

SBS GEM preparations during GEn

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On behalf of the GEM team

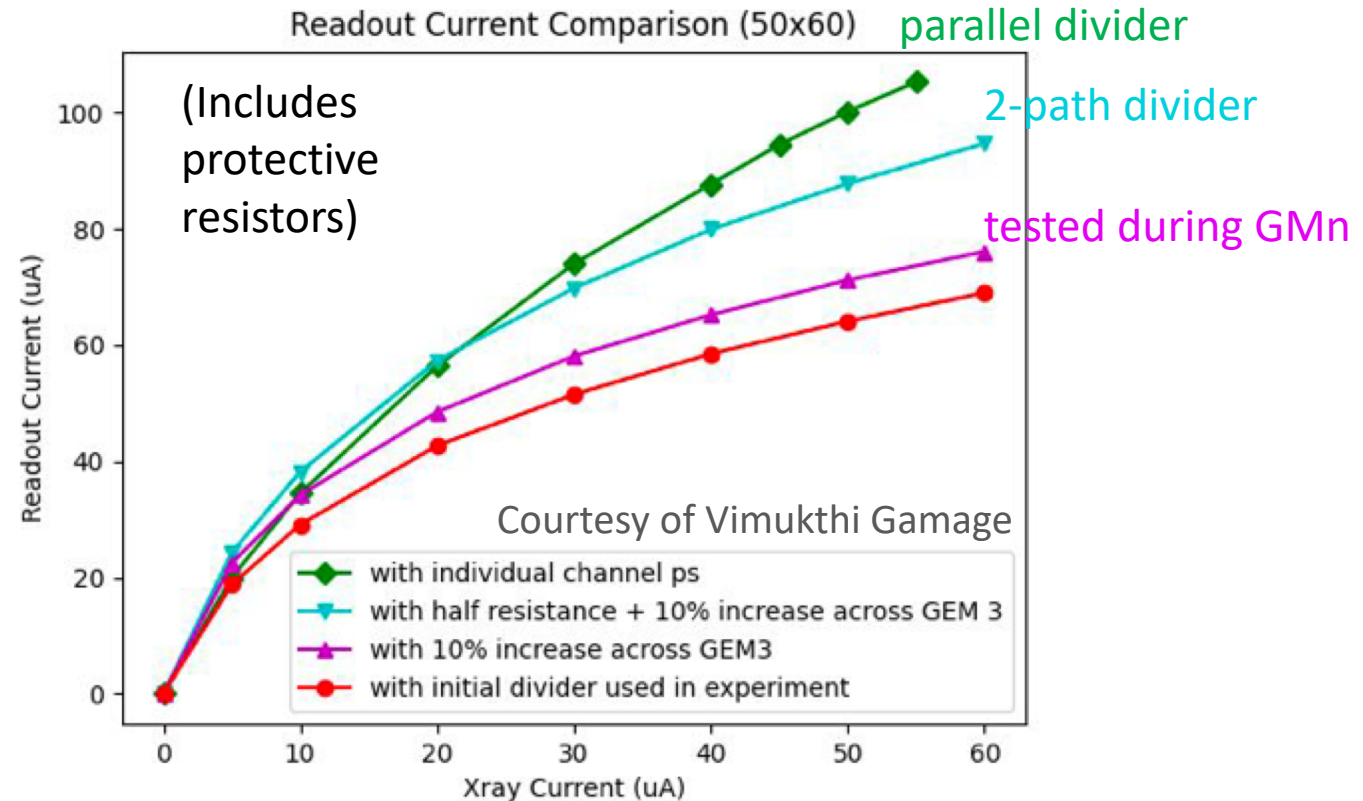
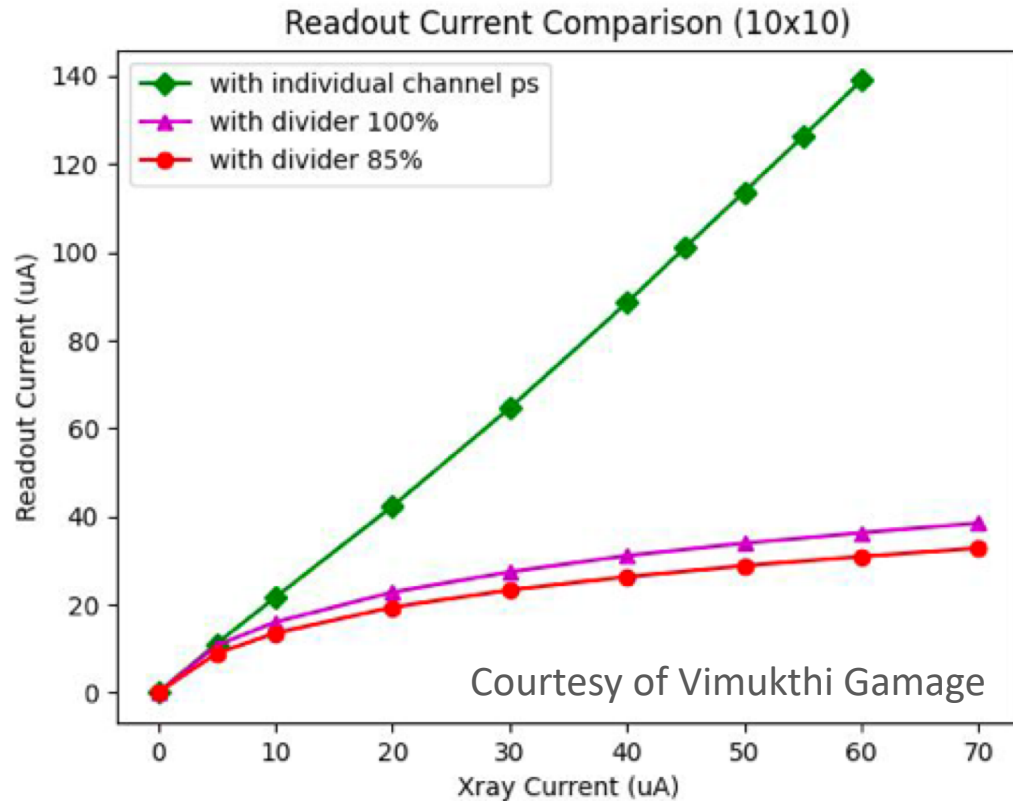
Jefferson Lab

Hall A Collaboration Meeting

27 Jan 2023

GEM HV divider issues discovered during GMn

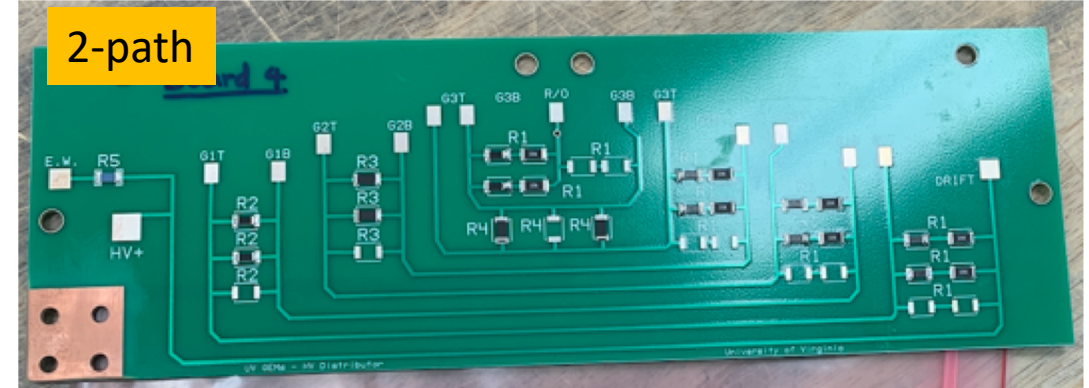
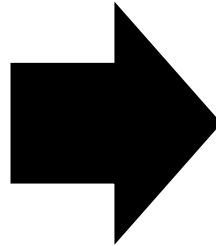
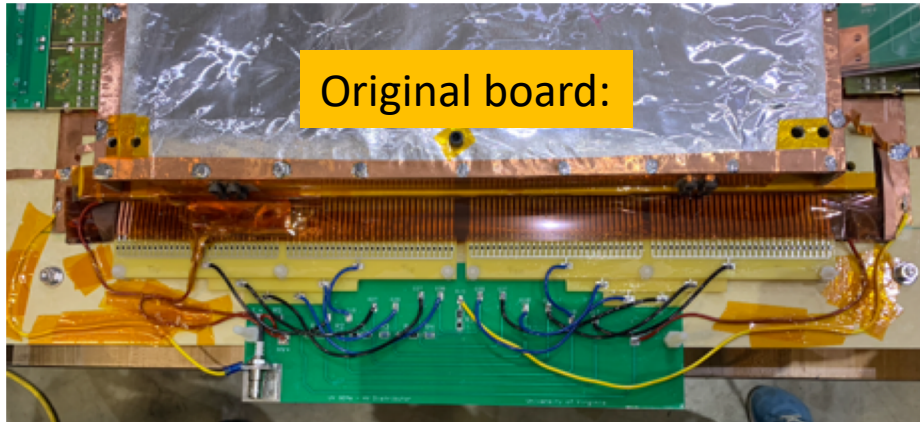
- Observed a loss of tracking efficiency that was correlated with occupancy due to the HV divider configuration
- Observed a non-linear increase in the current draw with the occupancy (replicated in lab in red curves below) due to inefficiencies related to the divider



BigBite GEMs testing different HV divider configuration

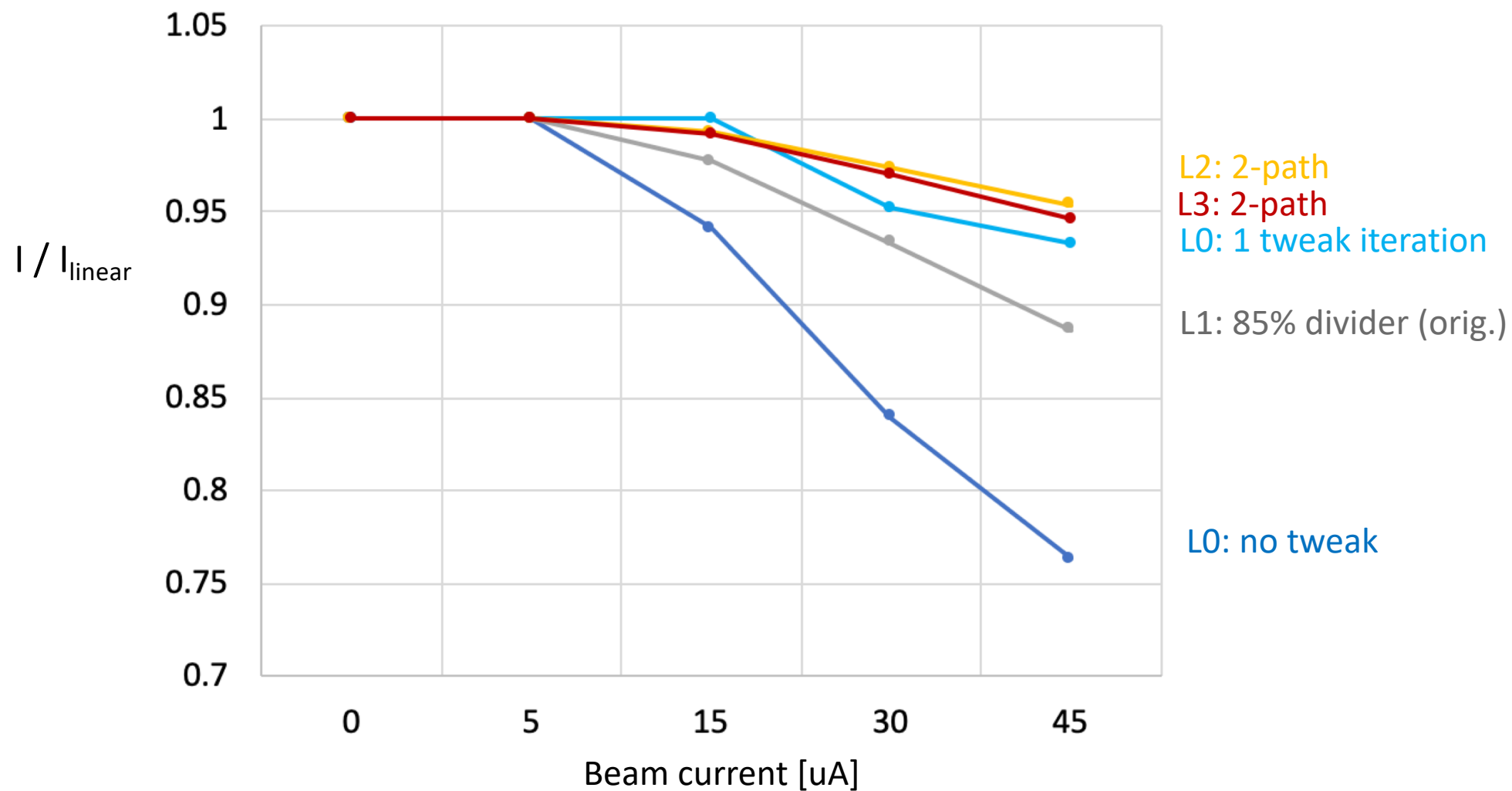
Upgraded the HV dividers for tracking layers 1, 3, and 4:

- Layer 1 is outfitted with a parallel-path (resistors removed) divider
- Layers 3 and 4 currently have a 2-path (2 resistors) divider installed



- Have power supplies to supply 7 GEM modules (parallel)
- March 2023, will equip the 4 UV BB layers and 3 XY modules
- All remaining modules will have 2-path dividers

Initial performance in beam



Installation of the inline GEMs into Hall A

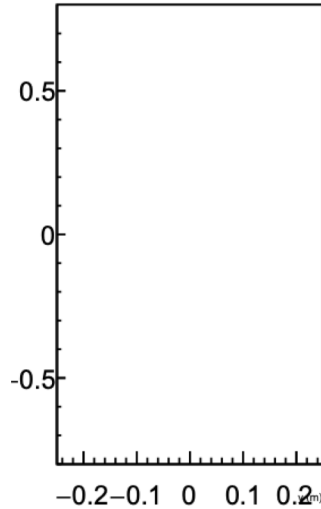
8 inline GEMs: 1st 2 layers are INFN, 6 subsequent layers are XY



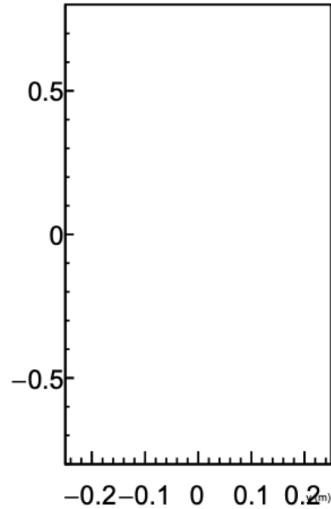
General SBS GEM performance

Summary Plots(Run #1998) 46: Layer hit maps on good tracks

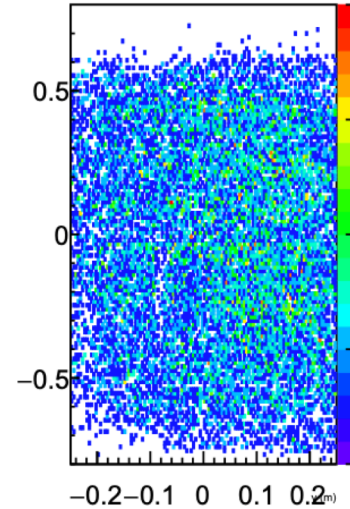
Layer 0



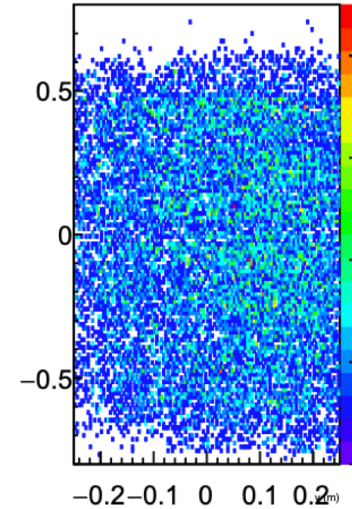
Layer 1



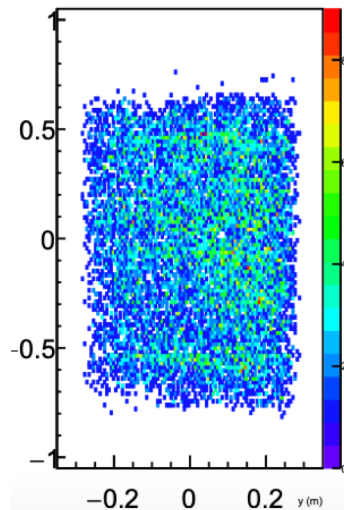
Layer 2



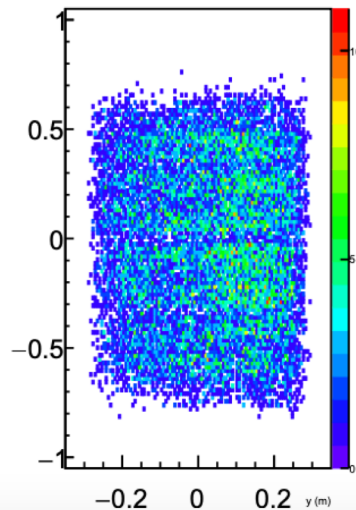
Layer 3



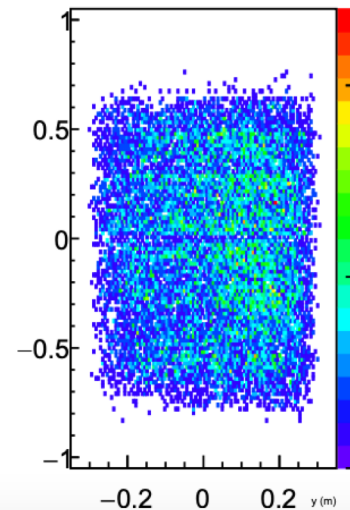
Layer 4



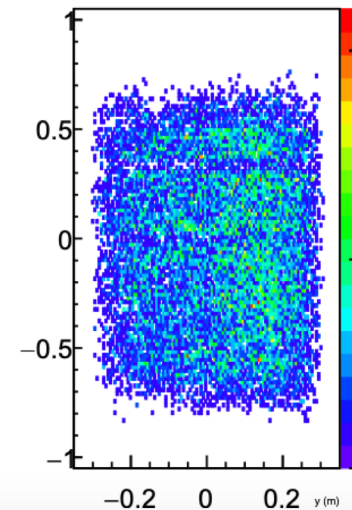
Layer 5



Layer 6



Layer 7

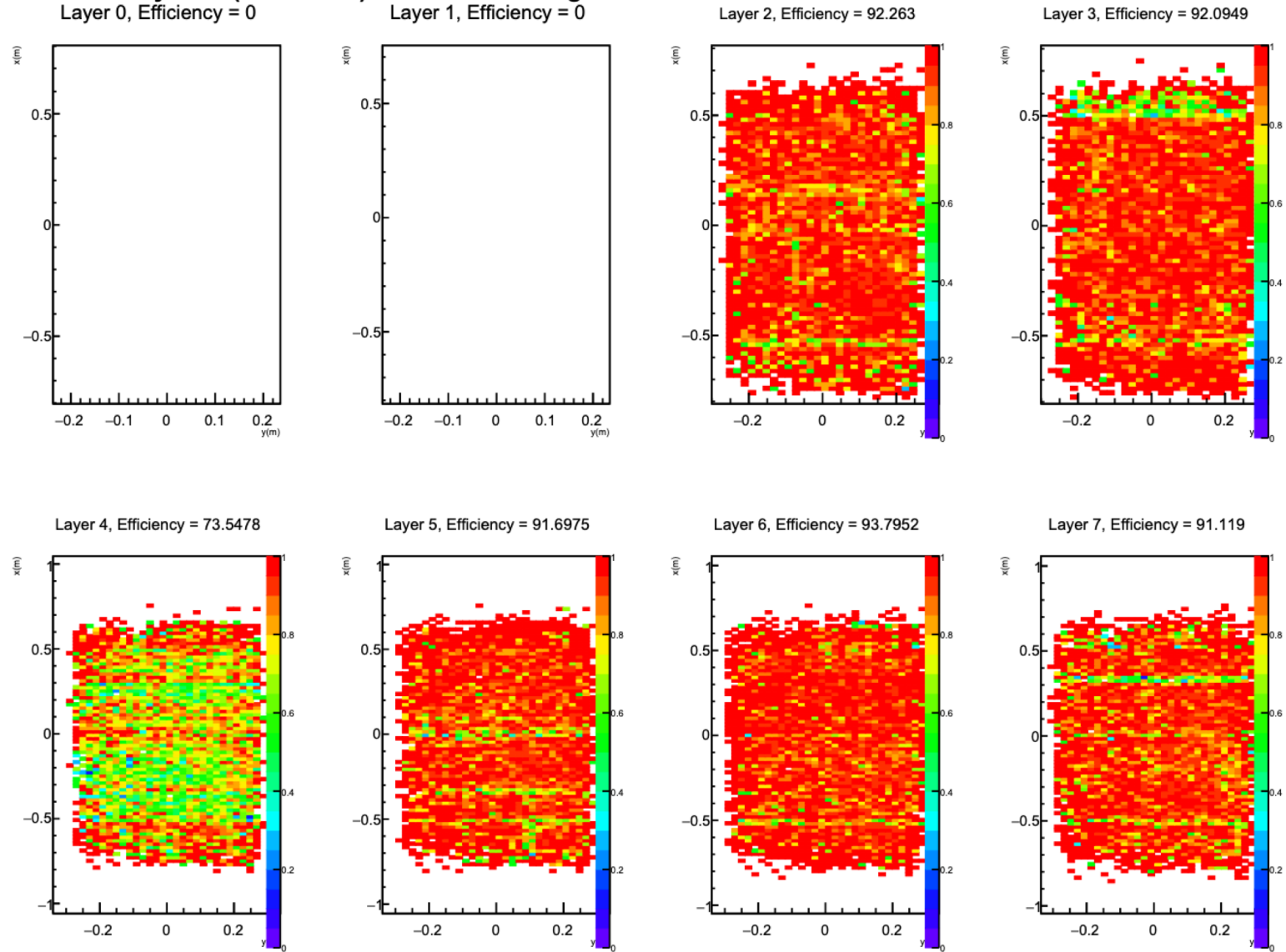


20 uA on H2

General SBS GEM performance

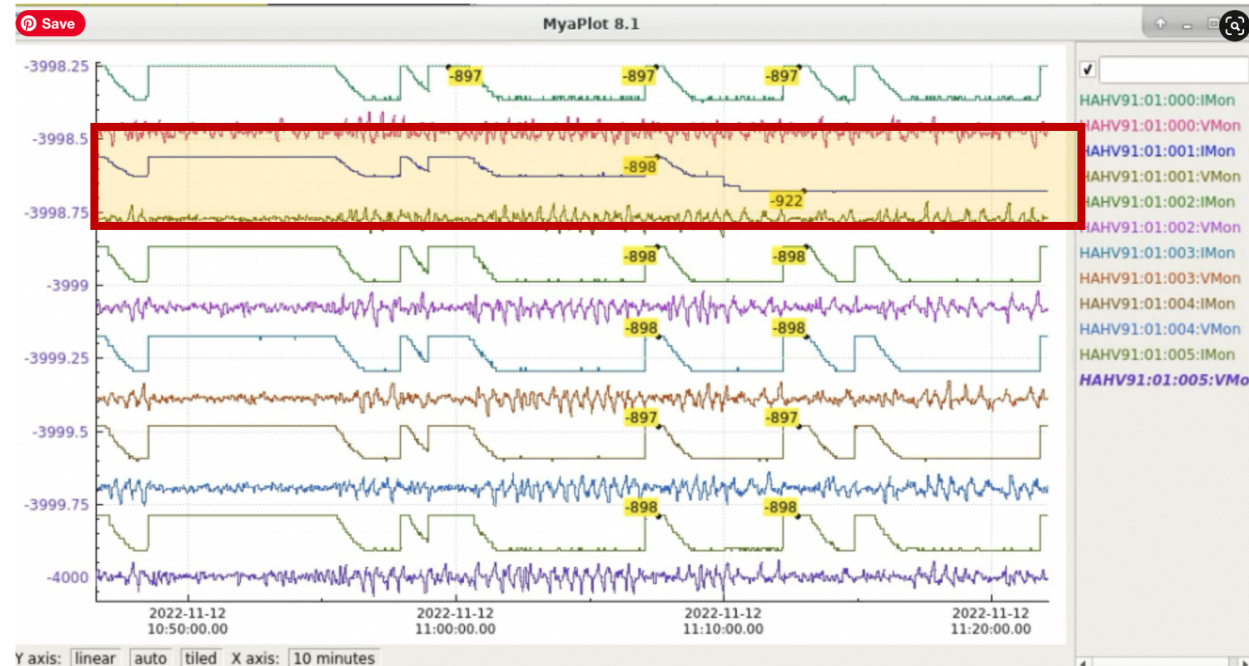
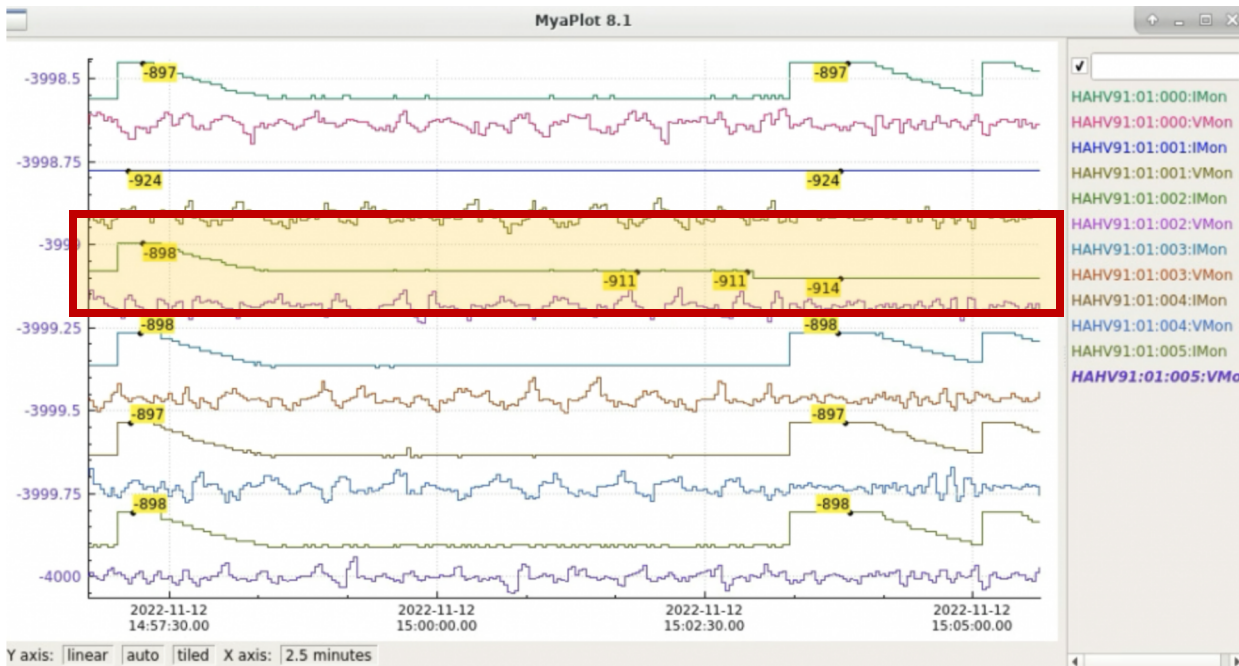
20 uA on H2

Summary Plots(Run #1998) 45: Module average efficiencies



INFN GEMs in SBS

1st layer bottom and middle modules appear to have possibly shorted within 4 hours each other on 12 Nov 22.



Unresolved low voltage issues when initializing layers 1 and 2 in beam conditions
(unclear if any correlation with magnet)

SBS GEM gas mixing system



7 Ar + 3 CO₂ cylinders



Mixing system



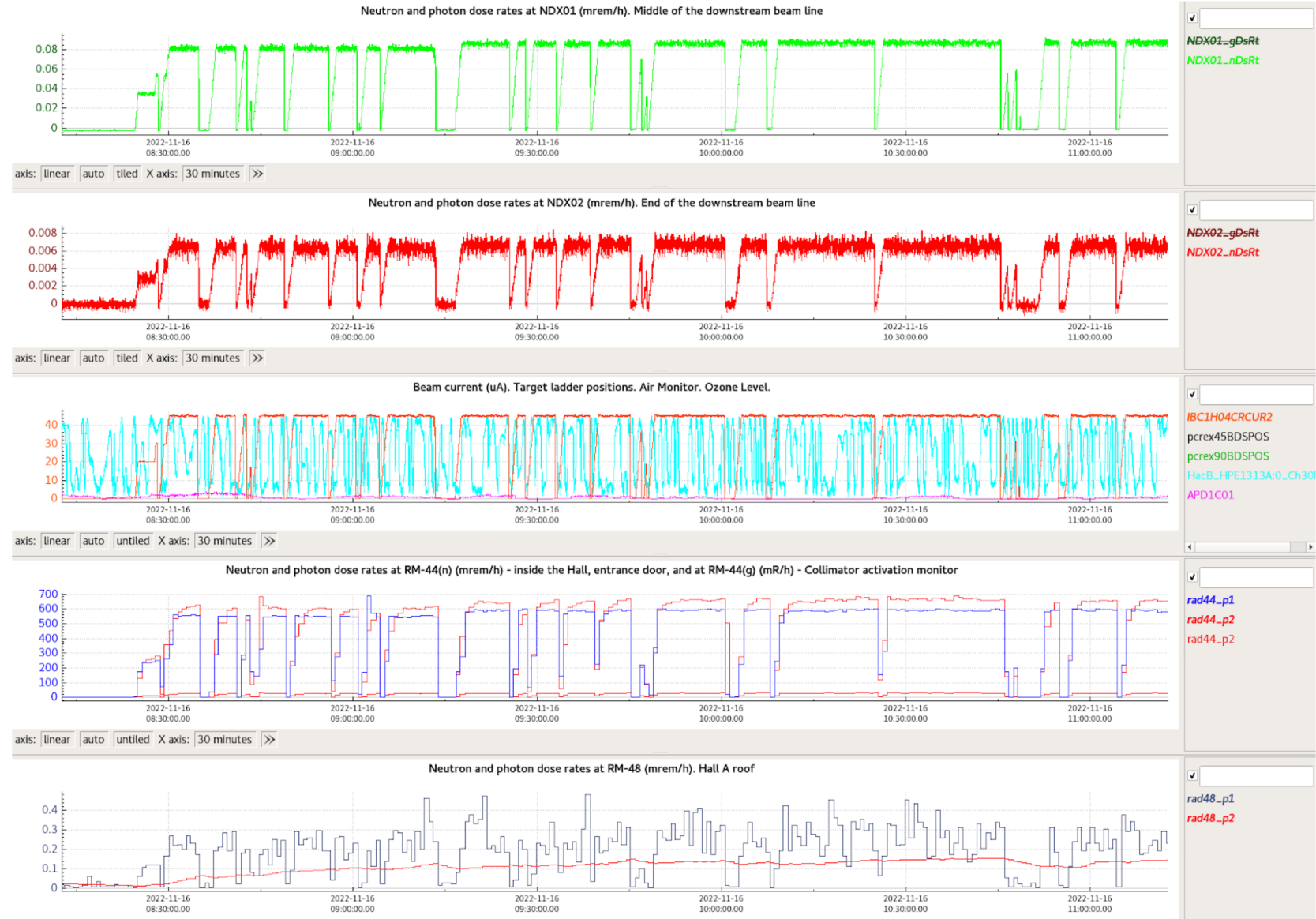
Mixing tube

Radiation at the SBS bunker

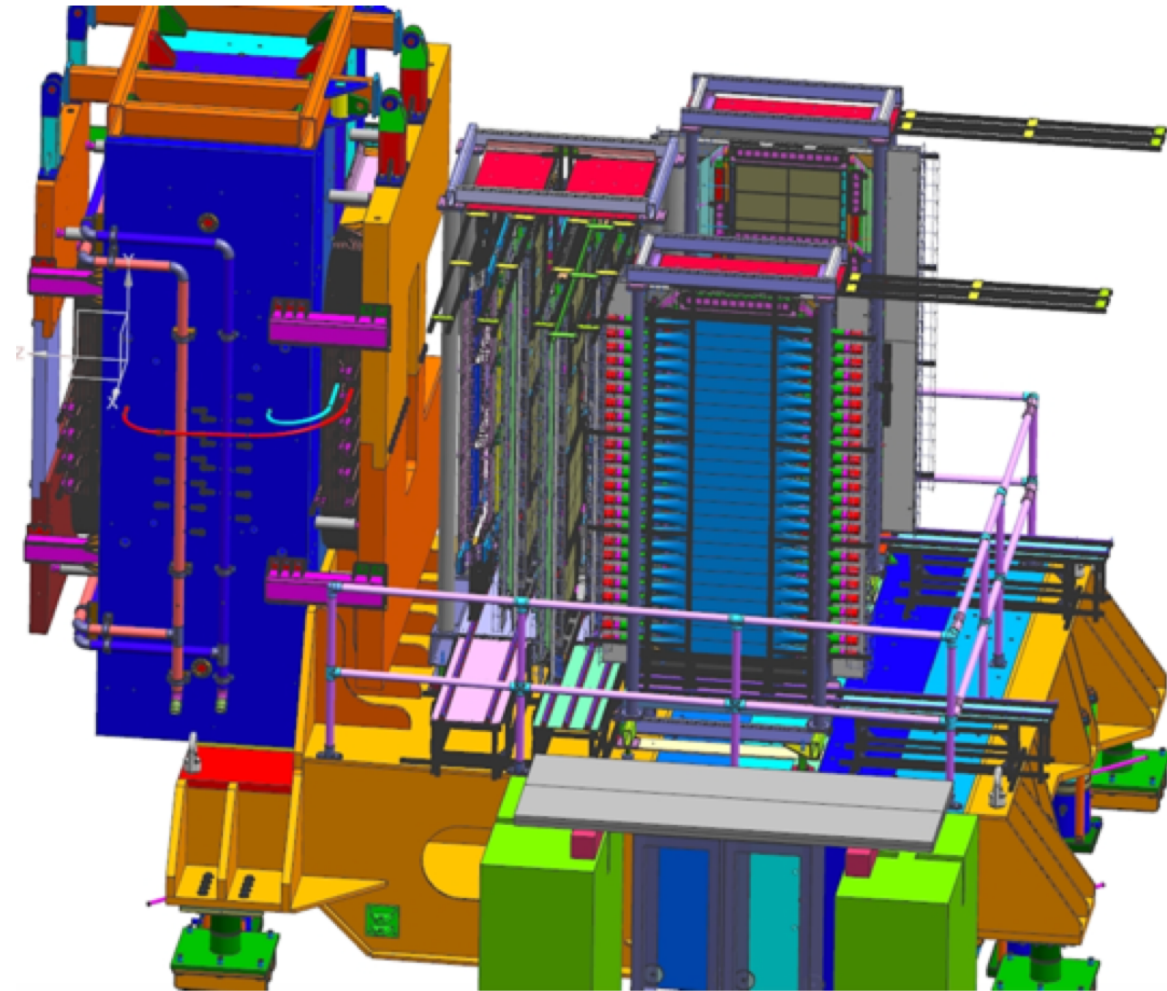
80 mrem/hr at 40 uA beam
(100 mrem/hr at same current in BB
bunker)

Maximum in GMn, sbs-14, 180 mrem/hr
at 10 uA

250 mg/cm² material in beamline
-> x9 in GEp



Plans for GEn-RP



HV upgrades and preparations for GEn-RP are driven by needs of GEp

Next work:

- Complete the last 2 RP layers in EEL (waiting on electronics)
- Front tracker BB layers will be outfitted with 2 HV individual power supply configurations per layer
- Installation of 2-path dividers on current SBS modules
- 2 new XW layers with individual power supply scheme

Power supplies:

- Individual power supply scheme: req. 8 channels in BB, 8 channels for 2 XY (needed for GEp), 6 channels total for 2 XW
 - Have 4 CAEN 1515BTG on hand (8 channels)
 - Jlab ordered 6 more (12 channels)
- Power supplies for 2-path dividers: req. 32 total channels
 - Have 3 CAEN 6533 = 12 channels
 - Have 2 CAEN 1470 = 6 good channels
 - Glasgow has 1-2 CAEN 1470 (4 or 8 channels?)

Summary

- SBS inline stack install in Hall A overall successful
- Not as much run time as desired at the request of spokespeople to maintain DAQ stability
- DAQ issues resolved....issues occur at roughly the frequency of BB scaled by the number of APVs.
- Issues with running the INFN GEMs are unresolved....did not see the same issues in BB (in terms of APV)
- Radiation not conclusively a problem for the crate electronics stability
- HV divider upgrades and testing in BB validates the upgrade plans for GEn-RP and GEp