

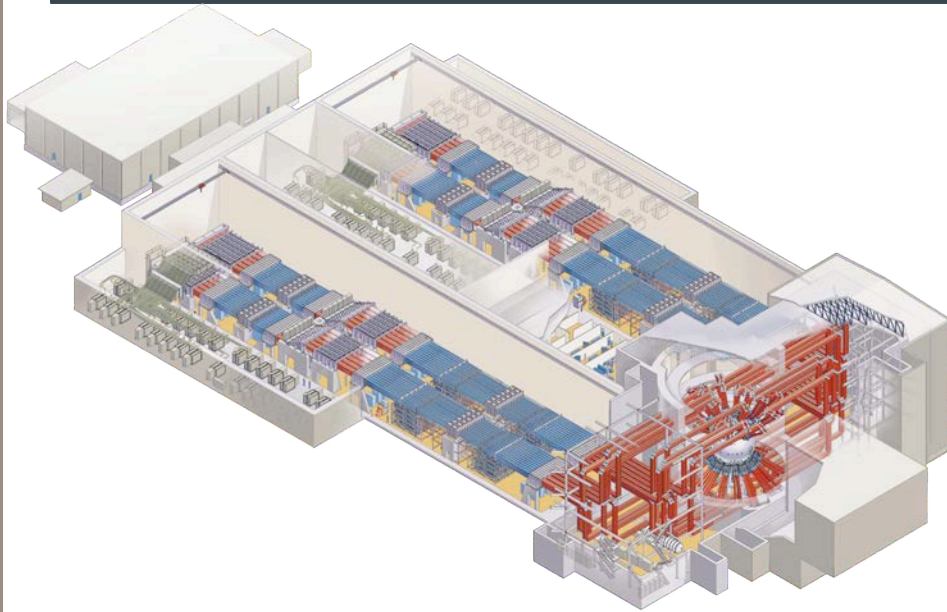


CHARACTERIZATION OF NOVEL SCINTILLATOR MATERIALS FOR APPLICATIONS IN  
NEUTRON DIAGNOSTICS AND FUNDAMENTAL NUCLEAR PHYSICS

Joshua A. Brown

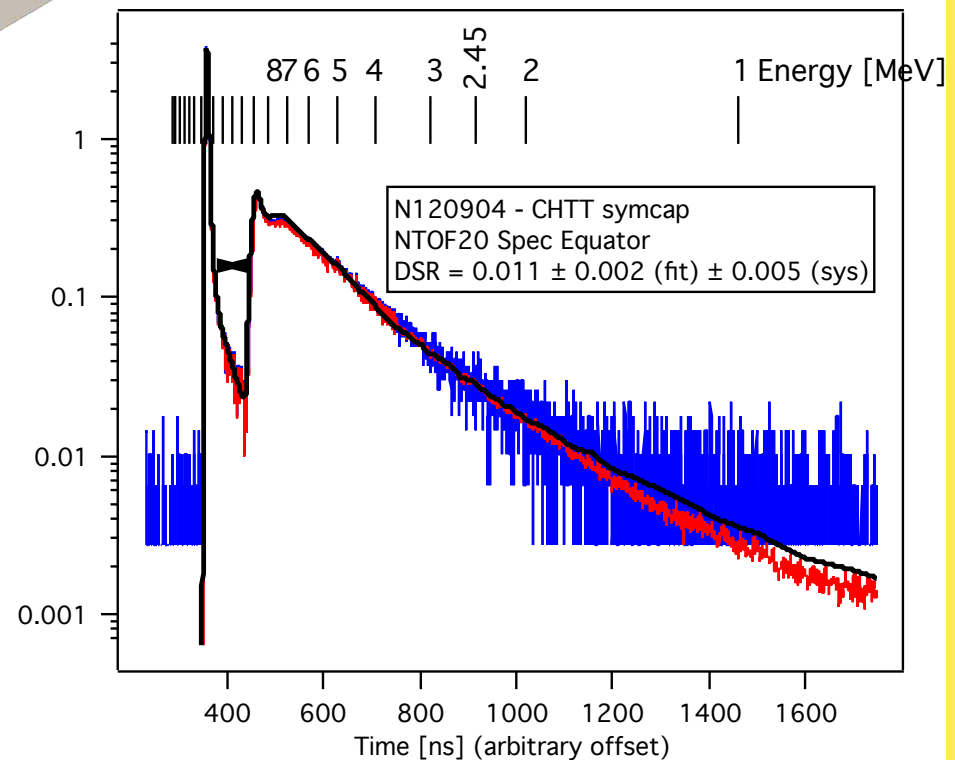
Department of Nuclear Engineering  
University of California, Berkeley

# Neutron Time of Flight (NTOF) at the National Ignition Facility

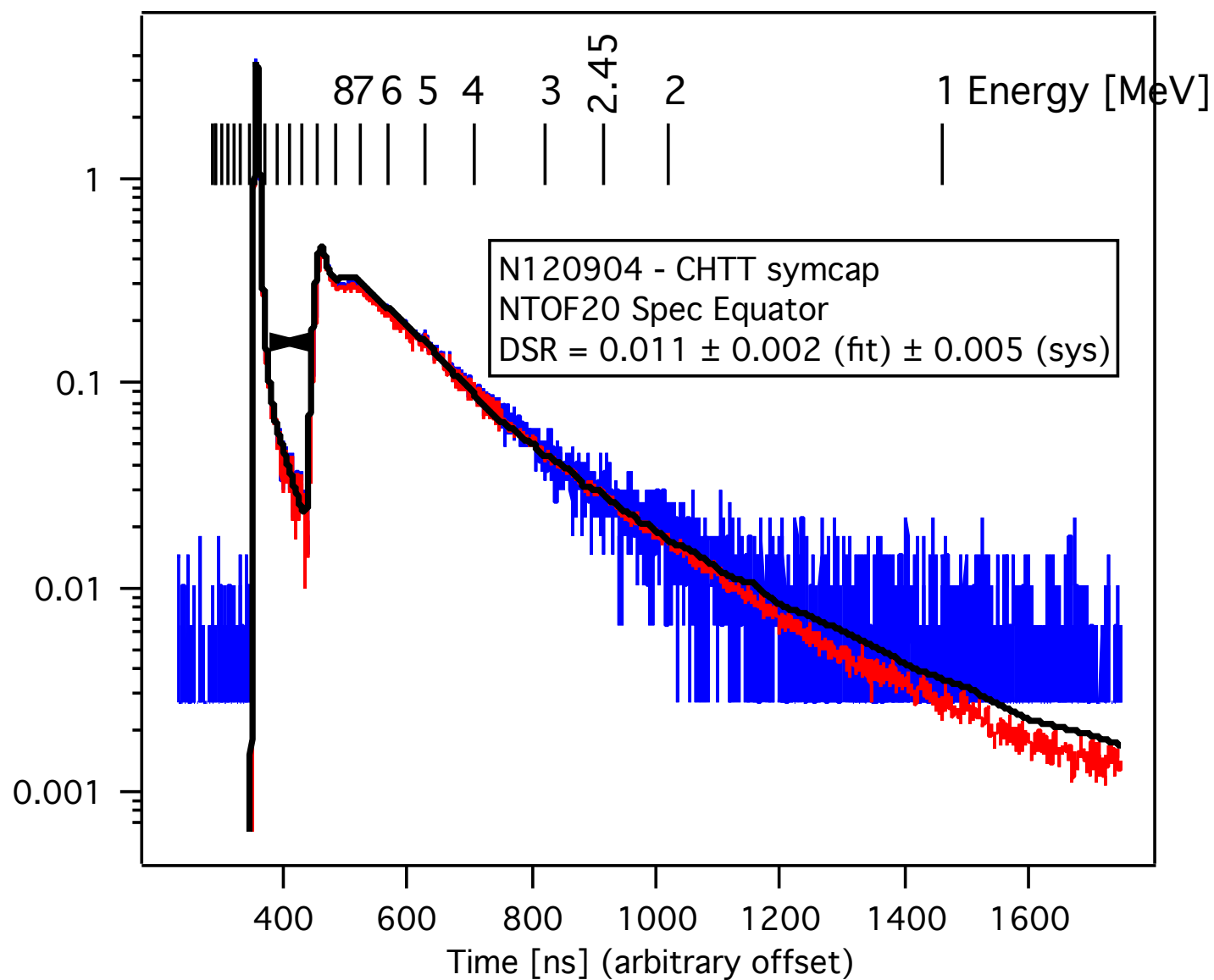


## NTOF Measurements Yield

- total neutron emission
- fuel temperature
- time of peak emission
- areal density of the compressed fuel



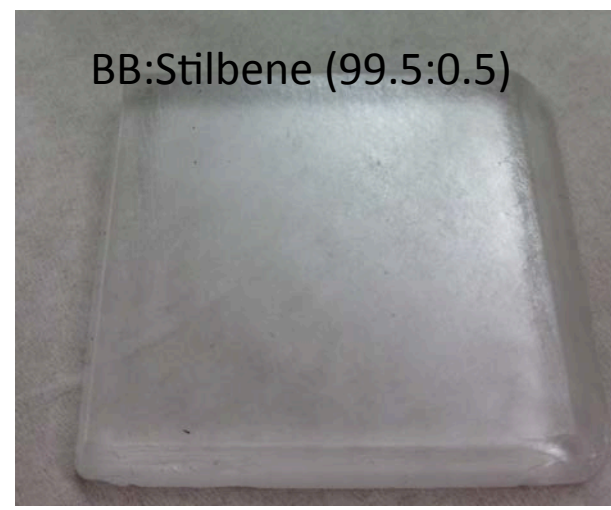
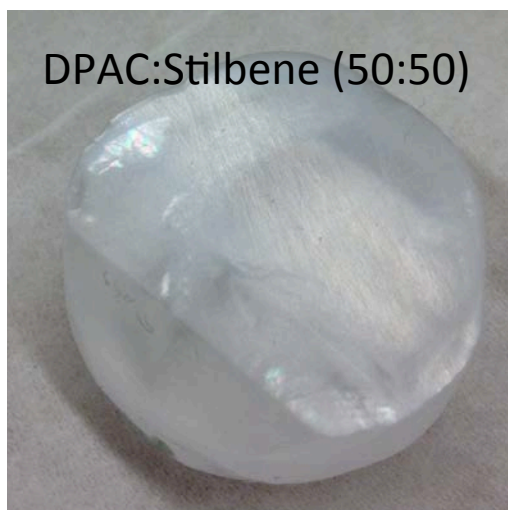
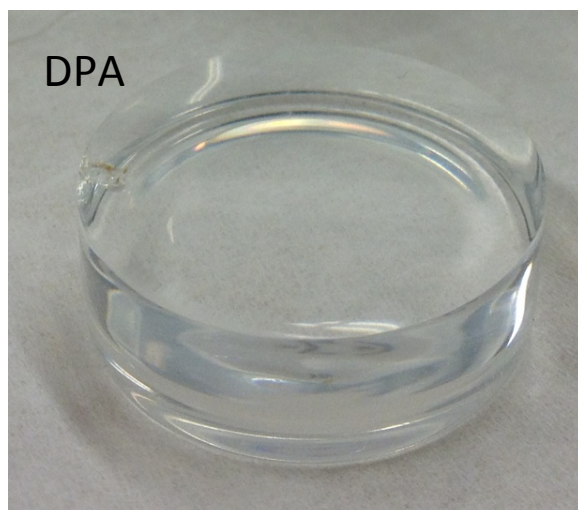
# Neutron Time of Flight (NTOF) at the National Ignition Facility





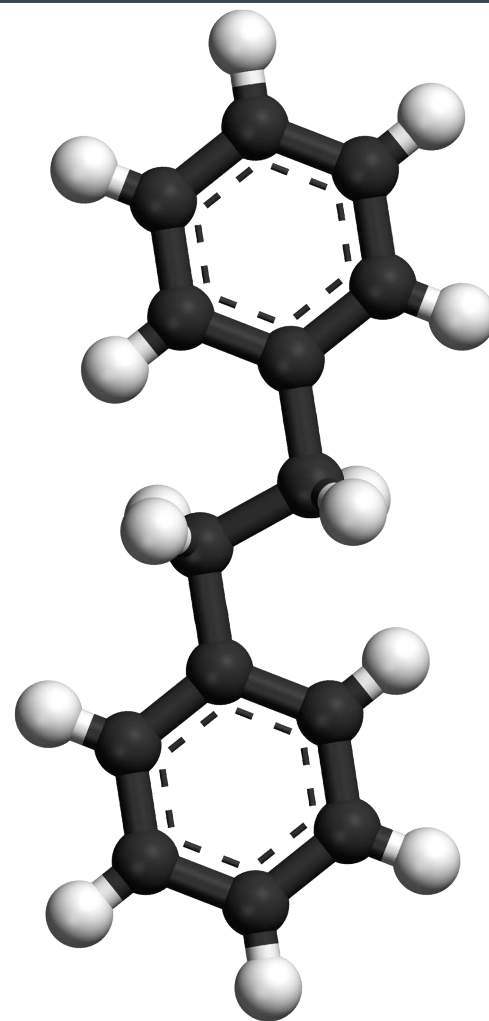
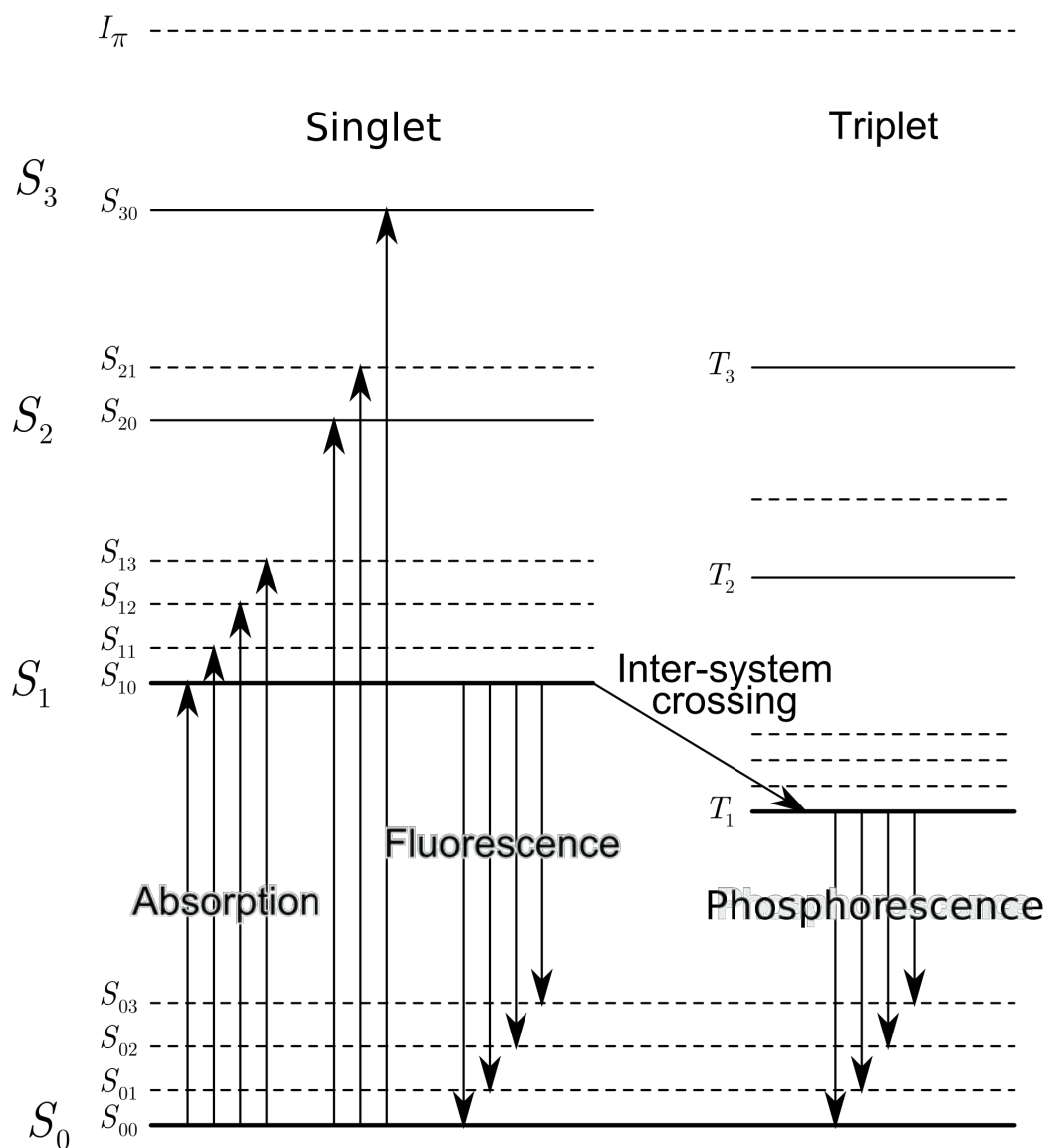
## A Suite of Scintillators for Characterization

| Organics                     | Plastics    |
|------------------------------|-------------|
| Stilbene                     | 0.05% DPA   |
| Bibenzyl:Stilbene (99.5:0.5) | 0.05% POPOP |
| Bibenzyl:Stilbene (50:50)    |             |
| DPAC:Stilbene (98:2)         |             |
| DPAC:Stilbene (50:50)        |             |



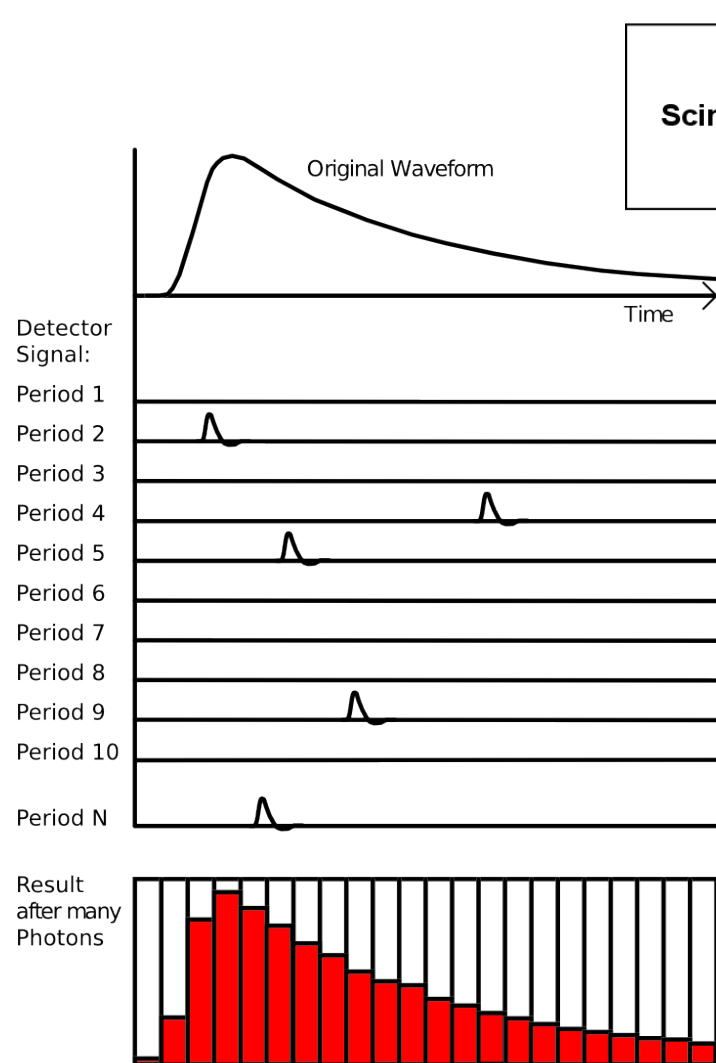
## Why do the crystals luminesce?

### OVERVIEW

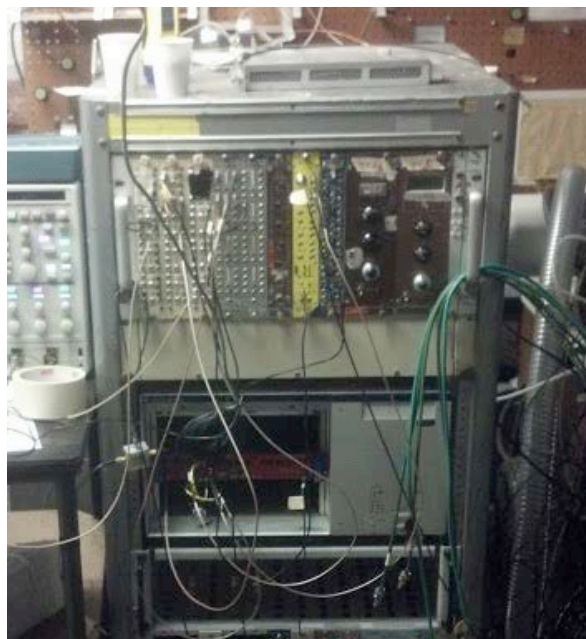
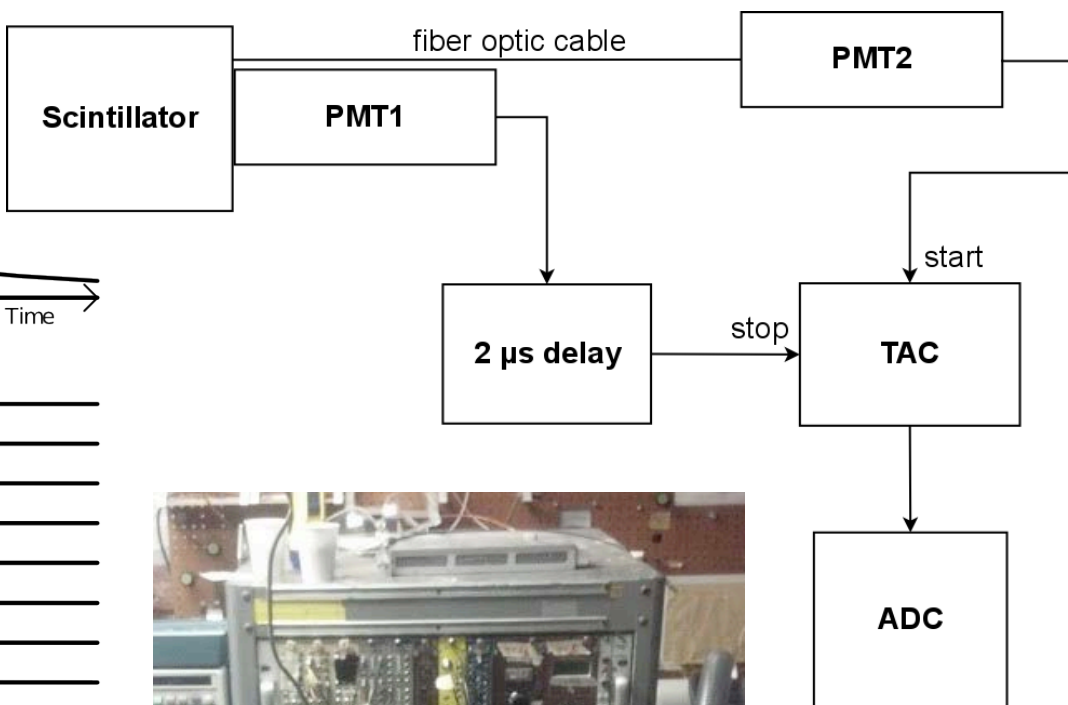


Bibenzyl

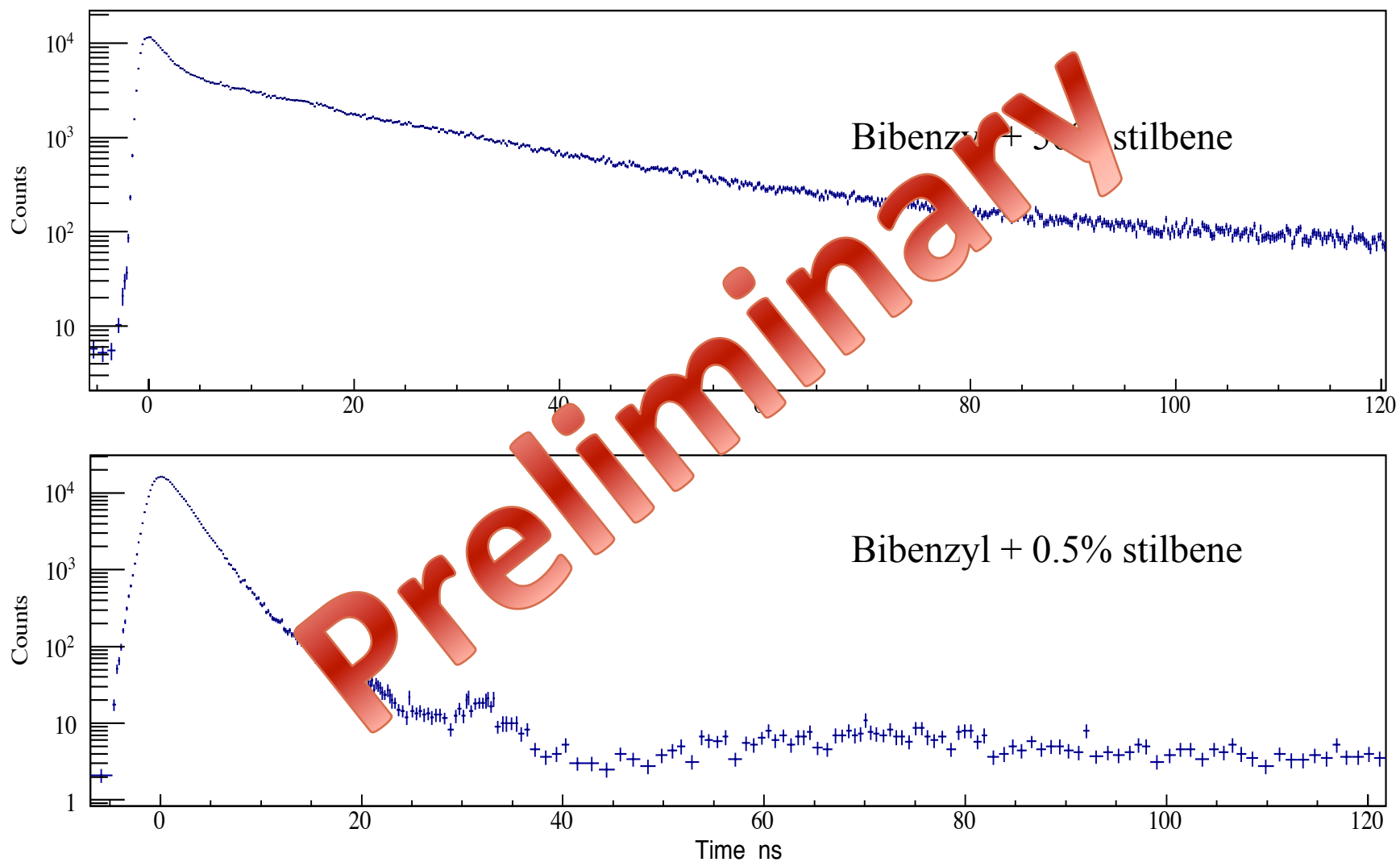
# Scintillator Light Decay



Principle of the TCSPC technique

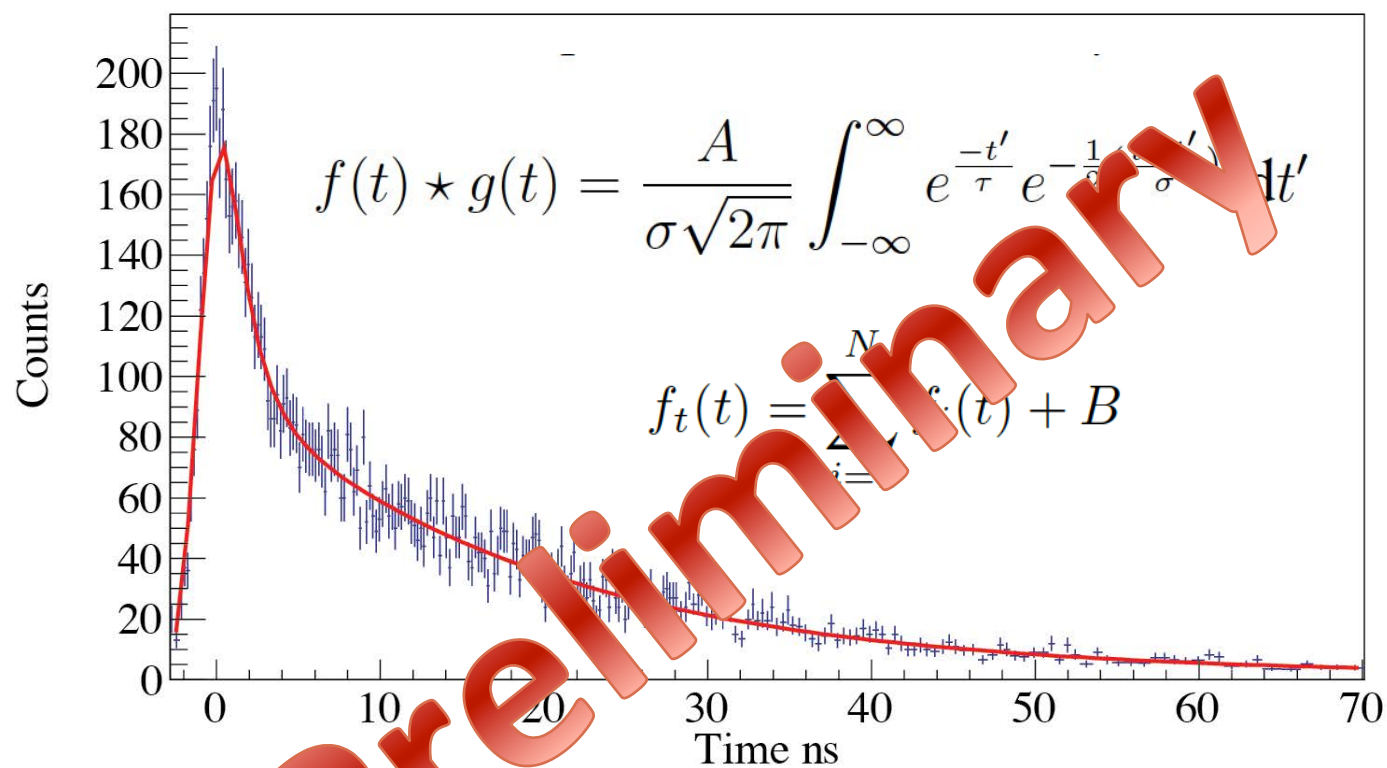


## Light Decay for Bibenzyl:Stilbene Scintillators



TIME CORRELATED SINGLE PHOTON COUNTING

## Results



| $\tau_i(\text{ns})$<br>BB+0.5% Stilbene | $\tau_i(\text{ns})$<br>BB+50% Stilbene |
|-----------------------------------------|----------------------------------------|
| $2.4 \pm 0.2$                           | $2.4 \pm 0.2$                          |
|                                         | $19.6 \pm 1.6$                         |



# Measuring Scintillator Detection Efficiency

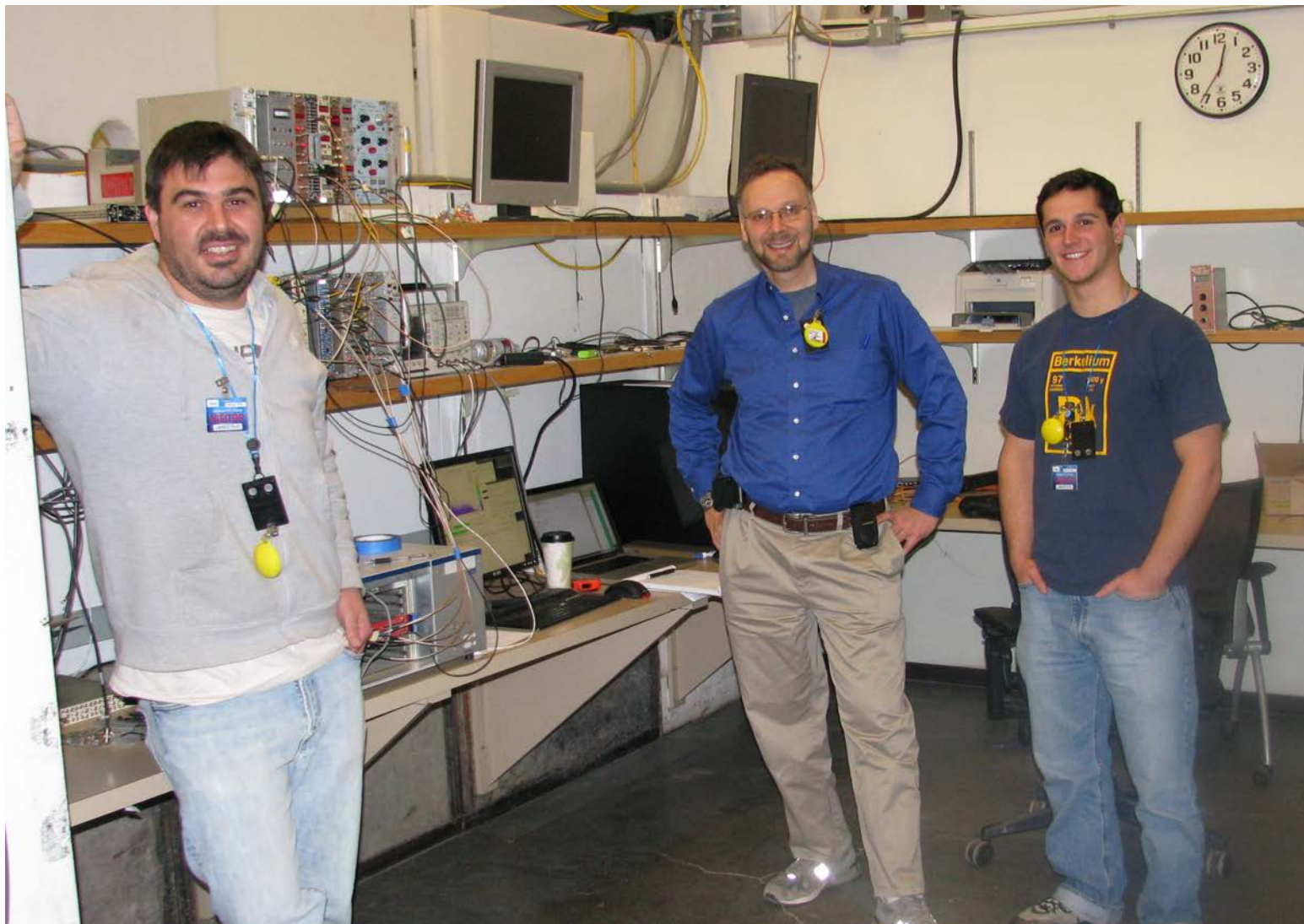


CIC-9: RN91-240-309

NEUTRON TIME OF FLIGHT



## Measuring Scintillator Detection Efficiency



NEUTRON TIME OF FLIGHT

# Measuring the Neutron Flux

*S.A. Wender et al. / Fission ionization detector for neutron flux*

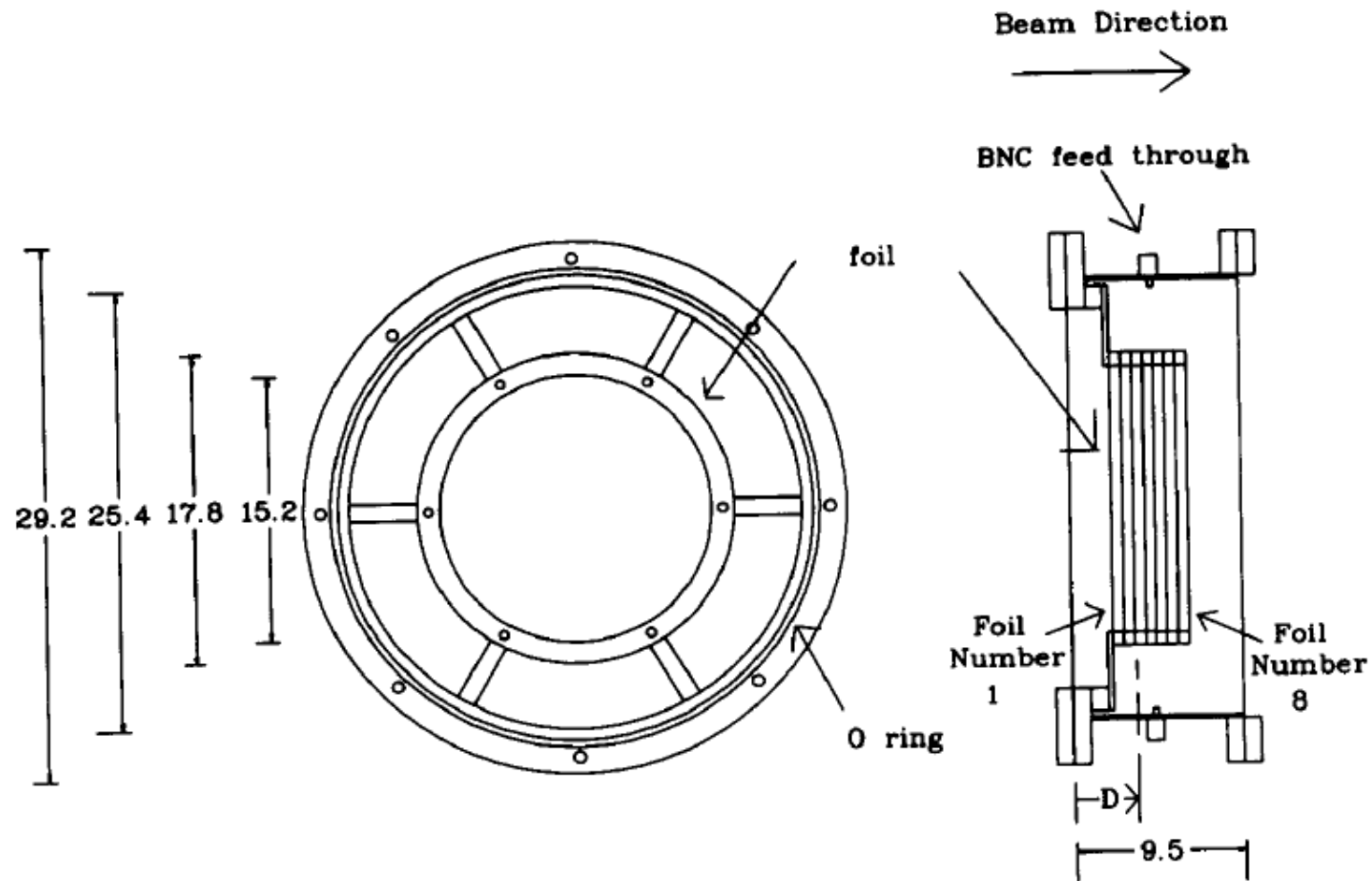
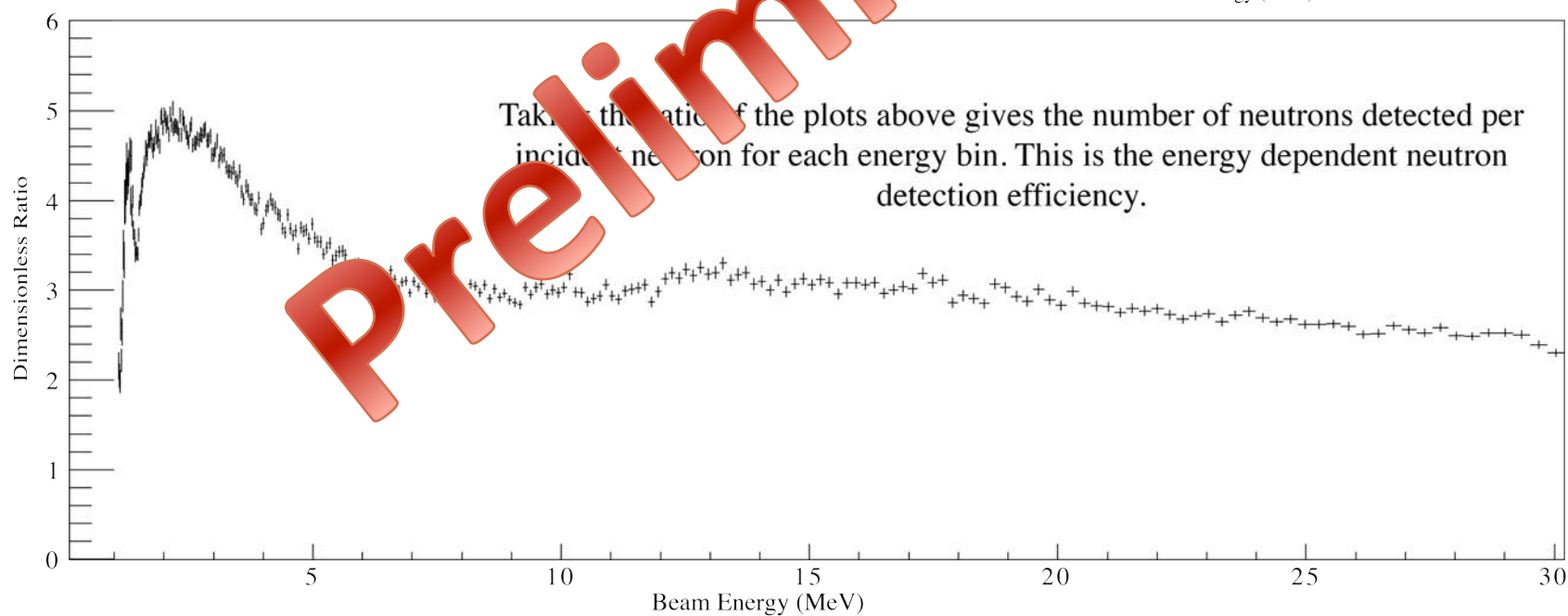
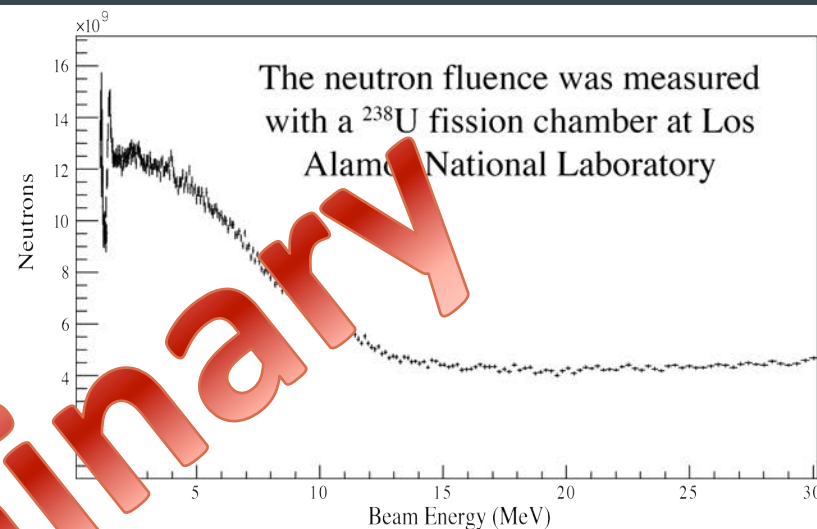
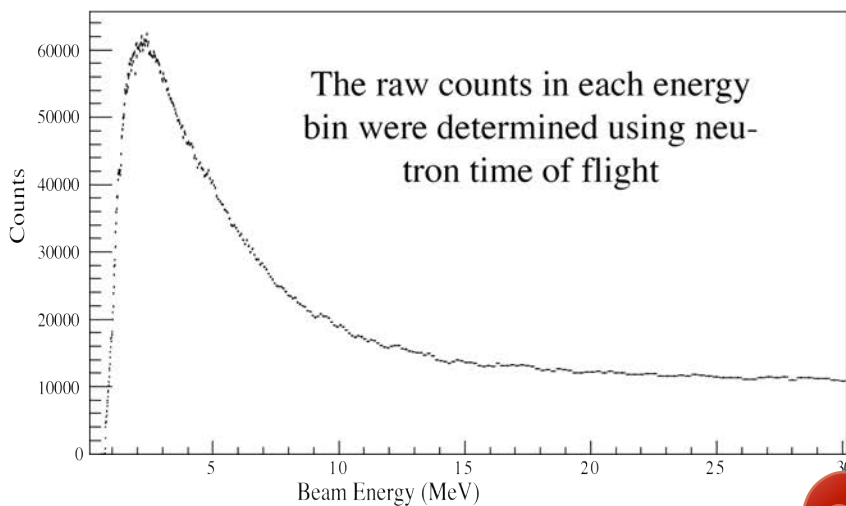


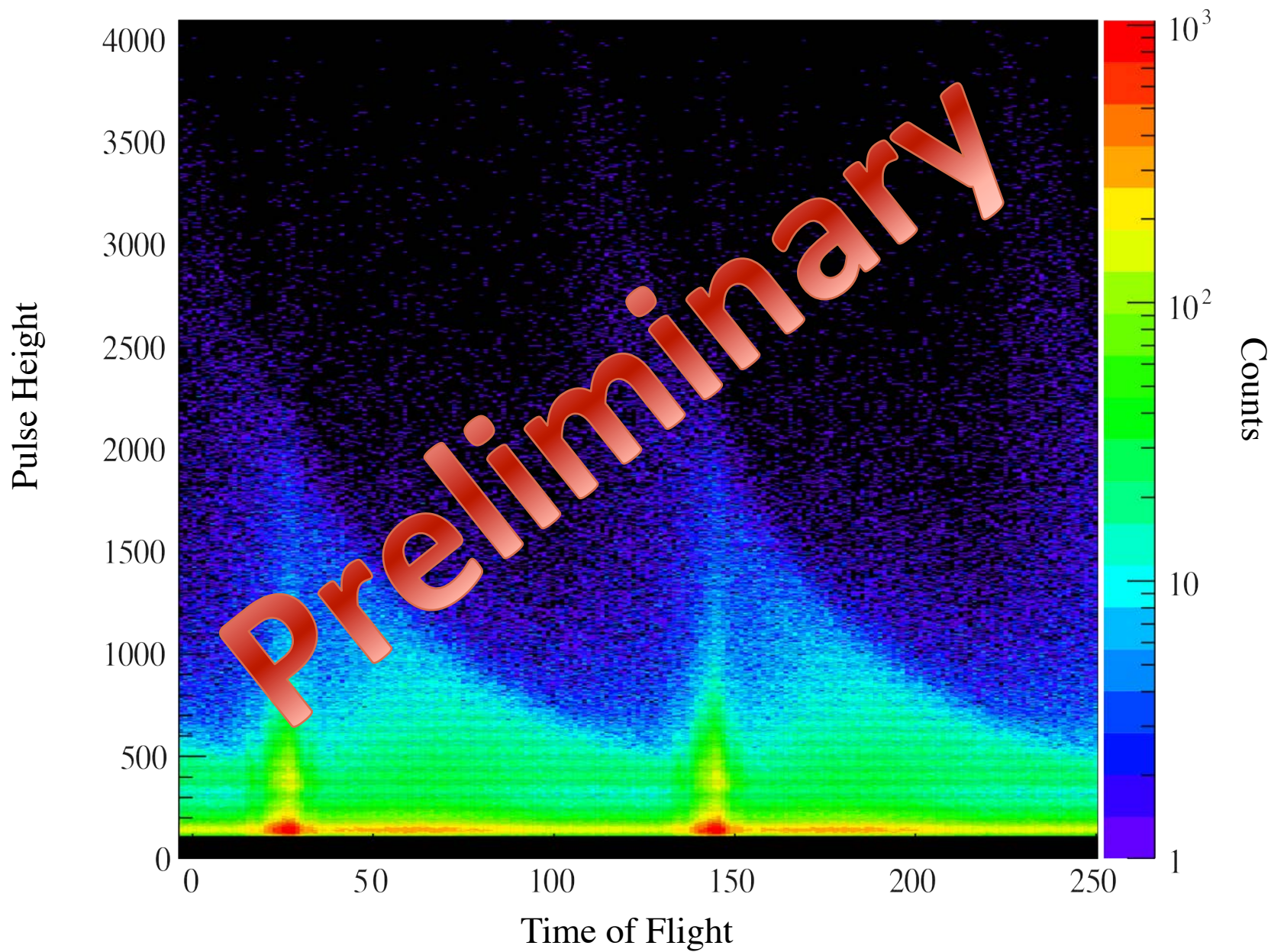
Fig. 1. Schematic diagram of the ionization chamber housing. Dimensions are in centimeters.

## Obtaining the Relative Ratio





## How much light is produced?



LUMINOSITY

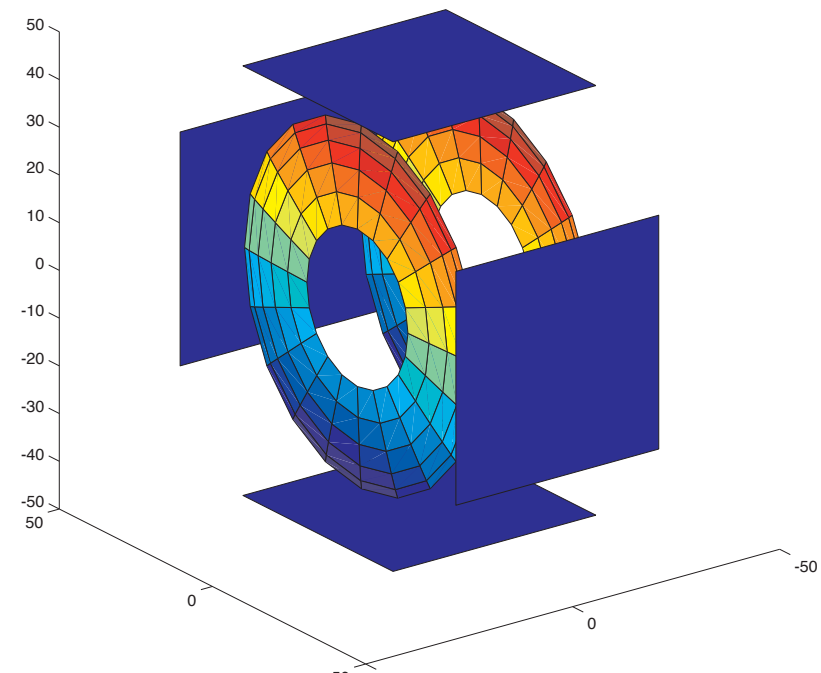


## Low Energy Neutron Spectrometer



### Next Steps

There is currently no capability at NIF to measure neutrons with  $E_n < 140$  keV.



## Many Thanks!

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