

//-----
 // 14.3.31 04/24/20

- // * d_Options dialog: **DONE!**
- //
- // * d_Block_base class : **DONE!**
- // * d_Dipole_base class : **DONE!**
- // * d_Dipole_magnetic dialog : **DONE!**
- //
- // * d_Dipole_transport dialog: **redesign 90%, connection 20%**

Preferences

Starting files and working directories

Starting configuration at loading the program: A1900_2019.lcn Browse

Starting options file at loading the program: A1900_2019.lopt Browse

Working directory

Current user has administrative privileges: Yes

LISE++ working directory (options, config, etc) is: User My Documents LISE++ root directory

Options dialogs

Calculation settings

Calculation threshold = 1.0e-30 pps

Dimension of distribution (NP) recommended

calculation WITHOUT charge states	64	64
calculation WITH charge states	32	32
wedge calculation	32	16

Calculate spectrometer settings using

maximal mean

value of the momentum distribution

left peak right peak

Apply the "Edge" effect in distribution cuts

Yes (default) No (It's recommended for extended configurations)

Charge States

No Yes

Cross Section

Fit File CS File Settings

Transmission information in the Table of Nuclides

Display 1: Ion Production Rate (pps)

Display 2: X-Section in target (mb)

Make default

Utility options

Primary beam scattering in target (MC)

Navigation map

Spectrometer scheme

Sound

3D-Balls Animation

Show Fitting constraint blocks in the Setup and Scheme windows

Debug & expert options

Show transmission calculation time

Charge State Optimization Debugging Mode

Distribution Debugging Mode (file 'distrib.txt')

Show Abrasion-Ablation in x-section plots

Check LIZ-file consistency (Options & Config)

Hold angles of an inclination of a target and a stripper together

D1

Dispersive block (M-dipole)

Strength

Brho: 4.48951 Tm

B: 1.44823 T

I: 92.755 A

Bend Sector

Radius = 3.1 m

Angle = 45 deg

Length = 2.4347 m

Optical block properties and data

Section-Element construction property

S-block (Section) E-block (Element) ?

Setting Charge state for the Block (Z-q): 0

Tweak: 1.000 %

Calculate Values using

Setting fragment from

E=A* C=h*B Calibration file

Calculate other blocks

Matrix calculation

Allow remote matrices calculations

//-----

// 14.3.32 04/25/20

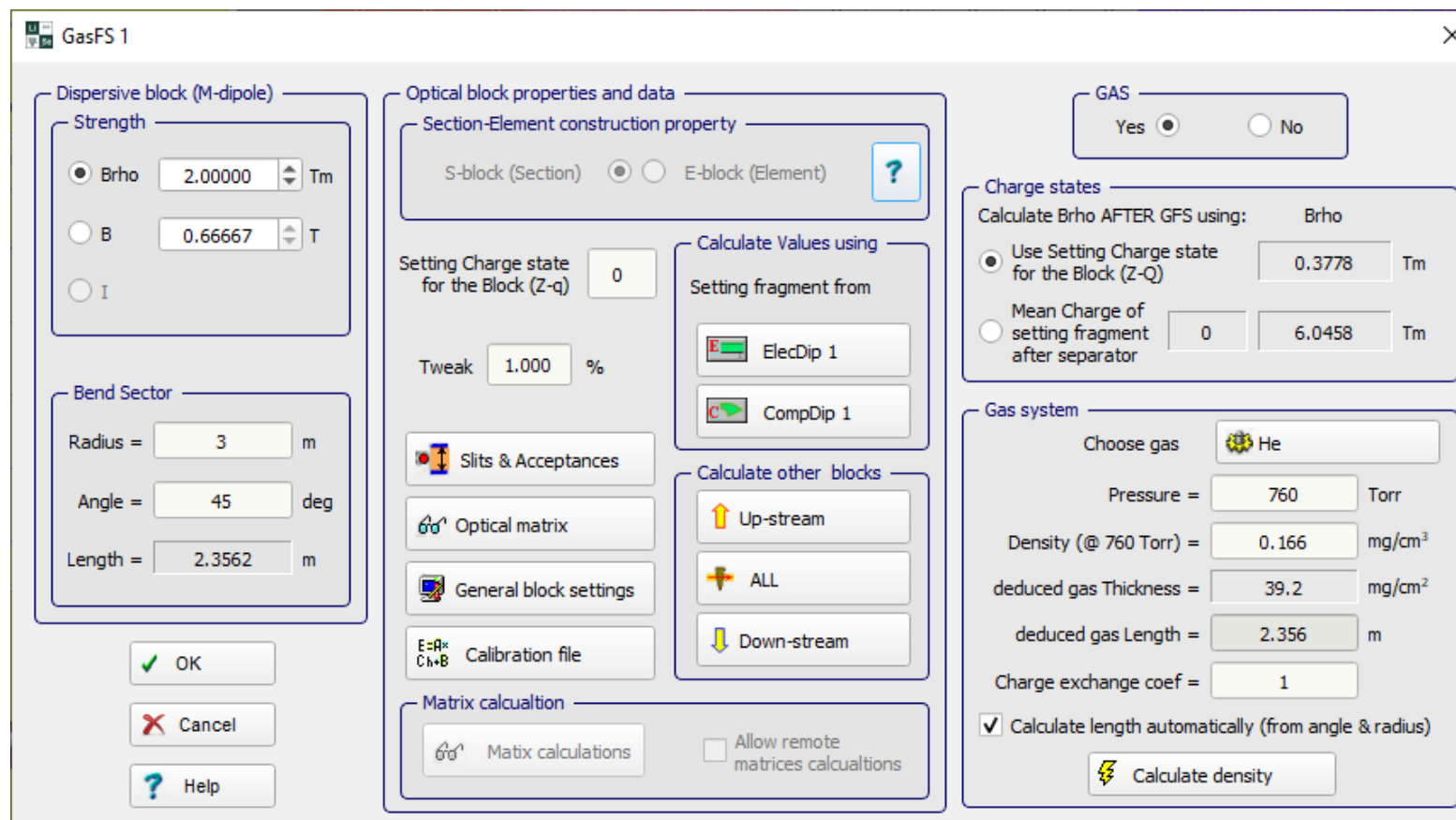
// * d_D6 (compensating dipole) dialog: DONE!

// * d_Dipole_transport dialog : DONE!

// * d_Dipole_transport calculation : DONE!

Type Code	Description	Value	Dimension
BENDING MAGNET SETTINGS	16.5 g/2 - Vertical half-aperture of bending magnet	4.5	cm
	16.7 K1 - an integral related to the extent of the fringing filed of a bending magnet	0	
	16.8 K2 - a second integral related to the extent of the fringing filed of a bending magnet	0	
ENTRANCE FACE OF BENDING MAGNET	16.12 1/R1 - where R1 is the radius of curvature of the entrance face	0	1/m
	2.0 Beta1 - Angle of pole-face rotation (pay attention for angle sign!)	0	degrees
MAGNET	4.0 * $n = -\left[\frac{1}{h B_y} \left(\frac{\partial B_y}{\partial x} \right) \right]_{x=0, y=0} = 0$	0	
	* this line has been set in the parent dialog (Radius, Bfield, angle) $\beta = \left[\frac{1}{2h^2 B_y} \left(\frac{\partial^2 B_y}{\partial x^2} \right) \right]_{x=0, y=0} = 0$	0	
EXIT FACE OF BENDING MAGNET	16.13 1/R2 - where R2 is the radius of curvature of the exit face	0	1/m
	2.0 Beta2 - Angle of pole-face rotation (pay attention for angle sign!)	0	degrees

- //-----
- // 14.3.33 04/26/20
- // * d_GNS (gas filled separator) dialog: DONE!
- // * creation of links from Lab images (ShowSetup (left panel))
- // * creation of special cursor shapes for slits and block buttons (ShowSetup (left panel))
- // * creation of icons for block dialogs



GasFS 1

Dispersive block (M-dipole)

Strength

Brho = 2.00000 Tm

B = 0.66667 T

I

Bend Sector

Radius = 3 m

Angle = 45 deg

Length = 2.3562 m

OK Cancel Help

Optical block properties and data

Section-Element construction property

S-block (Section) E-block (Element) ?

Setting Charge state for the Block (Z-q) = 0

Tweak = 1.000 %

Calculate Values using

Setting fragment from

Calculate other blocks

Slits & Acceptances

Optical matrix

General block settings

E=R*
Ch*B Calibration file

Matrix calculation

Allow remote matrices calculations

GAS

Yes No

Charge states

Calculate Brho AFTER GFS using: Brho

Use Setting Charge state for the Block (Z-Q) = 0.3778 Tm

Mean Charge of setting fragment after separator = 0 6.0458 Tm

Gas system

Choose gas

Pressure = 760 Torr

Density (@ 760 Torr) = 0.166 mg/cm³

deduced gas Thickness = 39.2 mg/cm²

deduced gas Length = 2.356 m

Charge exchange coef = 1

Calculate length automatically (from angle & radius)

//-----
 // 14.3.34 04/27/20
 // * d_Kicker (RF-separator) dialog: redesign 100%, connection 30%
 // * d_Buncher (RF-buncher) dialog: redesign 100%, connection 30%

RFsepar 1

Block for the Optimization utility: RFsepar 1

RF separator settings

Select method:
 Electric field E = 0.00 kV/m
 Voltage U = 0.00 kV
 Gap = 40 mm

Separation plane:
 Horizontal
 Vertical

Geometry:
 La = 0 m, L = 0.7 m, Lb = 0 m

RF settings:
 use Beam settings RF (MHz) = 20, Phase shift = 0 [deg]
 manually RF (MHz) = 19, Phase shift = [deg]

Separator Tuning at the Selection block

Mode:
 find the POSITION value using the phase shift
 find the PHASE SHIFT using the position value

Tuning on Position:
 0 (+/-) Maximum
 0 (-/+) manually (+/-)
 Minimum manually (-/+)
 Set slits automatically after tuning

Calculations for the setting fragment

	<E>-dE	<E>	<E>+dE
Energy [MeV/u]	96.55	122.32	148.09
Time of flight [ns]	263.17	263.17	263.17
Phase [deg]	94.82	94.82	94.82

After the RF separator:
 Position [mm]: 1.31, 1.09, 0.93

Reduced values:
 Dispersion (X/P): -0.017 mm/%

Slits after the RF separator corresponding to the separation plane (Centre +/- Size):
 0 +/- 20 mm

Optical block properties and data

Section-Element construction property:
 S-block (Section) E-block (Element)

Setting Charge state for the Block (Z-q): 0

Tweak: 1.000 %

Calculate Values using:
 Setting fragment from: D4, ElecDip 1

Calculate other blocks:

Matrix calculation:
 Matrix calculations Allow remote matrices calculations

Intensity & Purity optimization utility

RF buncher (cavity)

RF separator settings

Select method:
 Electric field E = 0.00 kV/m
 Voltage U = 0.00 kV

Geometry:
 La = 0 m, L (gap) = 0.2 m, Lb = 0 m

RF settings:
 use Beam settings RF (MHz) = 20, Phase shift = 90 [deg]
 manually RF (MHz) = 97, Phase shift = [deg]

tff (transit time factor)
 $V(t) = V_0 * ttf * \sin(\omega t + \text{phase_shift})$
 parameterization 300.569
 manually 1

tuning: chose d-mode, d5

Calculations for the setting fragment

	<E>-dE	<E>	<E>+dE
Energy [MeV/u]	102.71	122.36	142.01
Time of flight [ns]	257.2	257.1	257.1
Phase [deg]	141.7	141.3	141

After the RF buncher:
 Energy [MeV/u]: 102.83, 122.48, 142.13

Optical block properties and data

Section-Element construction property:
 S-block (Section) E-block (Element)

Setting Charge state for the Block (Z-q): 0

Tweak: 1.000 %

Calculate Values using:
 Setting fragment from: D4, RFsepar 1

Calculate other blocks:

Matrix calculation:
 Matrix calculations Allow remote matrices calculations

Calculate the RF buncher settings | Buncher plots: E = f(p,x), V = f(x), dE = f(p)

Optimization utility: Phase & V

//-----

// 14.3.35 04/28/20

// * d_Kicker (RF-separator) dialog: DONE!

// * d_Kicker_fit dialog: DONE!

// * d_Kicker_optimization dialog: DONE!

RFsepar 1

Block for the Optimization utility: RFsepar 1

Select method: Voltage (U = 101.0 kV, Gap = 40 mm)

Separation plane: Vertical

Geometry: La = 0 m, L = 0.7 m, Lb = 0 m

RF settings: use Beam settings (20 MHz, 283.38 Phase shift)

Calculations for the setting fragment:

Values corresponding to Energy	<E>-dE	<E>	<E>+dE
Energy [MeV/u]	96.81	122.9	148.99
Time of flight [ns]	262.72	262.72	262.72
Phase [deg]	168.18	168.18	168.18

After the RF separator: Position [mm] (-0.03, -0, 0.01)

Reduced values: Dispersion (X/P) 0.002 mm/%

Slits after the RF separator corresponding to the separation plane (Centre +/- Size) 0 +/- 20 mm

RF separator: intensity & purity optimization

$^{48}\text{Ca}(140 \text{ MeV/u}) + \text{Be} \rightarrow ^{12}\text{S}$

Tuning mode: find the PHASE SHIFT using the position value: "manually (-/+)"

Parameters to be modified:

Parameters	Min Value	Max Value	Number of Points
Slits center (mm)	-1.129	1.129	20
Slits width (mm)	1	1.129	5

Weights for the Combine plot:

WI = 1 "Intensity" $I_r = \log_{10}(I)$

WP = 1 "Purity" P

WIP = 0.1 "Product" $I_r * P$

Isotope rectangle for calculations:

+/- PROTONS 3 from the setting fragment

+/- NEUTRONS 3 from the setting fragment

Comb = $WI * I_r + WP * P + WIP * I_r * P$

Output statistics file: a1900_wedge_RFopt.fit

Press "Escape" to interrupt analysis

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//-----
// 14.3.36 04/29/20
// * d_Dipole_electric dialog : DONE!
// * d_Kicker (RF-separator) dialog: corrected
// * d_Solenoid_block dialog : redesign 90%, connection 10%
```

```

Utility for Electrostatic deflector: ElecDip 1

Electrostatic dipole; mode = Cylindrical
direct = X
radius = 2 m
angle = 45 deg
length = 1.571 m
n = 0
beta = 0.19553
e_xi = 1.4006
n_eta = 0
Nk = 0.99044
Nm = 0.0095566
k2x = 0.49 m^(-2)
k2y = 0 m^(-2)

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* TRANSFORM 1 *
transport format [cm-mrad]

[D] -- Momentum transfer matrix (Important!)
1 [X]: +4.5355e-001 +1.2726e-001 0 0 0 +1.0929e+000
2 [T]: -6.2414e+000 +4.5355e-001 0 0 0 +1.2483e+001
3 [Y]: 0 0 1 +1.5708e-001 0 0
4 [F]: 0 0 0 1 0 0
5 [L]: -1.2483e+000 -1.0929e-001 0 0 1 -5.8497e-001
6 [D]: 0 0 0 0 0 1

-----
* TRANSFORM 1 *
transport format [cm-mrad]

[D] -- Electrostatic rigidity selection (Important!)
1 [X]: +4.5355e-001 +1.2726e-001 0 0 0 +5.5710e-001
2 [T]: -6.2414e+000 +4.5355e-001 0 0 0 +6.3631e+000
3 [Y]: 0 0 1 +1.5708e-001 0 0
4 [F]: 0 0 0 1 0 0
5 [L]: -6.3631e-001 -5.5710e-002 0 0 1 -1.5200e-001
6 [D]: 0 0 0 0 0 1

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* TRANSFORM 2 *
Second Order
transport format [cm-mrad]

[D] -- Momentum transfer matrix (Important!)

1 1: -5.2412e-003 0 0 0 0 0
    
```

//-----
 // 14.3.37 04/30/20
 // * d_Solenoid_block dialog : DONE!
 // * d_Ideal_magnet dialog : DONE!
 // * d_Buncher (RF-buncher) dialog : redesign 100%, connection 80%

Solenoid 1

Solenoid settings

Strength: B, max field = 2.000 T; I, current = 33.843 A

Field Direction: "+" positive; "-" negative

Use the "soft-edge" corrections for solenoid matrix calculations

$V(L * B / \rho) = 0.3784$ Tm; $V / \text{Brho} = 0.2251$

Geometry

Coil length = 0.5944 m; Modern "non-drift" mode

Effective radius = 0.21 m; 1-st half = 0.2972 m

Block Length = 0.5944 m; 2nd half = 0.2972 m

MA=MAconst * I

MAconst = 0.03618 T/A; MA = 1.22445 T

$B(0) = MA * \text{CoilLength} / \sqrt{\text{EffRadius}^2 + \text{CoilLength}^2 / 4}$

Optical block properties and data

Setting Charge state for the Block (Z-q) = 0

Tweak = 1%

Slits & Acceptances

Block Tuning using the Setting fragment

Tune Solenoid

Take into account the GLOBAL matrix of the previous block

Tuning is minimisation of

absolute value: 01. beam sigma: X

after the block: Solenoid 1

Setting fragment parameters

	Mean	StDev	Method
1. X	20	387.46	"Gaussian" (5-points)
2. T	0	6	
3. Y	-1.1	7.32	
4. F	0	8	
5. E	19.6	19.6	

Setting fragment distribution parameters before Solenoid, based on the initial beam vector and its transport through blocks located in front of Solenoid

Ideal magnet - TRANSPORT formalism

General settings

Central trajectory length = 1 m

mode: Bending magnet; Quadrupole; Sextupole

$n = - \left[\frac{1}{h B_y} \left(\frac{\partial B_y}{\partial x} \right) \right]_{x=0, y=0} = 0.55$

$\beta = \left[\frac{1}{2 h^2 B_y} \left(\frac{\partial^2 B_y}{\partial x^2} \right) \right]_{x=0, y=0} = 0$

Calculate 2nd order matrix elements

Bending magnet settings (no fringed fields)

Angle of the bend = 19.0854 degrees

Radius of the curvature = 3.002 m

Quadrupole & Sextupole settings

Radius (half-aperture) = 10 cm

B (field at pole tip) = 10 kG

Corresponding Bhro-value = 3.336 Tm

$k_x^2 = 0.0499 \text{ m}^{-2}$; $k_y^2 = 0.061 \text{ m}^{-2}$; $h = 0.3331 \text{ m}^{-1}$

$k_x^2 = (1 - n)h^2$, $k_y^2 = nh^2$, and $h = 1/\rho_0$

Utility: The First- and Second-Order Matrix Elements for an Ideal Magnet

Save

Bending magnet

Length = 1.0000
 n = 5.5000e-001
 beta = 0.0000e+000
 angle = 19.09
 radius = 3

$k_{2x} = +4.9931e-002$ $k_{2y} = +6.1027e-002$ $k_{2s} = +0.0000e+000$ $h = 3.3310e-001$

transport format [cm-mrad]

*** TRANSFORM 1 ***

1 [X]:	+9.7514e-001	+9.9170e-002	0	0	0	+1.6586e-001
2 [T]:	-4.9516e-001	+9.7514e-001	0	0	0	+3.3034e+000
3 [Y]:	0	0	+9.6964e-001	+9.8986e-002	0	0
4 [F]:	0	0	-6.0408e-001	+9.6964e-001	0	0
5 [L]:	-3.3034e-001	-1.6586e-002	0	0	1	-1.8447e-002
6 [D]:	0	0	0	0	0	1

*** TRANSFORM 2 ***

1 1:	+1.8594e-005					
1 2:	+3.2882e-004	+8.2548e-006				
1 3:	0	0	-5.0609e-005			
1 4:	0	0	0	-8.2930e-006		
1 5:	0	0	0	0	0	
1 6:	+7.9420e-004	+4.5005e-005	0	0	0	-1.6210e-003
2 1:	+1.9825e-003					
2 2:	+1.9908e-004	-1.5848e-004				
2 3:	0	0	-1.0080e-003			



