AFE NOISE INSIGHTS WITH HD ELECTRONICS

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Setup and data

Two sites for a comparison

- Milano laboratories
  - 4 FBK flexes*
  - LN
  - DMEM*
  - DAPHNE V2

- VD Colbox @ CERN
  - 1 X-ARAPUCA channel with FBK SiPMs*
  - LAr
  - DMEM*
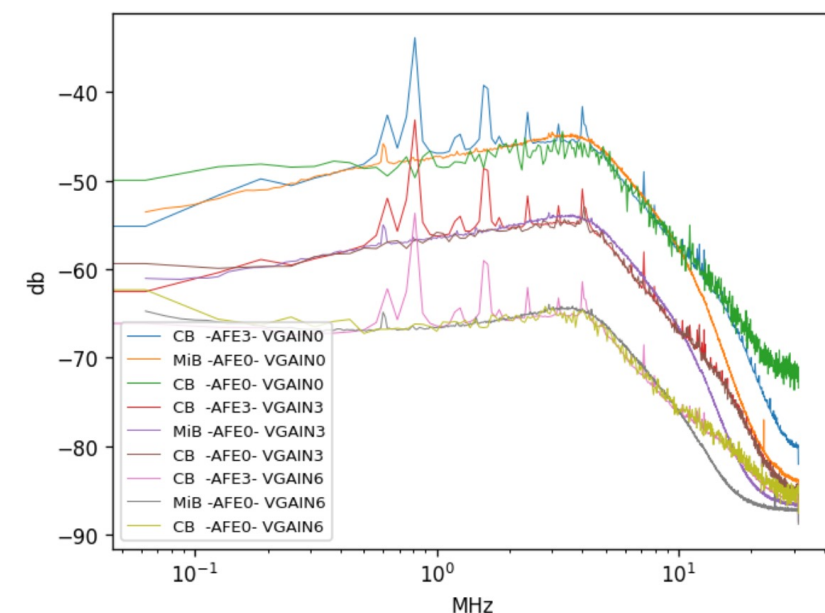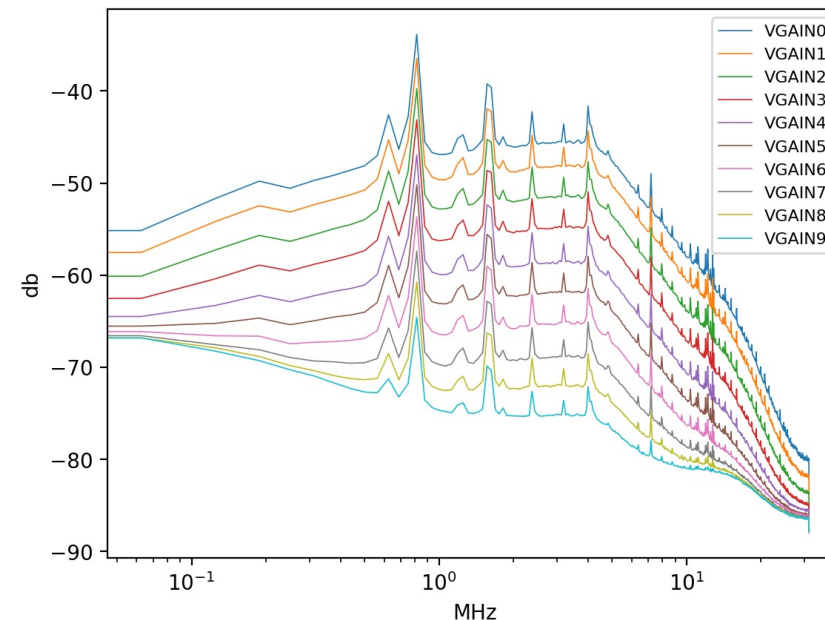 - DAPHNE V2

  * The same model, but not the very same

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Noise FFTs

The key to interpret the results

- We reproduced Esteban's study of the noise vs Vgain

- We can appreciate how the noise does not scale linearly with the gain (or attenuation)

- The Coldbox (CB) is a bit more noisy at high frequency (> 10MHz) then our setup in Milano (MiB)

- What is more interesing is the difference between AFE0 and AFE3 at the colbox – not yet explained

- We will further investigate with more data from the cpldbox and possibly in Milano again

I have little statistics for Coldbox AFE0 because I needed to select waveforms form calibration data, where we have LED pulses, dark current, cosmics…. But it is still meaningful

Standard analysis protocol was applied – No integration window length fine-tuning (But I think it was almost the optimal)

Gain and Dynamic Range
VGAIN scan

We can control DAPHNE's total gain setting the attenuation at the desired level (VGAIN setting)

- Remember: VGAIN ⬆ Attenuation ⬆ Total gain ⬇

- Dynamic Range computed as s.p.e. 2^14/peak-to-peak

Quite surprisingly, we found the same gain in LN and LAr despite the 10 degree difference

- The breakdown voltage depends on the temperature

- Possible reasons: different breakdown

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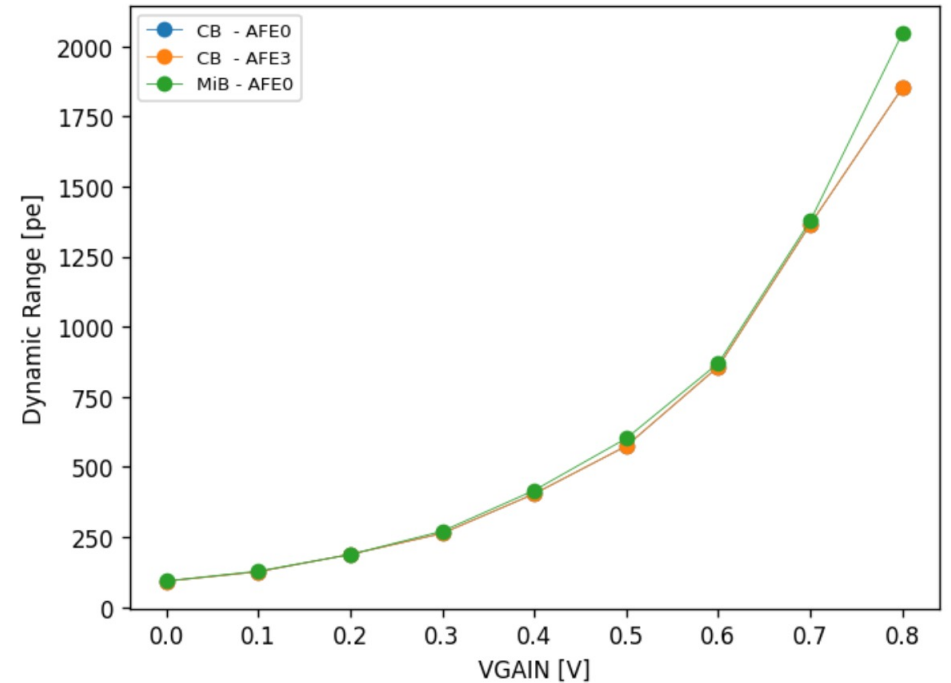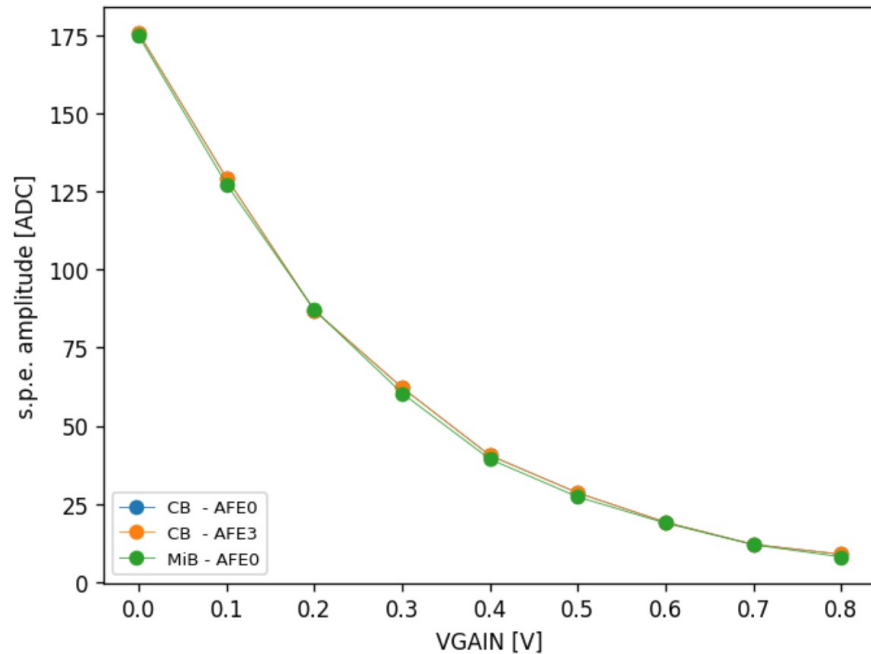
# SNR vs VGAIN

The balance between requirements

- SNR decrease with the attenuation level
  - Low freq noise observed in FFTs

- AFE3 gives lower SNRs, especially at low VGAIN
  - This comes from a higher level of noise

- AFE0 gives almost the same results in the two facilities
  - The high freq noise has little impact on the integration

- When low frequency noise dominates (large VGAIN) the SNR are almost the same
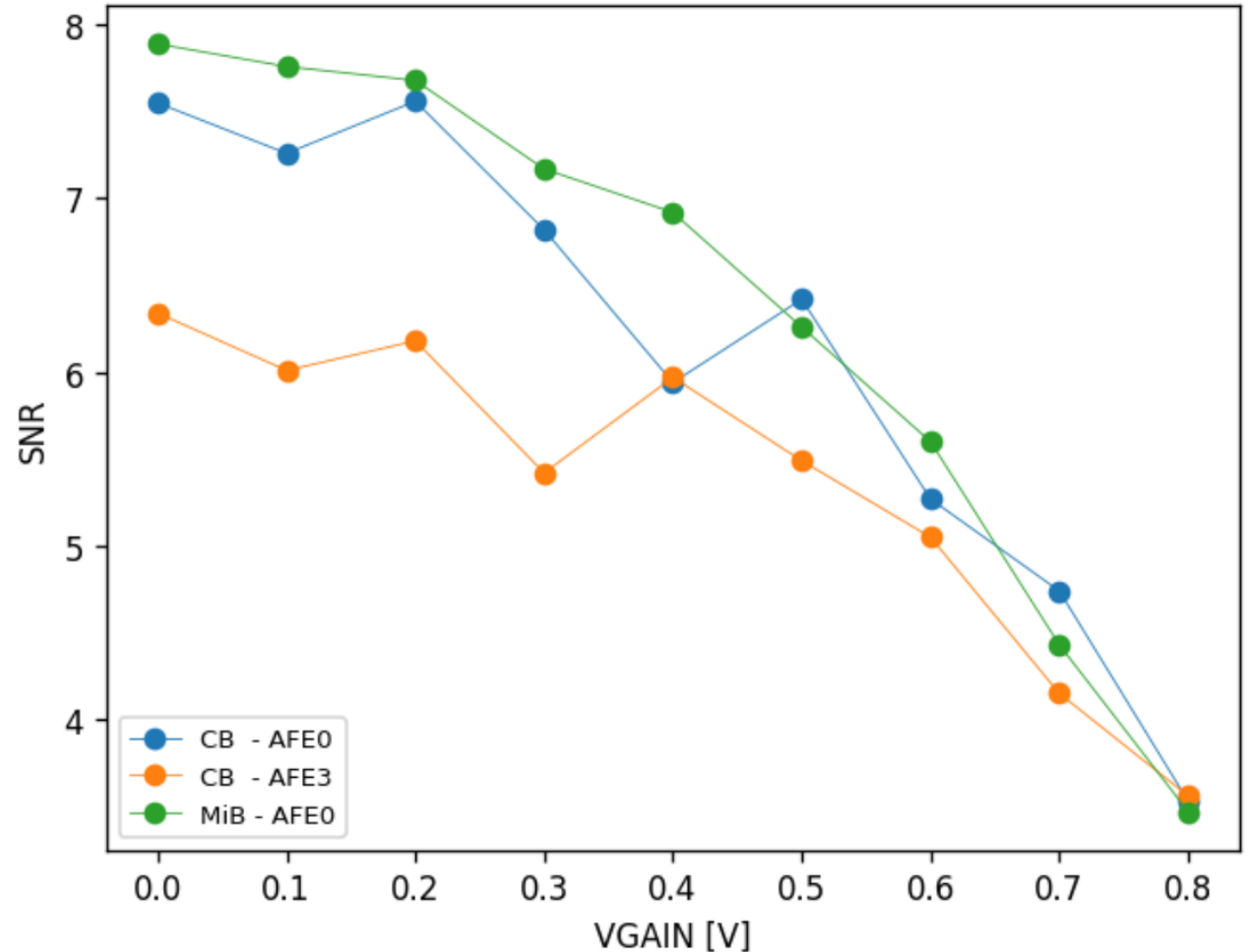
SNR vs Dynamic Range

The balance between requirements

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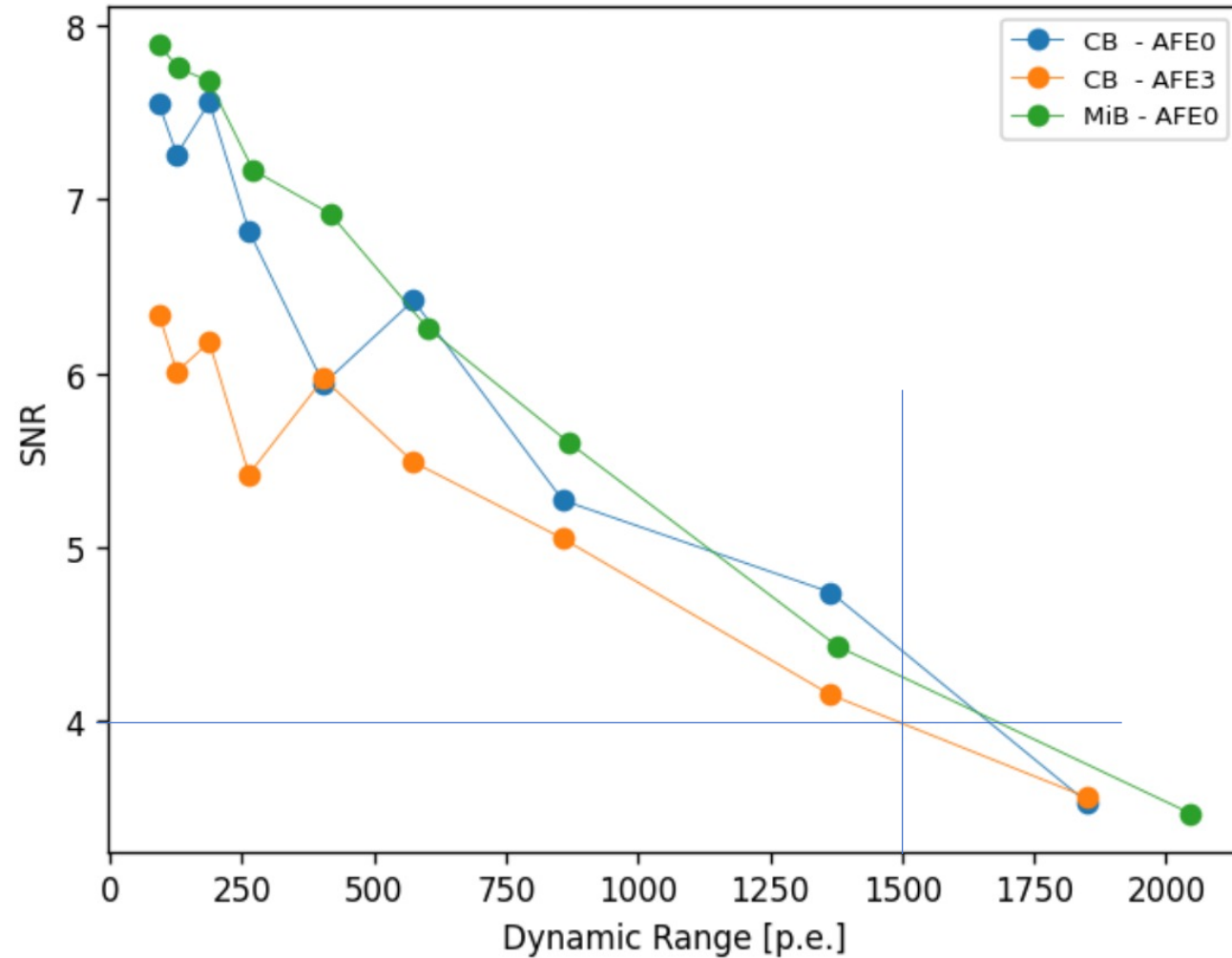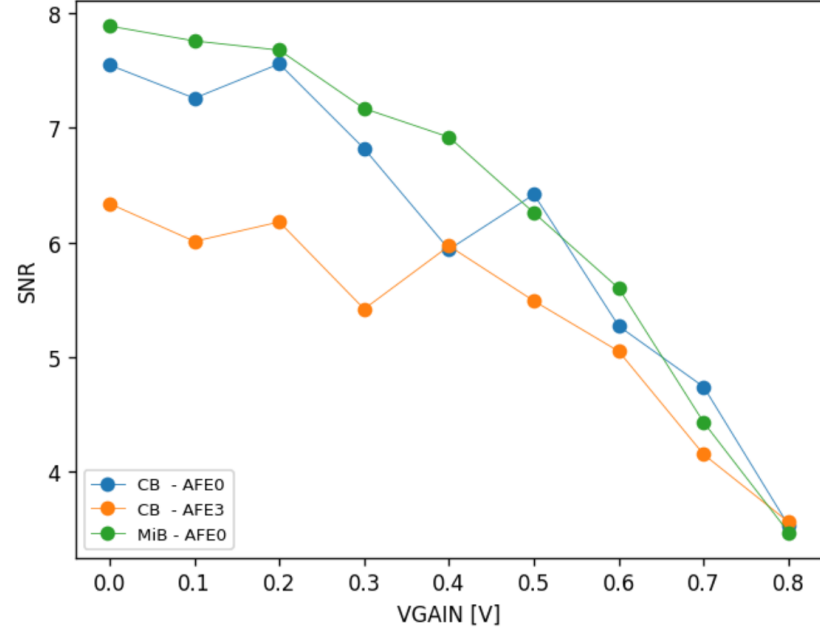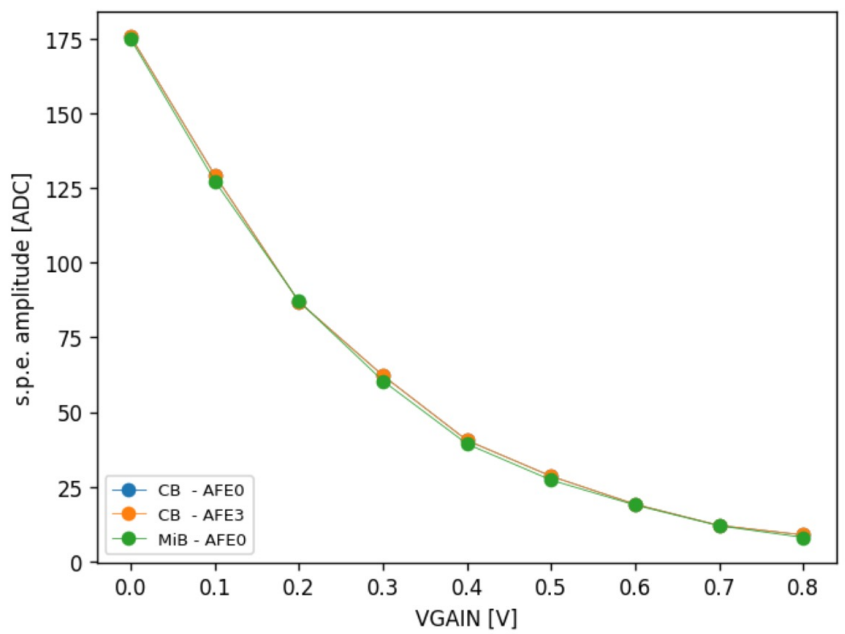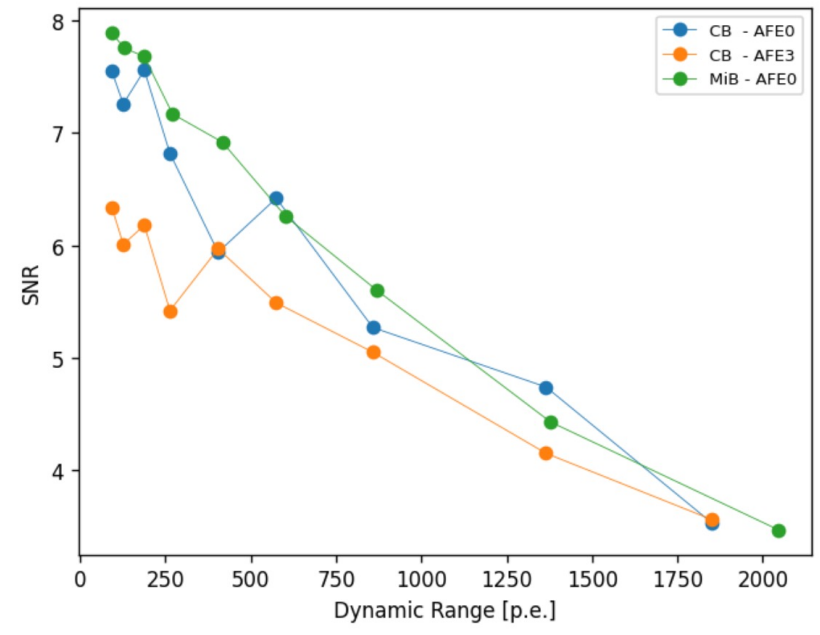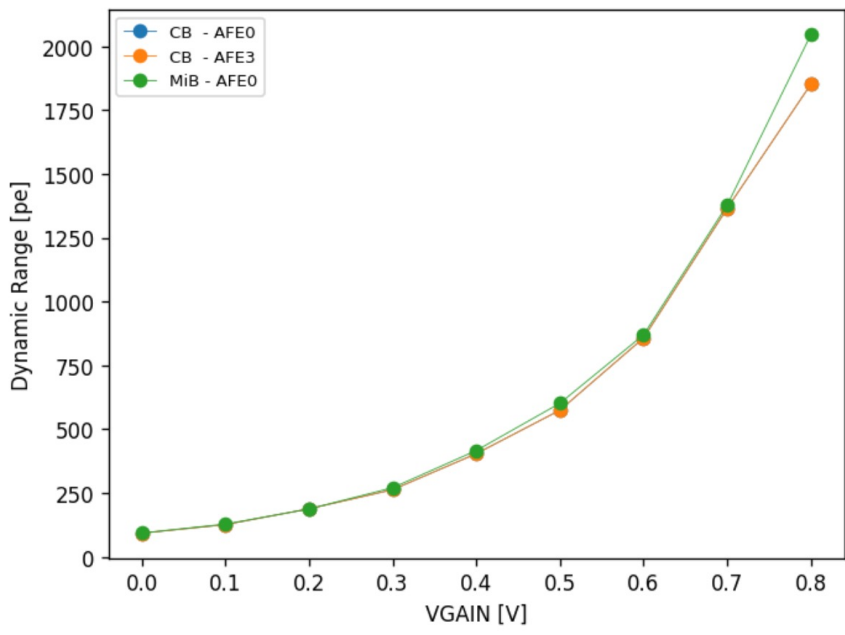
Conclusion

- We justified the results by studying the noise

To do:

- As usual, we will go on collecting data :)
  - Using more AFEs in during this colbox
  - Maybe also the CSU Daphne currently at CERN
  - …