

# ERL-based High-power FEL Source for EUV Lithography

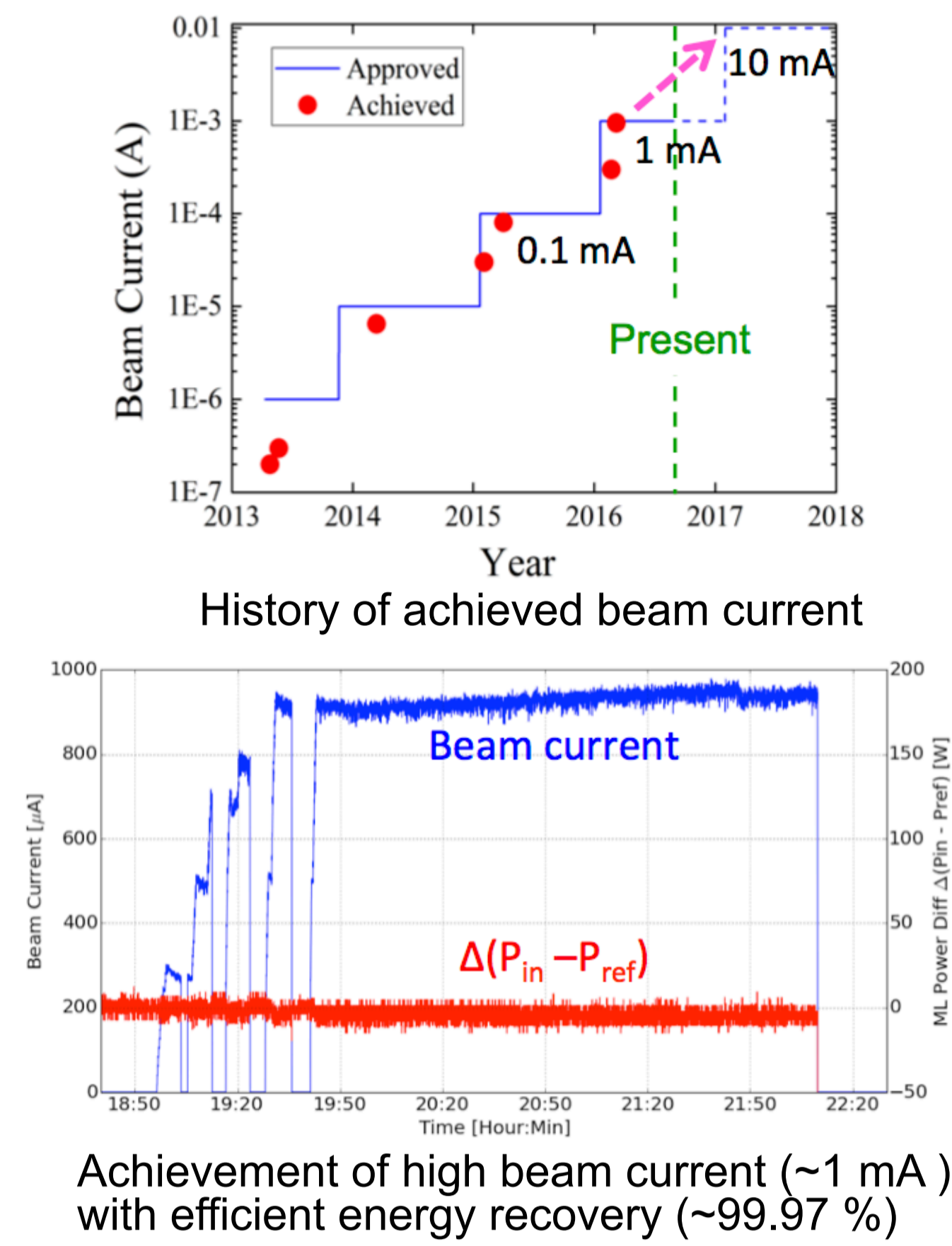
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## Abstract

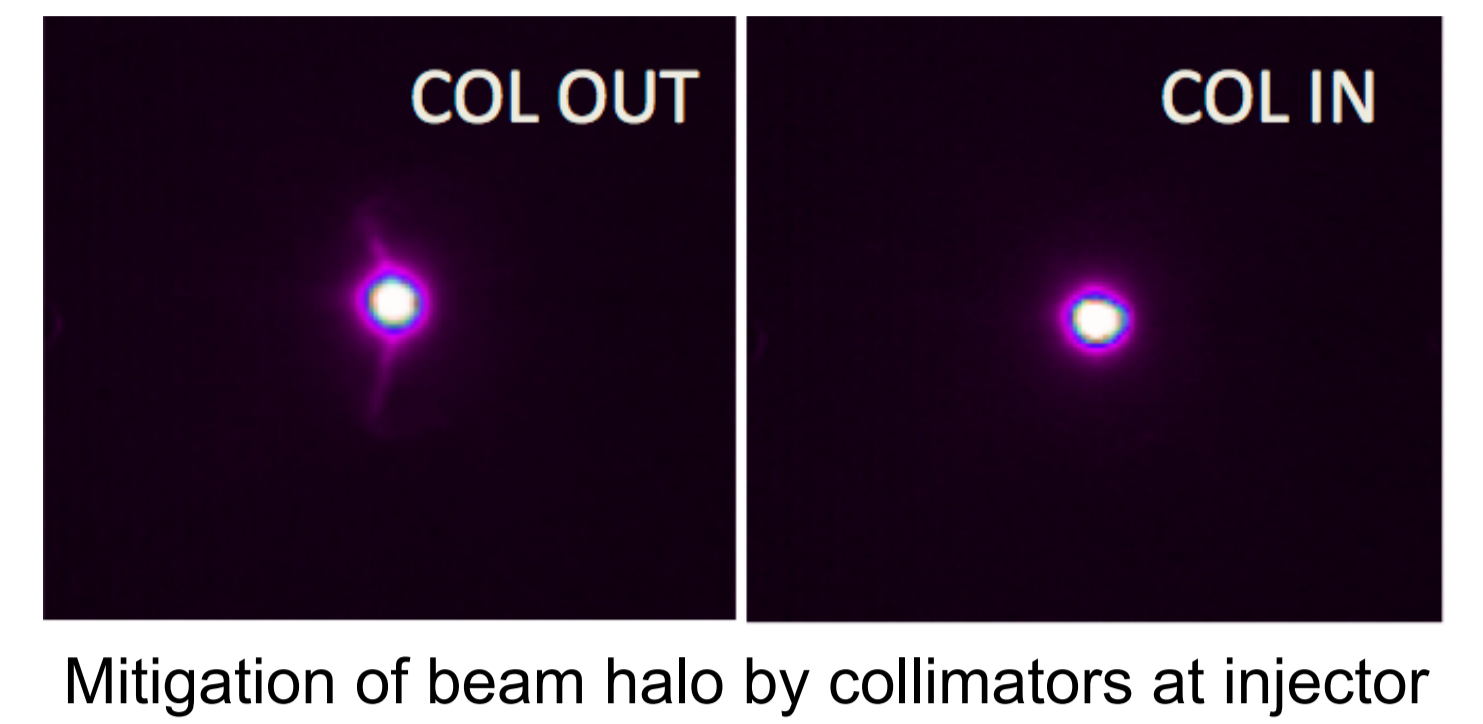
An energy recovery linac(ERL)-based free electron laser(FEL) is a possible candidate of a tens of kW EUV source for lithography. The ERL can provide a high-current and high-quality electron beam for the high-power FEL and also greatly reduce the dumped beam power and activation compared to ordinary linacs because it recover most acceleration energy from the electron beam before the beam dump. We have designed an ERL-based EUV-FEL source using available technology without too much development and performed simulations of the electron-beam transportation and SASE-FEL to evaluate the electron beam parameters and the FEL performance. This paper will present a feasible design of a 10-kW class ERL-FEL source operated at 13.5 nm with the simulation results. This design can be applied to a prototype of the EUV-FEL source for lithography. This paper will also briefly report recent progress of the operational ERL at KEK, the Compact ERL (cERL), which is a basis for designing the EUV-FEL source.

## Compact ERL(cERL) and its progress

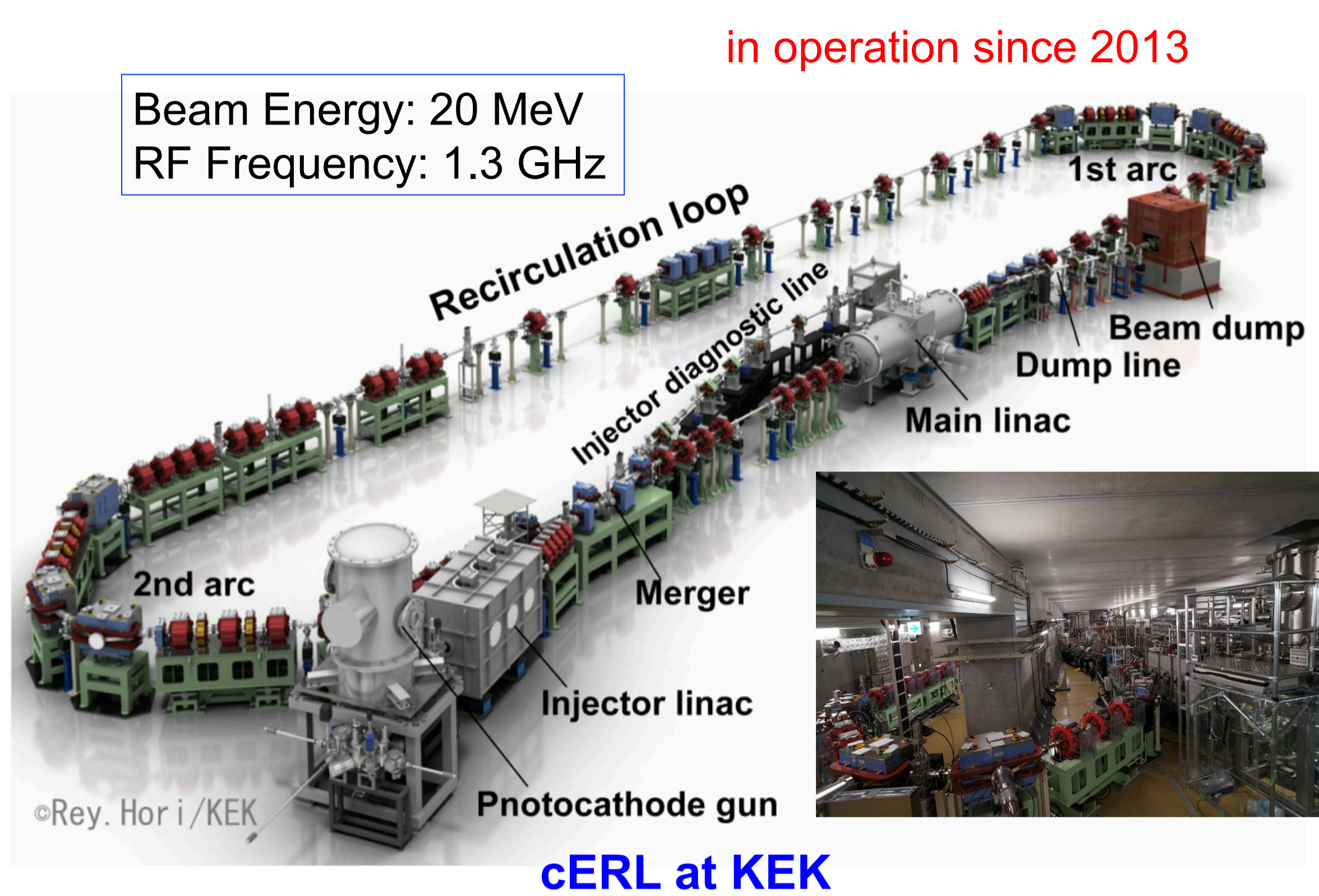
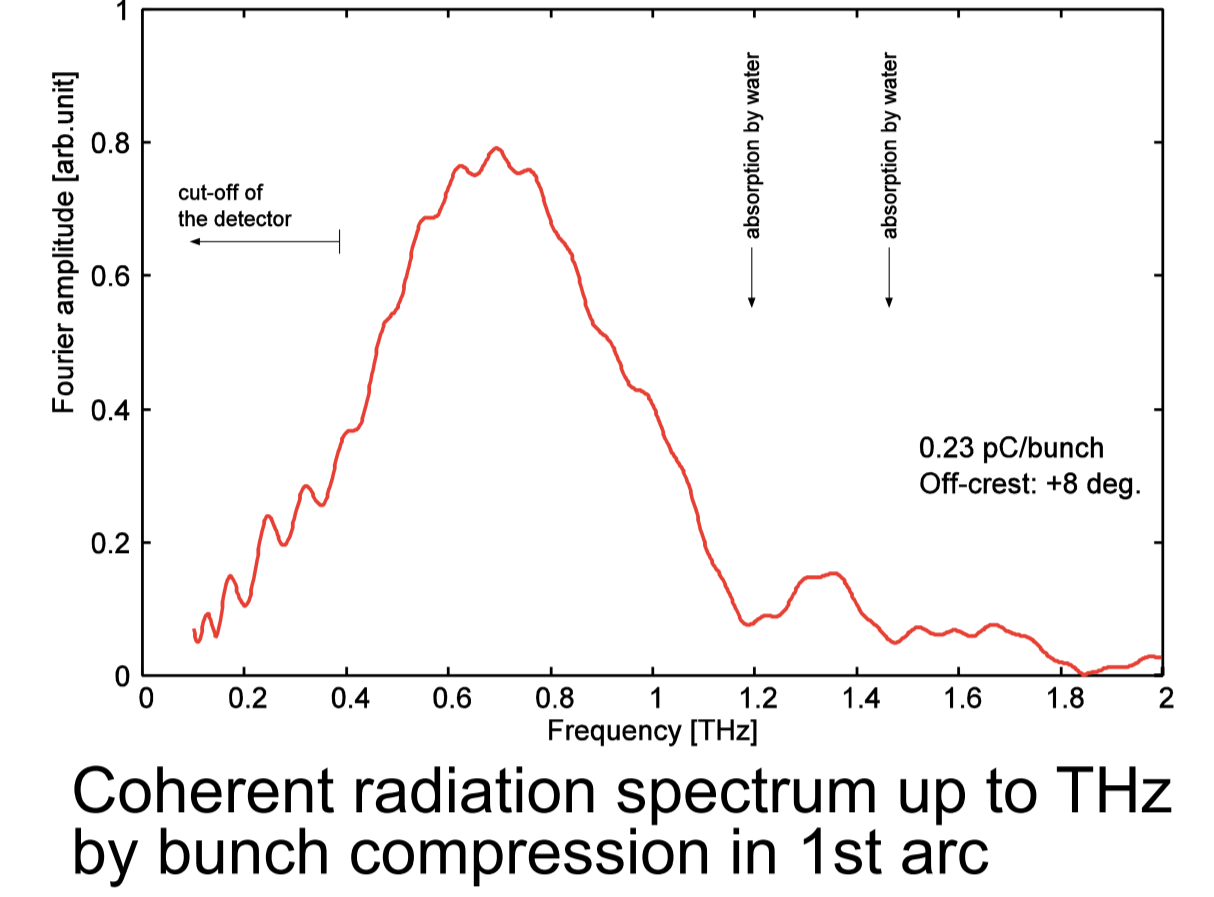
### (1) High average current



### (2) Beam loss reduction

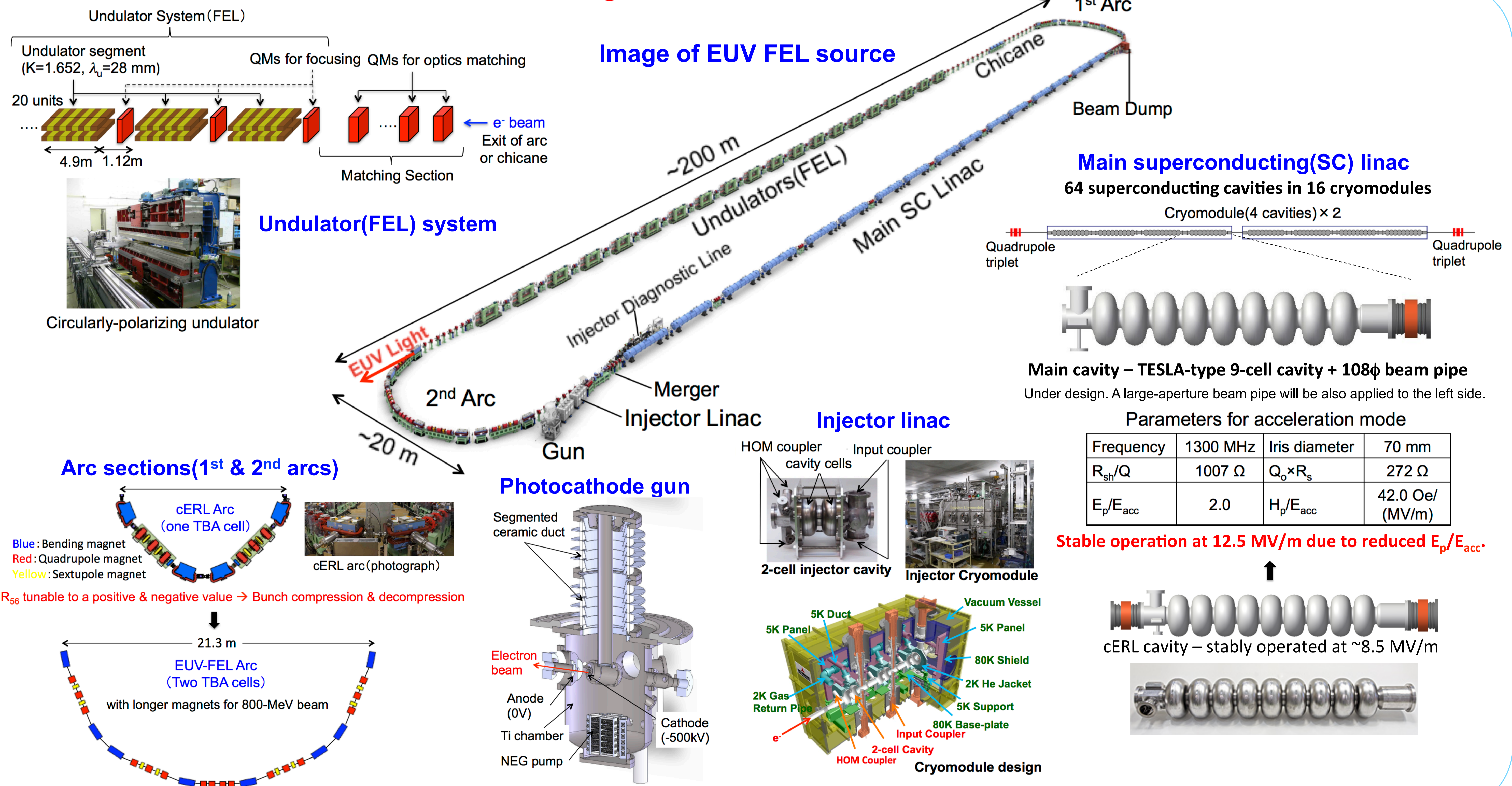


### (3) Bunch compression

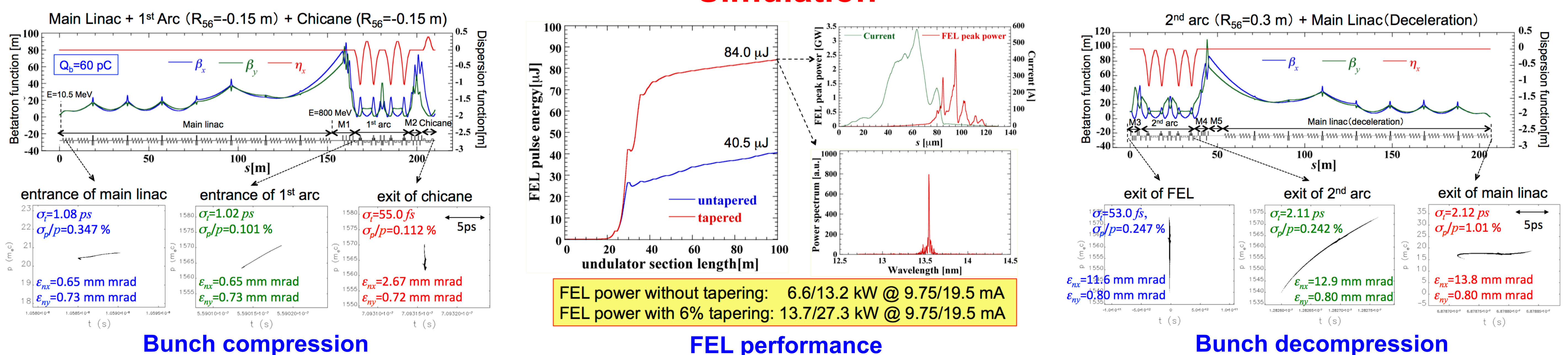


## Design of EUV-FEL Source

### Image of EUV FEL source



## Simulation



Strategy to realize the EUV-FEL source → See the next poster presentation by Prof. H. Kawata

## Conclusions

- (1) An ERL-based EUV-FEL source is designed using available technologies without too much development such as the cERL resources.
- (2) The electron beam is successfully transported without any beam loss in the simulation from the gun to the exit of the decelerating main linac.
- (3) FEL power more than 13 kW can be generated at 9.75 mA in the design of the EUV-FEL source to power multiple scanners simultaneously.