



Status of the e^+ Annihilation Counter

- NaI detector performance
- Previous positron rate measurements
- DAQ



Sadiq Setiniyaz
(Shadike Saitiniyazi)

Department of Physics
Idaho State University



JLab NaI Detector

Dimension: 12" x 2.5"

Max voltage: +1.5 kV

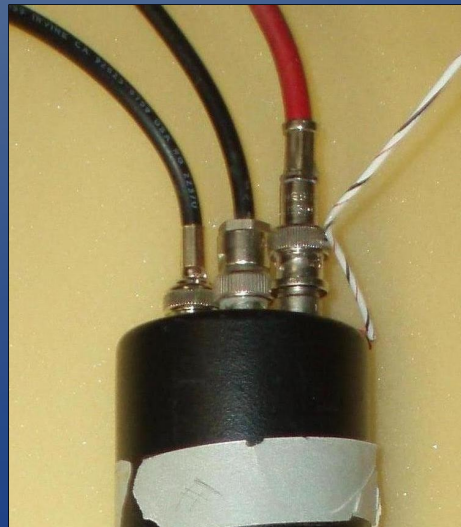
Max current: 3.2 mA

Crystal size: 2"x2"

HV supply (red)

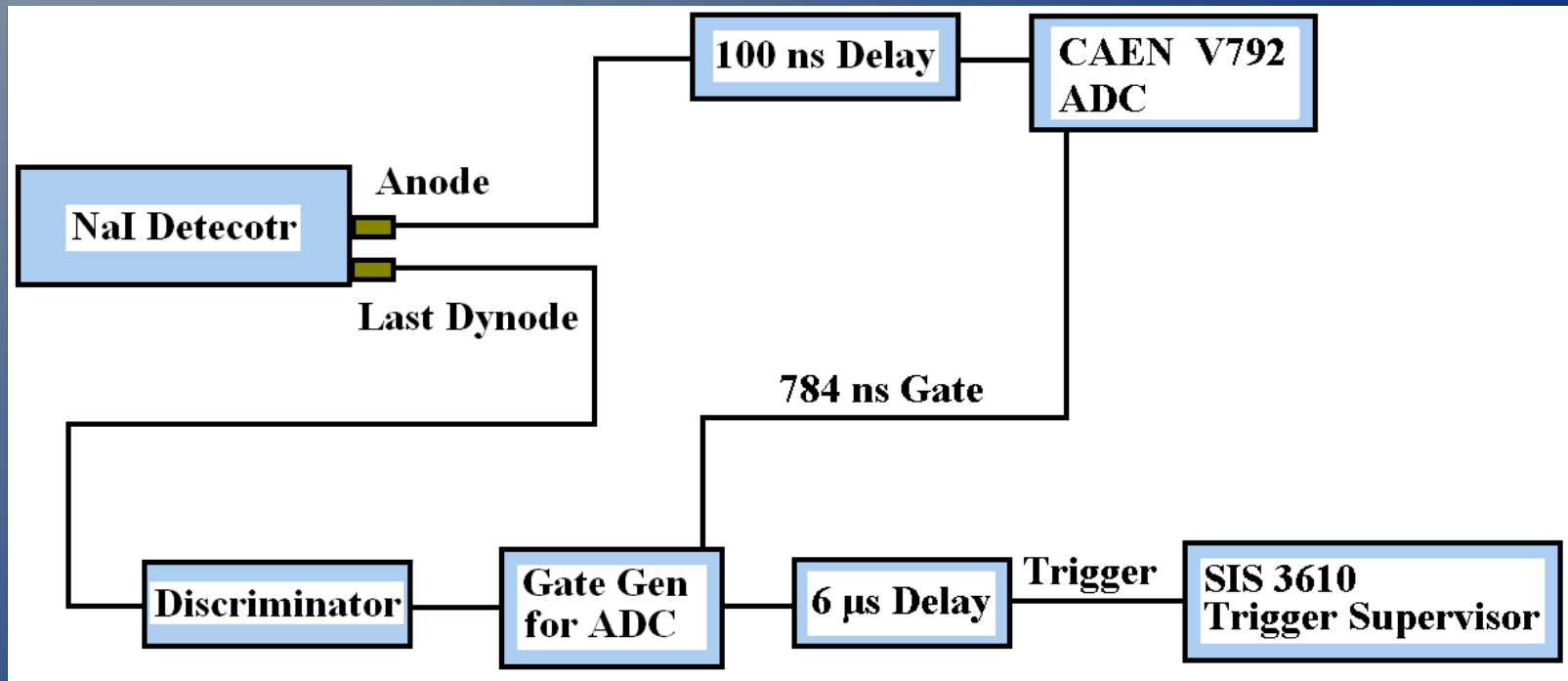
Last Dynode (middle): Trig

Anode (left): Signal



DAQ Elements

Last dynode generate trigger signal



JLab NaI Resolution

- HV = 1430 V, I = 3.15 mA

The Na-22 has peaks at 511 keV and 1275 keV.

$$\sigma_{511} = 36.5 \text{ keV}$$

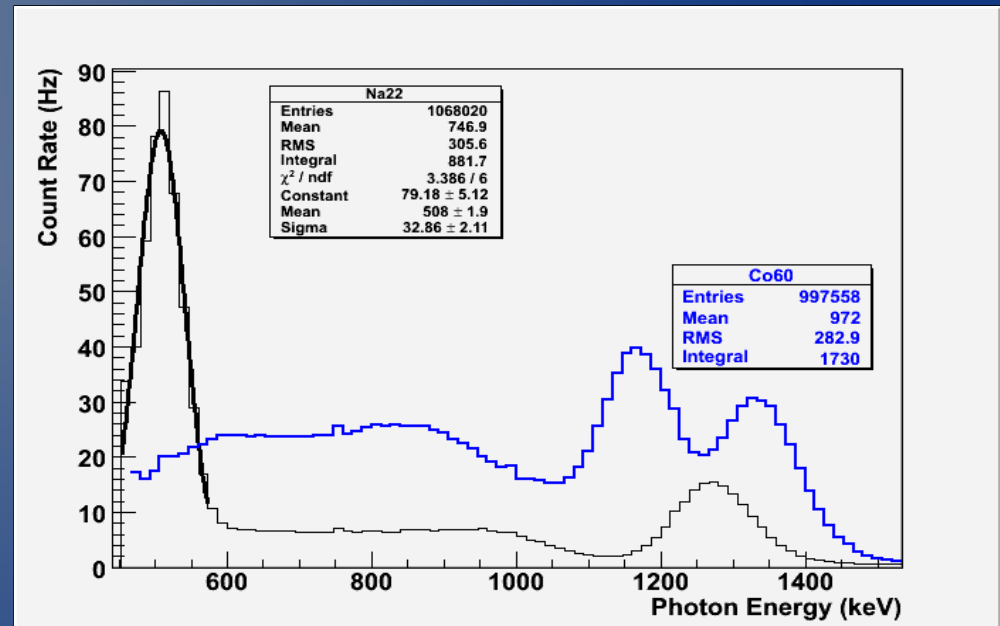
$$\sigma_{1275} = 57 \text{ keV}$$

The Co-60 has two peaks at 1173 keV and 1332.5 keV.

$$\sigma_{1173} = 64.1 \text{ keV}$$

$$\sigma_{1332.5} = 64.23 \text{ keV}$$

$$\sigma / \text{mean} = 7\%, 4.4\%, \\ 5.4\%, 4.5\%.$$



In 2008, we used HV of 1350 V. Max HV = 1500 V @ 3.2 mA
=> May need to use a pramp or get a new Tube!

Gain of v792 is 100 fC/channel

Gain of FADC is 20 fC/channel

IAC Detectors

- 3 PMT: 10" x 3"
- 1 PMT: 9" x 3"
- Bases
- NaI crystal sizes: 3"x3"



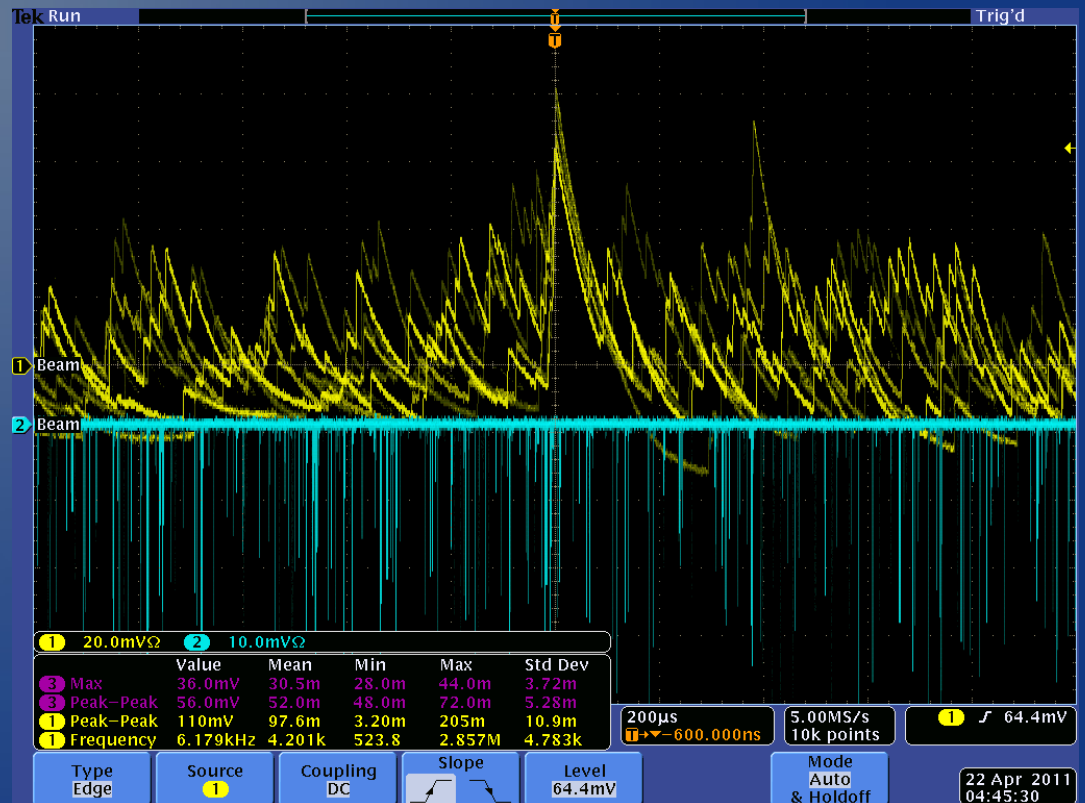
Scope Image of IAC Detector

- Yellow: IAC NaI.
- Turquoise: Jlab NaI.

IAC rise time = $400 \mu\text{s}$

JLab rise time = $1 \mu\text{s}$

New Bases for IAC detector?



Previous Experiment at Idaho Accelerator Center (IAC)

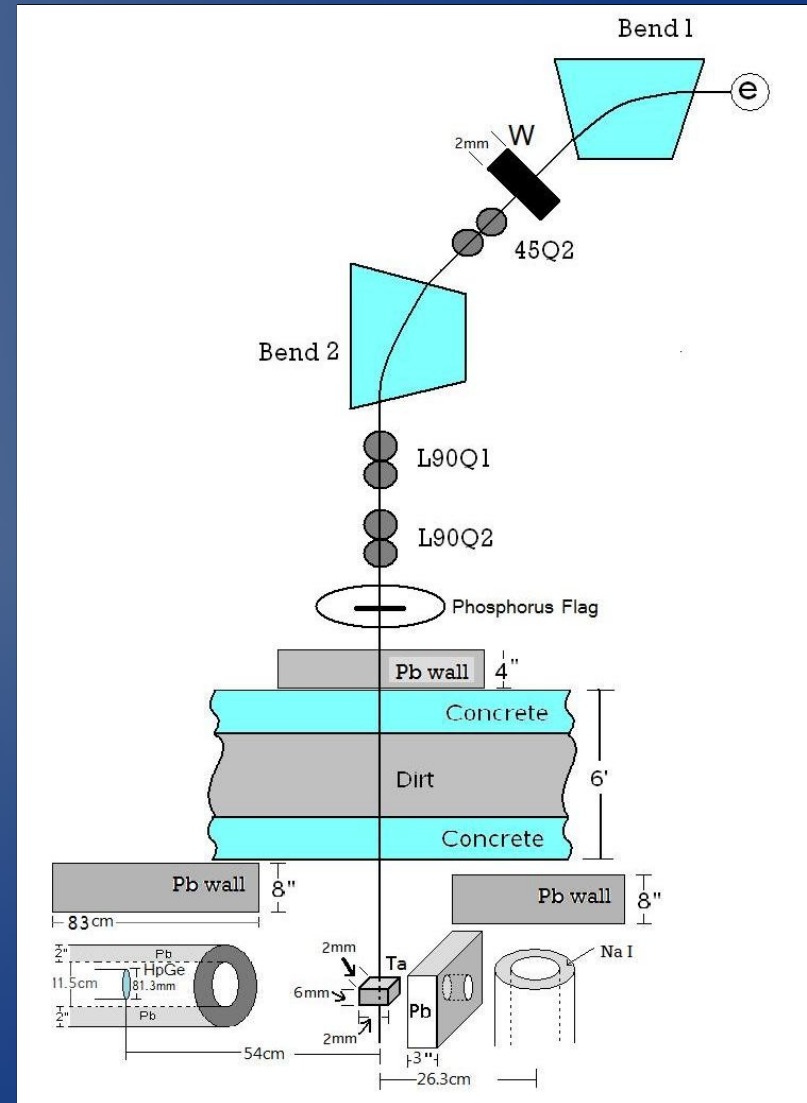
Tantalum: 6 mm thickness,
2x2 mm area facing beam.

Tungsten: positron target,
has **2 mm thickness.**

HpGe detector and NaI detectors placed 90° to the e- direction.

Lowest rate (single):

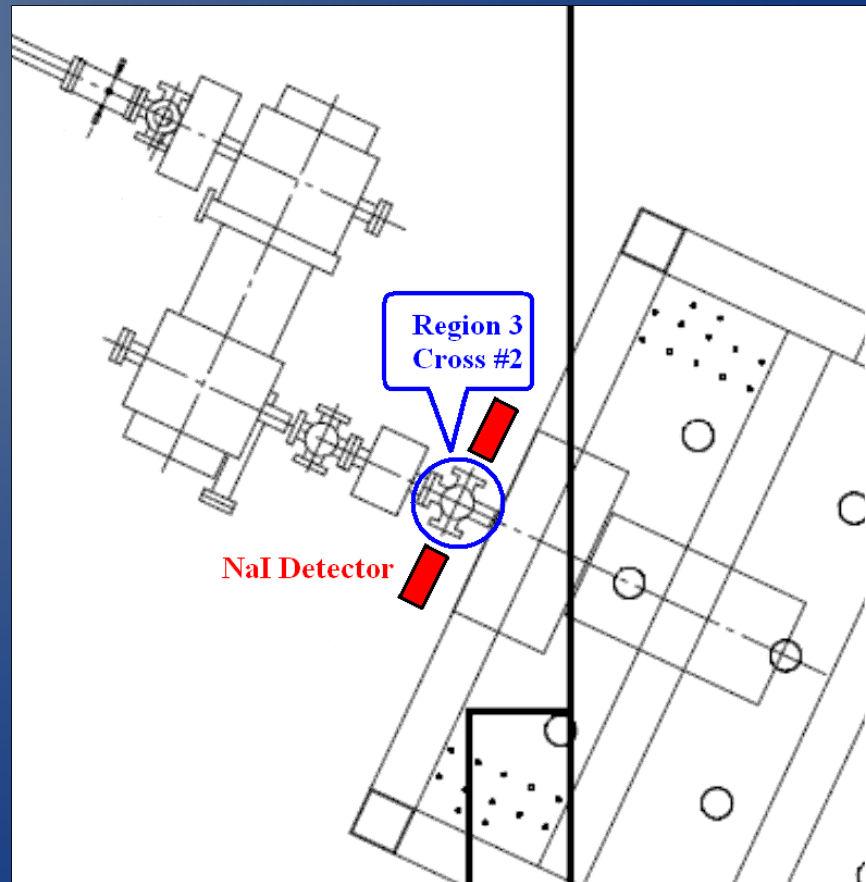
$$Y_{511}/e^{-a} = 1.4 * 10^{-14}$$



Expected Minimum Rate at PEPPo

- Our beam: $1 \mu\text{A}$ e- beam into 2 mm W target.
- We expect at least

$$1 \gamma_{511}/\text{s}$$



Setup

We need:

Tables to support detectors

Pb shielding around detectors

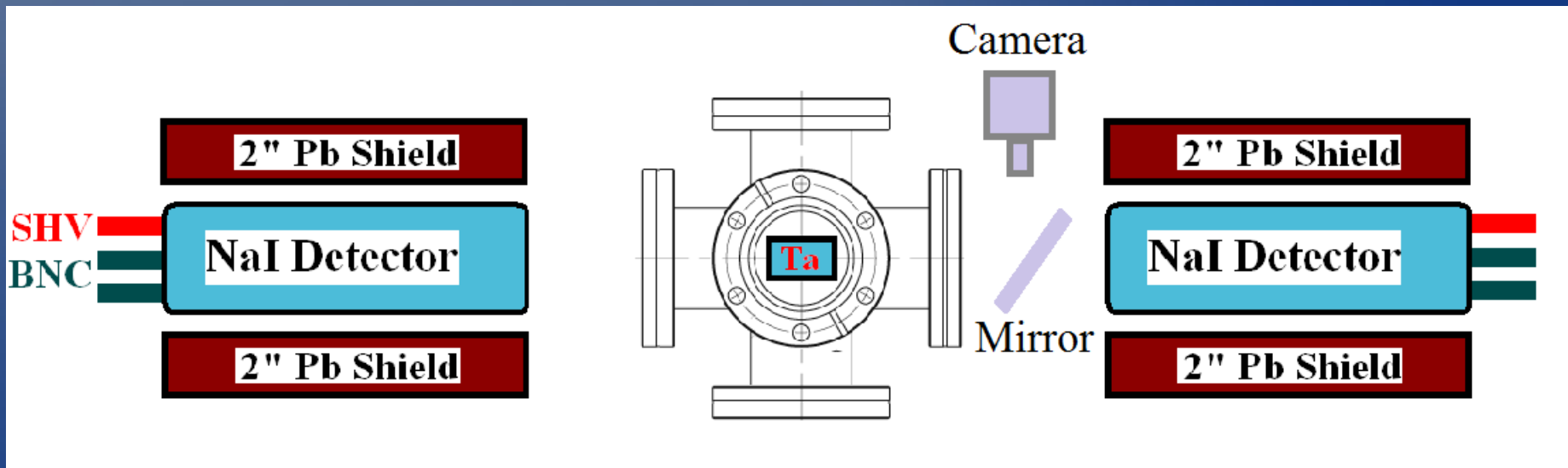
2 SHV cables

2 BNC cables

2 Pre-amplifiers

2 Channel discriminator

Trigger Logic



JLab Flash ADC

250 MHz => 4 ns

16 Channels

12 bit

Sensitivity: 20 fC/channels

We have been able to send software triggers and hardware triggers.

We are able to transfer data using a block read.

Next: data decoding



Detector Choices

JLab: need to use a pramp or get a new Tube!

IAC: need new Bases

Thank you!

Questions?