



MBHA-001 *forgotten signals*

2020-04-03

TE-MS-C-TF

F. Mangiarotti, G. Willering, G. Ninet, V. Desbiolles, M. Bajko



Acknowledgements to all involved.


What did we record with the SM18 DAQ?

- Current
- Coil, splice, bus bar, lead voltage
- Differential voltages
- Quench heater voltage and current
- Quench antenna voltage
- Trim voltages
- Individual splice and diode voltage

Always

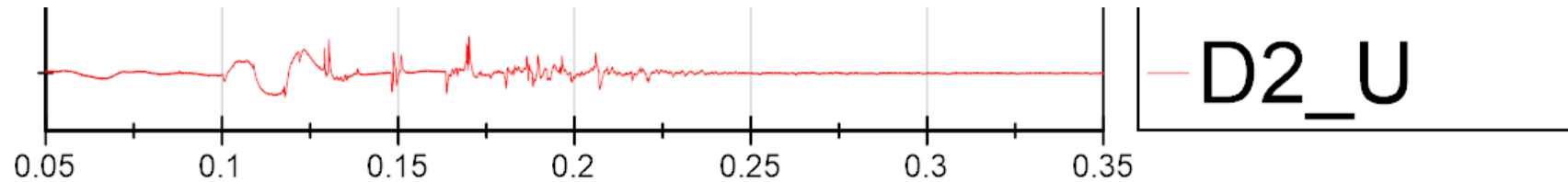
For some tests

What I will show here

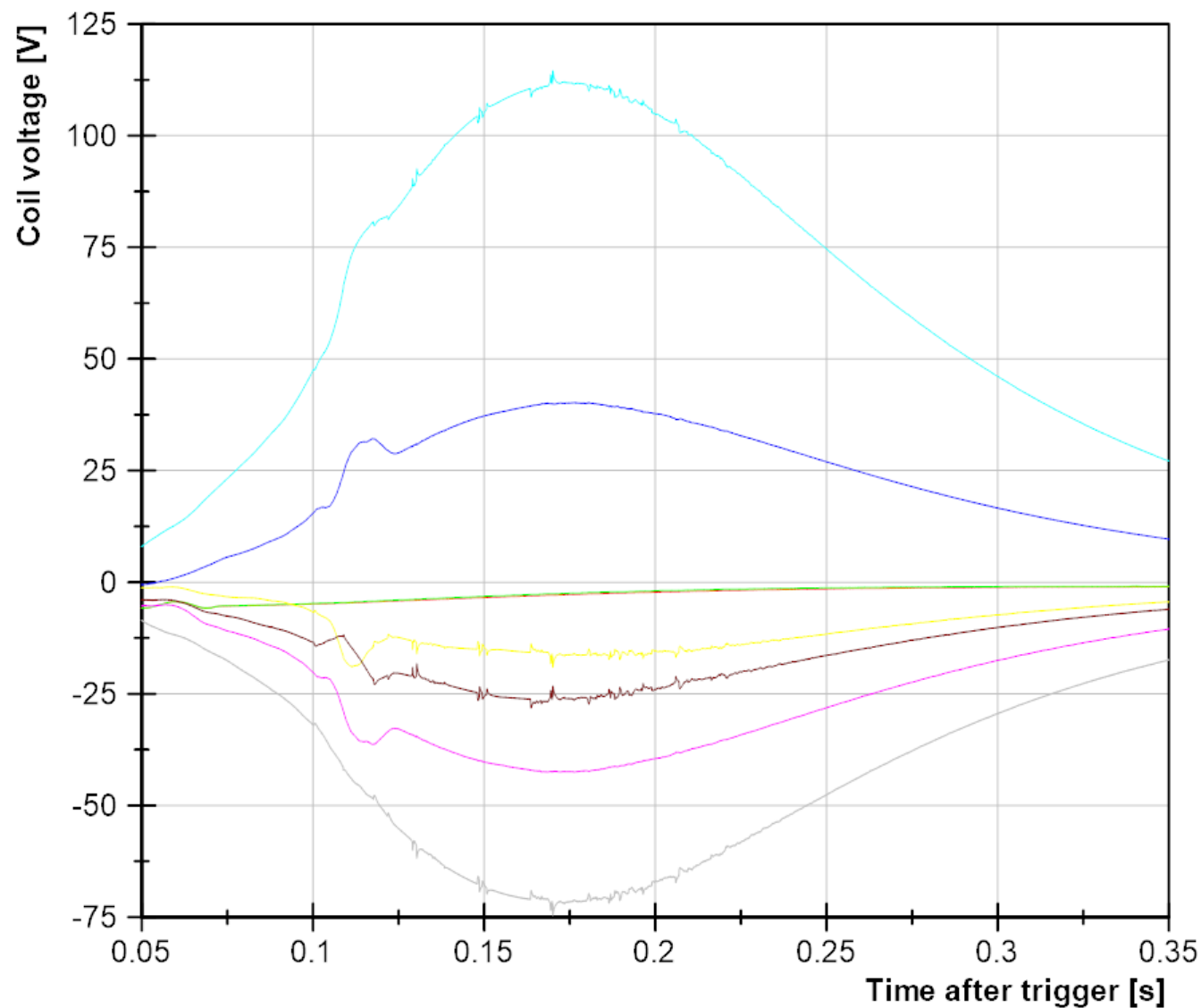
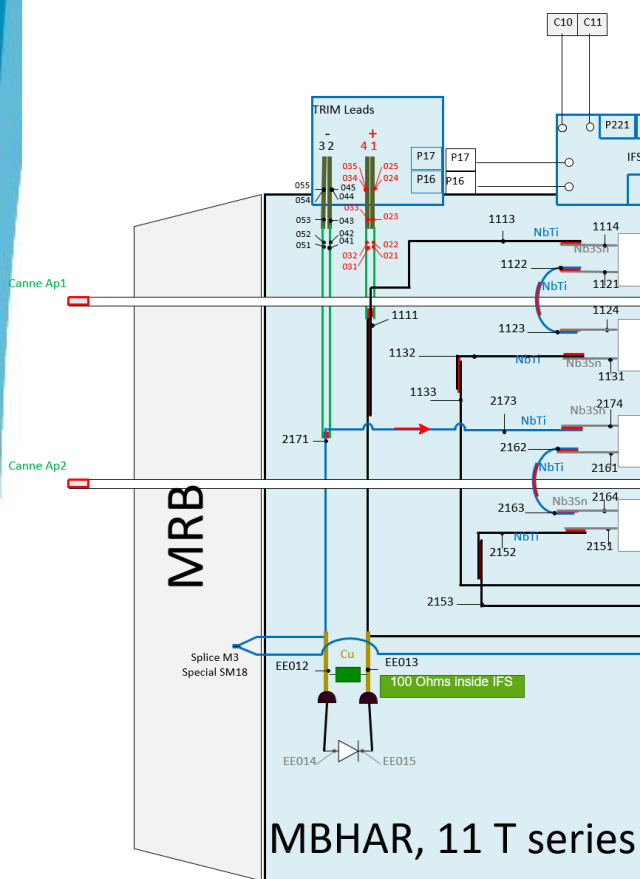
- Three case studies at 9 kA:
 - One quench from November, with high-gain quench antenna signals
 - One discharge from February, with Trim signals
 - One discharge from March, with low-gain QA, individual splices and diode signals
- Plots of signals and high-pass filtered signals, compared to D2_U (to see location of spikes)
- I will indicate with  when a signal has spikes

Case 1: HCLMBHA001- CR000001__K1911252008_a007(0)

Coil voltages

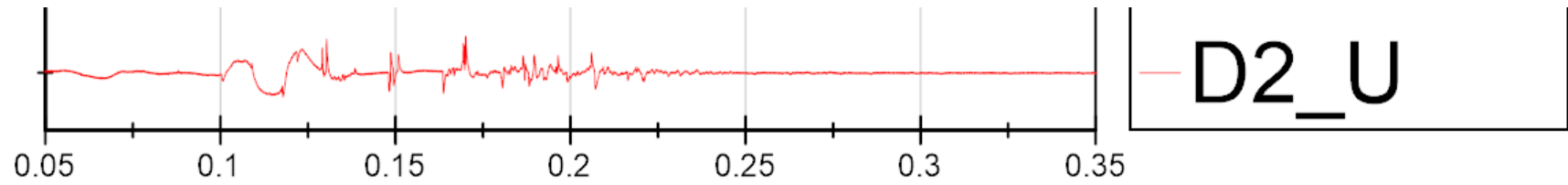


File: HCLMBHA001-CR000001__K1911252008_a007(0)

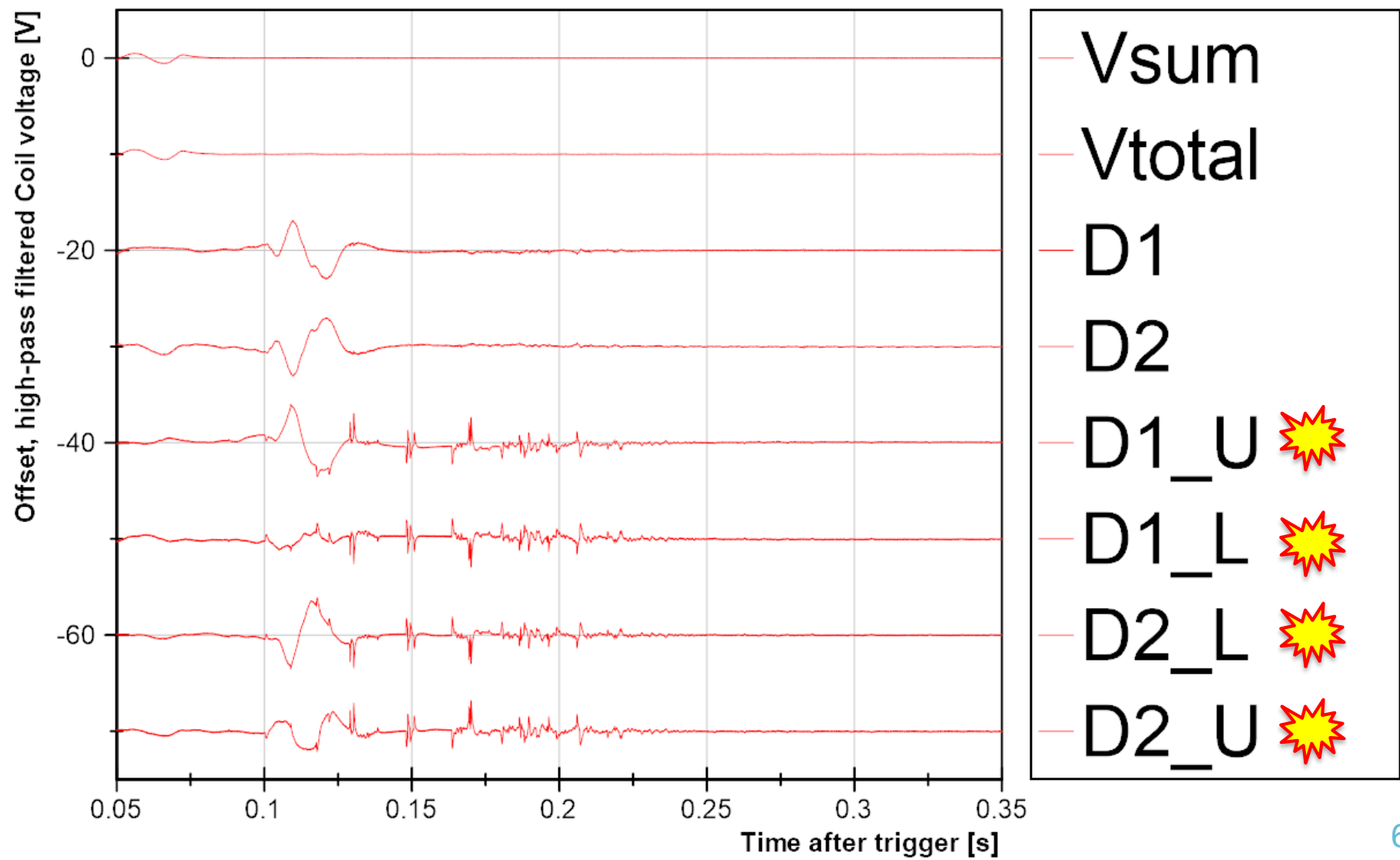
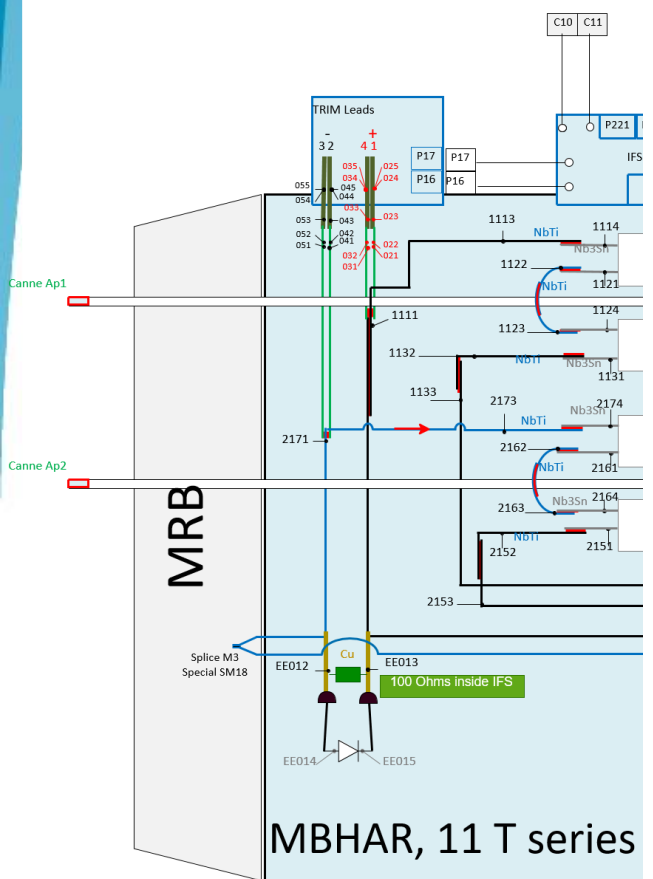


- Vsum
- Vtotal
- D1
- D2
- D1_U
- D1_L
- D2_L
- D2_U

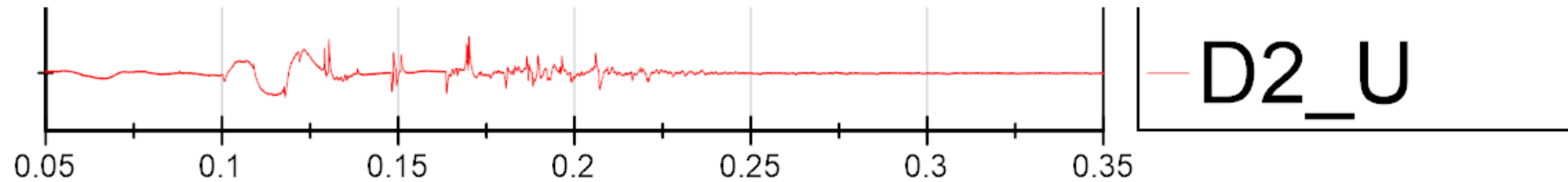
Coil voltages



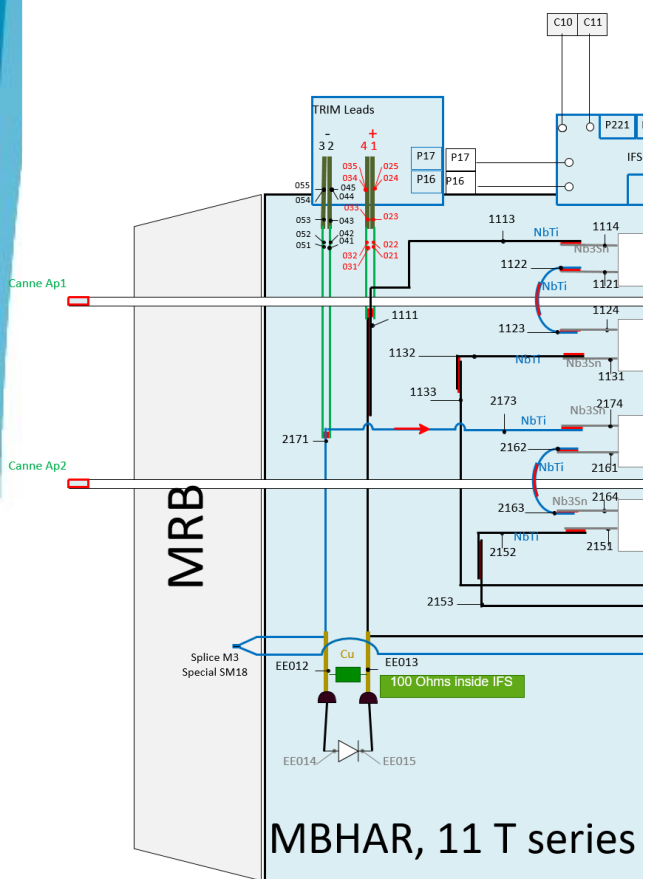
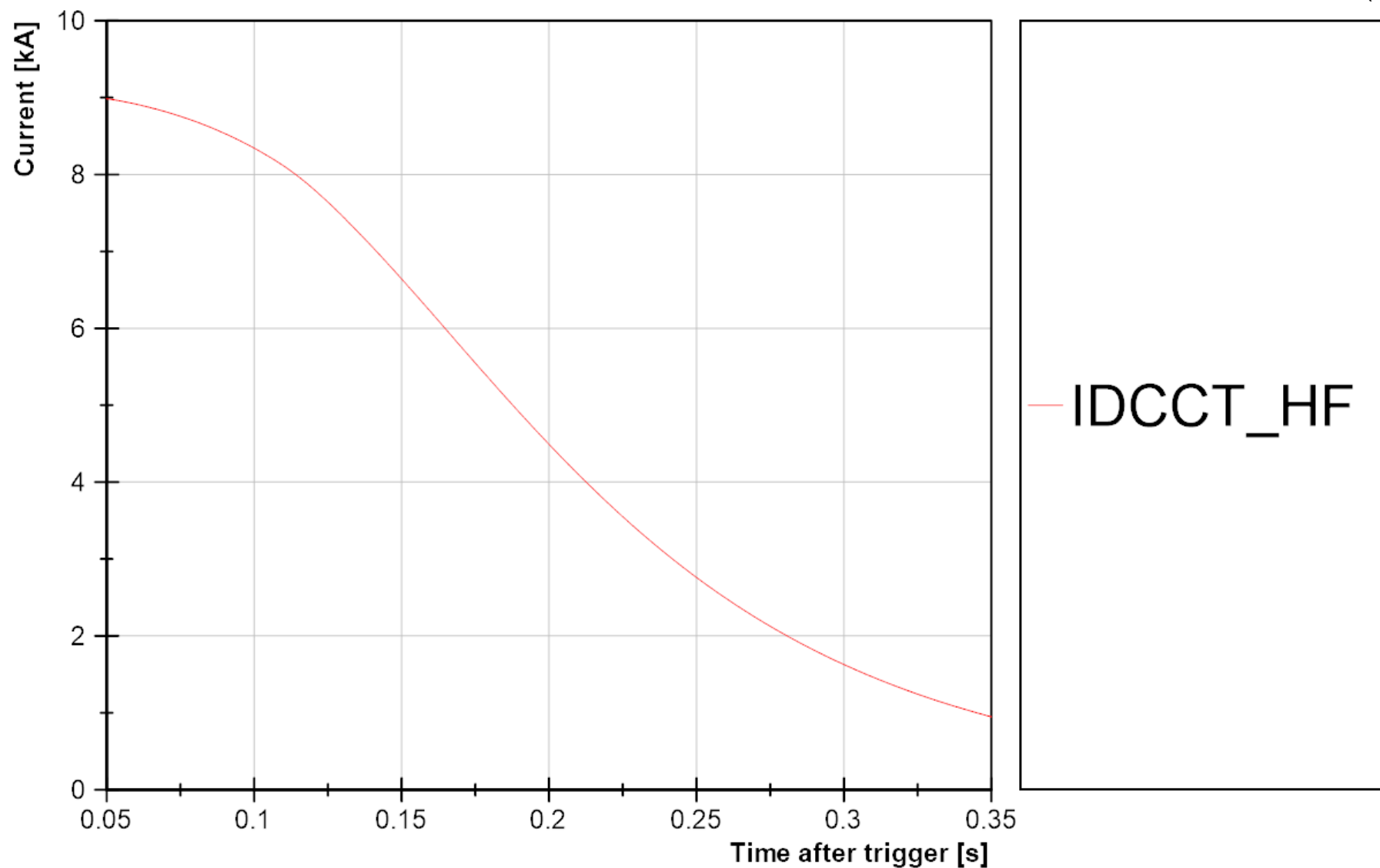
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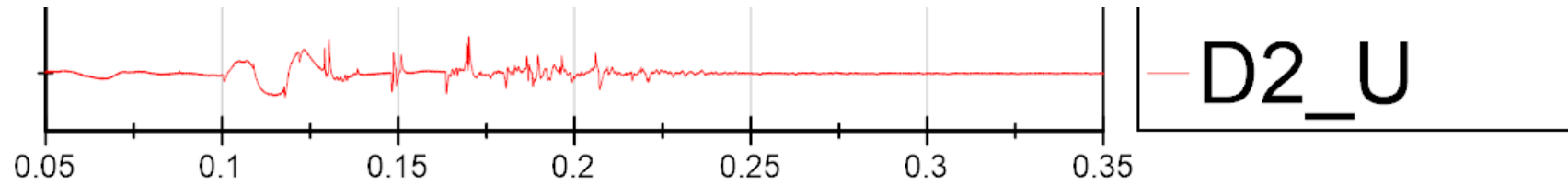
Current



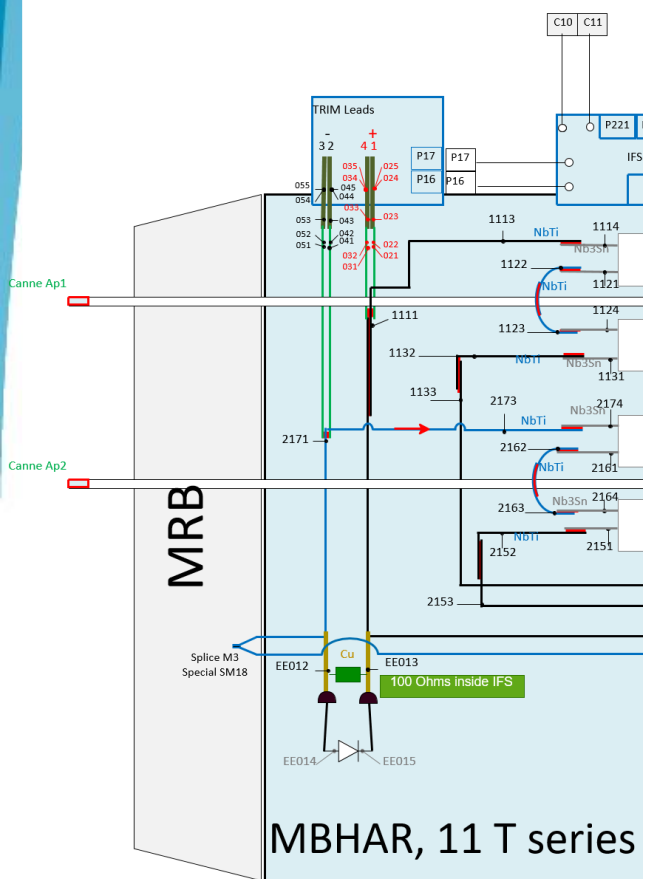
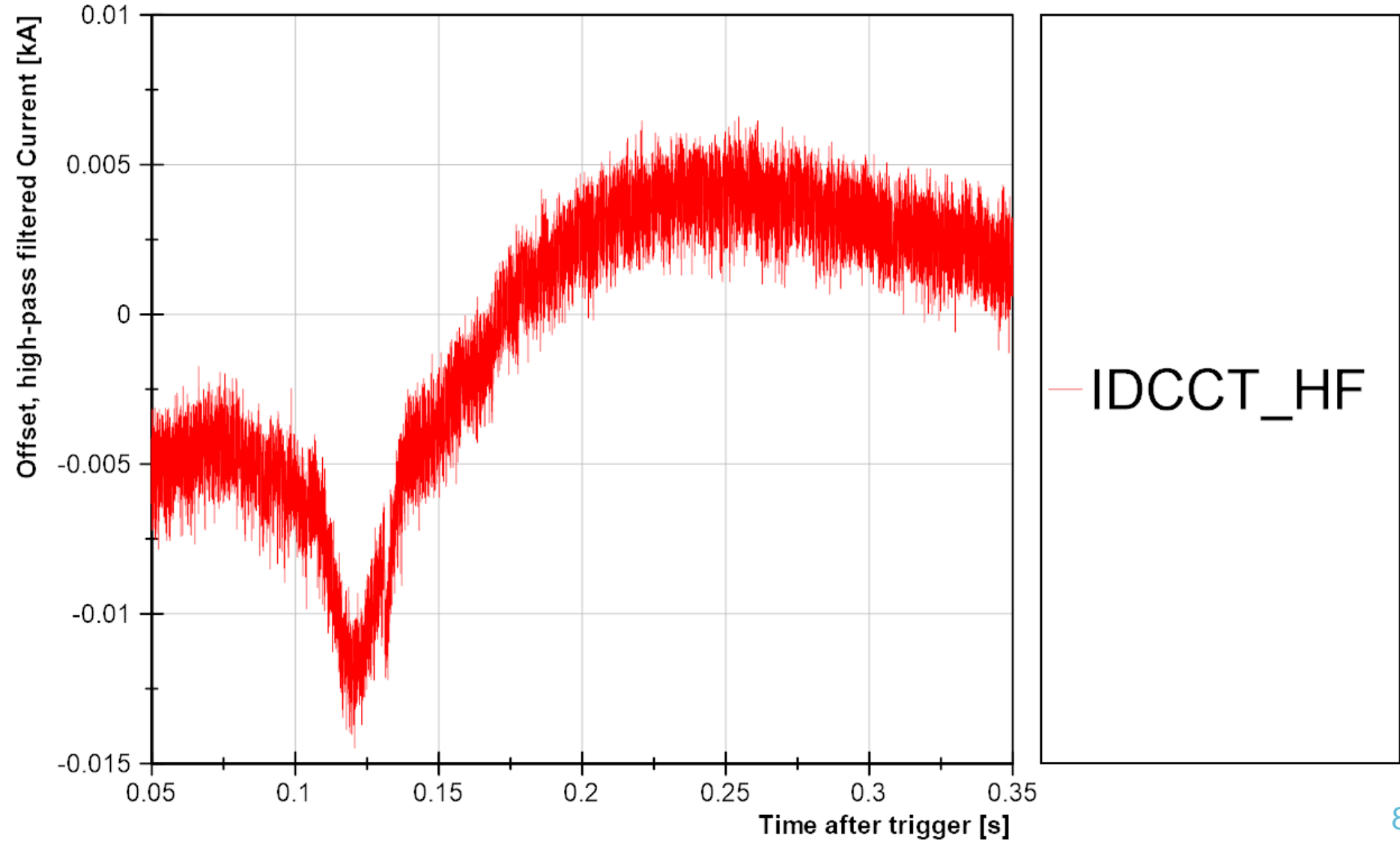
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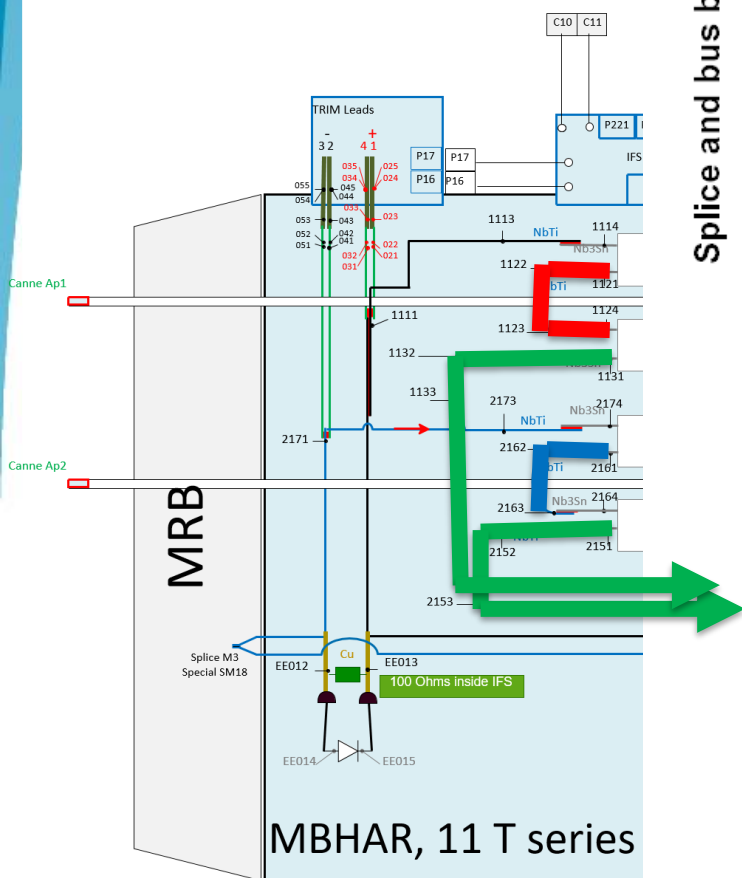
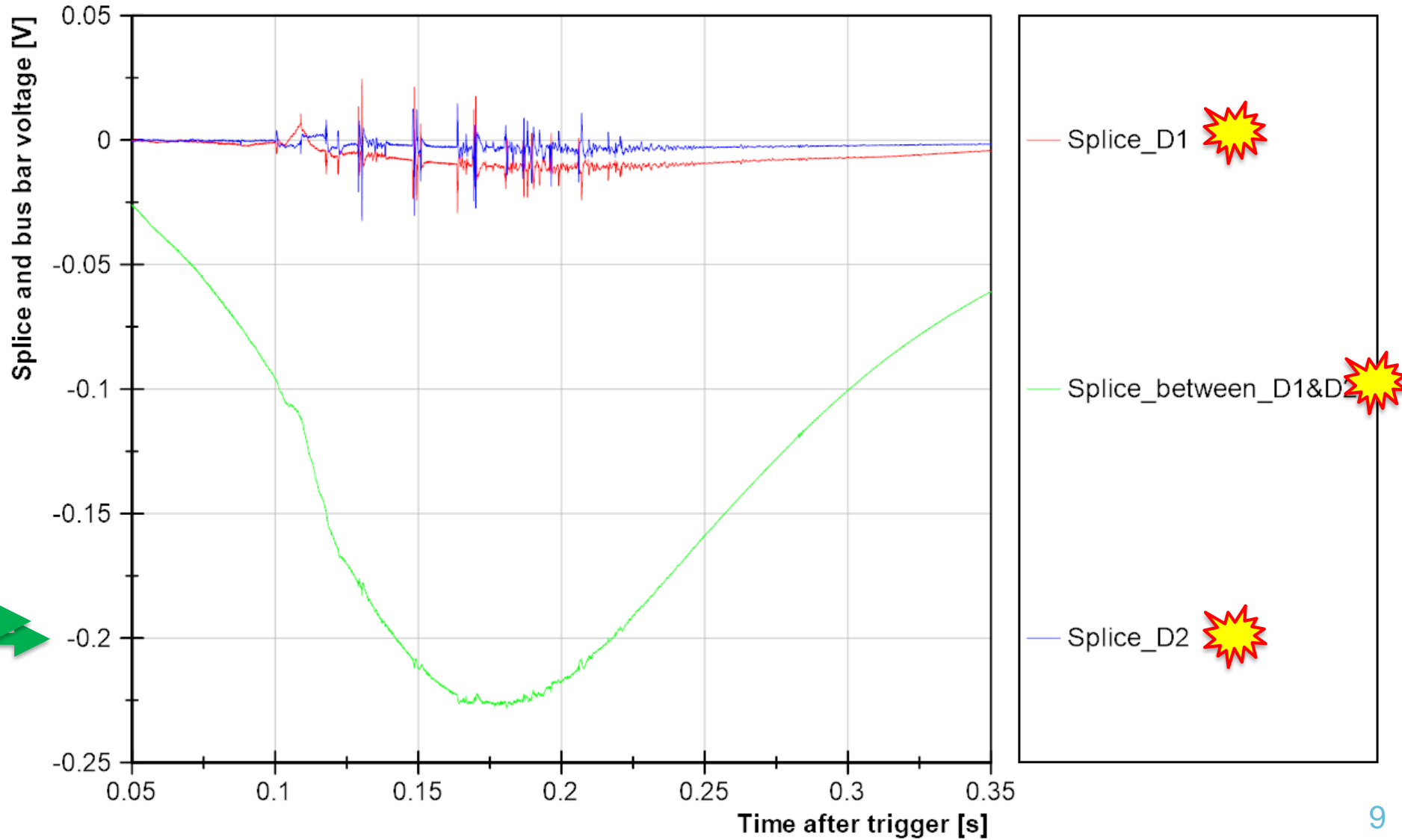
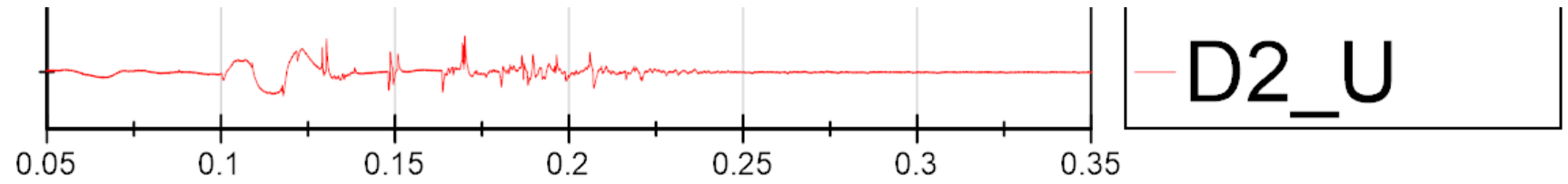
Current



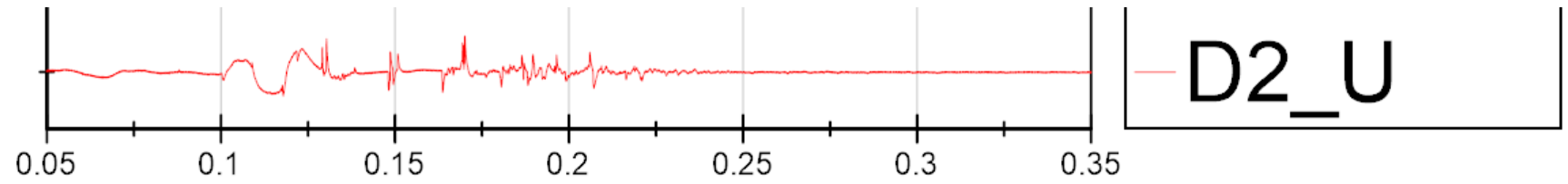
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Splices and m4 bus bar

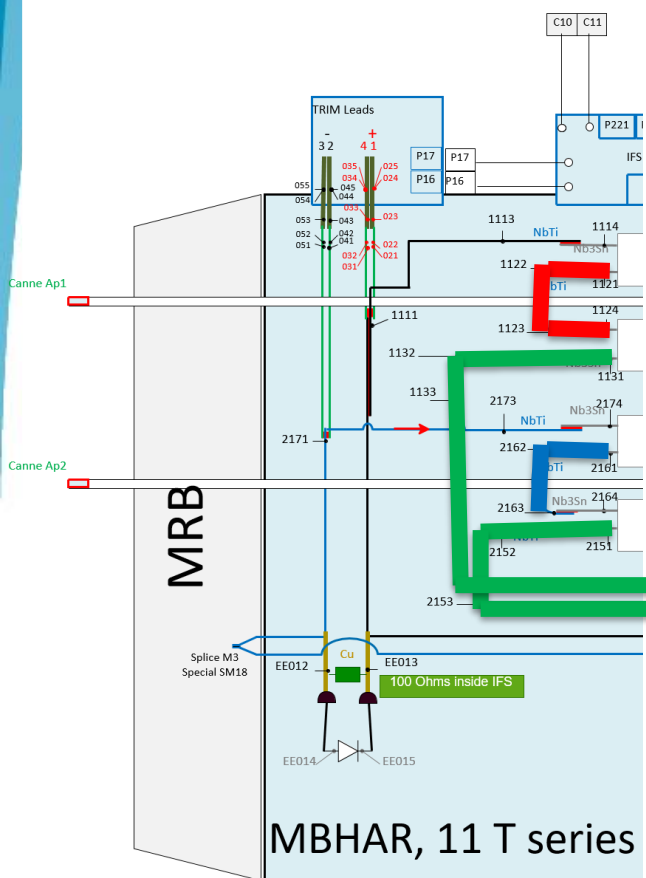
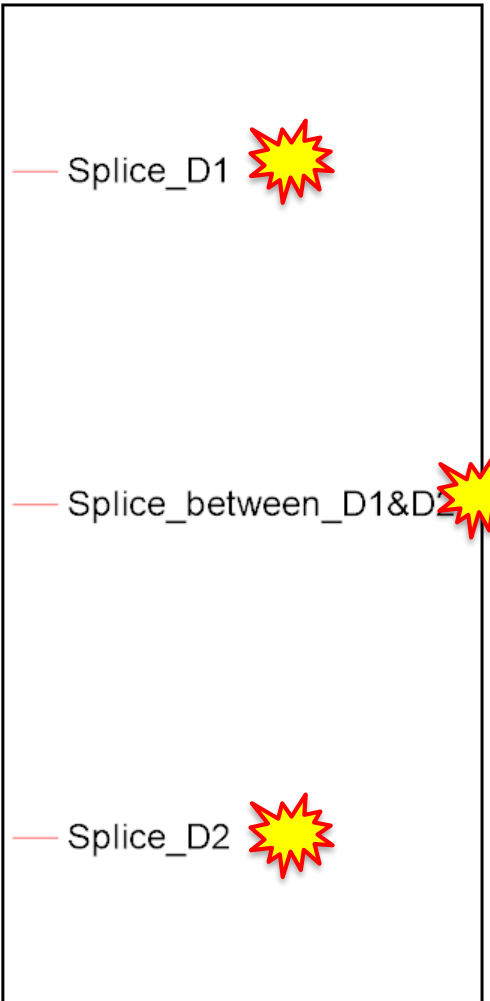
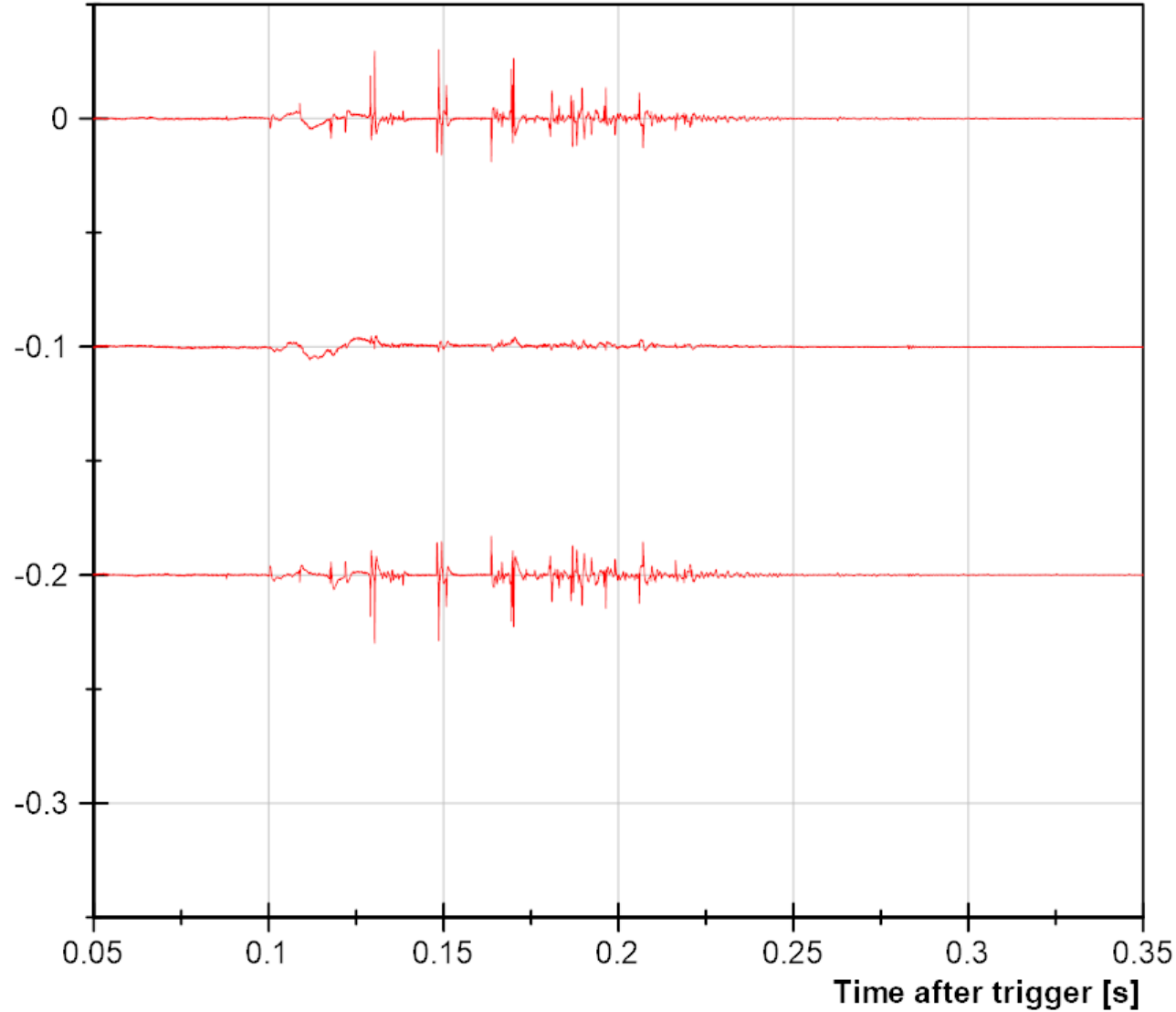


Splices and m4 bus bar

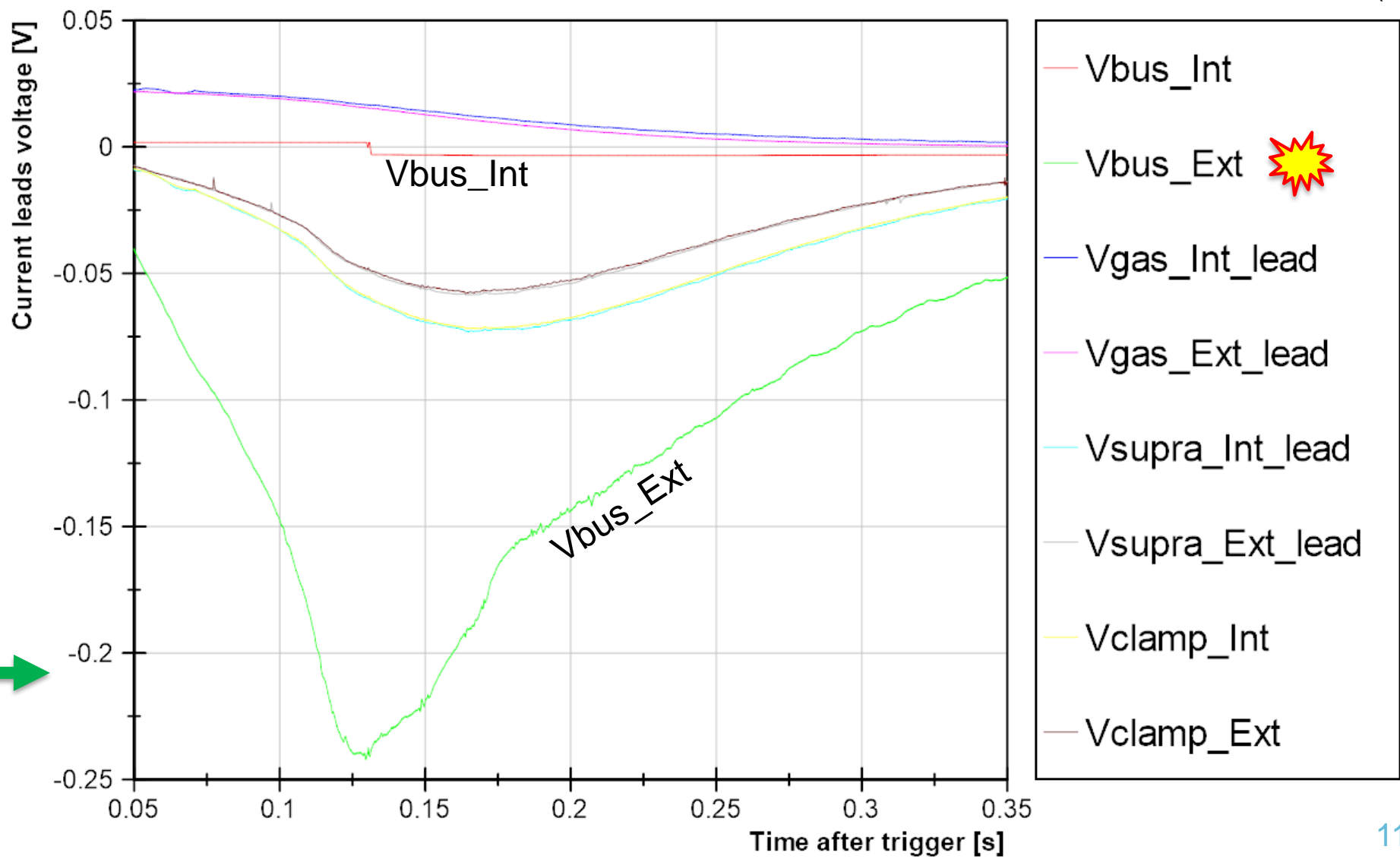
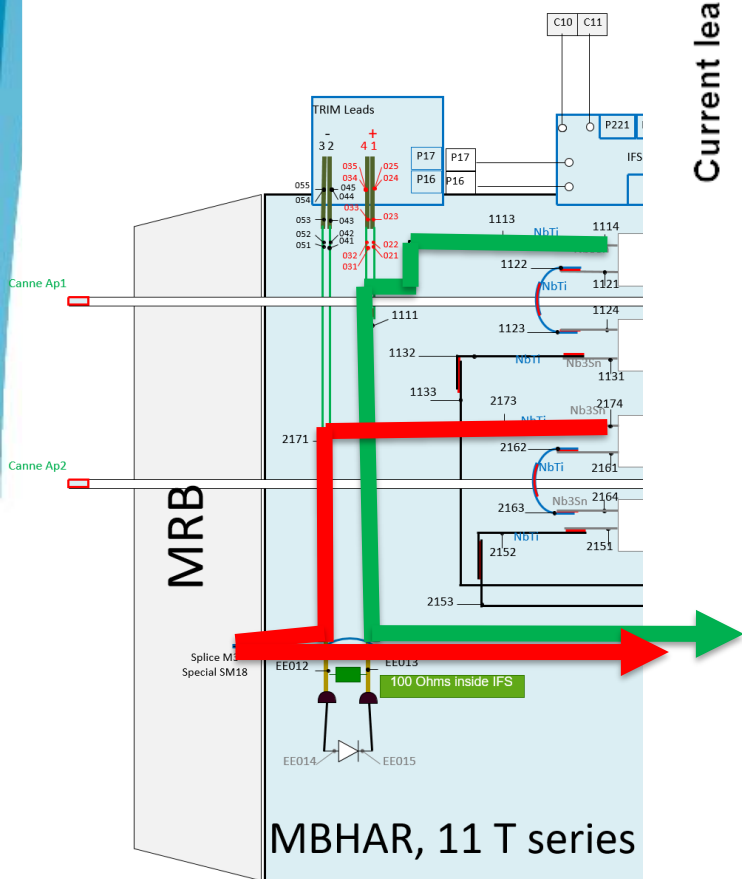
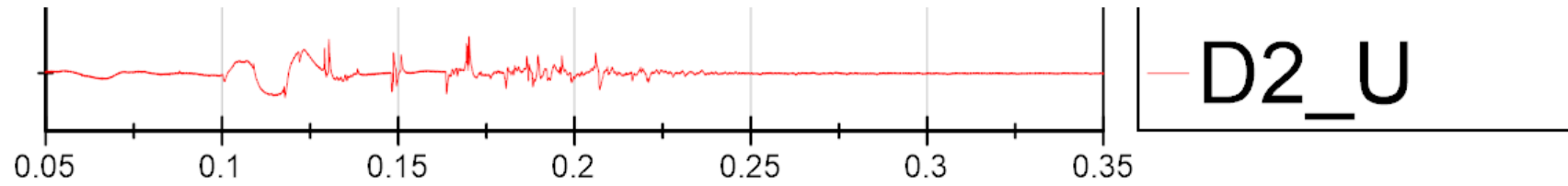


File: HCLMBHA001-CR000001__K1911252008_a007(0)

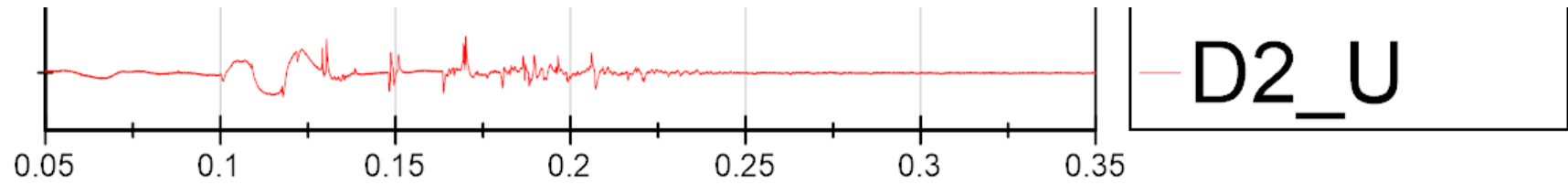
Offset, high-pass filtered Splice and bus bar voltage [V]



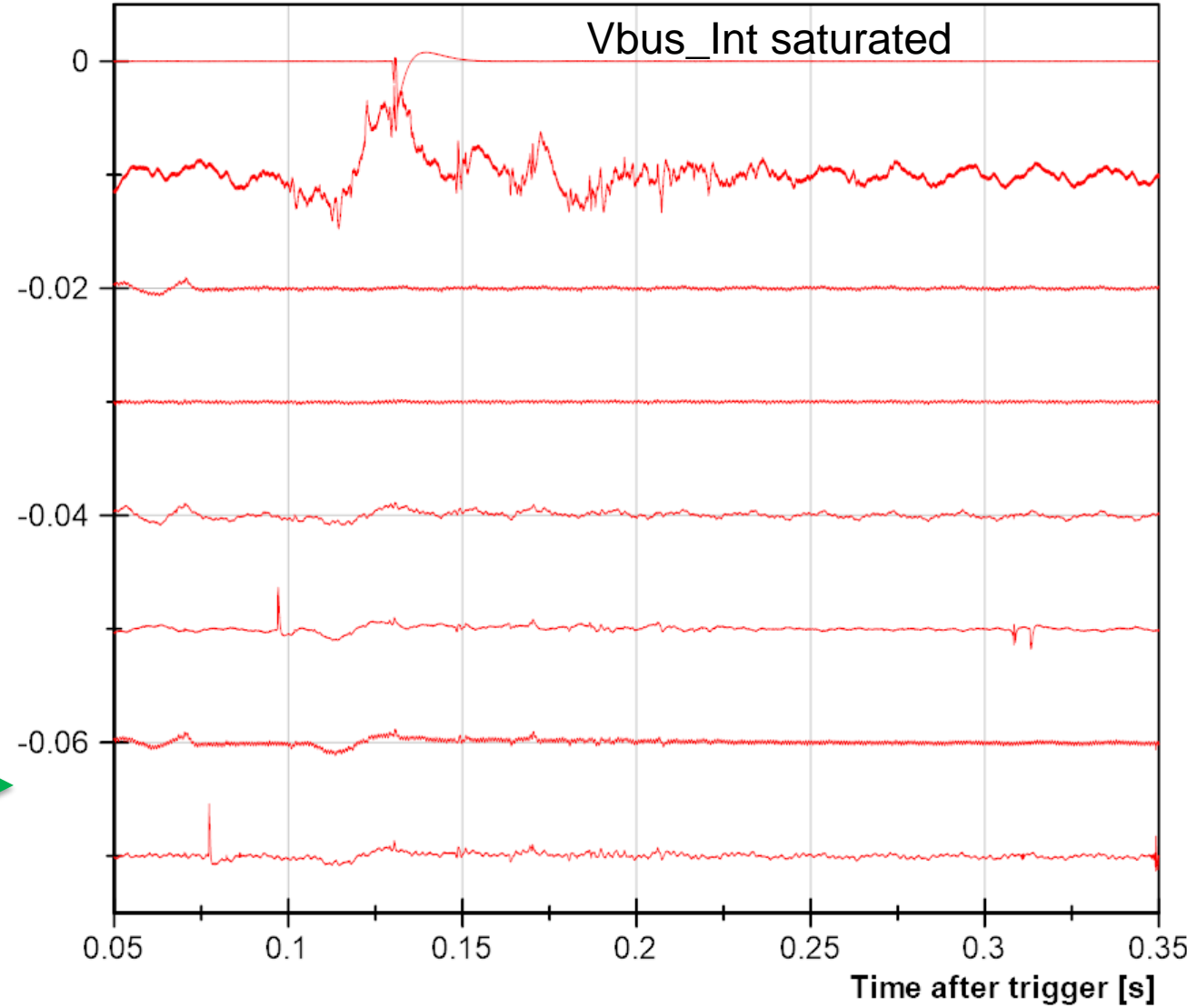
m3 bus bar & current leads




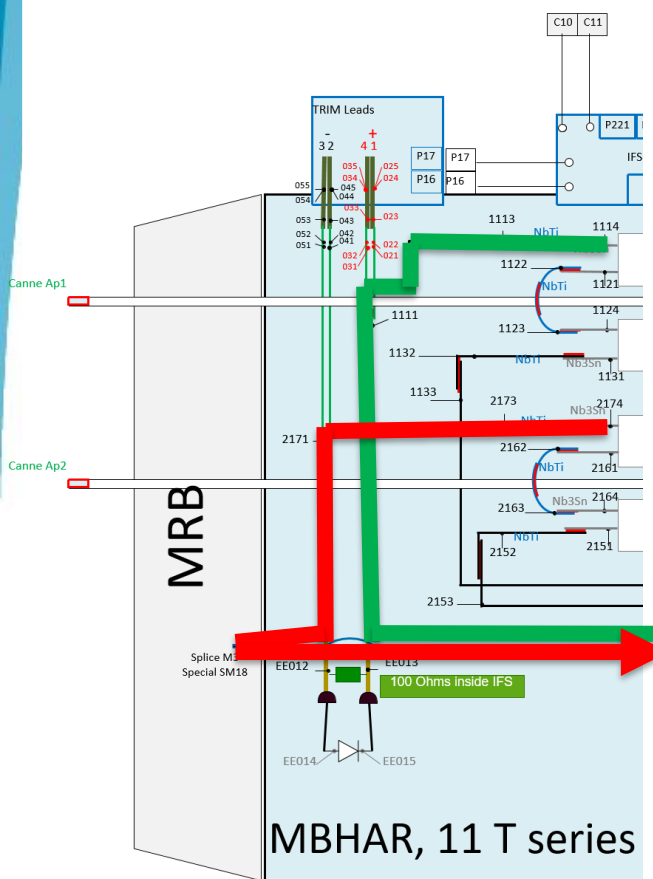
m3 bus bar & current leads



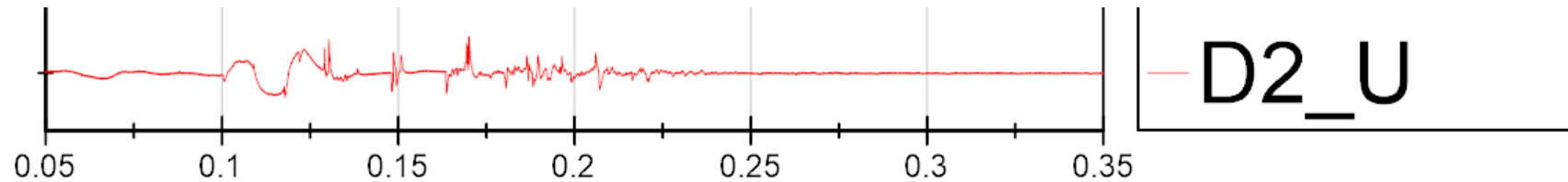
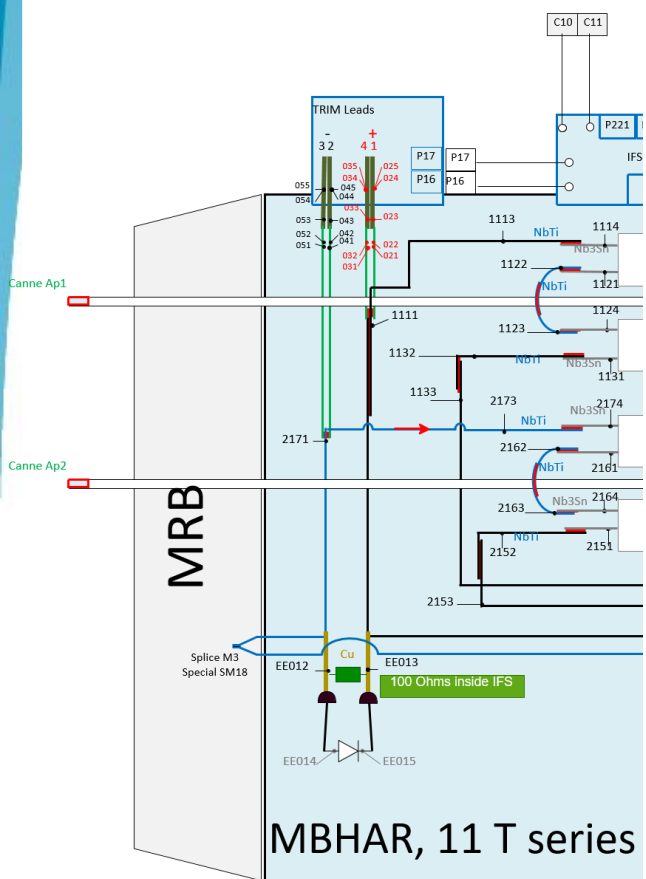
Offset, high-pass filtered Current leads voltage [V]



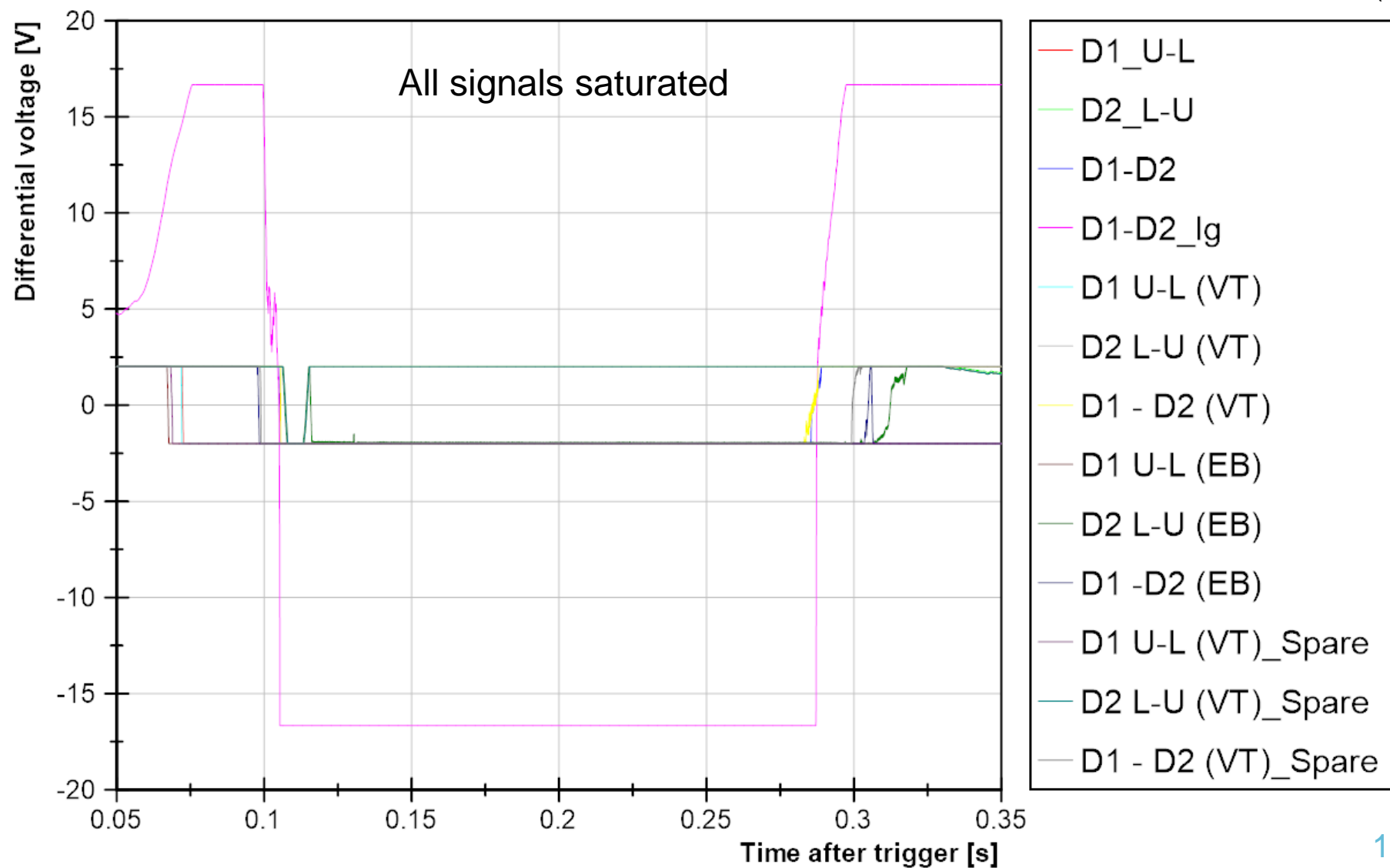
- Vbus_Int
- Vbus_Ext 
- Vgas_Int_lead
- Vgas_Ext_lead
- Vsupra_Int_lead
- Vsupra_Ext_lead
- Vclamp_Int
- Vclamp_Ext



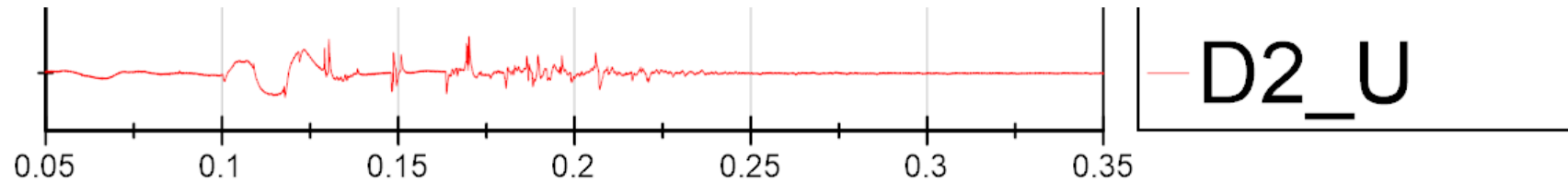
Differential voltages



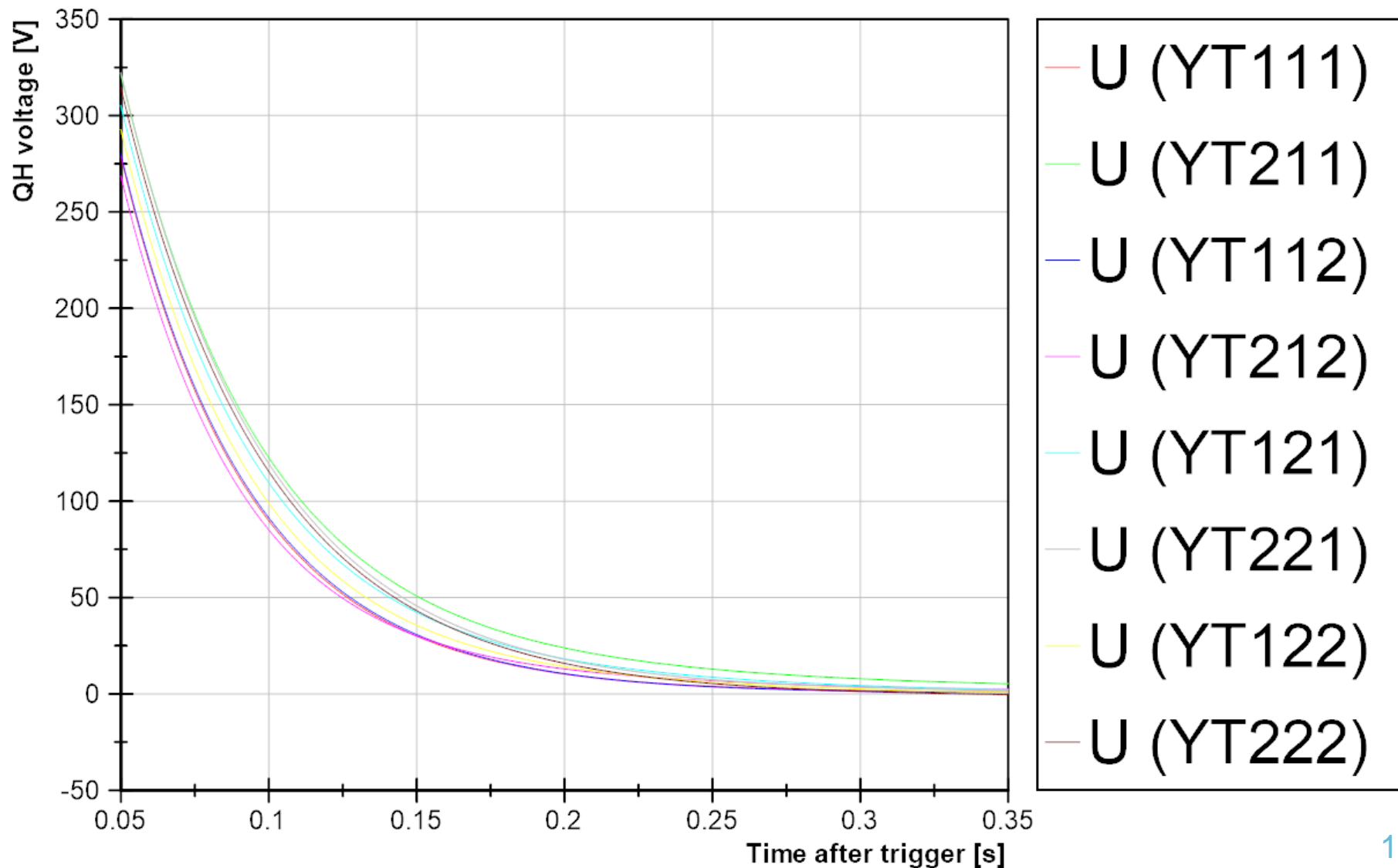
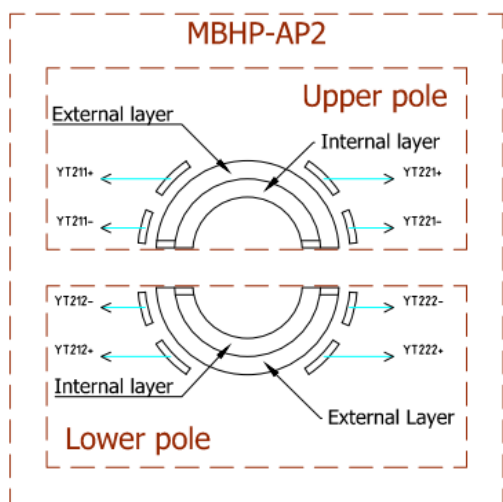
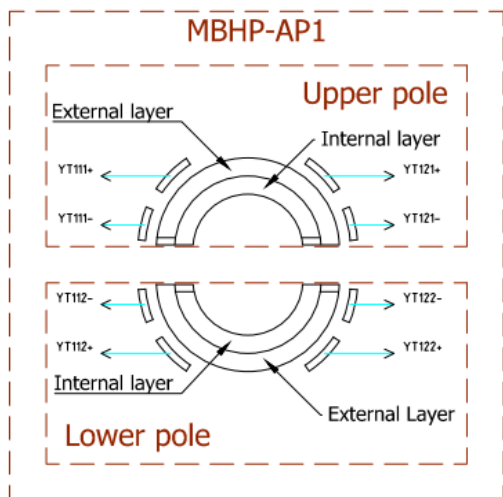
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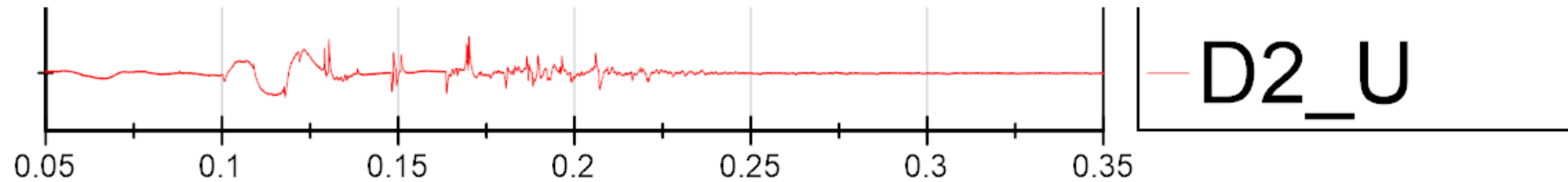
QH voltage



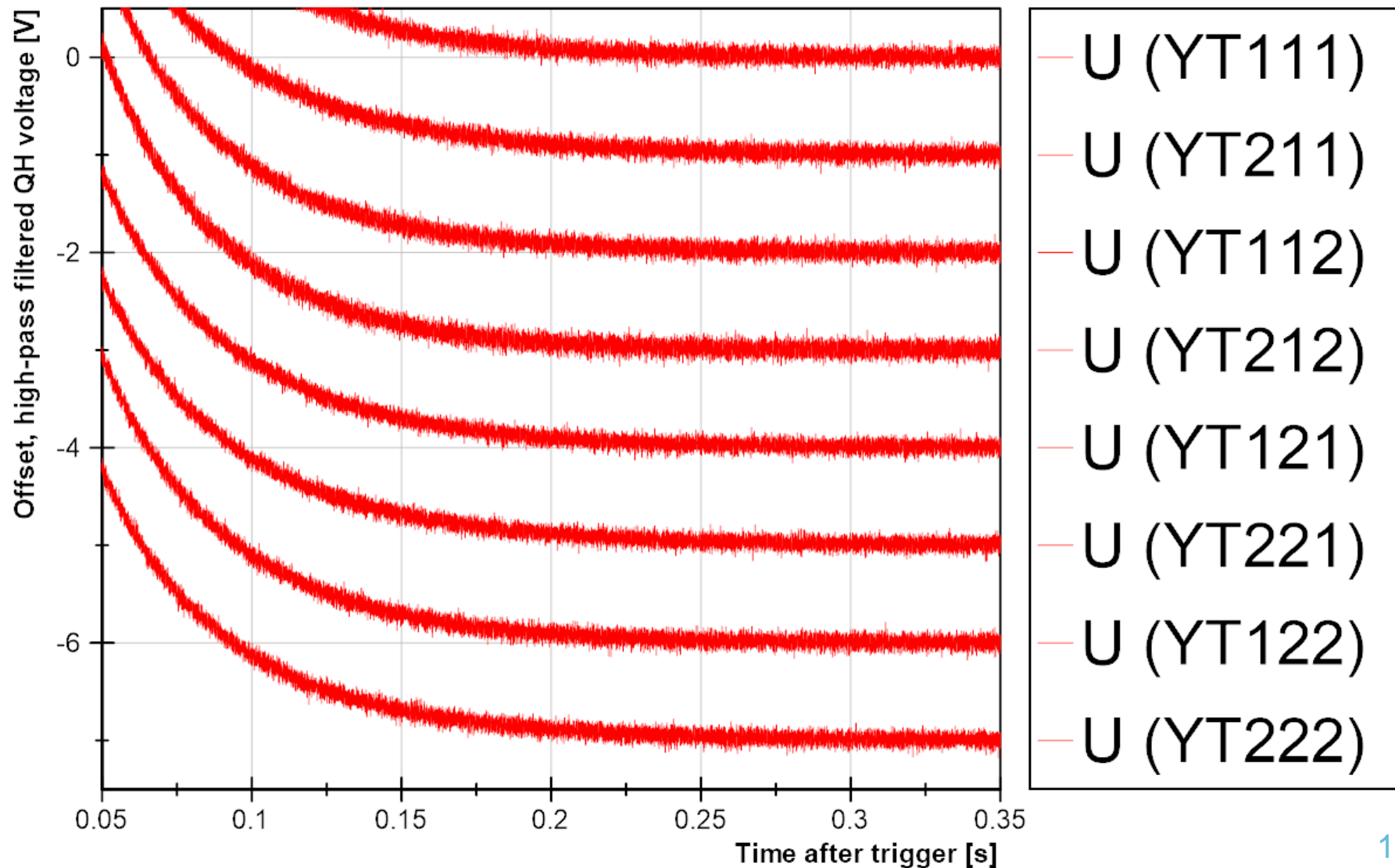
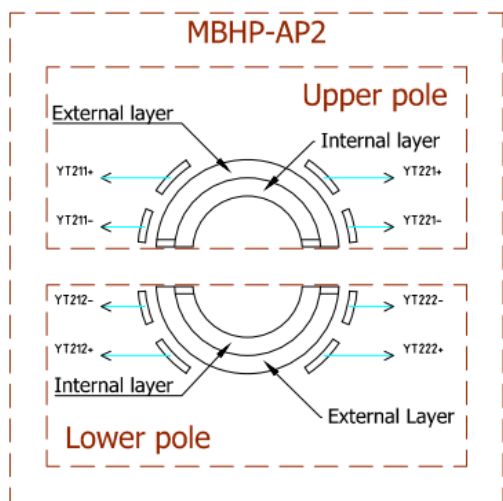
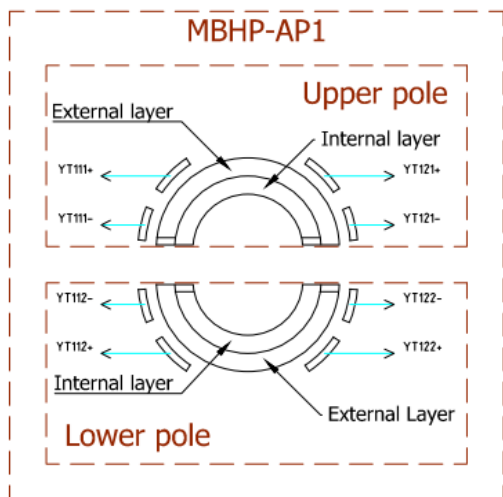
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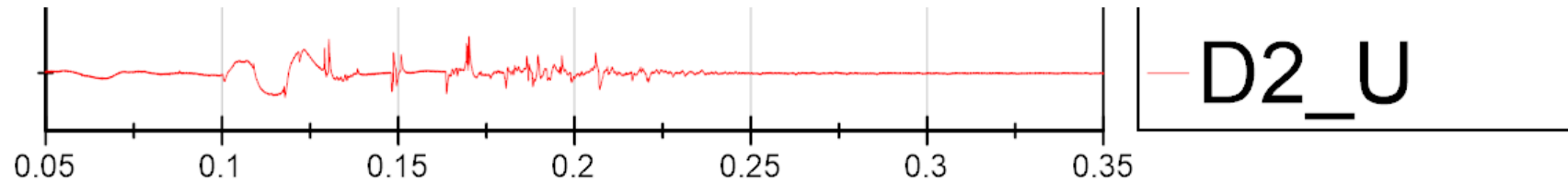
QH voltage



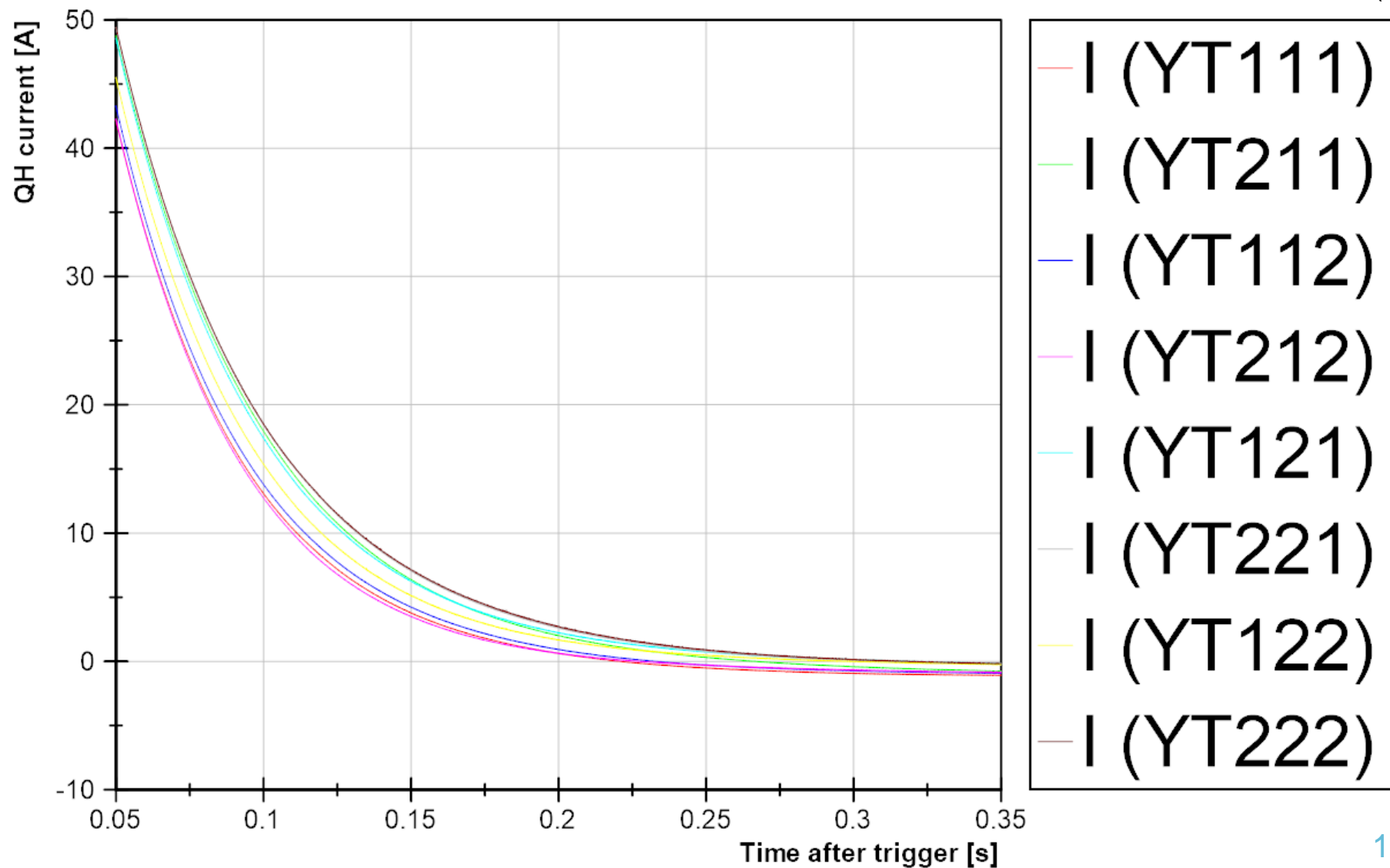
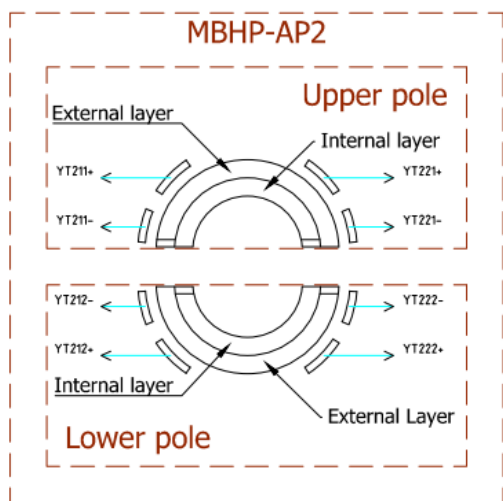
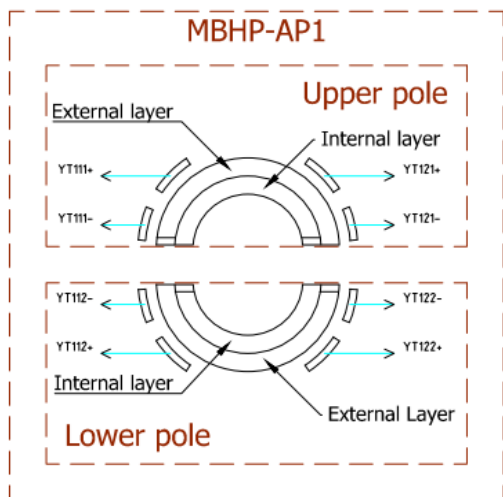
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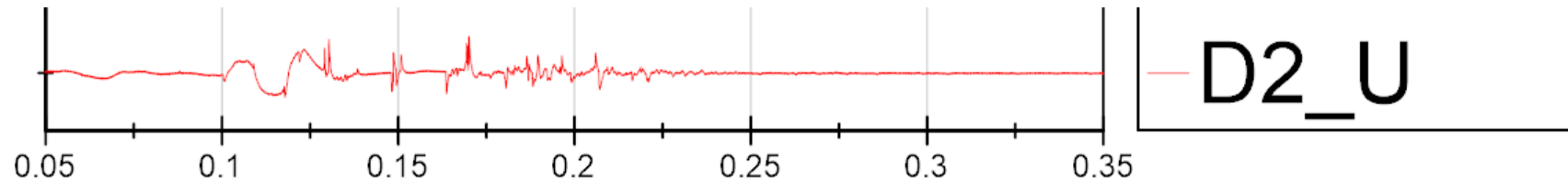
QH current



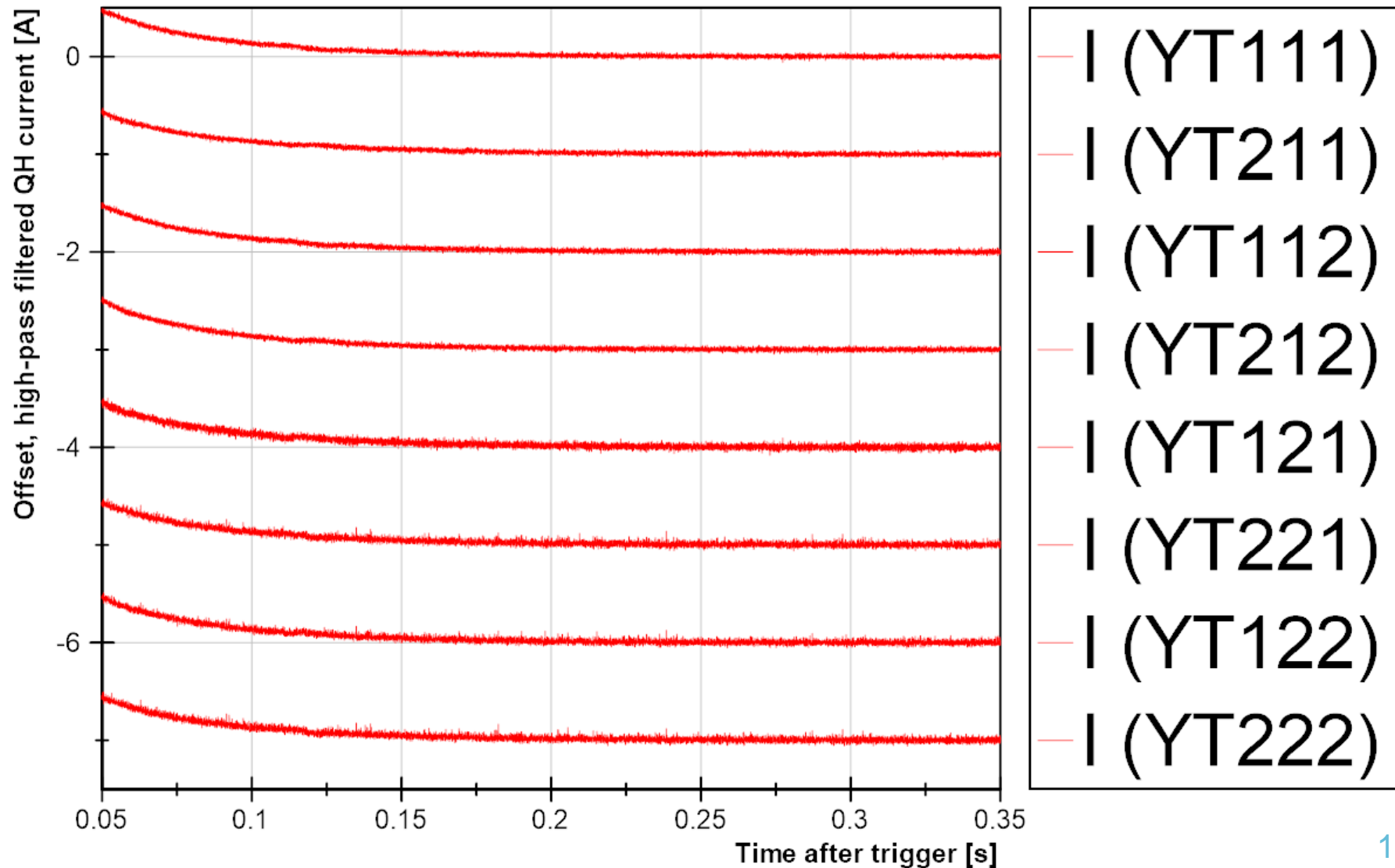
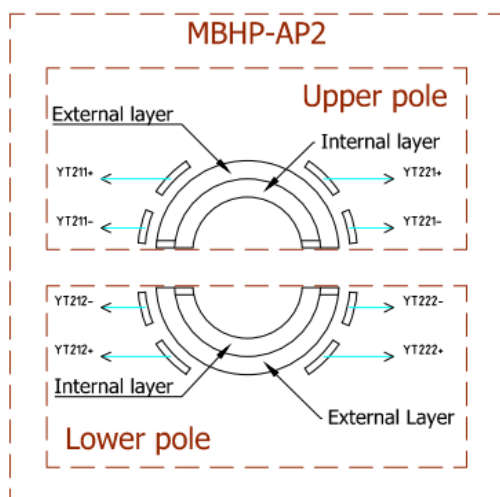
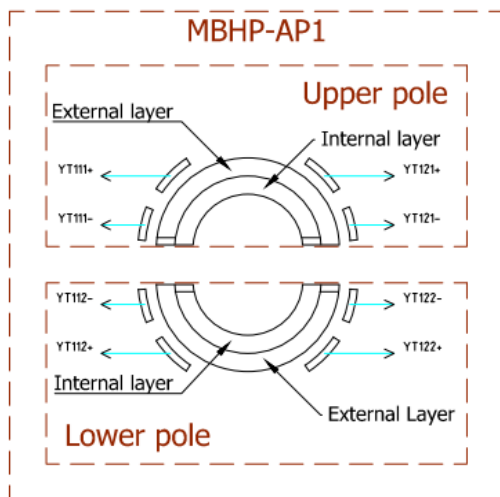
File: HCLMBHA001-CR000001__K1911252008_a007(0)



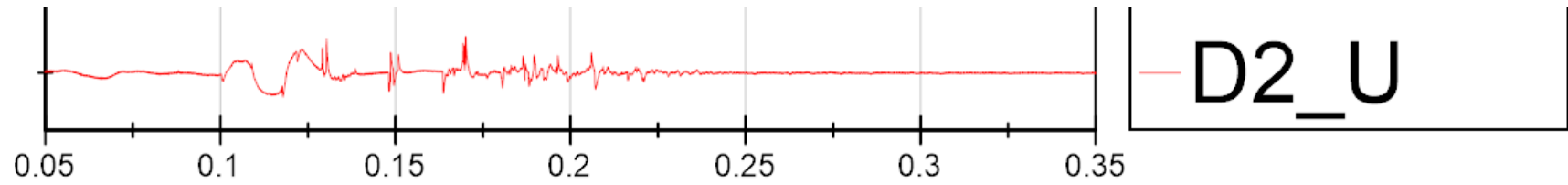
QH current



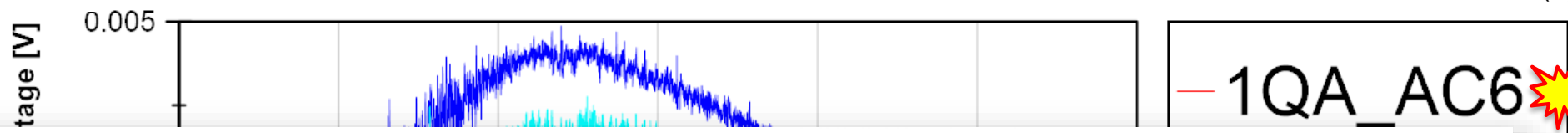
File: HCLMBHA001-CR000001__K1911252008_a007(0)



QA high gain voltage



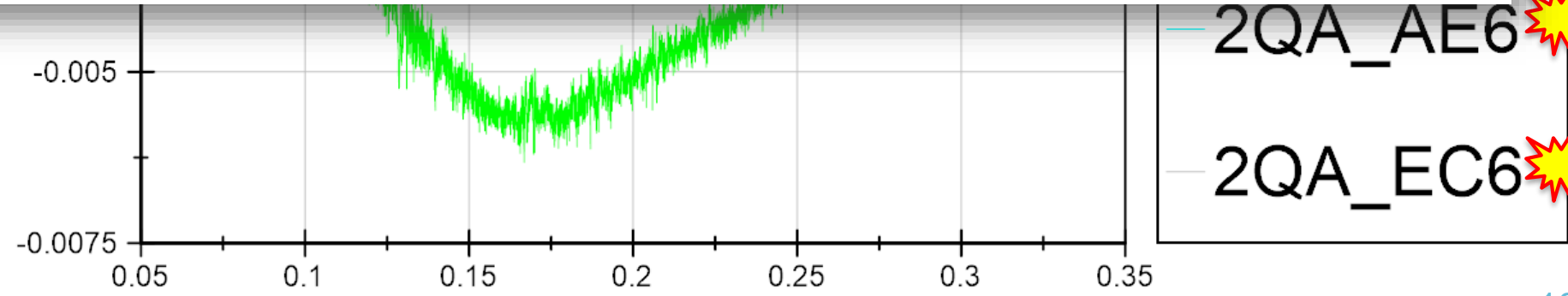
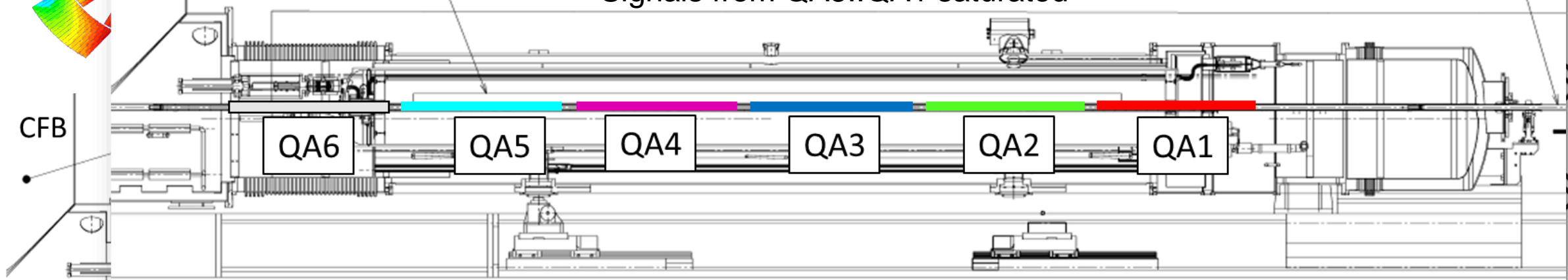
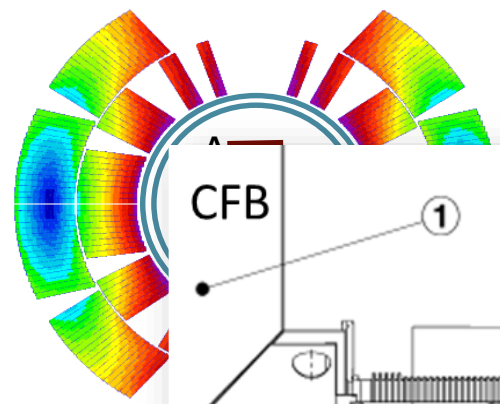
File: HCLMBHA001-CR000001__K1911252008_a007(0)



1:20

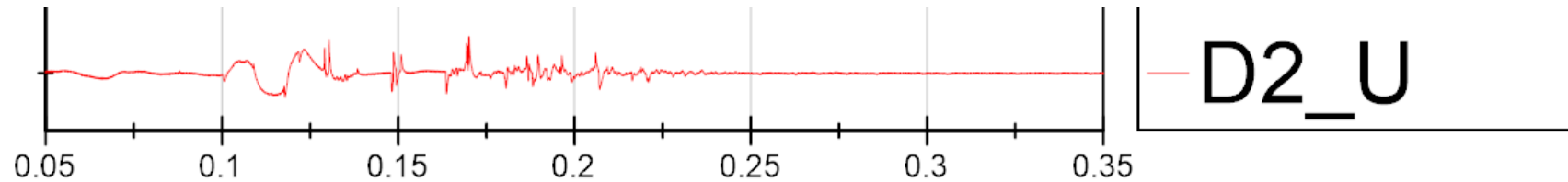
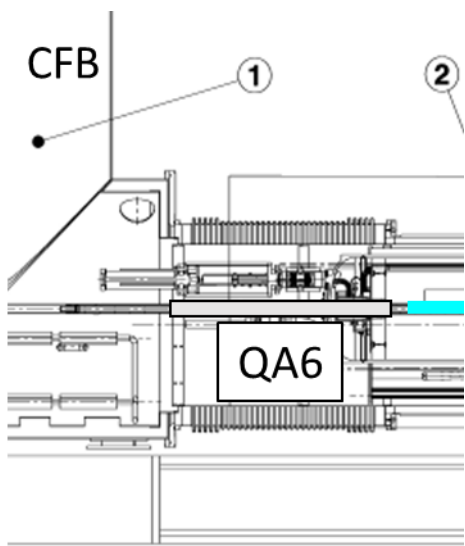
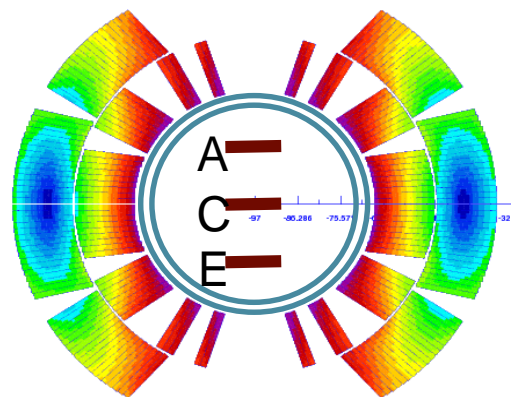
(Schematic location, colors don't correspond to signals)
Signals from QA5..QA1 saturated

Connection side



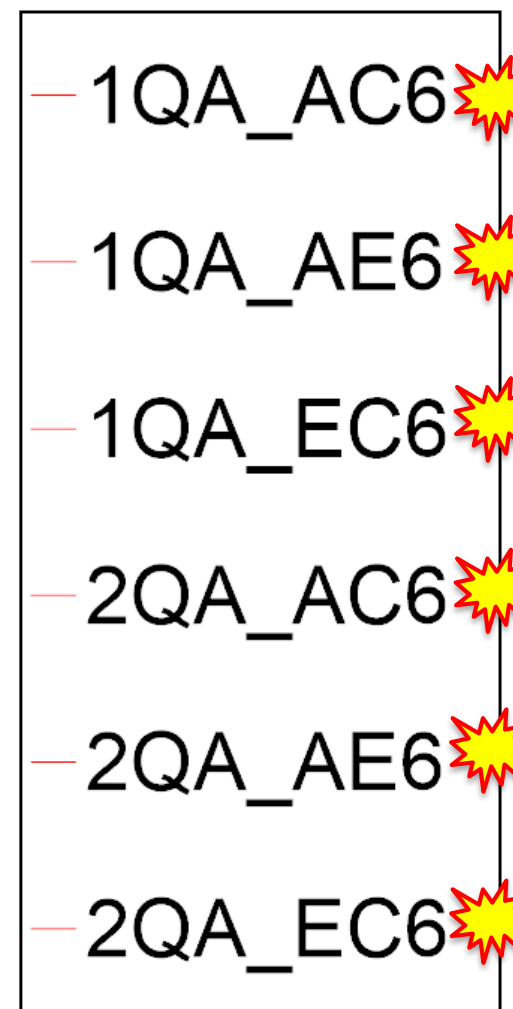
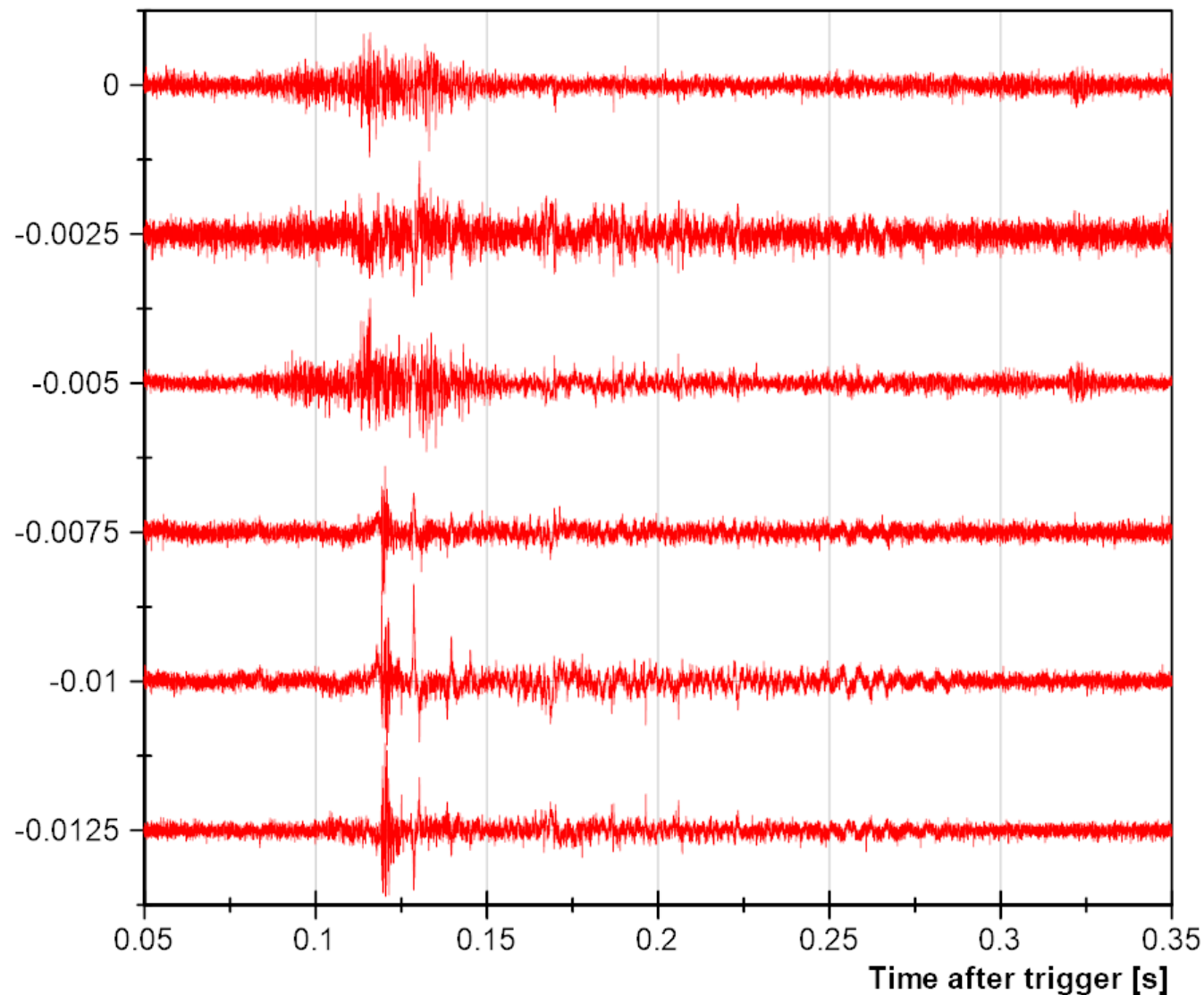
Time after trigger [s]

QA high gain voltage



File: HCLMBHA001-CR000001__K1911252008_a007(0)

Offset, high-pass filtered QA high gain voltage [V]



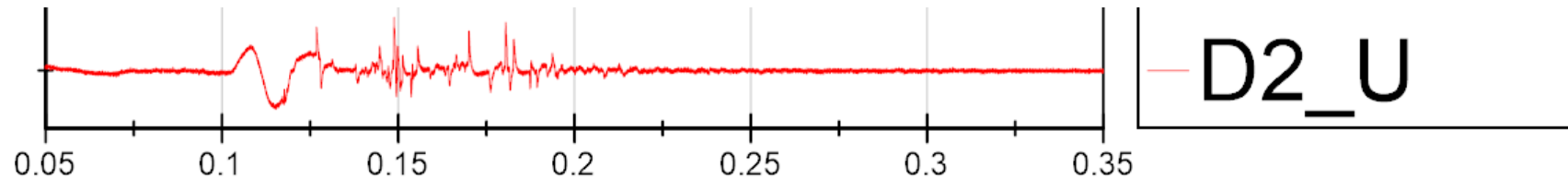
Case 1 conclusion

- Spikes seen in:
 - Coils
 - Splices
 - At least one of the m3 bus bars + coil splice
 - Quench antenna (high gain)
- Not seen in:
 - Full aperture and full magnet voltage
 - Current leads
 - Quench heaters

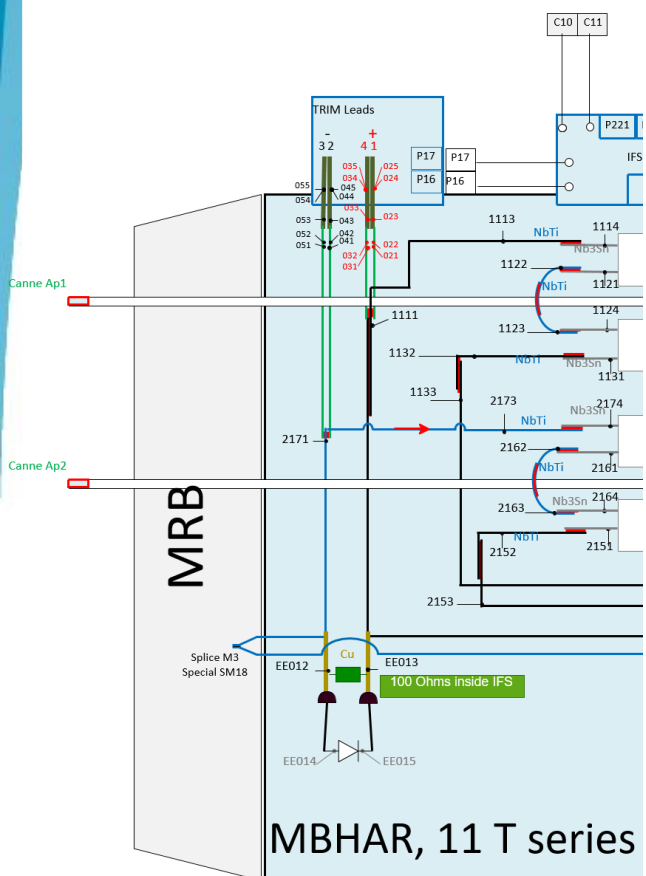
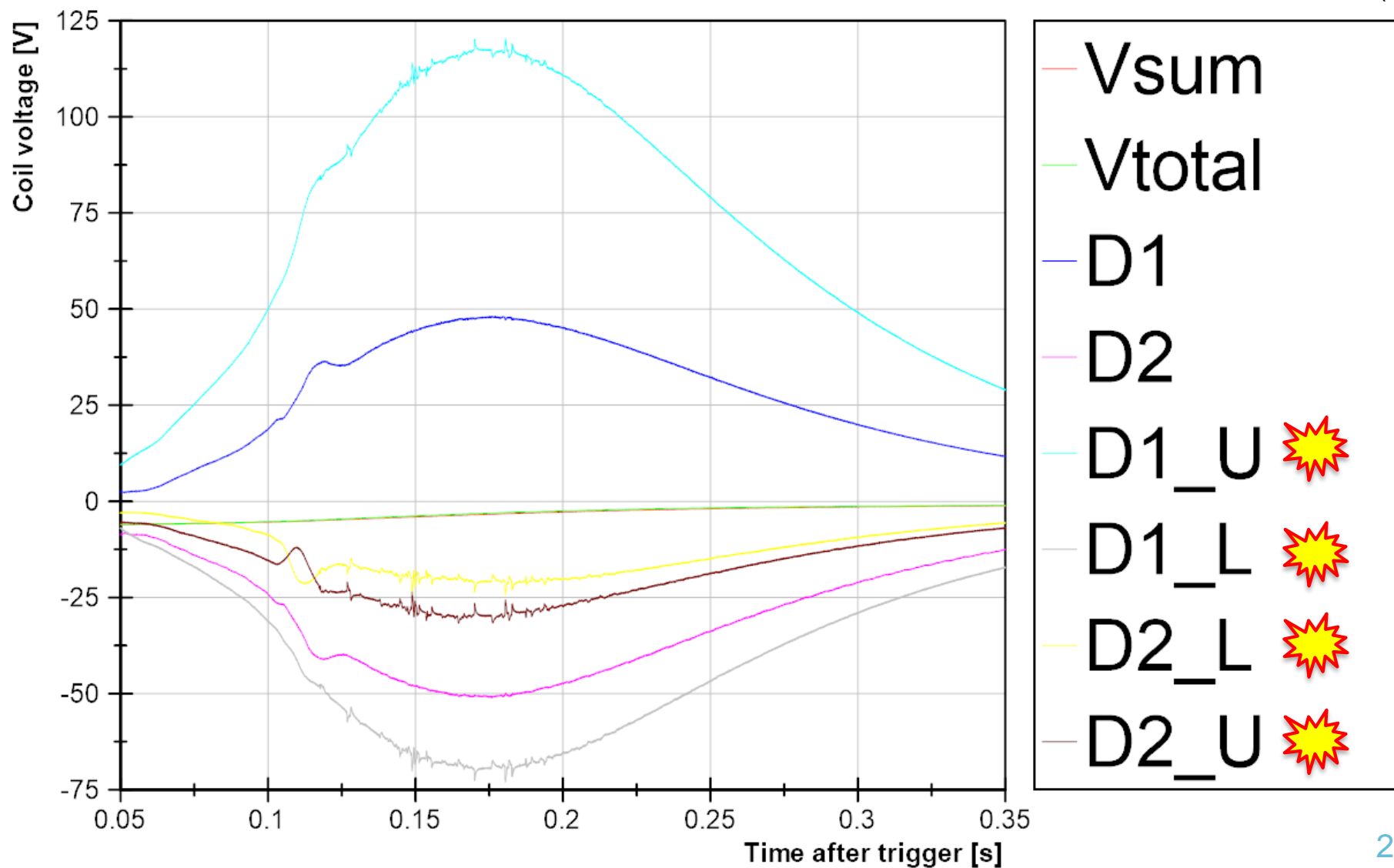
Case 2: HCLMBHA001- CR000001_2__K2002261648_a009(0)

Only the “new” signals

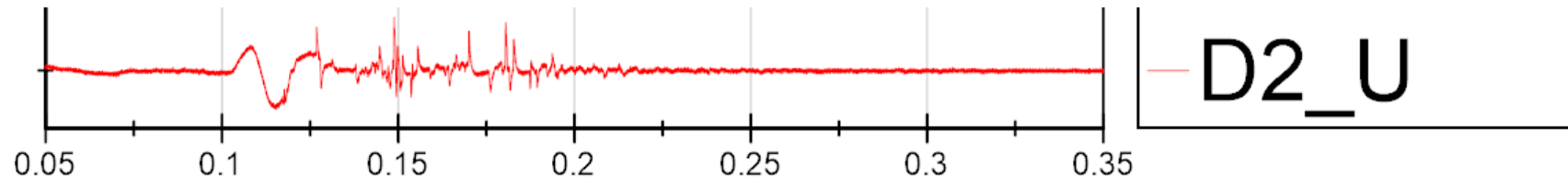
Coil voltages



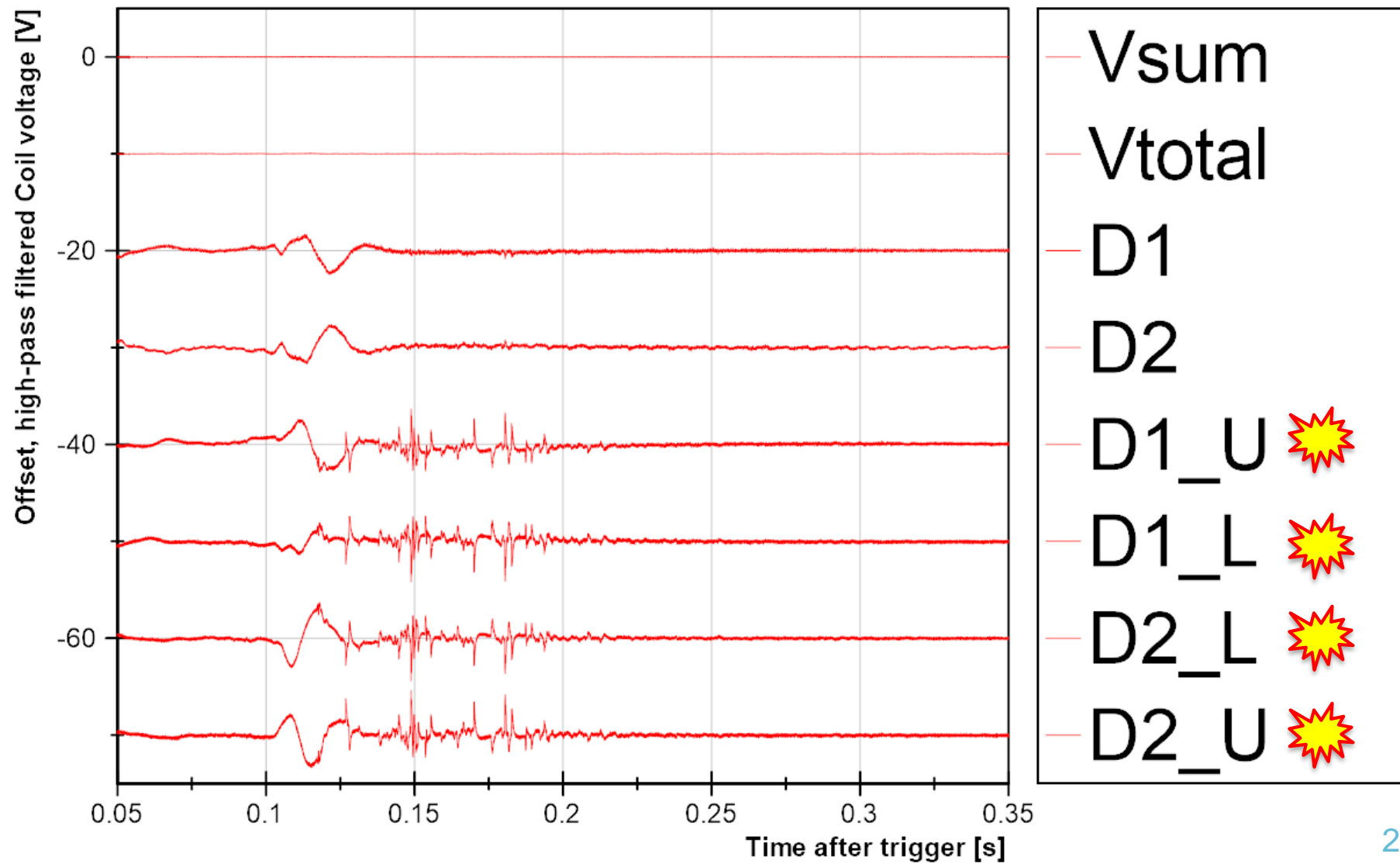
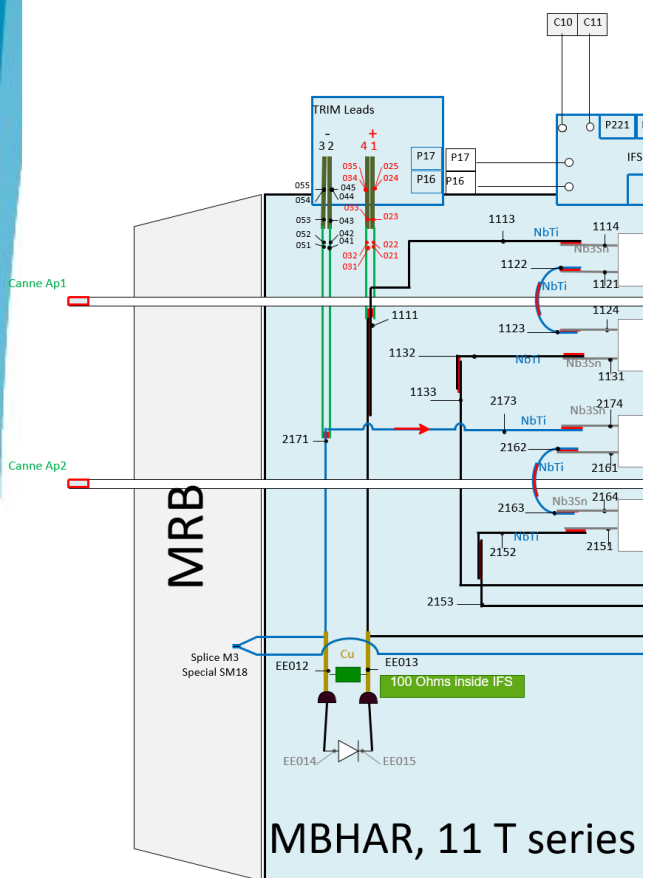
File: HCLMBHA001-CR000001_2_K2002261648_a009(0)



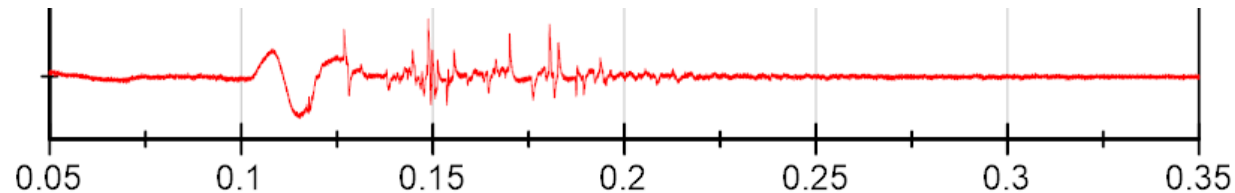
Coil voltages



File: HCLMBHA001-CR000001_2_K2002261648_a009(0)

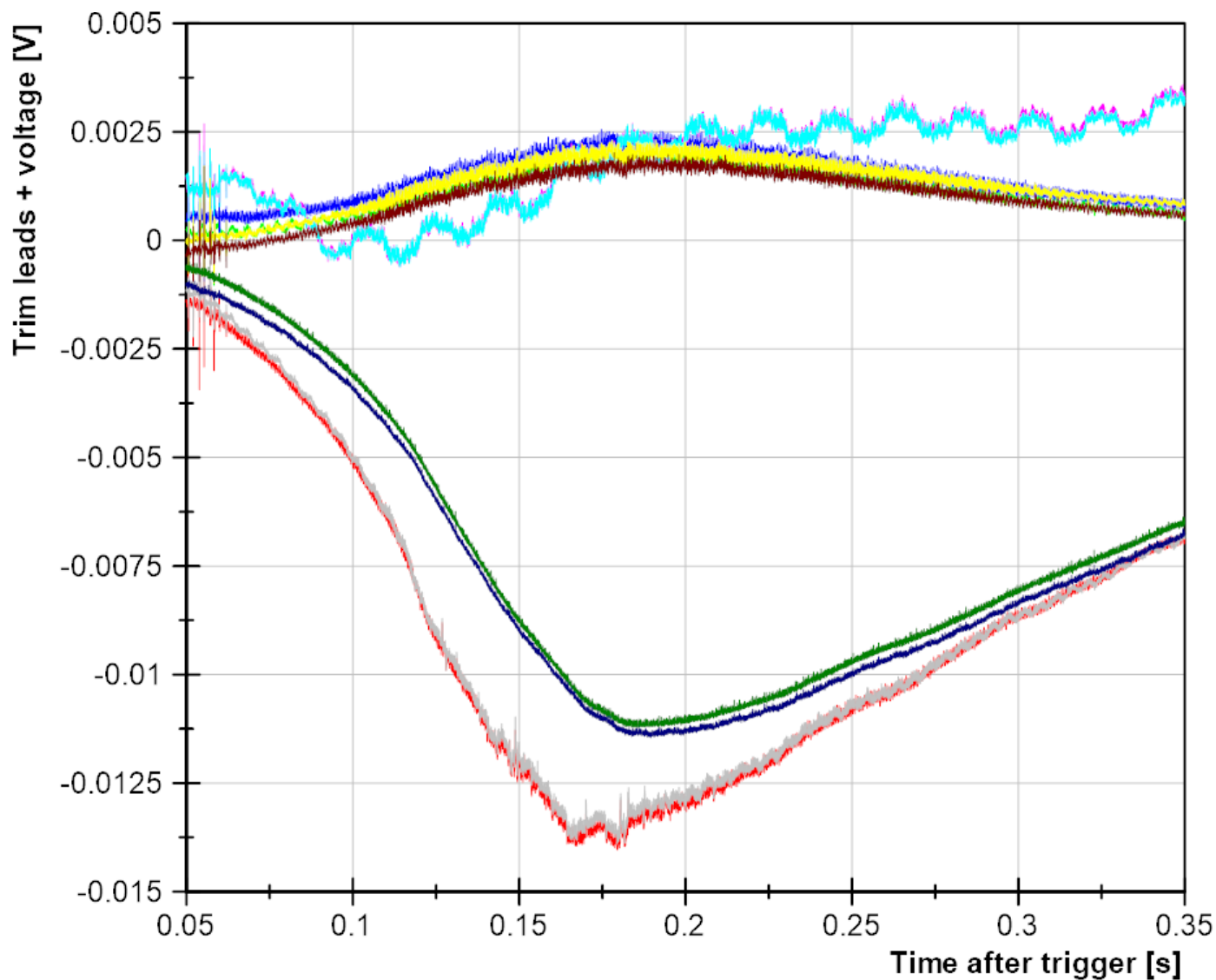


Trim +

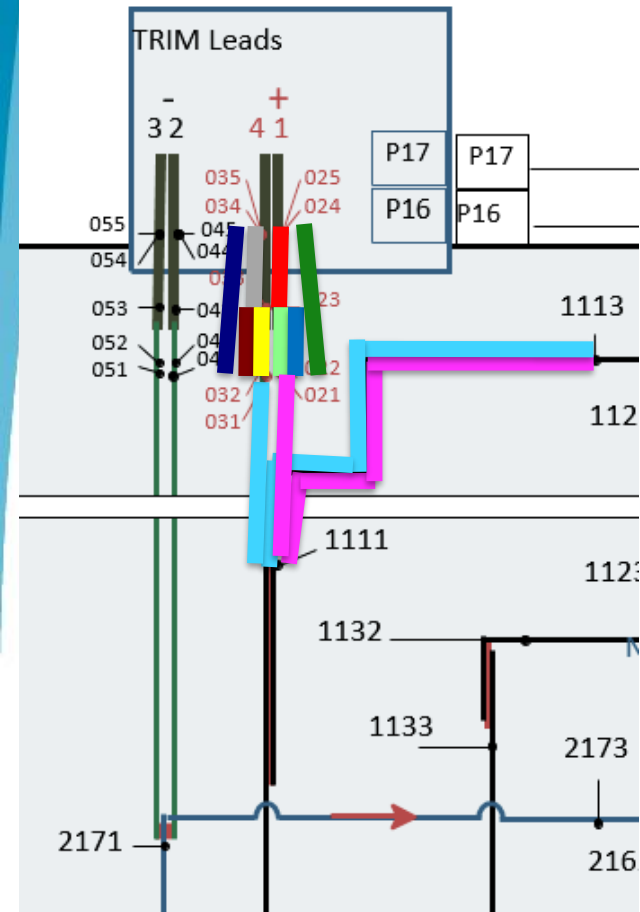


D2_U

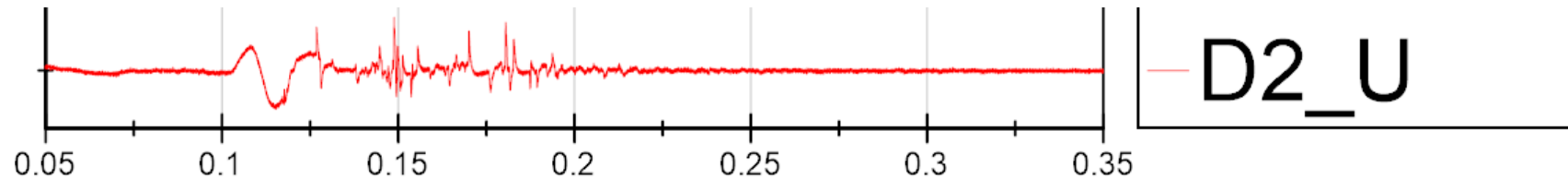
File: HCLMBHA001-CR000001_2_K2002261648_a009(0)



- TrimLead_+1_Copper
- TrimLead_+1_Splice_600A
- TrimLead_+1_Splice_600A_copy
- TrimLead_+1_Splice_Main
- TrimLead_+2_Splice_Main
- TrimLead_+2_Copper
- TrimLead_+2_Splice_600A
- TrimLead_+2_Splice_600A_copy
- Vsum_Trim_Lead_+1
- Vsum_Trim_Lead_+2

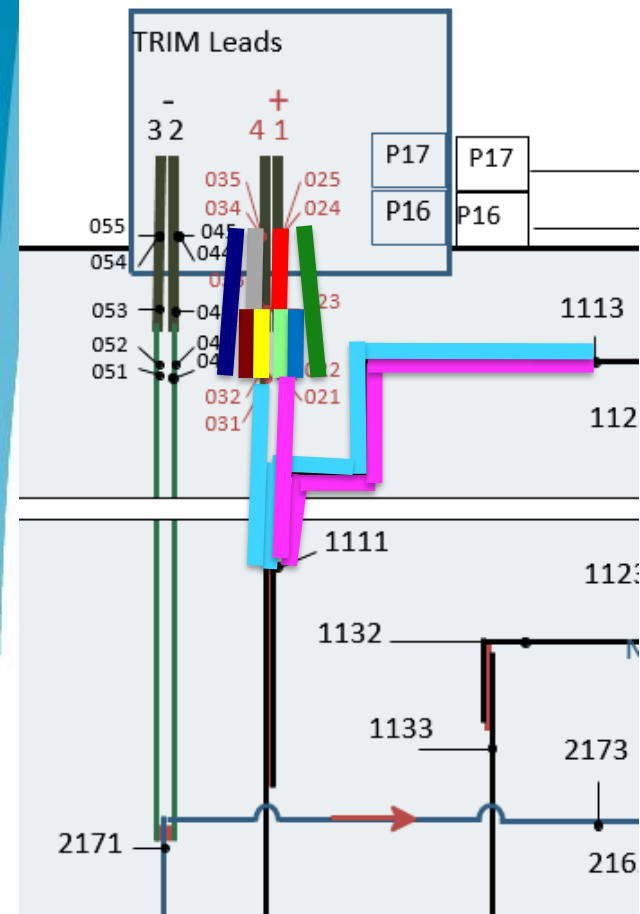
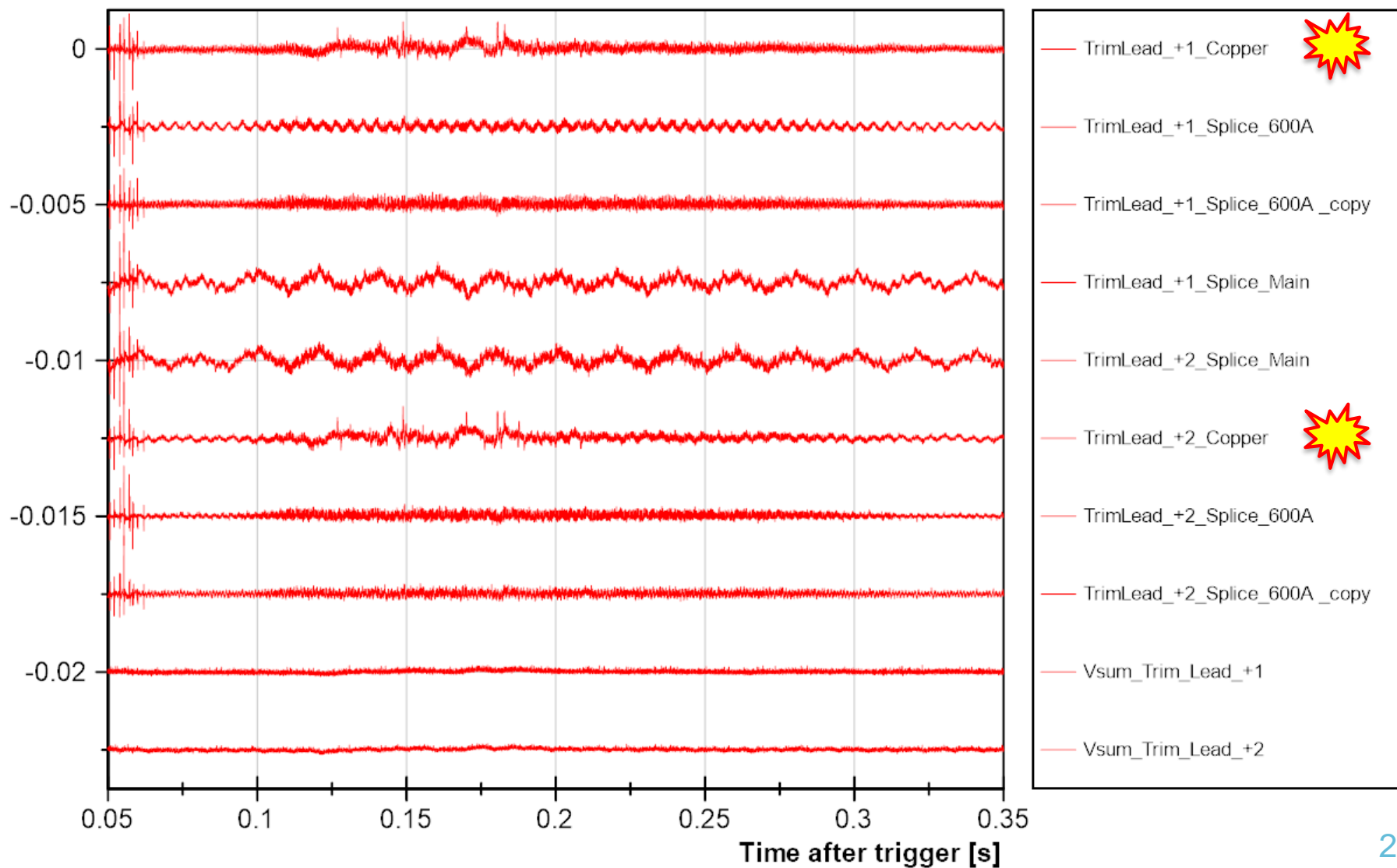


Trim +

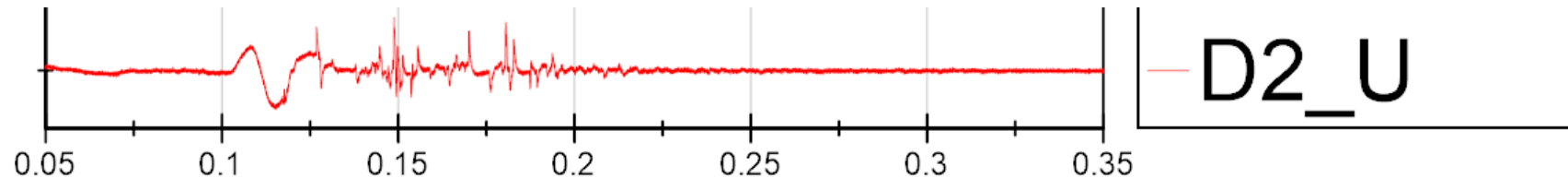


File: HCLMBHA001-CR000001_2_K2002261648_a009(0)

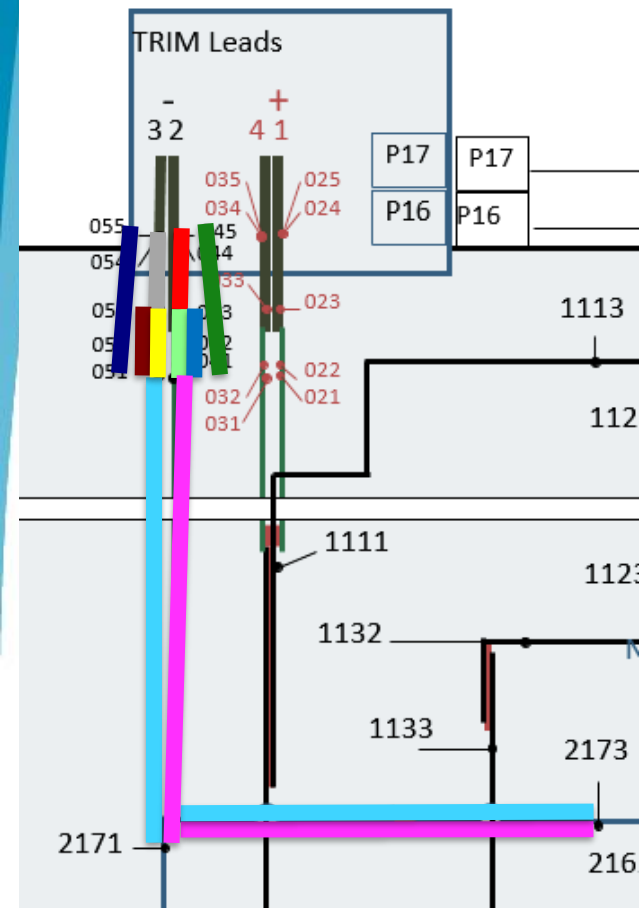
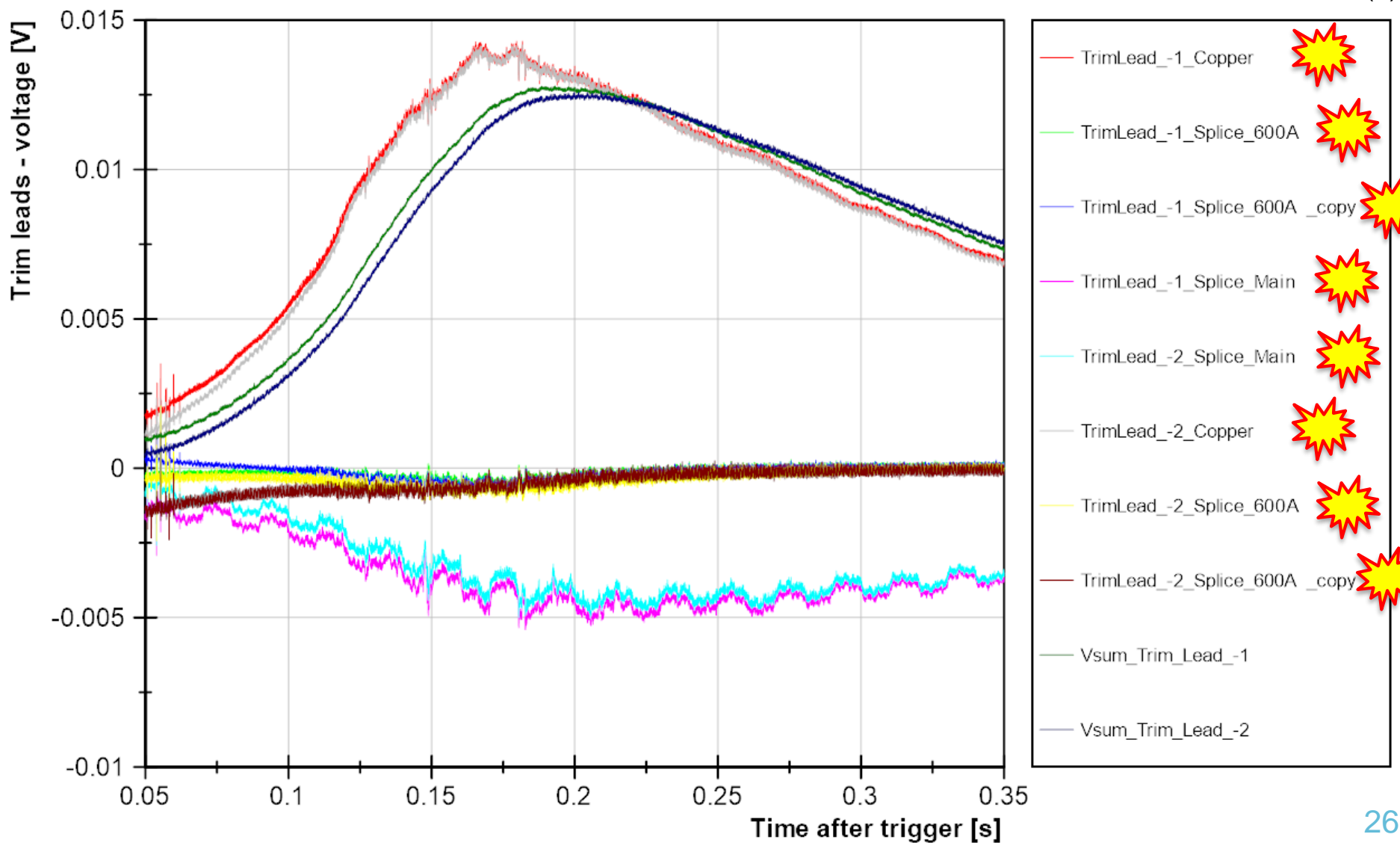
Offset, high-pass filtered Trim leads + voltage [V]



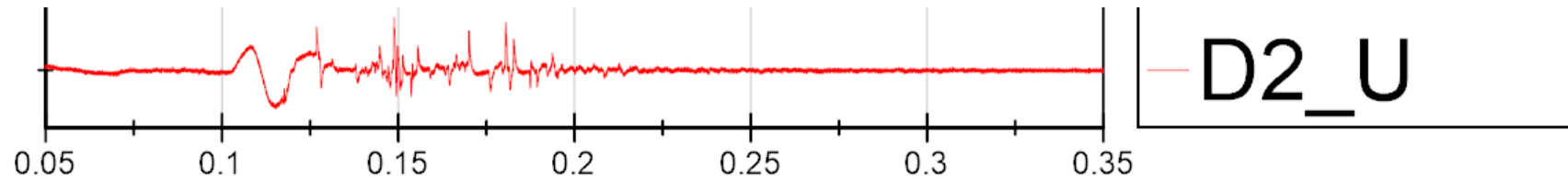
Trim -



File: HCLMBHA001-CR000001_2_K2002261648_a009(0)

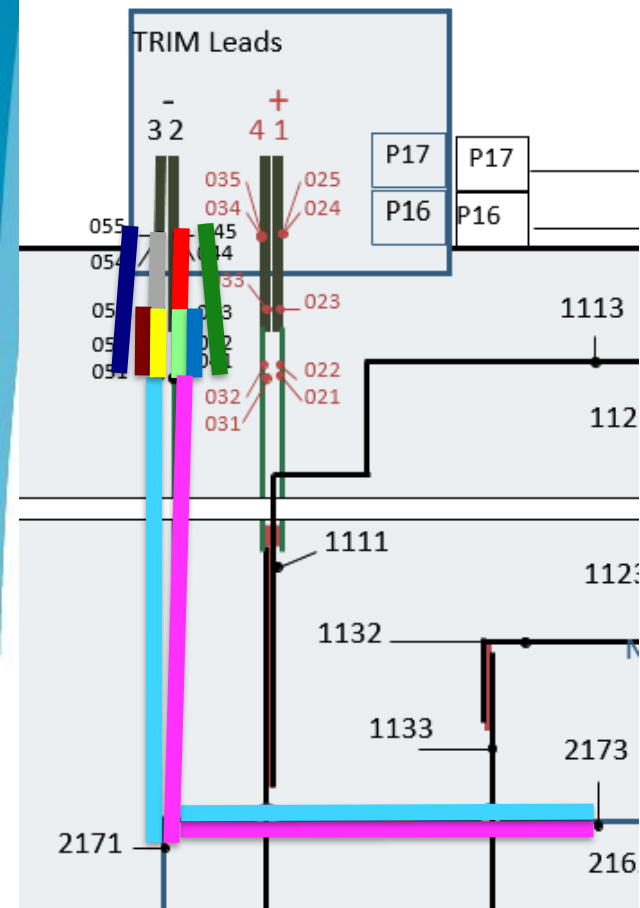
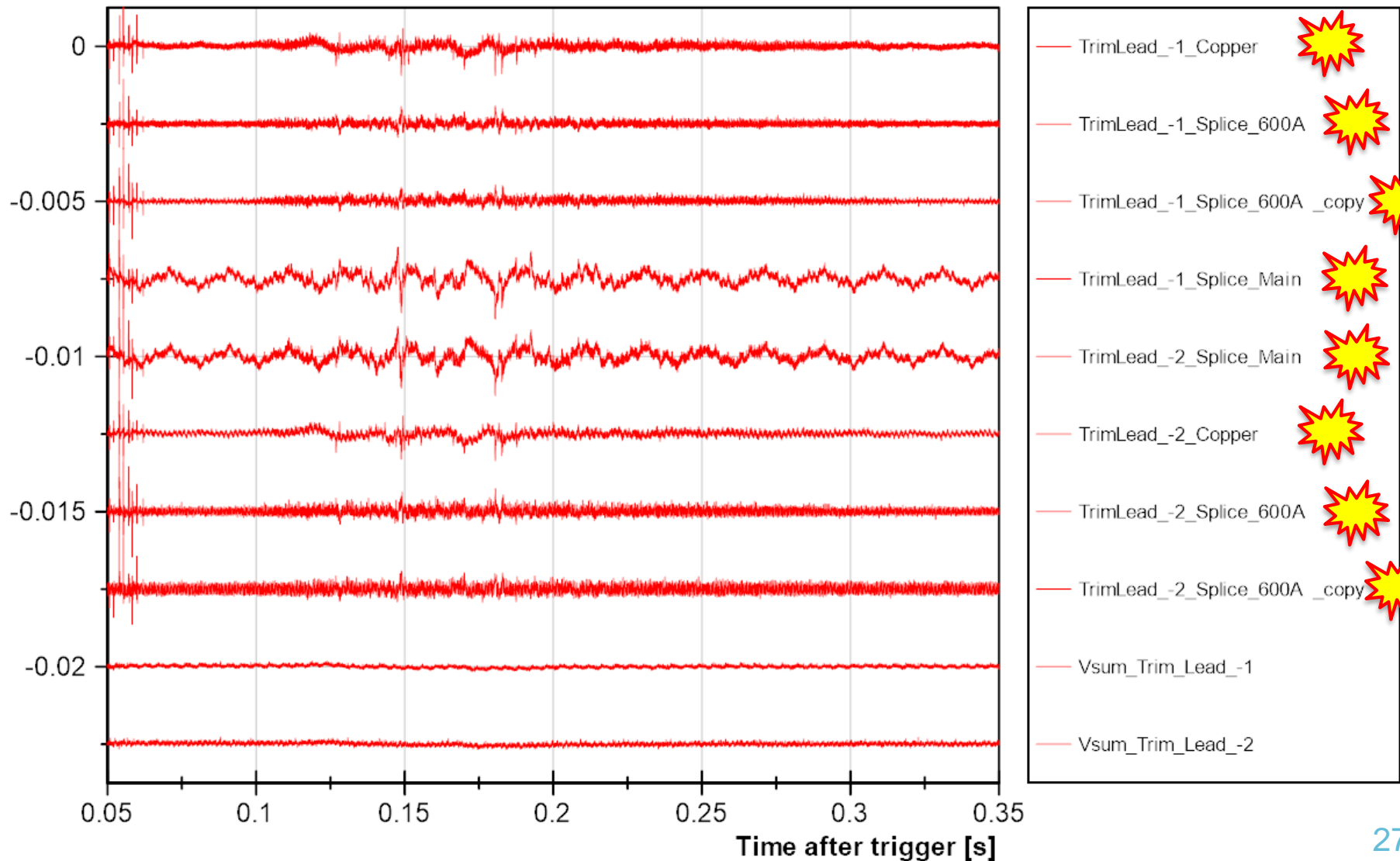


Trim -



File: HCLMBHA001-CR000001_2_K2002261648_a009(0)

Offset, high-pass filtered Trim leads - voltage [V]



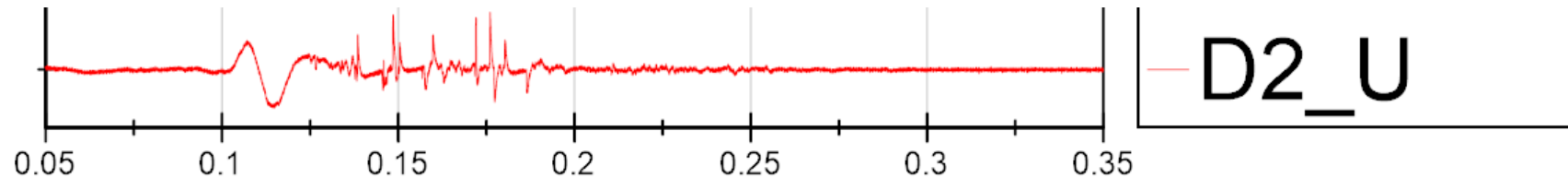
Case 1+2 conclusion

- Spikes seen in:
 - Coils
 - Splices
 - At least one of the m3 bus bars + coil splice
 - Quench antenna (high gain)
 - Most of the Trim signals
- Not seen in:
 - Full aperture and full magnet voltage
 - Current leads
 - Quench heaters
 - Some Trim signals

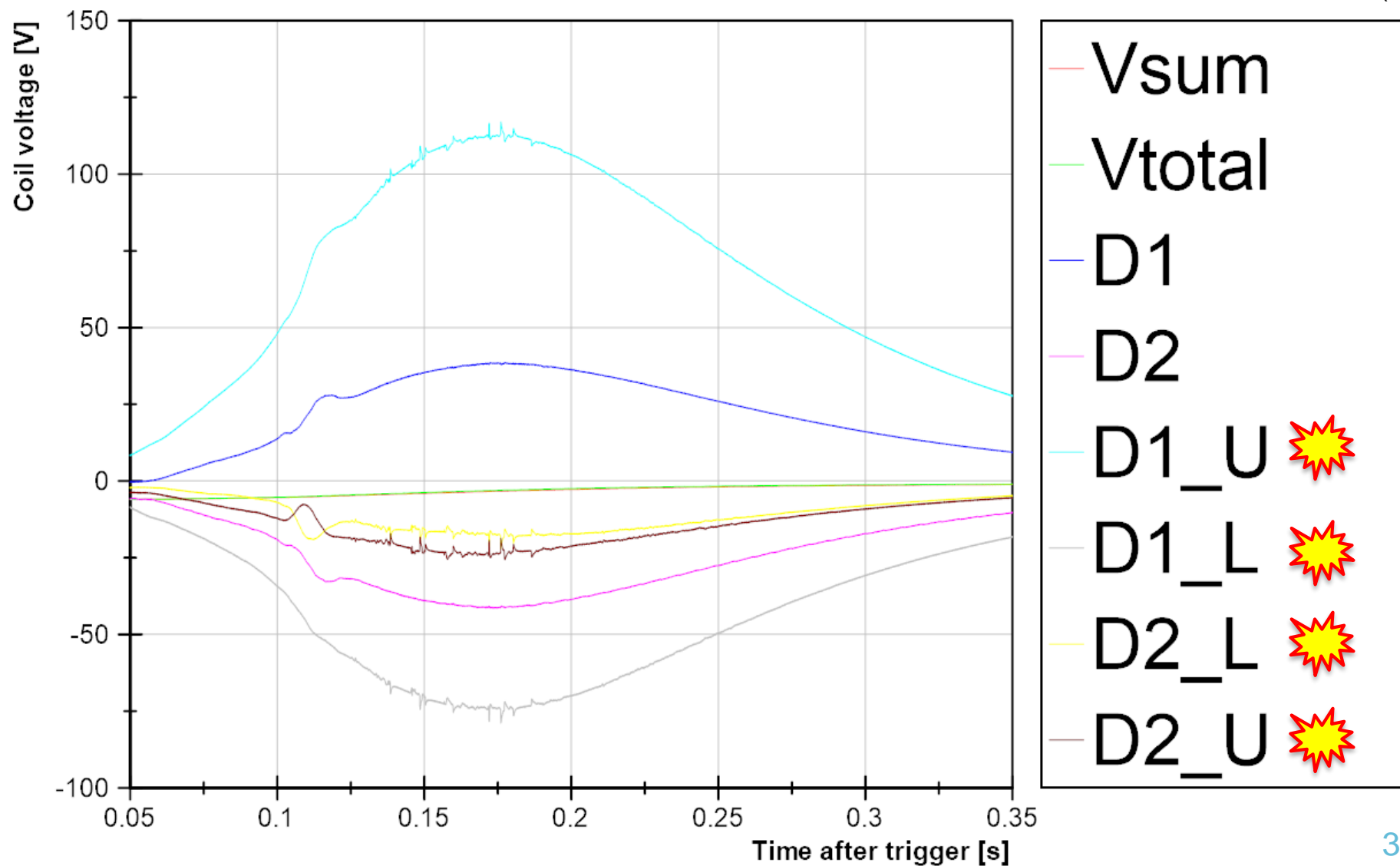
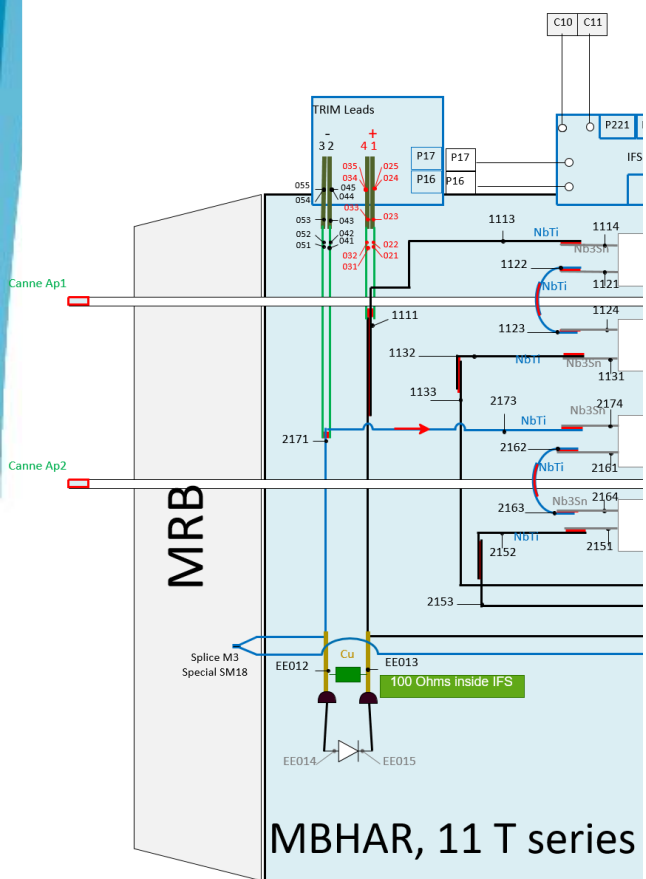
Case 3: HCLMBHA001- CR000001_2__K2003111907_a031(0)

Only the “new” signals

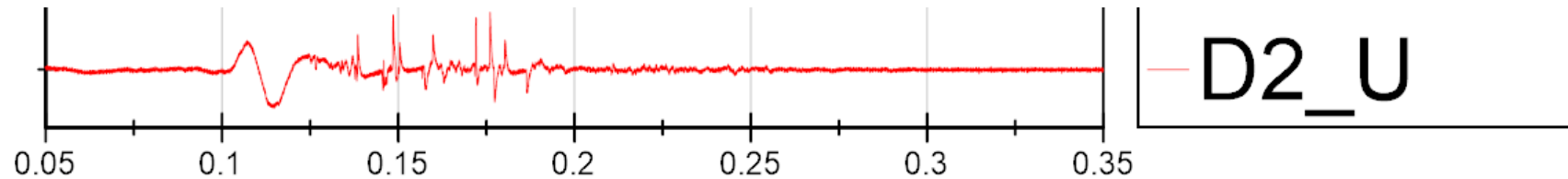
Coil voltages



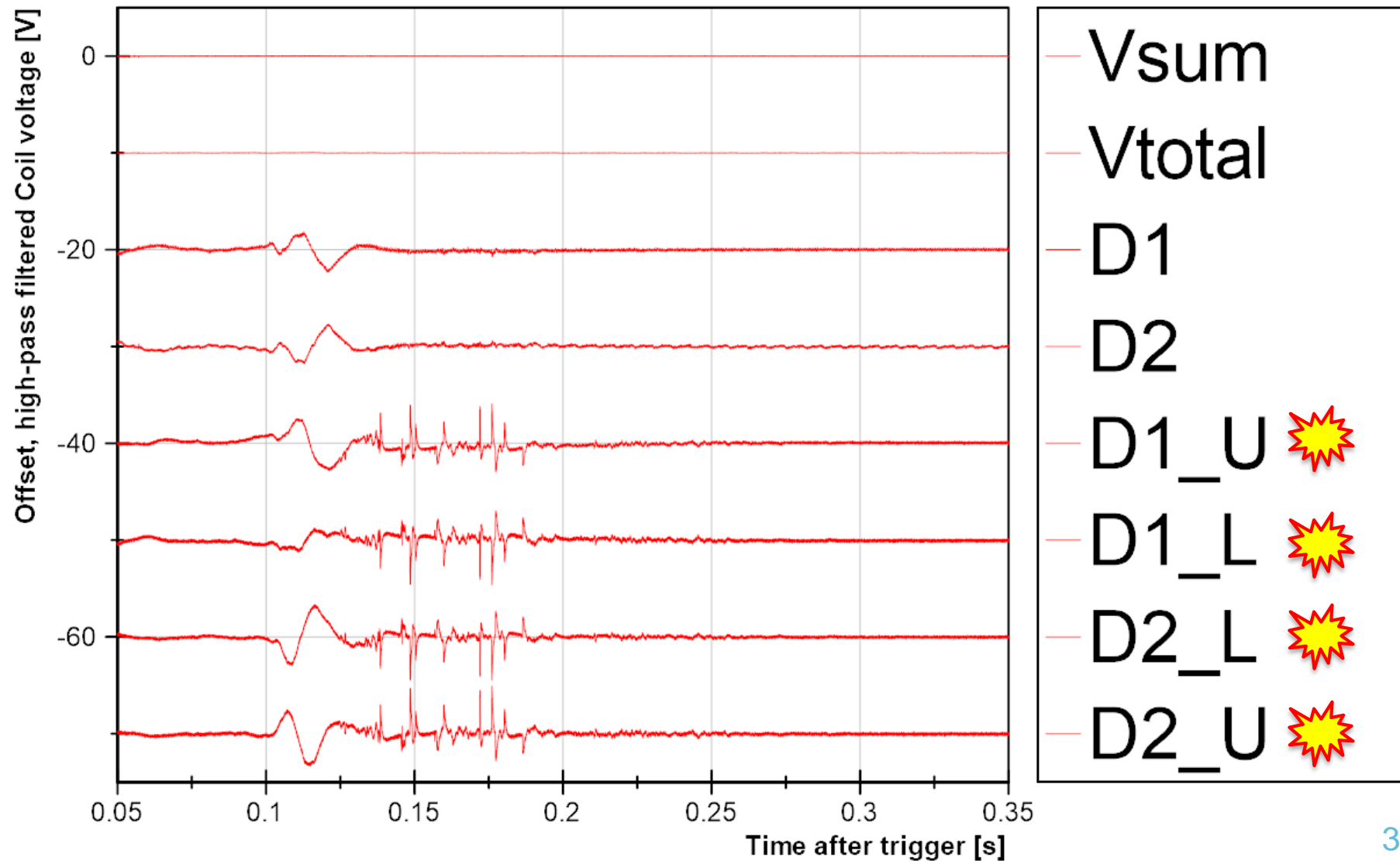
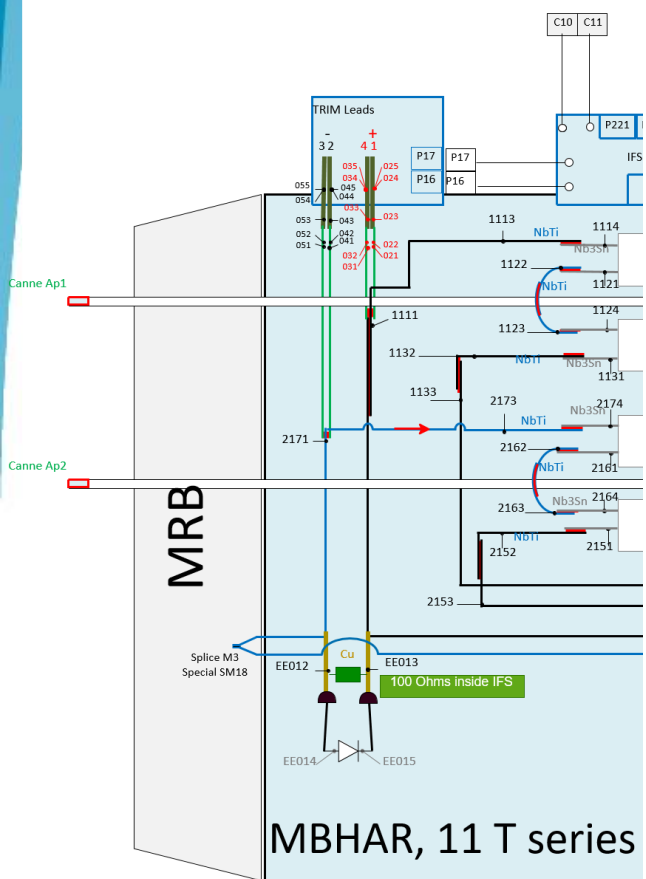
File: HCLMBHA001-CR000001_2_K2003111907_a031(0)



Coil voltages

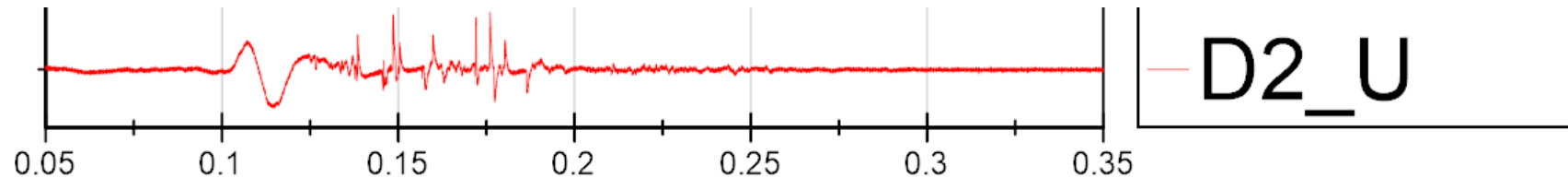
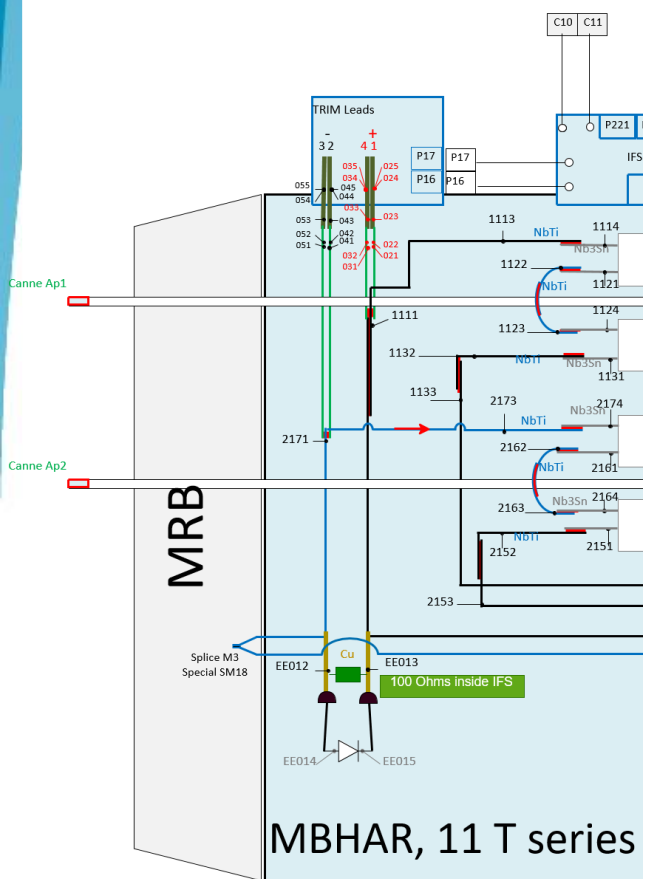


File: HCLMBHA001-CR000001_2_K2003111907_a031(0)

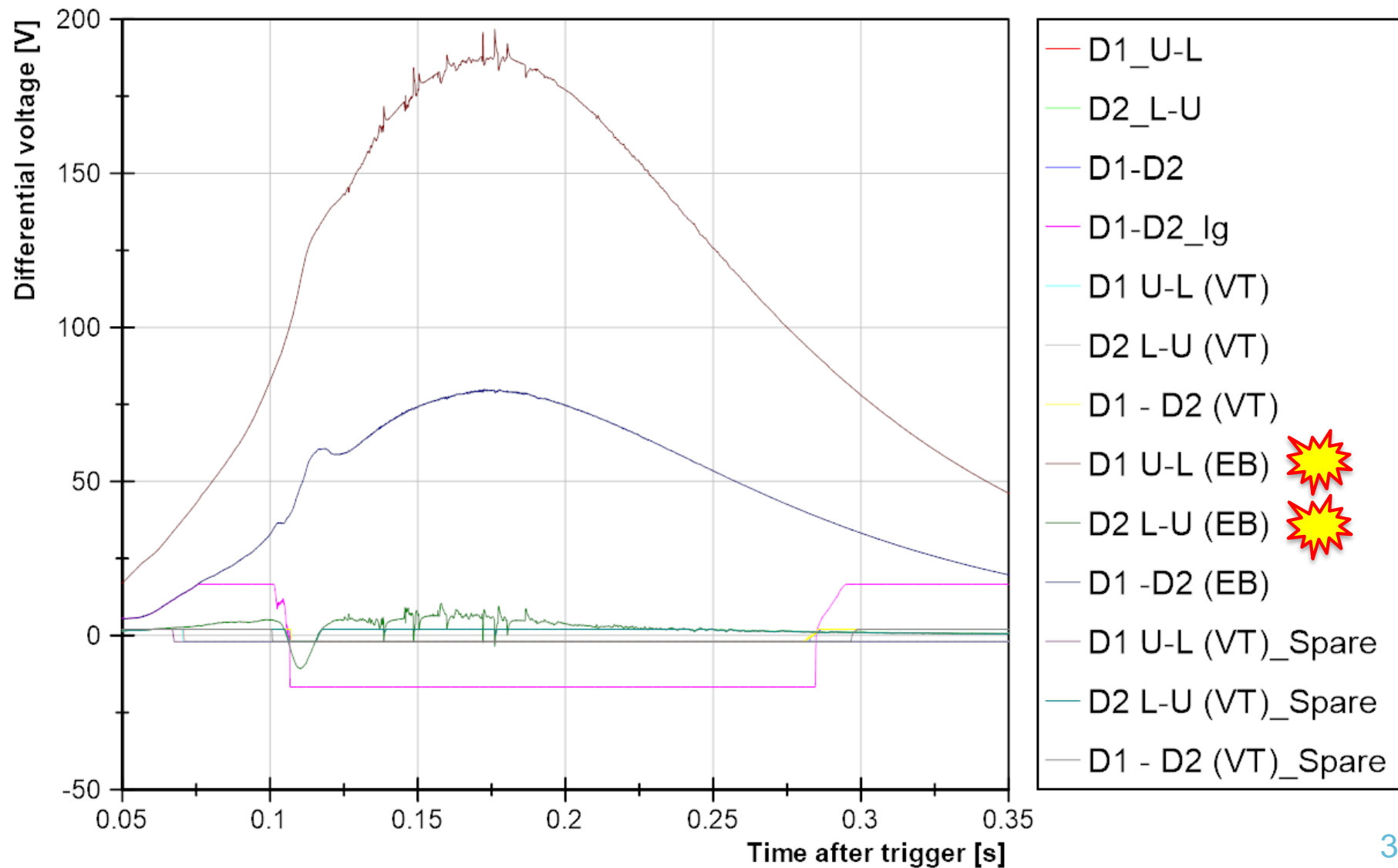


Differential voltages

Changed the gain on the (EB) cards w.r.t. case 1

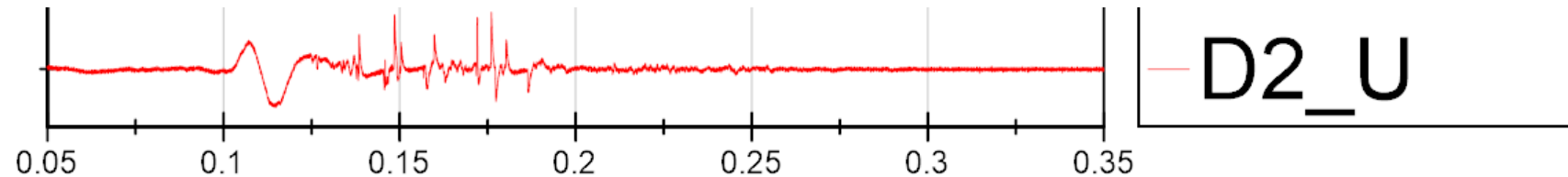
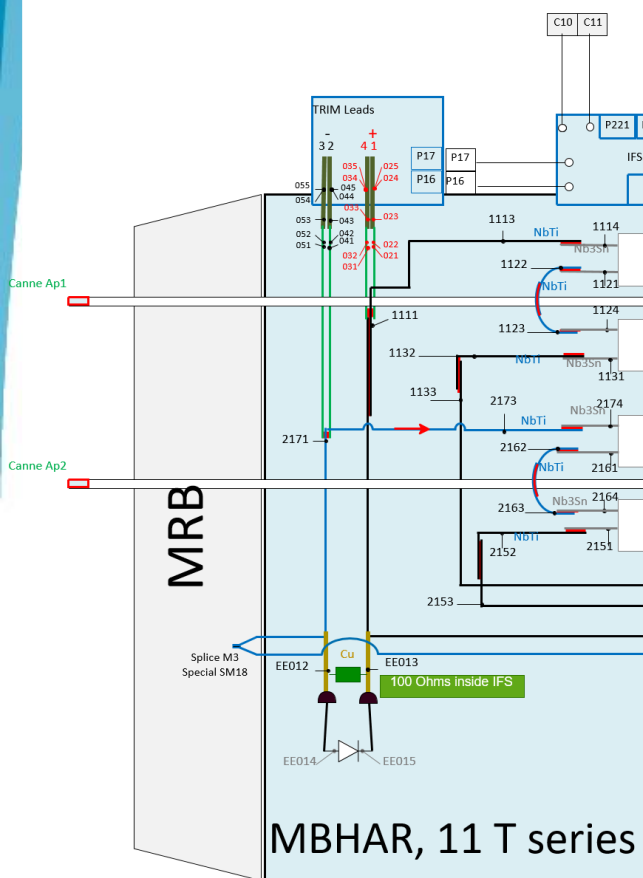


File: HCLMBHA001-CR000001_2_K2003111907_a031(0)



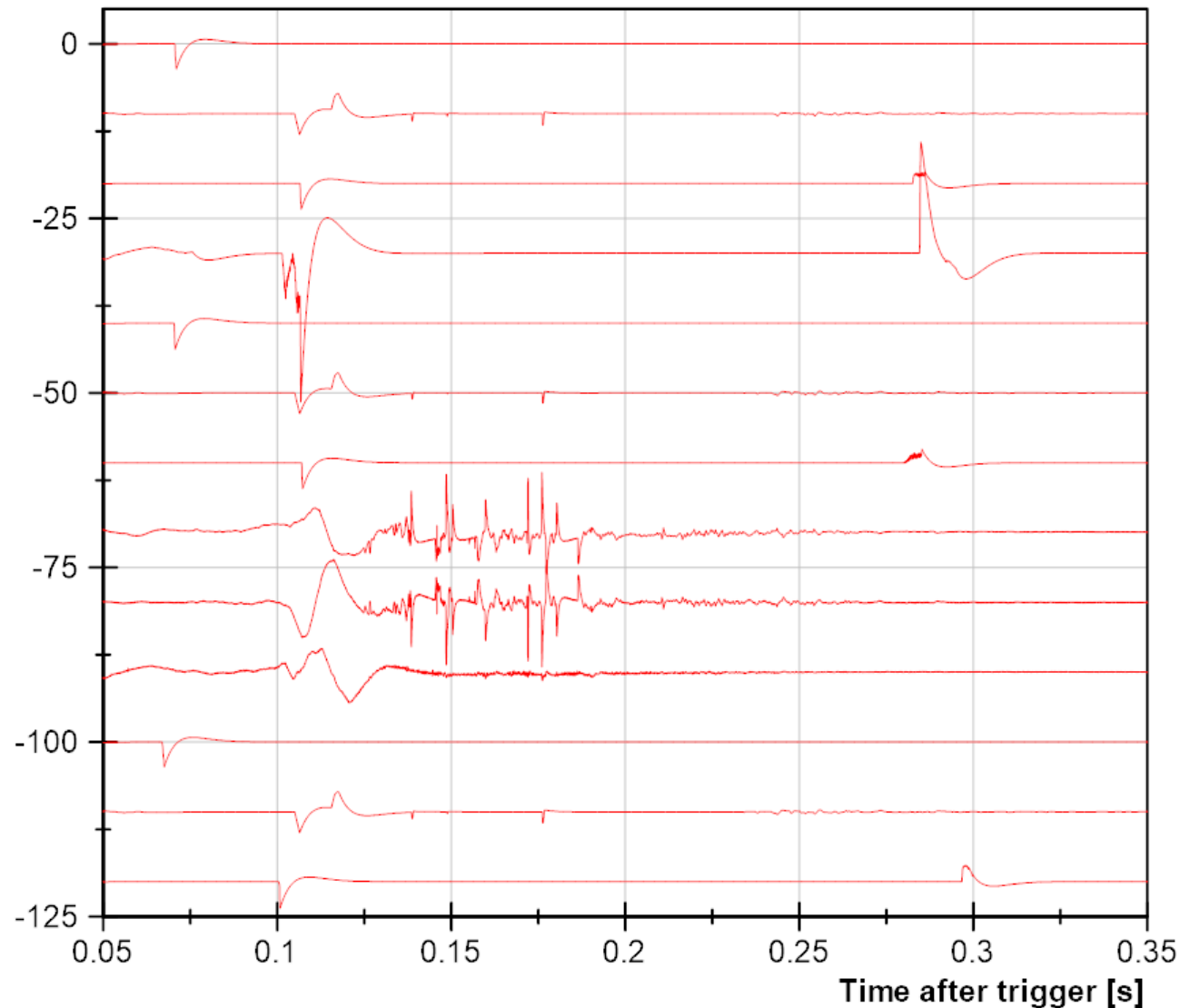
Differential voltages

Changed the gain on the (EB) cards w.r.t. case 1





File: HCLMBHA001-CR000001_2_K2003111907_a031(0)

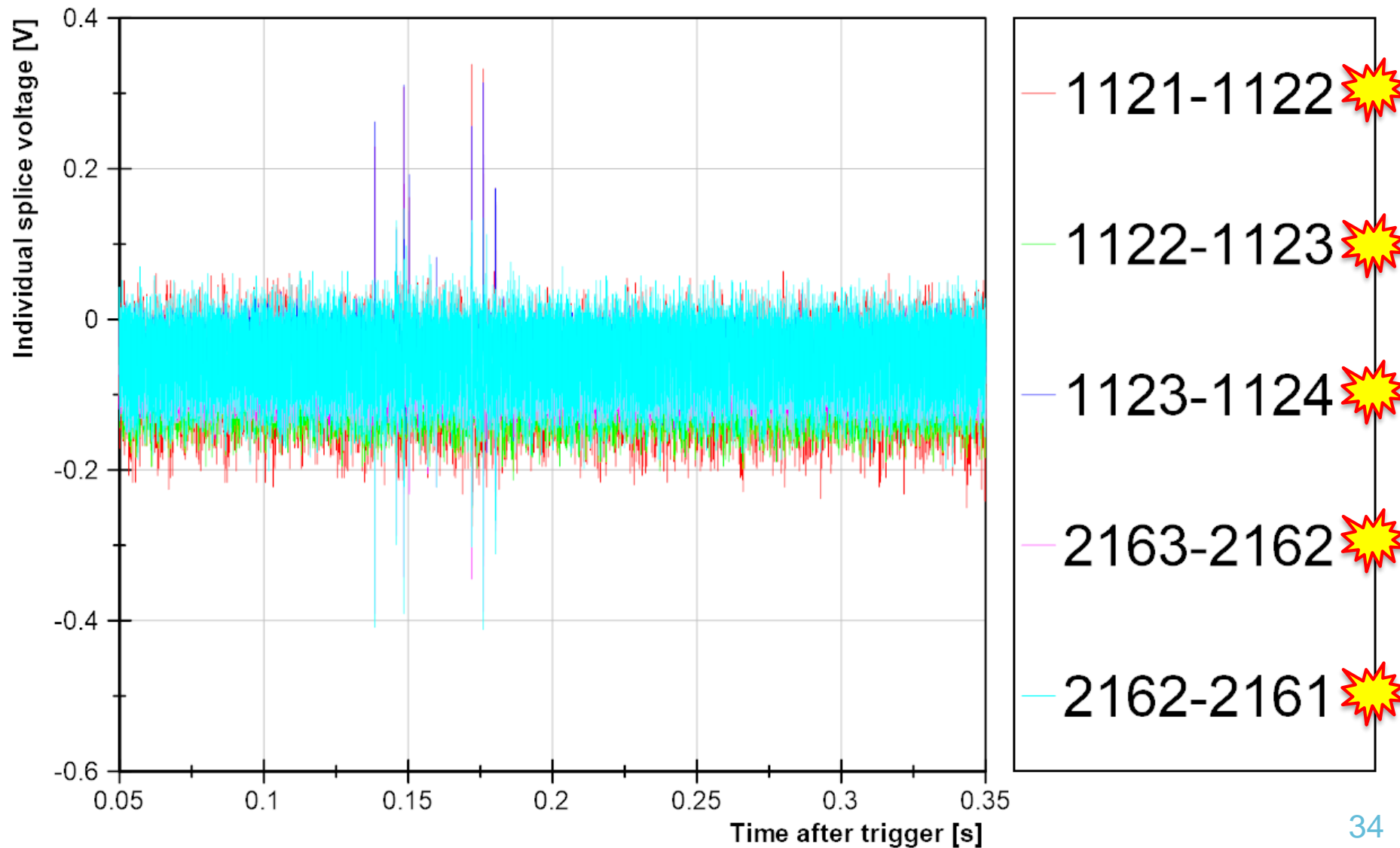
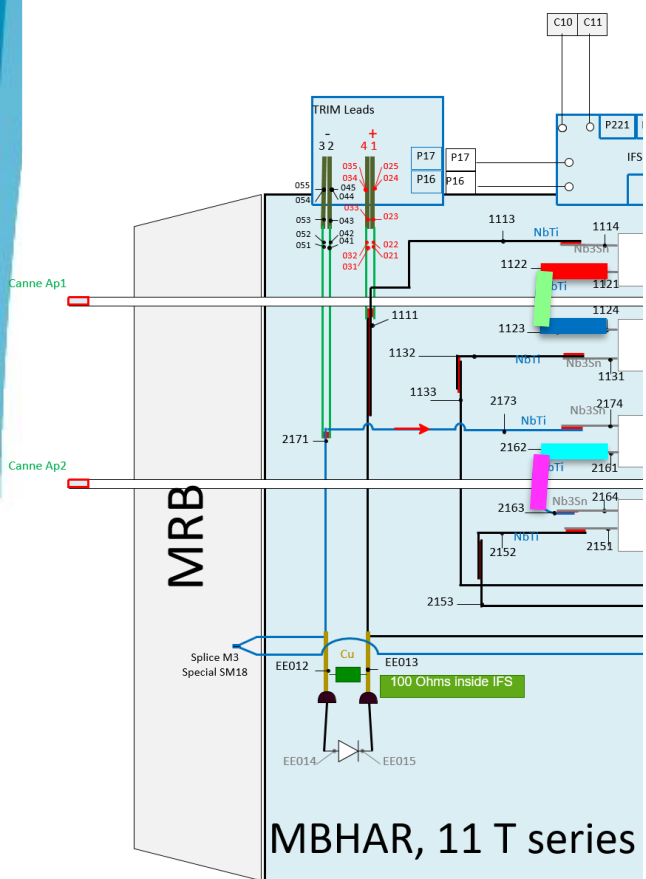
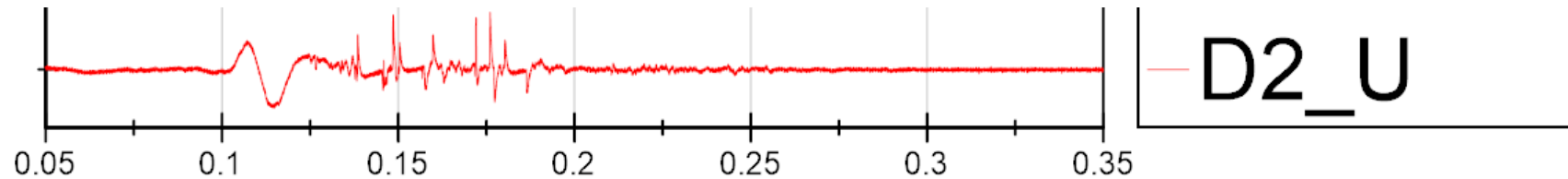
Offset, high-pass filtered Differential voltage [V]



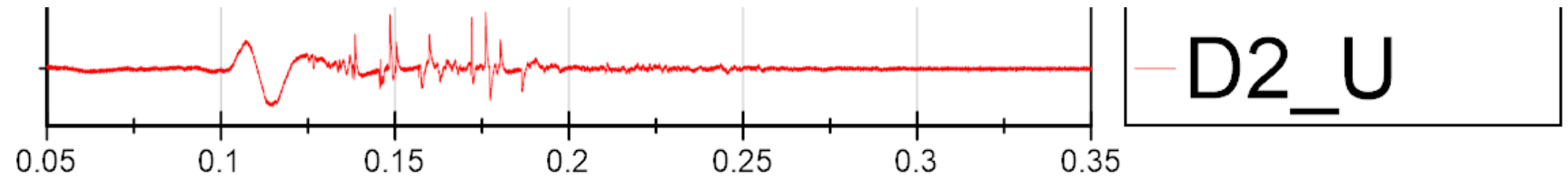
D2_U

- D1_U-L
- D2_L-U
- D1-D2
- D1-D2_lg
- D1 U-L (VT)
- D2 L-U (VT)
- D1 - D2 (VT)
- D1 U-L (EB) 
- D2 L-U (EB) 
- D1 - D2 (EB)
- D1 U-L (VT)_Spare
- D2 L-U (VT)_Spare
- D1 - D2 (VT)_Spare

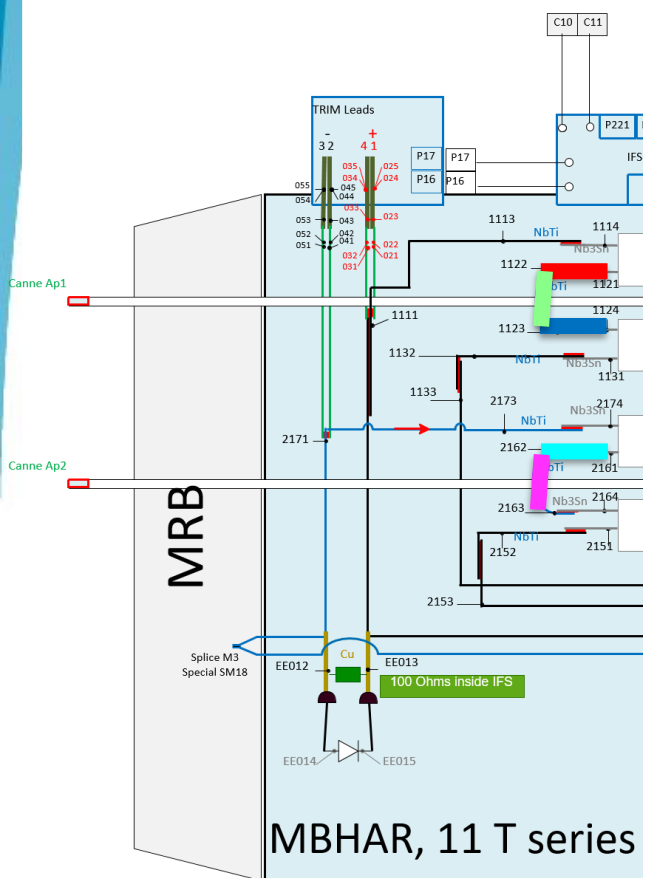
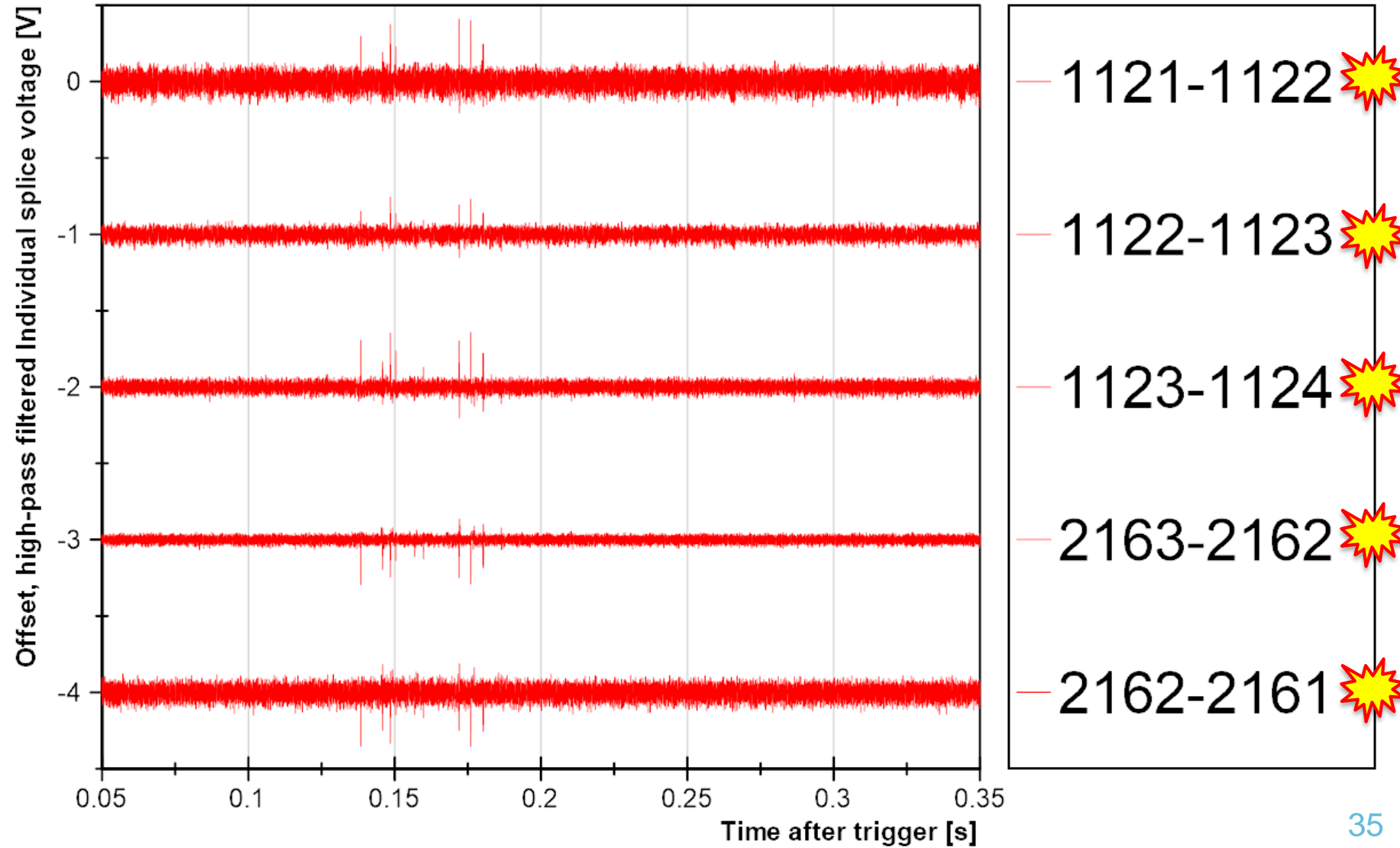
Individual splices



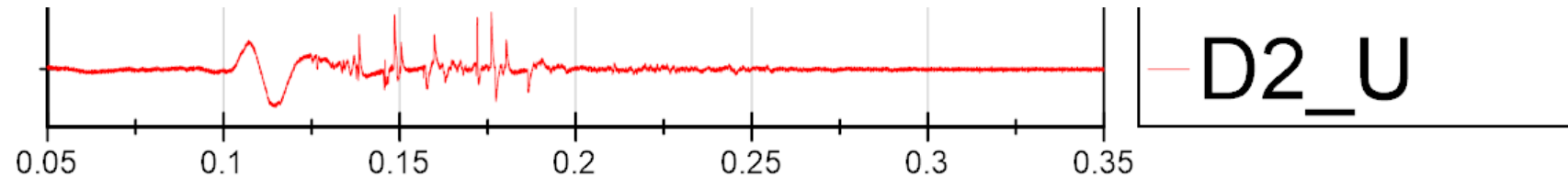
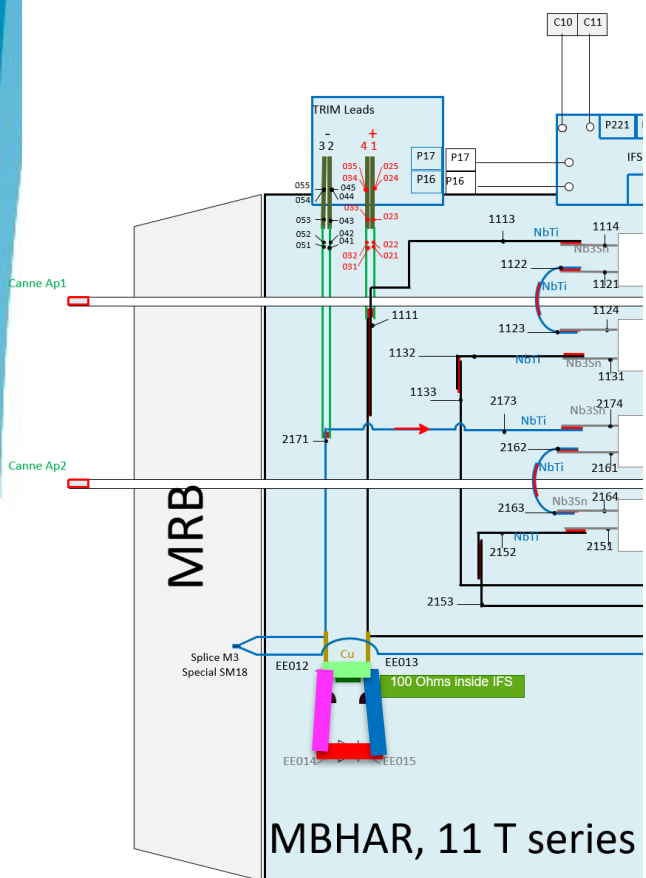
Individual splices



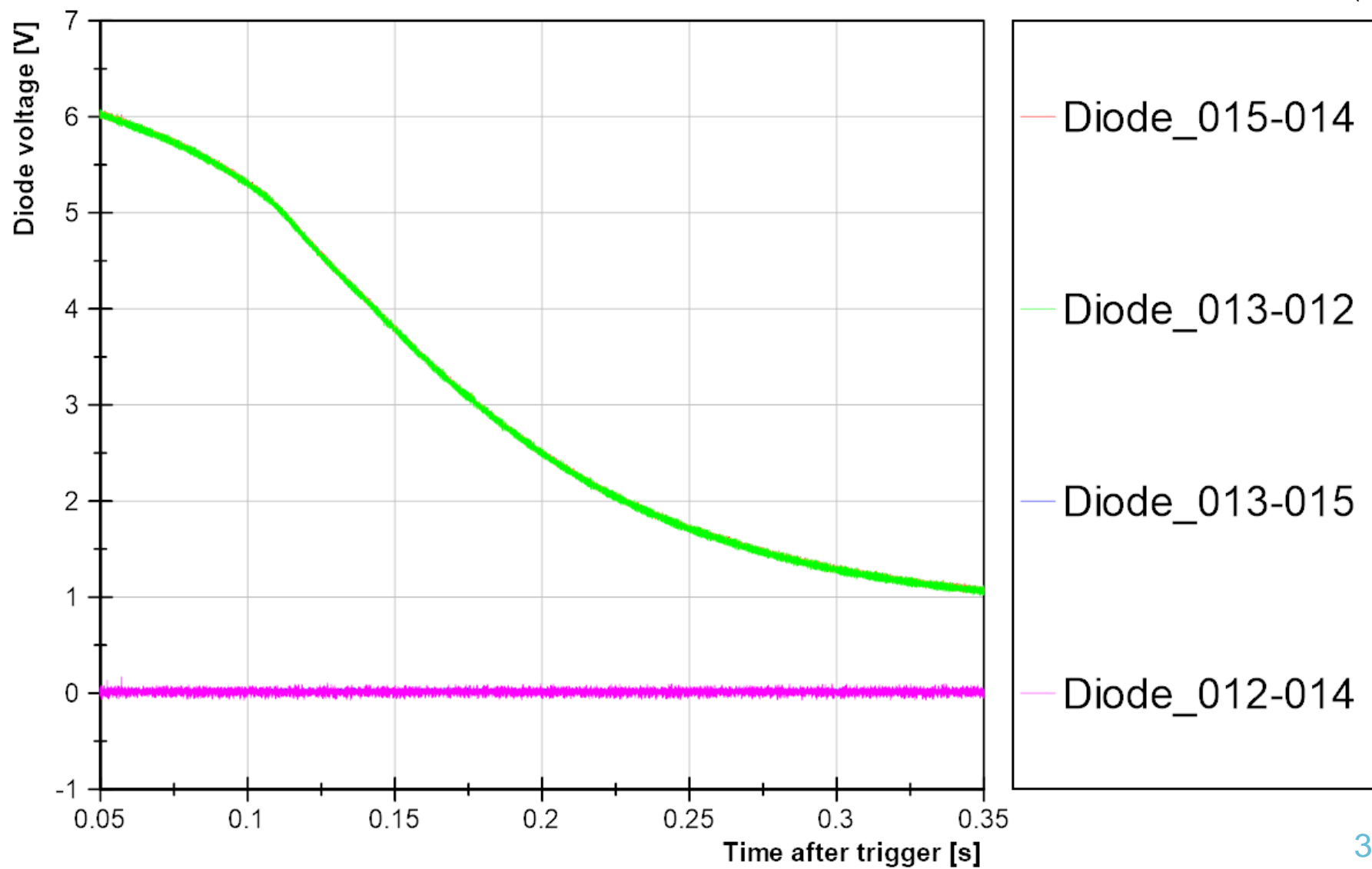
File: HCLMBHA001-CR000001_2_K2003111907_a031(0)



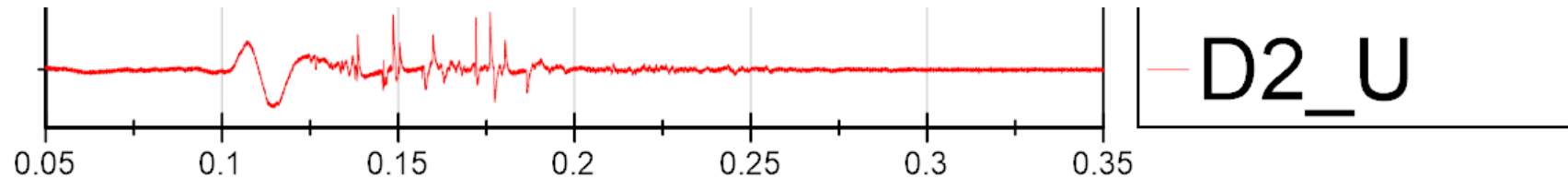
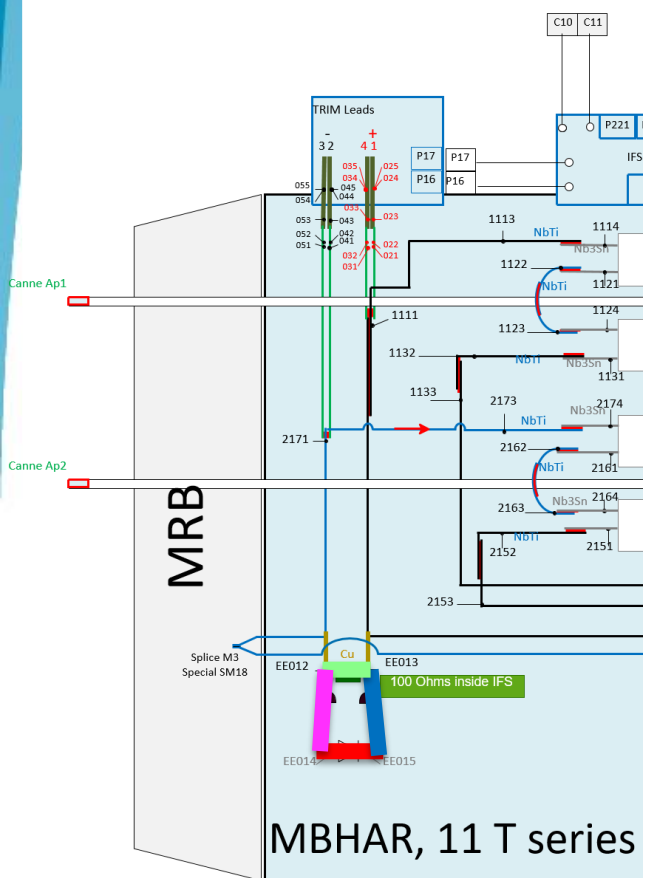
Diode segments



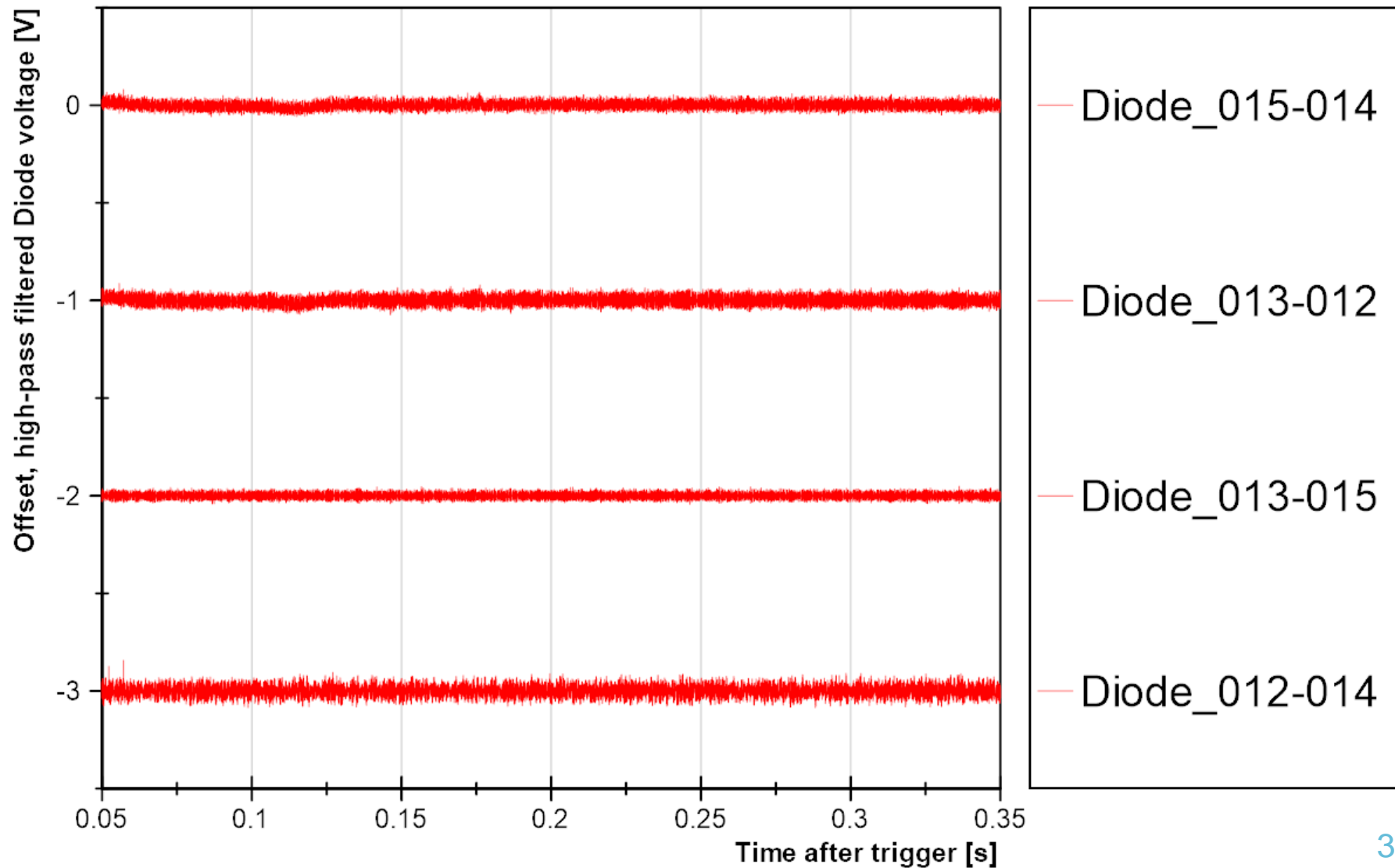
File: HCLMBHA001-CR000001_2_K2003111907_a031(0)



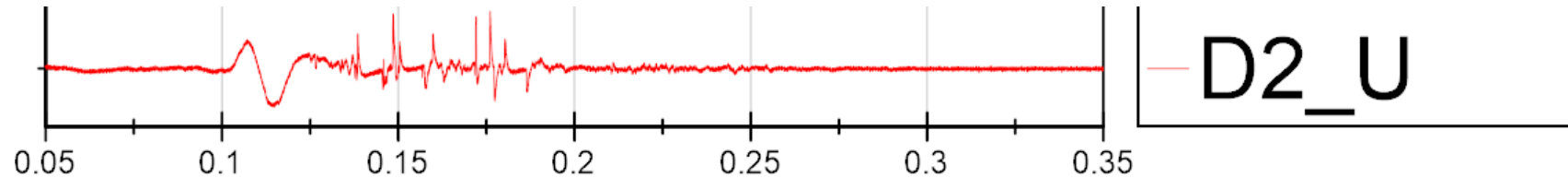
Diode segments



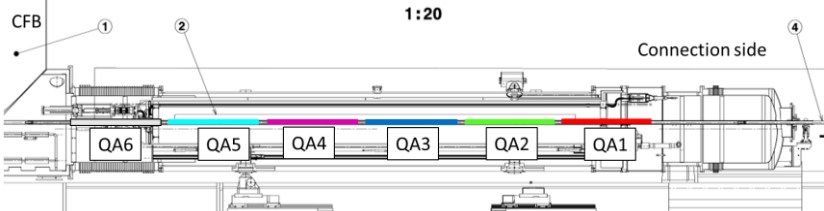
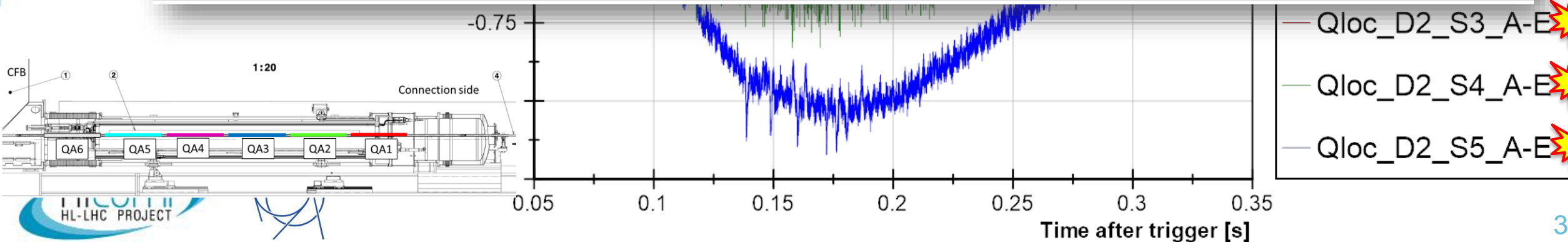
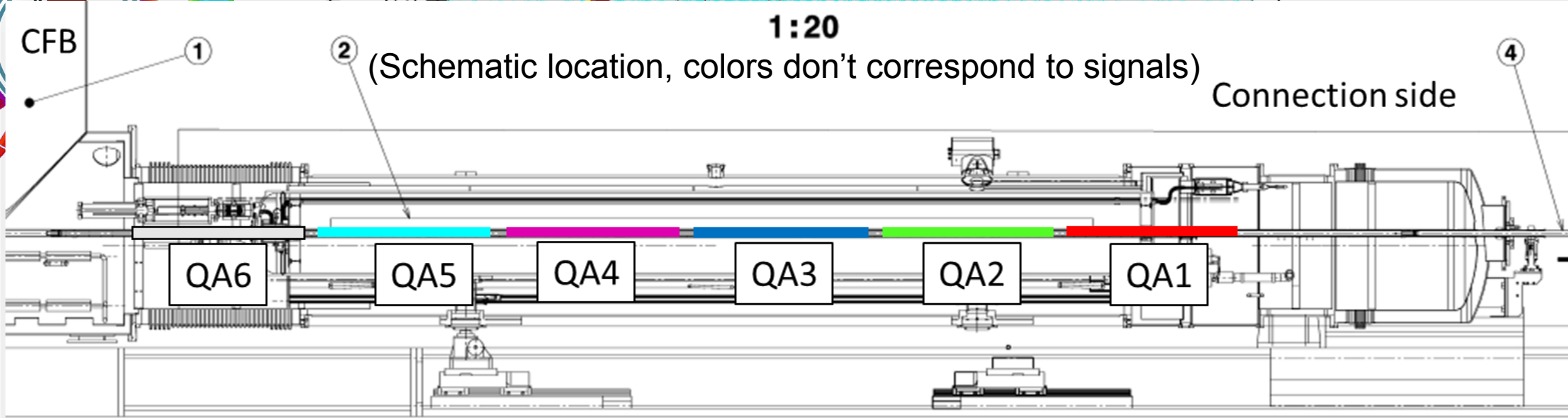
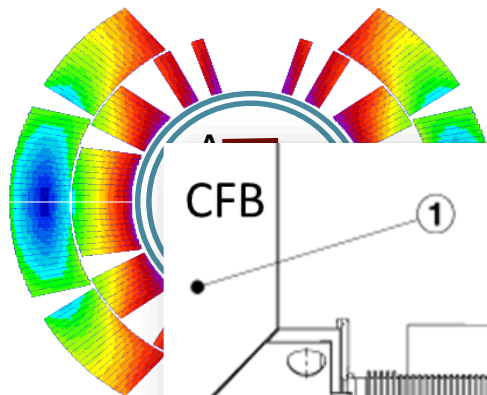
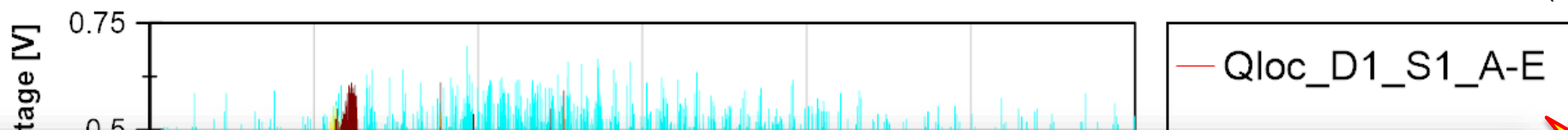
File: HCLMBHA001-CR000001_2_K2003111907_a031(0)



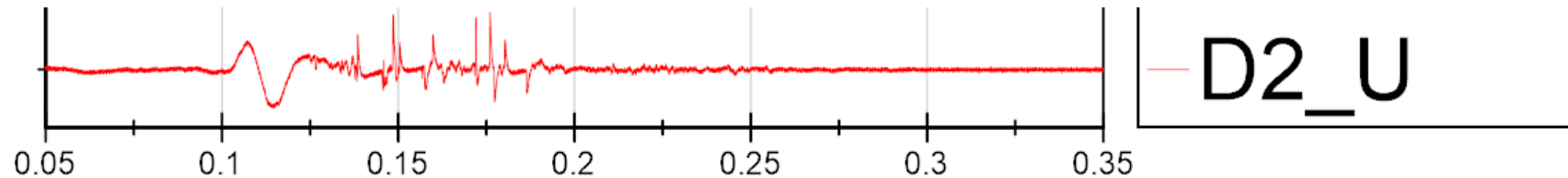
QA low gain



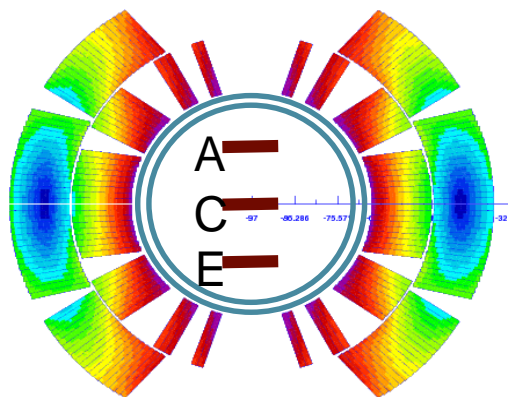
File: HCLMBHA001-CR000001_2_K2003111907_a031(0)



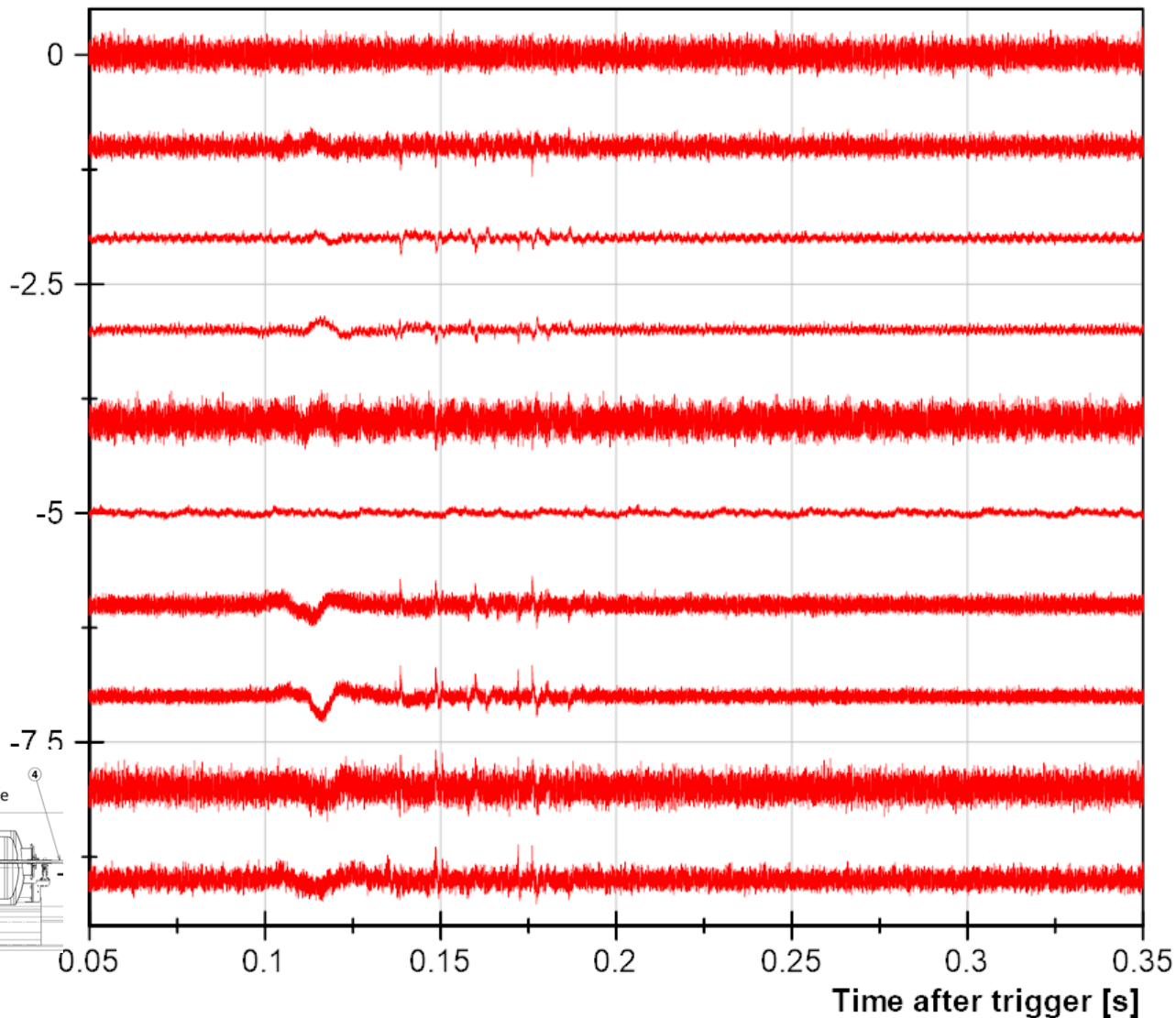
QA low gain



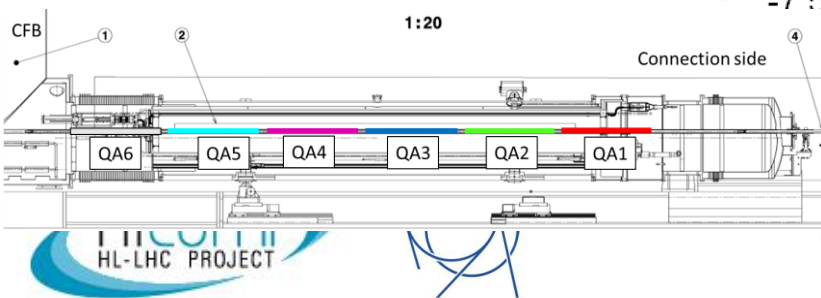
File: HCLMBHA001-CR000001_2_K2003111907_a031(0)



Offset, high-pass filtered QA low gain voltage [V]



- Qloc_D1_S1_A-E
- Qloc_D1_S2_A-E
- Qloc_D1_S3_A-E
- Qloc_D1_S4_A-E
- Qloc_D1_S5_A-E
- Qloc_D2_S1_A-E
- Qloc_D2_S2_A-E
- Qloc_D2_S3_A-E
- Qloc_D2_S4_A-E
- Qloc_D2_S5_A-E



Case 1+2+3 conclusion

- Spikes seen in:
 - Coils, aperture differential voltage (Lower-Upper)
 - Splices and individual splices
 - At least one of the m3 bus bars + coil splice
 - Quench antenna (most low gain and high gain)
 - Most of the Trim signals
- Not seen in:
 - Full aperture and full magnet voltage, D1-D2 differential voltage
 - Current leads
 - Quench heaters
 - Some Trim signals
 - Diode signals