Shielding Activities at FZJ-JCNS

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03.05.2017 | ESS Shielding Meeting

JÜLICH

FORSCHUNGSZENTRUM

JCNS - ESS Resources

Instruments: SKADI, DREAM and TREX

Software tools:

- **MCNP** .exe (not src)
- **PHITS**, an alternative to MCNP (not valid for the safety regulation)
- **CombLayer**, to create input files for MCNP (and PHITS)

Hardware environment:

- 4 nodes cluster (12-core each)
- Jülich supercomputers & HPC in Aachen (JARA-HPC)

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Strategy

- use PHITS to determine the geometry configuration of the shielding of the beam lines,
- implement the outcome of PHITS in MCNP,
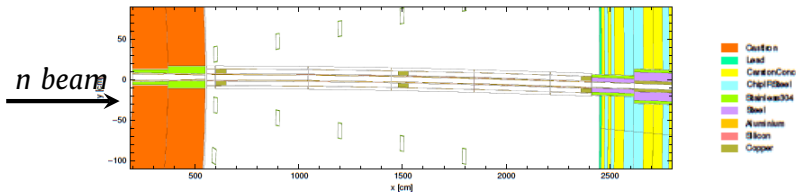- run a MCNP simulation of the final geometry for the safety purposes.

BL Implementation in CombLayer
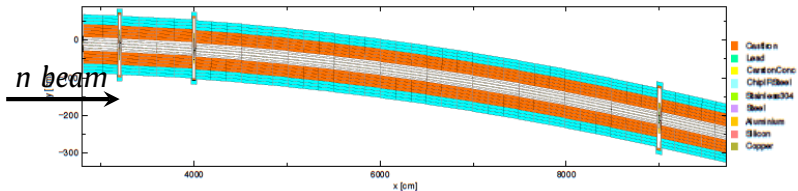## PHITS input for SKADI
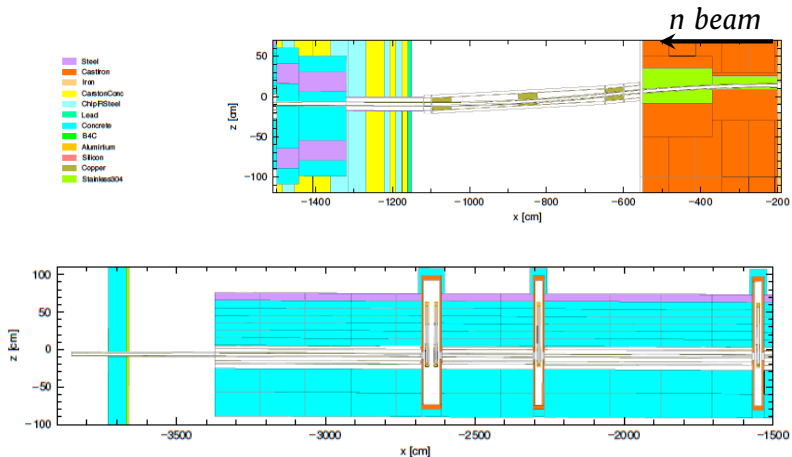
BL Implementation in CombLayer
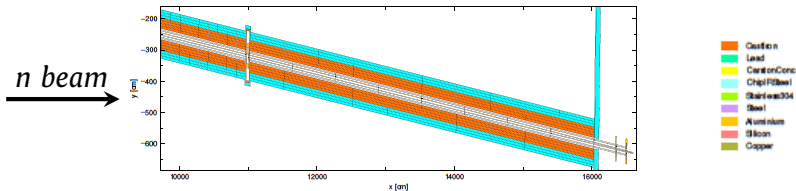## PHITS input for TREX
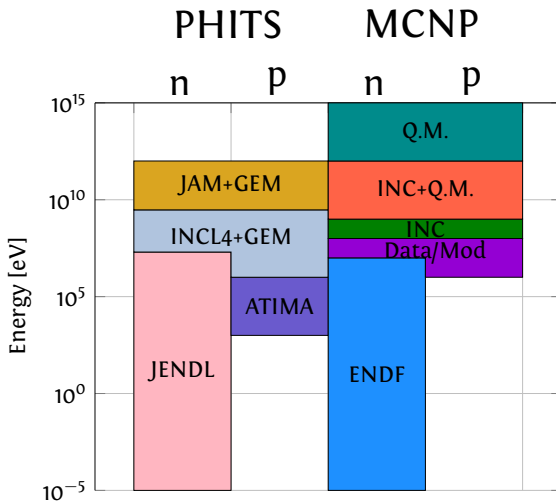
BL Implementation in CombLayer
PHITS input for TREX

BL Implementation in CombLayer
PHITS input for TREX
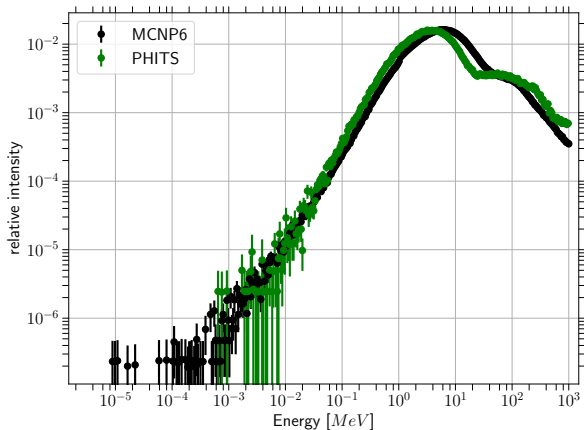
PHITS vs. MCNP
n and *p* (default) physics packages

PHITS vs. MCNP

Spallation neutron spectra from $(p + W)$

Preliminary Studies w/ PHITS
Spectrum of neutrons at the entrance of BL's

MCNP: Neutron source term for NMX (from V. Santoro)

- surface source of $7.5cm \times 7cm$ dimension
- position: $\sim$2m from IP
- ten $\cos\theta$ bins in forward direction and one $\cos\theta$ bin in backward direction

PHITS: Neutron flux for 7 beam lines

- source: 2 GeV proton beam
- surface tally perpendicular to beam axis, with a dimension of $7.5cm \times 7cm$
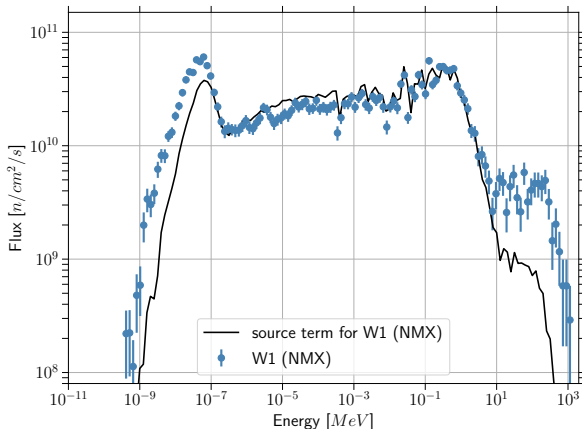- position: $\sim$2m from IP

Preliminary Studies w/ PHITS

Spectrum of neutrons at the entrance of BL's
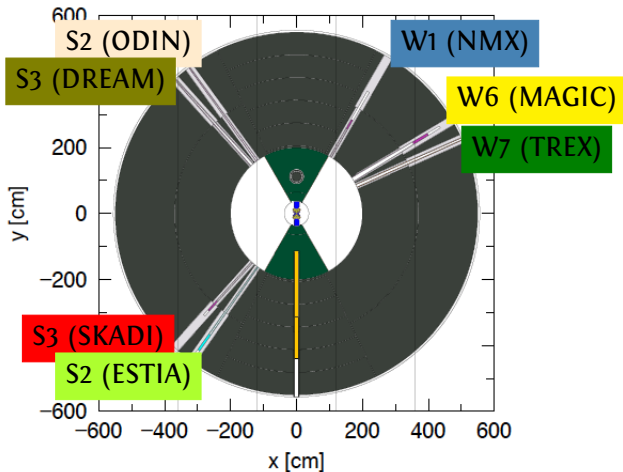
Preliminary Studies w/ PHITS
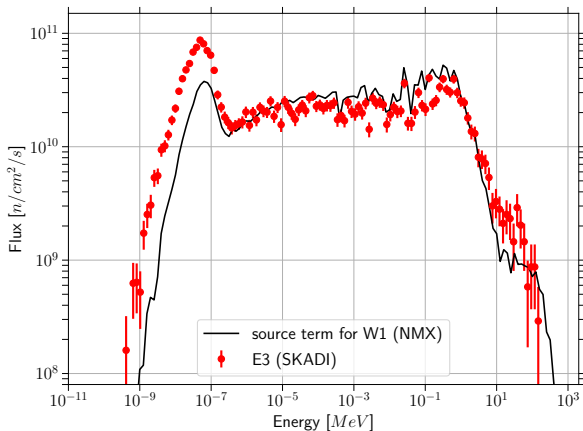
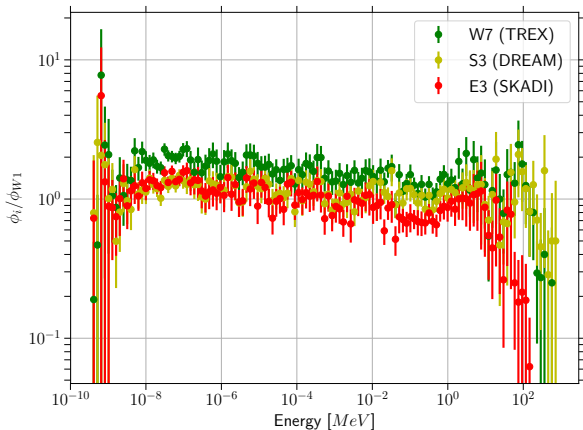## Source term vs. W1 neutron spectrum

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Preliminary Studies w/ PHITS

Source term vs. E3 neutron spectrum

Preliminary Works w/ PHITS
Flux Ratio between different BL's and W1

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Preliminary Works w/ PHITS

Flux Ratio between adjacent BL's
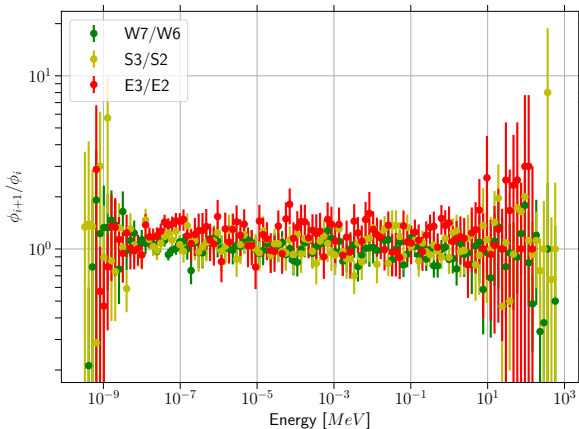
Next Step:

Heavy Shutter

- determine number (and position) of beam collimators
- consider neighbors

Beam Line Shielding

** Neutron source term will be used to speed up the simulations.

PHITS at JURECA (JSC)
PHITS Parallelism