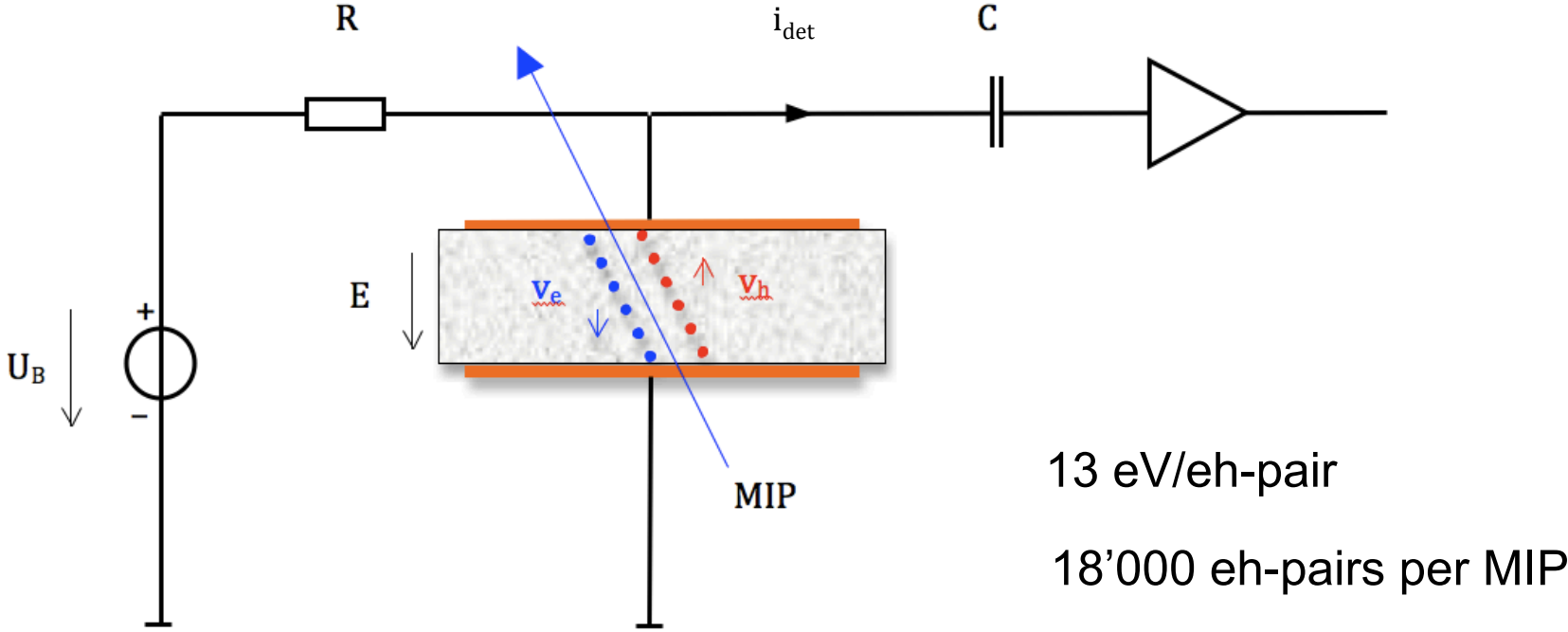# Diamond BLMs at CERN – Readout Electronics
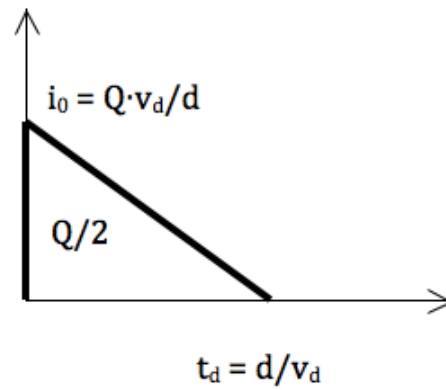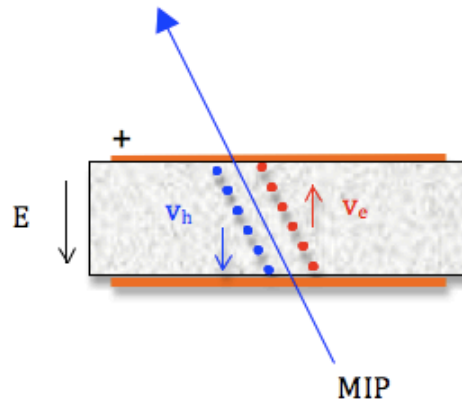
Cryogenic Beam Loss Monitors Workshop

Erich Griesmayer, CIVIDEC Instrumentation

Principle of Ionization
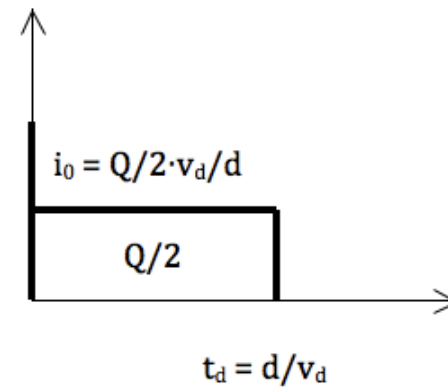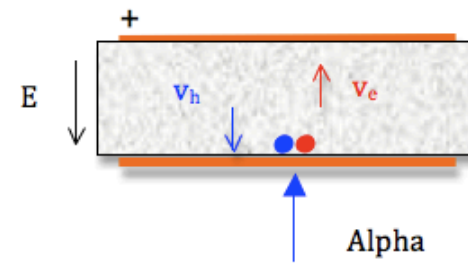

13 eV/eh-pair

18'000 eh-pairs per MIP

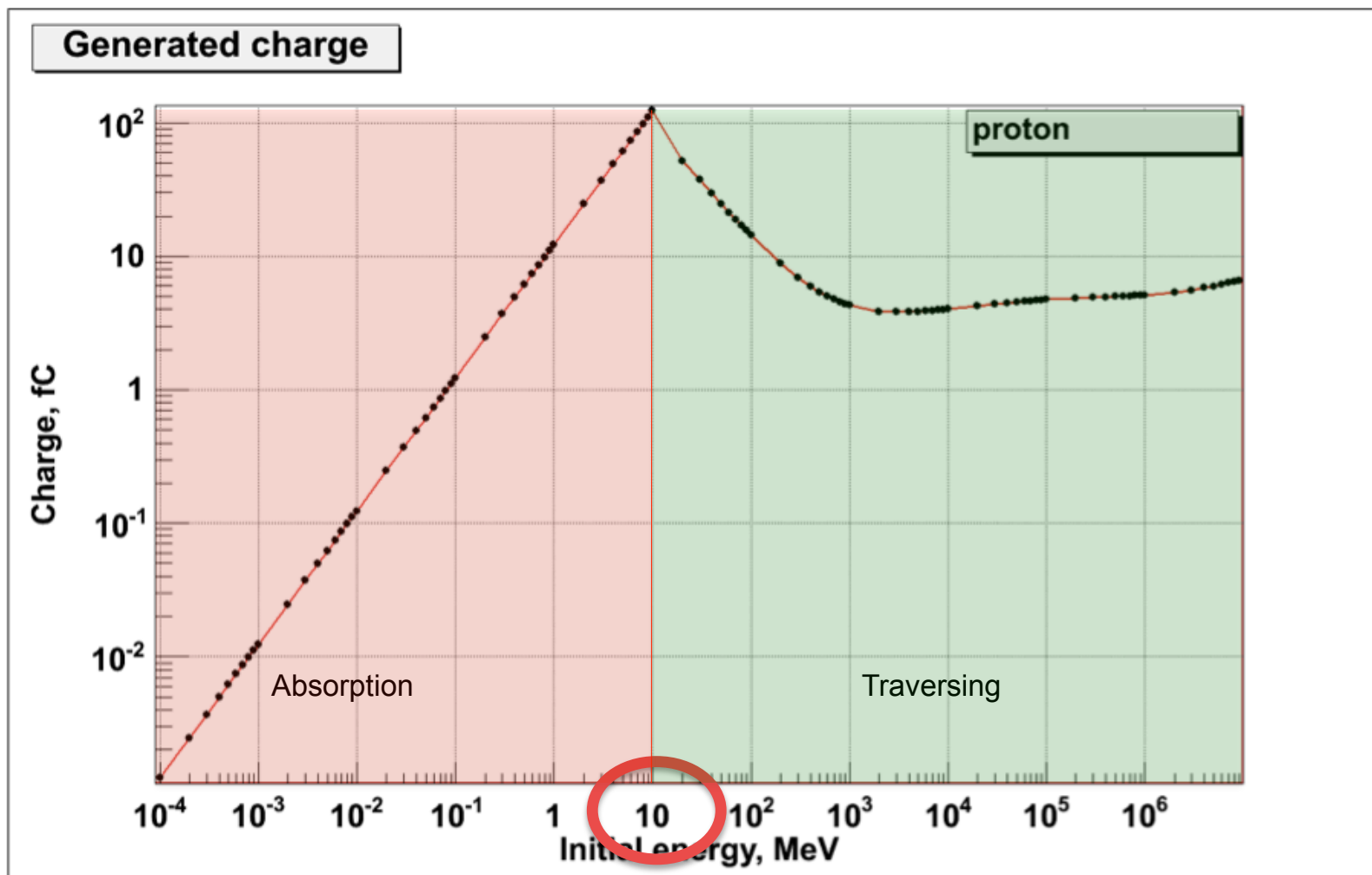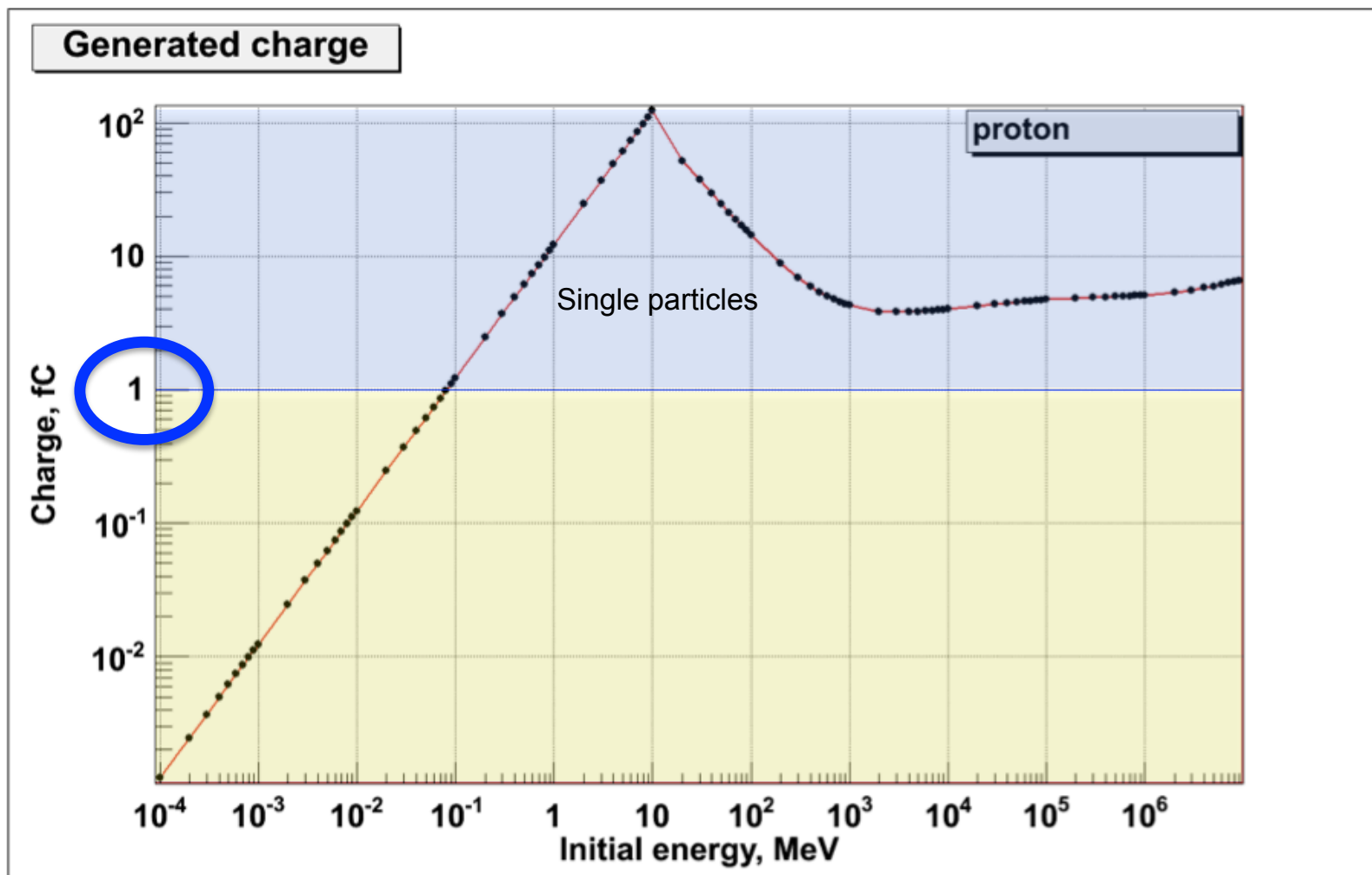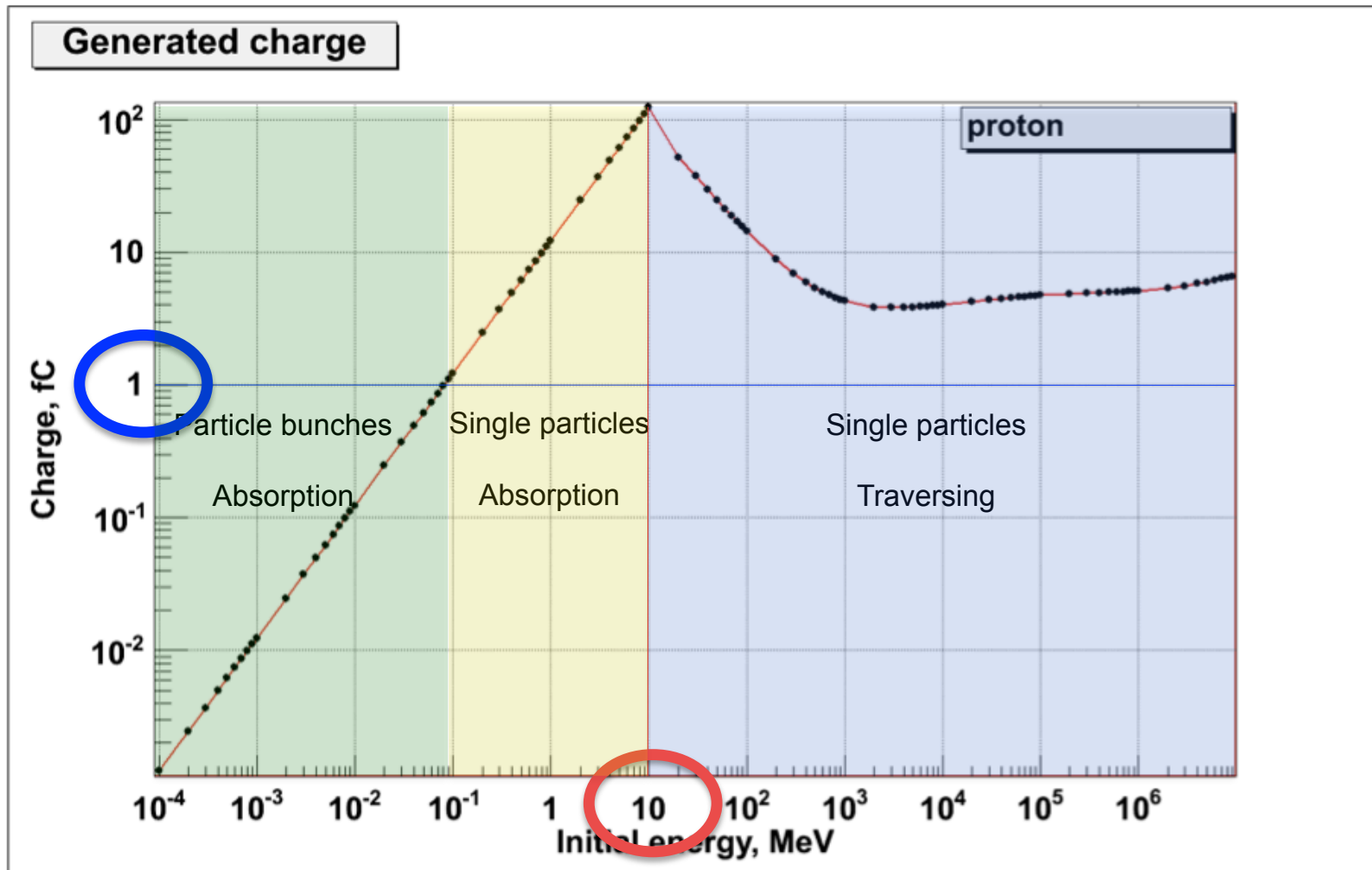# Modes of Operation

Proton Interaction
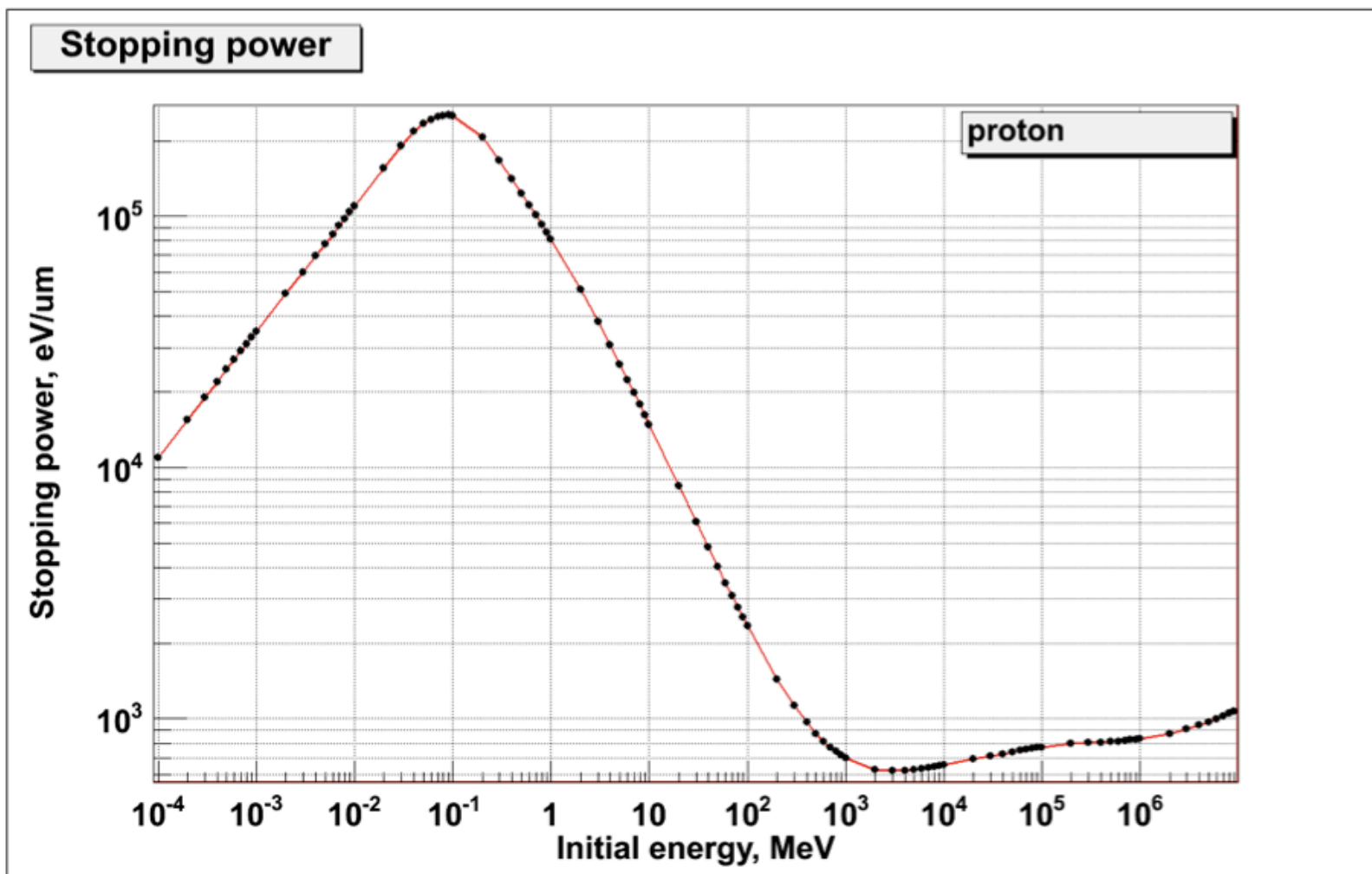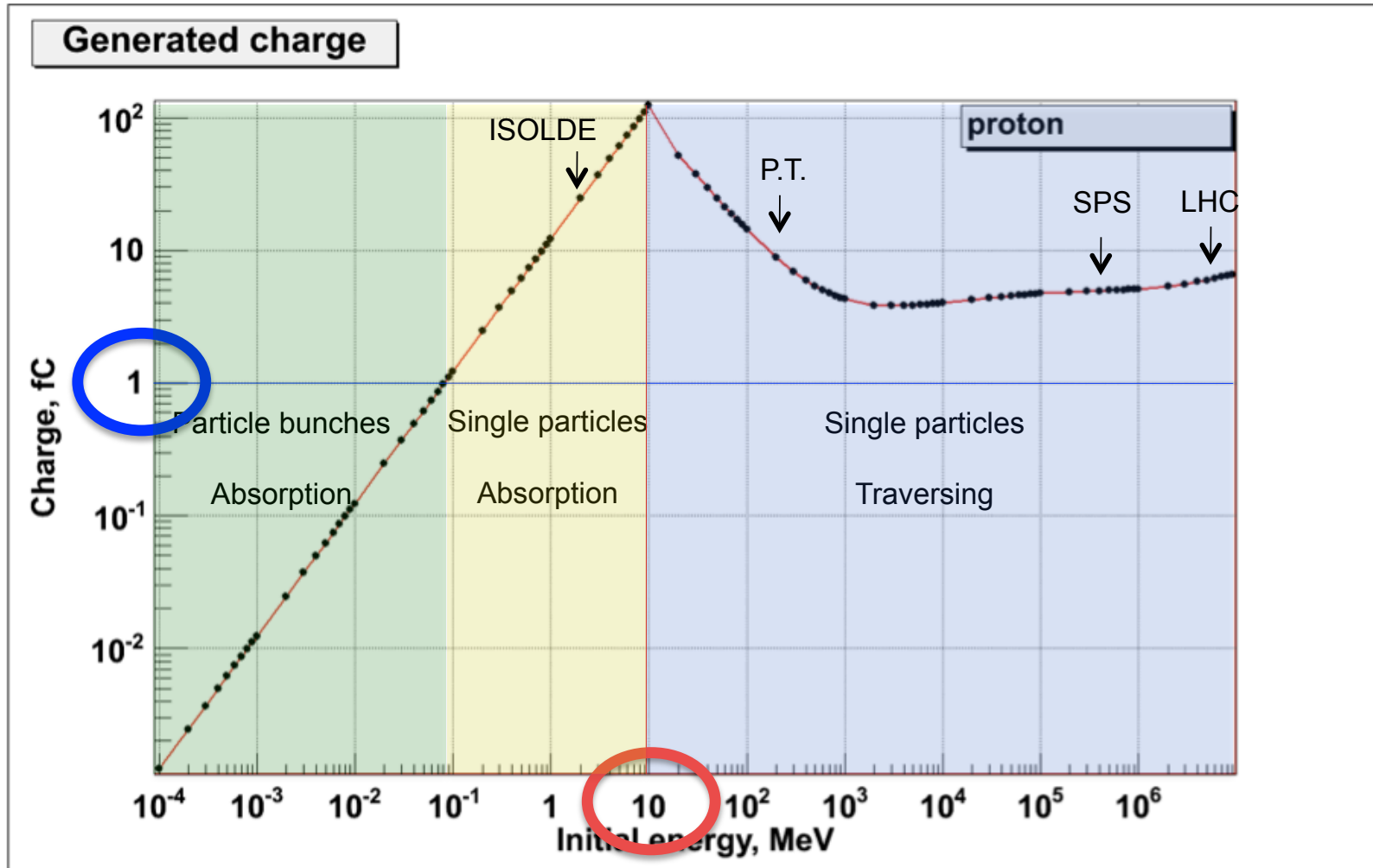
Proton Interaction
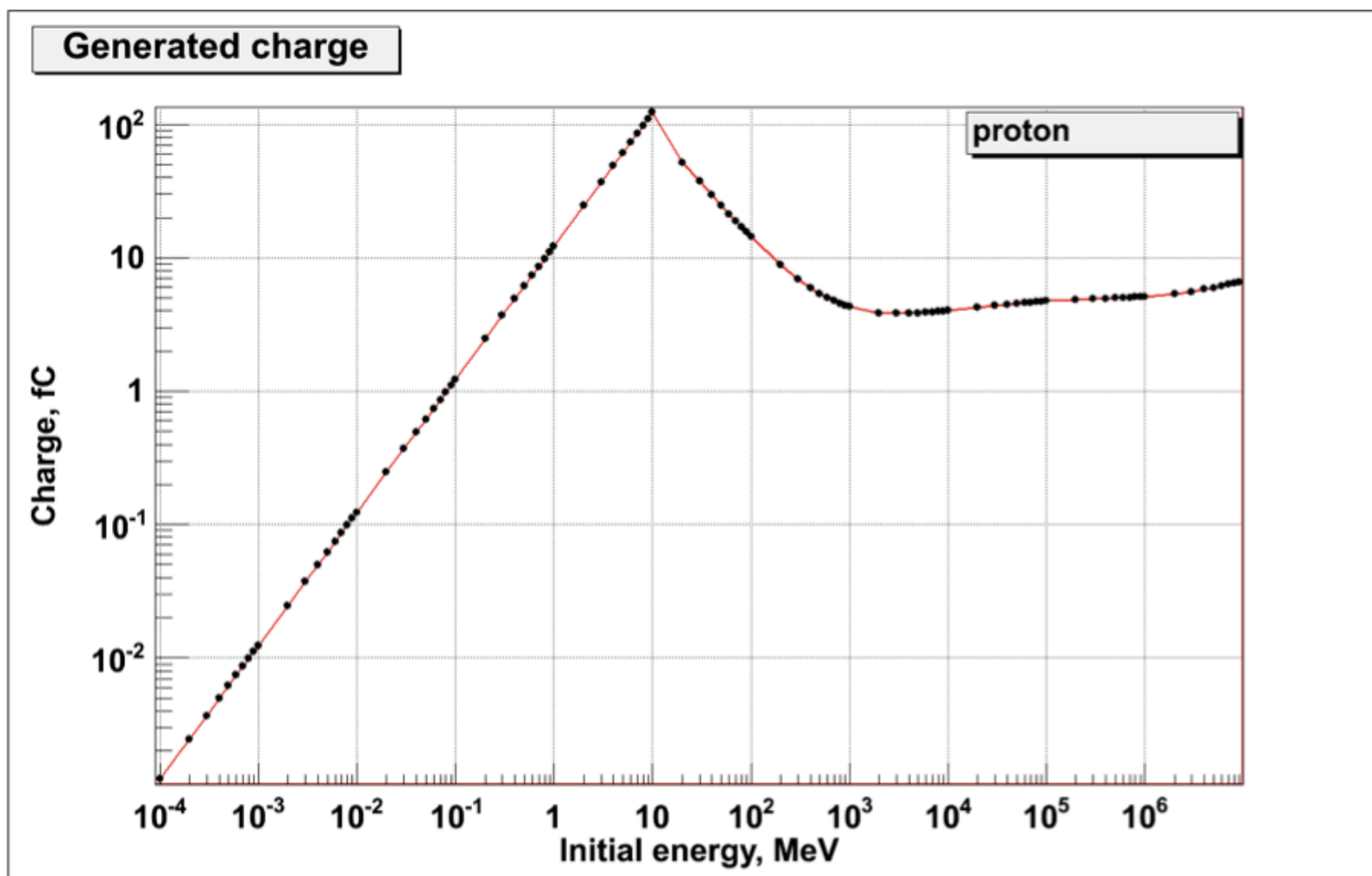
Proton Interaction

Proton Interaction
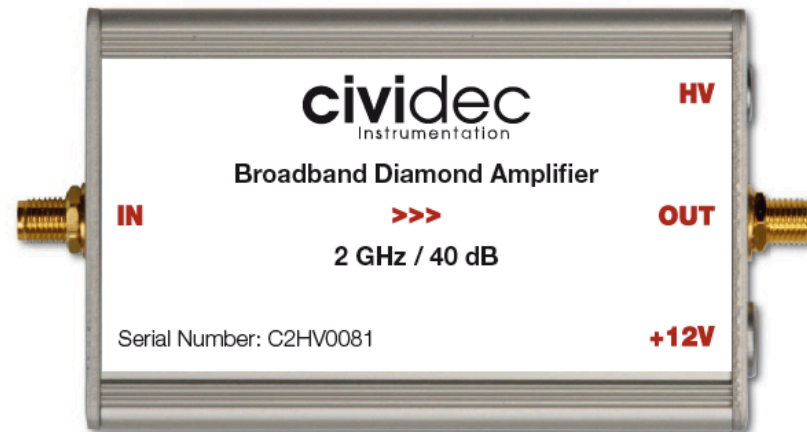
Proton Interaction
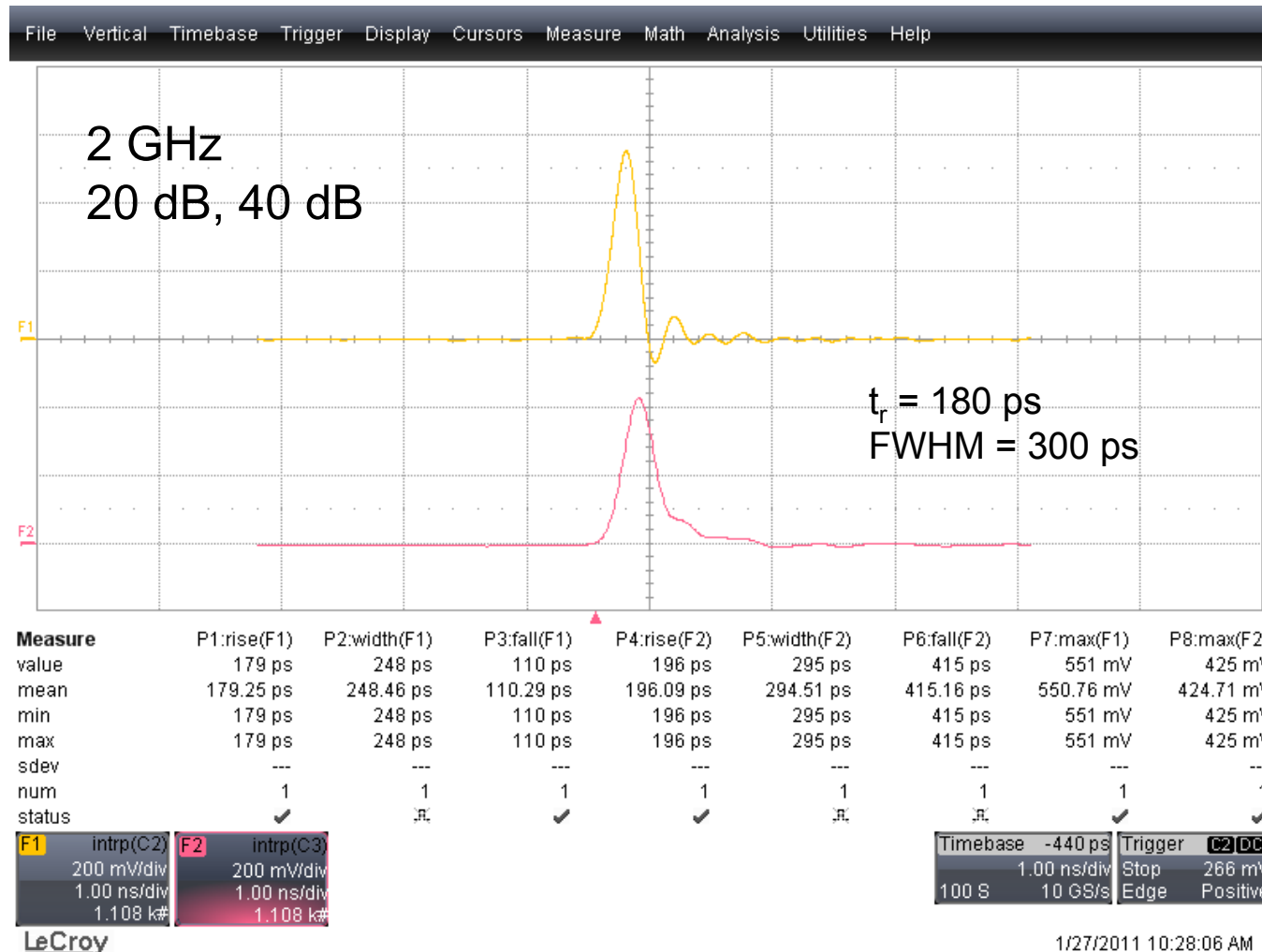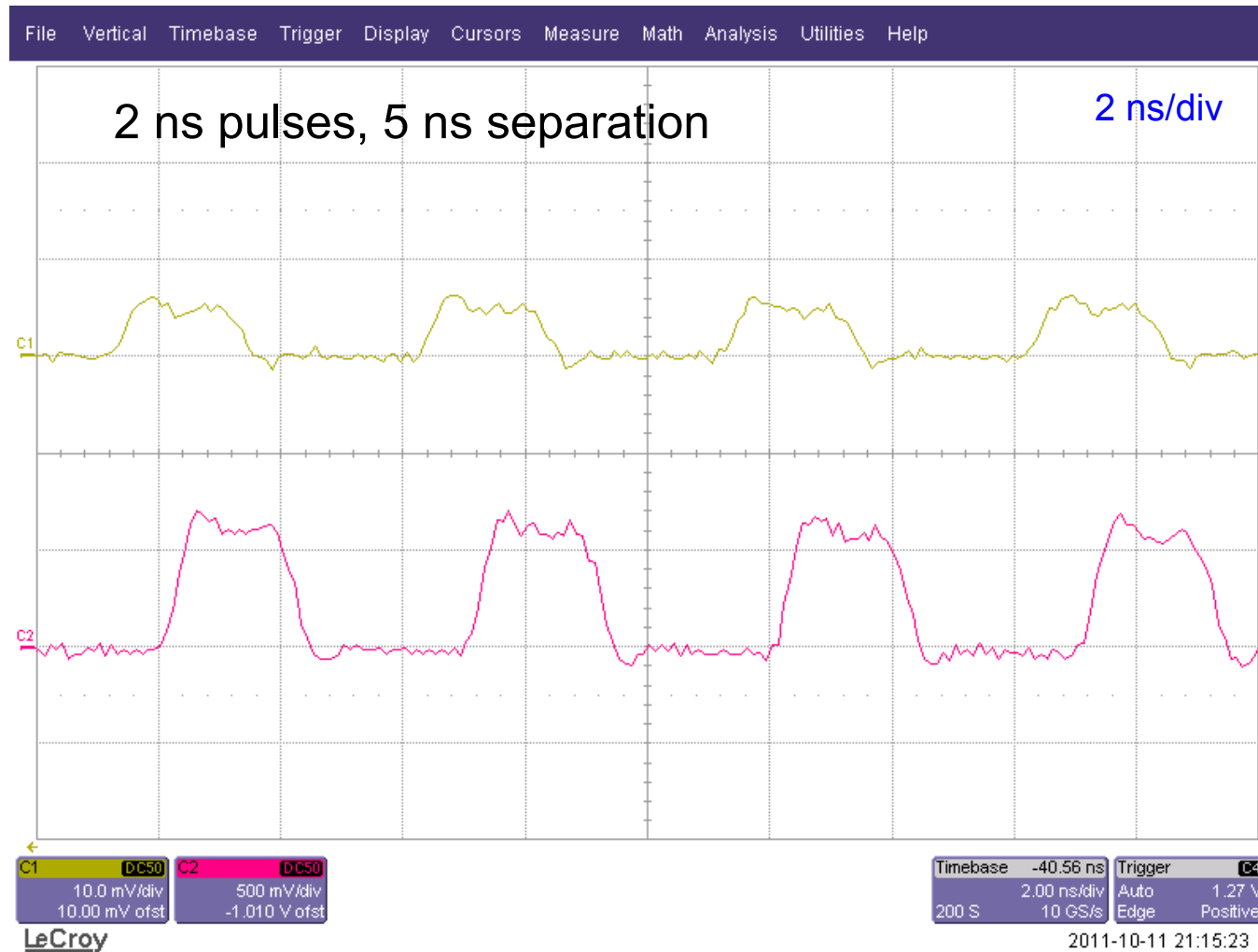
Proton Interaction

Preamplifiers

FAST & LOW NOISE

1. Current amplifier

2. Charge amplifier

3. DC amplifier

RF Current Amplifier
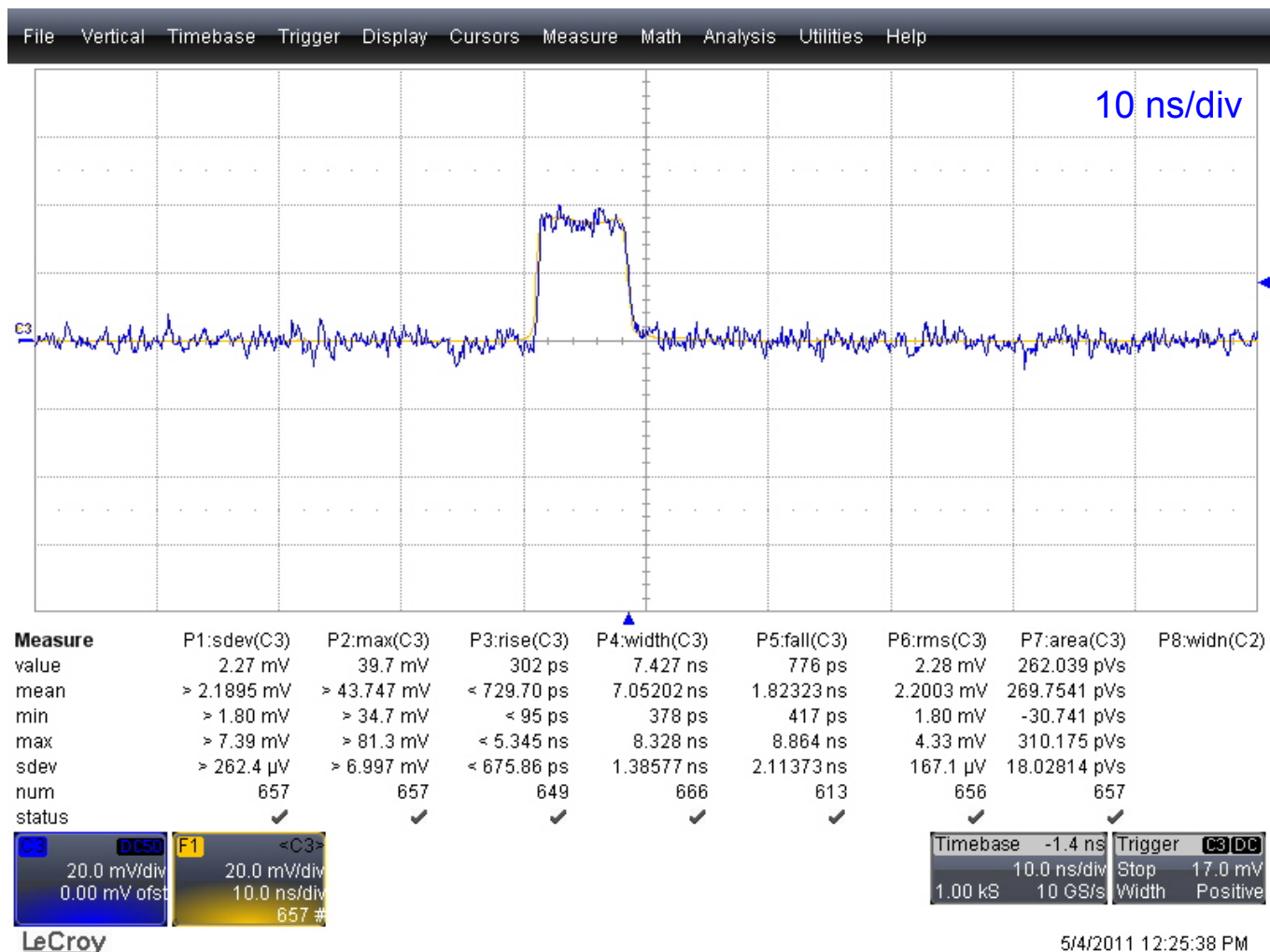

2 GHz
20 dB, 40 dB

t_r = 180 ps
FWHM = 300 ps

RF Current Amplifier
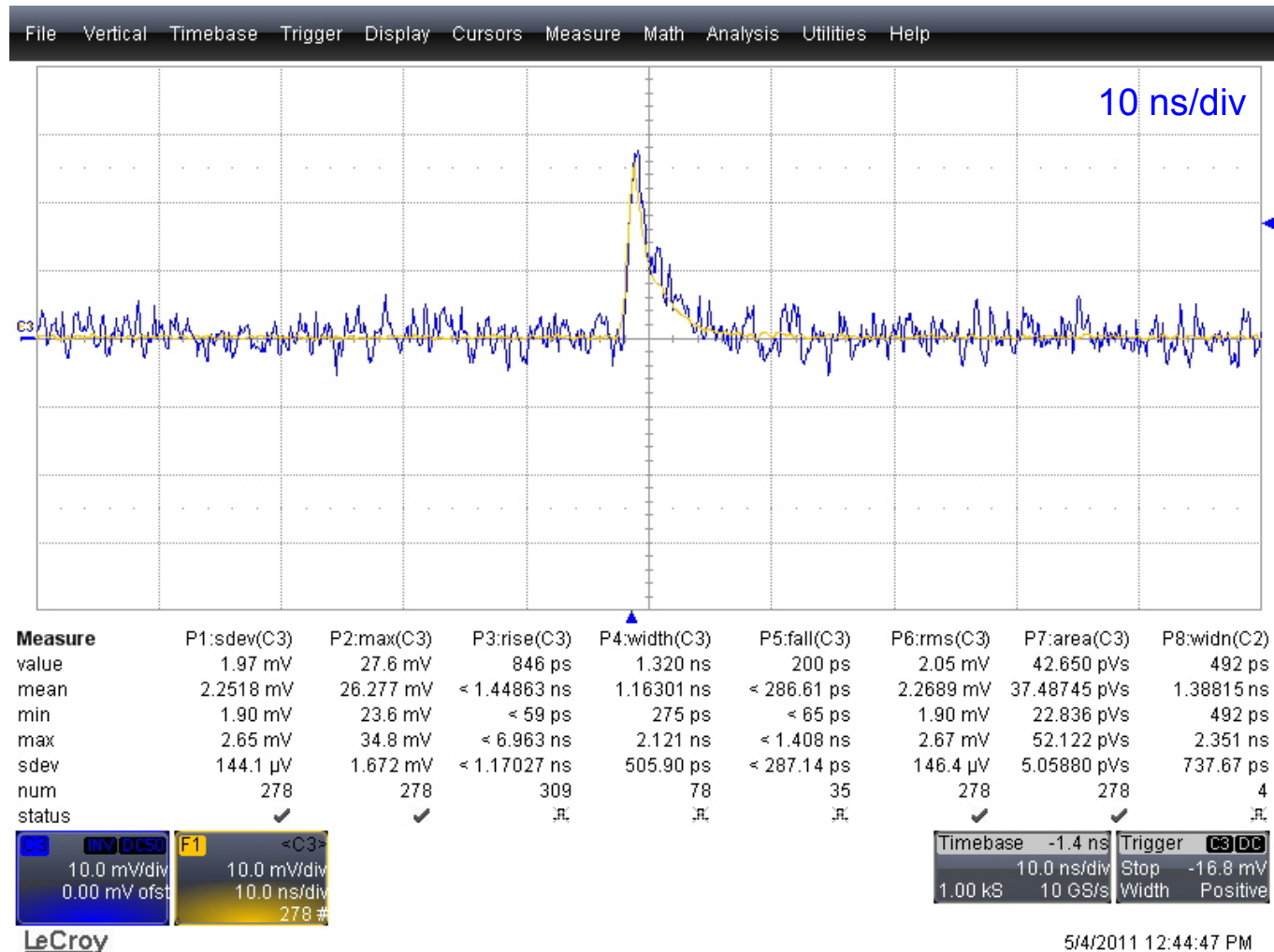
β in sCVD
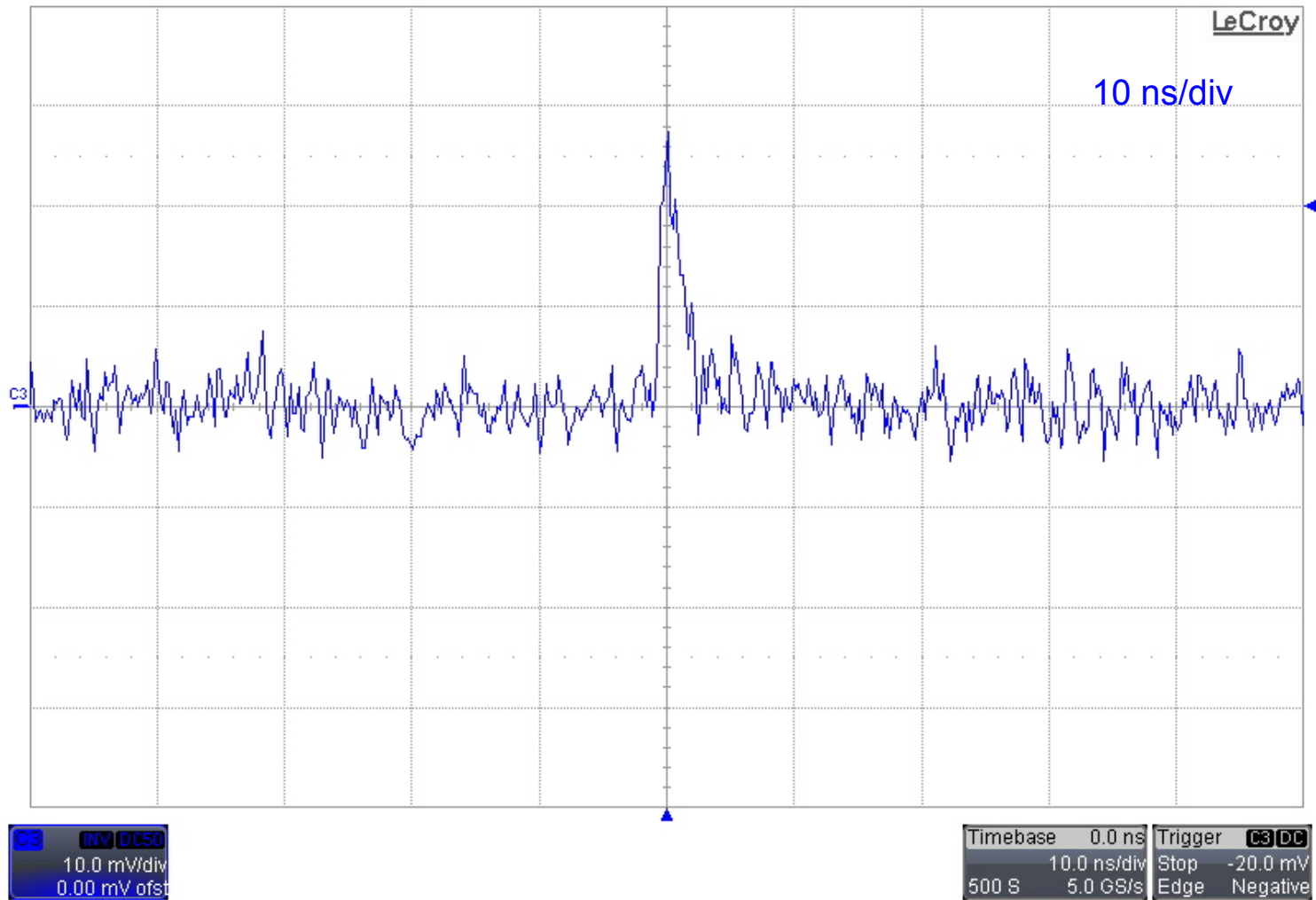
α in sCVD

β in pCVD
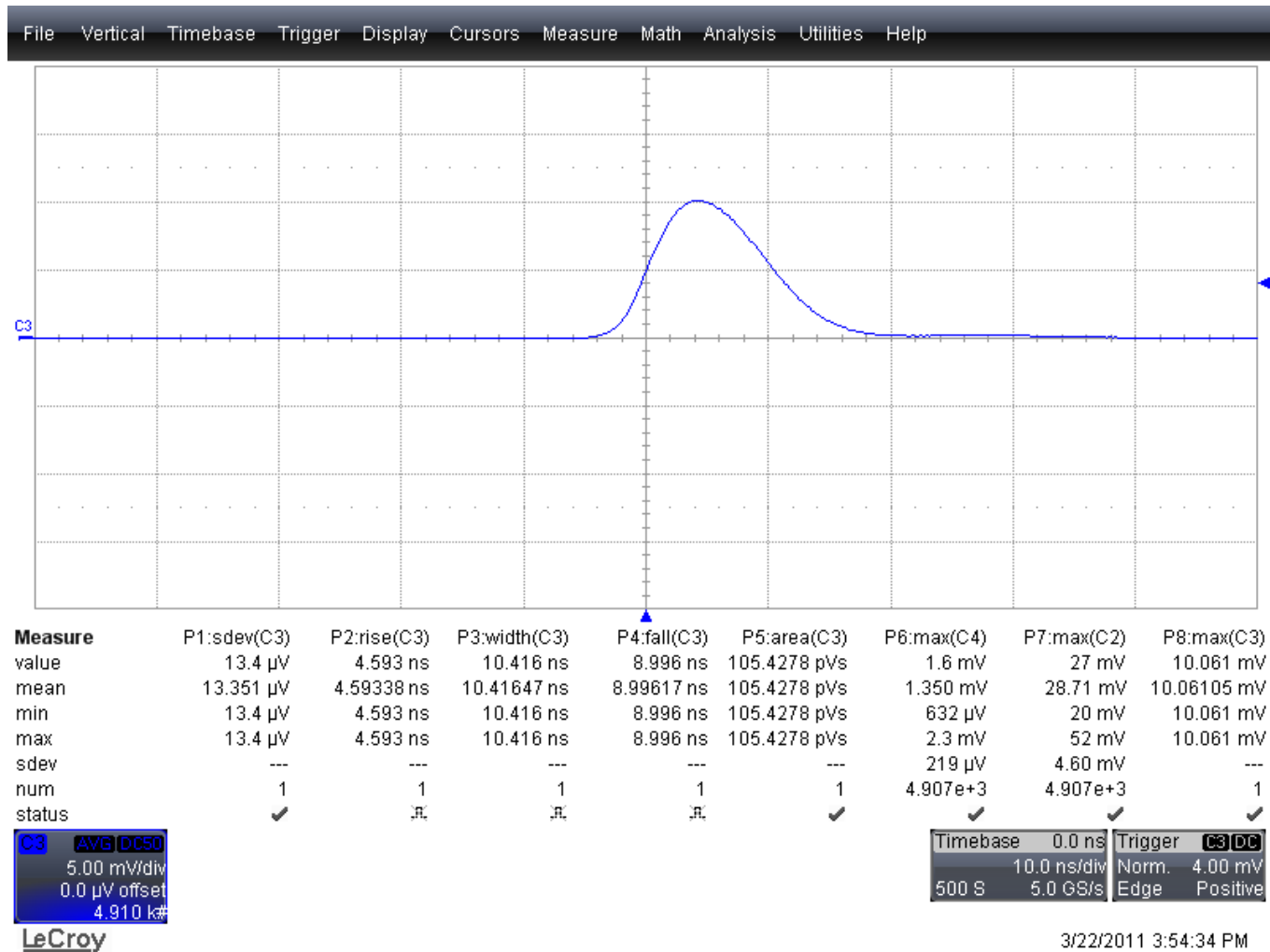
α in pCVD

Charge Amplifier

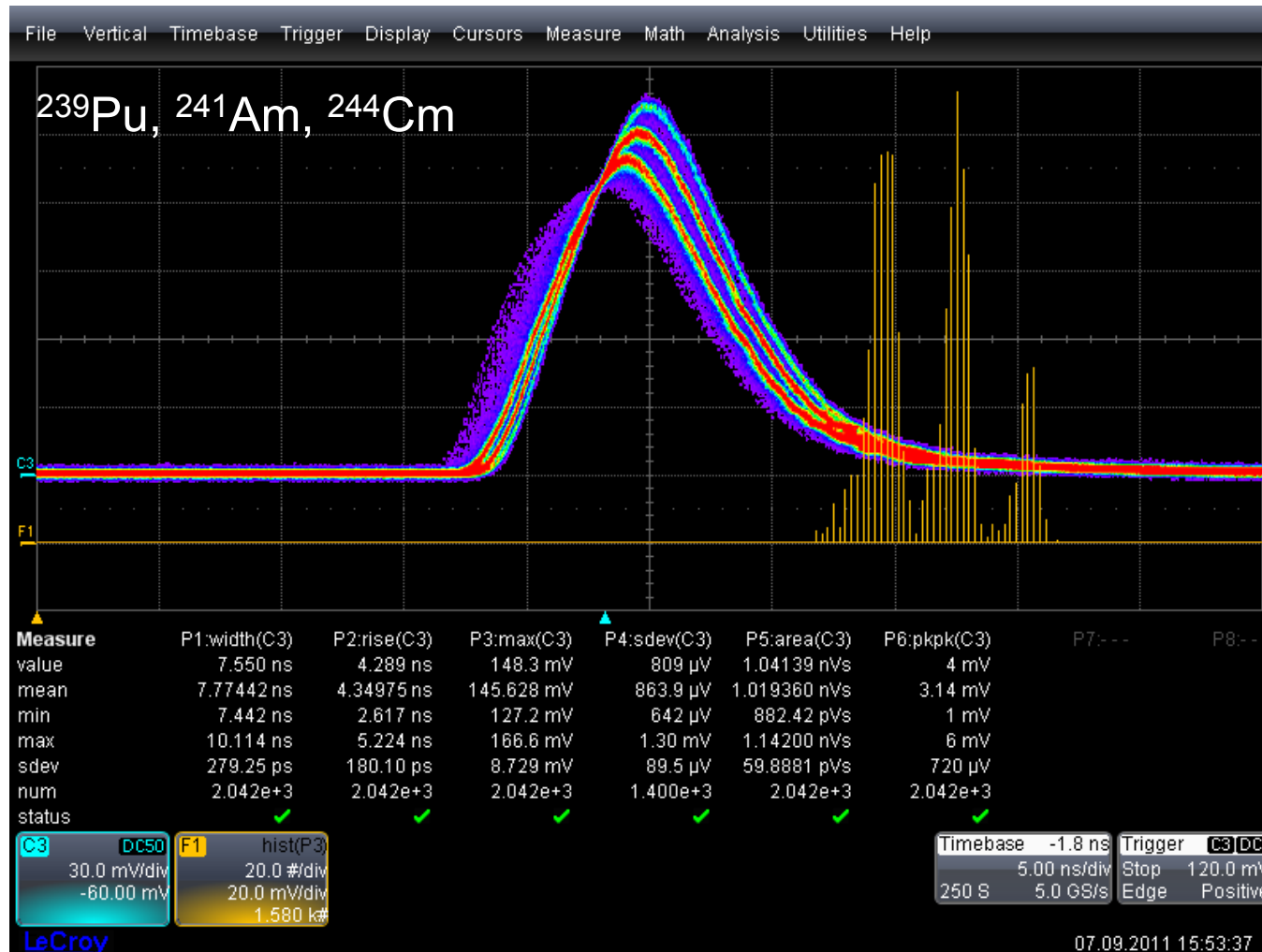100 MHz
6 mV/fC
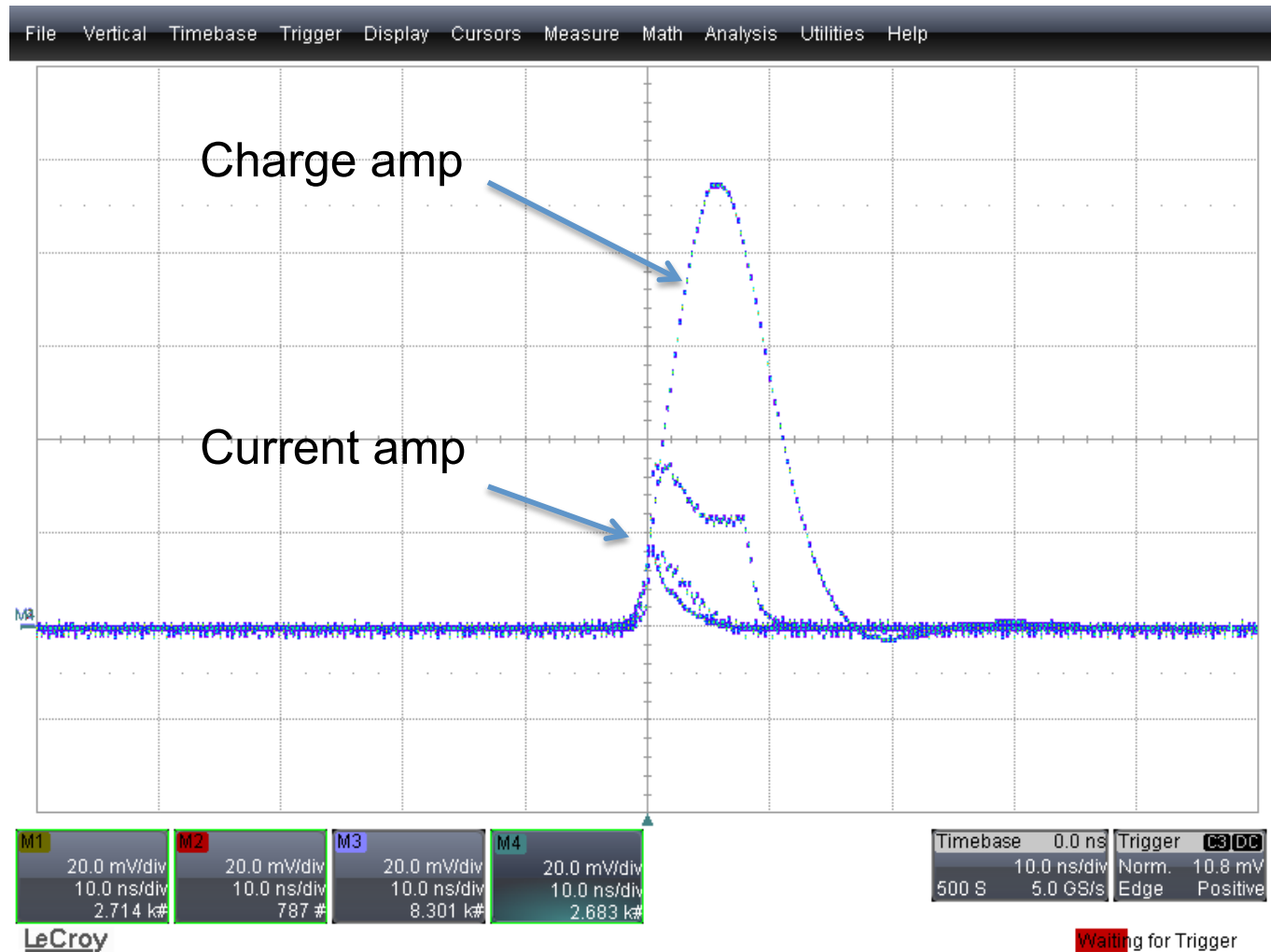SNR = 20 for MIP

FWHM = 8 ns

10 ns/div

β + pCVD
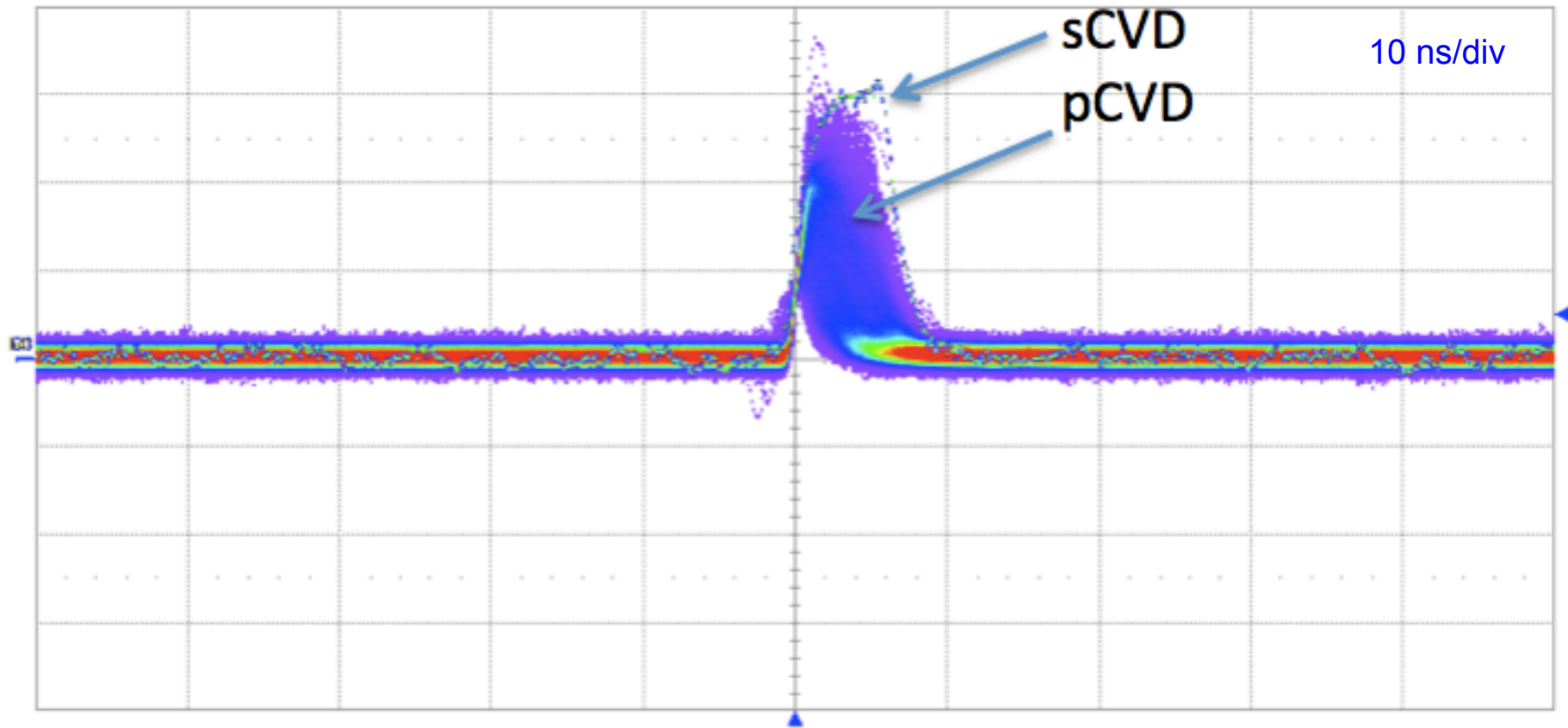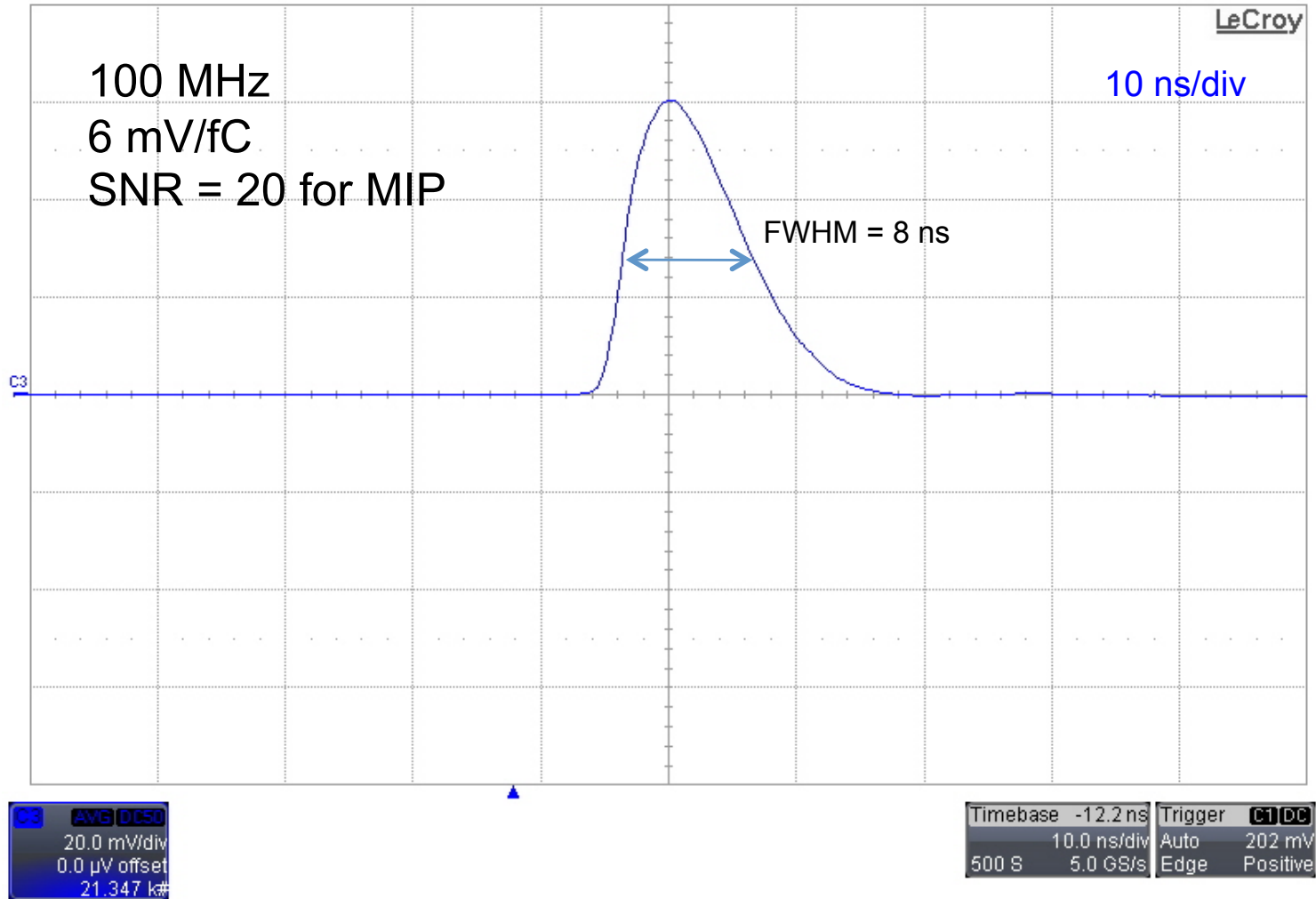
3xα in sCVD

Comparison

AC vs. DC

AC Amplifier – 2 GHz

DC Amplifier – 1 MHz

Diamond BLM

CERN - SPS

Single Particles

Pulse height = 20 mV

Pulse width = 5 ns
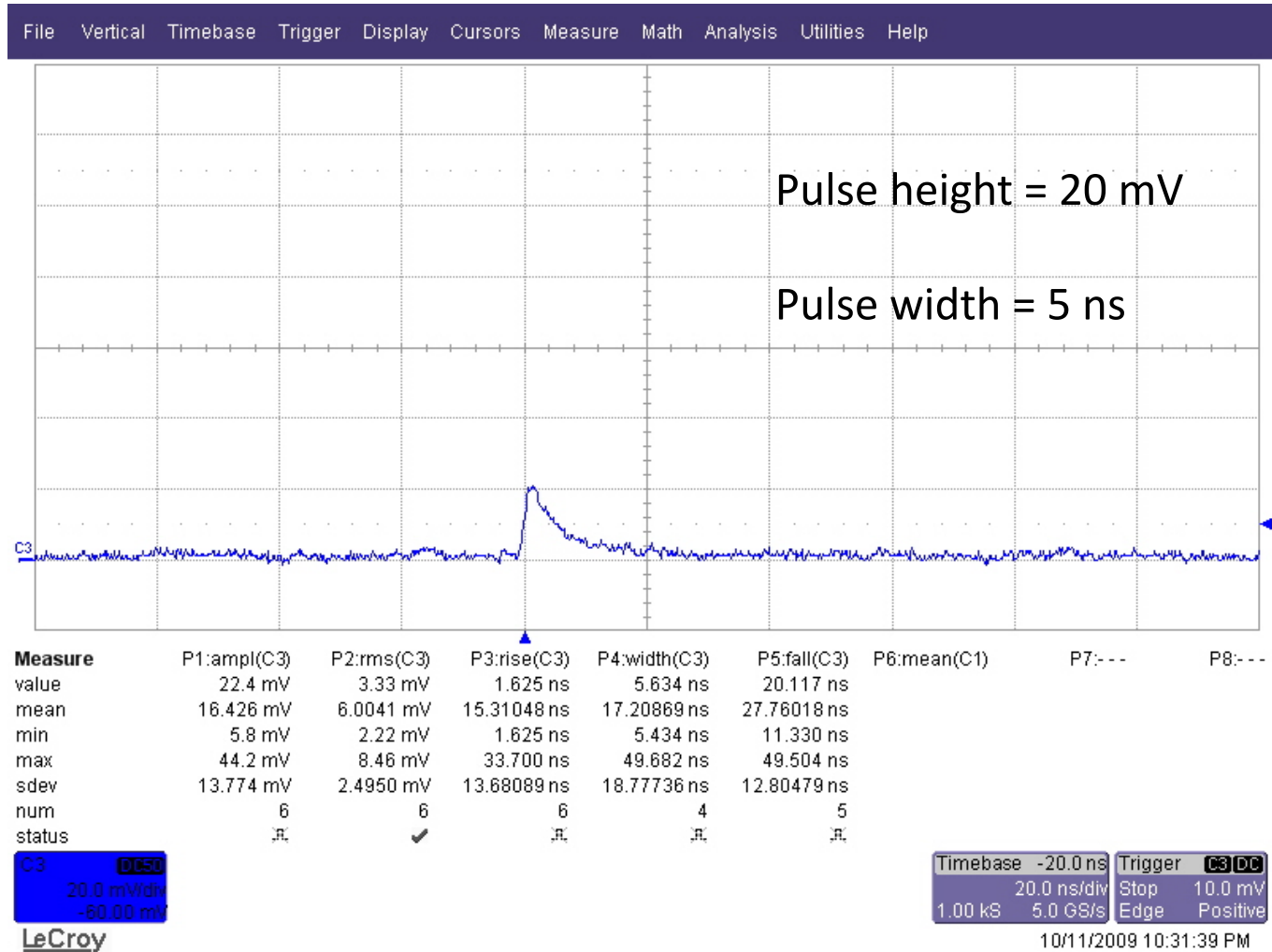
Particle Losses
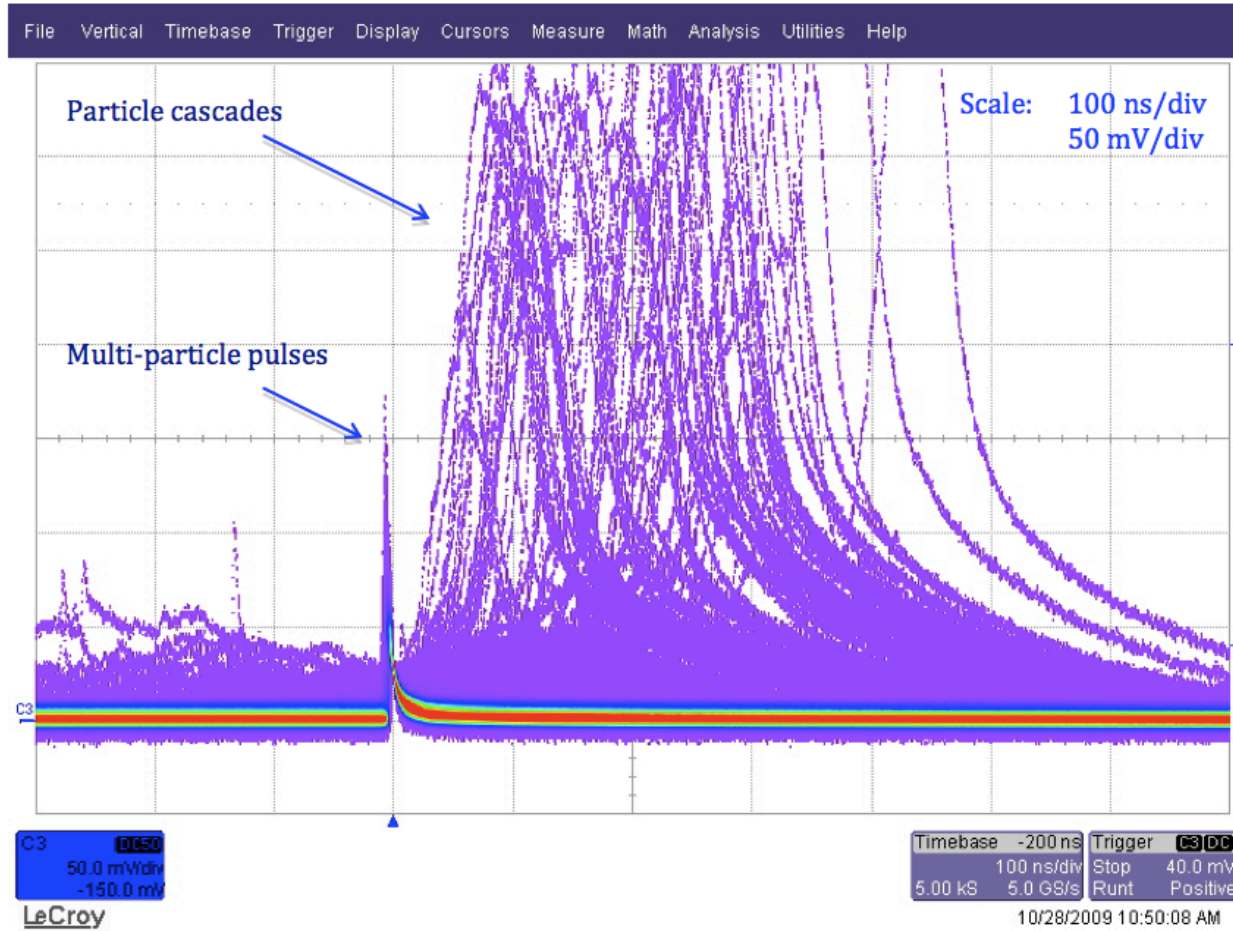
200 MHz SPS RF

LHC - Diamond Beam Loss Monitor
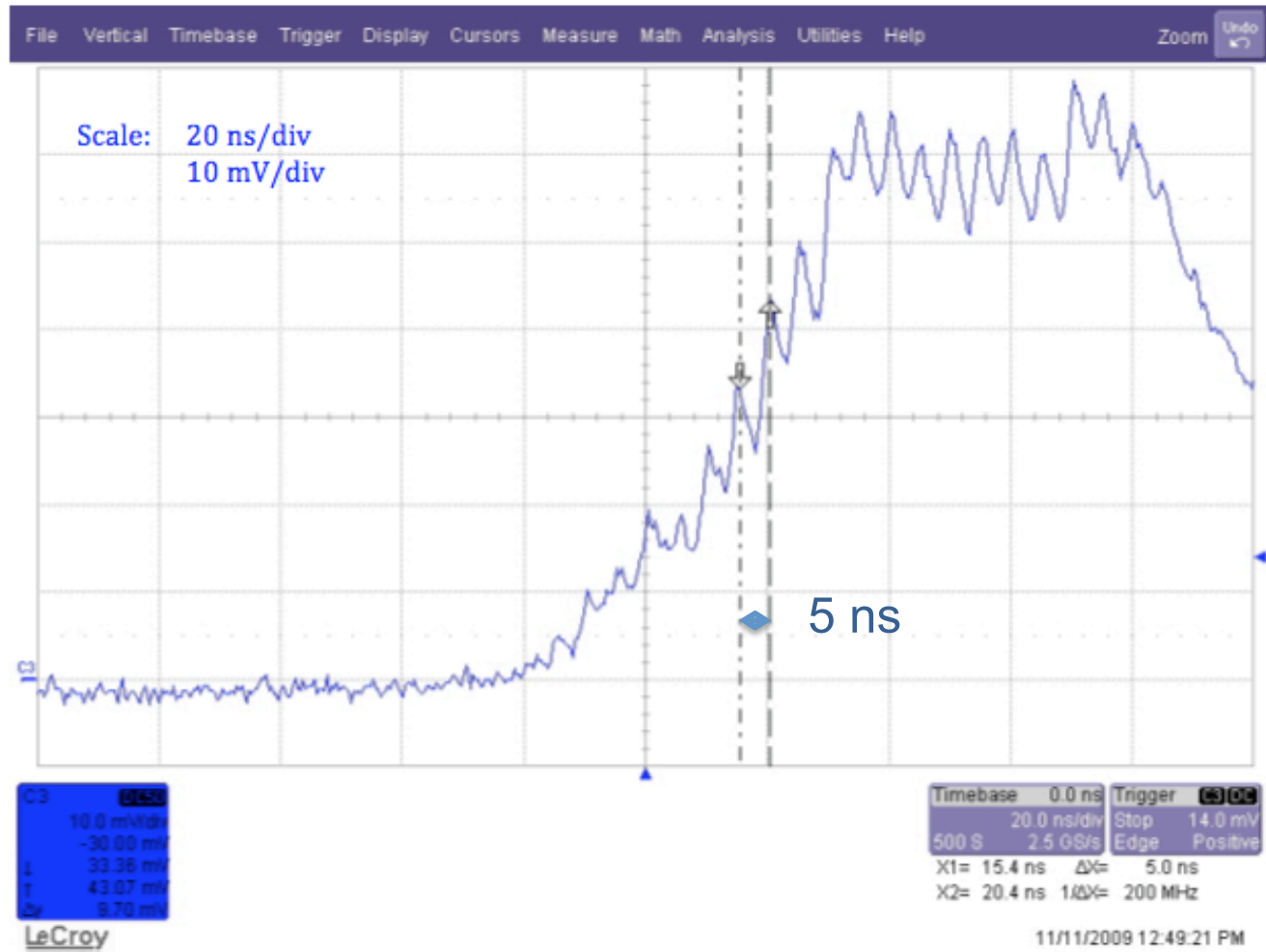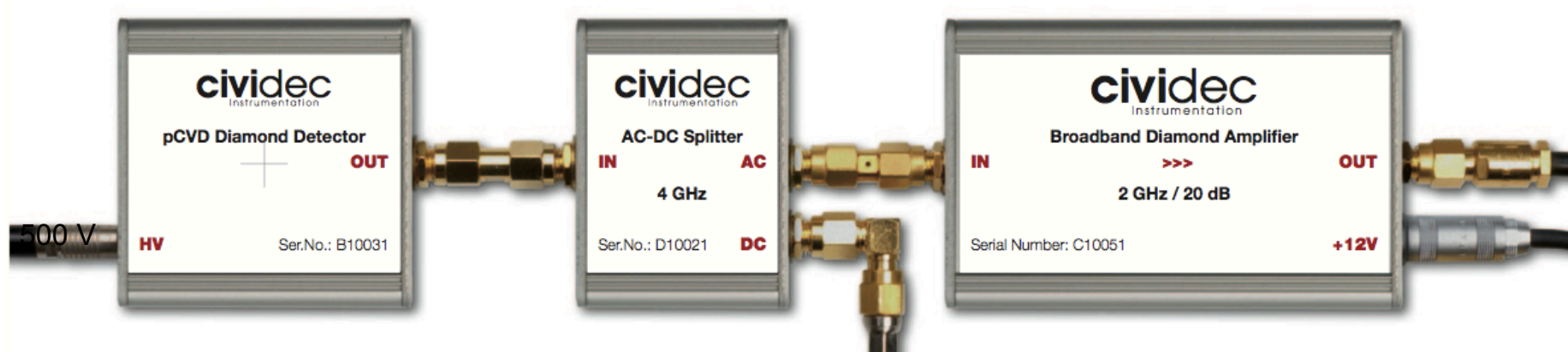

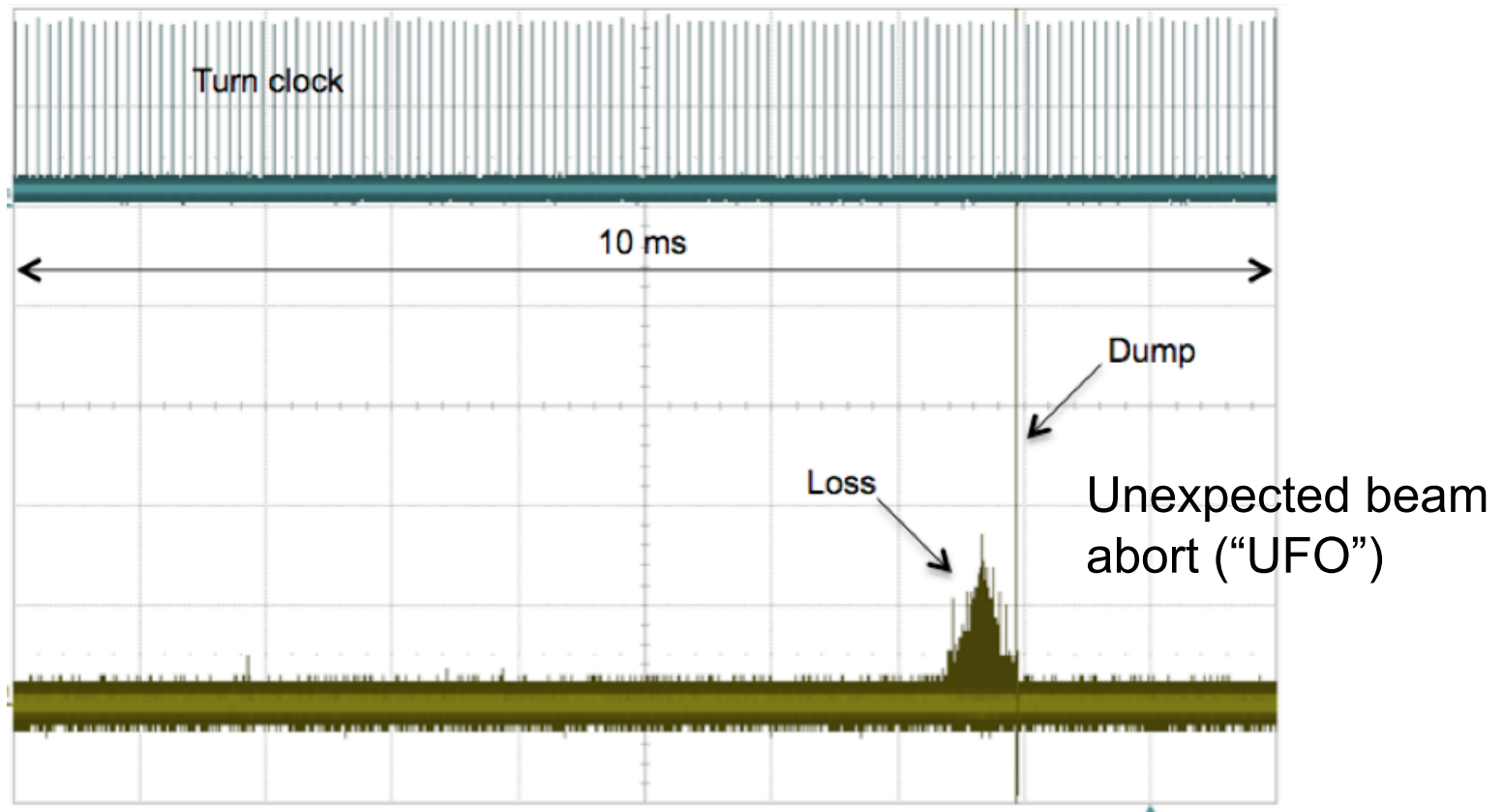Diamond Beam Loss Monitor
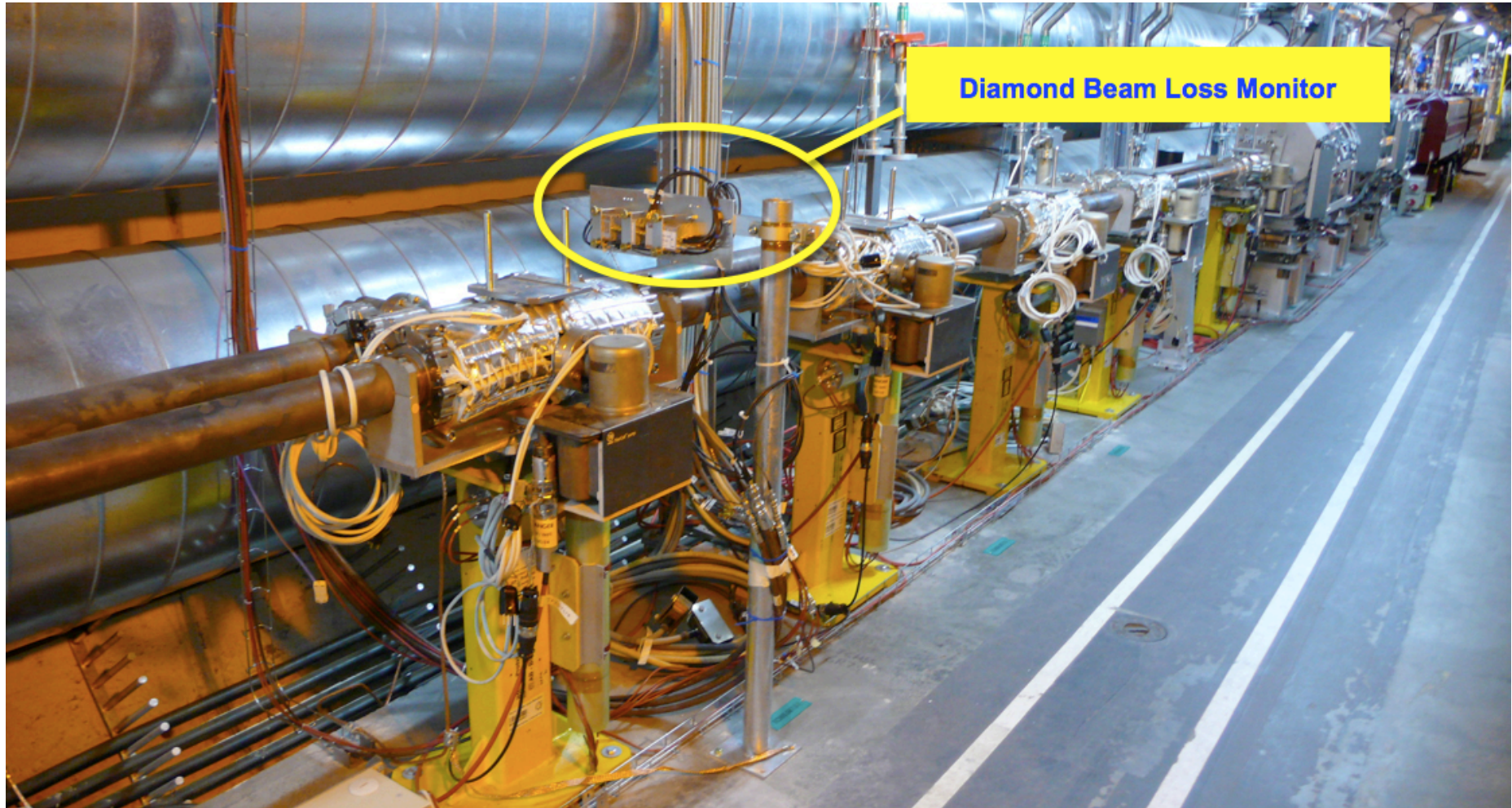
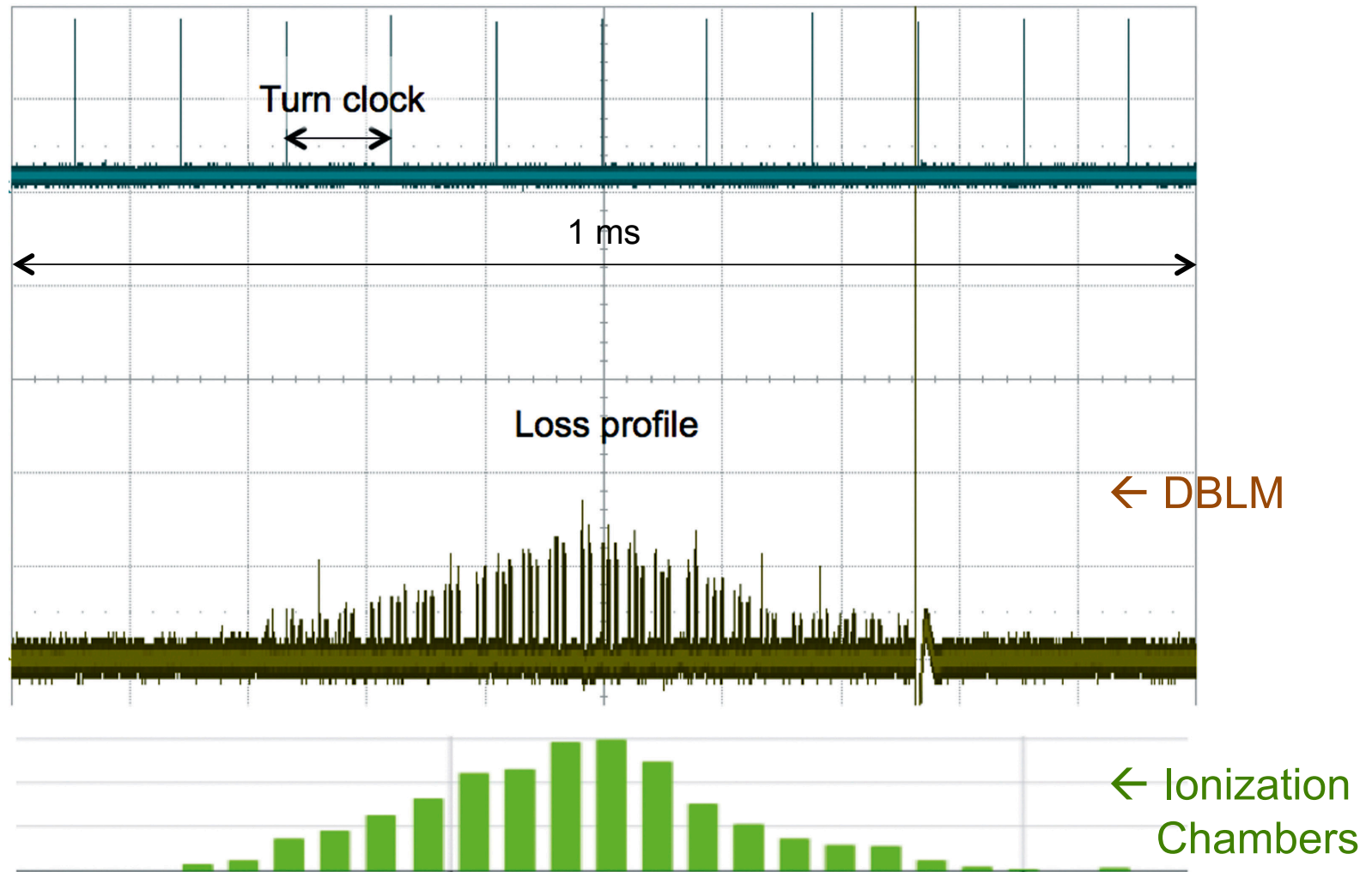LHC – Collimation Area – IP7

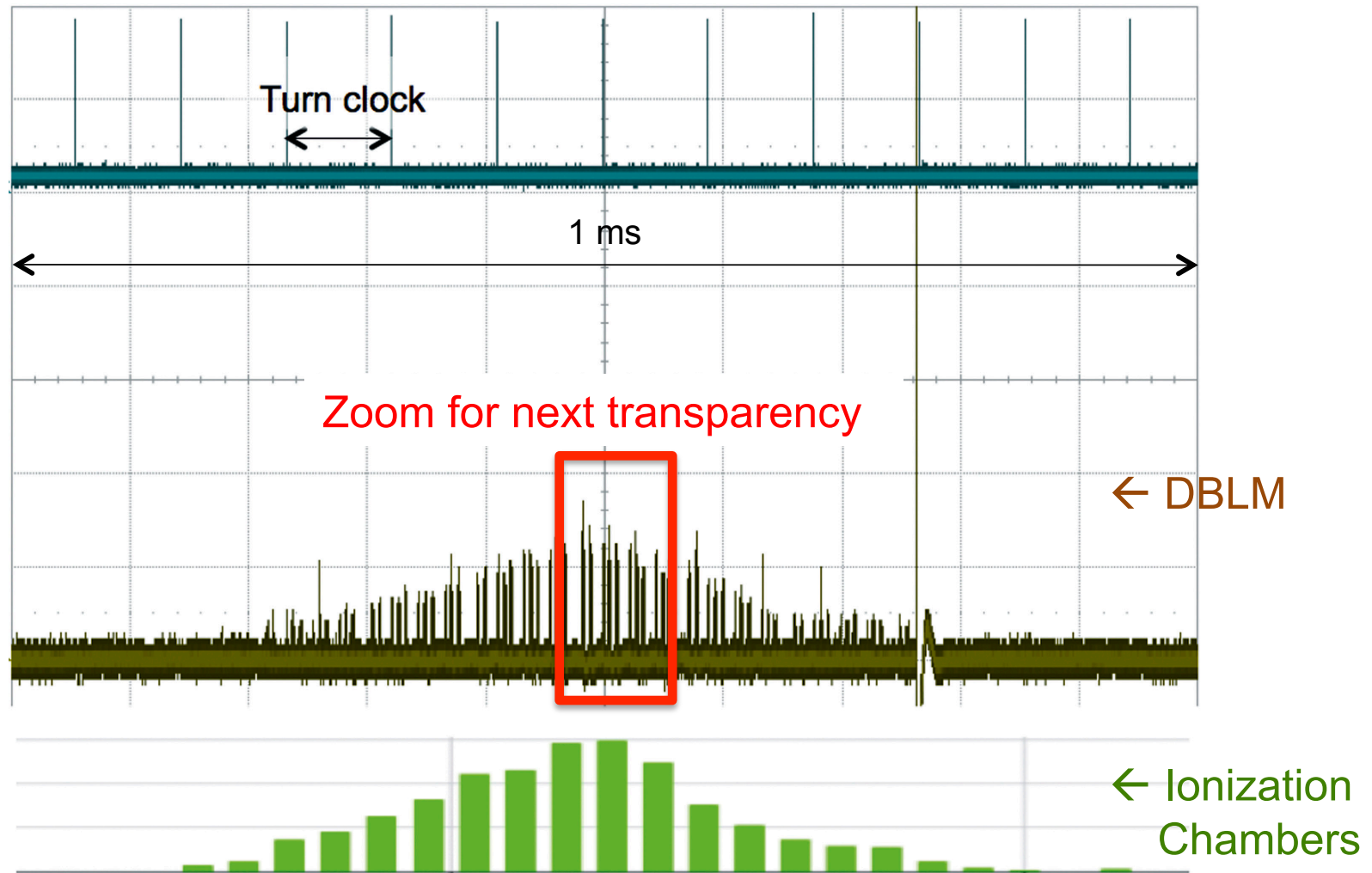# LHC DBLM
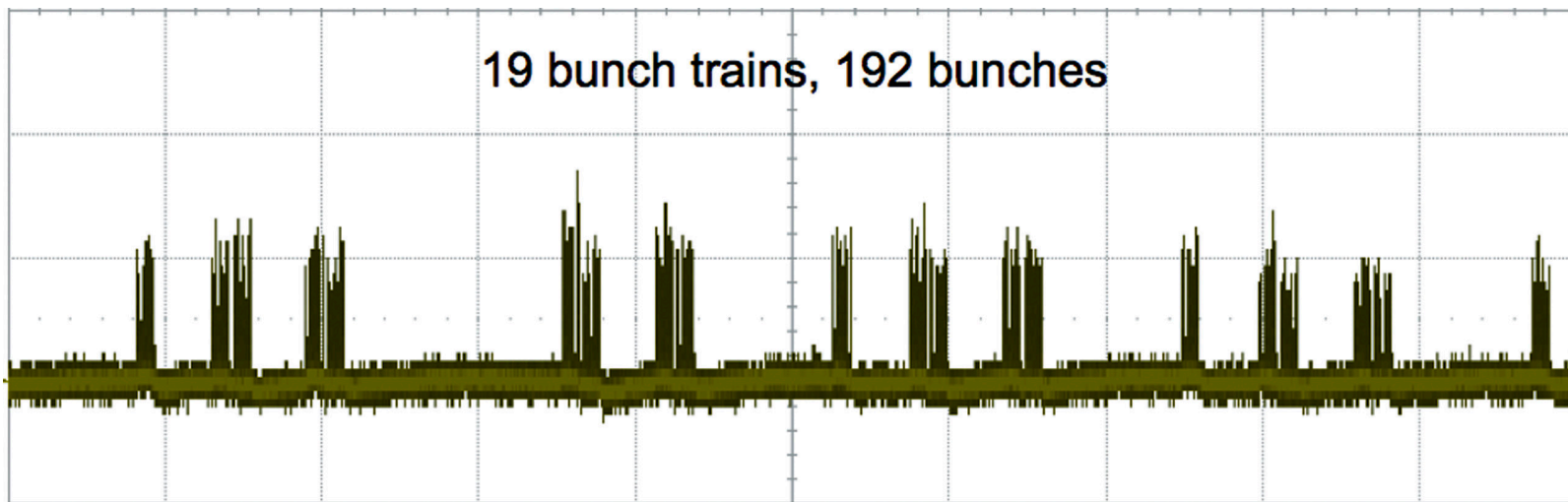

Detector

AC/DC Splitter
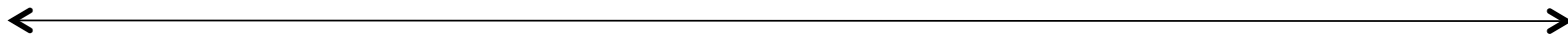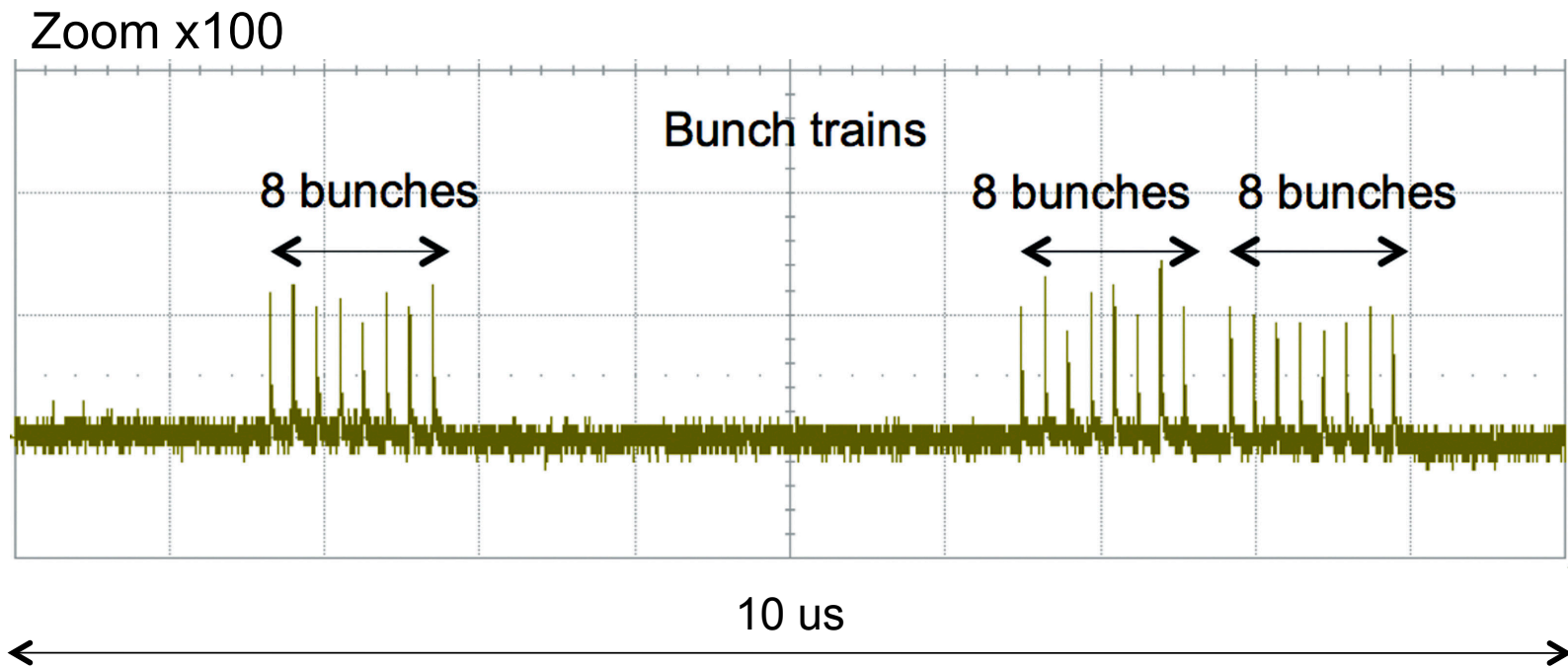
2 GHz Amplifier

^

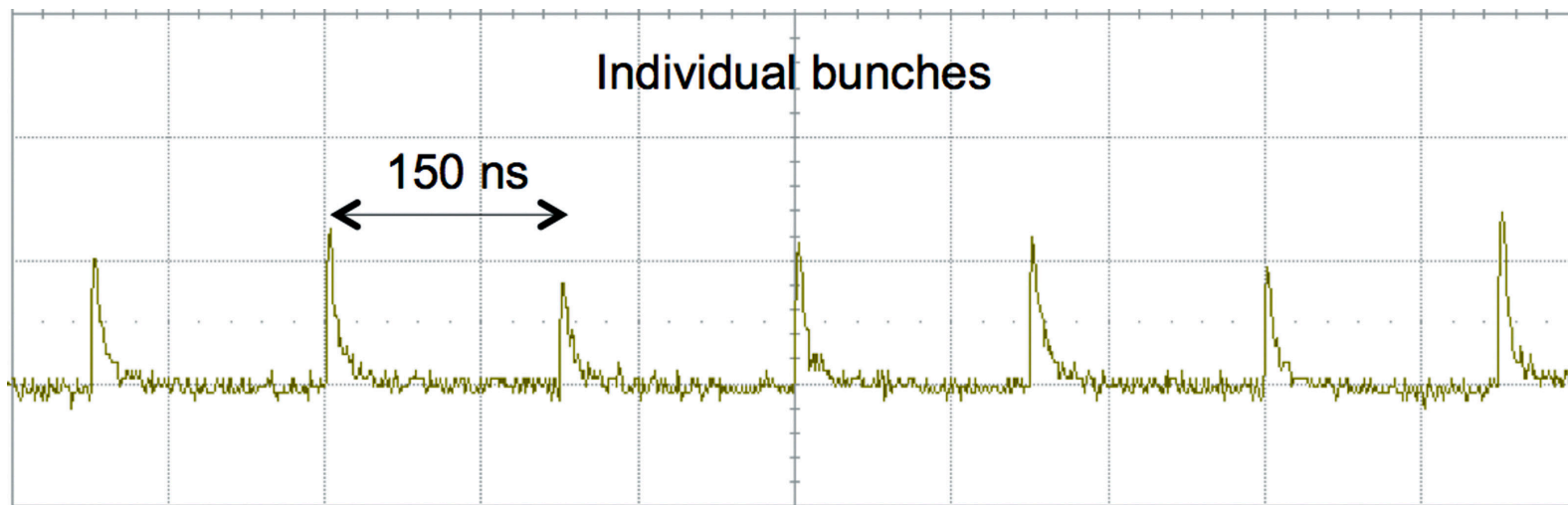# LHC - DBLM

LHC - DBLM

LHC - DBLM

LHC - DBLM

Zoom x10

19 bunch trains, 192 bunches

100 us

LHC - DBLM

LHC - DBLM

Zoom x1000

Individual bunches

150 ns

1 us

LHC - DBLM

Zoom x10'000

Single bunch signal

FWHM = 6 ns

100 ns
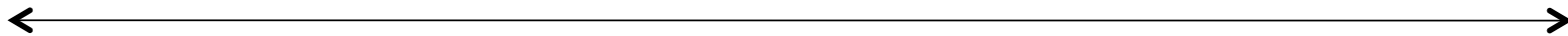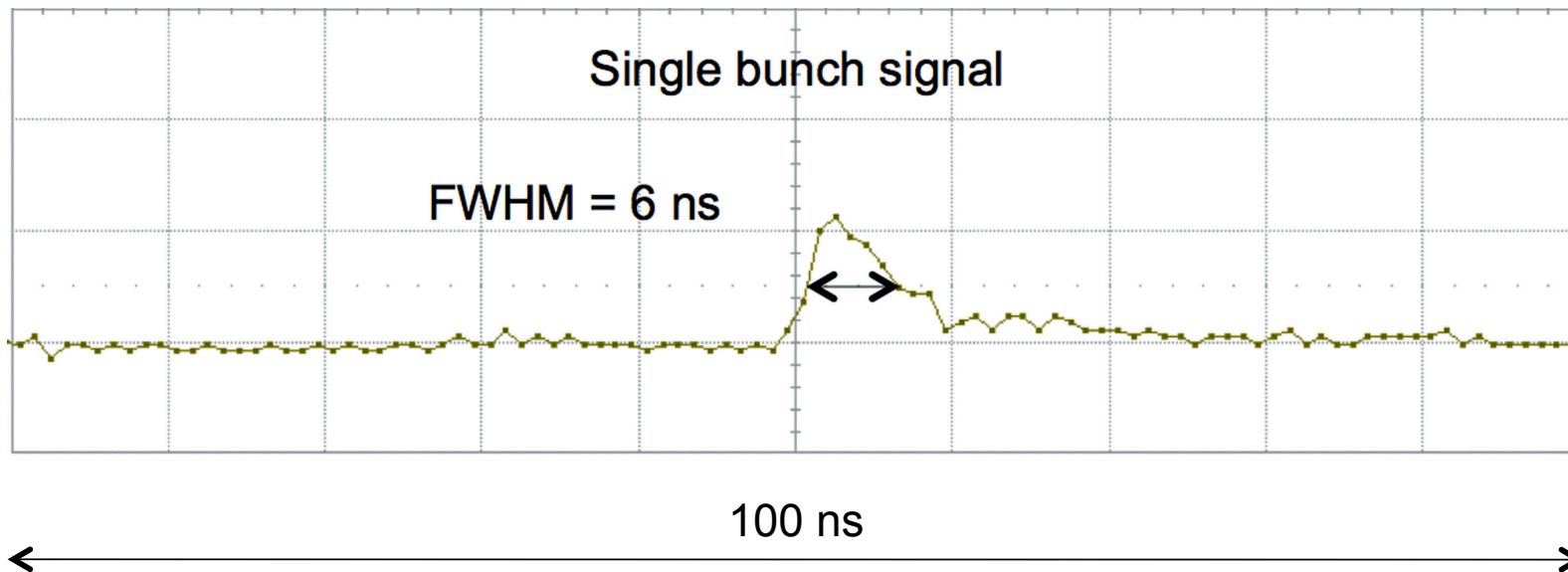
Readout System

Real-time responses to acquired & processed detector signals (suited for machine protection system and all applications requiring fast and deterministic triggering based in diamonds)

- 250 MHz, 5 GSPS, 32 MB, 4 channel digitizer

- Full trigger capacity

- Dead-time free data analysis (FPGA)

- Interface to Control Systems (FESA)

Summary

- Diamonds are in use as LHC DBLM
- R&D is going on to investigate linearity and space-charge limitations
- R&D is going on for neutrons (n_TOF) and electrons (XFEL)
- A Diamond Readout System is under construction (replace scope readout)

Thanks for your attention!

Bunch-by-Bunch Losses