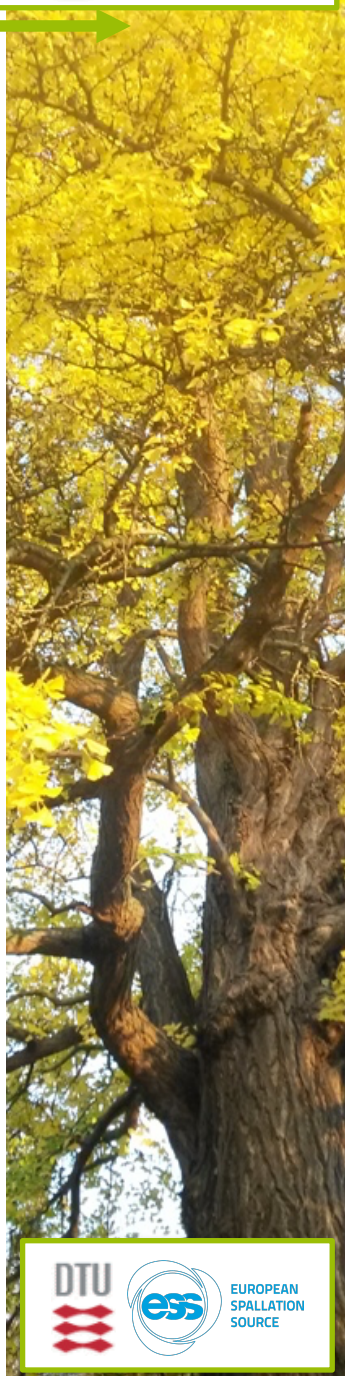
3 - Guides

3 - Guides

. Straight guide

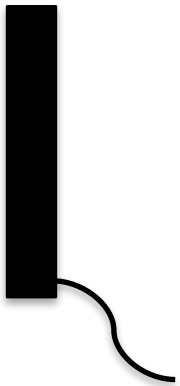
. Ballistic guide

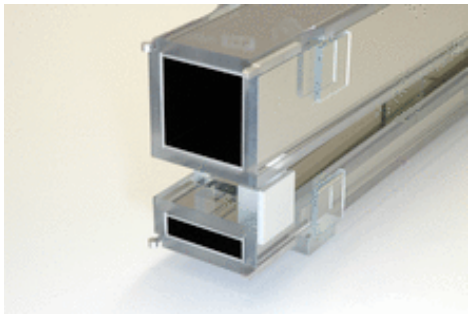
. Curved guide

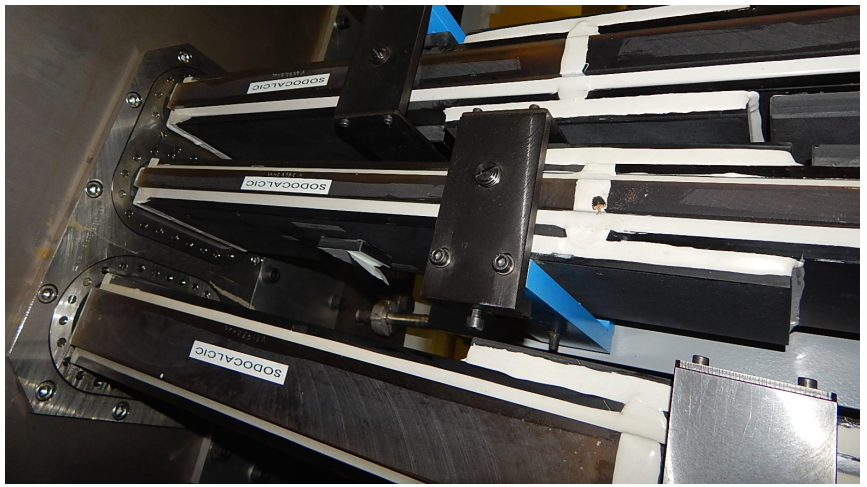


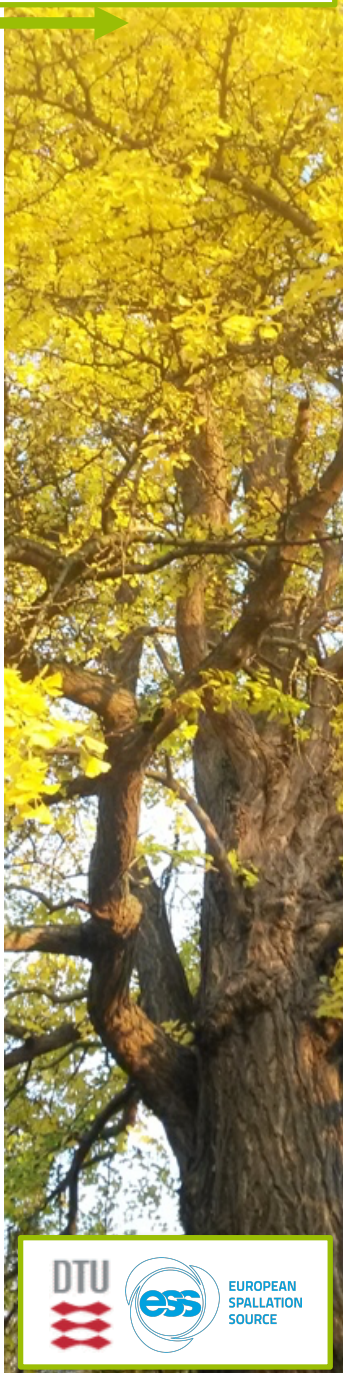
GUIDES

Neutron Transport

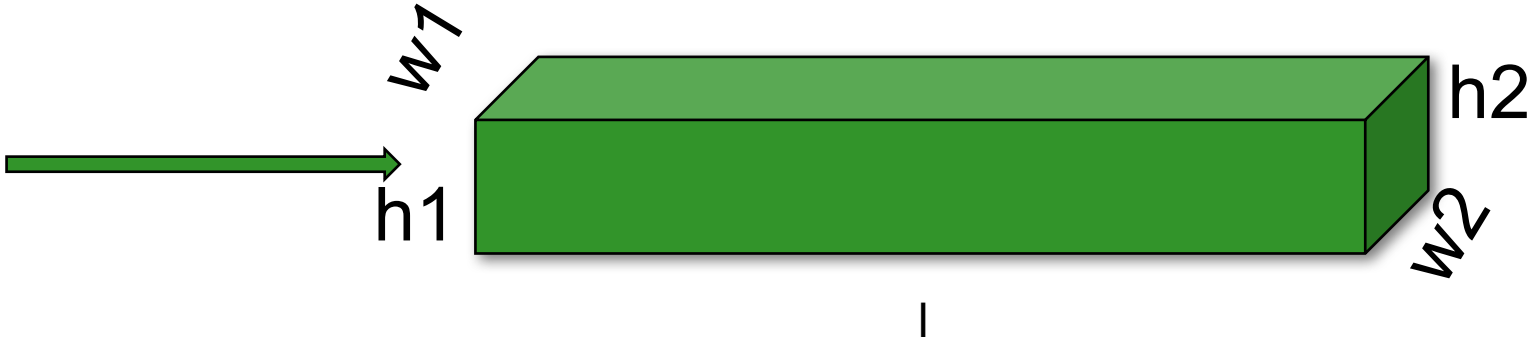


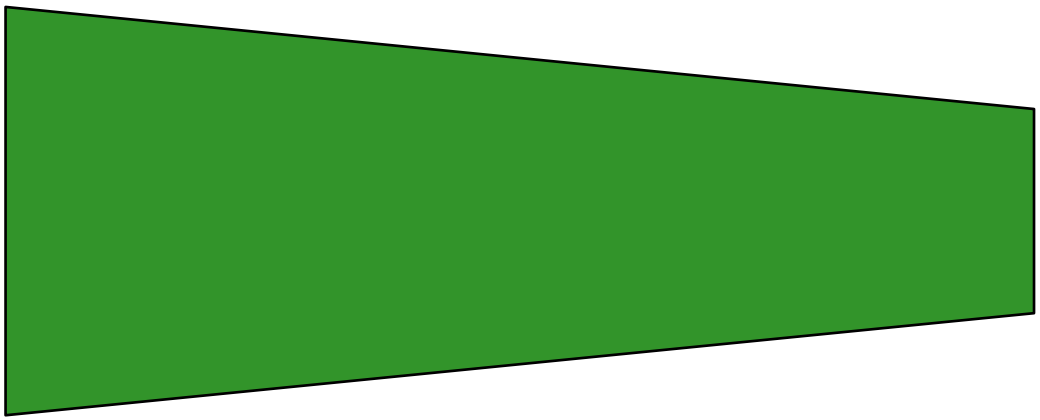


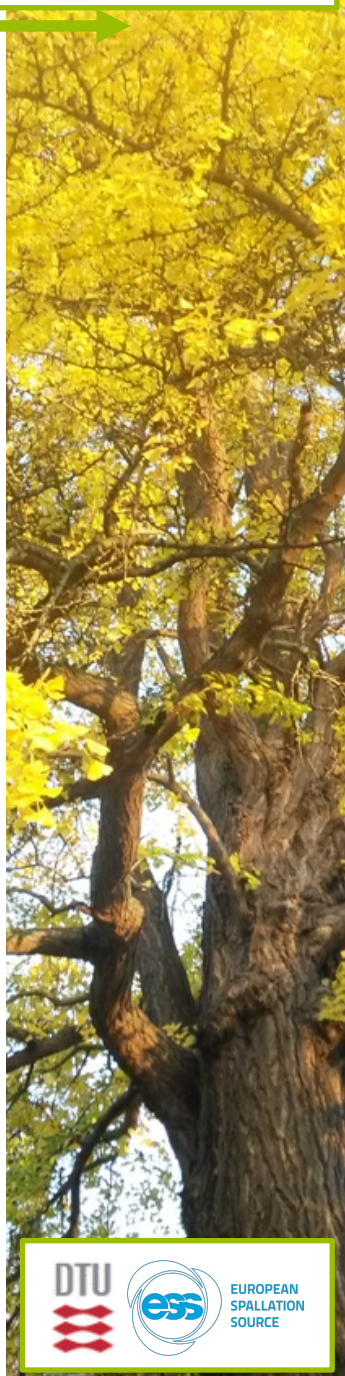


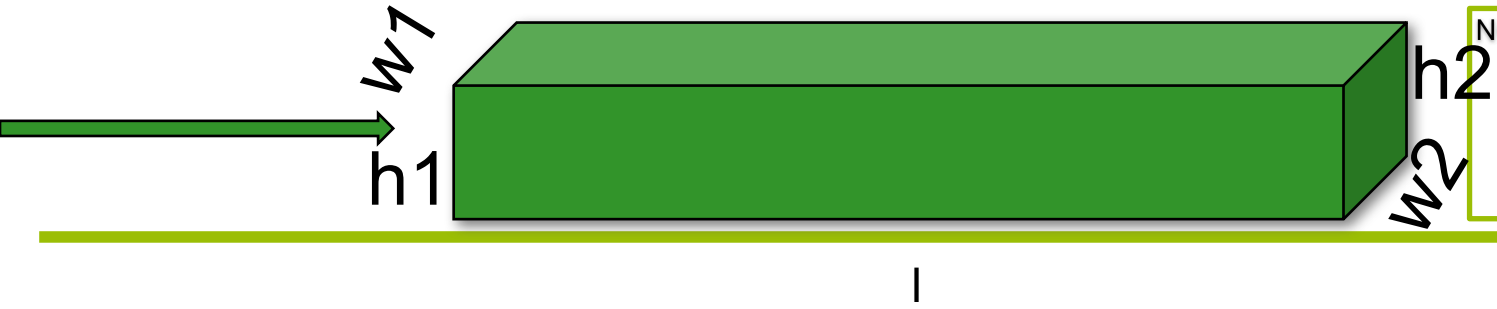


STRAIGHT GUIDE



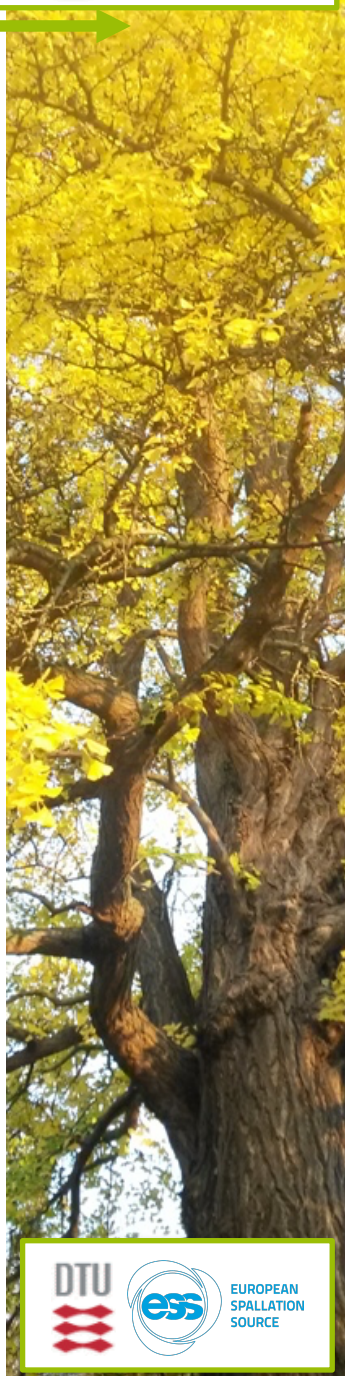




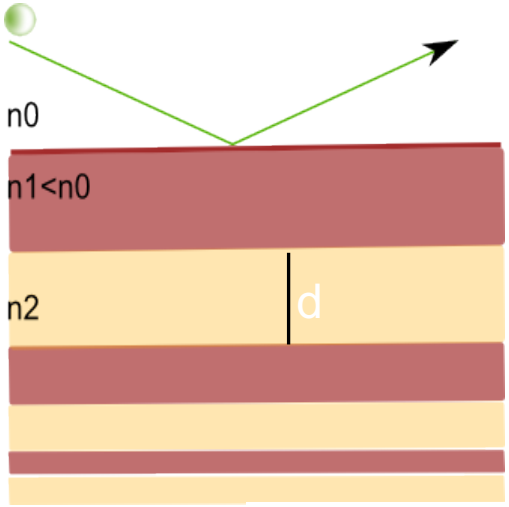


Parameters in **boldface** are required; the others are optional.

Name	Unit	Description	Default
reflect	str	Reflectivity file name. Format [q(Angs-1) R(0-1)]	0
w1	m	Width at the guide entry	
h1	m	Height at the guide entry	
w2	m	Width at the guide exit	
h2	m	Height at the guide exit	
l	m	length of guide	
R0	1	Low-angle reflectivity	0.99
Qc	AA-1	Critical scattering vector	0.0219
alpha	AA	Slope of reflectivity	6.07
m	1	m-value of material. Zero means completely absorbing.	2
W	AA-1	Width of supermirror cut-off	0.003



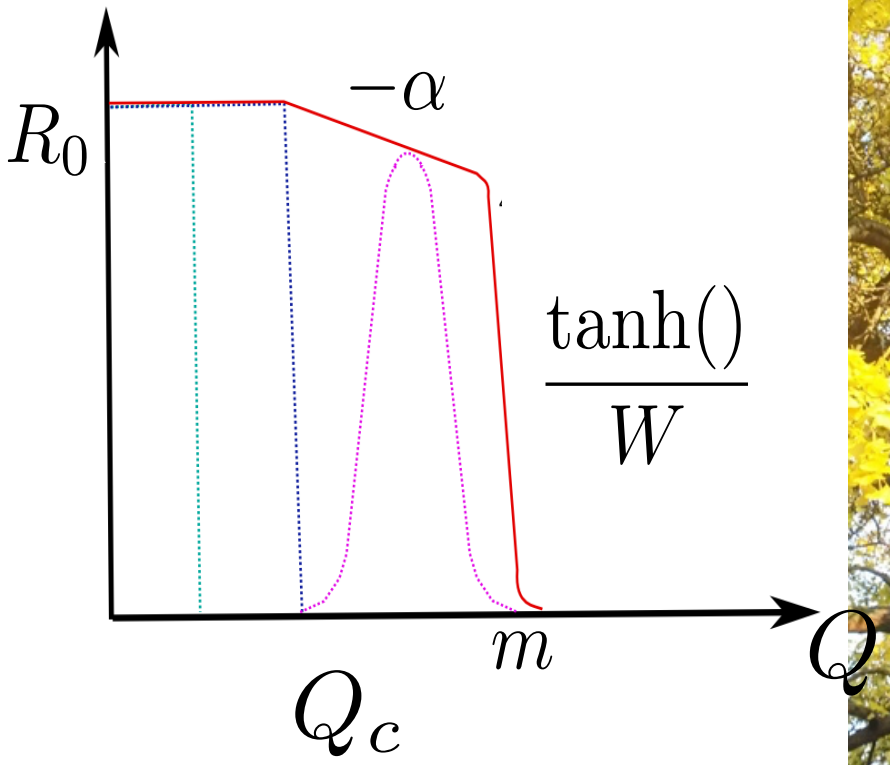
Supermirror Coating

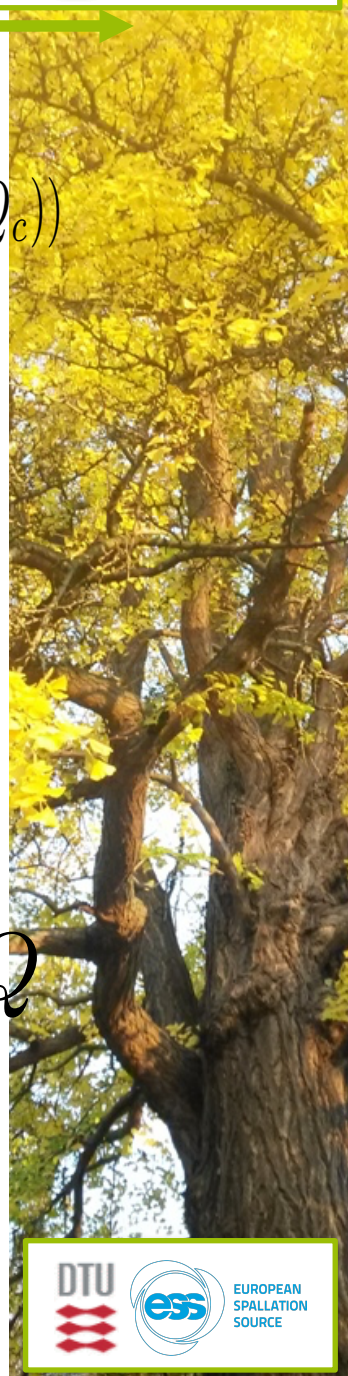


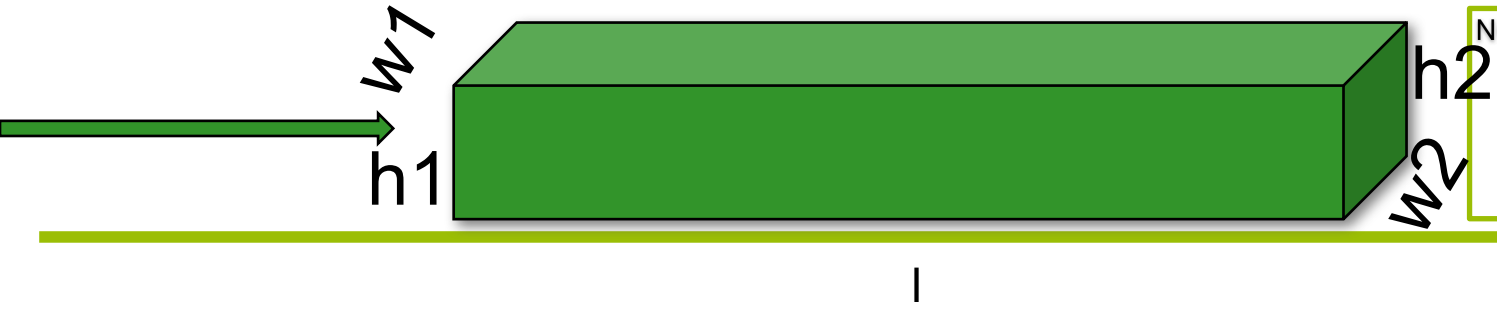
$$V = \frac{2\pi\hbar^2}{m} bN \qquad \sin\theta < \sqrt{\frac{mV}{2\pi^2\hbar^2}}\lambda$$

$$m = \frac{\theta_{mirror}}{\theta_{Ni}}$$

$$R_0 \cdot \left(1 - \frac{\tanh\left(Q - mQ_c\right)}{W}\right) \cdot \left(1 - \alpha(Q - Q_c)\right)$$







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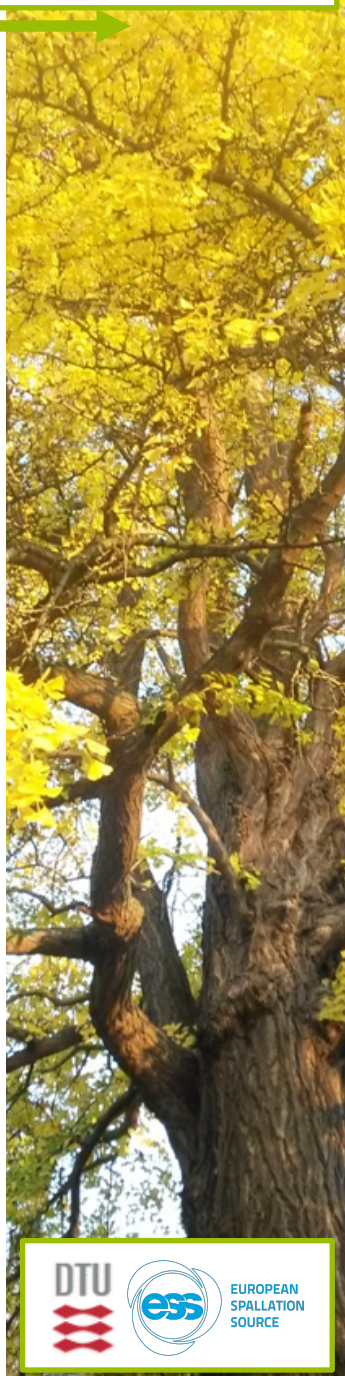
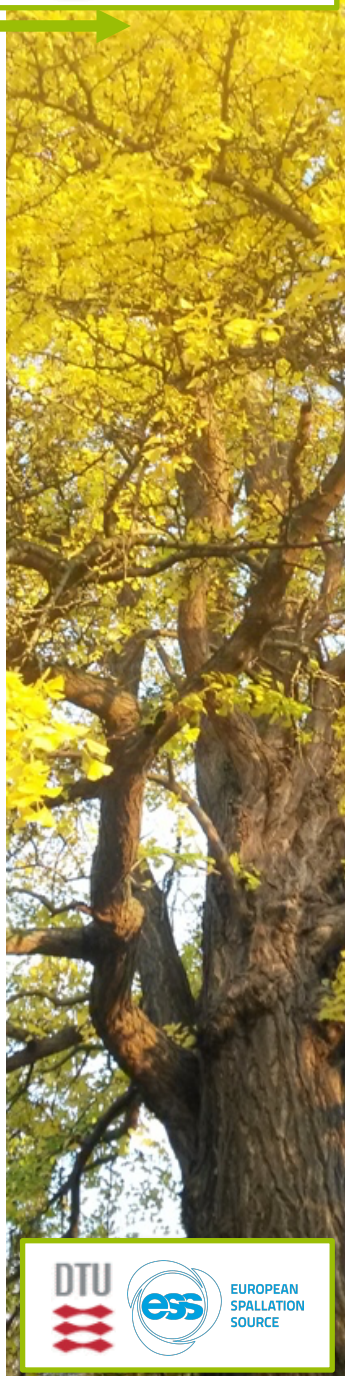
w1	m	Width at the guide entry	
h1	m	Height at the guide entry	
w2	m	Width at the guide exit	
h2	m	Height at the guide exit	
l	m	length of guide	
R0	1	Low-angle reflectivity	0.99
Qc	AA-1	Critical scattering vector	0.0219
alpha	AA	Slope of reflectivity	6.07
m	1	m-value of material. Zero means completely absorbing.	2
W	AA-1	Width of supermirror cut-off	0.003



Wanna try?

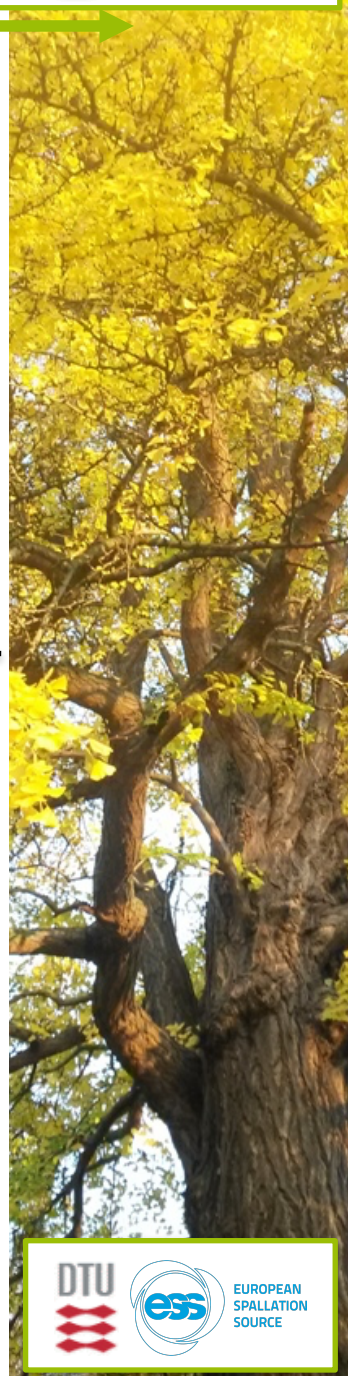


Ex_3_1_ballistic.instr

- Study the instrumentfile, notice use of the DECLARE and INITIALIZE sections
- Notice the use of Source_gen to describe the PSI cold source
- Notice the input parameter sa_pos, to vary the guide – sample position distance.

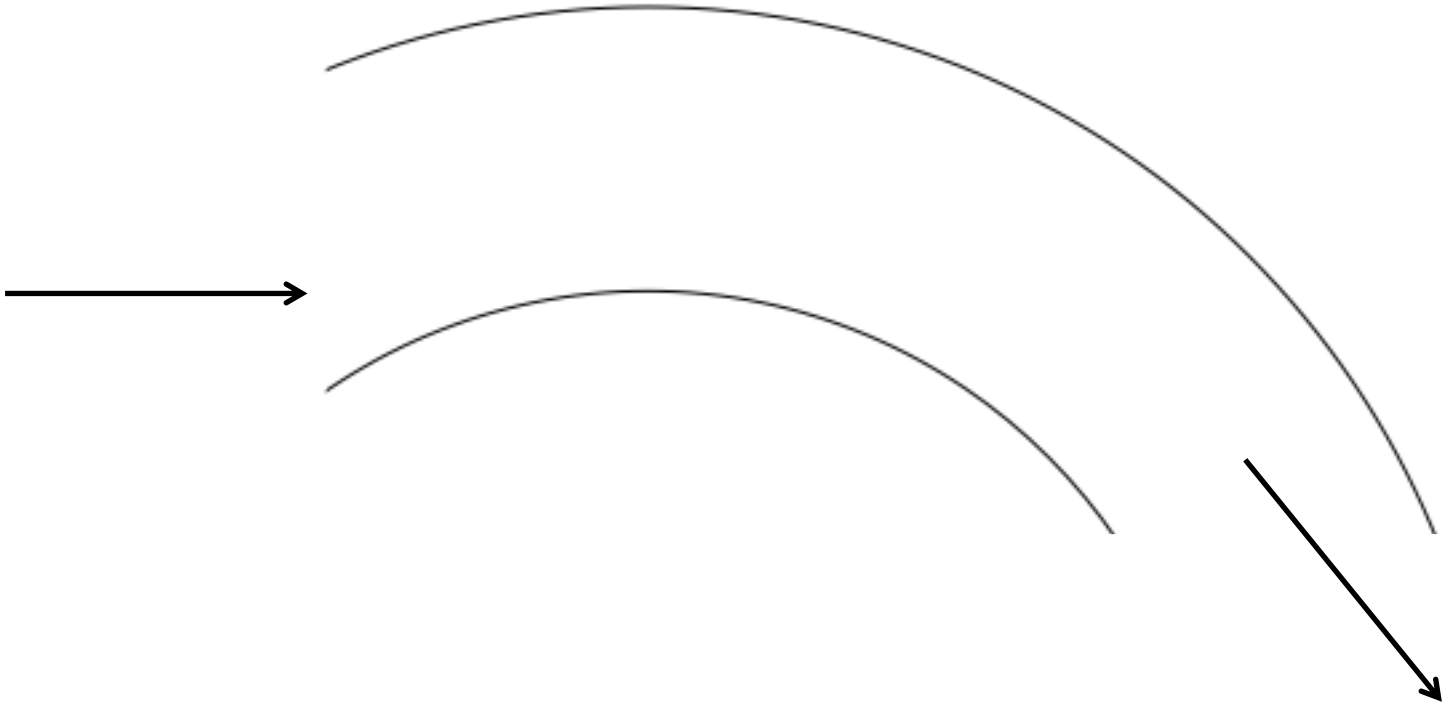
- **Insert a 30 m long guide at 3.5 meters from a1. Straight guide with a with of 5 cm an d height 15 cm.**
- **Use R0=R0, Qc=Qc, alpha = alpha, m = M, W =W**
- Simulate

GUIDE DESIGN

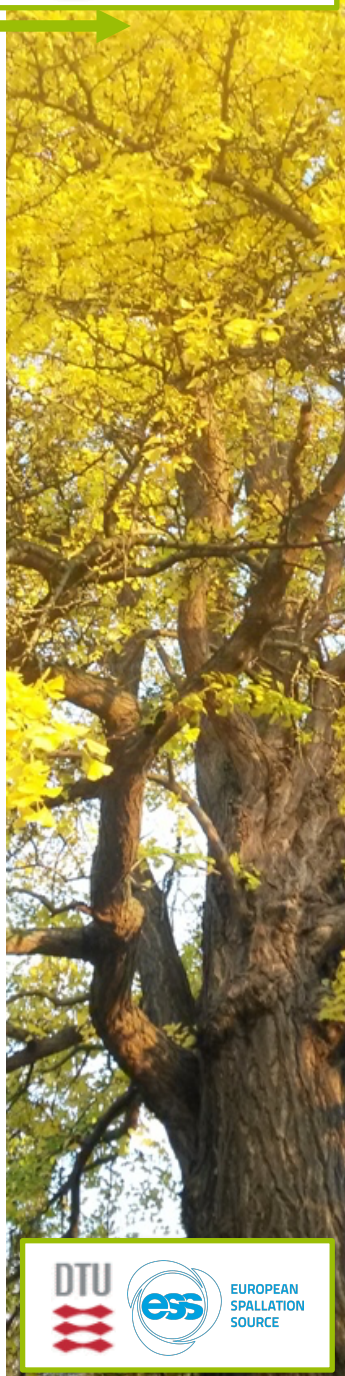


CURVED GUIDES

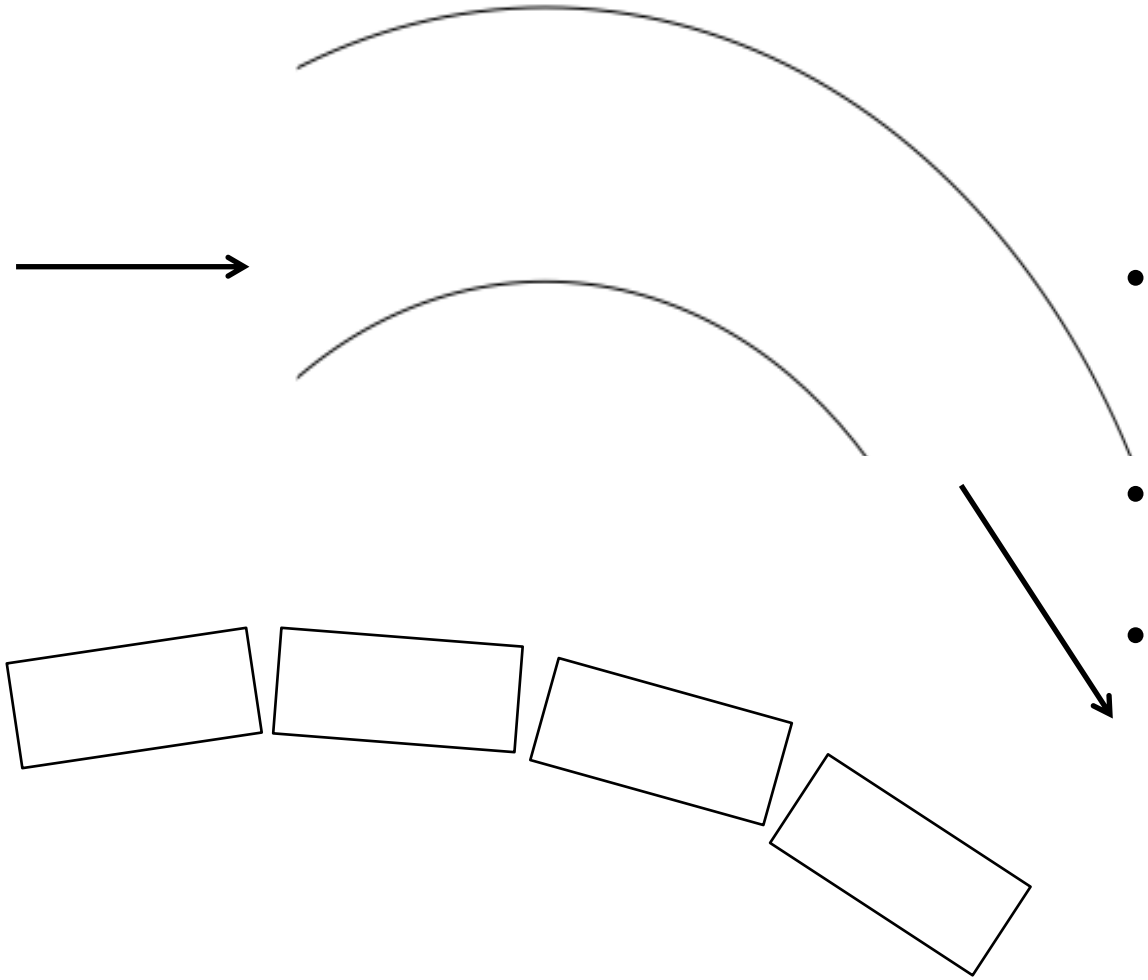
Getting out of direct line of sight



1 reflection per neutron mandatory to come out the other side of the guide

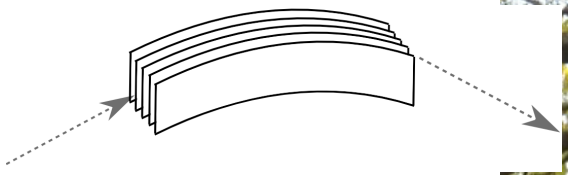


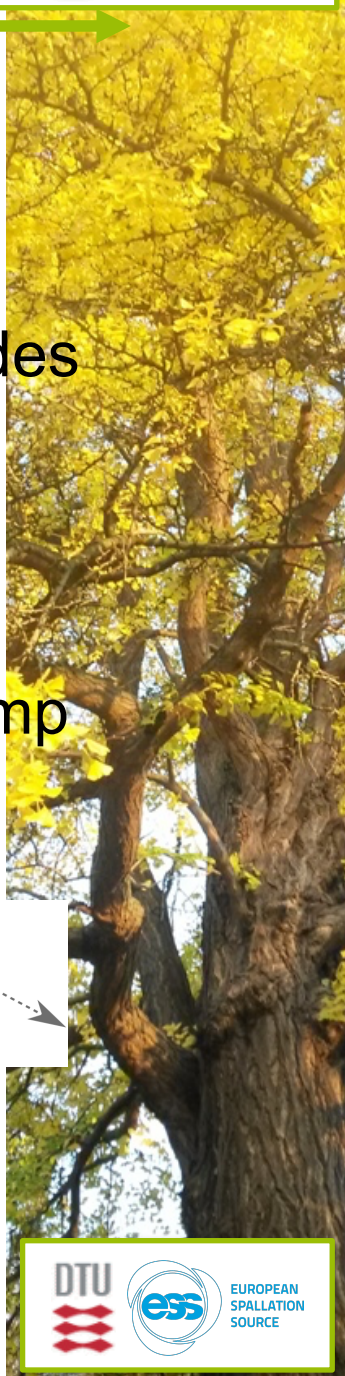
CURVED GUIDES



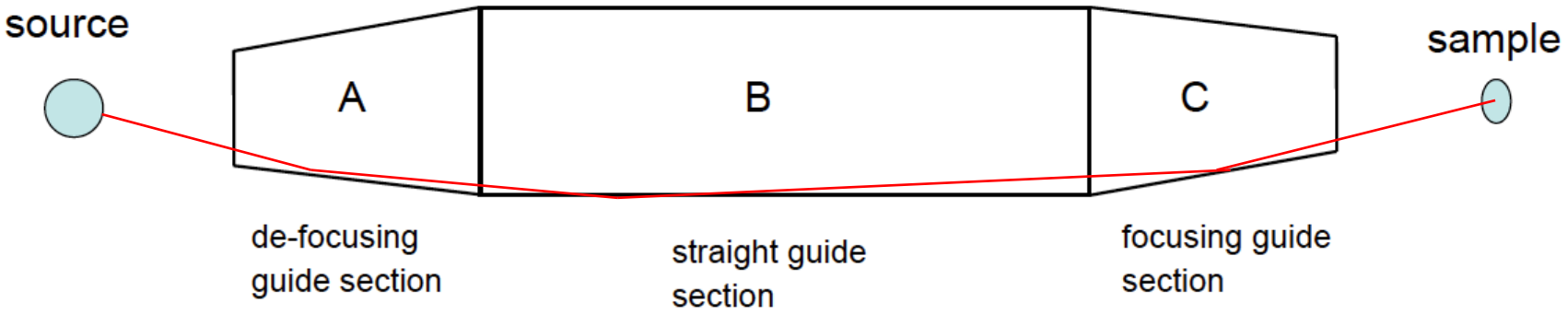
… in McStas

- Use straight guides & rotation
- Bender.comp
- curvedGuide.comp

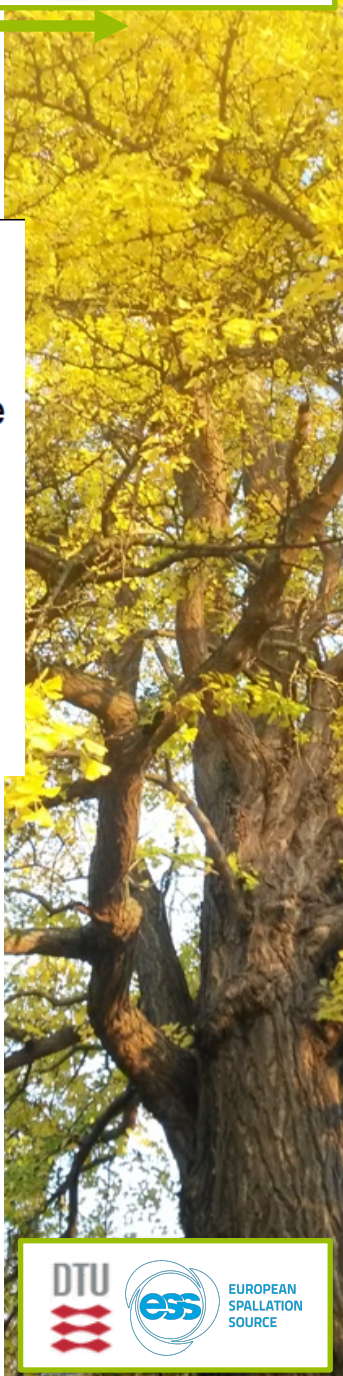




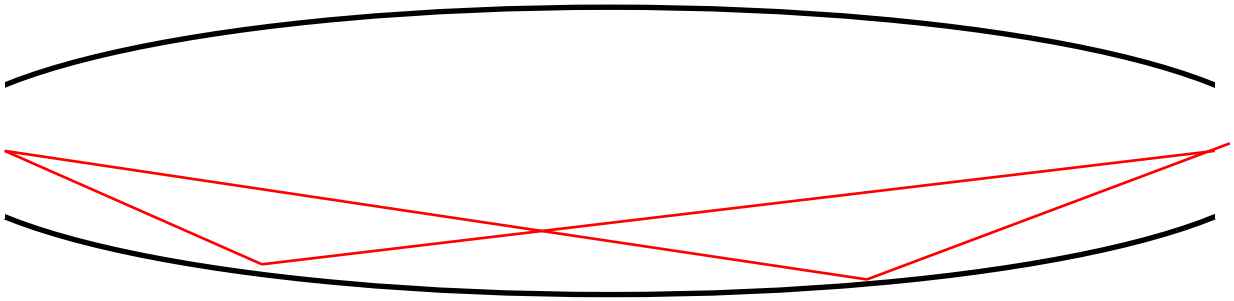
BALLISTIC GUIDE



Goal: high flux on sample

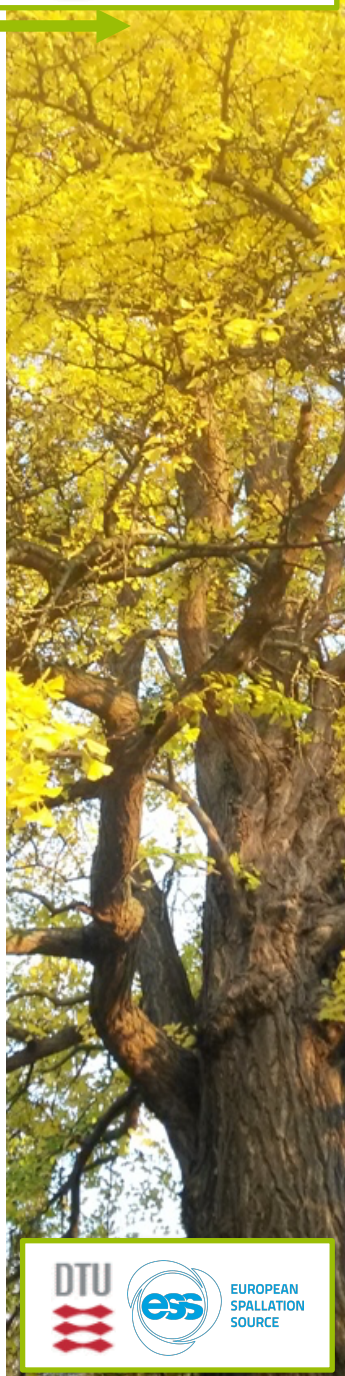


ELLIPTIC GUIDE



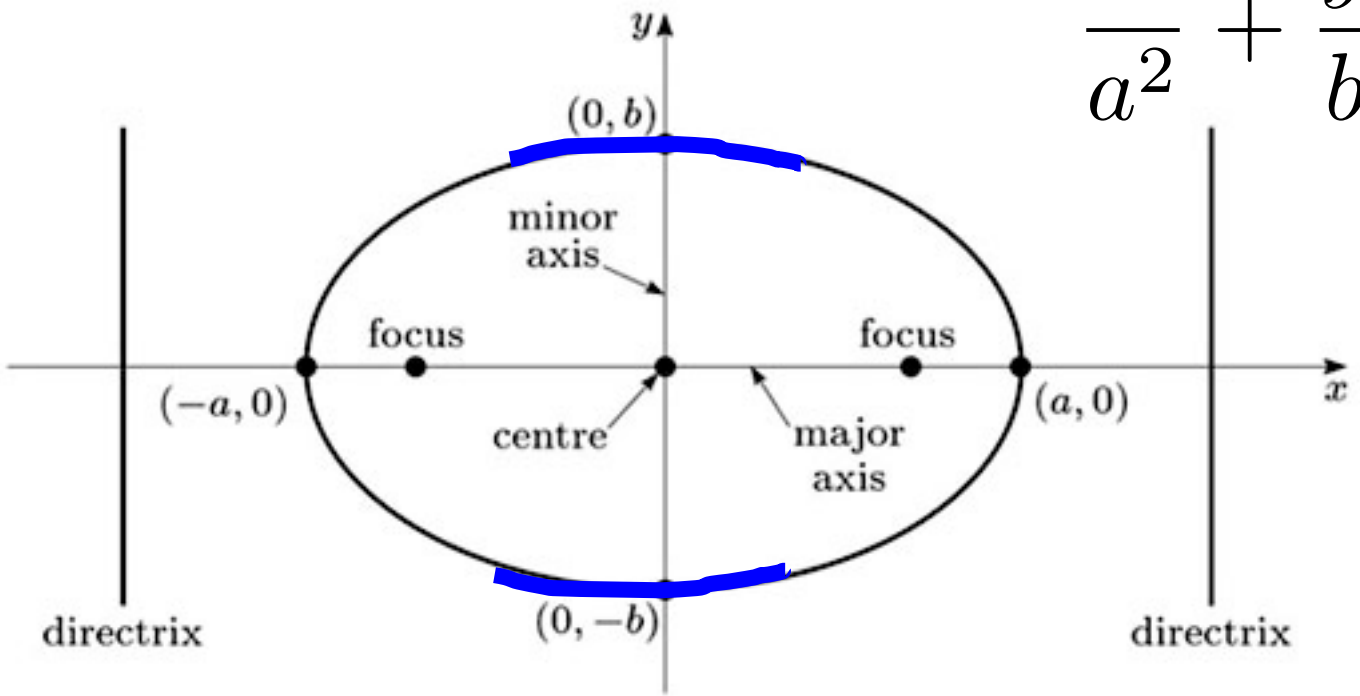
Few reflections - for transport loss in reflection cf next session

Focus on samples

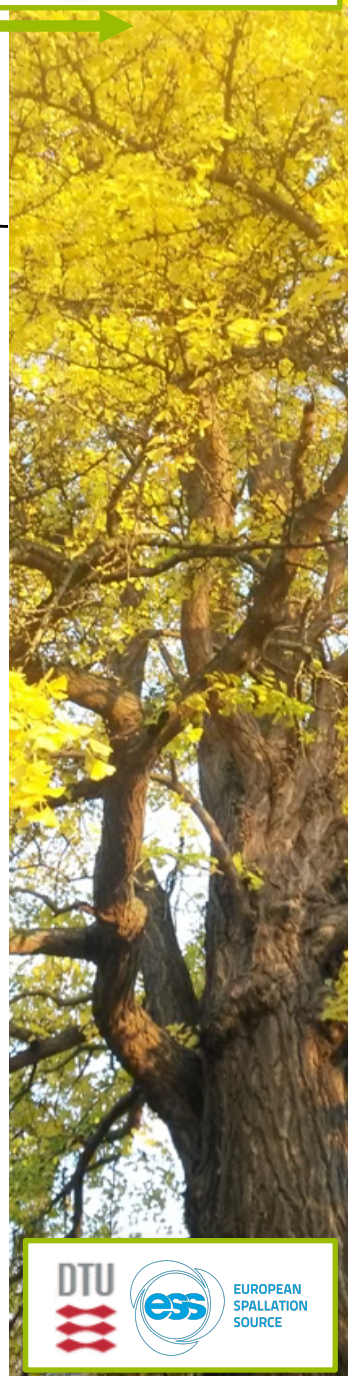


ELLIPTIC GUIDE

$$\frac{z^2}{a^2} + \frac{y^2}{b^2} = 1$$



Elliptic_guide_gravity(l=50,
linxw=5,linyh=5,loutxw=10,loutyh=10,
xwidth=0.1,yheight=0.1, R0 =
0.99,Qc=0.0219,alpha=6.07,m=1.0,W=0.003,
mvaluesright=marray,mvaluesleft=marray,mvaluestop=marr
ay,mvaluesbottom=marray)



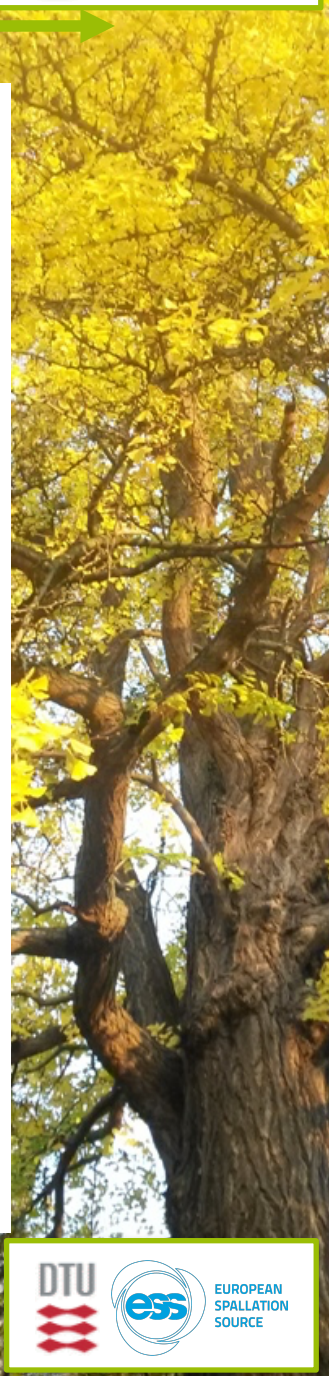
ELLIPTIC GUIDE

Input parameters

Parameters in **boldface** are required; the others are optional.

Name	Unit	Description	Default
mvaluesright	pointer	Pointer to array of m-values, right mirror	NULL
mvaluesleft	pointer	- same, left mirror	NULL
mvaluestop	pointer	- same, top mirror	NULL
mvaluesbottom	pointer	- same, bottom mirror	NULL
seglength	pointer	Pointer to array of segment lengths for discrete mirror description	NULL
l	m	length of the guide	
xwidth	m	width at the guide entry, mid or exit (see dimensionsAt)	0
yheight	m	height at the guide entry, mid or exit (see dimensionsAt)	0
linxw	m	distance from 1st focal point to guide entrance - left and right horizontal mirrors	0
loutxw	m	distance from 2nd focal point to guide exit - left and right horizontal mirrors	0
linyh	m	distance from 1st focal point to guide entrance - top and bottom vertical mirrors	0
loutyh	m	distance from 2nd focal point to guide exit - top and bottom vertical mirrors	0
majorAxisxw	m	direct defination of the guide geometry, will ignore w,h lin and lout parameters if this is nonzero. Length of the axis parallel to the z for the horizontal ellipse	0
minorAxisxw	m	direct defination of the guide geometry, will ignore w,h lin and lout parameters if this is nonzero. Length of the axis Perpendicular to the z for the horizontal ellipse	0
majorAxisyh	m	direct defination of the guide geometry, will ignore w,h lin and lout parameters if this is nonzero. Length of the axis parallel to the z for the vertical ellipse	0
minorAxisyh	m	direct defination of the guide geometry, will ignore w,h lin and lout parameters if this is nonzero. Length of the axis Perpendicular to the z for the vertical ellipse	0
majorAxisoffsetxw	m	direct defination of the guide geometry, distance between the center of the horizontal ellipse and the guide entrance	0
majorAxisoffsetyh	m	direct defination of the guide geometry, distance between the center of the vertical ellipse and the guide entrance	0
dimensionsAt	string	define whether xwidth and yheight sets the size of he opening, minor axis or the end of the guide.	"entrance"
option	string	options are 'ellipse' and 'halfEllipse'. Ellipse is defined by both the focal points, while halfEllipse locked the center of the ellipse either the entrance or exit of the guide, and use the focal point of the other end to define the ellipse	"ellipse"
R0	1	Low-angle reflectivity	0.99
Qc	AA-1	Critical scattering vector	0.0218
alpha	AA	Slope of reflectivity	6.07
m	1	m-value of material for all mirrors, zero means complete absorption.	2
W	AA-1	Width of supermirror cut-off	0.003
alpharight	AA	Slope of reflectivity for right vertical mirror	-1
mright	1	m-value of material for right vertical mirror	-1
alphaleft	AA	Slope of reflectivity for left vertical mirror	-1
mleft	1	m-value of material for left vertical mirror	-1
alphatop	AA	Slope of reflectivity for top horizontal mirror, overwrites alpha	-1
mtop	1	m-value of material for top horizontal mirror, overwrites m	-1
alphabottom	AA	Slope of reflectivity for bottom horizontal mirror	-1
mbottom	1	m-value of material for bottom horizontal mirror	-1
verbose	bool	Give extra information about calculations	"on"
curvature	m	Simulate horizontal radius of curvature by centripetal force added to the gravity. Note: Does not curve the guide in mcdisplay but "curves the neutron". Has opposite sign definition of Guide_curved.	0

- Gravity compatible
- Define your geometry as is convenient to you
- Chop the guide into segments
- Define reflectivity for each side



EUROPEAN SPALLATION SOURCE

OTHER McStas GUIDES

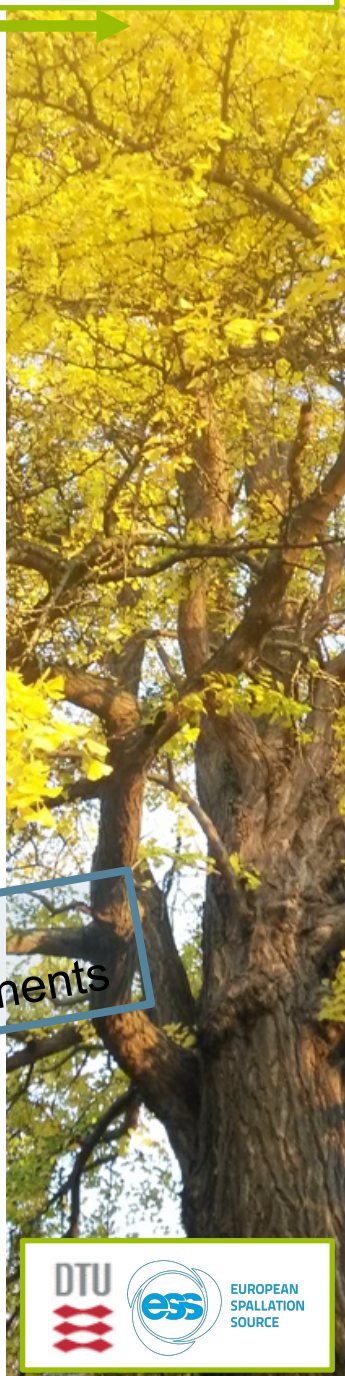
- Elliptic_guide_gravity.comp
- Guide_anyshape.comp
- Guide_channeled.comp
- Guide_curved.comp
- Guide_four_side_10_shells.comp
- Guide_four_side_2_shells.comp
- Guide_four_side.comp
- Guide_gravity.comp
- Guide_honeycomb.comp
- Guide_tapering.comp
- Guide_wavy.comp
- Guide.comp
- Pol_guide_vmirror.comp

Have fun with elliptic guides

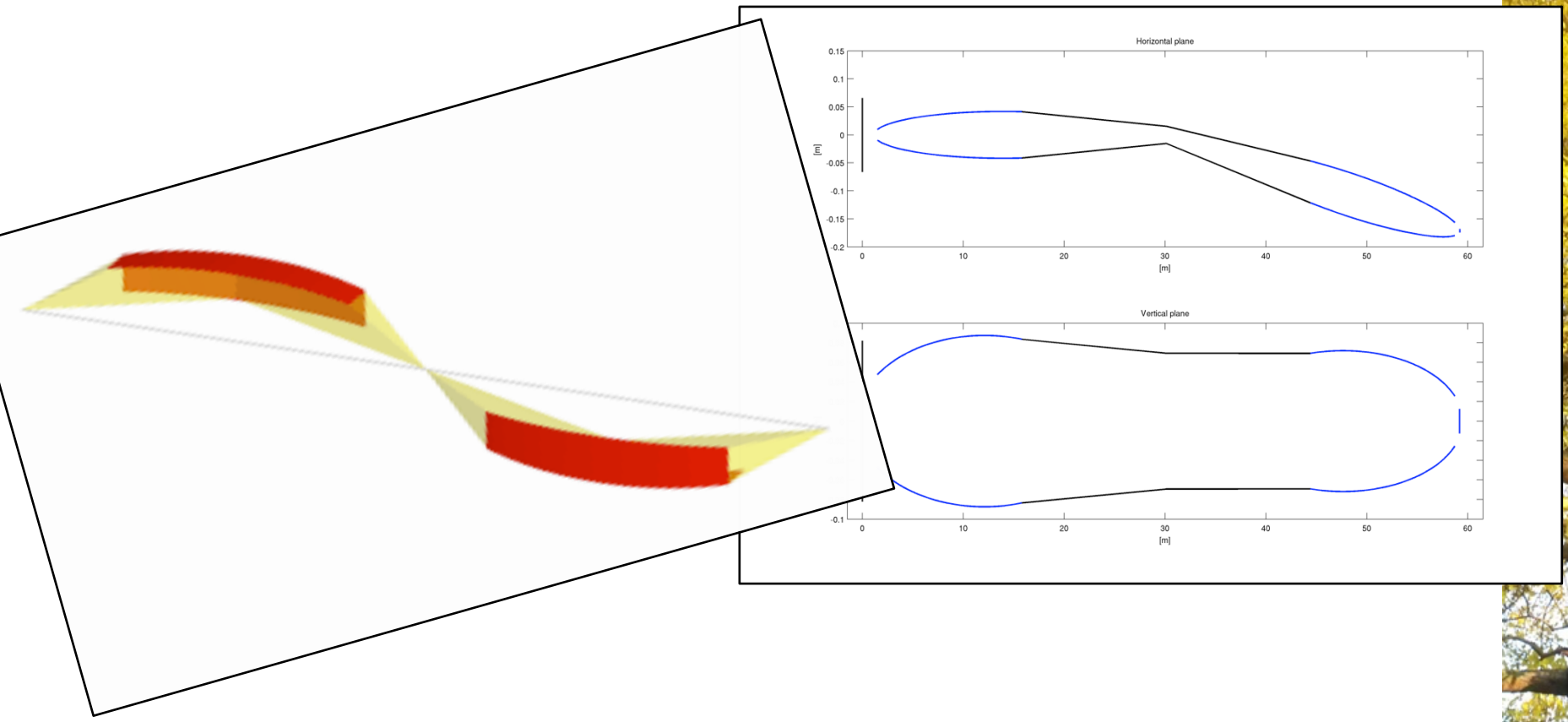
Add gravity to your simulation

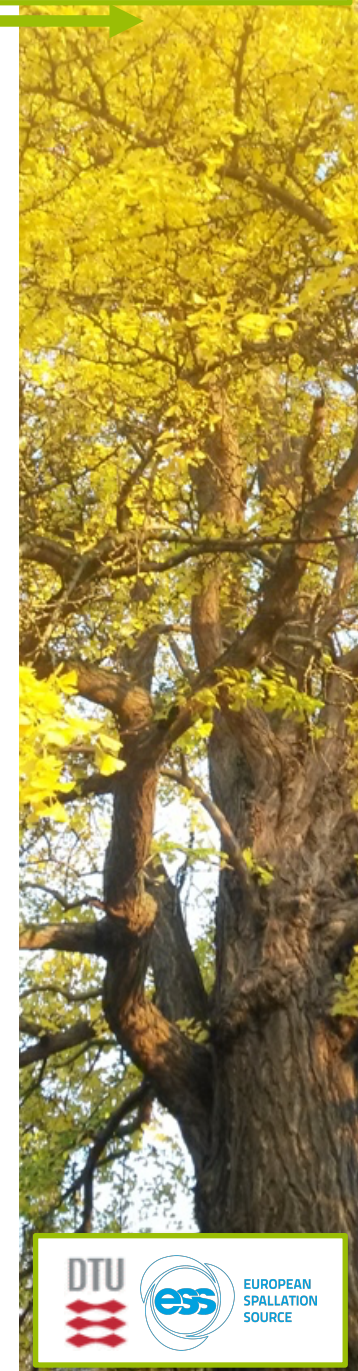
Think of fantastic shapes and import their .OFF description

Curious? Lost? Need help?
Try $ mcdoc or visit http://mcstas.org/download/components



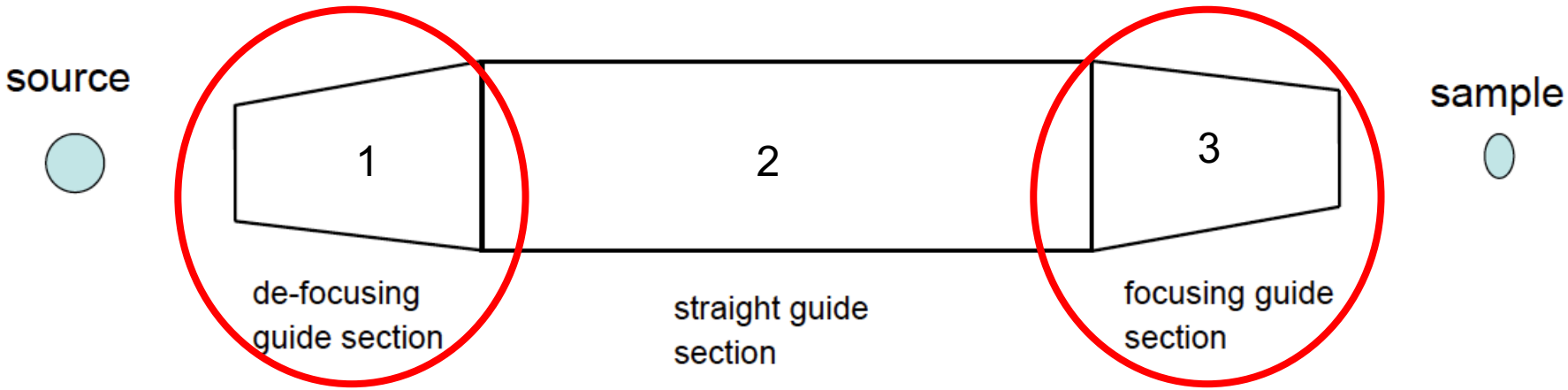
…stir and combine…

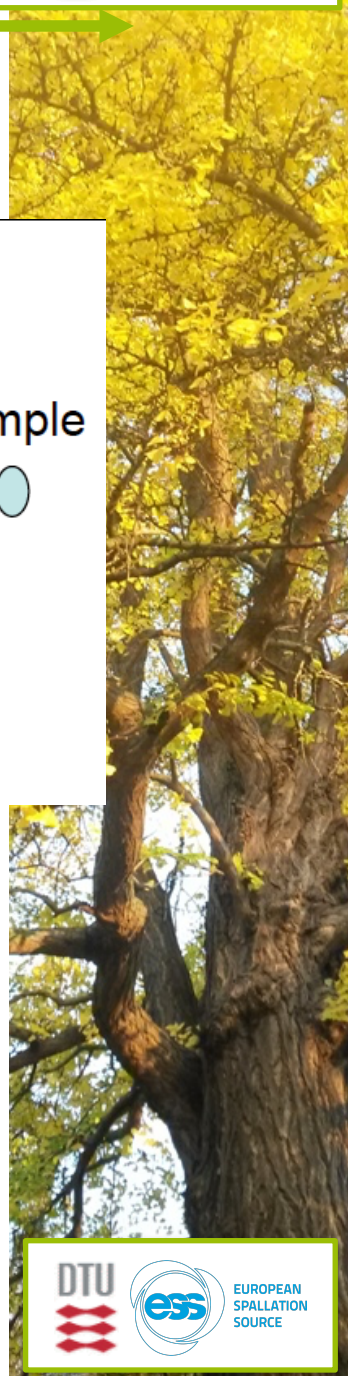




BALLISTIC GUIDE

Ex_3_2_ballistic.instr





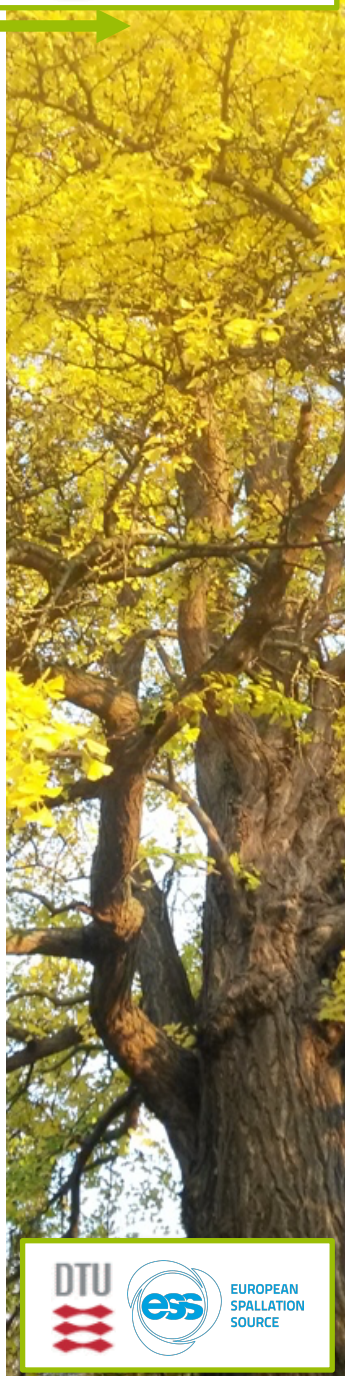
BALLISTIC GUIDE

- **Open the instrumentfile Ex_3_1_ballistic.instr**

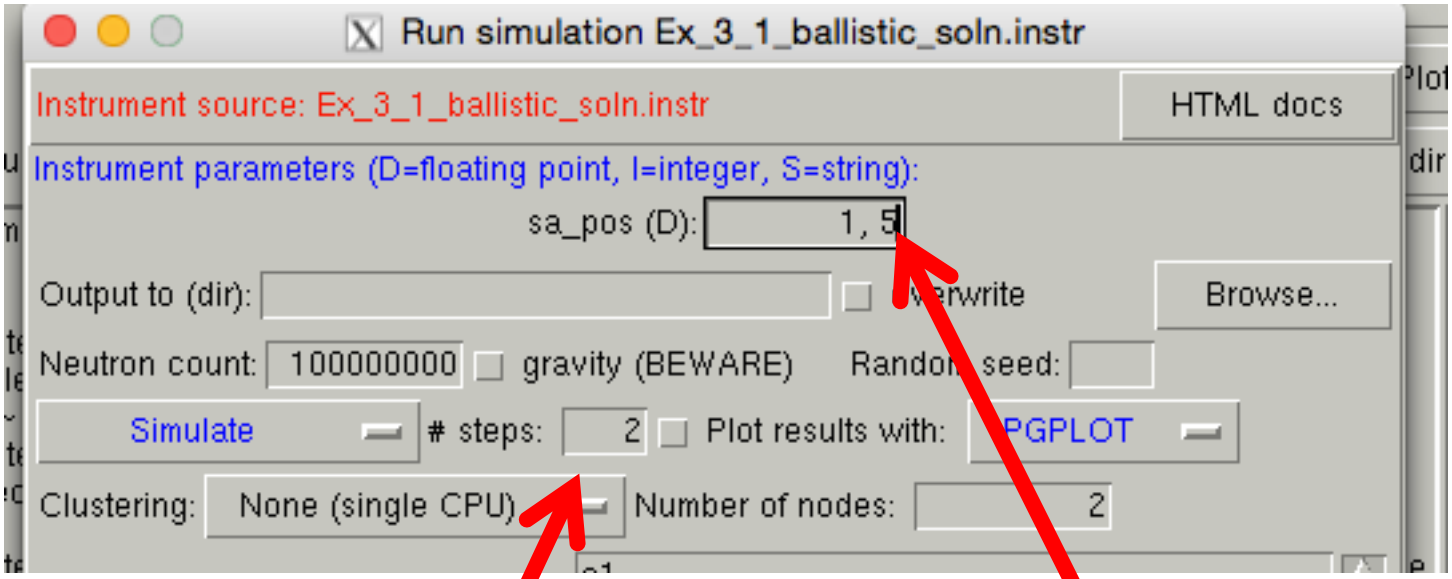
- Look at guide2. What exit(entry) dimensions do guide1 & 3 need?

- **Insert guide1** with an entry opening of w1=0.03m, h1=0.1m, length 3 m at 0.5m from a1
- **Insert guide3** with an exit opening of w2=0.03, length 3 m at 33.5m from a1

- For both guides, use the coating parameters from guide2

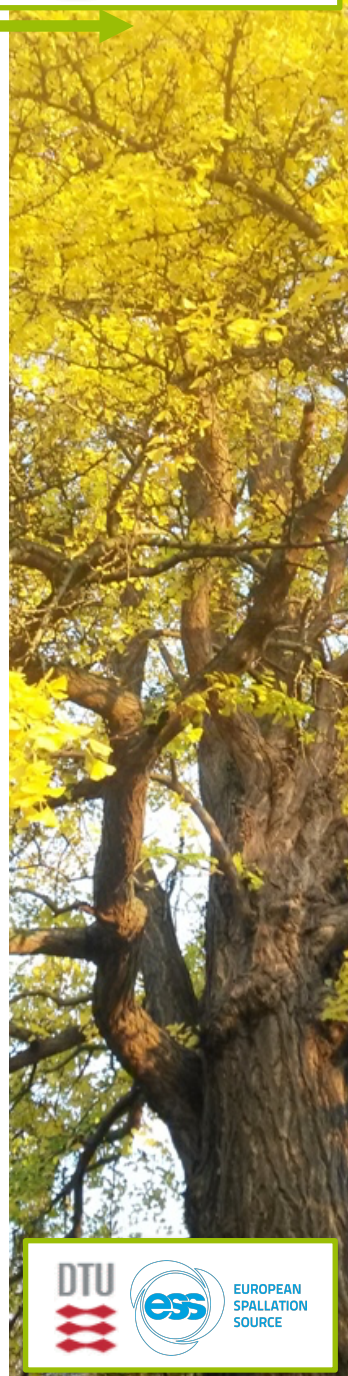


SCAN FUNCTION



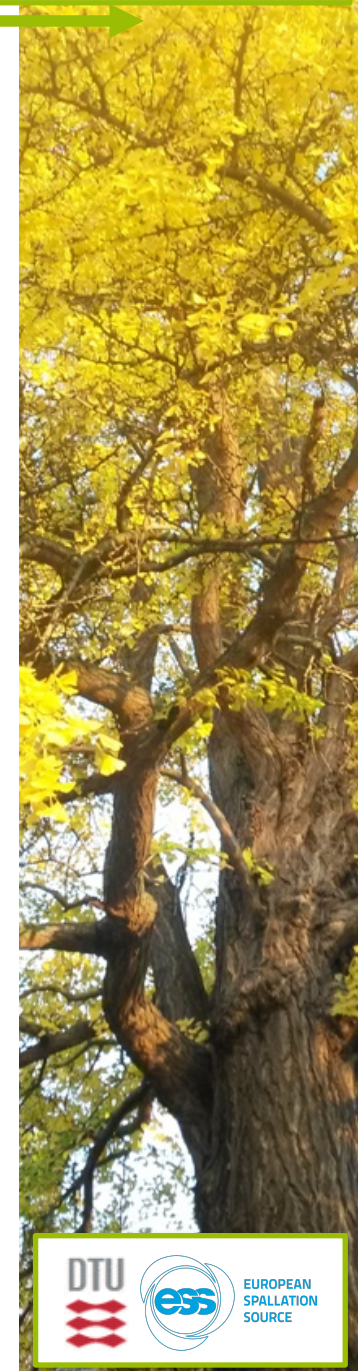
Give the interval to be scanned directly in the parameter position in the form lower_lim, upper_lim

Indicate the number of steps

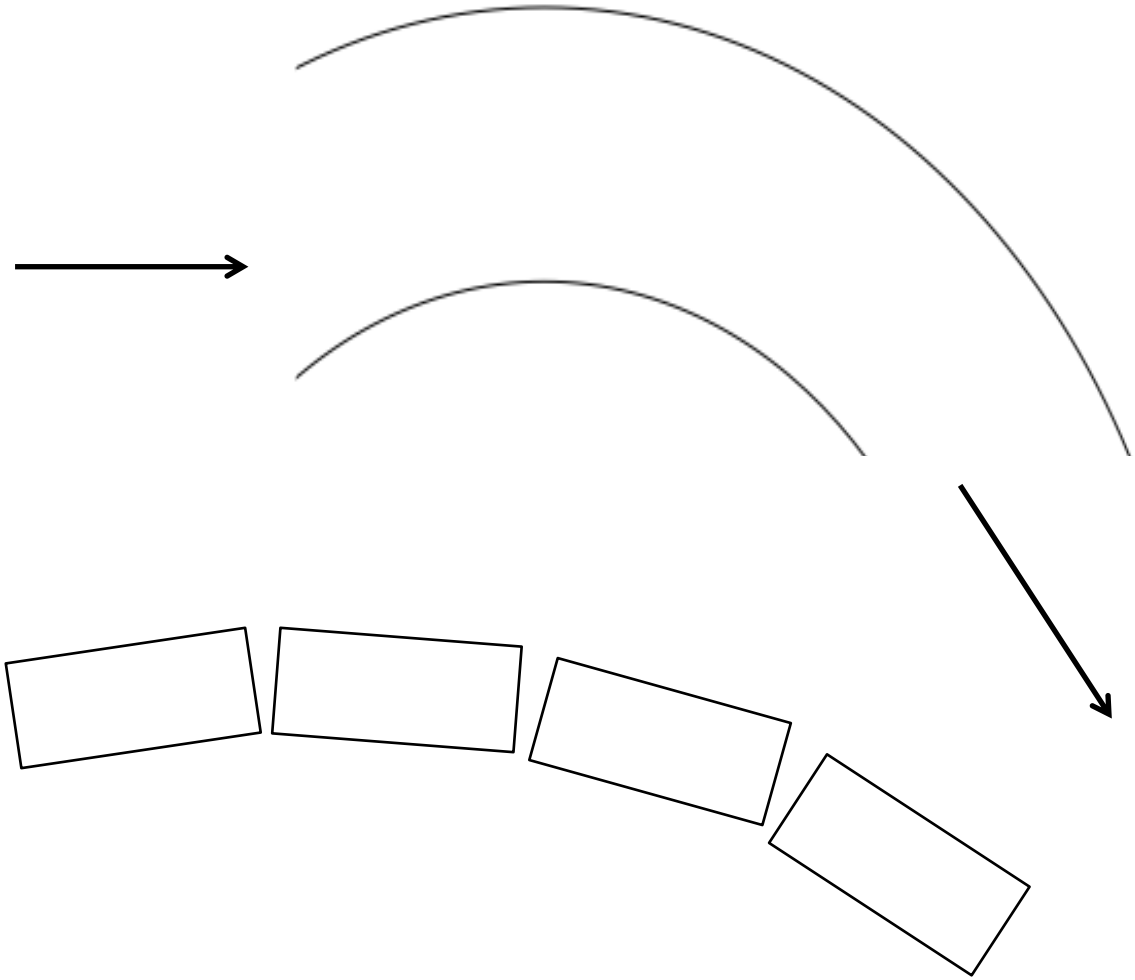


BALLISTIC GUIDE

- Compile and TRACE to have an **overview of the instrument**.
- **Run a simulation** and notice the wavelength distribution before and after guide.
- **Task:** Scan sa_pos between 0 and 1 m in 11 steps. Notice the effect on beam profiles and divergence.

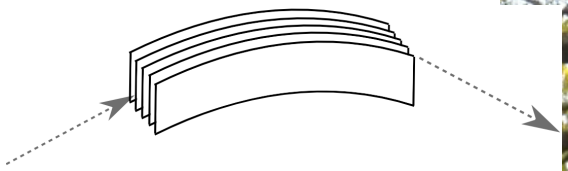


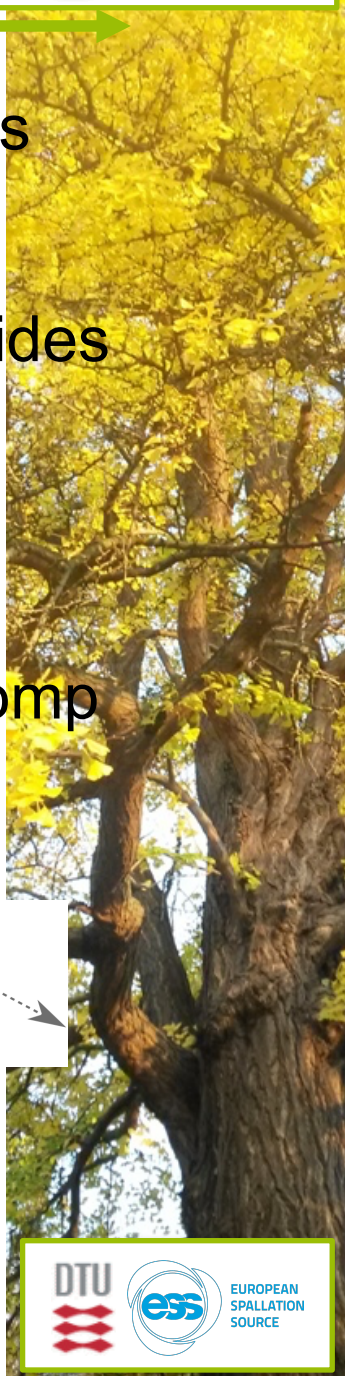
CURVED GUIDES



… in McStas

- Use straight guides & rotation
- Bender.comp
- curvedGuide.comp





CURVED GUIDES

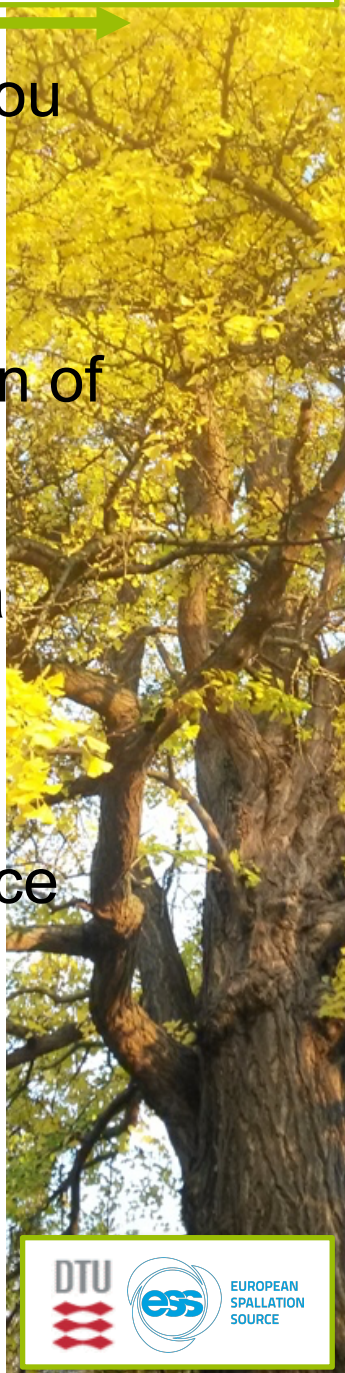
- Open the instrument file **Ex_3_2_curved.instr** given to you

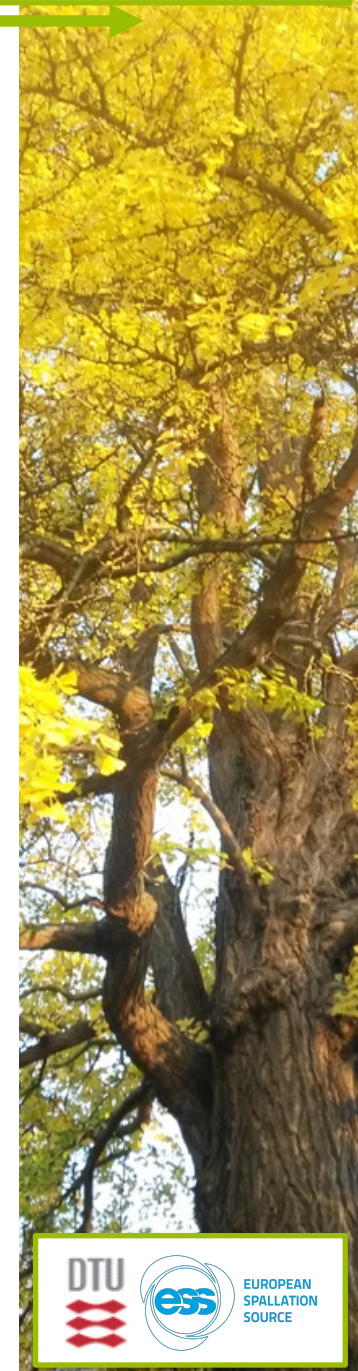
- Study the instrument file, notice use of the PREVIOUS keyword
- Notice input parameters of guide m-value, angular rotation of guide segments

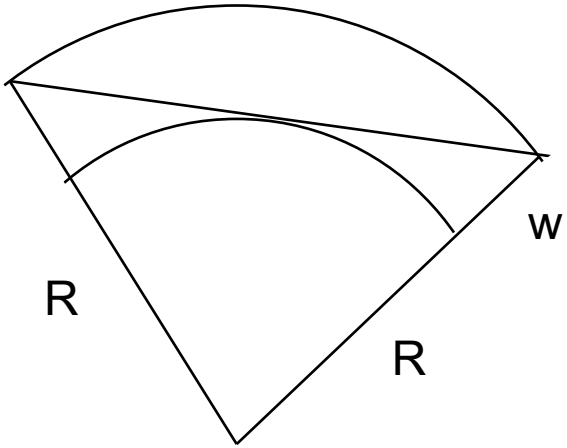
- Question: What is the relevant rotation angle to achieve a guide curvature of 1 km?

- Try performing a TRACE
- Try varying the guide curvature, notice effect on divergence and beam profile

Other curved guides:
Use McDoc -> Component Library Index to look at Guide_curved plus Bender from the McStas lib



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