


BEAM CHARGE MEASUREMENT AND SYSTEM CALIBRATION IN CSNS*

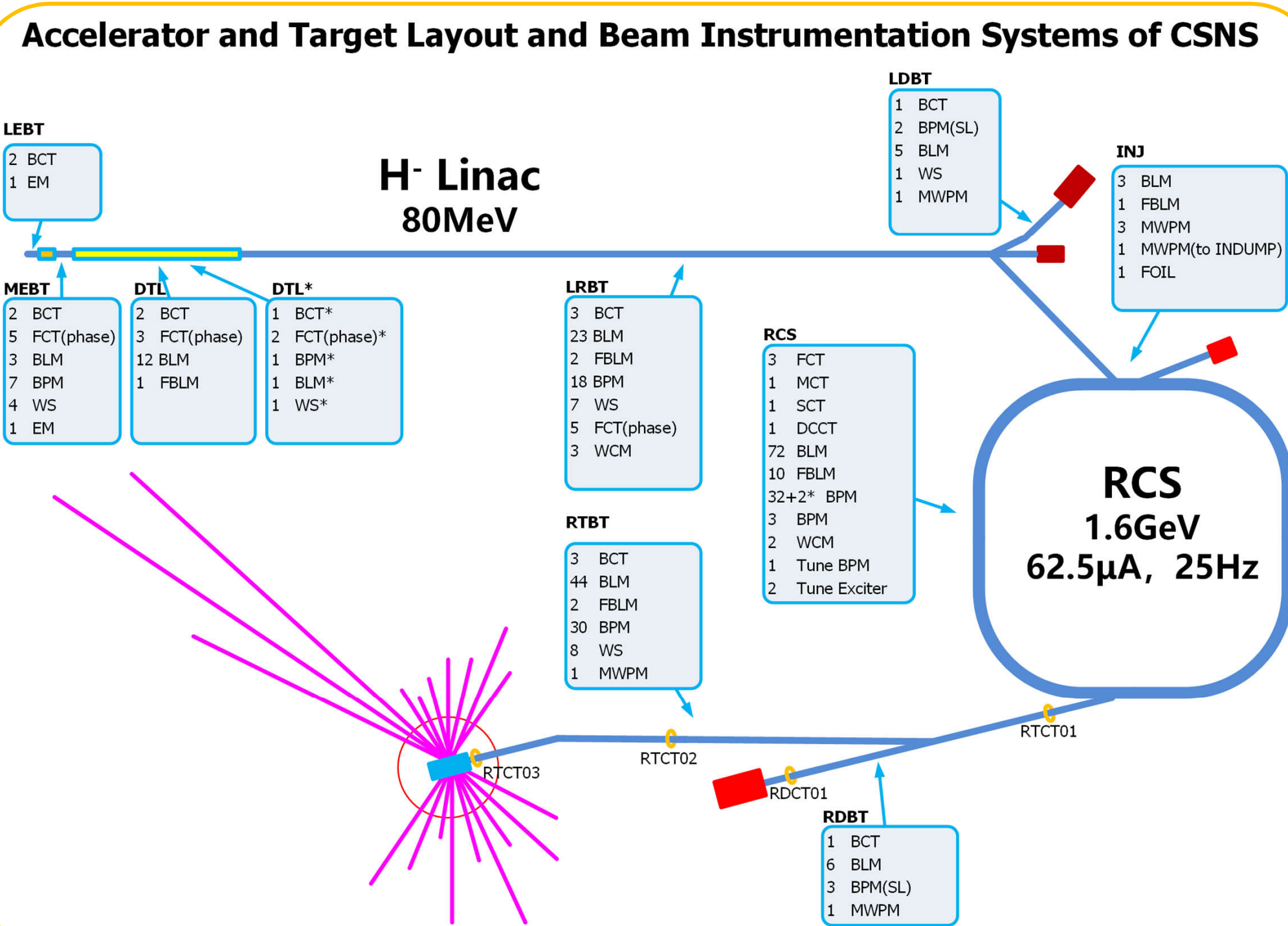


MOPC04
(Monday)

W. L. Huang[†], F. Li, L. Ma, S. Wang, T. G. Xu

Institute of High Energy Physics ,China Spallation Neutron Source, Dongguan, China

Introduction

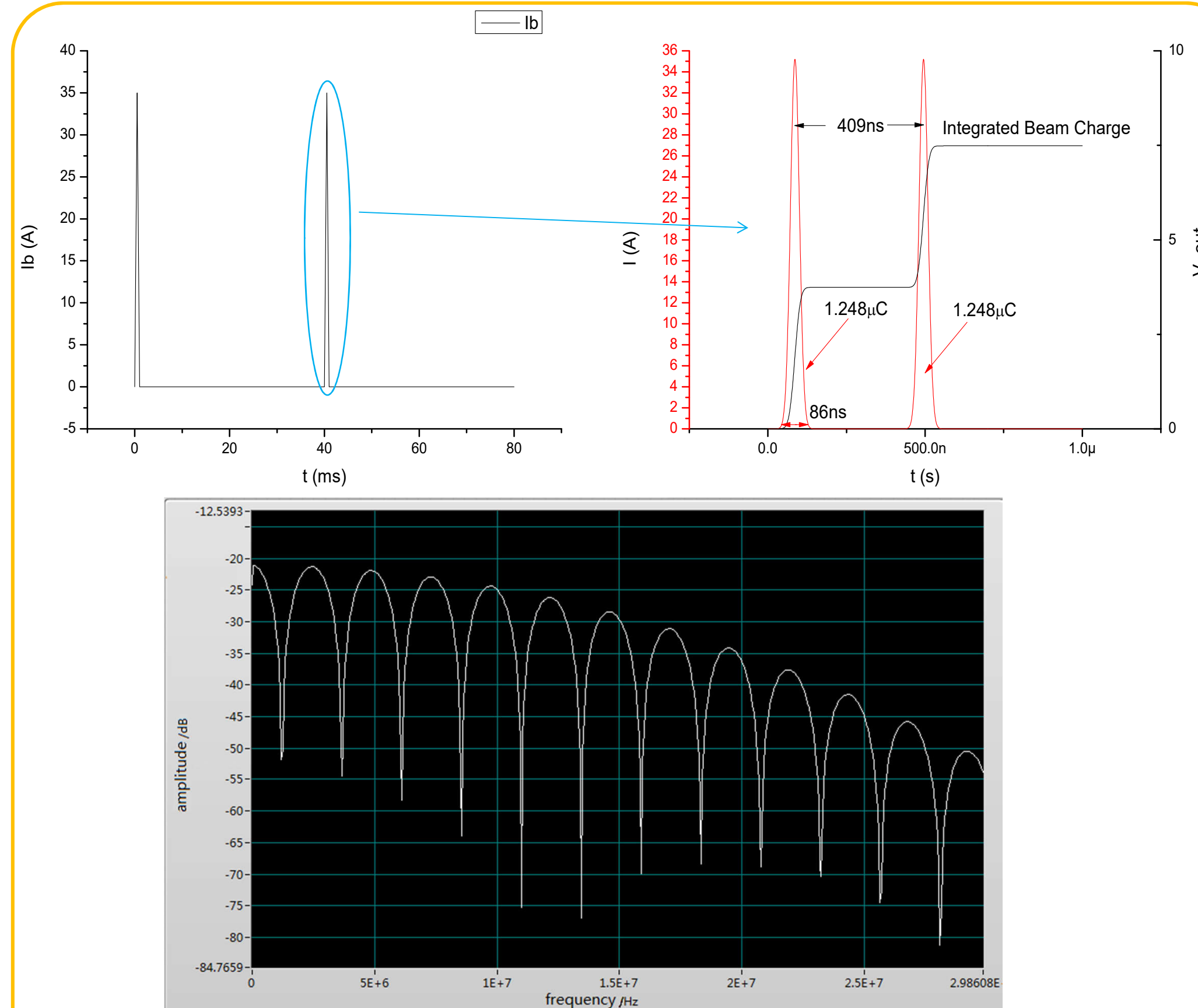
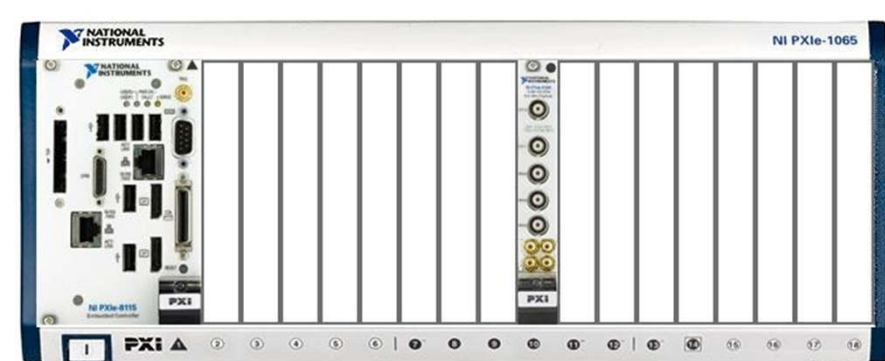


Purpose and Architecture of BCM System

Providing Information on:

- the quantity of protons bombarding the tungsten target;
- the efficiency of particle transportation;
- a T0 signal to the detectors and spectrometers of the white neutron source(Back-n beam line).

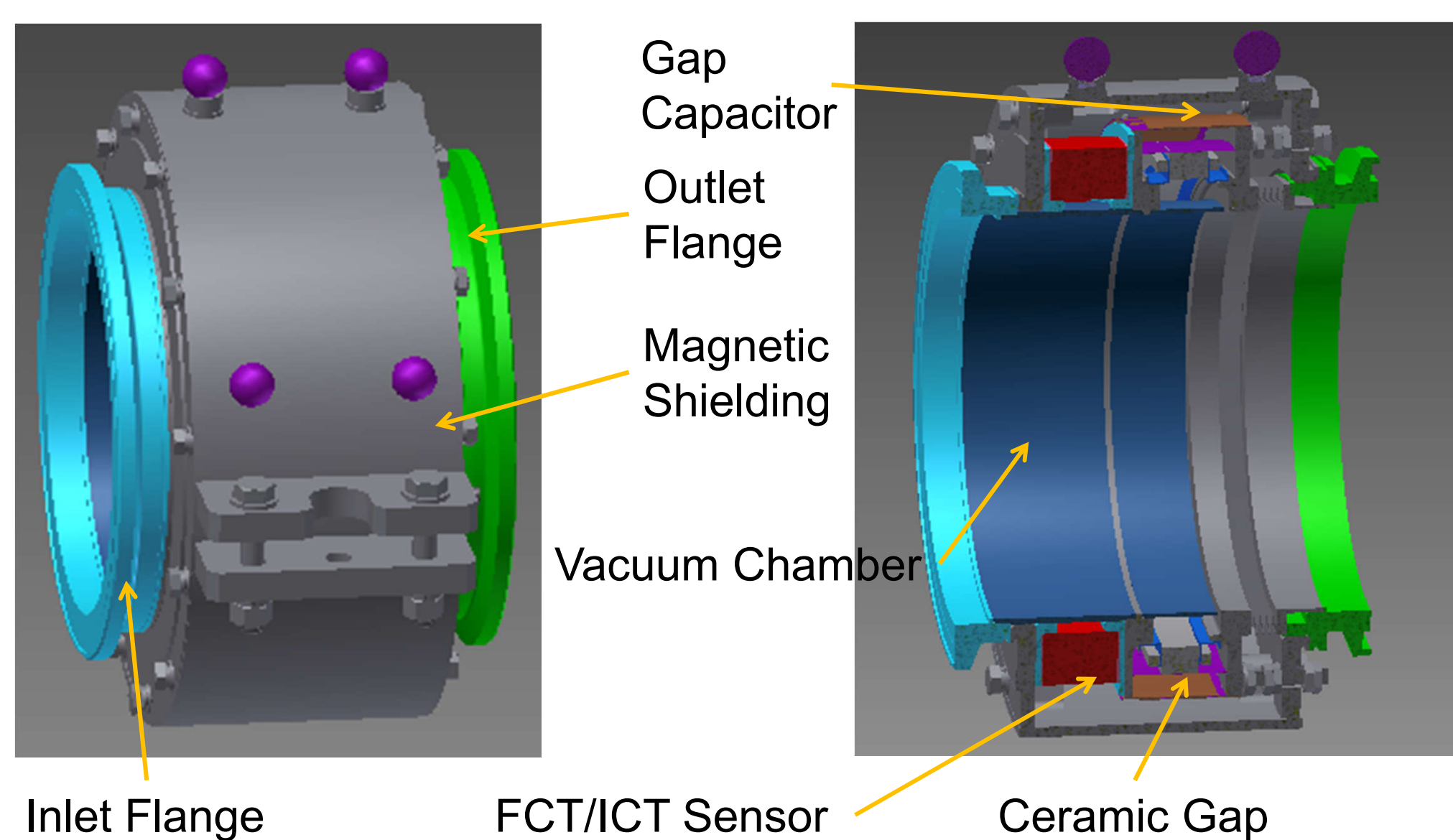
```
RTCT01: ICT
RTCT02: FCT
RTCT03: FCT + NI PXIe-5160
RDCT01: FCT
```



Time structure and spectrum of the extracted proton beam

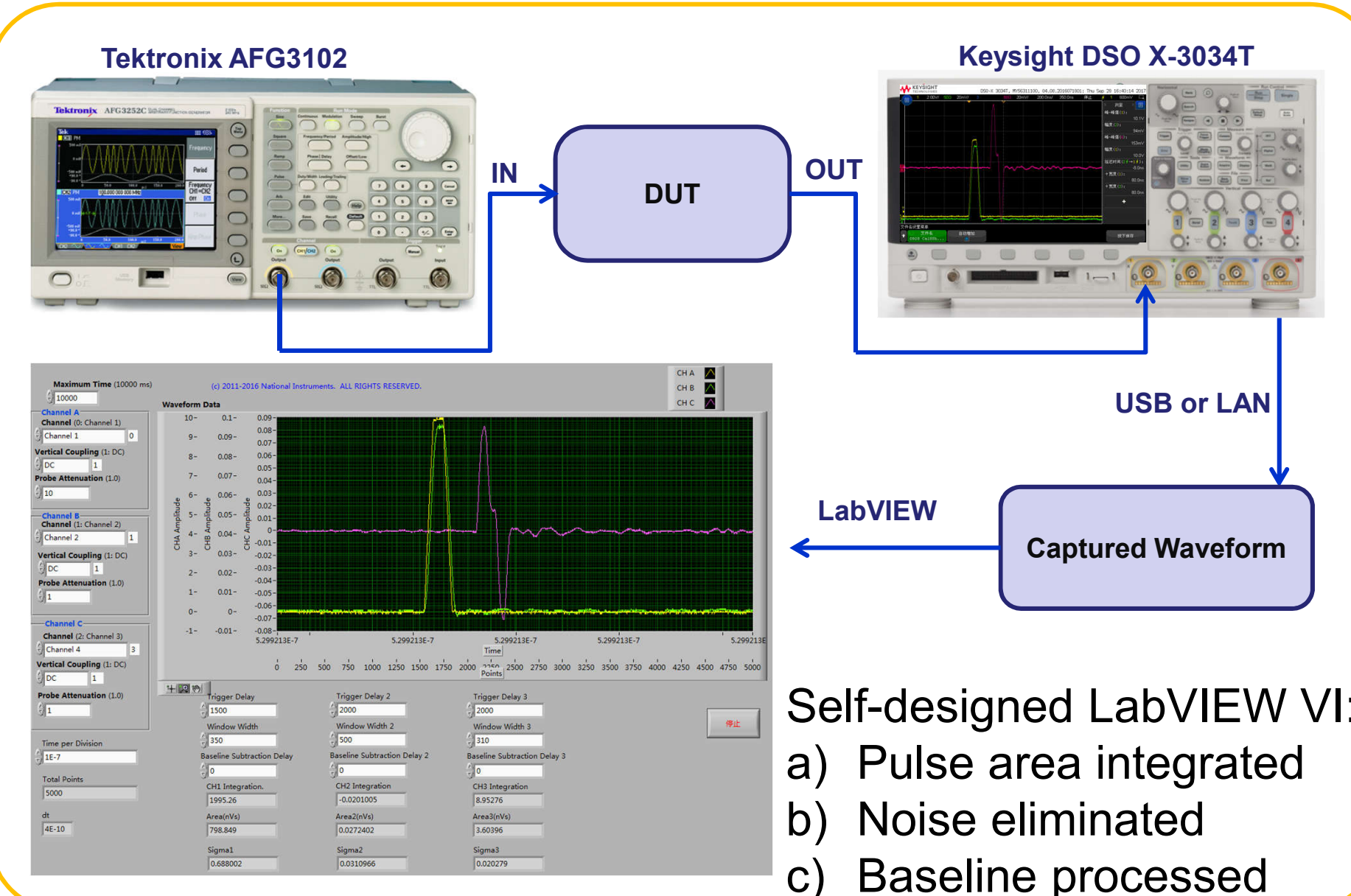
Main parameters of RTCTs/RDCT Sensors

Position	RTCT02	RTCT03	RDCT01
Model	FCT-178-0.5	FCT-302-0.5-H	FCT-302-0.5
$f_{\text{low}}(-3\text{dB})/\text{Hz}$	134.5	122.3	149.5
$f_{\text{high}}(-3\text{dB})/\text{MHz}$	810	708.8	708.5
Droop/(%/us)	0.08	0.08	0.09
Risetime/ps	432	494ps	494
Pulse Response/ps	413→754	405→551	413→610
Step Response/ps	427→808	410→959	405→824
Differentiation	21.2%/300μs	21.2%/300μs	23.4%/300μs



Mechanical Design of RTCTs/RDCT

Calibration

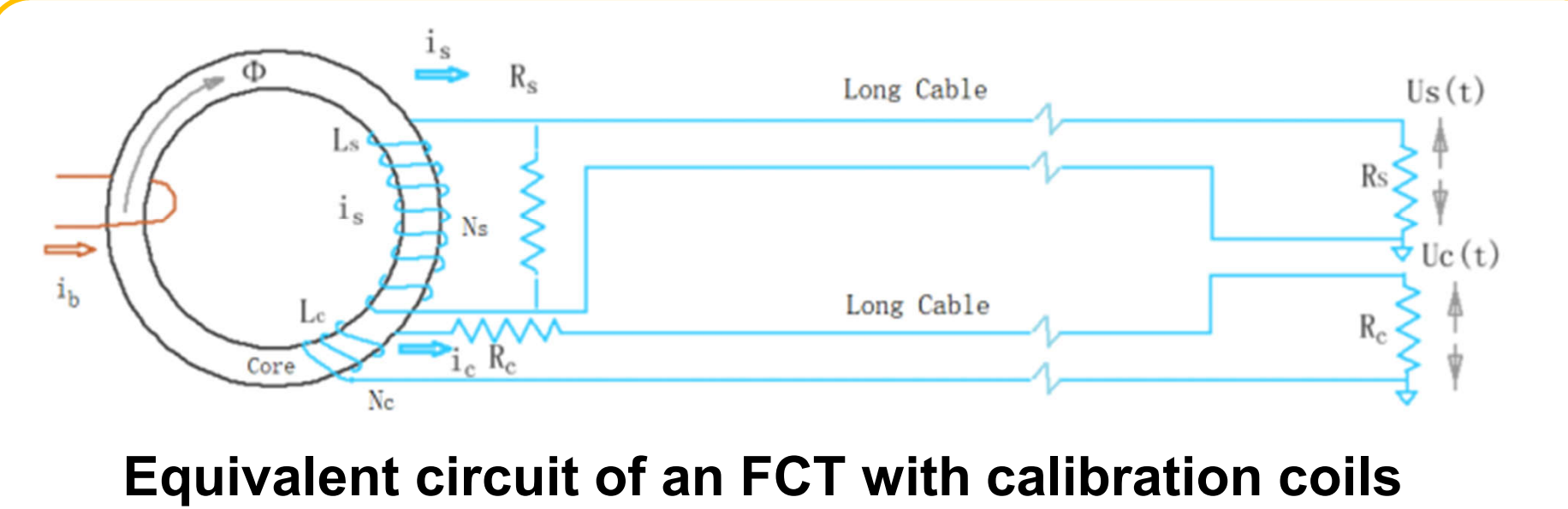


Self-designed LabVIEW VI:

- a) Pulse area integrated
- b) Noise eliminated
- c) Baseline processed

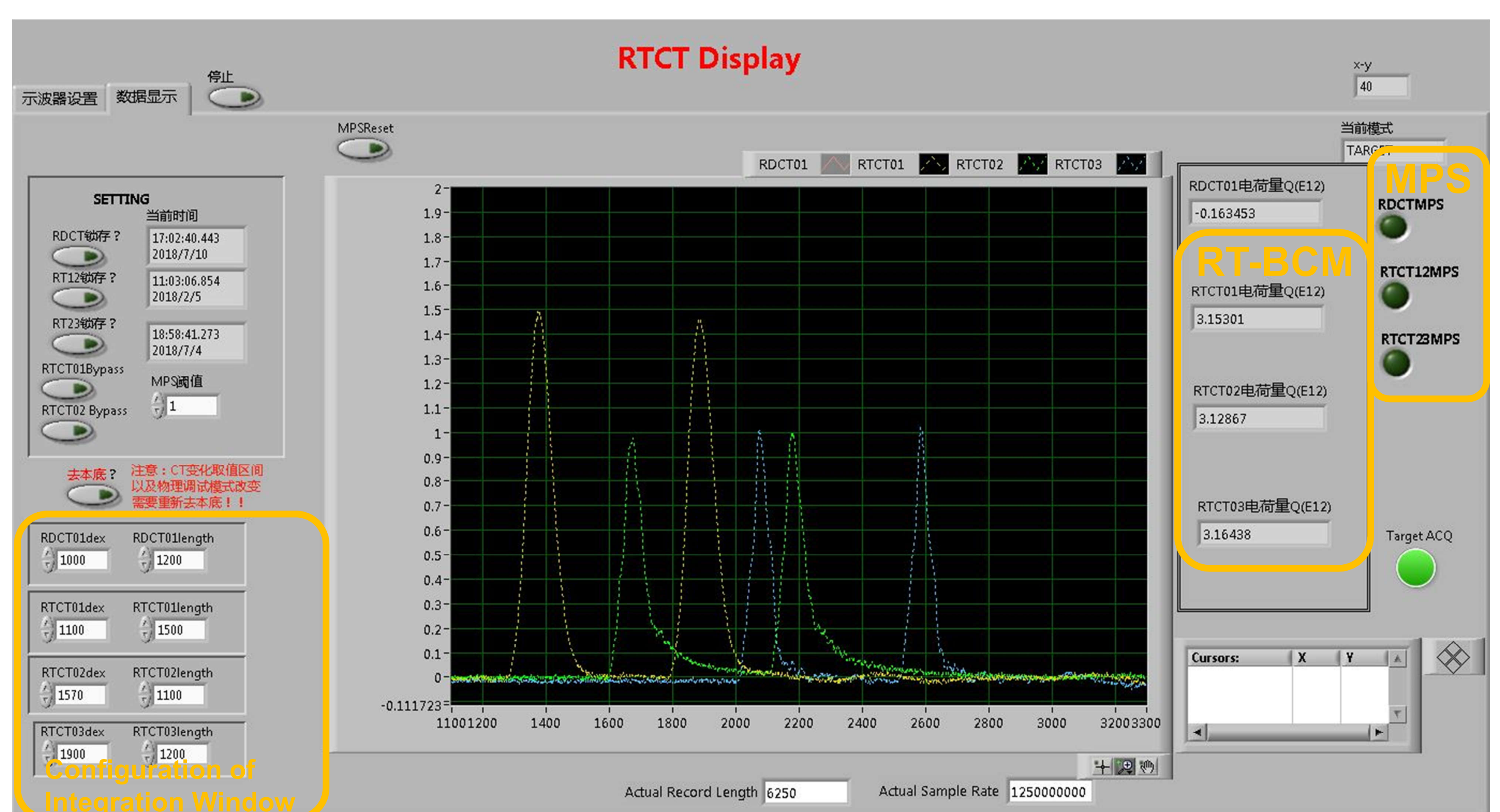


FCTs and ICT tied up to a 16-turn 8-direction coil with a 50Ω PCB board



$$\begin{aligned} \tau_s &= \frac{L_s}{R_s/2} = \frac{N_s^2 L_0}{R_s/2} & \tau_c &= \frac{L_c}{2R_c} = \frac{N_c^2 L_0}{2R_c} & \Rightarrow \frac{i_s'}{i_s} &= \frac{100}{102.56} \\ i_s &= \frac{\sigma \tau_s}{1 + \sigma \tau_s} \left(\frac{i_b}{N_s} \right) & i_s' &= \frac{\sigma \tau_s}{1 + \sigma \tau_s + \sigma \tau_c} \left(\frac{i_b}{N_s} \right) \end{aligned}$$

BCM in CSNS Operation



Statistics result of the comparison of RTCTs and DCCT (No obvious beam loss along the extraction and RTBT beam line)

Here for DCCT

$$Q = \frac{I_{beam}}{f_{rev}} = h \frac{I_{beam}}{f_{rf}}$$

