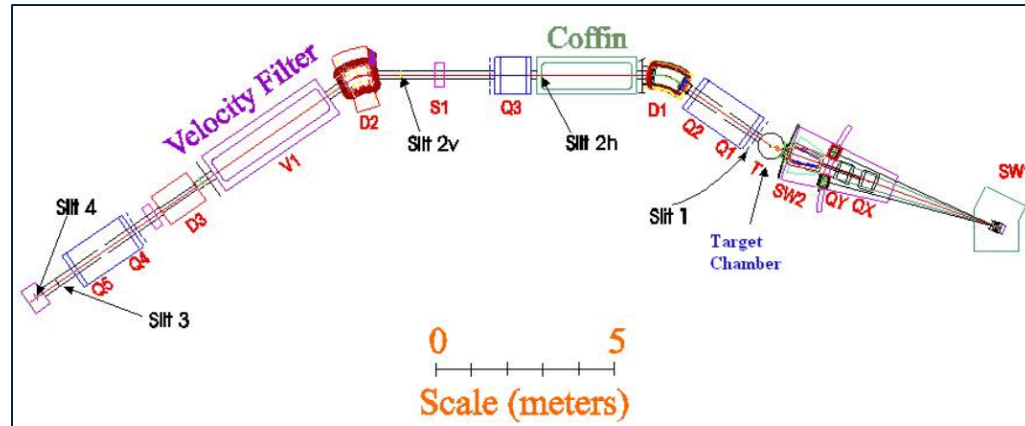


v.9.8.41  
from 03/15/14



1. **Compensating dipole**
2. **Using Quadrupole calibration files**
3. **TAMU extended configurations**
4. **MARS Angular and momentum acceptances**
5. **“Solenoid” configuration**

v.9.8.177  
from 12/28/14  
update

The presentation has been updated (12/28/2014) to order to include the MARS separator, Solenoid setup and Compensating dipole updates

The Compensating dipole can own only "E-block" property.

The matrices (up to second order) are calculated by the code based on its geometry (L1,L2,Platform inclination angle, Y-gap).

**Dispersive block**

- Brho: 1.48853 Tm
- B: 0.13285 T
- I: 162.225 A

**Bend Sector**

- Radius: 11.2 m
- Angle: 5 deg
- Length: 0.9778 m

**Optical block properties and data**

- Setting Charge state for the Block (Z-Q): 0
- Calculate the Values using the Setting fragment from: Wien Filter
- Next: [X]
- Tweak: 0.1 %
- Calculate other optic blocks: [X]

**Compensating dipole properties**

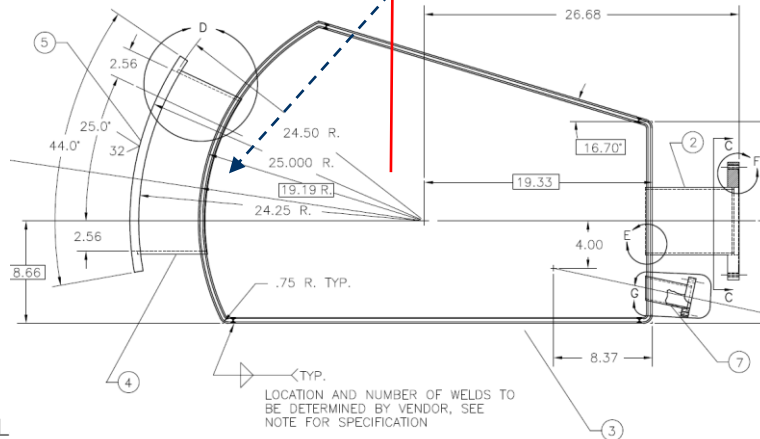
- Platform inclination angle: 5 deg
- Exit face shape of magnet: Rectangular  Circular
- Platform inclination range: Minimum angle 0 deg, Maximum angle 25 deg
- \* L2 = Radius in the case of circular exit shape

**Compensation property**

- Block to match global matrix values: drift
- select parameter for search abs.minimum
- X/X: 0.60 mm/mm 0.50 Y/Y
- X/T: 0.61 mm/mrad 0.12 Y/P
- X/D: -0.28 mm/% -0.11 Y/D
- T/D: -14.17 mrad/% -0.44 P/D

**Find minimum**

AbsMinimum-> "Y/D"=0.0 at Angle=4.86



calculation of platform inclination angle

Compensation property

Block to match global matrix values:

select parameter for search abs.minimum

X/X 0.60 mm/mm 0.50 Y/Y

X/T 0.61 mm/mrad -0.12 Y/P

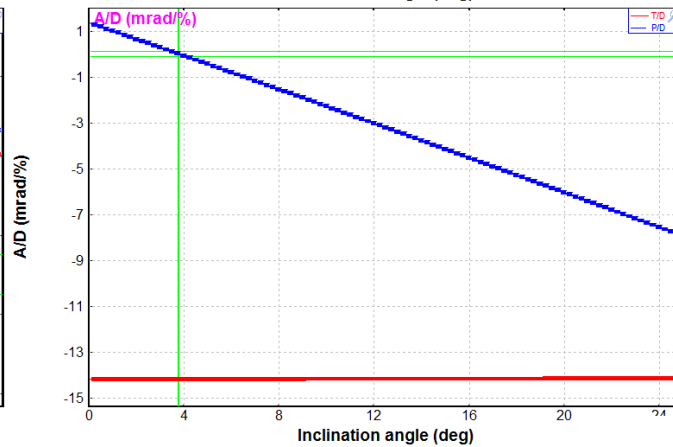
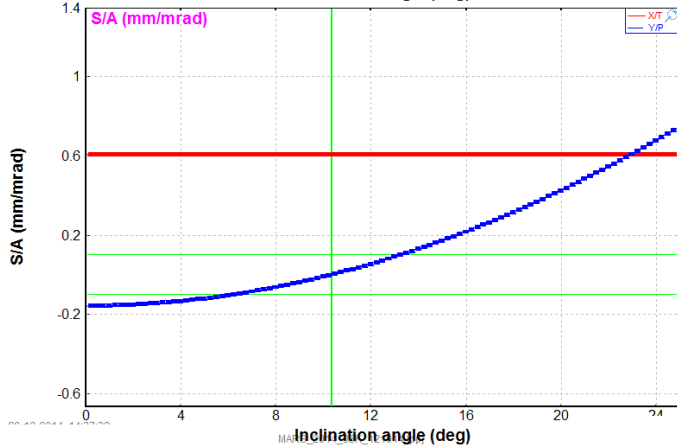
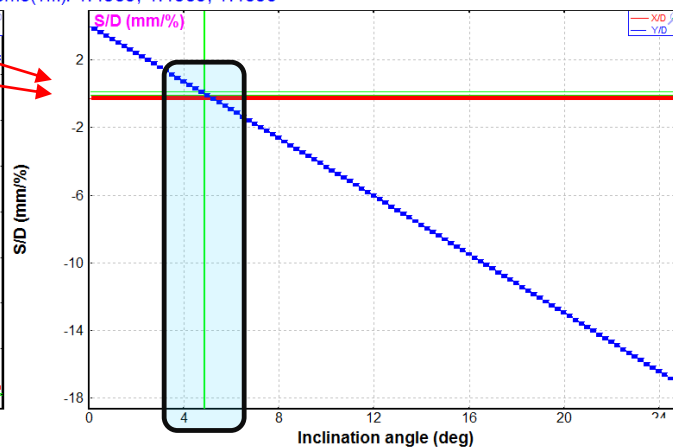
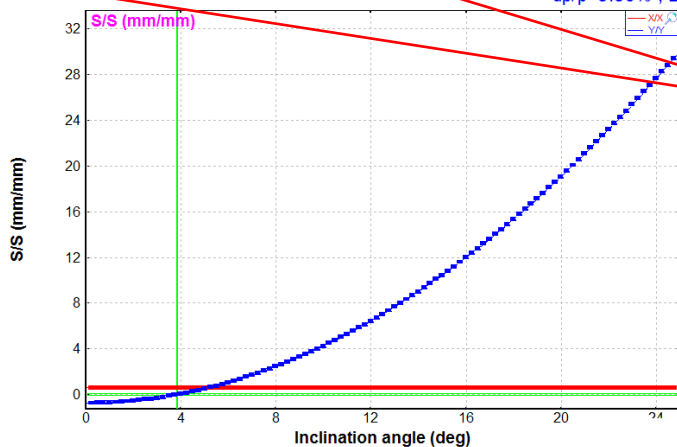
X/D -0.28 mm/% -0.11 Y/D

T/D -14.17 mrad/% -0.44 P/D

AbsMinimum-> "Y/D"=0.0 at Angle=4.86

## Compensating Dipole: Platform Inclination Angle

Compensating Dipole : "D3"; Block to match GOM values : "drift"  
<sup>35</sup>Ar (36.0 MeV/u) + H2 (100 mm); Settings on <sup>35</sup>K; Config: MDSSSSSDSSSSSSSDSONSSCOS...  
 dp/p=3.39%; Brho(Tm): 1.4885, 1.4885, 1.4885



Multipole: Q3

**Magnetic Multipole Settings**

QUADrupole		SEXTupole	
$L_{eff}$ (effective length) mode: <Keep>	0.7		m
B (field at pole tip)	1.58317	0	kG
Radius (half-aperture)	9.75	5	cm

Multipole fixed Brho-value corresponding to the setting fragment: 1.48853 Tm  
 Fix current value

Calculate 2nd order matrix elements  
 Allow remote matrices recalculation

**B(l) calibration**

if Brho-value has been changed then

- no actions
- recalculate automatically B (fields), keep the matrix [Recommended]
- recalculate automatically the matrix, keep B (fields)

**Block settings, Information**

Block length: 0.7 m  
 Current (Real) Brho-value for the setting fragment: 1.48853 Tm  
 Setting fragment: 35K19+

⚡ Recalculate B(field) for the fragment current Brho  
 ⚡ Calculate Optical matrix  OK  
 Edit optical matrix  Cancel

Q3 : quadrupole filed calibration

B 1.5832 kG  
 I 45.749 A

Accept value & Exit  Quit

## MARS quad and dipole calibration files

Vise \calibrations\TAMU\*.*			
Name	Ext	Size	Date
[.]	<DIR>		12/12/2014
MARS_D12	cal	347	03/14/2014
MARS_D3	cal	236	03/14/2014
MARS_D3_2014_08	cal	266	12/13/2014
MARS_Q1	cal	346	03/14/2014
MARS_Q2	cal	237	03/14/2014
MARS_Q3	cal	167	03/14/2014
MARS_Q4_2014_08	cal	217	12/13/2014
MARS_Q45	cal	158	03/14/2014
MARS_Q5_2014_08	cal	223	12/13/2014

## TAMU extended files in the LISE++ package

Vise\files\examples\TAMU\*			
↓Name	Ext	Size	Date
↑ [.]		<DIR>	12/28/2014
TAMU-Solenoid	lpp	60,233	03/27/2014
e_MARS_2014_beam	lpp	203,568	12/28/2014
e_MARS_2014_35K_121014	lpp	202,659	12/13/2014
e_MARS_2014_30S_121014	lpp	202,659	12/13/2014

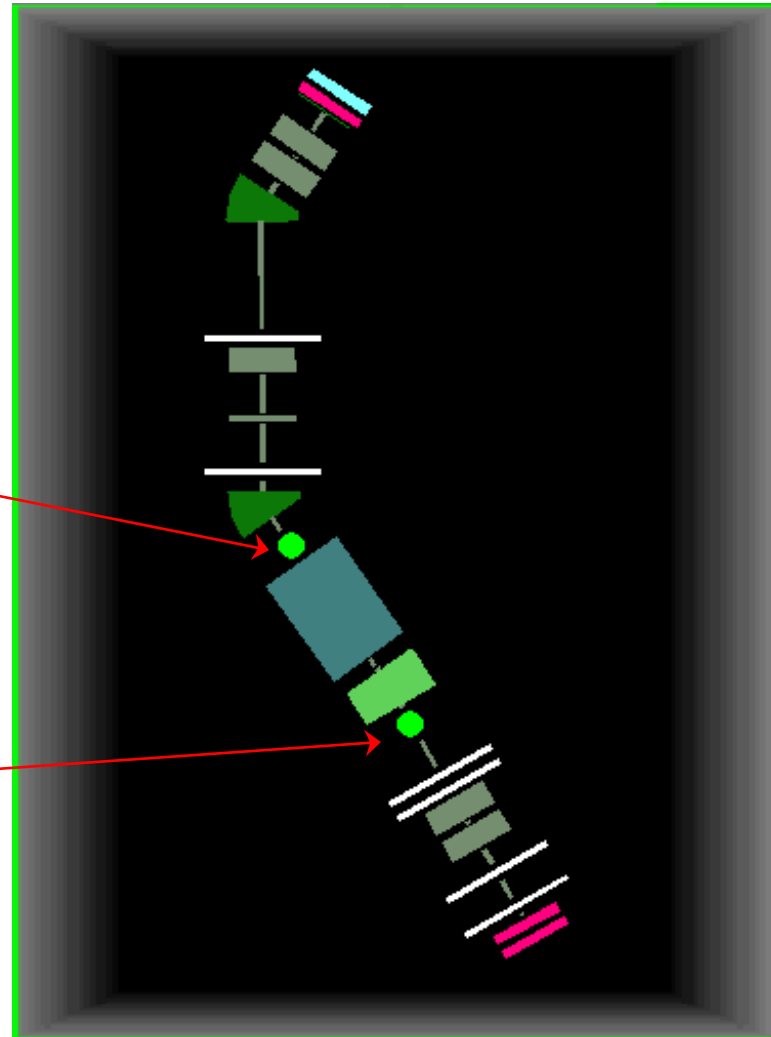
## TAMU extended configurations in the LISE++ package

Vise\config\TAMU\*			
↓Name	Ext	Size	Date
↑ [.]		<DIR>	12/13/2014
TAMU-Solenoid	lcn	26,611	03/27/2014
TAMU-MARS_extended_111014	lcn	182,954	12/13/2014

**Note: There are an extended configurations!**  
 For details on extended configuration approach please use the next links

[Configurations](#)  
[Angular acceptance](#)

<input checked="" type="checkbox"/>	Q3	QUAD 1.5822 kG
<input type="checkbox"/>	drift	standard 1.09 m
<input checked="" type="checkbox"/>	sextupole 1	m-dr 20 cm
<input type="checkbox"/>	drift	standard 1.07 m
<input type="checkbox"/>	Vert. Slit Box	slits
<input type="checkbox"/>	drift	standard 31.75 cm
<input checked="" type="checkbox"/>	D2	Brho 1.4885 Tm
<input type="checkbox"/>	drift	standard 50 cm
<input checked="" type="checkbox"/>	Rotate 1	Angle -90 deg
<input checked="" type="checkbox"/>	Wien Filter	E 2560 KV/m B 339.07 G DL -1.04 mm/%
<input type="checkbox"/>	Drift	standard 30 cm
<input type="checkbox"/>	Dipole chamber	standard 18.67 cm
<input checked="" type="checkbox"/>	D3	Br 1.4885 Tm Angle 5 deg
<input type="checkbox"/>	Dipole chamber	standard 14.76 cm
<input checked="" type="checkbox"/>	Rotate 2	Angle 90 deg
<input type="checkbox"/>	drift	standard 88 cm
<input type="checkbox"/>	sextupole 2	slits
<input type="checkbox"/>	drift	slits
<input checked="" type="checkbox"/>	Q4	QUAD -1.7263 kG
<input type="checkbox"/>	drift	standard 14 cm
<input checked="" type="checkbox"/>	Q5	QUAD 2.8368 kG
<input type="checkbox"/>	drift	standard



ANGULAR ACCEPTANCE

Shape

Rectangle ?

Ellipse

mrad <-> deg

Horizontal ± 27.4 mrad

Vertical ± 46.2 mrad

Solid angle 3.98 msr

1<sup>st</sup> order

2<sup>nd</sup> order

ANGULAR ACCEPTANCE

Shape

Rectangle ?

Ellipse

mrad <-> deg

Horizontal ± 27 mrad

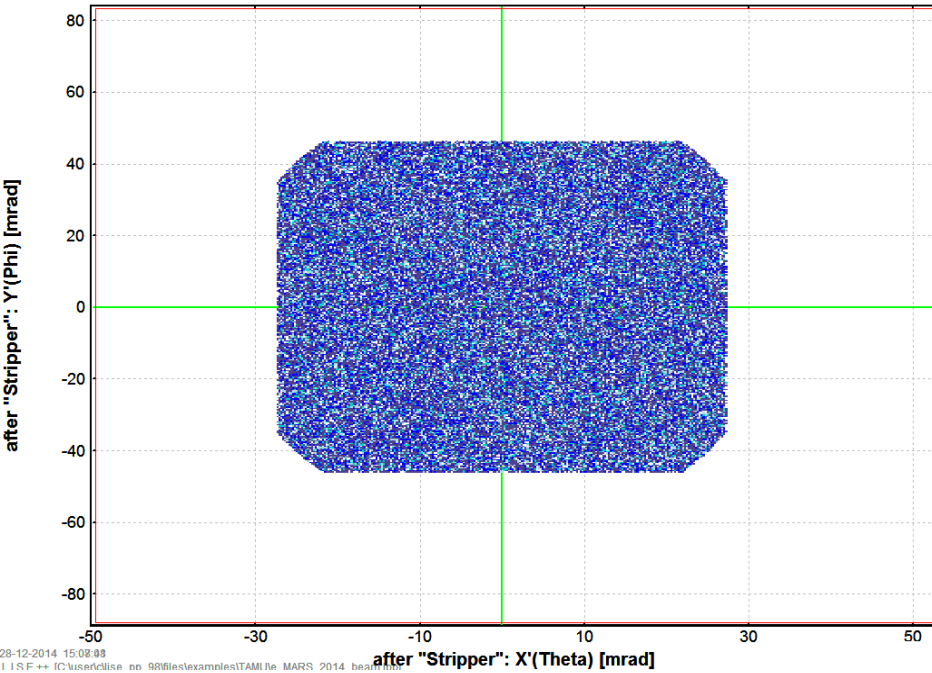
Vertical ± 46 mrad

Solid angle 3.9 msr

### <sup>36</sup>Ar : Monte Carlo Transmission Plot

<sup>36</sup>Ar (36.0 MeV/u) + ; Transmitted Fragment <sup>36</sup>Ar (beam); Optics Order: 1  
 dp/p=8.30% ; Brho(Tm): 1.7423, 1.7423, 1.7423

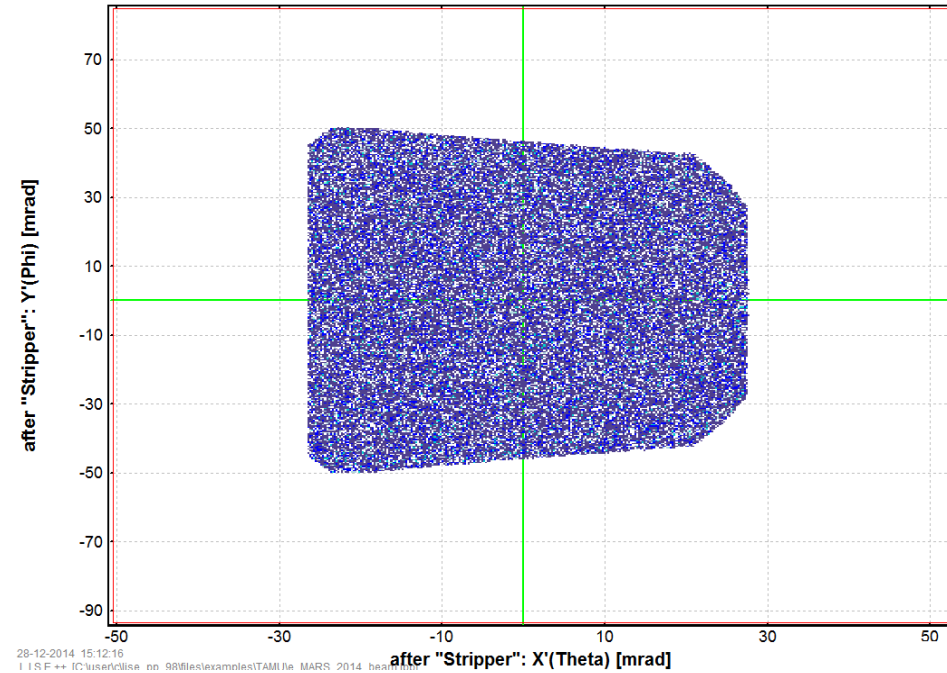
AngAccept: Off; Bounds: ON; "D2" - last block for MC calc; Gate 1: "AND" (X [mm]); Config: MDSSSSSDSSSSSS



### <sup>36</sup>Ar : Monte Carlo Transmission Plot

<sup>36</sup>Ar (36.0 MeV/u) + ; Transmitted Fragment <sup>36</sup>Ar (beam); Optics Order: 2  
 dp/p=8.30% ; Brho(Tm): 1.7423, 1.7423, 1.7423

AngAccept: Off; Bounds: ON; "D2" - last block for MC calc; Gate 1: "AND" (X [mm]); Config: MDSSSSSDSSSSSS





Ellipse shape!

2<sup>nd</sup> order

ANGULAR ACCEPTANCE

Shape

Rectangle

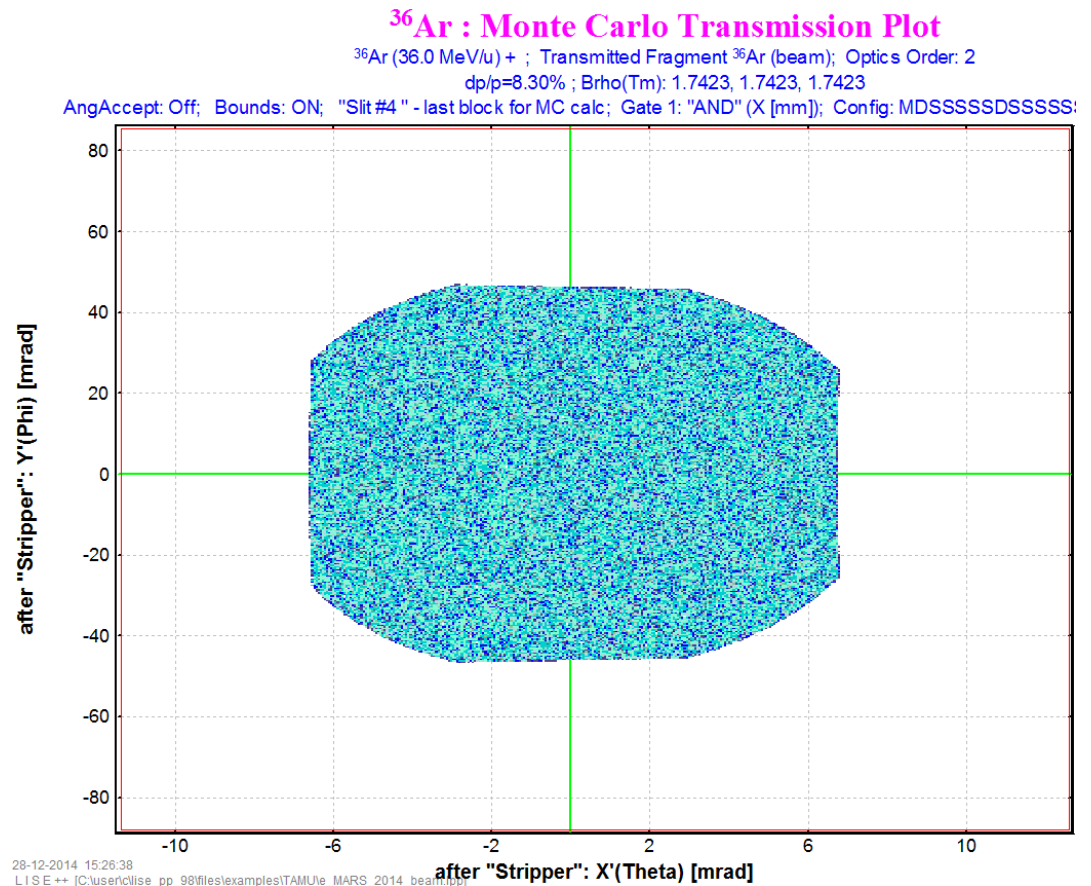
Ellipse

mrad <-> deg

Horizontal ± 6.7 mrad

Vertical ± 46 mrad

Solid angle 0.97 msr





drift	100.0%
Q1	94.55%
Inside of bounds	94.55%
drift	80.96%
Inside of bounds	80.96%
Q2	71.75%
Inside of bounds	71.75%
drift	100.0%
D1	100.0%

ANGULAR ACCEPTANCE

Shape

Rectangle ?

Ellipse

mrad <-> deg

Horizontal ± 27 mrad

Vertical ± 46 mrad

Solid angle 3.9 msr

**Target-D2**

**Main angular acceptance cut takes place in the X-plane after the Wien-filter**

Wien Filter	100.0%
Drift	66.06%
Inside of bounds	66.06%
Dipole chamber	58.19%
Inside of bounds	58.19%
D3	100.0%
Dipole chamber	76.09%
Inside of bounds	76.09%
Rotate 2	100.0%
drift	100.0%
sextupole 2	85.01%
Inside of bounds	85.01%

ANGULAR ACCEPTANCE

Shape

Rectangle ?

Ellipse

mrad <-> deg

Horizontal ± 6.7 mrad

Vertical ± 46 mrad

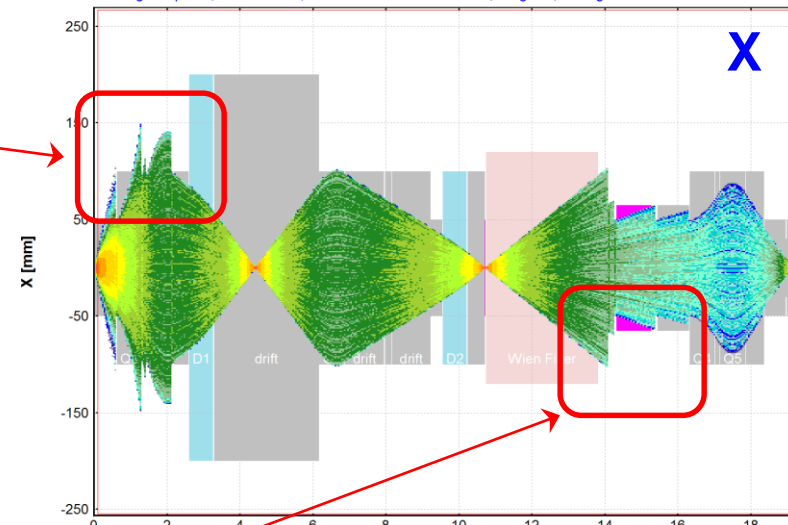
Solid angle 0.97 msr

**Target-End**

**<sup>36</sup>Ar : MC Transmission Plot - Envelope (all)**

<sup>36</sup>Ar (36.0 MeV/u) + ; Transmitted Fragment <sup>36</sup>Ar (beam); Optics Order: 1  
dp/p=8.30%; Brho(Tm): 1.7423, 1.7423, 1.7423

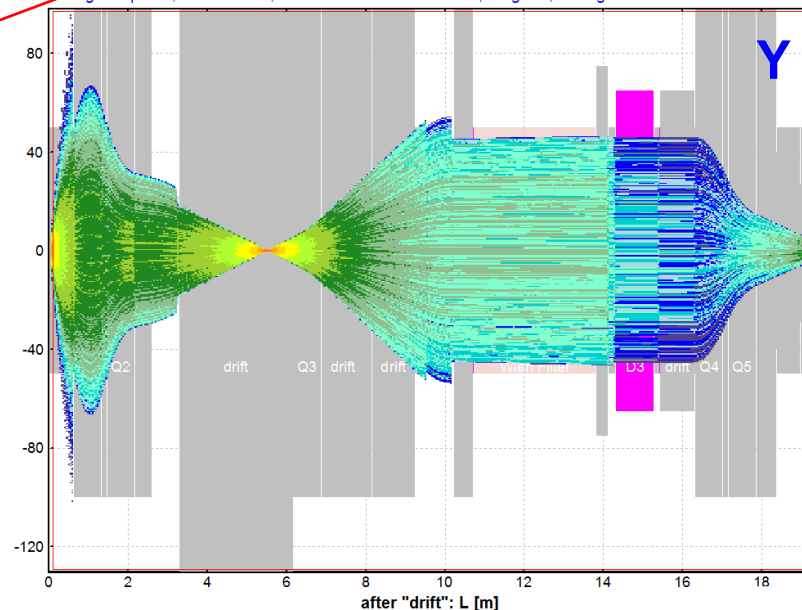
AngAccept: Off; Bounds: ON; "drift" - last block for MC calc; no gates; Config: MDSSSSSSSSSSSSSSSOI



**<sup>36</sup>Ar : MC Transmission Plot - Envelope (all)**

<sup>36</sup>Ar (36.0 MeV/u) + ; Transmitted Fragment <sup>36</sup>Ar (beam); Optics Order: 1  
dp/p=8.30%; Brho(Tm): 1.7423, 1.7423, 1.7423

AngAccept: Off; Bounds: ON; "drift" - last block for MC calc; no gates; Config: MDSSSSSSSSSSSSSDSC



File: e\_MARS\_2014\_beam.lpp

## “Distribution” (analytical) method

tuning

ANGULAR ACCEPTANCE

Shape

Rectangle ?

Ellipse

Horizontal ± 6.7 mrad

Vertical ± 46 mrad

Solid angle 0.97 msr

Emittance

Beam CARD (sigma, semi-axis, half-width...)

1D - shape (Distribution method)

1. X mm	0	Gaussian
2. T mrad	45	Rectangle uniform
3. Y mm	0	Gaussian
4. P mrad	60	Rectangle uniform
5. L mm	0	Gaussian
6. D %	0	Gaussian

## “Monte Carlo” method

Angular Acceptance & Bounds

Use fixed angular acceptances

Use physical limits (aperture) inside blocks to calculate fragment transmission

For block apertures LISE++ uses the slit limits accessible from the Block Cut & Acceptance dialog. (Pay attention there for the checkbox)

36Ar Stable (Z=18, N=18)

---

Q1 (tuning)	18
Q2 (D1)	18
Q3 (D2)	18
Q4 (Wien Filter)	18
Q5 (D3)	18
Reaction	BEAM
Ion Production Rate (pps)	6.84e+9
Total ion transmission (%)	10.941
Total: All reactions (pps)	6.84e+9
X-Section in target (mb)	beam
Target (%)	100
tuning (%)	11.19
X angular transmission (%)	14.63
Y angular transmission (%)	76.51

1<sup>st</sup> order

**SUM**

2.918e+04

CPU speed

1.02e+03 pps

Eff: 11.2%

Rate (pps)

6.986e+09

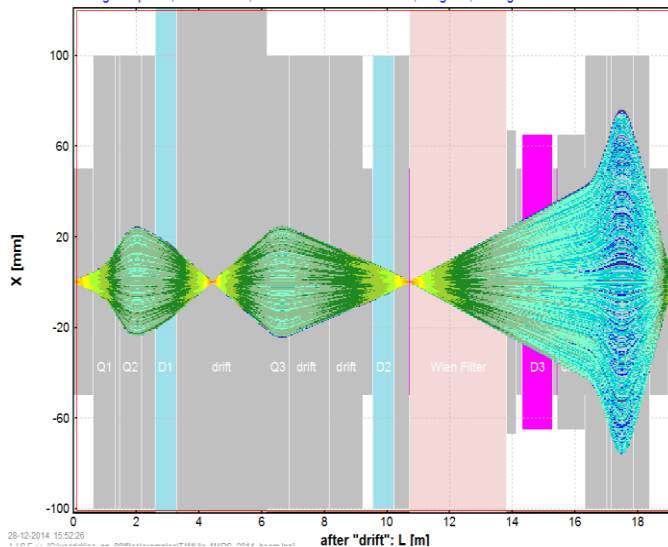
Beam: 2.6e+05



## <sup>36</sup>Ar : MC Transmission Plot - Envelope (only passed)

<sup>36</sup>Ar (36.0 MeV/u) + ; Transmitted Fragment <sup>36</sup>Ar (beam); Optics Order: 1  
dp/p=8.30% ; Brho(Tm): 1.7423, 1.7423, 1.7423

AngAccept: Off; Bounds: ON; "drift" - last block for MC calc; no gates; Config: MDSSSSSSSSSSSSSDSC

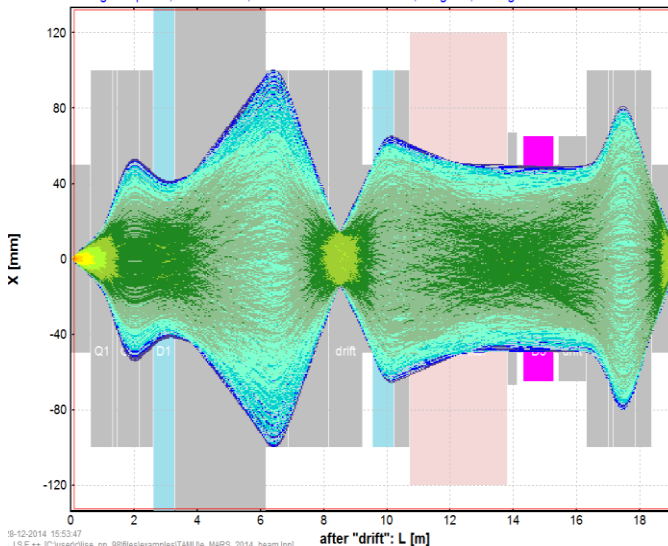


Emittance		
?	Beam CARD (sigma, semi-axis, half-width...)	1D - shape (Distribution method)
1. X mm	0	Gaussian
2. T mrad	45	Rectangle uniform
3. Y mm	0	Gaussian
4. P mrad	0	Rectangle uniform
5. L mm	0	Gaussian
6. D %	0	Gaussian

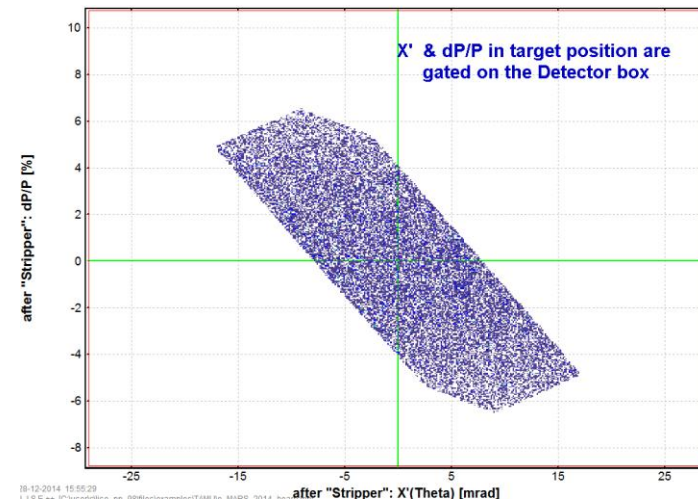
## <sup>36</sup>Ar : MC Transmission Plot - Envelope (only passed)

<sup>36</sup>Ar (36.0 MeV/u) + ; Transmitted Fragment <sup>36</sup>Ar (beam); Optics Order: 1  
dp/p=8.30% ; Brho(Tm): 1.7423, 1.7423, 1.7423

AngAccept: Off; Bounds: ON; "drift" - last block for MC calc; no gates; Config: MDSSSSSSSSSSSSSDSC



Emittance		
?	Beam CARD (sigma, semi-axis, half-width...)	1D - shape (Distribution method)
1. X mm	0	Gaussian
2. T mrad	45	Rectangle uniform
3. Y mm	0	Gaussian
4. P mrad	0	Rectangle uniform
5. L mm	0	Gaussian
6. D %	5	Gaussian

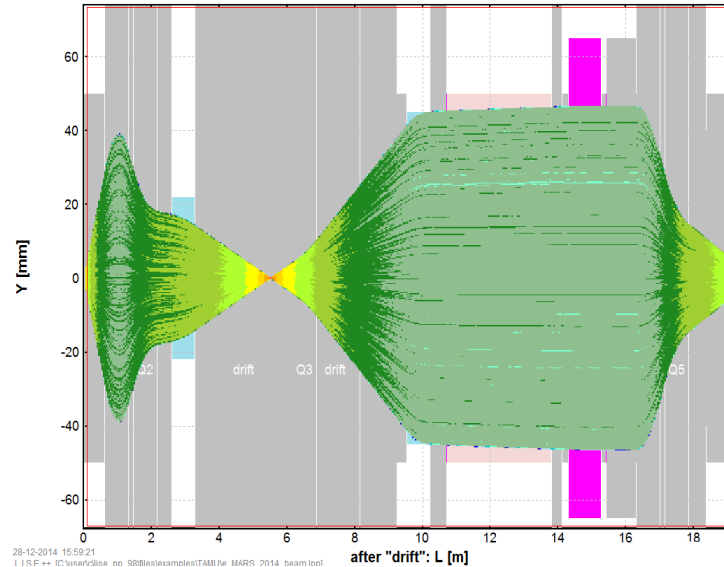


## <sup>36</sup>Ar : MC Transmission Plot - Envelope (only passed)

<sup>36</sup>Ar (36.0 MeV/u) + ; Transmitted Fragment <sup>36</sup>Ar (beam); Optics Order: 1  
 dp/p=8.30% ; Brho(Tm): 1.7423, 1.7423

AngAccept: Off; Bounds: ON; "drift" - last block for MC calc; no gates; Config: MDSSSSSDSSSSSSSDSC

Emittance		
?	Beam CARD (sigma, semi-axis, half-width...)	1D - shape (Distribution method)
1. X	mm 0	Gaussian
2. T	mrad 0	Rectangle uniform
3. Y	mm 0	Gaussian
4. P	mrad 60	Rectangle uniform
5. L	mm 0	Gaussian
6. D	% 0	Gaussian

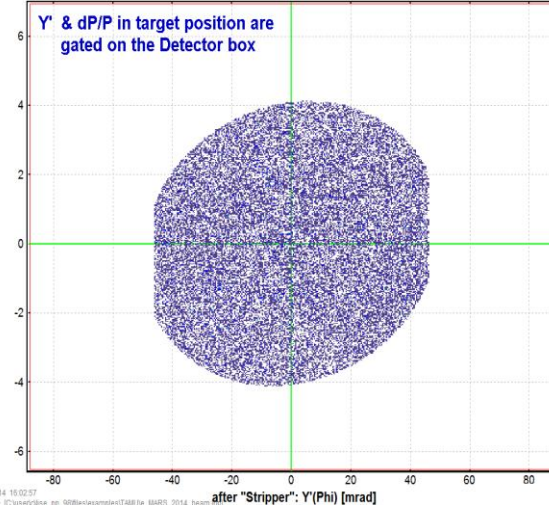
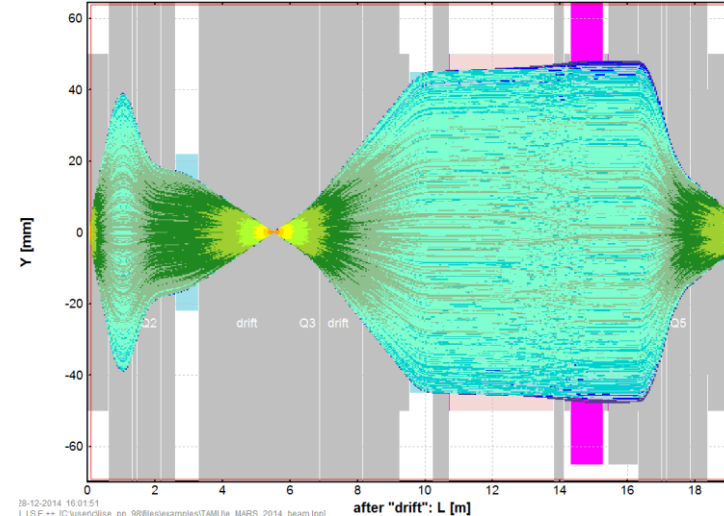


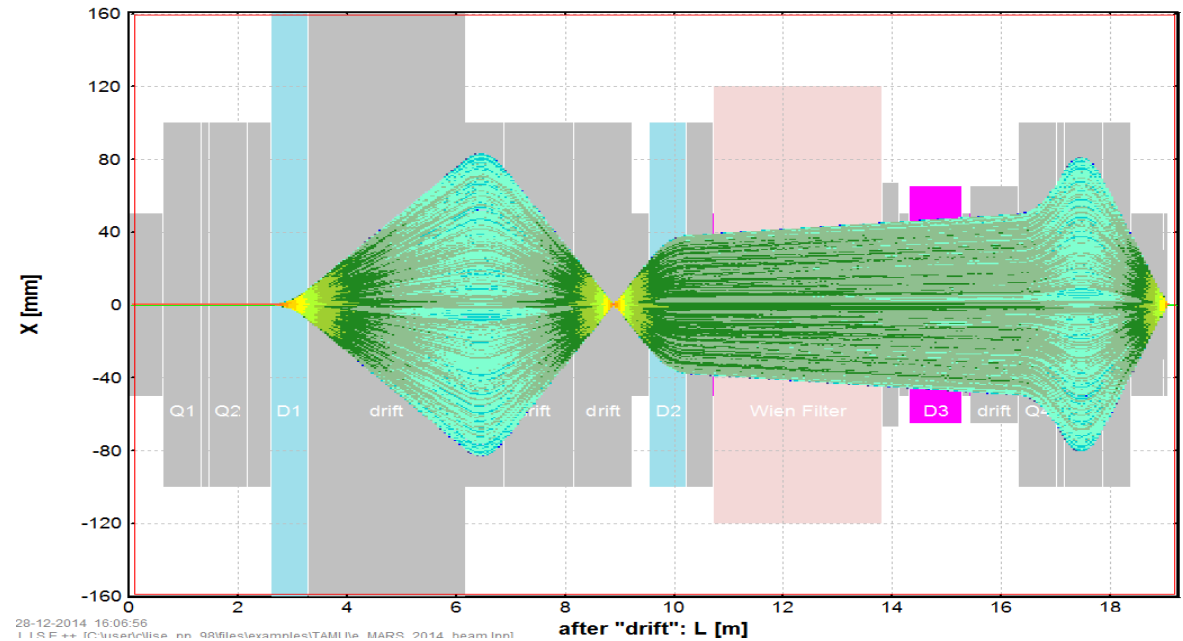
## <sup>36</sup>Ar : MC Transmission Plot - Envelope (only passed)

<sup>36</sup>Ar (36.0 MeV/u) + ; Transmitted Fragment <sup>36</sup>Ar (beam); Optics Order: 1  
 dp/p=8.30% ; Brho(Tm): 1.7423, 1.7423

AngAccept: Off; Bounds: ON; "drift" - last block for MC calc; no gates; Config: MDSSSSSDSSSSSSSDSC

Emittance		
?	Beam CARD (sigma, semi-axis, half-width...)	1D - shape (Distribution method)
1. X	mm 0	Gaussian
2. T	mrad 0	Rectangle uniform
3. Y	mm 0	Gaussian
4. P	mrad 60	Rectangle uniform
5. L	mm 0	Gaussian
6. D	% 6	Gaussian

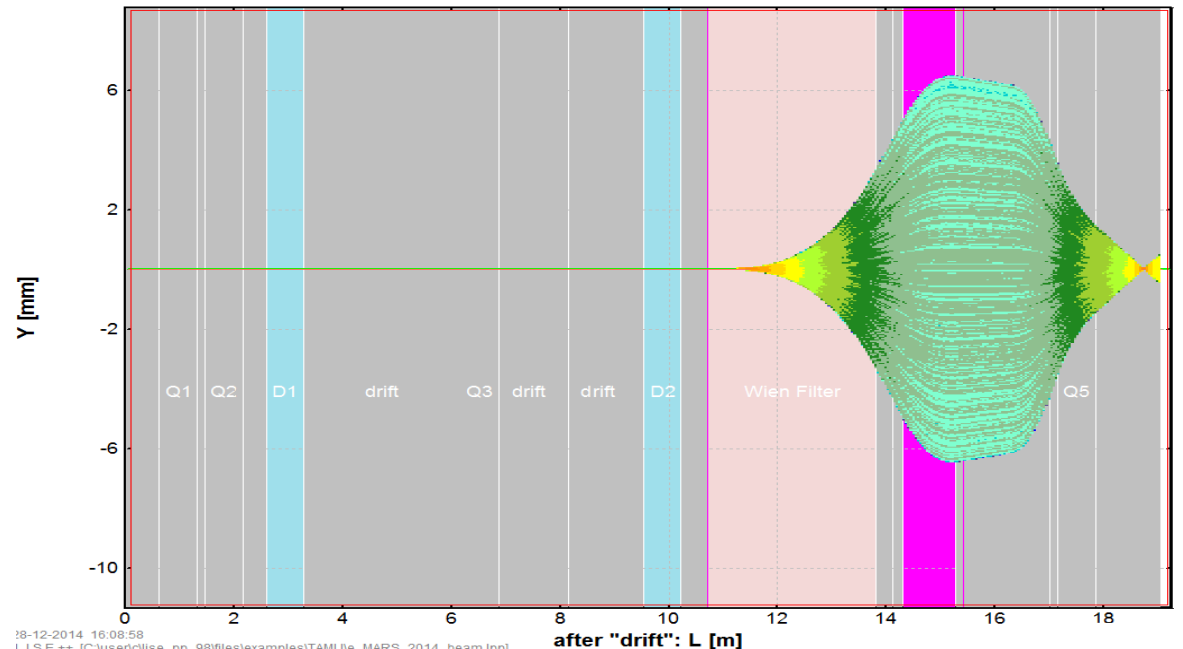




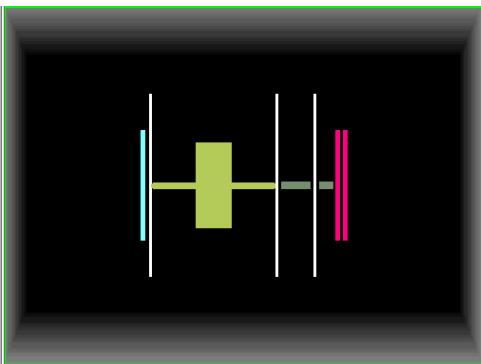
Emittance

	Beam CARD (sigma, semi-axis, half-width...)	1D - shape (Distribution method)
1. X mm	0	Gaussian
2. T mrad	0	Rectangle uniform
3. Y mm	0	Gaussian
4. P mrad	0	Rectangle uniform
5. L mm	0	Gaussian
6. D %	6	Gaussian

**Momentum acceptance is limited in the X-plane!!**



<b>P</b>	Projectile	$^{32}\text{S}^{16+}$
		23 MeV/u 10 pA
<b>C</b>	Compound	$^{36}\text{Ar}$
<b>R</b>	Residual	$^{32}\text{Ar}^{18+}$
<b>T</b>	Target	He 100 mm
<b>Str</b>	Stripper	
<b>S</b>	Slits	slits
		-2   +2
		-2   +2
<b>L</b>	Solenoid 1	4.2500 T
<b>S</b>	Slits 2	slits
		-2   +2
		-2   +2
<b>S</b>	drift 1	standard 50 cm
<b>S</b>	Blocker	slits
<b>S</b>	drift 2	standard 25 cm
<b>M</b>	dE	S1 E0 n c/cn
<b>M</b>	TKE	S1 1 mm

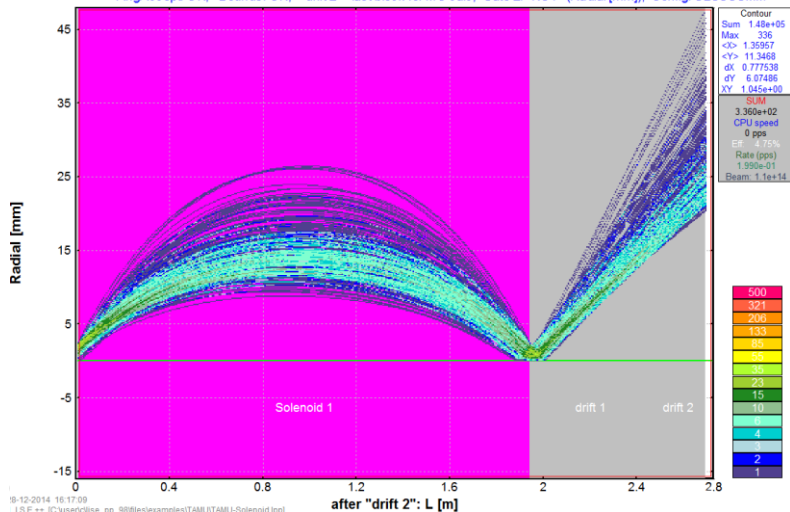


**Effective in the Monte Carlo mode!  
Use the Gate "Not" to simulate the "blocker"**

**$^{32}\text{Ar}$ : MC Transmission Plot - Envelope (only passed)** Continue

$^{32}\text{S}$  (23.0 MeV/u) + He (100 mm); Transmitted Fragment  $^{32}\text{Ar}$  (FusRes); Optics Order: 1  
dp/p=100.00%

AngAccept ON; Bounds ON; "drift 2" - last block for MC calc; Gate 2: "NOT" (Radial [mm]); Config: SLSSSSMM



Status (Condition)

absent

"AND "

"NOT "

Gate

v1 = -14

v2 = 14

Coordinate

After BLOCK

Blocker

X mm

X' (T) mrad

Y mm

Y' (P) mrad

dP/P %

Radial [(X,Y)] mm

Angle [(X',Y')] mrad

Energy MeV/u

TKE MeV

Momentum MeV/c

T...