

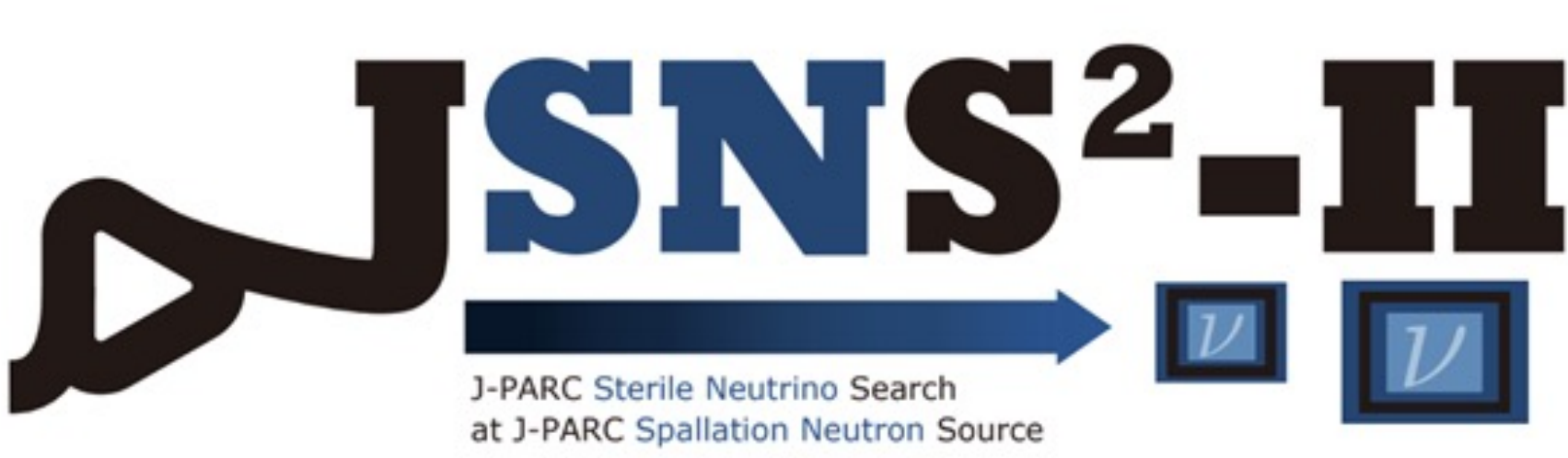
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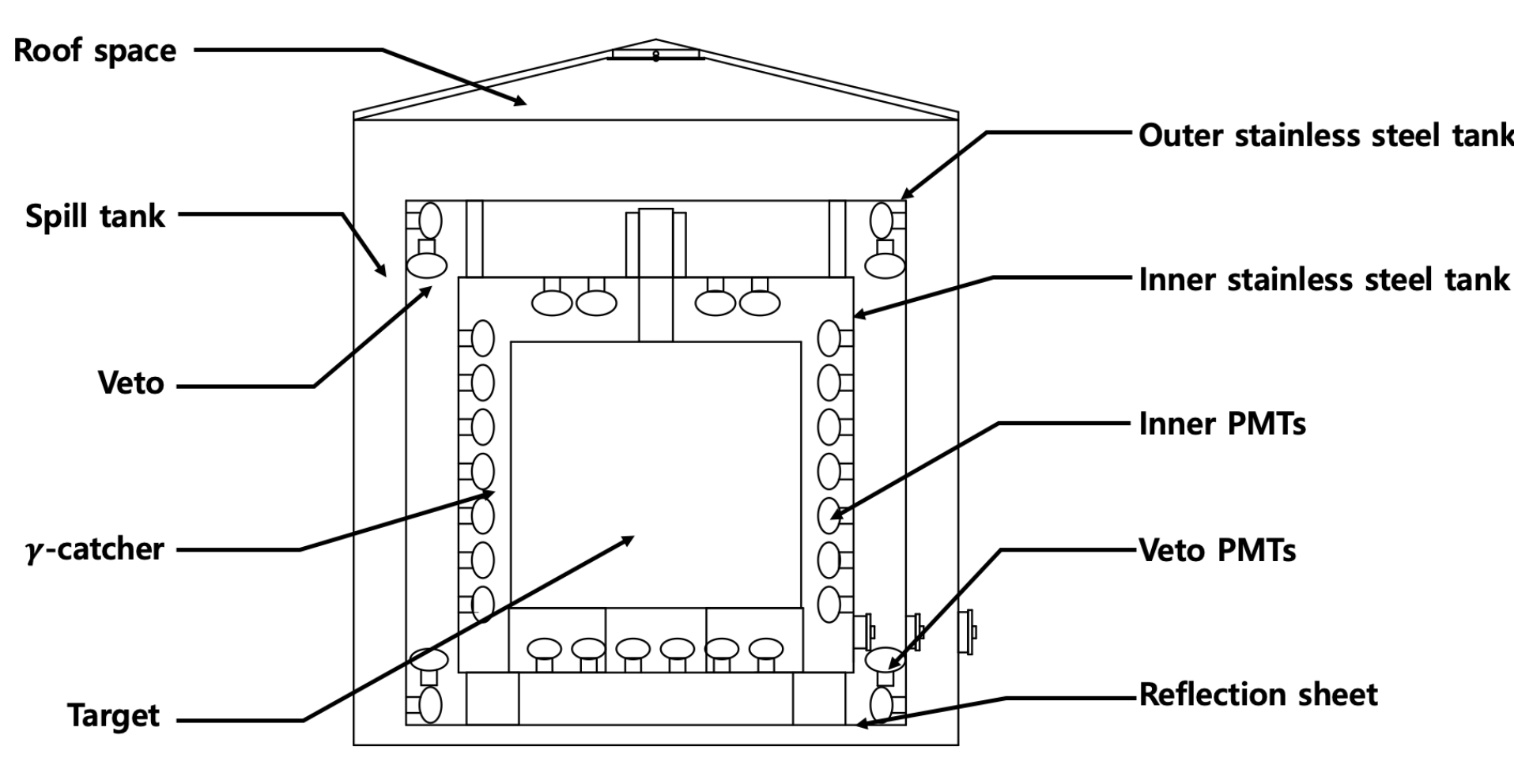
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On behalf of JSNS²-II collaboration

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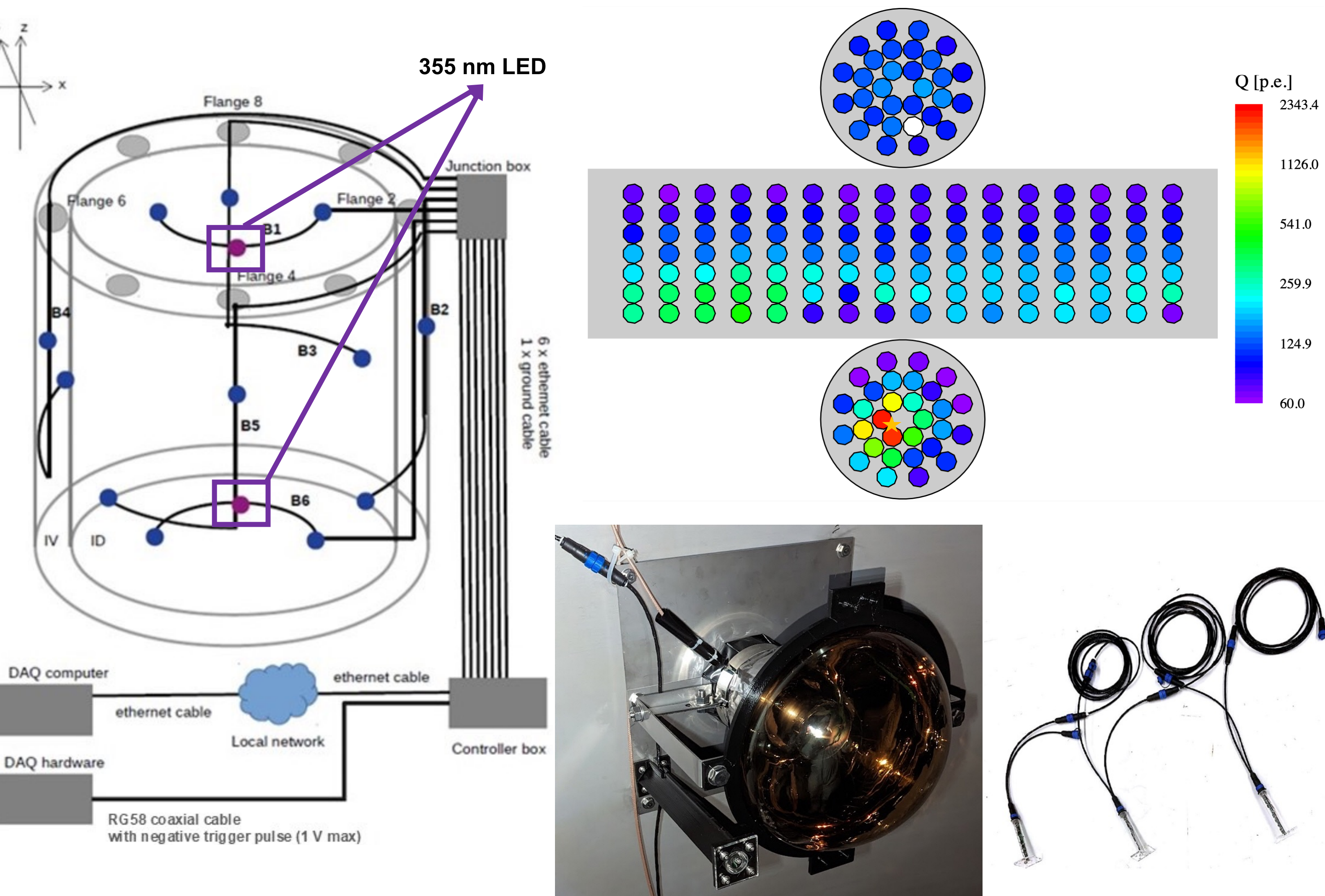


Introduction



- The **JSNS²-II**(J-PARC Sterile Neutrino Search at J-PARC Spallation Neutron Source) experiment searching for the sterile neutrinos using near and far detector.
- The far detector is equipped with 172 PMTs in the gamma catcher region and 48 PMTs in the veto region.
- To achieve good energy resolution for physics events, the PMT gains must be matched within 10% of their supplied high voltages.

LED system



Item	Performance
Wavelength	355 nm (2 LEDs) and 420 nm (12 LEDs)
Light intensity	Capability to provide (approximately) 100 to 1,000,000 photoelectrons
Flashing rate	Up to 100 kHz
Trigger	Capability to produce/accept a TTL trigger

- Relative charge of the 172 PMTs measured using the bottom UV LED.

10-inch PMT(R7081)



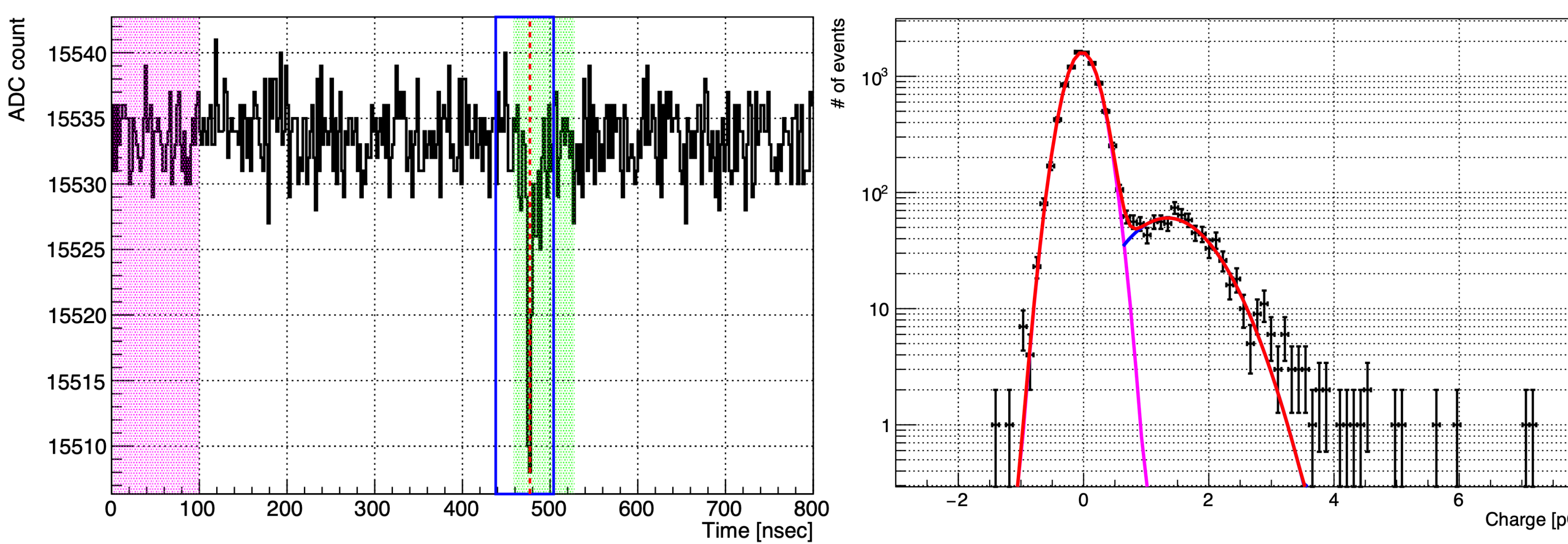
Applied voltage for 10 ⁷ gain(V)	PV ratio		Transit time spread(ns)	Dark count(s ⁻¹) (After 15 hours)	
Typ.	Min.	Typ.	Typ.	Typ.	Max.
1500	1.5	2.8	3.4	7000	15000

- All 172 PMTs in the gamma catcher region were donated from the Double Chooz experiment.

Reference

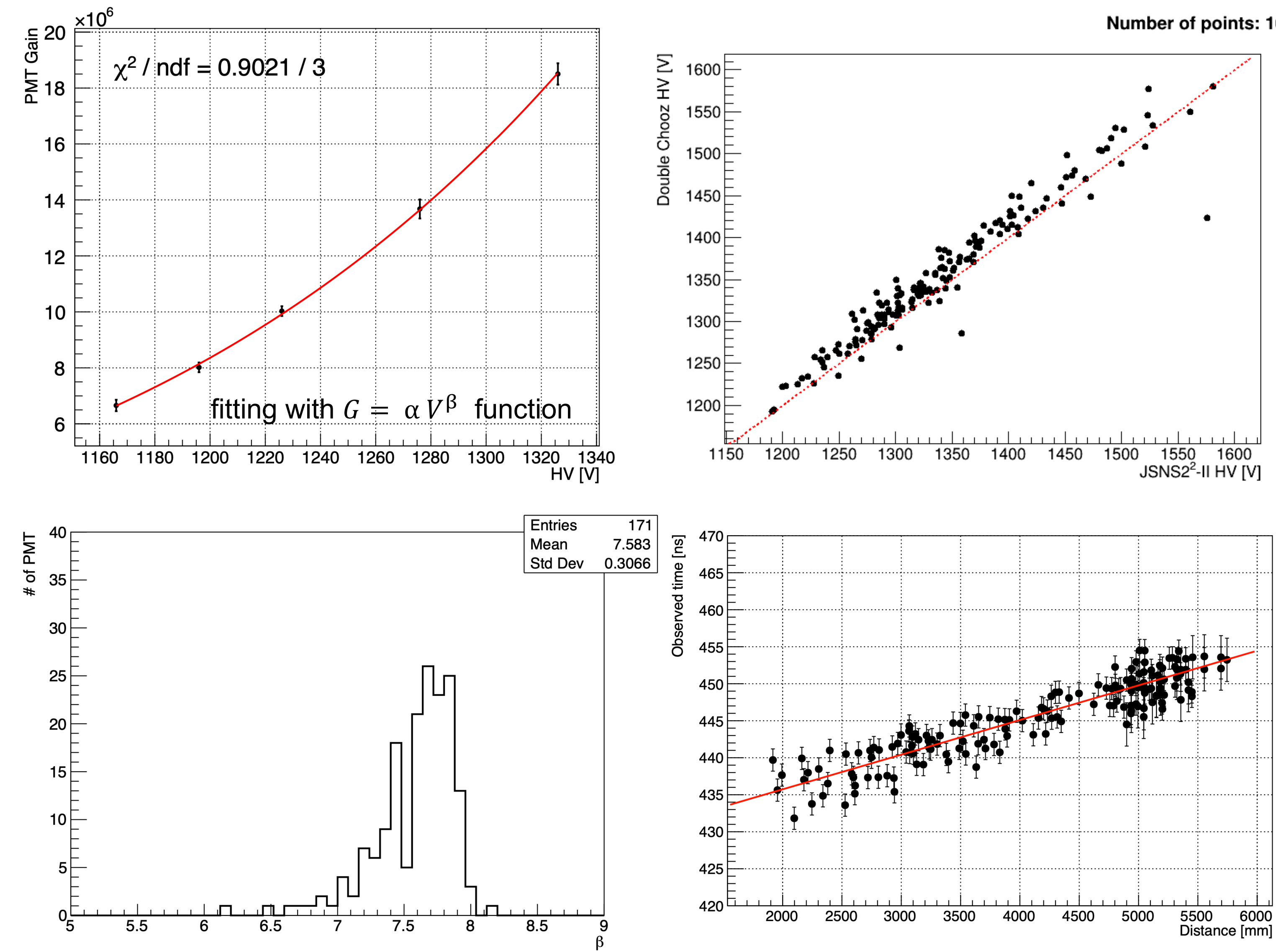
arXiv:2503.09031, Data sheet of PMT R7081 by Hamamatsu Photonics

Charge calculation



- The waveform illustrates a typical PMT signal measured with the bottom UV LED and top blue LED, using 14 bits resolution and 500 MHz sampling rate modules.
- Single photoelectron (SPE) signals from the LED system were used to extract PMT gain.
- The charge distribution was fitted with a double Gaussian fit function to determine the gain information.

Results



Summary & Plans

- Achieving good energy resolution for physics events requires matching the PMT gains within 10% of their corresponding high voltages.
- A lower gain setting is required to avoid PMT non-linearity and DAQ saturation.
- The installed LED system was used to verify and calibrate the gain of each PMT.
- Key parameters such as gain, HV curves, and pulse timing by PMT and LED distance were measured and applied for detector operation.
- HV values for all PMTs were set to achieve the target gain, and the resulting charge was verified accordingly.
- To ensure consistent detector performance, regular gain monitoring using LED system is planned.