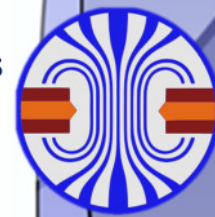


Jalousie Detector System

The ^{10}B based alternative for ^3He filled PSD counter tubes!

represented by
**Beijing Huanhe
Technology Co.**
Ltd. in P. R.
China

CDT GmbH
CASCADE Detector Technologies
Hans-Bunte-Straße 8-10
D - 69123 Heidelberg
www.n-cdt.com



CDT, Your partner since 2006 for ^{10}B based neutron detectors and system designwith a performance far beyond standard neutron detectors.

The Jalousie neutron detector is the detector alternative for modern neutron instruments: at POWTEX/FRM2 it will be assembled to cover 9m^2 on a closed cylindrical surface.

The CDT developed neutron detector employs solid $^{10}\text{B}_4\text{C}$ coatings to replace ^3He as neutron converter. The detection efficiency of an individual layer is enhanced by tilting the layer towards the incoming neutron path, thus increasing the effective absorption depth. Additionally, eight such boron layers are arranged along any neutron path to further enhance the overall detection efficiency up to 68% at 1.8Å and up to 55% at 1Å .

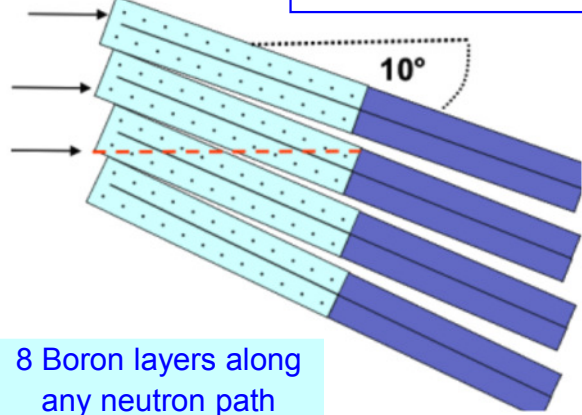
A Jalousie detector system comprises a multitude of lamella shaped individual modules, where each makes up an enclosed multi-wire proportional chamber with two anode planes and four cathode planes that are coated with the converter layers.

Several such lamellae, when stacked and tilted with respect to the neutron paths, may be arranged to cover square meter sized planes, or a cylindrical surface to enclose a scattering sample as in POWTEX at FRM2.

The POWTEX lamella length was chosen to be 160cm and includes a centric orientation of the cathode readout channels towards the scattering centre.

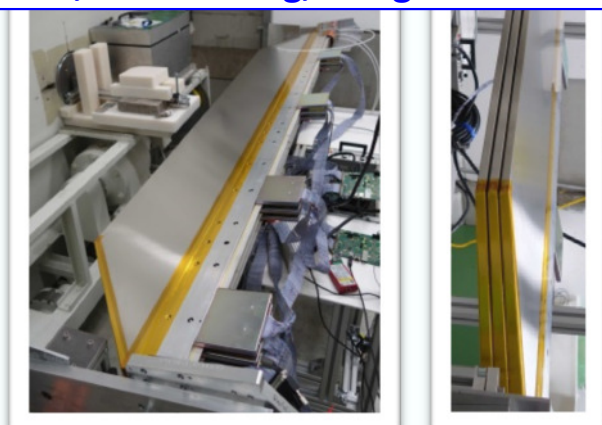
For the important front- and backside of the cylinder, a special rearranged configuration was developed that allows to cover these end-caps without additional blind areas.

Detector Concept



8 Boron layers along any neutron path

Detector segment, 160 cm long, design POWTEX



Novel Challenges and Chances

- The Jalousie detector system is a volume detector, where neutrons are also detected over the depth of the detector in 16 voxel.
- 4D detection: $x, y, z, \text{time} \rightarrow 2\theta, \phi, r, \text{TOF}$.
- New analysis and data evaluation software is in development.
- Stray reflections may be accounted for in the analysis (intrinsic collimation).

System Readout and Control

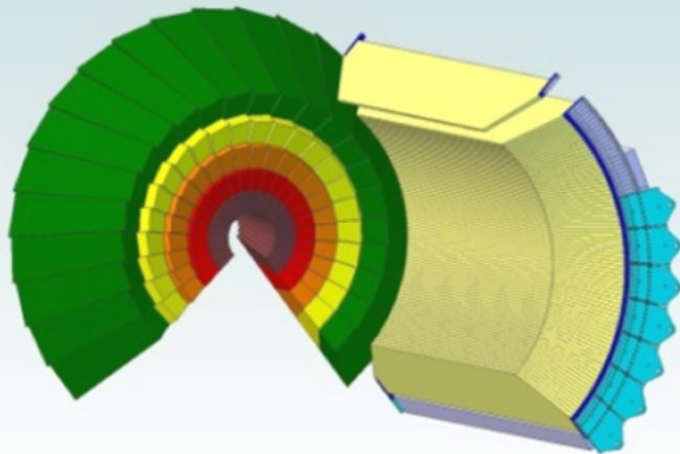
- Anode-cathode coincidence readout
- FPGA forms event-mode data (100 ns time binning)
- Central clock distribution system
- Multi path access and firmware upgrade
- Integration into TANGO and EPICs server

Two Jalousie segments under test at HEIDI (FRM II)



Design of POWTEX

(240 lamella segments as well as forward- and backward-end-cap, covering 273.6° of the full cylinder)

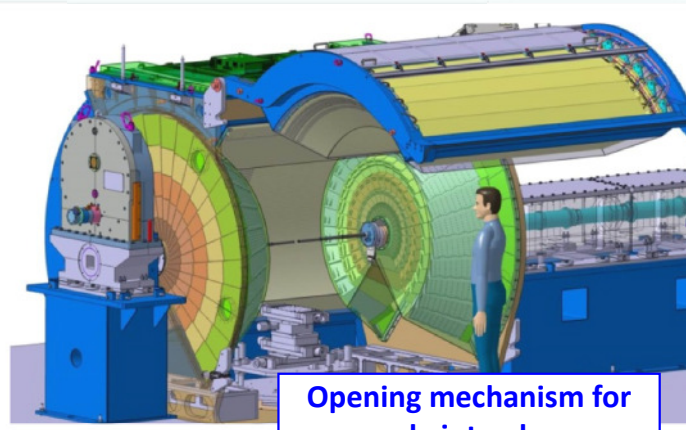


Actual status:

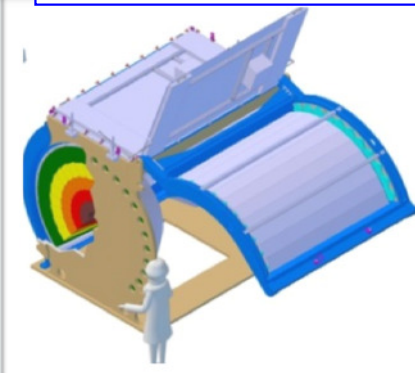
- POWTEX is in serial production at CDT

End-cap modules 100% active area

- End-cap modules have anode wires pointing at the sample
- Complicated in manufacturing but concept solves challenging geometry

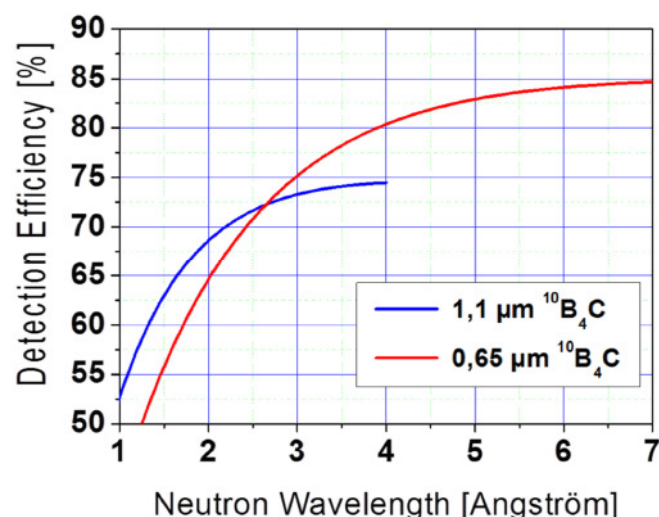


Opening mechanism for sample interchange



Jalousie: efficiency adaptable to application

The absolute detection efficiency has been proofed by measurement at HEIDI/FRM II within 3% of the calculated value.



Specifications

- Accumulate detection efficiency through:
 - 8 boron layers
 - inclined boron layers (10°) to increase effective absorption depth
 - Result: 68% (1.8Å) and 55% (1Å)
- Spatial resolution: FWHM = 5 mm at ambient counting gas pressure.
- TOF-resolution below FWHM = 3–10 μs due to many-folded anode readout wires within the depth of one lamella.
- High count rate capacity of 1 MHz (10% dead time) per module due to the segmented and individually read out cathode structure.
- Very low γ -background: Low Z converter material ^{10}B , the high energy of the α can easily be detected and small drift gaps amplify the enormous difference in ionization density, a fast electron from gamma interaction creates in the counting gas as opposed to an alpha particle from neutron conversion.
- Long term stability due to continuous purge of cheap counting gas through detector.

"The ^{10}B based Jalousie neutron detector – An alternative for ^3He filled position sensitive counter tubes", M. Henske et. al., Nucl. Instr. and Meth. A 686 (2012) 151–155.

"Absolute efficiency measurements with the ^{10}B based Jalousie detector", G. Modzel et. al., Nucl. Instr. and Meth. A 743 (2014) 90–95.

POWTEX is designed and build by RWTH Aachen/Forschungszentrum Jülich and funded by BMBF, Germany.