NaI Gamma-Ray Spectroscopy

Thursday, January 11, 2018 9:16 AM

Station 2 Partner: Nick Quartemont

Insert 1-5

4] Pre-Lab Prep

IT = Isomeric Transition
→ Gamma Ray or Internal Conversion

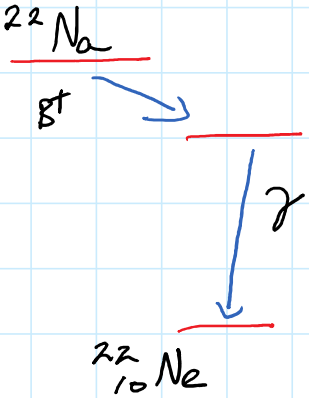
Photo Peak: Full energy deposition

a) Review decay schemes for

^{22}Na

β^+ 215.54 KeV
835.00 KeV

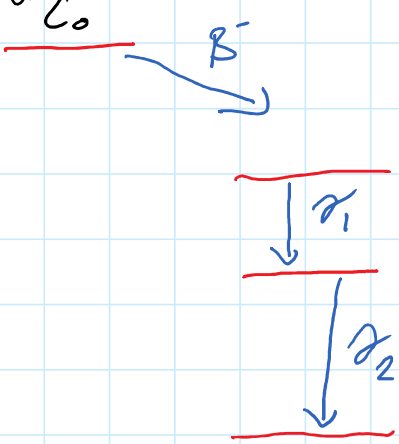
γ 1274 KeV

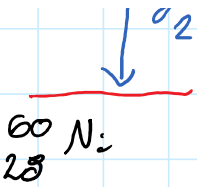


^{60}Co

β^- 317.32

γ_1 1173.24 KeV
γ_2 1332.508





^{109}Cd

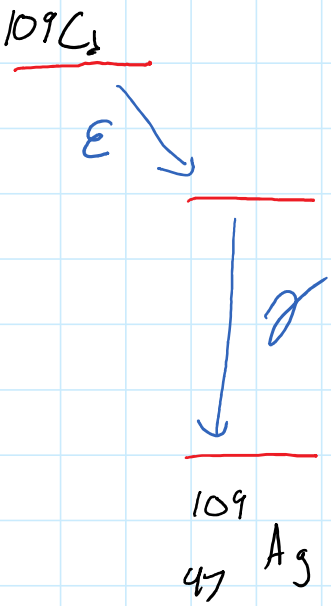
ε 100%

γ 100% 88.0336 KeV

X-ray 22.163
21.99

2.634 - 3.748

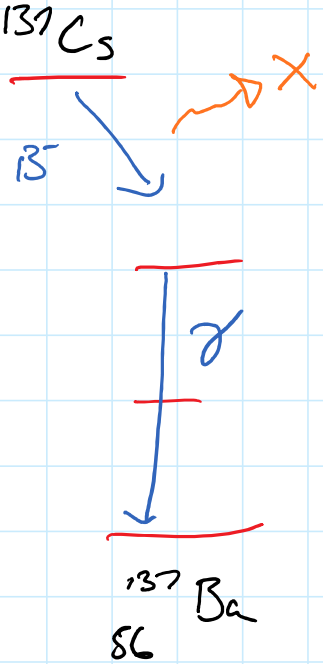
24.9118



^{137}Cs β^- 513.97 94%
1175.63 6%

γ 283.5 ~0%
661.659 94.36%

X 32.1939



b) Gamma Spectra detectable γ and X rays

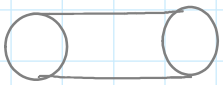
NaI (TI)

$LaBr_3$

6] Procedure

Tuesday, January 16, 2018 1:28 PM

$LaBr_3$



Smaller than the NaI

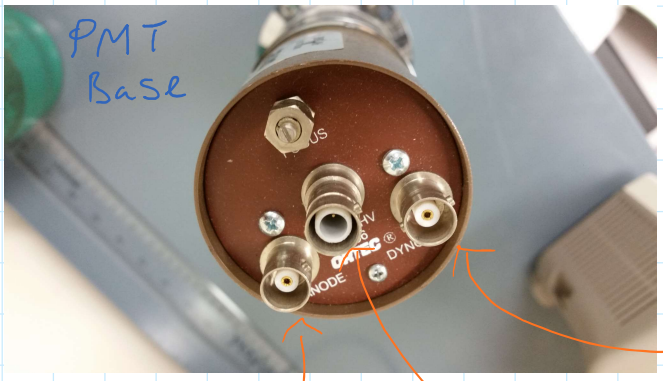
Both require a High voltage connection

NaI(TI) 3"

5] Equipment

2x2 NaI(TI)

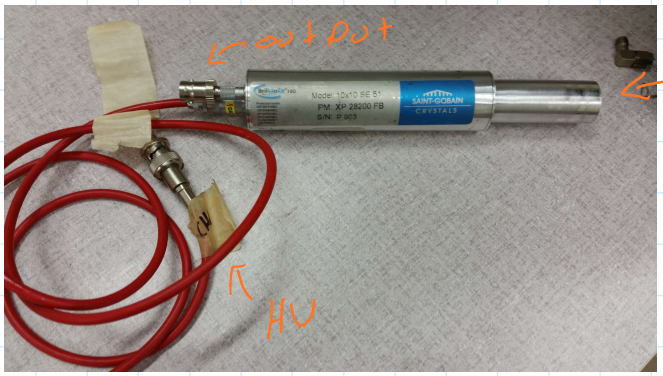
3x3 NaI(TI)



Dynode

Anode

High Voltage



$LaBr_3$

Back contains output for test (Hookup to Pulser)

Back contains output for test (Hookup to Pulser) and output
→ to Oscope
→ to Linear Amp

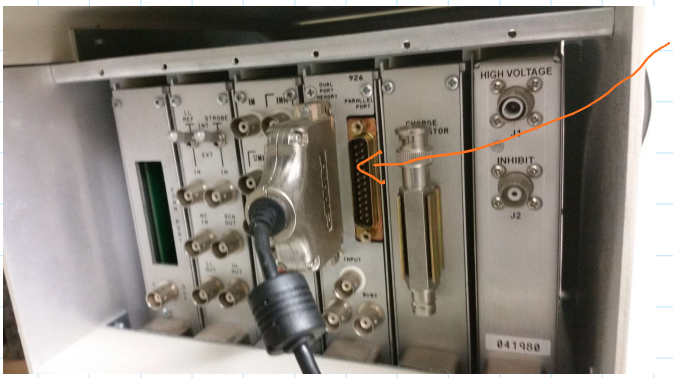
Sources Used

	Activity	Time Rec	Source Num	Uncertainty
22 Na				
57 Co				
60 Co				
109 Cd				
137 Cs	10.02 μCi 370.7 KBq	1 Aug 98 12 PST	6199-442	3%

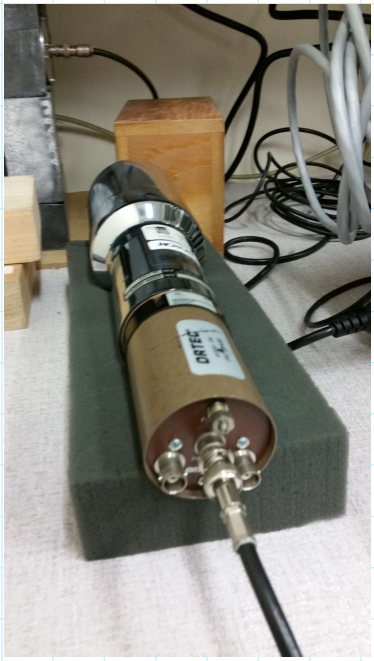
6. Procedure

a) Set up 3x3" NaI (TI)

1. Set up

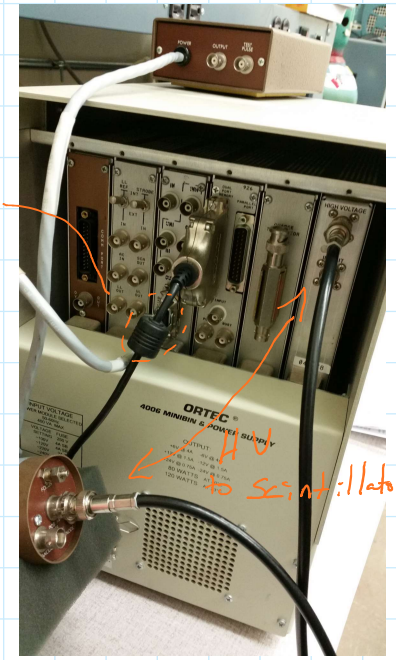


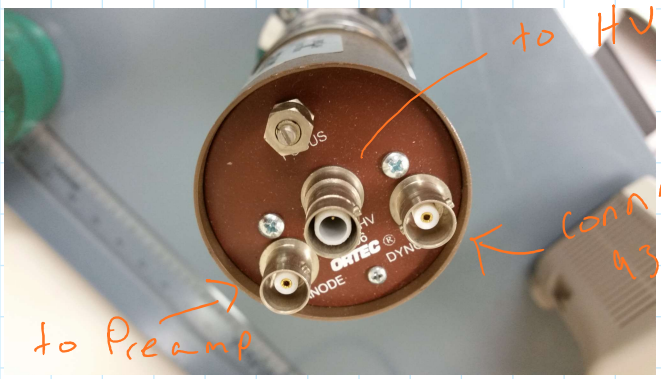
MCB Hookup to Laptop



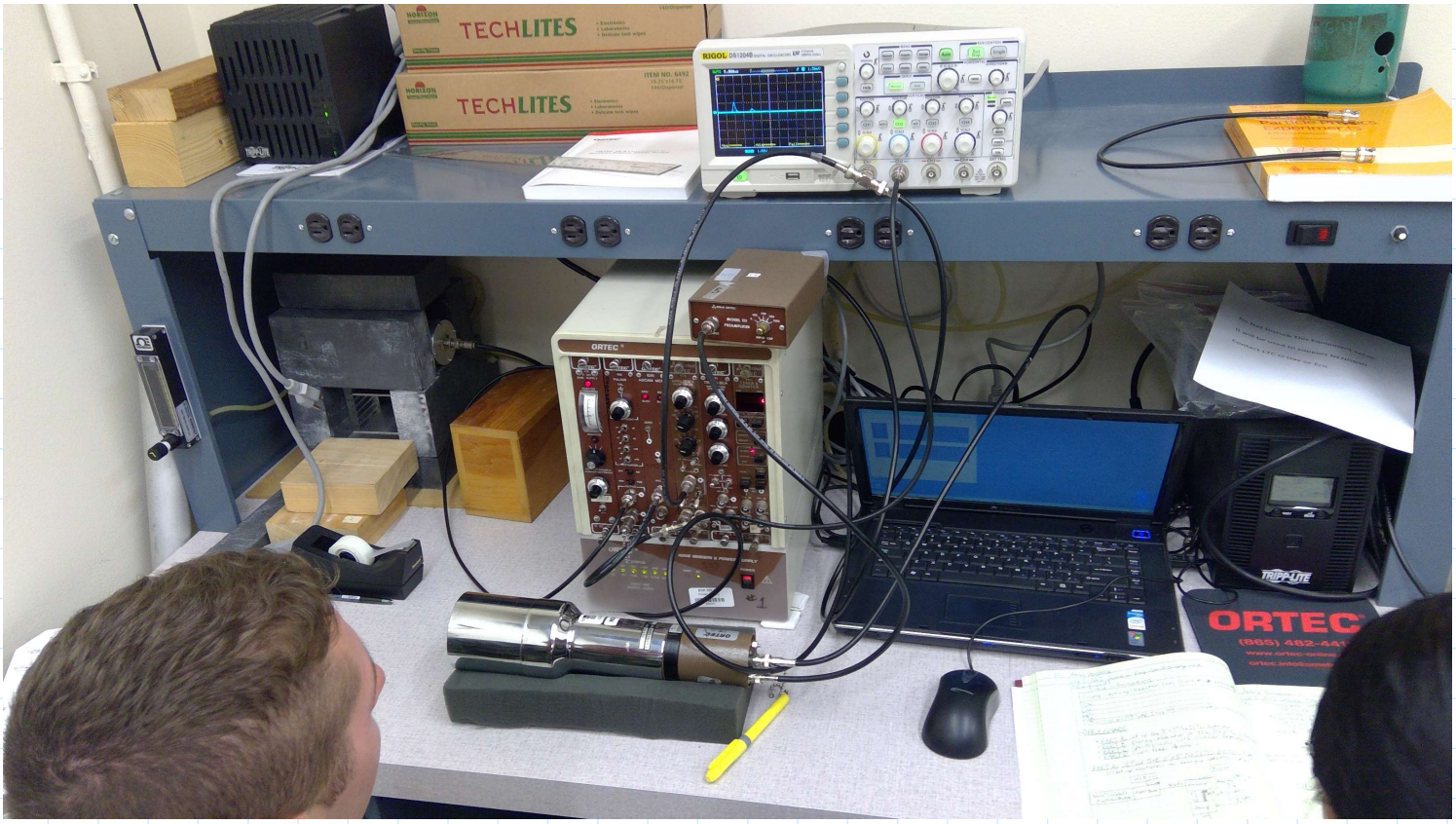
Lie down to prevent rolling. Detection from other side

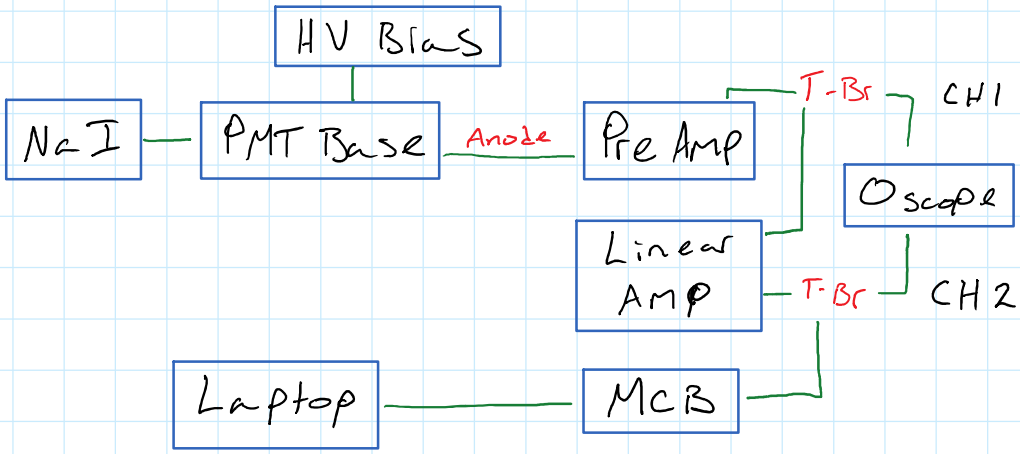
Pre Amp





Note for lab
100Ω ≈ 93Ω
Learning only





2. On Amp
   - .5 μs — Shaping time
   - POS — Input
   - Uni Polar — Output

Pre amp = 200 pf (capacitance)

increase capacitance →

93 Ω Terminator on dynode

Run Gamma Vision

Set Conversion Gain to 1024
(MCB = 1024 channels/bins)
Acquire
↳ MCB Properties
↳ Conversion Gain
↳ arrow select

Note: 10% change in HV bias can change the signal gain by a factor of 2

3. Swapped Oscope to read amplifier output

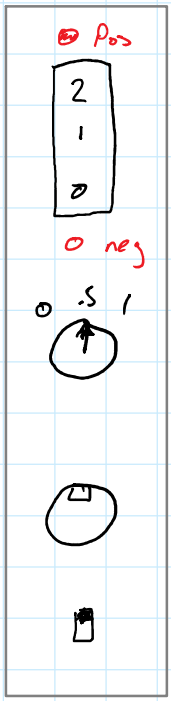
Vmax = 1.48 V

Pulser
3.34
x1 attenuator
Pos Output

Amplifier
FG = .68
CG = 20
Shape = .5 μs

4. Disconnect Pulser from Pic Amp

Set HV Bias to +1000 V



1 kV

.5

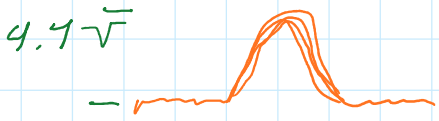
5.00

Note! Make sure everything is at Zero when Starting

Get 137 Cs Source
TO 89 - Used to look up info in certificate folder

Note: Trigger very Important causes Signal to disappear
Determine wanted signal by seeing it move in accordance to distance

Placed at 25 cm (centered)



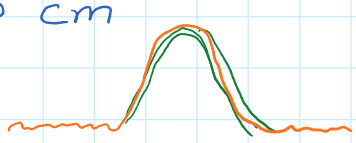
Stable the closer it is to the detector

Amplifier
FG = .5
CG = 20

Shape = .5 μs

Ch 2 = Amplified Ch 2 = Pre Amp

25 cm



Amp 4.4 V
Rise 800 ns (90% of Amp)
Fall 1.4 μs (90% to 10%)

Jumpy, multiple signals

25 cm

Amp 1v

Ignoring since it messes up Amplifier signals
Uses primarily to check for clipping