UF/PNPI GE1/1 HV prototype tests

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Prototype testing

Tests with real GEM chambers last week

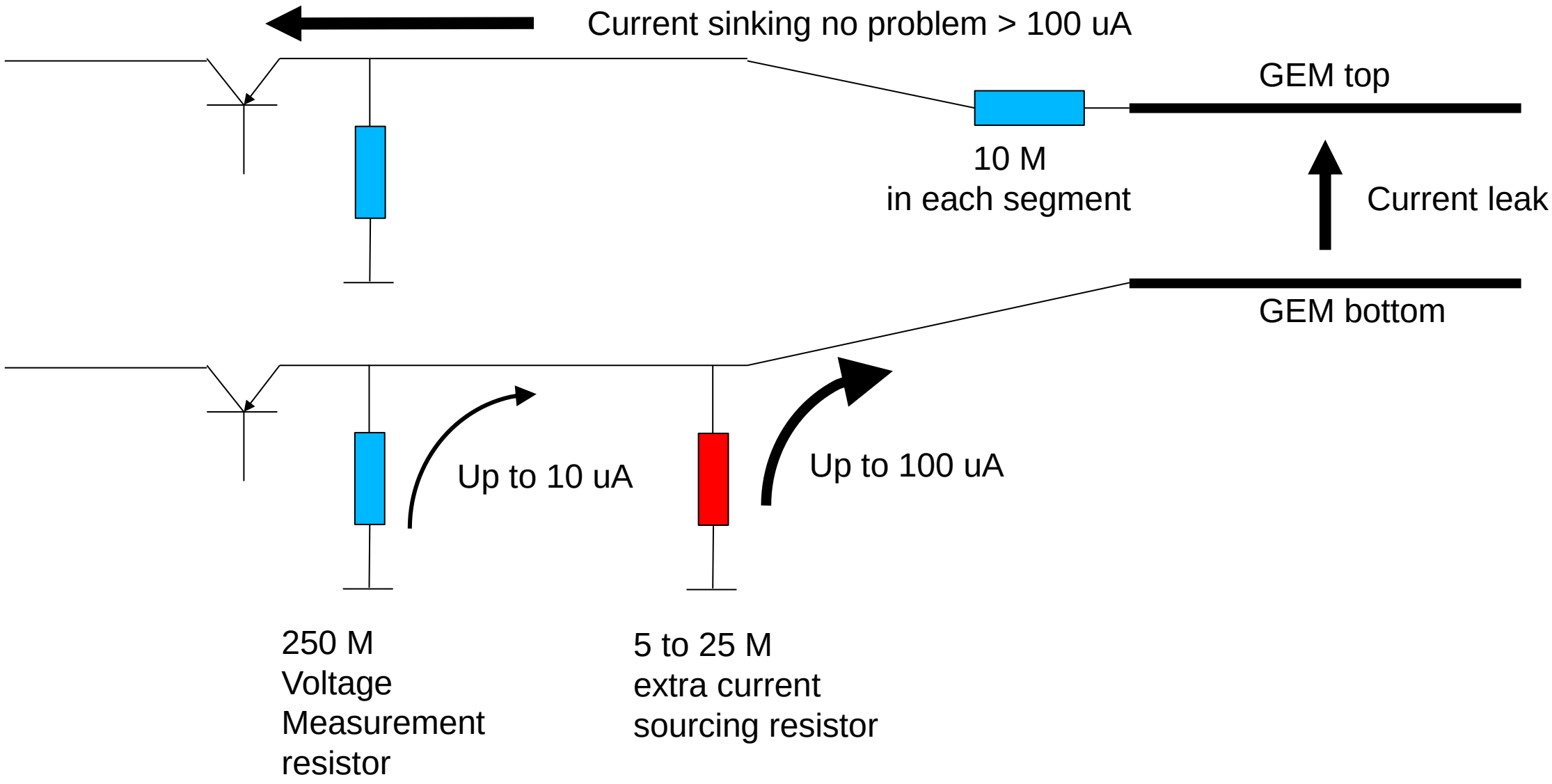
Chamber	Tests with regular resistive divider and CAEN PS	Tests with UF/PNPI prototype
Small 10x10 cm prototype	Sparks	--
GE1/1-V3-2	Works OK	Leakage currents: GEM1: 0.2 uA GEM2: 0.3 uA GEM3: **38 uA** Chamber still works OK
GE1/1-V3-??	Sparks	--

All further tests done with GE1/1-V3-2 chamber (with current leaks)

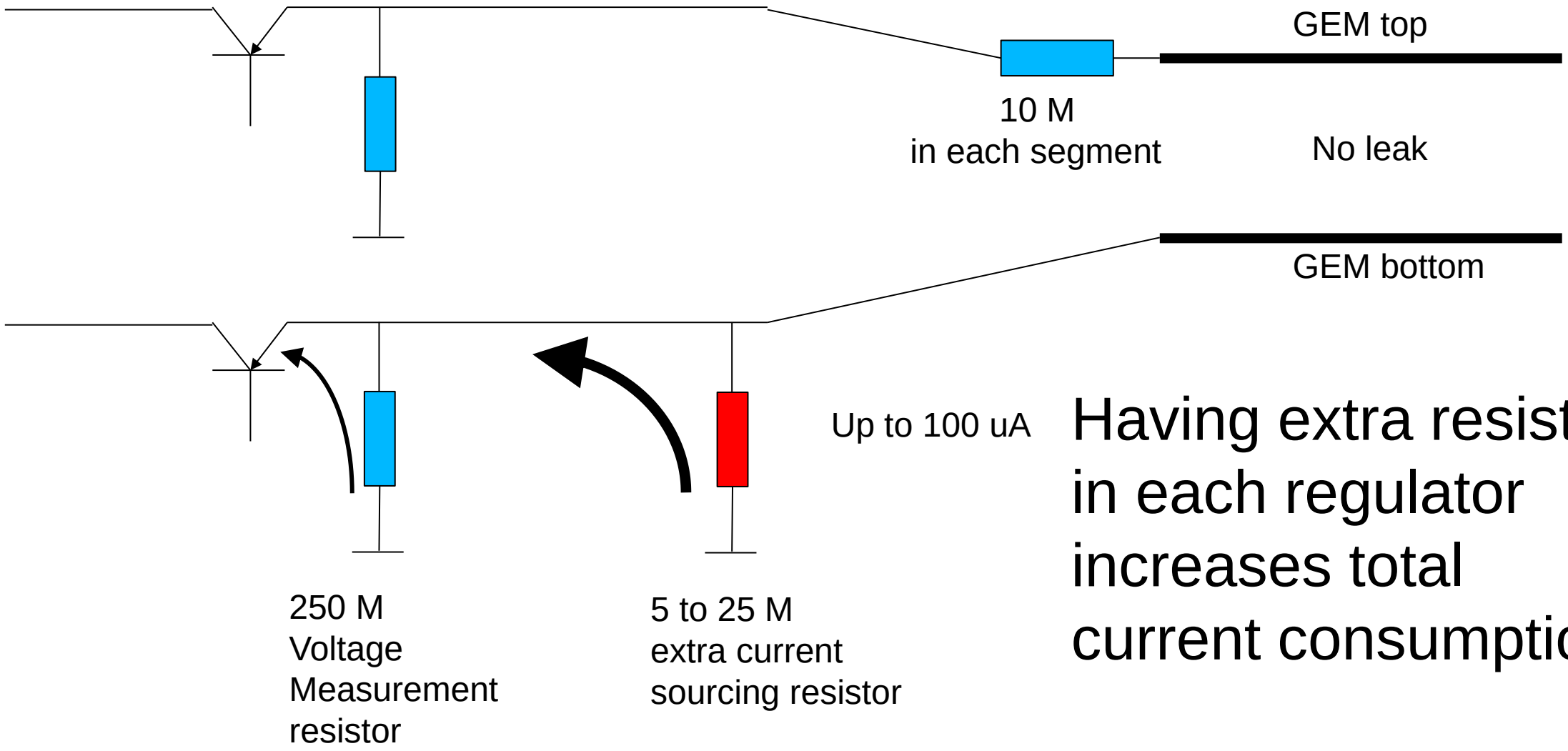
Tests with GE1/1-V3-2 chamber

- Chamber has significant current leak in GEM3
  - 38 uA
  - Leak from GEM3 Top to GEM3 Bottom foil
  - GEM2 Top regulator must sink 38 uA
  - GEM3 Bottom regulator must source 38 uA
- Our regulators can easily sink that current (and more), but
  - Cannot source a current so large
  - Maximum source currents at this time: up to 10 uA
- Small modification is implemented on GEM3 bottom regulator
  - Extra resistor to ground, to improve current sourcing
  - Voltage on GEM3 is adjusted to compensate for voltage drop on HV filter resistors
- Chamber works as expected even with large current leak
- For reference:
  - Standard resistive divider drops GEM3 voltage by ~17 volts because of that leak

Voltage regulators and GEM segment leaks



Voltage regulators and GEM segment leaks



Having extra resistors in each regulator increases total current consumption

Voltage regulators and GEM segment leaks

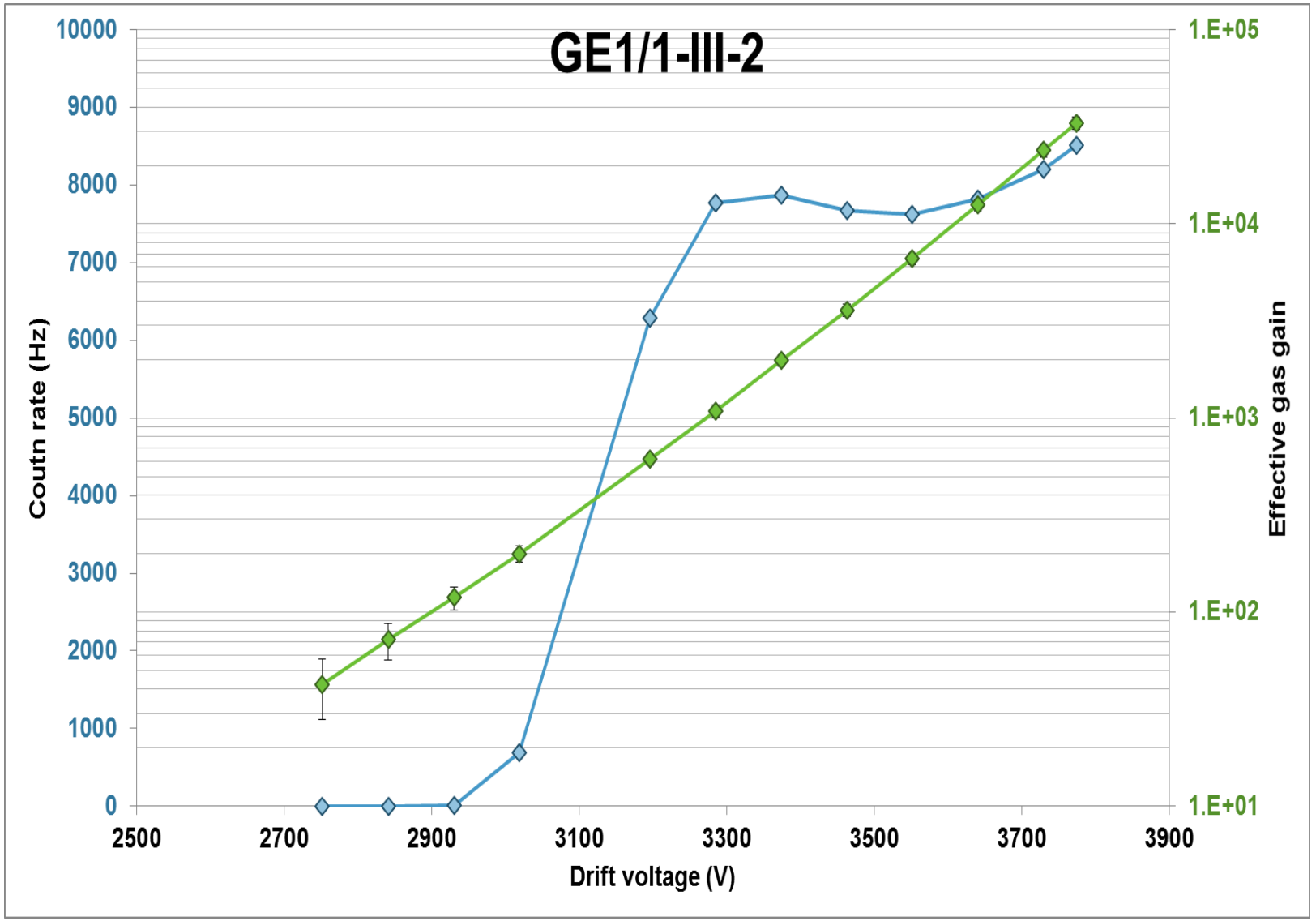
- If extra resistors are added to all GEM bottom regulators
  - 144 chambers in GE1/1
  - 3 high-current channels in each
  - ~173W of extra power!
- Makes Master boards more expensive
- Requires bigger primary power supplies

- Proposed solution at this time:
  - When a large GEM leak is identified:
    - Replace normal regulator with “extra-sourcing” regulator
  - Operation takes a few minutes
  - Can be done during numerous short technical stops during LHC operation

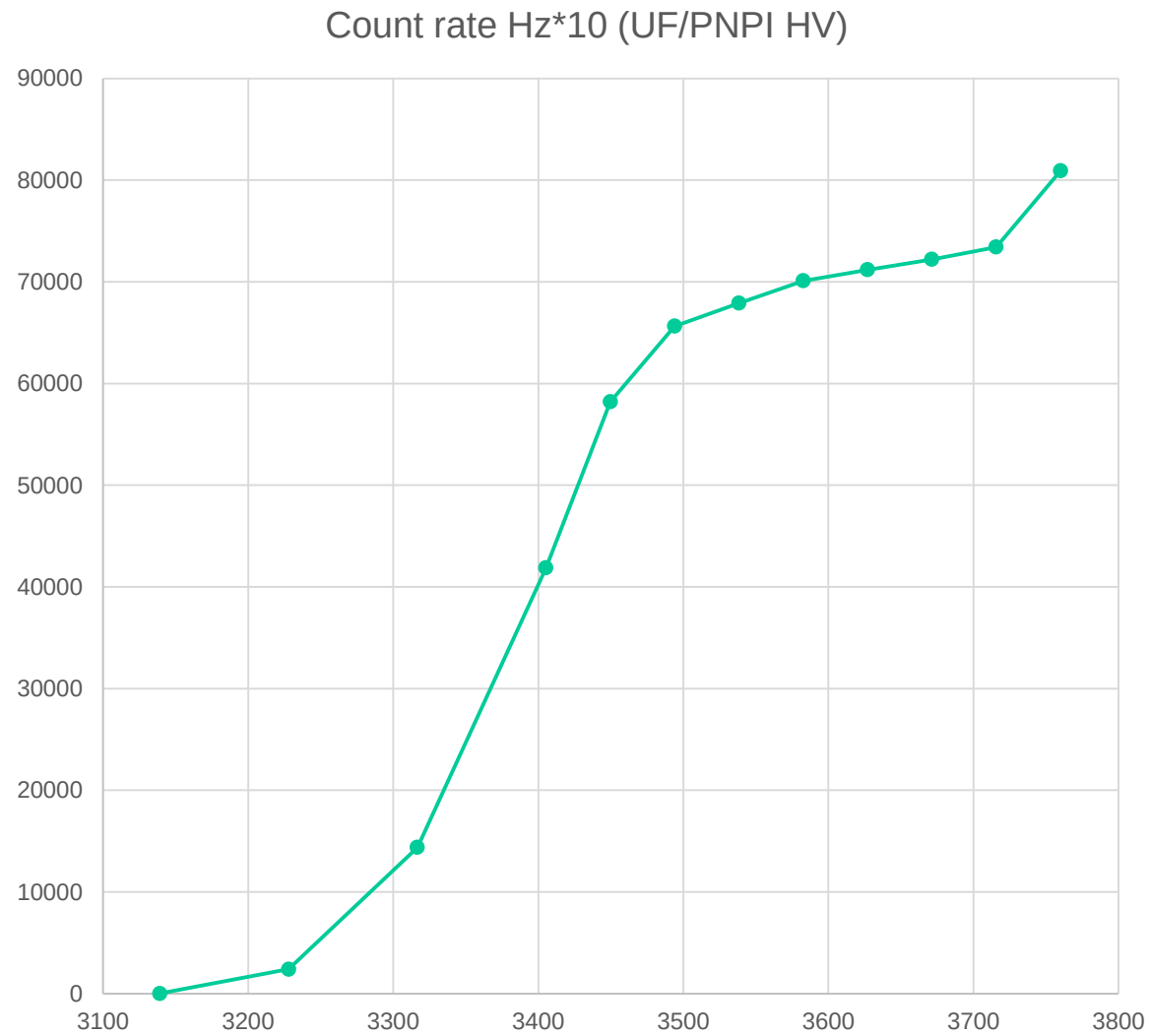
- We are exploring a possibility of a more elegant solution

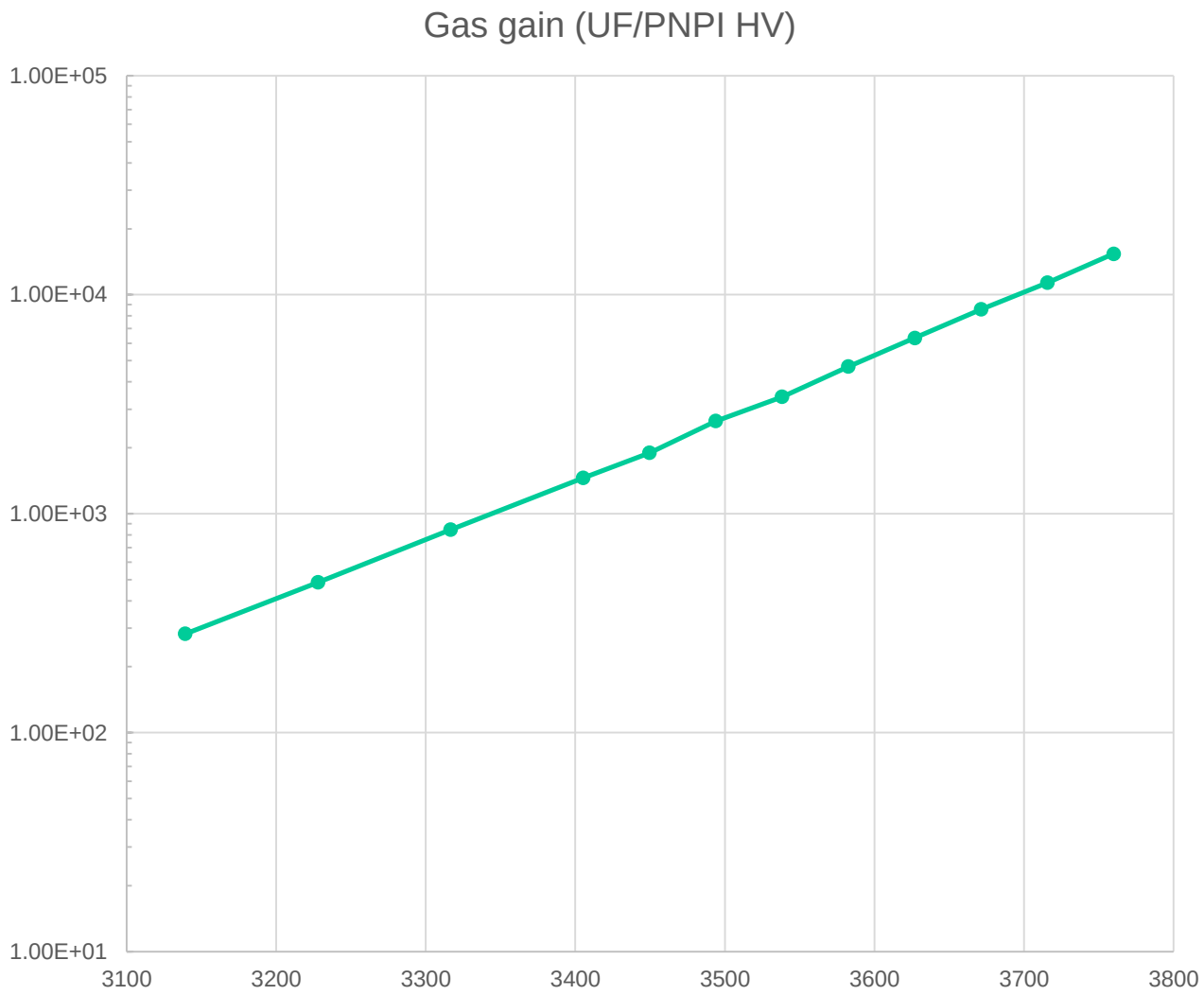
Reference plot

- Received from Alejandro
  - Gas gain
  - Particle counts with X-ray
- Taken with resistive divider and CAEN HVPS



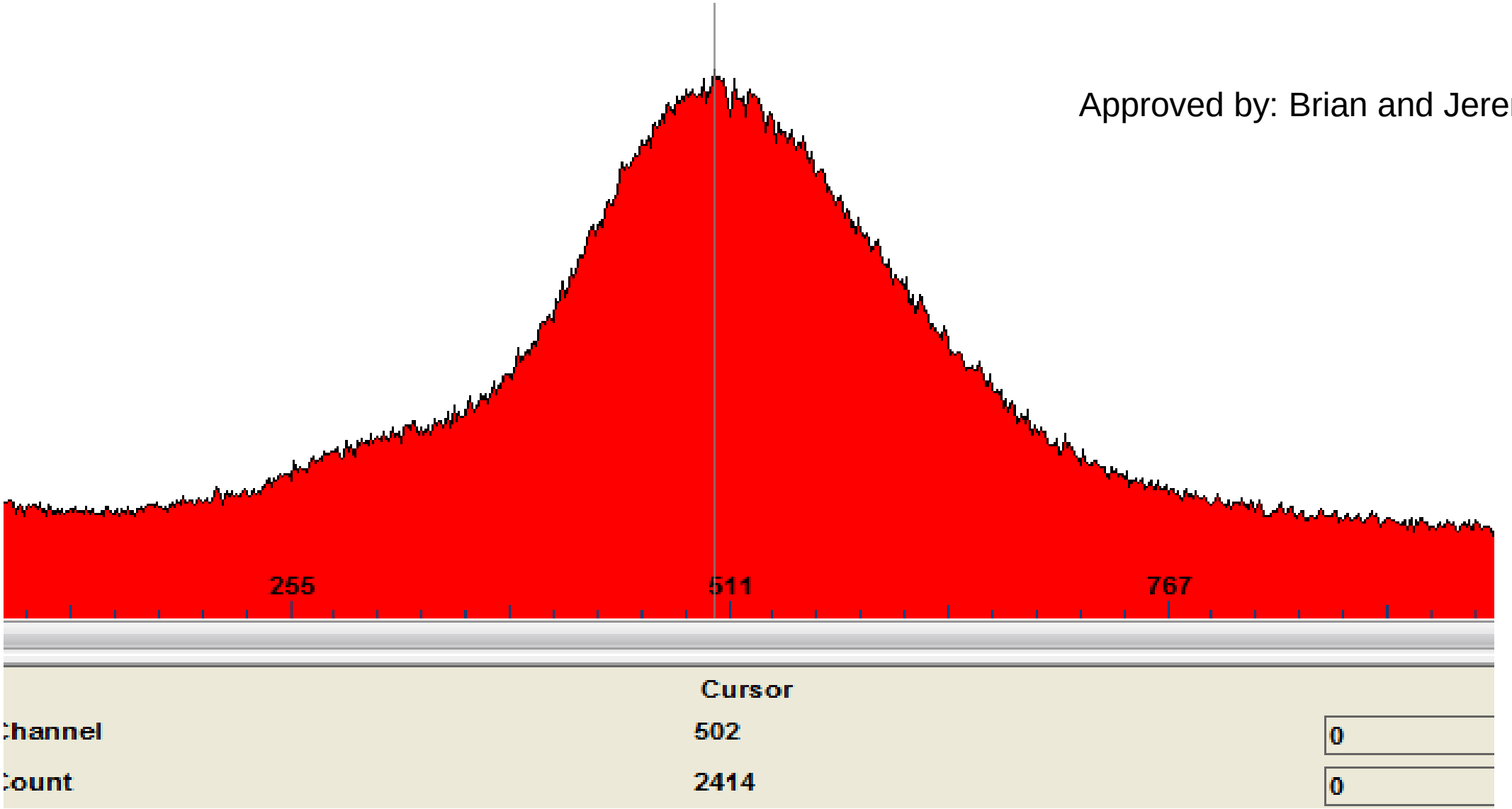
Plots with UF/PNPI HV PS





MCA plot

Approved by: Brian and Jeremie



Conclusions

- UF/PNPI prototype passed all preliminary tests
- Ready for beam test
- Moving equipment to GIF today

- Thanks to: Alejandro, Brian, Jeremie