

5.2 - Moving Optics

- Velocity selector
 - Disk Chopper
 - Fermi Chopper



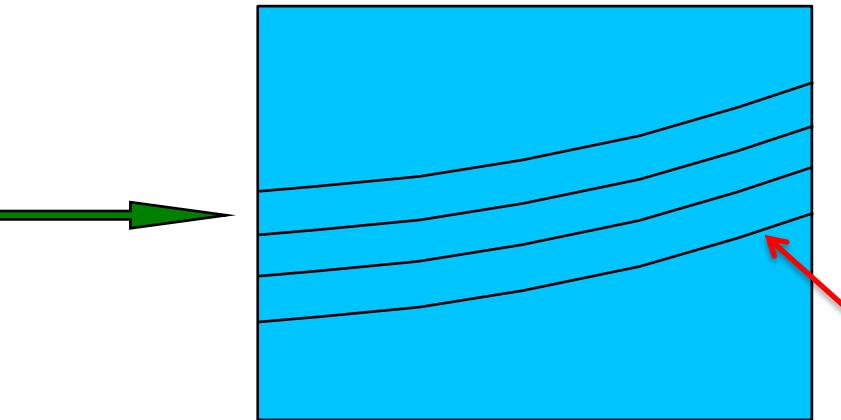
Velocity Selectors

-

Select the neutron energy you want



VELOCITY SELECTORS

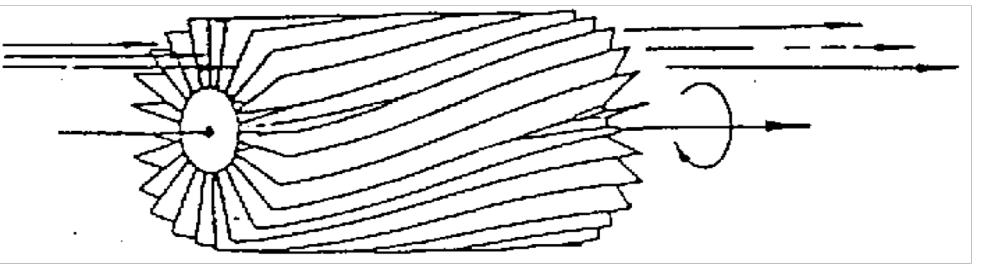


absorbing blades



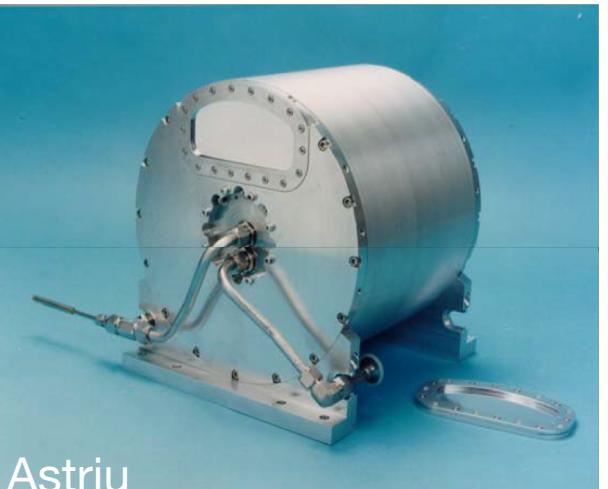
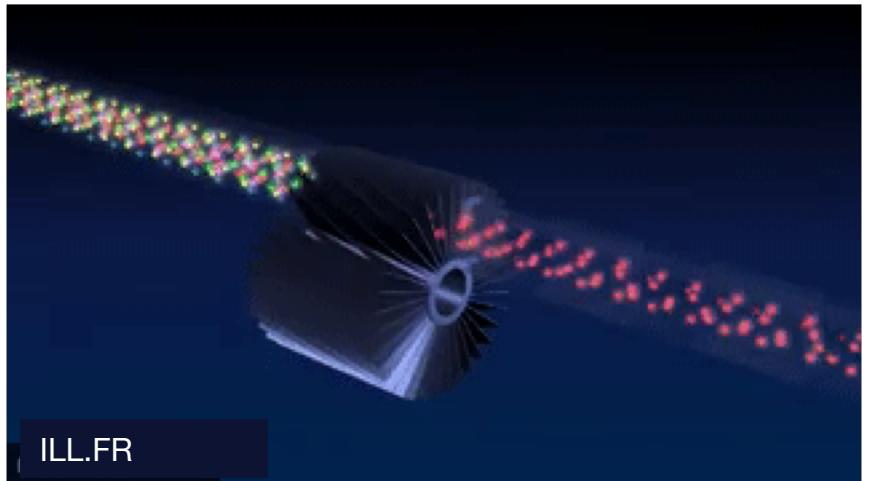
VELOCITY SELECTORS

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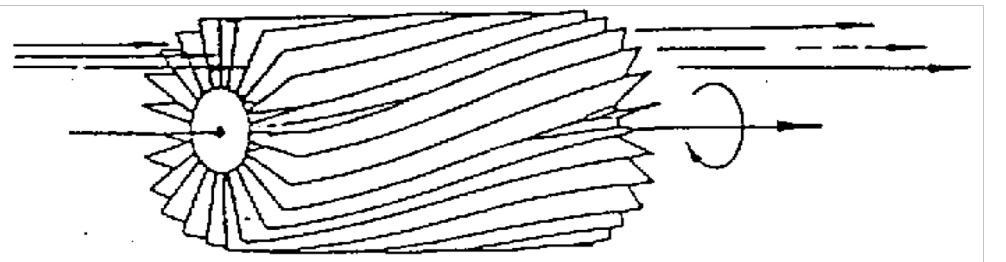


VELOCITY SELECTORS

'broad' monochromatization $\delta\lambda/\lambda \approx 10 \%$



VELOCITY SELECTORS



INPUT PARAMETER

xwidth	[m]	width entry aperture] housing
yheight	[m]	height entry aperture	
zdepth	[m]	housing! length	
length	[m]	blade length	
d	[m]	blade thickness	
alpha	[deg]	twisting angle	
radius	[m]	distance rotation axis – aperture centre	
nu	[Hz]	rotation speed, counterclockwise	
nslit	[]	number of blades	

DISK CHOPPER



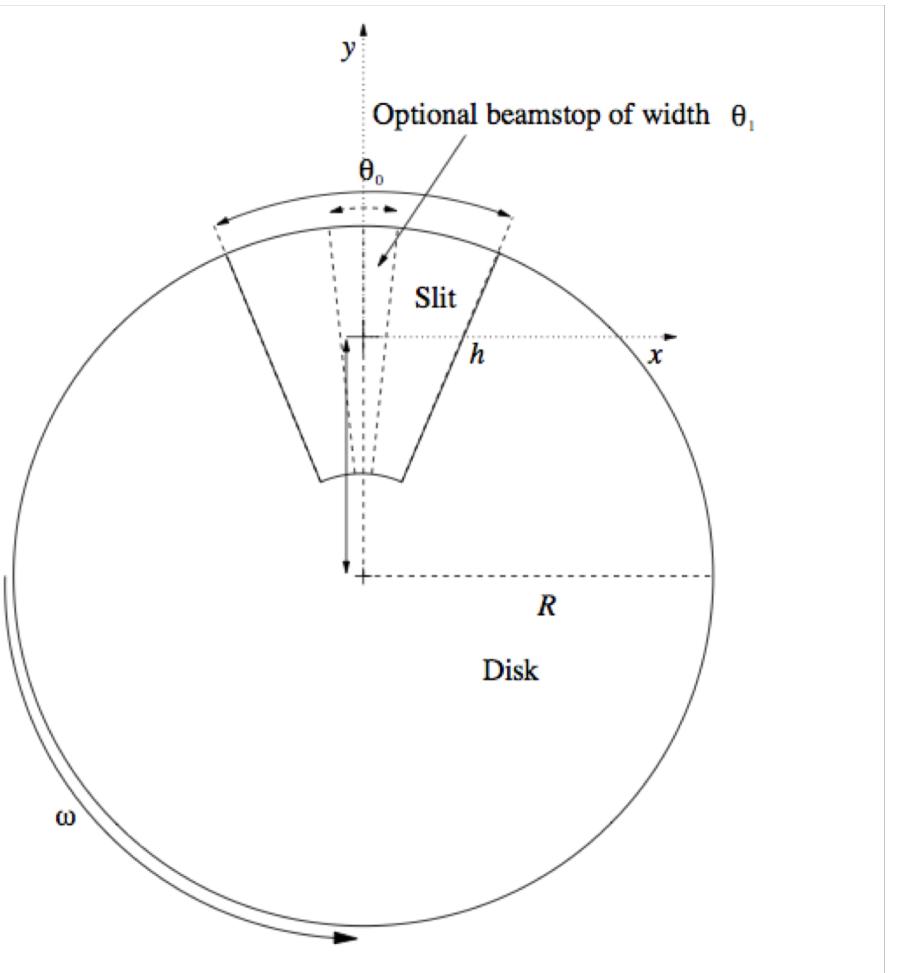
Define time structure of the beam

Time Of Flight (TOF) measurements



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DISK CHOPPER

INPUT PARAMETER

nu [Hz] frequency

yheight [m] slit height (if 0, yheight = radius)

radius [m] disk radius

theta_0 [deg] angular width of slits

xwidth [m] horizontal slit width opening, beam center

jitter [s] jitter in time phase

delay [s] time delay

phase [deg] angular delay, overrides time

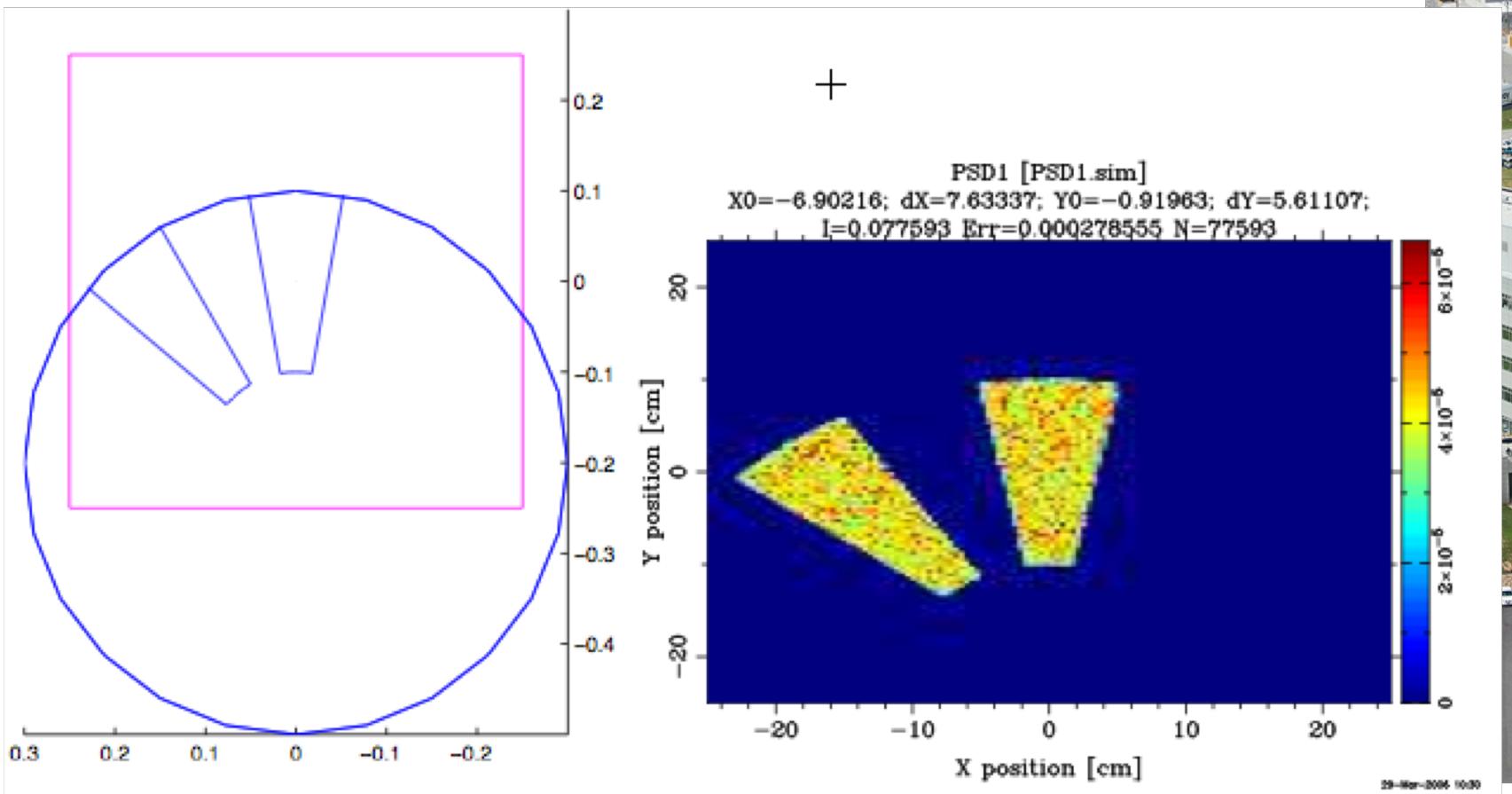
Isfirst [0/1] several choppers, defines first chopper

npulse [1] number of pulses if isfirst=true

verbose [1] display disk chopper config

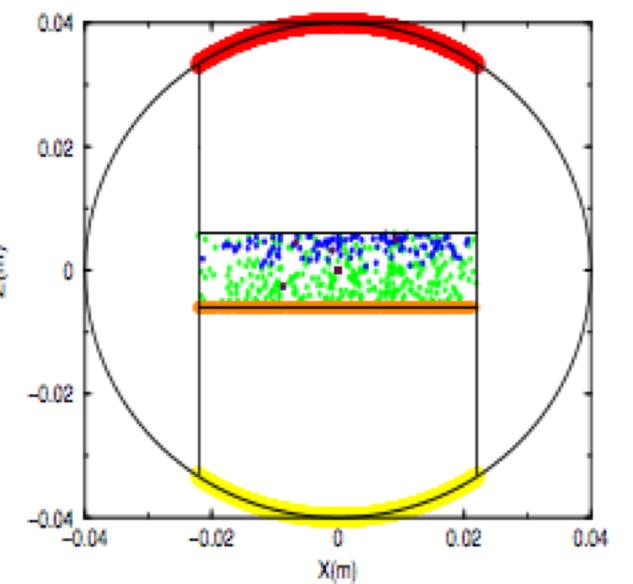
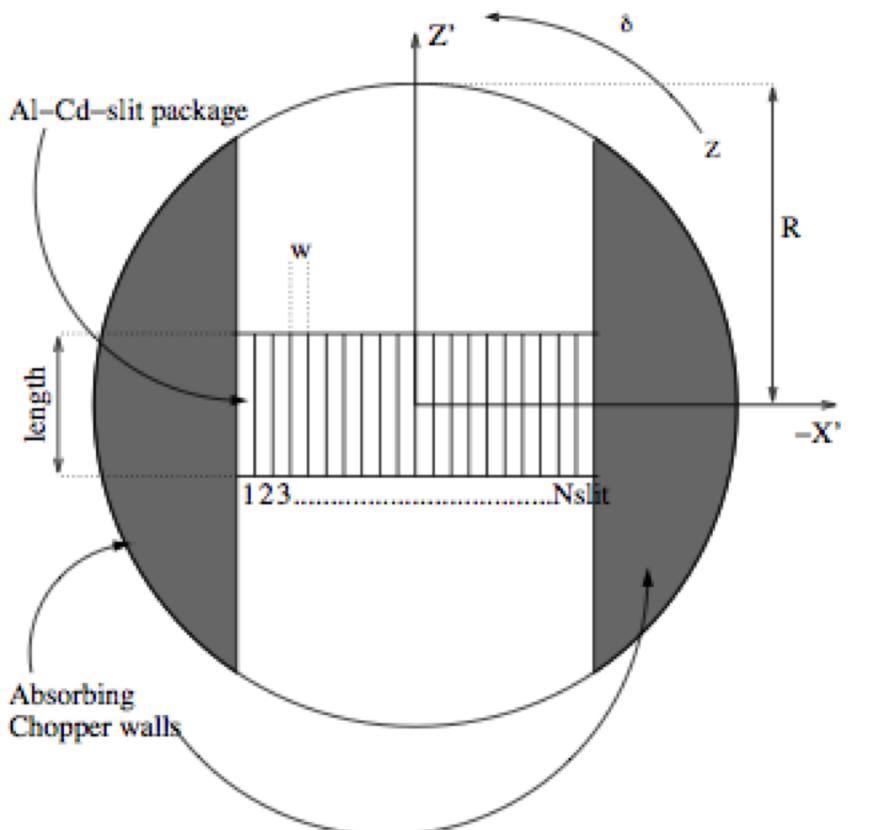


DISK CHOPPER_S



FERMI CHOPPER

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DISK CHOPPER

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Exercise

- Open the Ex_4_2_DiskChopper.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

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Exercice :

- **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



DISK CHOPPER

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Exercise

- Make a TRACE to get an overview of the instrument
- SIMULATE $1e7$ neutrons at the default of $f=5\text{Hz}$ and $\Theta_0=10$ degrees. While simulation is ongoing, estimate the number of pulses per second?
- Try another $1e7$ at $f=1\text{ hz}$. Notice space-time correlation in the third TOF panel
- At a given frequency, try changing the Θ_0 chopper opening to higher and lower value. Comment on the results.



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Velocity Selector

Exercise

- Open the `Ex_7_1_Selector.instr` instrument
- Notice use of wavelength monitors `L_mon`
- Notice use of the `V_select` component
- Input parameter `f` defines selector rotational velocity (Hz)



VELOCITY SELECTOR

Exercise

- Perform a TRACE at the default $f=300$ Hz
- Perform a SIMULATE of $1e7$ neutrons at default f
- Estimate the relative bandwidth $\delta\lambda/\lambda$ of the transmitted beam
- Perform a series of simulations in the range
 - $150 < f < 800$ (5 steps)
- Compare the transmitted beam in the different cases
- Question: What is the ideal rotational speed to select neutrons of 10 \AA with the selector from Ex 7.1?
Hint: $\lambda [\text{\AA}] \approx 3956/v [\text{m/s}]$



Hints / results

$$v = \frac{\delta z}{\delta t}$$

$$\delta z = l$$

$$\delta t = \frac{\alpha}{2\pi} \frac{1}{\nu}$$

$$v[\text{m/s}] = \frac{3956}{\lambda[\text{\AA}]}$$

- From the hint (de Broglie)

