

PAL-XFEL GMD photon diagnostics _Test Results



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(Electronics, DAQ)



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Mechanical)



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(Post Dr. Physics)

Background and history

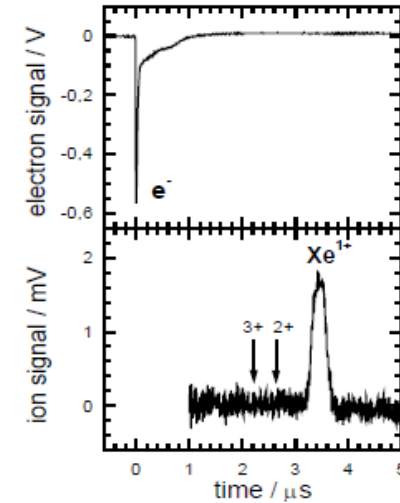
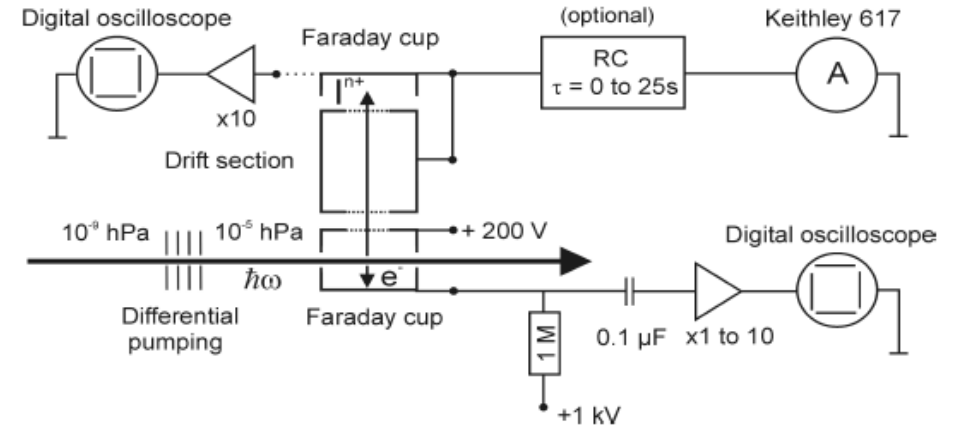
A group at DESY developed GMD for EUV photons in FLASH

The same Group developed XGMD for hard X-ray photons

Pulse resolved

Range : $10^7 \sim 10^{15}$ photons/pulse

Gas pressure $10^{-4} \sim 10^{-6}$ mbar



AIP Conf. Proc. 705, 557 (2004)

Background and history

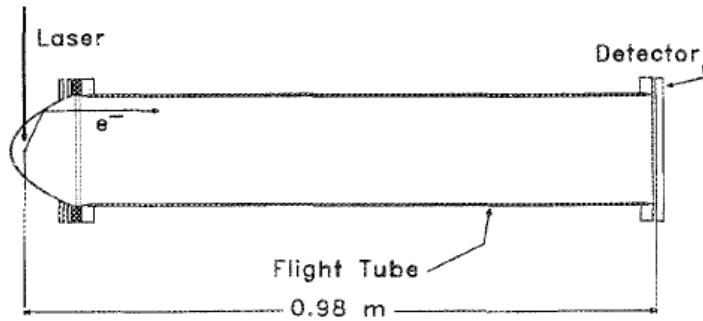


FIG. 1. Cross section of the time-of-flight spectrometer. The detail box shows electrons trajectories through the parabolic grids.

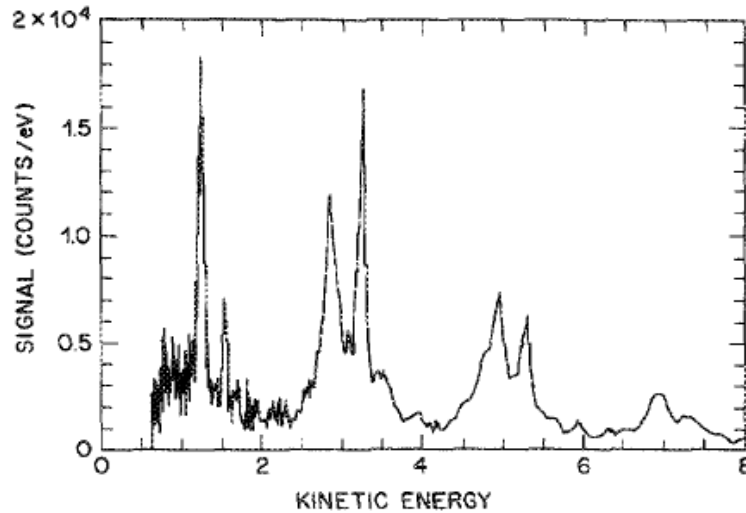


FIG. 3. TOF spectra of Xe taken with 250-fs, 100- μ J pulses of 616-nm light. The Xe pressure was 2×10^{-7} Torr.

PAL-XFEL first design based on Optical fs-Laser

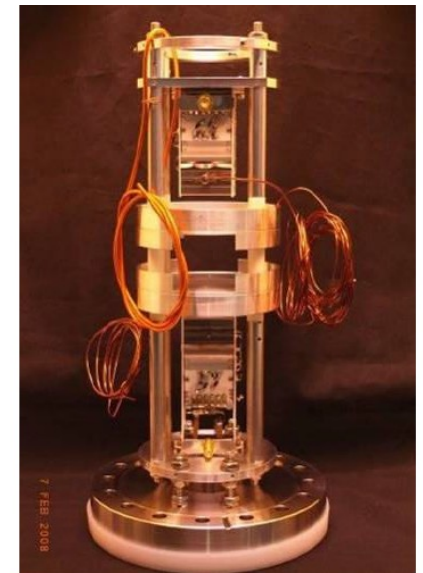
Fs-Laser : 266 nm, 60 Hz

Used Xe gas

Used Electron multiplier (SGE ETP-14882 which is the same as GMD).

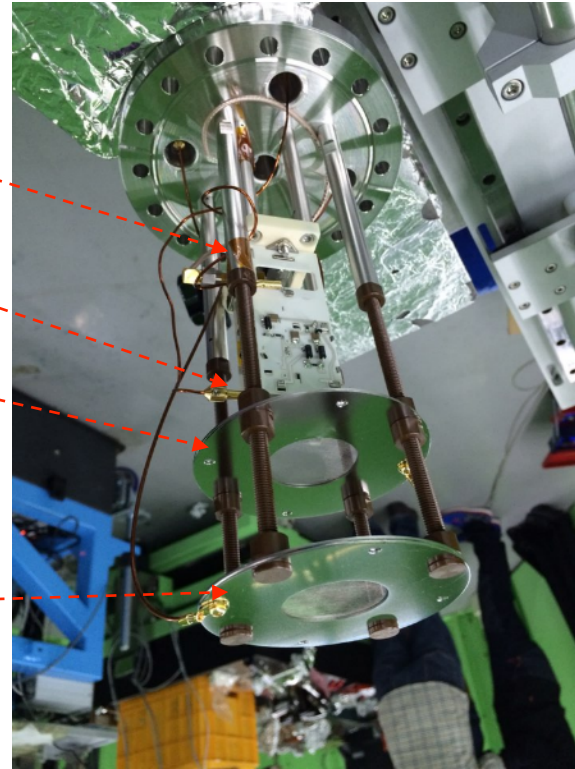
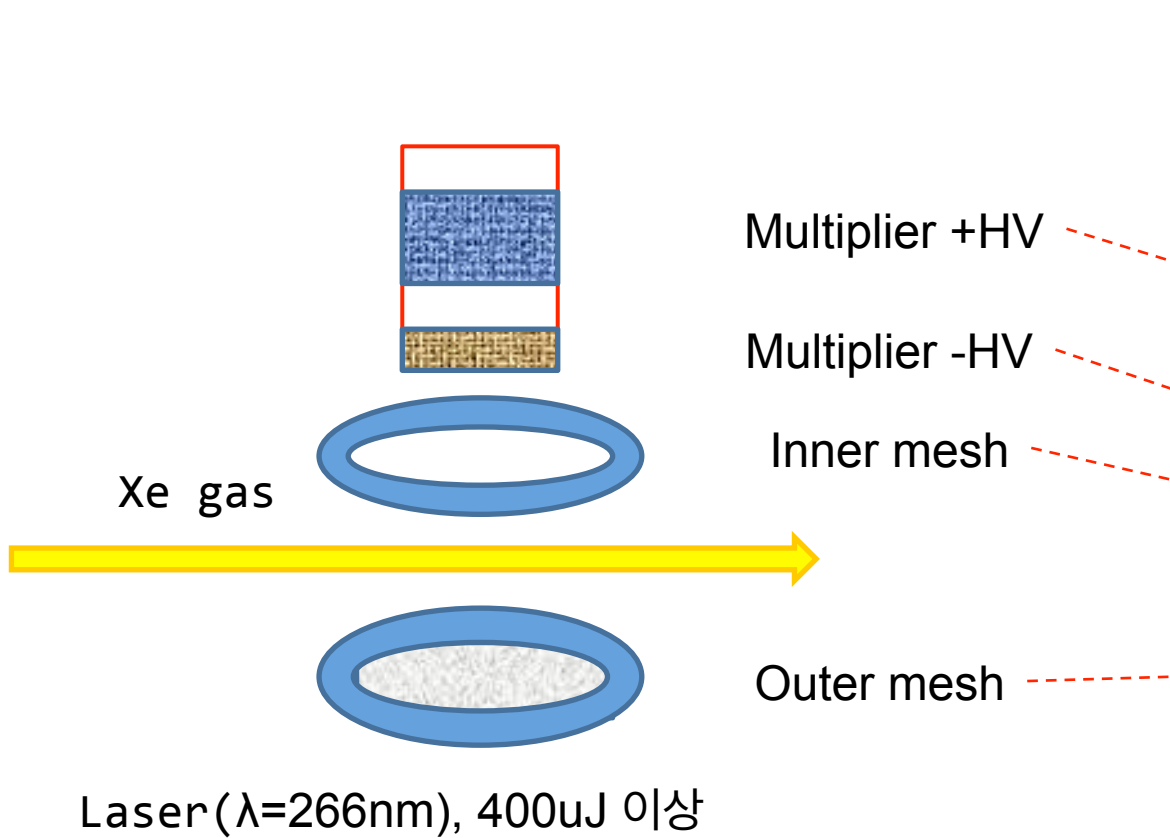


Sun-Min Hwang
(Electronics, DAQ)



GMD of DESY

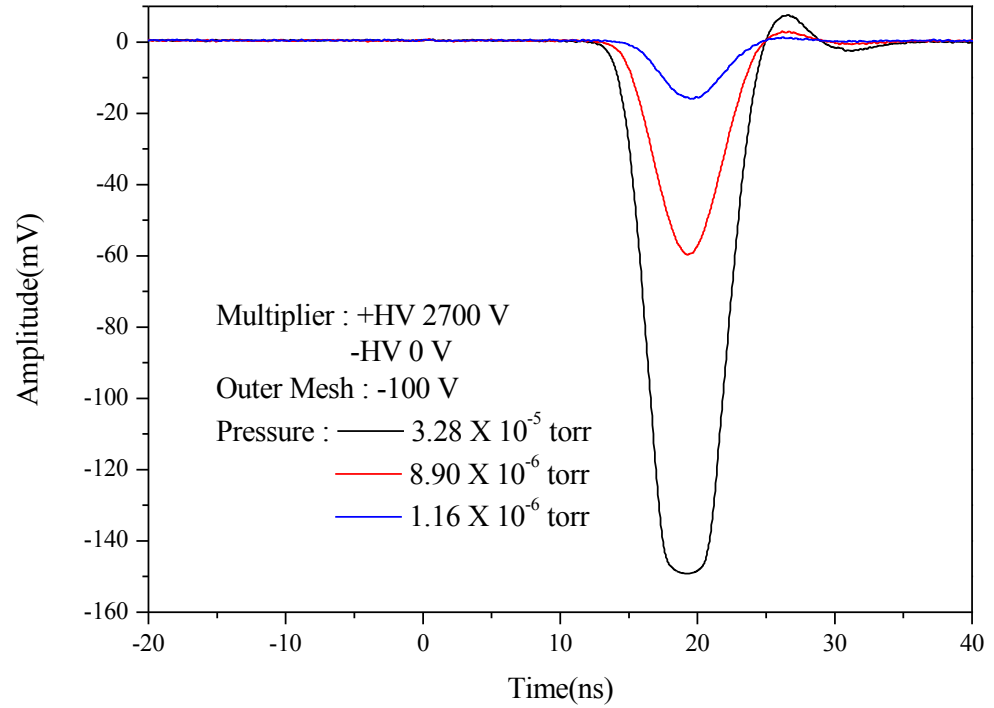
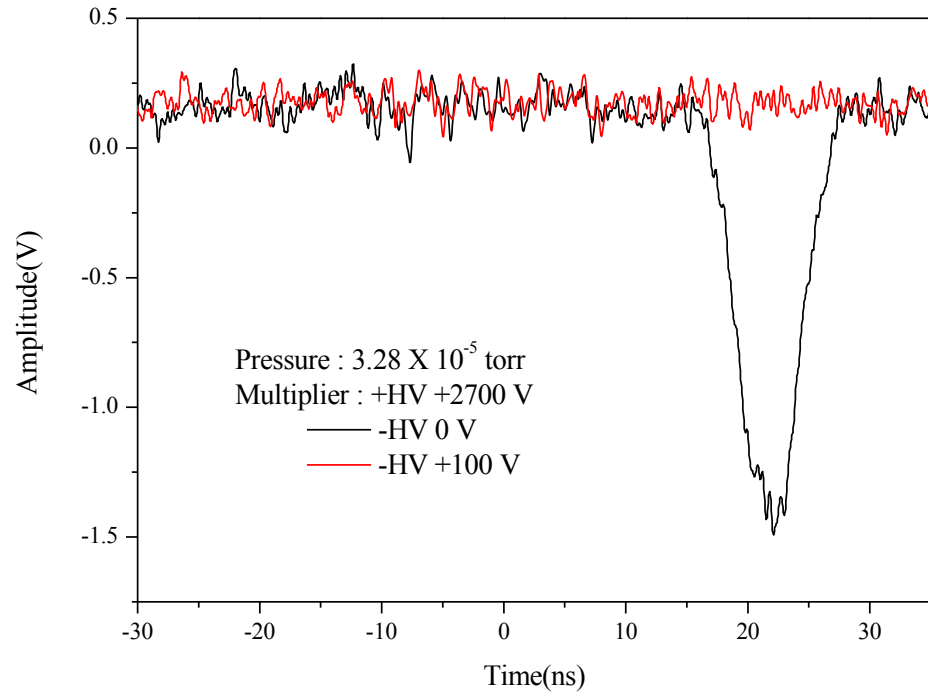
Experimental set up in storage ring beam line



Sample Holder GMD Imager



First Result (2015. 4.8)



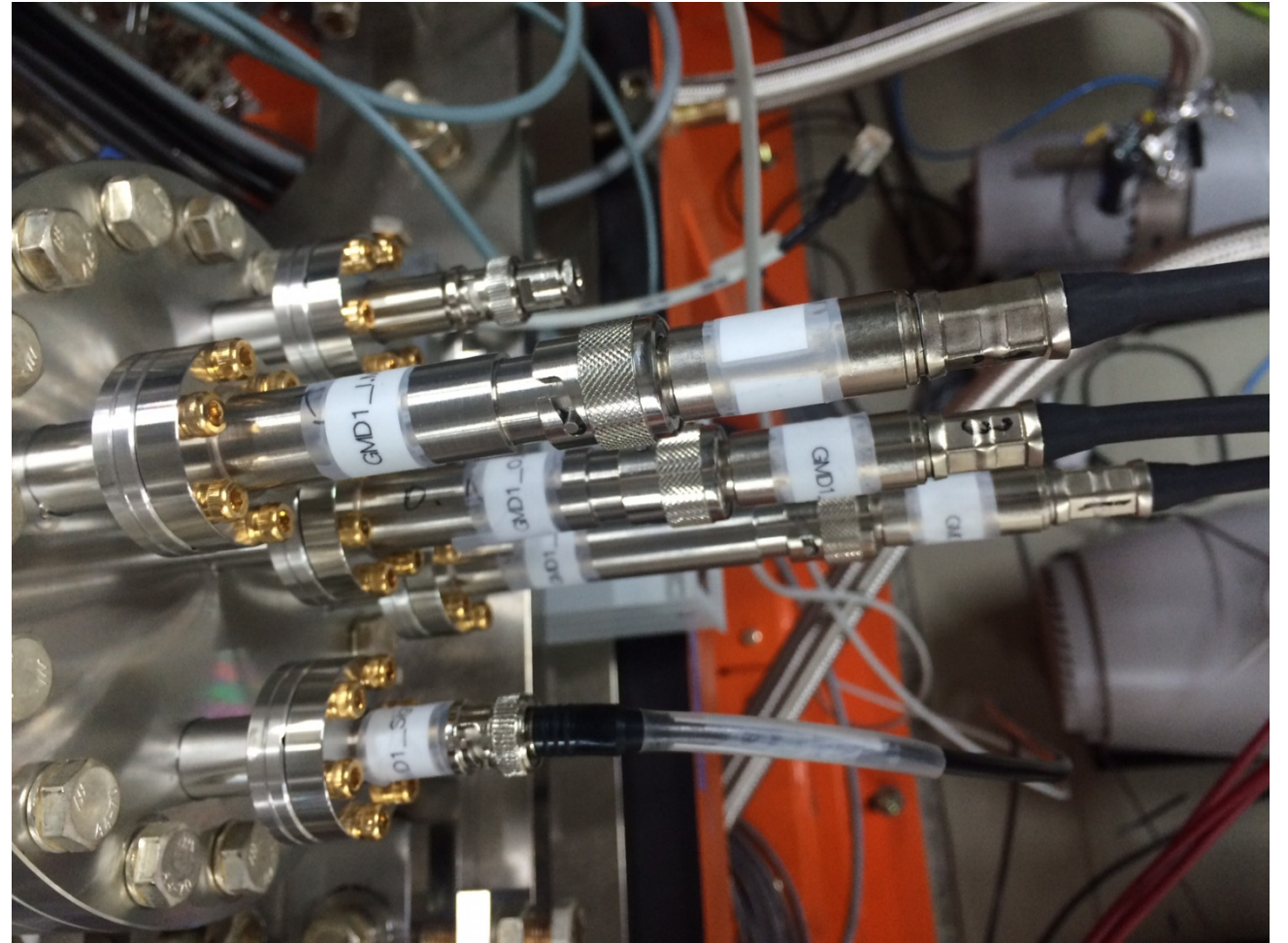
Second design change for hard X-ray

We replaced electron multiplier with MCP. (Hamamatsu MCP F2223-21S)

Electrical feed-through can be applied up to 15 keV

DAQ is developed for pulse by pulse data processing

New design



GMD Test at soft X-ray beam line in PAL-XFEL



<Delay generator>



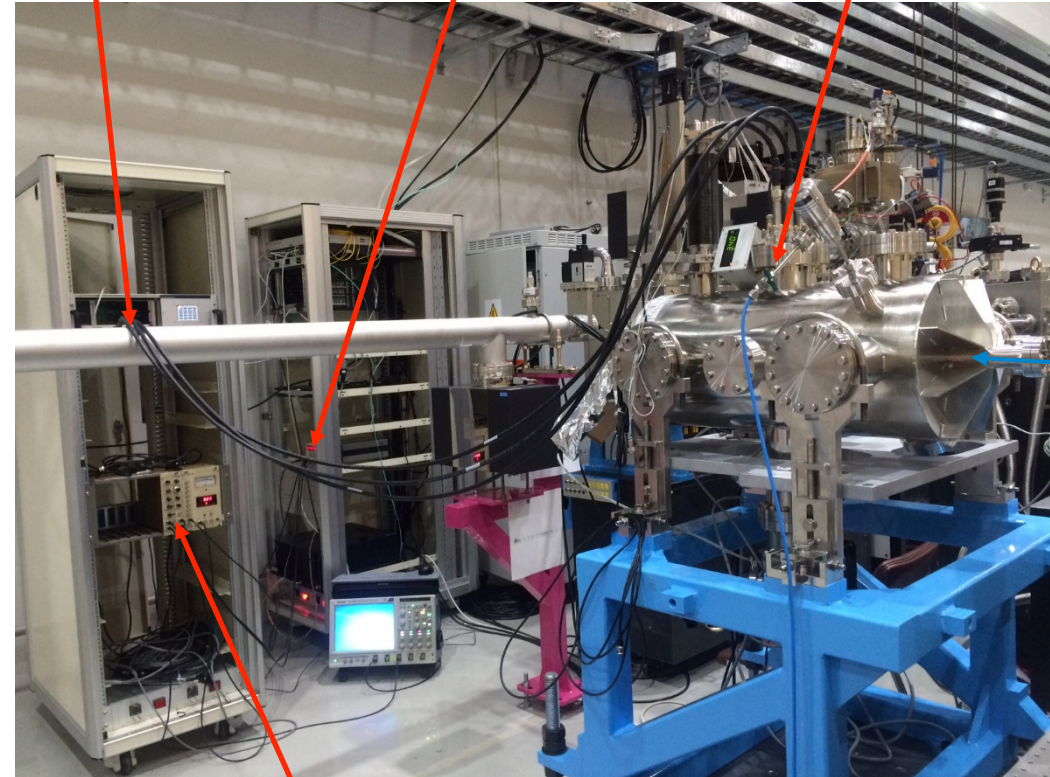
<Boxcar system>

(Gated intergrator, Computer interface)

High voltage
Power supply

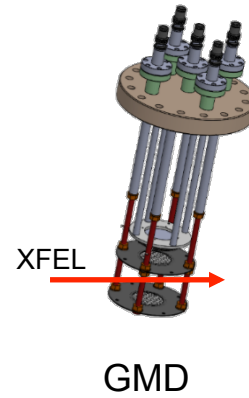
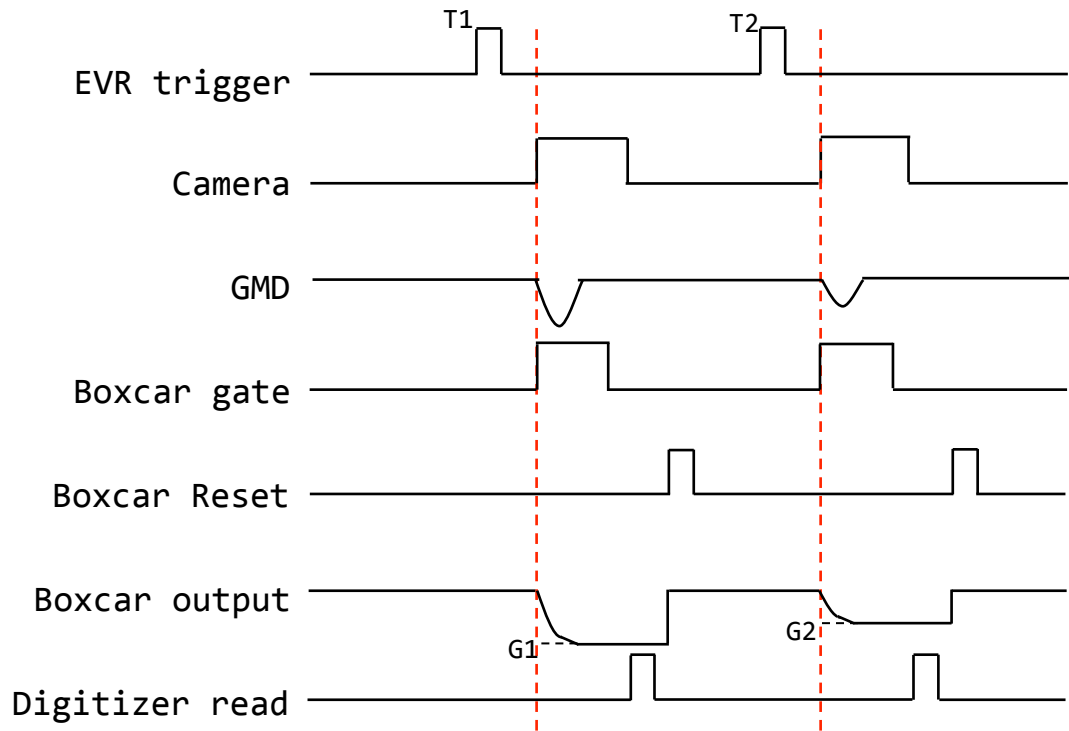
Delay generator

GMD



Laser

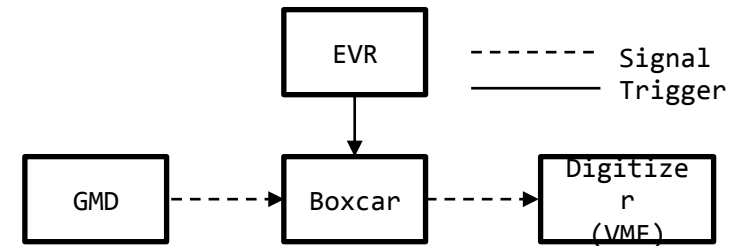
Gated integrator &
ADC Computer interace



Sun-Min Hwang
(Electronics, DAQ)

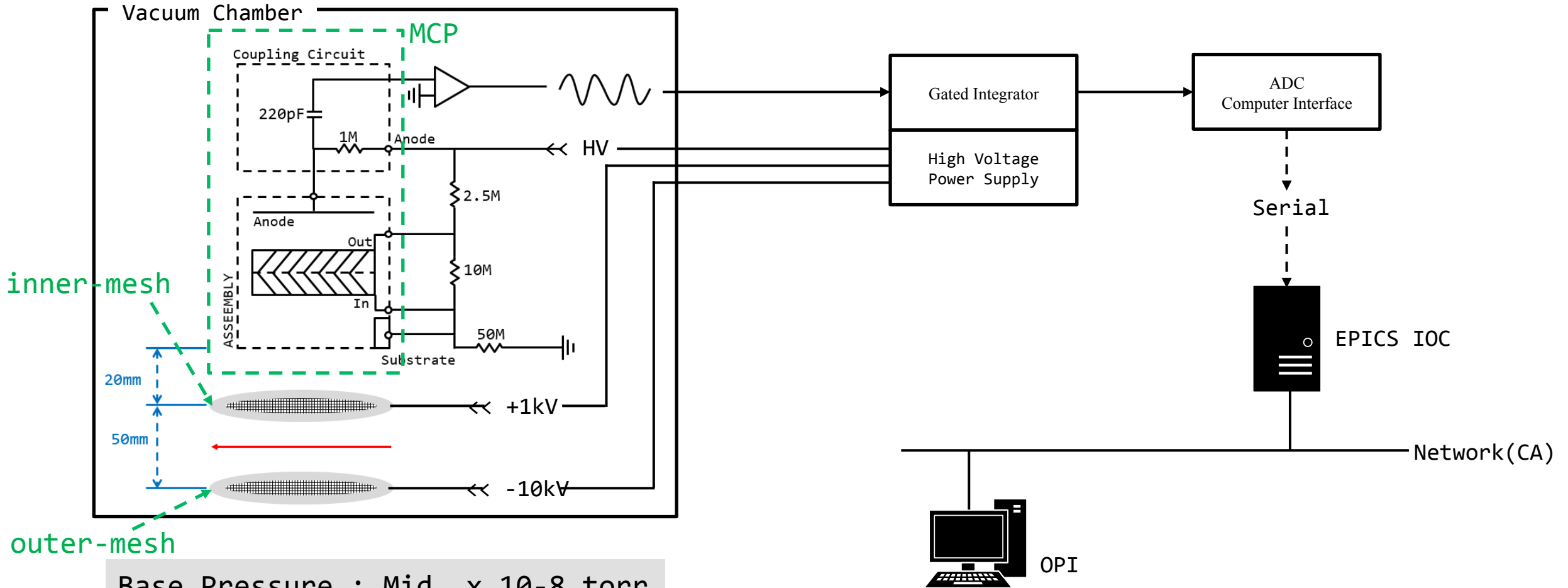


Geon-Yeong Mun
(Timing, S/W)



Pulse number	FEL intensity	Image
T1	G1	Img1
T2	G2	Img2
T3	G3	Img3
...	...	

Electronic Wiring

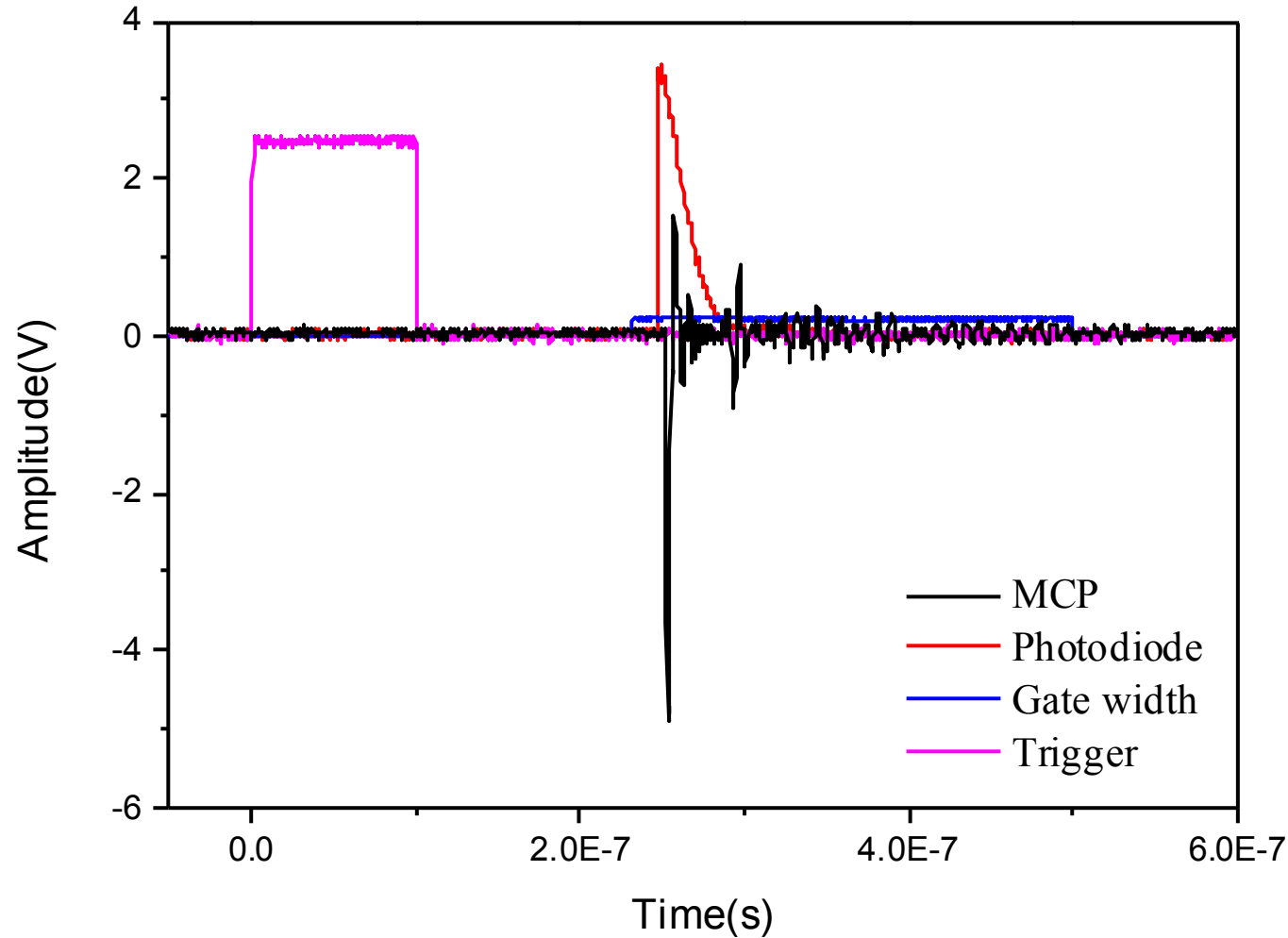


Base Pressure : Mid. $\times 10^{-8}$ torr
 Laser : Ti-sapphire laser(266nm)
 Detector : Hamamatsu MCP
 Gas : Xe

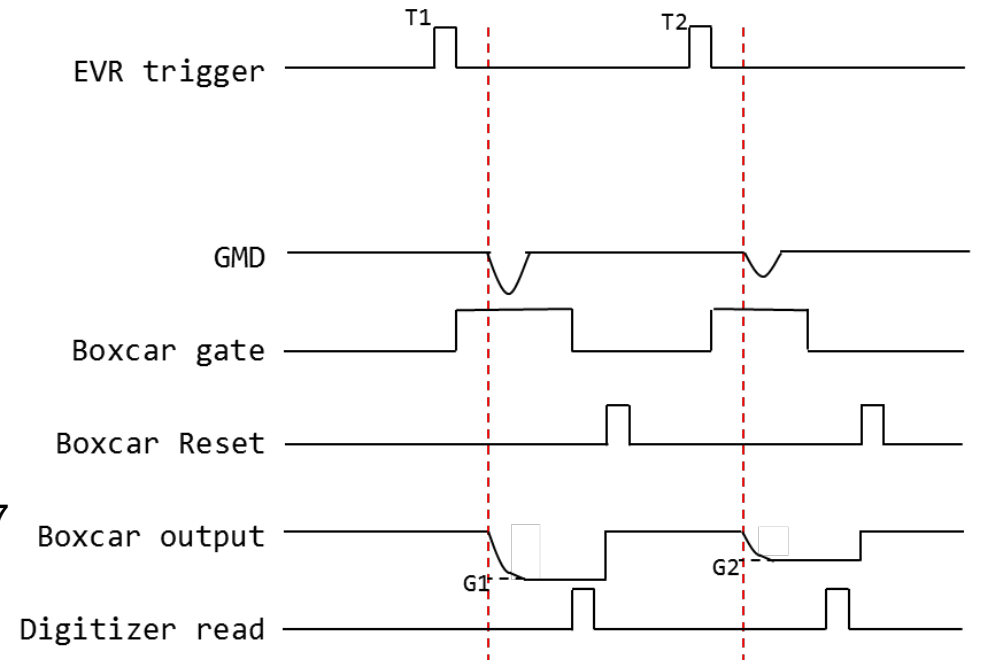
Parameters for the experiments

- Gated integrator
 - Delay : 100ns, Multiplier 0-50
 - Width : 100ns, Multiplier 3 = 300ns
 - Signal sensitivity : .1
 - Average : Last
 - Average Reset : trigger input
- Delay generator External trigger input
 - AB : T0+499.8us, Width : 100ns -> Gated integrator External trigger input
 - CD : A+70us, Width : 1us -> Gated integrator External average reset input
 - GH : A+50us, Width : 500ns -> ADC Computer interface External trigger input
- ADC Computer interface
 - Digital port CH1 : External trigger input
 - Analog port CH1 : Gated integrator Last sample signal input
 - Synchronous mode
 - Response delay time : 0
 - Serial interface : 19200 8N1

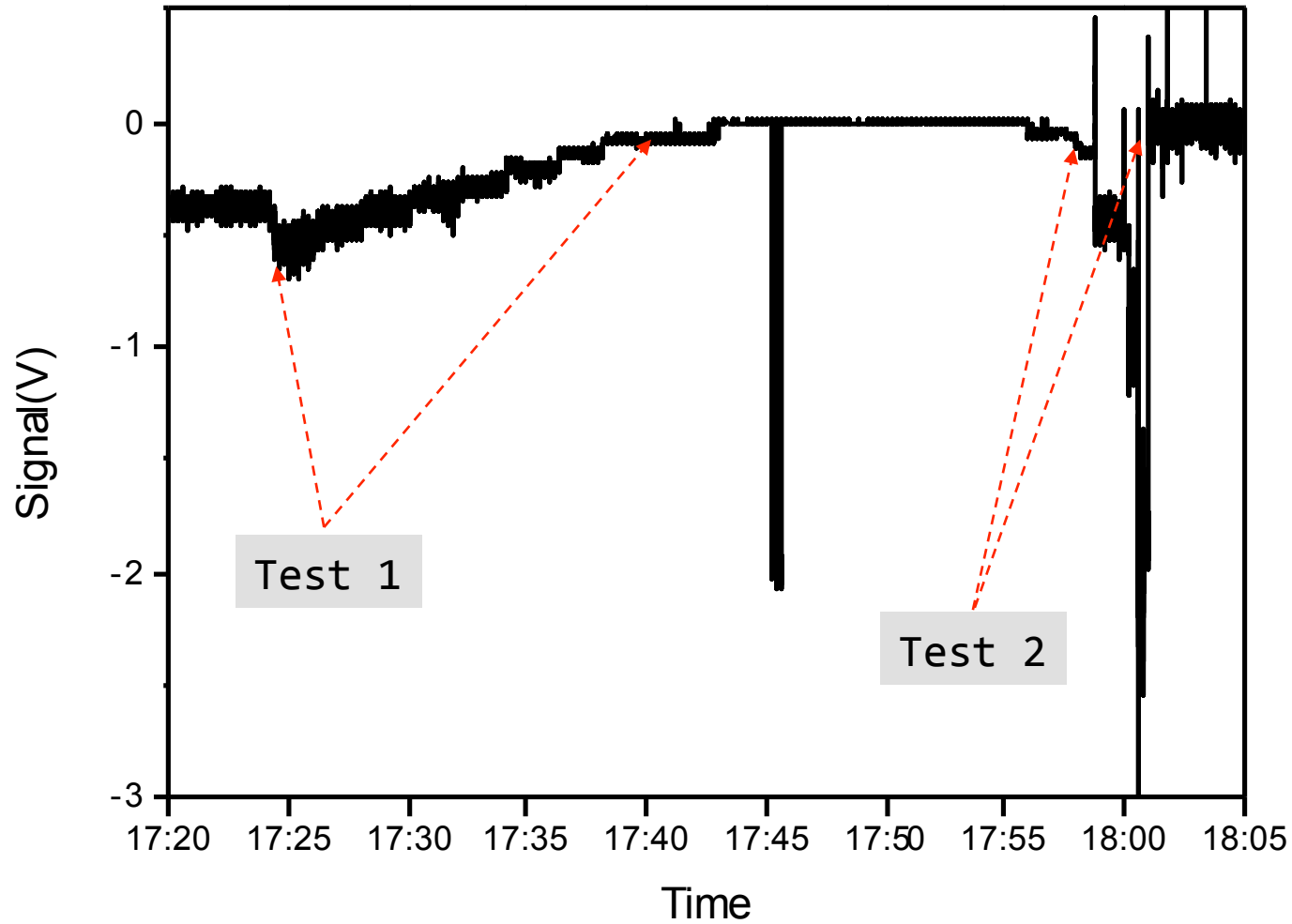
First Results (2016. 3.29)



Photodiode : 266nm Laser
Gate width : 300 ns
Trigger : EVR



SECOND Results (2016. 4.7)



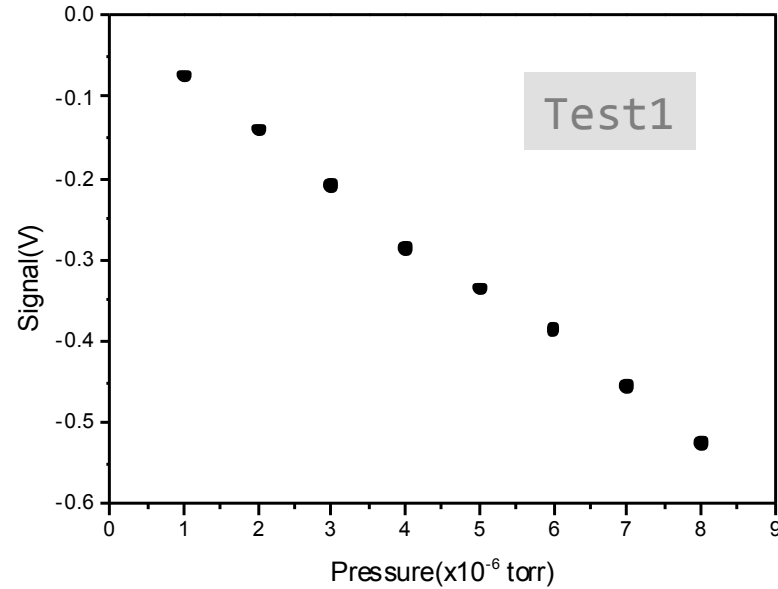
Test 1

- Laser power : 300uJ
- MCP applied voltage : 1.44kV
- Xe Gas pressure change

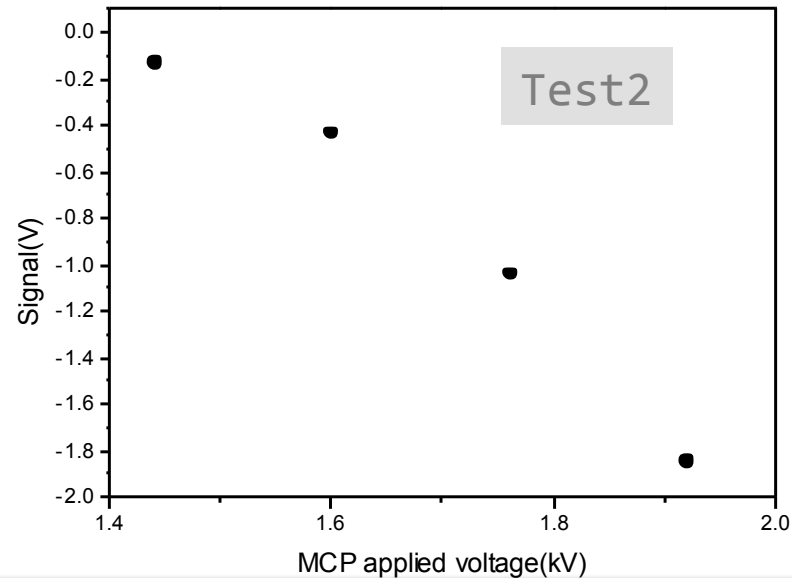
Test 2

- Laser power : 100uJ
- Xe Gas pressure : 2.0×10^{-6} torr
- MCP bias voltage change

Test Result

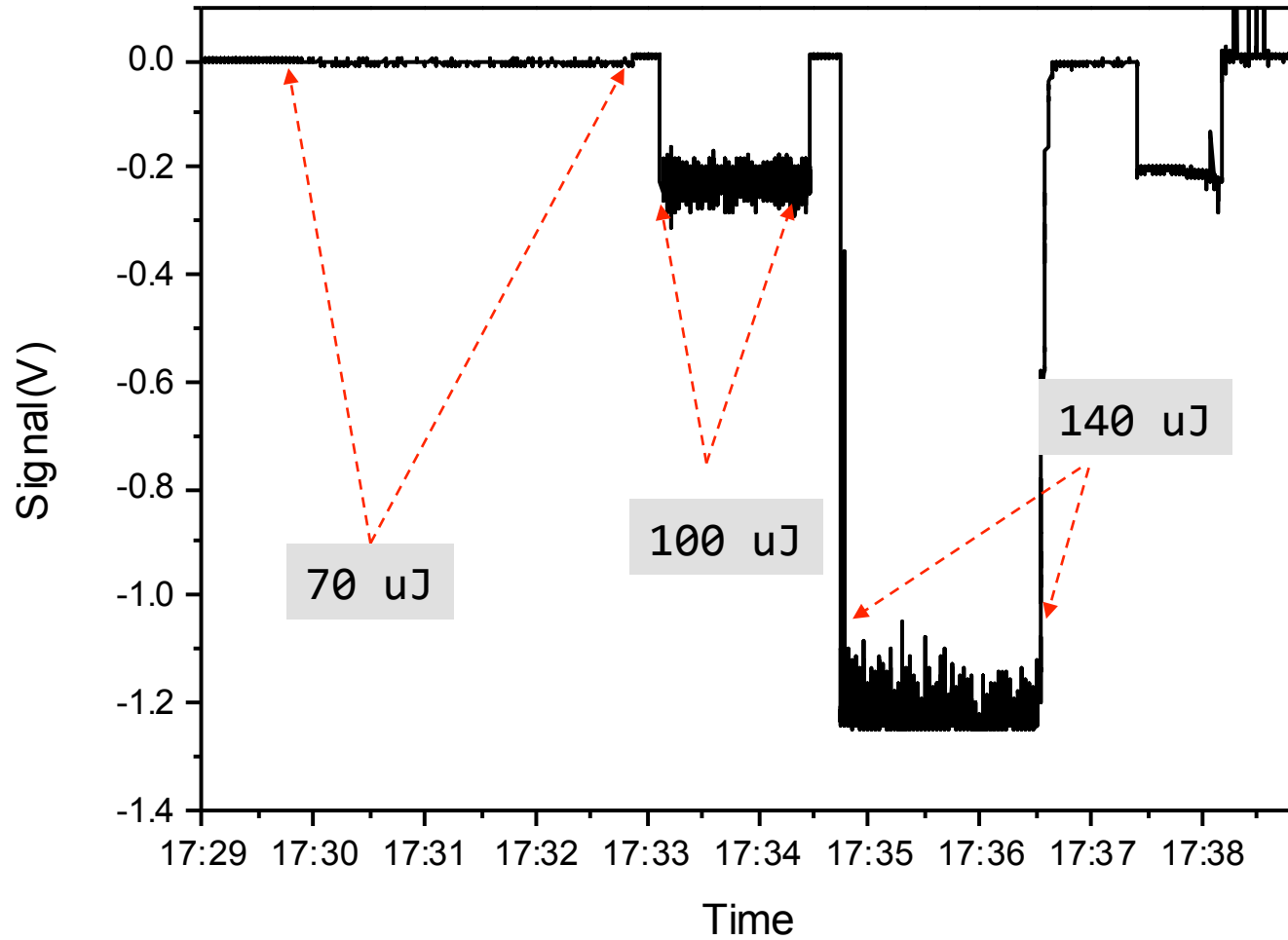


- Laser power : 300uJ
- MCP applied voltage : 1.44kV(gain : 4×10^5)
- Observed the relationship of Signal vs gas pressure
- Gas pressure is changed in the range of 8×10^{-6} ~ 1×10^{-6} torr

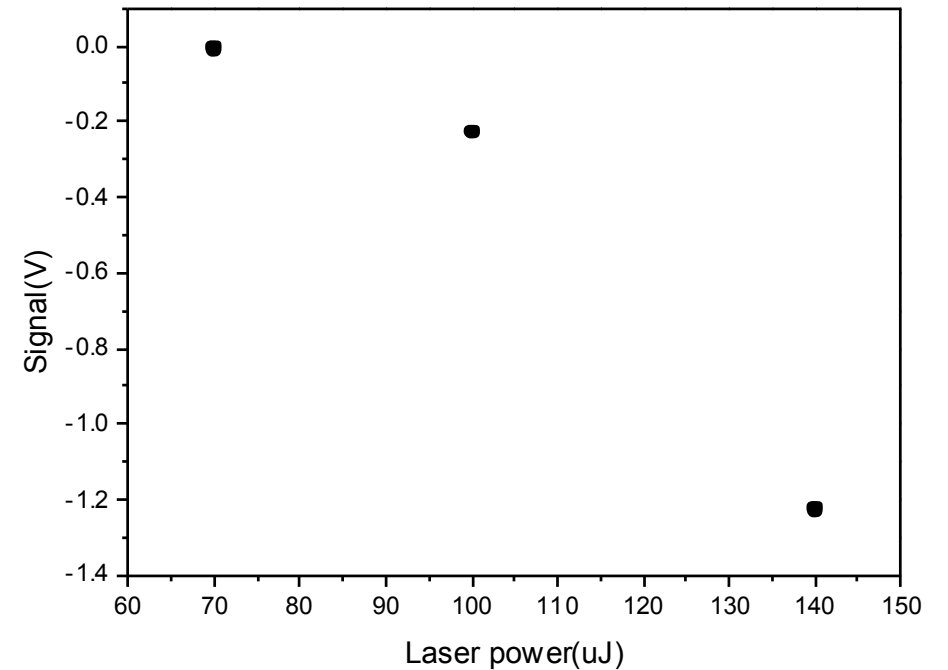


- Laser power : 100uJ
- Gas pressure : 2×10^{-6} torr
- Observed the relationship of Signal vs bias voltage to MCP

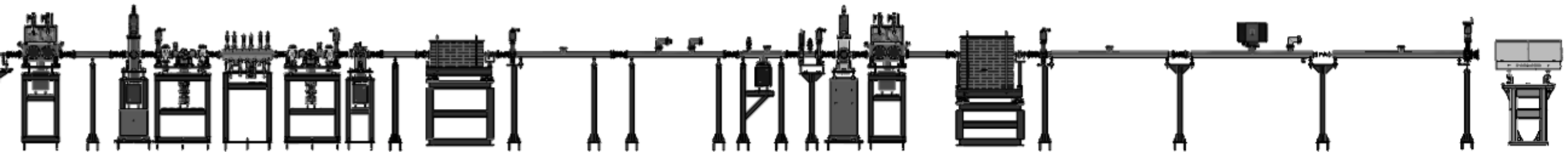
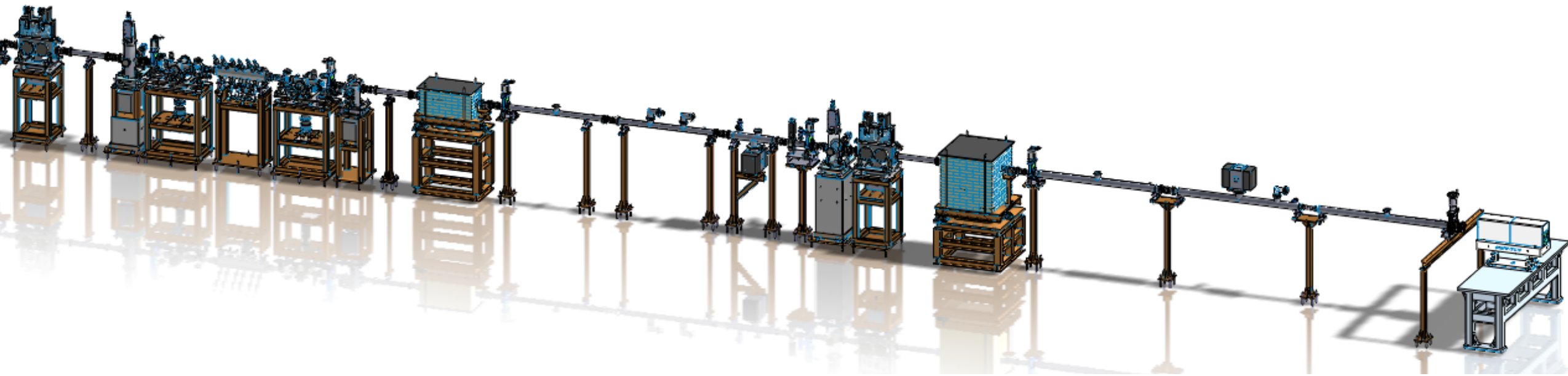
Test 3



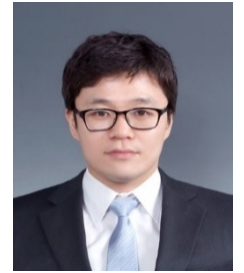
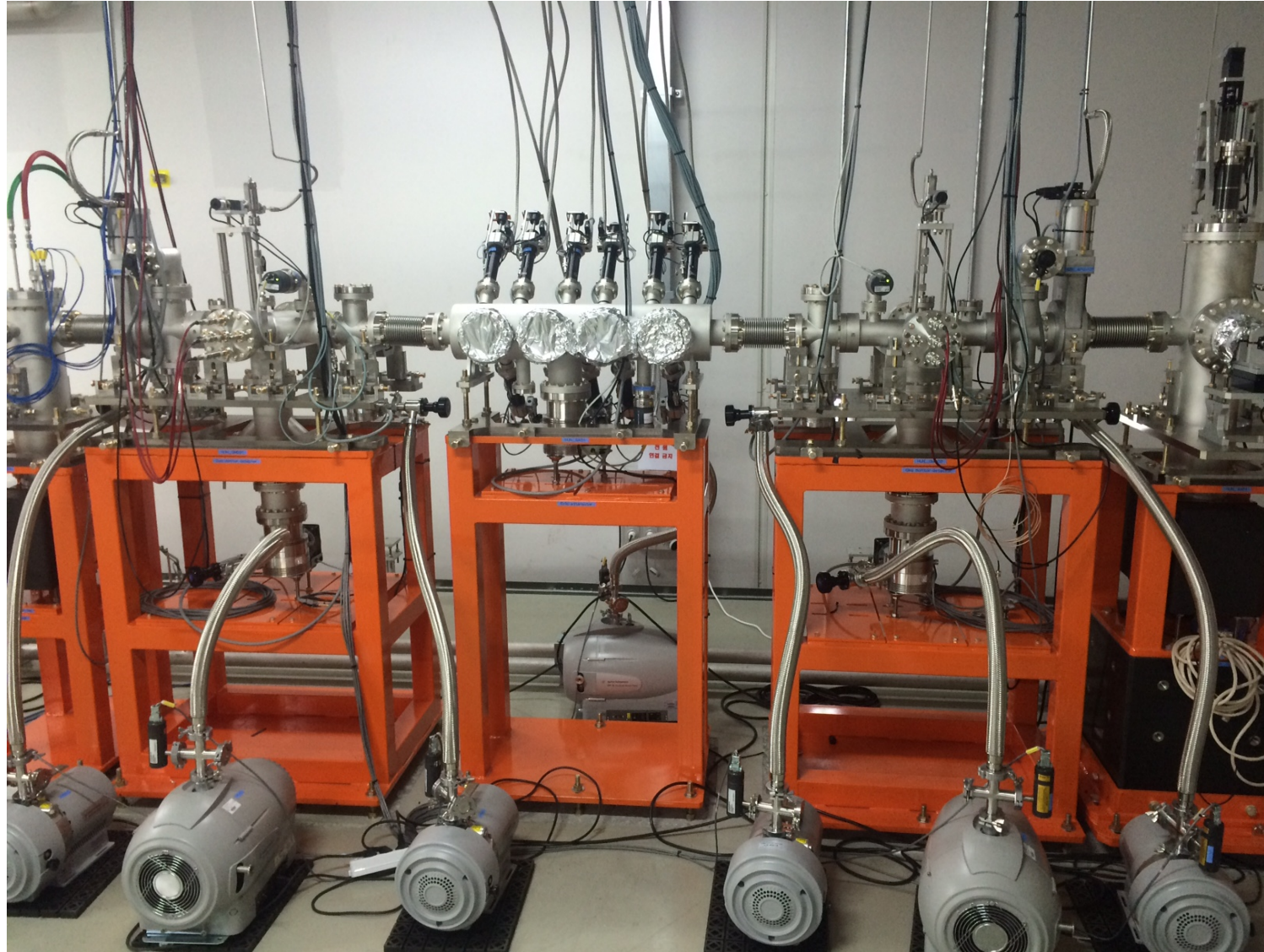
- MCP applied voltage : 1.44 kV
- Pressure : Mid $\times 10^{-6}$ torr
- Laser Power change



Set up in beam line



Set up in beam line



Sung-Han Kim
(Vacuum &
Mechanical)