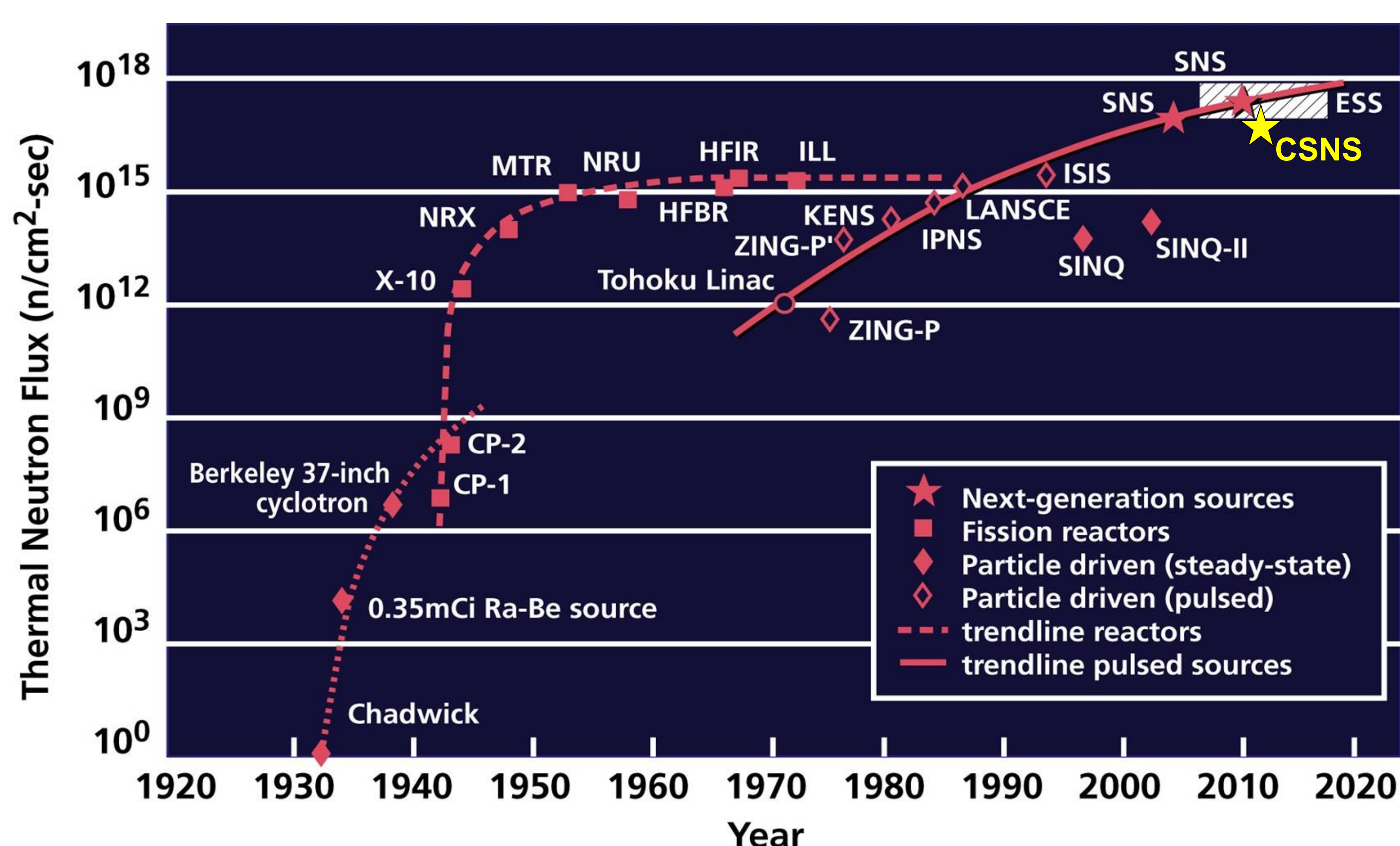
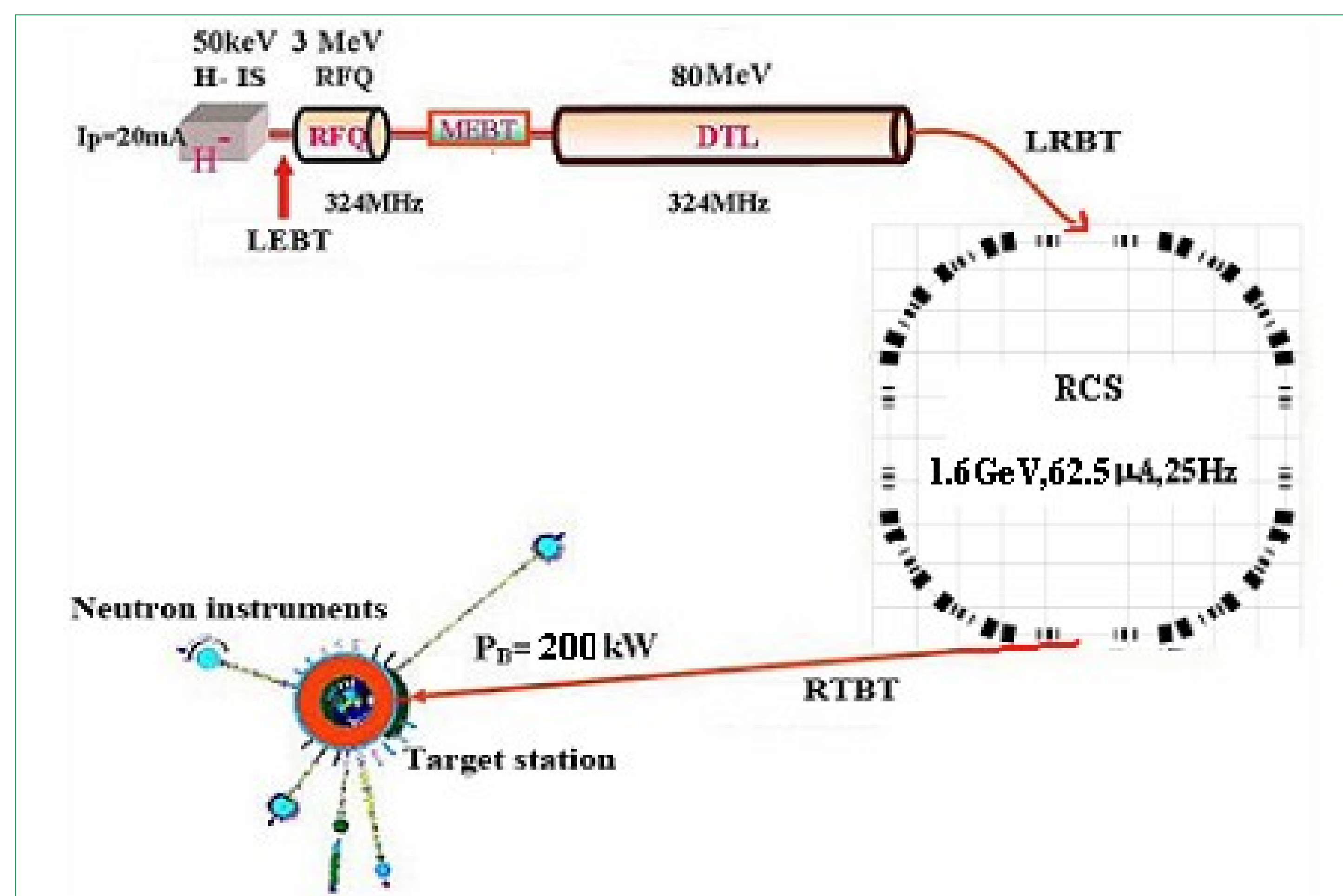


SNS China Spallation Neutron Source

Neutron, like x-ray, is a powerful means to probe the structure of the microscopic world. Moreover, neutron has some special properties that x-ray does not possess:

- 1) no charge, but with magnetic vector;
- 2) owns high ability of penetration;
- 3) more sensitive to light element and isotopes;
- 4) can detect both the structure and dynamics behavior of a matter.

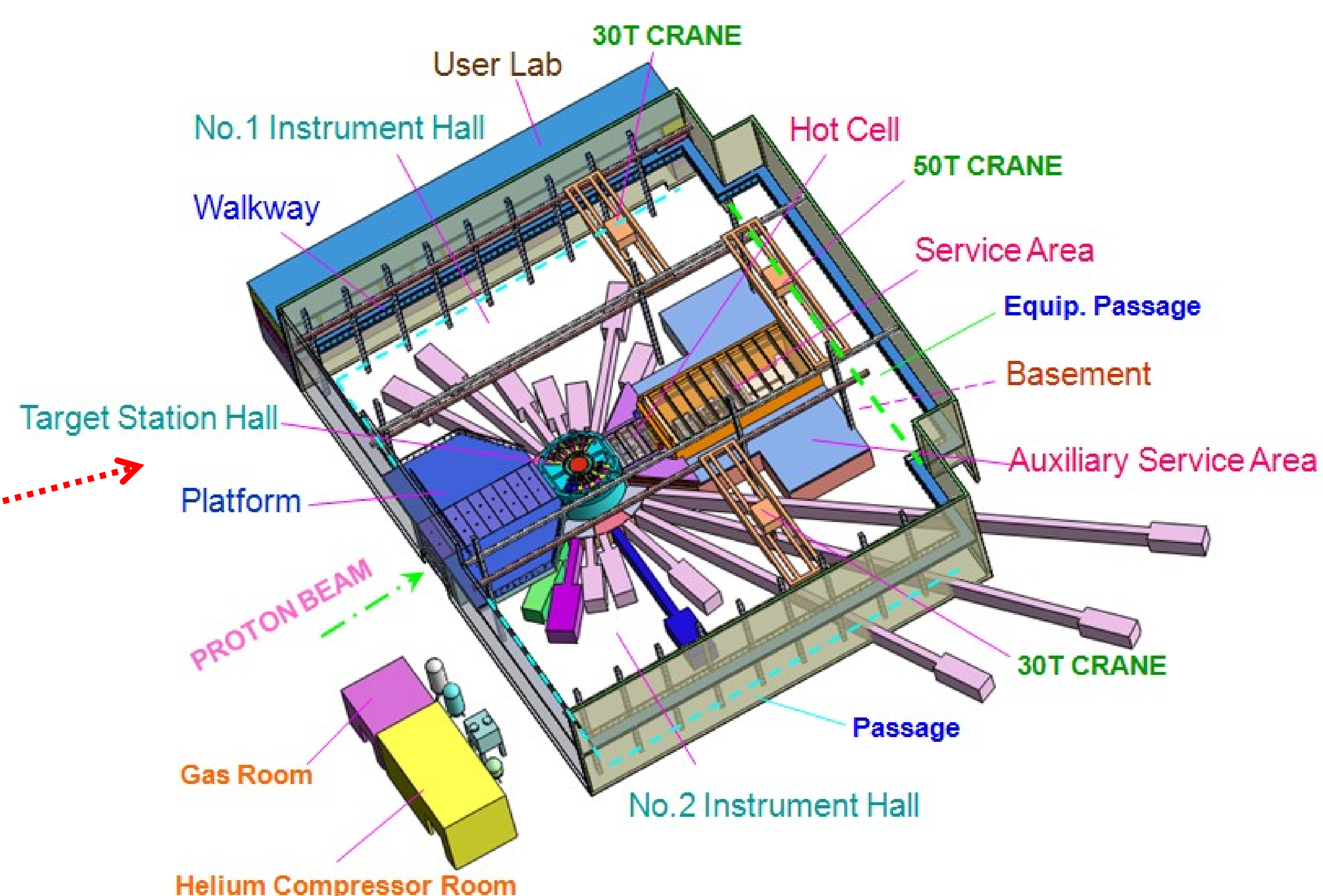


(Updated from *Neutron Scattering*, K. Skold and D. L. Price: eds., Academic Press, 1986)

Beam power	200 kW
Proton energy	1.6 GeV
Ave. current I	62.5 μA
Repetition rate, Hz	25 Hz
Proton per pulse	$1.63 \cdot 10^{13}$
Pulse length	<500 ns
Linac energy	80 MeV
Linac peak current	15 mA
Target material	Tungsten
No. Moderators	3
No. neutron instruments	3



Layout of CSNS



Instruments at Phase I:

3 neutron instruments

HIPD: general purpose to determine crystallographic and magnetic structures

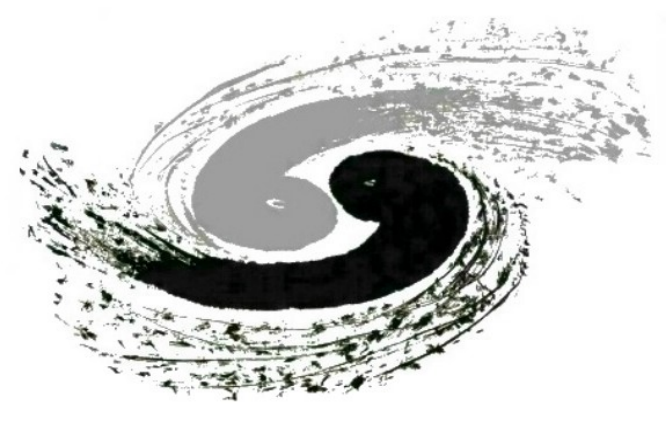
SANS: rapid characteristic check for nano-scale materials

MR: interface structure for films



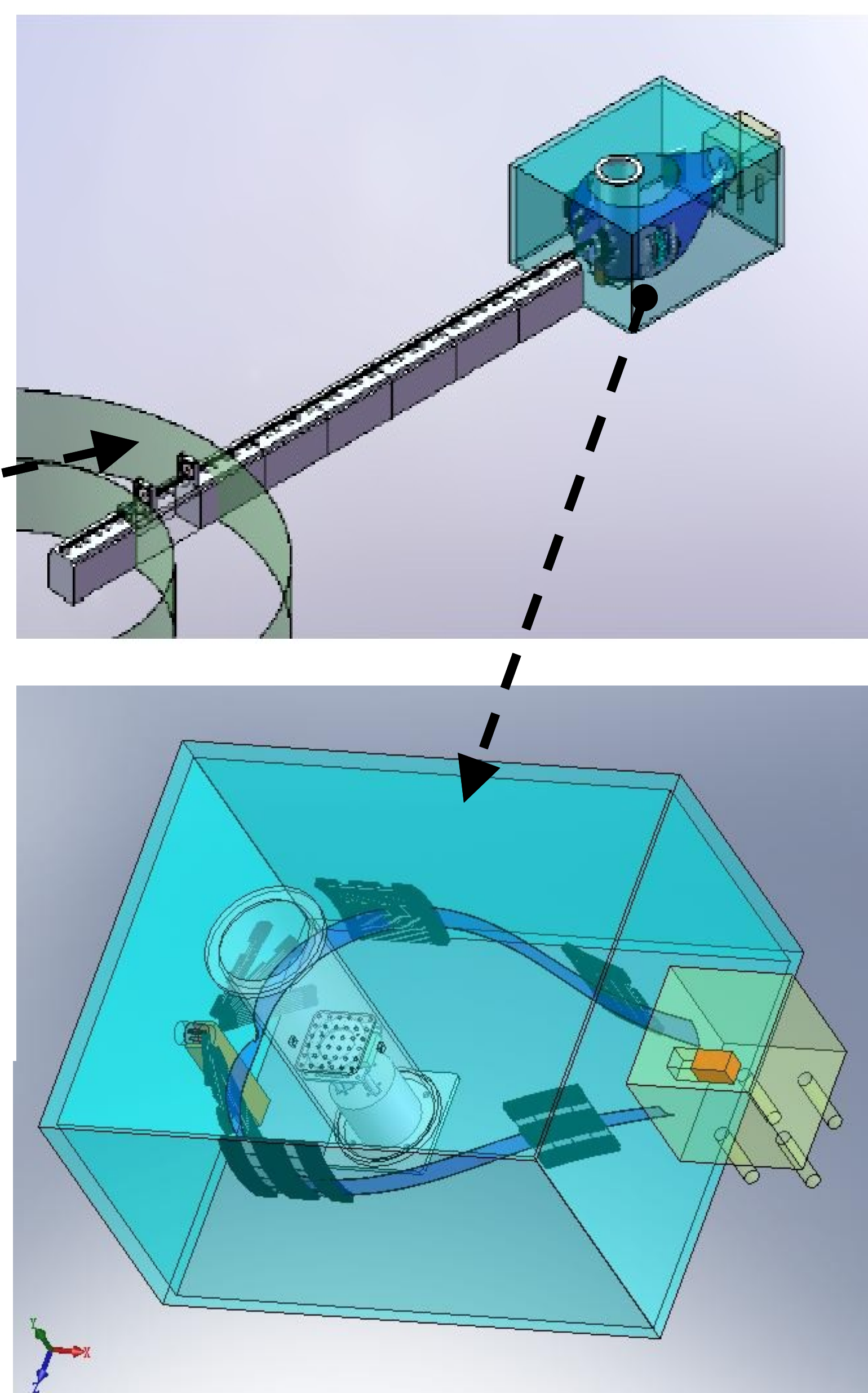
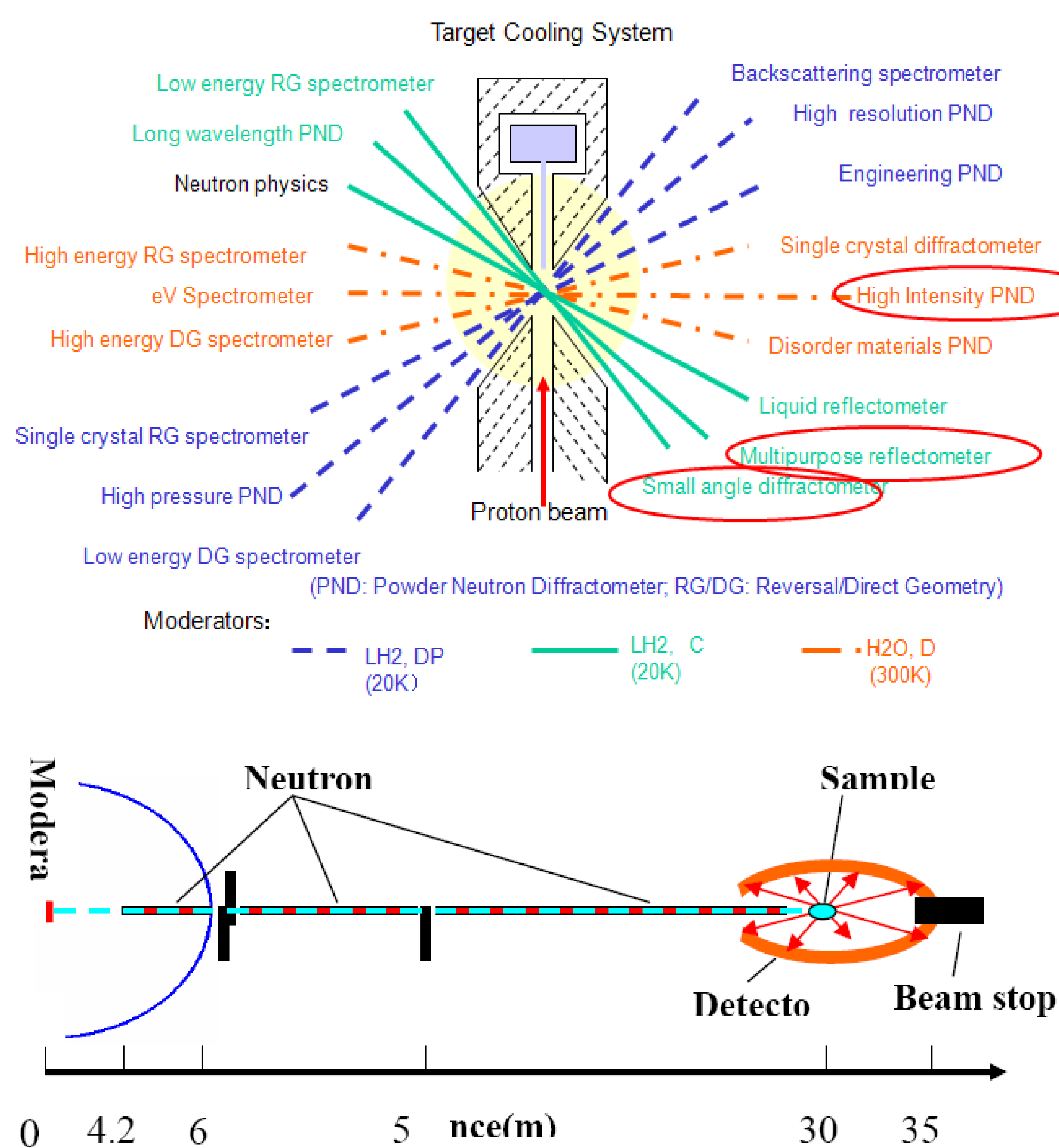
中国散裂中子源装置地A点拍摄 (09.5.9)

Construction place of CSNS(Dongguan,China)



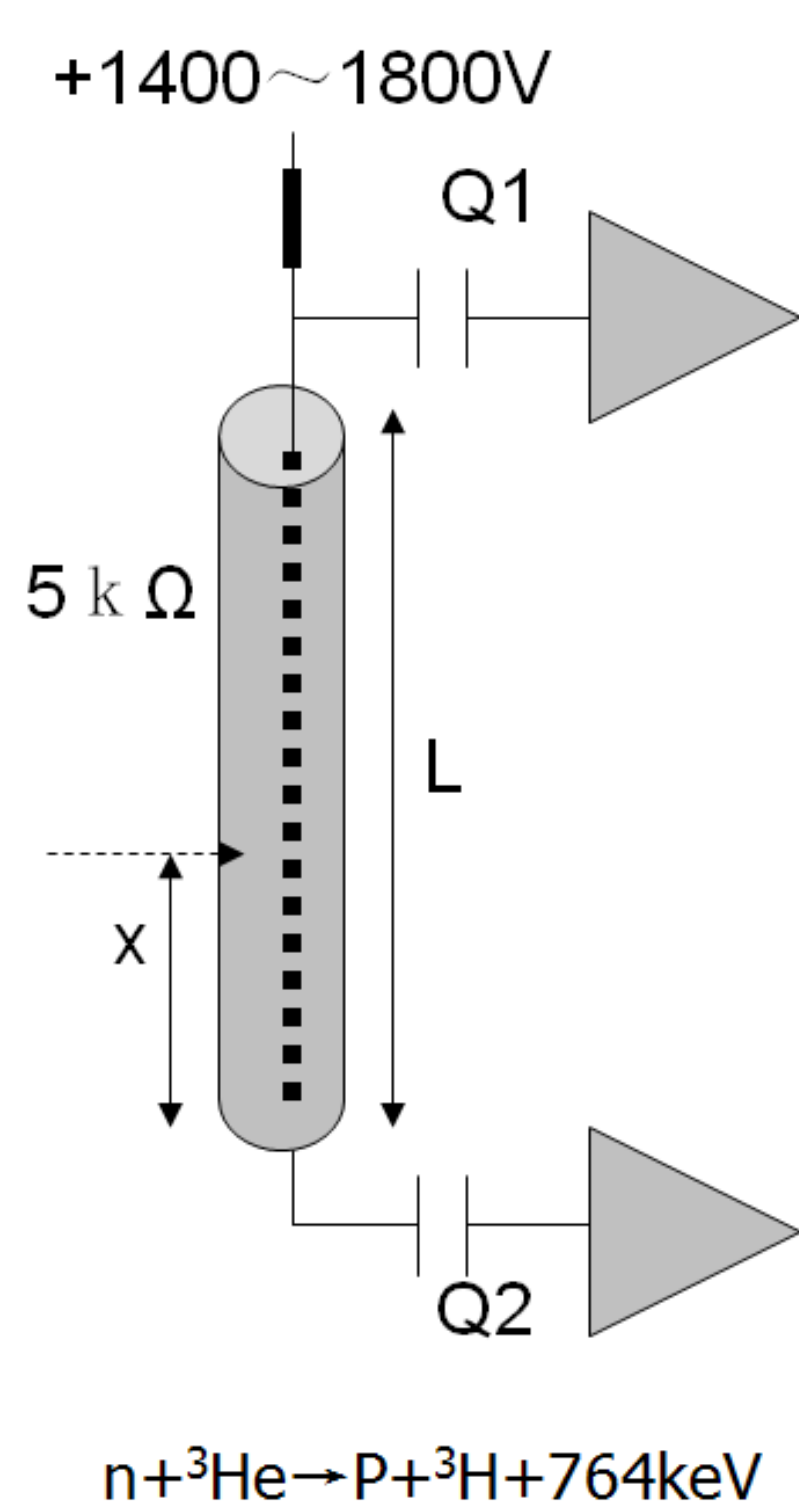
中国科学院高能物理研究所
Institute of High Energy Physics
Chinese Academy of Sciences

High Intensity Powder Diffractometer (HIPD)

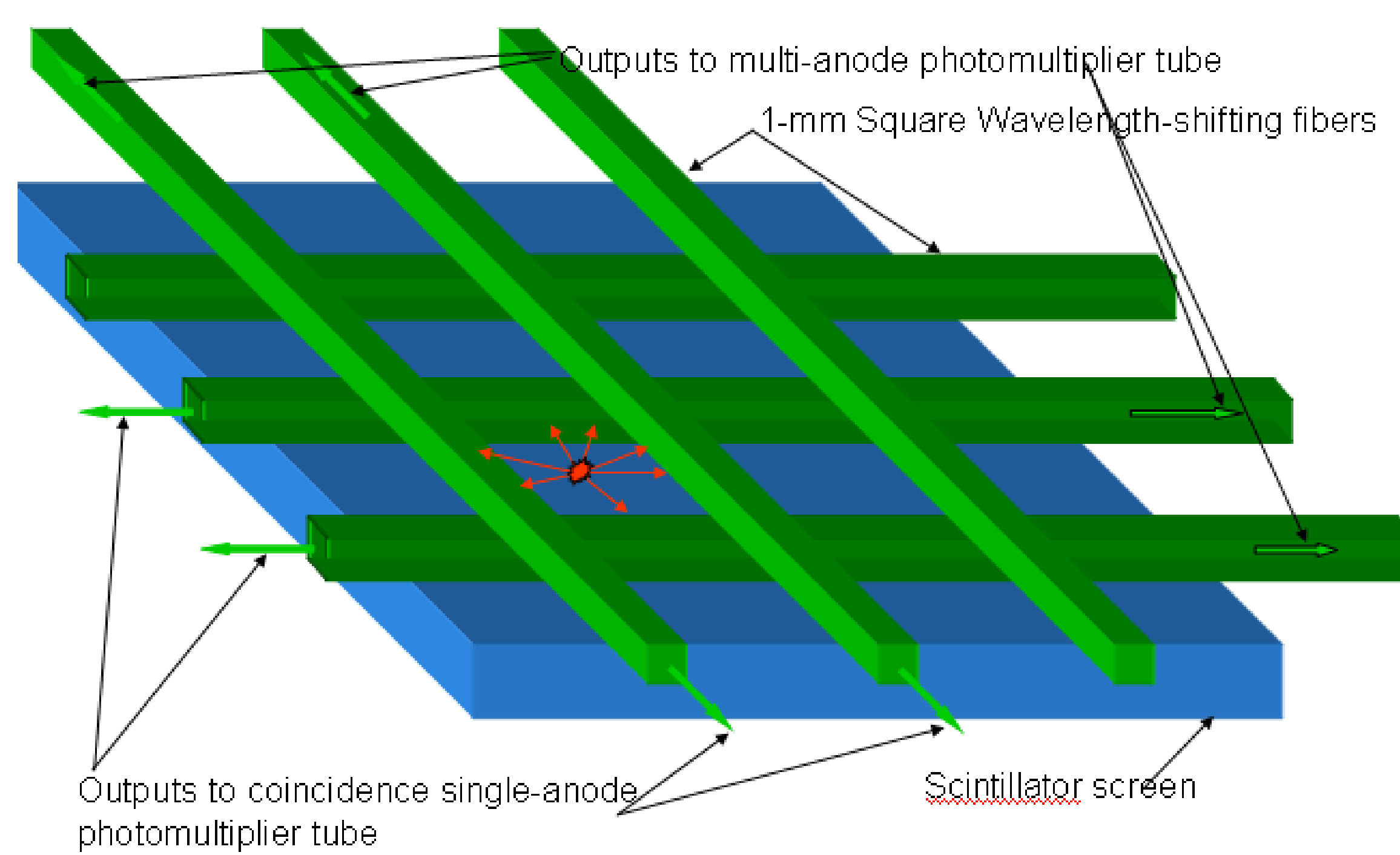


Moderator	decoupled water moderator (300 K)
Bandwidth($\Delta\lambda$)	4.5 Å
Max. Beam Size	40(h)×20(w) mm
Flux at sample position	$\sim 10^7$ n/cm ² /s
Best Resolution($\Delta d/d$)	0.2 % at $2\theta = 150^\circ$
Guide	Taper focus, m=3
Source to sample distance L1	30 m
Sample-detector distance L2	
$2\theta = 150^\circ$	1.5 m
$2\theta = 90^\circ$	2.0 m
$2\theta = 15^\circ$	3.8 m

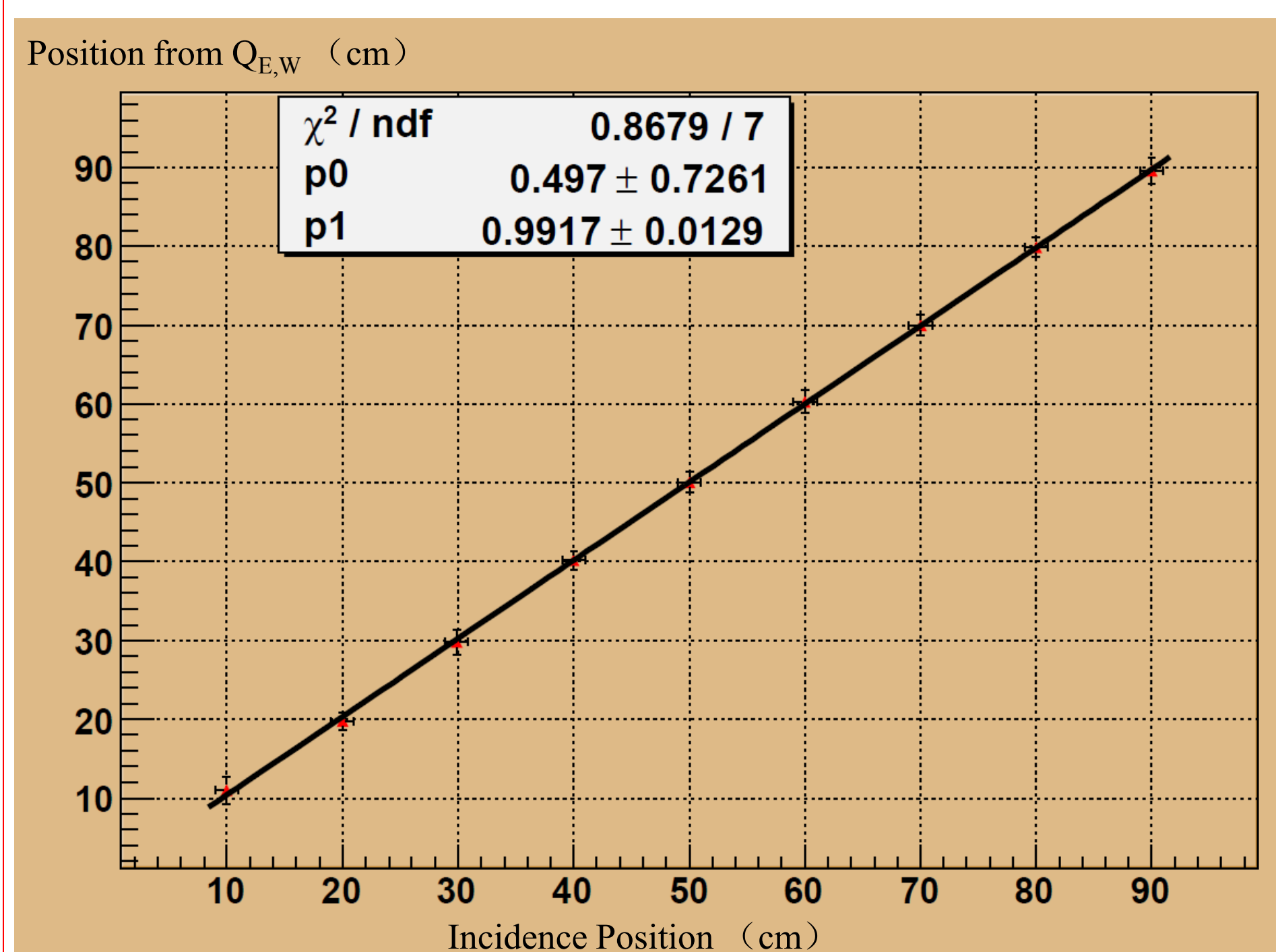
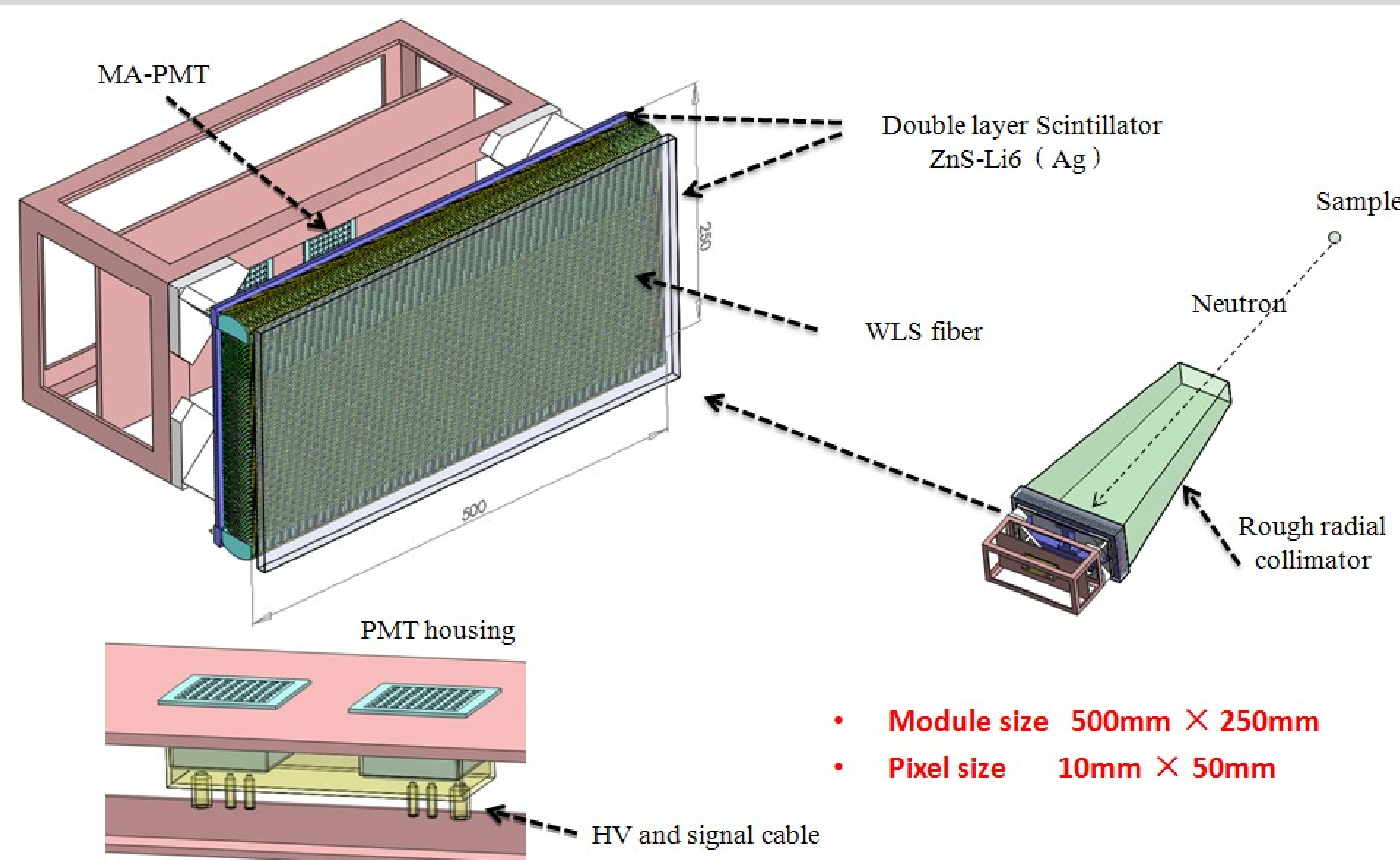
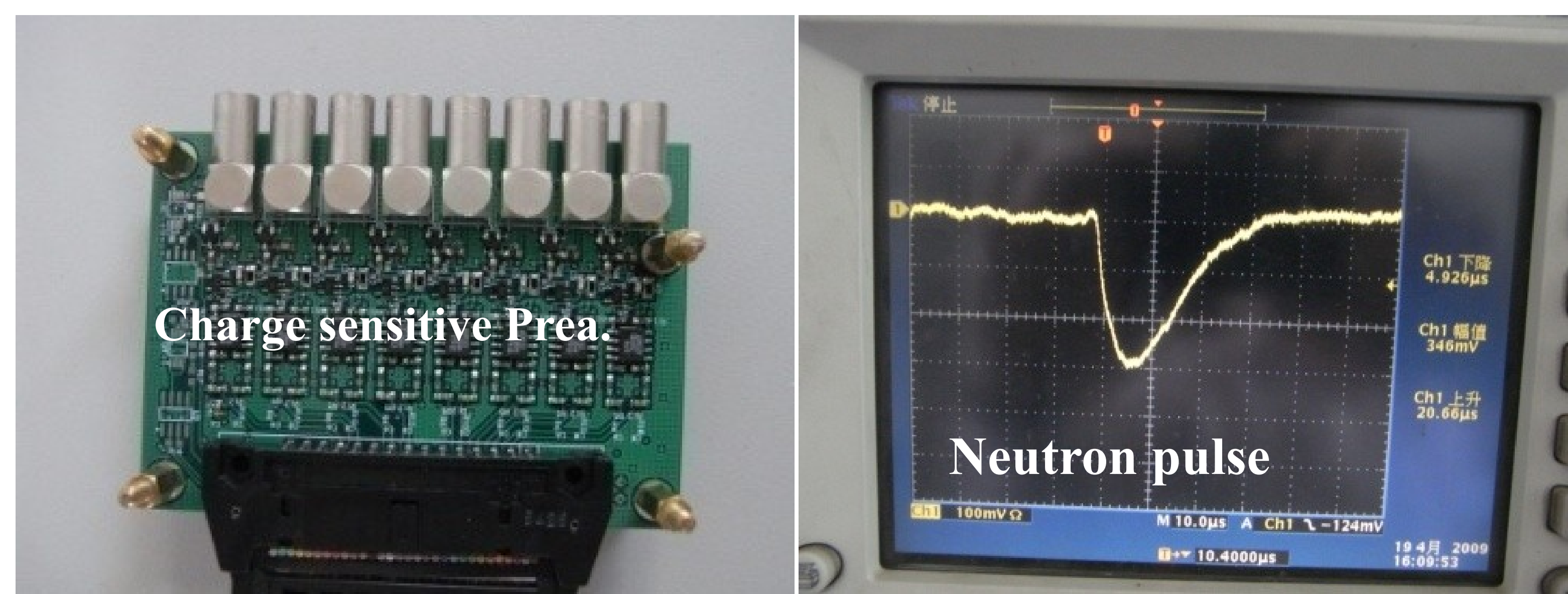
Scintillator + WLS fiber + PMT Neutron Detector (SSND)



Position sensitive ³He tube array for neutron detection

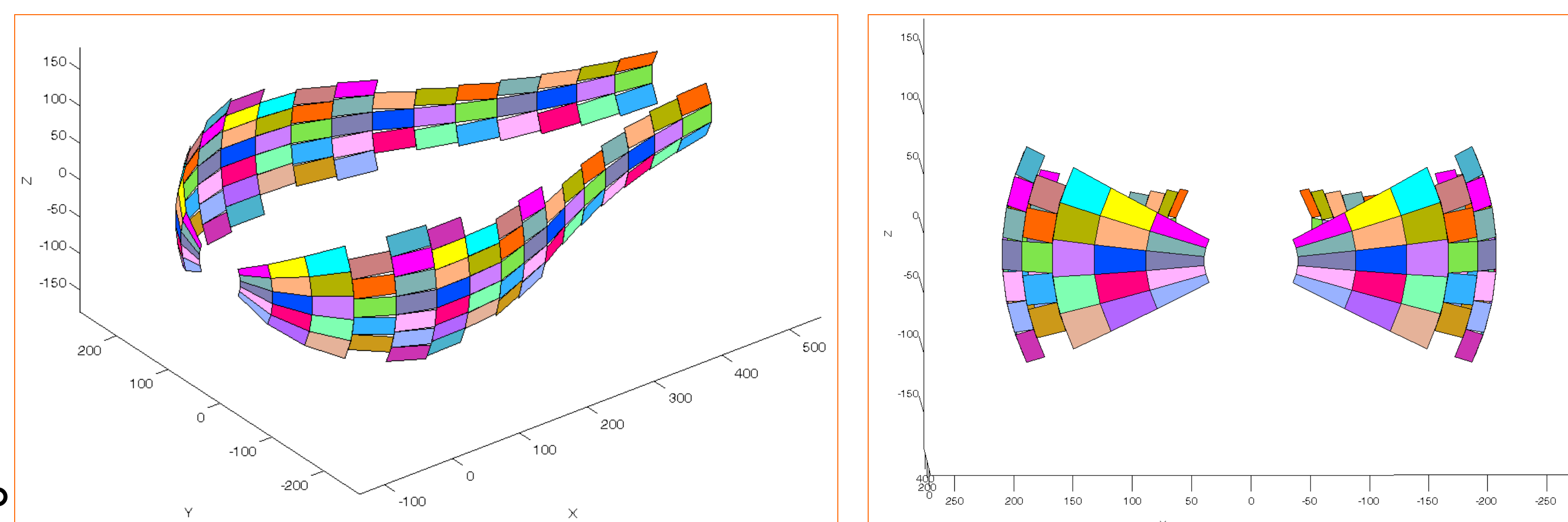


Structure of SSND



Position linearity of ³He tube

- Time Resolution: 2μs
- Time window: 40ms
- Detect efficiency: 80% @ 2Å
- Three Detect Area: $2\theta = 15^\circ, 2\theta = 90^\circ, 2\theta = 150^\circ$

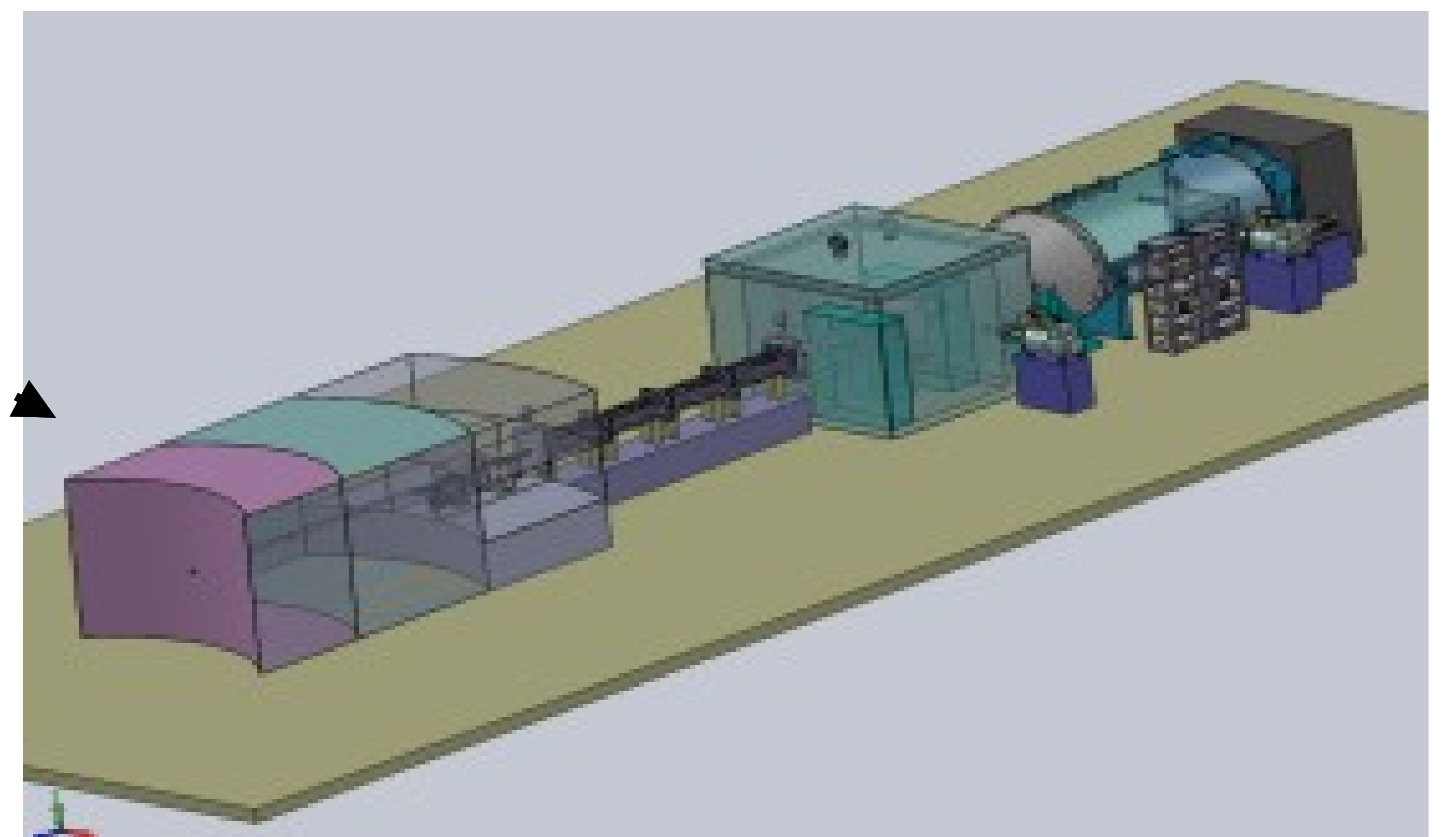
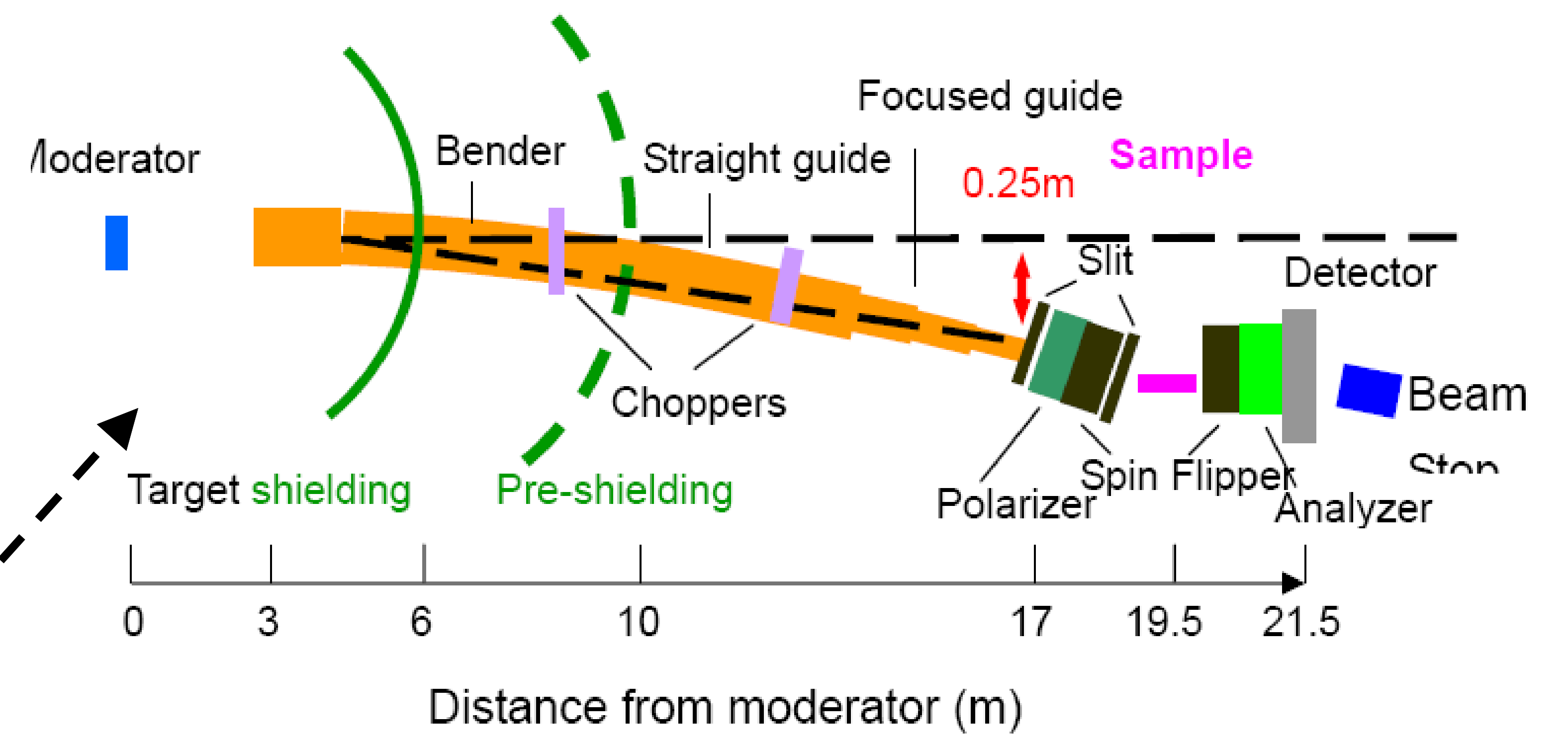
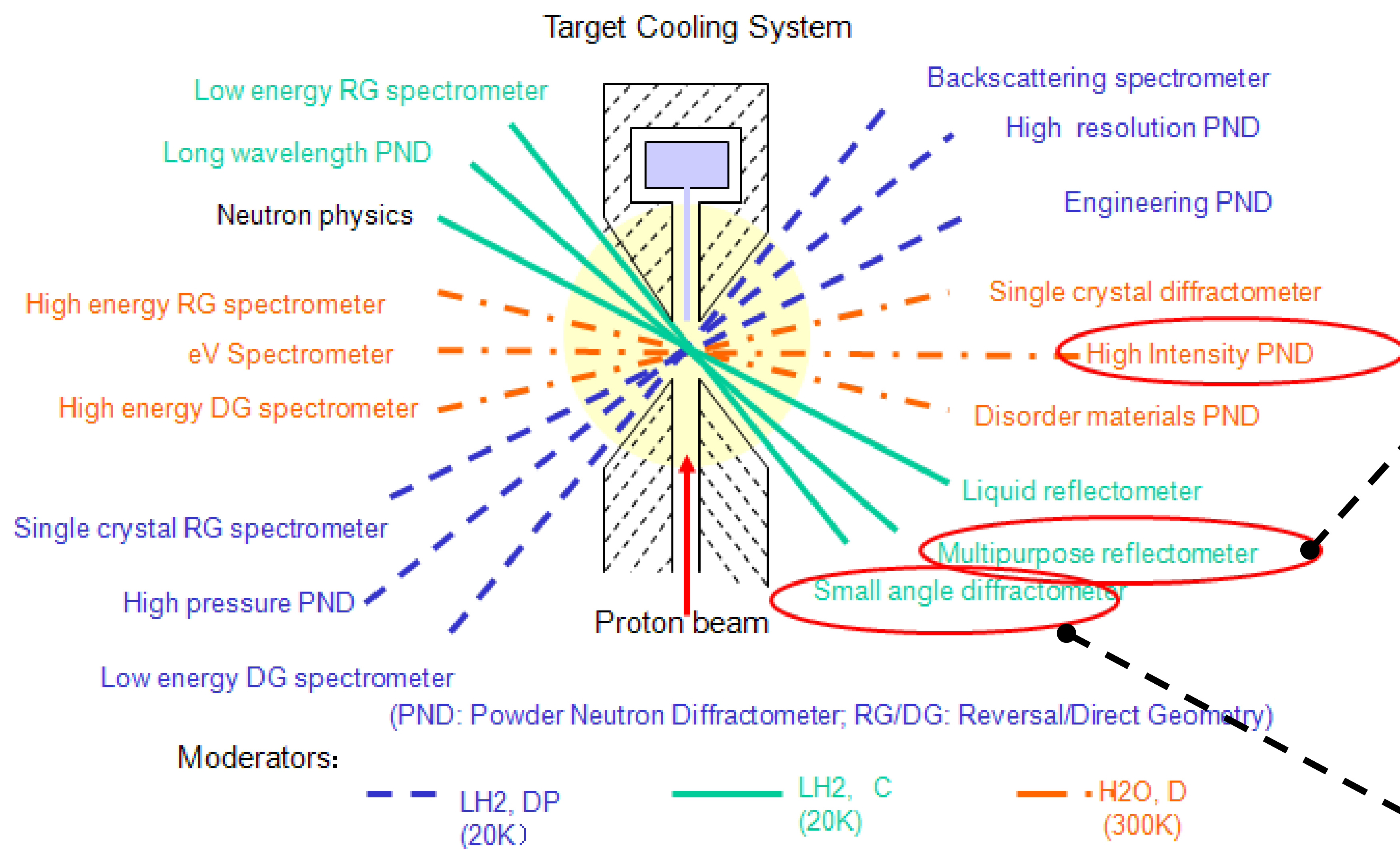


three dimensional coordinate of SSNDs in HIPD



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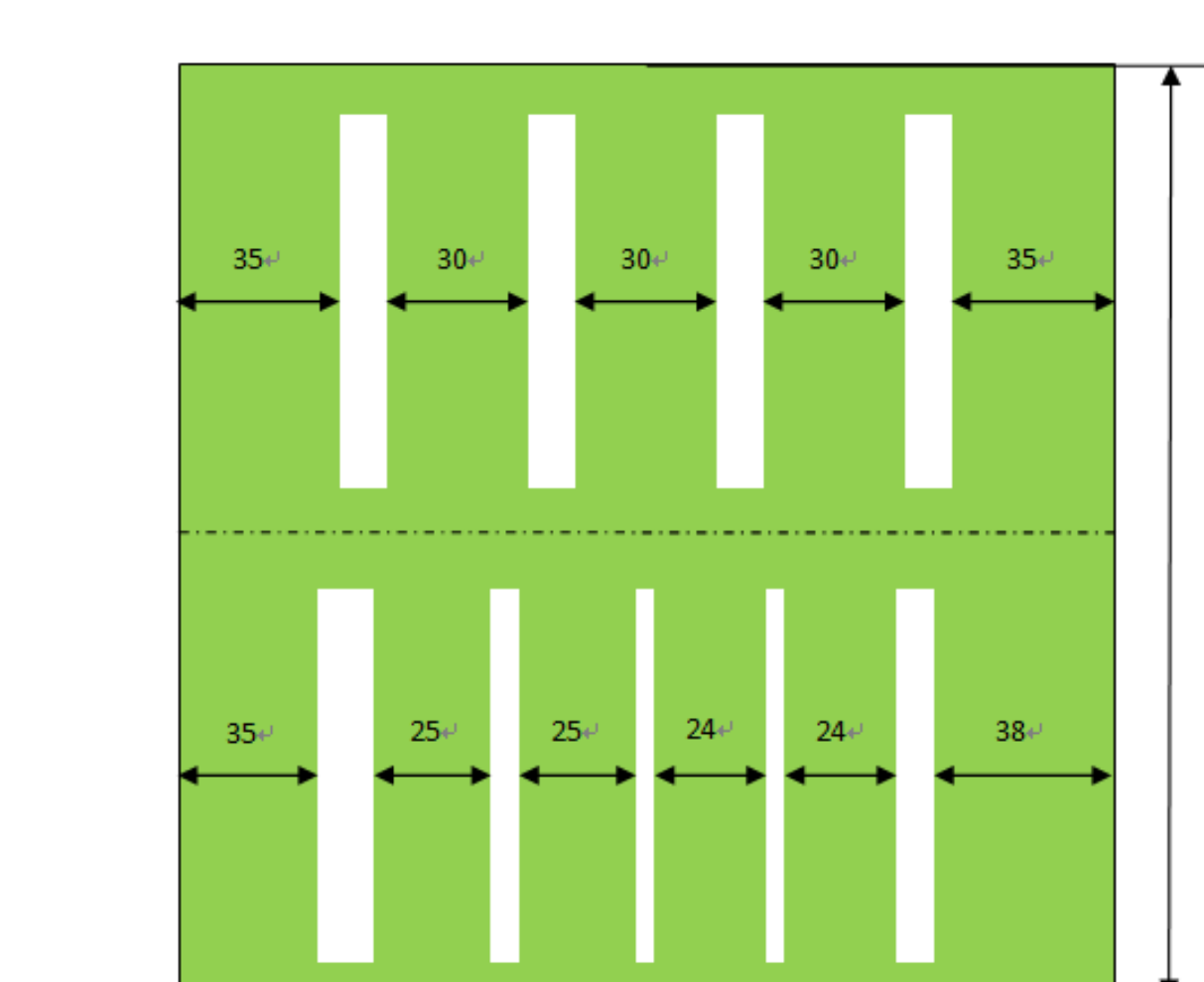
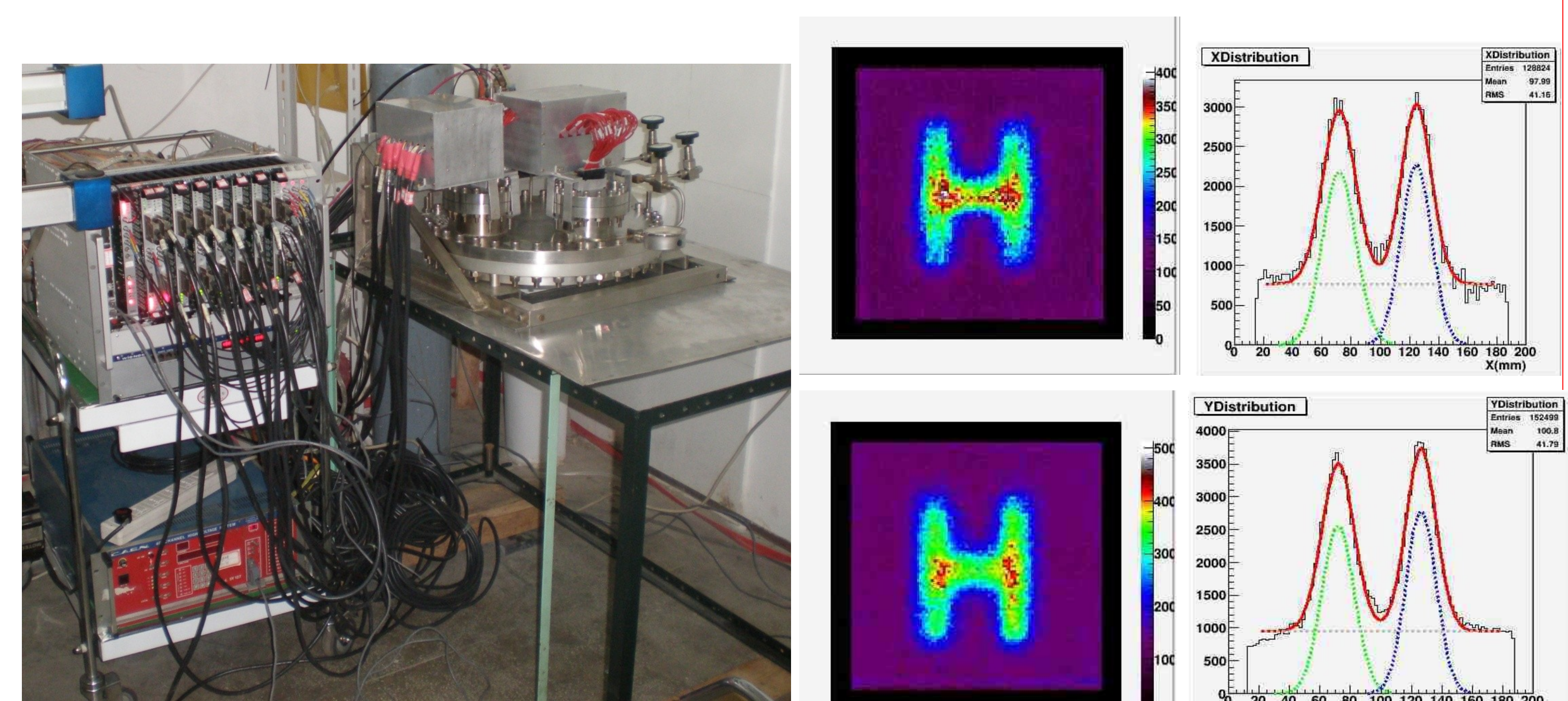
Position sensitive neutron detector (MWPC)



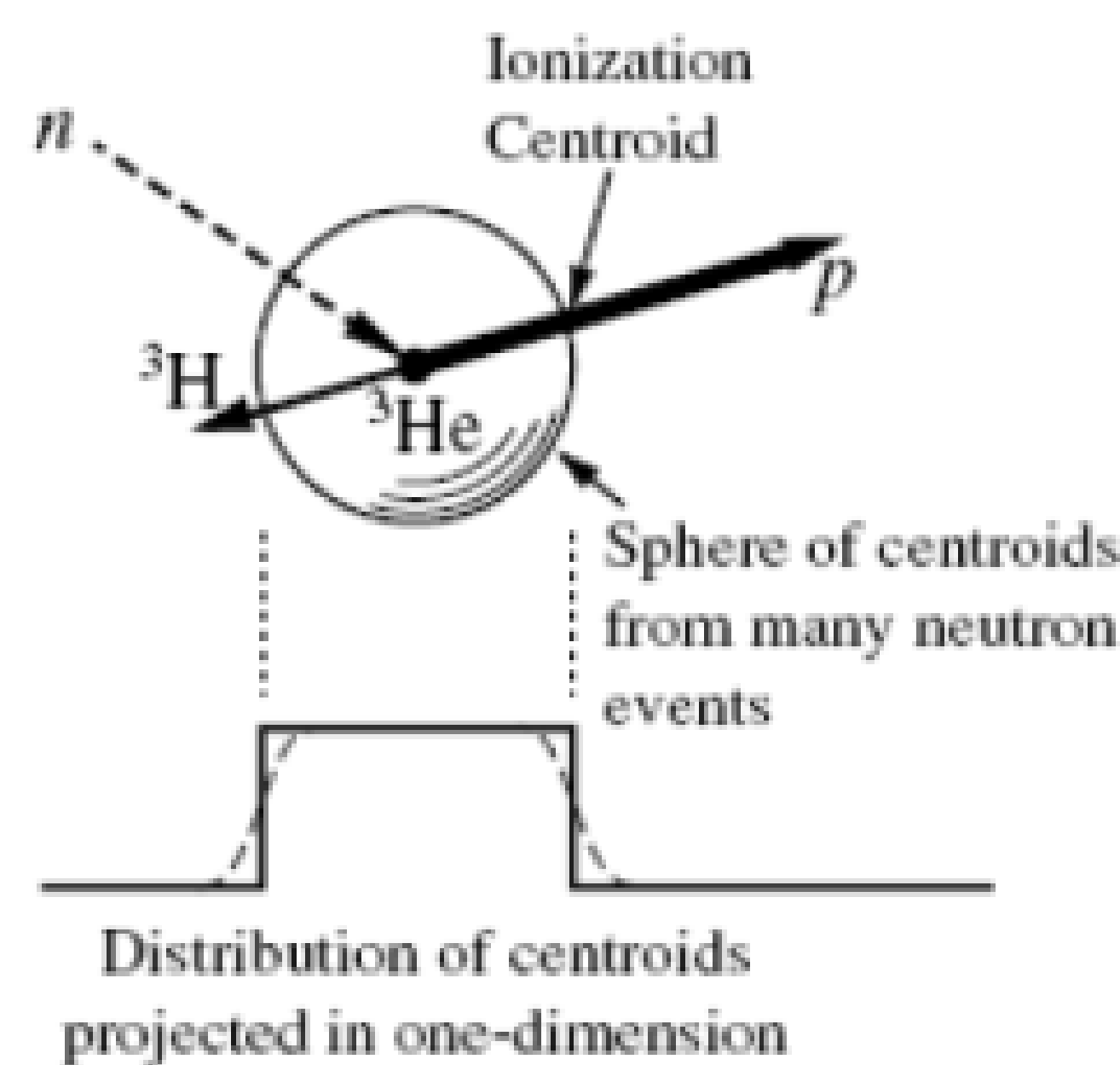
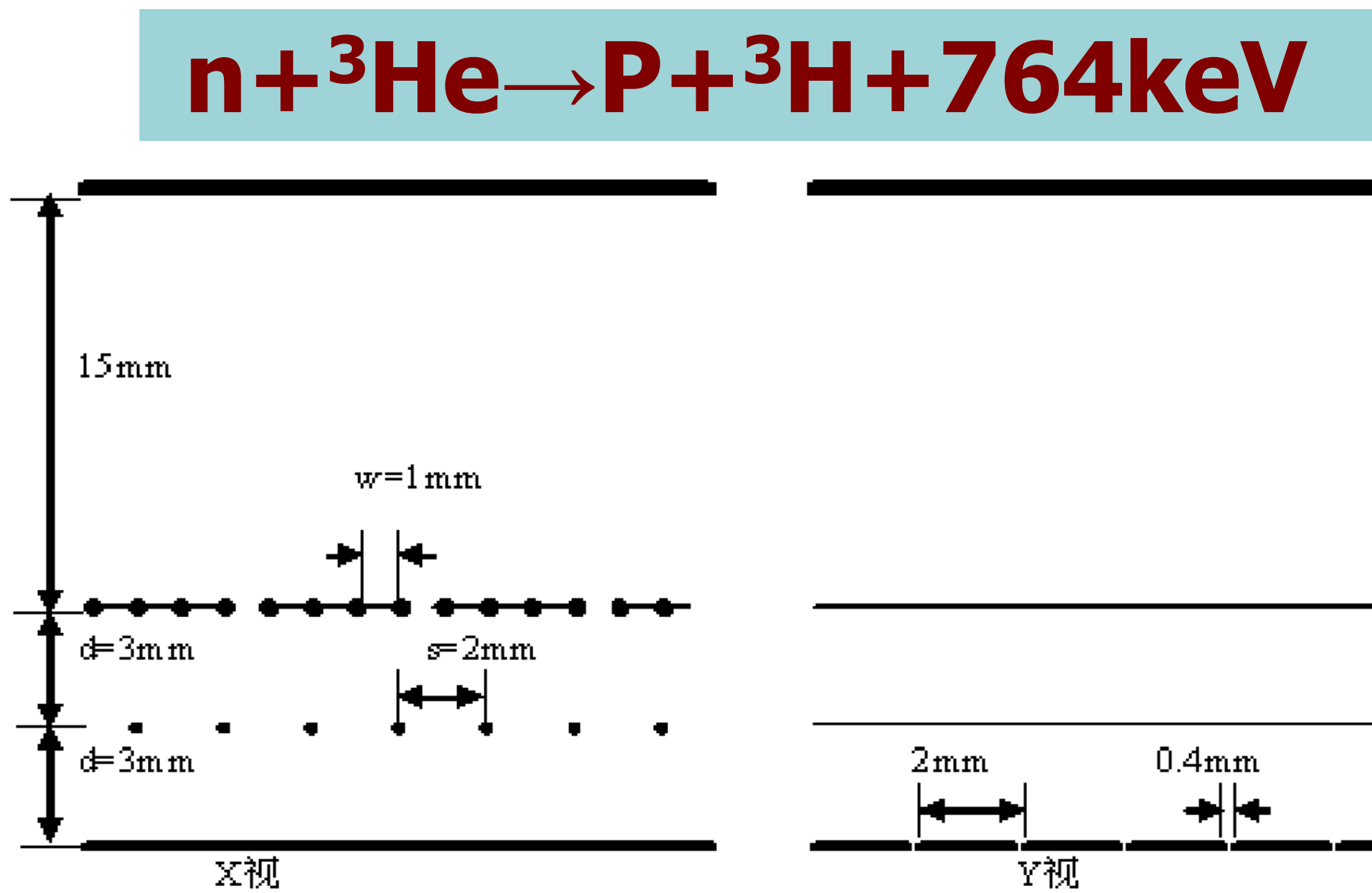
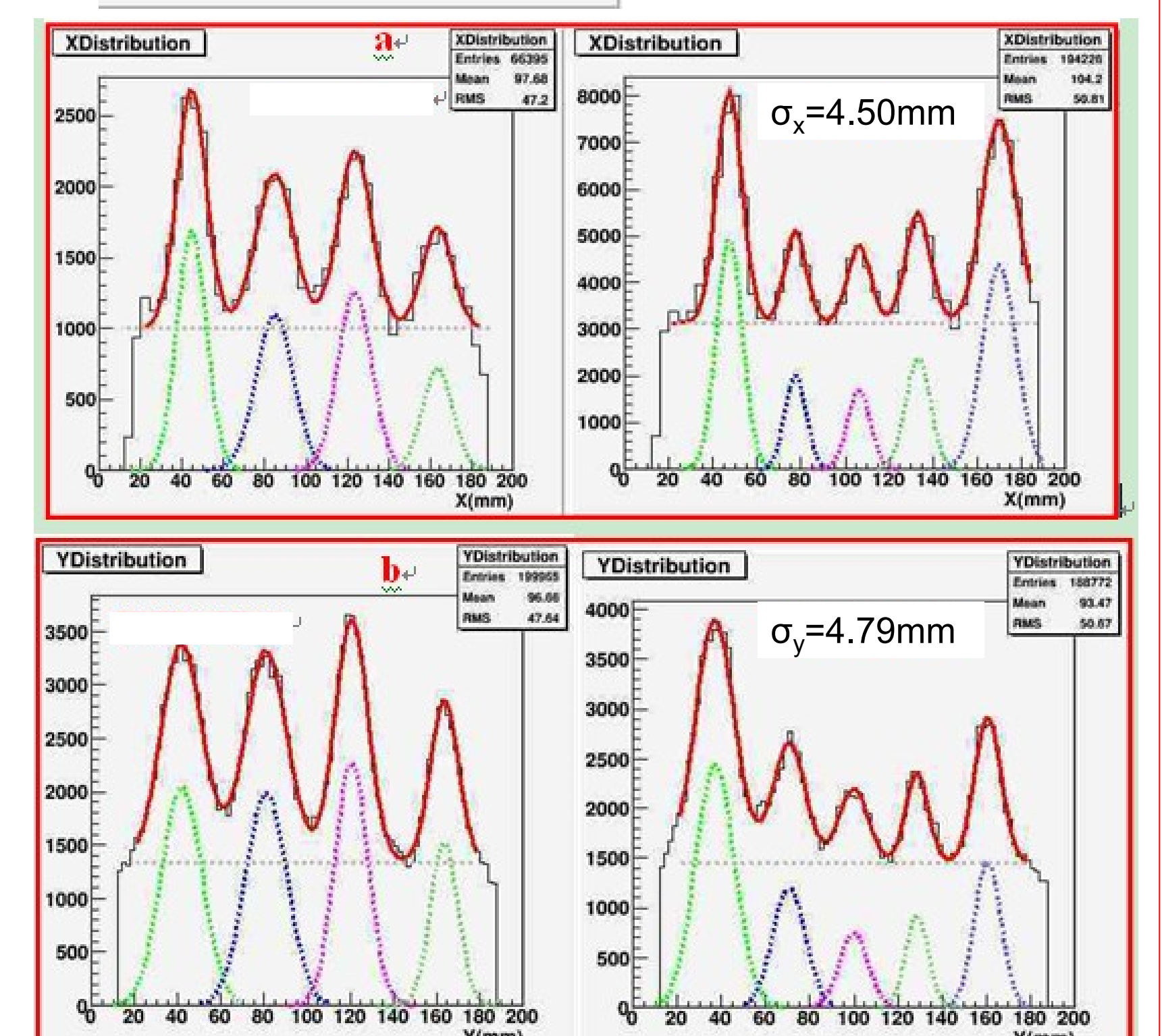
Instrument requirements

Instrument	Active area	Pixel area (cm ²)	Neutron capture efficiency	Time resolution (μs)
MR Multi-purpose Reflectometer	20cm × 20cm	0.2 × 0.2	50% @ 1Å	1
SANS Small Angle Neutron Spectrometer	65cm × 65cm	1.0 × 1.0	50% @ 2Å	1

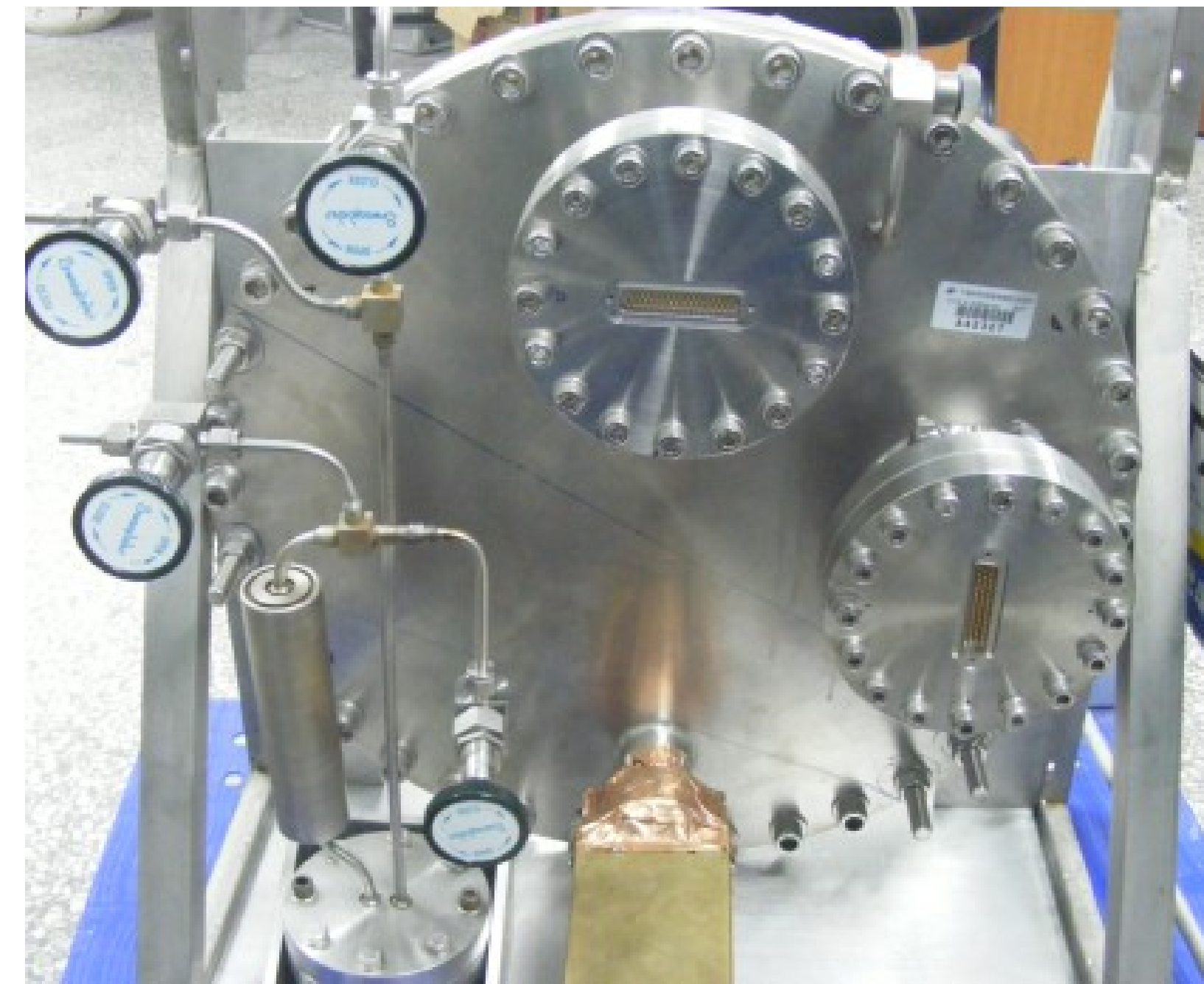
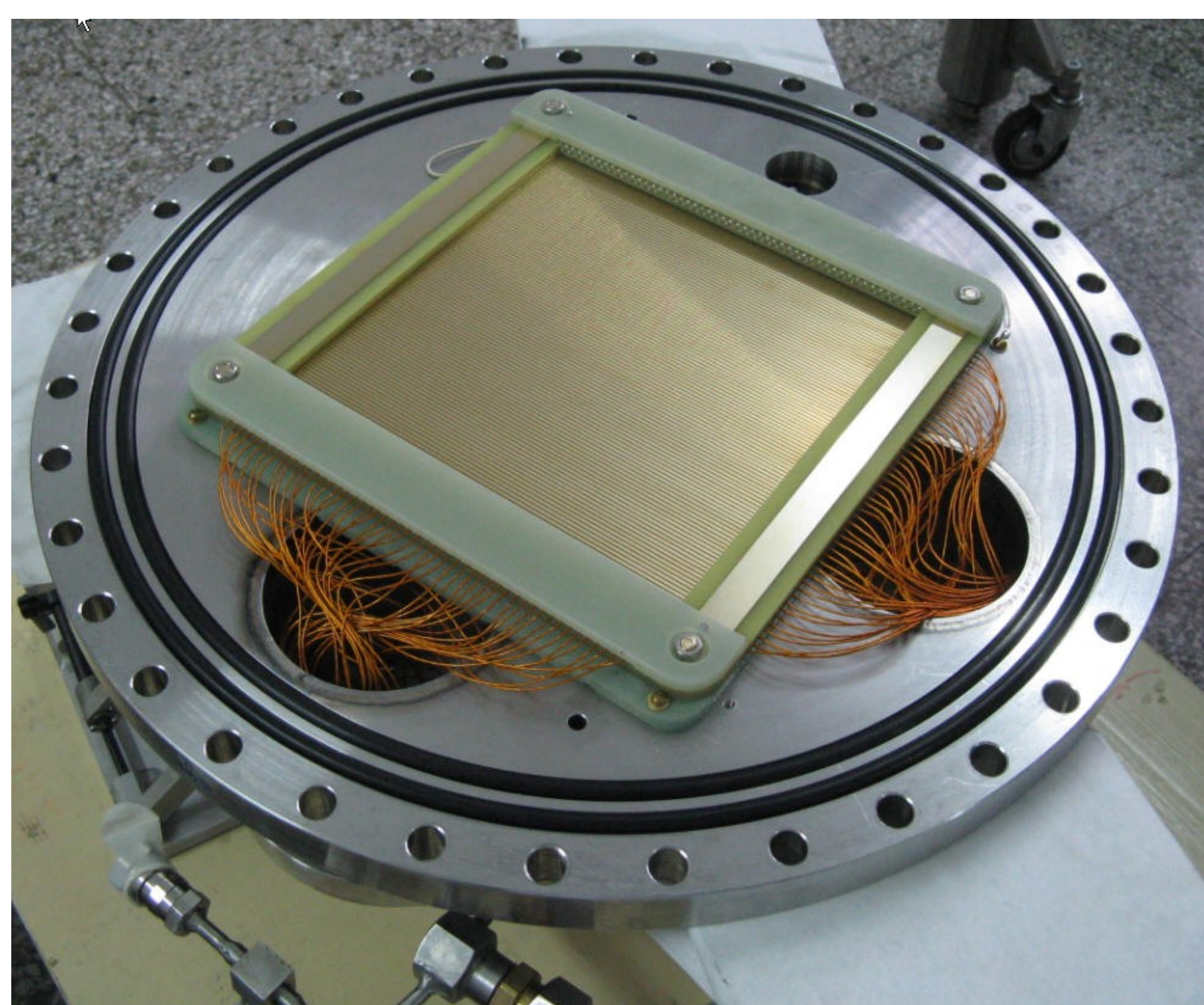
Am-Be neutron source test



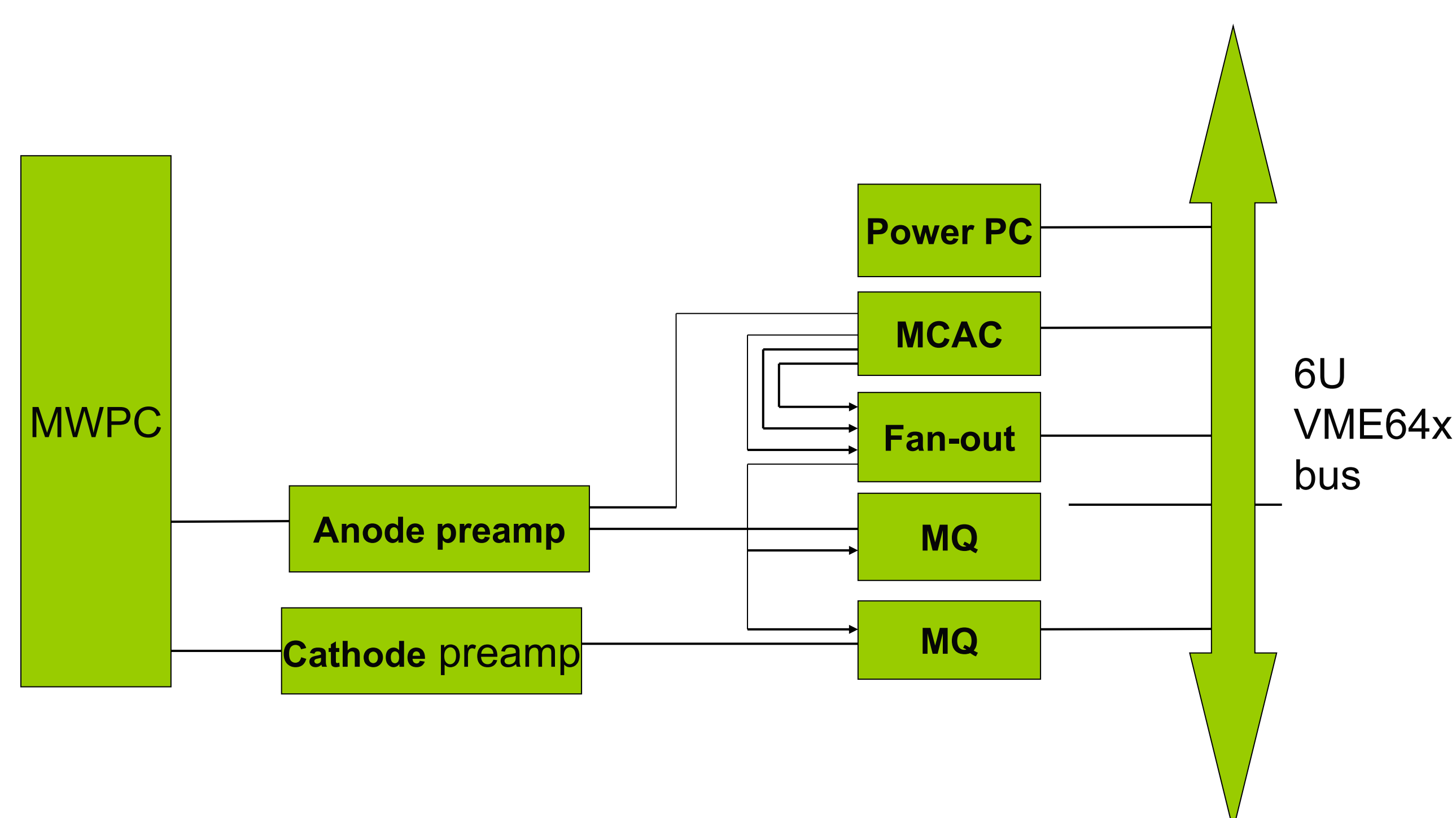
Cd Slits with different width for position resolution test



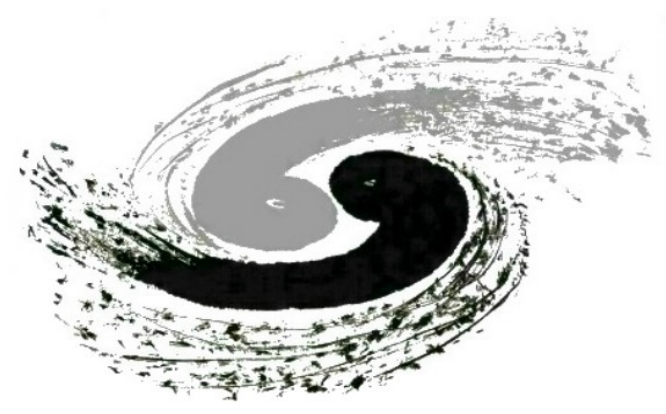
Structure of MWPC



Active area	20cm × 20cm
Pixel size	2mm*2mm
Number of electronic channels	200 (X: 100, Y: 100)
Gas	(5.5atm) ³ He + (2.5atm)C ₃ H ₈
Detection efficiency	50% @ 1Å

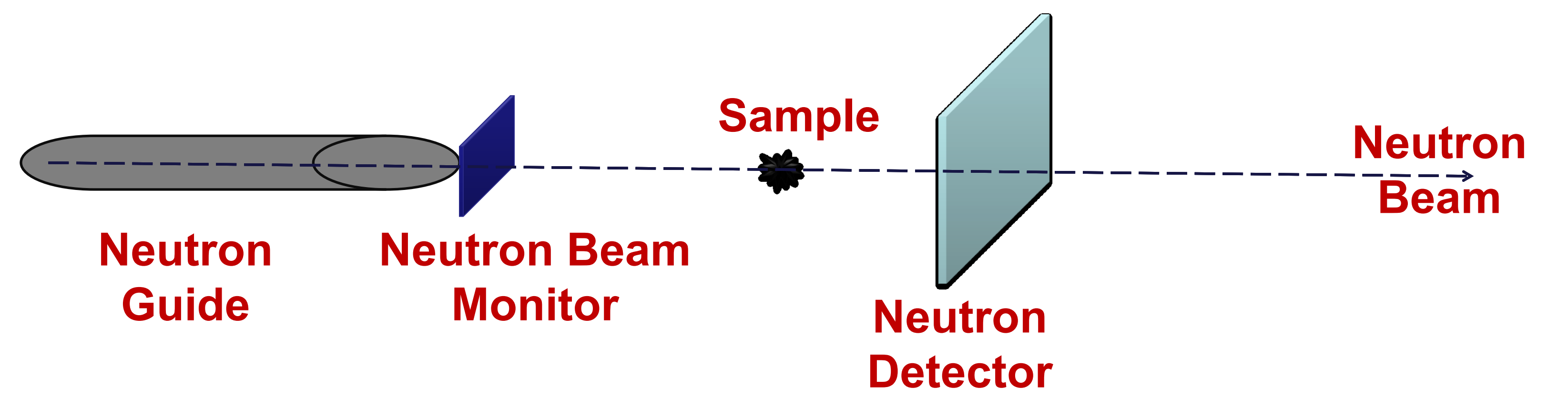
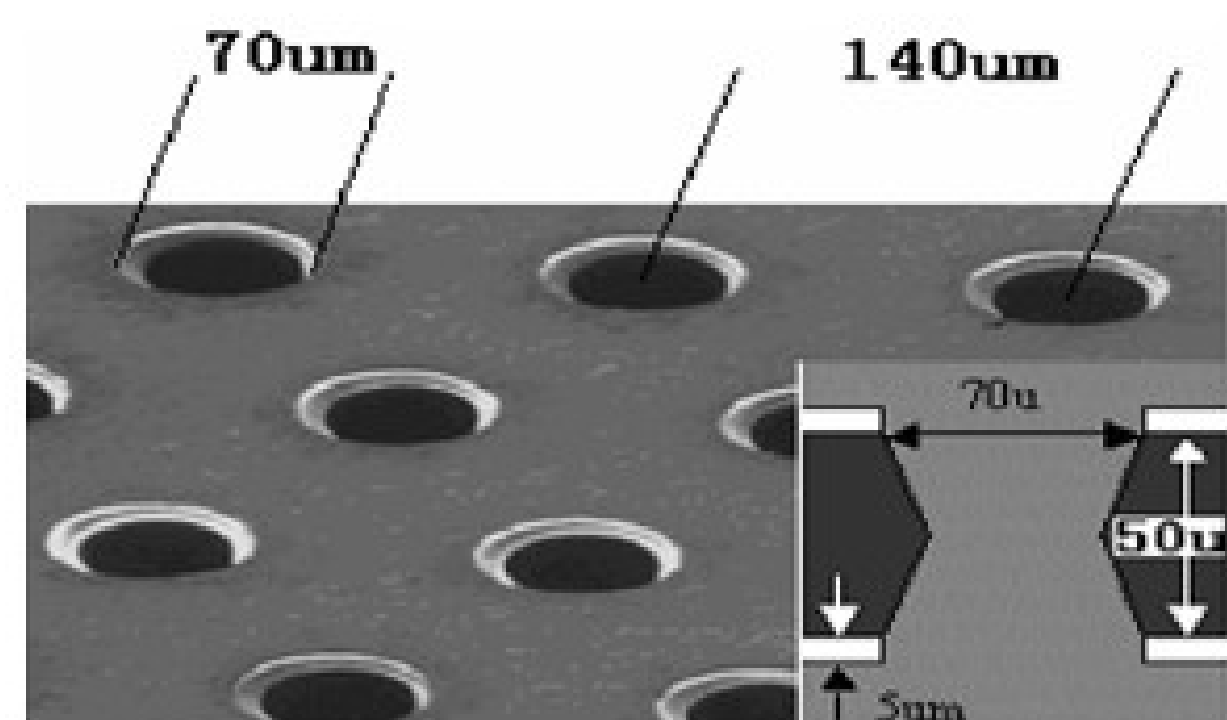
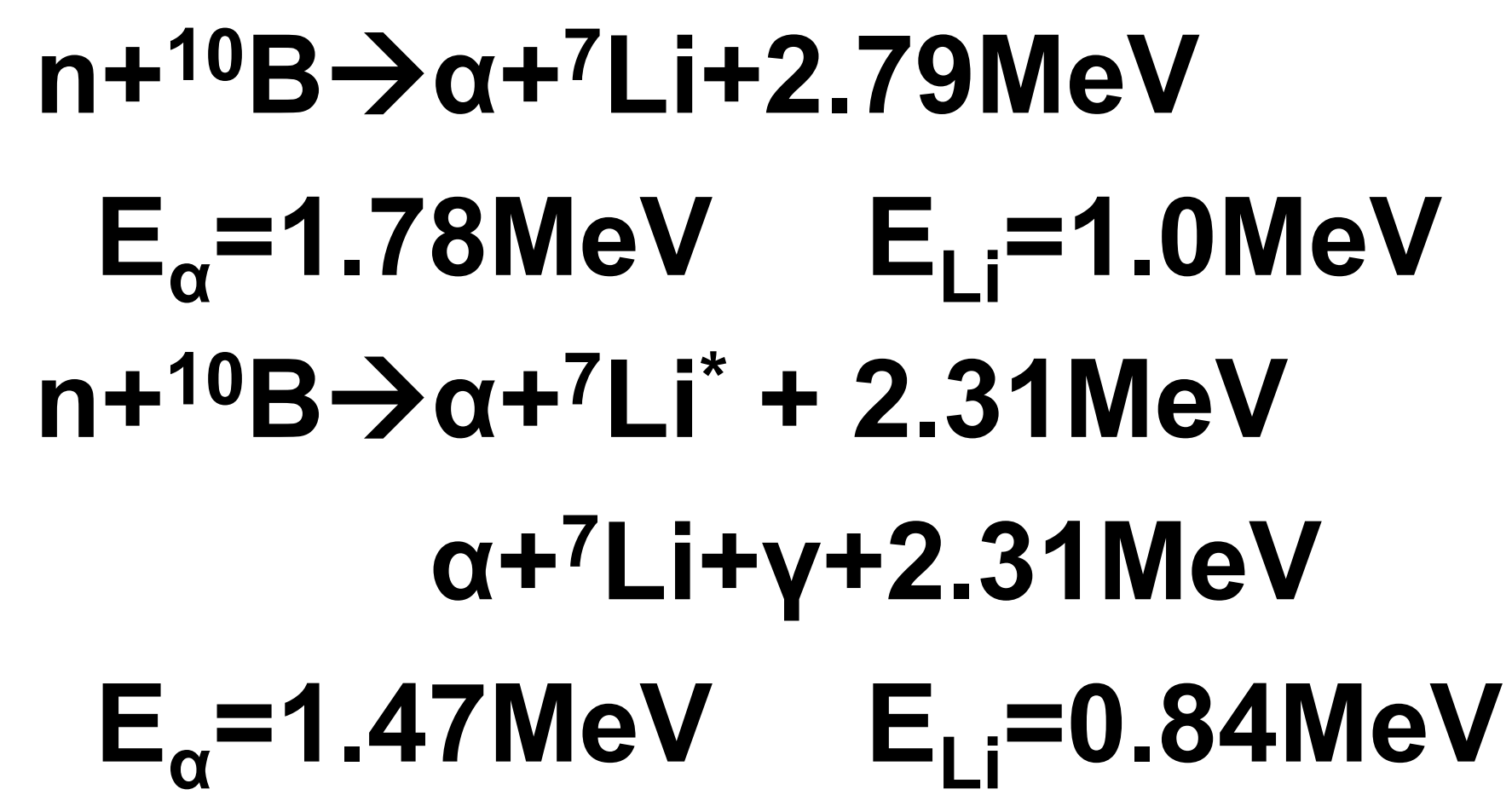
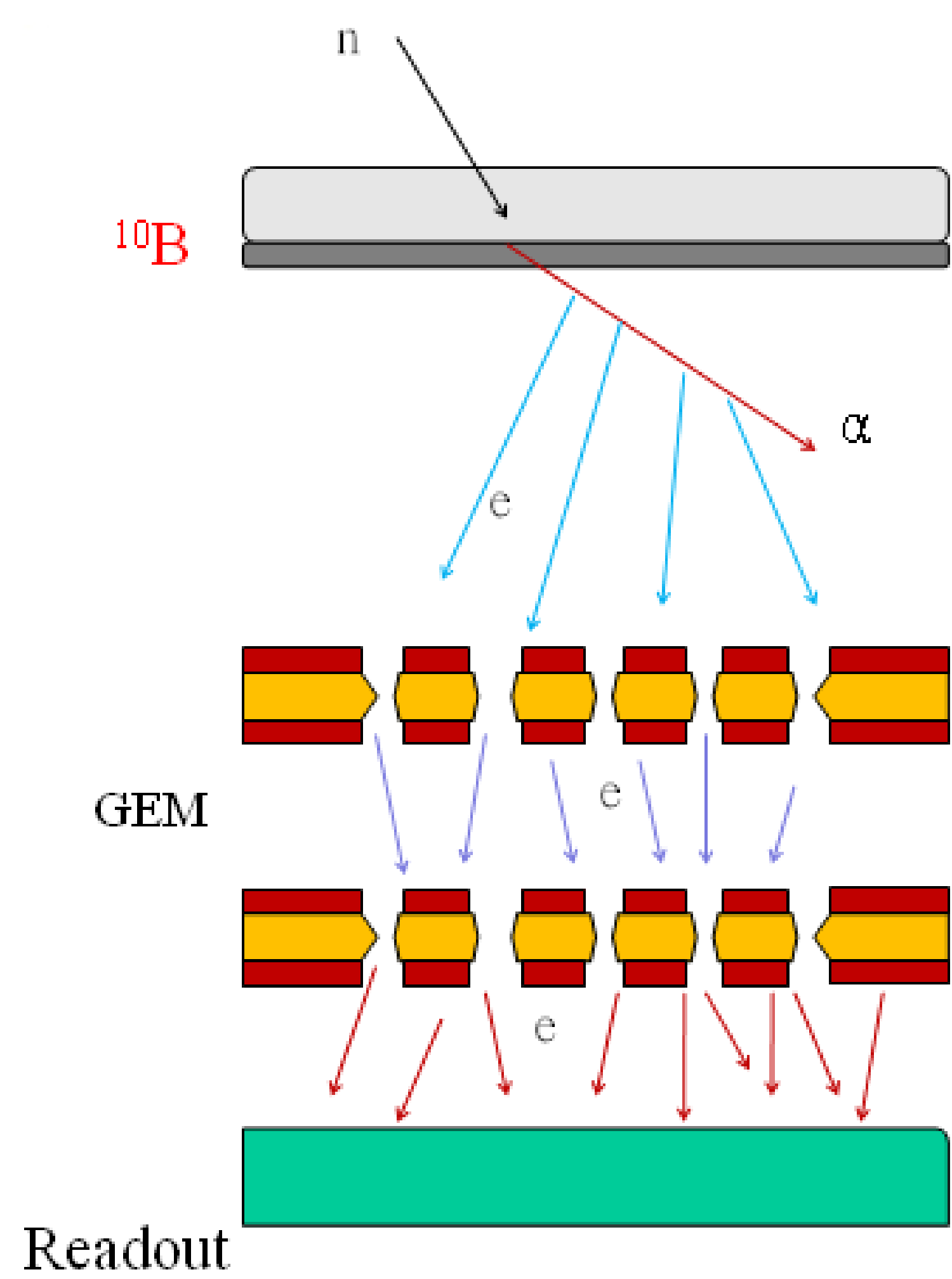


Frame of electrics



Neutron Beam Monitor

(GEM)

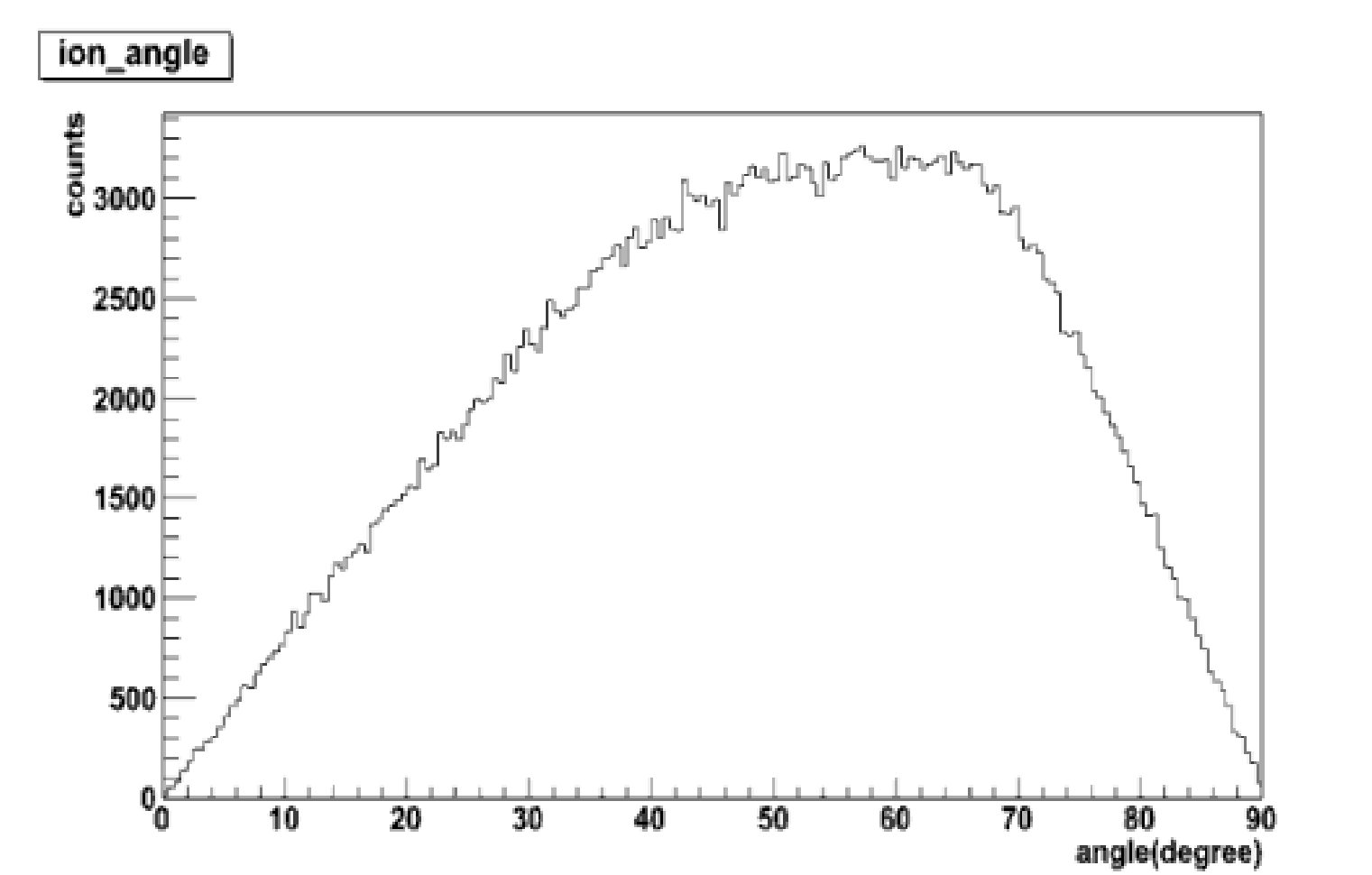
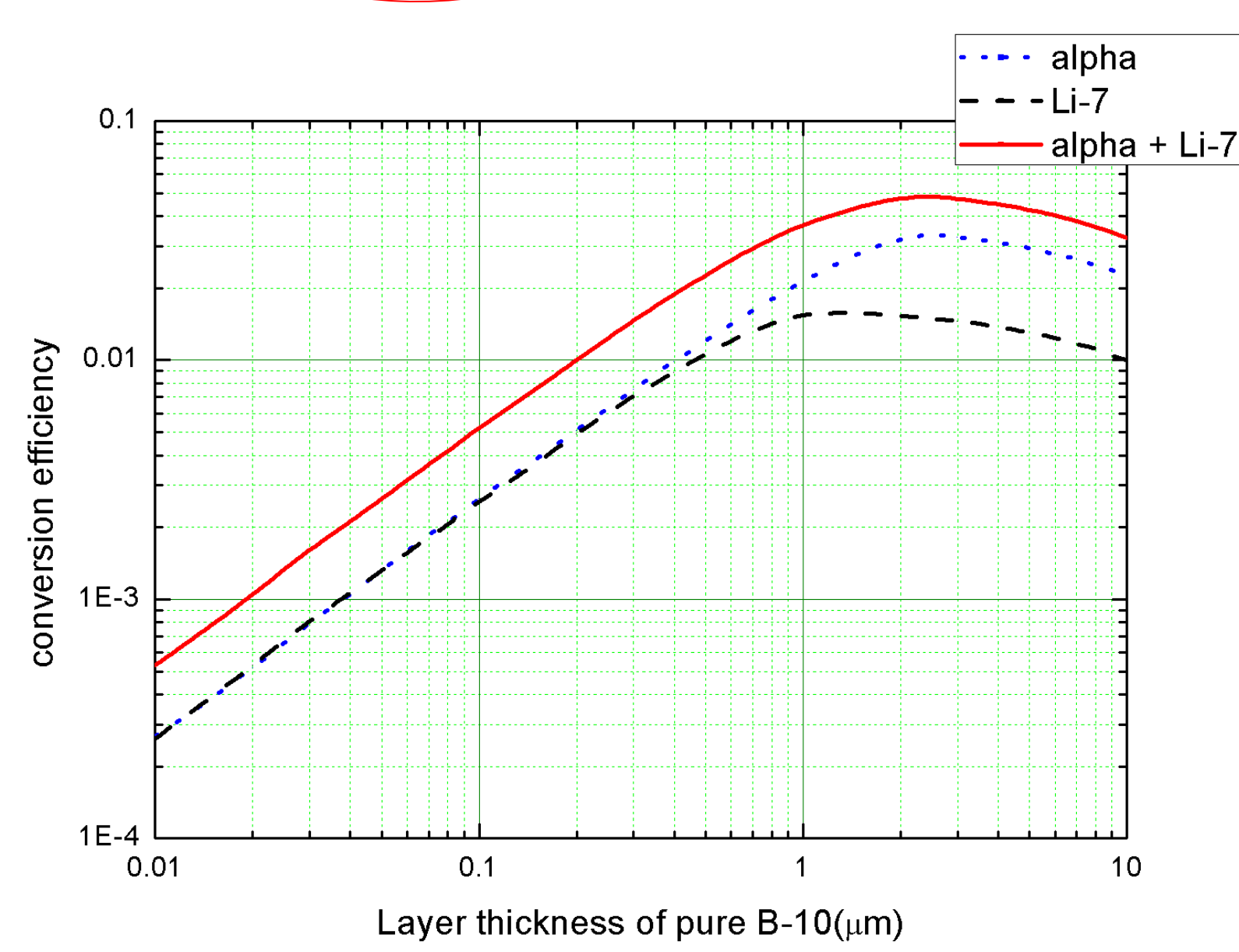
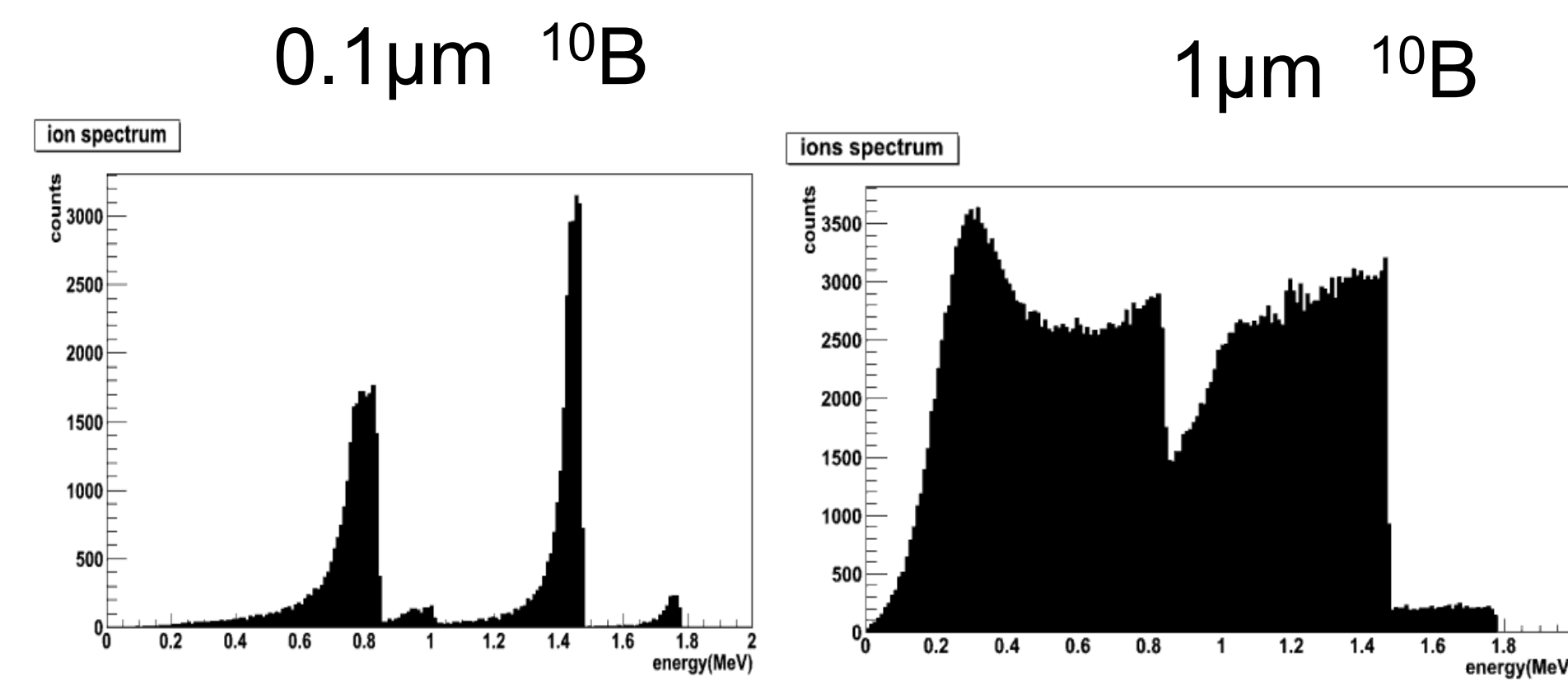
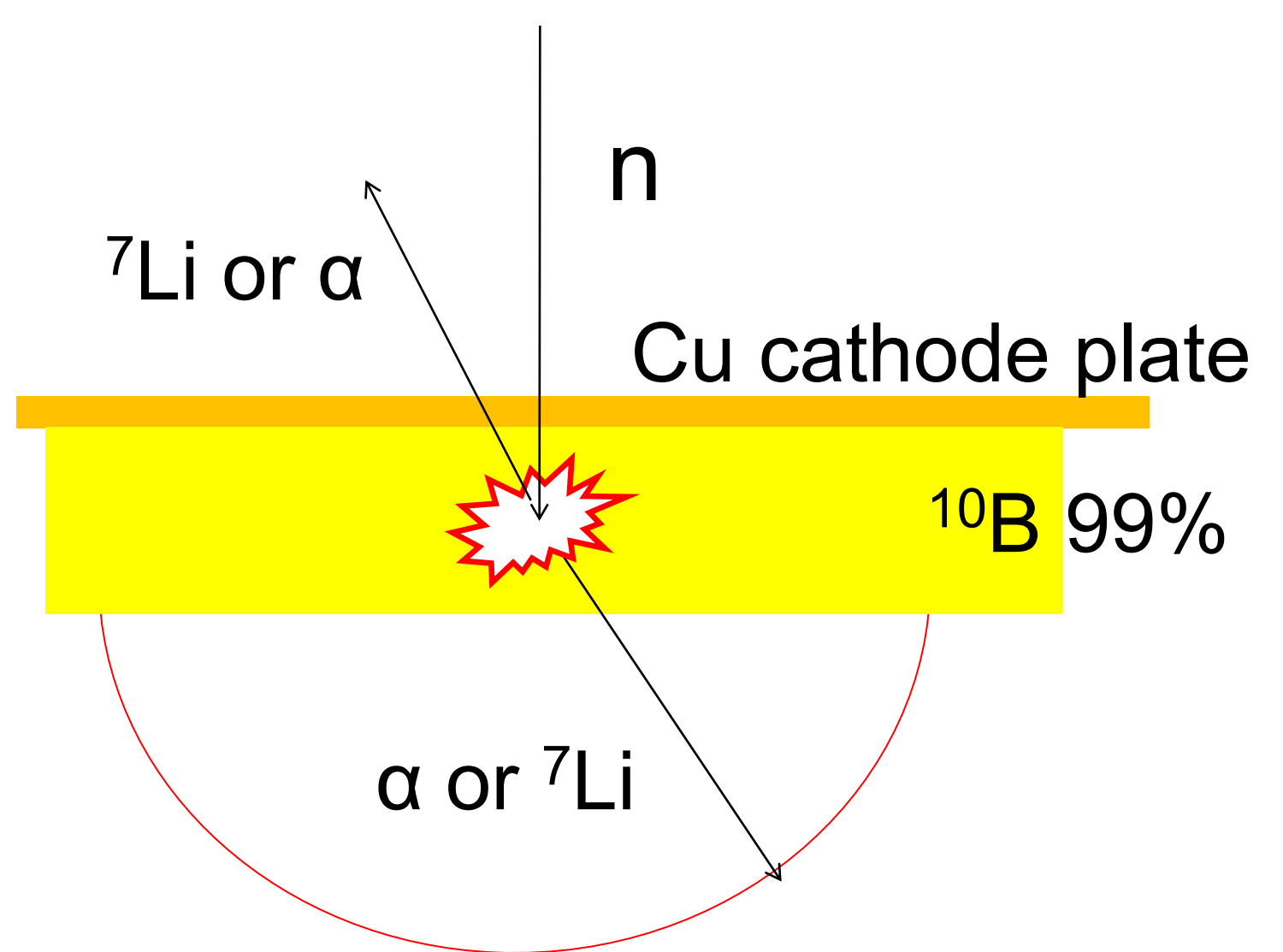


- Intensity fluctuations of the incident beam due to the accelerator or reactor power changes
- Need beam monitor to correct the experimental data of each neutron scattering instrument

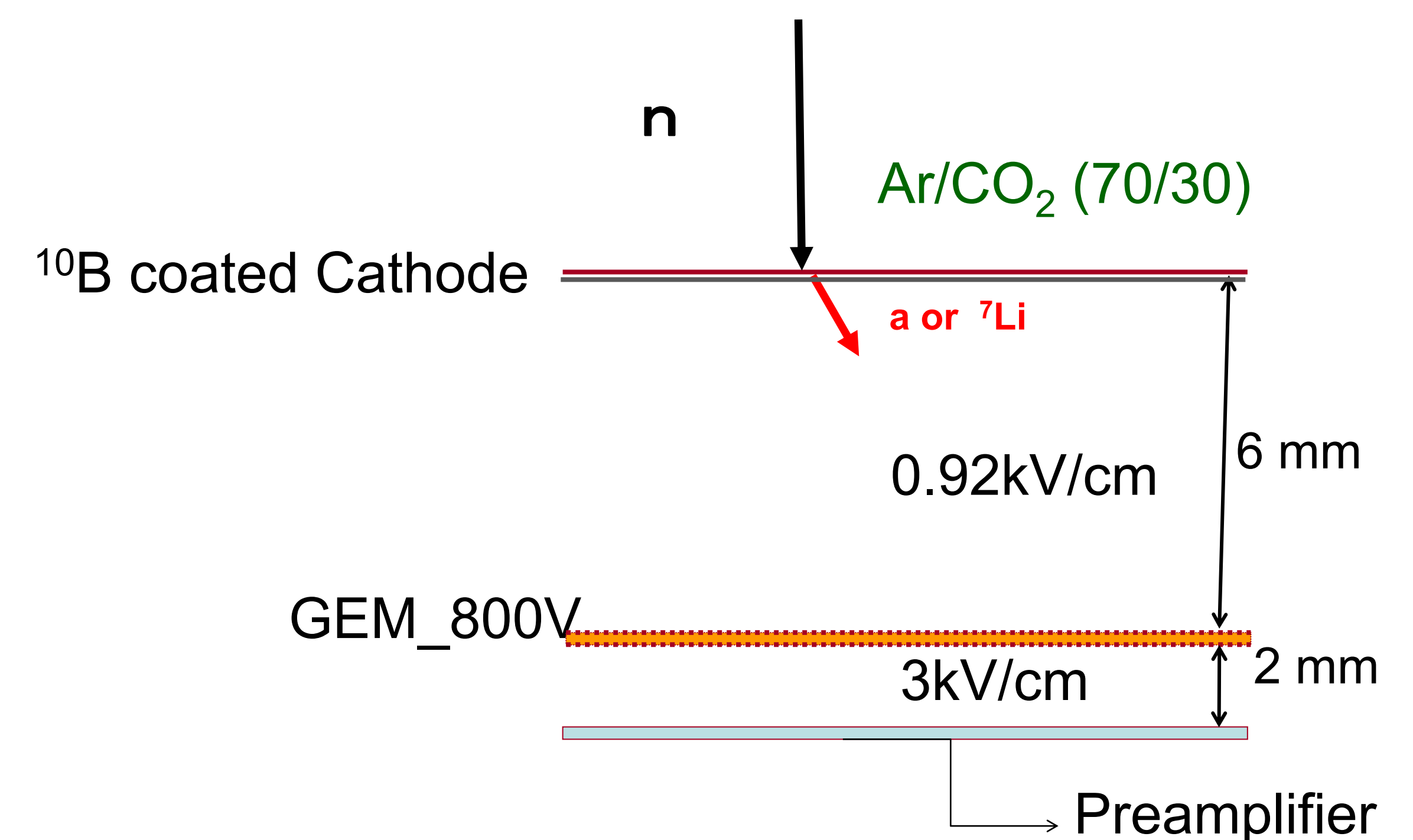
Requirements

- low efficiency (~1%) → least perturbation
- Timing resolution (~1μs) → High Wavelength resolution
- Spatial resolution (1~10mm) → More accurate corrections
- Gamma to neutron separation → γ insensitivity
- High counting rate (~10⁶Hz) → High intensity (>10⁹n/cm²·s)

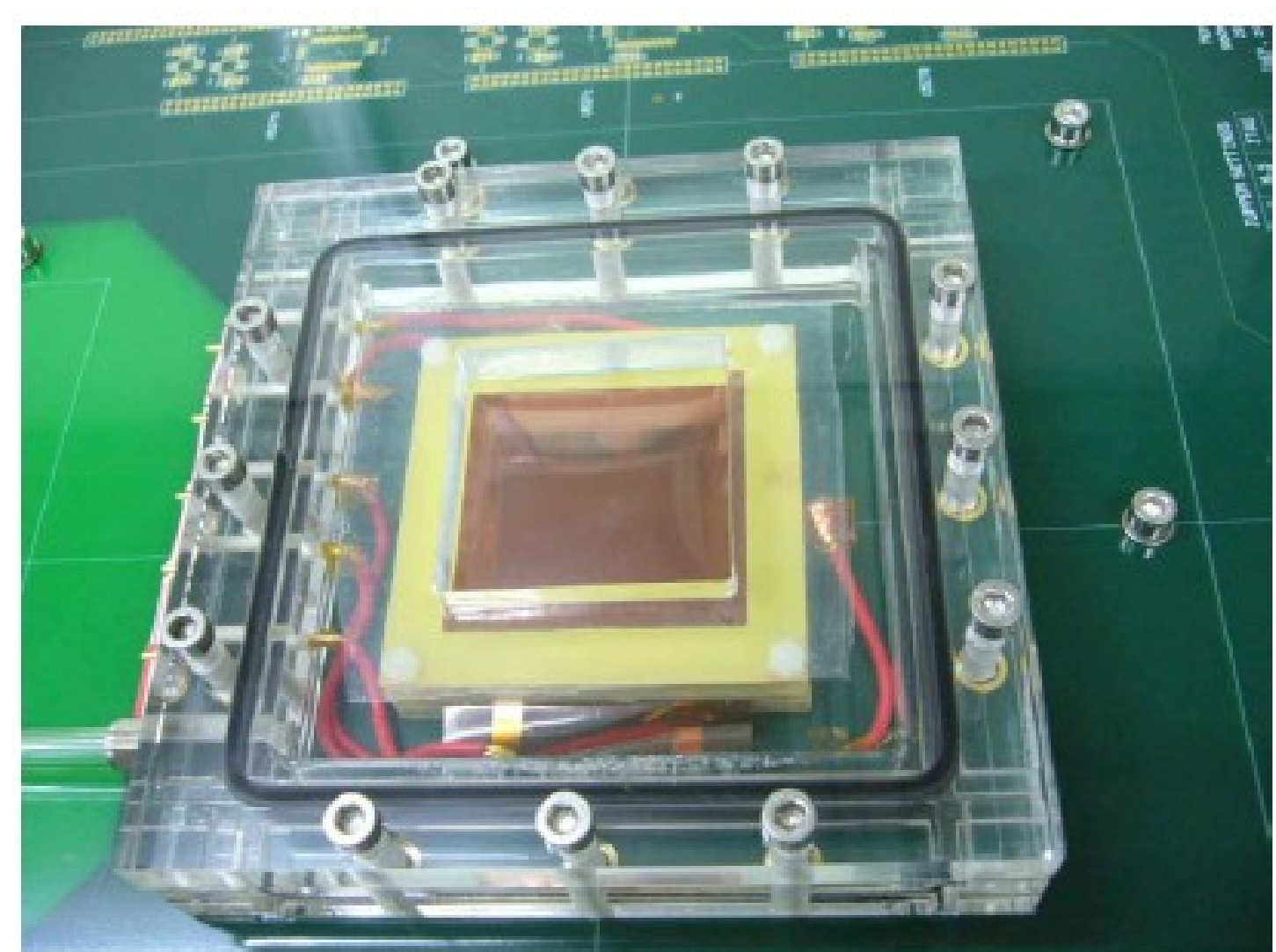
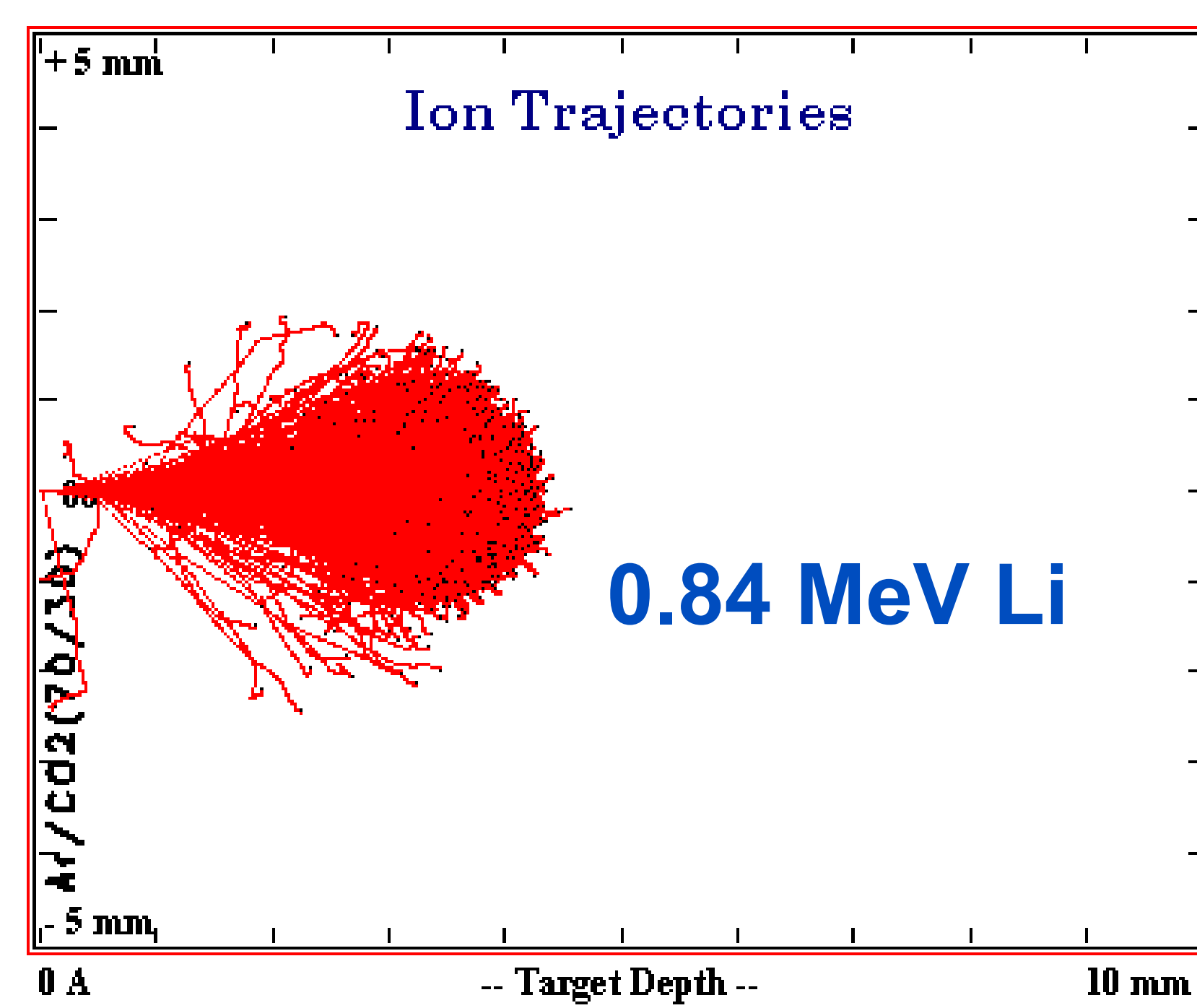
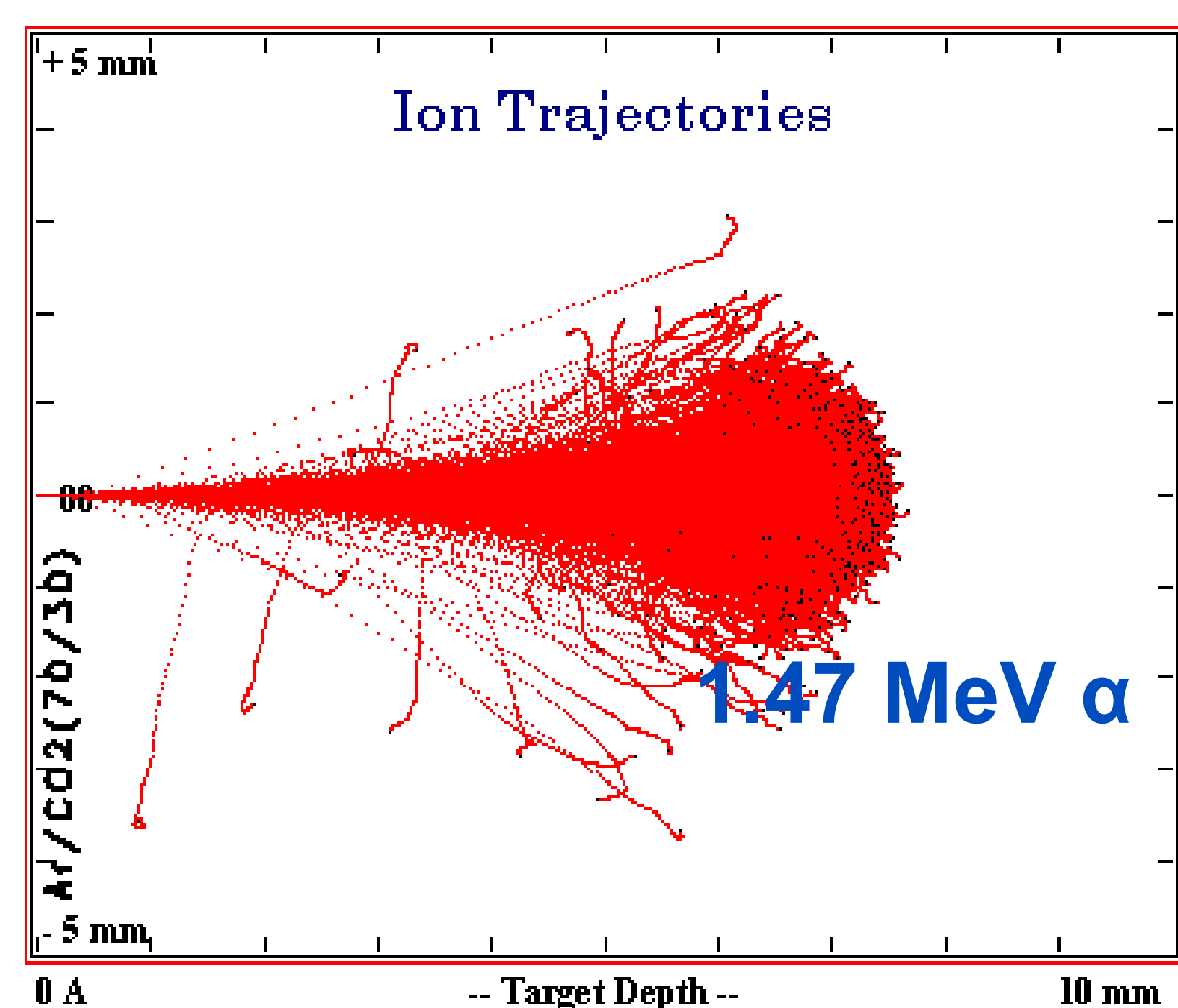
Geant4 Simulation for Thermal Neutron



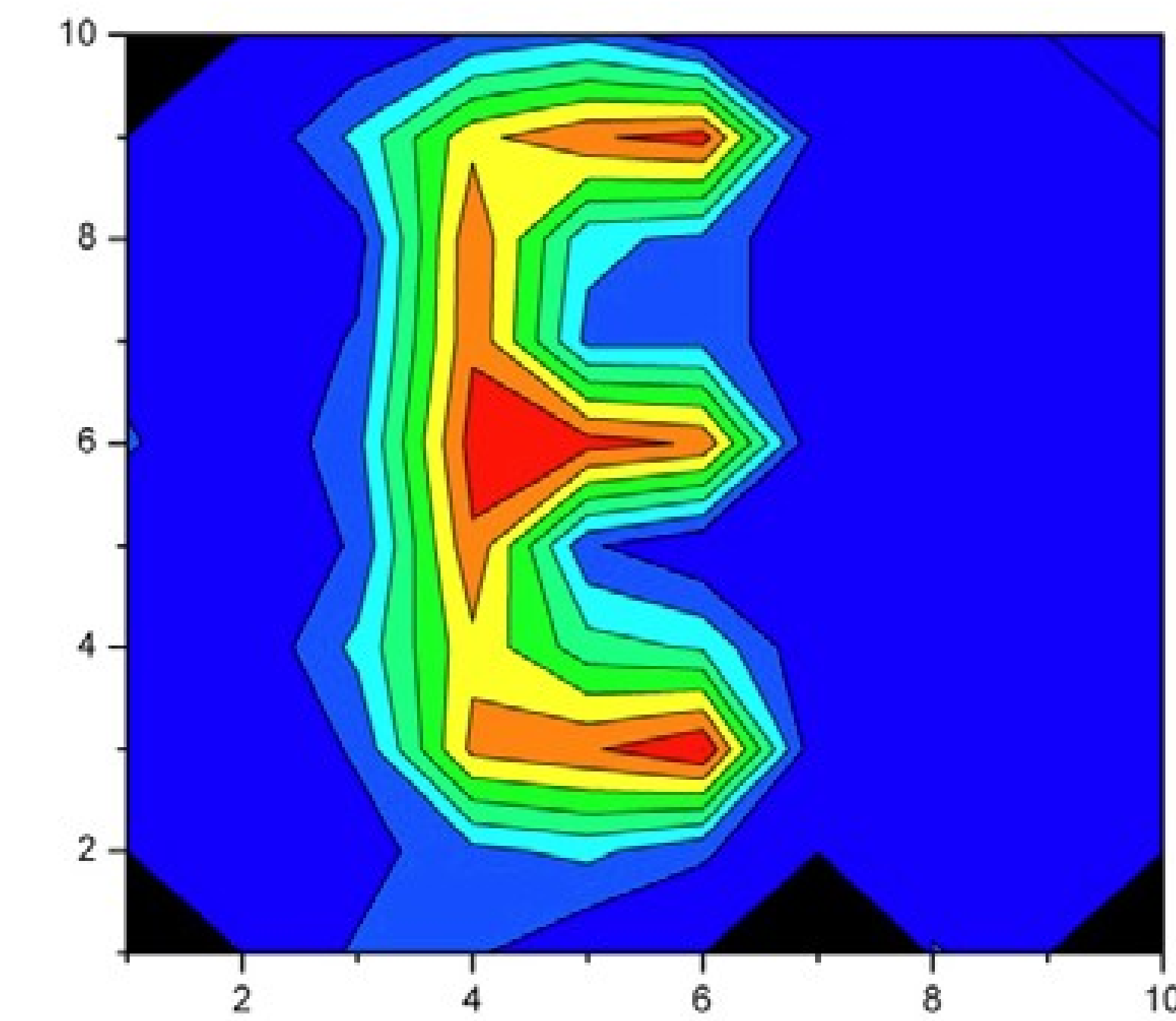
angle distribution of the charge particles



Cf-252 neutron source test



Detector Prototype



α source test

