

# **PROGRESS OF RESEARCH**

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# MOTIVATION

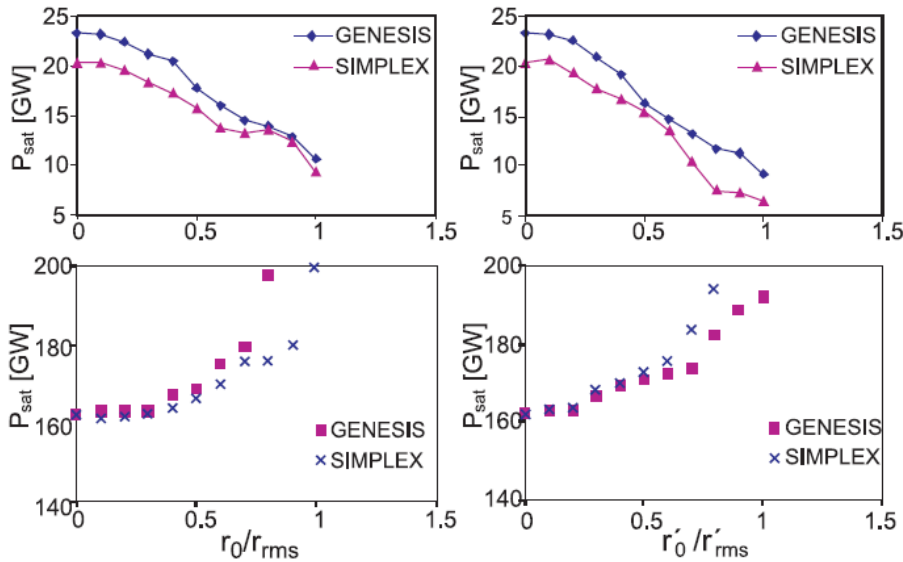


Figure 3: Saturation power (top) and saturation length (bottom) versus beam initial space (left) and angular (right) offsets.

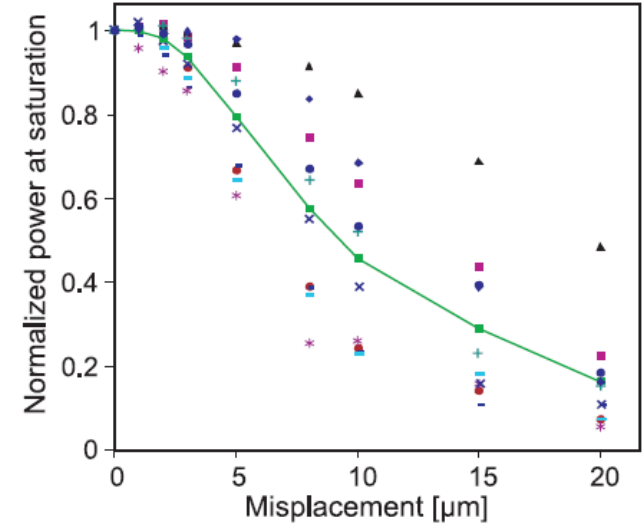


Figure 4: The saturation power versus quadrupole rms misalignments for 10 random seeds.

*V. Khachatryan, Proceedings of EPAC08, Genoa, Italy*

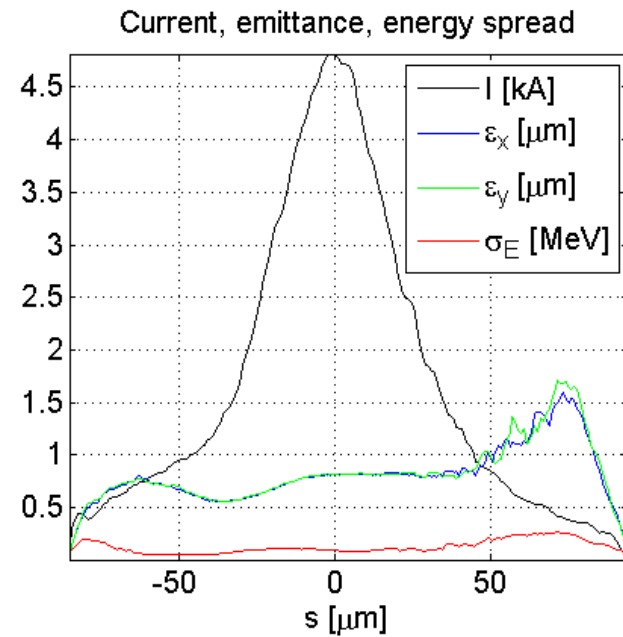
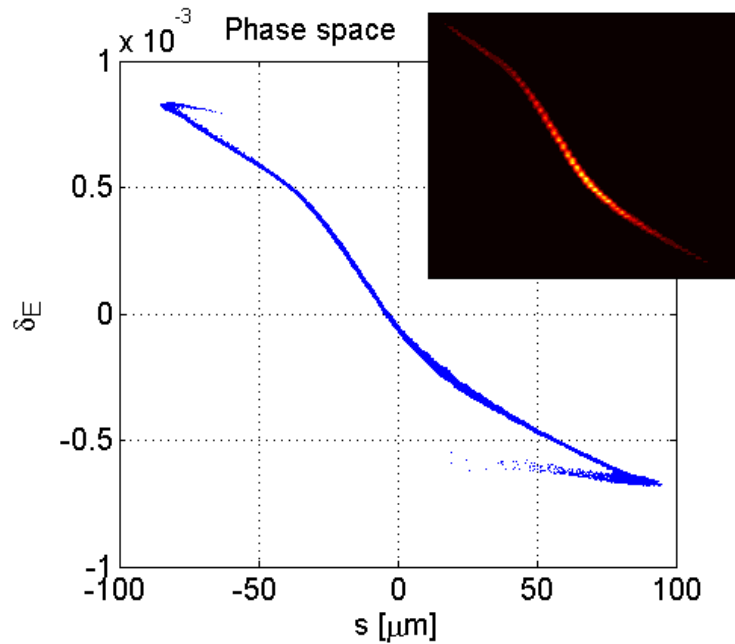
- Steady-state simulation of the radiation process at the XFEL SASE1 was presented. The impacts of the beam initial offset and quadrupole misalignment were investigated.
- Time-dependent simulations of the radiation process after aligning quadrupole misalignment are needed for more precise results in the XFEL.

# TASK & GOAL

- Tasks
  - Start to end (S2E) simulation for XFEL
  - Orbit correction in undulator section of XFEL
- Simulation codes
  - Gun → ACC1 : ASTRA
  - ACC39 → T2 : ELEGANT
  - SASE1 : GENESIS
- Orbit correction simulation
  - ELEGANT : correct the distorted orbit induced by errors
  - GENESIS : calculation of the radiation process with aligned quadrupoles

# S2E - ELEGANT

## Beam profile after main linac



Remove about 3% bad particles in the analysis

$$\epsilon_{\text{proj},x} = 0.9 \mu\text{m}$$

$$\epsilon_{\text{proj},y} = 2.9 \mu\text{m}$$

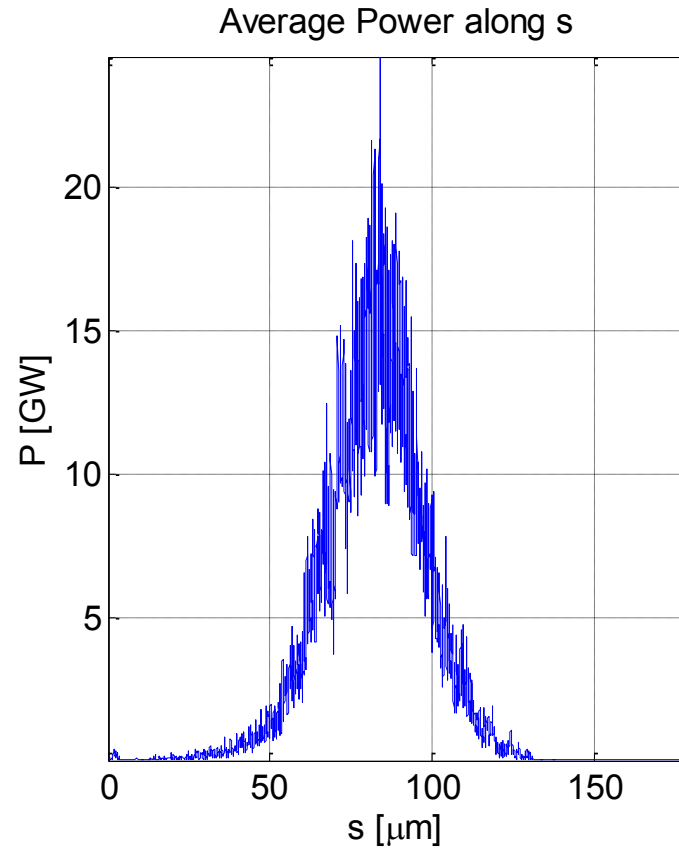
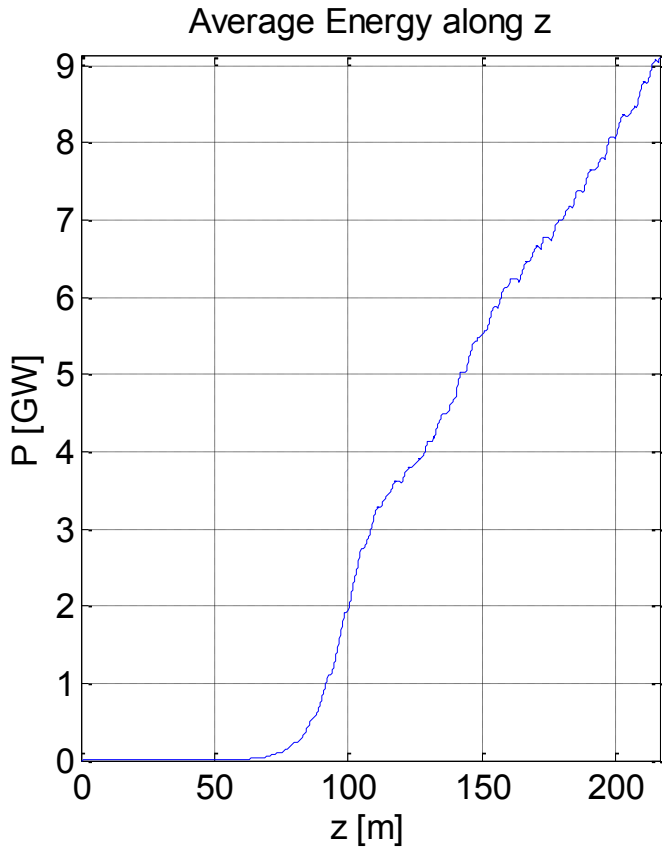
$$\text{FWHM} = 164.7 \text{ fs}$$

### Compression factors

C1	C2	C3	C
3.5	8.0	4.0	112

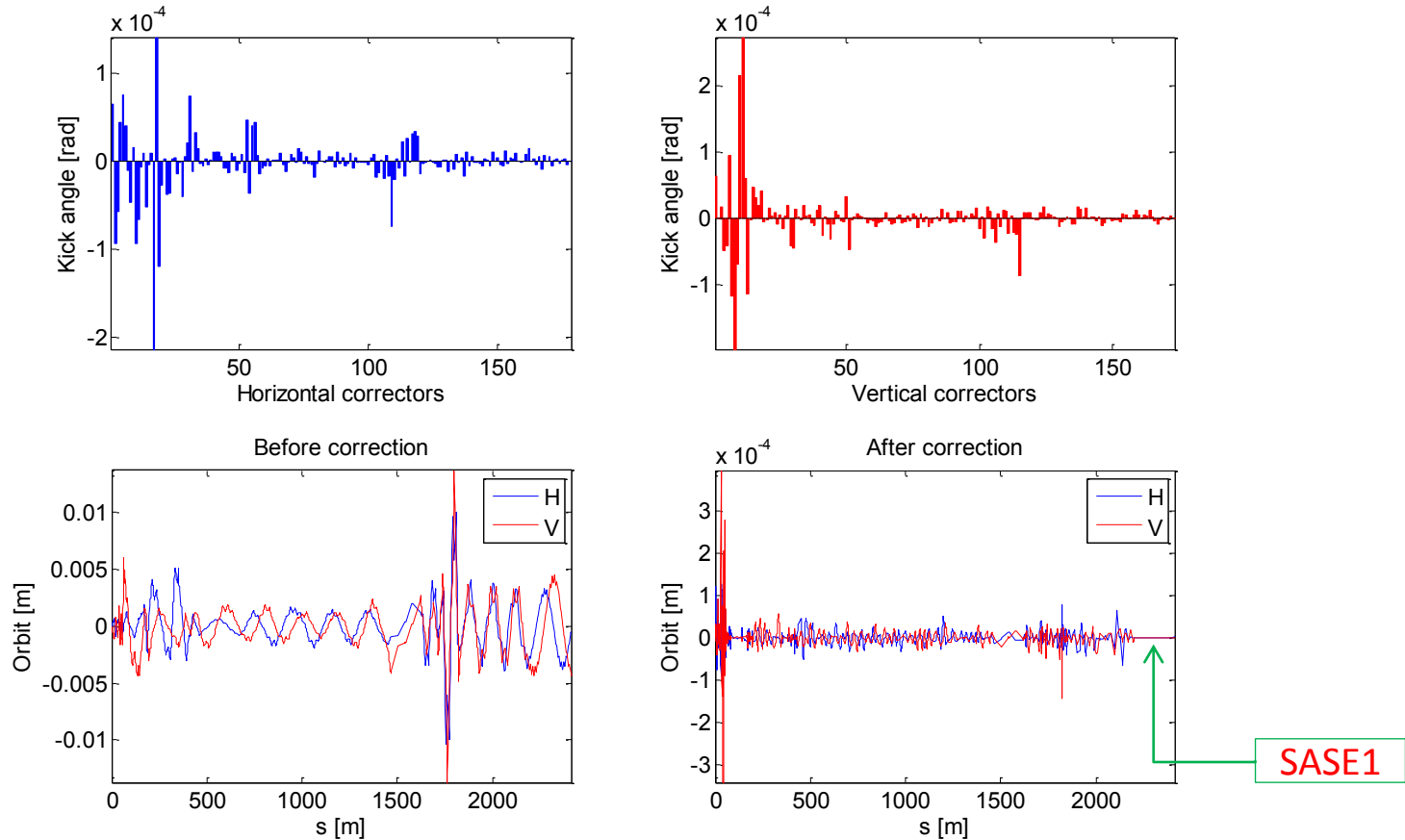
# S2E - GENESIS

Average radiation power (1 seed)



# Orbit correction - ELEGANT

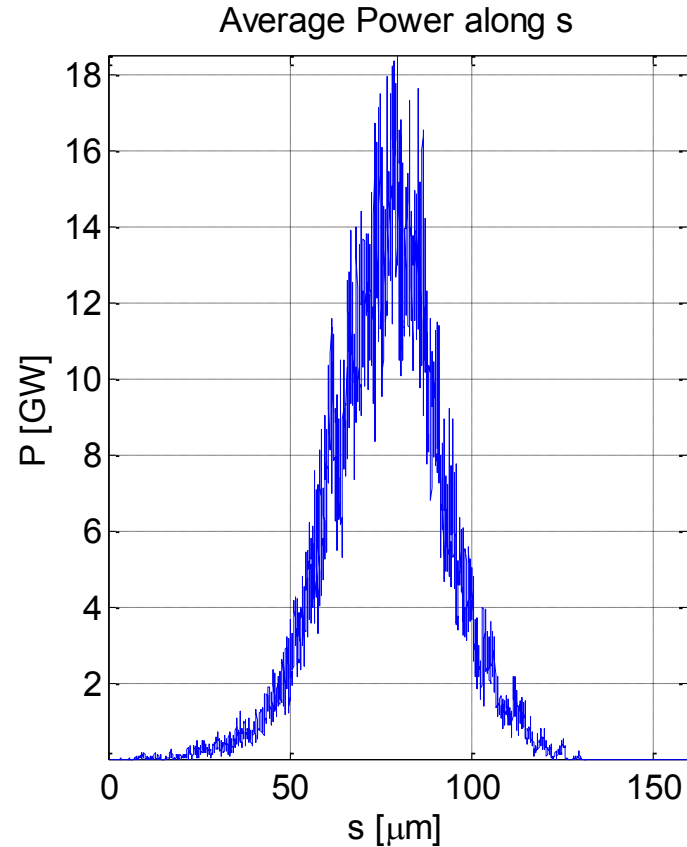
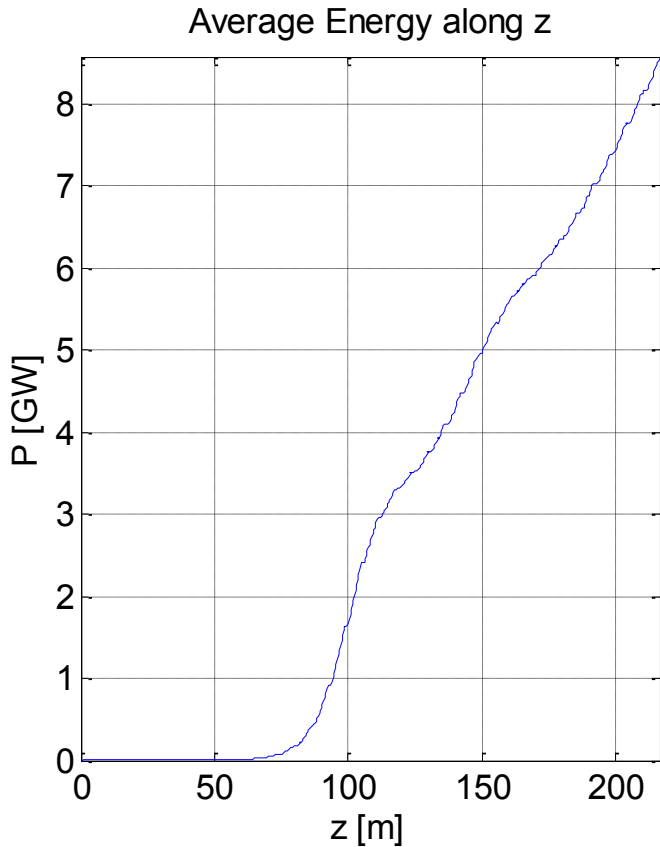
## Corrector strength & orbit size (1 seed)



Quad-misalignment : 100  $\mu\text{m}$

# Orbit correction - GENESIS

Average radiation power (1 seed)



# SUMMARY

- S2E
  - ELEGANT : achieved
  - GENESIS : simulations are needed for different random seeds
- Orbit correction
  - ELEGANT : distorted orbit is corrected well in undulator section ( $< 1 \mu\text{m}$ )
  - GENESIS : on going