Investigation of the Neutron-induced Deuteron Breakup Process

April 5, 2008

Steve Thomson

Mark Yuly

Department of Physics
Houghton College
One Willard Avenue
Houghton, NY 14744

Houghton College Physics

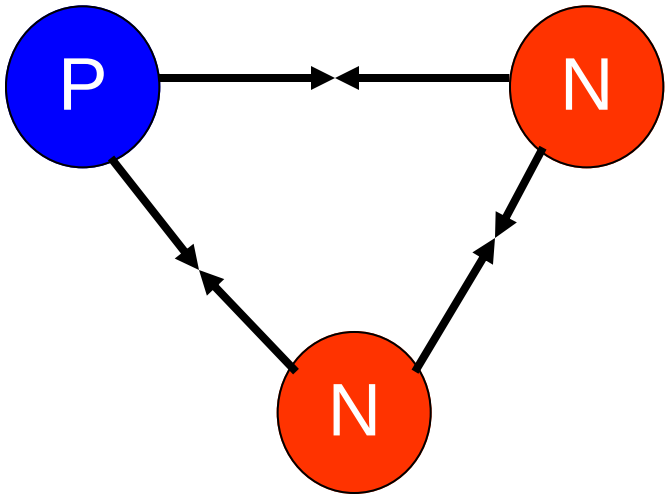
- Fundamental Forces
- Strong Force
- Theoretical Models
- Experimental Setup
- Future Plans for the Experiment

The Four Fundamental Forces

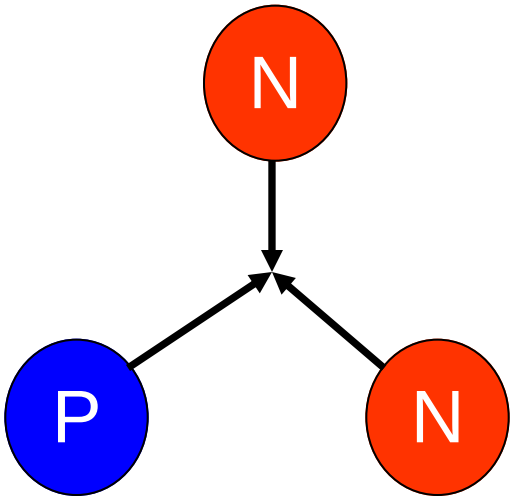
Force	Relative Strength	Range	Example
Strong Nuclear	1	10^{-15} m	Holds nuclei together
Electromagnetic	1/137	Infinite	Holds atoms together
Weak Nuclear	1/10,000	10^{-16} m	Radioactive decay
Gravity	10^{-38}	Infinite	Holds Solar system together

Strong Force

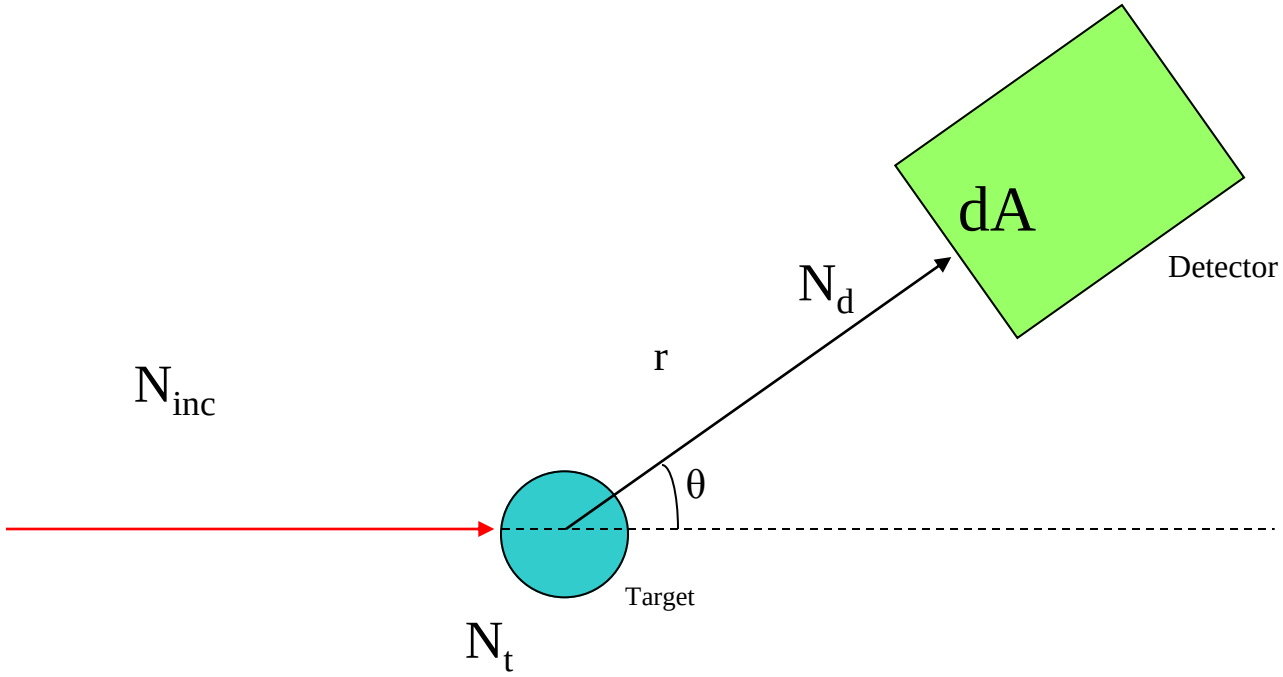
Two-Nucleon Force



Three-Nucleon Force

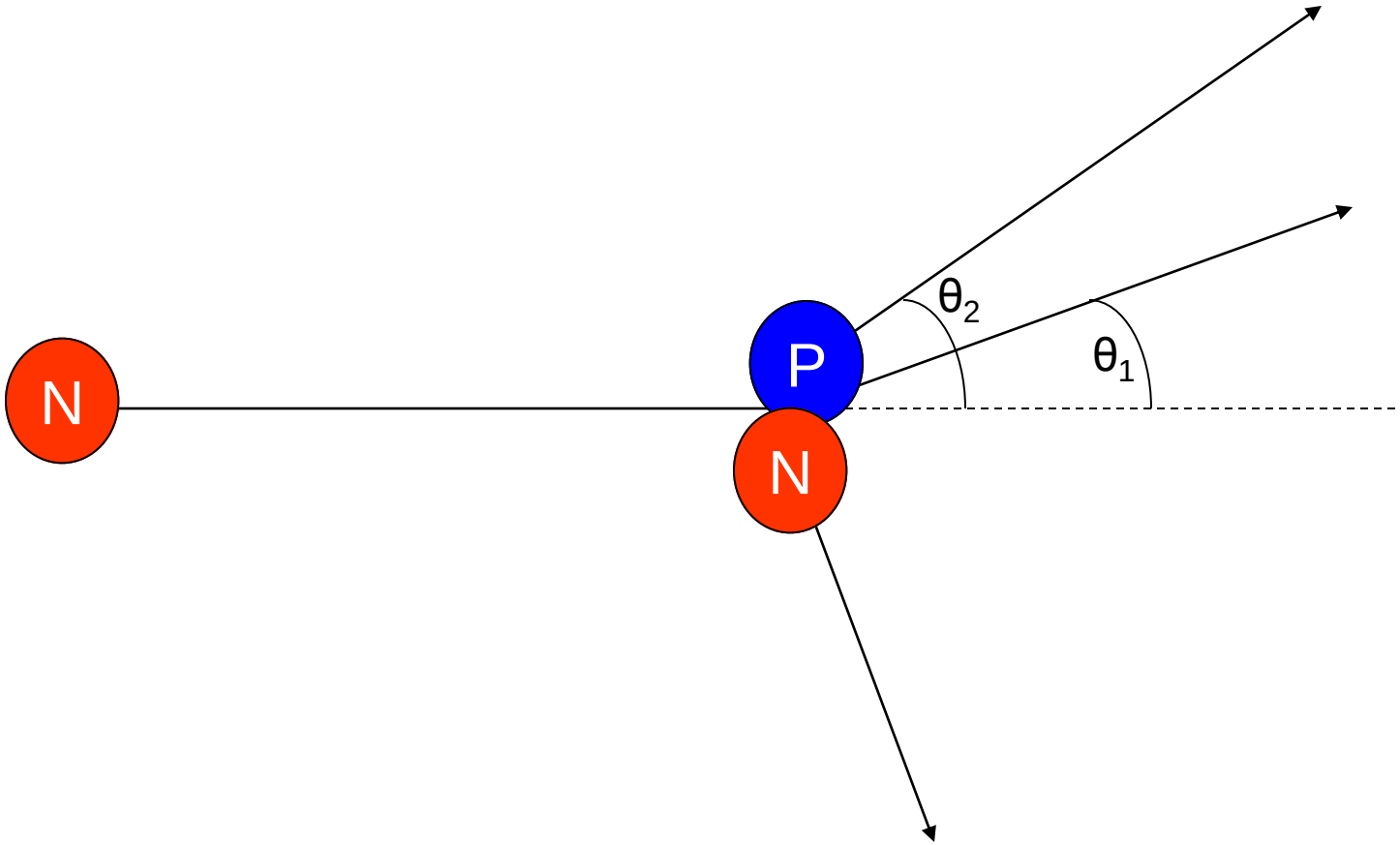


Cross Section

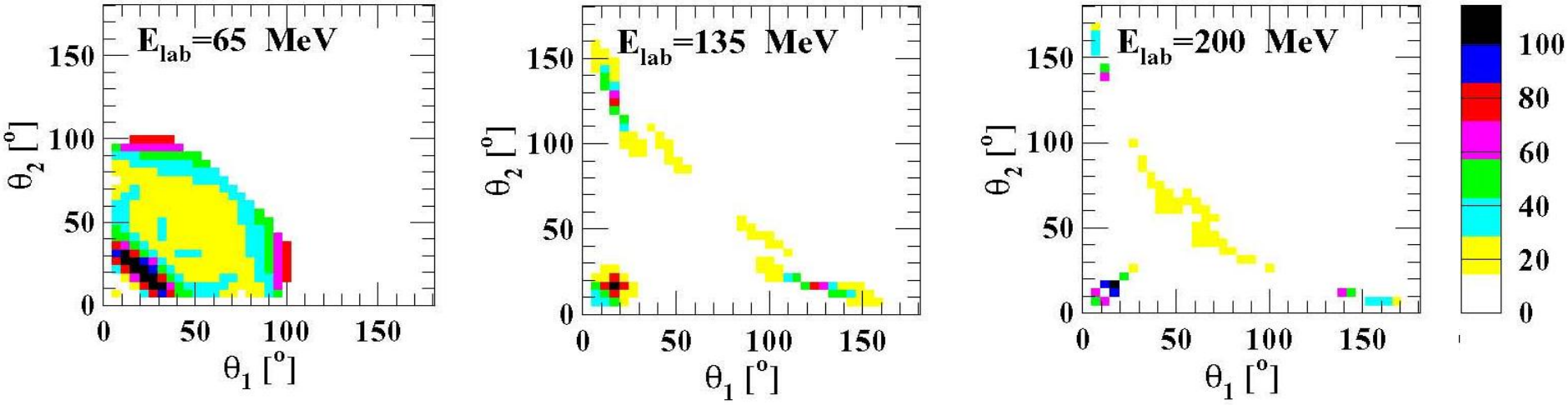


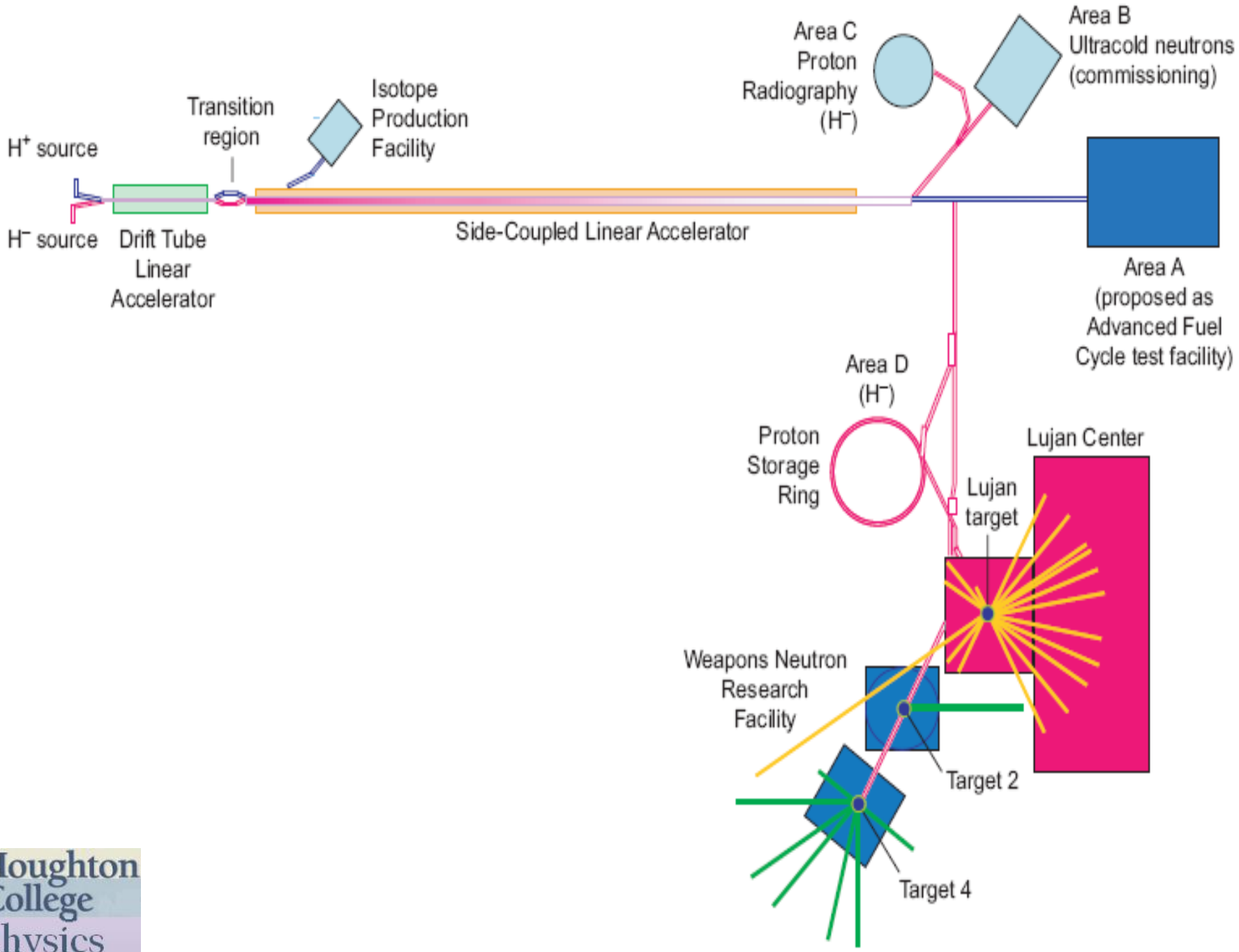
$$N_d = \sigma N_{inc} N_t d\Omega$$

Neutron-Deuteron Breakup

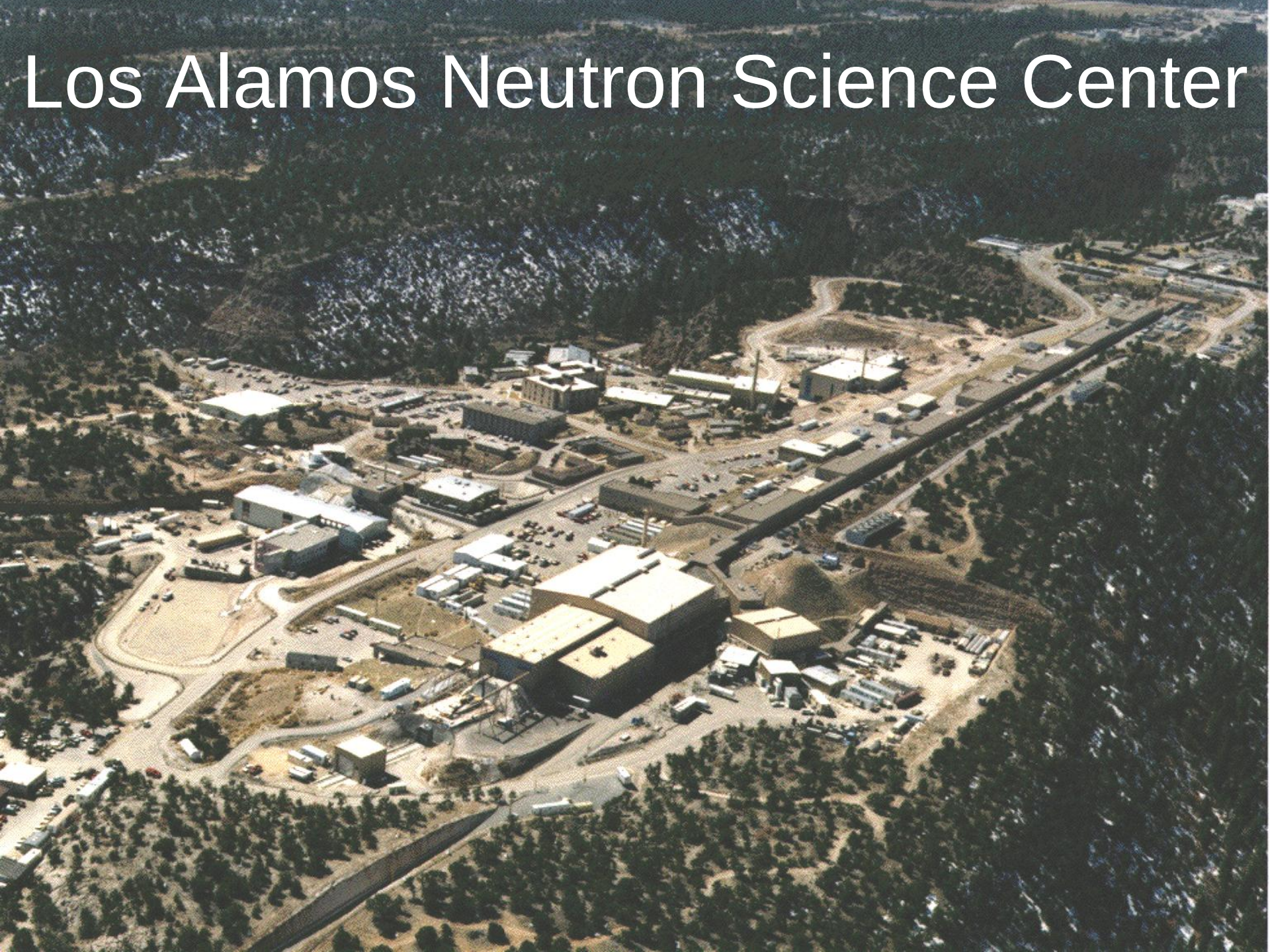


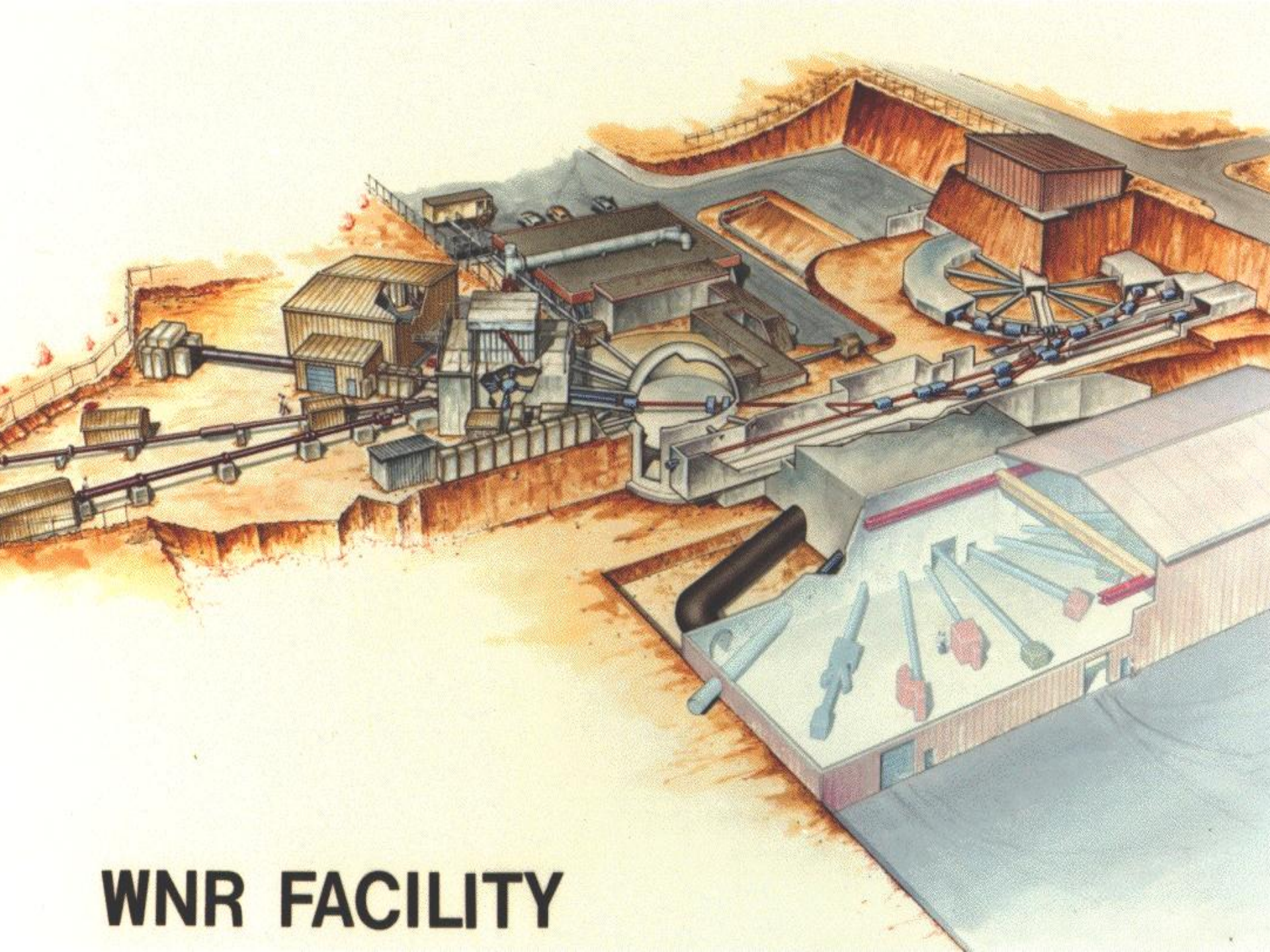
N-d Breakup Cross-Sections



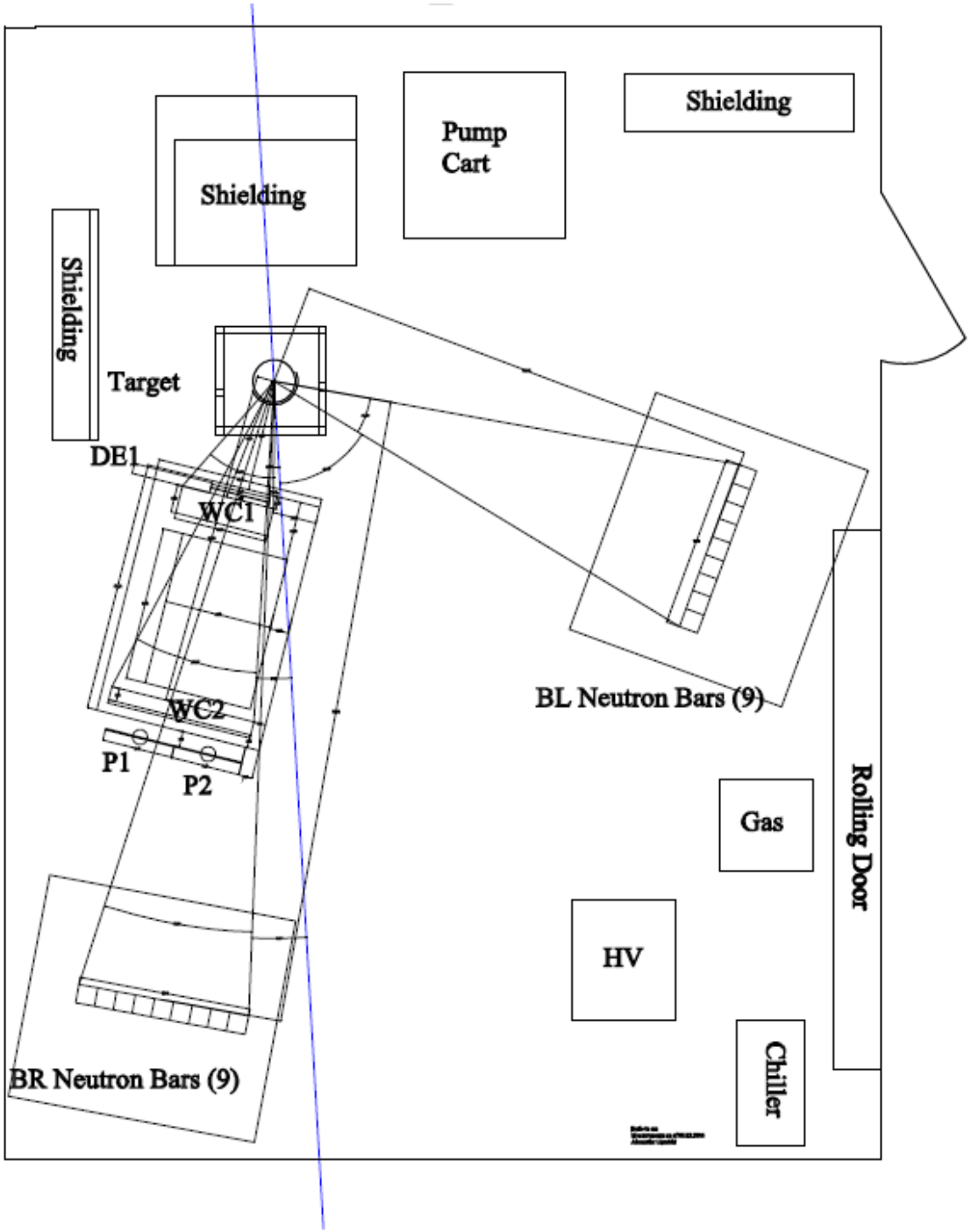


Los Alamos Neutron Science Center

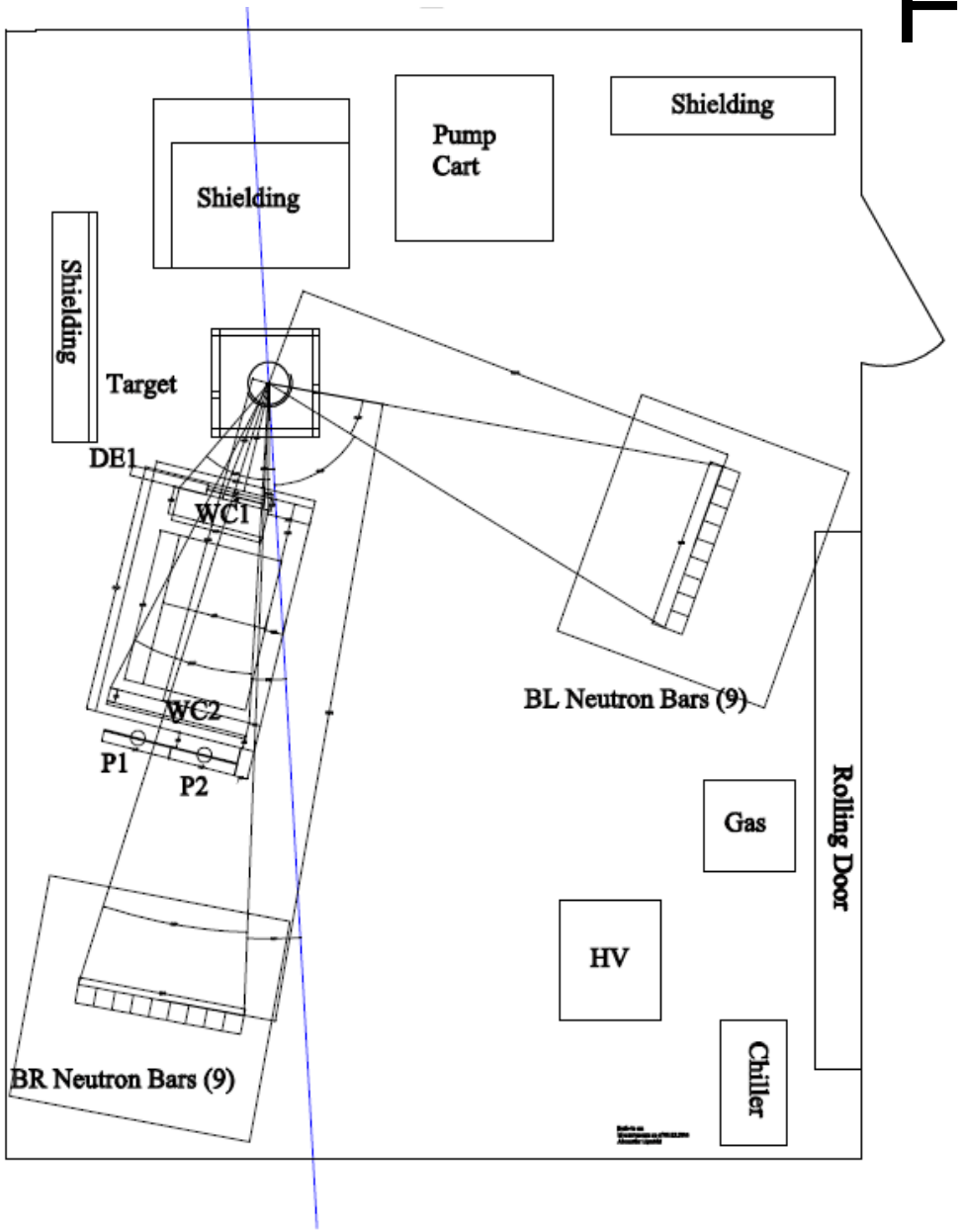




WNR FACILITY

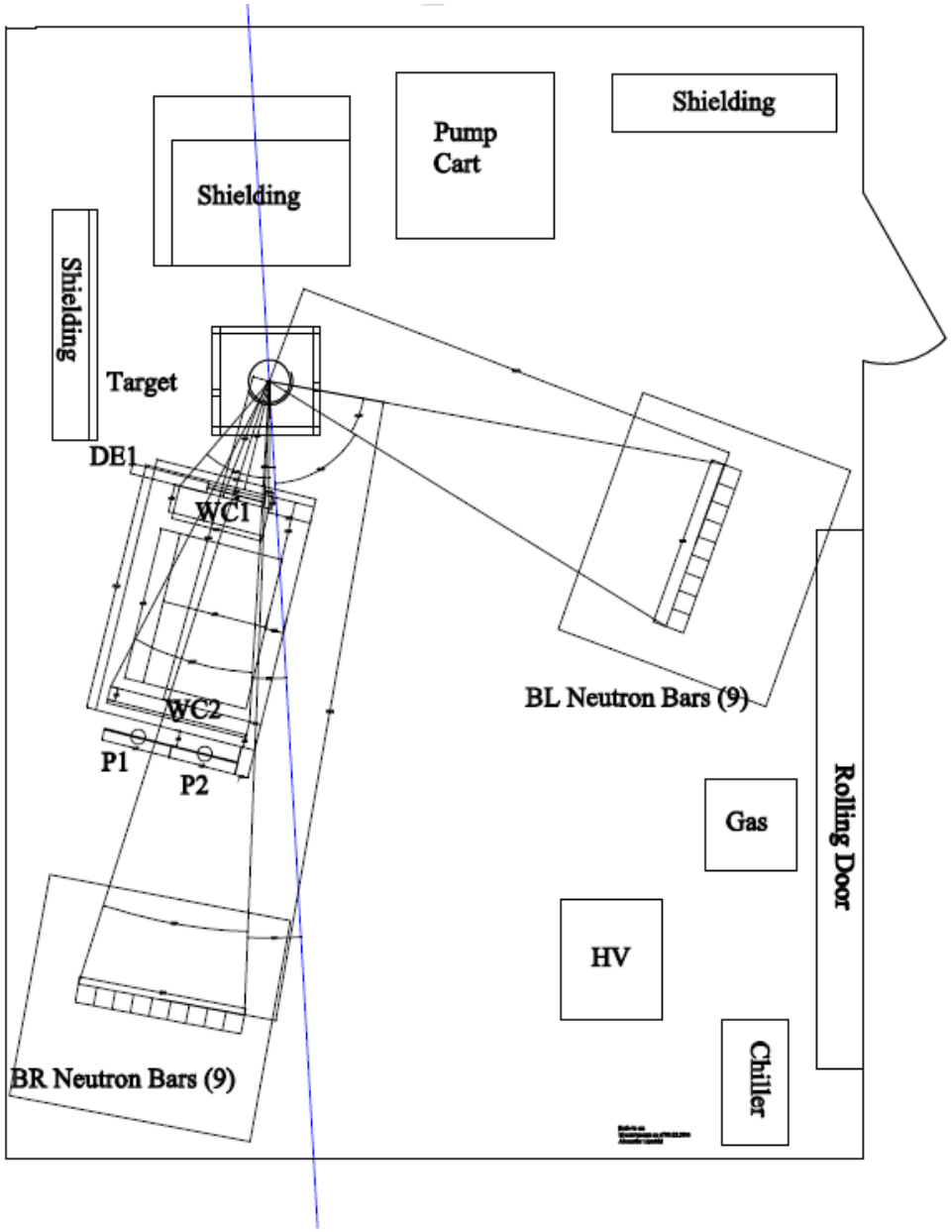

Shielding
Pump Cart
Shielding
Shielding
Target
DE1
WC1
WC2
P1
P2
BL Neutron Bars (9)
Rolling Door
Gas
HV
Chiller
BR Neutron Bars (9)
Beam Dump

Fission Chamber

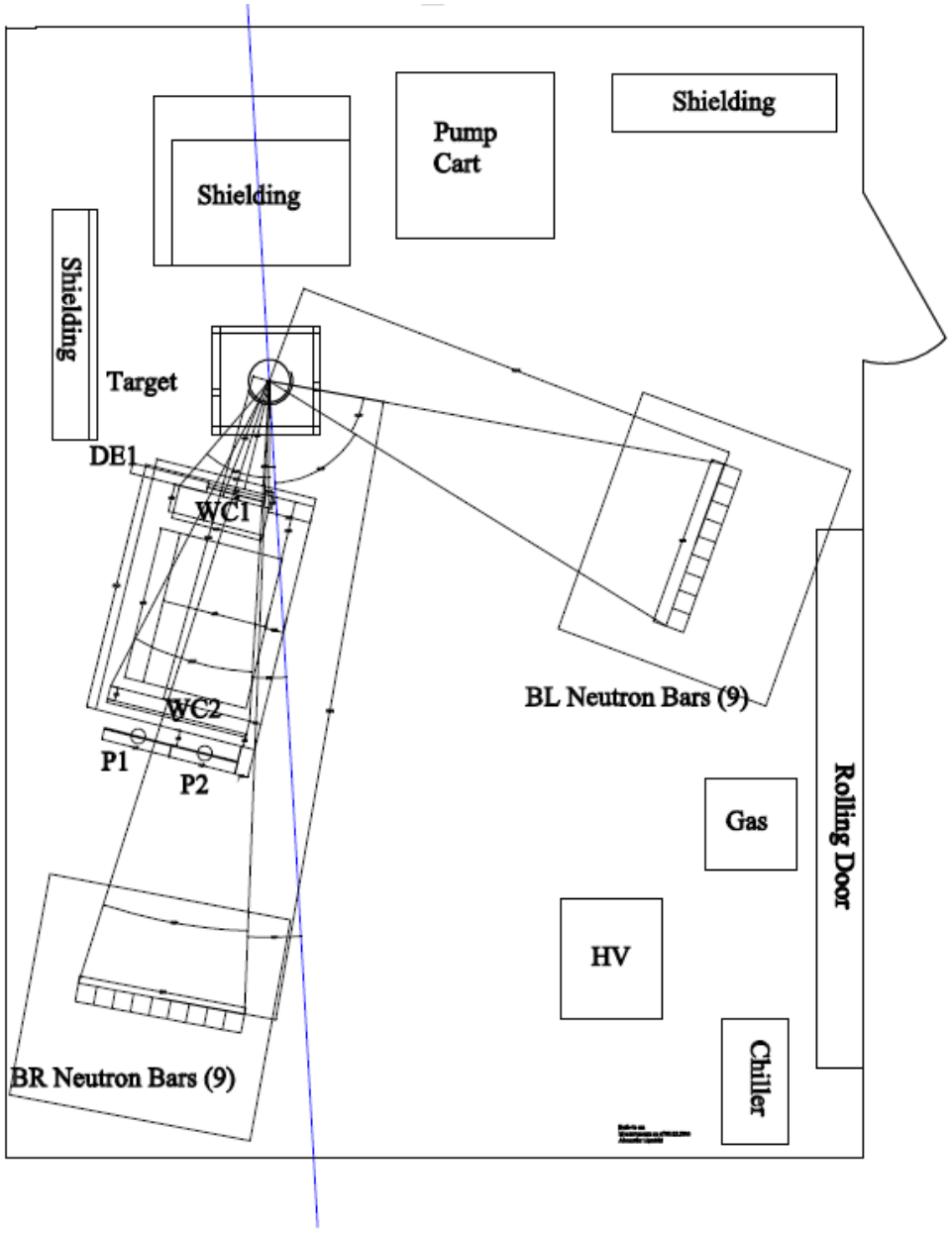


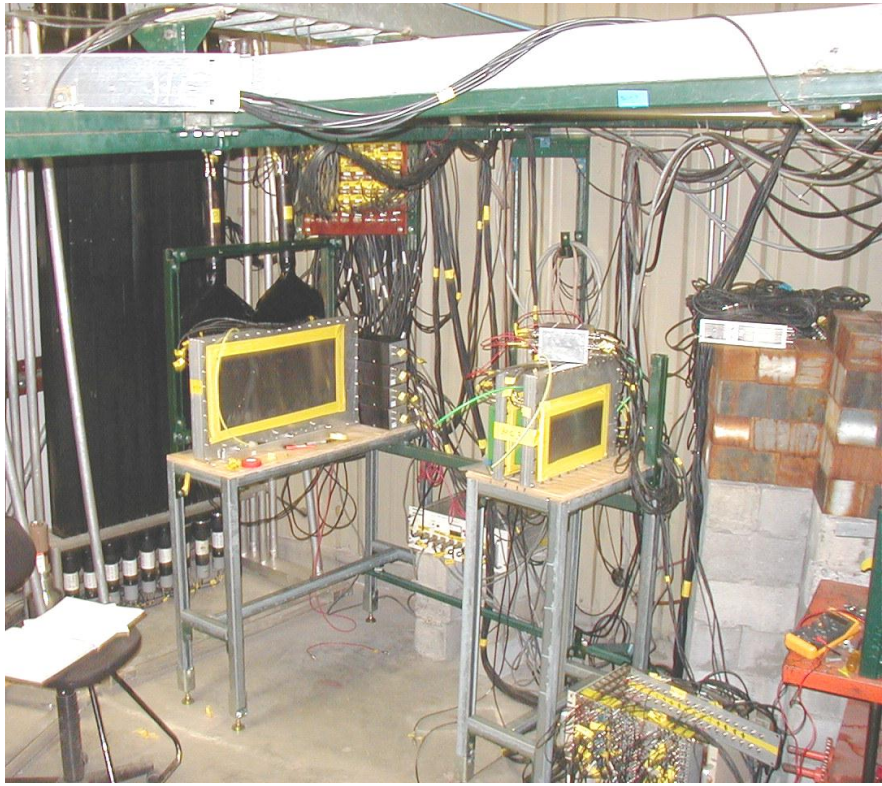
http://en.wikipedia.org/wiki/Nuclear_fission

Liquid Deuterium Target

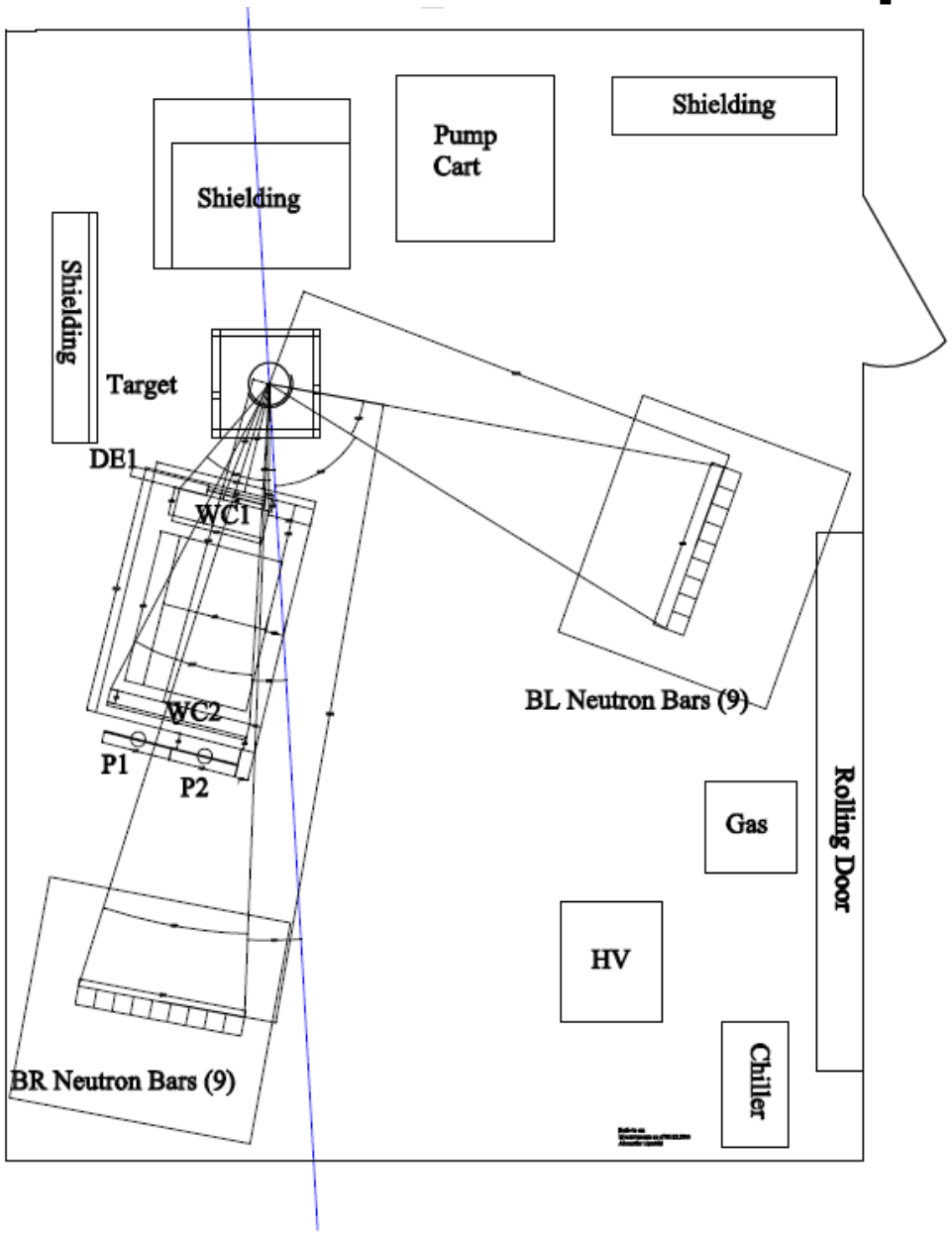


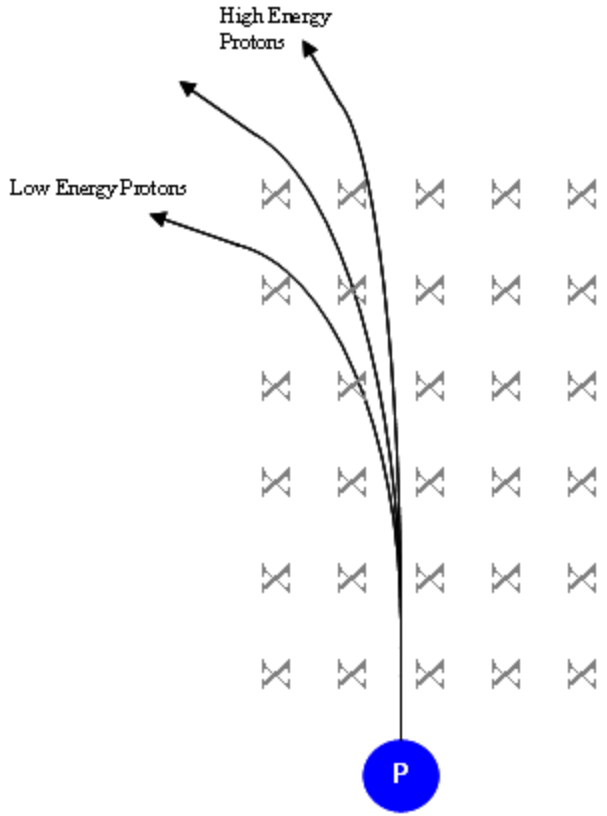
Neutron Bars



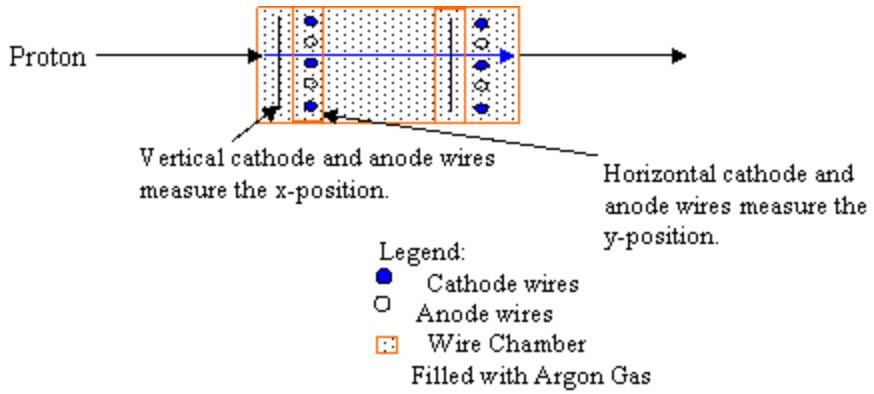


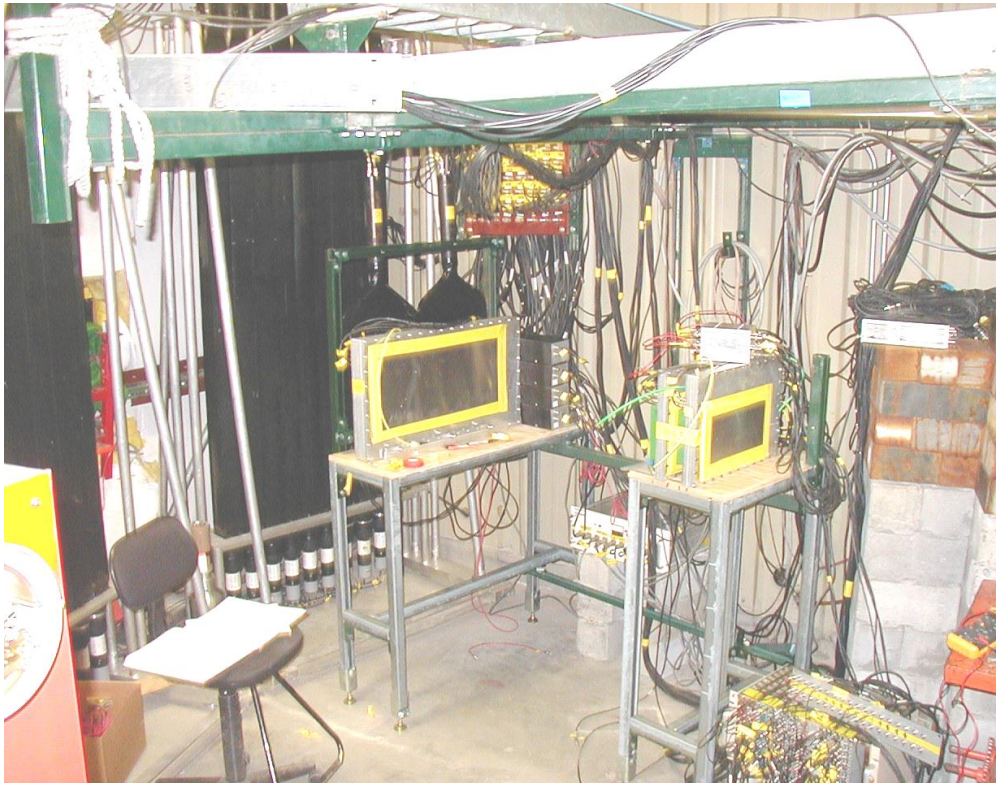
Permanent Magnet Spectrometer

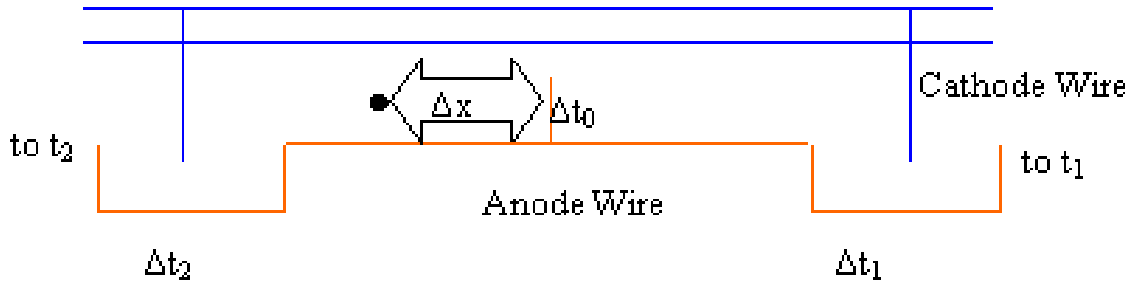




Wire Chambers





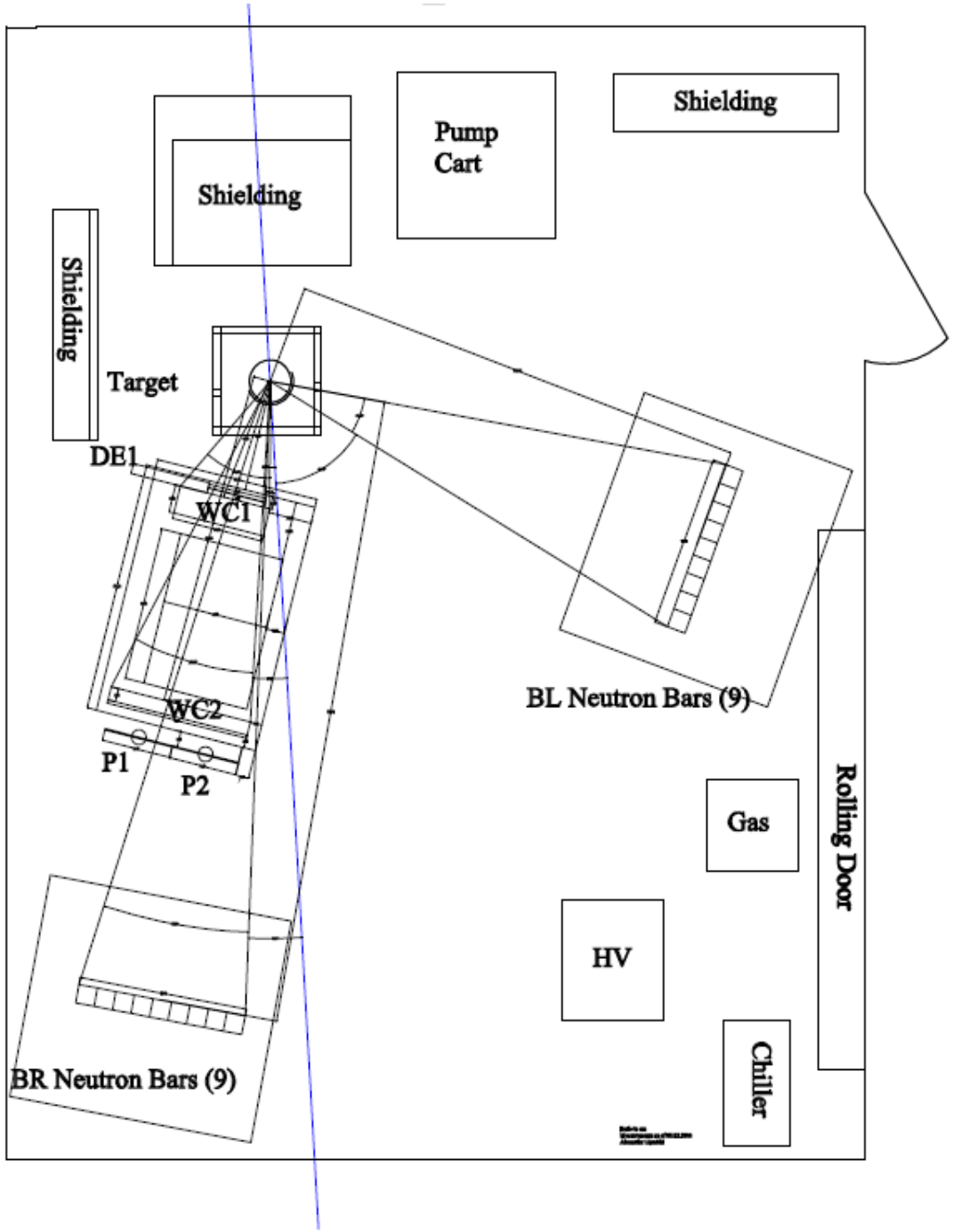


$$t_1 = \Delta t_1 + \Delta t_0 + \frac{\Delta x}{v}$$

$$t_2 = \Delta t_2 + \Delta t_0 + \frac{\Delta x}{v}$$

$$t_1 - t_2 = \Delta t_1 - \Delta t_2$$

$$t_1 + t_2 = \Delta t_1 + \Delta t_2 + 2\Delta t_0 + 2\frac{\Delta x}{v}$$


Shielding
Pump
Cart
Shielding
Shielding
Target
DE1
WC1
WC2
P1
P2
BL Neutron Bars (9)
Rolling Door
Gas
HV
Chiller
BR Neutron Bars (9)

Future Plans

- Analyze data
- Statistics
- $^{3}He(n,2p)2n$