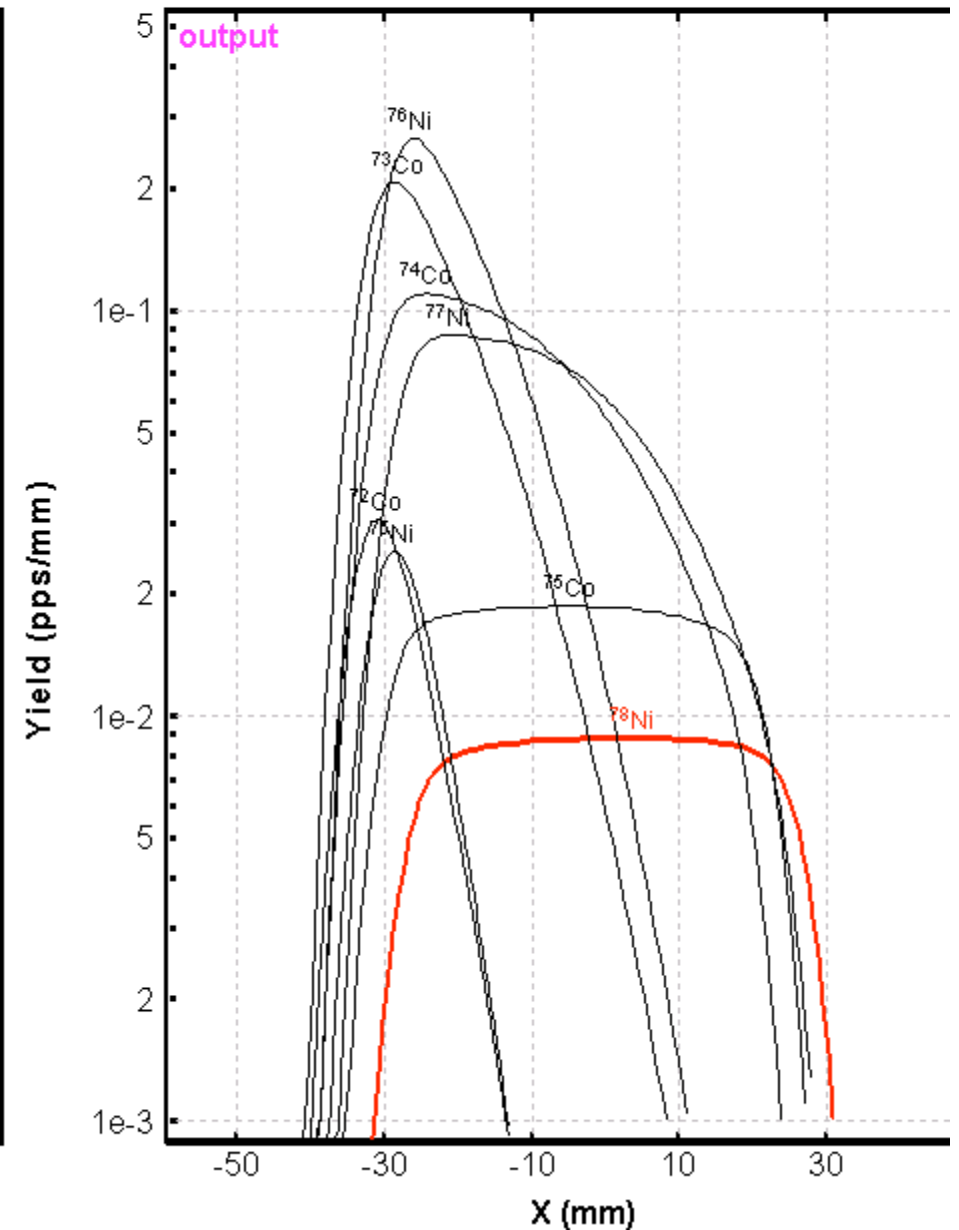
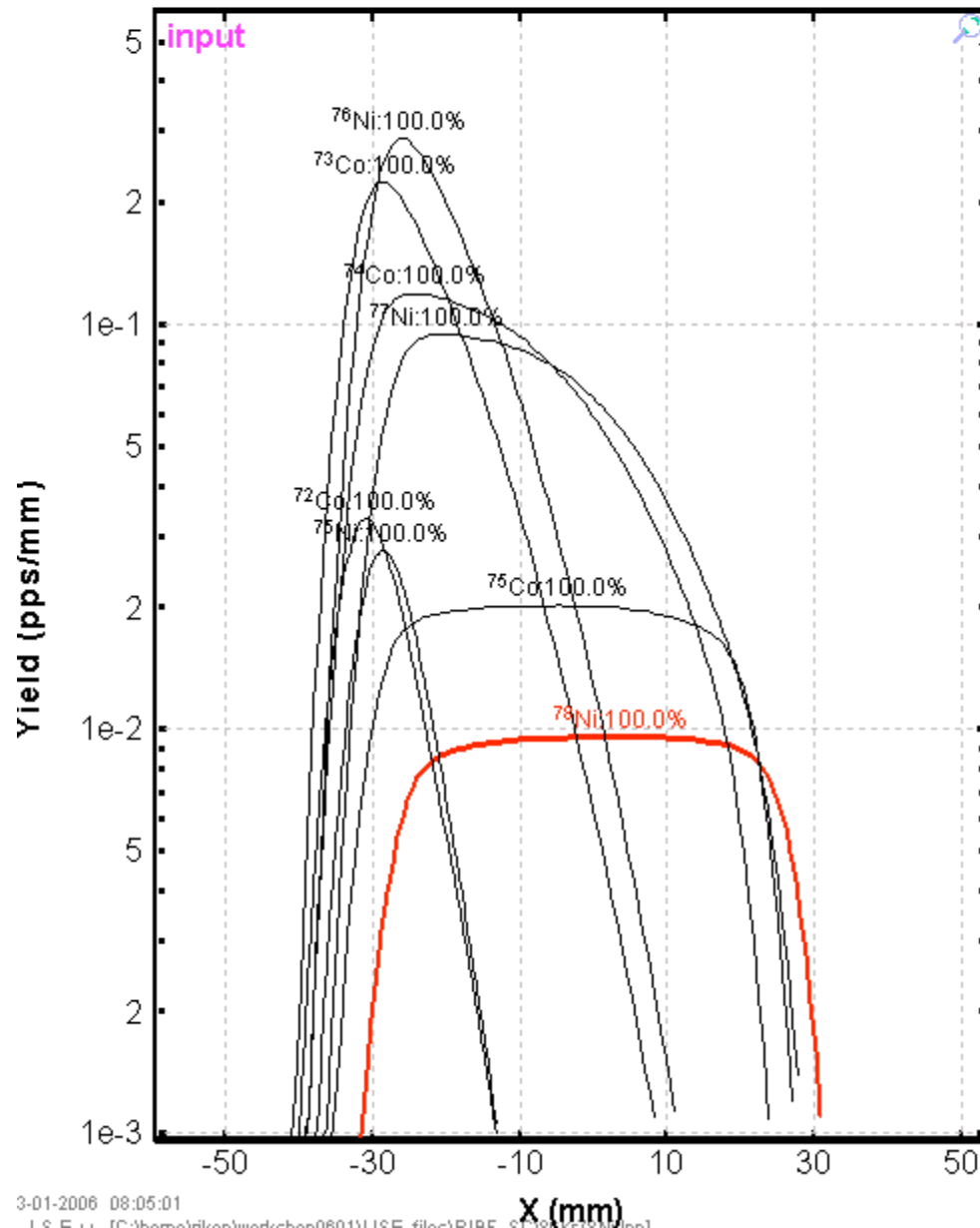




# F3pla-Xspace

$^{86}\text{Kr}$  (300.0 MeV/u) + Be (1000 mg/cm<sup>2</sup>); Settings on  $^{78}\text{Ni}$ ; Config: DSWDSMDDMMDDMM  
dp/p=2.34% ; Wedges: Al (500 mg/cm<sup>2</sup>); Brho(Tm): 6.9311, 6.6976, 6.3722, 6.3722, 4.5448, 4.5448

without charge  
all reactions



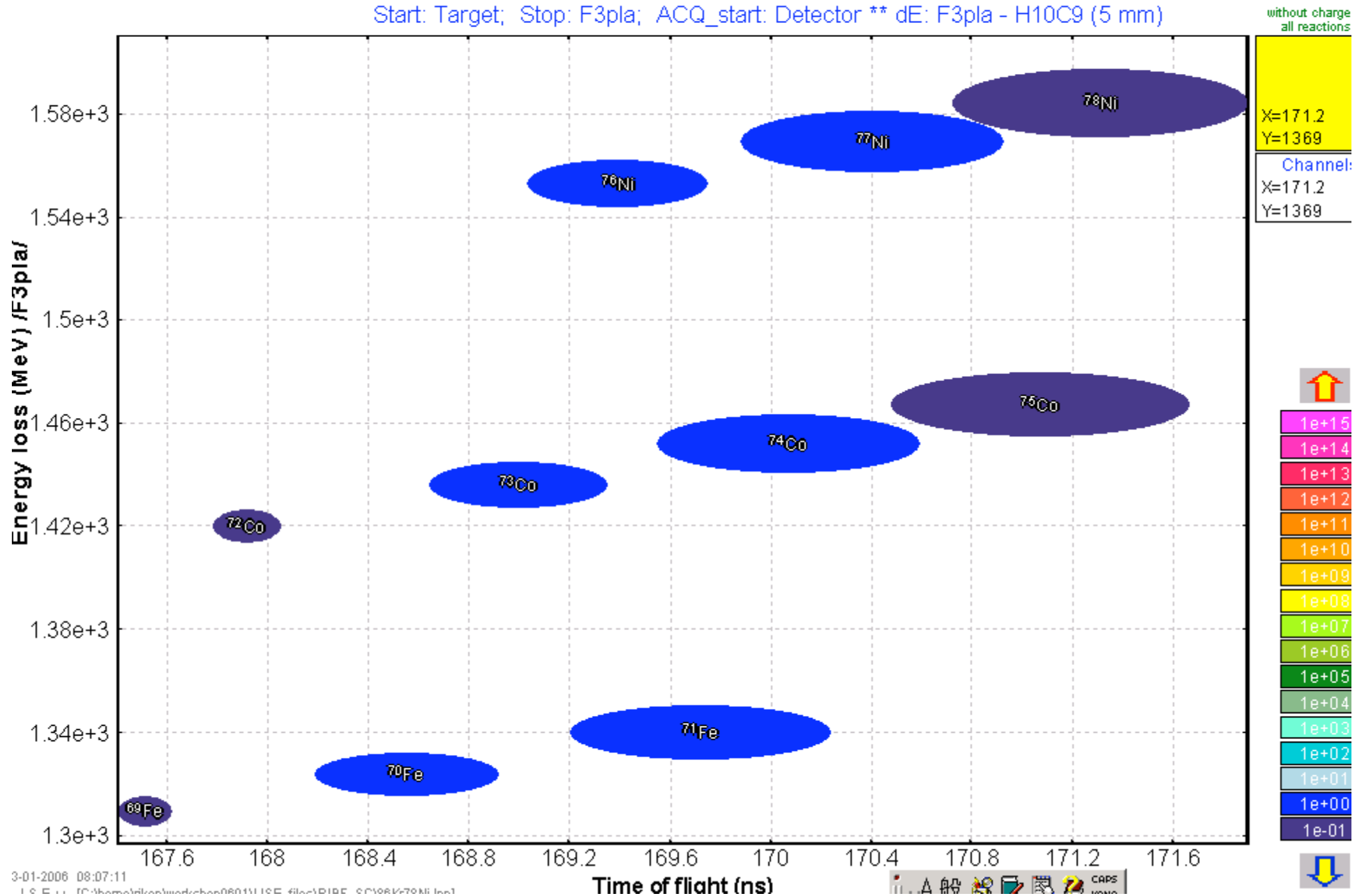


# no degrader

## dE-TOF

Monte Carlo

$^{86}\text{Kr}$  (300.0 MeV/u) + Be (1000 mg/cm<sup>2</sup>); Settings on  $^{78}\text{Ni}$ ; Config: DSWDSMDDMMDDMM  
dp/p=2.34% ; Wedges: 0; Brho(Tm): 6.9311, 6.9311, 6.6252, 6.6252, 5.0009, 5.0009  
Start: Target; Stop: F3pla; ACQ\_start: Detector \*\* dE: F3pla - H10C9 (5 mm)



# R-tgt-Xspace

$^{86}\text{Kr}$  (300.0 MeV/u) + Be (1000 mg/cm<sup>2</sup>); Settings on  $^{78}\text{Ni}$ ; Config: DSWDSMDDMMDDMM  
dp/p=2.34% ; Wedges: 0; Brho(Tm): 6.9311, 6.9311, 6.6252, 6.6252, 5.0009, 5.0009

without charge  
all reactions

