

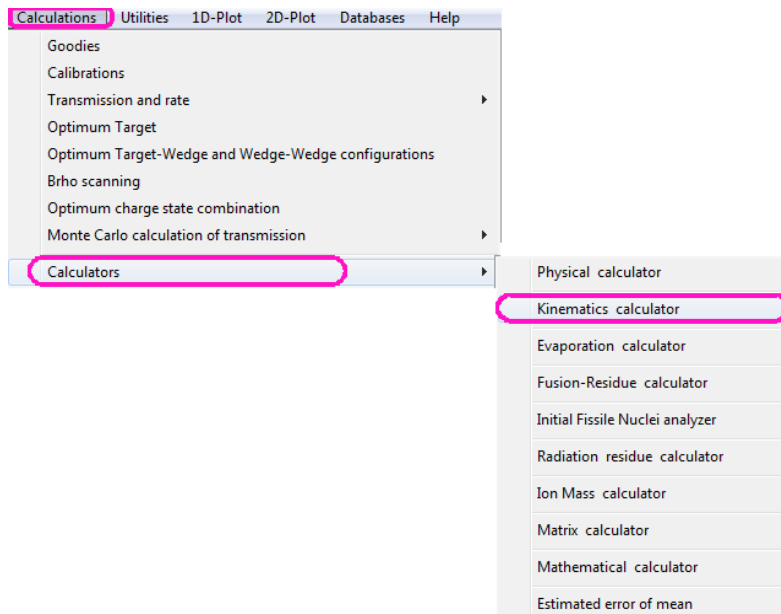
v.11.0.64 04/16/19

LISE++ example file:

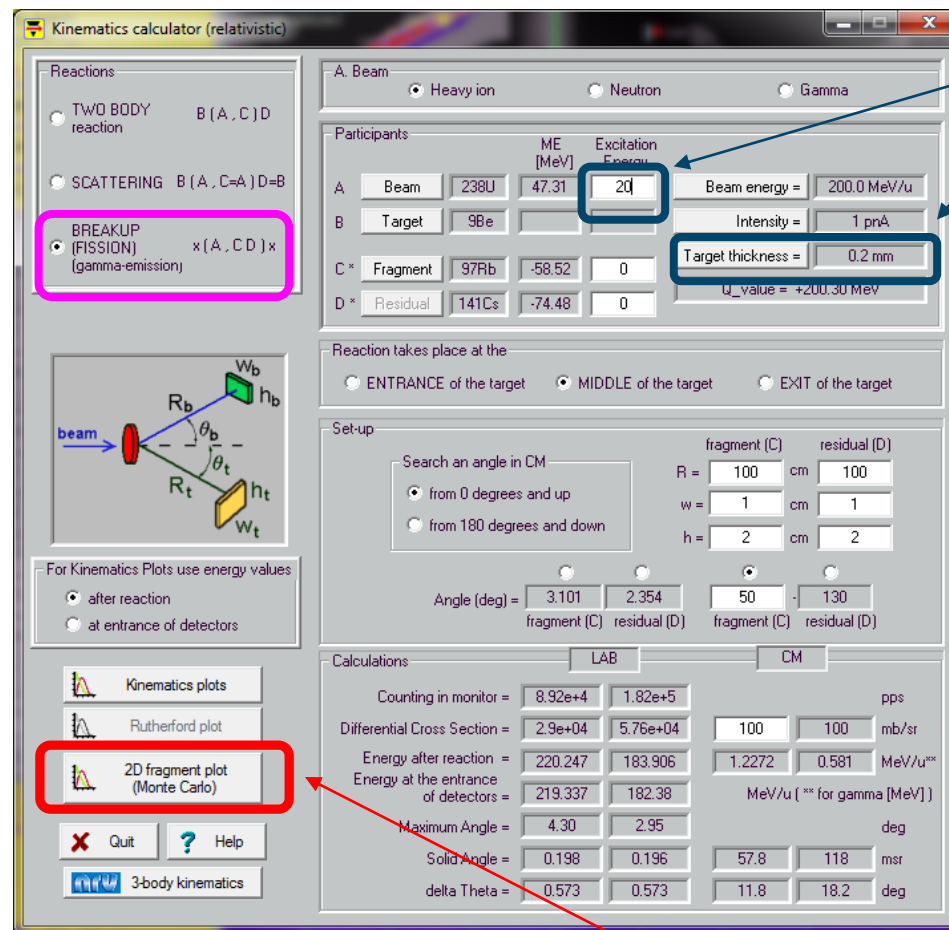
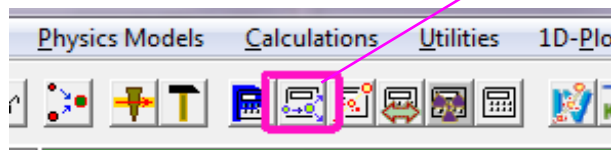
[fission2.lpp](#)

http://lise.nsci.msu.edu/10_1/fission2.lpp

- Access to the Fission Kinematic MC Calculator
- New features of the Fission Kinematic MC Calculator
- Plotting two fission fragments simultaneously
- Passing two fission fragments simultaneously
 - Angular Acceptance
 - Momentum Acceptance
 - Angular Acceptance & Momentum Acceptance
- Using non-zero target thickness
- Acceptances and non-zero target thickness
- Some other plots.....



OR



Set fissile nucleus excitation energy and target thickness in this dialog

Access to the Fission Kinematic MC Calculator

BREAKUP (FISSION)

Projectile: 238U (200.0 MeV/u)
Target: 9Be

Fragment (C *): 97Rb, Ex. energy: 18.39
Residual (D *): 141Cs, Ex. energy: 22.51
Q-value (MeV): 159.88 MeV

Excitations

take from systematics
 set manually in Kinematics calculator

Expected final fragments

C_final: 95Rb: 49.5% <dn> 2.51
D_final: 138Cs: 48.2% <dn> 2.85
TKE(CM) from systematics: 161.87
TKE(CM) from calculations: 156.52

Fragment to plot

Excited (C *)
 Expected final (C_final)
 add conjugated fragment (D)

Plots

Lab: Vz & Vx, E & A, Brho (q=Z) & A
 Vz & Vxy, E & Ax, Brho (q=Z) & Ax
 Vz & Ax, E & Ay, Brho (q=Z) & Ay
 Vz & Ay, Vz & phi, Ax & Ay

CM: Vz & Vx
 Vz & Vxy
 Ax & Ay
 A & phi

Acceptances (in case of C_final fragment plot)

Angular Acceptance
Angular acceptance shape: Ellipse, Rectangle

| | Value | Variance |
|--------------|-------|----------|
| Horizontal ± | 3000 | 0.5 mrad |
| Vertical ± | 3000 | 0.5 mrad |

Momentum acceptance
Setting Brho: 5.612 T*m
Acceptance ±: 1000 %

Take into account a target thickness: No (fast), Yes

Energy variation after the reaction due to straggling: 0.1 MeV/u
** Warning: it takes a lot of computing time if this value is more than 0

Initial emittance
Horizontal Angular ±: 0 mrad
Vertical Angular ±: 0 mrad
Energy** ±: 0 MeV/u

Broadening due to particle emission
Angular ±: 0.79 mrad
Energy ±: 0.02 MeV/u

Angular Distribution (CM): ISOTROPIC

Momentum acceptance instead the previous pseudo-energy acceptance

"Brho" plots

Main new feature to start plotting and passing two fission fragments simultaneously

add conjugated fragment (D)

add conjugated fragment (D)

^{95}Rb fragment kinematics (expected final)

$^{238}\text{U} \Rightarrow ^{95}\text{Rb}(^{97}\text{Rb}^*) + ^{138}\text{Cs}(^{141}\text{Cs}^*)$ (Projectile Energy : 200.00 MeV/u)

Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Iso

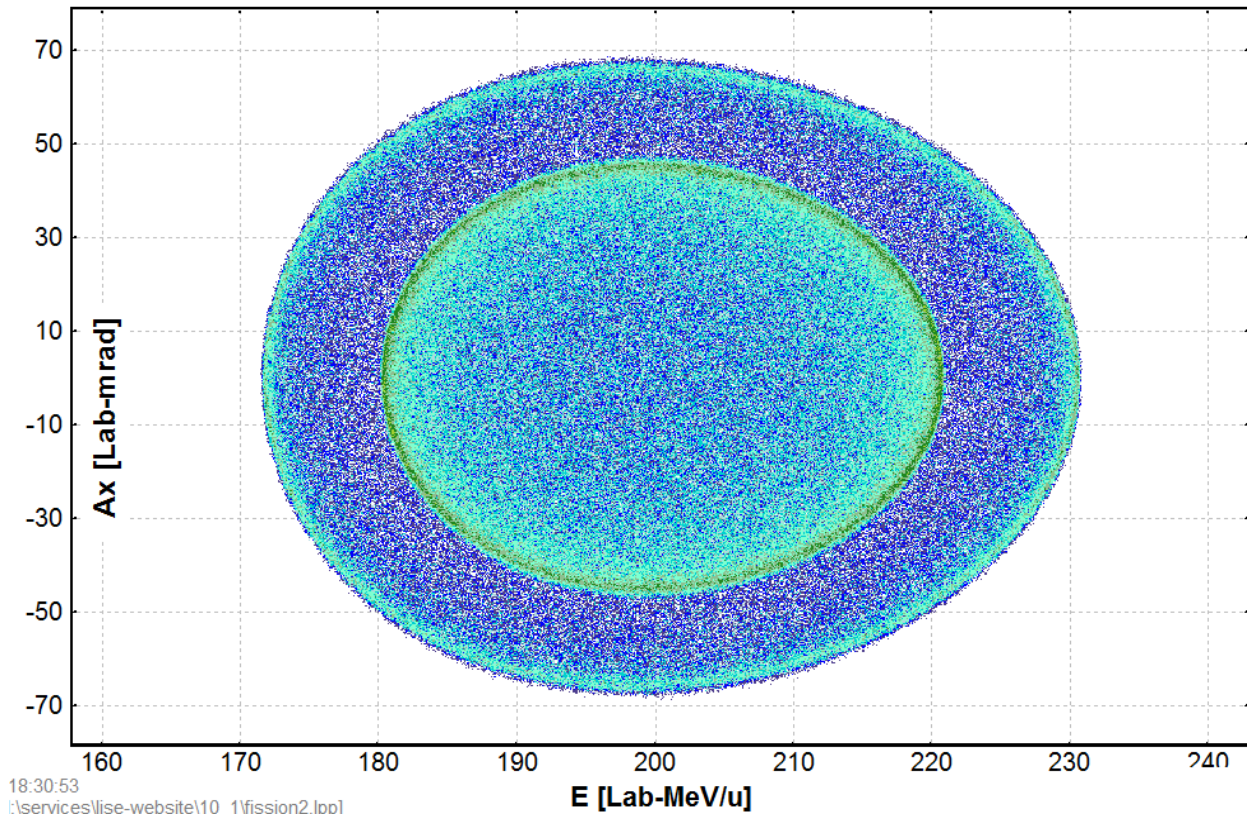
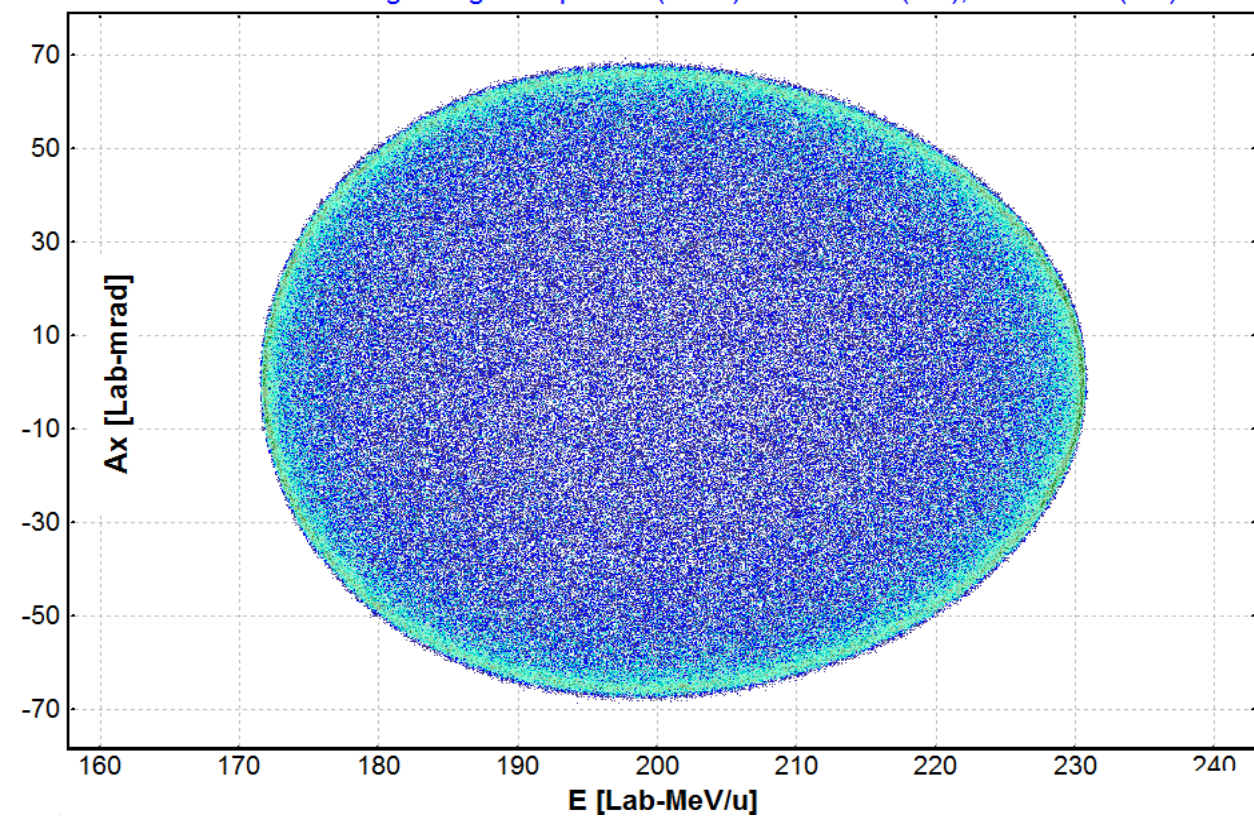
Rectangle Ang.Acceptance (mrad): H = 3000.0(0.5); V = 3000.0(0.5)

^{95}Rb & ^{138}Cs fragment kinematics (expected final)

$^{238}\text{U} \Rightarrow ^{95}\text{Rb}(^{97}\text{Rb}^*) + ^{138}\text{Cs}(^{141}\text{Cs}^*)$ (Projectile Energy : 200.00 MeV/u)

Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotrc

Rectangle Ang.Acceptance (mrad): H = 3000.0(0.5); V = 3000.0(0.5)



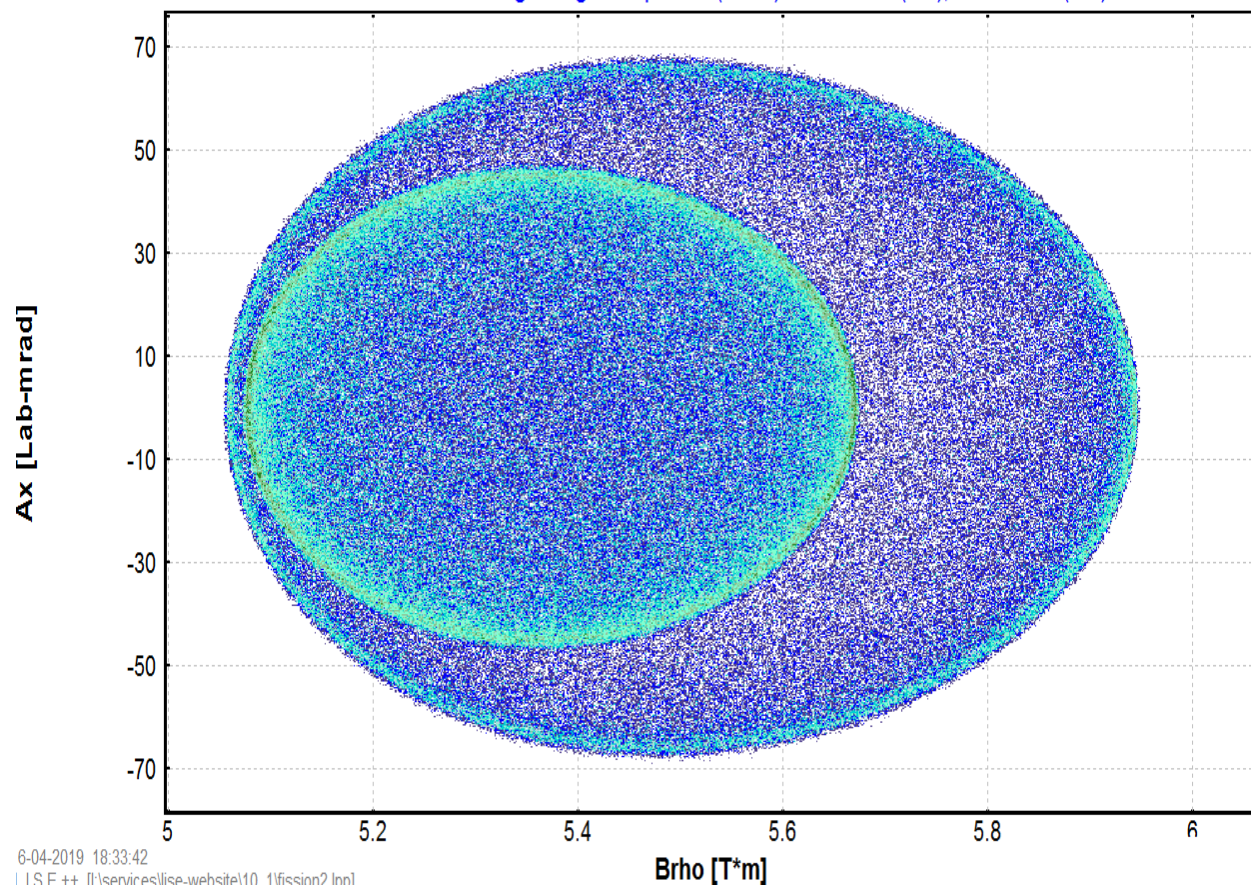
add conjugated fragment (D)

Brho (q=Z) & A

Brho (q=Z) & A_x

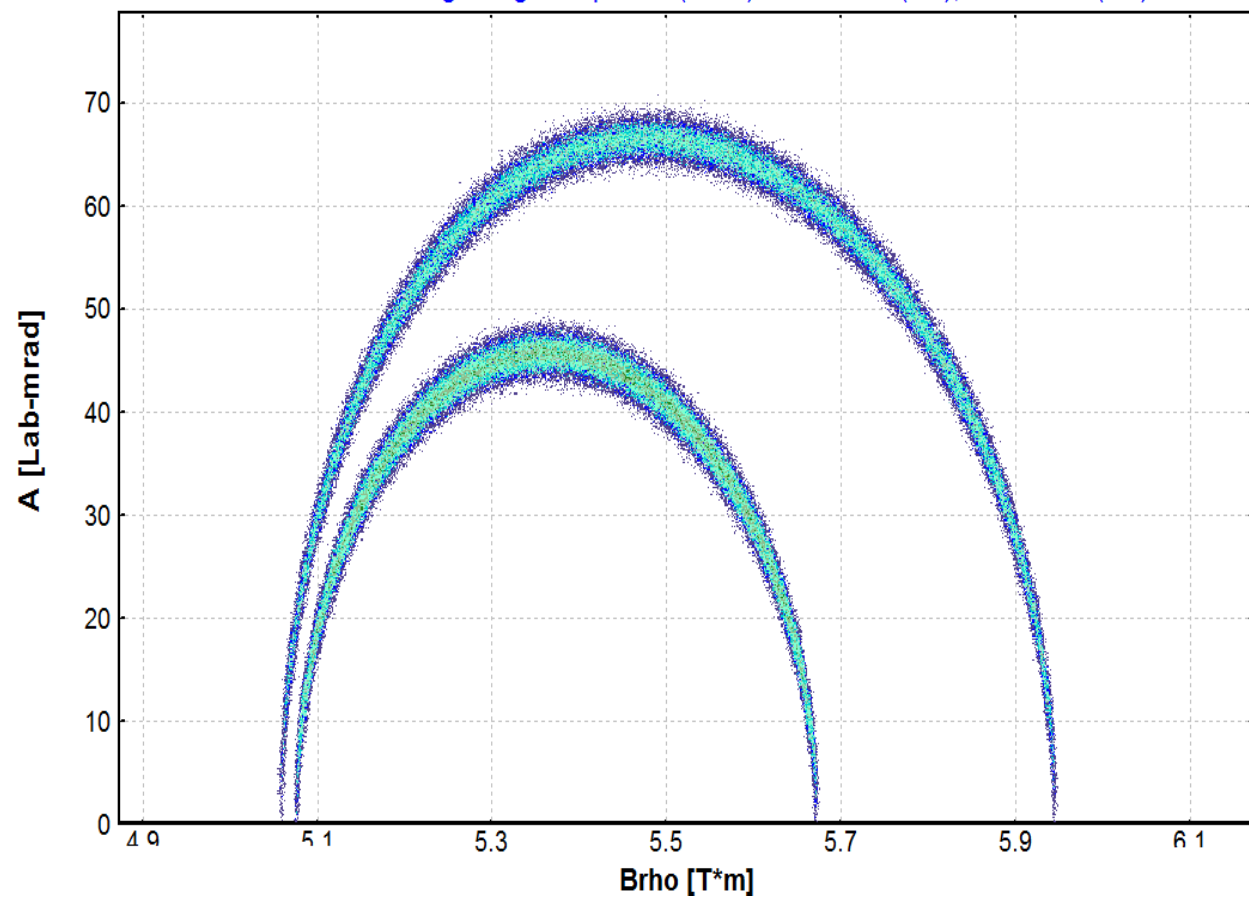
^{95}Rb & ^{138}Cs fragment kinematics (expected final)

$^{238}\text{U} \Rightarrow ^{95}\text{Rb}(^{97}\text{Rb}^*) + ^{138}\text{Cs}(^{141}\text{Cs}^*)$ (Projectile Energy : 200.00 MeV/u)
 Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic
 Rectangle Ang.Acceptance (mrad): H = 3000.0(0.5); V = 3000.0(0.5)



^{95}Rb & ^{138}Cs fragment kinematics (expected final)

$^{238}\text{U} \Rightarrow ^{95}\text{Rb}(^{97}\text{Rb}^*) + ^{138}\text{Cs}(^{141}\text{Cs}^*)$ (Projectile Energy : 200.00 MeV/u)
 Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotro
 Rectangle Ang.Acceptance (mrad): H = 3000.0(0.5); V = 3000.0(0.5)



E. PELLEREAU *et al.* PHYSICAL REVIEW C 95, 054603 (2017)

Two-fission registration setups (SOFIA, SAMURAI) use a wide aperture magnet : large A_x angular acceptance, moderate A_y (vertical gap), and large Brho-acceptance

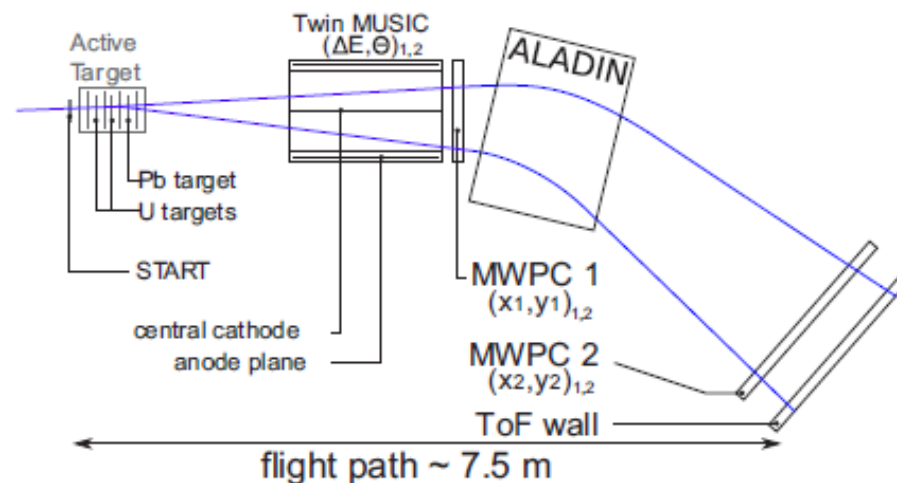


FIG. 4. Schematic view of the SOFIA setup to identify the nuclear mass and charge of both fission fragments in coincidence (top view, not on scale).

Lets start with angular acceptances:

Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape

Ellipse Rectangle

| | Value | Variance | |
|--------------|-------|----------|------|
| Horizontal ± | 150 | 0.5 | mrad |
| Vertical ± | 50 | 0.5 | mrad |

Momentum acceptance

Setting Brho T*m

Acceptance ± %

BOTH fragments should pass Angular and Momentum Acceptances

Unchecked : at least one fragment
Checked : **BOTH** fragments

should pass to register this fission event

Passing two fission fragments simultaneously (Angular acceptance)

Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape

Ellipse Rectangle

| | Value | Variance |
|--------------|-------|----------|
| Horizontal ± | 150 | 0.5 mrad |
| Vertical ± | 50 | 0.5 mrad |

Setting Brho: 5.612 T*m

Acceptance ±: 1000 %

BOTH fragments should pass Angular and Momentum Acceptances

"A" - angle, "V" - velocity, "E" - energy
 "CM" - center of mass, "LAB" - laboratory
 "z" corresponds to the beam direction.
 No events with Vz<0 in the case of non-zero target thickness

Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape

Ellipse Rectangle

| | Value | Variance |
|--------------|-------|----------|
| Horizontal ± | 150 | 0.5 mrad |
| Vertical ± | 50 | 0.5 mrad |

Setting Brho: 5.612 T*m

Acceptance ±: 1000 %

BOTH fragments should pass Angular and Momentum Acceptances

"A" - angle, "V" - velocity, "E" - energy
 "CM" - center of mass, "LAB" - laboratory
 "z" corresponds to the beam direction.
 No events with Vz<0 in the case of non-zero target thickness

⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final)

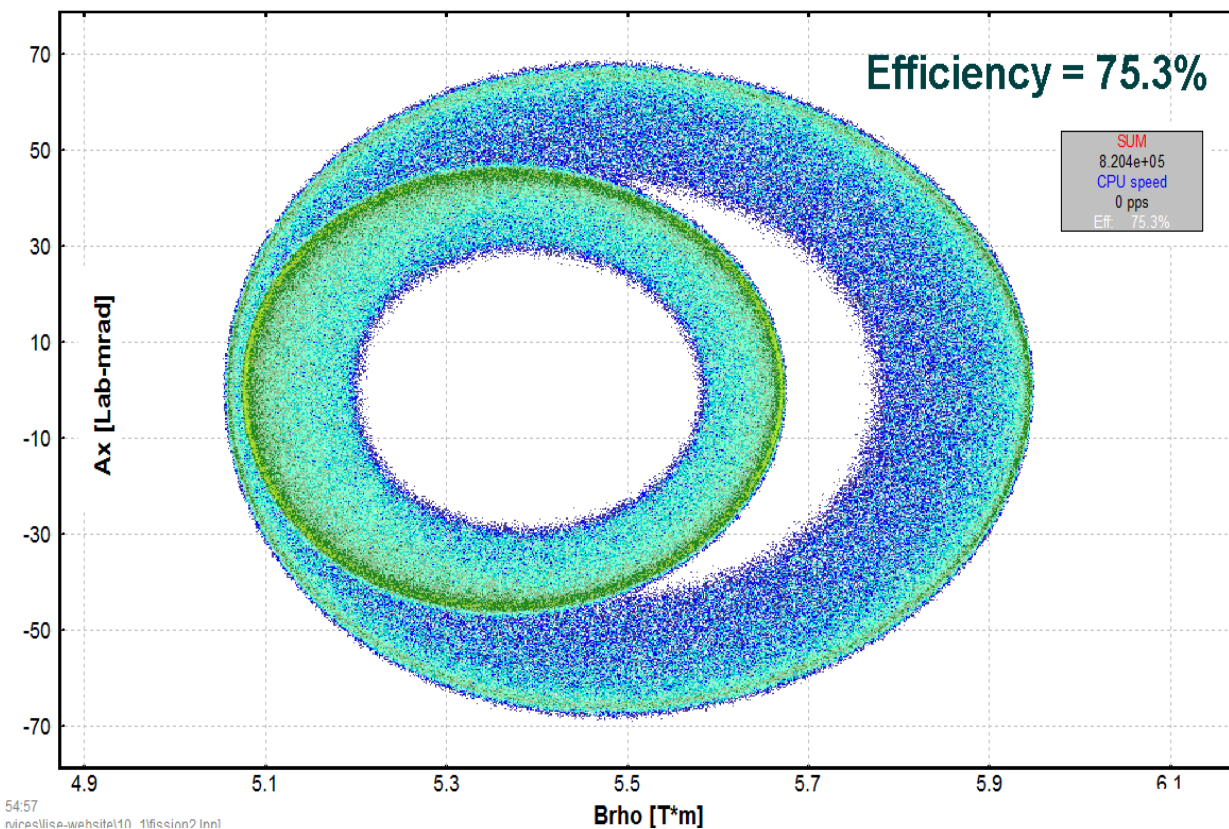
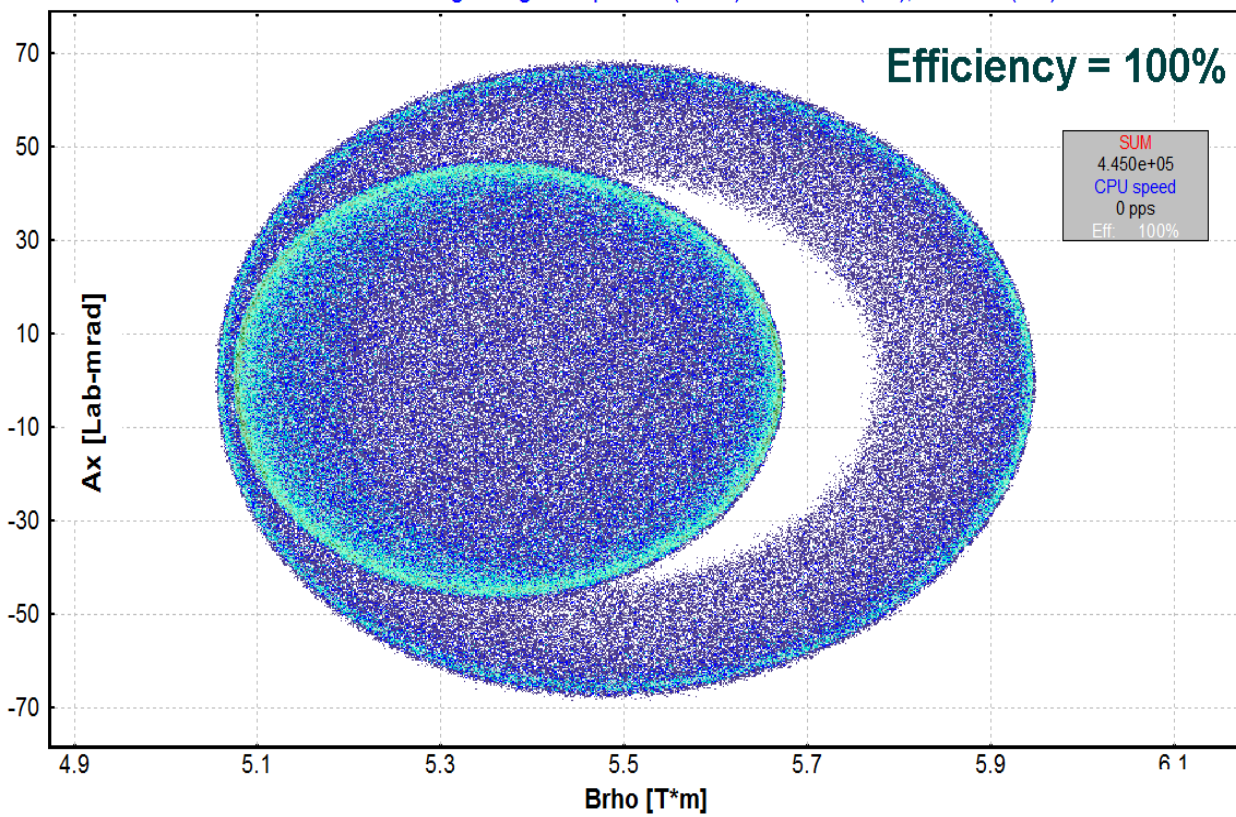
$^{238}\text{U} \Rightarrow ^{95}\text{Rb}(^{97}\text{Rb}^*) + ^{138}\text{Cs}(^{141}\text{Cs}^*)$ (Projectile Energy : 200.00 MeV/u)

Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic
 Rectangle Ang.Acceptance (mrad): H = 150.0(0.5); V = 50.0(0.5)

⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final) **BOTH fragments should**

$^{238}\text{U} \Rightarrow ^{95}\text{Rb}(^{97}\text{Rb}^*) + ^{138}\text{Cs}(^{141}\text{Cs}^*)$ (Projectile Energy : 200.00 MeV/u)

Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic
 Rectangle Ang.Acceptance (mrad): H = 150.0(0.5); V = 50.0(0.5)

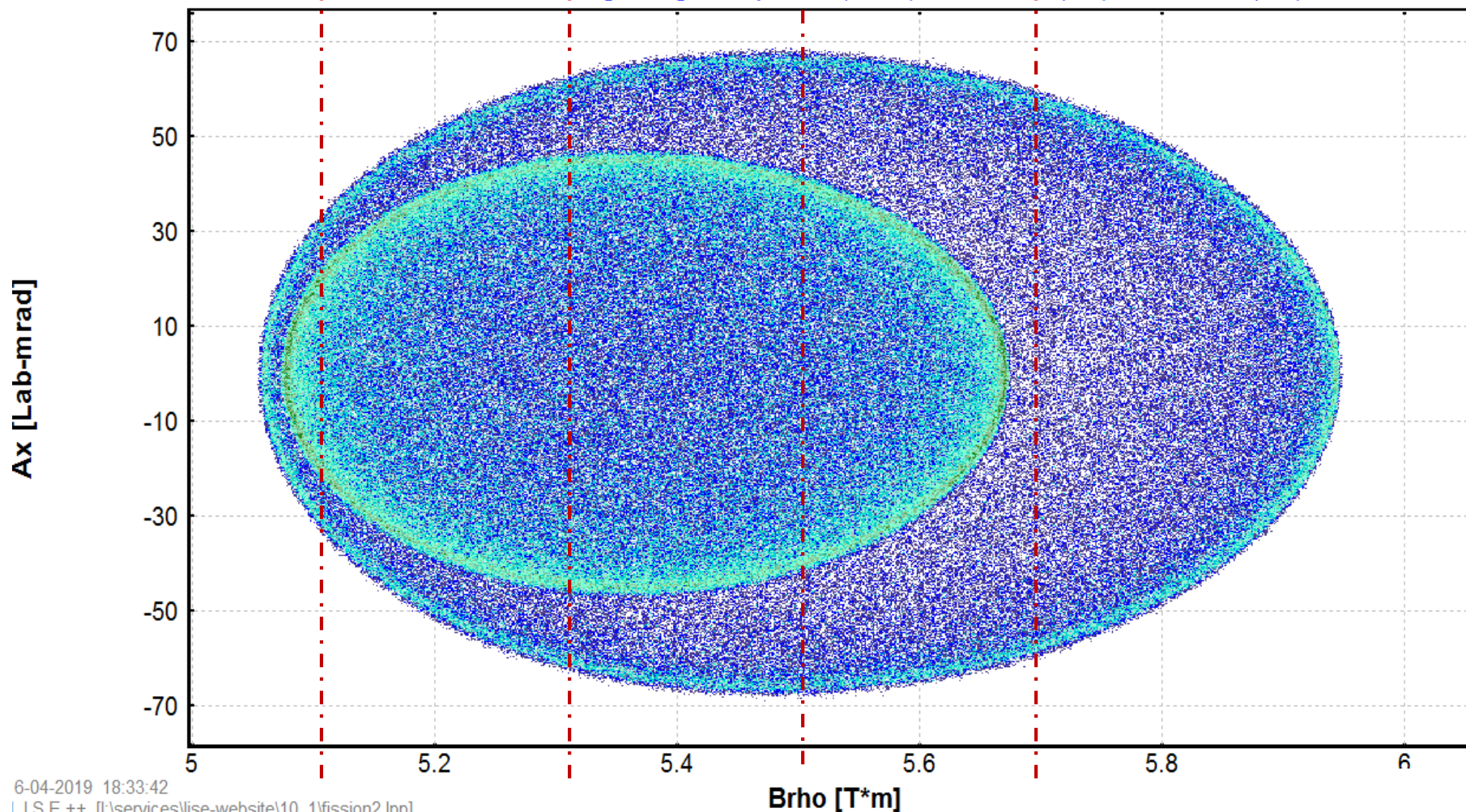


Let's use 4 Brho settings with $\pm 5\%$ momentum acceptance at $Brho_0 = 5.1, 5.3, 5.5, 5.7 \text{ T}\cdot\text{m}$

^{95}Rb & ^{138}Cs fragment kinematics (expected final)

$^{238}\text{U} \Rightarrow ^{95}\text{Rb}(^{97}\text{Rb}^*) + ^{138}\text{Cs}(^{141}\text{Cs}^*)$ (Projectile Energy : 200.00 MeV/u)

Q reaction: 159.88 MeV (Excitations: 20.0 \Rightarrow 18.4+22.5); Angular Distribution (CM): Isotropic
 Rectangle Ang. Acceptance (mrad): H = 3000.0(0.5); V = 3000.0(0.5)



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Passing two fission fragments simultaneously : Brho = 5.1 Tm

Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape

Ellipse Rectangle

| | Value | Variance | |
|--------------|-------|----------|------|
| Horizontal ± | 3000 | 0.5 | mrad |
| Vertical ± | 3000 | 0.5 | mrad |

"A" - angle, "V" - velocity, "E" - energy
 "CM" - center of mass, "LAB" - laboratory
 "z" corresponds to the beam direction.
 No events with Vz<0 in the case of non-zero target thickness

Momentum acceptance

Setting Brho T*m

Acceptance ± %

BOTH fragments should pass Angular and Momentum Acceptances

Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape

Ellipse Rectangle

| | Value | Variance | |
|--------------|-------|----------|------|
| Horizontal ± | 3000 | 0.5 | mrad |
| Vertical ± | 3000 | 0.5 | mrad |

"A" - angle, "V" - velocity, "E" - energy
 "CM" - center of mass, "LAB" - laboratory
 "z" corresponds to the beam direction.
 No events with Vz<0 in the case of non-zero target thickness

Momentum acceptance

Setting Brho T*m

Acceptance ± %

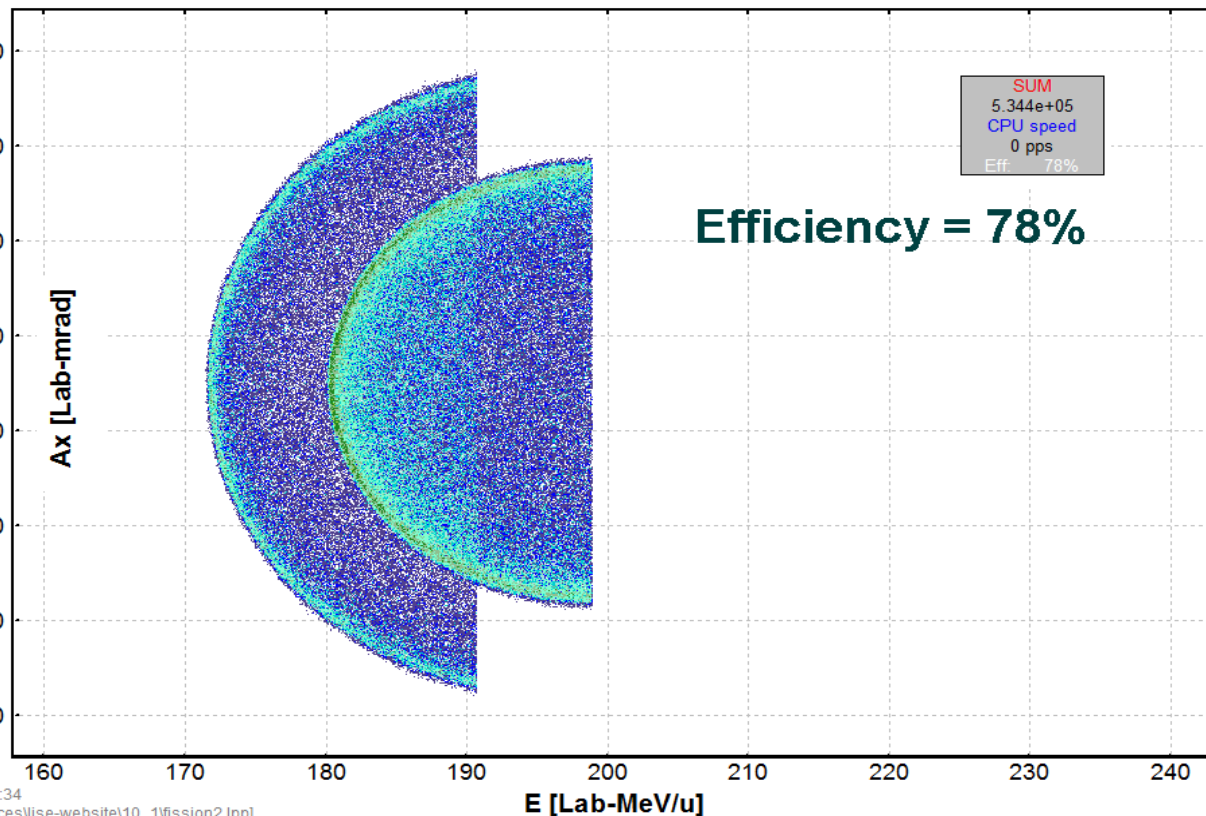
BOTH fragments should pass Angular and Momentum Acceptances

⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final)

²³⁸U => ⁹⁵Rb(⁹⁷Rb*) + ¹³⁸Cs(¹⁴¹Cs*) (Projectile Energy : 200.00 MeV/u)

Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic

Rectangle Ang.Acceptance (mrad): H = 3000.0(0.5); V = 3000.0(0.5); Momentum Acceptance : 5.00 % @

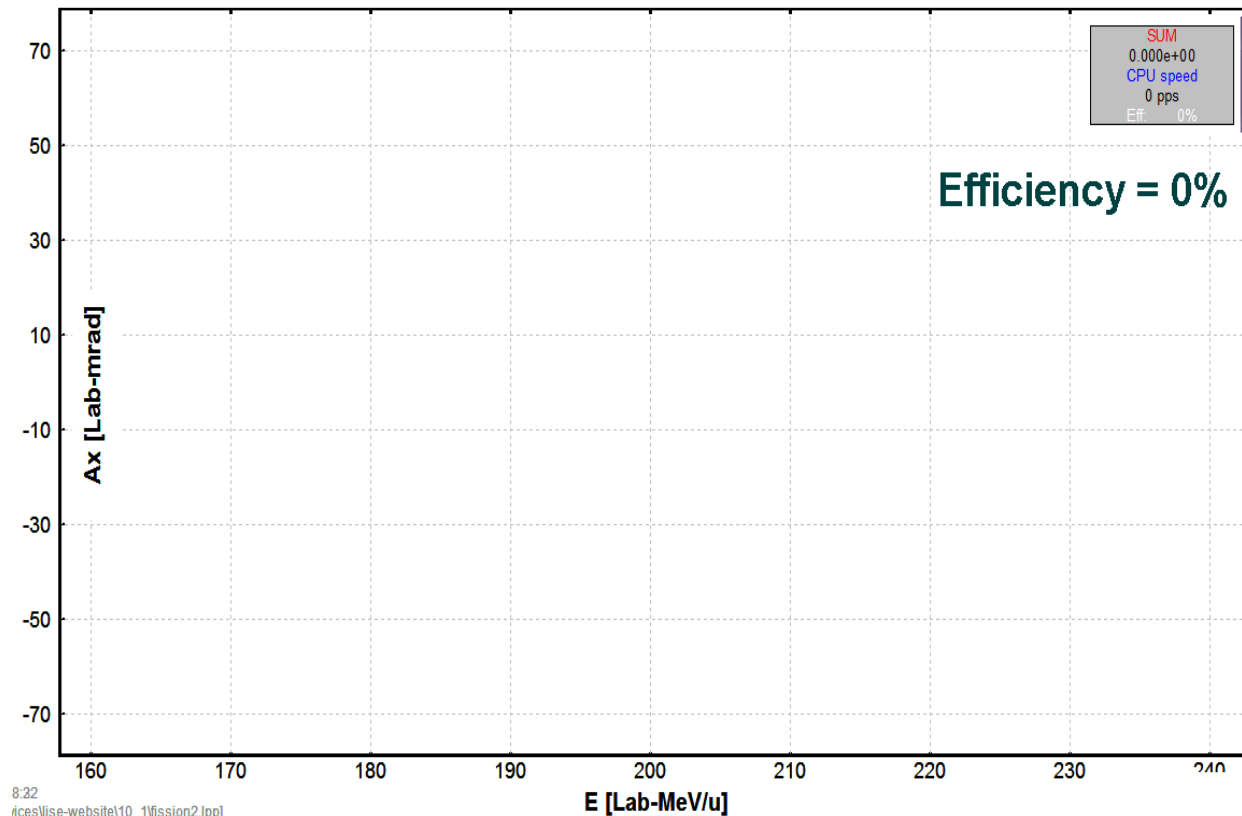


⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final) BOTH fragments should

²³⁸U => ⁹⁵Rb(⁹⁷Rb*) + ¹³⁸Cs(¹⁴¹Cs*) (Projectile Energy : 200.00 MeV/u)

Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic

Rectangle Ang.Acceptance (mrad): H = 3000.0(0.5); V = 3000.0(0.5); Momentum Acceptance : 5.00 % @ Brho = 5.10



Passing two fission fragments simultaneously : Brho = 5.3 Tm

Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape

Ellipse Rectangle

| | Value | Variance | |
|--------------|-------|----------|------|
| Horizontal ± | 3000 | 0.5 | mrad |
| Vertical ± | 3000 | 0.5 | mrad |

"A" - angle, "V" - velocity, "E" - energy
 "CM" - center of mass, "LAB" - laboratory
 "z" corresponds to the beam direction.
 No events with Vz<0 in the case of non-zero target thickness

Momentum acceptance

Setting Brho T*m

Acceptance ± %

BOTH fragments should pass Angular and Momentum Acceptances

Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape

Ellipse Rectangle

| | Value | Variance | |
|--------------|-------|----------|------|
| Horizontal ± | 3000 | 0.5 | mrad |
| Vertical ± | 3000 | 0.5 | mrad |

"A" - angle, "V" - velocity, "E" - energy
 "CM" - center of mass, "LAB" - laboratory
 "z" corresponds to the beam direction.
 No events with Vz<0 in the case of non-zero target thickness

Momentum acceptance

Setting Brho T*m

Acceptance ± %

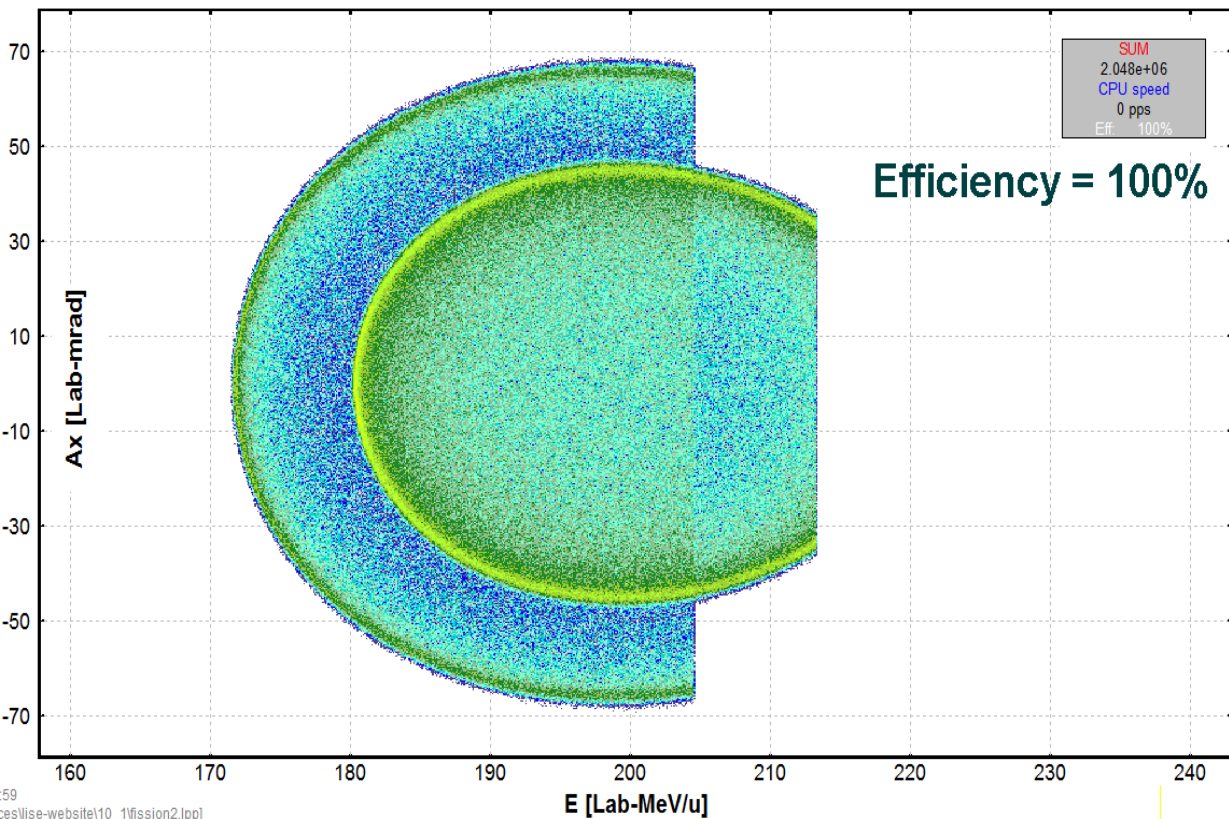
BOTH fragments should pass Angular and Momentum Acceptances

⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final)

²³⁸U => ⁹⁵Rb(⁹⁷Rb*) + ¹³⁸Cs(¹⁴¹Cs*) (Projectile Energy : 200.00 MeV/u)

Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic

Rectangle Ang.Acceptance (mrad): H = 3000.0(0.5); V = 3000.0(0.5); Momentum Acceptance : 5.00 % @ Brho = 5.30

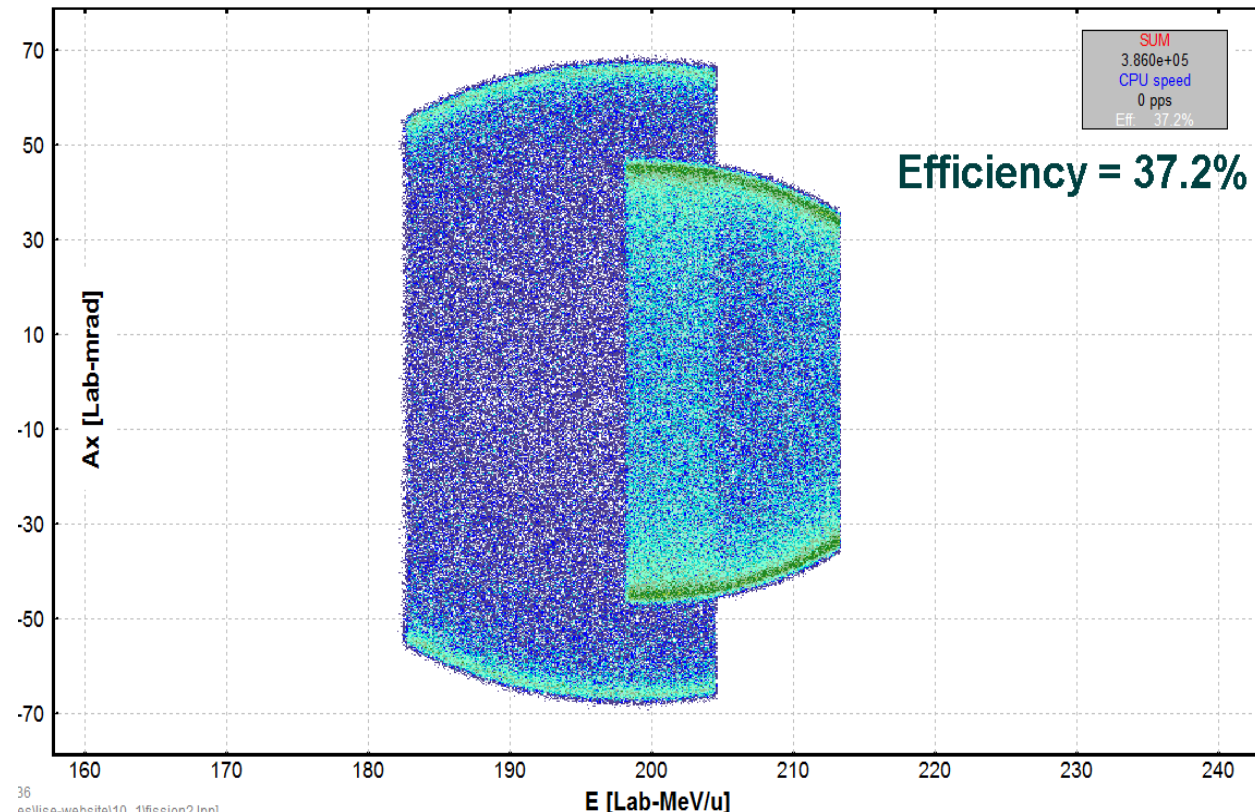


⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final) BOTH fragments should

²³⁸U => ⁹⁵Rb(⁹⁷Rb*) + ¹³⁸Cs(¹⁴¹Cs*) (Projectile Energy : 200.00 MeV/u)

Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic

Rectangle Ang.Acceptance (mrad): H = 3000.0(0.5); V = 3000.0(0.5); Momentum Acceptance : 5.00 % @ Brho = 5.30



Passing two fission fragments simultaneously : Brho = 5.5 Tm

Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape

Ellipse Rectangle

| | Value | Variance | |
|--------------|-------|----------|------|
| Horizontal ± | 3000 | 0.5 | mrاد |
| Vertical ± | 3000 | 0.5 | mrاد |

Momentum acceptance

Setting Brho T*m

Acceptance ± %

BOTH fragments should pass Angular and Momentum Acceptances

"A" - angle, "V" - velocity, "E" - energy
 "CM" - center of mass, "LAB" - laboratory
 "z" corresponds to the beam direction.
 No events with Vz<0 in the case of non-zero target thickness

Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape

Ellipse Rectangle

| | Value | Variance | |
|--------------|-------|----------|------|
| Horizontal ± | 3000 | 0.5 | mrاد |
| Vertical ± | 3000 | 0.5 | mrاد |

Momentum acceptance

Setting Brho T*m

Acceptance ± %

BOTH fragments should pass Angular and Momentum Acceptances

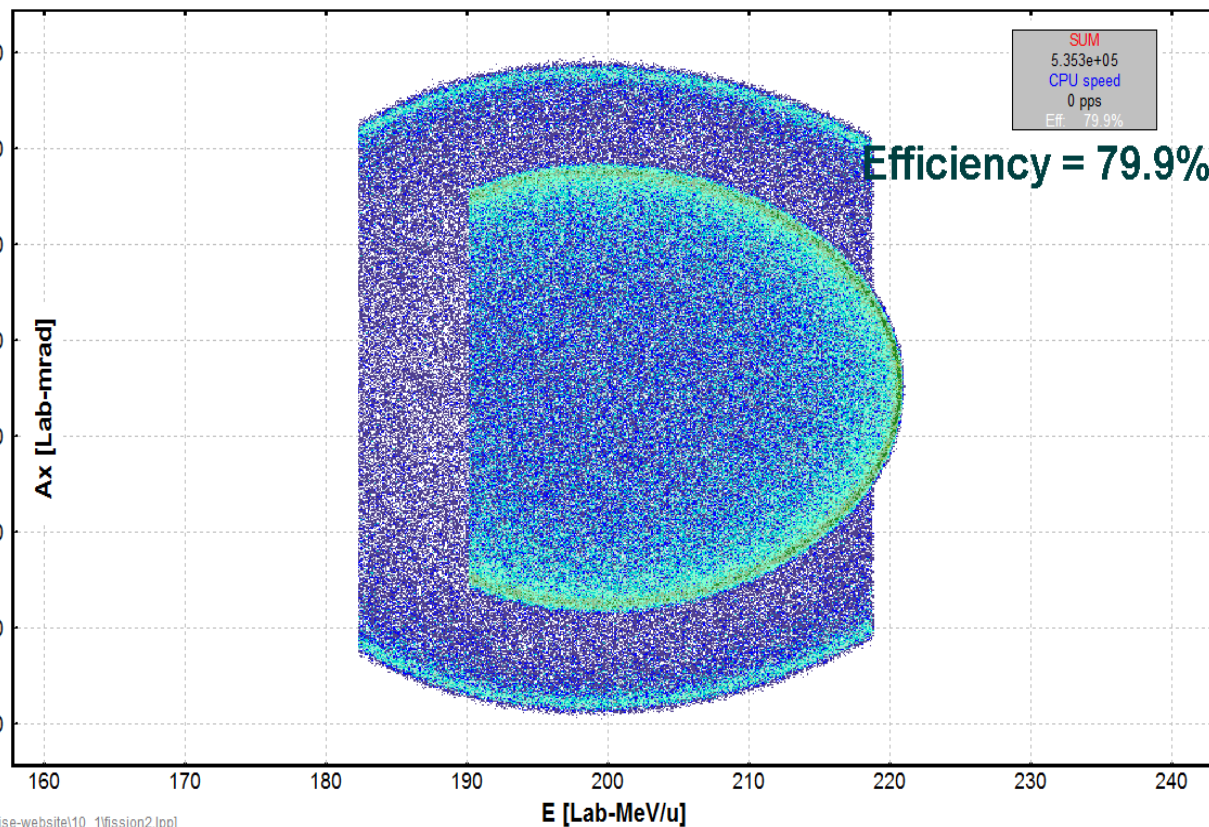
"A" - angle, "V" - velocity, "E" - energy
 "CM" - center of mass, "LAB" - laboratory
 "z" corresponds to the beam direction.
 No events with Vz<0 in the case of non-zero target thickness

⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final)

²³⁸U => ⁹⁵Rb(⁹⁷Rb*) + ¹³⁸Cs(¹⁴¹Cs*) (Projectile Energy : 200.00 MeV/u)

Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic

Rectangle Ang.Acceptance (mrad): H = 3000.0(0.5); V = 3000.0(0.5); Momentum Acceptance : 5.00 % @ Brho = 5.5

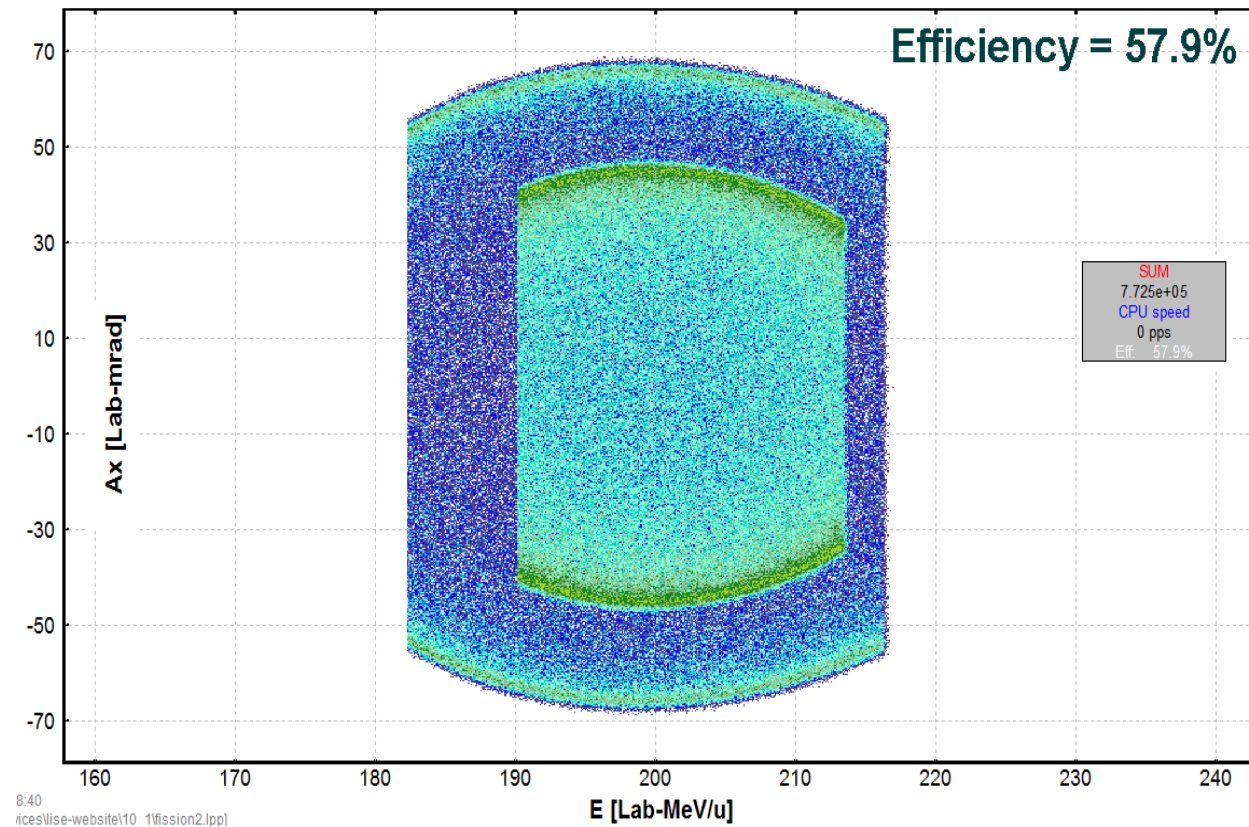


⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final) BOTH fragments should

²³⁸U => ⁹⁵Rb(⁹⁷Rb*) + ¹³⁸Cs(¹⁴¹Cs*) (Projectile Energy : 200.00 MeV/u)

Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic

Rectangle Ang.Acceptance (mrad): H = 3000.0(0.5); V = 3000.0(0.5); Momentum Acceptance : 5.00 % @ Brho = 5.5



Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape

Ellipse Rectangle

| | Value | Variance | |
|--------------|-------|----------|------|
| Horizontal ± | 3000 | 0.5 | mrad |
| Vertical ± | 3000 | 0.5 | mrad |

"A" - angle, "V" - velocity, "E" - energy
 "CM" - center of mass, "LAB" - laboratory
 "z" corresponds to the beam direction.
 No events with Vz<0 in the case of non-zero target thickness

Momentum acceptance

Setting Brho T*m

Acceptance ± %

BOTH fragments should pass Angular and Momentum Acceptances

Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape

Ellipse Rectangle

| | Value | Variance | |
|--------------|-------|----------|------|
| Horizontal ± | 3000 | 0.5 | mrad |
| Vertical ± | 3000 | 0.5 | mrad |

"A" - angle, "V" - velocity, "E" - energy
 "CM" - center of mass, "LAB" - laboratory
 "z" corresponds to the beam direction.
 No events with Vz<0 in the case of non-zero target thickness

Momentum acceptance

Setting Brho T*m

Acceptance ± %

BOTH fragments should pass Angular and Momentum Acceptances

⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final)

²³⁸U => ⁹⁵Rb(⁹⁷Rb*) + ¹³⁸Cs(¹⁴¹Cs*) (Projectile Energy : 200.00 MeV/u)

Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic

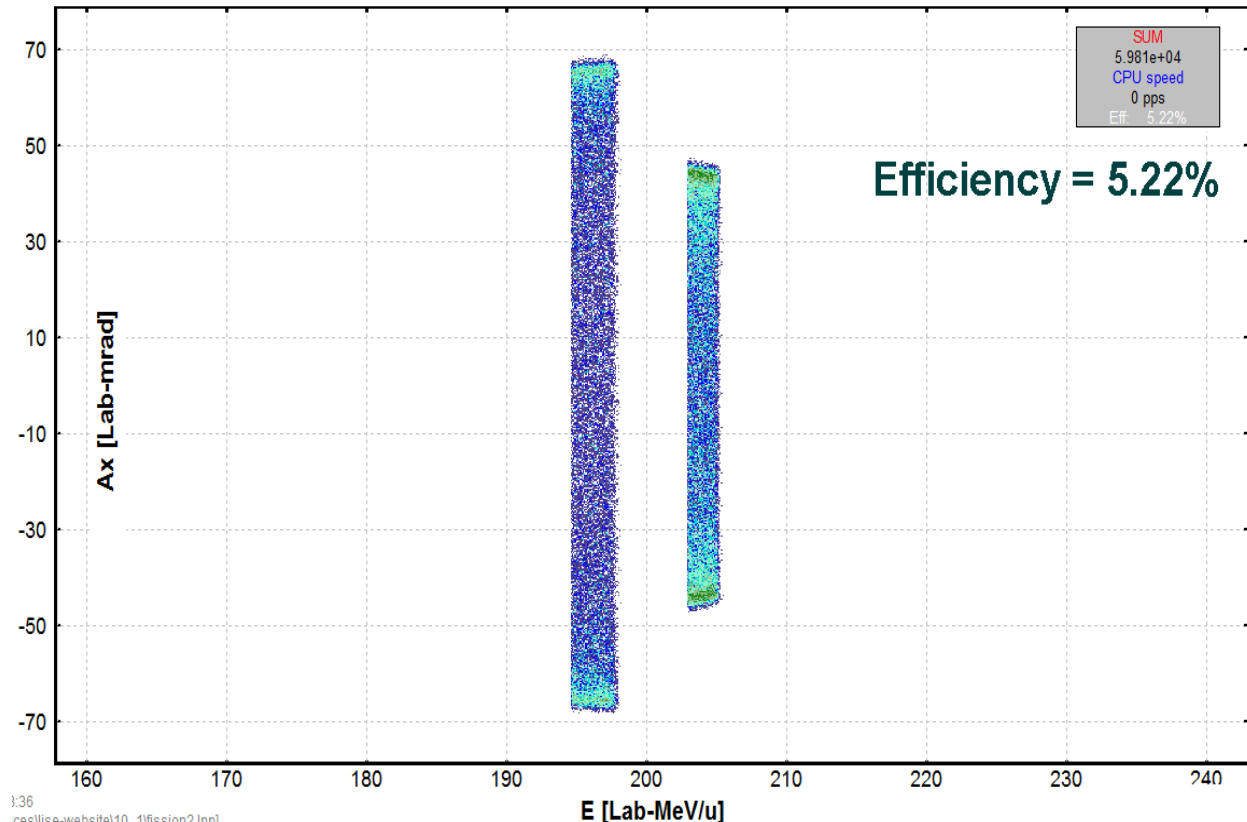
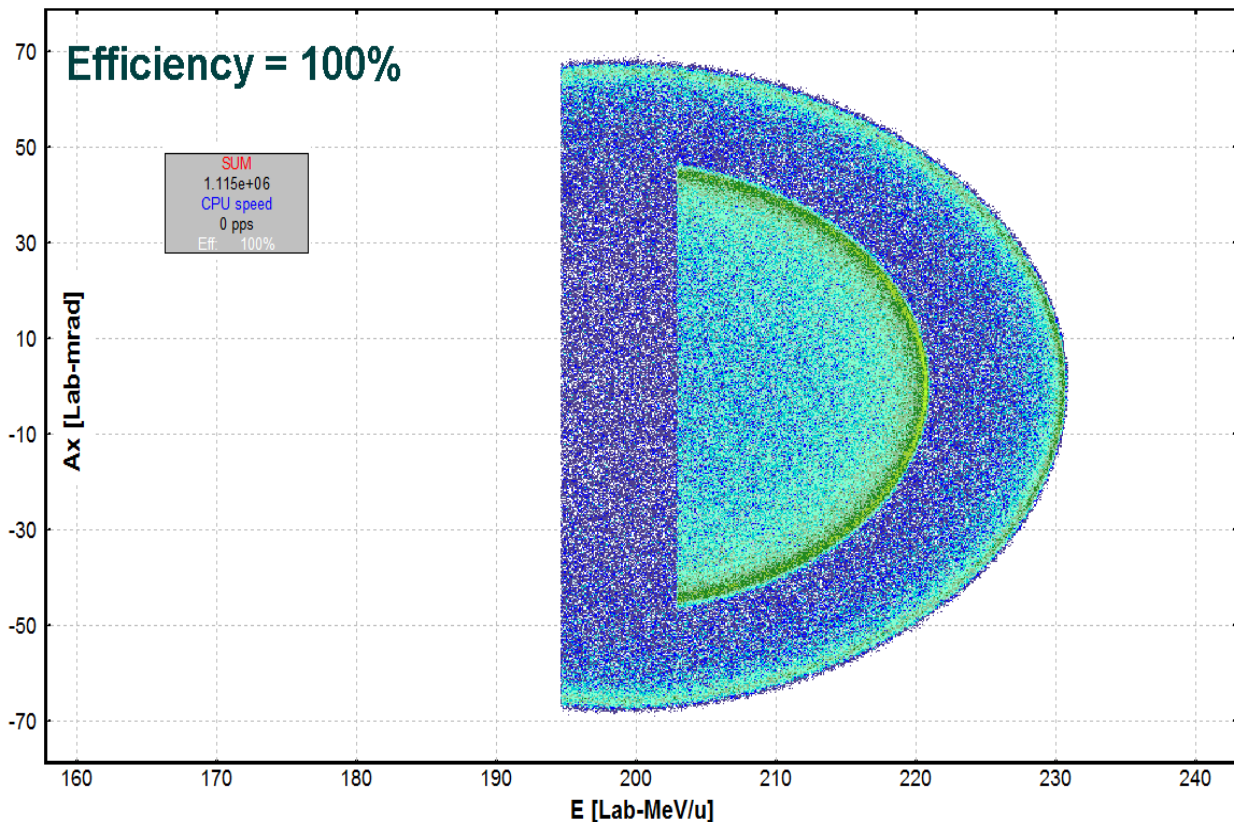
Rectangle Ang.Acceptance (mrad): H = 3000.0(0.5); V = 3000.0(0.5); Momentum Acceptance : 5.00 % @ Brho = 5.70

⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final) BOTH fragments should

²³⁸U => ⁹⁵Rb(⁹⁷Rb*) + ¹³⁸Cs(¹⁴¹Cs*) (Projectile Energy : 200.00 MeV/u)

Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic

Rectangle Ang.Acceptance (mrad): H = 3000.0(0.5); V = 3000.0(0.5); Momentum Acceptance : 5.00 % @ Brho = 5.70



Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape

Ellipse Rectangle

| | Value | Variance | |
|--------------|-------|----------|------|
| Horizontal ± | 150 | 0.5 | mrad |
| Vertical ± | 50 | 0.5 | mrad |

"A" - angle, "V" - velocity, "E" - energy
 "CM" - center of mass, "LAB" - laboratory
 "z" corresponds to the beam direction.
 No events with Vz<0 in the case of non-zero target thickness

Momentum acceptance

Setting Brho T*m

Acceptance ± %

BOTH fragments should pass Angular and Momentum Acceptances

Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape

Ellipse Rectangle

| | Value | Variance | |
|--------------|-------|----------|------|
| Horizontal ± | 150 | 0.5 | mrad |
| Vertical ± | 50 | 0.5 | mrad |

"A" - angle, "V" - velocity, "E" - energy
 "CM" - center of mass, "LAB" - laboratory
 "z" corresponds to the beam direction.
 No events with Vz<0 in the case of non-zero target thickness

Momentum acceptance

Setting Brho T*m

Acceptance ± %

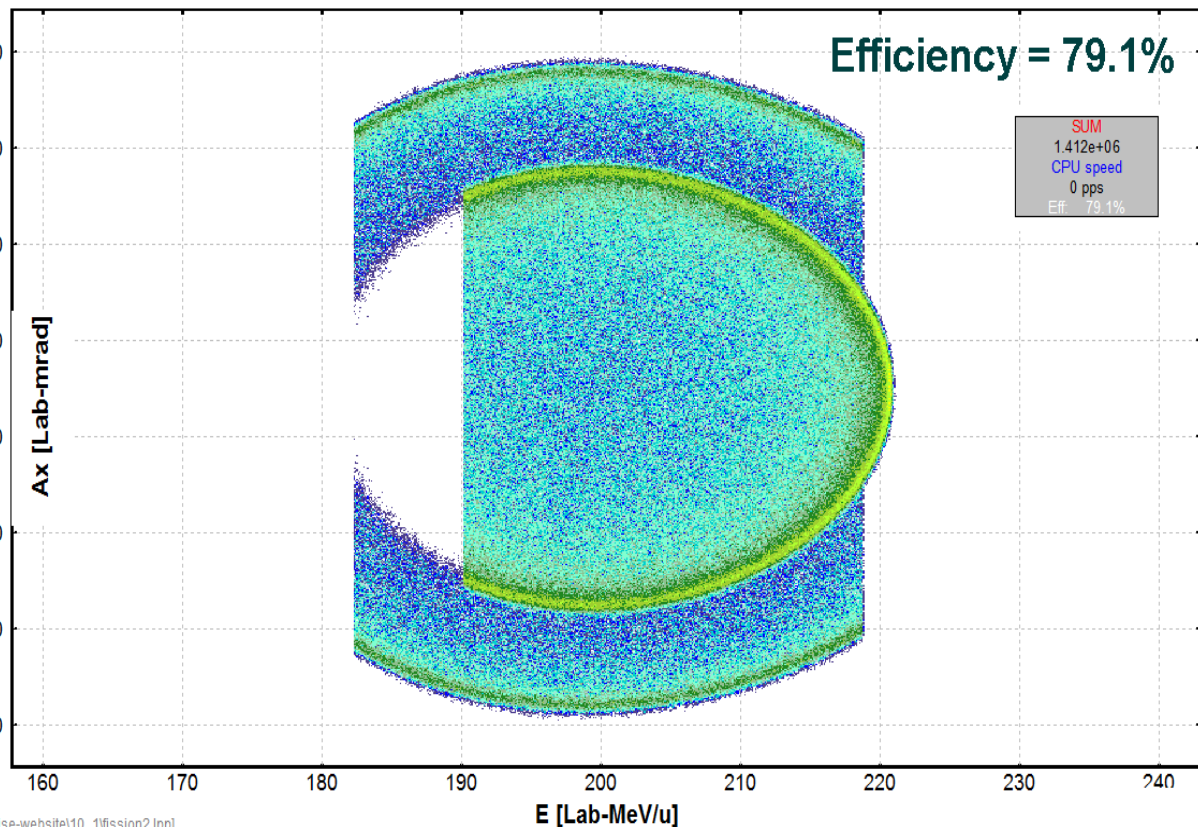
BOTH fragments should pass Angular and Momentum Acceptances

⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final)

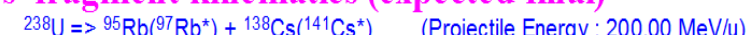


Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic

Rectangle Ang.Acceptance (mrad): H = 150.0(0.5); V = 50.0(0.5); Momentum Acceptance : 5.00 % @ Brho = 5.5000

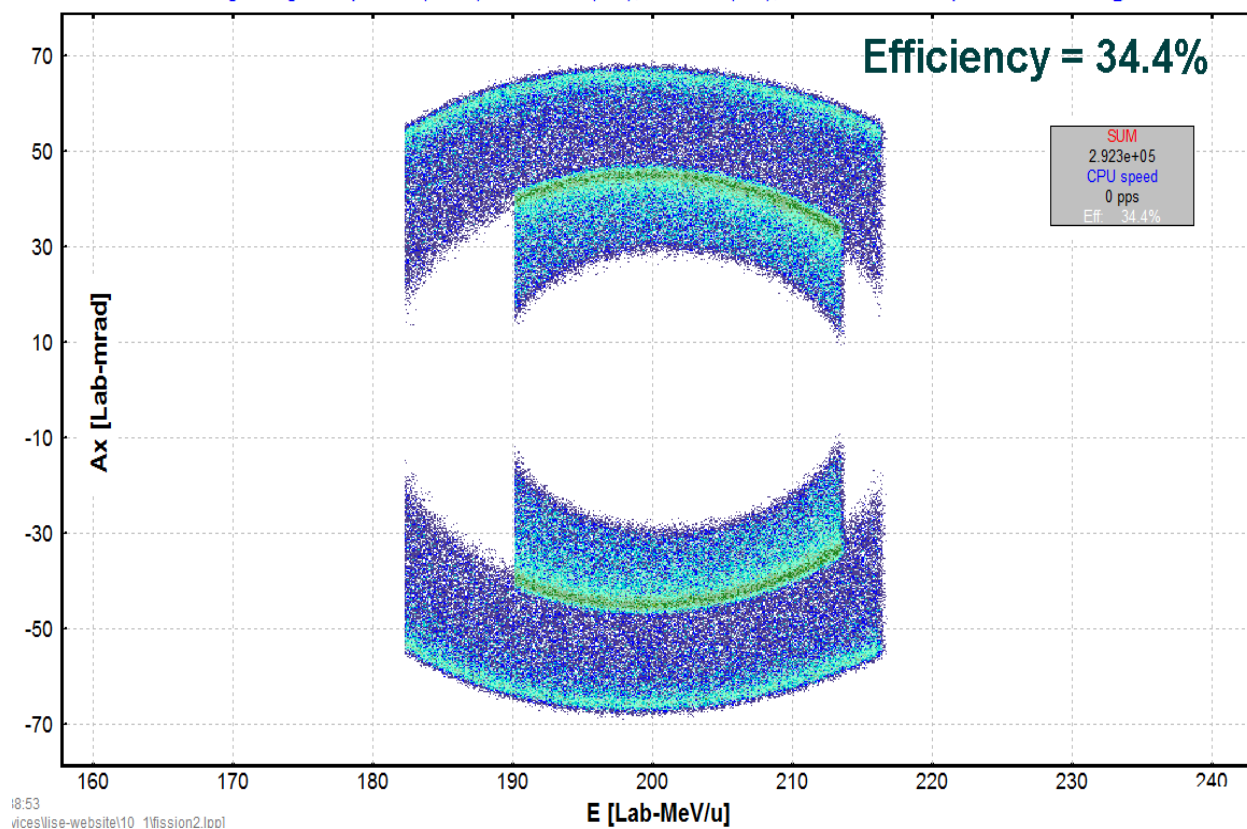


⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final) BOTH fragments should



Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic

Rectangle Ang.Acceptance (mrad): H = 150.0(0.5); V = 50.0(0.5); Momentum Acceptance : 5.00 % @ Brho = 5.5000



Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape

Ellipse Rectangle

| | Value | Variance | Unit |
|--------------|-------|----------|------|
| Horizontal ± | 150 | 0.5 | mrاد |
| Vertical ± | 50 | 0.5 | mrاد |

Momentum acceptance

Setting Brho T*m

Acceptance ± %

BOTH fragments should pass Angular and Momentum Acceptances

"A" - angle, "V" - velocity, "E" - energy
 "CM" - center of mass, "LAB" - laboratory
 "z" corresponds to the beam direction.
 No events with Vz<0 in the case of non-zero target thickness

The same like the previous page but another representation : Energy vs A_y

Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape

Ellipse Rectangle

| | Value | Variance | Unit |
|--------------|-------|----------|------|
| Horizontal ± | 150 | 0.5 | mrاد |
| Vertical ± | 50 | 0.5 | mrاد |

Momentum acceptance

Setting Brho T*m

Acceptance ± %

BOTH fragments should pass Angular and Momentum Acceptances

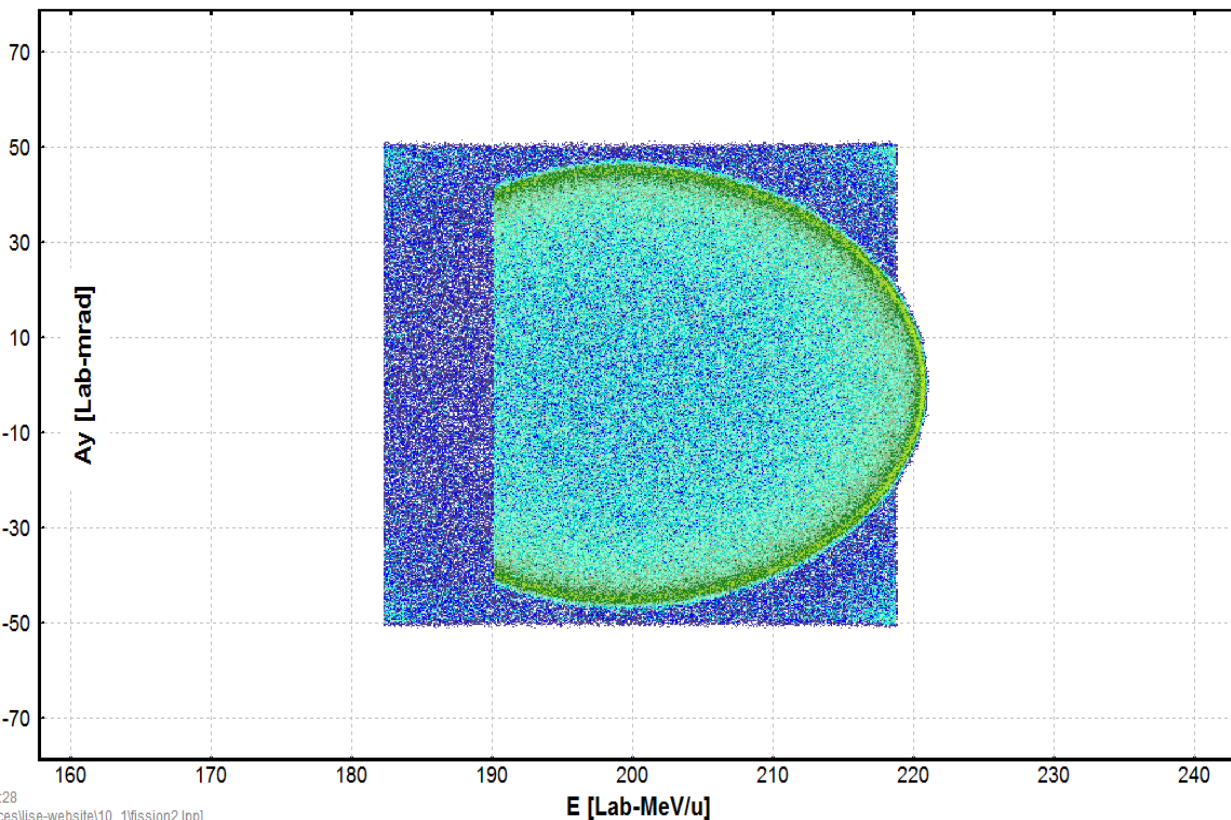
"A" - angle, "V" - velocity, "E" - energy
 "CM" - center of mass, "LAB" - laboratory
 "z" corresponds to the beam direction.
 No events with Vz<0 in the case of non-zero target thickness

^{95}Rb & ^{138}Cs fragment kinematics (expected final)

$^{238}\text{U} \Rightarrow ^{95}\text{Rb}(^{97}\text{Rb}^*) + ^{138}\text{Cs}(^{141}\text{Cs}^*)$ (Projectile Energy : 200.00 MeV/u)

Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic

Rectangle Ang.Acceptance (mrاد): H = 150.0(0.5); V = 50.0(0.5); Momentum Acceptance : 5.00 % @ Brho = 5.5000

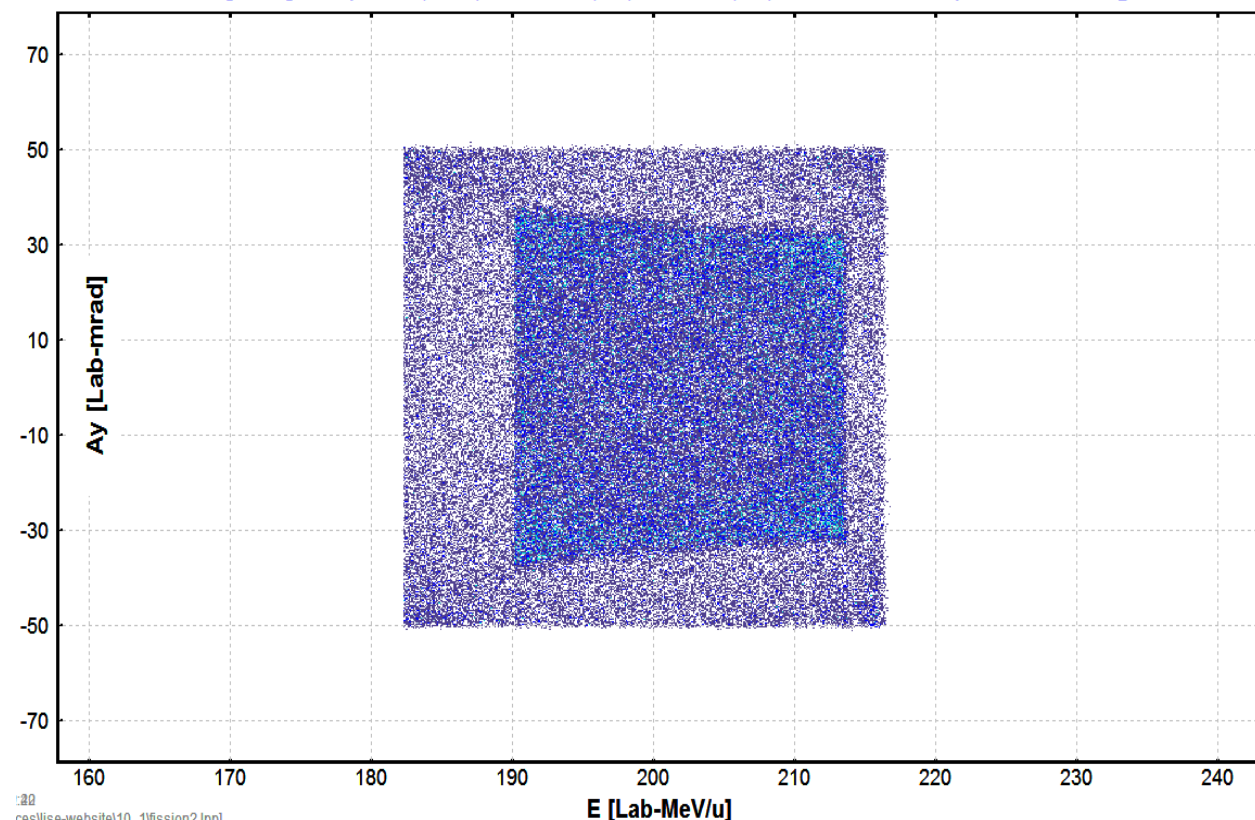


^{95}Rb & ^{138}Cs fragment kinematics (expected final) BOTH fragments should

$^{238}\text{U} \Rightarrow ^{95}\text{Rb}(^{97}\text{Rb}^*) + ^{138}\text{Cs}(^{141}\text{Cs}^*)$ (Projectile Energy : 200.00 MeV/u)

Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic

Rectangle Ang.Acceptance (mrاد): H = 150.0(0.5); V = 50.0(0.5); Momentum Acceptance : 5.00 % @ Brho = 5.5000



2D fragment plot (Monte Carlo)

BREAKUP (FISSION)

Projectile: 238U (200.0 MeV/u)

Target: **9Be (1 mm)**

Ex. energy

| | | |
|----------------|------------|-------|
| Fragment (C *) | 97Rb | 18.39 |
| Residual (D *) | 141Cs | 22.51 |
| Q-value (MeV) | 159.88 MeV | |

Excitations

take from systematics

set manually in Kinematics calculator

TKE plot

Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape: Ellipse Rectangle

| | Value | Variance |
|--------------|-------|----------|
| Horizontal ± | 150 | 0.5 mrad |
| Vertical ± | 50 | 0.5 mrad |

BOTH fragments should pass Angular and Momentum Acceptances

Momentum acceptance

Setting Brho: 5.612 T*m

Acceptance ±: 200 %

Take into account a target thickness

No (fast) Yes

Initial emittance

| | |
|----------------------|---------|
| Horizontal Angular ± | 0 mrad |
| Vertical Angular ± | 0 mrad |
| Energy** ± | 0 MeV/u |

Broadening due to particle emission

| | |
|-----------|------------|
| Angular ± | 0.81 mrad |
| Energy ± | 0.02 MeV/u |

Angular Distribution (CM): **ISOTROPIC**

Energy loss and energy straggling inclusion

Ok Cancel

Expected final fragments

| | | | |
|---------------------------|--------------|------|------|
| C_final | 95Rb: 49.5% | <dn> | 2.51 |
| D_final | 138Cs: 48.2% | <dn> | 2.85 |
| TKE(CM) from systematics | 161.87 | | |
| TKE(CM) from calculations | 156.52 | | |

Fragment to plot

Excited (C *)

Expected final (C_final)

add conjugated fragment (D)

Plots

Lab

- Vz & Vx
- Vz & Vxy
- Vz & Ax
- Vz & Ay
- E & A
- E & Ax
- E & Ay
- Vz & phi
- Brho (q=Z) & A
- Brho (q=Z) & Ax
- Brho (q=Z) & Ay
- Ax & Ay

CM

- Vz & Vx
- Vz & Vxy
- Ax & Ay
- A & phi

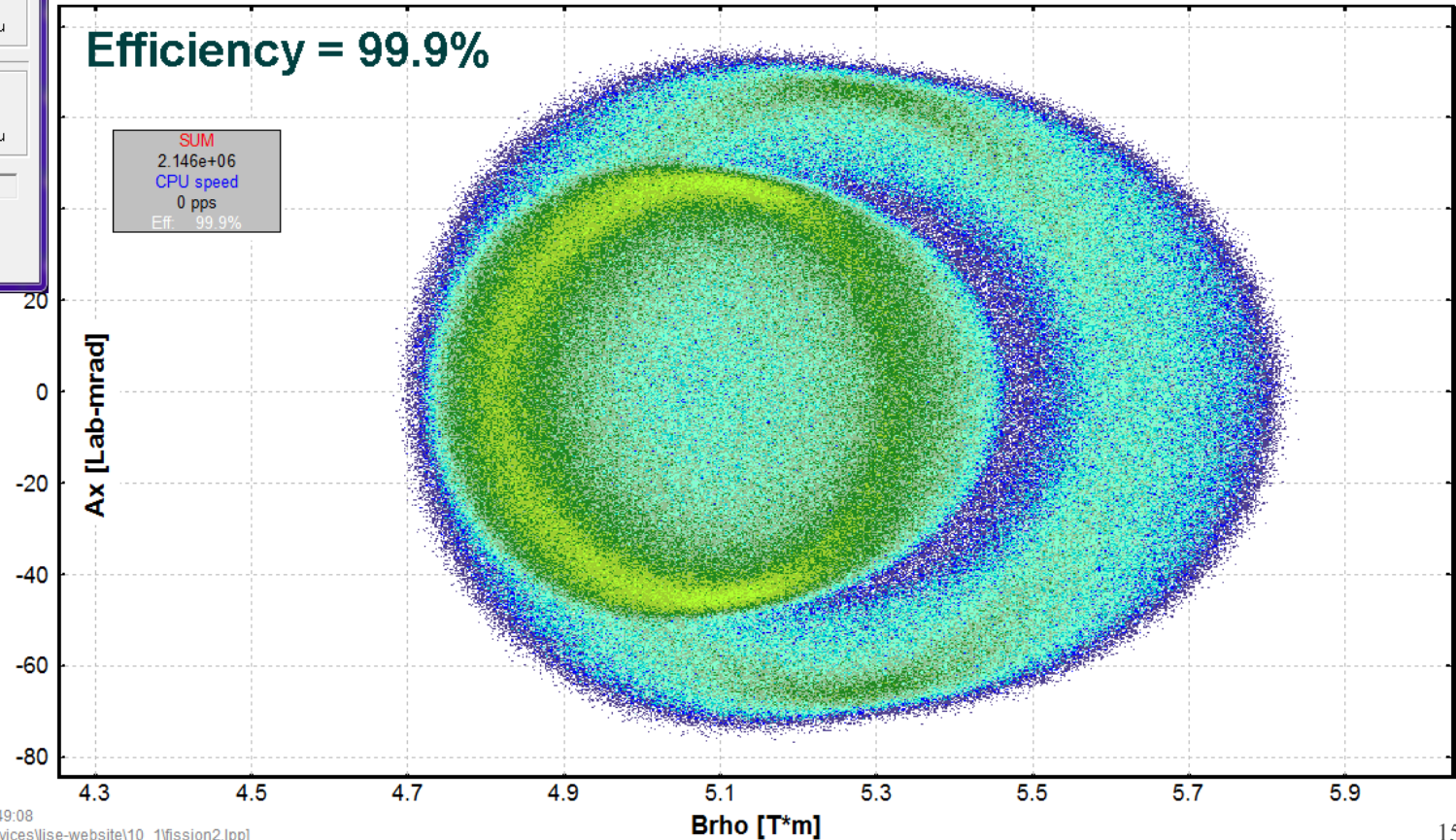
⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final)

²³⁸U => ⁹⁵Rb(⁹⁷Rb*) + ¹³⁸Cs(¹⁴¹Cs*) (Projectile Energy : 200.00 MeV/u)

Target: Be (1 mm); Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotrop

Rectangle Ang.Acceptance (mrad): H = 150.0(0.5); V = 50.0(0.5)

Efficiency = 99.9%



Acceptances and non-zero target thickness

Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape
 Ellipse Rectangle

| | Value | Variance | |
|--------------|-------|----------|------|
| Horizontal ± | 150 | 0.5 | mrاد |
| Vertical ± | 50 | 0.5 | mrاد |

Momentum acceptance

Setting Brho T*m

Acceptance ± %

BOTH fragments should pass Angular and Momentum Acceptances

Acceptances (in case of C_final fragment plot)

Angular Acceptance

Angular acceptance shape
 Ellipse Rectangle

| | Value | Variance | |
|--------------|-------|----------|------|
| Horizontal ± | 150 | 0.5 | mrاد |
| Vertical ± | 50 | 0.5 | mrاد |

Momentum acceptance

Setting Brho T*m

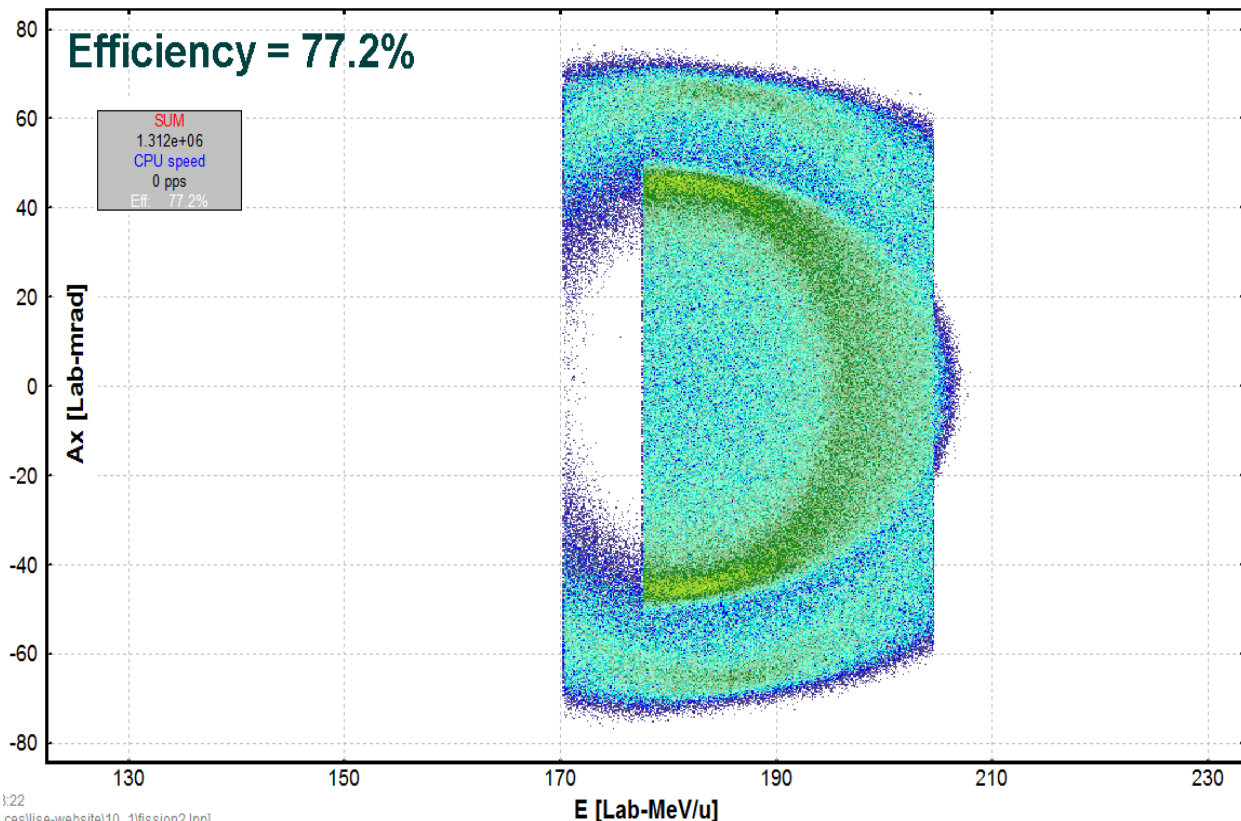
Acceptance ± %

BOTH fragments should pass Angular and Momentum Acceptances

⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final)

²³⁸U => ⁹⁵Rb(⁹⁷Rb*) + ¹³⁸Cs(¹⁴¹Cs*) (Projectile Energy : 200.00 MeV/u)

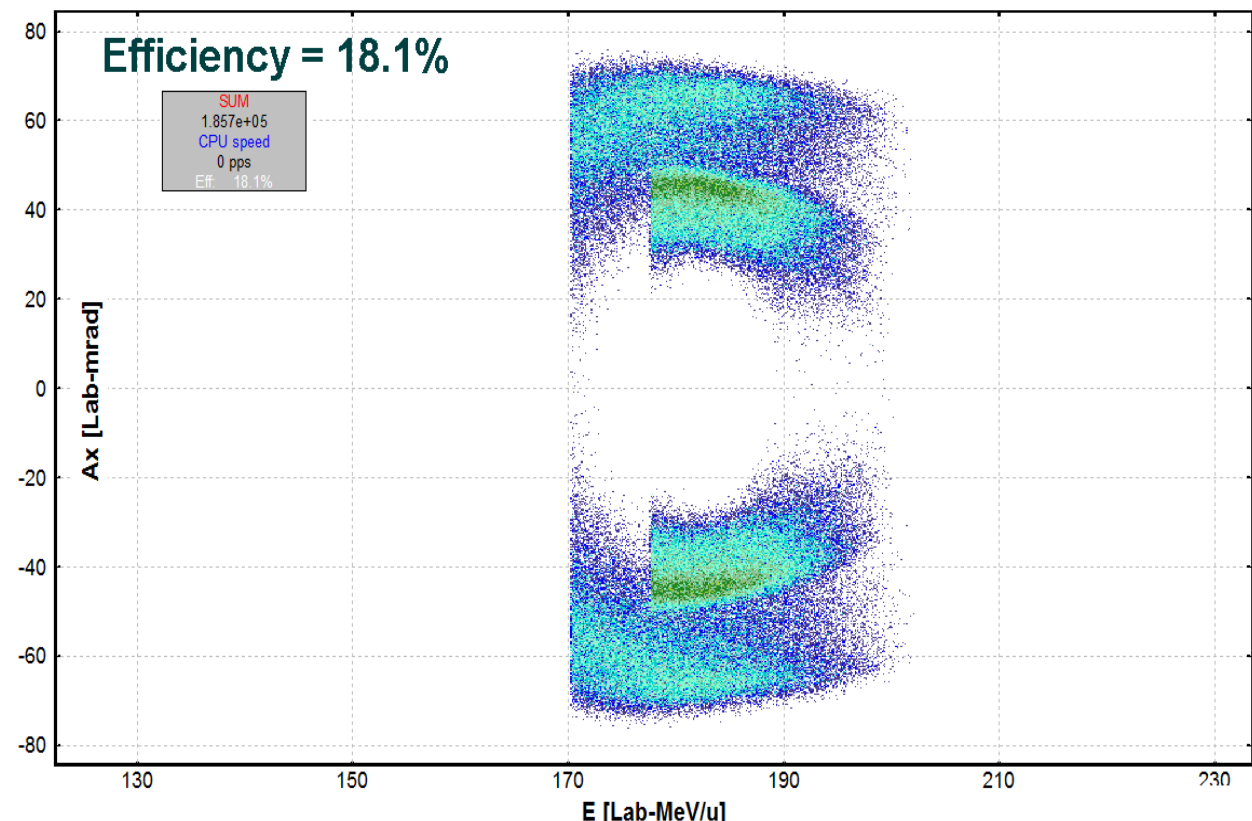
Target: Be (1 mm); Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotrop
 Rectangle Ang.Acceptance (mrad): H = 150.0(0.5); V = 50.0(0.5); Momentum Acceptance : 5.00 % @ Brho = 5.3001



⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final) BOTH fragments should

²³⁸U => ⁹⁵Rb(⁹⁷Rb*) + ¹³⁸Cs(¹⁴¹Cs*) (Projectile Energy : 200.00 MeV/u)

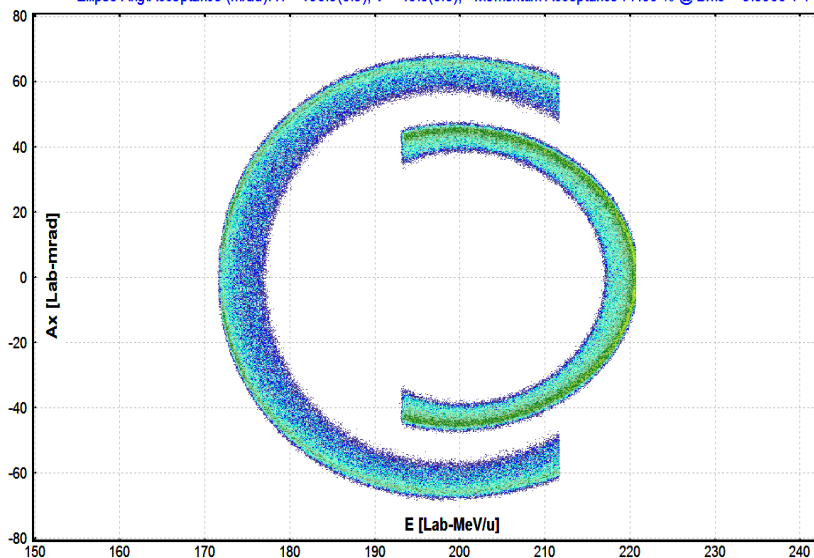
Target: Be (1 mm); Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotrop
 Rectangle Ang.Acceptance (mrad): H = 150.0(0.5); V = 50.0(0.5); Momentum Acceptance : 5.00 % @ Brho = 5.3001



Some other plots.....

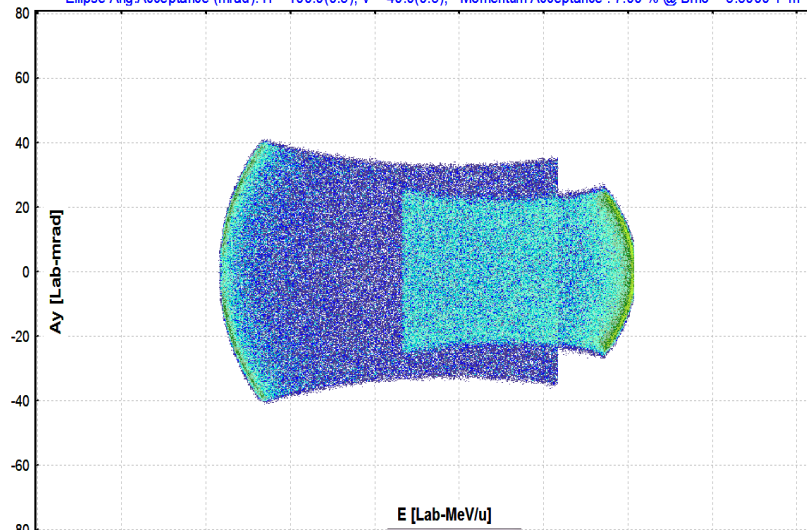
⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final) BOTH fragments should pass

$^{238}\text{U} \Rightarrow ^{95}\text{Rb}(^{97}\text{Rb}^*) + ^{138}\text{Cs}(^{141}\text{Cs}^*)$ (Projectile Energy : 200.00 MeV/u)
 Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic
 Ellipse Ang.Acceptance (mrad): H = 100.0(0.5); V = 40.0(0.5); Momentum Acceptance : 7.00 % @ Brho = 5.3000 T*m



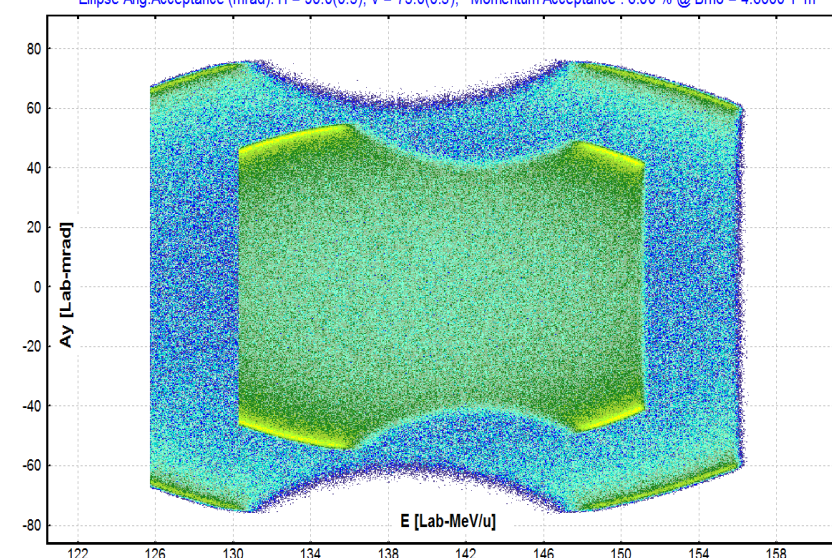
⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final) BOTH fragments should pass

$^{238}\text{U} \Rightarrow ^{95}\text{Rb}(^{97}\text{Rb}^*) + ^{138}\text{Cs}(^{141}\text{Cs}^*)$ (Projectile Energy : 200.00 MeV/u)
 Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic
 Ellipse Ang.Acceptance (mrad): H = 100.0(0.5); V = 40.0(0.5); Momentum Acceptance : 7.00 % @ Brho = 5.3000 T*m



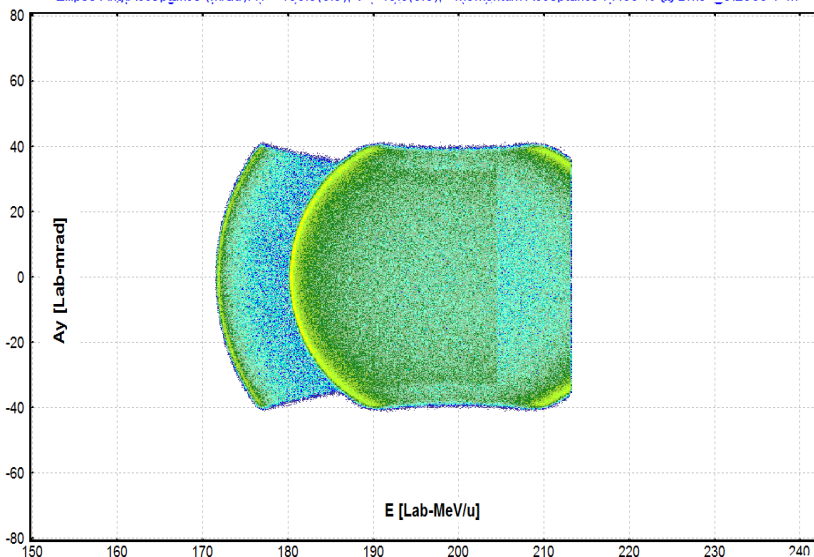
⁹⁶Rb & ¹⁴⁰Cs fragment kinematics (expected final) BOTH fragments should pass

$^{238}\text{U} \Rightarrow ^{96}\text{Rb}(^{97}\text{Rb}^*) + ^{140}\text{Cs}(^{141}\text{Cs}^*)$ (Projectile Energy : 140.00 MeV/u)
 Q reaction: 159.88 MeV (Excitations 0.0=>9.7+11.2); Angular Distribution (CM): Isotropic
 Ellipse Ang.Acceptance (mrad): H = 90.0(0.5); V = 75.0(0.5); Momentum Acceptance : 6.00 % @ Brho = 4.6000 T*m



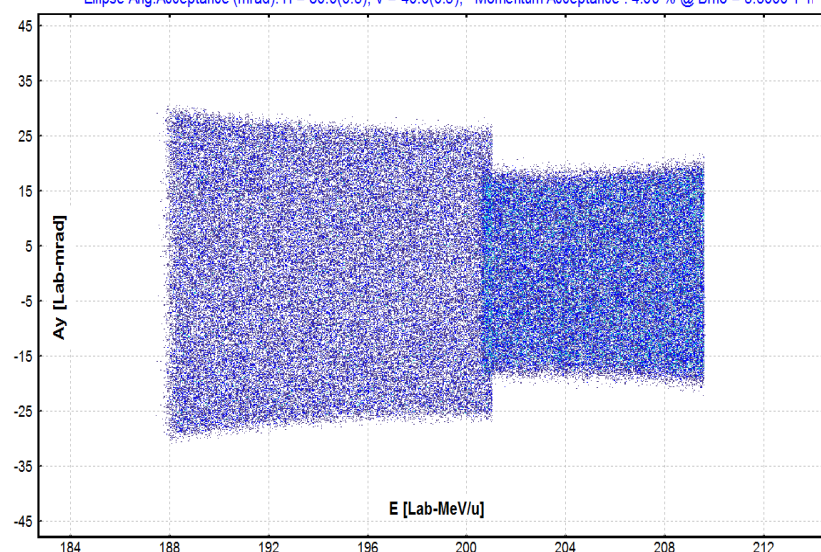
⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final)

$^{238}\text{U} \Rightarrow ^{95}\text{Rb}(^{97}\text{Rb}^*) + ^{138}\text{Cs}(^{141}\text{Cs}^*)$ (Projectile Energy : 200.00 MeV/u)
 Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic
 Ellipse Ang.Acceptance (mrad): H = 100.0(0.5); V = 40.0(0.5); Momentum Acceptance : 7.00 % @ Brho = 5.2000 T*m



⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final) BOTH fragments should pass

$^{238}\text{U} \Rightarrow ^{95}\text{Rb}(^{97}\text{Rb}^*) + ^{138}\text{Cs}(^{141}\text{Cs}^*)$ (Projectile Energy : 200.00 MeV/u)
 Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic
 Ellipse Ang.Acceptance (mrad): H = 80.0(0.5); V = 40.0(0.5); Momentum Acceptance : 4.00 % @ Brho = 5.3000 T*m



⁹⁵Rb & ¹³⁸Cs fragment kinematics (expected final)

$^{238}\text{U} \Rightarrow ^{95}\text{Rb}(^{97}\text{Rb}^*) + ^{138}\text{Cs}(^{141}\text{Cs}^*)$ (Projectile Energy : 200.00 MeV/u)
 Q reaction: 159.88 MeV (Excitations 20.0=>18.4+22.5); Angular Distribution (CM): Isotropic
 Ellipse Ang.Acceptance (mrad): H = 100.0(0.5); V = 40.0(0.5); Momentum Acceptance : 7.00 % @ Brho = 5.3000 T*m

