Aim of the Experiment

JESSICA investigates the neutronic performance of cold moderators

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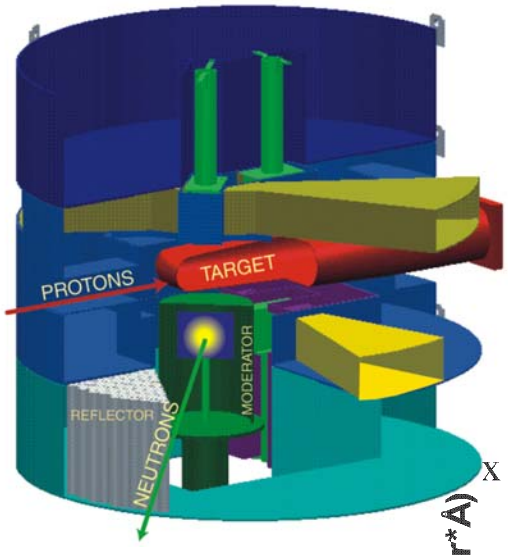
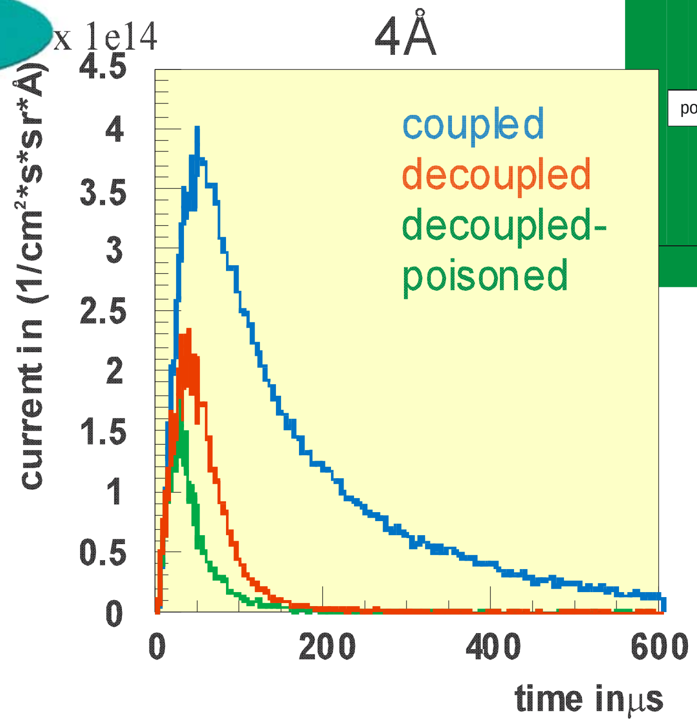
By measurement of:

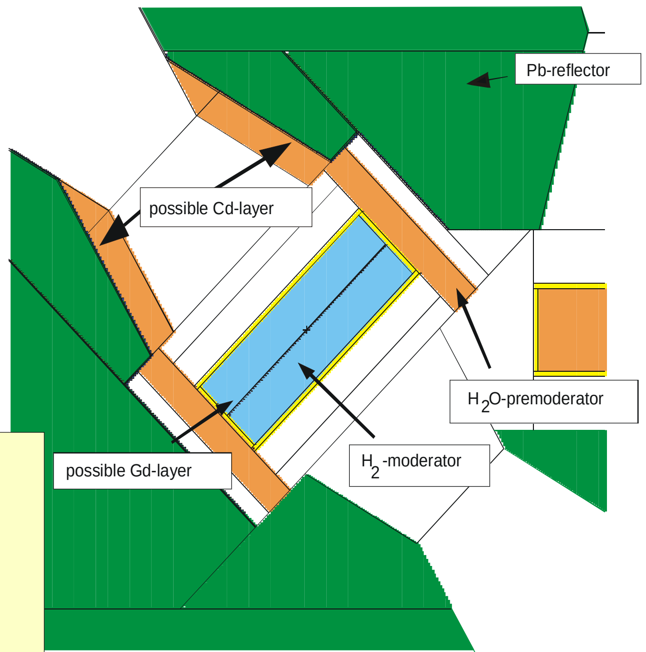
- **Thermal time of flight spectra**
- **Wavelength dependent neutron pulse widths**
- **Determination of n/p ratio**

and validation of Monte-Carlo-models

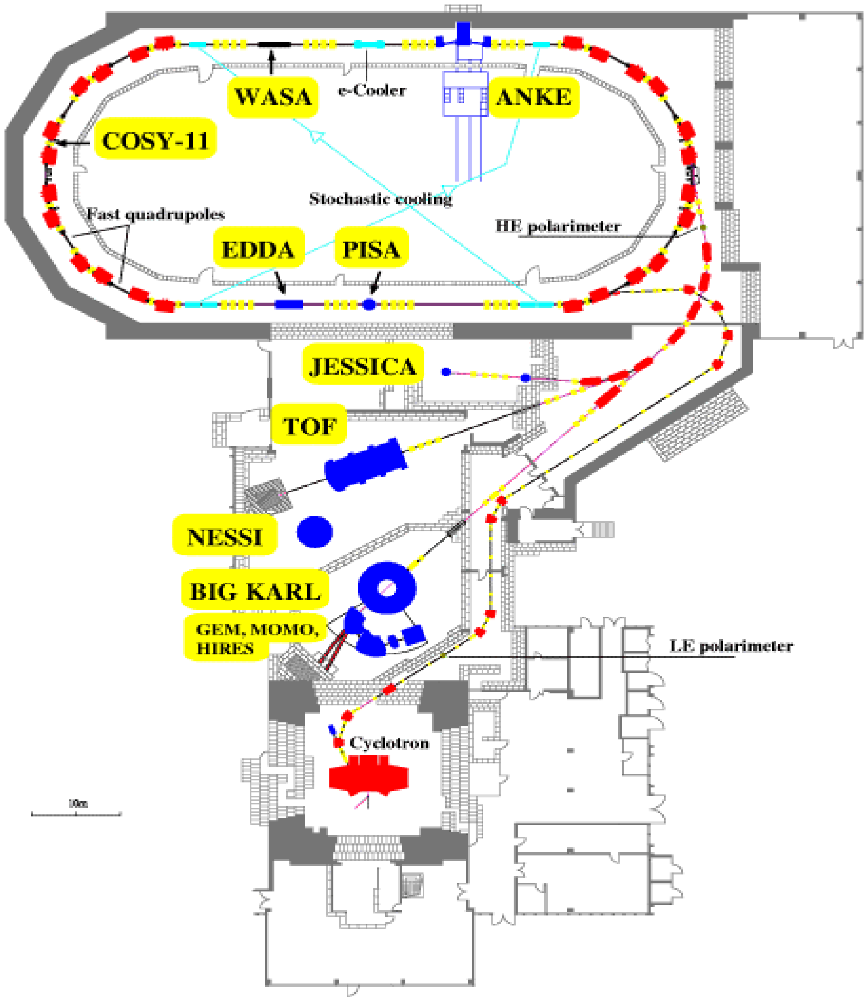
Moderator Geometry







COSY (COoler SYnchrotron) 150 MeV- 2.5 GeV



JESSICA (Jülich Experimental Spallation Target Setup in COSY Area)
external beam

NESSI (Neutron Scintillator and SIlicium detector)
external beam

PISA (Proton Induced SpAllation)
-internal beam
-luminosity: 6.6*10^{-34} $cm^{-2}s^{-1}$
-low absorption and small energy loss of ejectiles due to target thicknesses (down to 50 $\mu g/cm^2$

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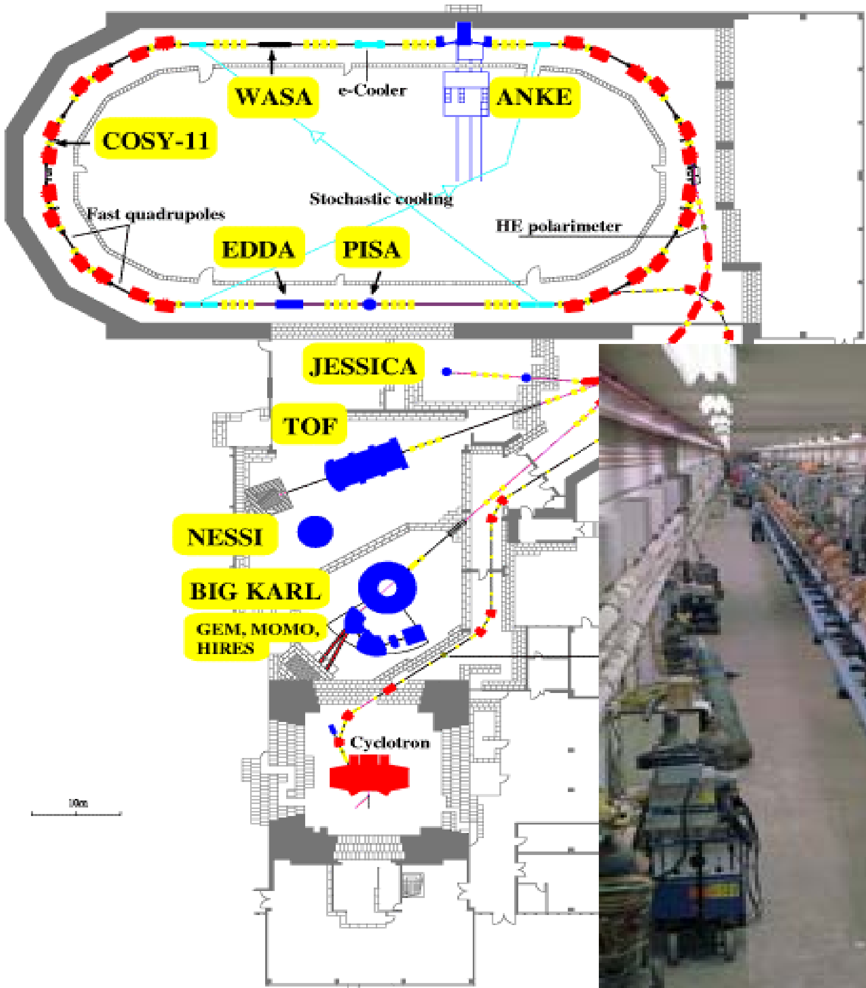

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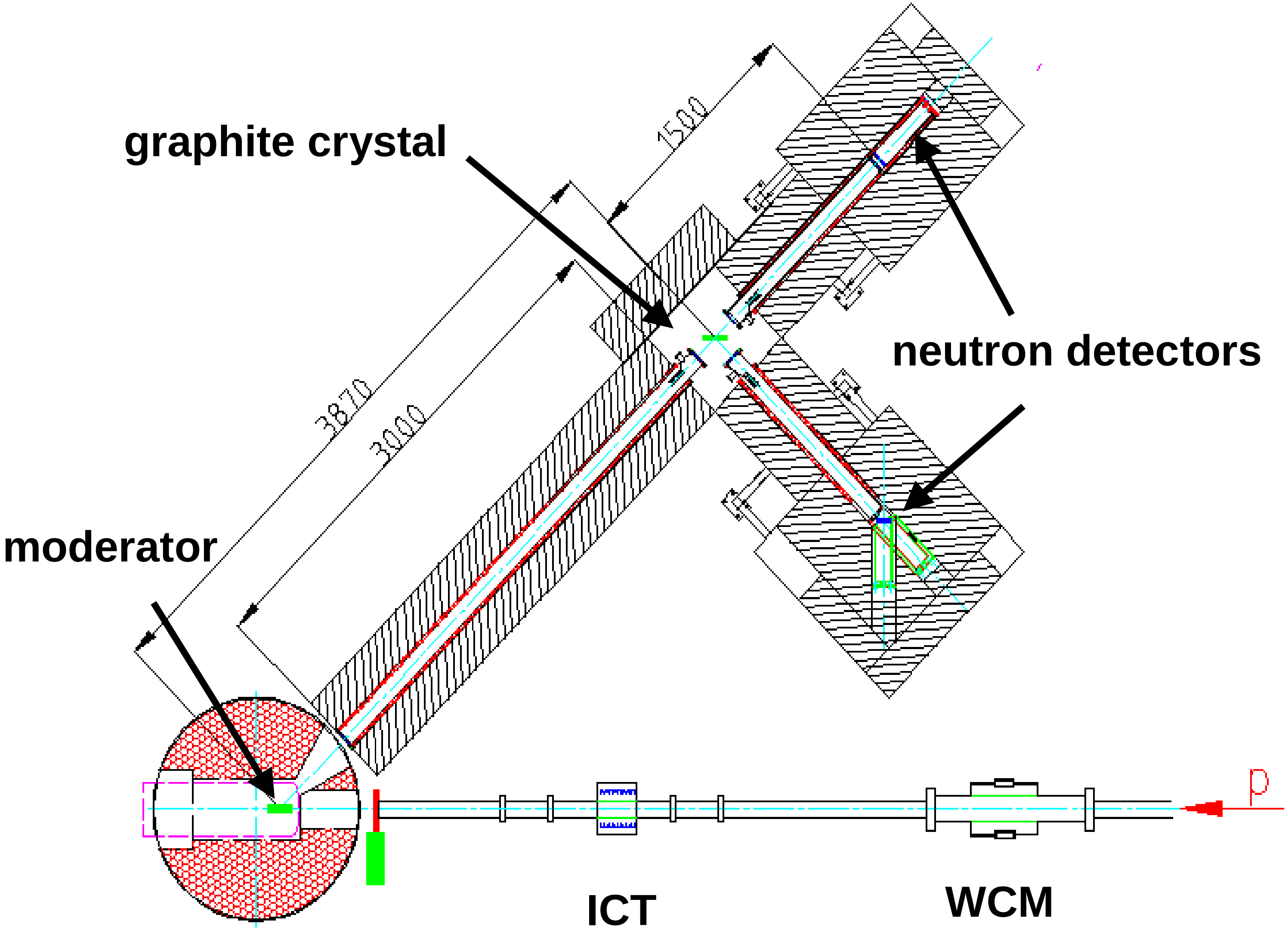
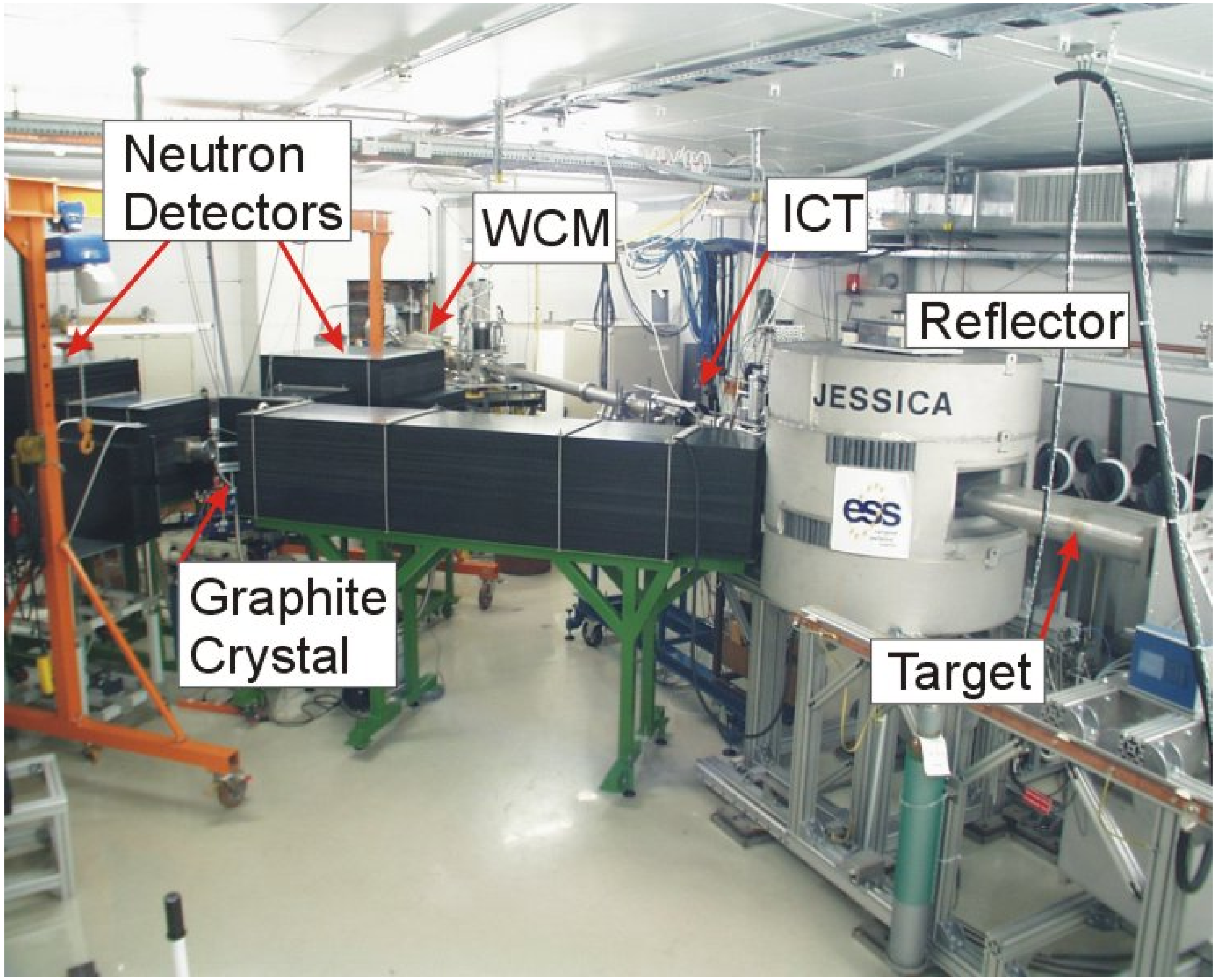
Experimental Setup

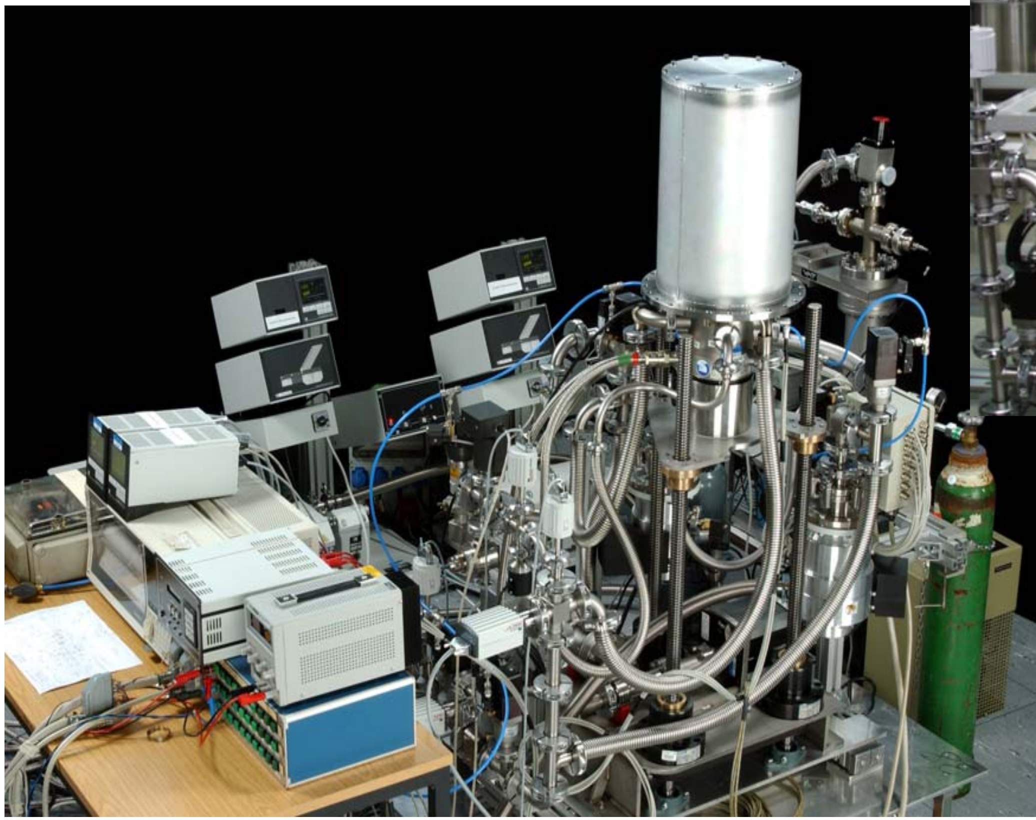


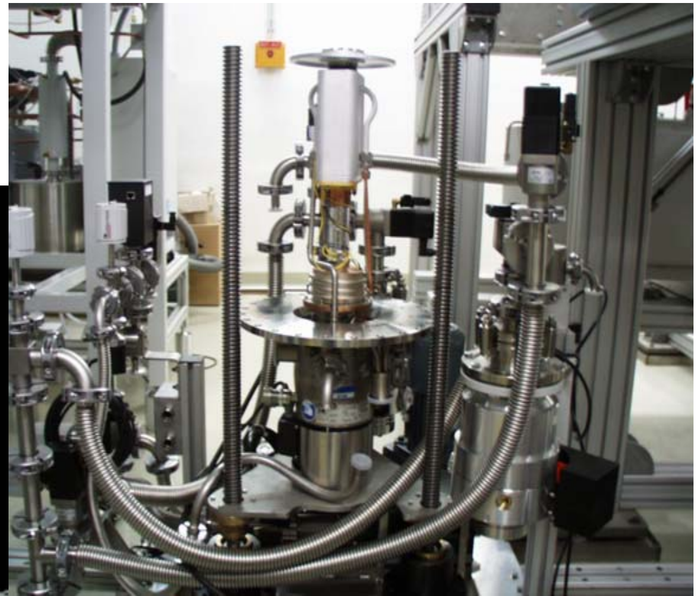
A view into the JESSICA hall



Cold Moderator System

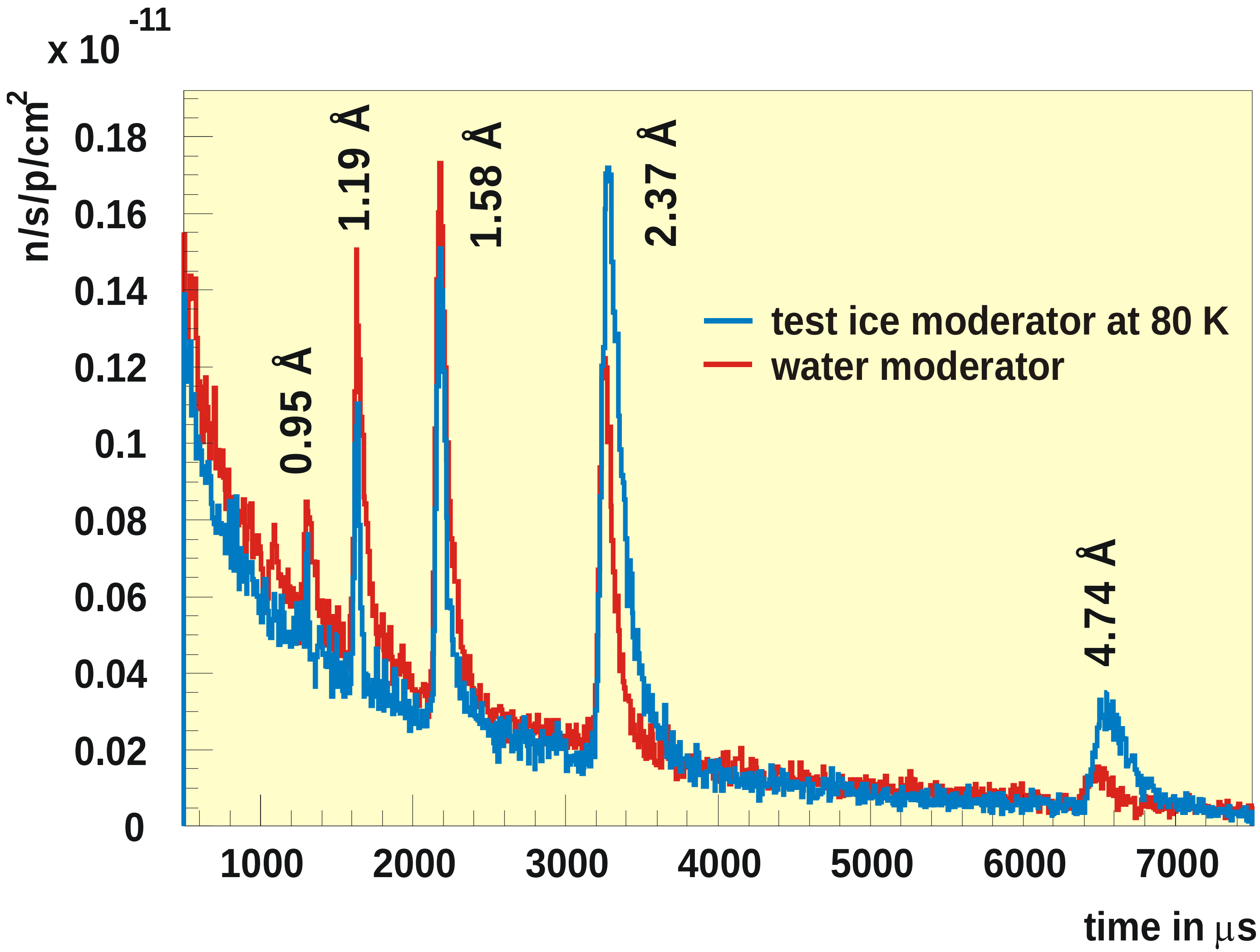
Test setup at ZAT



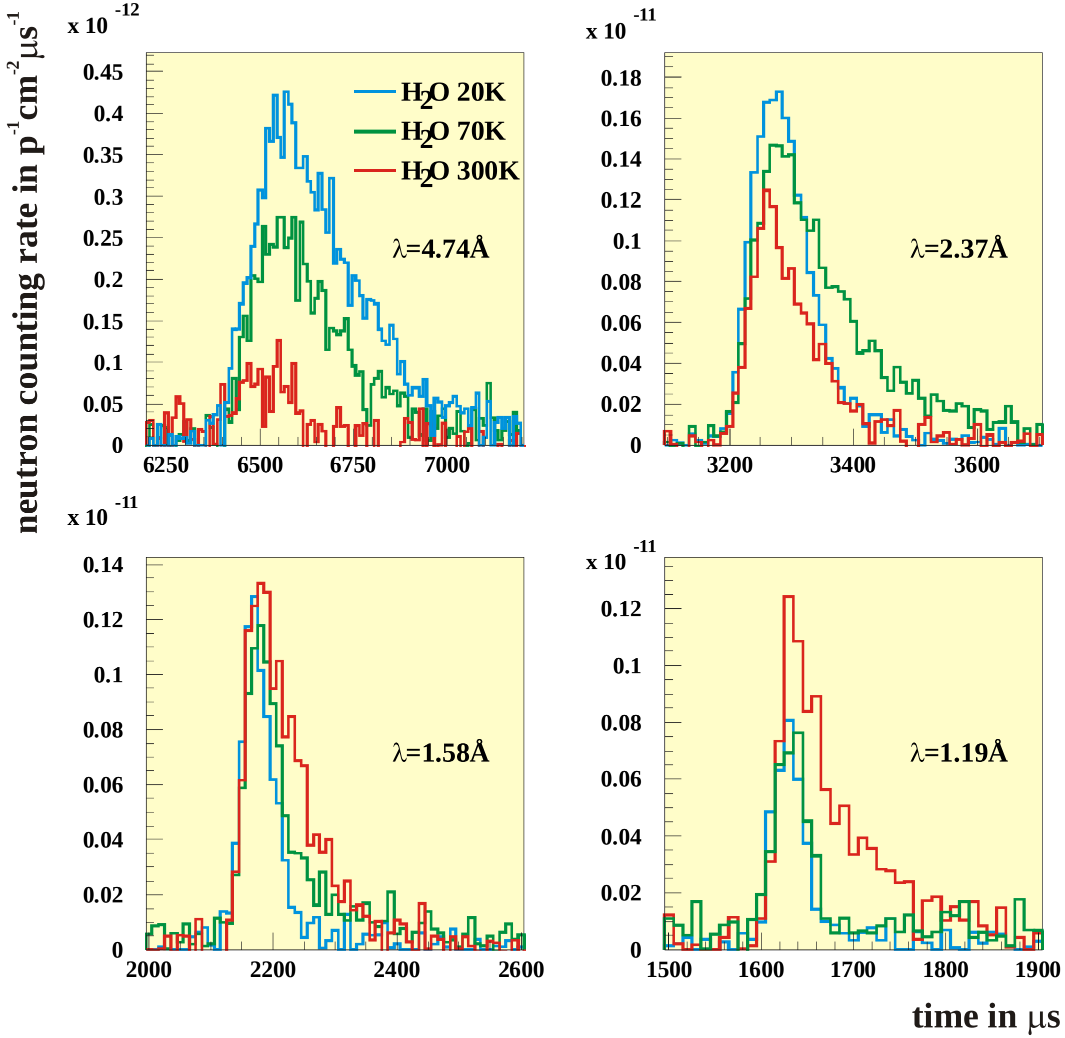


Opened moderator vessel at JESSICA

Wavelength Dependent Time Structure of the Neutron Pulses



Wavelength dependent TOF-Spectra

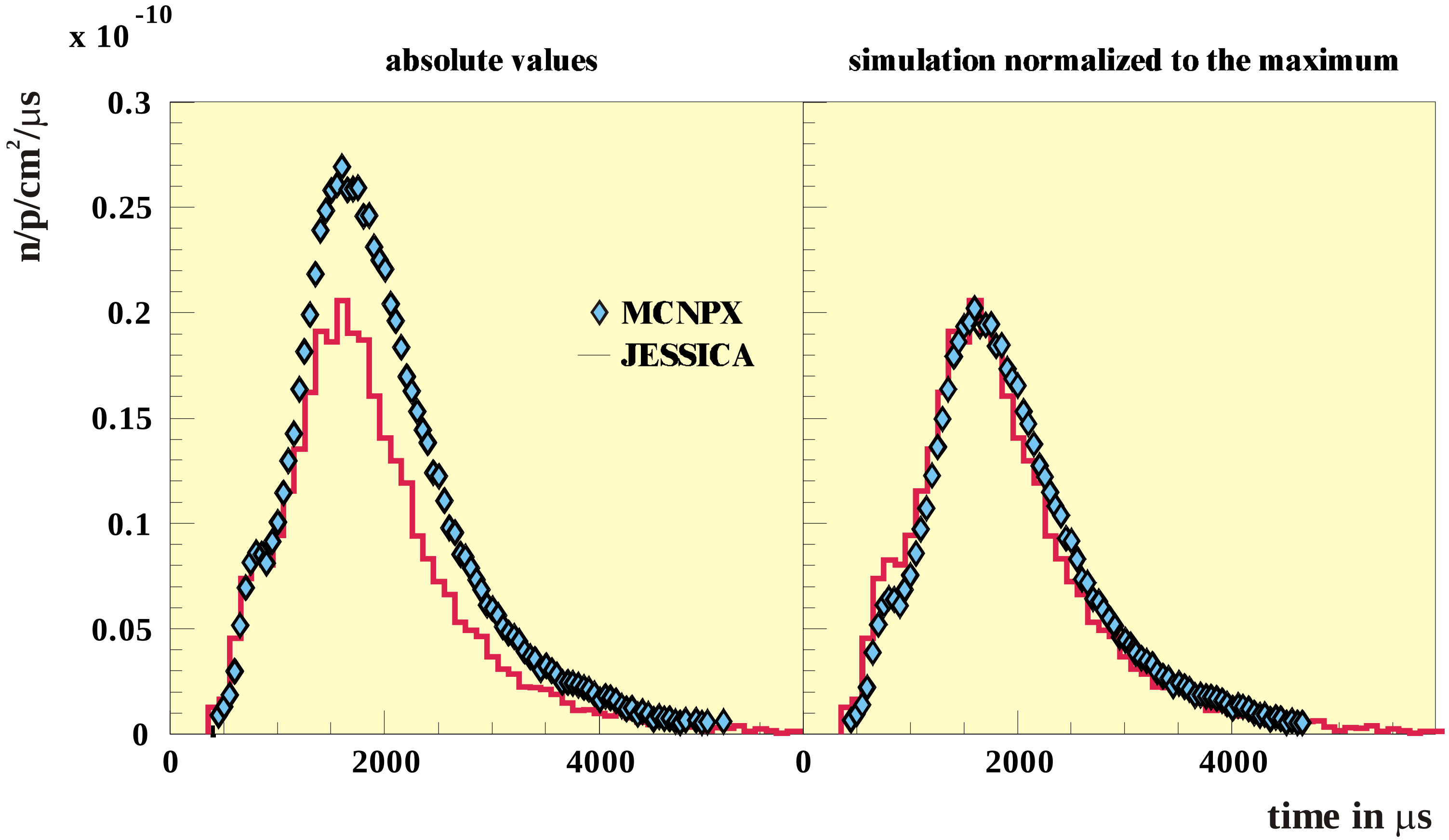


New Evaluated S(α,β) Data

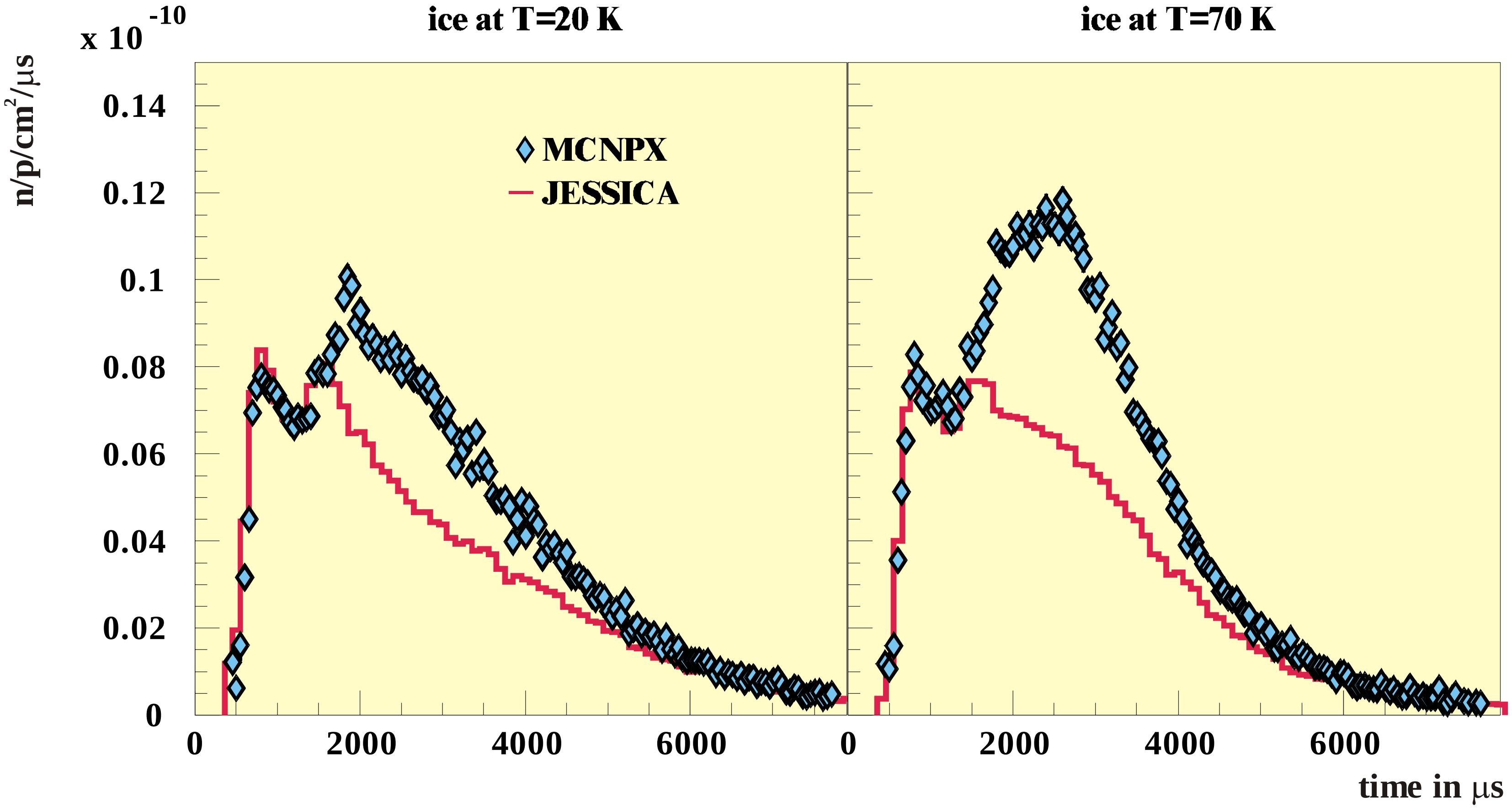
The following thermal libraries have been evaluated for MCNPX:

- **H in H_2O ice at T=20, 77, 113, 165, 218, 248, 273 K**
- **H in light water at T= 273, 278, 293, 308 K**
- **para and ortho H in liquid H_2 at T=14, 16, 20 K**
- **para and ortho H in gaseous H_2 at T=20, 25 K**
- **H in solid methane at T=31, 57, 77, 89 K**
- **Al at T=20 K**

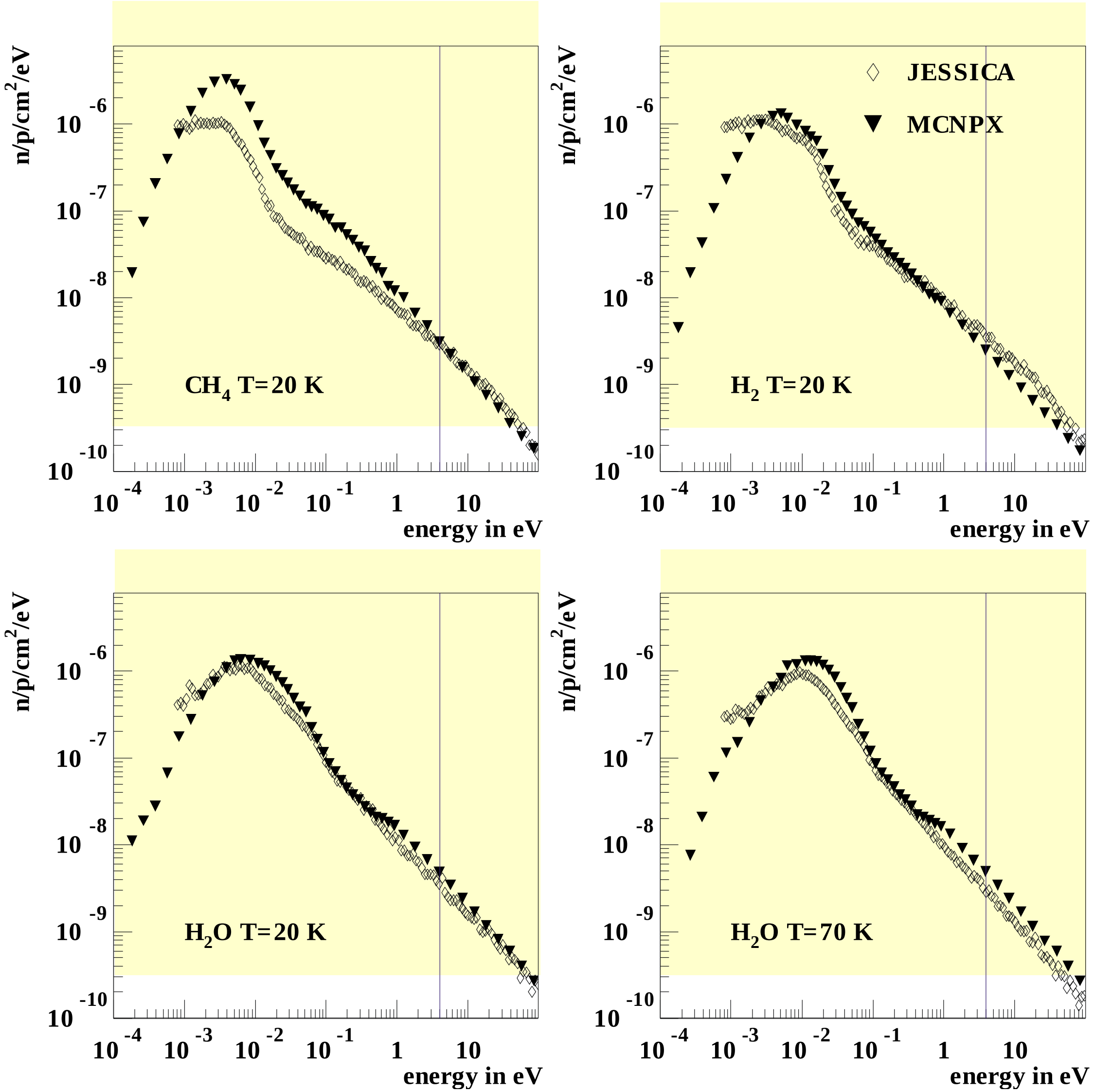
Comparison of TOF-Spectra for water at T=293 K between MCNPX and JESSICA



Comparison of TOF-Spectra for ice between MCNPX and JESSICA



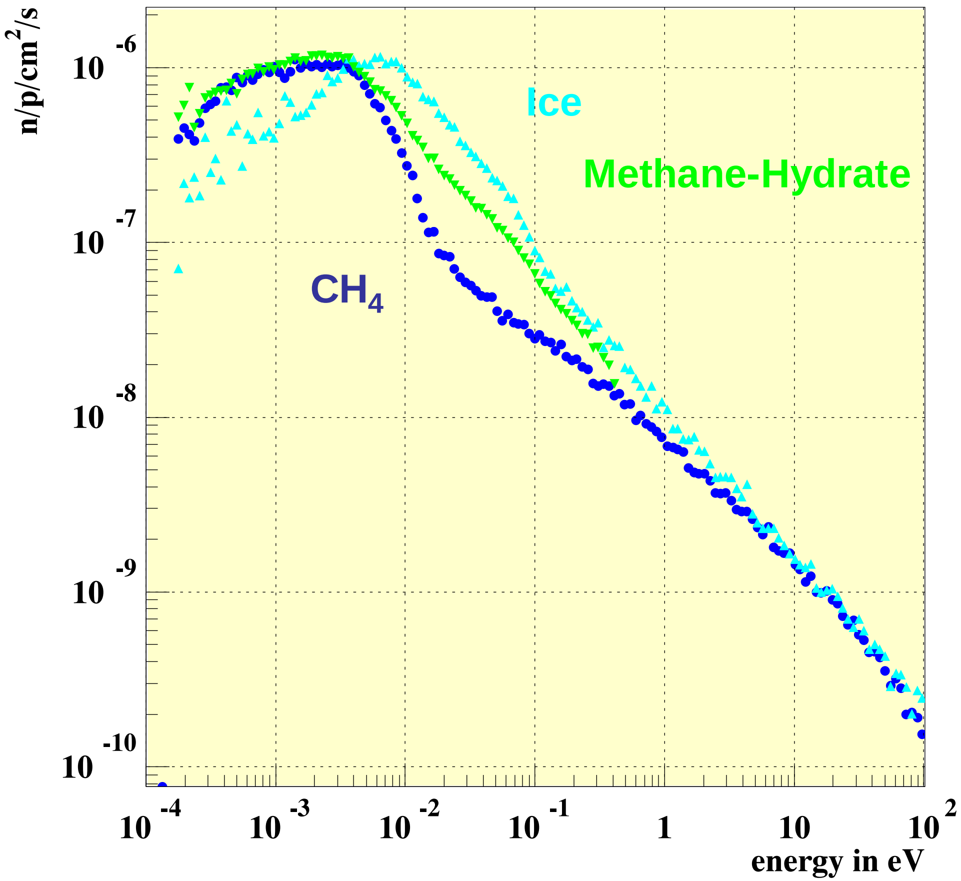
Comparison of Energy-Spectra between MCNPX and JESSICA



- **For the first time we compared Monte Carlo simulations with experimental data on an absolute scale!**
- **Simulation of the whole history: From 1.3 GeV protons down to a few meV neutrons in a complex geometry**
- **Applied a new developed data base for neutron transport below 4 eV**

Energy Spectra for Ice, methane-clathrate, and solid methane

Does methane hydrate combine the properties of solid methane and ice ?



- We see an increase of the neutron flux in the energy range from 8 meV to 300 meV for a methane-hydrate moderator compared to solid methane.
- The maximum is comparable to solid methane.
- MC-simulation of methane-clathrate currently not possible due to missing neutron scattering kernels.