

Study of gain of LGAD

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1/31/2024



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Gain Characterization

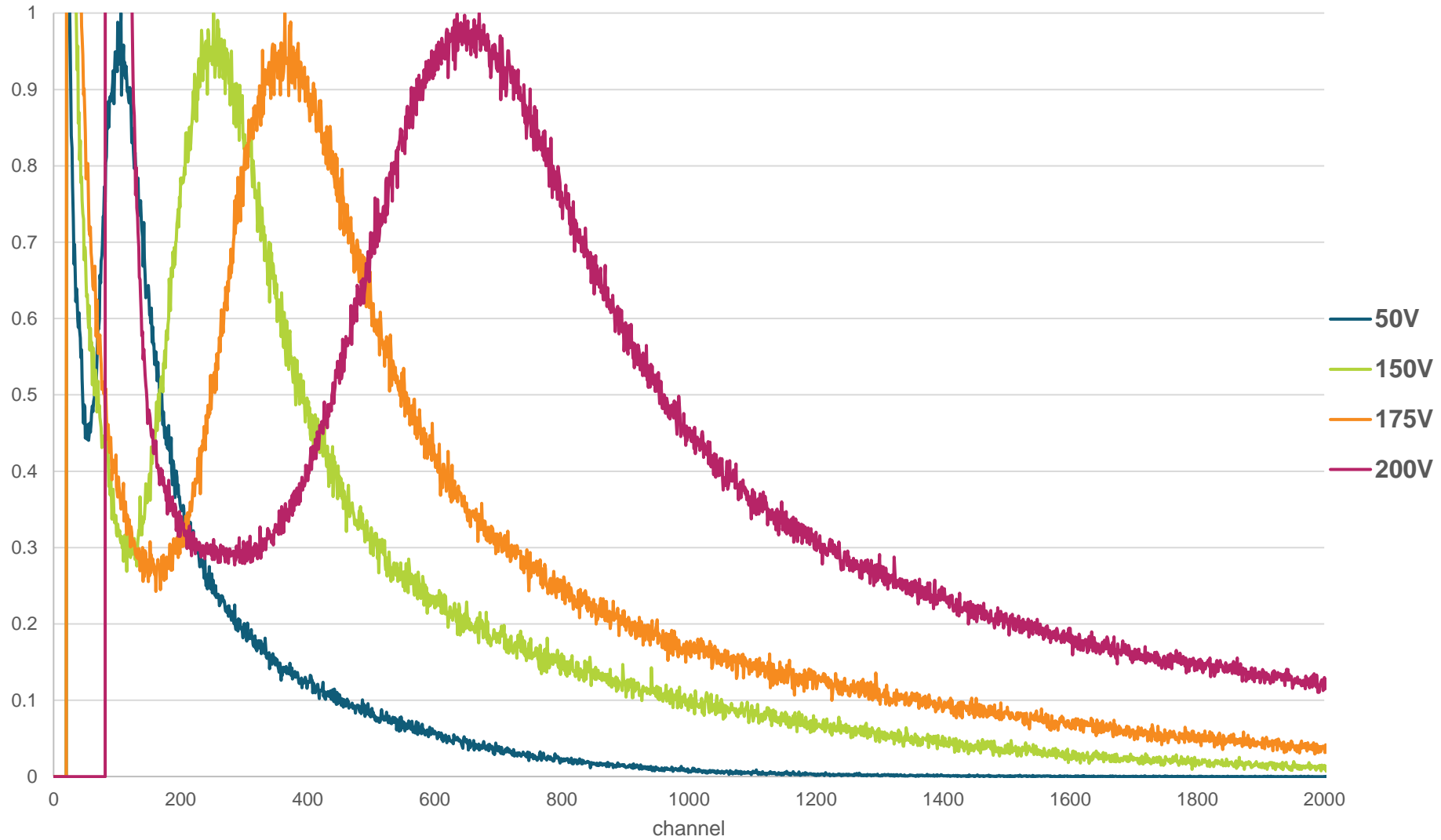
Use of a low-noise Charge Sensitive pre-amplifier (Amptek A250) to determine the gain of several families of LGADs exposed to different radiation sources (^{90}Sr , ^{241}Am , ^{55}Fe , Alphas).

In this presentation, OLD BNL LGAD (shallow gain implant), new BNL LGAD (deeper implant), HPK (deep gain implant) - we submitted a paper on NIM (soon on arxiv.org)

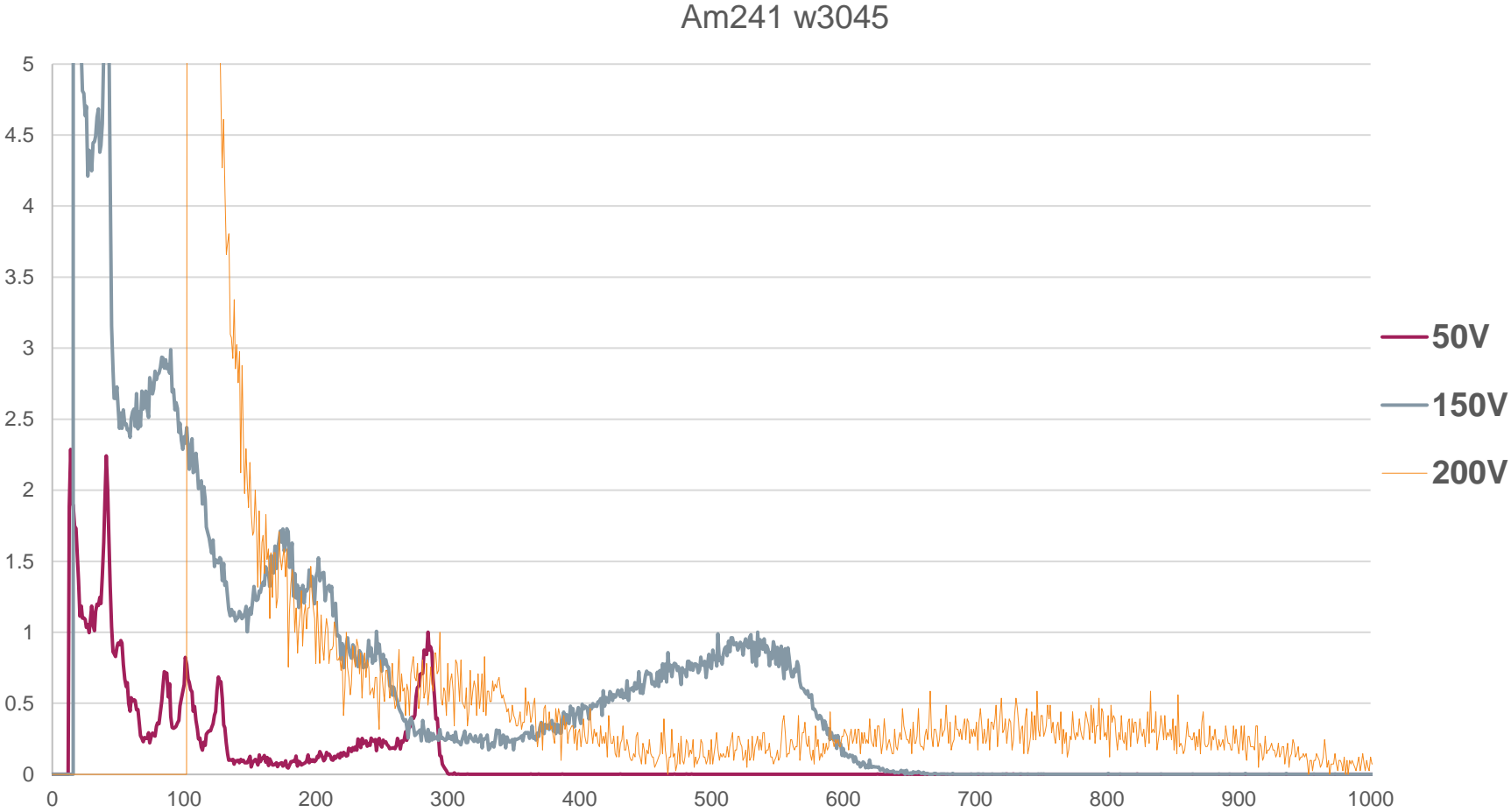
All BNL fabricated LGAD/AC-LGAD will undergo the same tests.

Betas from ^{90}Sr

BNL 3045 - Sr - PX5 Gain = 5

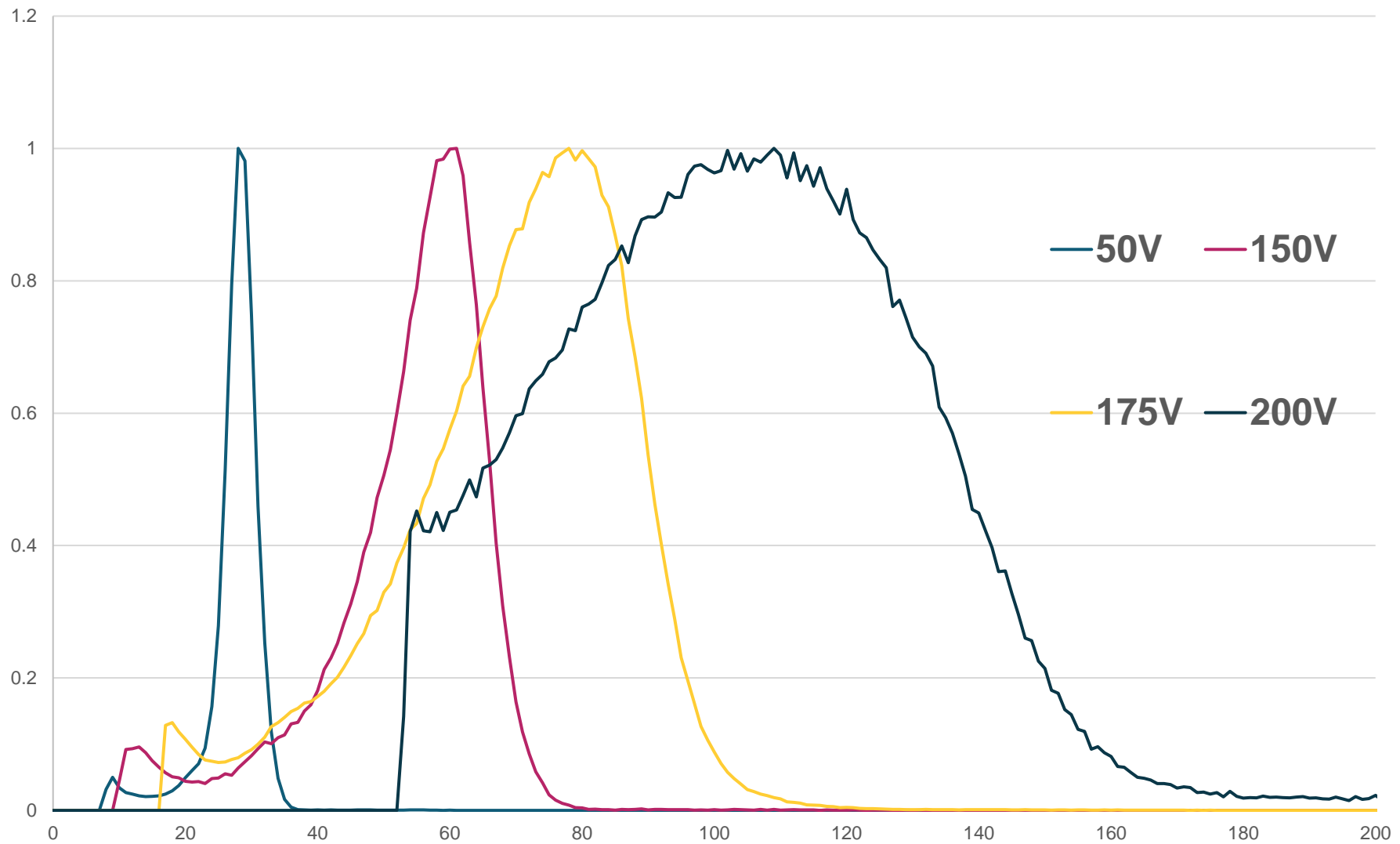


Gamma rays from ^{241}Am



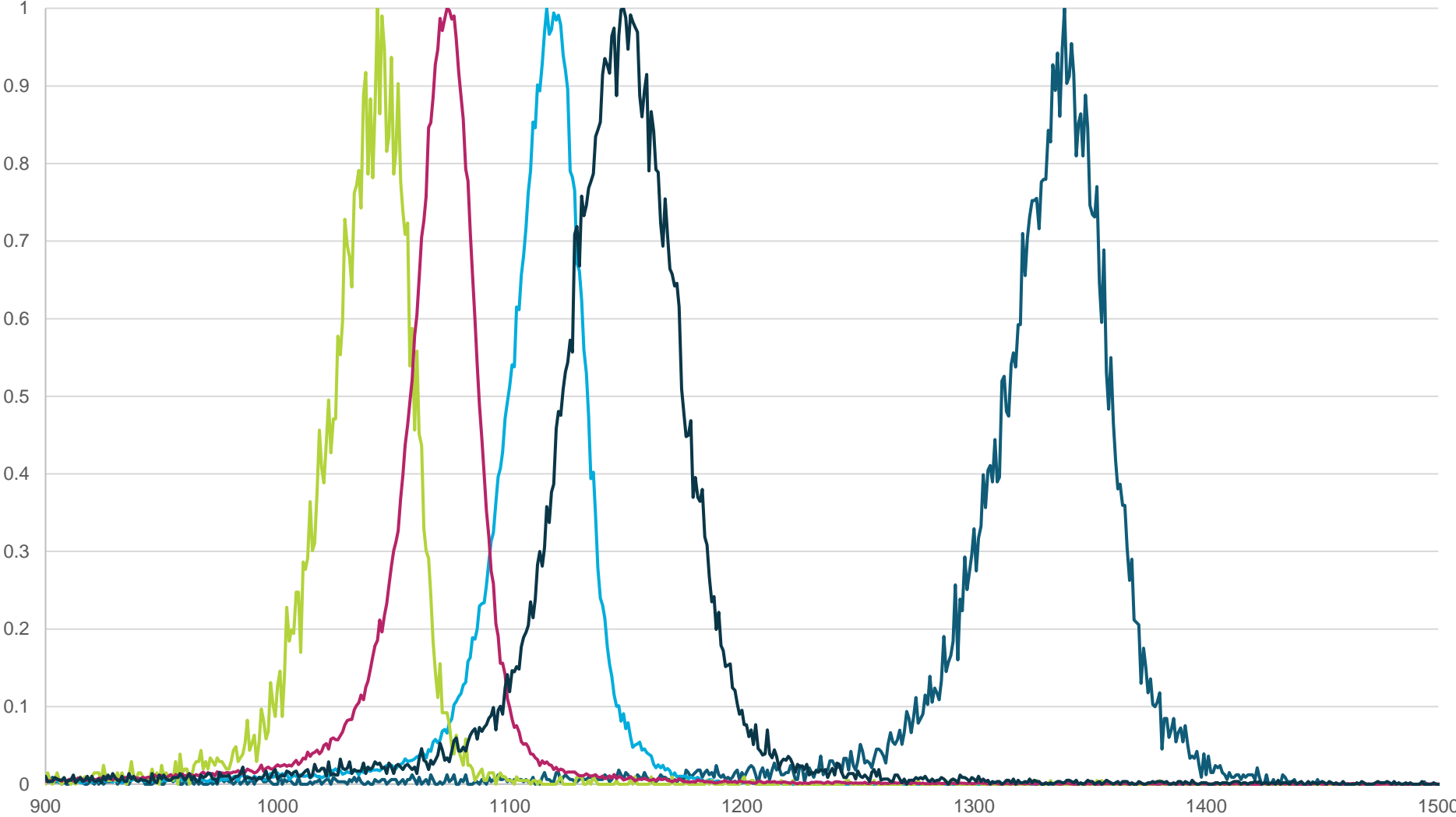
X rays from ^{55}Fe

Fe 55 - w3045



Alphas from ^{241}Am

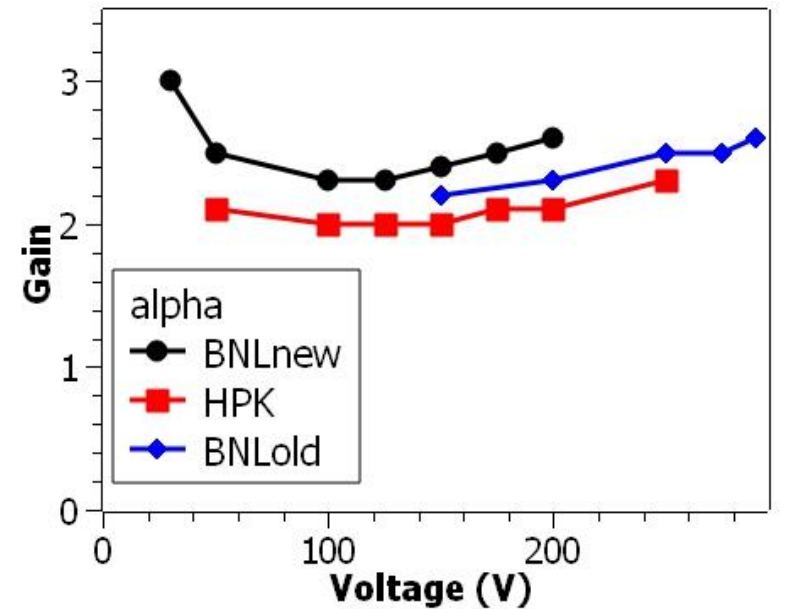
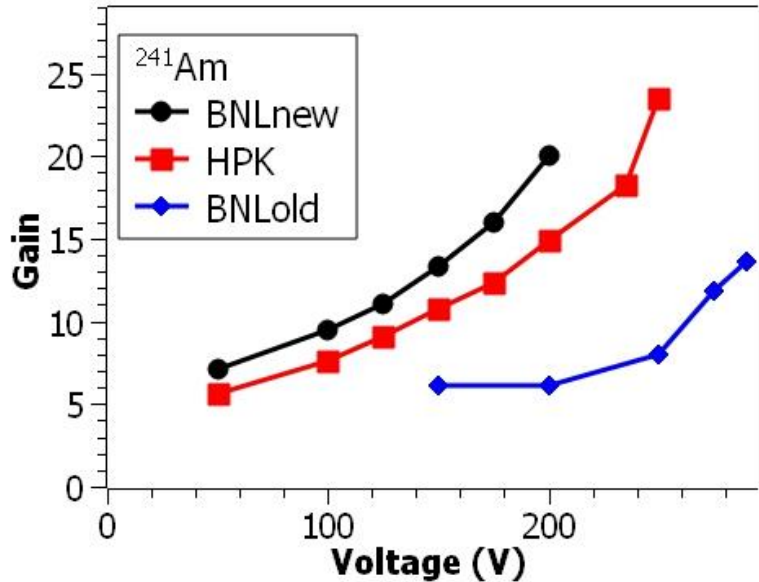
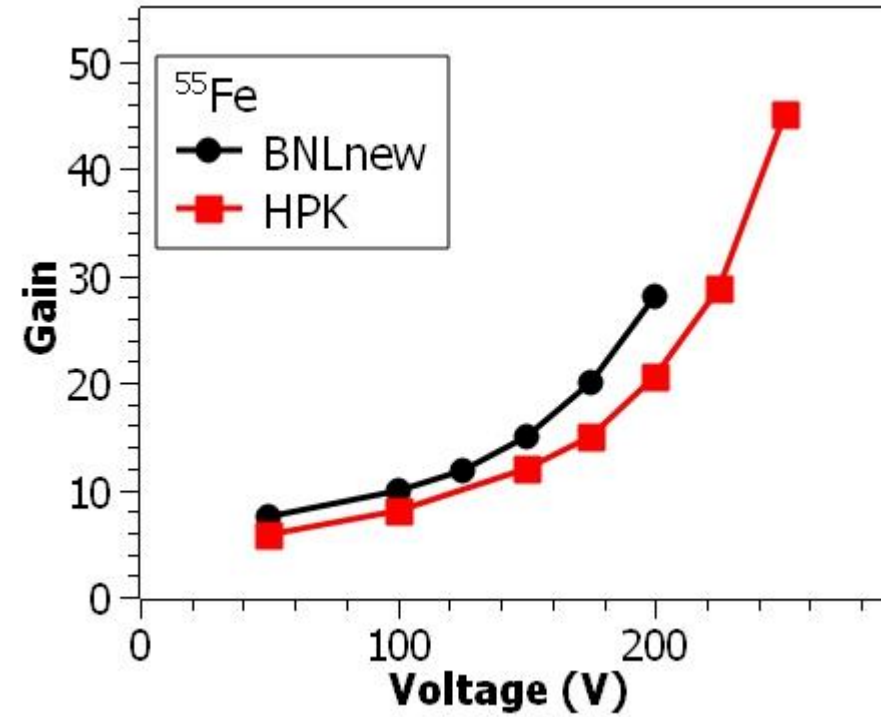
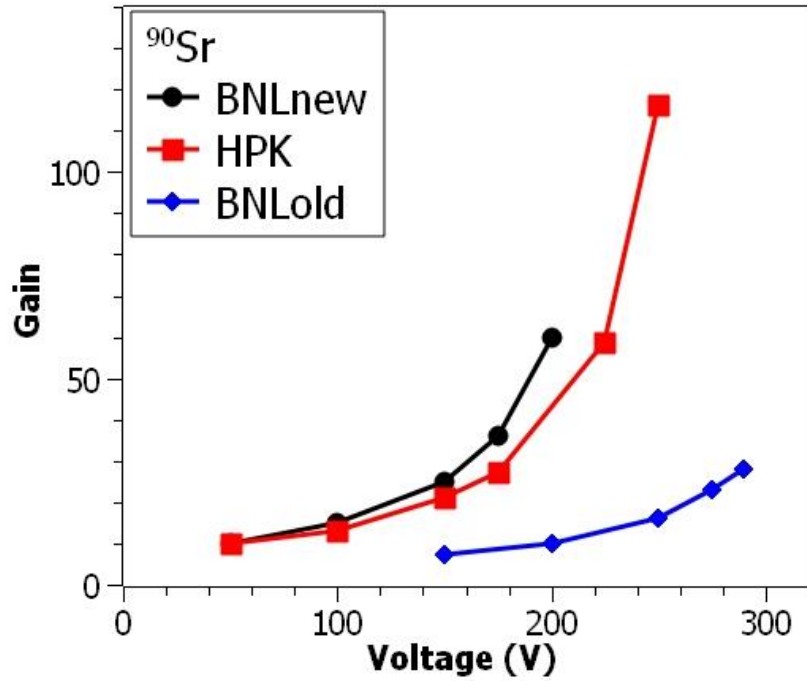
alpha w3045



Gain

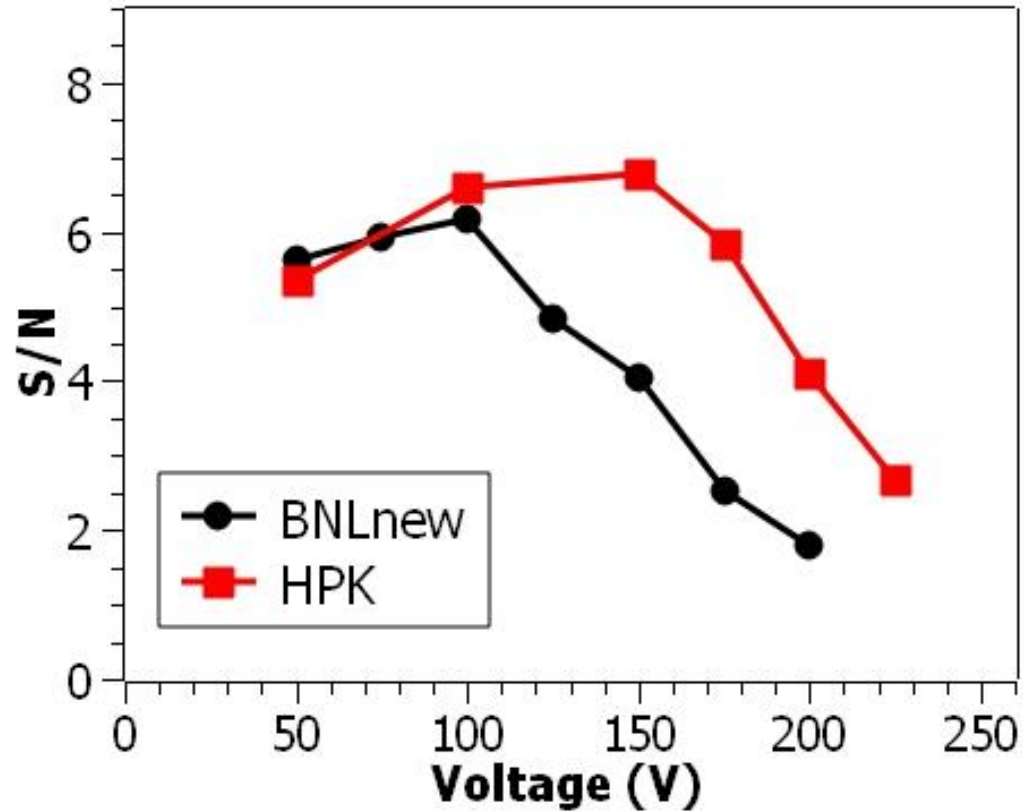
Easy calibration with PIN diode or with C_{inj} (2.1pF)

Max gain for betas: effects of charge cloud shape clearly visible

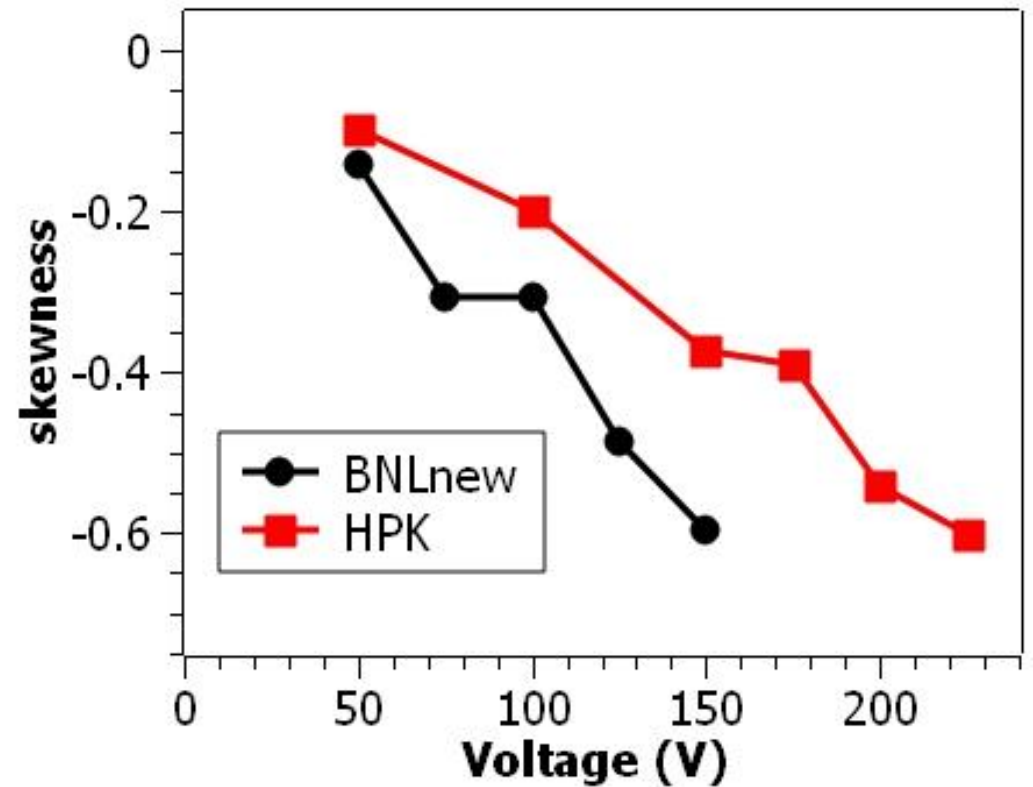


Spectroscopic parameters (^{55}Fe)

Multiplication noise dominant at higher gains



Low-gain shoulder in spectra



Laser Tests

Searching for effects of gain saturation in LGADs hit by laser

- scan in laser threshold
- Scan in voltage
- Diode and LGAD coming from same wafer
- FNAL board

Mip generates charge along small radius track and instantaneously

vs

Laser focused at 15um and signal ~350ps long at high threshold (longer at lower threshold).

→ Laser track is order of magnitudes less dense.

Still, interesting to see saturation effects with laser injection.

A lot of data acquired so far, still interpreting them.

Much more soon.