

- Introduction to Extended configurations
- What are S- and E- blocks?
- LISE<sup>++</sup> optical block scheme
- Property of S- and E- blocks
- The Optical blocks editing dialog
- Manual recalculation of e-block matrices

The one of main directions of LISE++ development is the “Extended configurations” branch (or “Segmentation”) according to the LISE++ “White Book”


- Switch between extended (element) and segment (sector) configurations
- Minimization tools for extended configurations
- Export/Import separator configurations :  
LISE++ ↔ other beam transport codes
- Experiment set-up feedback

Why now?


Do not extremely change the optical blocks after adoption of the new version 9.9 in order to avoid complications with LISE++ transportation to QT-framework.

1. The SE property is the serious reconstruction of the code;
2. Quad fields minimization need.

[http://lise.nsl.msui.edu/9\\_8/LISE3/Extended%20configurations%20at%20LISE++.pdf](http://lise.nsl.msui.edu/9_8/LISE3/Extended%20configurations%20at%20LISE++.pdf)






## Discussion of configurations in LISE<sup>++</sup>



This document describes the options for determining the transmission through a fragment separator and includes some description of these options

1. **Introduction, definitions**
2. **Using Quadrupole and Dipole fast editing dialog**
3. **Concept of “Tuning” dipole**
4. **Definition of the cuts by the block**  
(Angular acceptances, Apertures, Slits)
5. **Slits and optical blocks**
6. **Slits and material blocks**
7. **Angular acceptance and apertures**
8. **Using extended configurations with Monte Carlo**
9. **How to obtain an angular acceptance?**
10. **Benchmarks**

Some definitions will be used in the presentation

	<b>User</b>
	<b>Advanced</b>
	<b>Beam physicist</b>

OT, 08-Jul-2014, East Lansing

[http://lise.nsci.msu.edu/9\\_8/LISE3/Extended%20configurations%20at%20LISE++.pdf](http://lise.nsci.msu.edu/9_8/LISE3/Extended%20configurations%20at%20LISE++.pdf)



## Comparison of the Classical Segmented & Extended configurations



### ➤ **Classical (segmented) configuration:**

- Fast transmission calculations
- Optical matrices can be input by user or linked to COSY maps
- Simple and compact description of optical system
- **Effective with analytical calculations for experiment planning**



### ➤ **Extended (elemental) configuration:**

- Allows detailed analysis of transmission
- Optical matrices can be input by user, linked to COSY maps or calculated in the LISE++ code, and used in segmented configurations
- Tools to obtain angular acceptances, (which can be entered into classical segmented configurations)
- Tools for displaying ion-beam optics

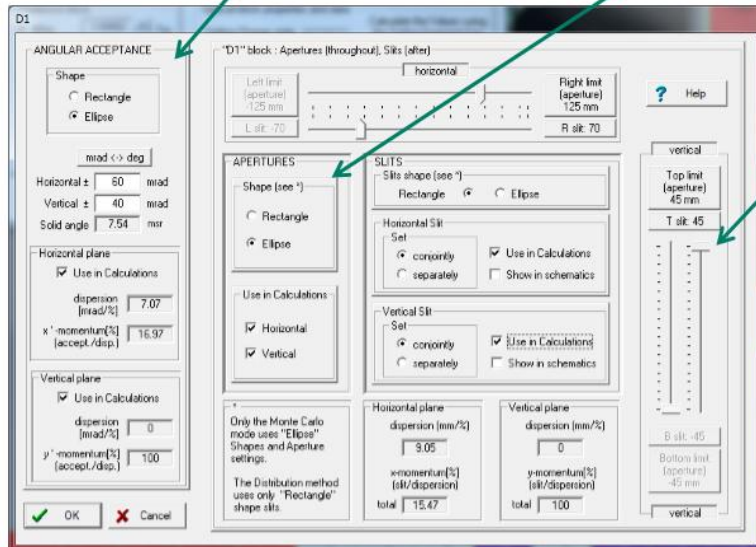
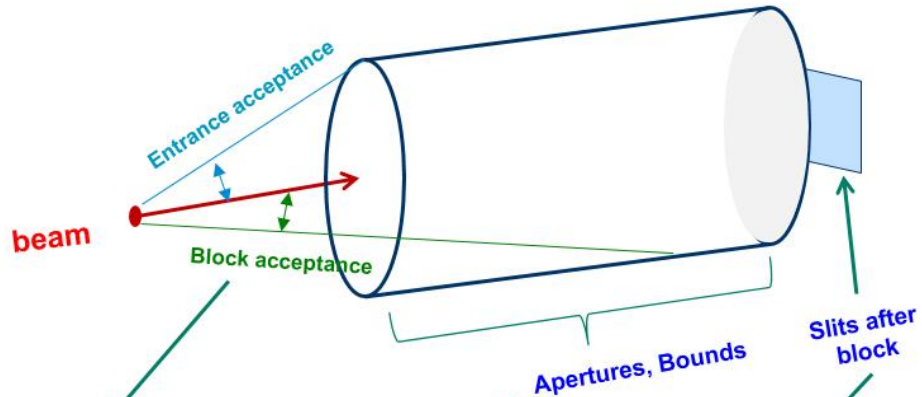


**Very useful with Monte Carlo calculations including fragment separator design**

[http://lise.nsci.msu.edu/9\\_8/LISE3/Extended%20configurations%20at%20LISE++.pdf](http://lise.nsci.msu.edu/9_8/LISE3/Extended%20configurations%20at%20LISE++.pdf)

## 4. Definition of the cuts by the block

Block angular acceptance < Entrance acceptance



Configuration type	Angular Acceptance	Apperture	Slits after block
Classical ("segment")	Yes	No	Yes
Extended ("element")	No	Yes*	please use only for "slits" element

**Note:** the code does not distinguish segmented and extended configurations, it's up to the user.

\* - Apertures are used only in Monte Carlo calculations

From the previous slide

~~Note: the code does not distinguish segmented and extended configurations, it's up to the user.~~

Nowadays LISE++ can distinguish!

## s-block

(section, segment configuration)

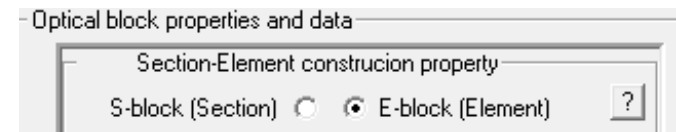
## Construction property

## e-block

(element, extended configuration)

1. Main feature of E-block – possibility to calculate the optical matrix by means of LISE++ : so, this construction property tells to the code how and where this block can be used
2. This new construction property allows split properties and utilities of optical blocks. So, less confusion for the user, more simple and informative
3. Use new commands only for blocks of specified construction properties
4. All optical block classes are separated on three construction categories (on 11/14/2014):

*a. only e-blocks (6 classes);      b. only s-blocks (6 classes);      c. property defined by user (M & E- dipoles, Wien-filter)*

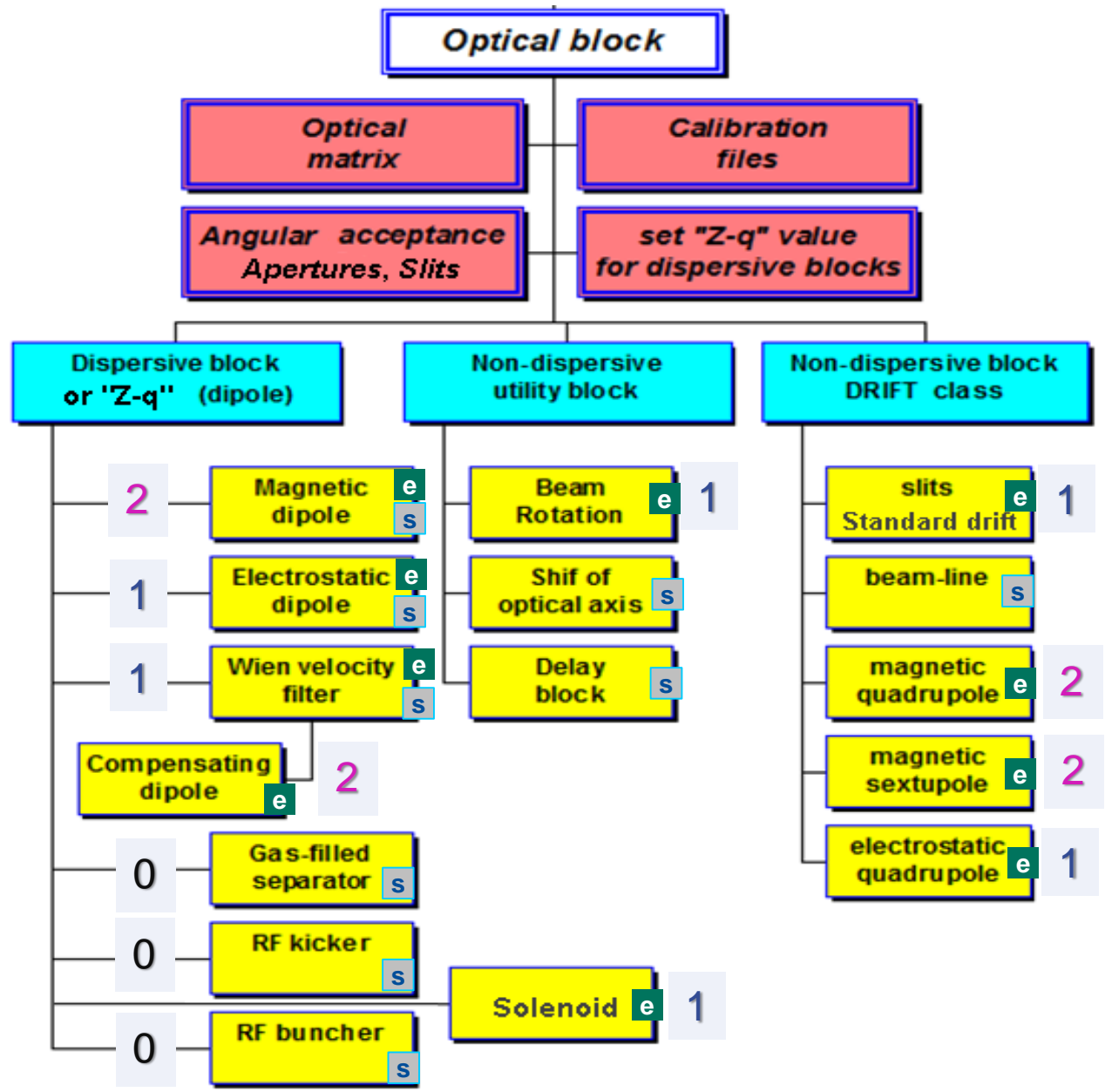


High order optics  
calculated by LISE<sup>++</sup>

0 1 2

**e** e-block  
(element, extended configuration)

**s** s-block  
(section, segment configuration)





Property	S-block (sector)	E-block (element)
Optical matrix can be calculated inside of the code	no	yes
Length of block	manually	calculated
Drawing quadrupoles in scheme	allowed	no
Aperture property	no	yes
Slits after block property	yes	yes but not recommended
Angular acceptance block property	yes	yes but not recommended
Aperture property	no	yes
Block use in the segmentation process (in future)	no	yes
Block use in the minimization process (in future)	no	yes
Export/Import separator configuration (LISE++ ↔ other beam transport codes)	no	yes
User level	Regular	Expert
Efficiency to calculation model, designation	Effective with analytical calculations for experiment planning	Very useful with Monte Carlo calculations including fragment separator design



## S-block

**D22\_1**

Dispersive block

- Brho 0.74779 Tm
- B 0.46256 T
- I 498.66 A

Bend Sector

- Radius = 1.61665 m
- Angle = 22.08 deg
- Length = 0.6230 m

Optical block properties and data

Section-Element construction property

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

Setting Charge state for the Block (Z-Q) 84

Calculate the Values using the Setting fragment from

C1

D22\_2

Tweak 0.1 %

Buttons:  Allow remote matrices calculation, Matrix calculations, OK, Cancel, Help

## E-block

**D22\_1**

Dispersive block

- Brho 0.74779 Tm
- B 0.46256 T
- I 498.66 A

Bend Sector

- Radius = 1.61665 m
- Angle = 22.08 deg
- Length = 0.6230 m

Optical block properties and data

Section-Element construction property

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

Setting Charge state for the Block (Z-Q) 84

Calculate the Values using the Setting fragment from

C1

D22\_2

Tweak 0.1 %

Buttons:  Allow remote matrices calculation, Matrix calculations, OK, Cancel, Help

**General Block Settings**

Type of Block Dispersive (Dipole)

Let call automatically

Block Name D22\_2

Block Length 4 m

Distances from the target to

- beginning of block 4.7575 m
- end of block 8.757 m

Quadruples number

- just for the spectrometer scheme
- Don't plot just leave empty space
- in the beginning 2
- at the end 2

Buttons: Ok, Cancel

**General Block Settings**

Type of Block Dispersive (Dipole)

Let call automatically

Block Name D22\_2

Block Length 0.623 m

Distances from the target to

- beginning of block 4.7575 m
- end of block 5.38 m

Quadruples number

- just for the spectrometer scheme
- Don't plot just leave empty space
- in the beginning 0
- at the end 0

Buttons: Ok, Cancel

Quadrupoles and dipoles fast editing

Block	Given Name	Start(m)	Length(m)	B0(kG)	Br(Tm)corr/*r...	DriftM/*An...	Rapp(cm)/*R...	L_eff(m)/*L_dip(m)	2nd order	CalcMatr/*Z-Q	AngAcc_Apps.Slits	COSY_lin	SE
Dipole	tuning	0.000	0.0001	-2.4926	* 0.7478	* 0.0	* 3.0000	* 0.0001	no	* 84	-- -- --	-	S
Drift	DTS1	0.000	0.3500			standard					-- HV --	-	e
Drift	slits 1	0.350	0.0000			SLITS					-- -- HV	-	e
Drift	DS1Q1	0.350	0.0700			standard		c_0.0350			-- HV --	-	e
Drift	Quad 1	0.420	0.3100	+4.5138	0.7478	QUAD	9.0000	c_0.3800	yes	1	-- HV --	-	e
Drift	dqiqk	0.730	0.2700			standard		c_0.2000			-- HV --	-	e
Drift	Quad 2	1.000	0.3100	-4.1172	0.7478	QUAD	9.0000	c_0.3800	no	1	-- HV --	-	e
Drift	dqiqk	1.310	0.2700			standard		c_0.2000			-- HV --	-	e
Drift	Quad 3	1.580	0.3100	+2.0125	0.7478	QUAD	9.0000	c_0.3800	yes	1	-- HV --	-	e
Drift	dq3c1	1.890	0.5515			standard		c_0.5165			-- HV --	-	e
ElecDip	C1	2.442	0.6592							* 84	-- HV HV	-	E
Drift	dc1d1	3.101	0.4229			standard					-- HV --	-	e
Dipole	D22_1	3.524	0.6230	+4.6256	* 0.7478	* 22.1	* 1.6166	* 0.6230	yes	* 84	-- -- --	-	E
Drift	dd1sv	4.147	0.3054			standard					-- HV --	-	e
Drift	slits SV	4.452	0.0000			SLITS					-- -- H-	-	e
Drift	dsvd2	4.452	0.3054			standard					-- HV --	-	e
Dipole	D22_2	4.757	0.6230	-4.6256	* 0.7478	* -22.1	* 1.6166	* 0.6230	yes	* 84	-- -- --	-	E
Drift	dd2c2	5.380	0.4229			standard					-- HV --	-	e
ElecDip	C2	5.803	0.6592							* 84	-- HV HV	-	E
Drift	dc2q4	6.463	0.5515			standard		c_0.5165			-- HV --	-	e
Drift	Quad 4	7.014	0.3100	+0.6284	0.7478	QUAD	9.0000	c_0.3800	yes	1	-- HV --	-	e
Drift	dqiqk	7.324	0.2700			standard		c_0.2000			-- HV --	-	e

Selected block: Dispersive (Dipole)

Block Length [m]: 0.0001

Length after this block [m]: 0.0001

Charge State [Z-Q]: 84

Angular acceptance (mrad): Horizontal  $\pm$  [ ] [ ] Use [ ] Vertical  $\pm$  [ ] [ ] Use [ ]

Shape: Rectangle  Ellipse

Inside Aperture (mm): X = min [ -50 ] max [ 50 ] Use [ ] Y = min [ -50 ] max [ 50 ] Use [ ]

Shape: Rectangle  Ellipse

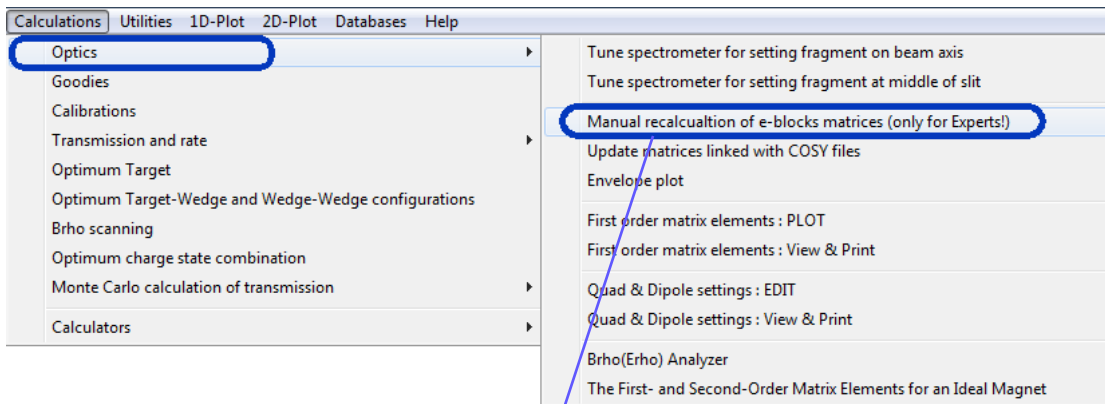
Slits (mm) after this BLOCK: X = min [ ] max [ ] Use [ ] Y = min [ ] max [ ] Use [ ]

Shape: Rectangle  Ellipse

1-st order Matrix Elements: Plot View

Quit Help

Small “e” and “s” chars show permanent properties of blocks.  
 Large “E” and “S” chars show block properties set by user.  
 S-blocks cannot be used for the segmentation process (in future).



Applied only to S-blocks with "allowed remote permission" flag and without COSY-links!!!

## Manual recalculation of optical matrices of e-blocks (approved blocks for extended configurations)

L I S E ++ [C:\\_Popeko\SHELS v7.lpp]  
13-11-2014 18:15:28

N	Block	Name	Option	Status	delta
1:	Dipole	"tuning"		checked	
2:	Drift	"DTS1"	standard	checked	
3:	Drift	"slits 1"	SLITS	checked	
4:	Drift	"DSIQ1"	standard	checked	
5:	Drift	"Quad 1"	QUAD	checked	
6:	Drift	"dq1qk"	standard	checked	
7:	Drift	"Quad 2"	QUAD	checked	
8:	Drift	"dq1qk"	standard	checked	
9:	Drift	"Quad 3"	QUAD	checked	
10:	Drift	"dq3c1"	standard	checked	
11:	ElecDip	"C1"		checked	
12:	Drift	"dc1d1"	standard	checked	
13:	Dipole	"D22_1"		== MODIFIED ==	-3.330%
14:	Drift	"dd1sv"	standard	checked	
15:	Drift	"slits SV"	SLITS	checked	
16:	Drift	"dsvd2"	standard	checked	
17:	Dipole	"D22_2"		checked	
18:	Drift	"dd2c2"	standard	checked	
19:	ElecDip	"C2"		checked	
20:	Drift	"dc2q4"	standard	checked	
21:	Drift	"Quad 4"	QUAD	checked	
22:	Drift	"dq1qk"	standard	checked	
23:	Drift	"Quad 5"	QUAD	checked	
24:	Drift	"dq1qk"	standard	checked	
25:	Drift	"Quad 6"	QUAD	checked	
26:	Drift	"dq6d3"	standard	checked	
27:	Dipole	"D8"		checked	
28:	Drift	"drift"	standard	checked	
29:	Drift	"slits 3"	SLITS	checked	
30:	Drift	"drift"	standard	checked	
31:	Drift	"slits 4"	SLITS	checked	
32:	Drift	"drift"	standard	checked	

If the previous matrix is different from the recalculated one, it is shown in the information window

Number of optical blocks: 32  
Number of cosy links: 0  
Number of updated blocks: 32  
Number of modified blocks: 1

