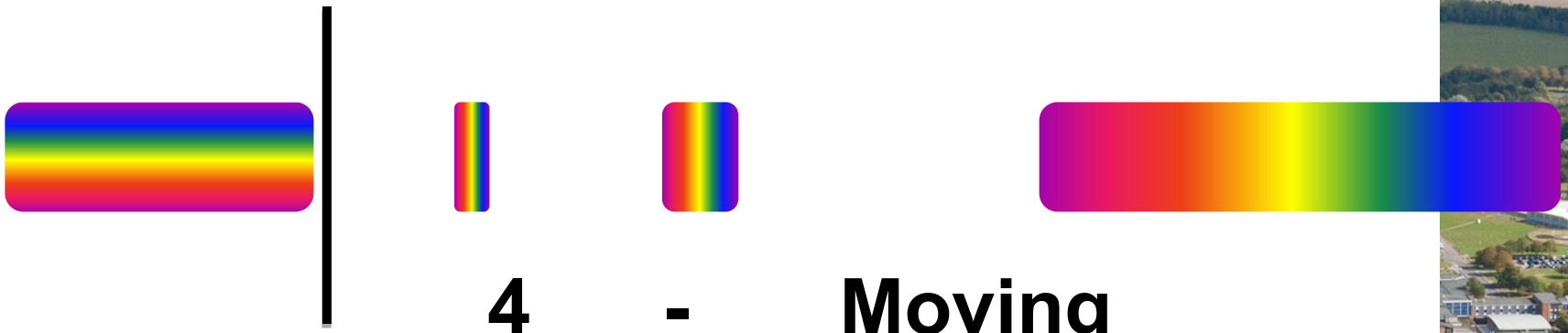
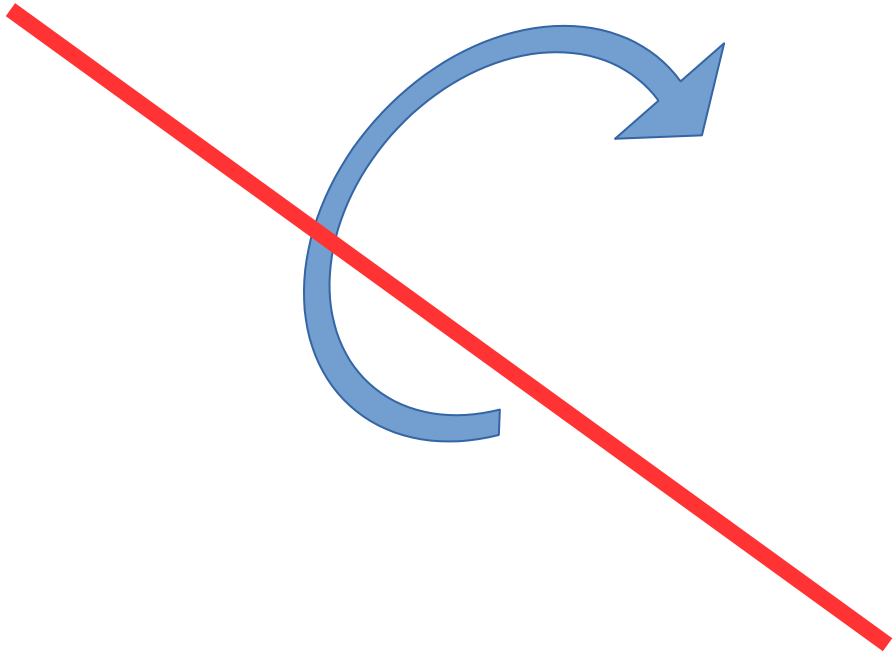


4 - Moving Optics

- Velocity selector
- Disk Chopper
- Fermi Chopper

Not optics that move



...optics with moving parts

Moving optics

I.e. we can't do:

```
COMPONENT something = Sometype(
        par1=value1, par2=value2, ….)
AT( f_x(t), f_y(t), f_z(t) )RELATIVE someother
```

So what *can* we do?

Moving optics

I.e. we can't do:

```
COMPONENT something = Sometype(
        par1=value1, par2=value2, ….)
AT( f_x(t), f_y(t), f_z(t) )RELATIVE someother
```

So what *can* we do?

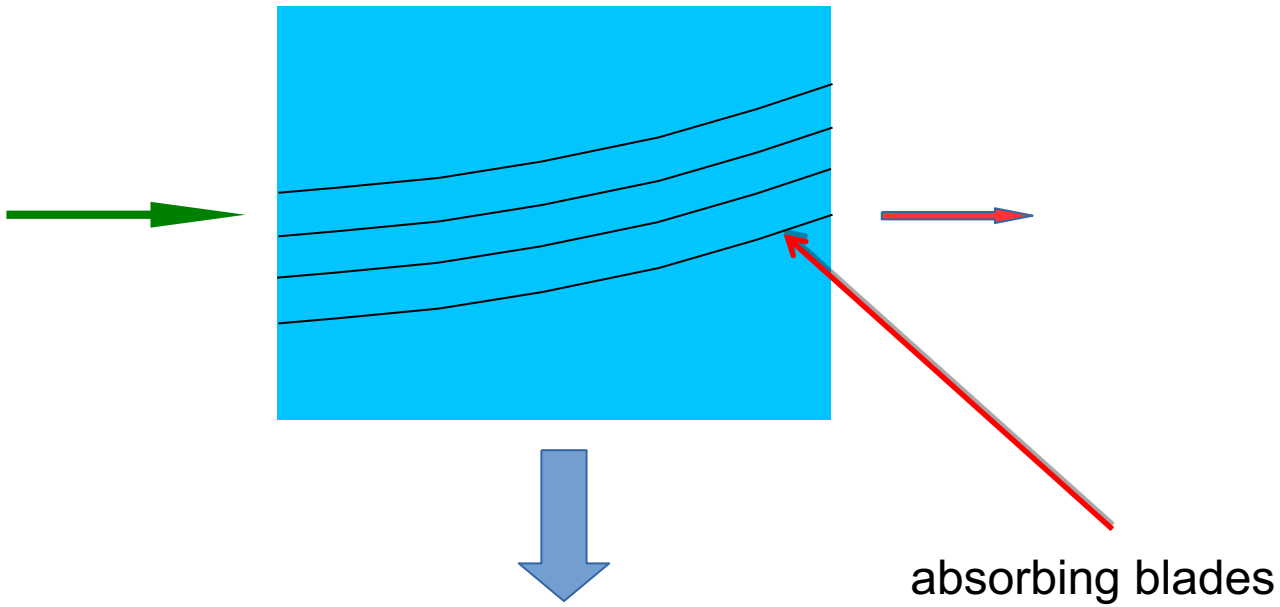
Instead, we operate internally in the component on the neutron state, e.g. "rotate" the neutron etc.

Velocity Selectors

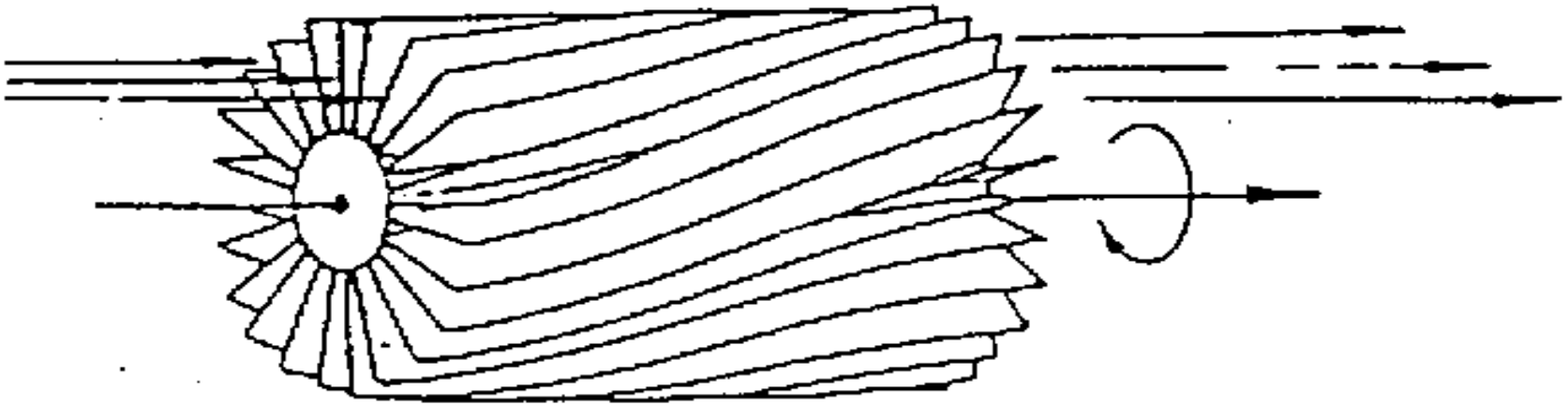
-

Select the neutron energy you want

Velocity Selectors

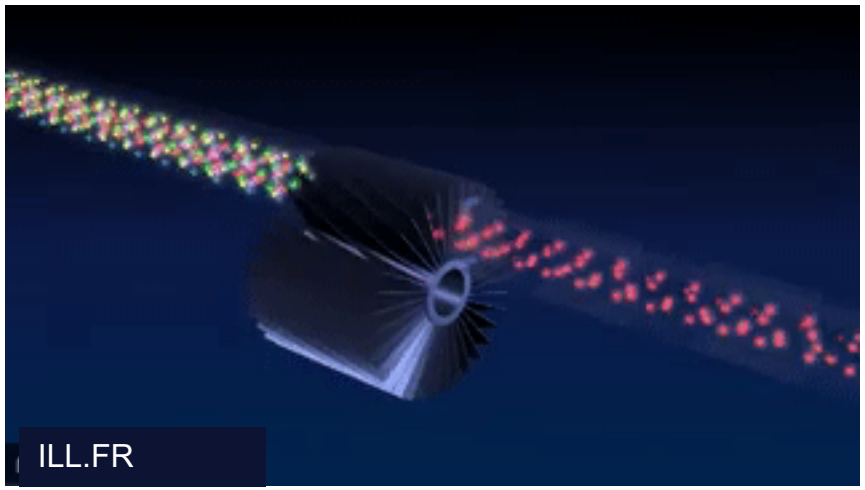


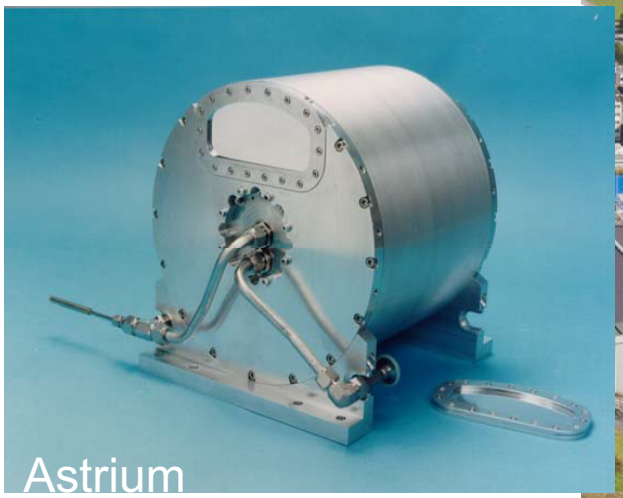
Velocity Selectors



Velocity Selector

‘broad’ monochromatization δλ/λ ≈ 10 %





Input parameters

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

Name	Unit	Description	Default
xwidth	m	Width of entry aperture	0.03
yheight	m	Height of entry aperture	0.05
zdepth	m	Distance between apertures, for housing containing the rotor	0.30
radius	m	Height from aperture centre to rotation axis	0.12
alpha	deg	Twist angle along the cylinder	48.298
length	m	Length of cylinder/rotor (less than zdepth)	0.25
d	m	Thickness of blades	0.0004
nu	Hz	Cylinder rotation speed, counter-clockwise, which is ideally 3956*alpha*DEG2RAD/2/PI/lambda/length	300
nslit	1	Number of Soller blades	72

Exercise 4.1

-Open the Ex_4_1_selector.instr instrument

- Notice the use of wavelength monitors L_mon

- Notice the use of the V_selector component

-Input parameter defines selector rotational

- velocity/frequency (Hz)

Exercise 4.1 cont'd

Perform a TRACE at the default f=300Hz

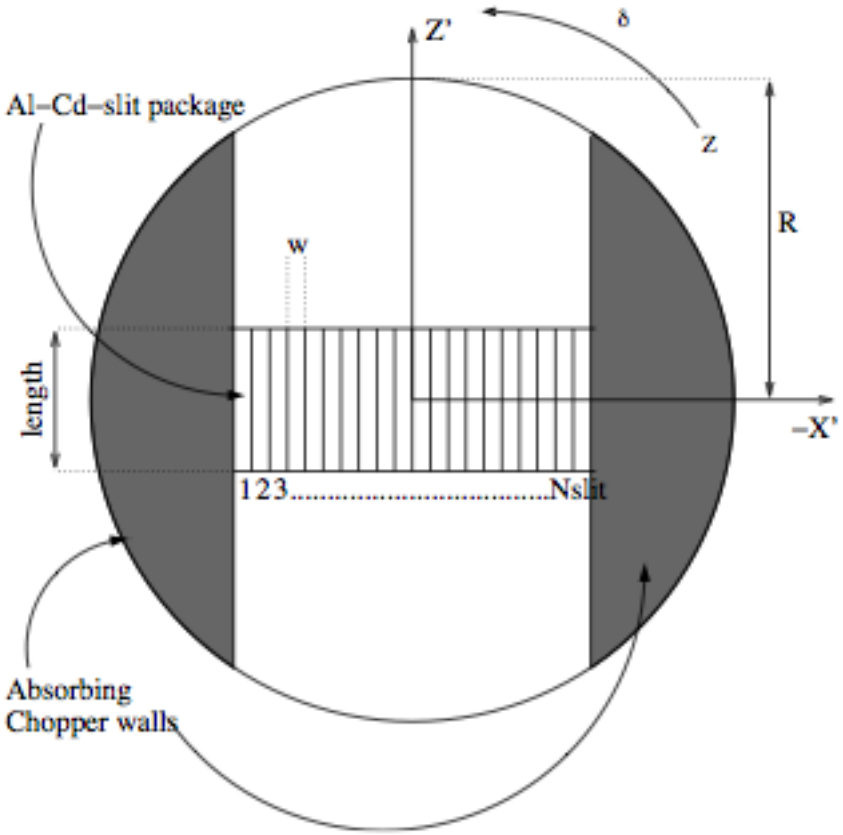
- Perform a SIMULATE of 1e7 neutrons at default f
- Perform a series of simulations in the range: 150 < f < 800 (e.g. 5 steps)
- Compare the transmitted beam in the different cases
- Question: What is the ideal rotational speed to select neutrons of 10 Å with the selector from Ex 7.1 (Hint l[Å] ~= 3956 / v [m/s]

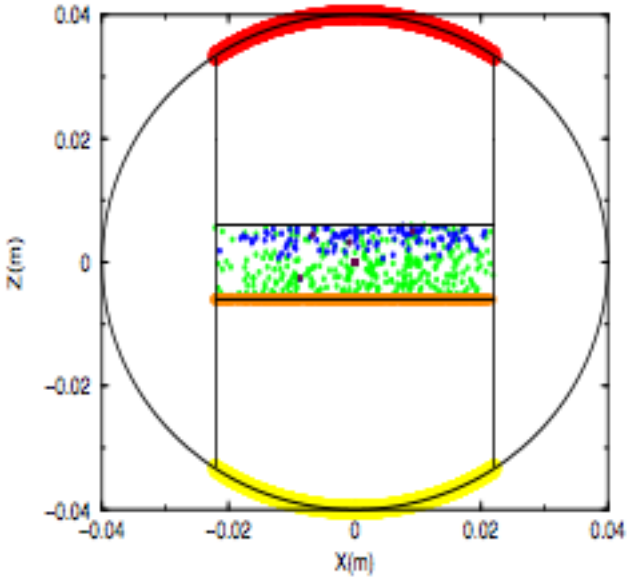
Choppers – Fermi and Disk

Define time structure of the beam

Time Of Flight (TOF) measurements

Fermi Chopper





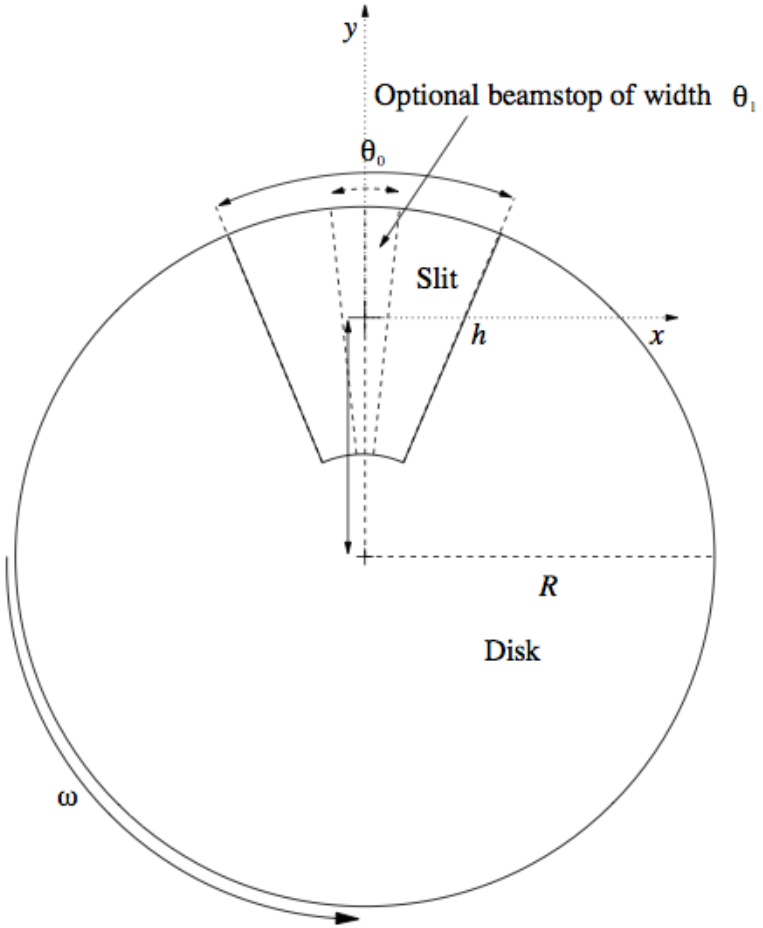
Fermi Chopper

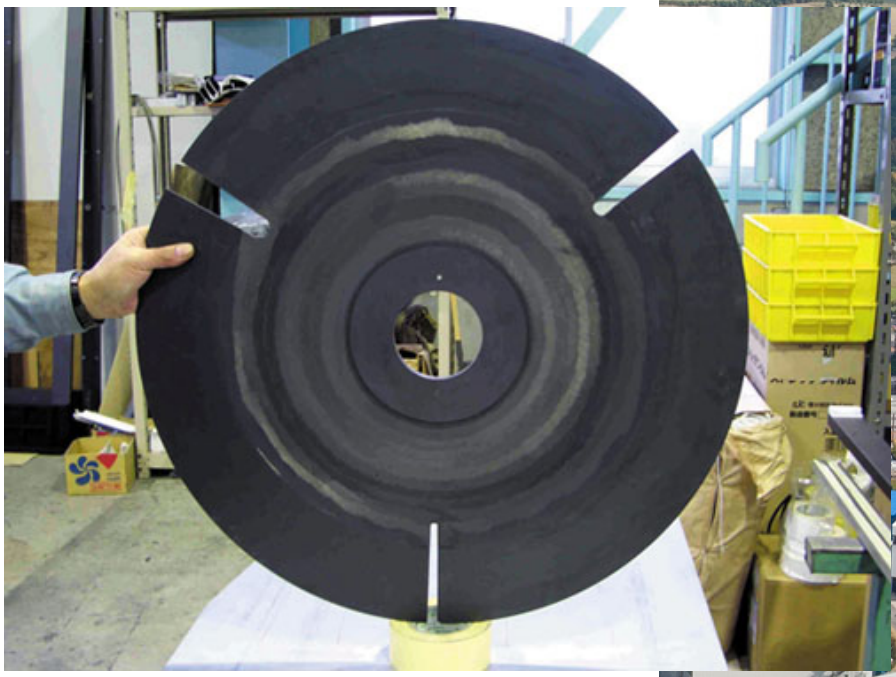
Input parameters

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

Name	Unit	Description	Default
phase	deg	chopper phase at t=0	0
radius	m	chopper cylinder radius	0.04
nu	Hz	chopper frequency. Omega=2*PI*nu in rad/s, nu*60 in rpm. Positive value corresponds to a clockwise rotation from X towards Z from above (y>0).	100
w	m	width of one chopper slit	0.00022475
nslit	1	number of chopper slits	200
R0	1	low-angle reflectivity	0.0
Qc	AA-1	critical scattering vector	0.02176
alpha	AA	slope of reflectivity	2.33
m	1	m-value of material. Zero means completely absorbing.	0.0
W	AA-1	width of supermirror cut-off	2e-3
length	m	channel length of the Fermi chopper	0.012
eff	1	efficiency = transmission x fraction of transparent material	0.95
zero_time	1	set time to zero: 0=no, 1=once per half cycle, 2=auto adjust phase	0
xwidth	m	optional total width of slit package	0
verbose	1	set to 1,2 or 3 gives debugging information	0
yheight	m	height of slit package	0.08
curvature	m-1	Curvature of slits (1/radius of curvature).	0
delay	s	sets phase so that transmision is centered on 'delay'	0

Disk Chopper





- If h not explicitly specified, h=R
- Auto-centering the beam axis ‘z’ at R-h (half-height of slit)

Disk Chopper

Input parameters

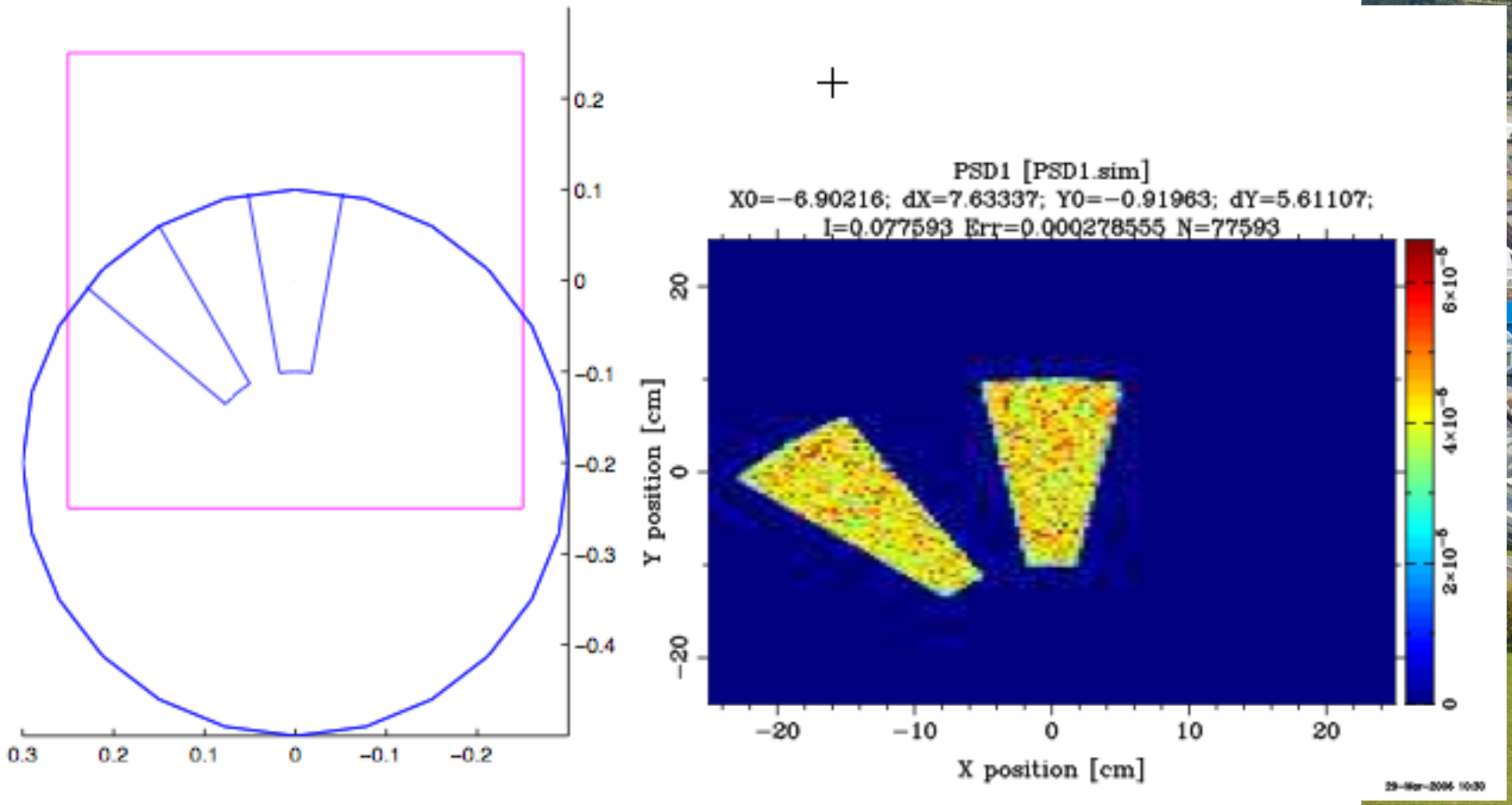
Parameters in **boldface** are required; the others are optional.

Name	Unit	Description	Default
theta_0	deg	Angular width of the slits.	0
radius	m	Radius of the disc	0.5
yheight	m	Slit height (if = 0, equal to radius). Auto centering of beam at half height.	
nu	Hz	Frequency of the Chopper, omega=2*PI*nu (algebraic sign defines the direction of rotation)	
nslit	1	Number of slits, regularly arranged around the disk	3
jitter	s	Jitter in the time phase	0
delay	s	Time 'delay'.	0
isfirst	0/1	Set it to 1 for the first chopper position in a cw source (it then spreads the neutron time distribution)	0
n_pulse	1	Number of pulses (Only if isfirst)	1
abs_out	0/1	Absorb neutrons hitting outside of chopper radius?	1
phase	deg	Angular 'delay' (overrides delay)	0
xwidth	m	Horizontal slit width opening at beam center	0
verbose	1	Set to 1 to display Disk chopper configuration	0

nslit placed equidistantly around the disk….

Disk Chopper

Non-equidistant configurations should be realized via the GROUP keyword…. (illustrated below, nu=0)



DTU ESS EUROPEAN SPALLATION SOURCE

Exercise 4.2

- Open the Ex_4_2_chopper.instr instrument

- Notice use of the EXTEND %{ %} section, defining a time structure (1 second, flat distribution)

- Notice use of Monitor_nD, our “Swiss army knife” monitor

  options=”t auto bins=200”

  options="t auto bins=200 x auto bins=200"

Disk Chopper

Exercise 4.2 cont'd:

- Insert a disk chopper 0.5 mm after guide exit

- Chopper Component Parameters:
  - radius of disk-chopper (we use 0.5 m)
  - n, number of openings (we use 2)
  - Phase (angular phase at t=0, in degrees, we use 90 deg)

- Instrument input parameters:
  f (Hz) - chopper frequency
  Theta0 (degrees) - opening width of slits

Exercise 4.2 Cont'd

- Make a TRACE to get an overview of the instrument
- SIMULATE 1e7 neutrons at the default of f=5Hz and Theta0=10 degrees. While simulation is ongoing, estimate the number of pulses per second?
- Try another 1e7 at f=1 hz. Notice space-time correlation in the third TOF panel
- At a given frequency, try changing the Theta0 chopper opening to higher and lower value. Comment on the results.