



Making Matrices for ARIS SpecTcl from savesets

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Research presentation



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ARIS extended file (LISE-optics)

- Open the extended LISE file (available in the LISE distribution package: `\My Documents\LISEcute\files\examples\FRIB\eARIS\eL_ARIS_k3cb2.lpp`).
 - This file uses the most common optics setting used in ARIS: momentum compression in the pre-separator and high transmission in the C-Bend.
- Next, set your experimental configuration up (primary beam, energy, and power; fragment setting; target thickness; wedges, if applicable, etc.)
- Then, read in the saveset for the run you want to analyze:
 - Utilities → Set-up utilities → Load ARIS experimental settings

The screenshot shows the LISE++ software interface. The title bar reads "LISE++ [!:\projects\lisedev\Shane\Experiments\24605_82Se_07-2024\eL_ARIS_k3cb2_65Ti_228MeV_Run2515_LISEbrho.lpp*]". The menu bar includes File, Options, Experimental Settings, Physics Models, Calculations, Utilities, 1D-Plot, 2D-Plot, Databases, and Help. The Utilities menu is open, showing options like "Load ARIS experimental settings", "ARIS Beam Dump", "Load A1900 experimental settings", "Calculation of Angle on the LISE3 target", "Catcher utility (ISOL, Fusion-Residues)", "MSP-144 utility", "Twinsol (solenoid) utility", "Gas pressure optimization for gas-filled dipole", and "FRIB mass table converter to LISE++ lme file".

The main window displays a periodic table with the element ^{82}Se highlighted in yellow. On the left, there are control panels for "Projectile" (82 Se 34+, 228 MeV/u, 20 kW), "Fragment" (65 Ti), "Target" (12 C 8 mm), "Stripper", "Shield Slits", "DL_0.887", "WIQ1", "Q1_sR", "DL_1.850", "WIQ2", "Q2_sR", and "DL_2.950". At the bottom left, there is a logo for IN2P3 (Institut National de Physique Nucléaire et de Physique des Particules) and "Projectile Fragmentation (E3)".

At the bottom of the window, there are status indicators: "show disabled blocks", "charge states", "Ncalc=1", "Sum=7.140e-6", "DG=4.38mm%", "NP=64", and "R=0x1".

Loading saveset

- In the dialog box that pops up, browse for the saveset you want to use.
- Once selected, click the “Read data” button below.

Load ARIS settings

ARIS configuration

This utility works properly with "e_ARIS_v*.lpp" file (extended configuration)

1. Load default eARIS(k3) configuration

1a. Browse & Load eARIS configuration

ARIS saveset file

Default printout directory: /projects/lisedevl_Shane/Experiments/24605_82Se_07-2024/

2. Browse saveset file: 2024_07_17_12h47m51_Run2515.bt

Run title

3. Read data

ARIS configuration settings

Exit, Quit, Help

Run title

3. Read data

Title: ARIS 2024_07_17_12h47m51.bt -- Wed 17 Jul 2024 12:47:51
"Run 2515: 65Ti with wedge shifted by 2 mm towards thicker"
Expt# 24605 [O. Tarasov] "20 kW Se-82 Beam Test"
Primary beam: 82 Se (Z=34) 228.0 MeV/nuc; D1000 Target: C 8.000 mm 500.0 rpm

ARIS configuration settings

Utilities e values loading

- Load only Brho value
- Load Brho value and "frozen" radius from saveset. Calculate block matrix
- Load B-NMR field, get Radius from calibration. Calculate block matrix

	Values	use		Values	use
Projectile =	82Se	<input type="checkbox"/>	Dipole fields =	N = 7 (8)	<input checked="" type="checkbox"/>
Production Target =	C 8.00 mm	<input type="checkbox"/>	Quadrupole fields =	N = 42 (42)	<input checked="" type="checkbox"/>
Wedge (D1184) =	empty	<input type="checkbox"/>	Sextupole fields =	N = 33 (42)	<input checked="" type="checkbox"/>
D1184 slit =	+50.0 : -50.0	<input checked="" type="checkbox"/>	DB1 detectors =		<input checked="" type="checkbox"/>
DB1 vert slit =	-100.0 : +100.0	<input checked="" type="checkbox"/>	DB3 detectors =		<input checked="" type="checkbox"/>
DB2 horiz slit =	-100.0 : +100.0	<input checked="" type="checkbox"/>	DB4 detectors =		<input checked="" type="checkbox"/>
DB4 horiz slit =	-100.0 : +100.0	<input checked="" type="checkbox"/>	DB5 detectors =		<input checked="" type="checkbox"/>
DB5 horiz slit =	-100.0 : +100.0	<input checked="" type="checkbox"/>	Use Quadrupole fudging factors		<input type="checkbox"/>
DB5 vert slit =	-100.0 : +100.0	<input checked="" type="checkbox"/>	Manual additional quadrupole field factor (default 0.9702)		<input type="checkbox"/>

4. Load values into code & Calculate matrices

Save current quad fields to scratch

Exit, Quit, Map plot, Help



Load ARIS settings

- There are several options for dipole settings: Brho only, Brho and 'frozen' radii from saveset, and B-NMR field, radius from calculation.
 - Brho and frozen radius are the most commonly used.

Leave these boxes unchecked, as they may mess up the primary beam settings and/or the fragment settings.

If there is slit information, it will appear here.

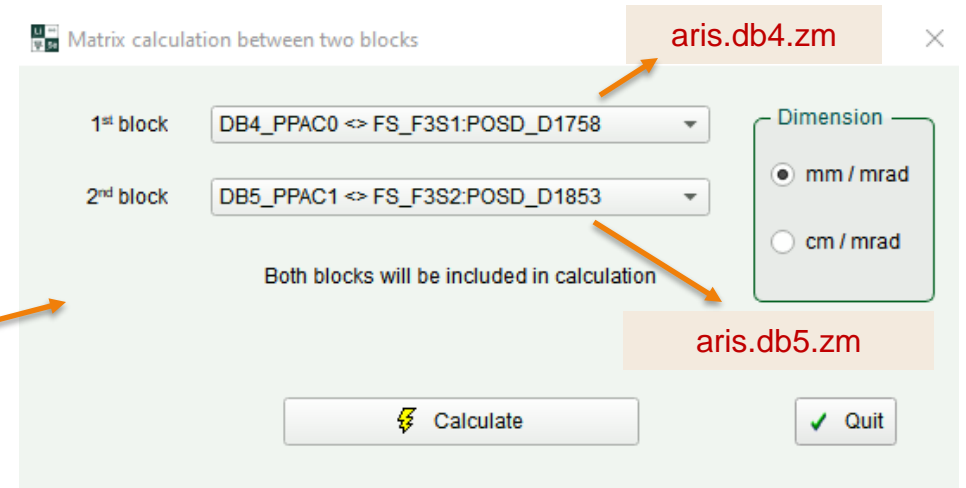
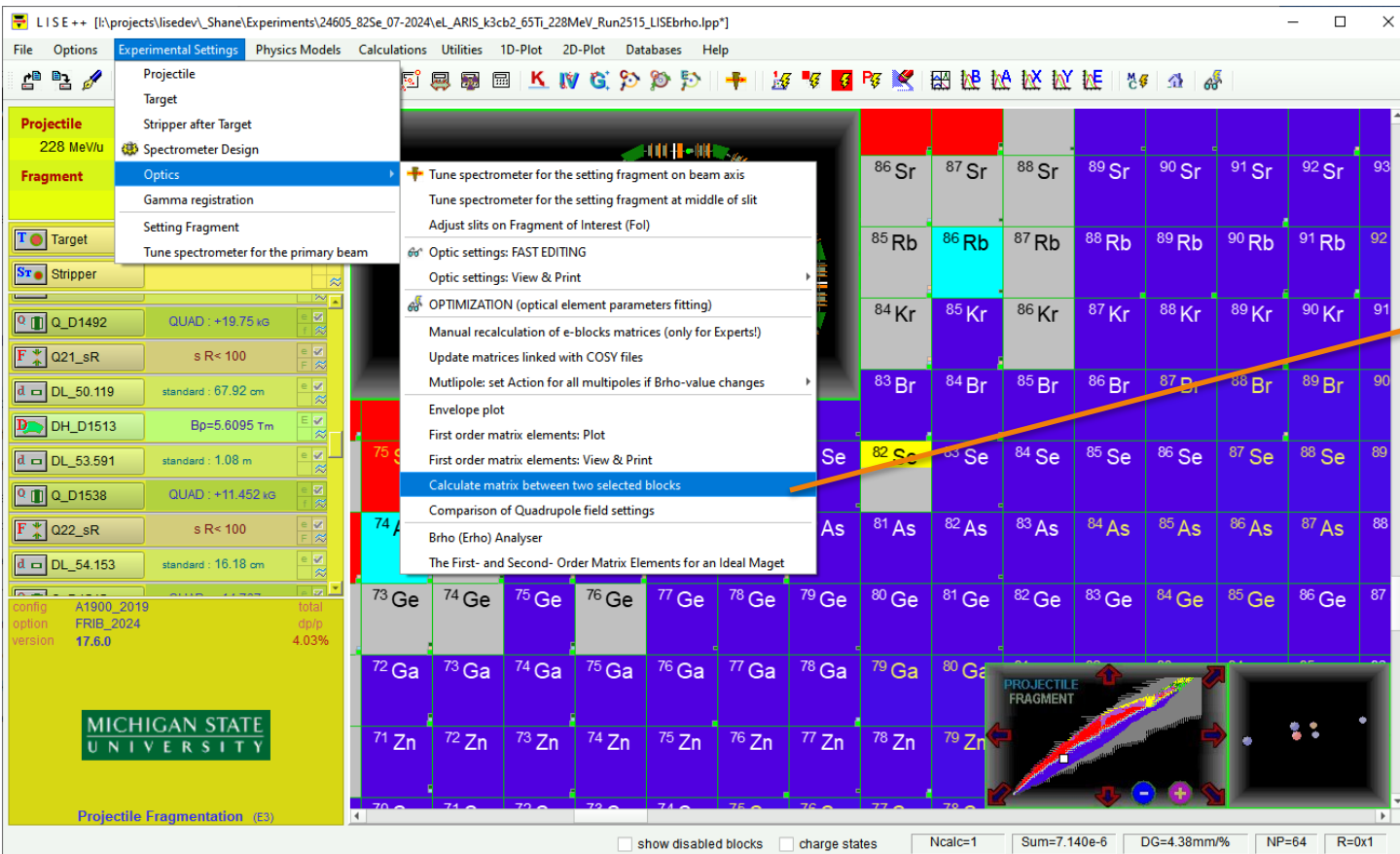
	Values	use	Values	use
Projectile =	82Se	<input type="checkbox"/>	Dipole fields =	N = 7 (8) <input checked="" type="checkbox"/>
Production Target =	C 8.00 mm	<input type="checkbox"/>	Quadrupole fields =	N = 42 (42) <input checked="" type="checkbox"/>
Wedge (D1184) =	empty	<input type="checkbox"/>	Sextupole fields =	N = 33 (42) <input checked="" type="checkbox"/>
D1184 slit =	+50.0 : -50.0	<input checked="" type="checkbox"/>	DB1 detectors =	<input type="checkbox"/> <input checked="" type="checkbox"/>
DB1 vert slit =	-100.0 : +100.0	<input checked="" type="checkbox"/>	DB3 detectors =	<input type="checkbox"/> <input checked="" type="checkbox"/>
DB2 horiz slit =	-100.0 : +100.0	<input checked="" type="checkbox"/>	DB4 detectors =	<input type="checkbox"/> <input checked="" type="checkbox"/>
DB4 horiz slit =	-100.0 : +100.0	<input checked="" type="checkbox"/>	DB5 detectors =	<input type="checkbox"/> <input checked="" type="checkbox"/>
DB5 horiz slit =	-100.0 : +100.0	<input checked="" type="checkbox"/>	Use Quadrupole fudging factors	<input type="checkbox"/>
DB5 vert slit =	-100.0 : +100.0	<input checked="" type="checkbox"/>	Manual additional quadrupole field factor (default 0.9702)	<input type="checkbox"/>

Make sure to load the values into LISE and calculate the new matrices!

These will input the magnetic fields from the saveset.

Calculate matrix between two locations: db4.ppac0 and db5.ppac1

- Once the saveset has been implemented, you may extract the transfer matrices you desire.
- Go to Experimental Settings → Optics → Calculate matrices between two selected blocks



- This dialog window will allow you to select the two blocks you wish to calculate the matrix between.
- mm/mrad is the most common units to use.
- If you don't see the blocks you want, go to Spectrometer Design and ensure they are enabled.

Matrix calculation result

Matrix from DB3_PPAC1 (FS_F2S2:POSD_D1663) to DB4_PPAC0 (FS_F3S1:POSD_D1758)
 Number of blocks: 21; Length: 9.50463 m

transport format [mm-mrad]

* TRANSFORM 1 *

1 [X]:	-1.7803e+00	+8.9367e-01	0	0	0	+2.3272e+01
2 [T]:	+1.6204e-01	-6.4306e-01	0	0	0	-2.8103e-01
3 [Y]:	0	0	-1.1337e+00	-3.5053e-01	0	0
4 [F]:	0	0	+8.8480e-01	-6.0850e-01	0	0
5 [L]:	+3.2707e-01	-1.4714e+00	0	0	+1.0000e+00	-1.0761e+00
6 [D]:	0	0	0	0	0	+1.0000e+00

* TRANSFORM 2 *

1 1:	-3.2324e-05					
1 2:	+3.7187e-04	-4.7336e-04				
1 3:	0	0	-8.1684e-05			
1 4:	0	0	-3.7679e-04	-1.9245e-03		
1 5:	0	0	0	0	0	
1 6:	+1.0113e-02	+2.8771e-02	0	0	0	-2.2392e-01

2 1:	+8.6894e-06					
2 2:	-8.7659e-05	-1.6549e-04				
2 3:	0	0	+1.0051e-06			
2 4:	0	0	+6.1326e-05	+1.8666e-04		
2 5:	0	0	0	0	0	
2 6:	-1.8102e-03	-6.3868e-03	0	0	0	+2.1920e-03

- The output will look like the example to the left.
- The top matrix is the first order transfer matrix, while the ones below it are the second order matrices.
- This example is the transfer matrix between DB3 PPAC1 and DB4 PPAC0.
- This resulting map should be transferred to file CB2_Dip34_*.tcl and linked in pid.tcl



Matrices in ARIS SpecTcl (CB2-optics)

calibrations/pid.tcl

```
if {$RunNumber >=3117 && $RunNumber <= 3156 } {
```

```
set aris.db1.zm ${aris.db1.z}
set aris.db2.zm ${aris.db2.z}
set aris.db3.zm ${aris.db3.ppac1.z}
set aris.db4.zm ${aris.db4.ppac0.z}
set aris.db5.zm ${aris.db5.ppac1.z}
```

```
source ./calibrations/matrix/CB2_Dip34_run3120.tcl
source ./calibrations/matrix/CB2_Dip45_run3120.tcl
}
```

ARIS SpecTcl supports CB1-optics.
Check CB1_Dip13.tcl and
CB1_Dip35.tcl files in the matrix folder

/calibrations/matrix/

CB2_Dip34_run3120.tcl

CB2_Dip45_run3120.tcl

```
#----- Dip34 exp 21035 db3.ppac1 - db4.ppac0 138Sb
puts -nonewline "matrix CB1_Dip34 run 3120"
```

```
treevariable -set aris.Dip34.matr.xx -1.6857;
treevariable -set aris.Dip34.matr.xa 0.2
treevariable -set aris.Dip34.matr.xd 23.058;
```

```
treevariable -set aris.Dip34.matr.xdd 0;
```

```
treevariable -set aris.Dip34.matr.ax 0.12888;
treevariable -set aris.Dip34.matr.aa -0.61580;
treevariable -set aris.Dip34.matr.ad -0.19710;
```

```
treevariable -set aris.Dip34.matr.yy -1.0727;
treevariable -set aris.Dip34.matr.yb -0.17076;
```

```
treevariable -set aris.Dip34.matr.by 0.83006;
treevariable -set aris.Dip34.matr.bb -0.80011;
```

```
treevariable -set aris.Dip34.matr.lx 0.26395;
treevariable -set aris.Dip34.matr.la -1.4141;
treevariable -set aris.Dip34.matr.ld -1.0772;
```

```
treevariable -set aris.Dip34.b_use_x 2; # "-1,0,1,2"); // -1 not use, 0- ppac0, 1-ppac1, 2 - both ppacs
treevariable -set aris.Dip34.e_use_x 2; # "-1,0,1,2"); // -1 not use, 0- ppac0, 1-ppac1, 2 - both ppacs
treevariable -set aris.Dip34.b_use_a 1;
treevariable -set aris.Dip34.e_use_a 0;
```

```
treevariable -set aris.Dip34.delta_method 0; # forward
```

```
#-----
puts " end CB2_Dip34 **"
```

```
#----- Dip45 e21035 db4.ppac0 db5.ppac1 138Sb
puts -nonewline "matrix CB1_Dip45 run 3120"
```

```
treevariable -set aris.Dip45.matr.xx -0.68612;
treevariable -set aris.Dip45.matr.xa 0.4;
treevariable -set aris.Dip45.matr.xd 15;
```

```
treevariable -set aris.Dip45.matr.ax 0.006406;
treevariable -set aris.Dip45.matr.aa -1.4563;
treevariable -set aris.Dip45.matr.ad 0.030511;
```

```
treevariable -set aris.Dip45.matr.yy -0.51088;
treevariable -set aris.Dip45.matr.yb -0.24174
```

```
treevariable -set aris.Dip45.matr.by 1.4126
treevariable -set aris.Dip45.matr.bb -1.2890
```

```
treevariable -set aris.Dip45.matr.lx 0.012144;
treevariable -set aris.Dip45.matr.la -2.2843;
treevariable -set aris.Dip45.matr.ld -1.0752;
```

```
#-----
treevariable -set aris.Dip45.b_use_x 0; # "-1,0,1,2");
# // -1 not use, 0- ppac0, 1-ppac1, 2 - both ppacs only db4-ppac0
treevariable -set aris.Dip45.e_use_x 2;
# "-1,0,1,2"); // -1 not use, 0- ppac0, 1-ppac1, 2 - both ppacs
treevariable -set aris.Dip45.b_use_a 0;
treevariable -set aris.Dip45.e_use_a 1;
```

```
treevariable -set aris.Dip45.delta_method 1; # reverse
```

```
puts " end CB1_Dip45 **"
```

