

The $n(d,np)n$ Reaction as a Probe of Three-body Effects in the Strong Nuclear Interaction

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The Four Fundamental Forces

Force	Relative Strength	Range	Example
Strong Nuclear	1	10^{-15} m	Holds nuclei together
Electromagnetic	1/137	Infinite	Holds atoms together
Weak Nuclear	1/10,000	10^{-16} m	Radioactive decay
Gravity	10^{-38}	Infinite	Holds Solar system together

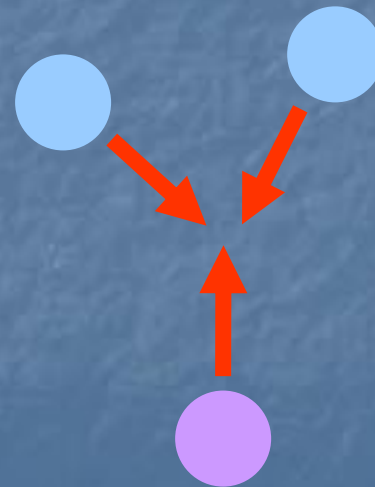
2NF versus 3NF

- Two Body Force (2NF)

- Gravitational
- Electrostatic

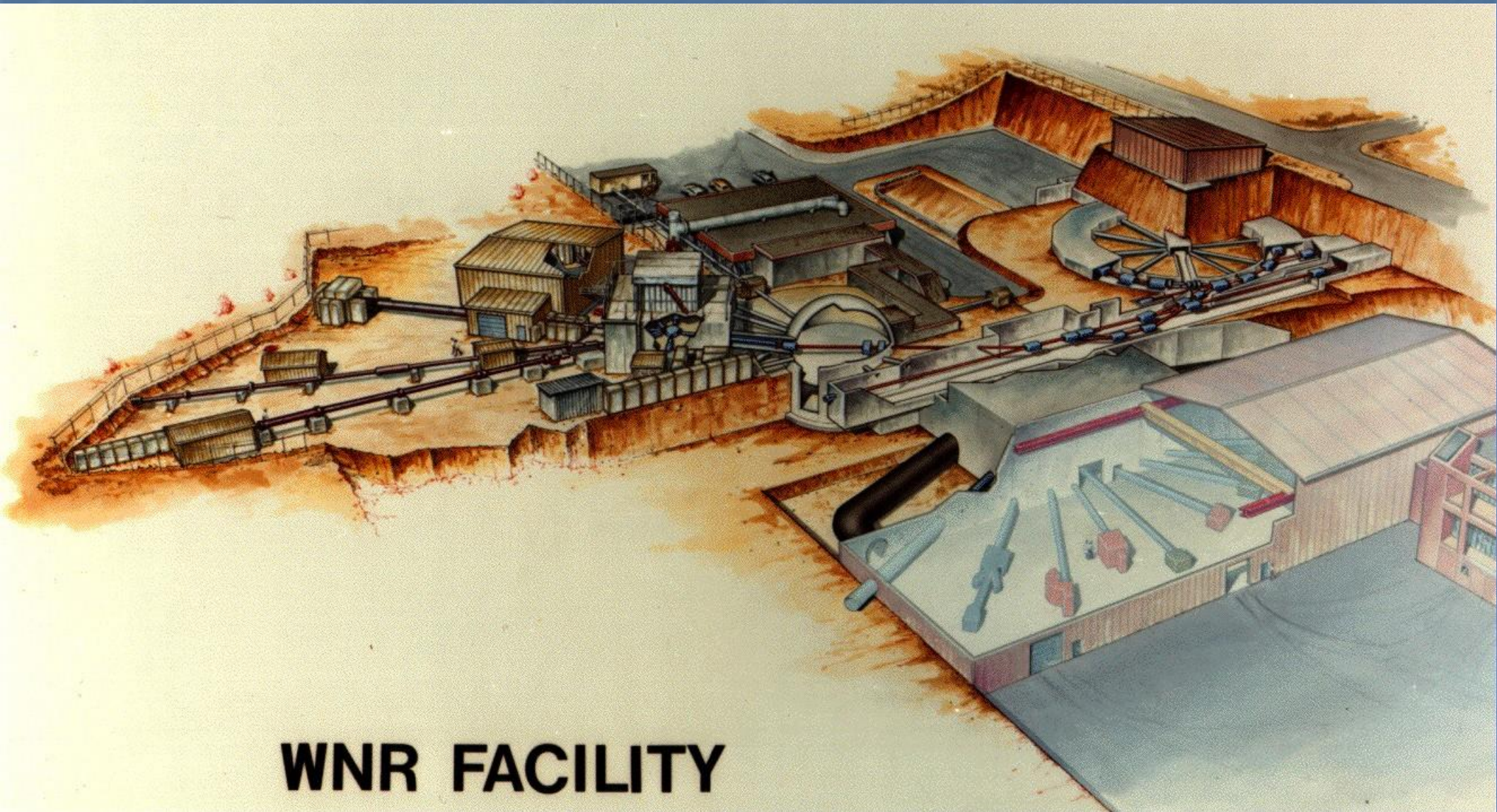


- Three Body Force (3NF)



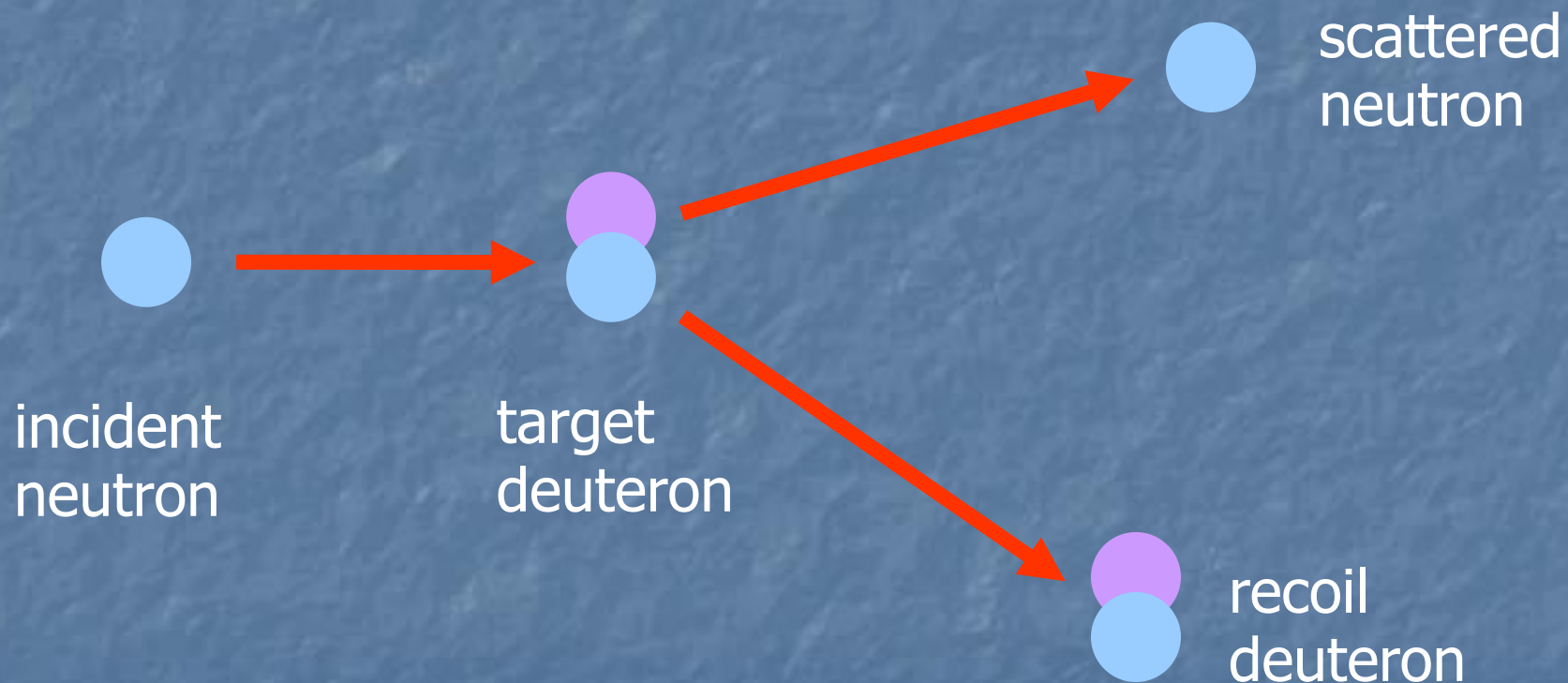
Los Alamos Neutron Science Center (LANSCE)



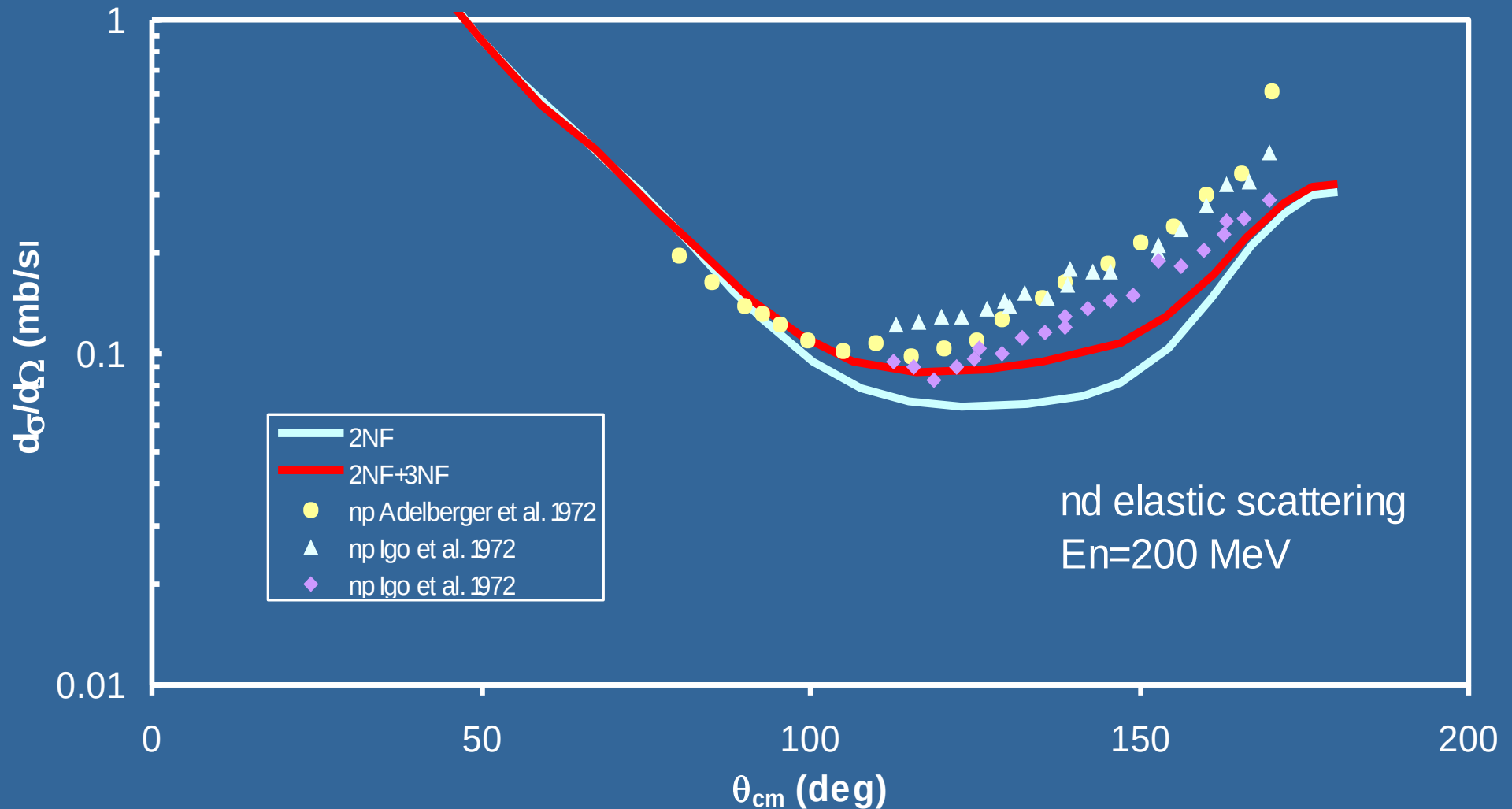


WNR FACILITY

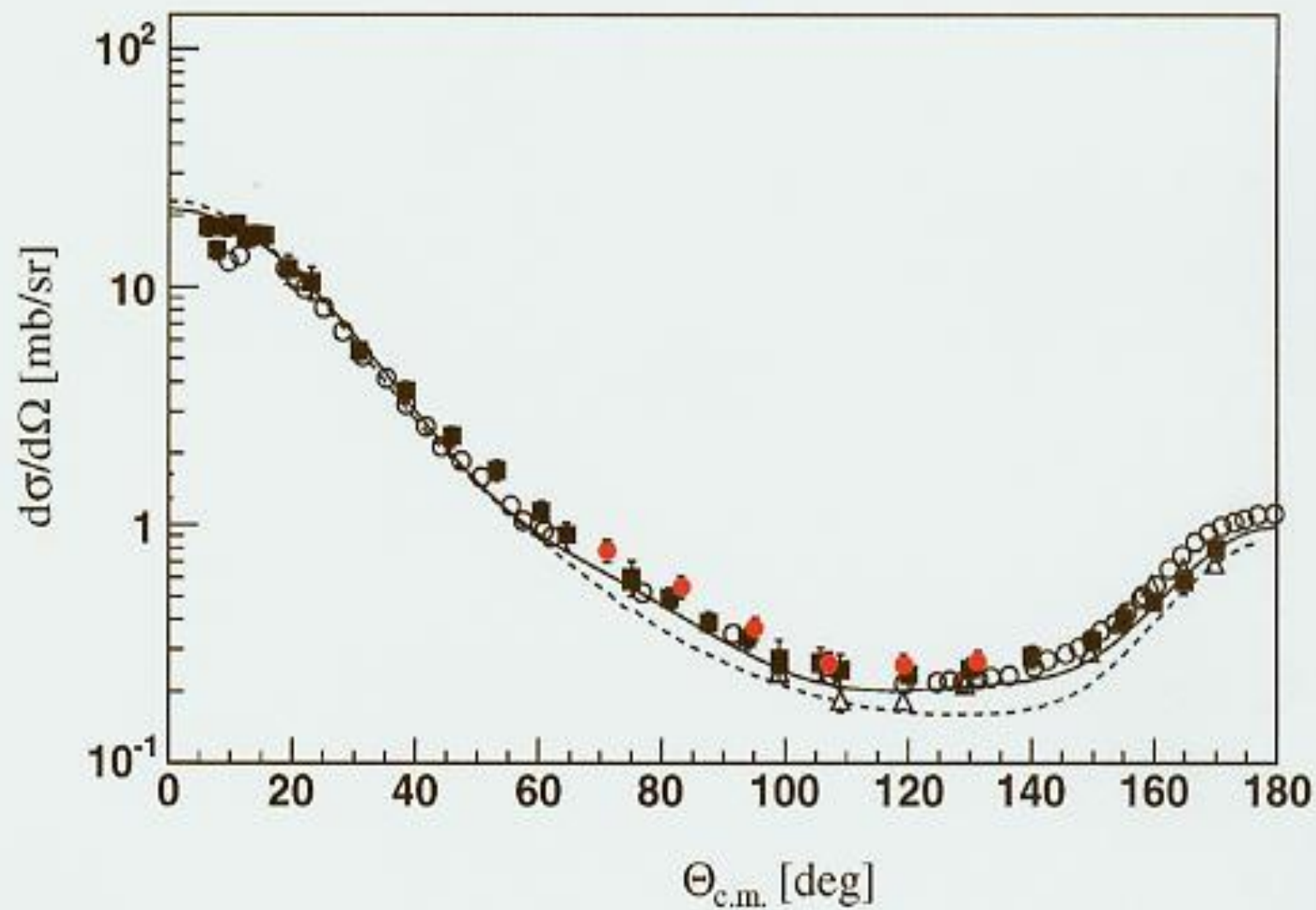
$d(n,nd)$



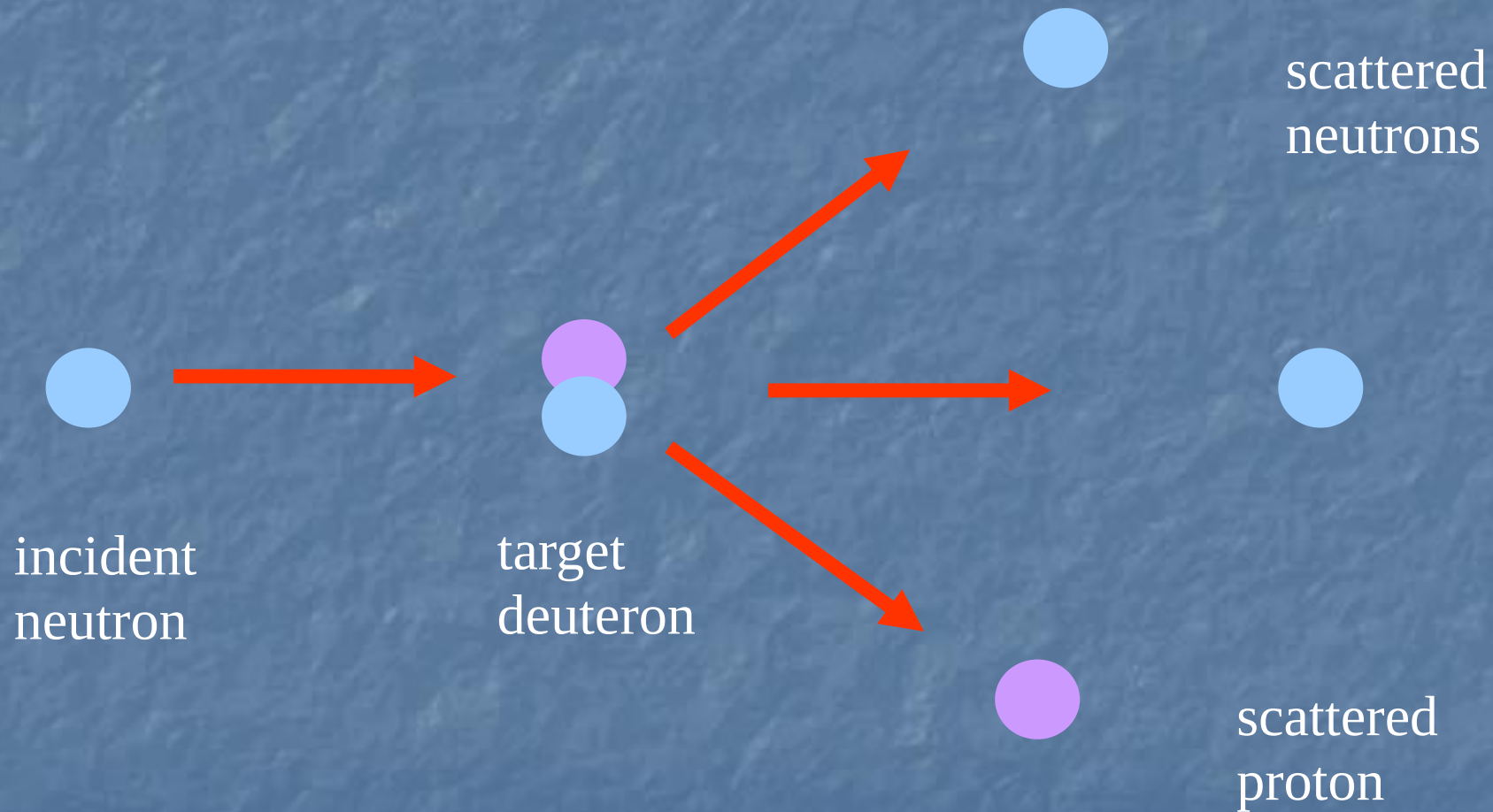
Previous Measurements

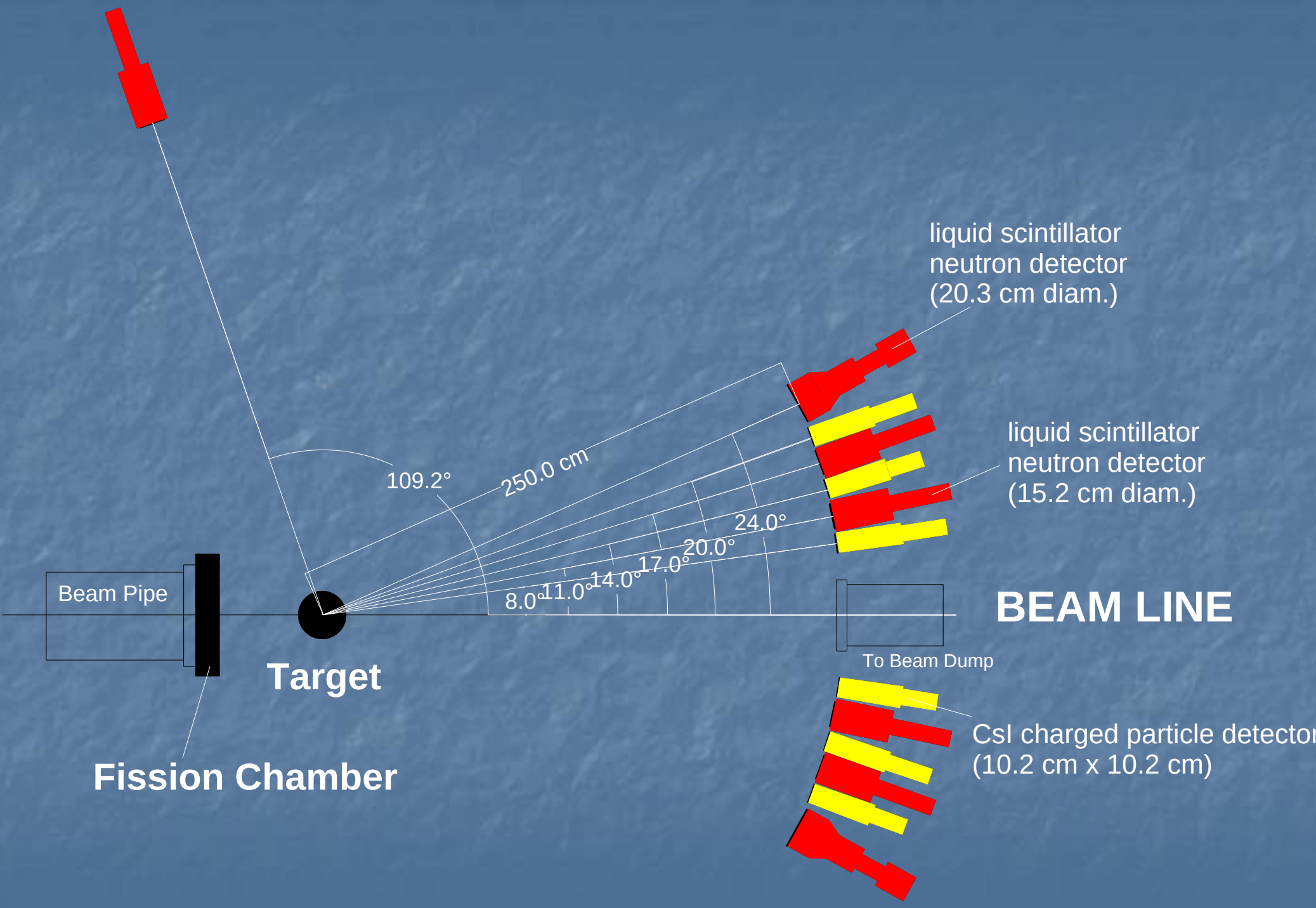


Preliminary ND Elastic Scattering Cross Section at 140 MeV



$$d(n,np)n$$





Beam Pipe

Target

Fission Chamber

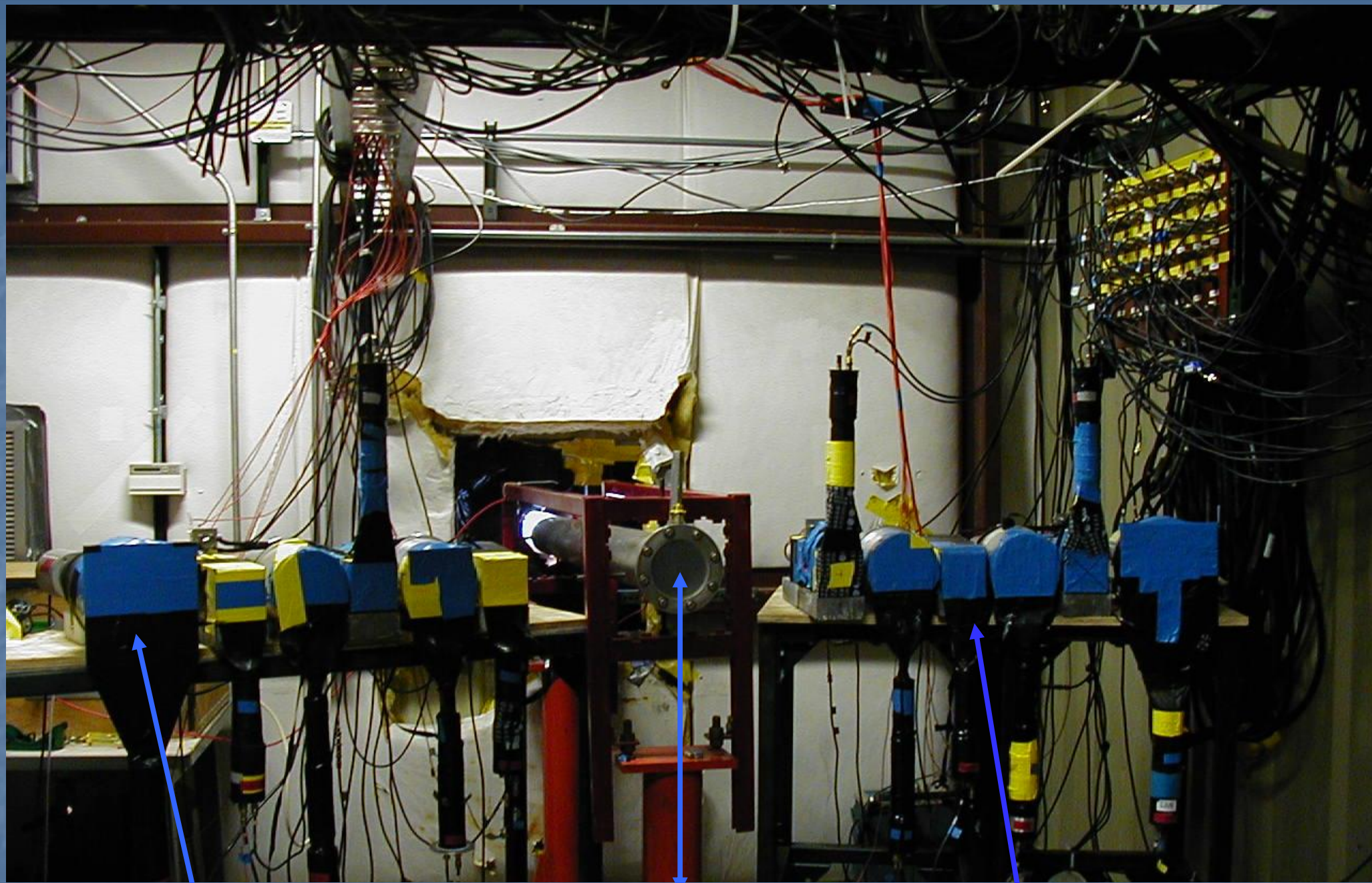
liquid scintillator
neutron detector
(20.3 cm diam.)

liquid scintillator
neutron detector
(15.2 cm diam.)

BEAM LINE

To Beam Dump

CsI charged particle detector
(10.2 cm x 10.2 cm)

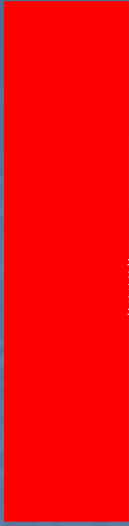


Neutron detector

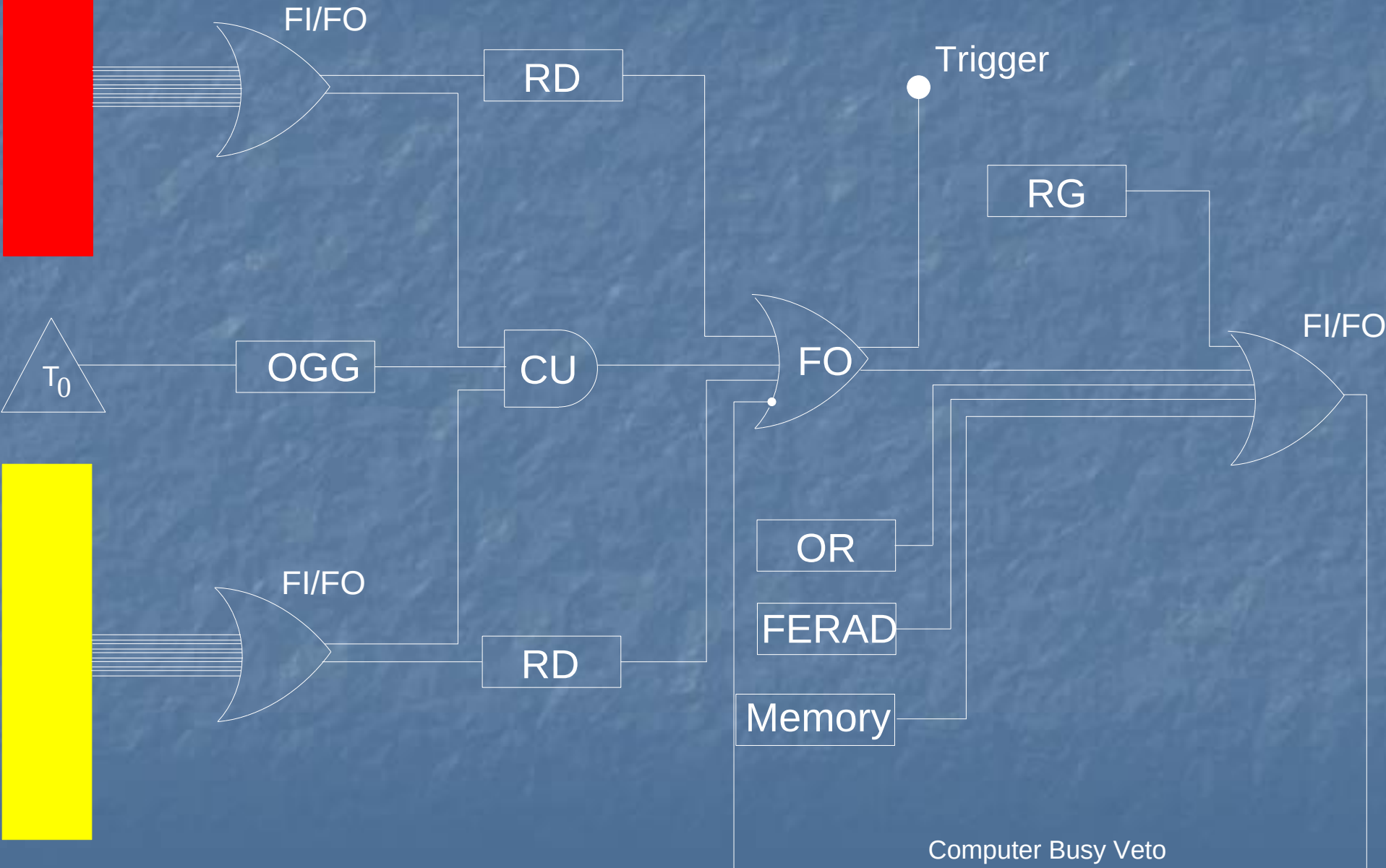
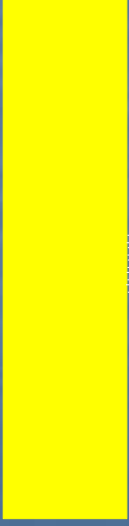
Beam Pipe

CsI detector

Neutron
Detectors

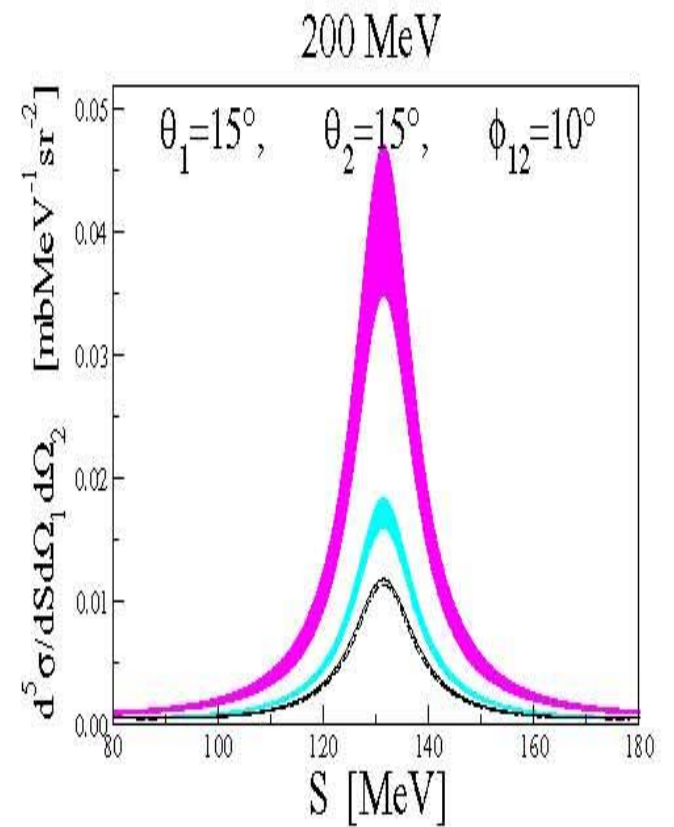
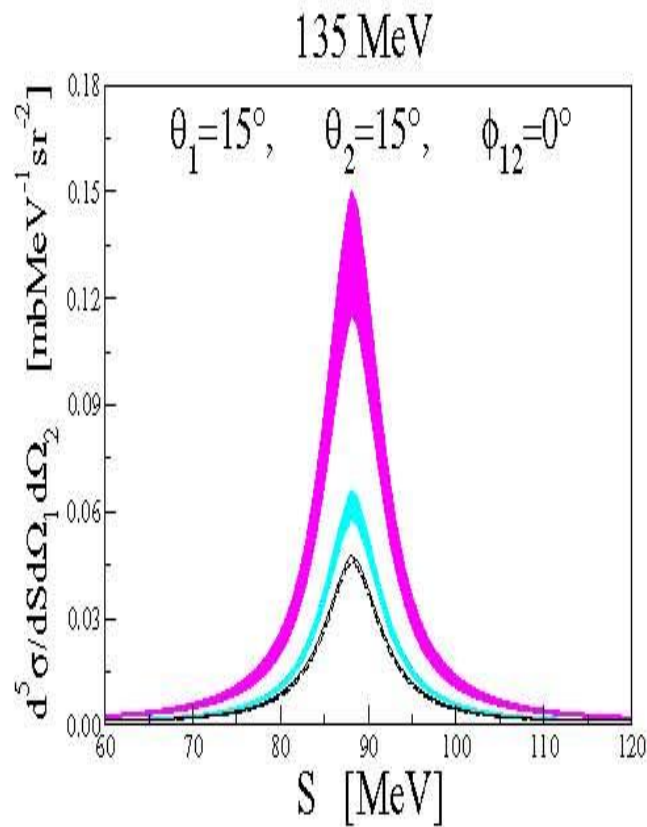
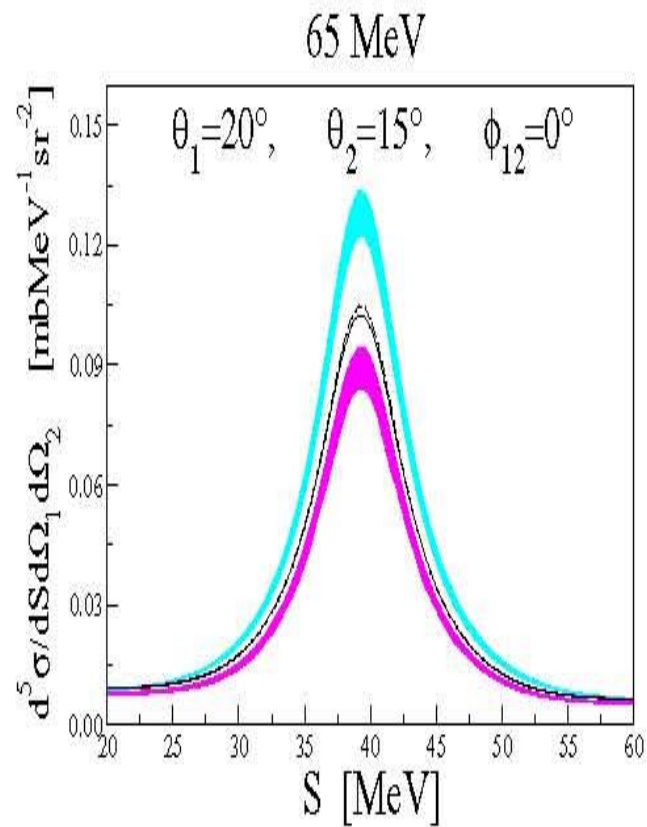


Proton
Detectors



Findings from 2003

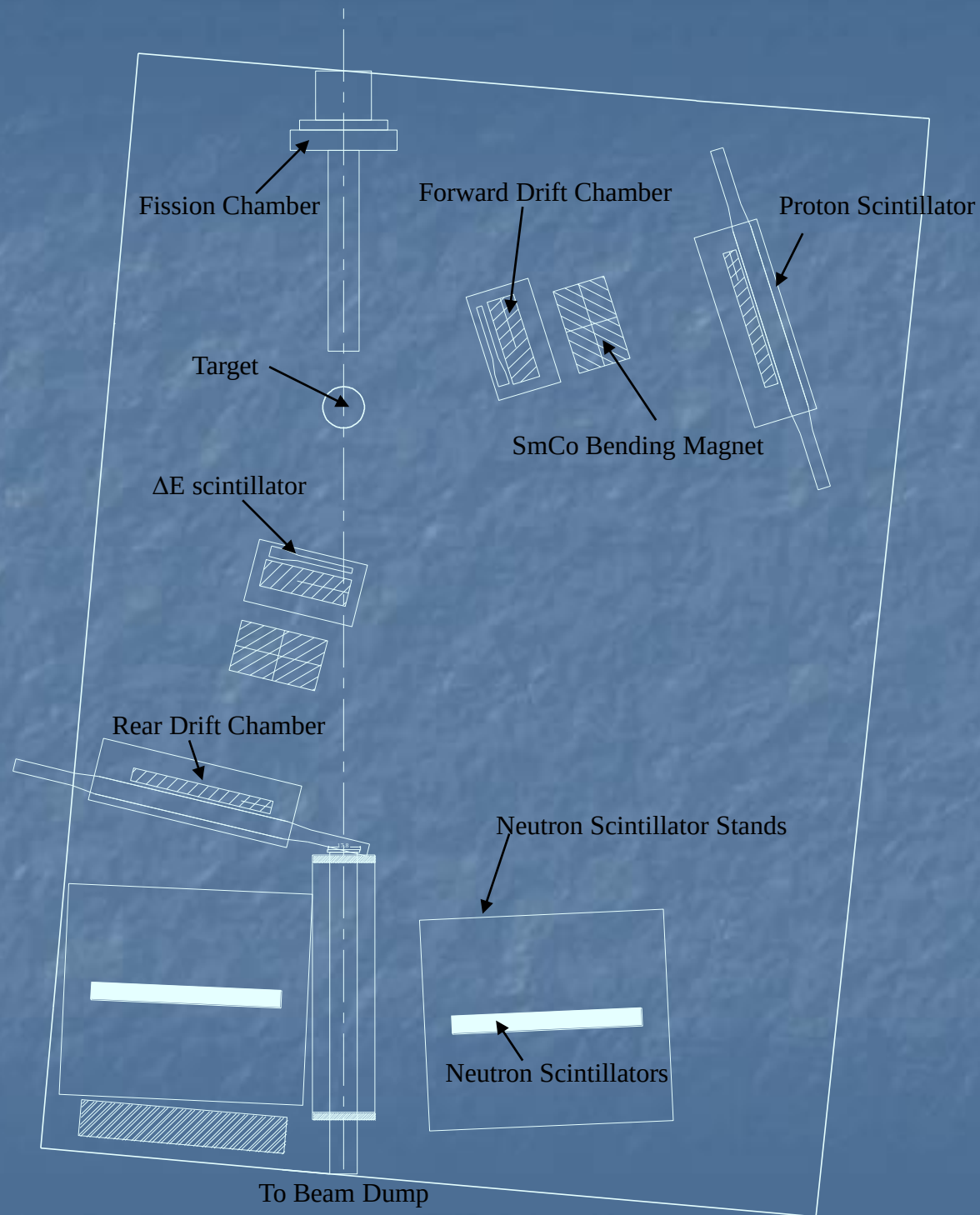
- Exaggerated predictions
 - TM versus TM'
- Multiple scattering
- Unpredictable Background



Blue band: 2NF

Red band: 2NF + TM 3NF

Dashed black curve: 2NF + TM' 3NF



Conclusion

- Delays in 2004
 - CREM
 - Safety
- 2005
 - Finish Setup
 - Take Data in August