

# DoseX as a Per-Pulse UHDR and Conventional Electrometer Compatible with Standard Clinical Probes

Austin Sloop, MS<sup>1</sup>; Rongxiao Zhang, PhD<sup>2</sup>; Petr Bruza, PhD<sup>1</sup>, David Gladstone, ScD<sup>1,3</sup>  
<sup>1</sup>Dartmouth Engineering, <sup>2</sup>University of Missouri School of Medicine, <sup>3</sup>Geisel School of Medicine

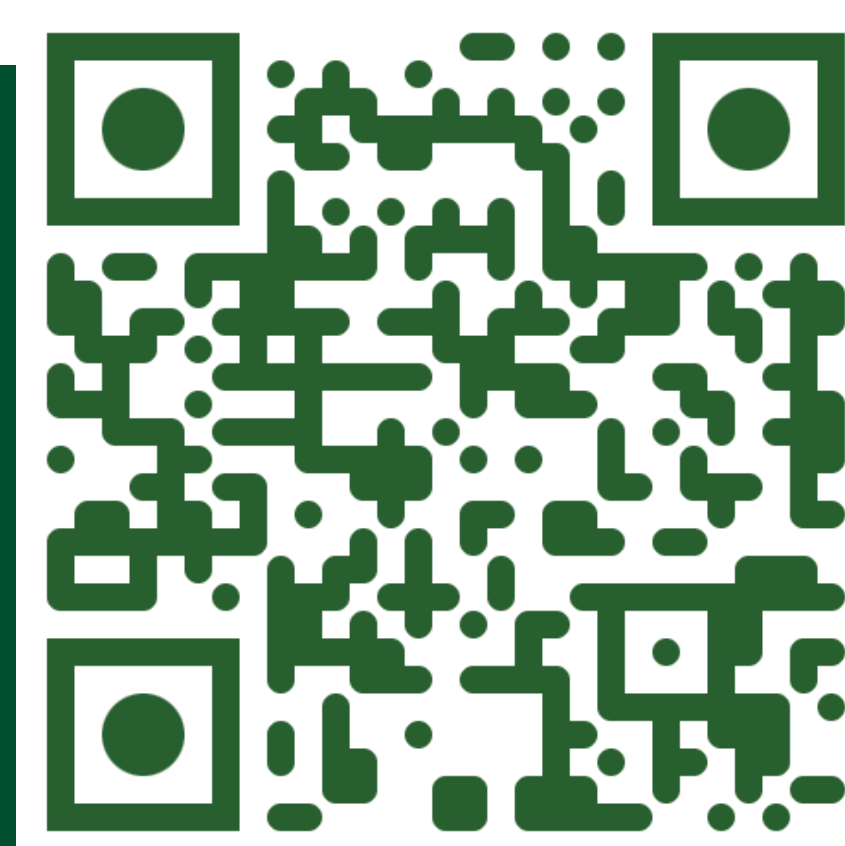
## ABSTRACT

UHDR Radiation Therapy has gained significant research traction as FLASH sparing has shown promise as a means to widen the therapeutic window in oncology treatments. Dosimetry remains as one of the largest challenges to robust experiential reporting, and per-pulse information is essential for both vital delivery parameters but also critical for in-vivo verification of radiation deliveries. Since UHDR-specialized probes are often expensive to procure with long manufacturing lead times, the DoseX aims to serve as a probe- and modality-agnostic electrometer to measure conventional and UHDR conditions with standard clinical probes.

## Methods:

Raw data internal to the electrometer was sampled through the device ethernet port. Pulse pile-up (Figure 1) was eliminated by fitting a series of exponential decays for each delivered pulse. This decay was characterized across numerous deliveries and per-pulse data was compared against validated BCT fluence and a per-pulse diode dosimeter<sup>(Rahmen 2023)</sup>. Radiation was delivered under a UHDR-Mobetron for 10-90Hz and 1.36-4.05  $\mu$ s pulses at varying SSDs.

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web site!



Austin Sloop  
Dartmouth College,  
Thayer School of Engineering

1 Medical Center Dr, Williamson 7-39,  
Lebanon NH 03756

Austin.M.Sloop.Th@Dartmouth.edu

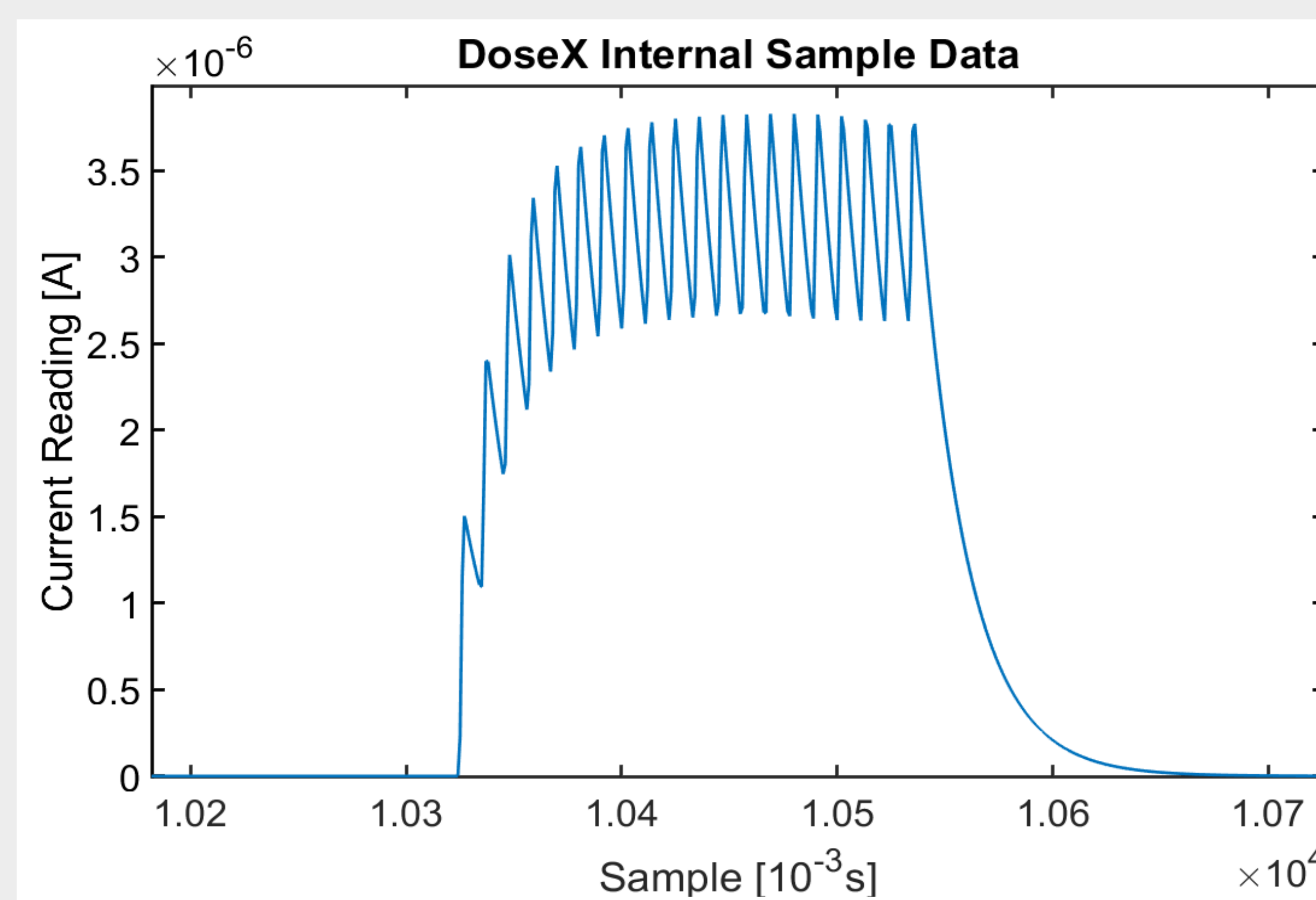
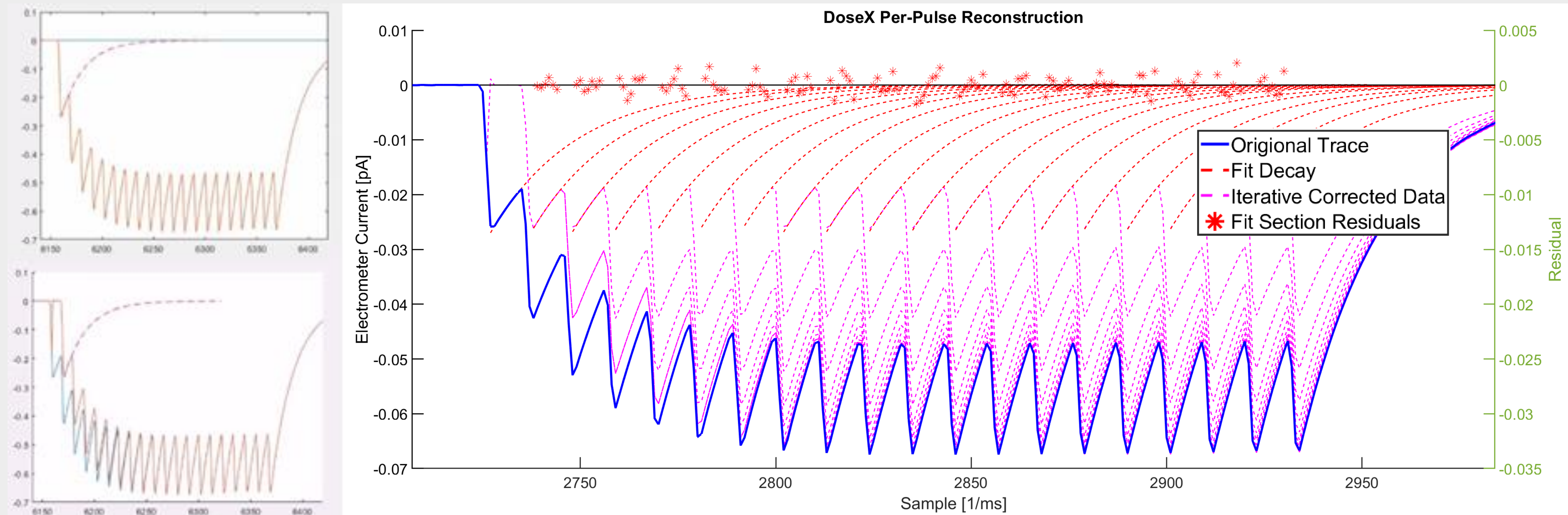
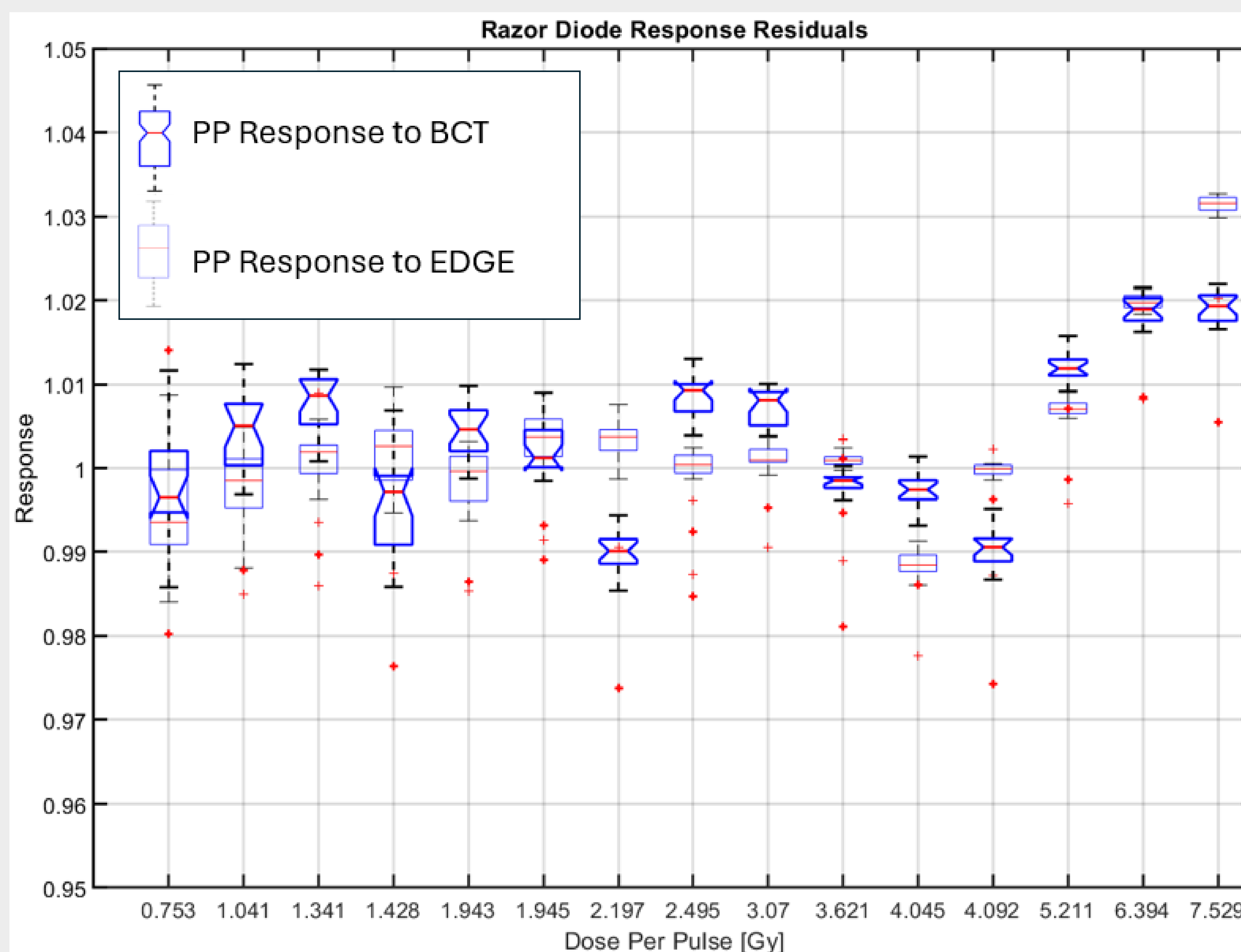
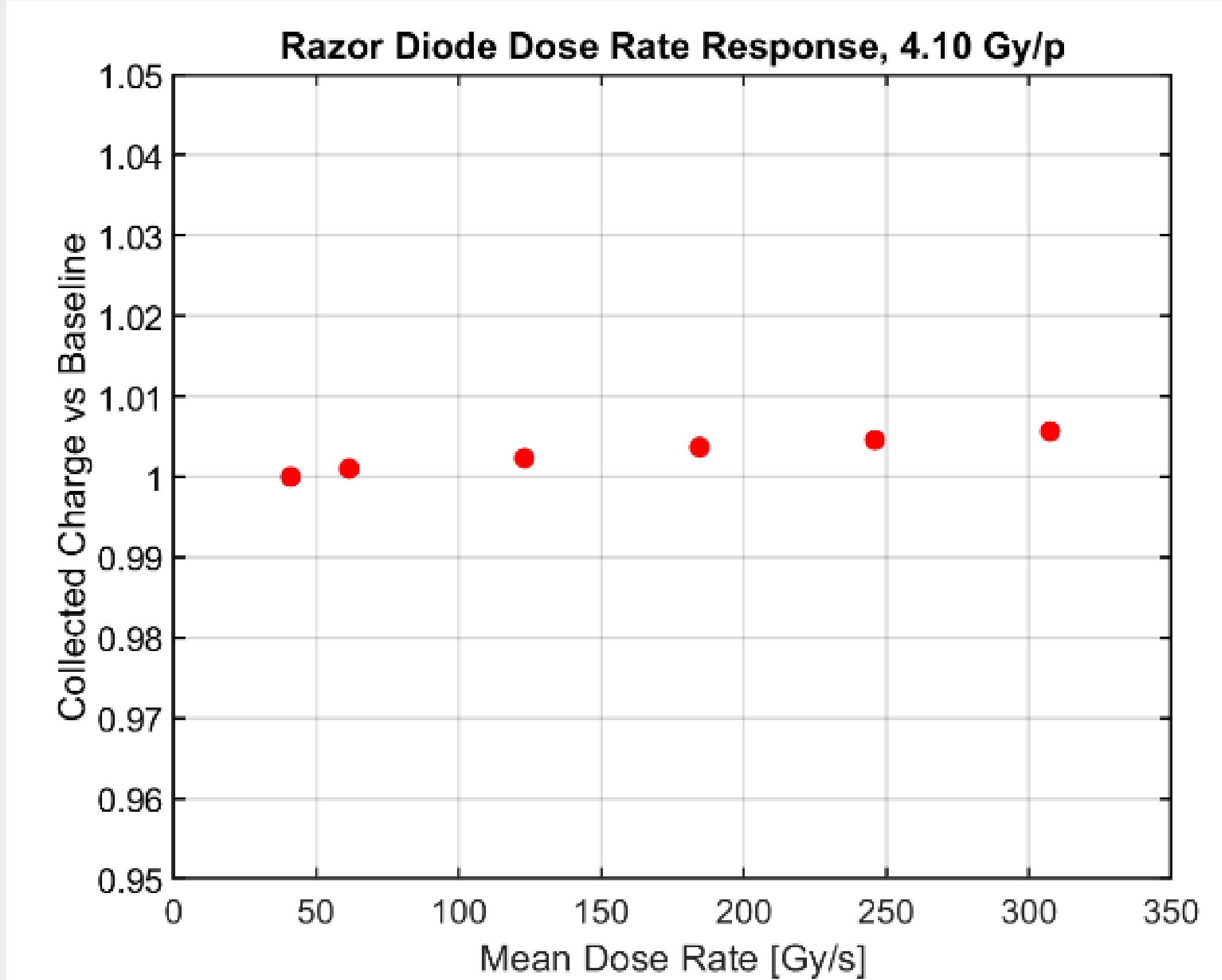


Figure 1: Raw data sampled at the electrometer ADC circuitry.

Iterative fits isolated each pulse, and the contribution was removed from the original signal. Fit residuals were a fraction of %, overall performance was  $\pm 1\%$  up to 4Gy/pulse. A slight over-response was seen for larger pulse magnitudes, but this may be intrinsic to the Razor diode. At 4 Gy/pulse, the response was independent of dose rate with linearities to  $<1\%$ .



## CONCLUSIONS

The DoseX electrometer was able to measure both UHDR and conventional fluences to sub-% accuracies for pulses up to 4 Gray. Response was independent of dose rate and only showed minor over-responses at large Dpp. Accurate per-pulse data is essential for validating LINAC performance and verifying realized Dpp and DR in in-vivo settings.

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