Neutron and γ-ray Activation Activities (NNSA)

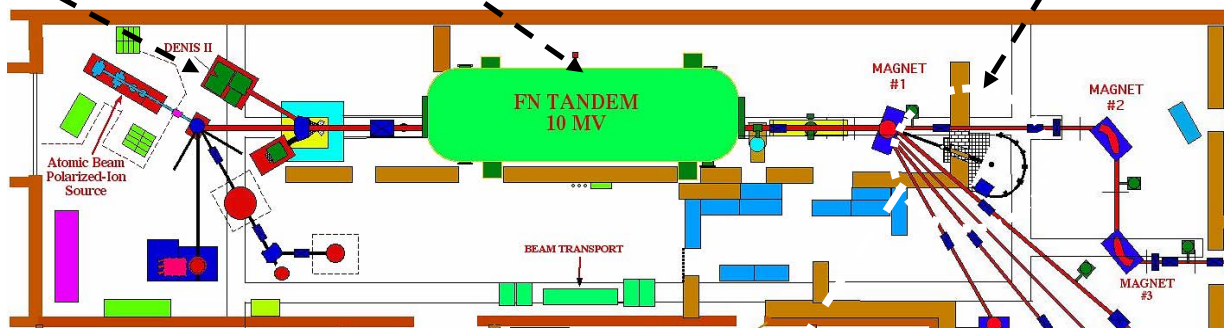
Leaders: Anton Tonchev & Werner Tornow (Duke)

Shielded neutron Source Area v.1

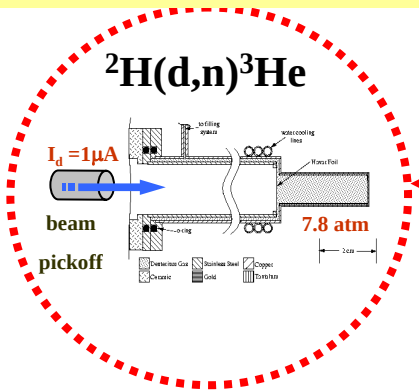
DENIS

FN TANDEM 10MV

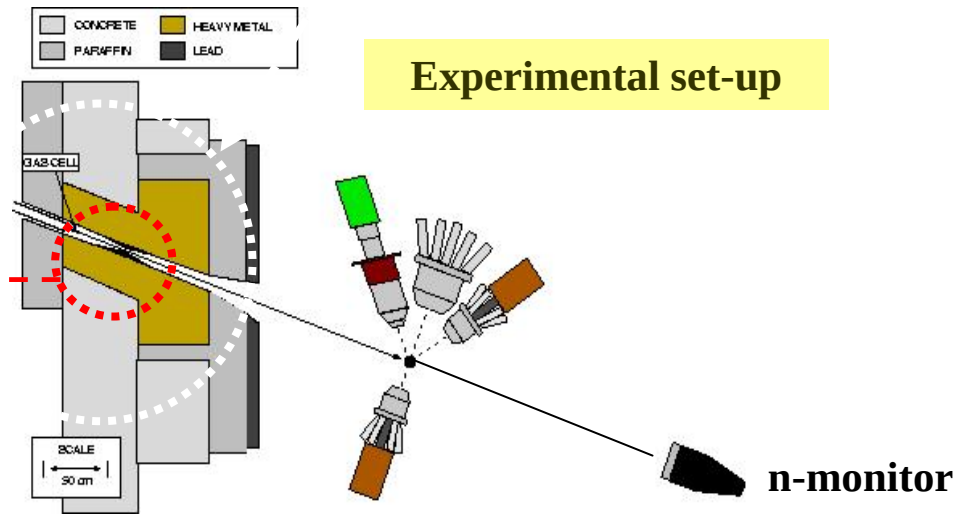
Shielded neutron source area



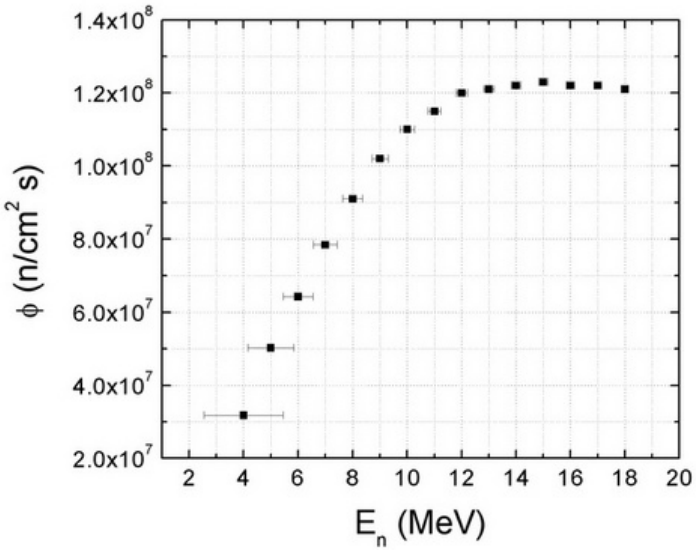
Deuterium gas cell

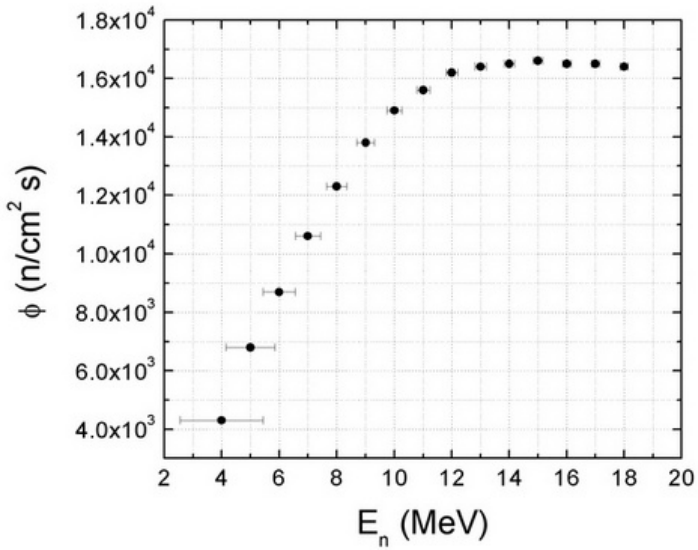


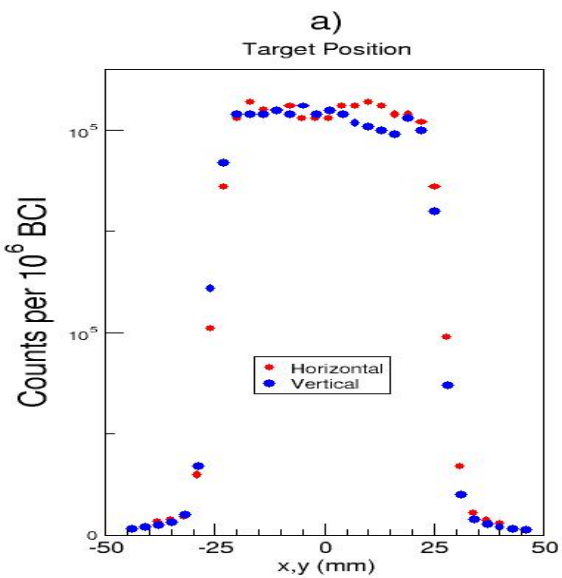
Experimental set-up

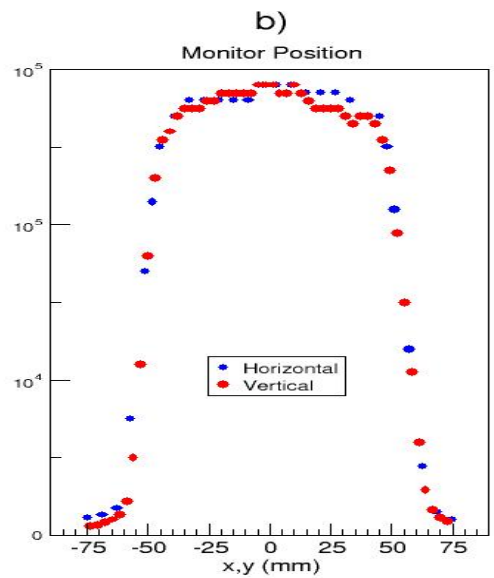


Beam Properties







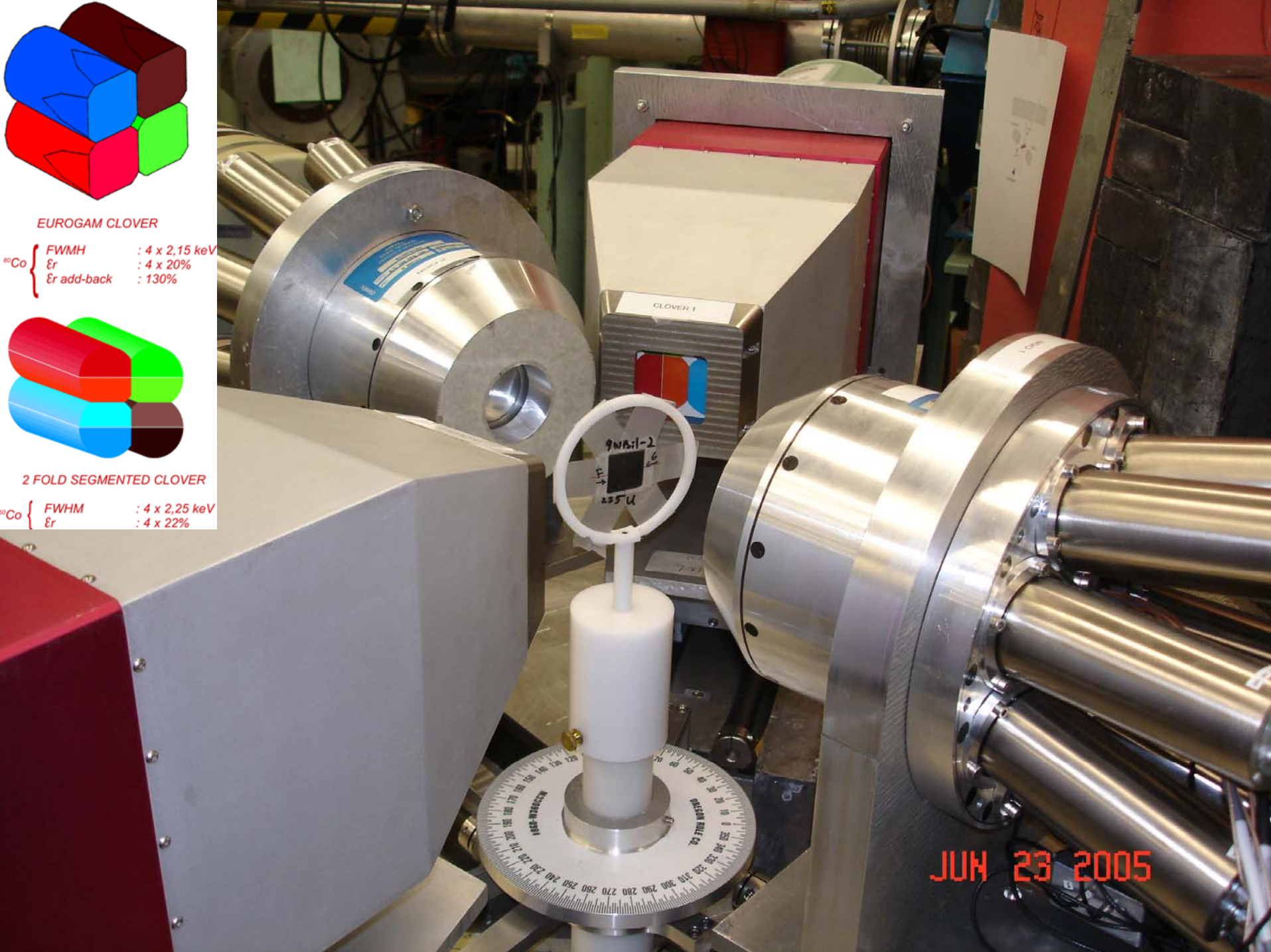


EUROGAM CLOVER

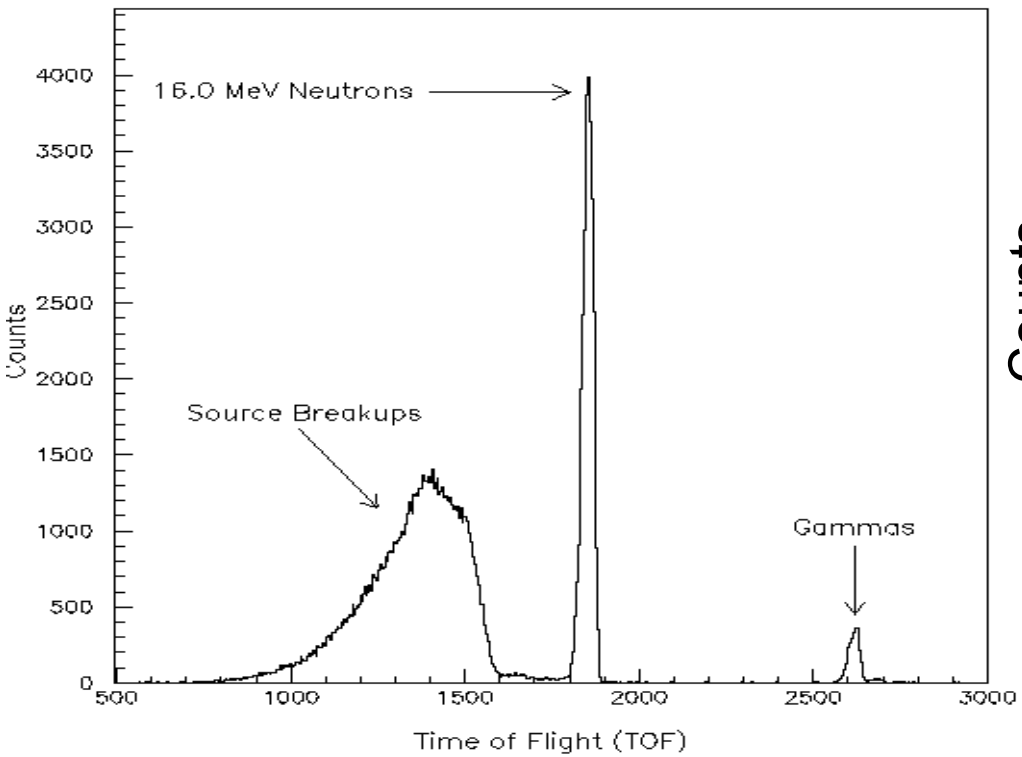
^{60}Co	FWMH	: 4 x 2,15 keV
	εr	: 4 x 20%
	εr add-back	: 130%

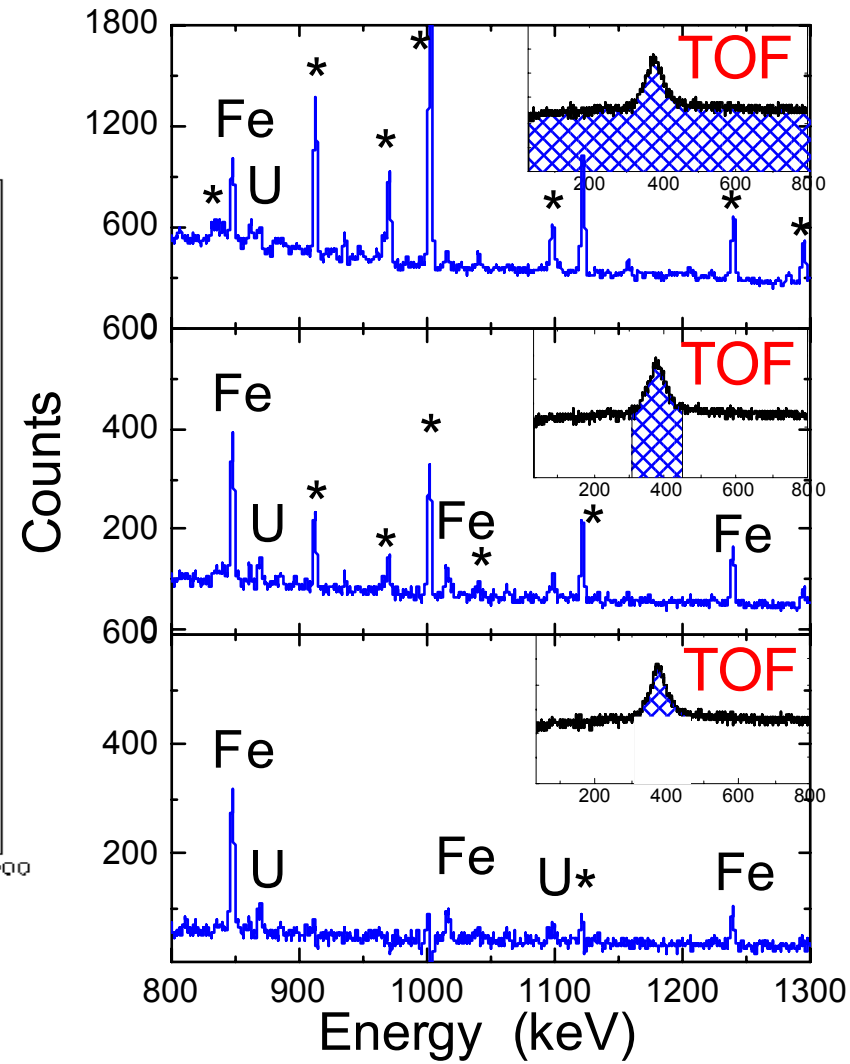
2 FOLD SEGMENTED CLOVER

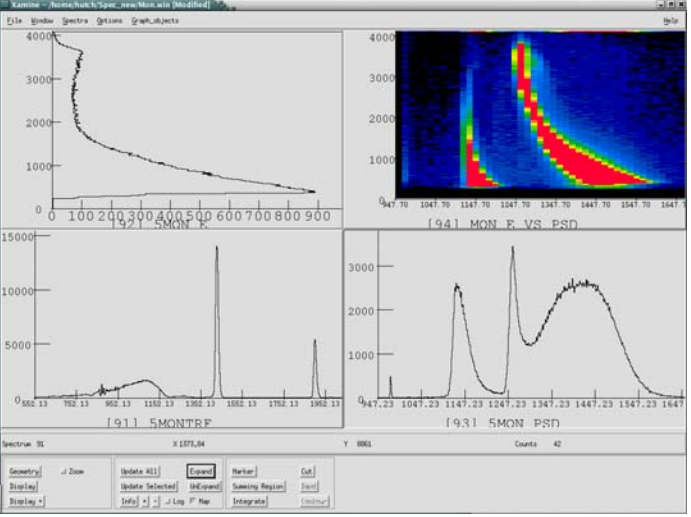
^{60}Co	FWHM	: 4 x 2,25 keV
	εr	: 4 x 22%



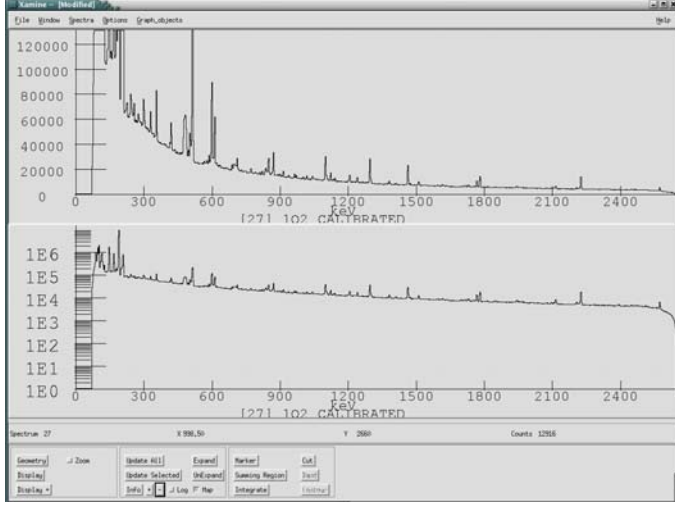
Observations



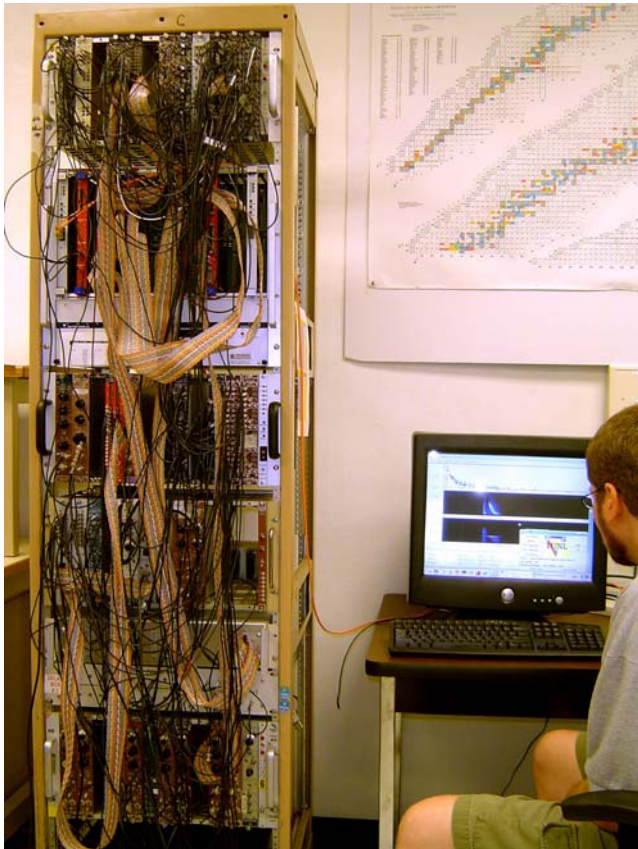




DAQ



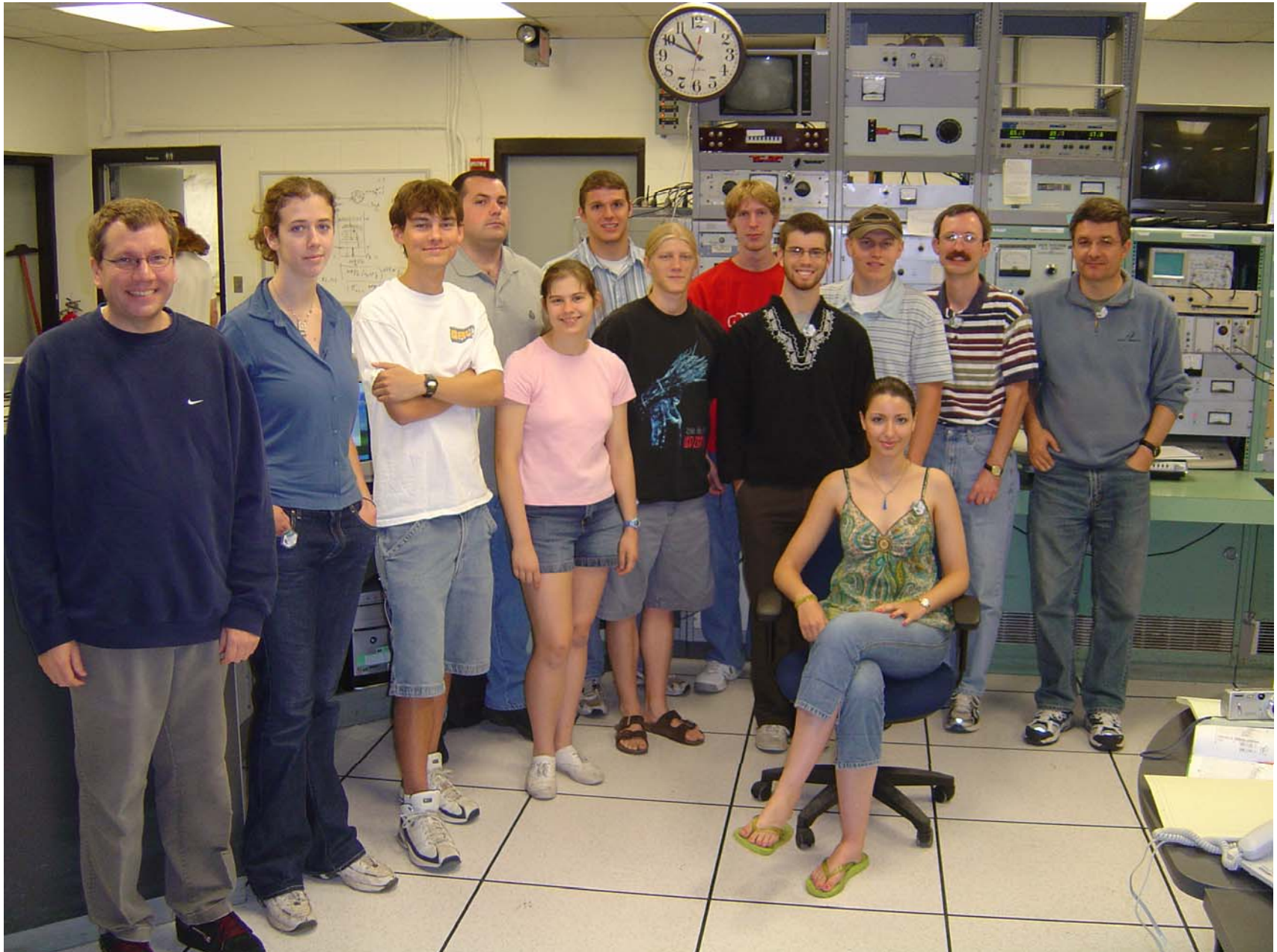
- NSCL Spectrodaq/SpecTCL
- VME based {CAEN etc.}
- TCL Scripted setup for ease of modification
- Free on Sourceforge
- Great support from Ron Fox



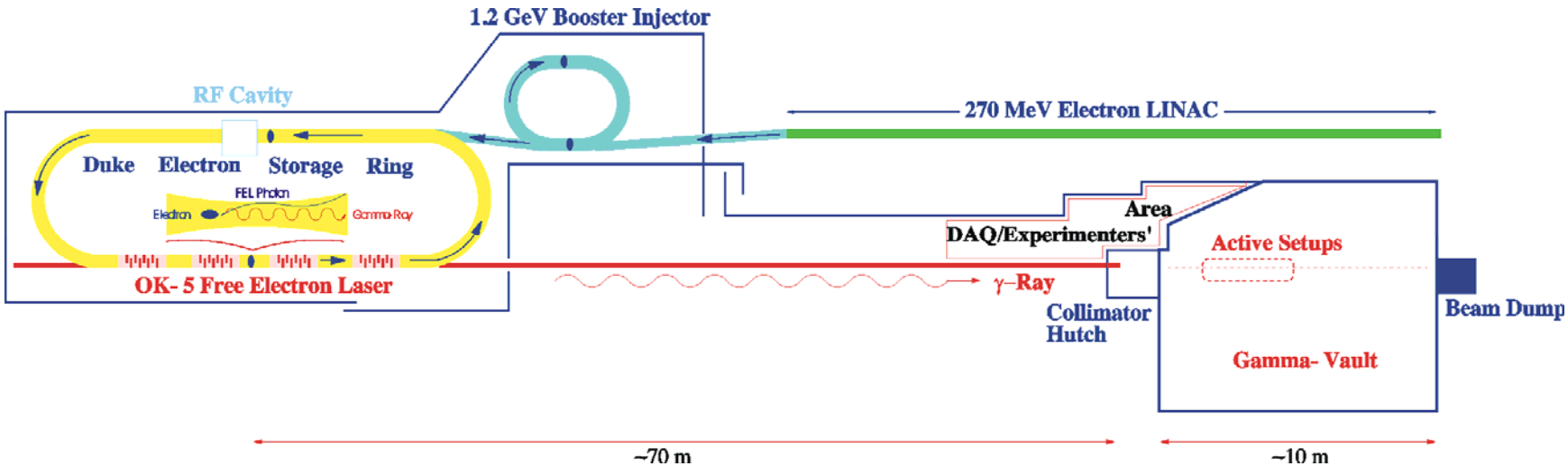
NNSA – (n, xn γ) in the actinide region Measure partial cross sections (normalized to Fe)

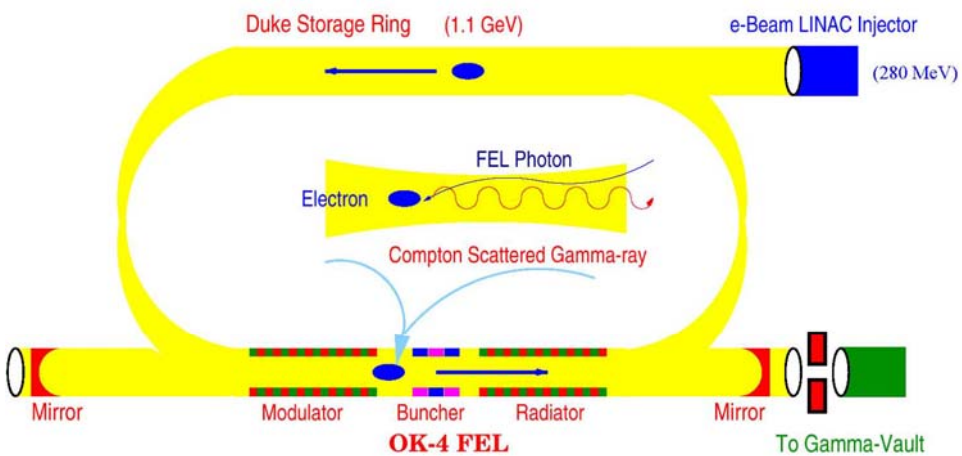
Time	ReactionEnergies	[MeV]
May 2003	^{238}U(n,2nγ)237U	En = 6, 10
Aug 2004	^{238}U(n,2n&gamma)237U	En = 8, 10, 14
Feb 2005	^{90}Zr(n,n'γ)90Zr	En = 6
Feb 2005	^{89}Yb(n,n'γ)89Yb	En = 6
Feb 2005	^{112}Sn(n,n'γ)112Sn	En = 6.5, 7.5, 8.0
Feb 2005	^{124}Sn(n,n'γ)124Sn	En = 6.5, 7.5, 8.0
May 2005	^{235}U(n,n'γ)235U	En = 5
Jun 2005	^{235}U(n,2n'γ)234U	En = 12
Jun 2005	^{nat}Hf(n,xn'γ)natHf	En = 12
Jun 2005	^{16}O(n,n'γ)16O	En = 7
Jun 2005	^{12}C(n,n'γ)12C	En = 7
Dec 2005	^{235}U(n,2n'γ)234U	En = 12.0
Jan 2006	^{235}U(n,2n'γ)234U	En = 10.0, 8.0
Jan 2006	^{181}Ta(n,2n'γ)180Ta	En = 14.5
Feb 2006	^{140}Ce(n,2n'γ)139Ce	En = 14.5
2006	^{92}Zr(n,n' g-g)	
2006	^{241}Am(n,2n) Activation	En 8-14
2006	^{nat}Cu, ^{nat}Pb(n,n' g)	En=8,12

TUNL REU students ^{28}Si, $^{32}S(n,n'\gamma)$



HIGS High Intensity Gamma-ray Source





E(photon) $\longrightarrow$ 3 eV - 12.5 eV

E(gamma) $\sim$ $4\gamma^2$ E(photon)

E(gamma) $\longrightarrow$ 2.0 - 225 MeV