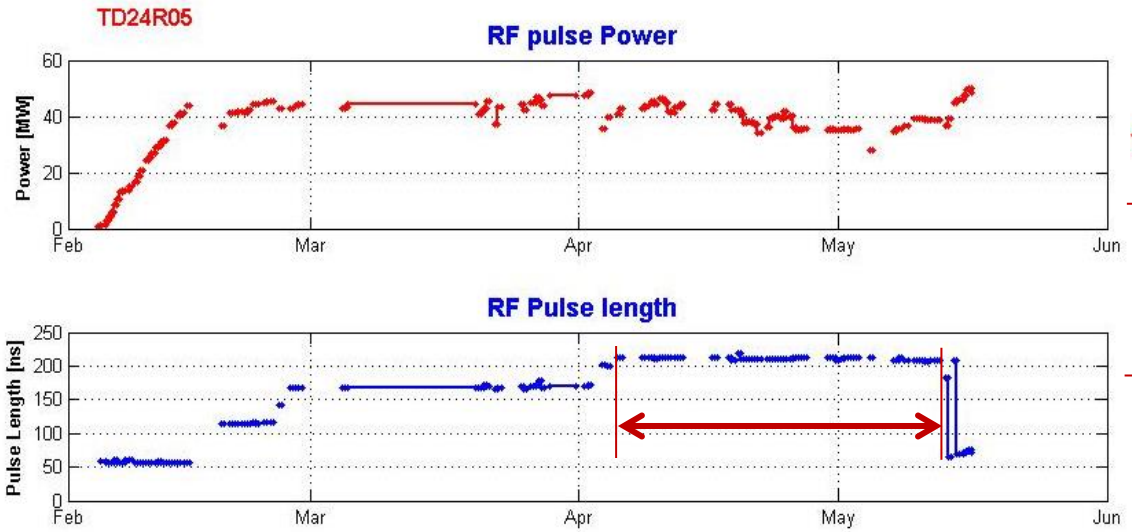
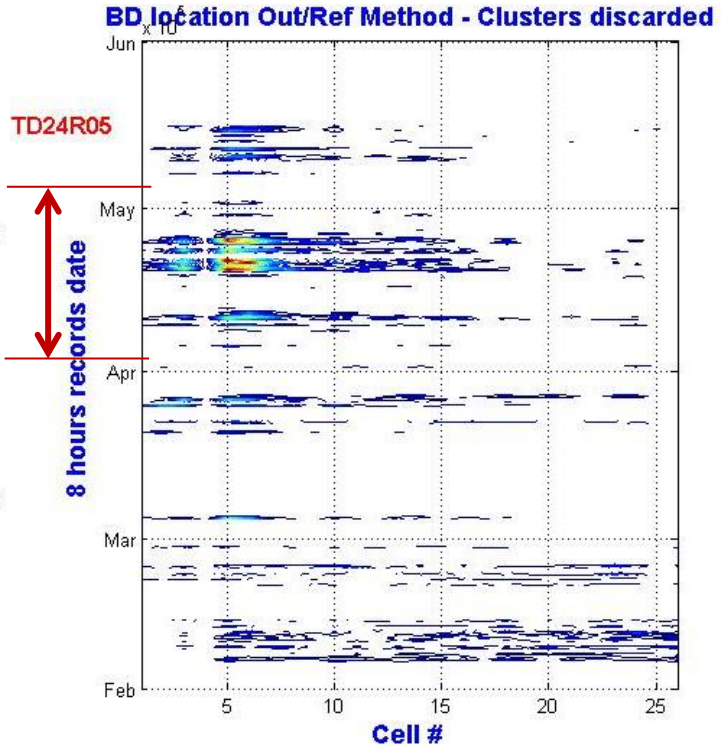
# TD24R05 BDR results

W. Farabolini – 24th June 2013

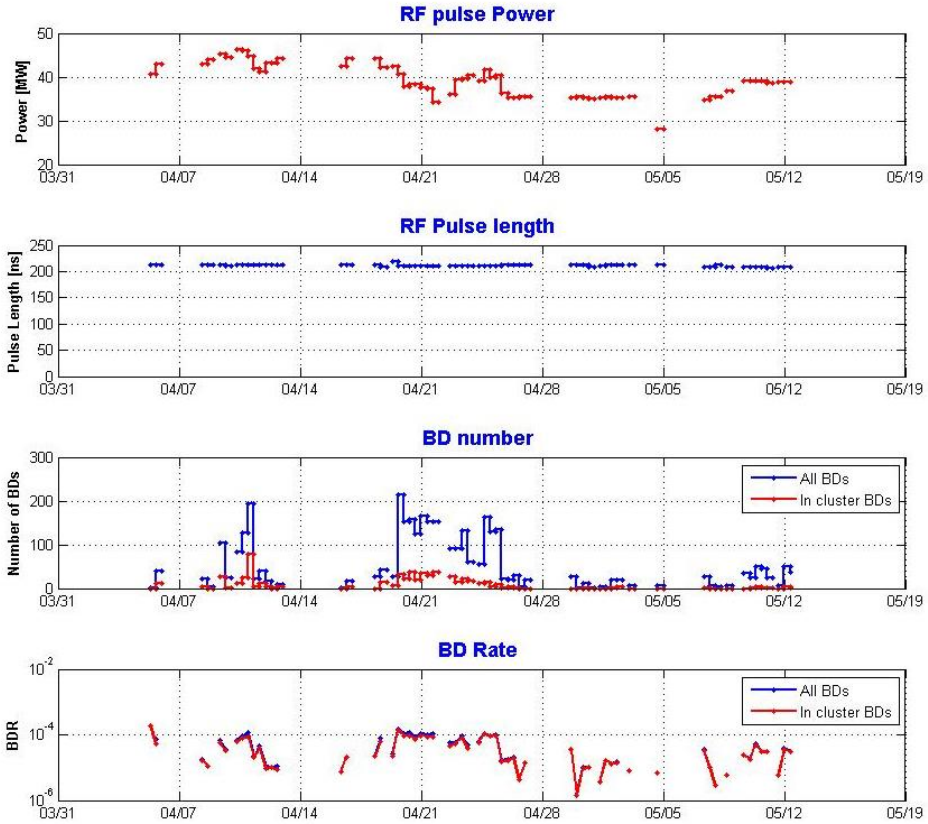
# Testing condition evolution




- Constant Pulse length period analyzed: from 5 April to 12 May 2013
  Total nb. of 8 hours files: 61
- The hot spot around cell #5 has already appeared before this period.

# Main parameters of this period




Total nb. of RF pulses : 68.6 x $10^6$

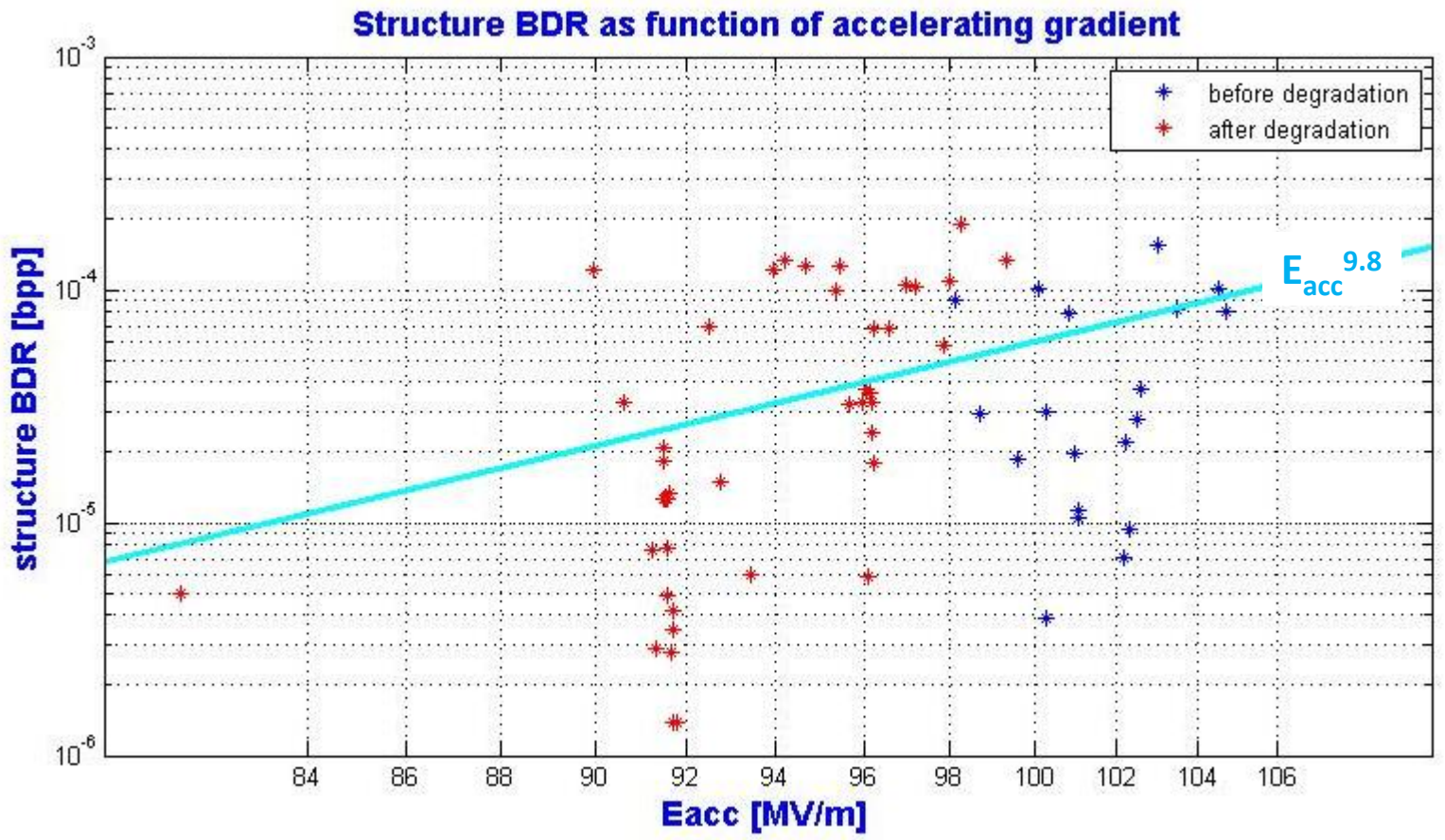
Total nb. of BD : 3281

Mean pulse length: 211 ns [207-218]

Mean power: 39.1 MW [from 28.0 to 46.3] (adapted for BD rate < $10^{-4}$)

-> Mean accelerating gradient: 96.1 MV/m [81.5-104.7]

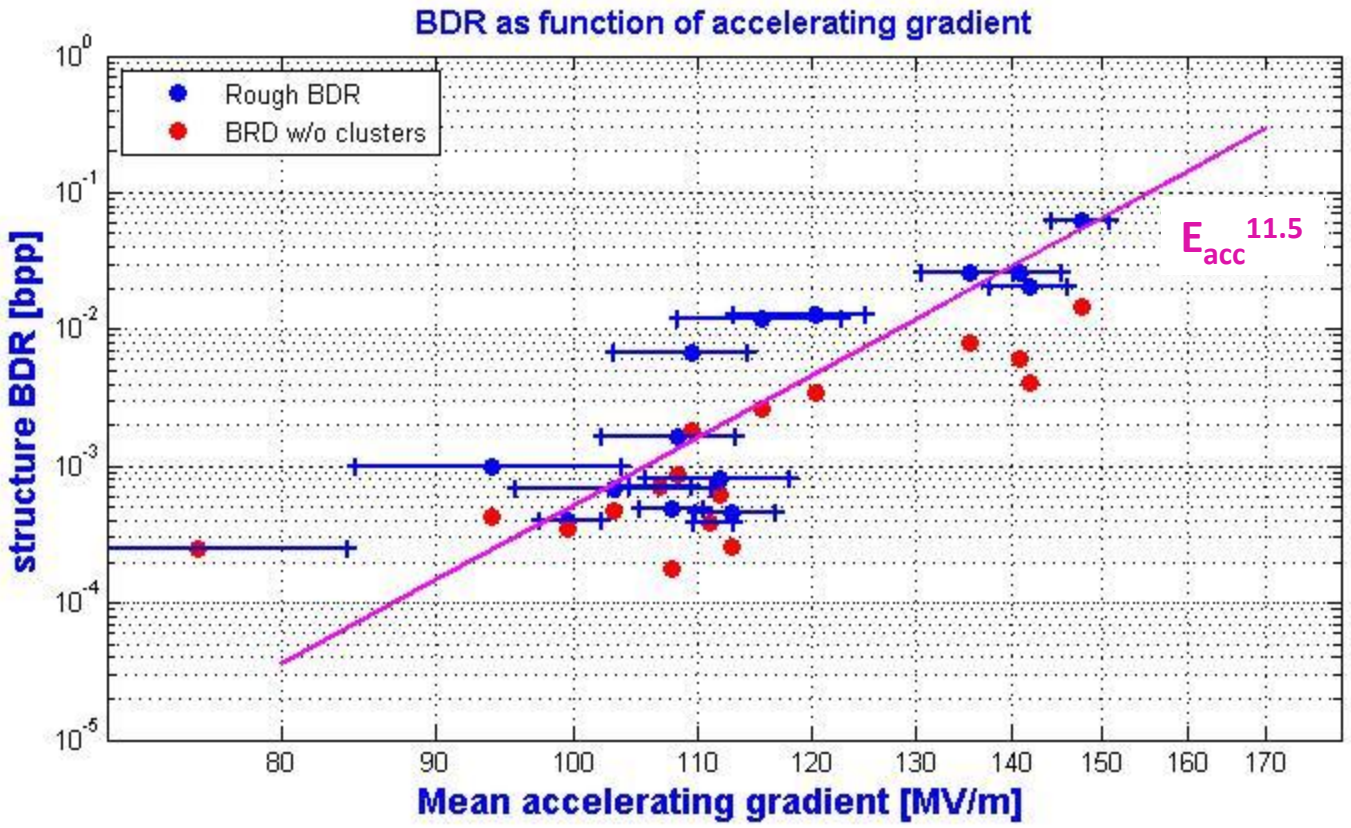
# BDR power law



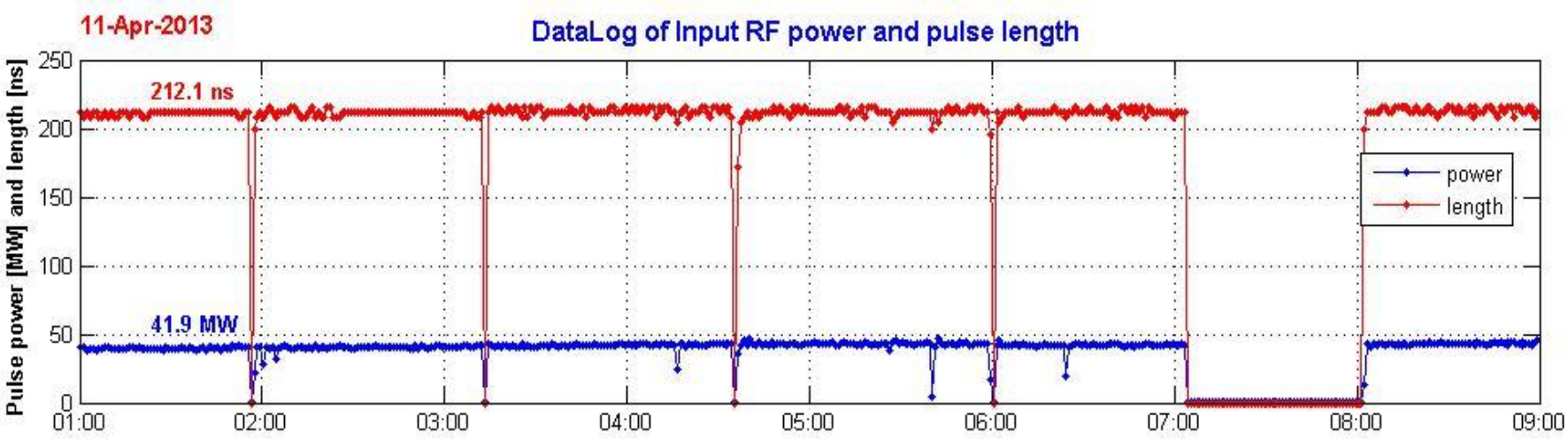

Quite a great dispersion of BDR for a constant accelerating gradient

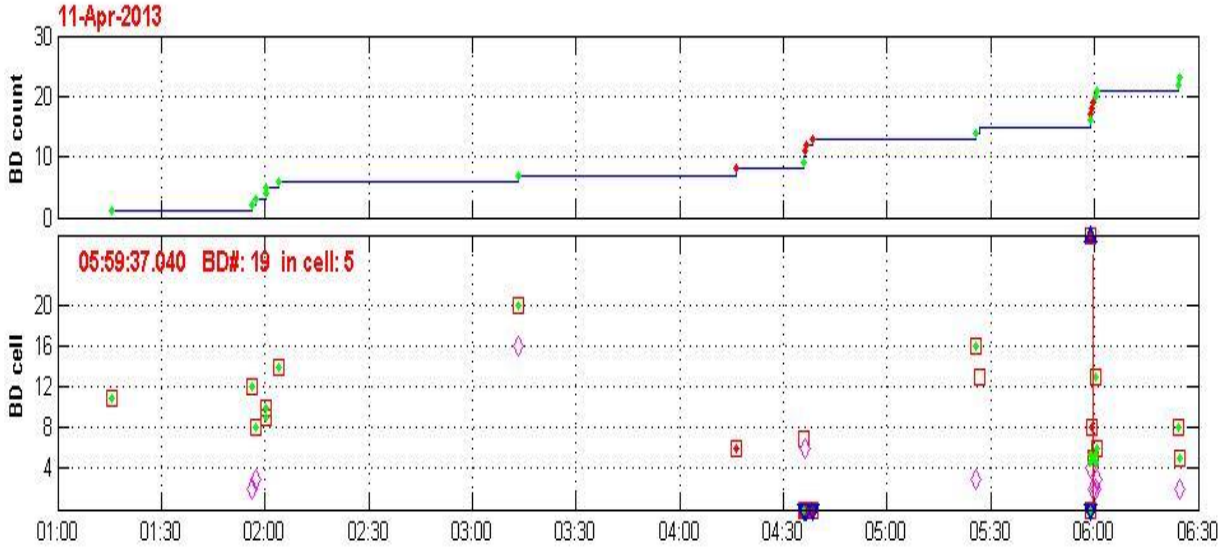
-> detailed analyze of each 8 hours period record (61) still to be completed (see below)

# TBTS 2nd period comparison



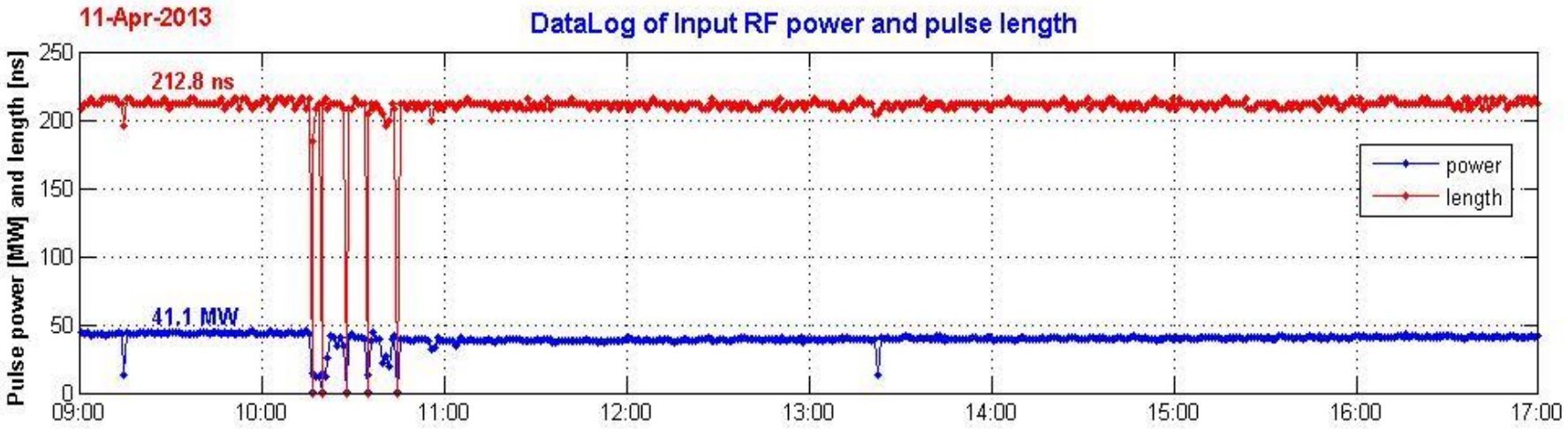
# Power, pulse length and BD time evolution 11 Apr (a)

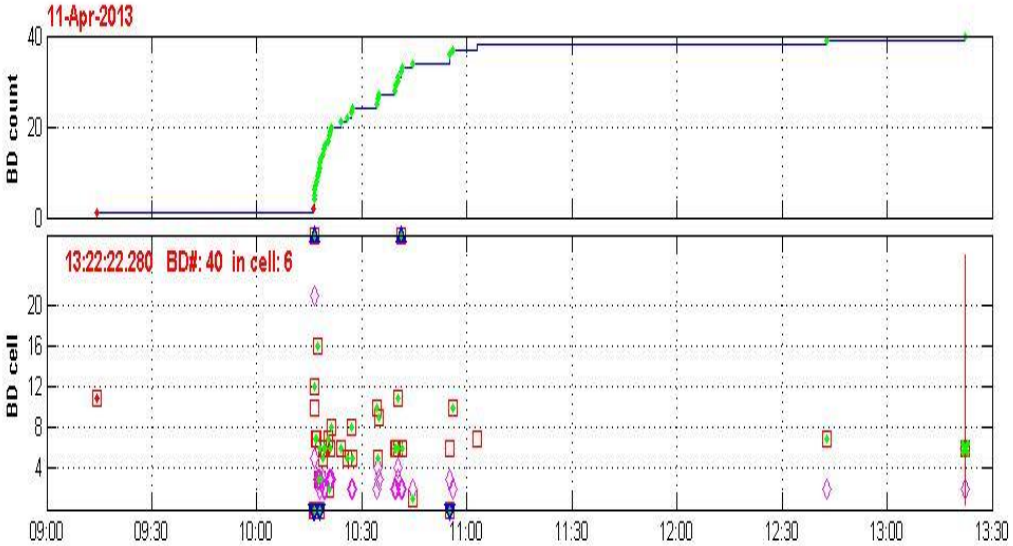



BDR = 2.2 x $10^{-5}$

# Power, pulse length and BD time evolution 11 Apr (b)

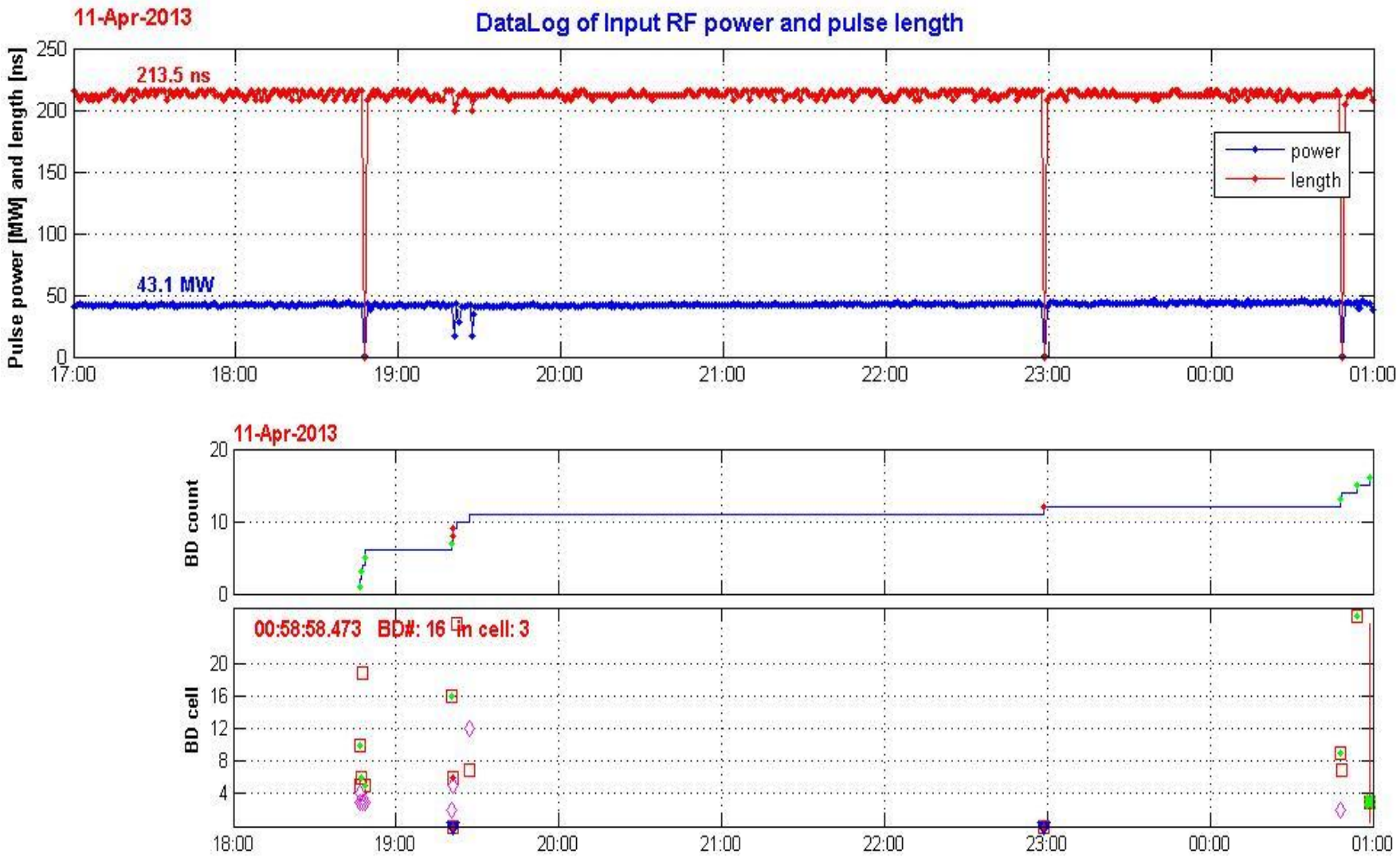



Short period of high BDR

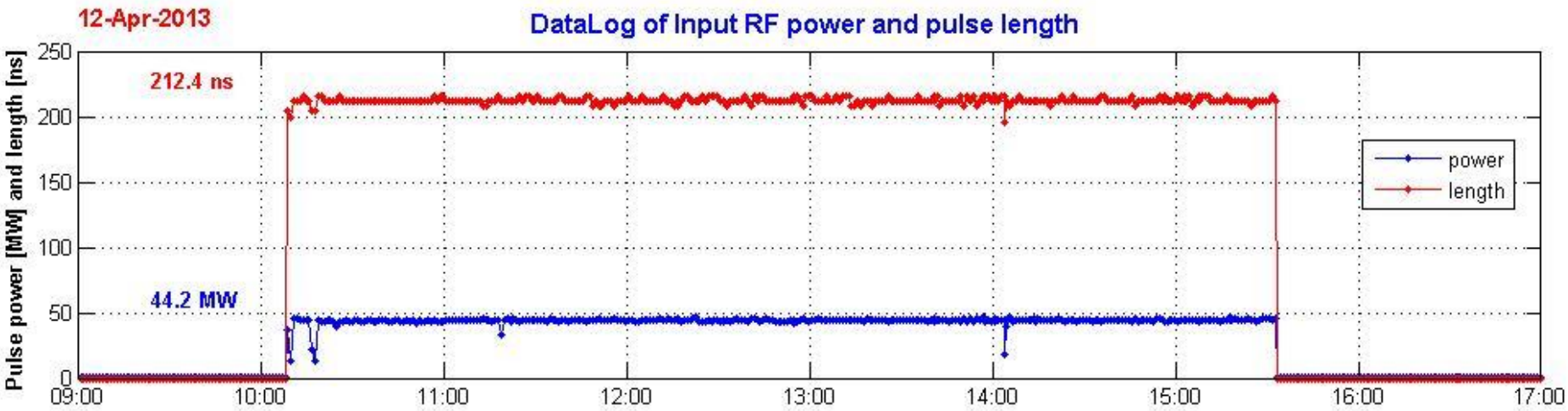
BDR = 4.5 x $10^{-5}$

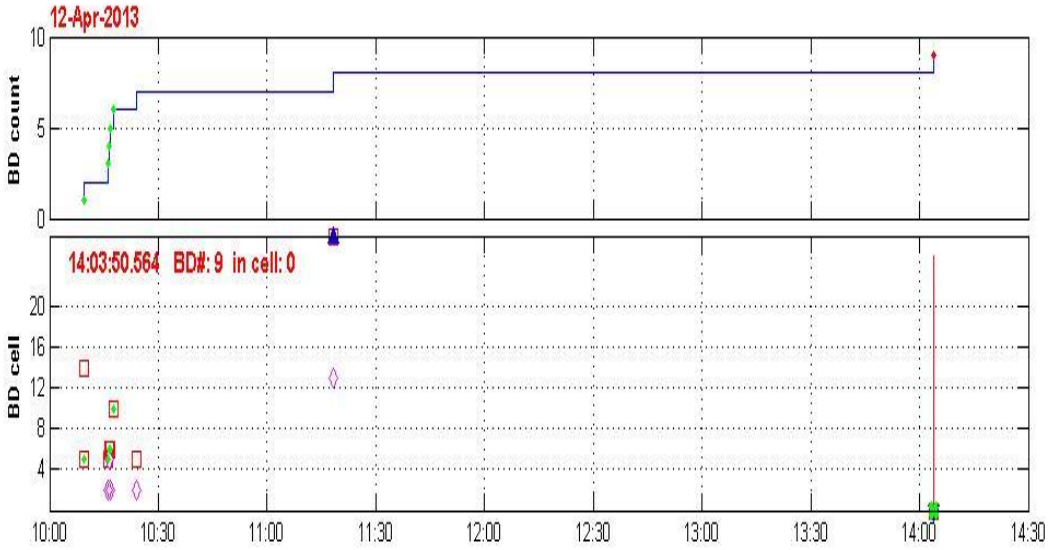
# Power, pulse length and BD time evolution 12 Apr (a)




BDR = 1.12 x $10^{-5}$

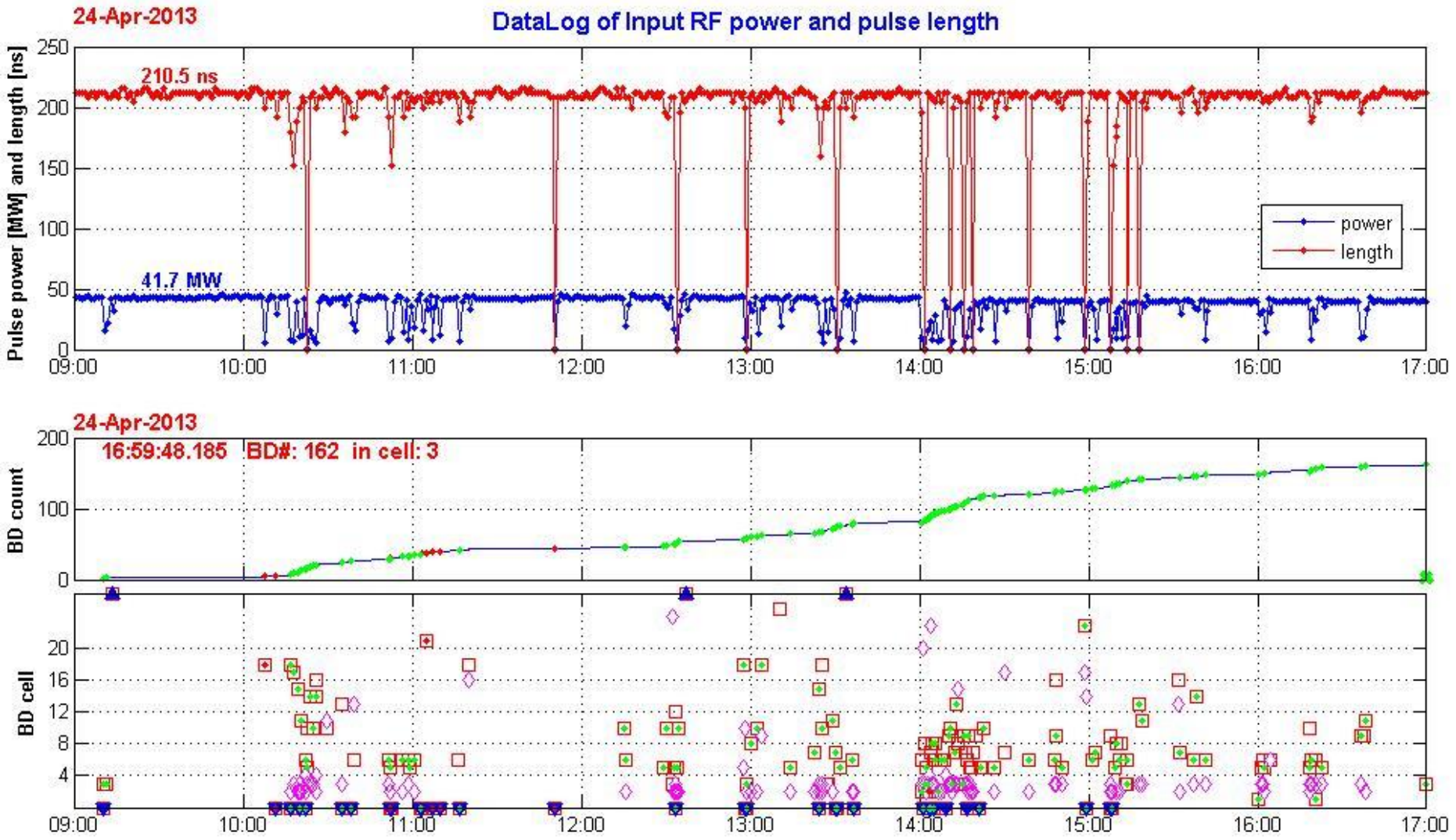
# Power, pulse length and BD time evolution 12 Apr (b)




BDR = 1.14 x $10^{-5}$

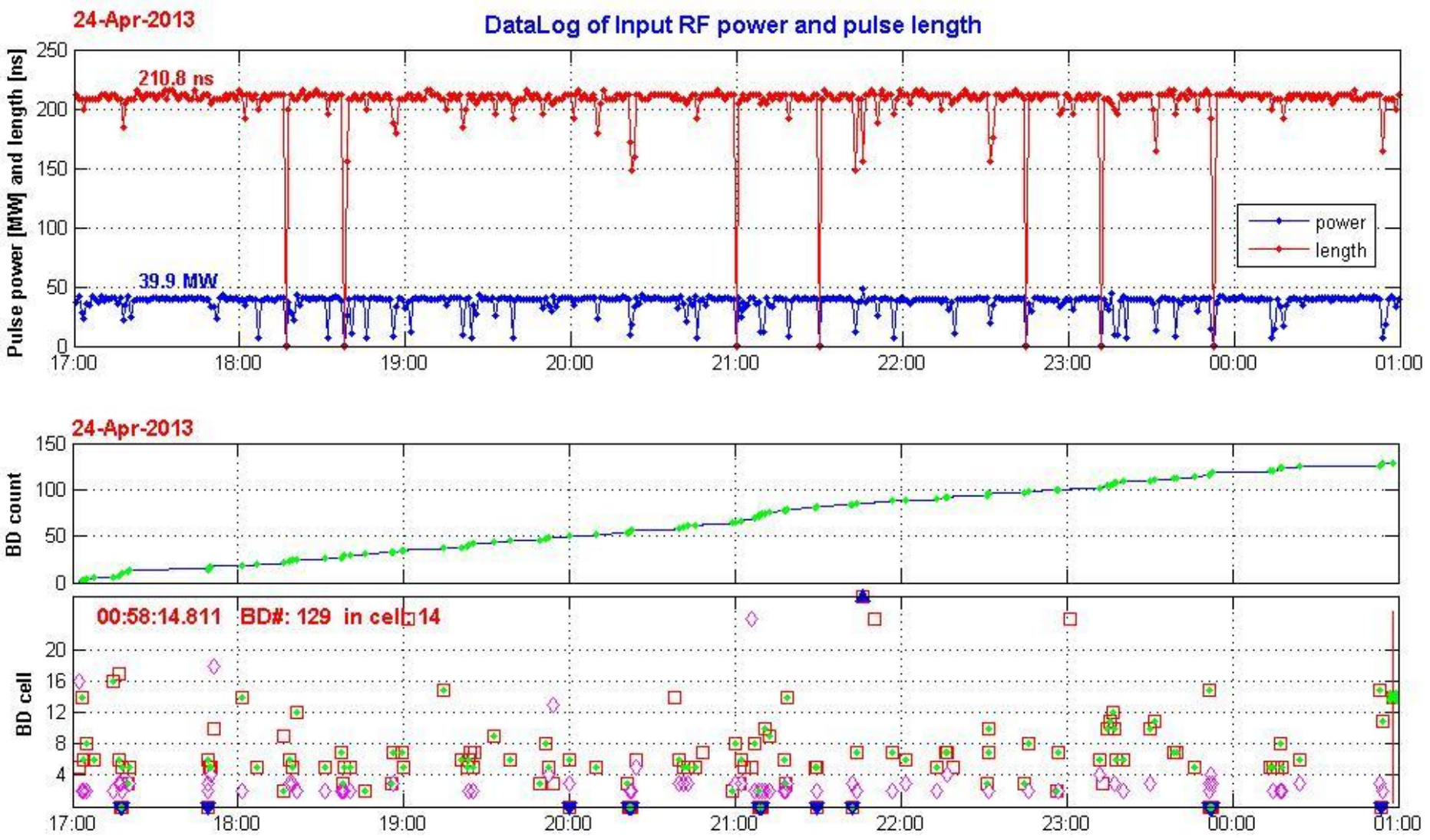
# Power, pulse length and BD time evolution 24 Apr (a)




BDR = 1.1 x $10^{-4}$

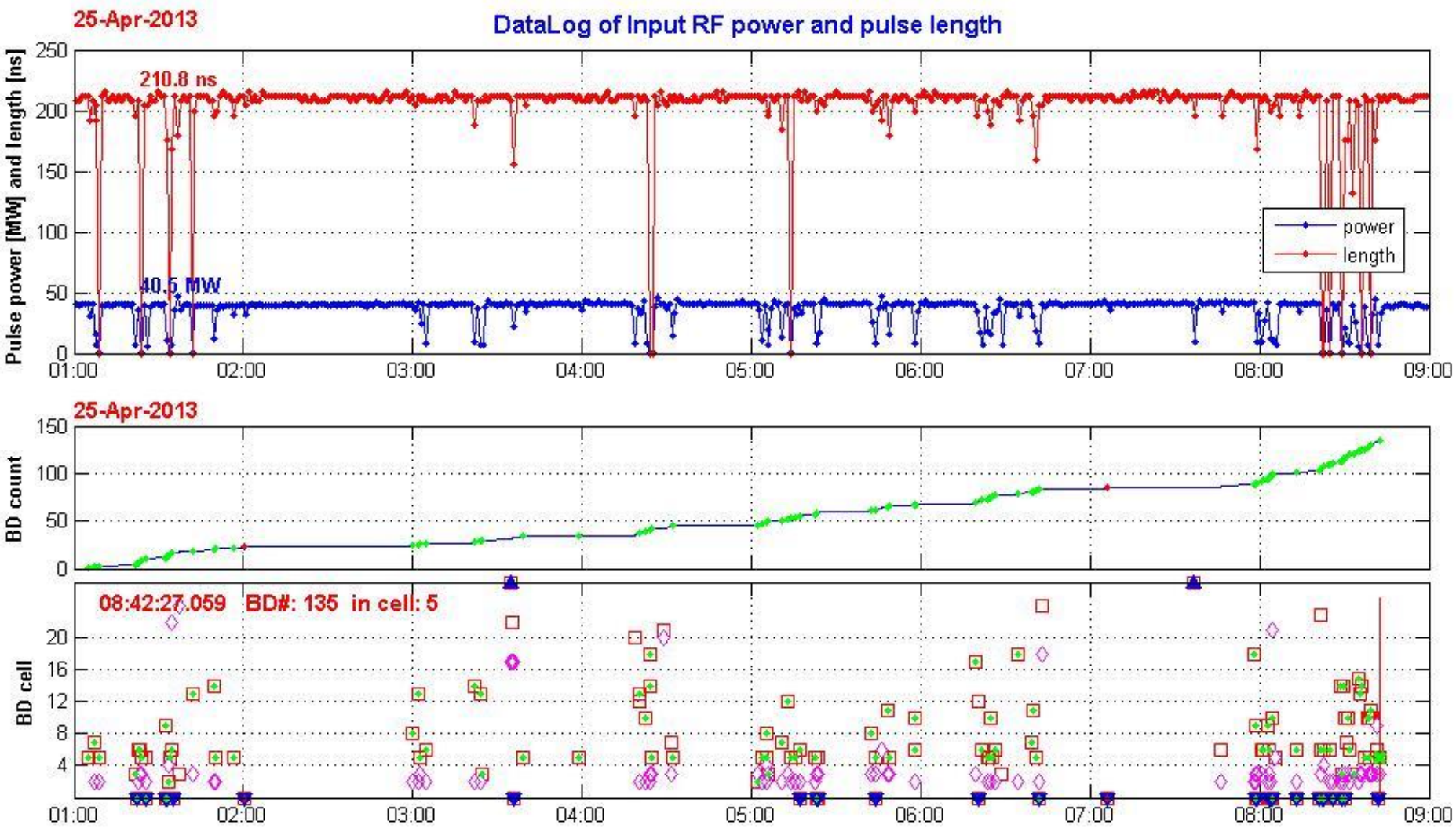
A strong degradation has appeared !

# Power, pulse length and BD time evolution 25 Apr (a)




BDR = $9.0 \times 10^{-5}$

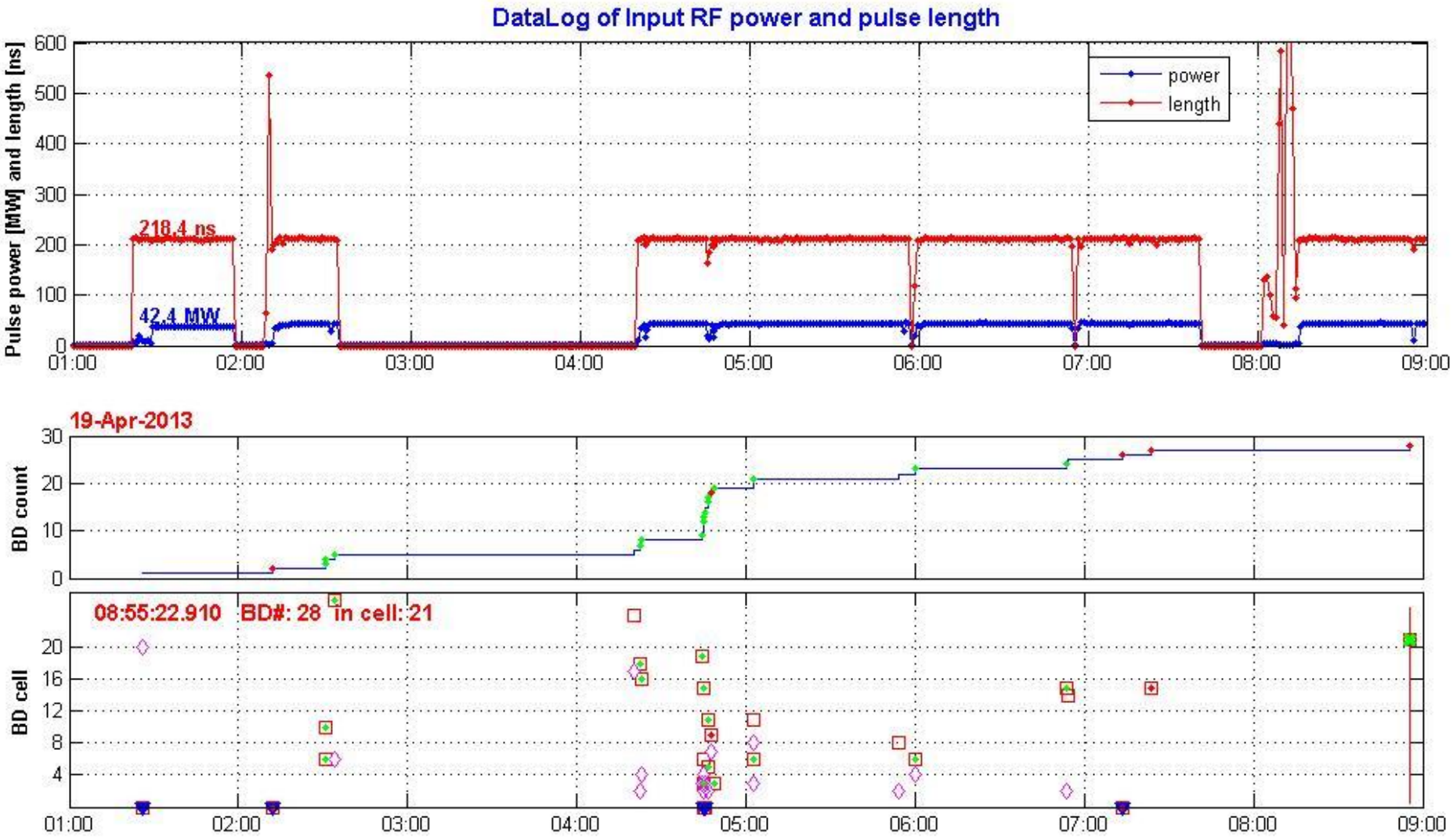
# Power, pulse length and BD time evolution 25 Apr (b)




BDR = 9.6 x $10^{-5}$

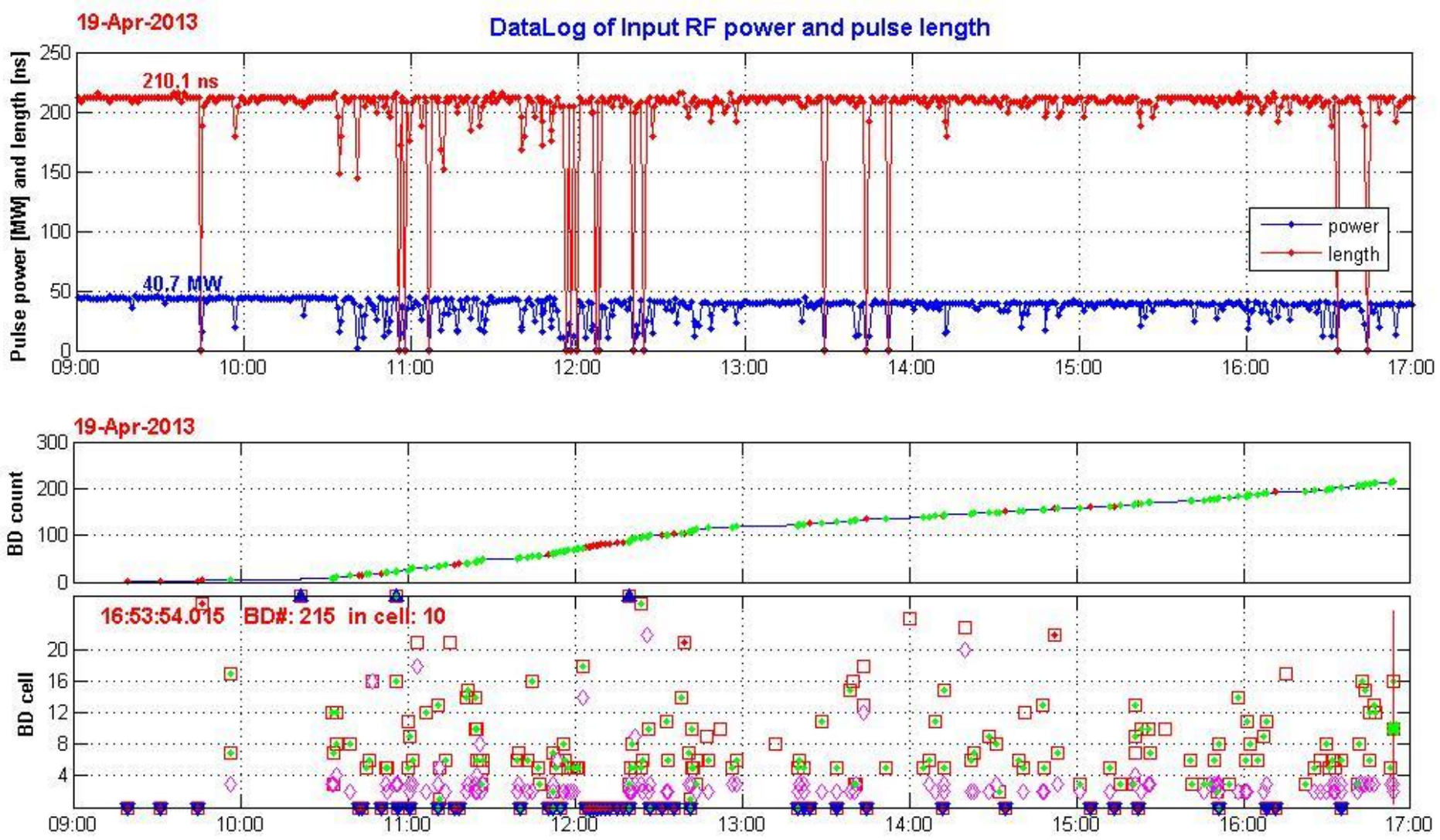
From 26 April, power has been reduced to 35 – 39 MW (91 -96 MV/m) to keep BDR around $10^{-5}$ but the ACS did not recover

# 19th April – before degradation



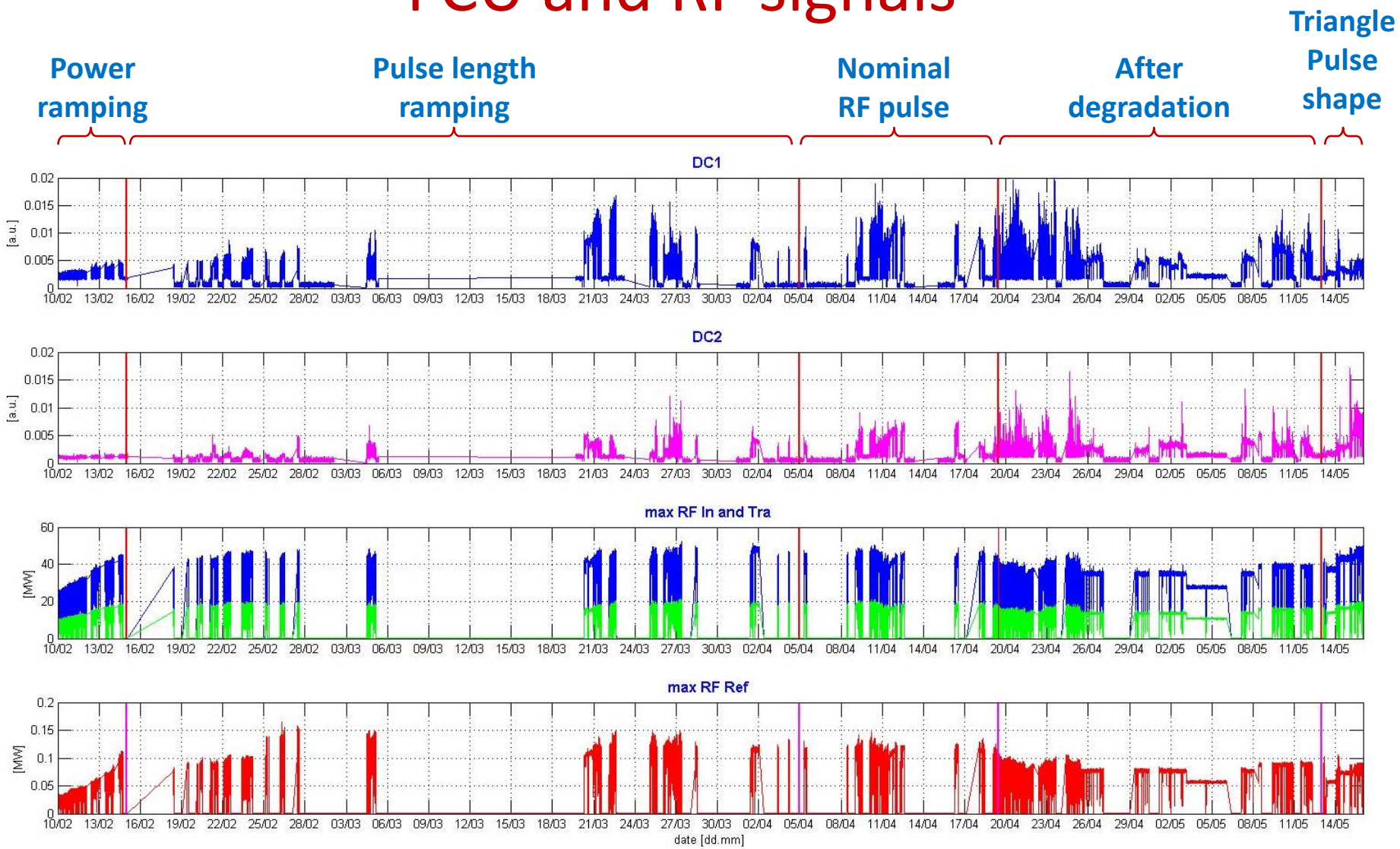

BDR = 2.7 x $10^{-5}$

# 19th April – degradation starts at 10:30

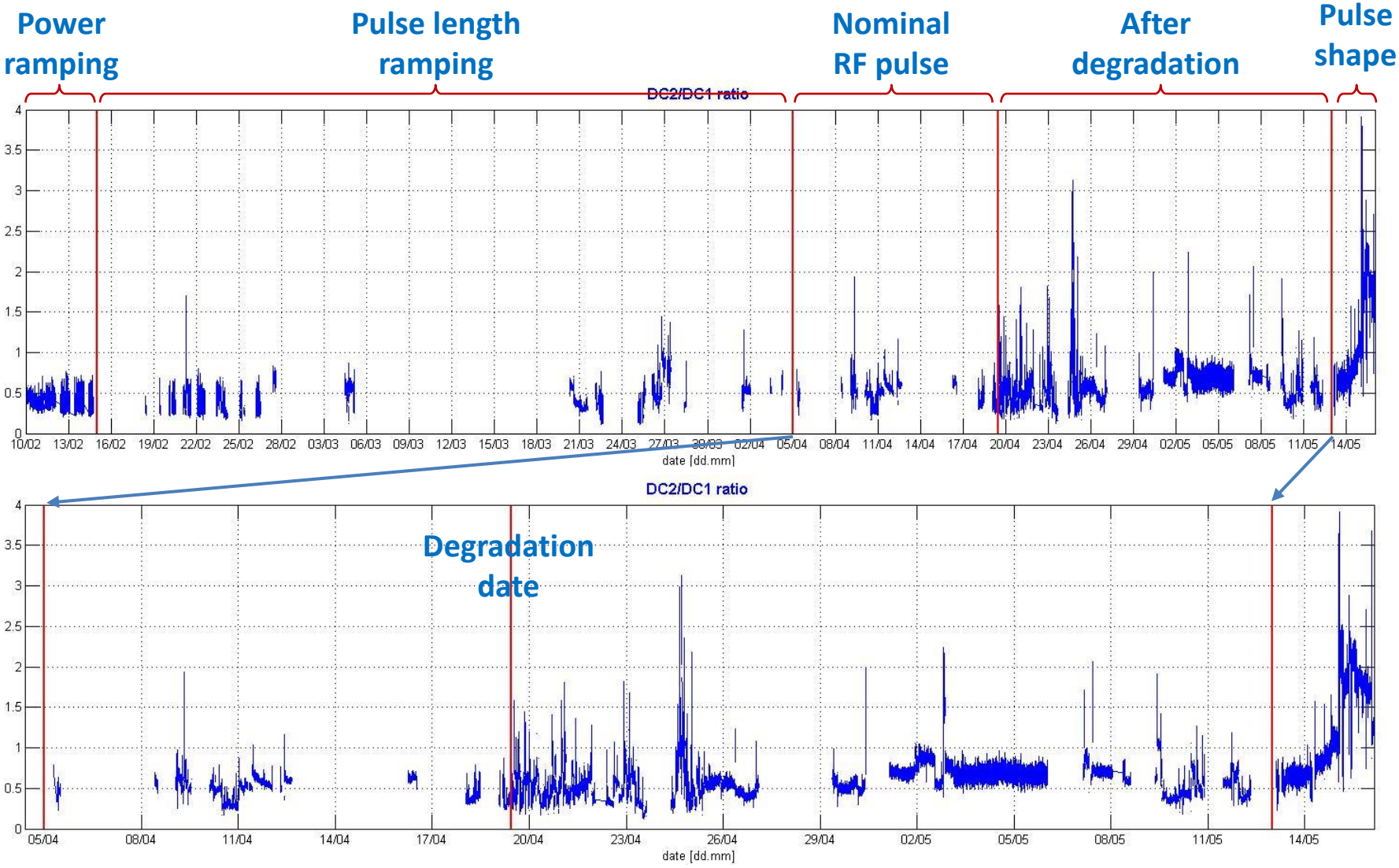



BDR = 1.5 x $10^{-4}$

# FCU and RF signals

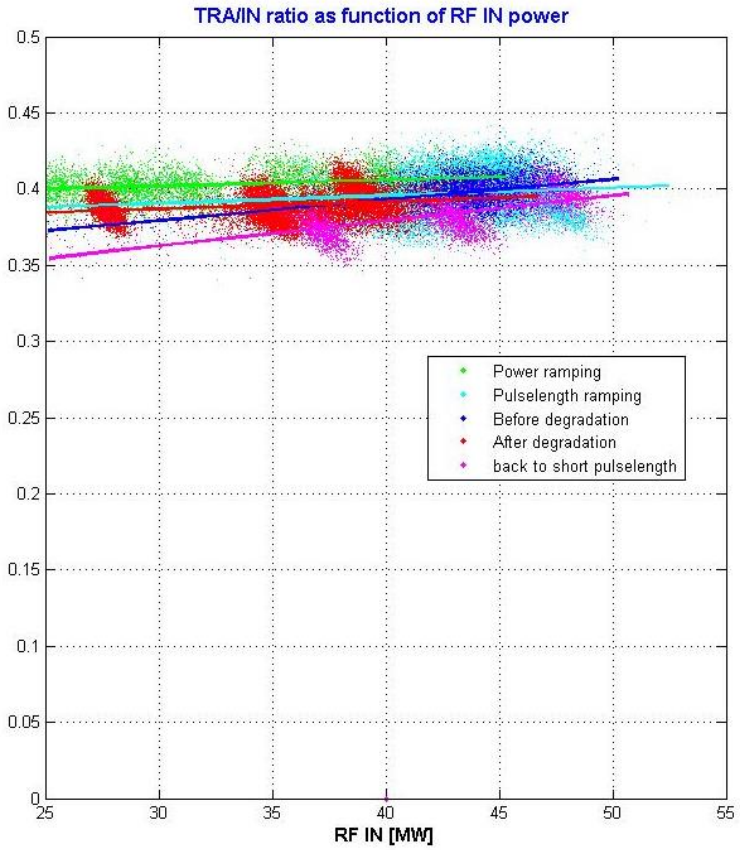


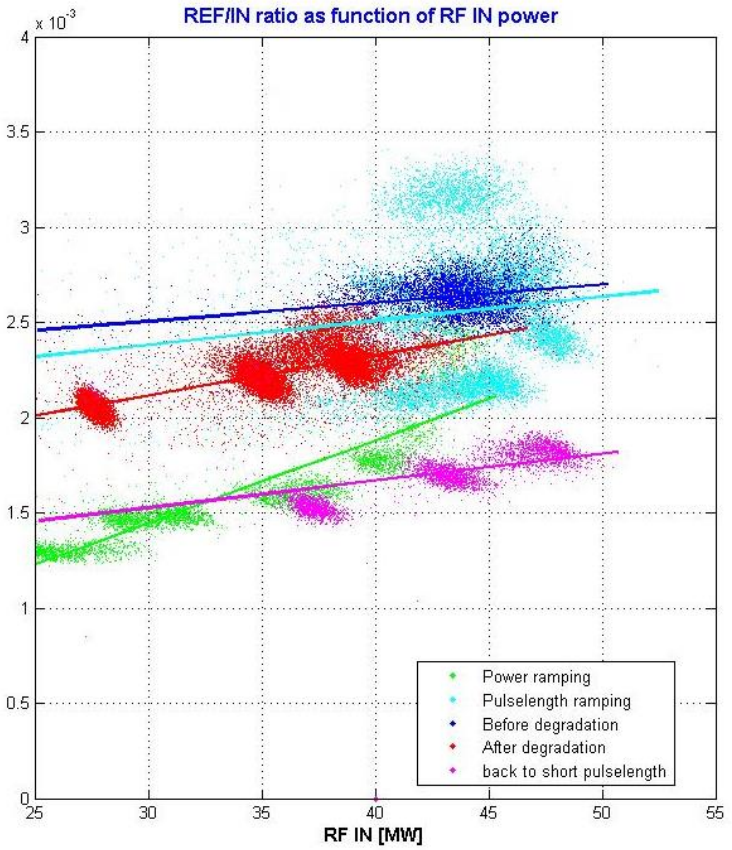
# Upstream / downstream Faraday cups ratio




DC2/DC1 ratio is more frequently larger than 1 since the degradation occurred

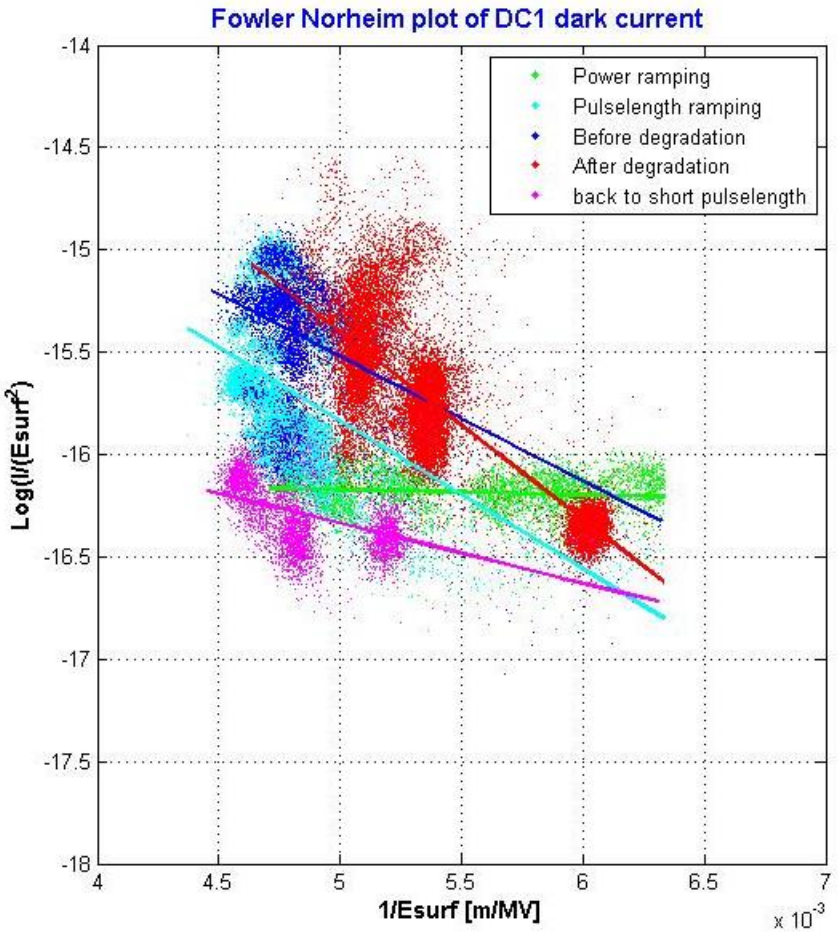
# Tra/In and Ref/In ratios

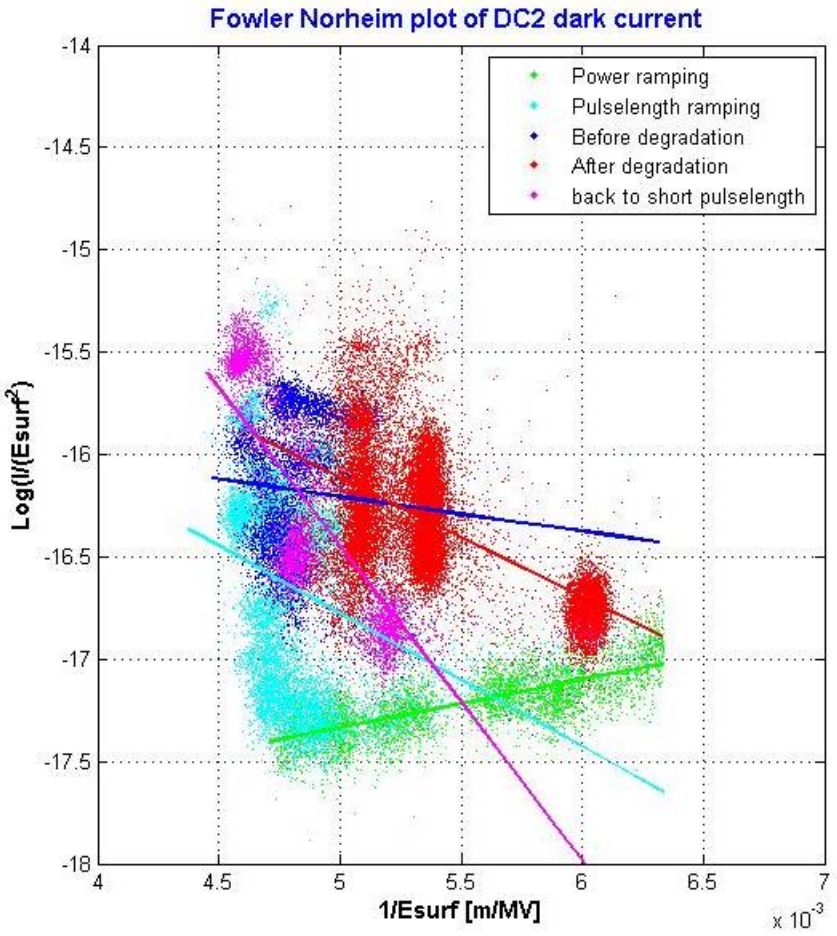


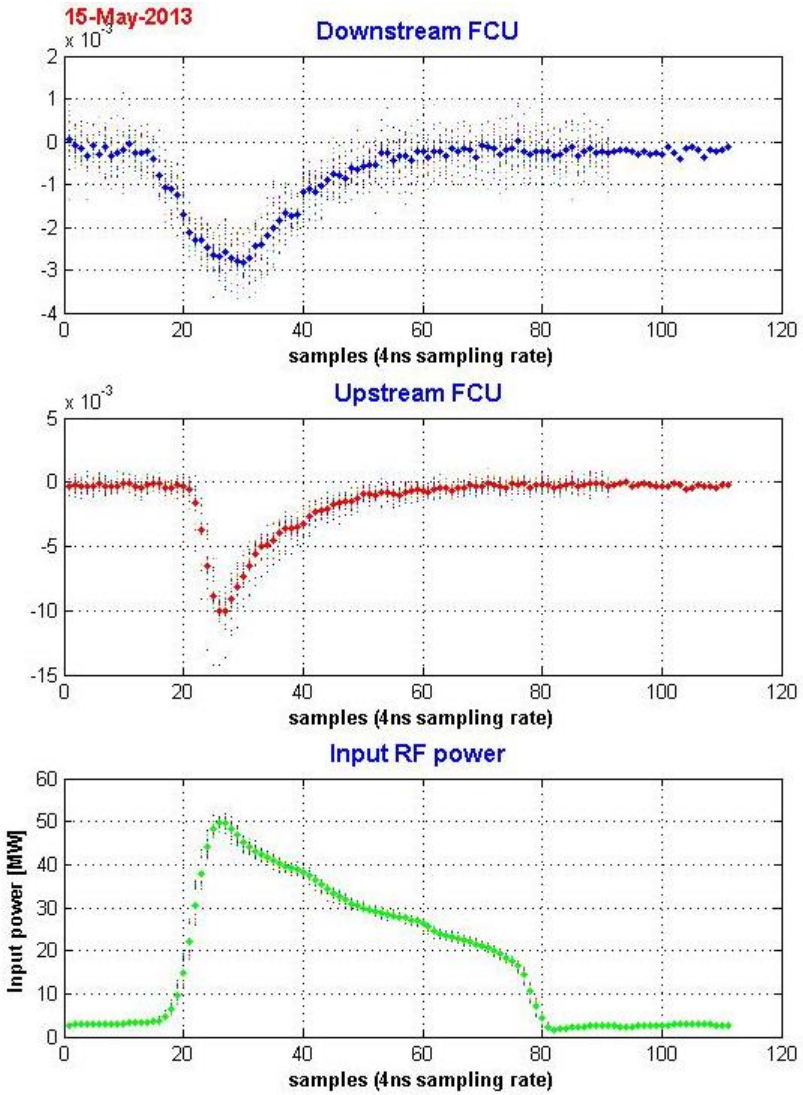

Ref/In ratio increases with the RF input power (but it could be an artifact due to the non linearity of the log detectors)

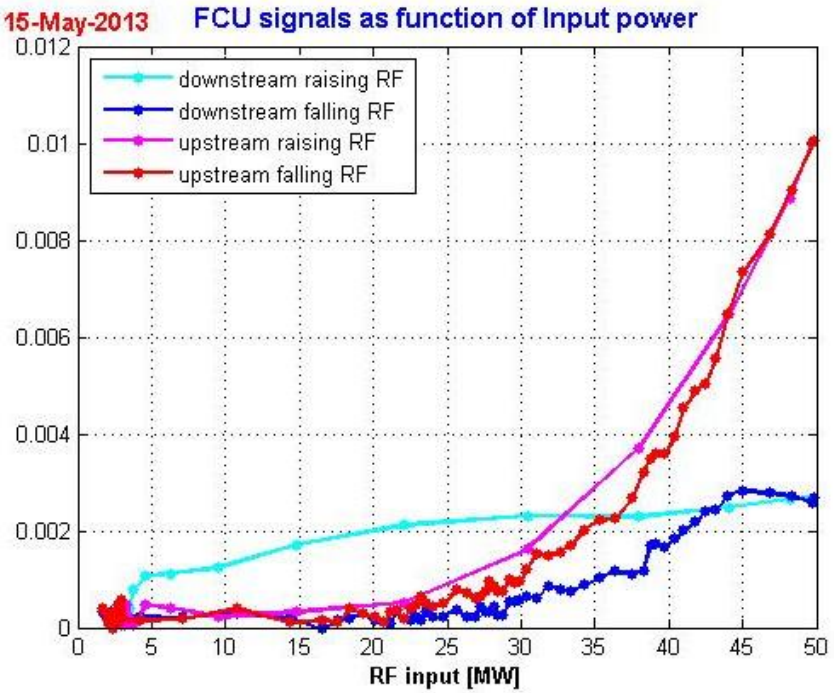
# Fowler-Norheim plots on peaks



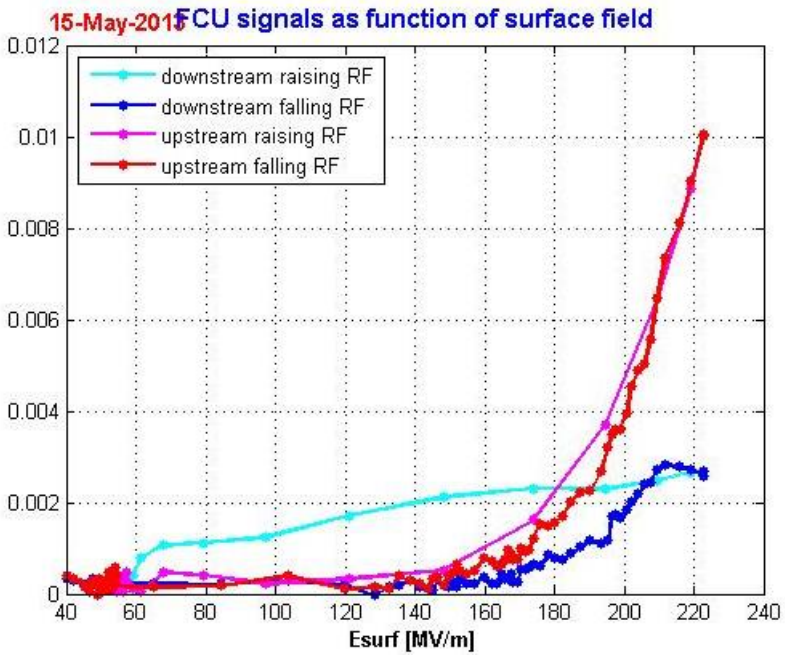



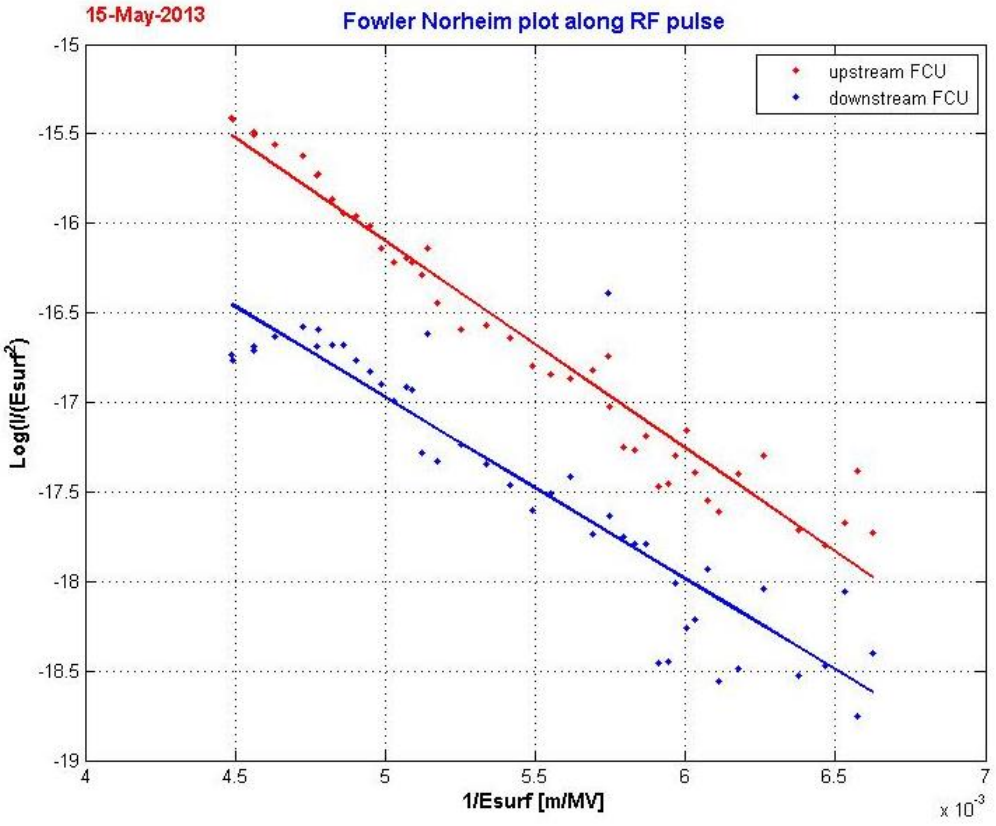
# FCU as function of RF power along pulses



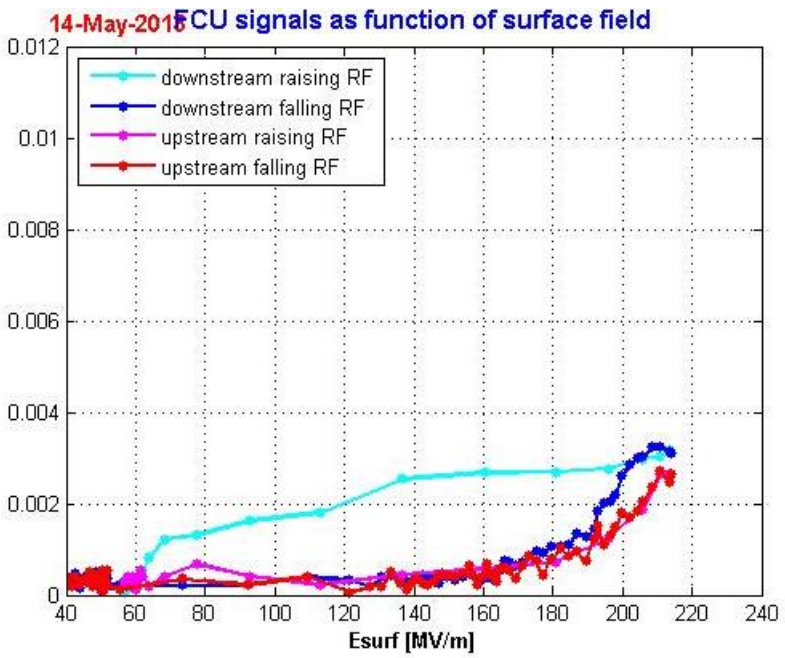



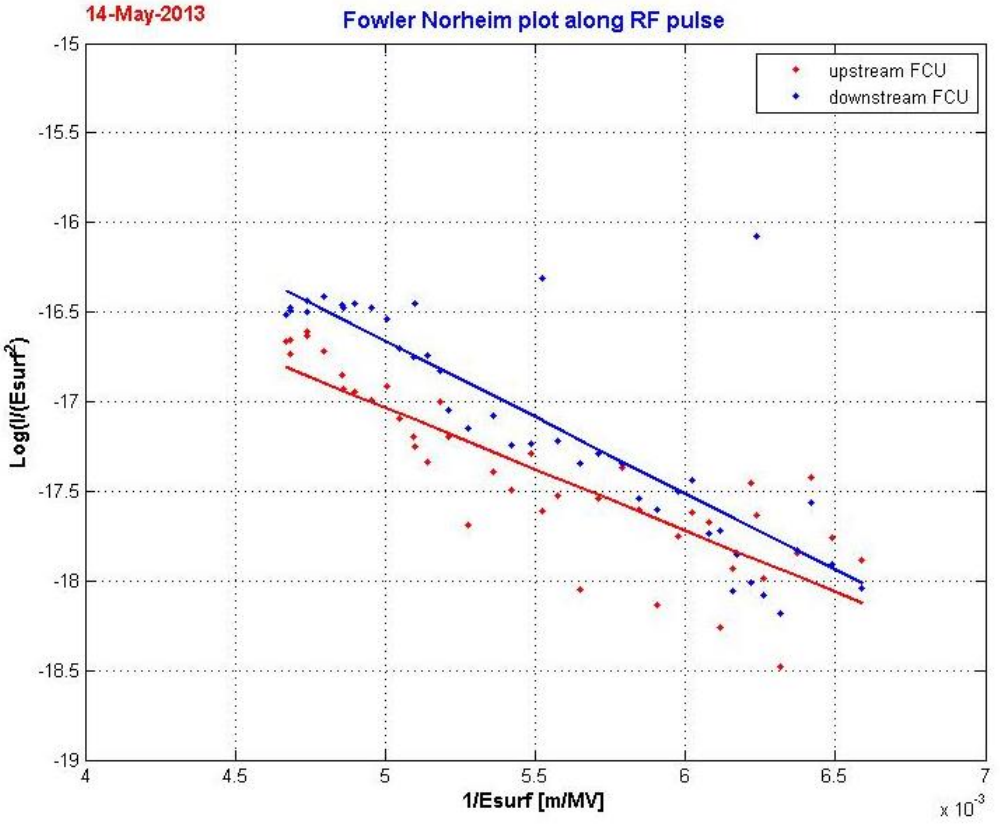
# Fowler-Nordheim plot along RF pulses



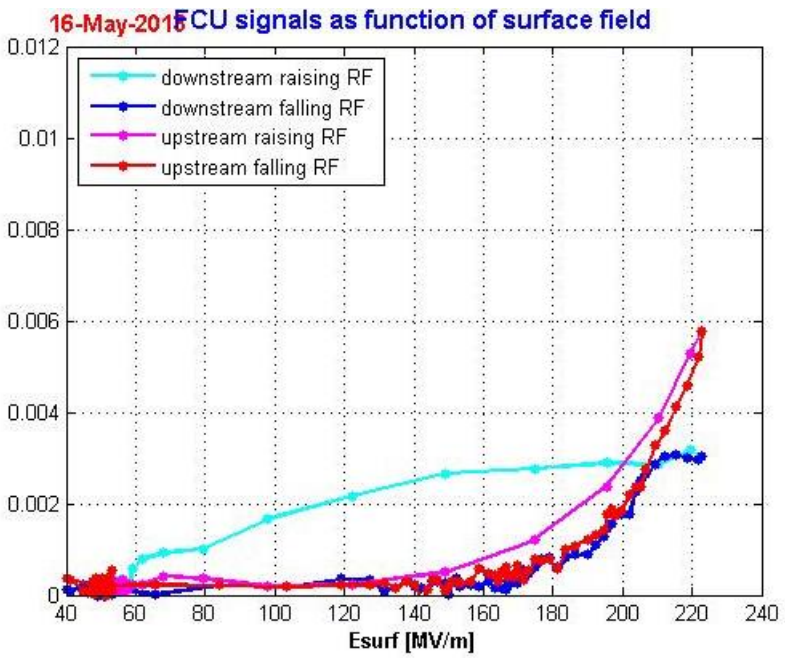



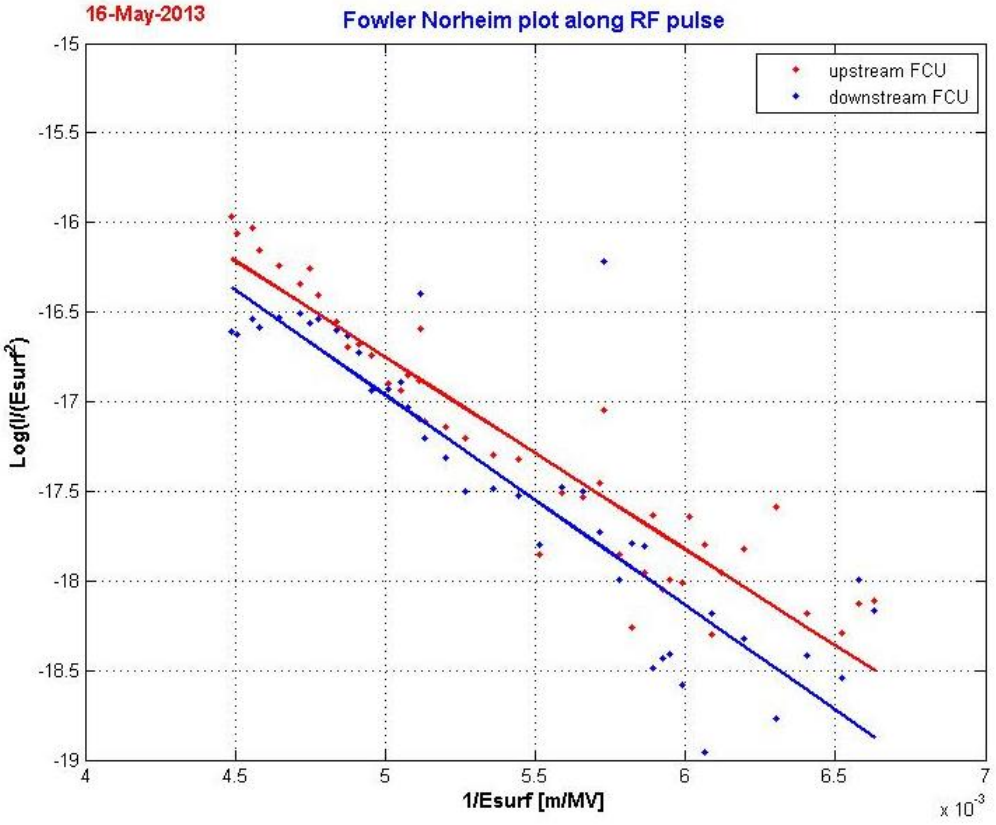
# Fowler-Nordheim plot along RF pulses



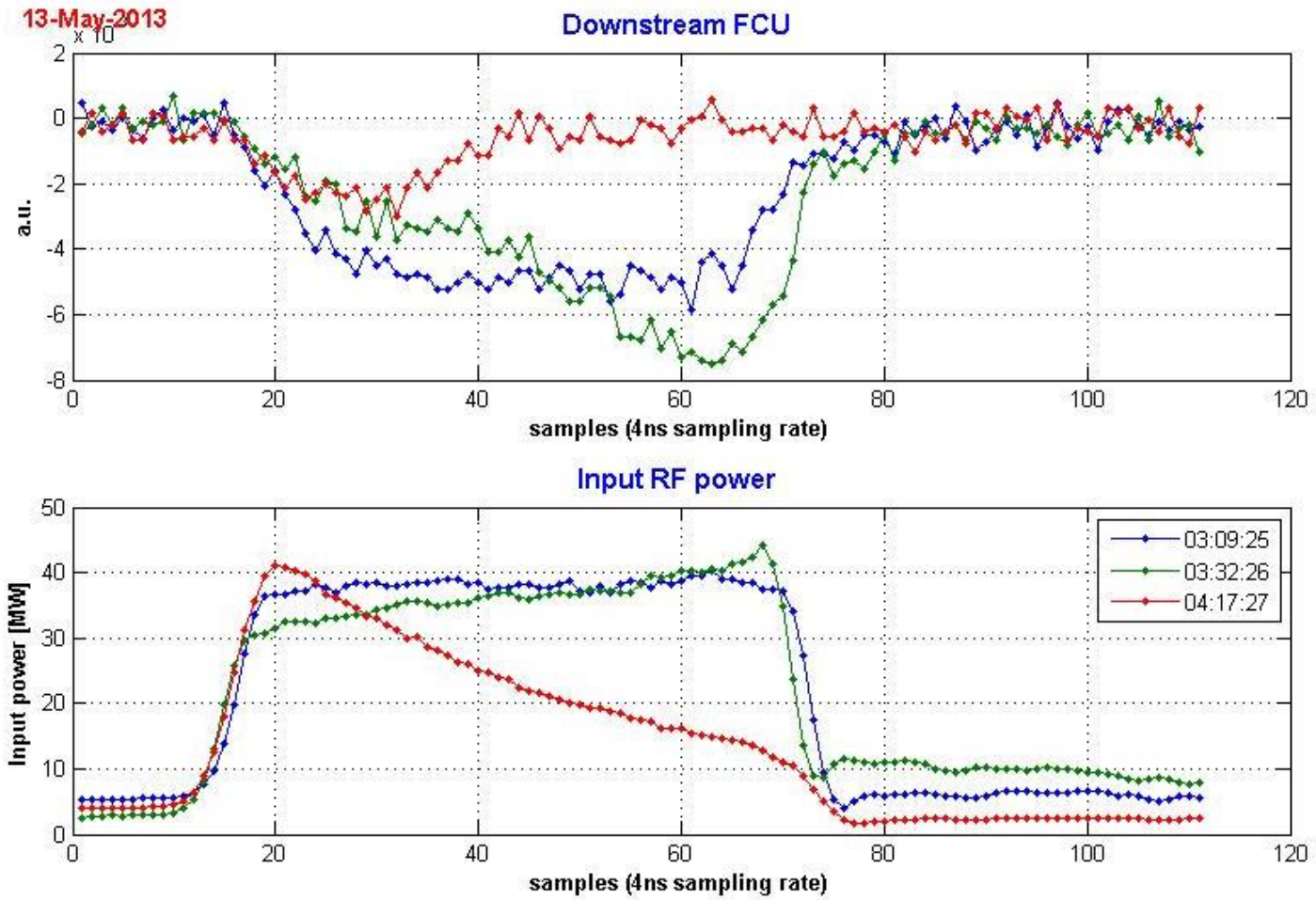



# Fowler-Nordheim plot along RF pulses



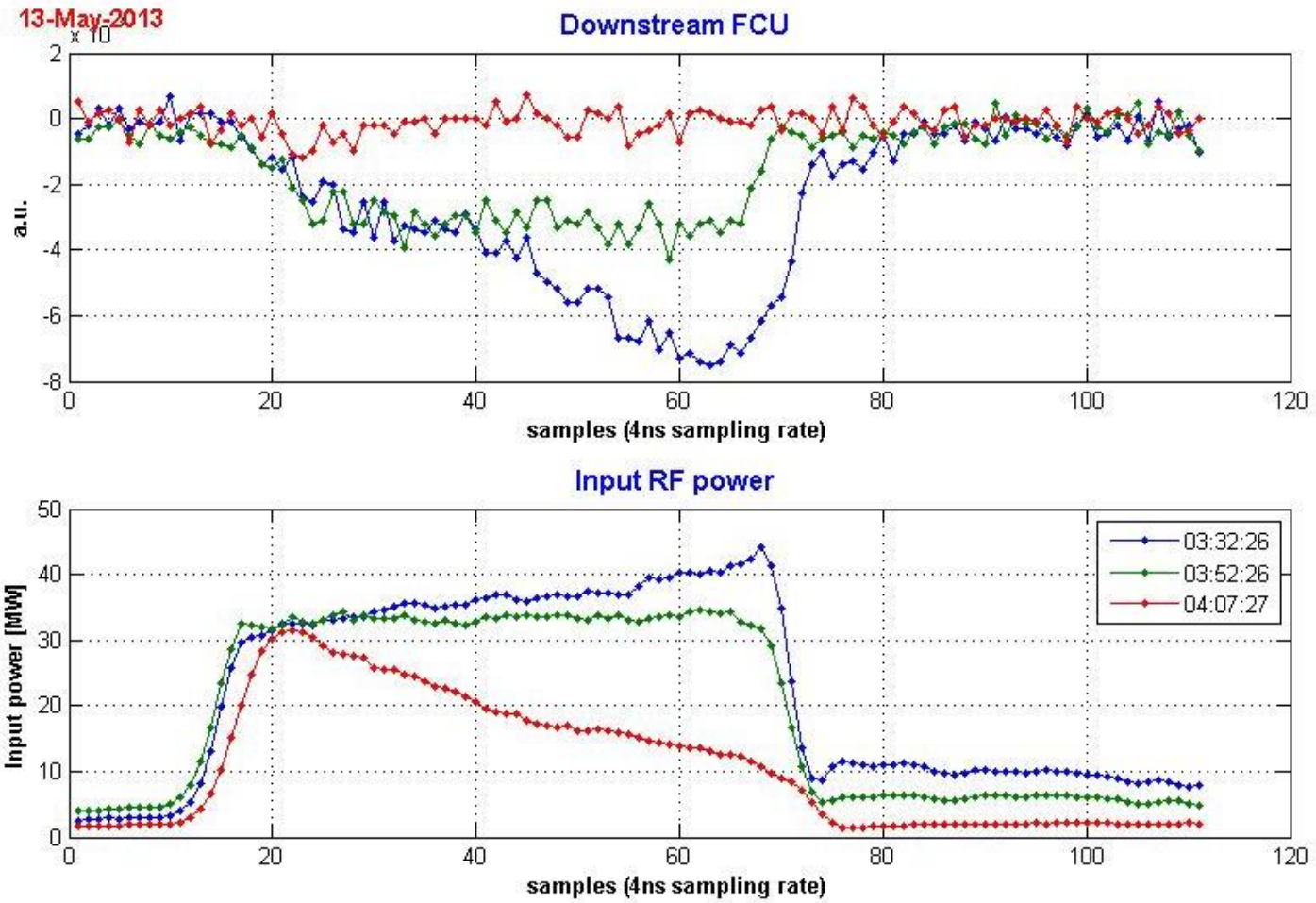



# Does pulse length matter in dark current ?

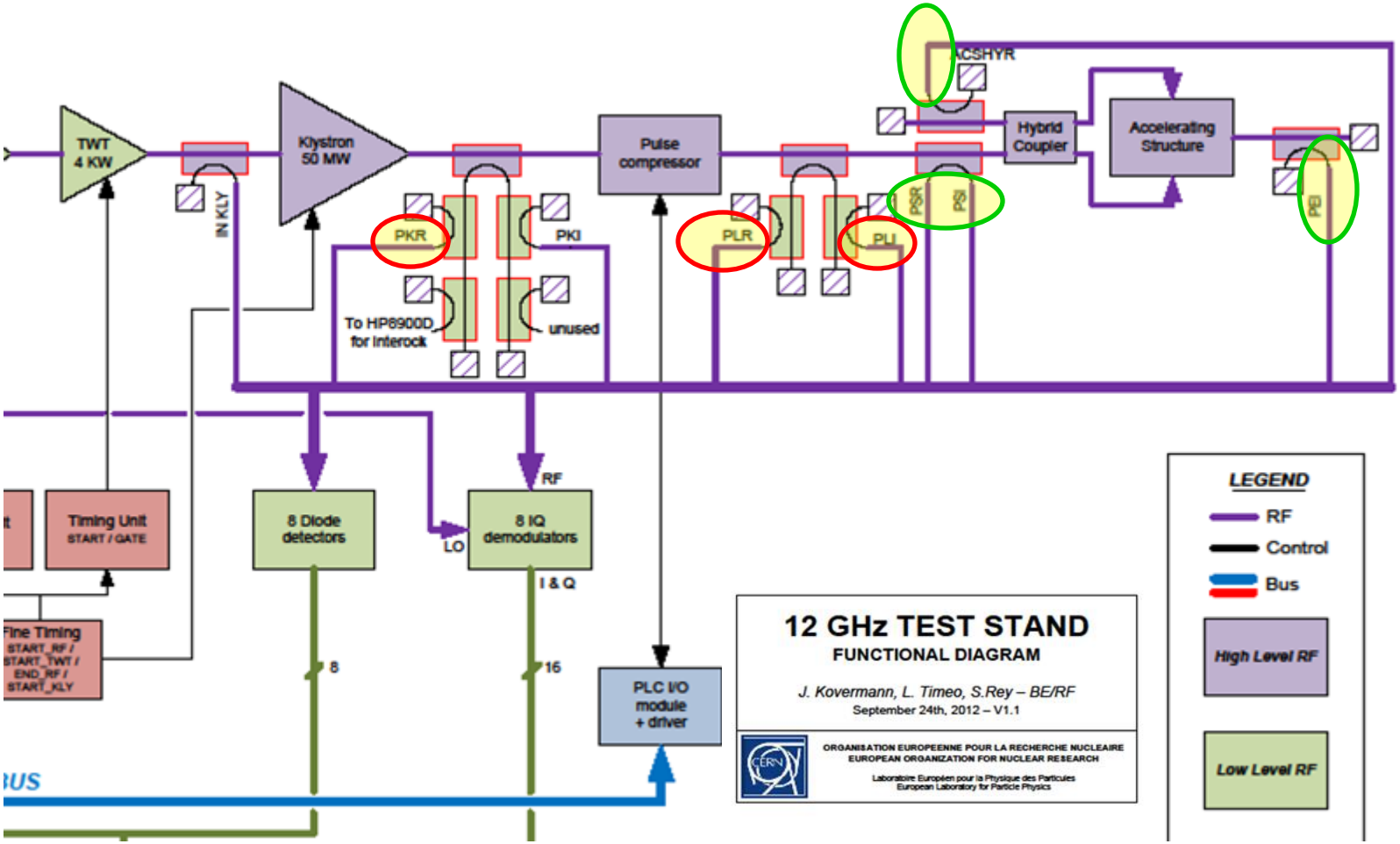



Three different RF pulses (same peak power but different shapes) give different peak dark current. Electronic bandwidth effect or real field emission behavior ?

# Another example



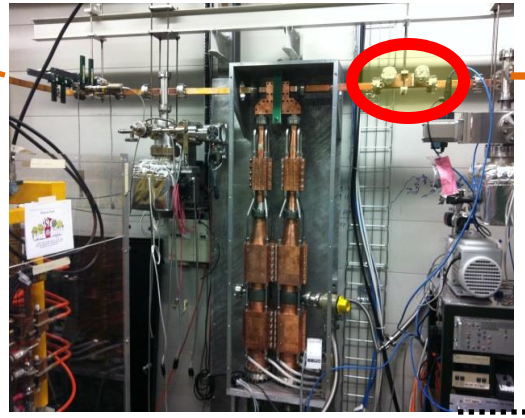
# Where are the RF couplers ?



# Layout of the CERN x-band test stand (X-box 1) [I. Kovermann]

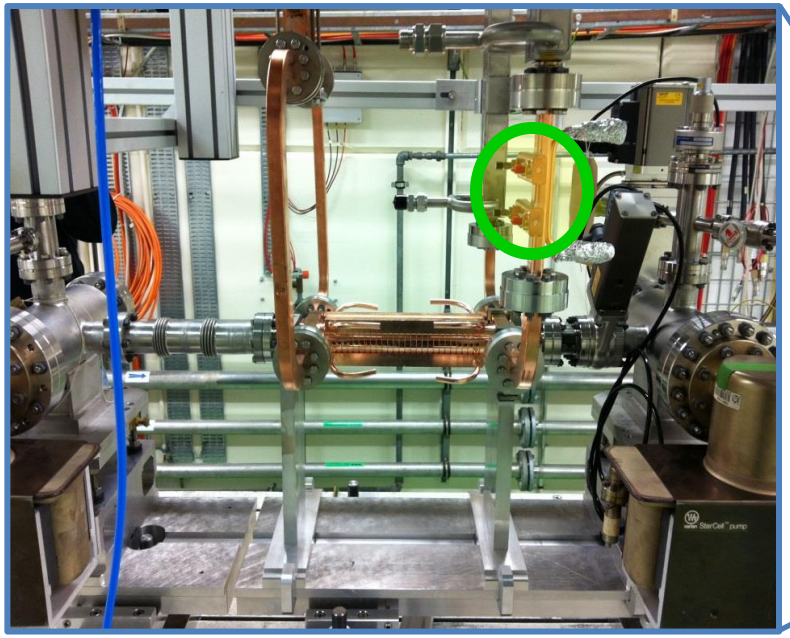
**Clockwise from top-left:**

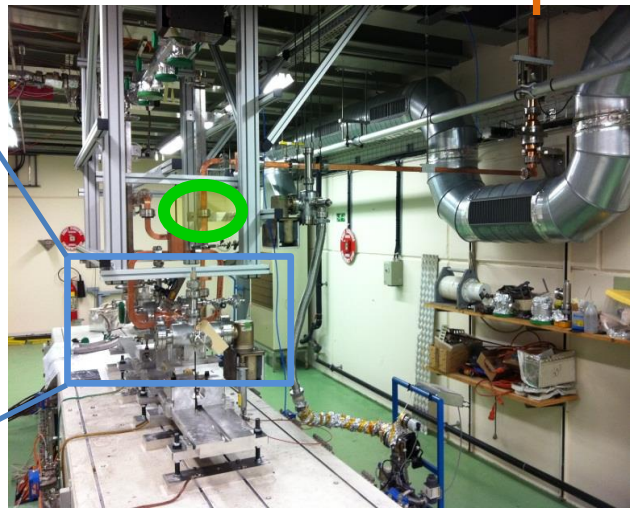
- Modulator
- Pulse compressor
- DUT + connections
- Accelerating structure

Gallery

Bunker





# Action for the next X-Box1 run

- Decoupled signals used for test stand monitoring (safety interlock) and for test of the accelerating structure.
- Accurately calibrate delays between structure diags (RF and FCU)
- Use faster sampling rate (1 ns) and adjust the dynamic of the I/Q
- Use 2 different dynamics for the FCU (dark current and BD current)
- Implement a method for periodic Fowler-Nordheim plots (ramping power up and down RF power during 10 s every 15 min. for example)
- Define less stringent rules for stopping the RF on structure BDs signal (use energy loss threshold)
- New diagnostics development (optical fibers, higher frequency RF signal probe)