

# Axial-Vector Form Factor (AVFF)

## A (super-)Brief Update on Project Status

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# Proposal Improvement Strategy

## Set-up Passive Materials Shaping [MonteCarlo]

Target Cell + Collimators are considerable sources of unwanted neutron backgrounds [in medium + surface "mirror" re-scattering]

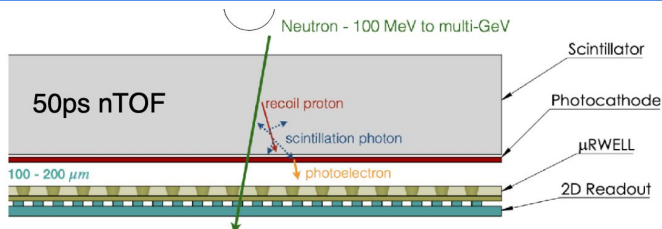
- thinning target materials (windows etc.)
- re-shaping collimator geometry

## Time-Of-Flight development [LAB]

Challenge:

nTOF\_WALL from 100 ps to 50 ps + nCAL down to 400 ps (BNL/E864)

- new scintillator geometries
- increased flight path TOF/nCAL [hires bunch ID]



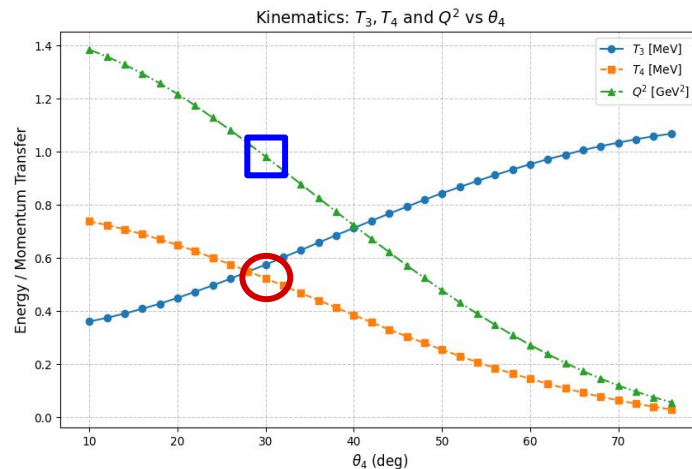
New Technology?  
 $\mu$ RWELL based  
photocathode readout

## New kinematics

$$Q^2 = 1 \text{ GeV}^2 \text{ [}\sim\text{same signal Rate]}$$

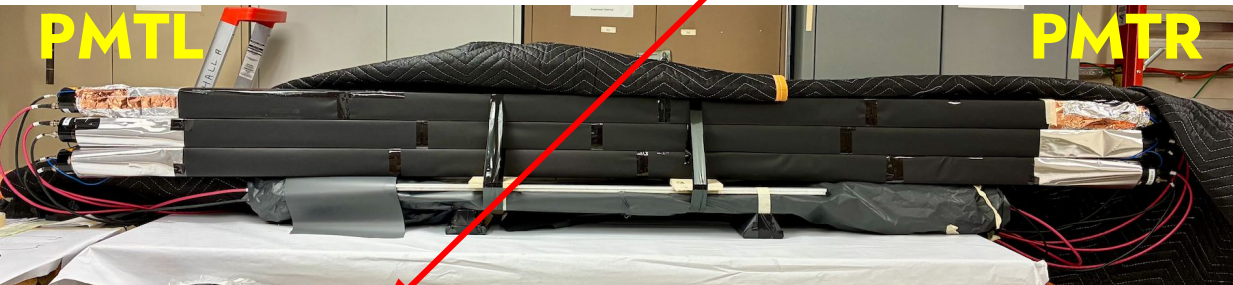
→ (Move detection angle from 48 to 30 deg)

Beam energy **2.2** → **1.1 GeV**  
[better  $E_b$  resolution, significant reduction of  $\pi$  and  $\Lambda$  production]



# Timing Test of Long Scintillators for the AVFF neutron\_TOF

[credits: **Sofia Betto** - Borsa di Studio INFN/CSN3 3 mesi @ |Lab|  
+ **M. Lucentini** (ISS technical staff)]



Scintillator: EJ-200 200x6x6 cm<sup>3</sup>

PMT: Hamamatsu R13089

## Project Status Summary

- [1] Old setup measurement
- [2] New setup prep: scintillator polishing, lightguides+PMTs glueing, wrapping, elx (Vetroc/TDC, FADC, trigger elx)
- [3] Measurements with new set-up, comparison of Vetroc/TDC+FADC (time/charge correction) and CFD technique

## Project Plan Summary

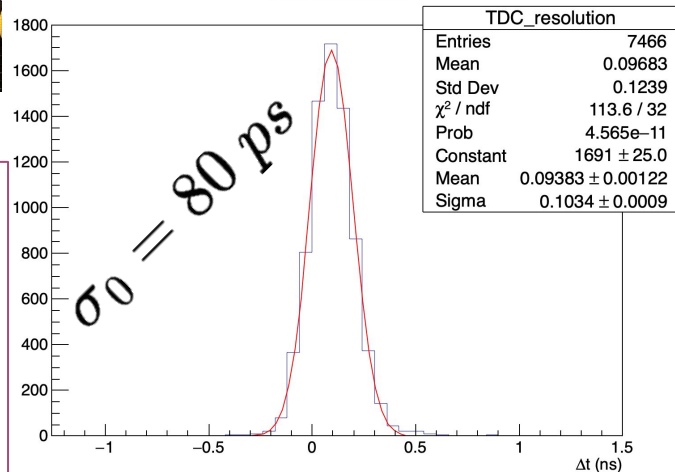
- [1] Setup in Rome with SiPM
- [2] New BC408 scintillators ordered
- [3] Monte Carlo simulation
- [4] Results planned for the next SBS General Meeting (March 2026)

## Meantime Method

$$\Delta t = \frac{1}{2}(\bar{t}_1 + \bar{t}_3) - \bar{t}_2$$

$$\bar{t}_k = \frac{1}{2}(TDCL + TDCR)_k$$

TDC resolution



$$\sigma_{\Delta t}^2 = \frac{1}{4}\sigma_1^2 + \frac{1}{4}\sigma_3^2 + \sigma_2^2$$

$$\sigma_2 = \sqrt{\frac{2}{3}}\sigma_{\Delta t}$$

## Outreach/Dissemination

### **"Axial-Vector Form Factor (AVFF) from an electron-to-neutrino process with a proton";**

Presenter: [R. Perrino](#) 

Mini-Symposium: Early Results from Nucleon Form Factor Campaign with SBS at JLab III

APS Global Physics Summit 2025, Anaheim, CA - March 2025

### **"Probing the proton Axial Vector Form Factor with an inverse $\beta^-$ decay experiment"**

Presenter: [R. Perrino](#) 

Session: Hadron Structure, Spectroscopy and Dynamics

European Nuclear Physics Conference 2025, Caen, France - Sept. 2025

### **"A First Measurement of the Nucleon Axial-vector Form Factor at $Q^2 = 1 \text{ GeV}^2$ using Polarized Electron Scattering from Protons"**

Presenter: Todd Averett

Session: Neutrino Physics I: Low-Energy Neutrinos I - 2025 Fall Meeting of the APS Division of Nuclear Physics, Chicago - October 2025

### **"Development of Electron Beam Study of the Nucleon Axial Vector Form Factor at JLab"**

Presenter: Weizhi Xiong

Session: Plenary - BARYON 2025, Jeju, Korea - November 2025