

# SiPM-Based Gamma Spectrometer for Nuclear Spectroscopy

S. Nuruyev<sup>1,2</sup>, G. Ahmadov<sup>1,2,3,4</sup>, R. Akbarov<sup>1,2,3</sup>, F. Ahmadov<sup>1,2,3</sup>, A. Sadigov<sup>1,2,3</sup>,  
D. Berikov<sup>1,5</sup>

<sup>1</sup> *Joint Institute for Nuclear Research, IIO, Joliot-Curie 6, 141980, Dubna*

<sup>2</sup> *Institute of Radiation Problems under Ministry of Science and Education, B.Vahabzade str. 9, AZ1143, Baku, Azerbaijan*

<sup>3</sup> *Innovation and Digital Development Agency, Nuclear Research Department, Gobu str. 20th km of Baku-Shamakhi Highway, AZ0100, Baku, Azerbaijan*

<sup>4</sup> *Innovative Electronics and Detectors LLC, Badamdard STQ-1, AZ1021, Baku, Azerbaijan*

<sup>5</sup> *Institute of Nuclear Physics of the National Nuclear Center of Kazakhstan, Ibragimova 1, 050032, Almaty, Kazakhstan*

This study presents the results of a scintillation gamma spectrometer detector developed using a 16-element SiPM matrix. The matrix was coupled with different scintillator crystals, including GaGG, YSO, and BGO. Each SiPM element had a sensitive area of 3×3 mm<sup>2</sup>, a pixel density of 1440 pixels/mm<sup>2</sup>, a photon detection efficiency of 40% at 470 nm wavelength, and an operating voltage of 55.5 V. The characteristics of the gamma detector were evaluated using gamma rays from Am-243, Co-60, Cs-137, Na-22, and Th-228 sources.

The detectors coupled with GaGG and YSO crystals exhibited a perfectly linear relationship between detected signal amplitude and gamma-ray energy from 26.3 keV to 1.33 MeV. The BGO scintillator crystal demonstrated a 1 MeV longer linear range for gamma-ray energy but exhibited low sensitivity for energies below 300 keV. The energy resolutions for the 662 keV gamma-ray peak were 8.17%, 9.3%, and 10.2% with GaGG, YSO, and BGO scintillator crystals, respectively.