



# Development of an Argon Light Source as a Calibration and Quality Control Device for Liquid Argon Light Detectors

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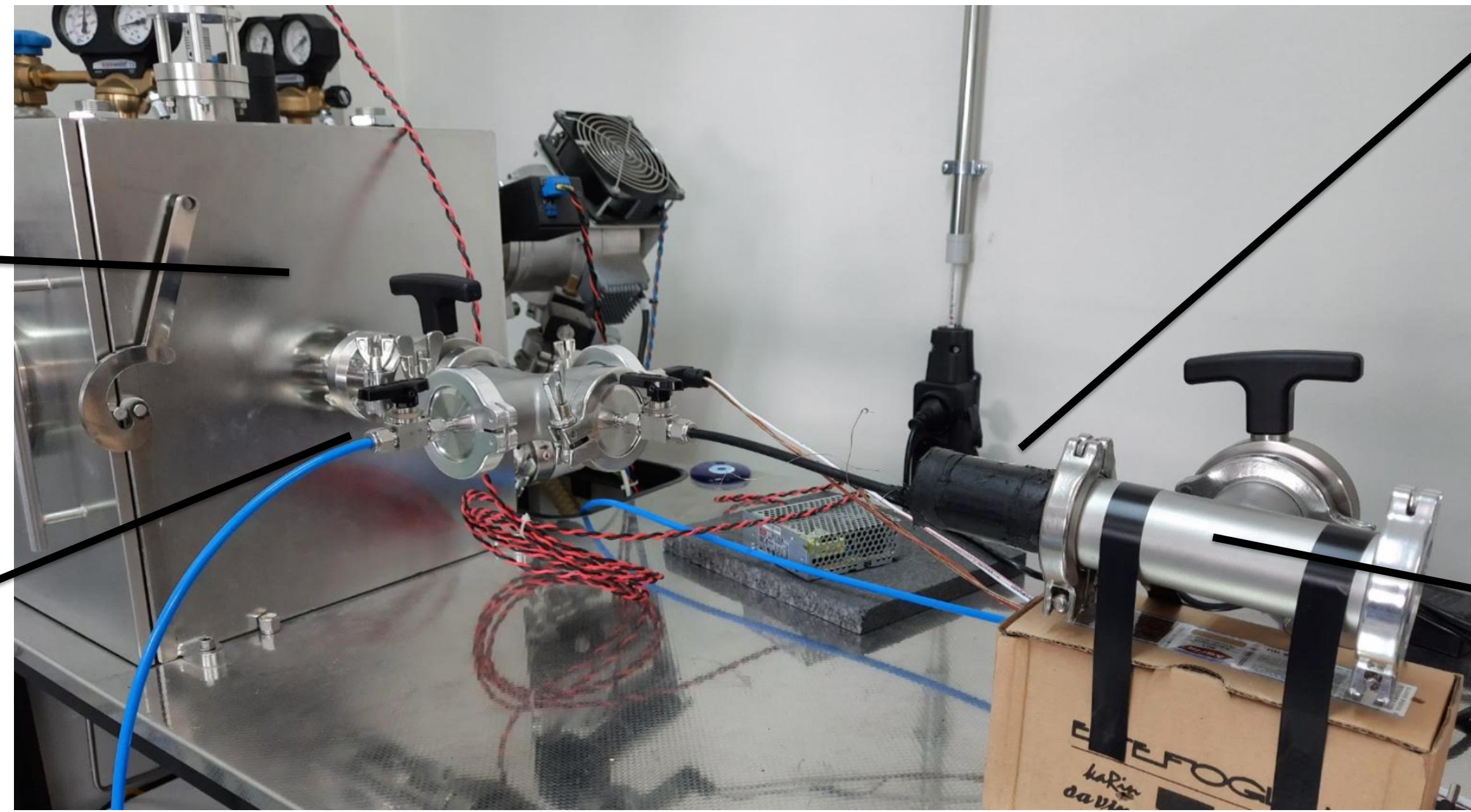
**1.** The majority of future large-scale neutrino and dark matter experiments are based on liquid argon detectors. Since liquid argon is also a very effective scintillator, these experiments also have light detection systems. 127 nm wavelength of the liquid argon scintillation leads to the development of specialized light detectors, mostly based on wavelength shifters, and recently photodetectors sensitive to deeper UV. The effective calibration and quality control of these newly developed detectors is still a persisting problem.

**2.** In order to respond to this need, we developed an argon light source which is based on plasma generation and light transfer across a  $\text{MgF}_2$  window. The light source is designed as a small, portable and easy to operate device to enable the acquisition of performance characteristics of several square meters of light detectors. Here we will report on the development of the light source and its preliminary performance characteristics.

Vacuum system:

- Part of a magnetron sputtering system (no dedicated vacuum pump for the light source).
- Can go down to  $1.5 \times 10^{-6}$  mbar.

Gas inlet



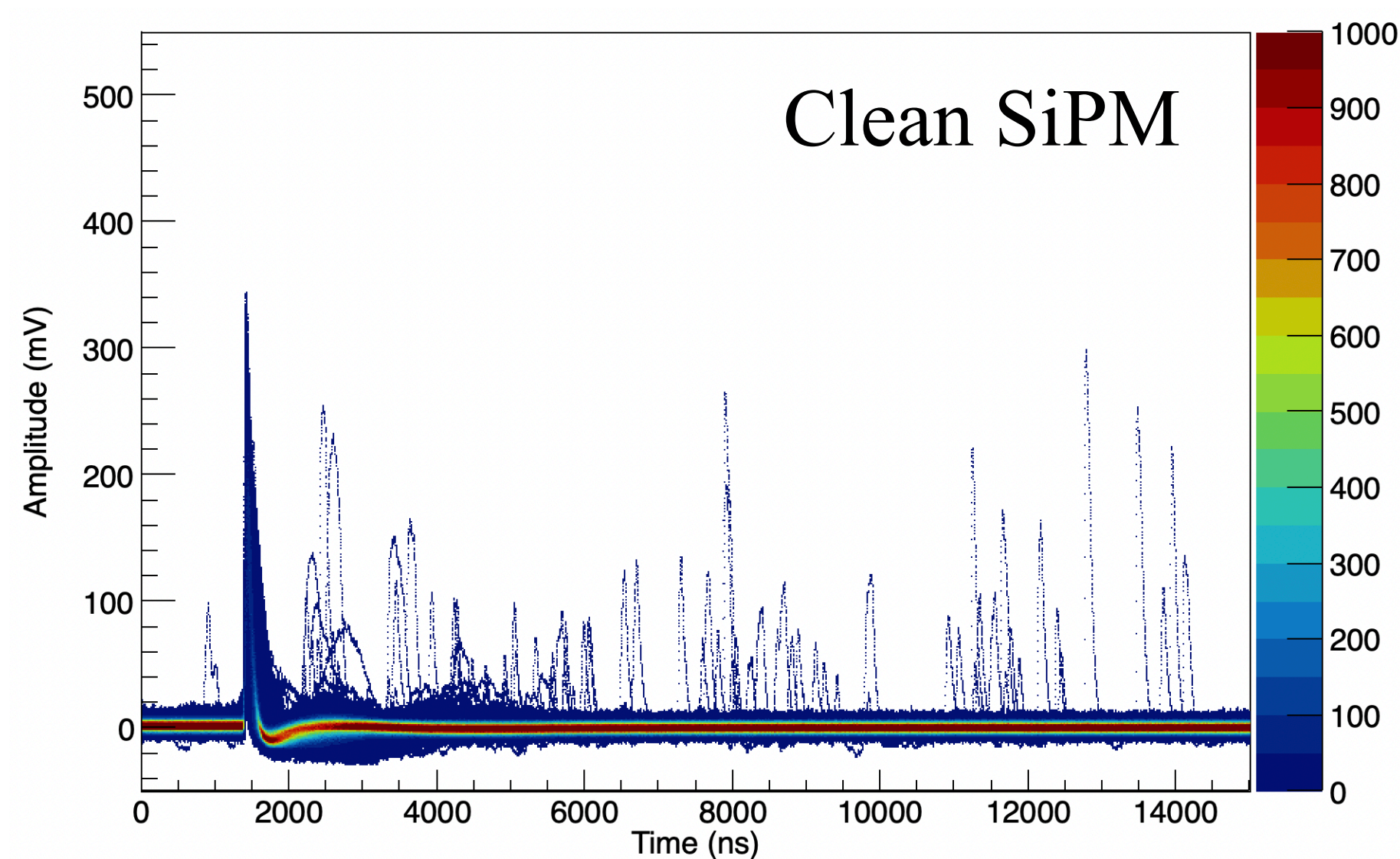
The light source:

- Polyoxymethylene body.
- 1 mm thick  $\text{MgF}_2$  window.
- Titanium electrodes with 2 mm separation.

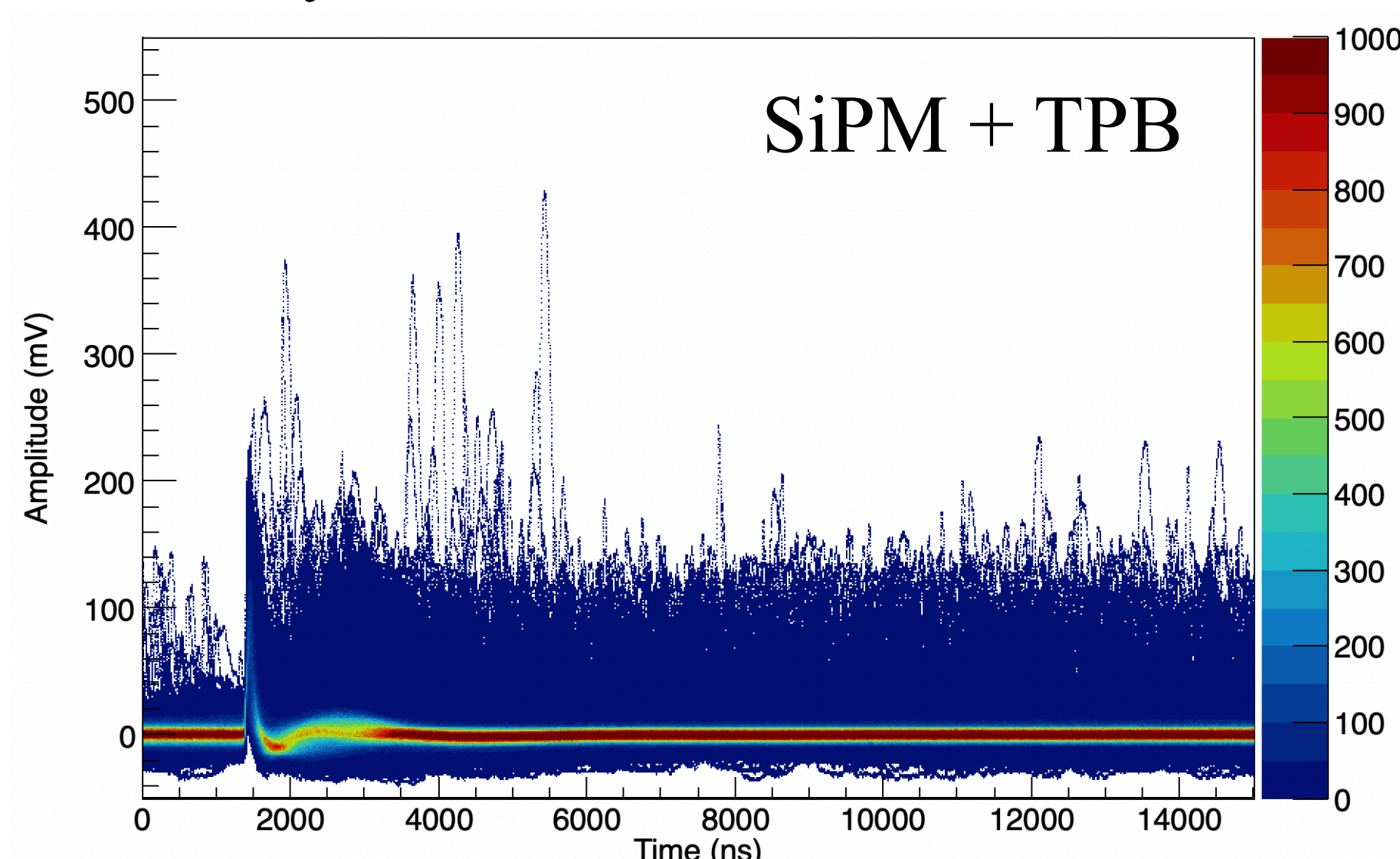
Test tube:

- Under vacuum.
- Clean and TPB coated SiPMs placed across the light source.

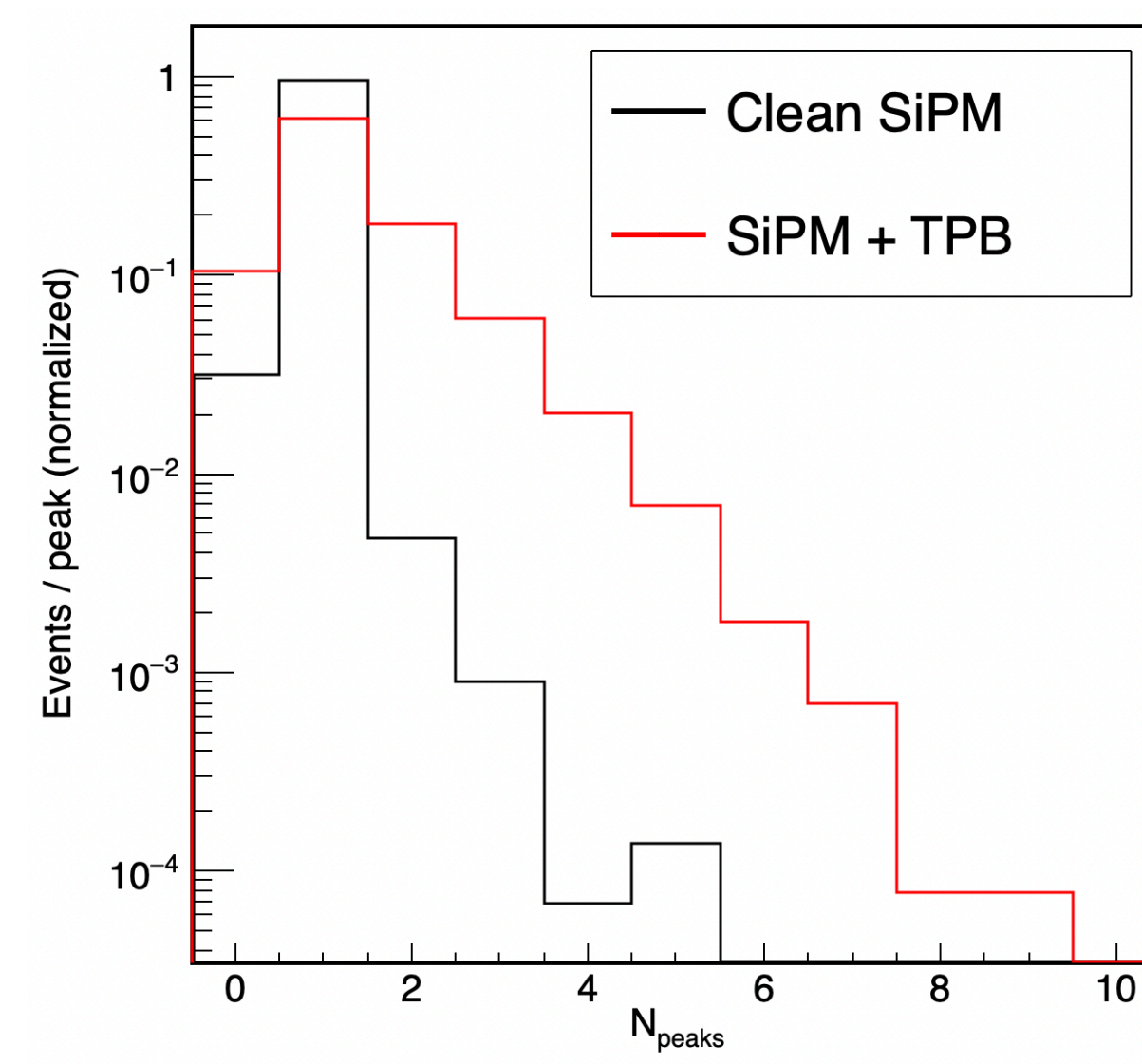
Overlaid signals measured with a SiPM looking directly at the light source under vacuum.



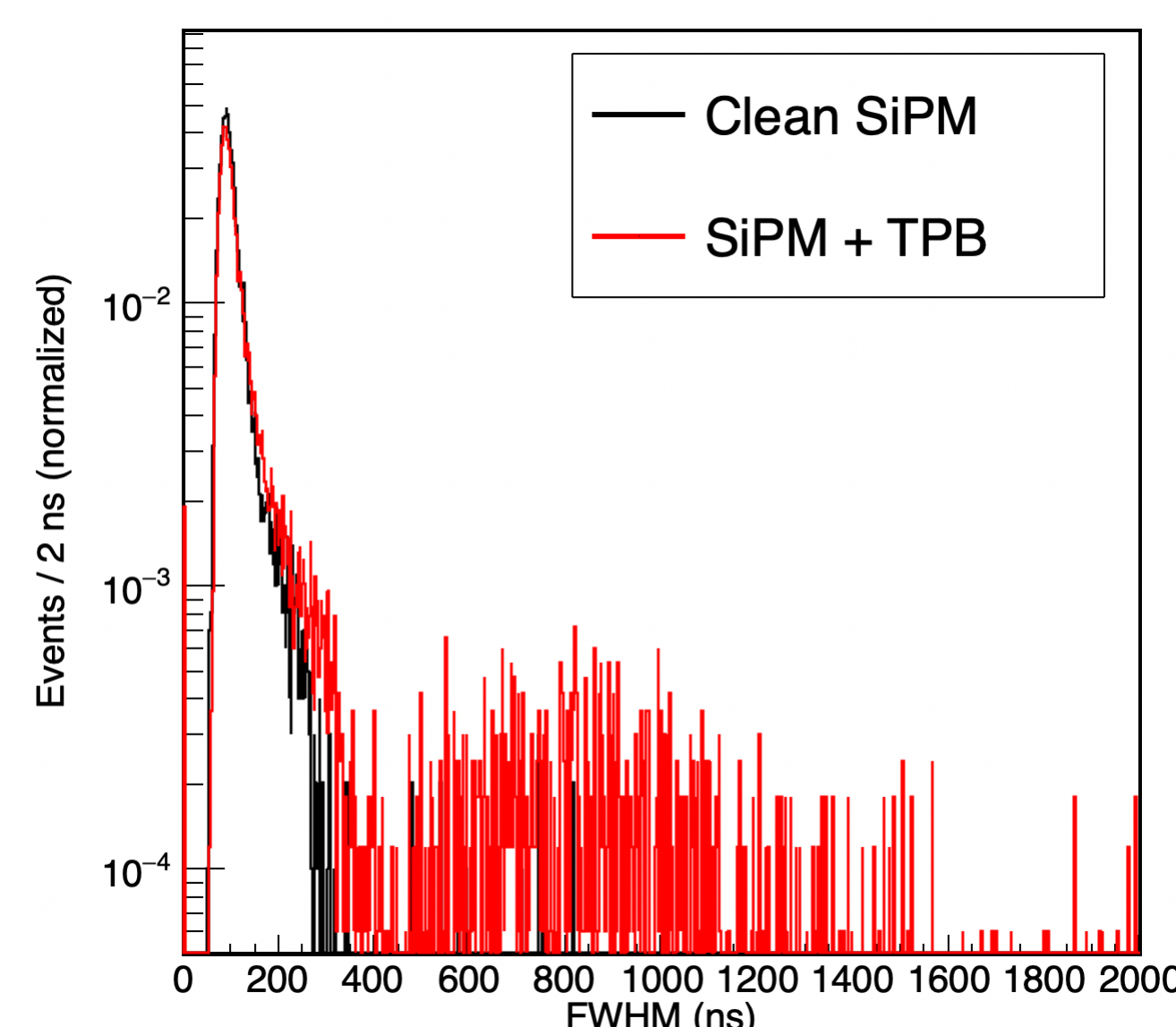
TPB (tetraphenyl butadiene) is applied directly on the SiPM window.



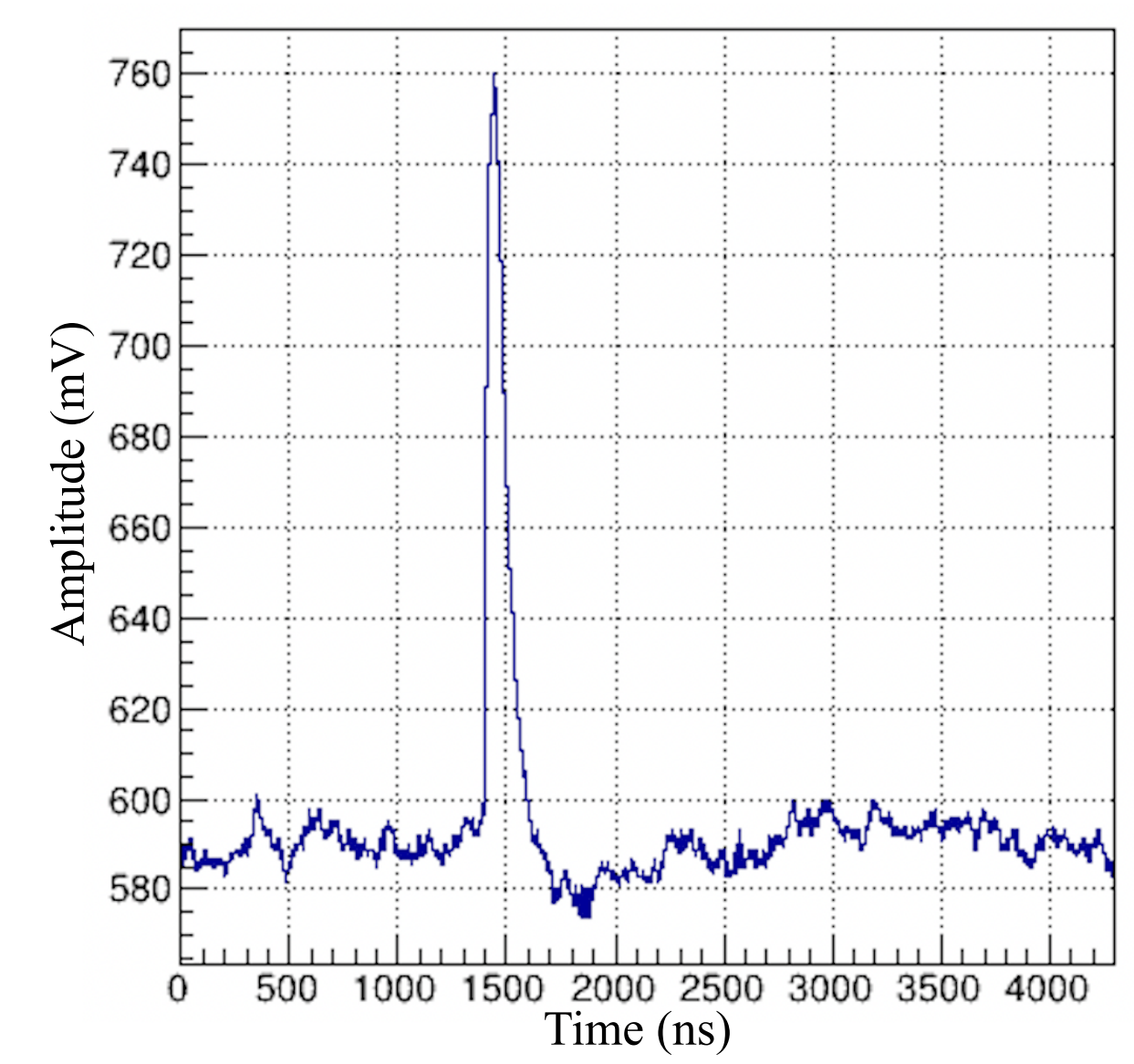
Number of peaks above 30 mV in the  $15 \mu\text{s}$  window.



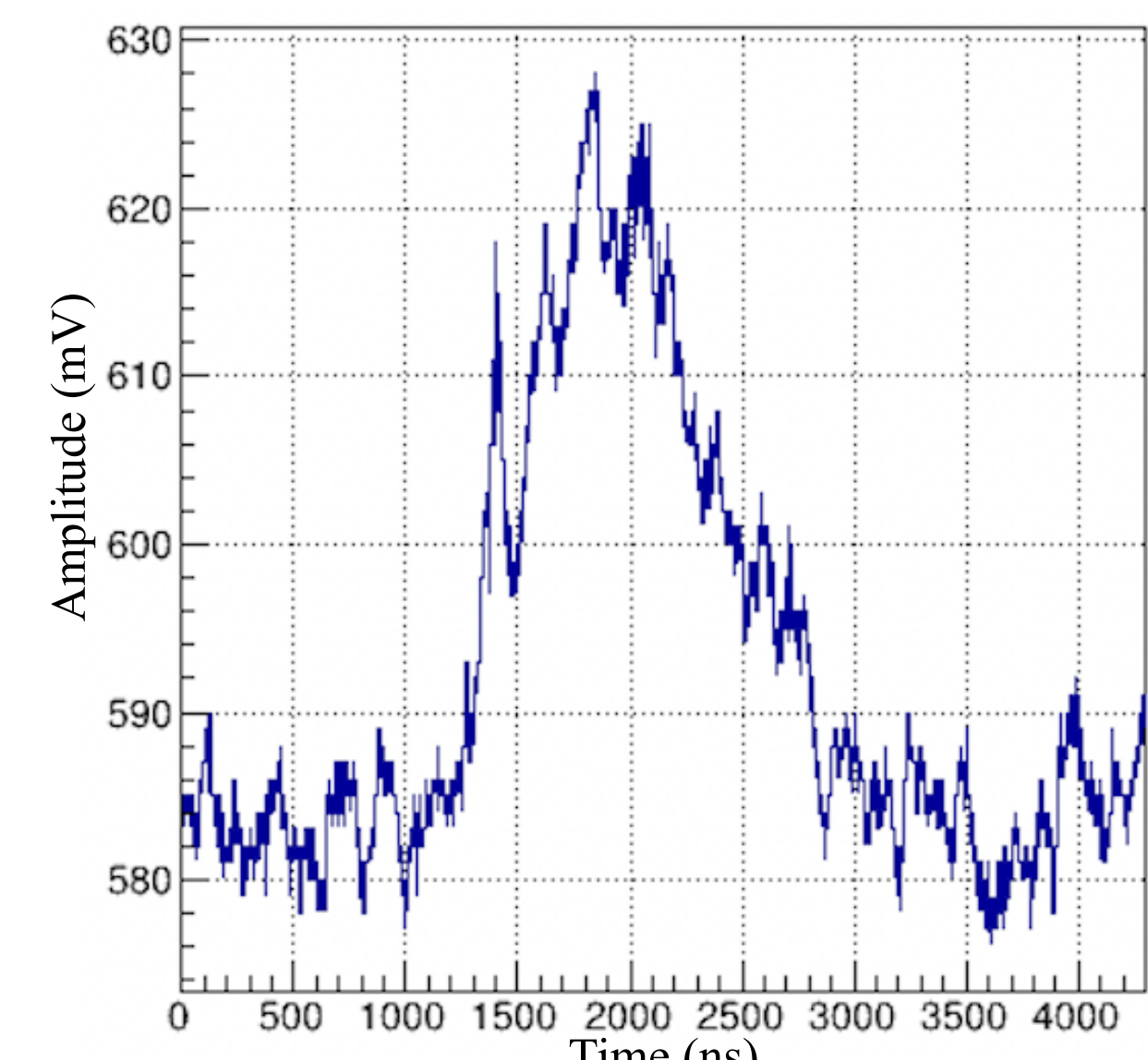
Full width at half maximum for the pulses with peak amplitudes above 30 mV.



Sample pulse shape with  $\text{FWHM} < 500$  ns.



Sample pulse shape with  $\text{FWHM} > 500$  ns.



An argon light source to be utilized as a calibration and quality control device for liquid argon light detectors is developed. The characterization of the light source is underway. The preliminary measurements indicate a successful generation and detection of the VUV light. Various operational parameters such as the pressure and high voltage are under study. Plans include improvements on vacuum sealing and a careful study of the duration of stable performance with single filling.

This work is supported by TÜBİTAK Grant No: 118C224.