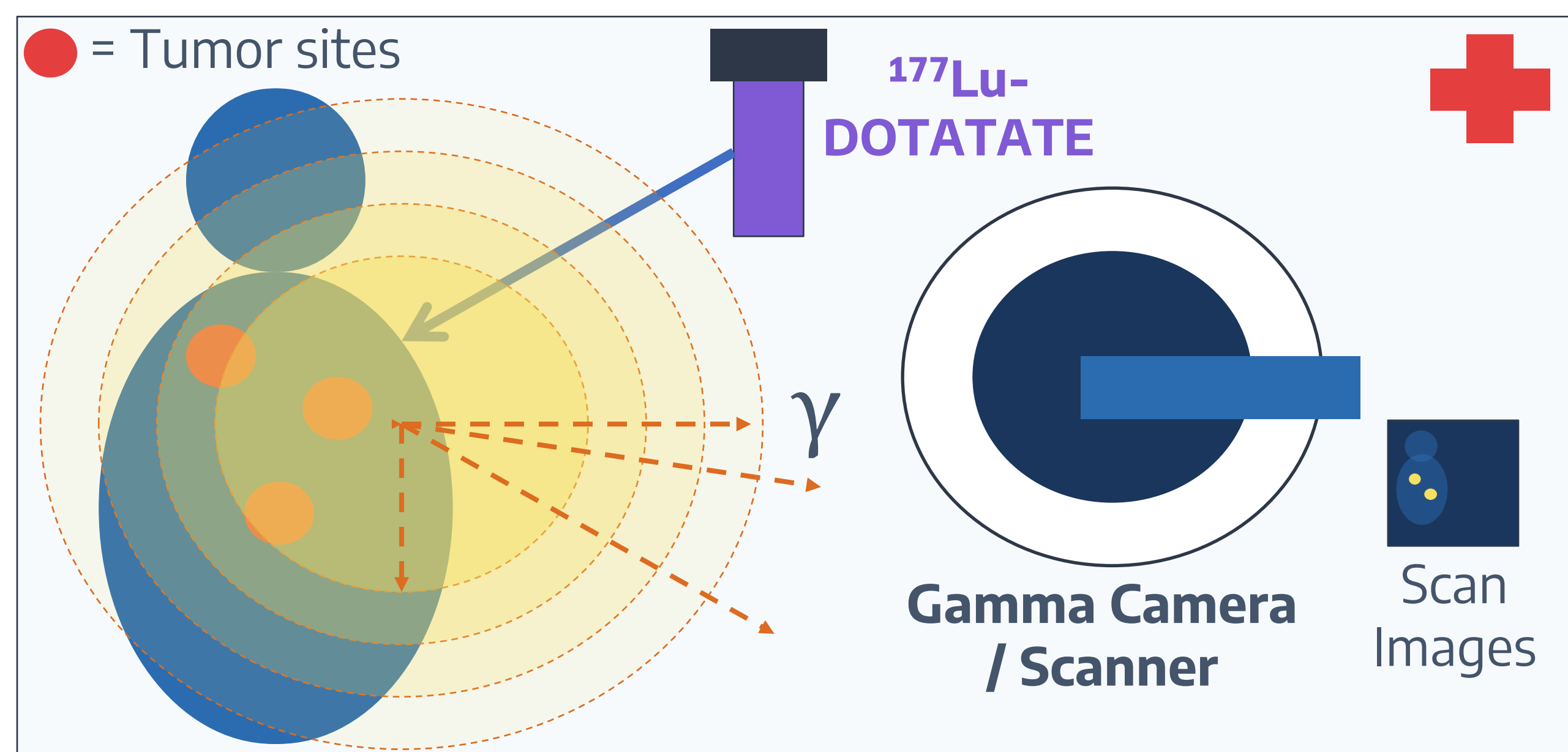
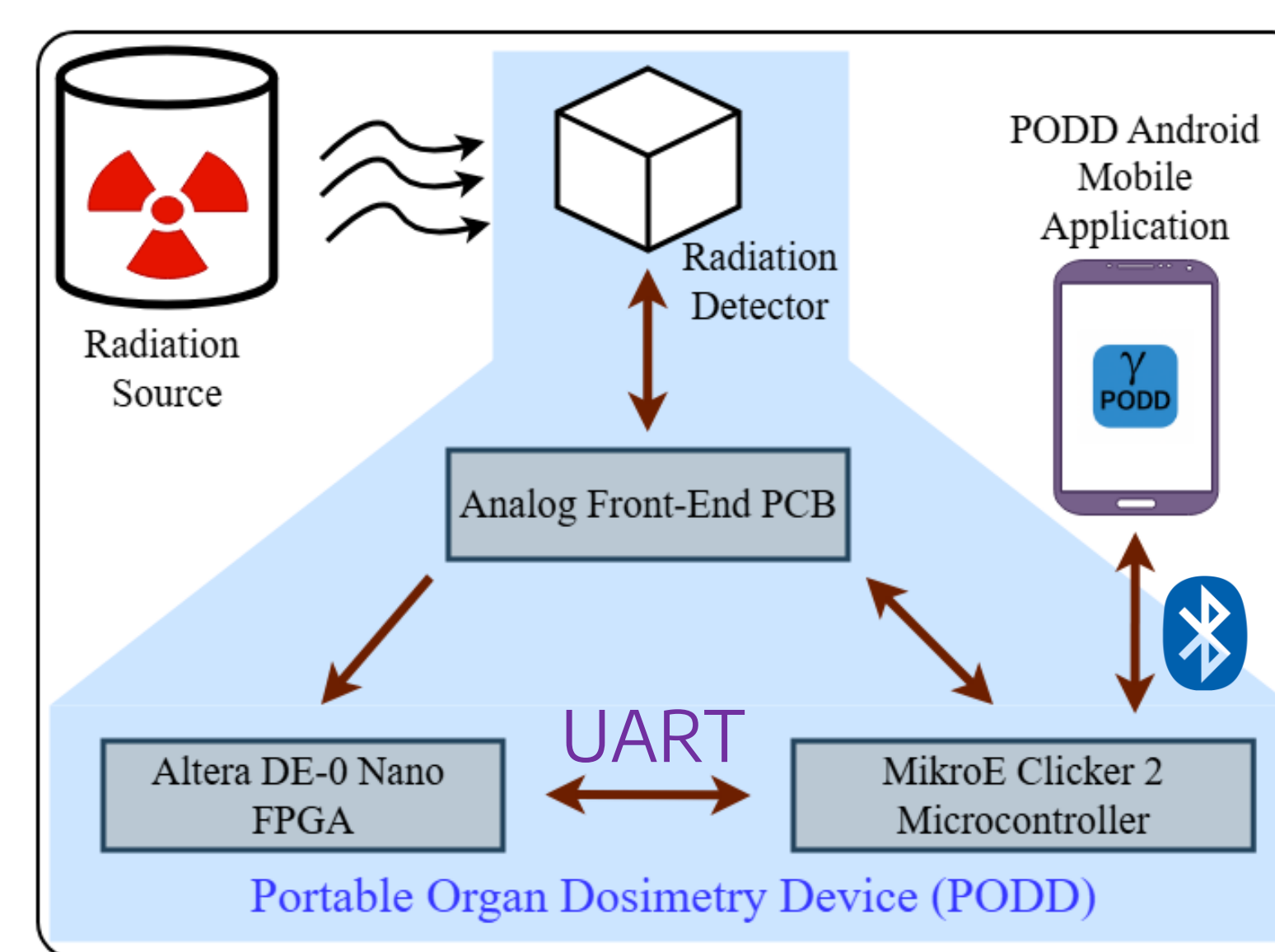


## RADIOTHERANOSTICS PRIMER



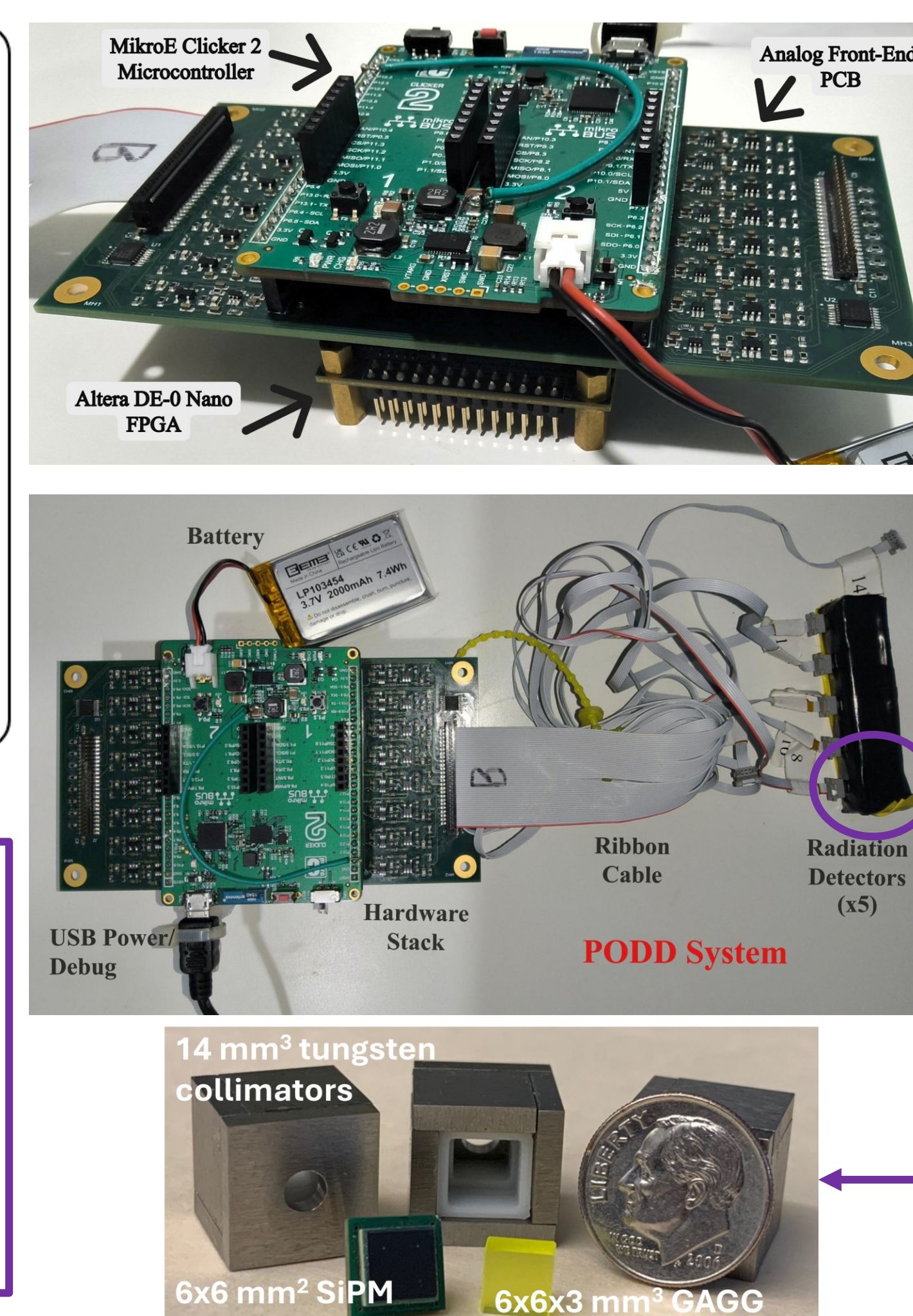
- Current Lu-177 DOTATATE dosimetry requires **multiple hospital visits** for SPECT/CT imaging, dependent on **expensive infrastructure** and specialized staff
- Sparse temporal sampling** (3-4 time points) limits dose estimation accuracy, yet cost and patient burden discourage additional scans
- Most clinics default to **fixed-activity prescriptions** instead of personalized dosimetry, risking suboptimal treatment outcomes
- The proposed **Portable Organ Dosimetry Device (PODD)** aims to enable **dense temporal sampling** at the point of care, reducing dependence on hospital infrastructure while improving **personalized dose estimation**

## PODD HARDWARE SYSTEM

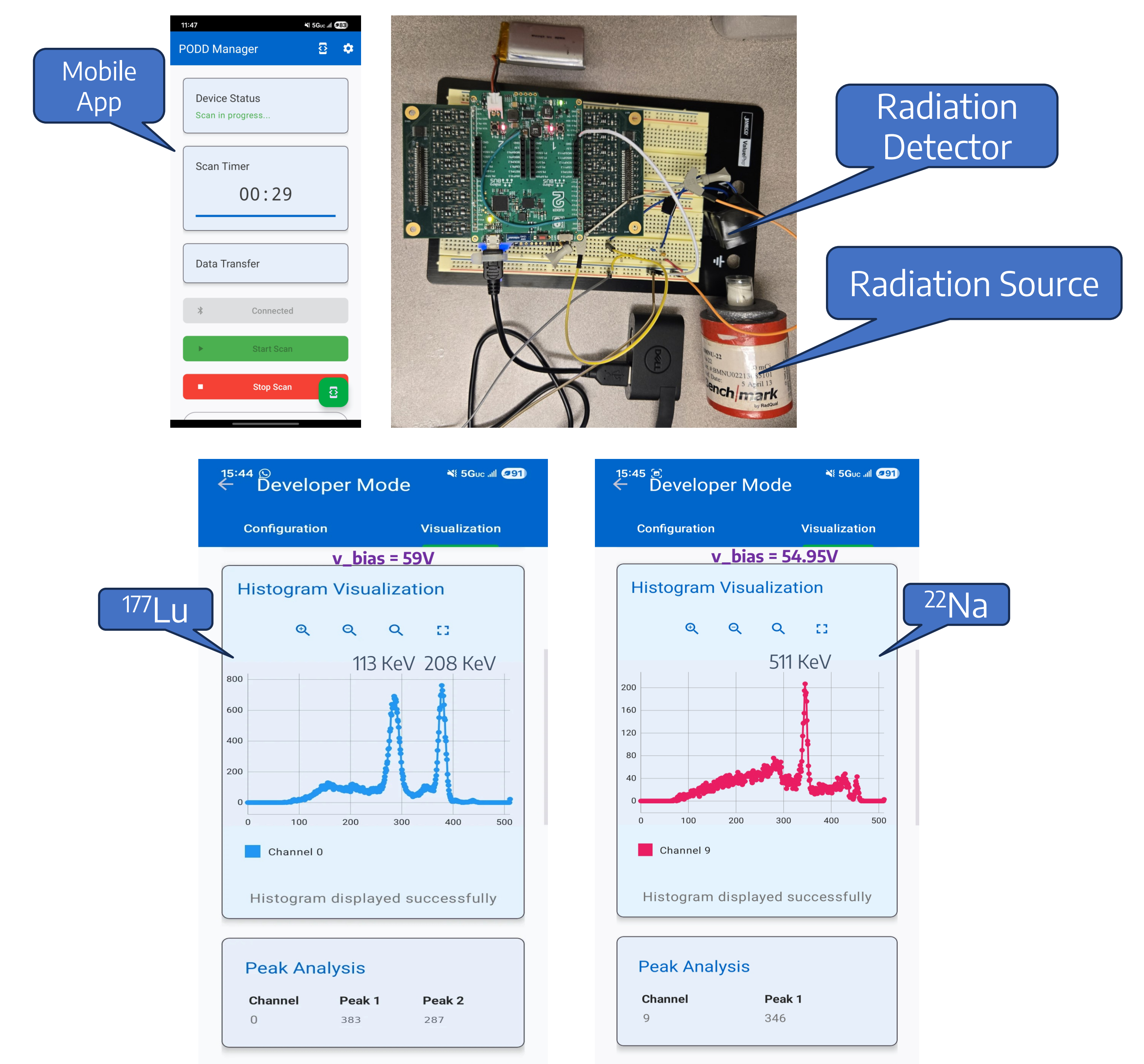


### Key System Features:

- ✓ Portable, battery-powered, easy to use.
- ✓ Supports 16 radiation detectors.
- ✓ Real-time temperature monitoring of SiPMs.
- ✓ Wireless data transfer to Android app via BLE.
- ✓ Medical audio alarms compliant with IEC 60601-1-8



## RESULTS

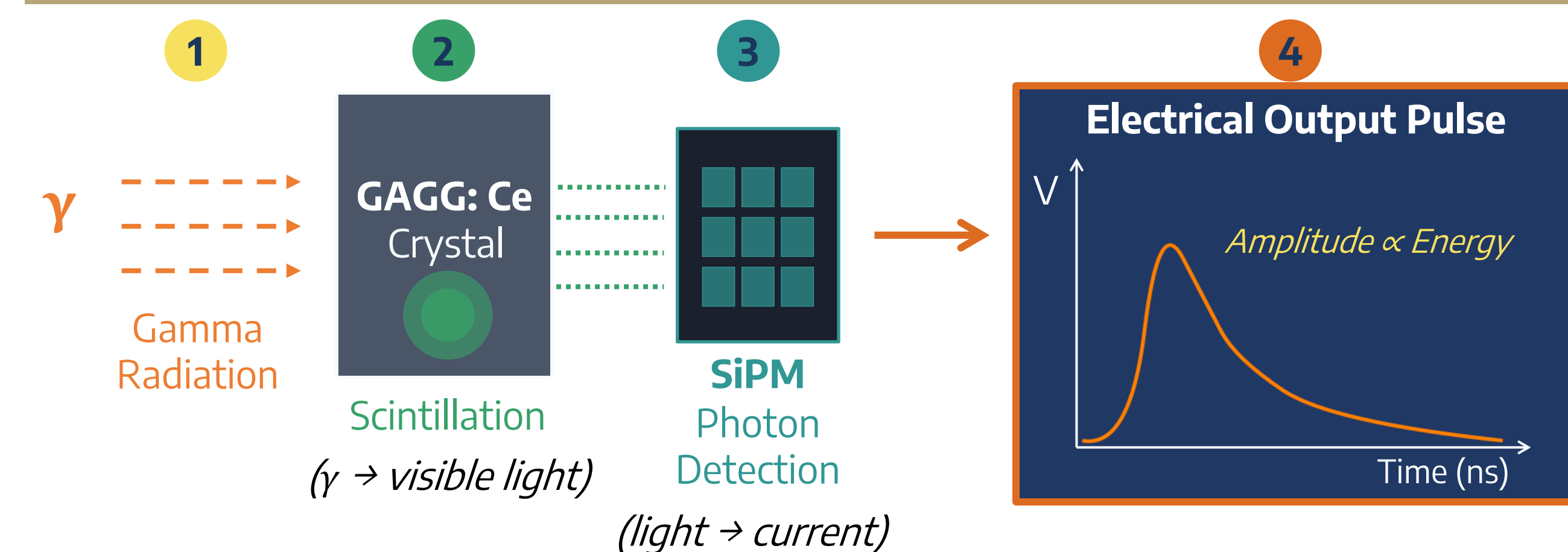


- ✓ Successfully resolved  $^{177}\text{Lu}$  photo peaks (**113 keV and 208 keV**) and  $^{22}\text{Na}$  annihilation photopeak (**511 keV**) — confirming spectroscopic capability across a wide energy range.
- ✓ Energy measurement achieved **without high-speed ADCs** — using only time-domain pulse width encoding.

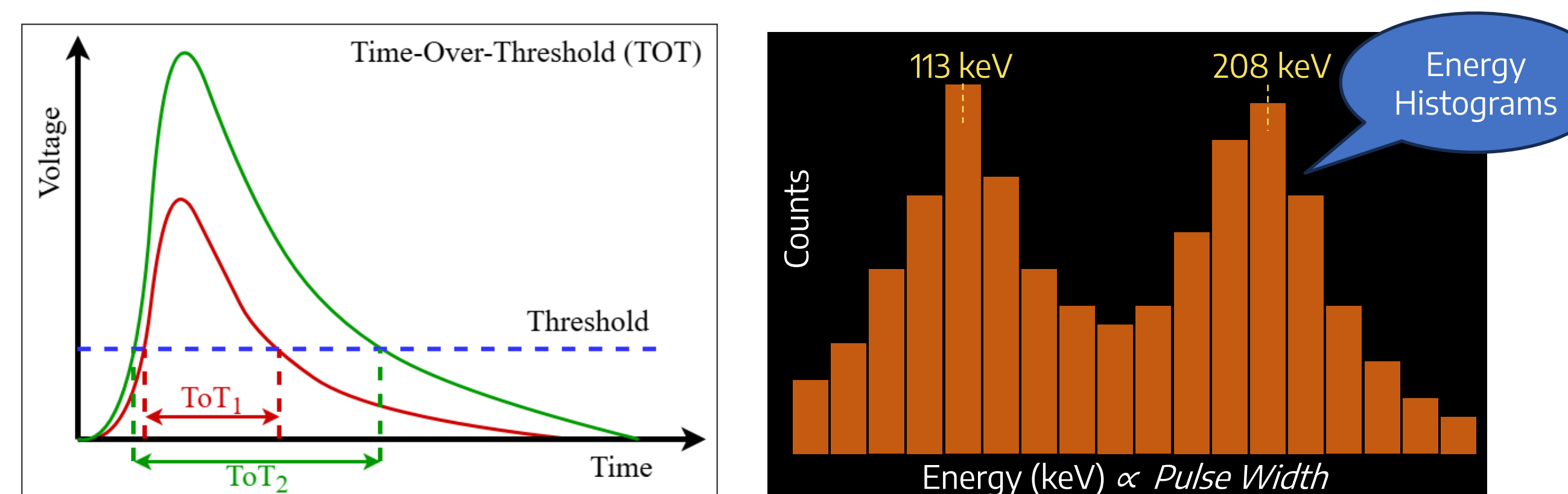
## FUTURE WORK

- ❑ **Real-time temperature compensation:** Apply bin-shifting corrections on the fly to compensate for SiPM gain variation with temperature.
- ❑ **Clinical validation:** Conduct patient trials with Lu-177 DOTATATE
- ❑ **2D imaging array:** Extend from the current 16-channel linear arrangement to a two-dimensional detector grid for spatial dose mapping and tumor dose heterogeneity assessment.

## RADIATION DETECTION MECHANISM

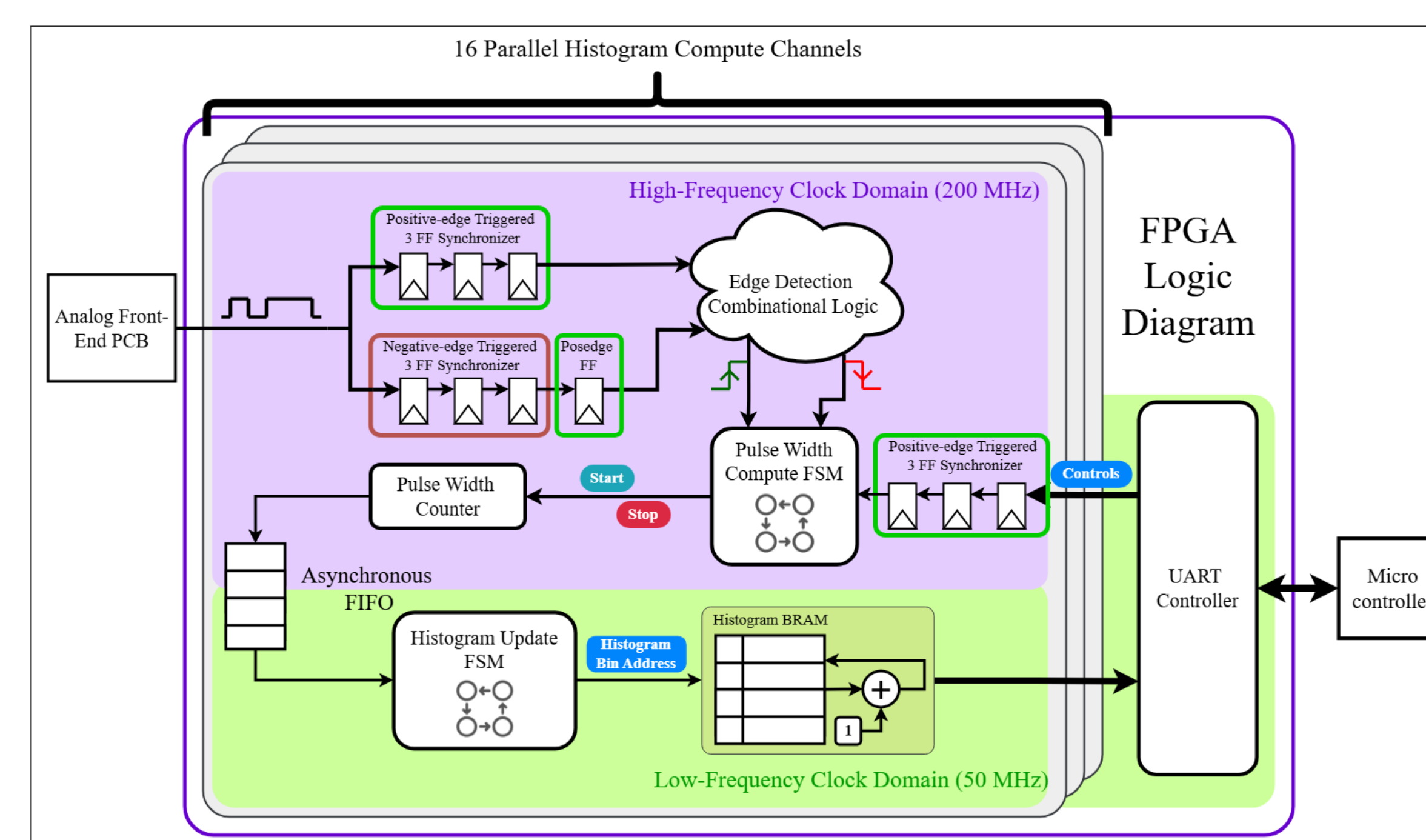


## ENERGY HISTOGRAMS – TIME-OVER-THRESHOLD



TOT approximates pulse amplitude, which is proportional to deposited gamma energy.

## FPGA LOGIC DIAGRAM – HISTOGRAM COMPUTATION



- ✓ Dual-edge sampling at 200 MHz achieves **2.5 ns** time binning (no 400 MHz clock needed)
- ✓ **512 energy bins** per channel, each storing up to 65,535 events
- ✓ Measures pulse widths from **2.5 ns to 1.28 μs**
- ✓ Full 16-channel histogram transfer to microcontroller in **just 1.5 seconds** over UART
- ✓ **Zero high-speed ADCs** — energy measured entirely through pulse width