

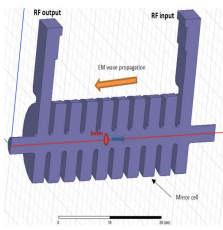
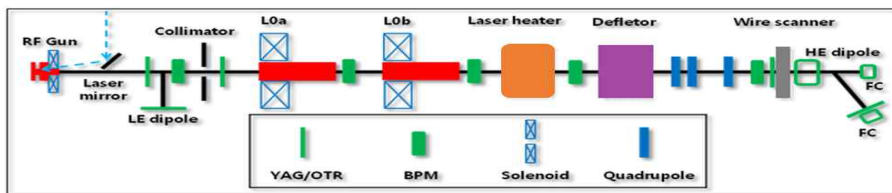
Emittance Measurements at the PAL-XFEL Injector Test Facility

J. H. Lee, J. H. Han, J. H. Hong, H. Yang, C. H. Kim, S. J. Park, S. J. Lee, In Soo Ko
Pohang Accelerator Laboratory, Pohang, 37673, Korea
E-mail : hyunny@postech.ac.kr

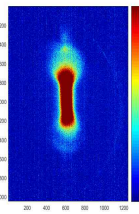
- Abstract -

The PAL-XFEL Injector Test Facility (ITF) at PAL has been operating for experimental optimization of electron beam parameters and beam test of various accelerator components. It consists of a photocathode RF gun, two S-band accelerating structures, a laser heater system, and beam diagnostics such as ICTs, BPMs, screens, beam energy spectrometers and RF deflector. Projected and slice emittance is measured by using single quadrupole scan. In this paper, we present the emittance measurements.

- ITF Elements -



RF parameter	Value
Frequency f	2.856 GHz
Transverse Shunt Impedance	28.7 M Ω /m
Unloaded Q	13,400
Number of cells N	28 (L=1m)
Attenuation Constant α	0.158 (m ⁻¹)
Group velocity v_g	0.014 c
Kick/Power	2.7 MV/MW

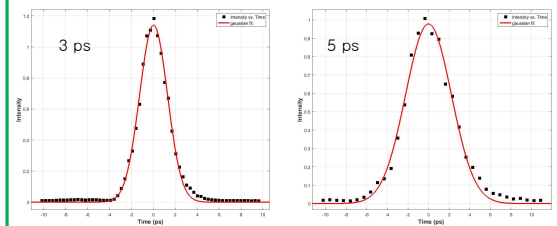


- S-band 1.6-cell photocathode RF gun, solenoids, two S-band accelerating columns, and diagnostics including quads and transverse RF deflector.

- The Quadrupole for quad scan and YAG screen are located at 13.22 m and 15.86 m from the cathode, respectively.

Figure : Transverse RF Deflector and a streaked beam image.

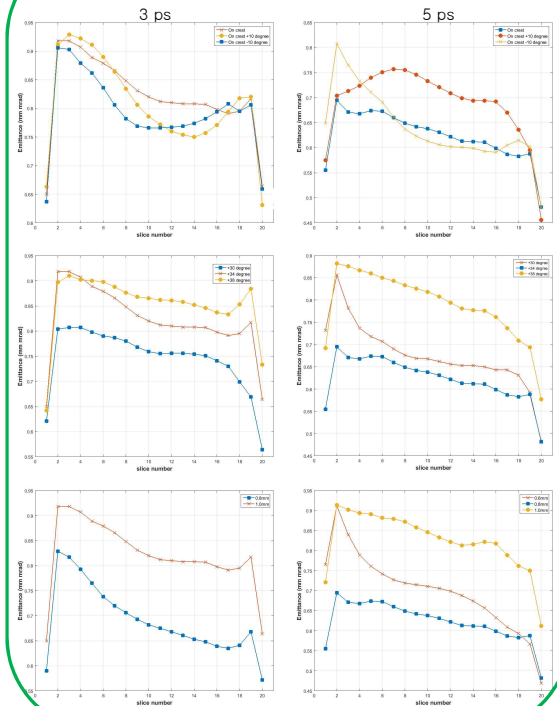
- Longitudinal Profile of UV Laser -



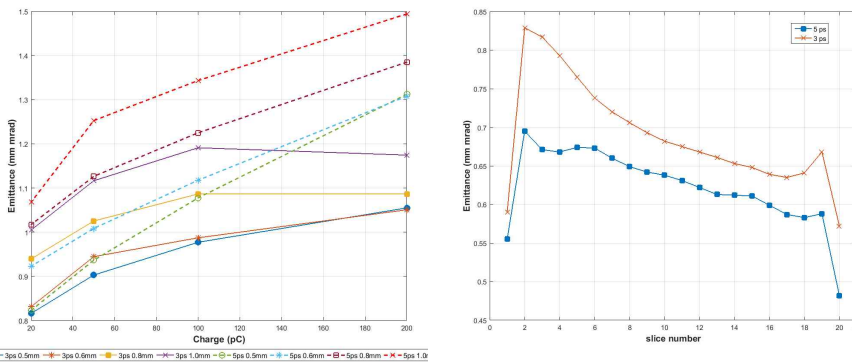
- σ : 1.27 ps
- FWHM : 3.00 ps

- σ : 2.22 ps
- FWHM : 5.23 ps

- Slice Emittance -



- Results of Projected and Slice Emittance -



- Beam energy of measurement are 68 MeV (projected) and 102 MeV (slice).
- Projected emittance is generally over 1.0 mm-mrad at 200 pC.
- Slice emittance is generally over 0.6 mm-mrad at 200 pC.
- It shows a tendency that the projected emittance using a 3 ps laser is smaller than the one using a 5 ps

- Conclusions -

- The understanding of emittance plays a significant role in the optimization of high brightness electron sources and in the operation of PAL-XFEL.
- The measurements of projected and slice emittance have been successfully performed.
- The measured emittance is over the designed emittance of PAL-XFEL.
- We consider the thermal emittance might be high based on the emittance at low charge.
- Supplementary of slice emittance is required with 3ps UV laser.