

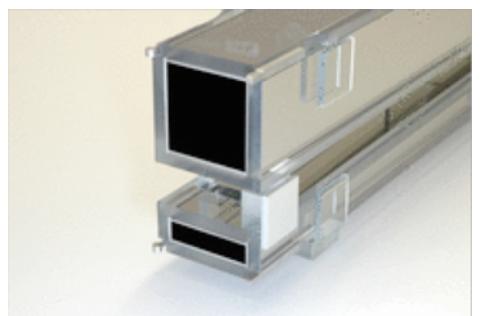
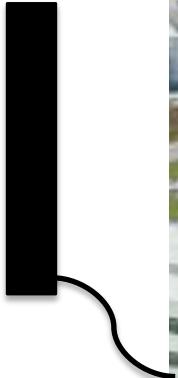
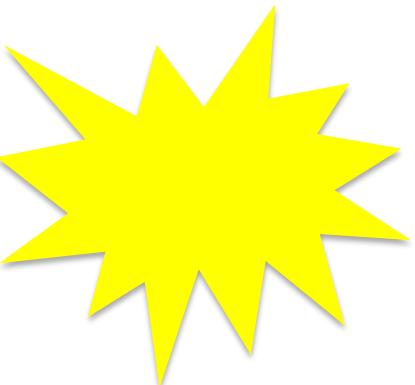
Optics, guides

- **Guides**
 - . *Straight guide*
 - . *Ballistic guide*
 - . *Curved guide*

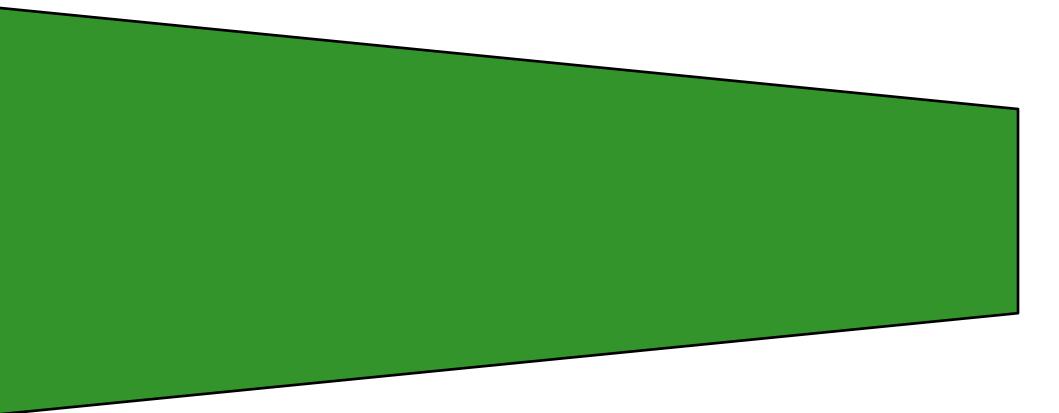
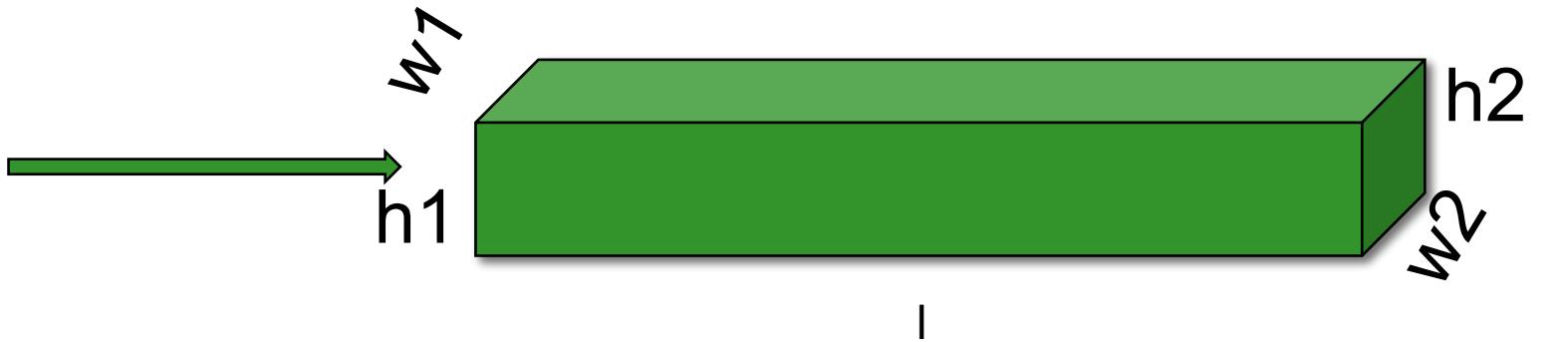


GUIDES

Neutron Transport



STRAIGHT GUIDE





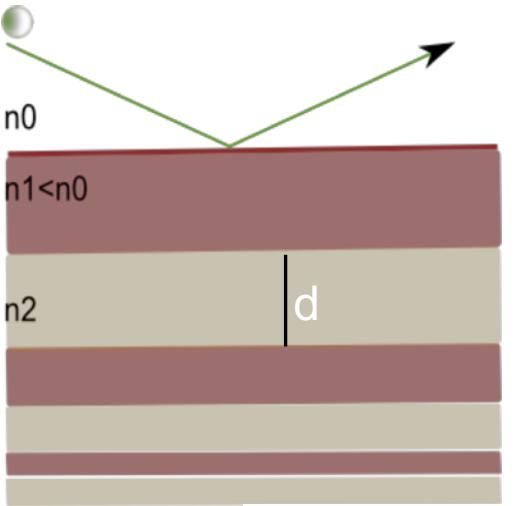
|

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



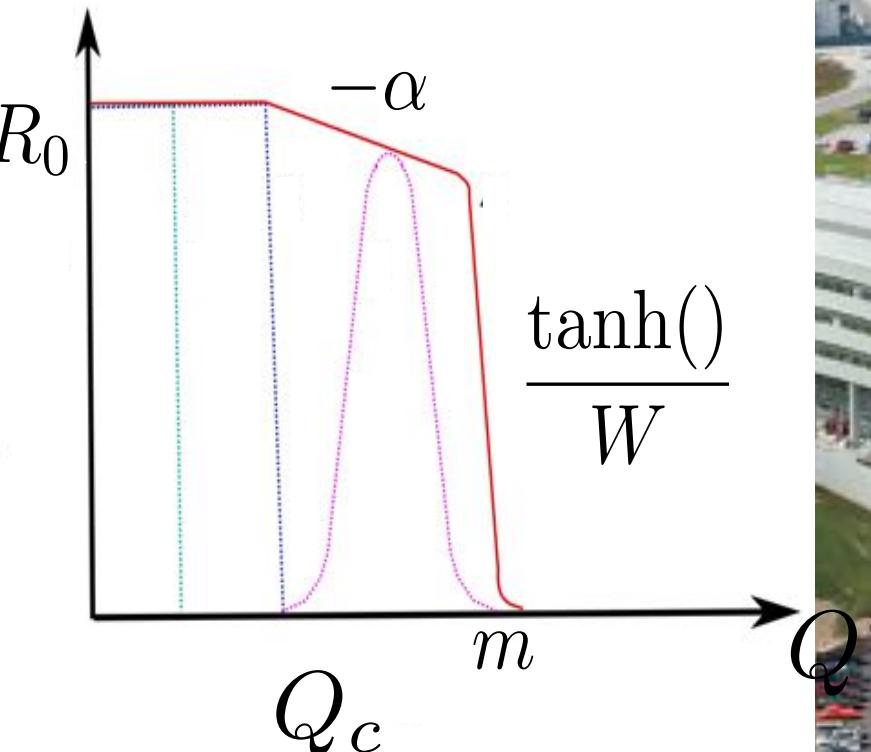
Supermirror Coating

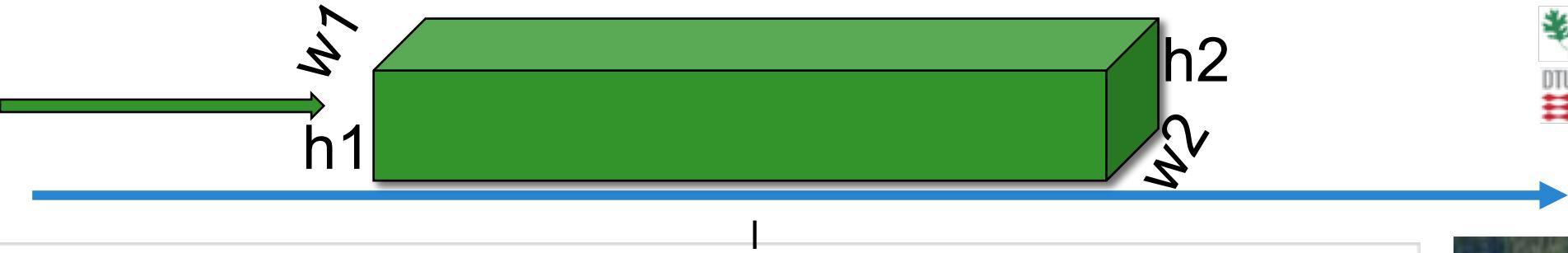


$$V = \frac{2\pi\hbar^2}{m} bN \quad \sin\theta < \sqrt{\frac{mV}{2\pi^2\hbar^2}}\lambda$$

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

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





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
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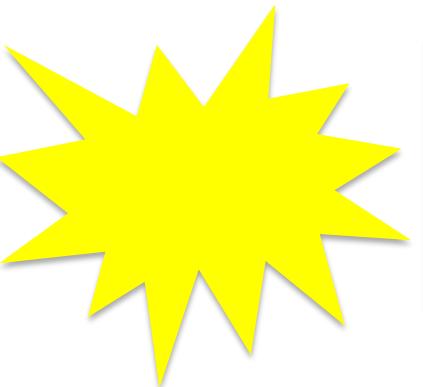
| Wanna try?

A simple, straight guide



- 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 width of 5 cm and height 15 cm.***
- ***Use R0=R0, Qc=Qc, alpha = alpha, m = M, W =W***
- ***Simulate***

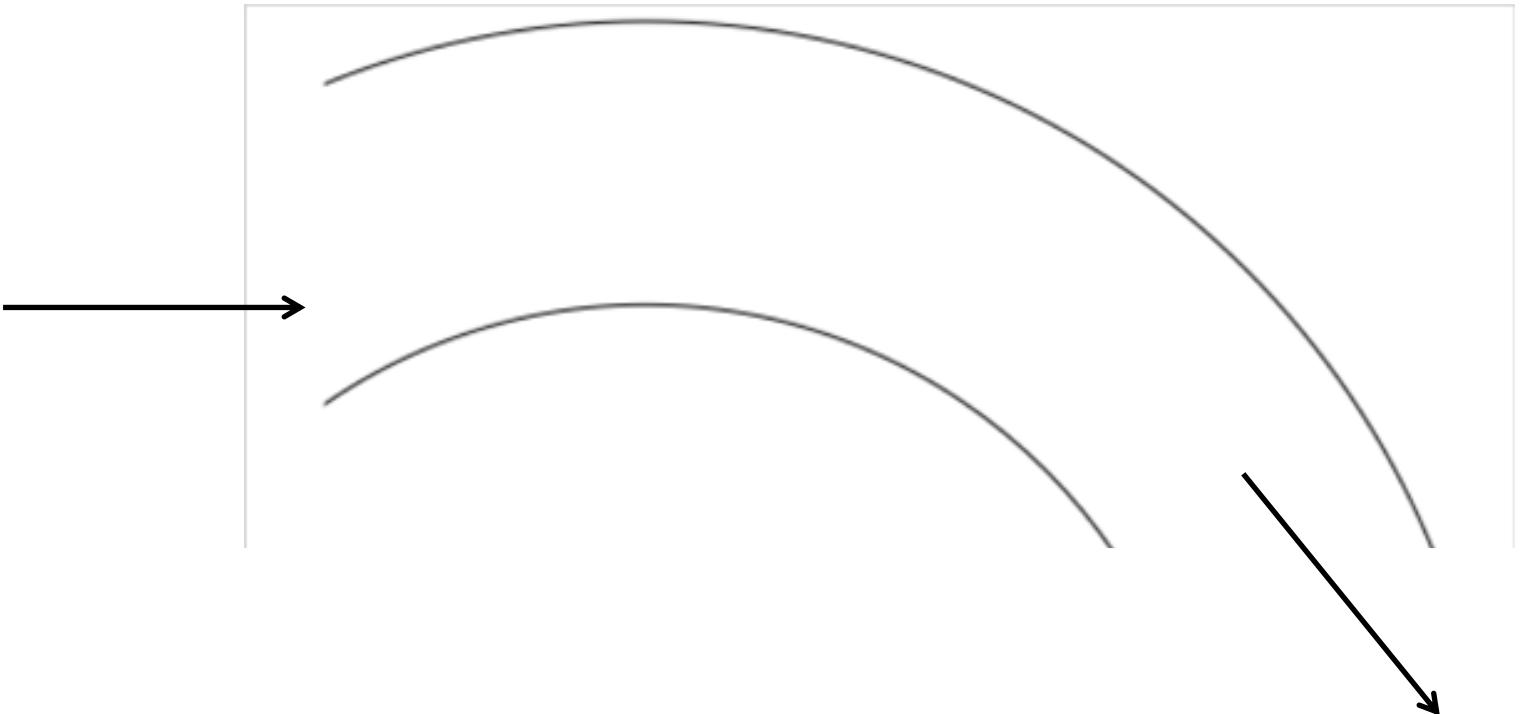
Ex_3_1_ballistic.instr



GUIDE DESIGN

CURVED GUIDES

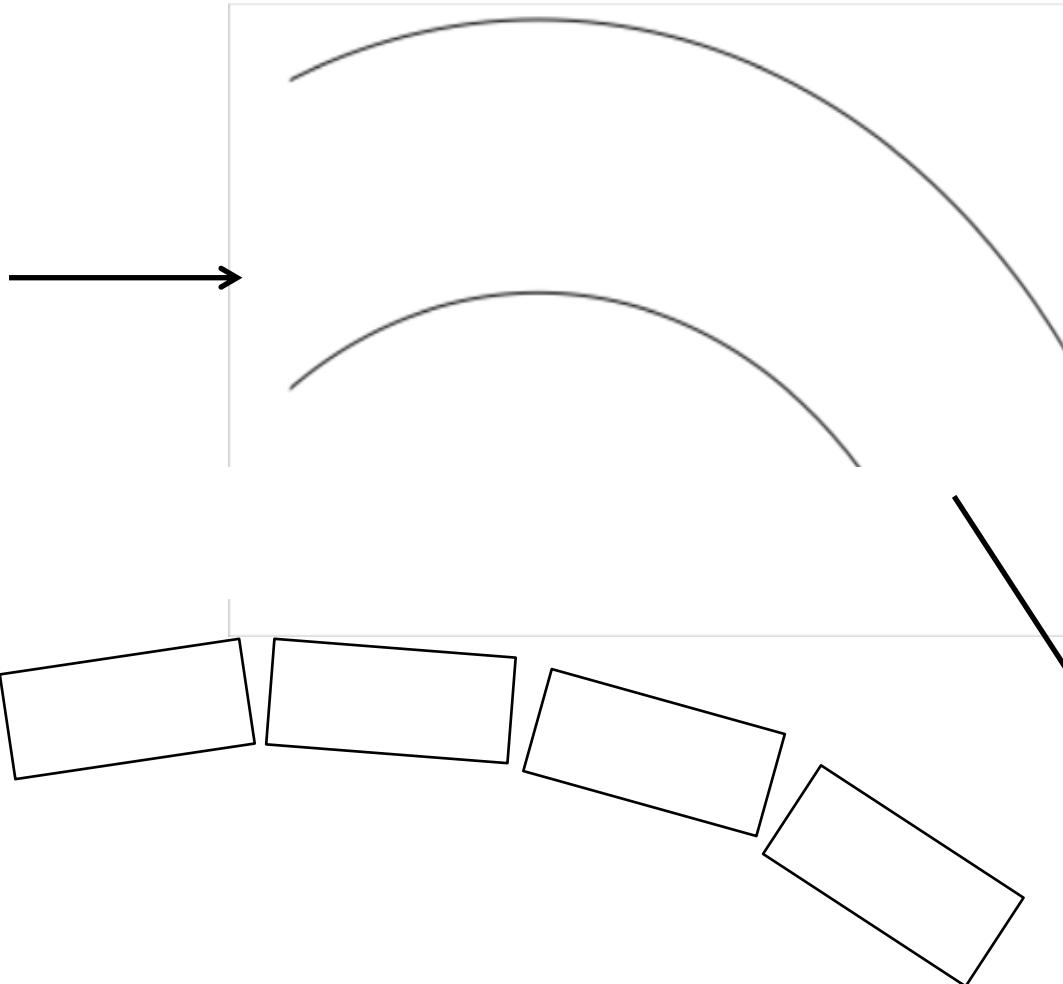
Getting out of direct line of sight



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

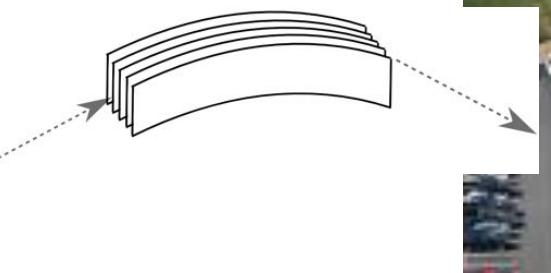


CURVED GUIDES

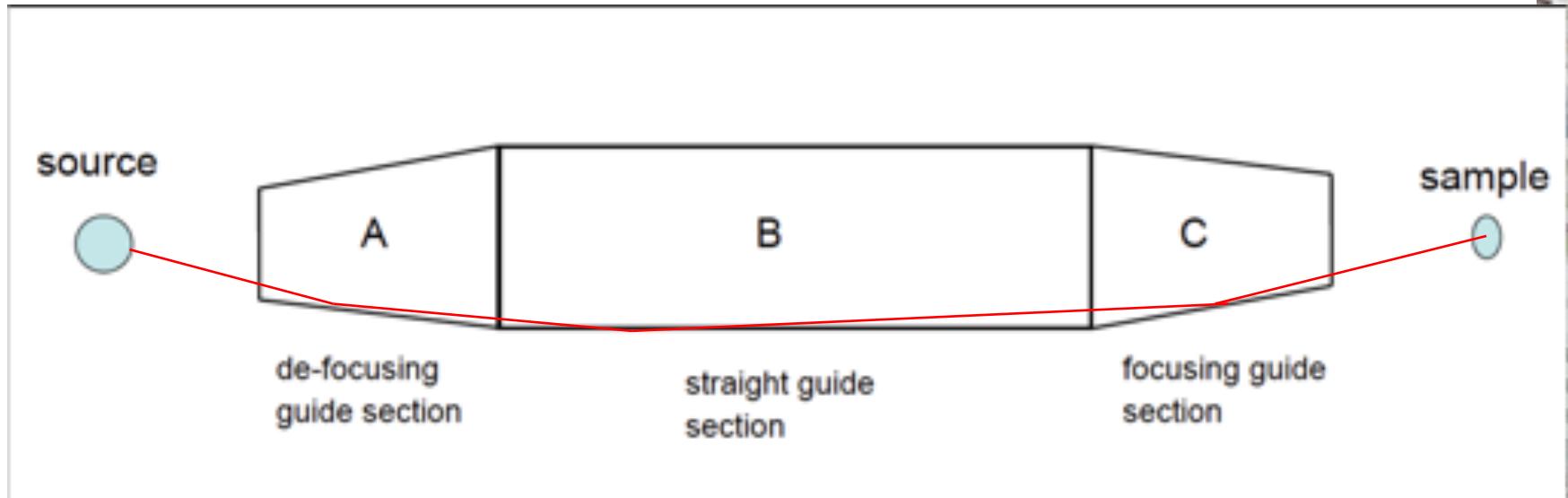


... in McStas

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



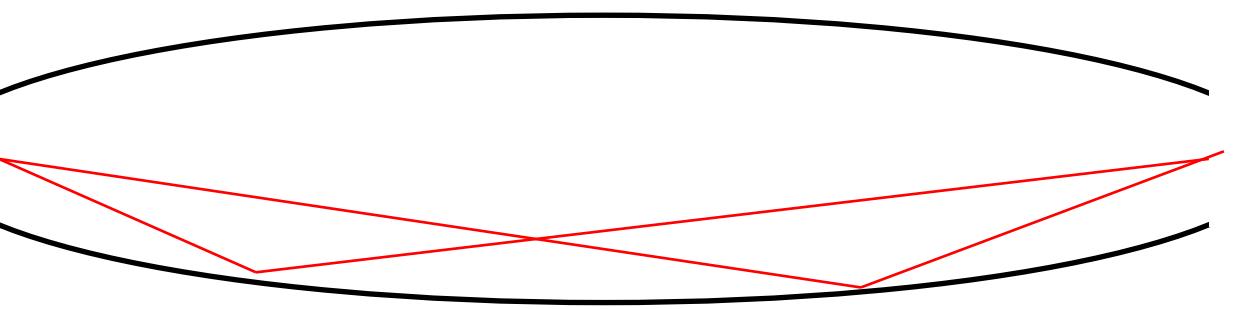
BALLISTIC GUIDE



Goal: high flux on sample



ELLIPTIC GUIDE

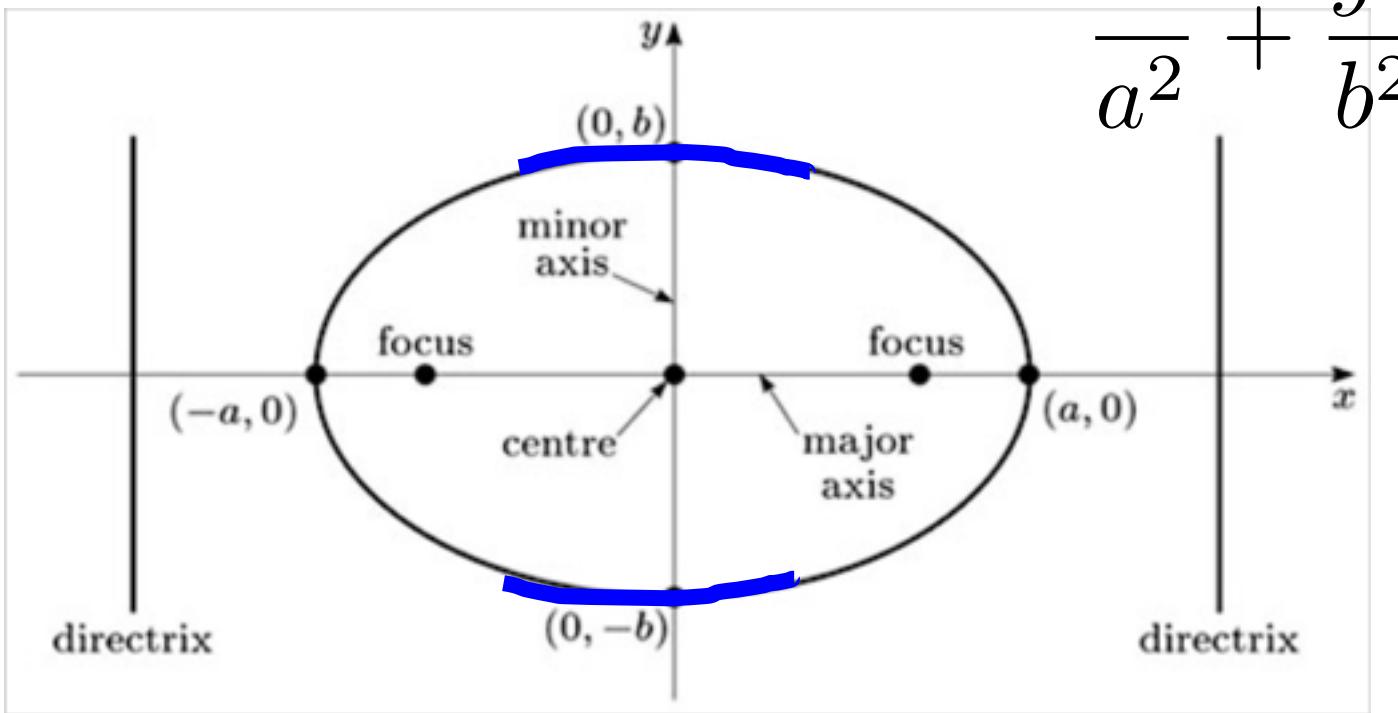


Few reflections - for transport loss in reflection cf next session

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
invalueright	pointer	Pointer to array of m-values, right mirror	NULL
invalueleft	pointer	- same, left mirror	NULL
invaluetop	pointer	- same, top mirror	NULL
invaluembottom	pointer	- same, bottom mirror	NULL
seglength	pointer	Pointer to array of segment lengths for discrete mirror description	NULL
l	m	length of the guide	0
xwidth	m	width at the guide entry, mid or exit (see dimensionsR)	0
yheight	m	height at the guide entry, mid or exit (see dimensionsR)	0
lxin	m	distance from 1st focal point to guide entrance - left and right horizontal mirrors	0
lxout	m	distance from 2nd focal point to guide exit - left and right horizontal mirrors	0
lyin	m	distance from 1st focal point to guide entrance - top and bottom vertical mirrors	0
lyout	m	distance from 2nd focal point to guide exit - top and bottom vertical mirrors	0
majorAxissow	m	direct definition of the guide geometry, will ignore wch, lch and lout parameters if this is nonzero. Length of the axis parallel to the z for the horizontal ellipse	0
minorAxissow	m	direct definition of the guide geometry, will ignore wch, lch and lout parameters if this is nonzero. Length of the axis Perpendicular to the z for the horizontal ellipse	0
majorAxissowh	m	direct definition of the guide geometry, will ignore wch, lch and lout parameters if this is nonzero. Length of the axis parallel to the z for the vertical ellipse	0
minorAxissowh	m	direct definition of the guide geometry, will ignore wch, lch and lout parameters if this is nonzero. Length of the axis Perpendicular to the z for the vertical ellipse	0
majorAxiscenterx	m	direct definition of the guide geometry, distance between the center of the horizontal ellipse and the guide entrance	0
majorAxiscentery	m	direct definition of the guide geometry, distance between the center of the vertical ellipse and the guide entrance	0
dimensionsR	string	define whether xwidth and yheight sets the size of the 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 along our, and use the focallent of the other side to define the ellipse	"ellipse"
R0	f	Low-angle reflectivity	0.99
Q0	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
is	AA-1	Width of supermirror cut-off	0.003
alpharight	AA	Slope of reflectivity for right vertical mirror	-5
inright	1	m-value of material for right vertical mirror	-5
alphaleft	AA	Slope of reflectivity for left vertical mirror	-5
inleft	1	m-value of material for left vertical mirror	-5
alphatop	AA	Slope of reflectivity for top horizontal mirror, overwrites alpha	-5
intop	1	m-value of material for top horizontal mirror, overwrites m	-5
alphabottom	AA	Slope of reflectivity for bottom horizontal mirror	-5
inbottom	1	m-value of material for bottom horizontal mirror	-5
verbose	bool	Give extra information about calculations	0
curvature	m	Simulate horizontal radius of curvature by centripetal force added to the gravity. Note: Does not curve the guide in modeisplay 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



OTHER McStas GUIDES



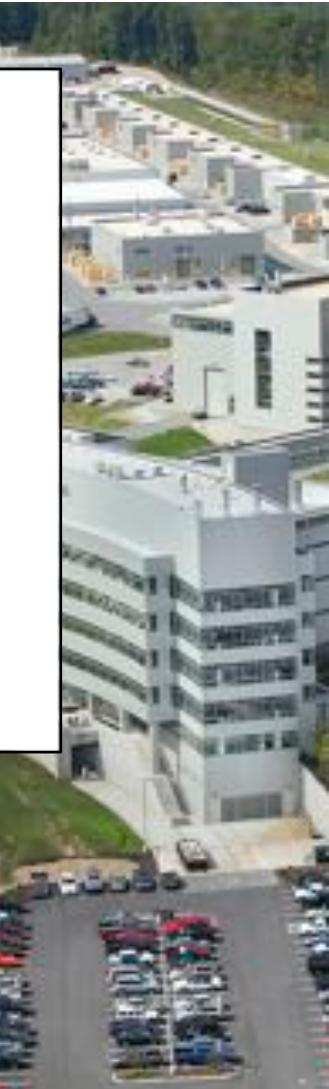
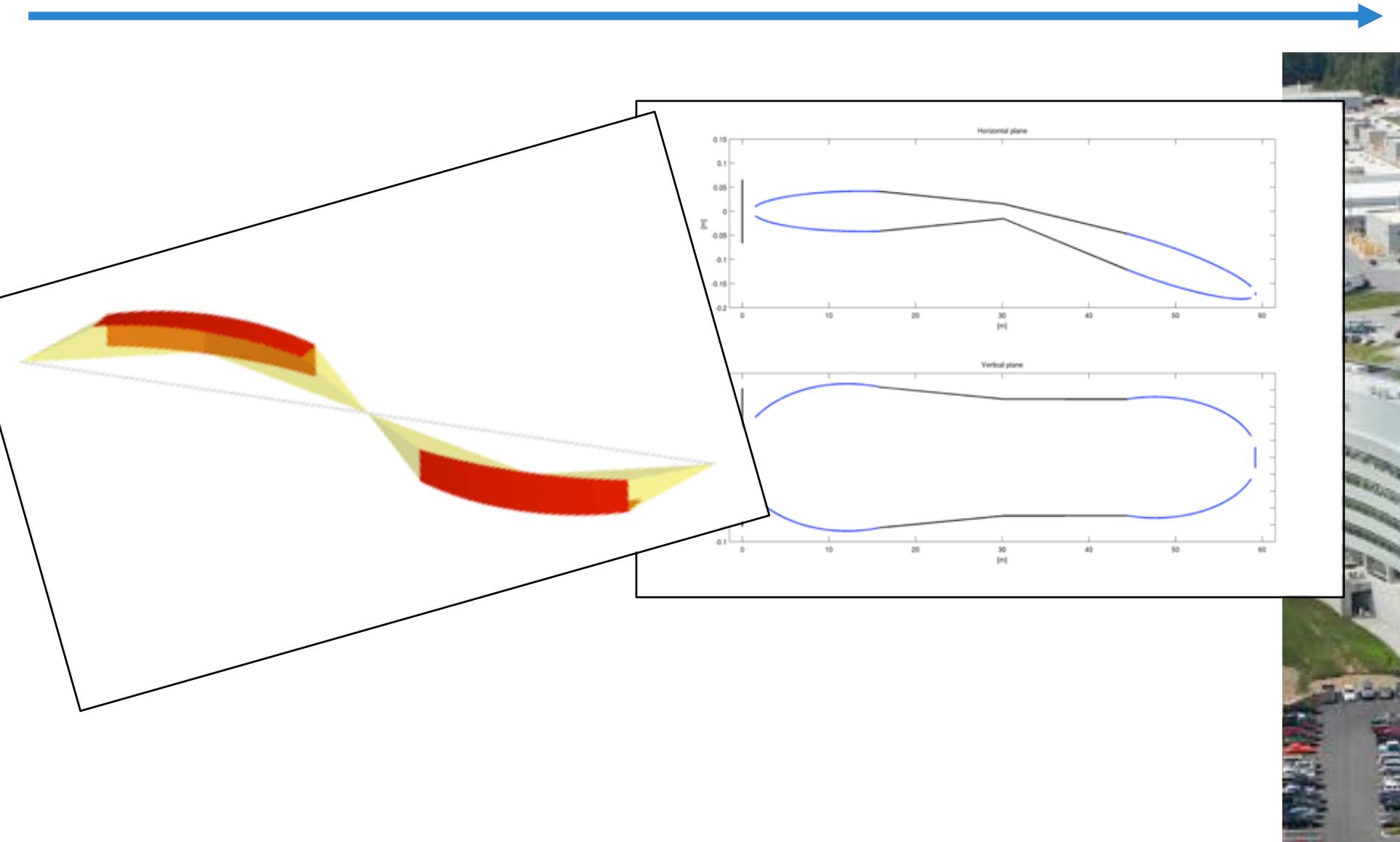
- | *Elliptic_guide_gravity.comp*
- | *Guide_anyshape.comp*
- | *Guide_channeled.comp*
- | *Guide_curved.comp*
- | *Guide_four_side_10_shells.comp*
- | *Guide_four_side_2_shells.comp*
- | *Guide_four_side.comp*
- | *Guide_gravity.comp*
- | *Guide_honeycomb.comp*
- | *Guide_tapering.comp*
- | *Guide_wavy.comp*
- | *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 \$ mcdoch or visit <http://mcstas.org/download/components>

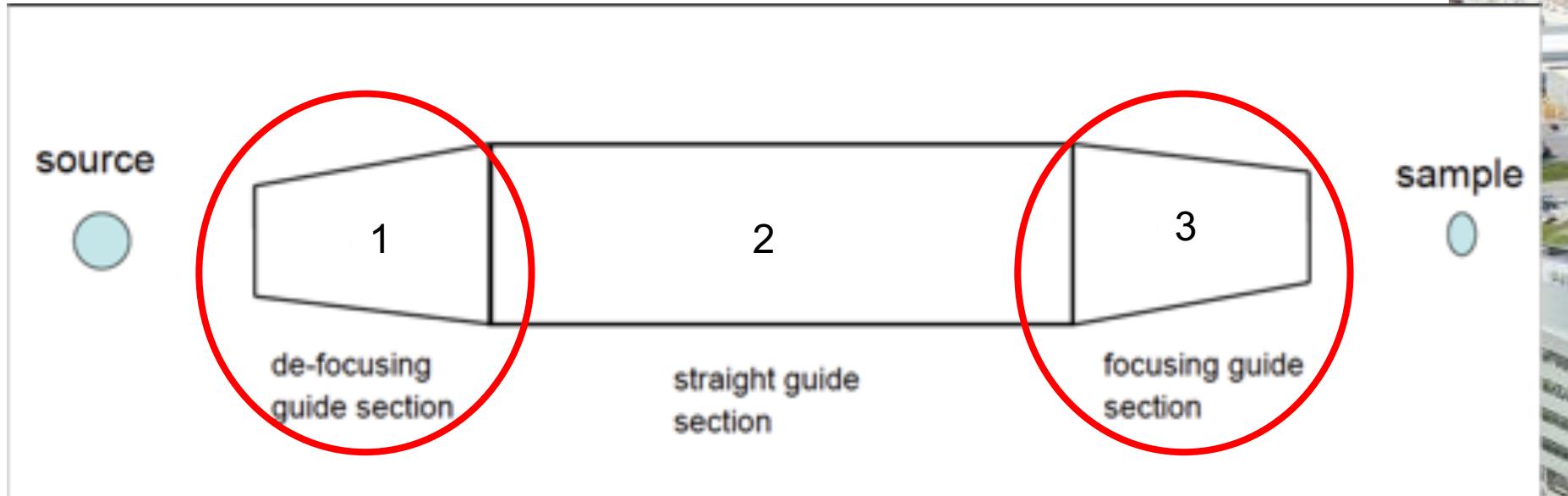
...stir and combine...





Optional: BALLISTIC GUIDE

Ex_3_2_ballistic.instr

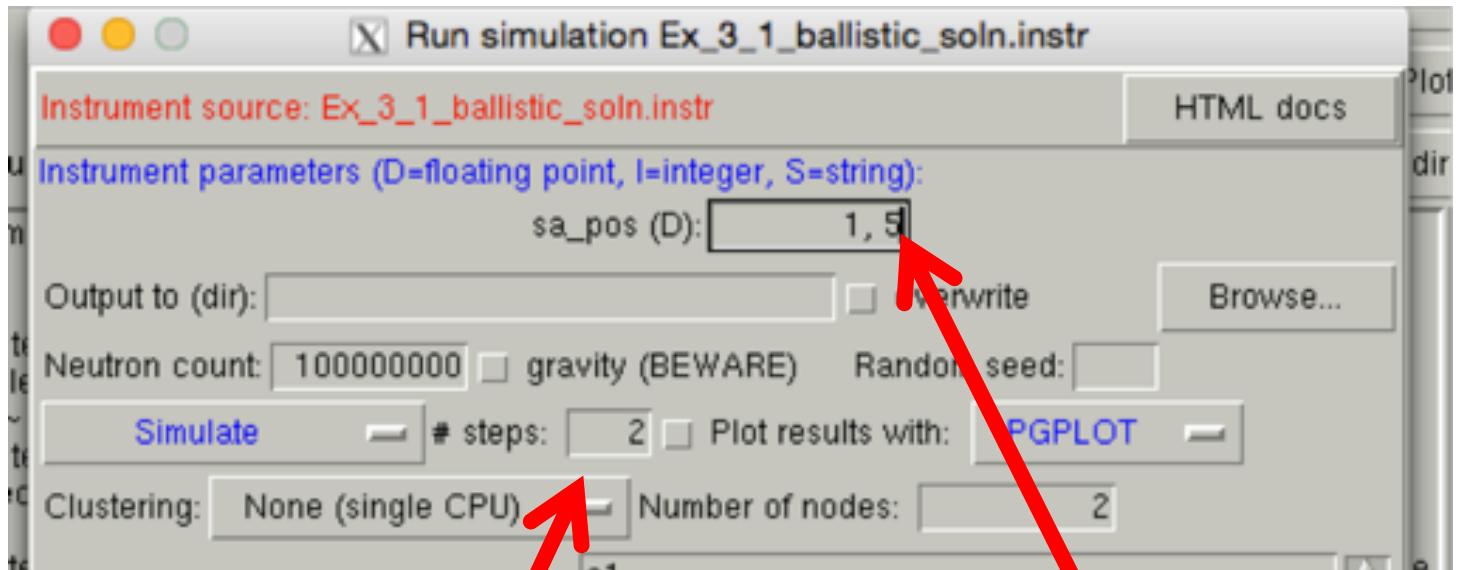


Optional: BALLISTIC GUIDE

- 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



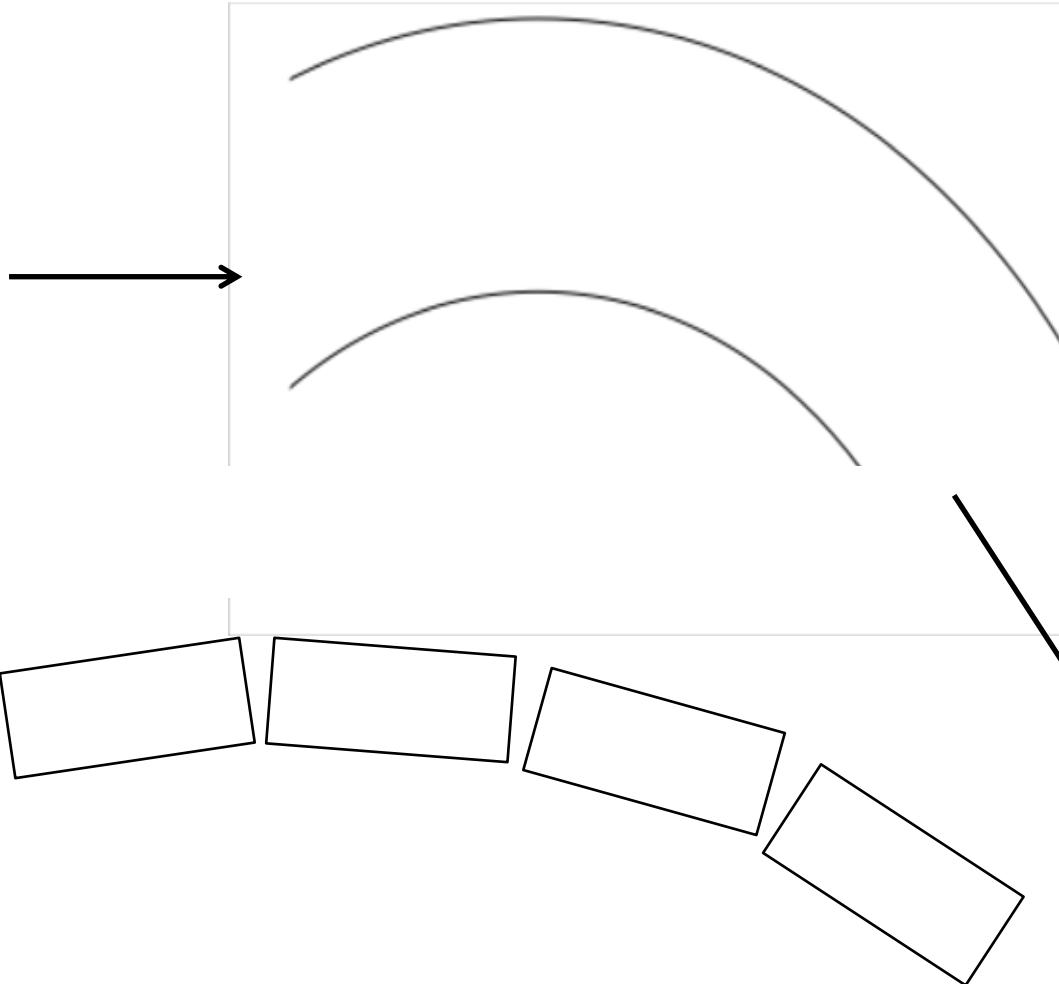
Optional: BALLISTIC GUIDE

- 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.



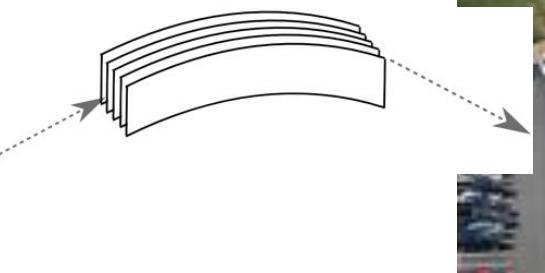


CURVED GUIDES



... 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





