High energy mono-energetic and white neutron sources in RCNP

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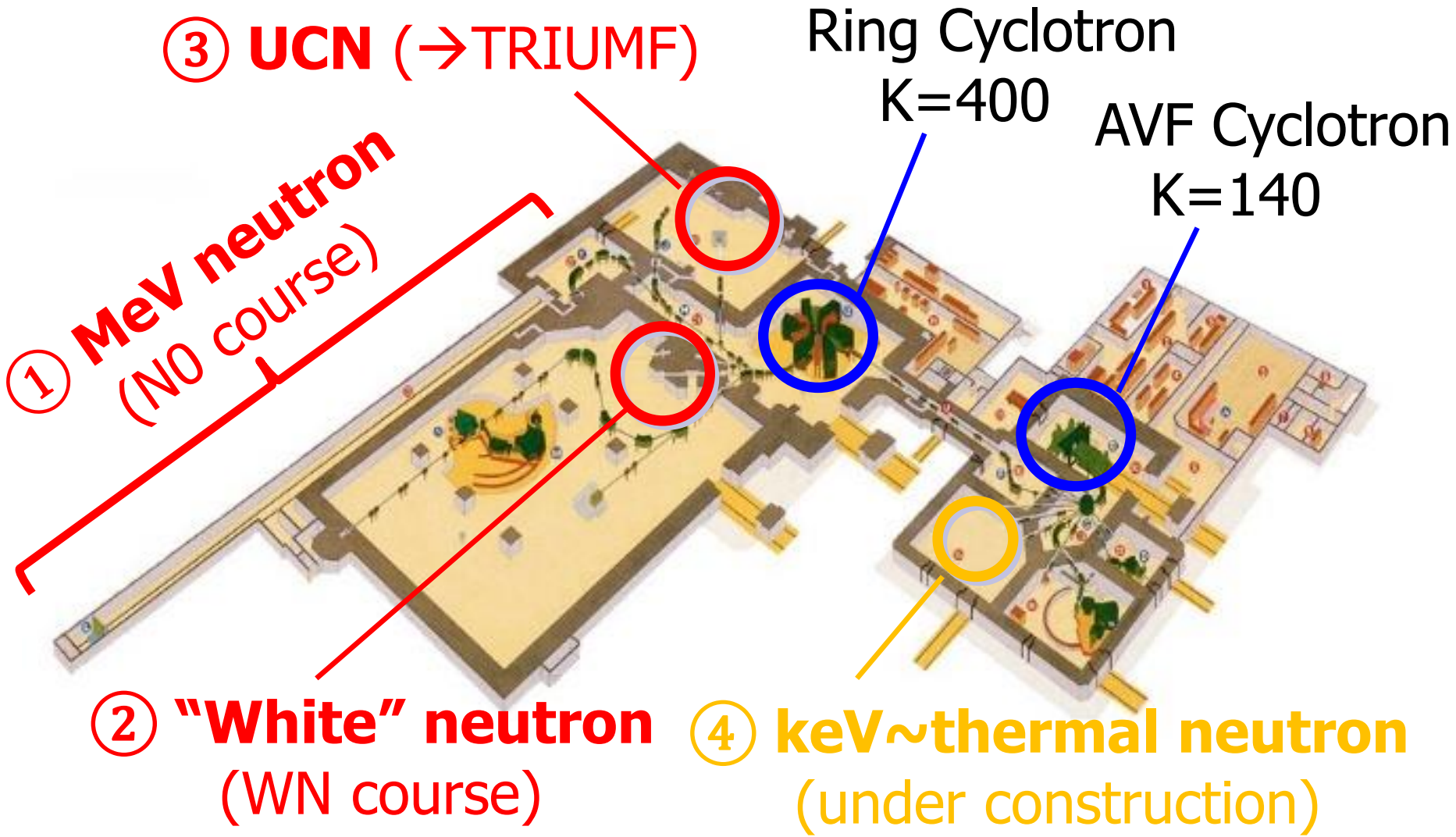
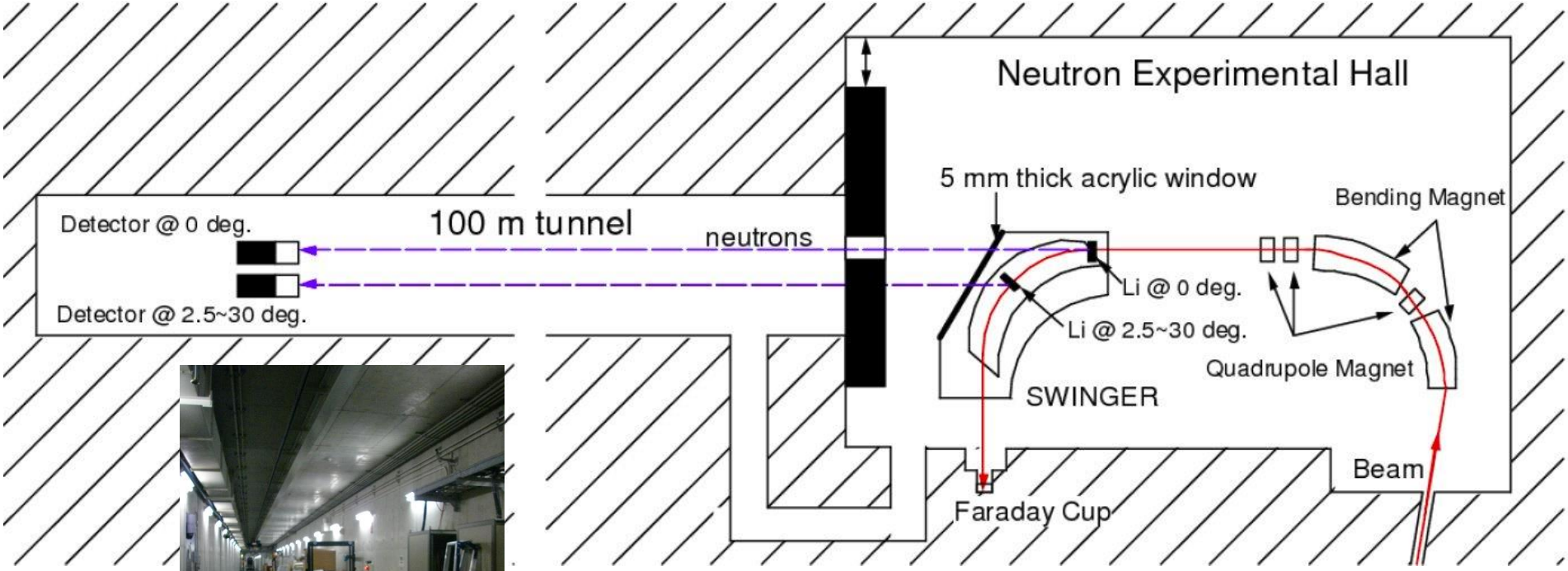
RCNP Cyclotron Facility



MeV neutron source (N0 course, since 1996)



Specifications

Primary beam: proton, 5~392 MeV

Beam current: 1μA (typical)

Pulse width: <100ps (FWHM)

Repetition rate: 16MHz (freq. division down to ~1MHz)

Neutron production reaction: ^{7}Li(p,n)^{7}Be

Neutron intensity: ~2×10^{9} n/MeV/sr/μC (peak component)

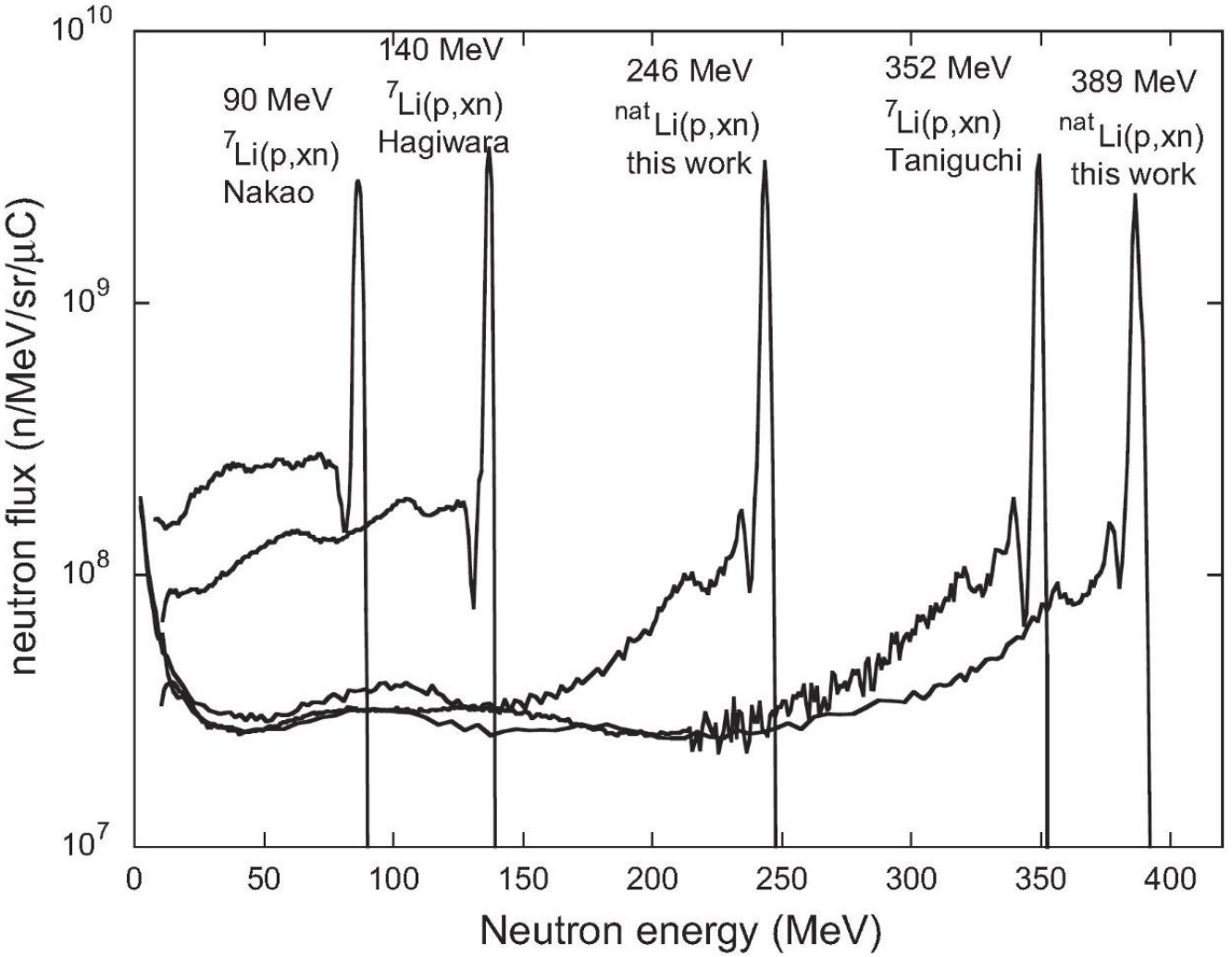
~10^{11} n/μC (integrated)

FWHM: 660keV@198MeV, 2.1MeV@389MeV

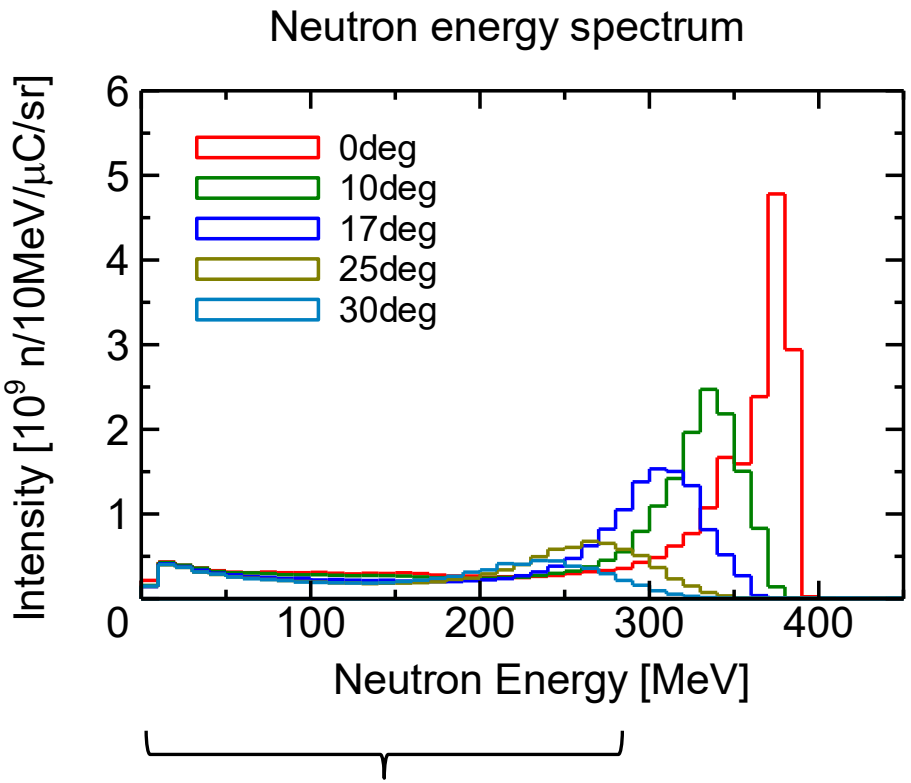
(consistent with ΔE in target and σ_t =0.7ns (FWHM))

Energy distribution

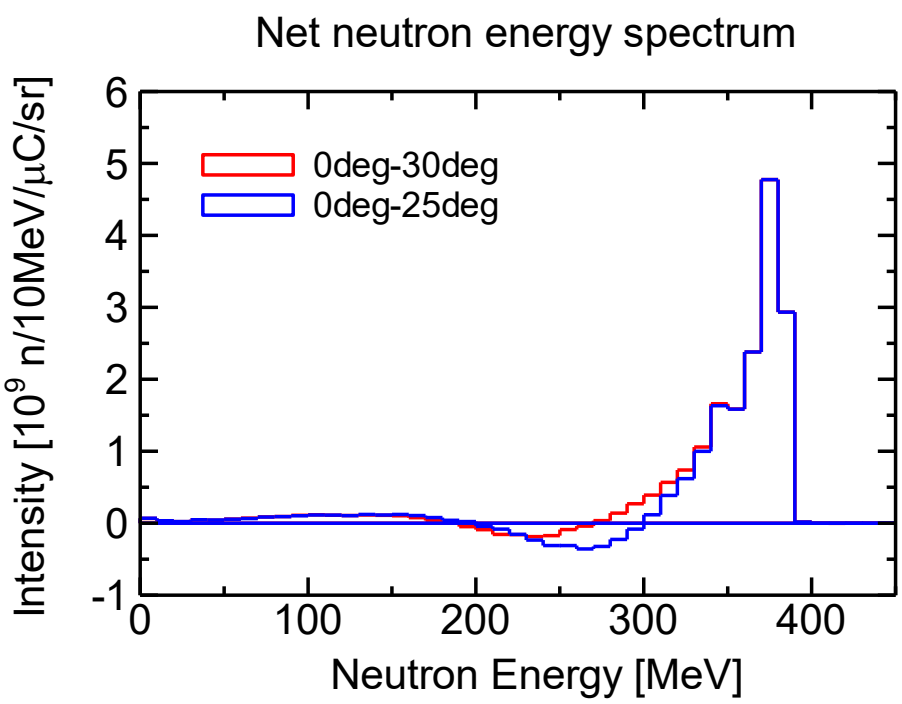
Y. Iwamoto et al.,
NIMA629, 43-49 (2011)



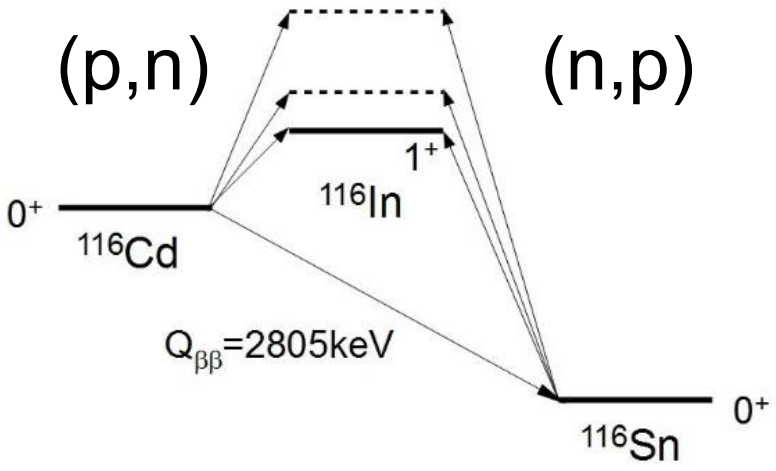
Angular dependence; subtraction of continuum



Evaporation neutrons
→ Common for different angles

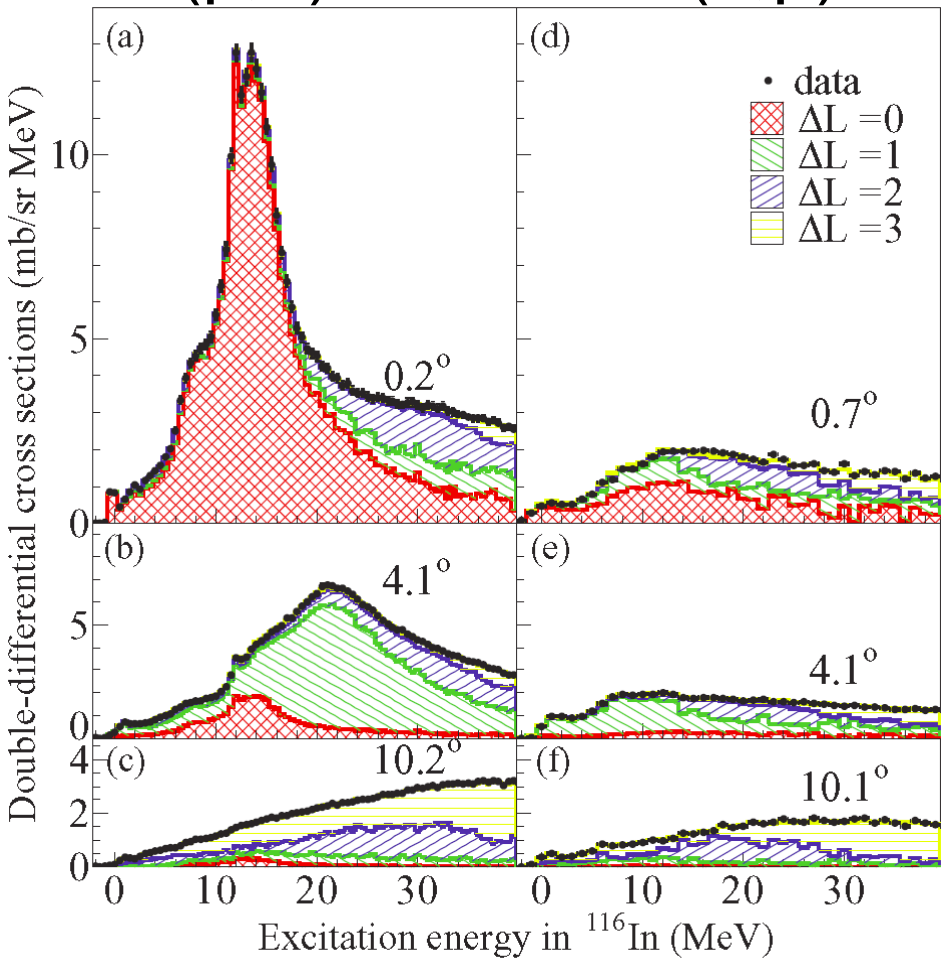


Gamow-Teller strength in ^{116}Cd ββ



M. Sasano et al.,
Phys. Rev. C85, 061301(R) (2012)

^{116}Cd(p,n)^{116}In ^{116}Sn(n,p)^{116}In



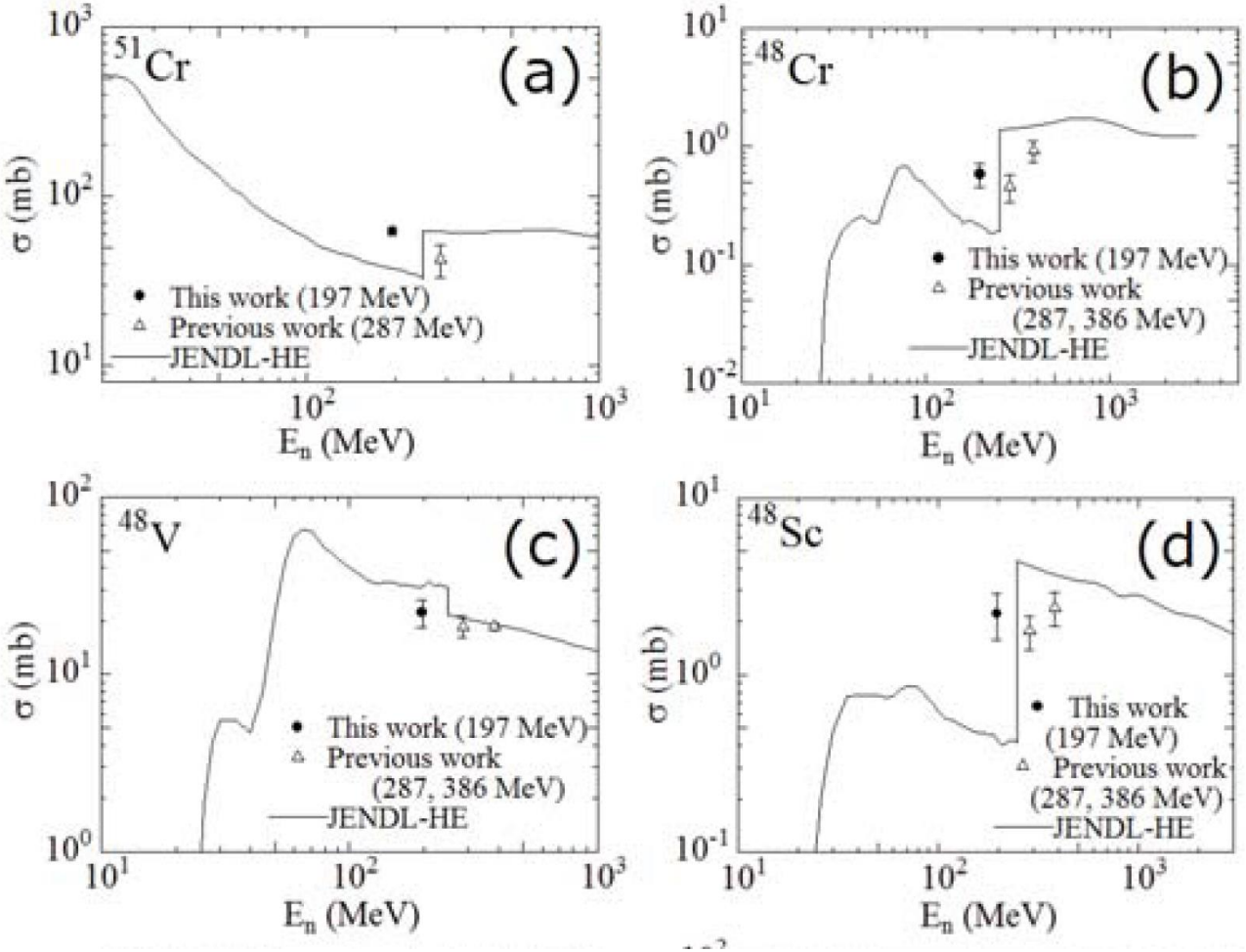
Neutron Polarimeter NPOL3

□ = 1m×1m

Ay(eff.)=
0.37-0.43 (n,n)
0.13-0.15 (n,p)

H. Sakai et al., NIMA369, 120 (1996).
T. Wakasa et al., NIMA547, 569 (2005).

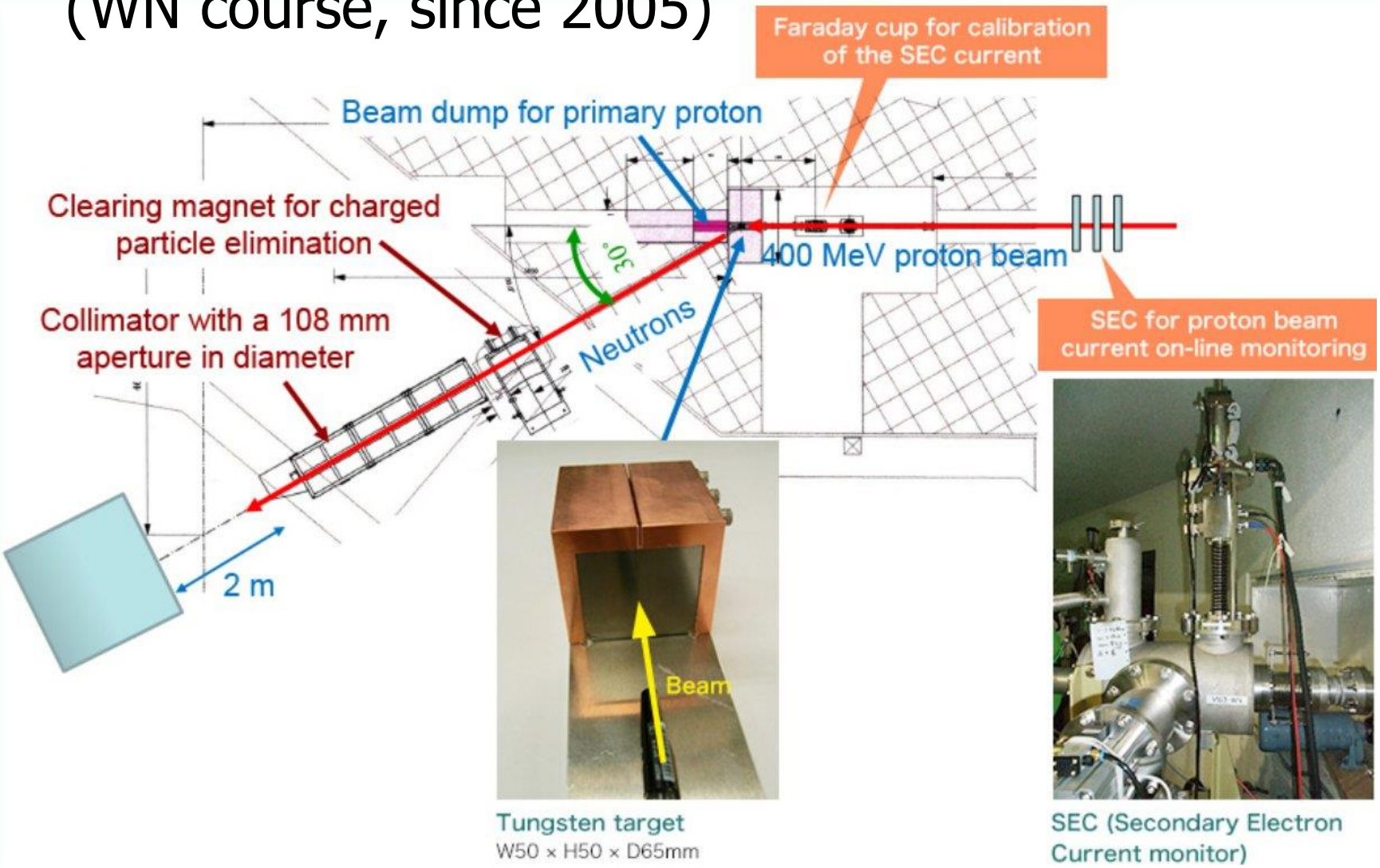
Neutron-induced reaction cross sections on Chromium at 197MeV



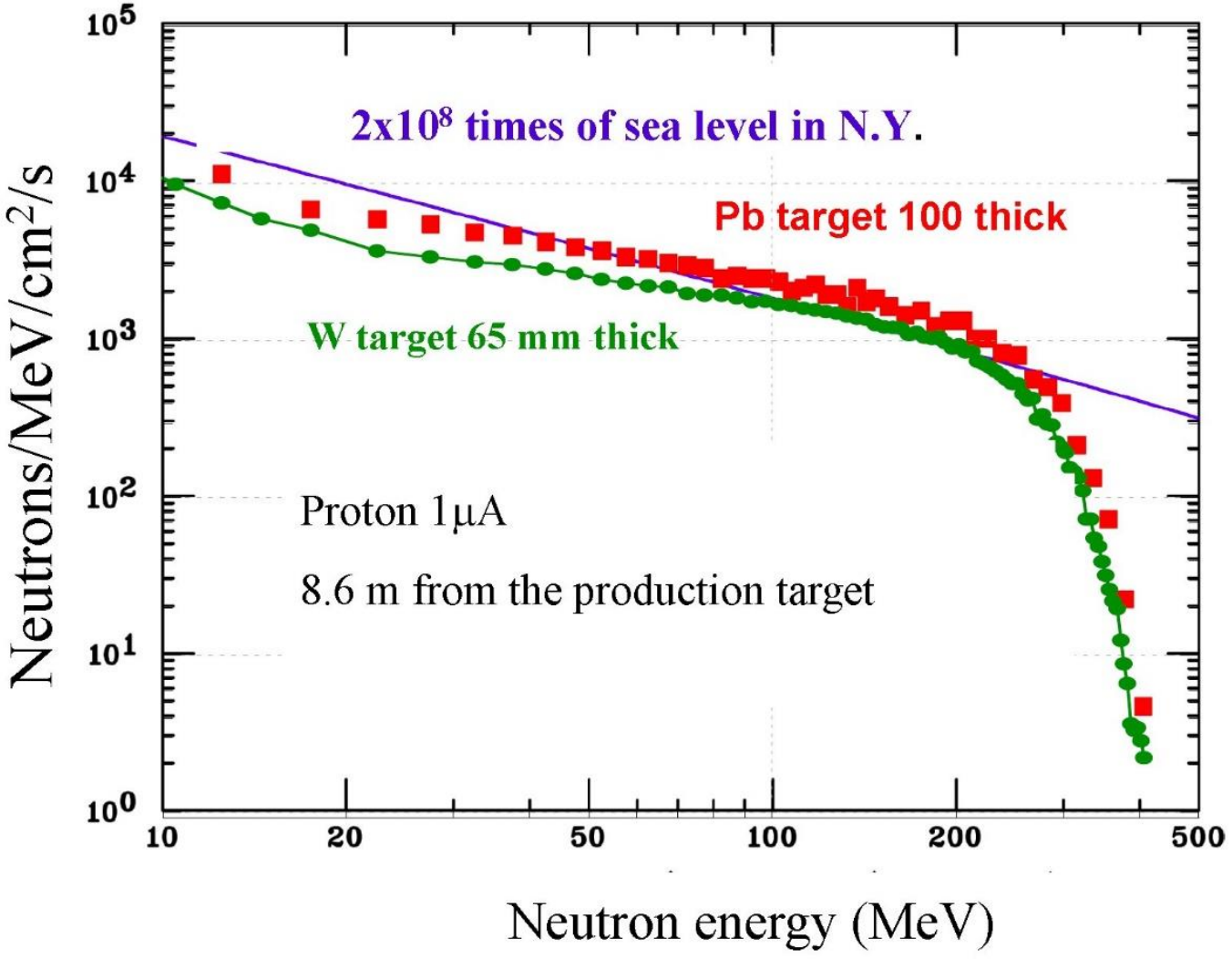
S. Sekimoto et al., Nucl. Data Sheets 119, 197-200 (2014)

"White" neutron source

(WN course, since 2005)



Energy spectrum of spallation neutrons



Summary

RCNP provides a variety of high-quality neutron beams;

- quasi-mono-E neutrons with $E_n \leq 390$MeV, $L_{TOF} \leq 100$m
- white neutrons with $E_n \leq 390$MeV
- epithermal ~ keV neutrons (under construction)

which are used for experimental researches on

- nuclear physics
- nuclear data at $E \geq \sim 100$MeV
- tests of detectors and shieldings for high-E neutrons
- irradiation test for semi-conductor devices (white)
- BNCT (epithermal)

- To use the beams, proposal submission to the PAC (twice/year) is needed.
- Discussion for upgrading to ~1GeV is ongoing.