NP02 - PDS

Top Membrane modules' first operation in cold and summary of all PDS moduels

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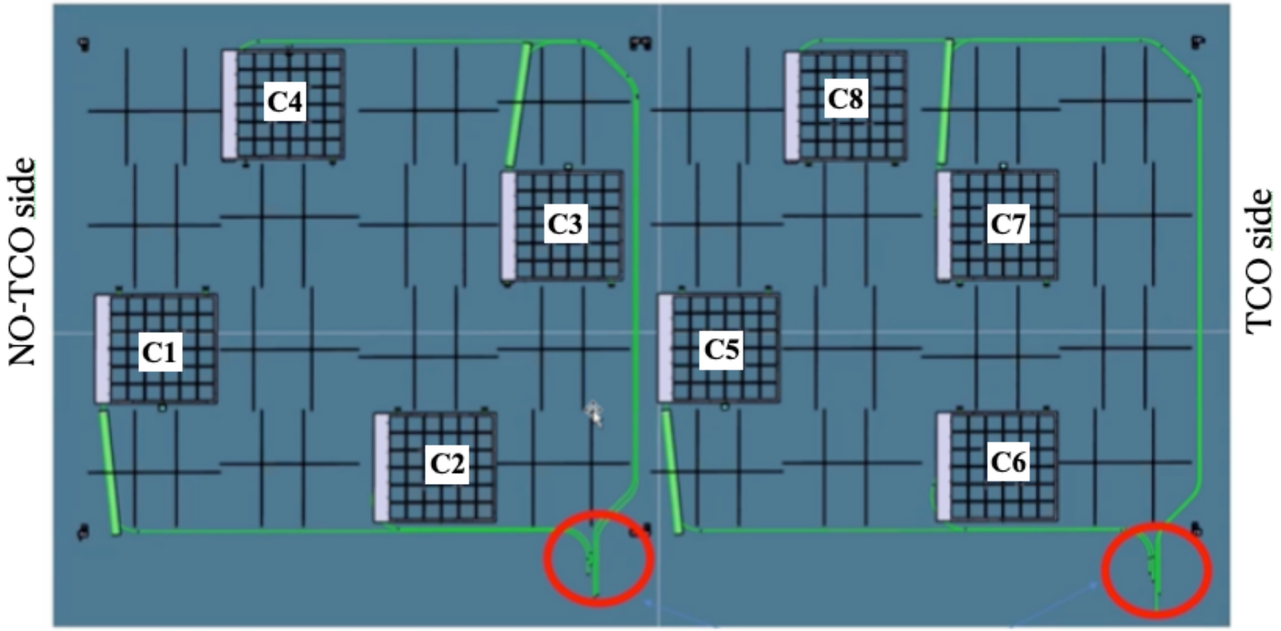
NP02-PDS modules

Cathode view from top

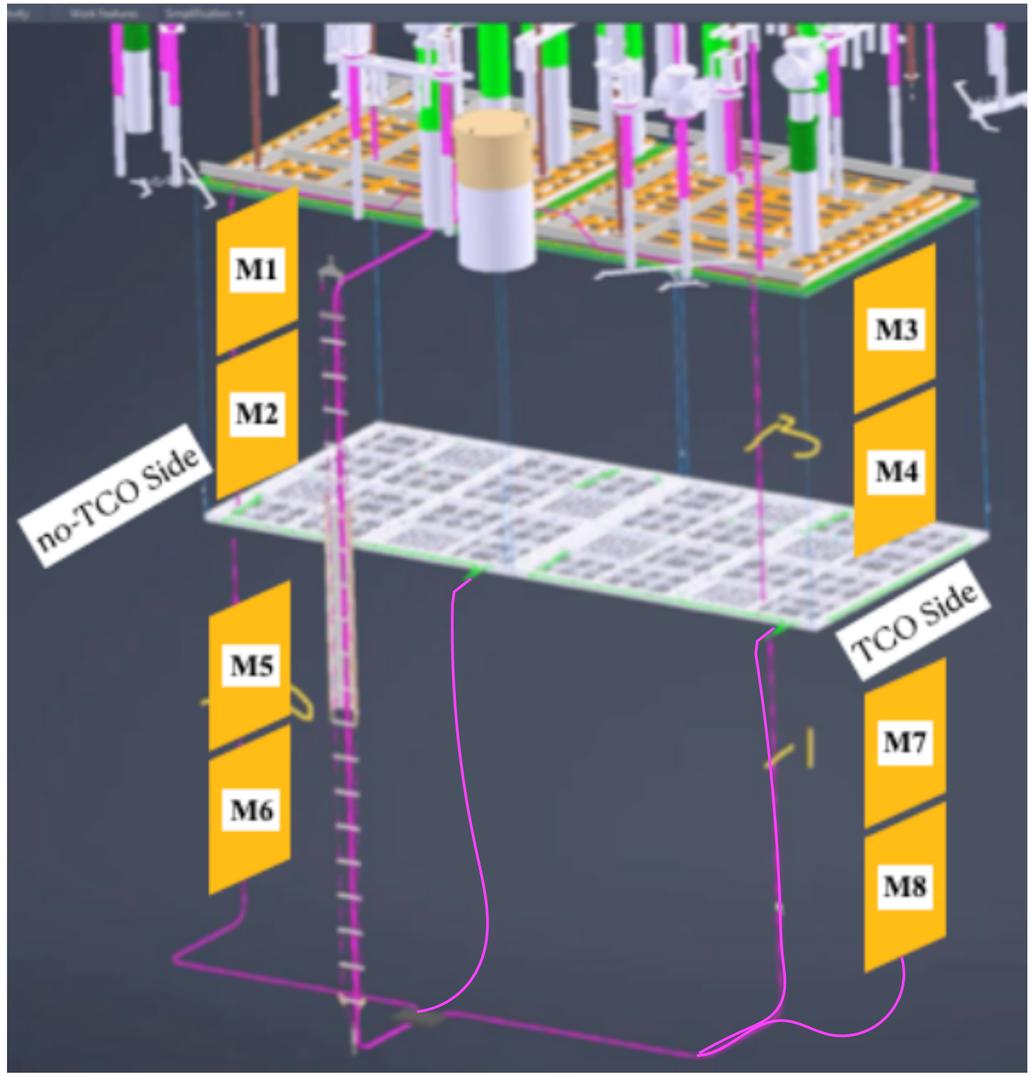


C1, C2, C3, C4 = DCEM CMOS - SiPM HPK
C5, C6, C7, C8 = DCEM Bipolar - SiPM HPK

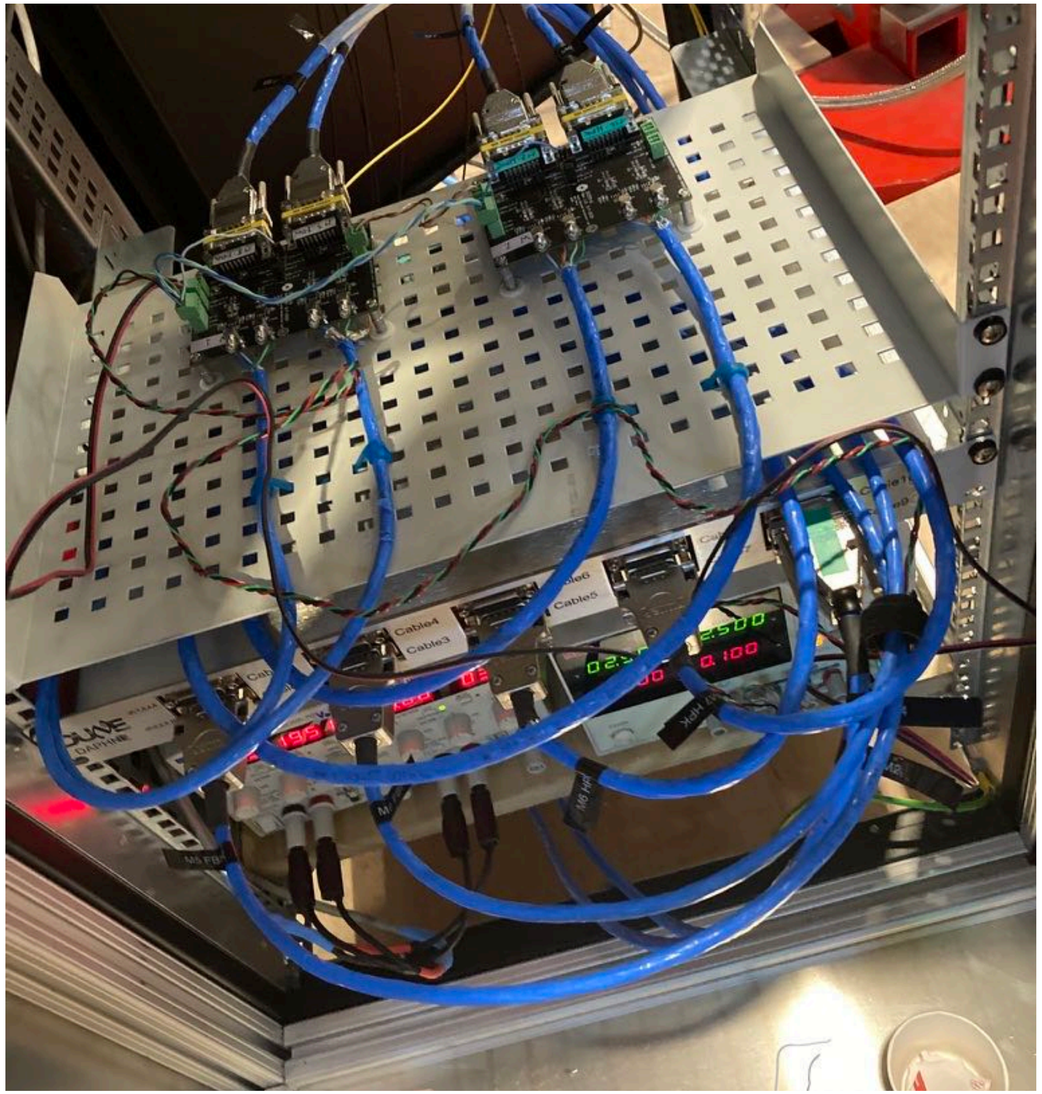
M1, M2, M3, M4, = HD-Style - SiPM HPK

M5, M8 = VD-Style - SiPM FBK
M6, M7 = VD-Style - SiPM HPK

NP-02 PDS modules view



NP02-PDS rack



NP02 DAPHNE #5, endpoint 107 (in NP02 rack - bottom position)

Connection at Jan 22nd, 2025

HD_style: (temporary)

- Daphne AFE 4
- 8 ch all HPK
- transformer in place
- no warm stage

Daphne Mapping

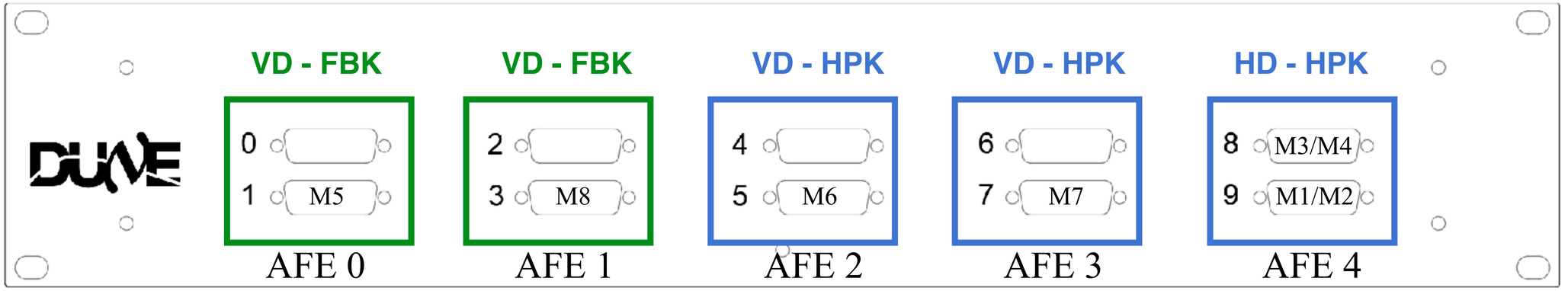
M1/M2 - HPK	**AFE 4**	DB15 **#9**
M3/M4 - HPK	**AFE 4**	DB15 **#8**

VD_style: (final)

- Daphne AFE 0,1,2,3
- 2x HPK and 2x FBK
- 2 ch per AFE
- transformer bypassed
- warm stage V 1.0
- SiPM bias form Daphne
- Warm stage power from Power Supply

M5 - FBK	**AFE 0**	DB15 **#1**
M8 - FBK	**AFE 1**	DB15 **#3**
M6 - HPK	**AFE 2**	DB15 **#5**
M7 - HPK	**AFE 3**	DB15 **#7**

NP02 DAPHNE #5, endpoint 107 (in NP02 rack - bottom position)
Connection at Jan 22nd, 2025



VD_style membrane modules mapping

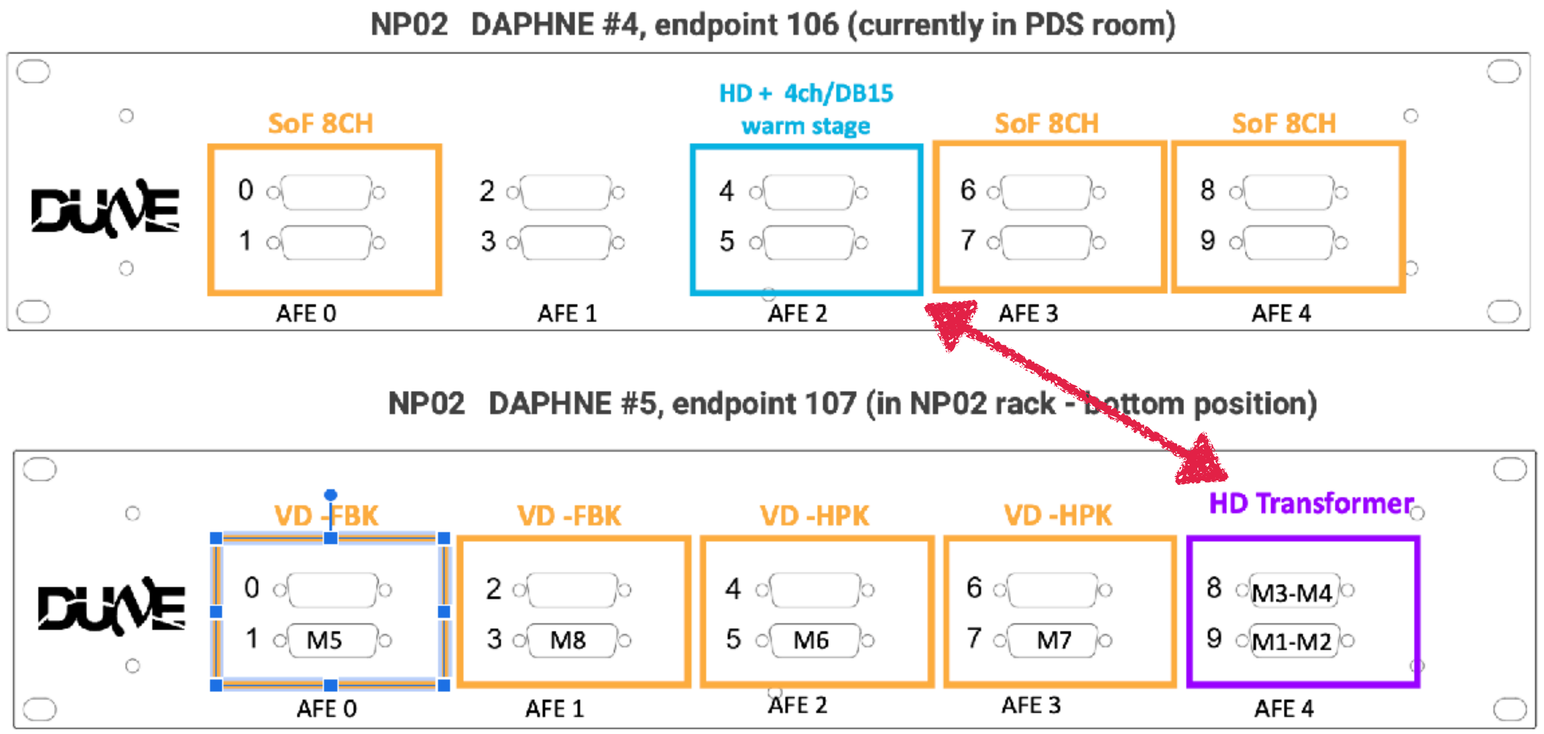
Module M5,M8,M6,M7	Daphne AFE 0,1,2,3 ch.
Ch1 signal	ch7
Ch2 signal	ch0
Ch1/2 bias	ch2

HD_style membrane modules mapping

Module Channels	Daphne AFE 4	Module Channels	Daphne AFE 4 ch.
M1 Ch1 bias/ signal	ch7	M3 Ch1 bias/ signal	ch6
M1 Ch2 bias/ signal	ch5	M3 Ch2 bias/ signal	ch4
M2 Ch1 bias/ signal	ch0	M4 Ch1 bias/ signal	ch3
M2 Ch2 bias/ signal	ch2	M4 Ch2 bias/ signal	ch1

2x Daphne's current mapping/plan

Mapping at Jan 22nd, 2025



In the final configuration, we want to have:

- 16 SoF channels in one Daphne
- 16 membrane channels in one Daphne with all warm stages

The plan is to modify the AFE 4 in Daphne #5 to host the HD_style warm stages.

Cathode modules

Cathode modules setup still not in place in the rack

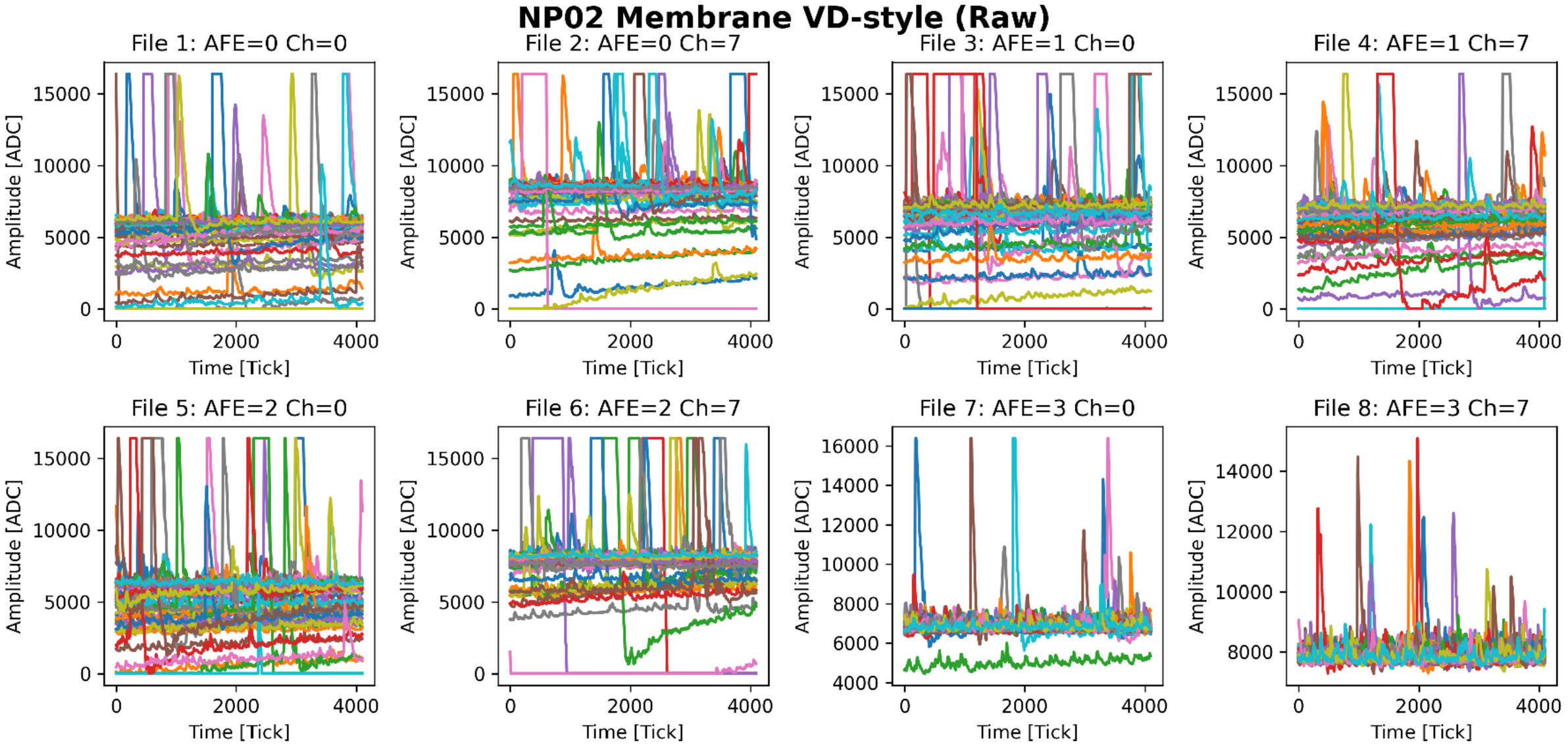
- 2x Laser boxes for PoF
  - 1 at CERN
  - 1 at Fermilab
- 1x Daphne for SoF readout
- 1x metallic chasee for storing fibers boundless

Cathode modules PoF-SoF Fibers Mapping

Module	PoF Fibers Tag	SoF Fibers Tag
C1	PoF(T1-F3)	SoF(T1-F1)
	PoF(T1-F4)	SoF(T1-F2)
C2	PoF(T2-F3)	SoF(T2-F1)
	PoF(T2-F4)	S(SoF-T2-F6)
C3	PoF(T3-F3)	SoF(T3-F1)
	PoF(T3-F4)	SoF(T3-F2)
C4	S(PoF-T4-F8)	S(SoF-T4-F5)
	PoF(T4-F4)	S(SoF-T4-F6)
C5	S(PoF-T5-F7)	SoF(T5-F1)
	S(PoF-T5-F8)	S(SoF-T5-F6)
C6	PoF(T6-F3)	SoF(T6-F1)
	PoF(T6-F5)	SoF(T6-F2)
C7	PoF(T7-F5)	SoF(T7-F1)
	PoF(T7-F3)	SoF(T7-F2)
C8	PoF(T8-F4)	SoF(T8-F1)
	S(PoF-T8-F5)	SoF(T8-F2)

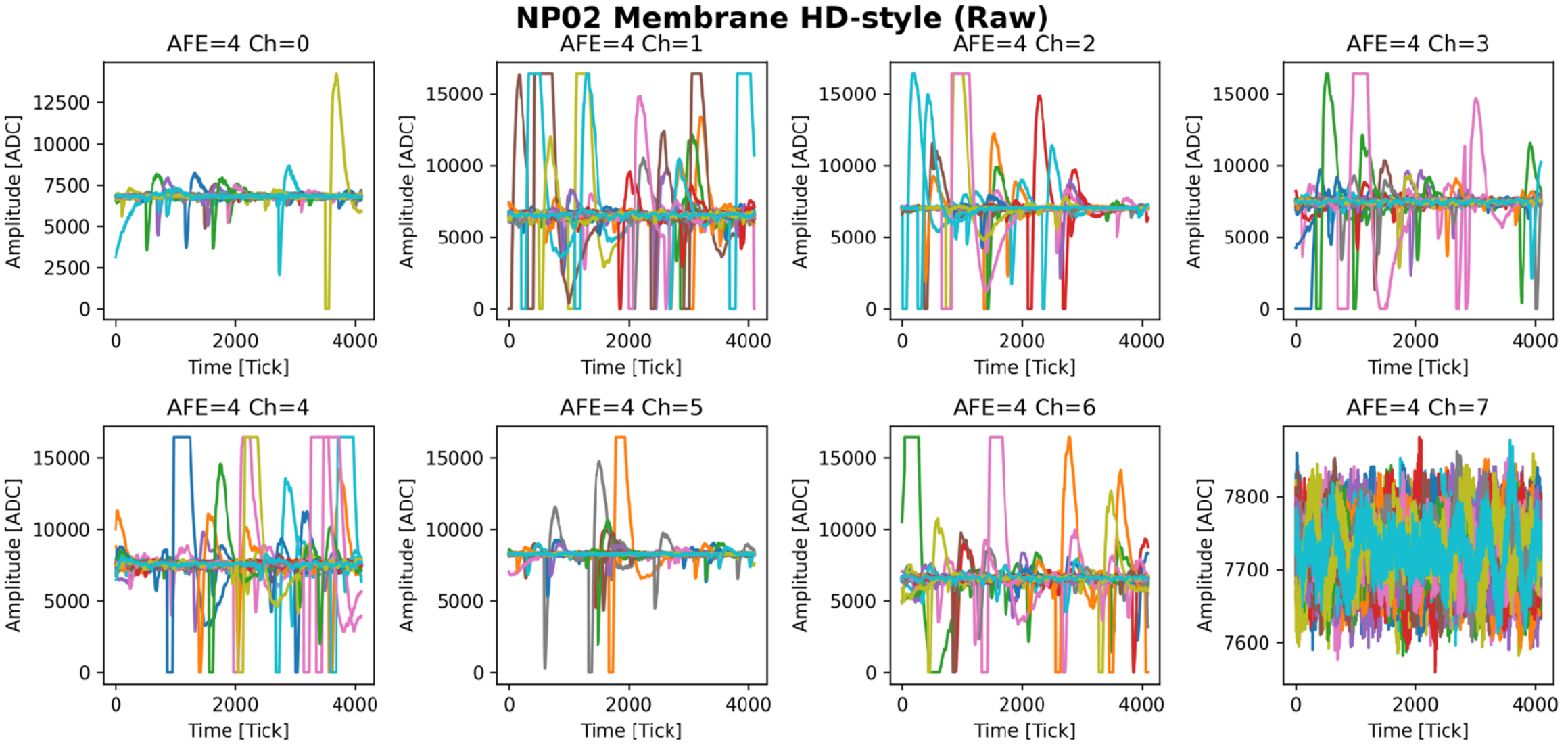
VD_style membrane modules

Daphne w/o transformer + VD-style warm stage



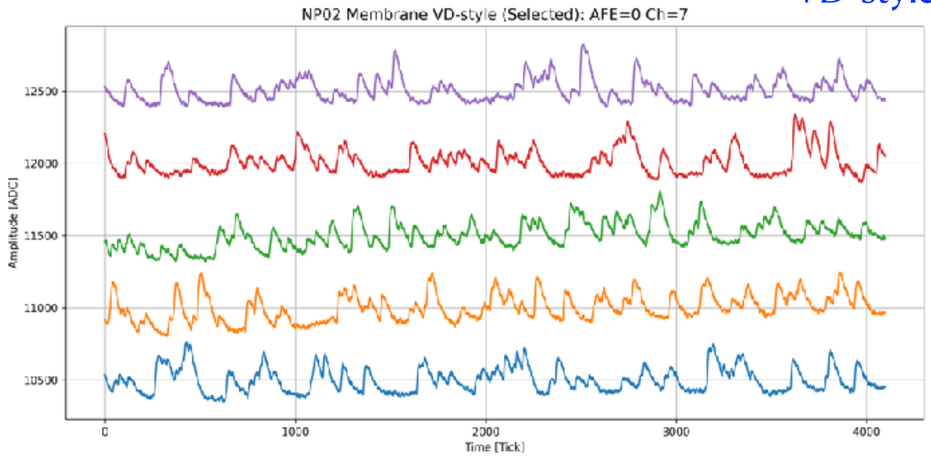
HD_style membrane modules

Daphne w/ transformer (no warm stage)

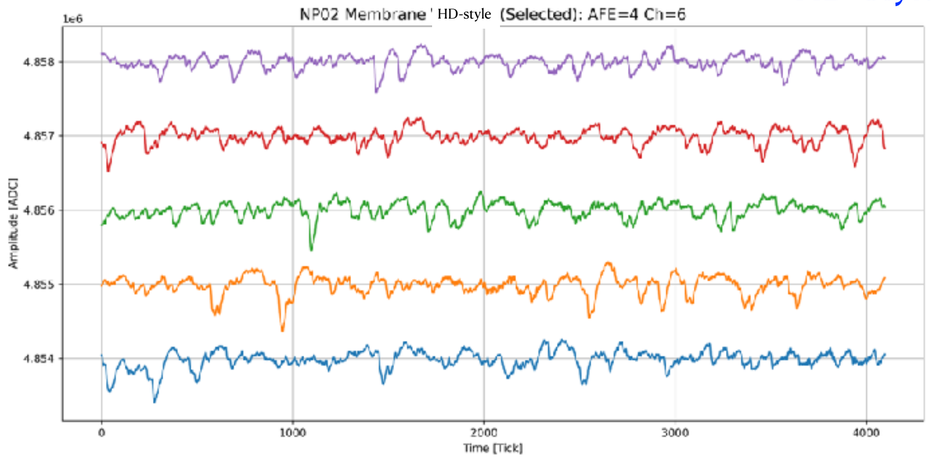


Waveforms

VD-style



HD-style



Both HD-style and VD-style see a lot of background light, not-uniform across the modules.

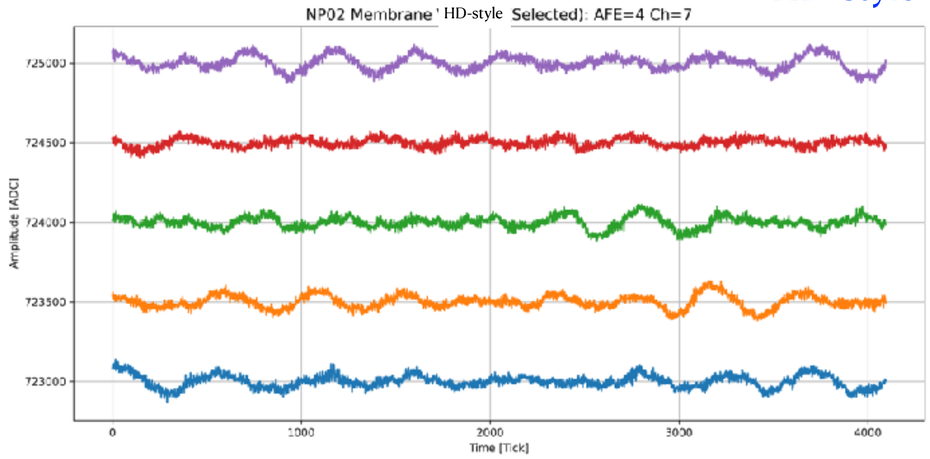
There could be some light leak, maybe the calibration laser port? … under investigation (waiting for free access to NP02 roof).

We found 1 of 16 channels not working well, NO SIGNALs, M1 Ch1
Need to check DB15 connection and Daphne front-end electronics.

It was alive and showing signal during the warm check made with an oscilloscope. The plan is to re-check with the oscilloscope.

This test will tell us if problem is in cold or in warm.

HD-style



Waveforms

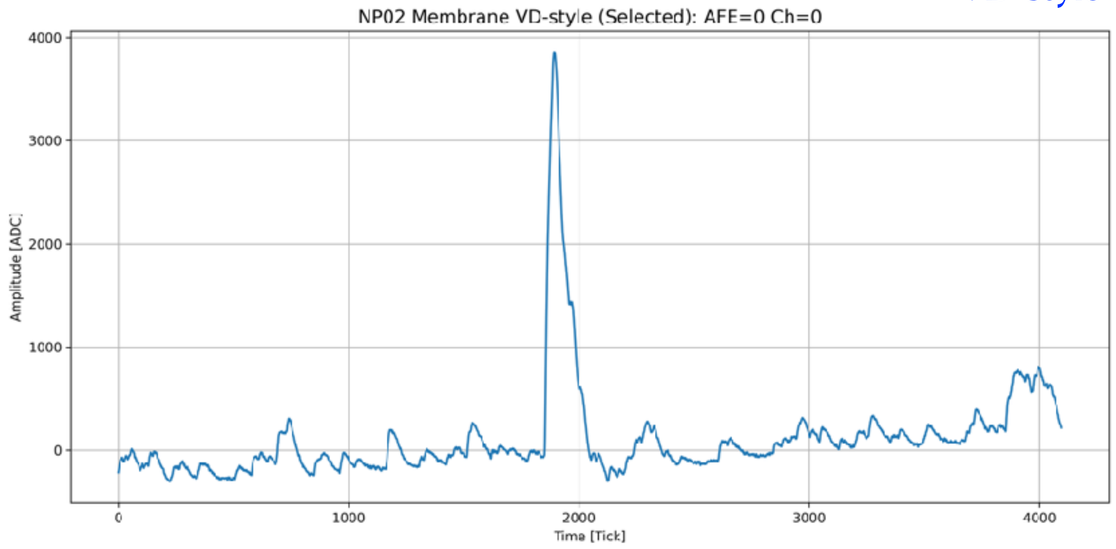
larger pulses selected

VD-style modules have warm stage w/o AFE compensator -> ~5% undershoot
HD-style modules go directly in the Daphne transformer -> ~25% undershoot

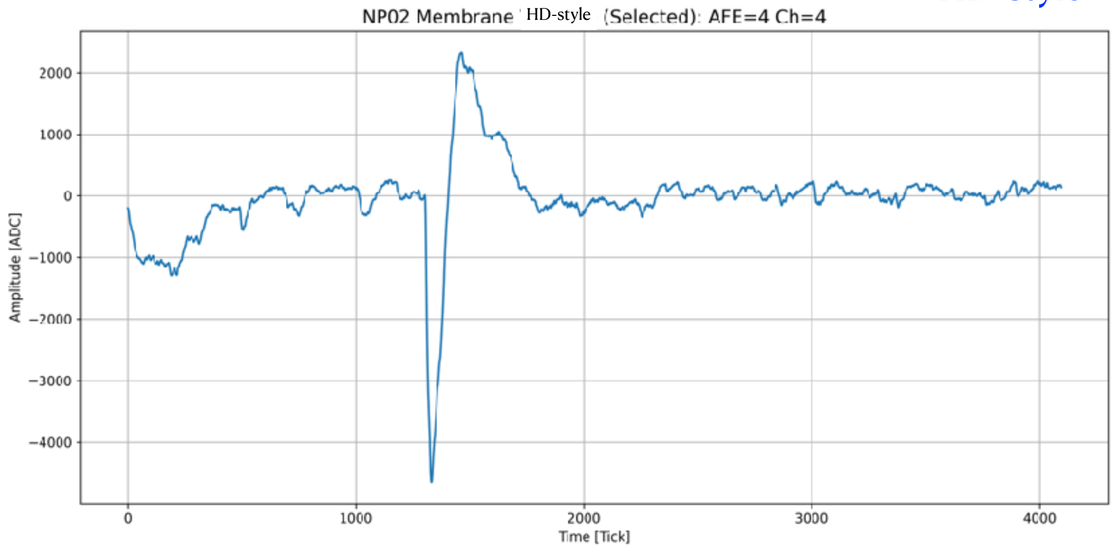
The plan is:
- include AFE compensator to VD-style warm stage and
- include HD-style warm stage + AFE compensator

NOTE: VD-style positive pulses, HD-style negative pulses.

VD-style



HD-style



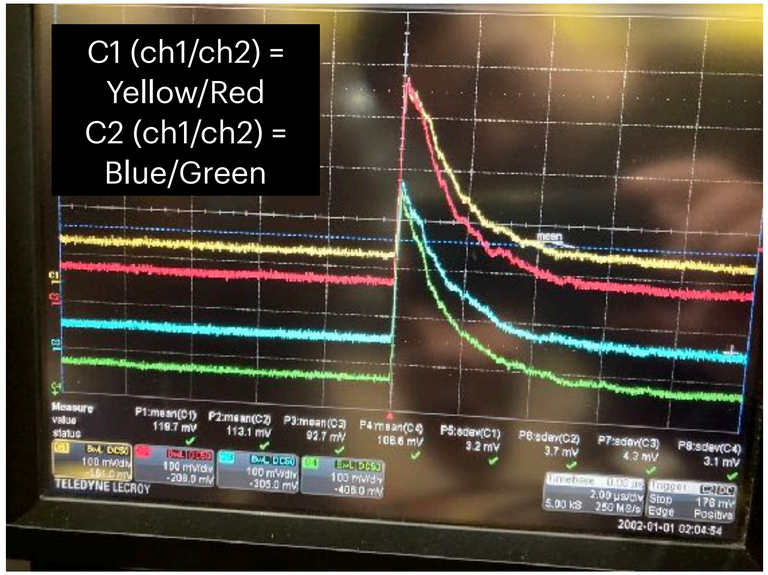
Cathode modules

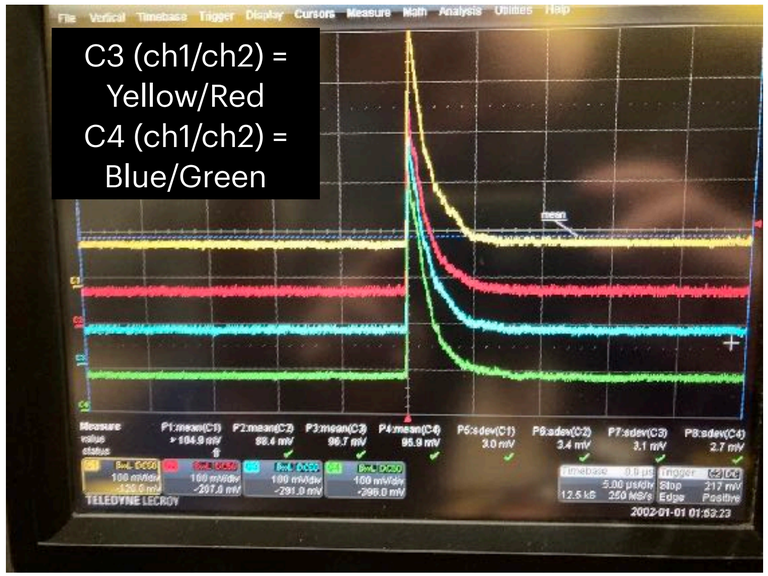
First cold test made with Cold Box equipment:

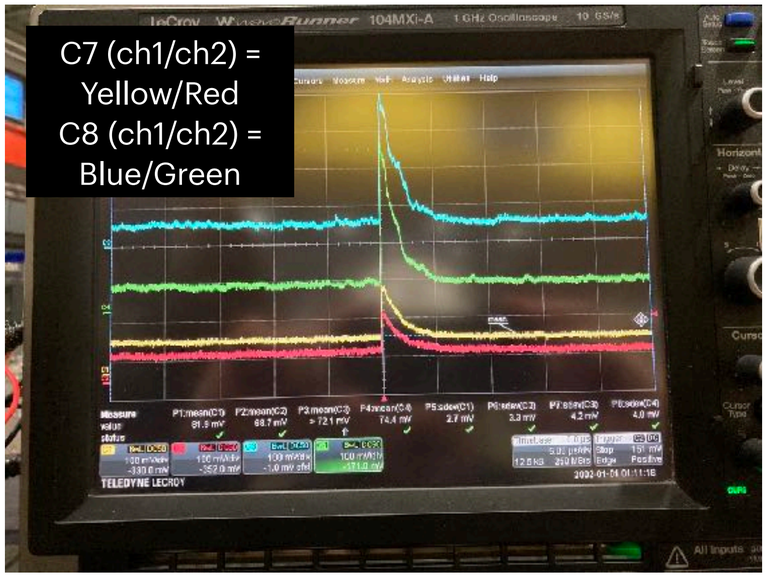
- **Power:** Cold Box laser box
- **Readout:** Cold Box Koheron + Oscilloscope

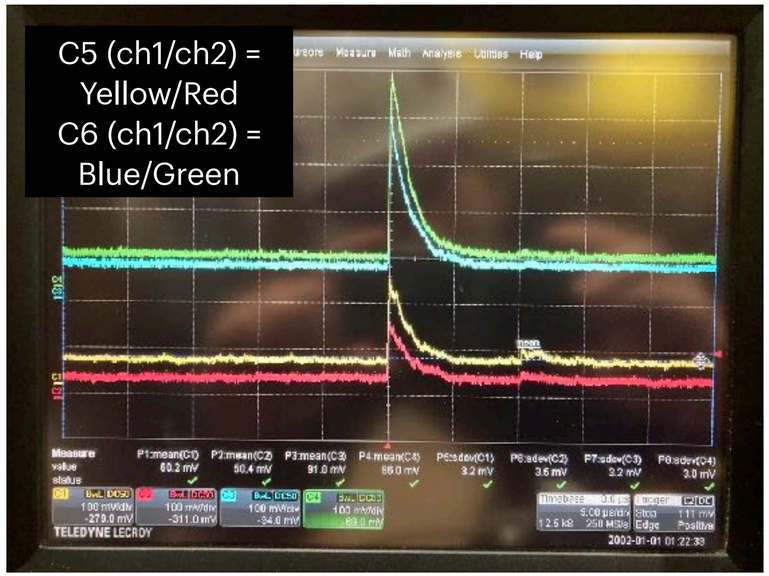
All 16 cathode module channels are alive!

Self-trigger using an internal threshold on ch2.
The channel in the same module (ch1) and the two channels in a closer module (ch3,ch4) see correlated light -> scintillation light





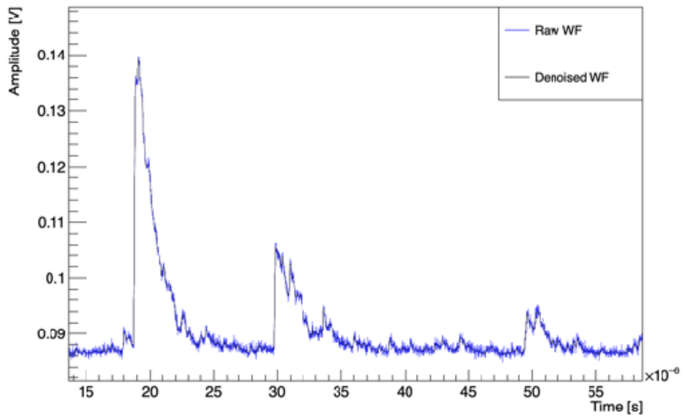


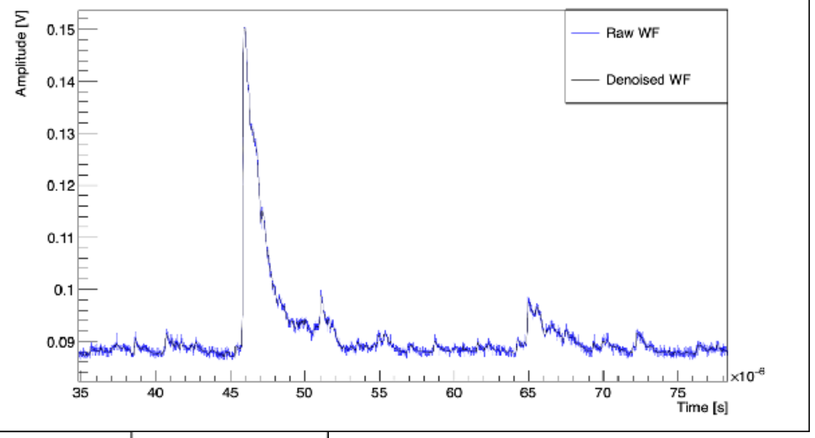


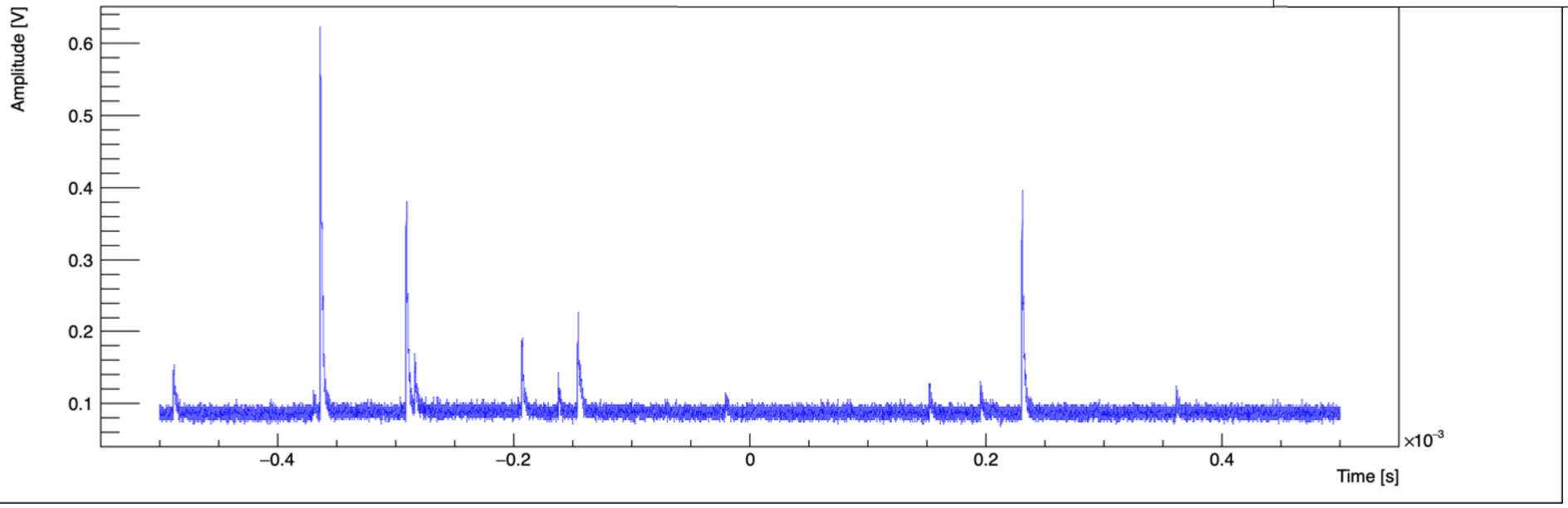
Waveforms

WF's from C1 ch1,
acquired with the oscilloscope, random trigger (no thresholded self-trigger)

As for the HD-style and VD-style, cathode modules see a lot of background light,
not-uniform across the modules.

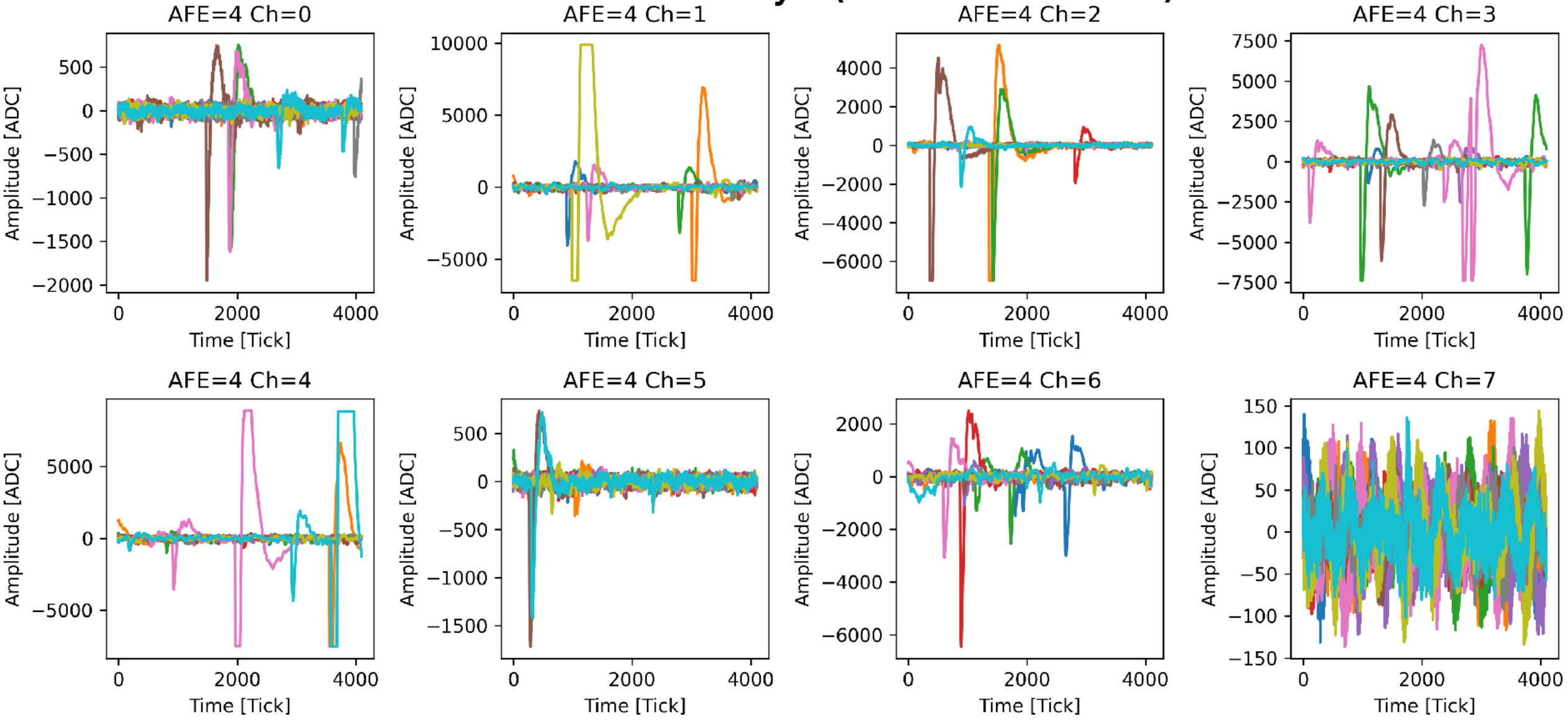




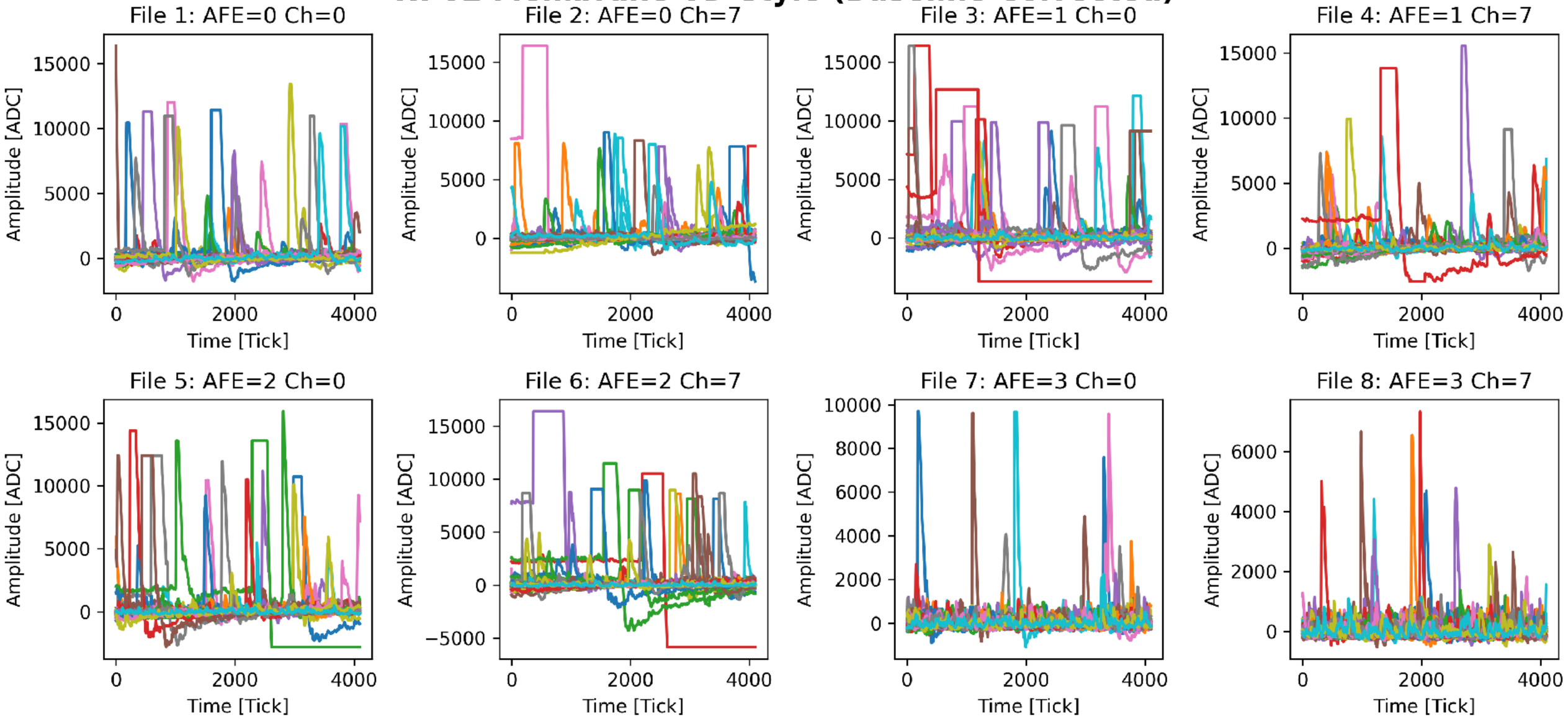


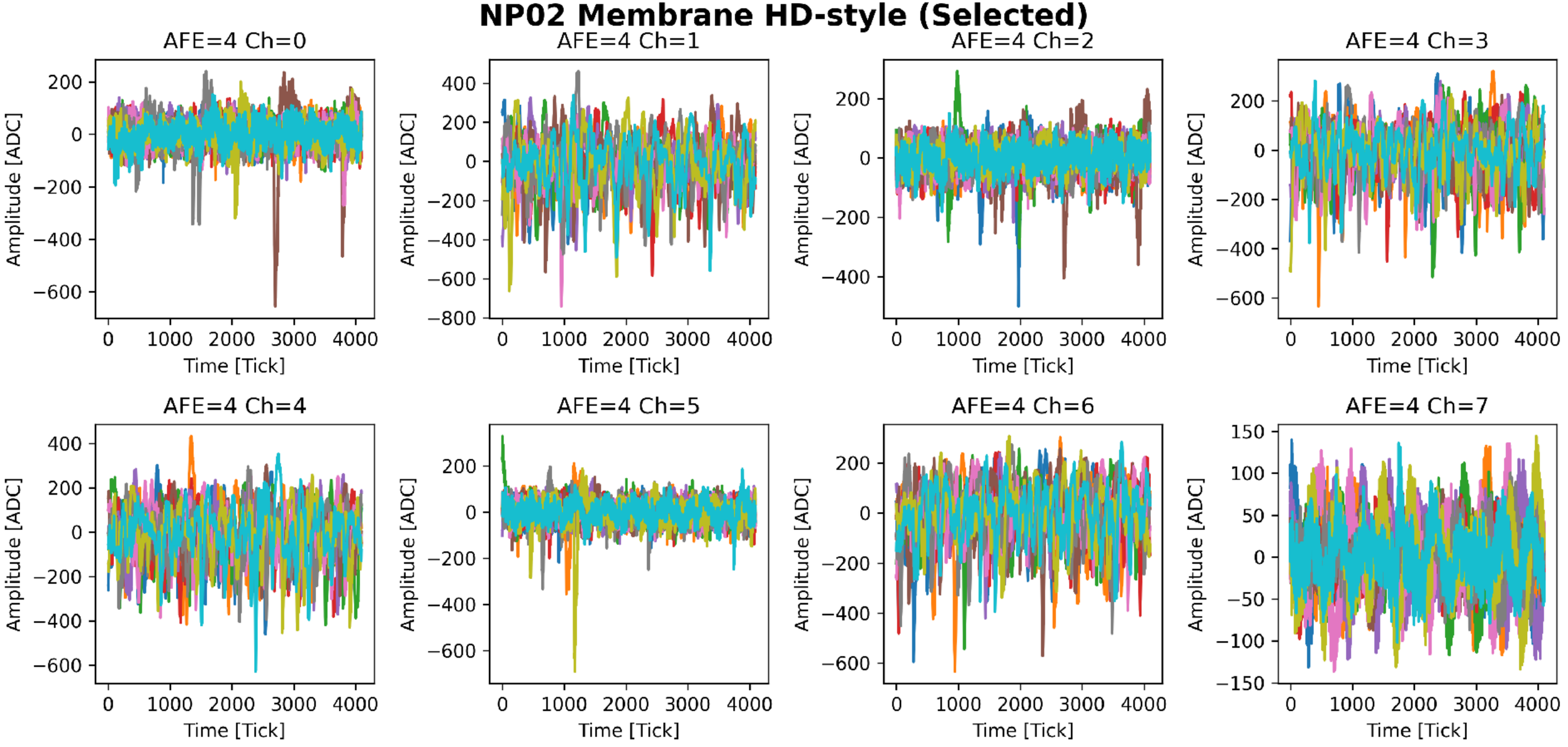
Backup

NP02 Membrane HD-style (Baseline Corrected)



NP02 Membrane VD-style (Baseline Corrected)




NP02 Membrane HD-style (Selected)
AFE=4 Ch=0
AFE=4 Ch=1
AFE=4 Ch=2
AFE=4 Ch=3
AFE=4 Ch=4
AFE=4 Ch=5
AFE=4 Ch=6
AFE=4 Ch=7
Amplitude [ADC]
Time [Tick]

NP02 Membrane VD-style (Selected)