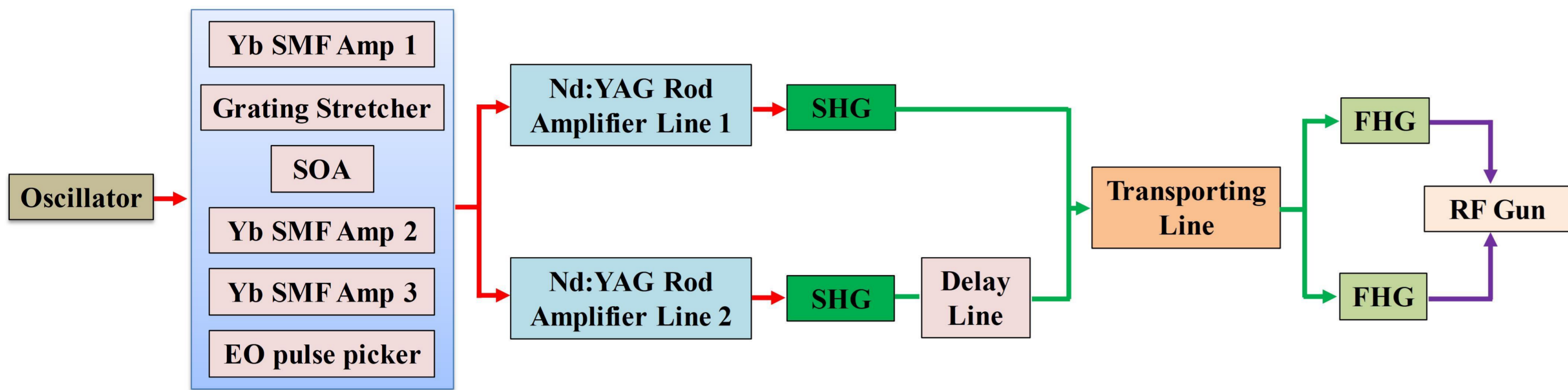


LASER SYSTEM FOR SuperKEKB RF GUN IN PHASE-III COMMISSIONING

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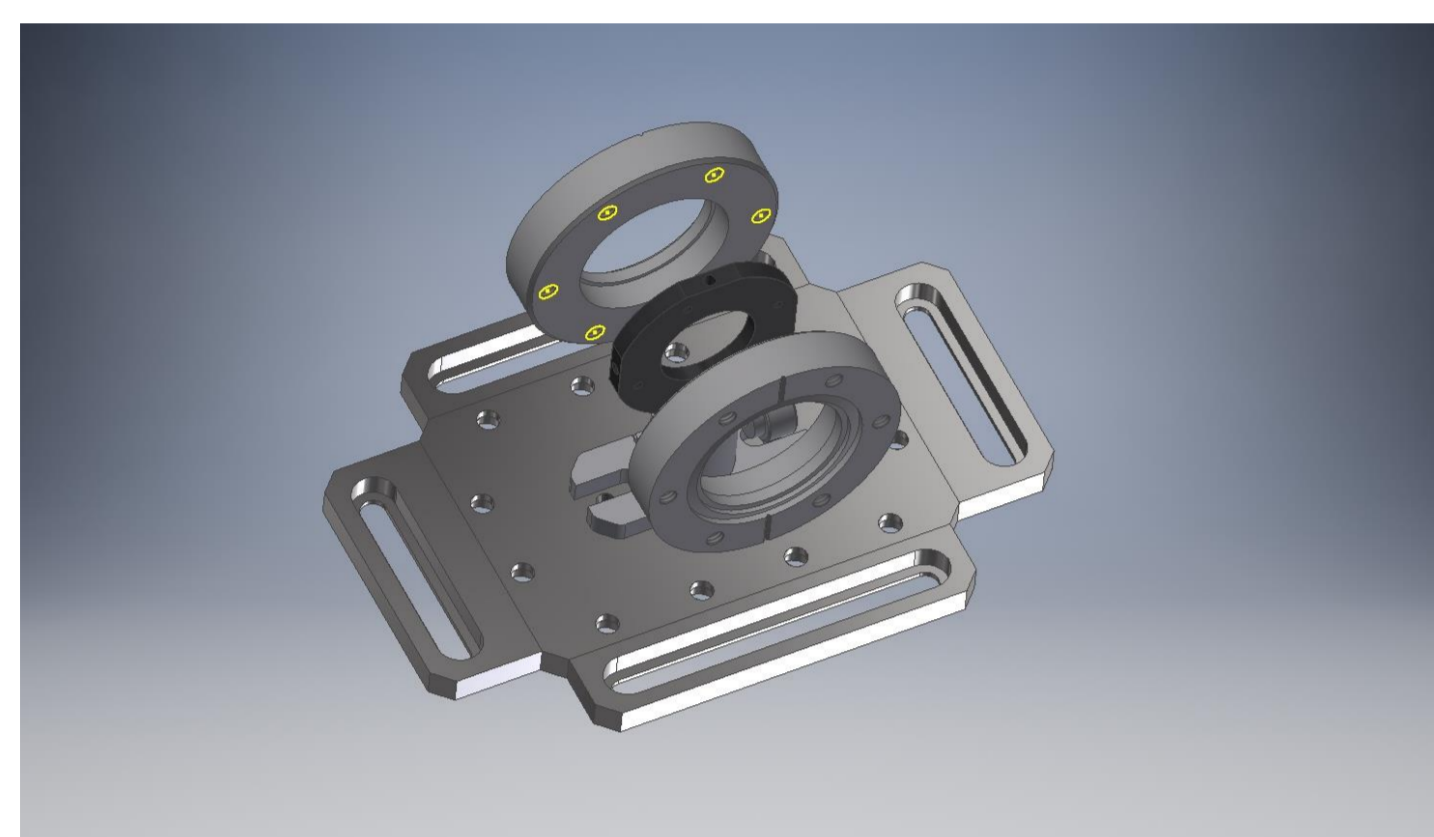
Yb/ND HYBRID LASER SYSTEM FOR RF GUN



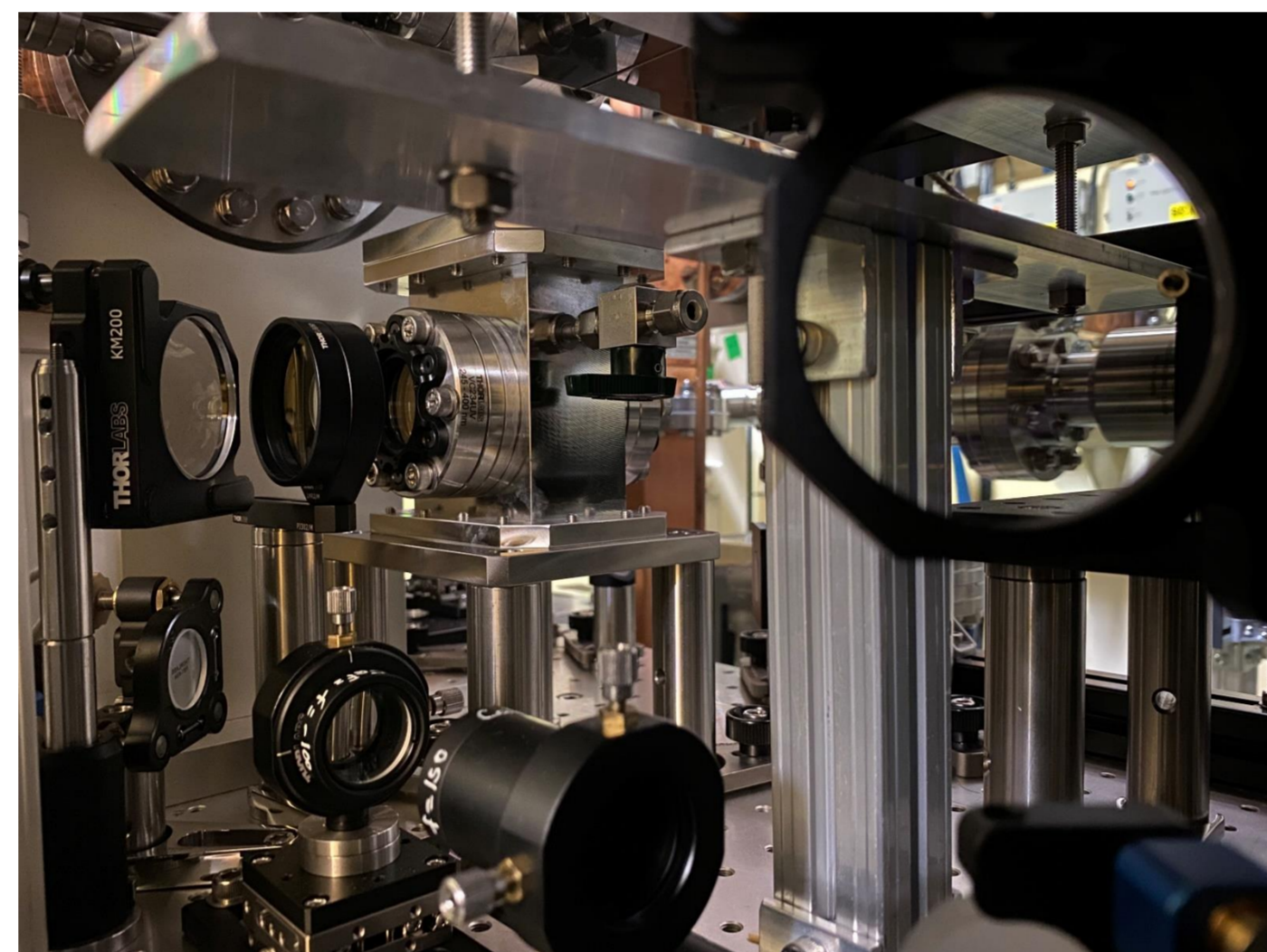
Yb/ND hybrid laser system for RF gun in SuperKEKB phase III

- Oscillator: Yb-doped fiber mode lock laser oscillator
- Yb-doped fiber amplifier: Three stages of Yb SMF amplifiers and one semi-conductor optics amplifier (SOA)
- Preferred repetition rate (1-25 Hz) is realized by an EO
- Two Nd:YAG rod amplification lines with 5 stages amplifiers, a delay line is inserted in the 2nd laser line
- After amplification part, two lasers combined by one transporting line and transmitted to tunnel RF gun box
- Two UV lasers generate separately and impinge into photocathode from two windows of RF gun

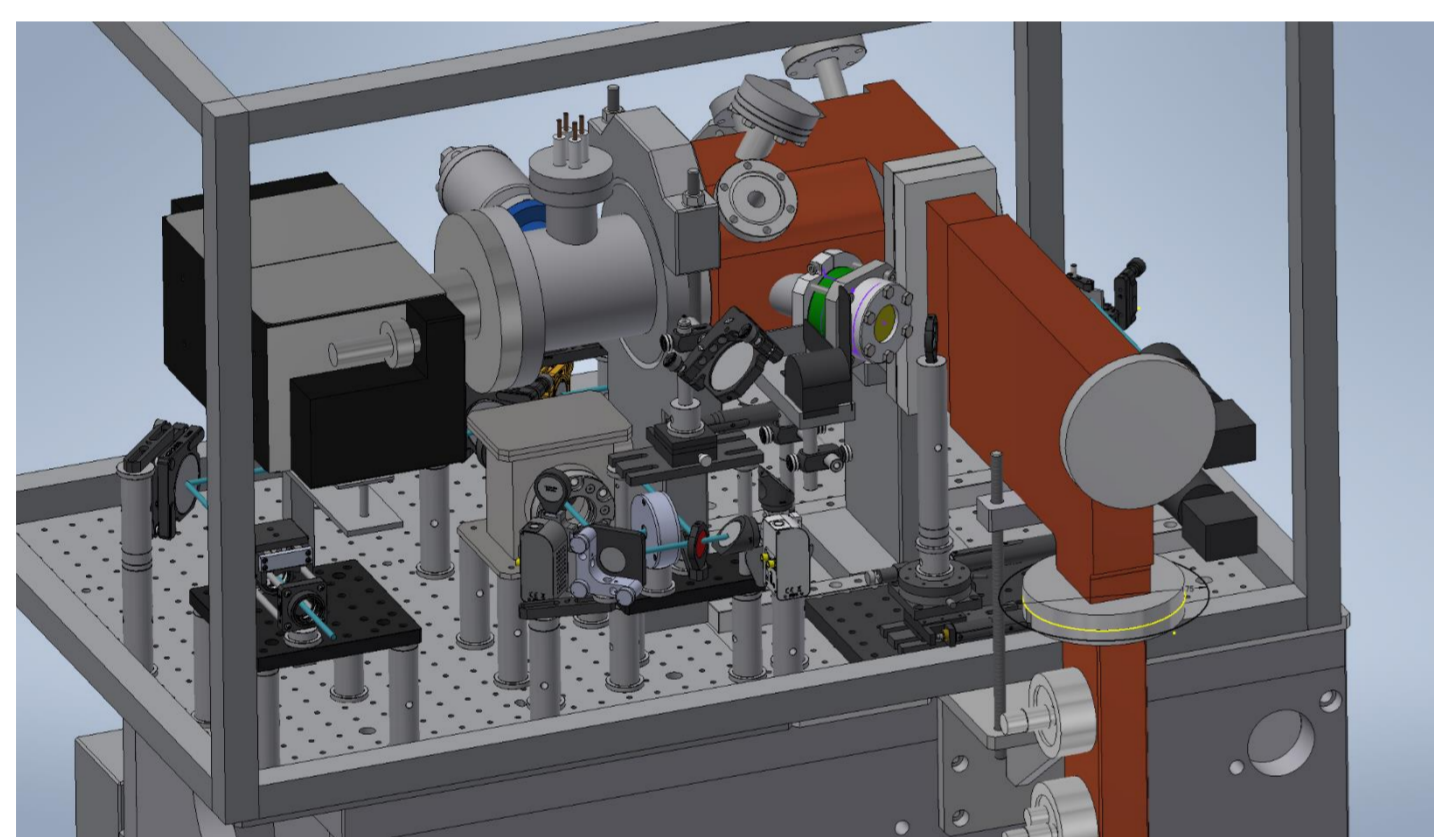
LASER SPATIAL RESHAPING FOR LOW EMITTANCE ELECTRON BEAM



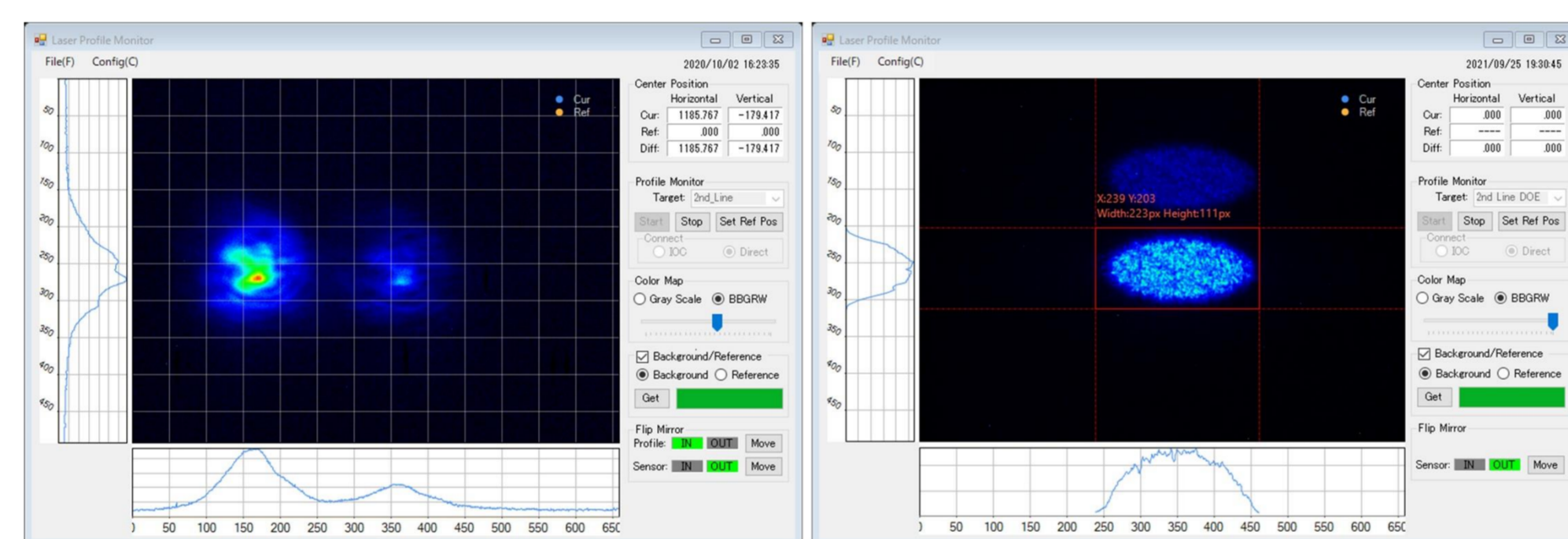
Vacuum chamber for DOE



DOE experimental setup



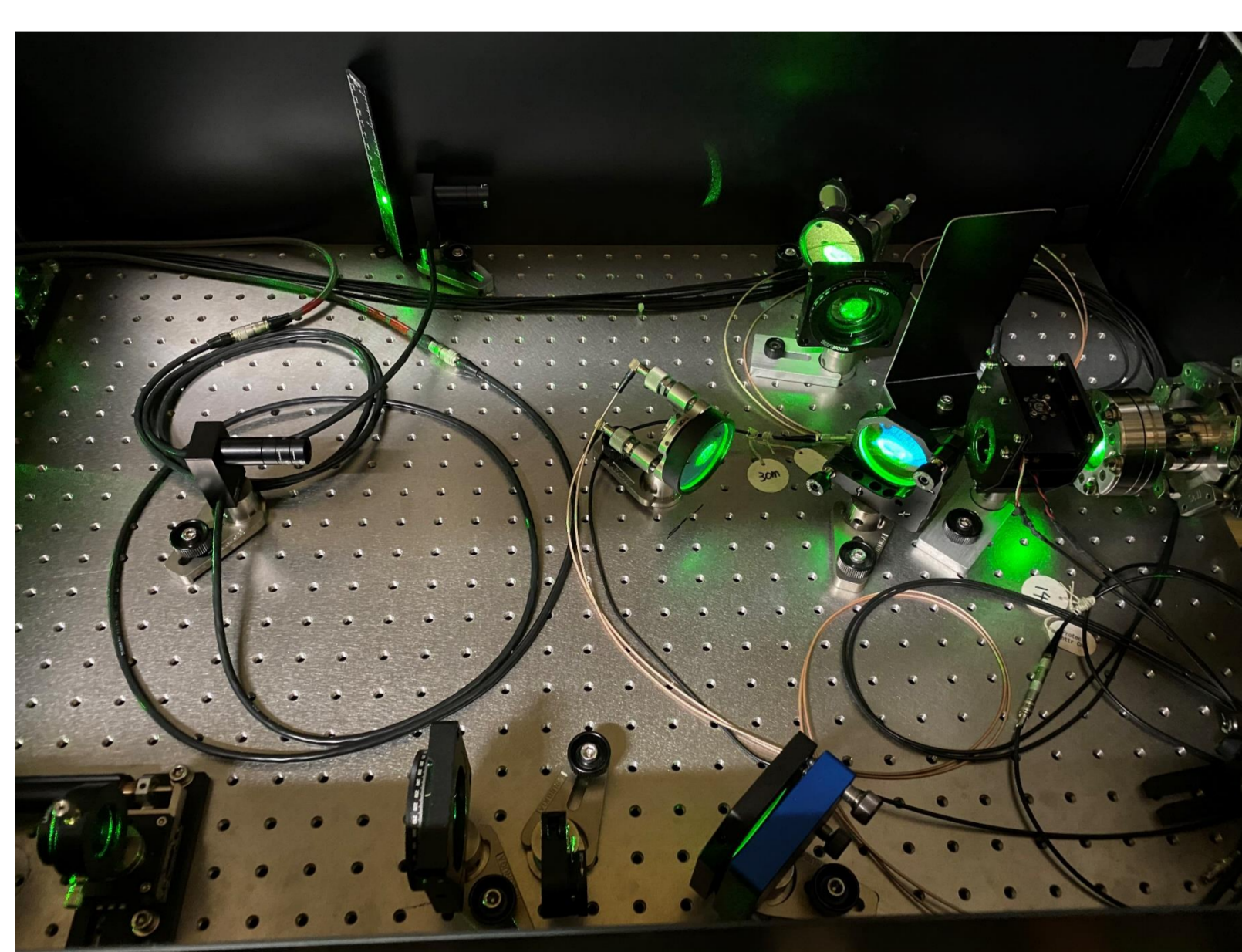
Optics layout of the 2nd laser line



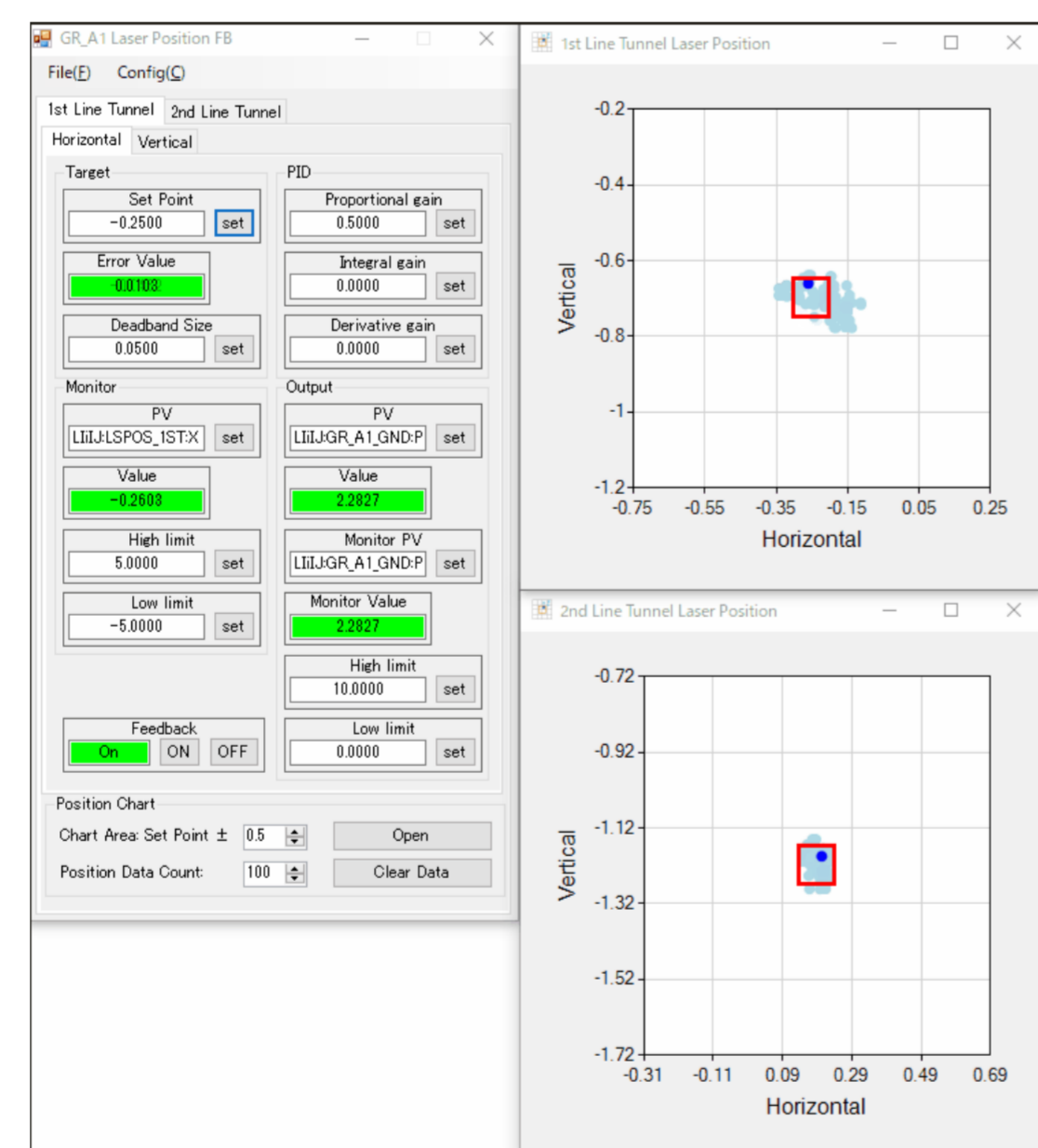
Laser beam profiles before and after reshaping

- Laser beam with flat-top intensity distribution can generate low emittance electron beam
- By use of diffractive optics component (DOE), the laser spatial reshaping is realized
- DOEs are applied in both laser lines
- DOE components are placed in small vacuum chambers and filled with Nitrogen gas
- 2D elliptical cross section flat-top laser beam is achieved (long axis: 6 mm, short axis: 3 mm)
- Discharge inside RF gun introduced by the laser beams are decreased dramatically
- Best emittance records for 2 nC electron beam are obtained at B sector and BT line

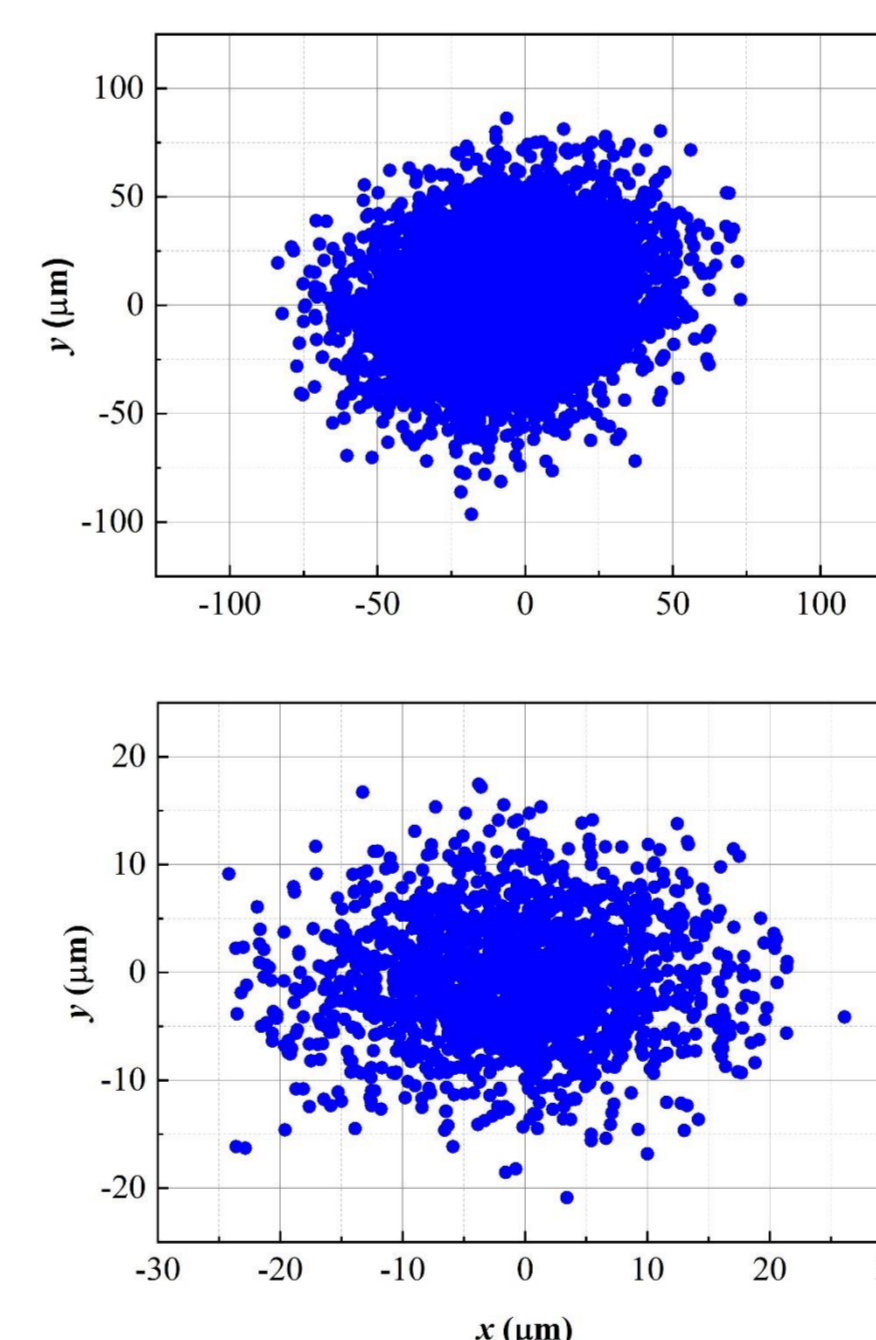
LASER POSITION MONITOR FEEDBACK SYSTEM FOR STABLE ELECTRON BEAM



Laser position sensor setup



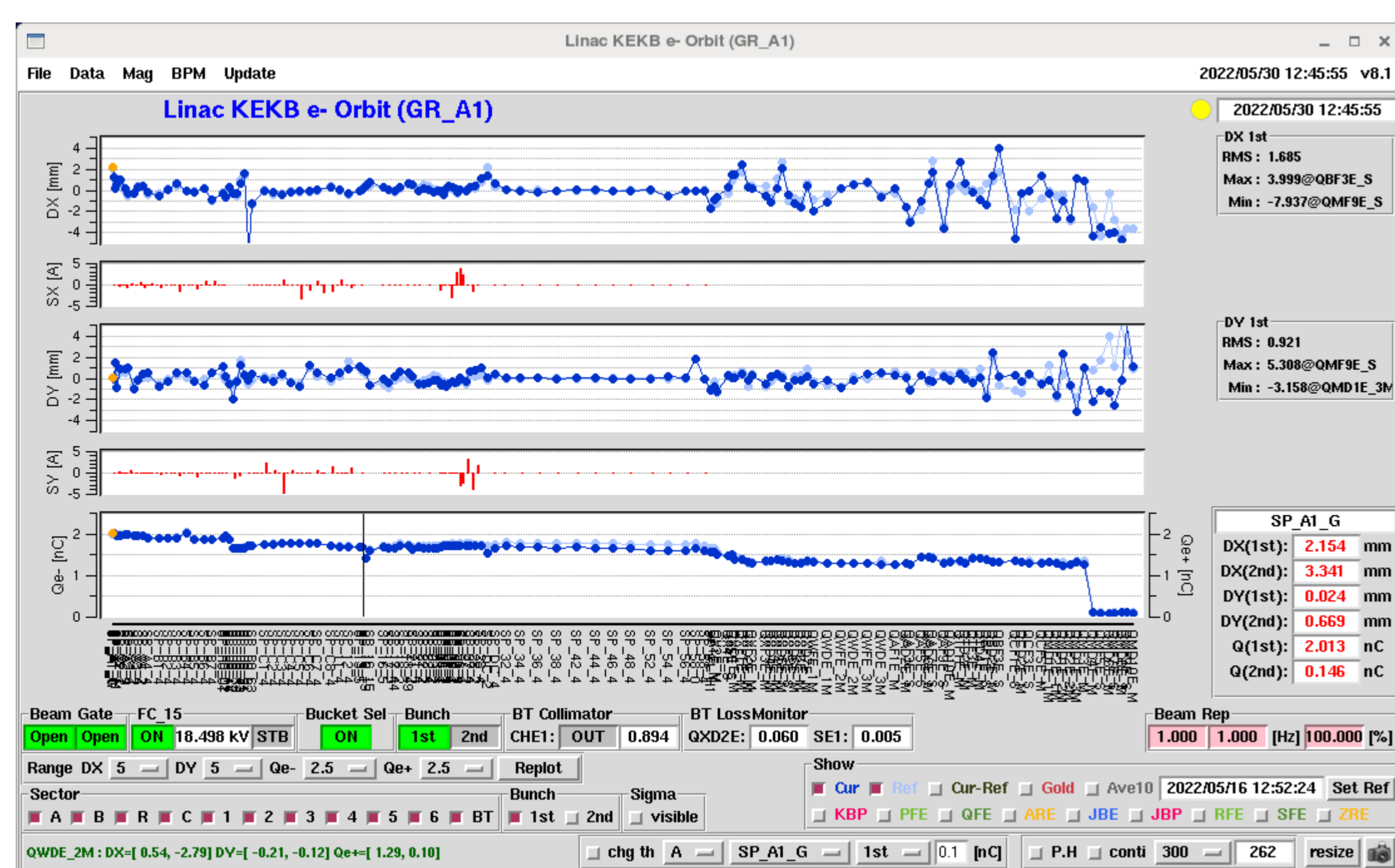
Position feedback system



Laser pointing stability w.o/w laser position monitor

- Laser position monitor feedback system is applied to suppress the electron beam instability which is induced by the laser position drift
- Three parts: Laser position sensor, piezo mirror mount and feedback system
- By use of this feedback system, the vertical pointing fluctuation has been suppressed to one-fifth of the previous value, the horizontal one is also decreased to half

LATEST COMMISSIONING RESULTS AND PLAN



Electron orbit for SuperKEKB HER injection

Wire scanner results at B-sector and BT line for 2 nC electron beam

	Horizontal	Vertical
Linac B-sector	8.57 μm	8.89 μm
BT Line	20.95 μm	17.82 μm

- 2 nC electron beam for HER injection has been being used in 2022a commissioning by use of Yb/ND hybrid laser system
- Reshaping of laser spatial distribution is realized by use of DOE. The best emittance results have been achieved at Linac B sector and BT line by 2 nC electron beam
- Laser position monitor system has been applied for stabilizing laser pointing stability. Stable and continuous electron beam is generated for HER injection
- To decrease electron beam energy spread, temporal reshaping for laser will be carried out in the future by new Yb:YAG laser system