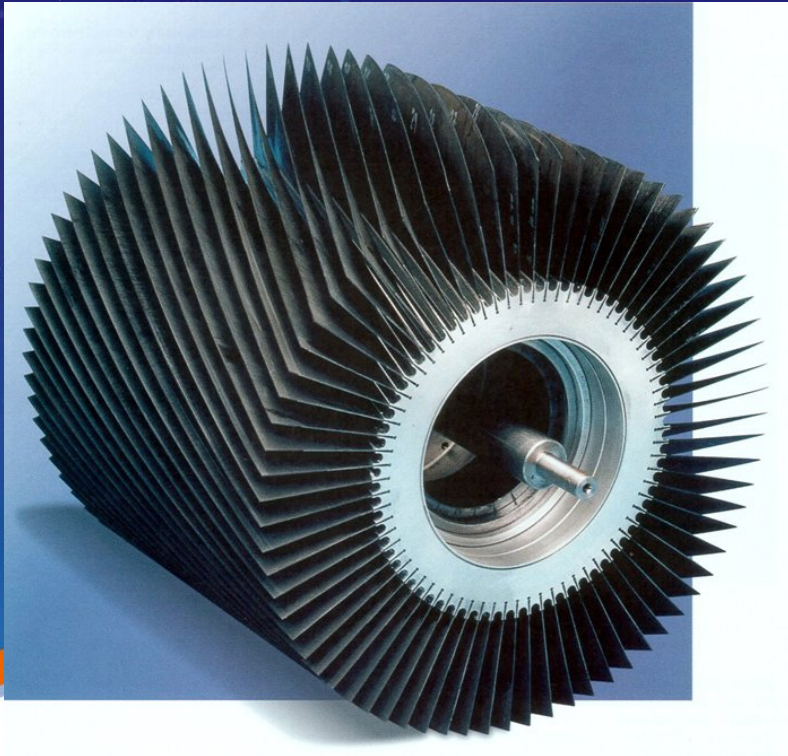
Neutron Velocity Selector



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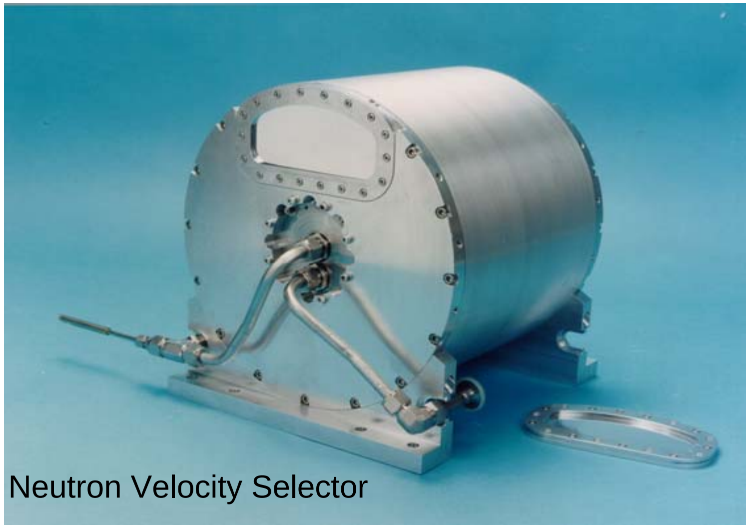
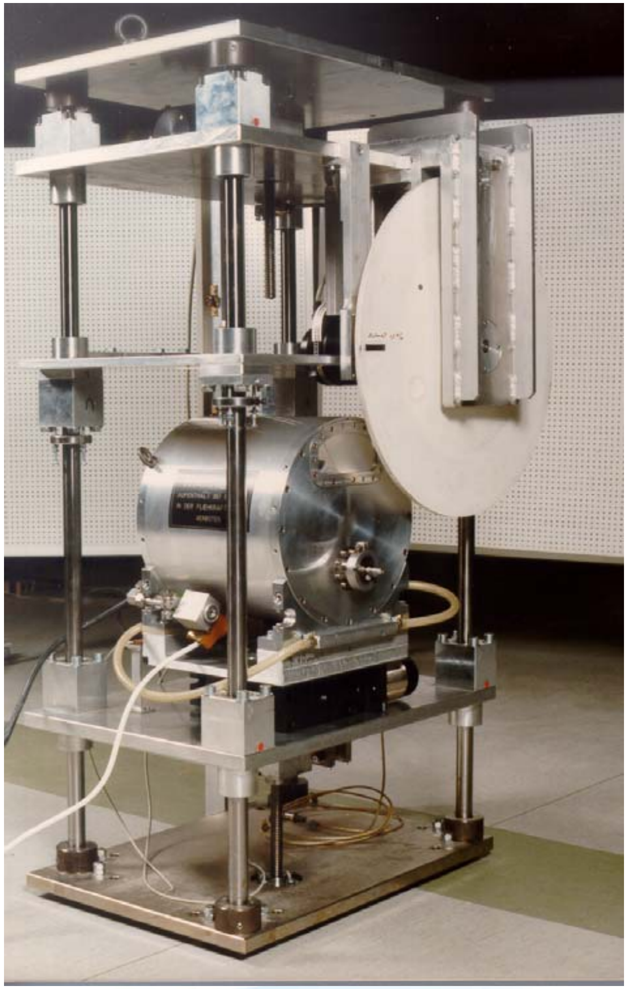
Neutron – Velocity Selector



Neutron Velocity Selector

Converter



Neutron Velocity

Selector

Setup

Neutron Velocity Selector

Application

Generation of a monochromatic beam of low-velocity neutrons

Type

Blade rotor developed by Dornier / GKSS* / PTB*

Neutron characteristics for a Selector with standard design data

Standard design data: 72 blades, α= 48.3° (screw angle of the blades), length (0.25 m)

Transmission in maximum T and resolution R are dependent upon neutron beam divergence α, beam height h and tilt angle ξ between beam and rotor axis.

a) Standard operation (ξ = 0, h = 55 mm), wavelength λ 0.45 to 4.2 nm (4.5 to 42 Å), 72 blades, α= 48.3° (screw angle of the blades)

α fwhm triangular	Transmission	Resolution fwhm
(')	(%)	(%)
0 30 60	94.5 87.0 79.4	9.8 10.6 11.4

Calculated by *

* P. Wille, GKSS, Geesthacht, H. Friedrich, V. Wagner, PTB, Braunschweig

Neutron Velocity Selector

b) Beam height h influence @ $\xi = 0$, $\alpha = 30'$: negligible

c) Tilt angle ξ influence for wavelength extension and / or change in resolution R.
$\alpha = 30'$, h = 20 mm:

ξ	λ at max. speed	T	R
(°)	(nm)	(%)	(%)
-10	0.252	77	20.6
-5	0.353	84	13.9
0	0.450	88	10.5
10	0.637	77	8.2

For greater beam hights h, the Transmission and Resolution values become less favoraable @ $\xi \neq 0$

d) Application with external magnetic field and polarized neutrons is successfully tested

e) Transmission of thermal neutrons < 5*10-4 with an absorber coating of 35 g per sqm of blade material

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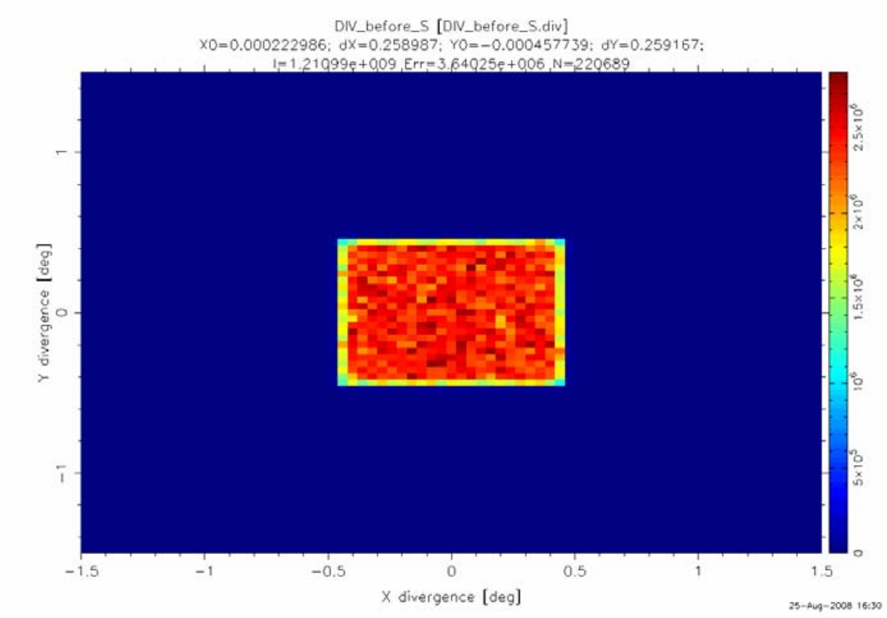
Mechanical characteristics (standard selector)

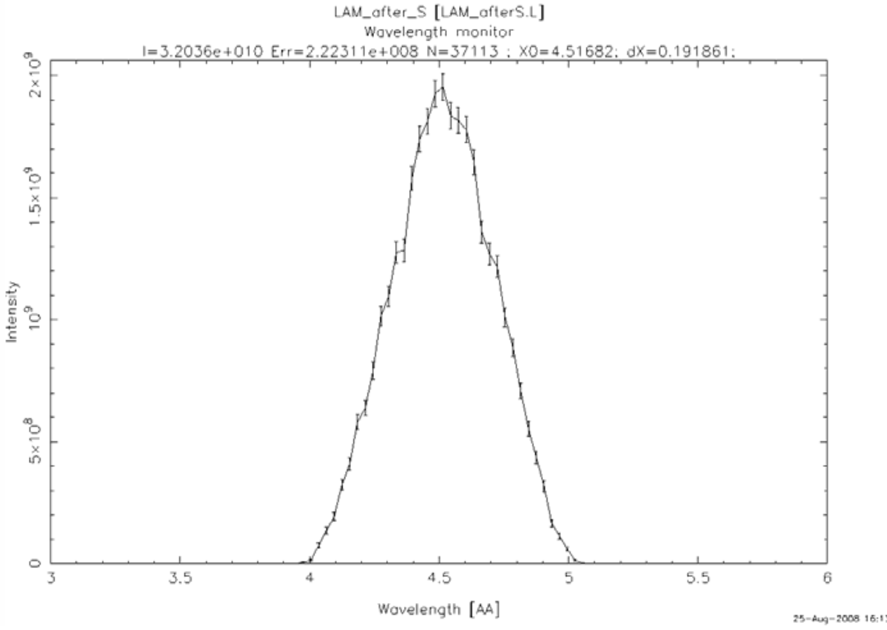
Rotor diameter	(mm)	290
Rotor length	(mm)	250
Angle of selector screw (angle between the front and rear edges of a blade)	(°)	48.3 (selectable)
Speed range	(rpm)	3,000 - 28,300
Speed constancy	(%)	0.2
Blade		
- Number		72
- Material		carbon fiber in epoxy
- Thickness	(mm)	0.4
- Height	(mm)	60 from r = 85 to r = 145
- Absorber coating		35g 10B per sqm of blade surface
Window		
- Material		aluminum foil
- Thickness	(mm)	< 0.5
- Width (max.)	(mm)	150
- Height (max.)	(mm)	65
- Position		can be staggered in increments of 22.5° as required
Case		
- Material		aluminum
- Length	(mm)	306, without connections for power supply, cooling water
- Overall length	(mm)	approx. 330
- Diameter	(mm)	340, without base, base removable

Based on the fundamental design of the selector, variations are possible according to the specific needs of the customer.

Neutron Velocity Selector



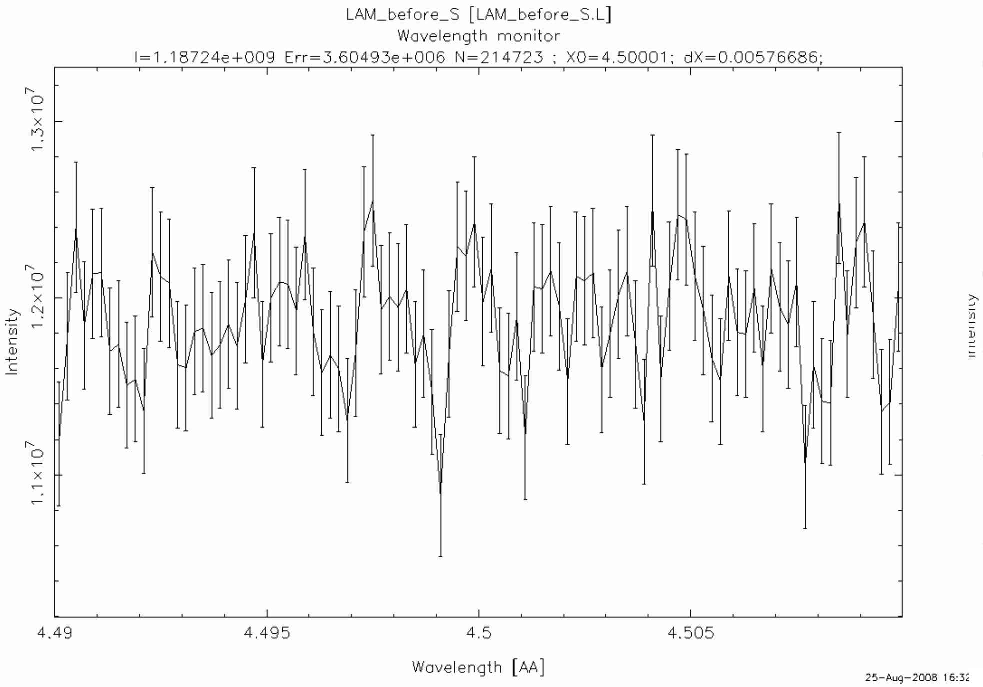
e.g. divergence before selector ± 0.5°



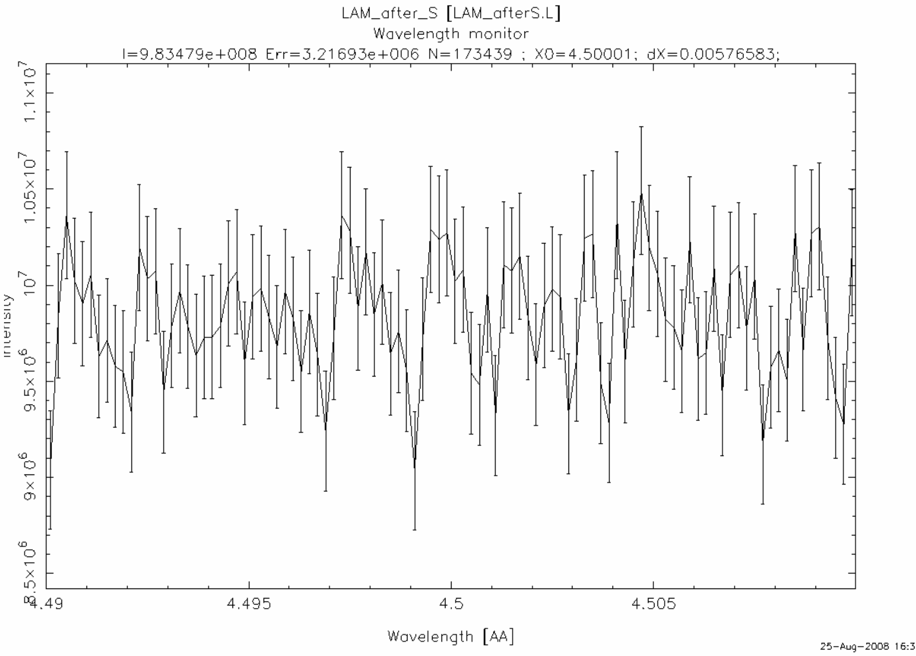
wavelength resolution after selector

NVS example simulated with McStas V1.12

Neutron Velocity Selector



λ= 4.5 Å (±.01°) – n= 214723 before selector



λ= 4.5 Å (±.01°) – n= 173439 after selector

Peak-transmission @ resolution 0.01

Transmission ≈ 81 %

NVS example simulated with McStas V1.12

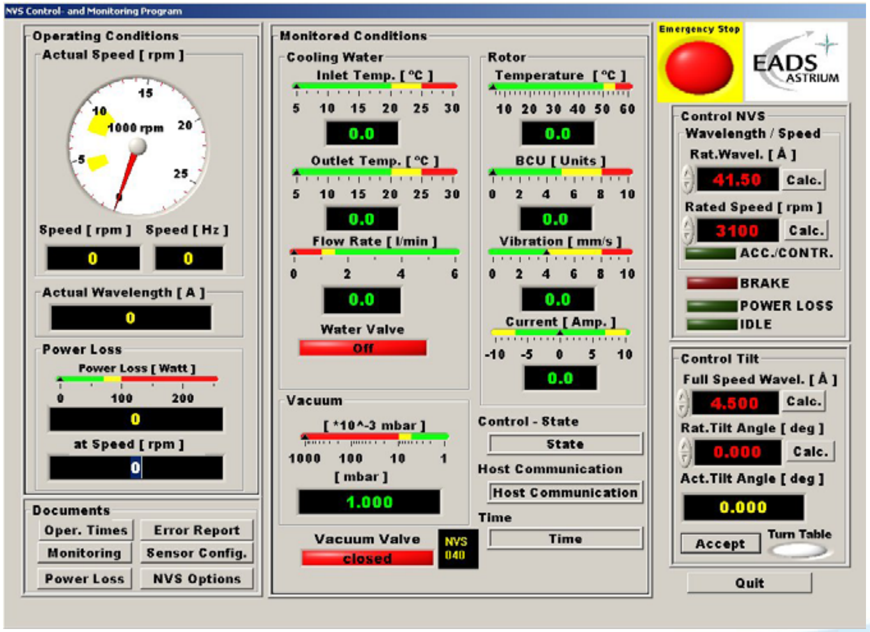
Neutron Velocity Selector

Control-System (baseline)

The Neutron Velocity Selector (NVS) can be controlled by:

- Converter – buttons (only simple speed controlled mode)
- Local computer – Graphical User Interface (GUI)
- Remote computer – TCP/IP via the local computer

The converter and the local computer are parts of the baseline delivery of the NVS



Functions of the control program:

- speed/wavelength control
- slip montoring
- current monitoring
- power loss monitoring (switchable)
- prevent the NVS of operating in critical speed ranges

<- GUI of the control- and monitoring program*
and the tilt-table* control.

* options

Neutron Velocity Selector

Monitoring System (option)

The monitoring system takes over various safety and process analysis tasks to prevent the NVS from damage.

In addition to the NVS baseline control functions, the monitoring system can take over various safety and process analysis tasks.

For this purpose the following process parameters are monitored and compared with stored limit values:

- vibrations
- BCU value
- rotor temperature
- cooling water inlet temperature
- cooling water outlet temperature
- cooling water flow rate
- operating vacuum
- sensor defect of the measuring tube (operating vacuum)
- position of the vacuum valve (open / closed)

The system above is a normal configuration, which can be reduced or extended on customer needs

Monitoring System

19“-rack ->

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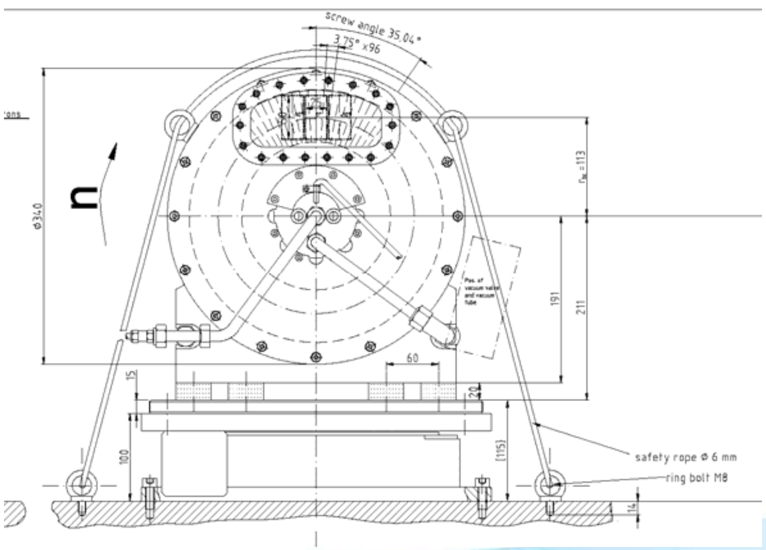
Tilt–Table (option)

The tilt-table completes the NVS with the following additional functions:

- extending the wavelength range for faster neutrons
- reducing of the wavelength resolution
- reducing of the neutron transmission

As one part of the tilt-table option all control components are installed in a 19“-rack

The control of the tilt-table is integrated in the NVS Control-GUI. Therefore a safe tilt-table operation can be ensured (only when the speed of the NVS = 0 rpm).



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