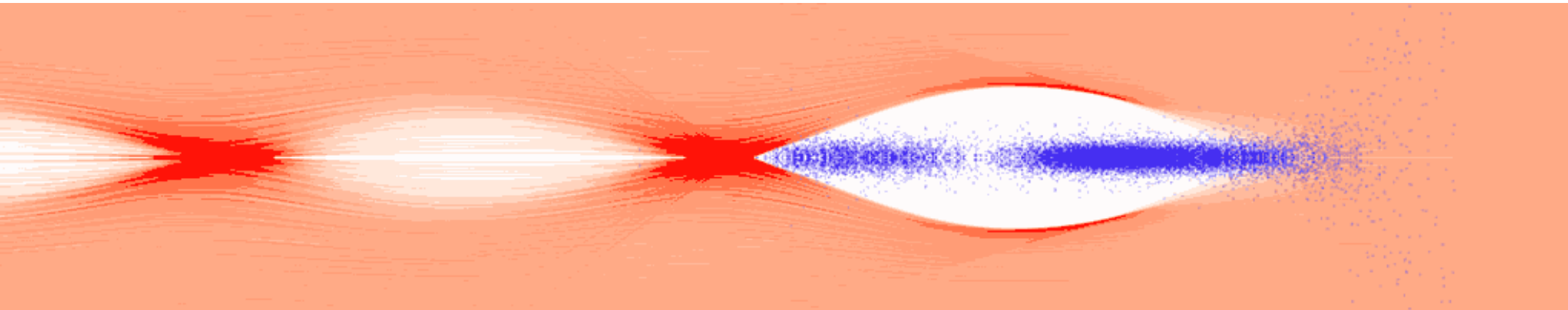


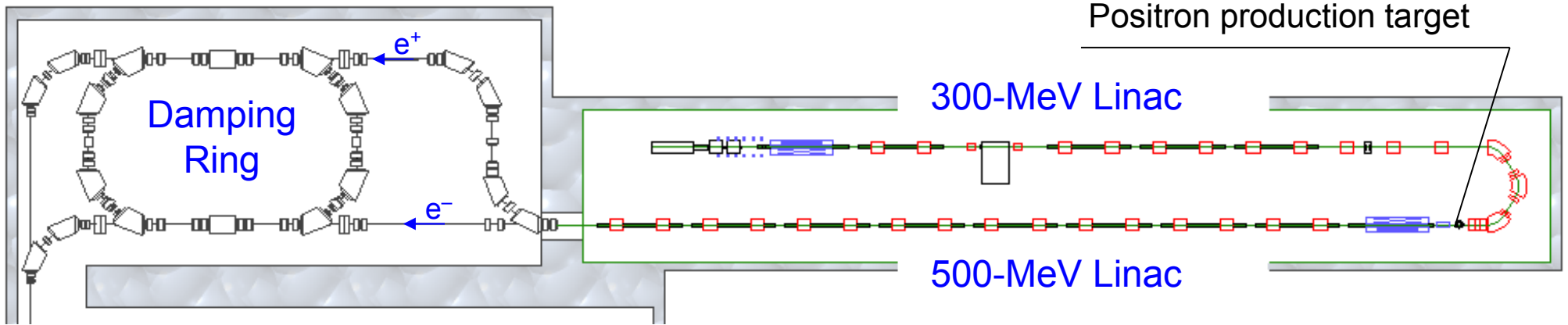
# The facility for 500 MeV plasma wake-field acceleration experiments at Budker INP



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Pavel Logatchov, Alexander Burdakov

Budker Institute of Nuclear Physics, Novosibirsk, Russia

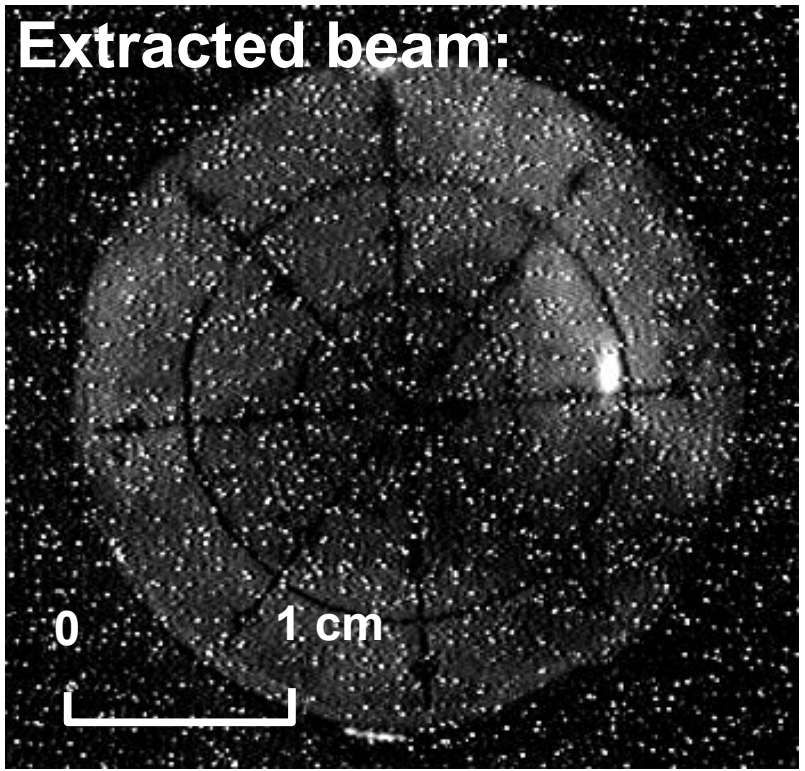
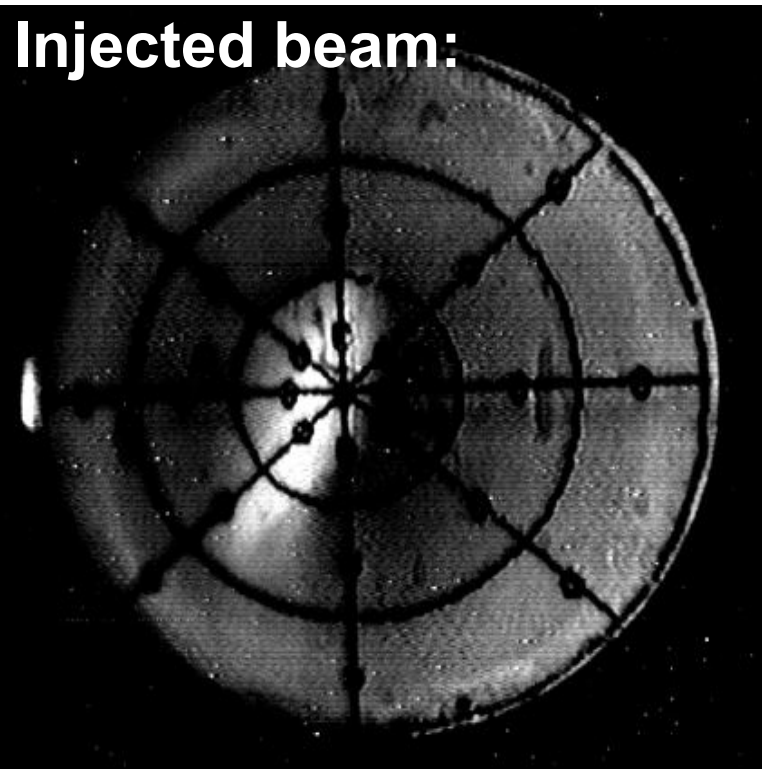
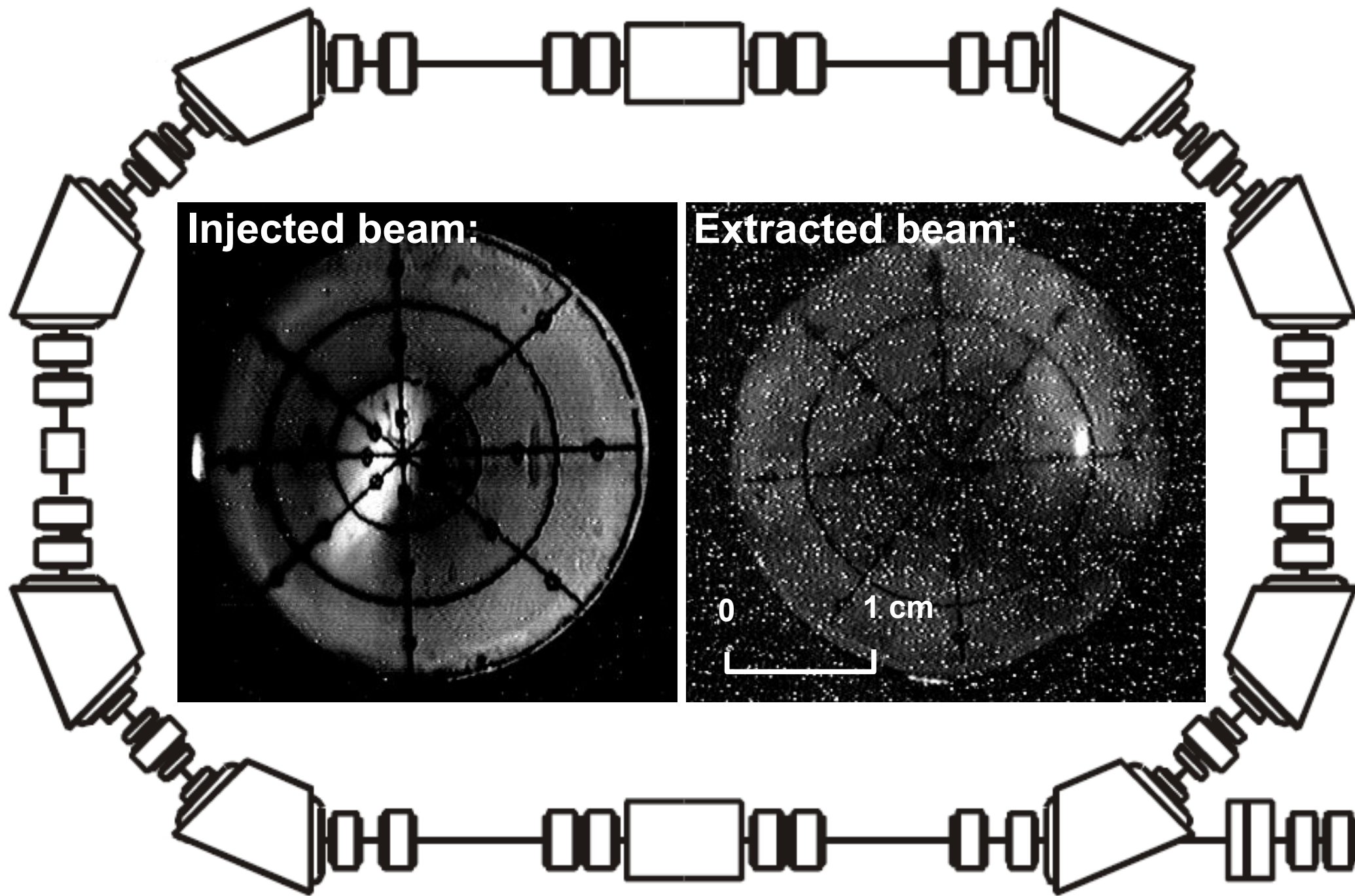
# VEPP-5 Injection Complex

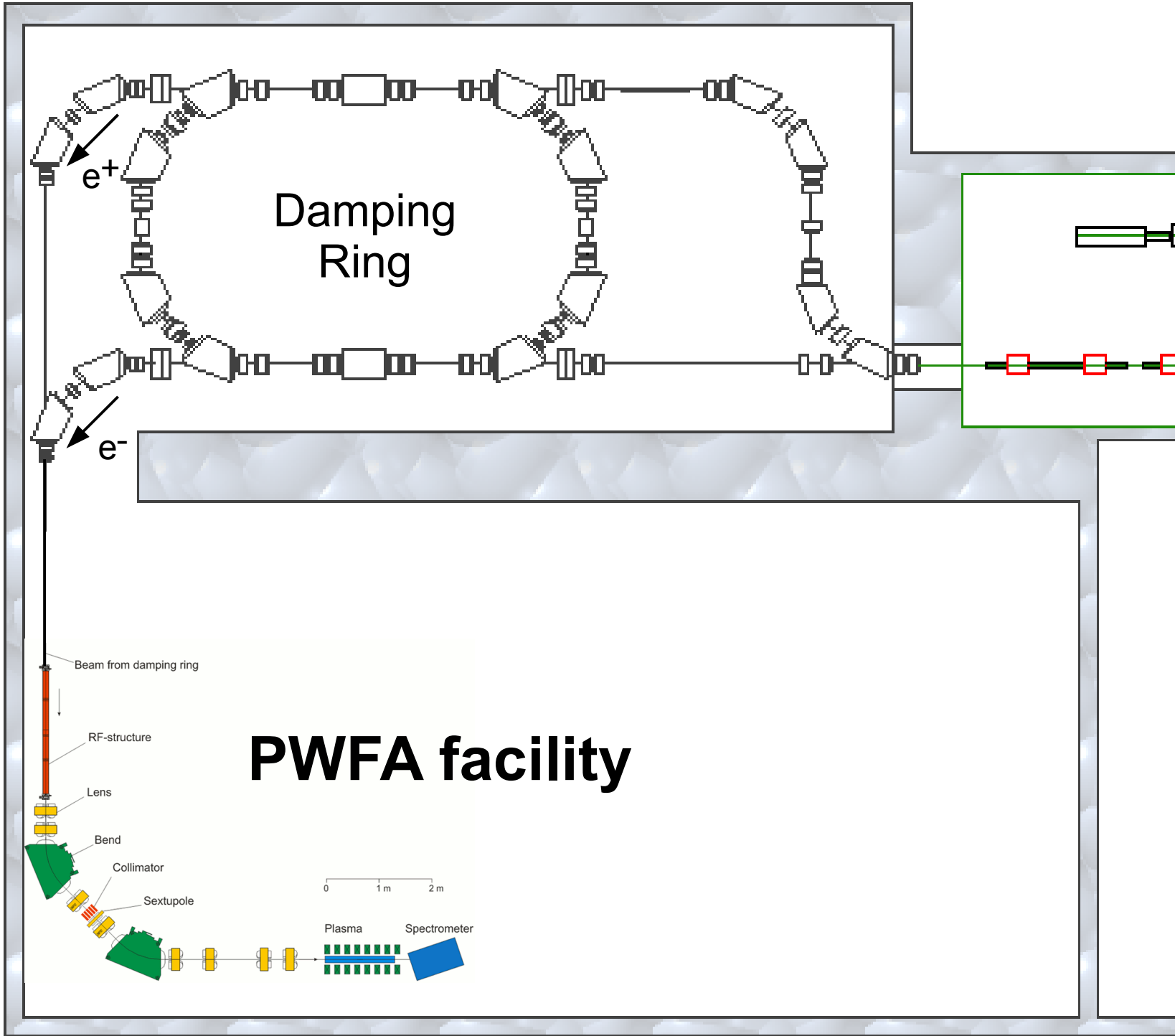


**Electron beam obtained  
in the damping ring:**

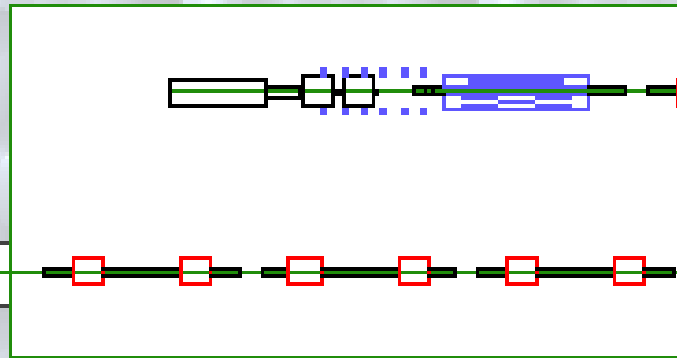
$$\begin{aligned} E &= 200 \dots 400 \text{ MeV} \\ N(e^-) &= 2 \cdot 10^{10} \\ \sigma_S &= 8 \text{ mm} \quad (I_{\text{peak}} = 50 \text{ A}) \end{aligned}$$

Positron beam commissioning  
is scheduled for 2011

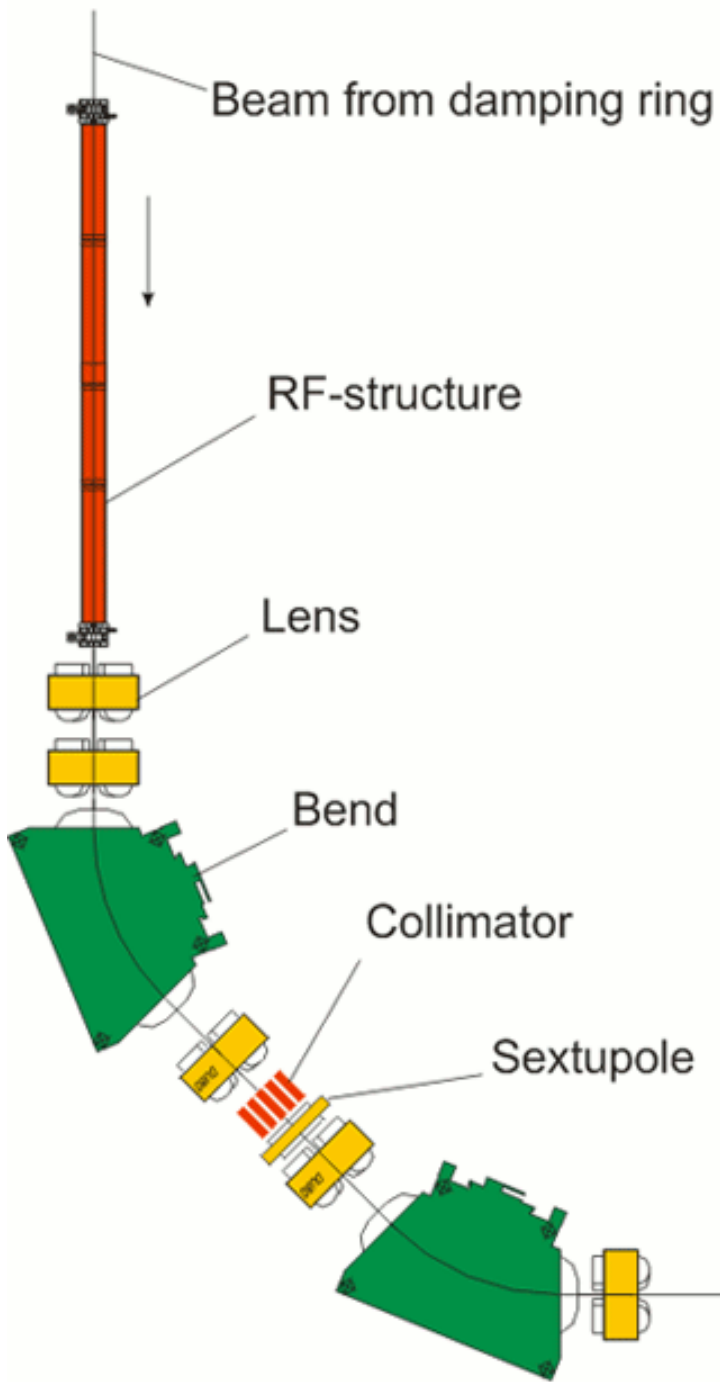




# PWFA facility

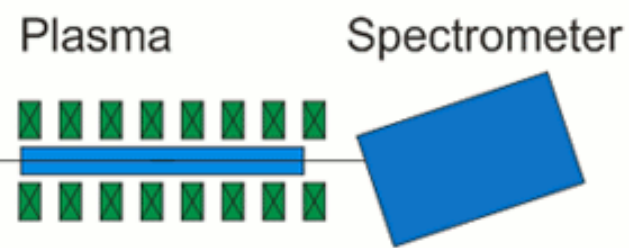
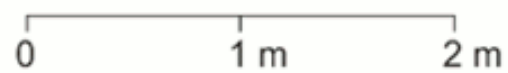


# PWFA experiment at Budker INP

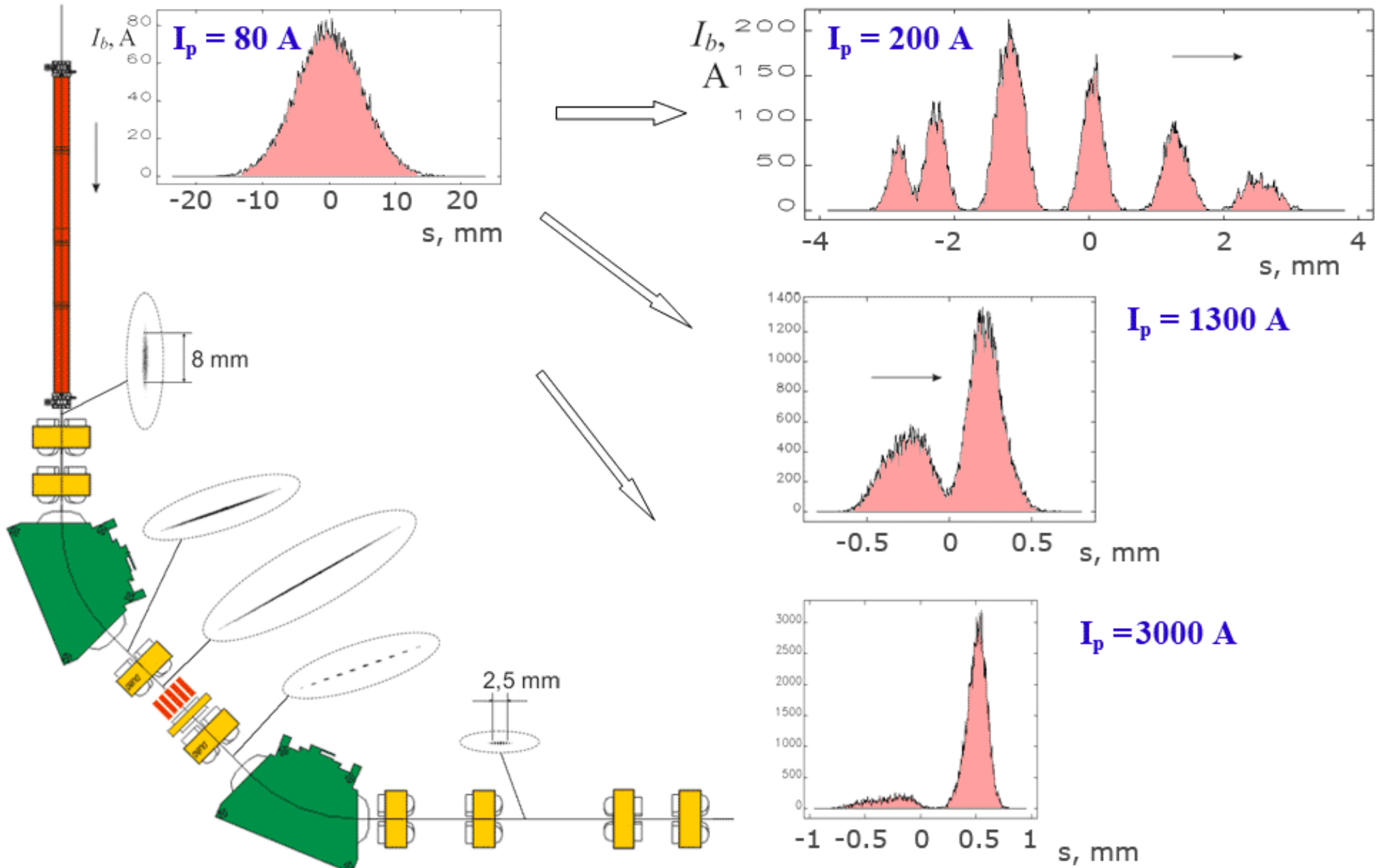


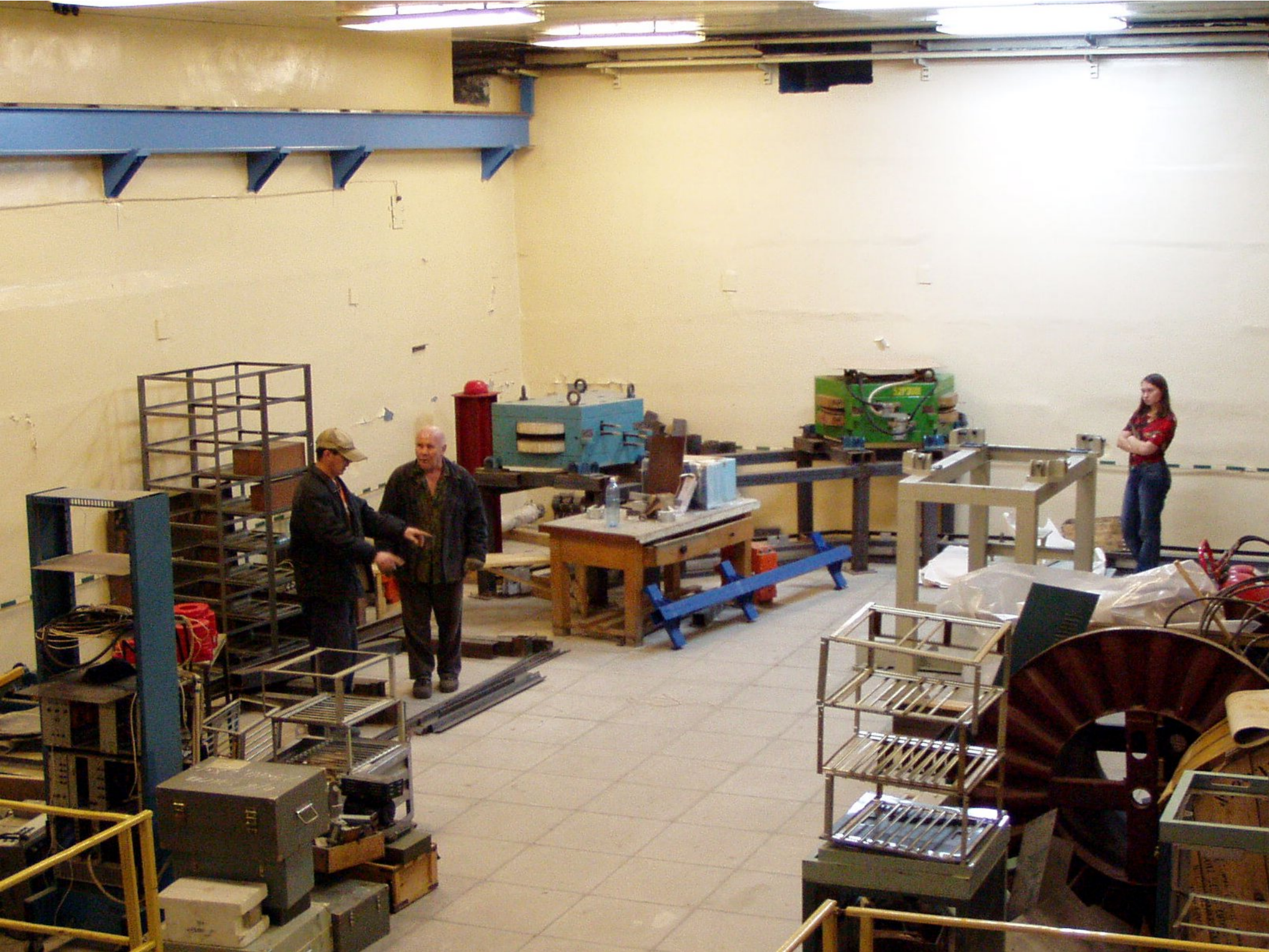
Main goal: demonstration of the beam quality in a plasma wake-field accelerator

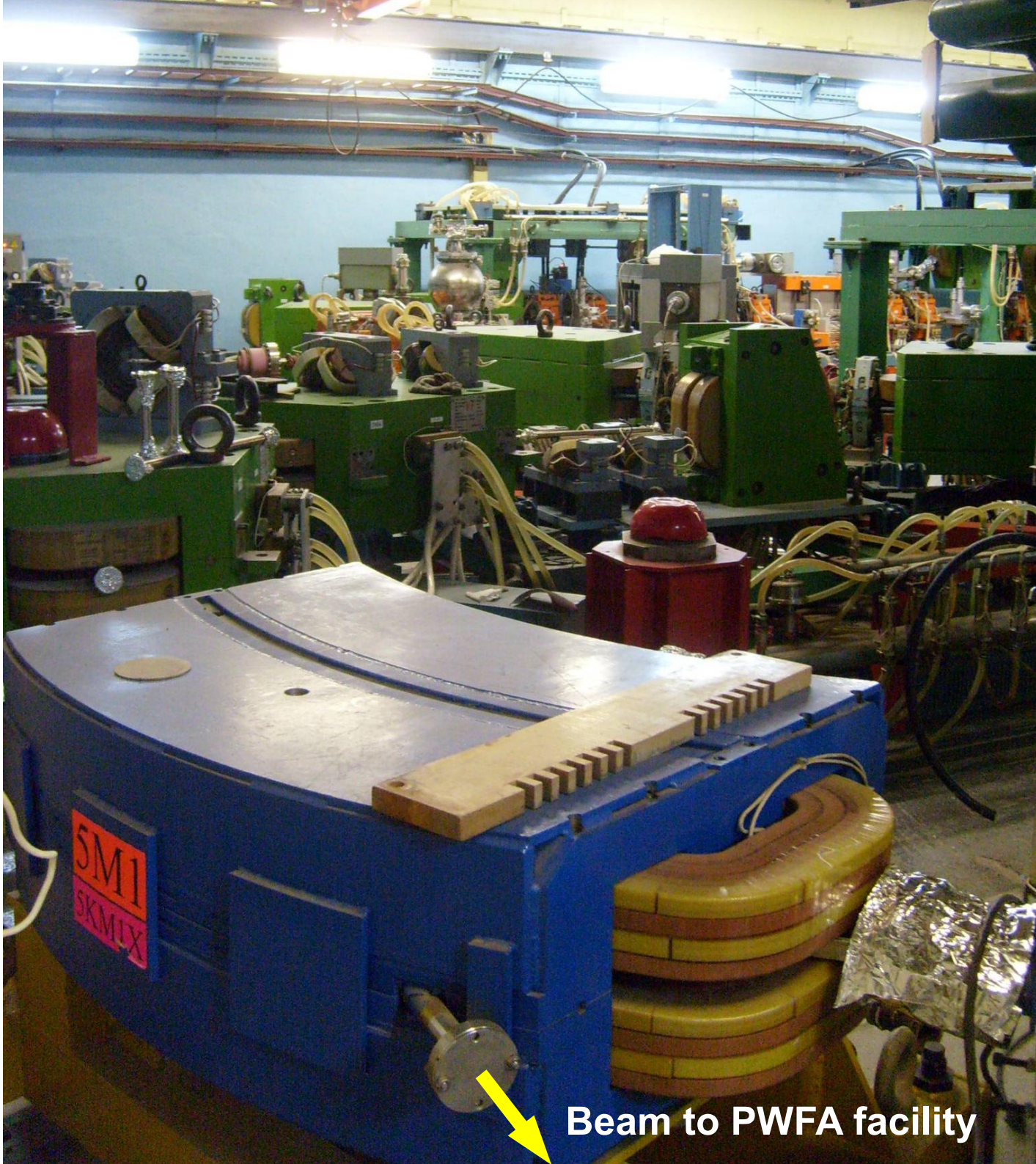
also: physics of short and dense electron bunches (production, interaction with plasmas, dielectric waveguides, etc.)



# Beam compression (ELEGANT tracking including CSR)



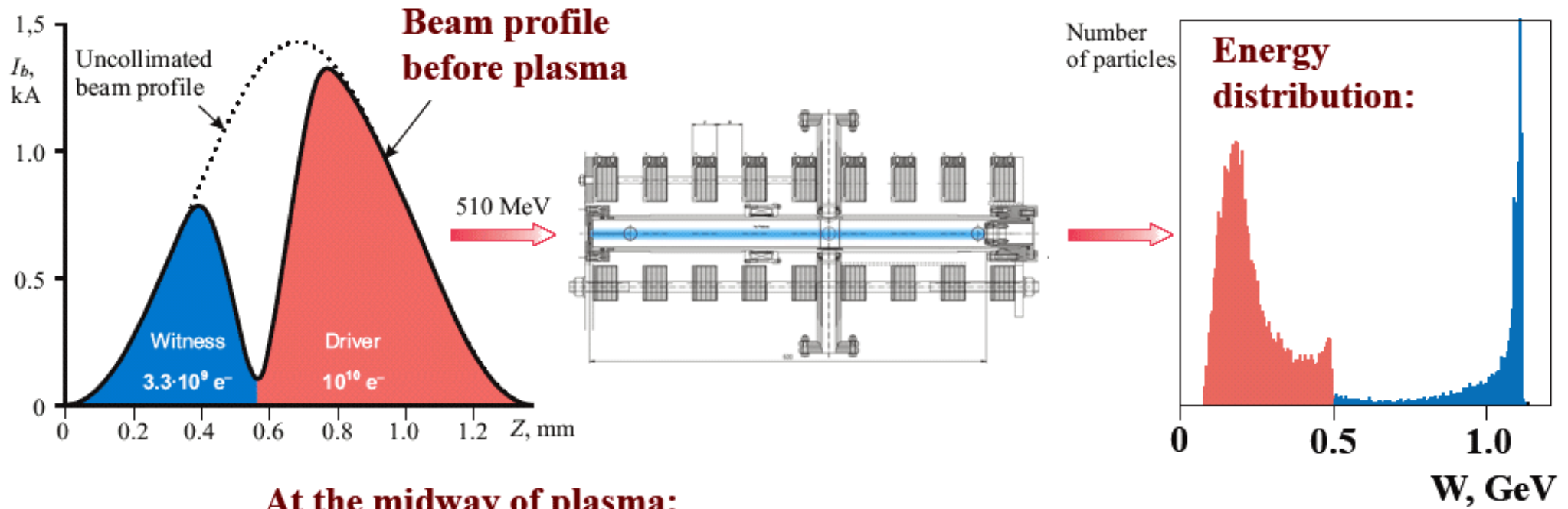




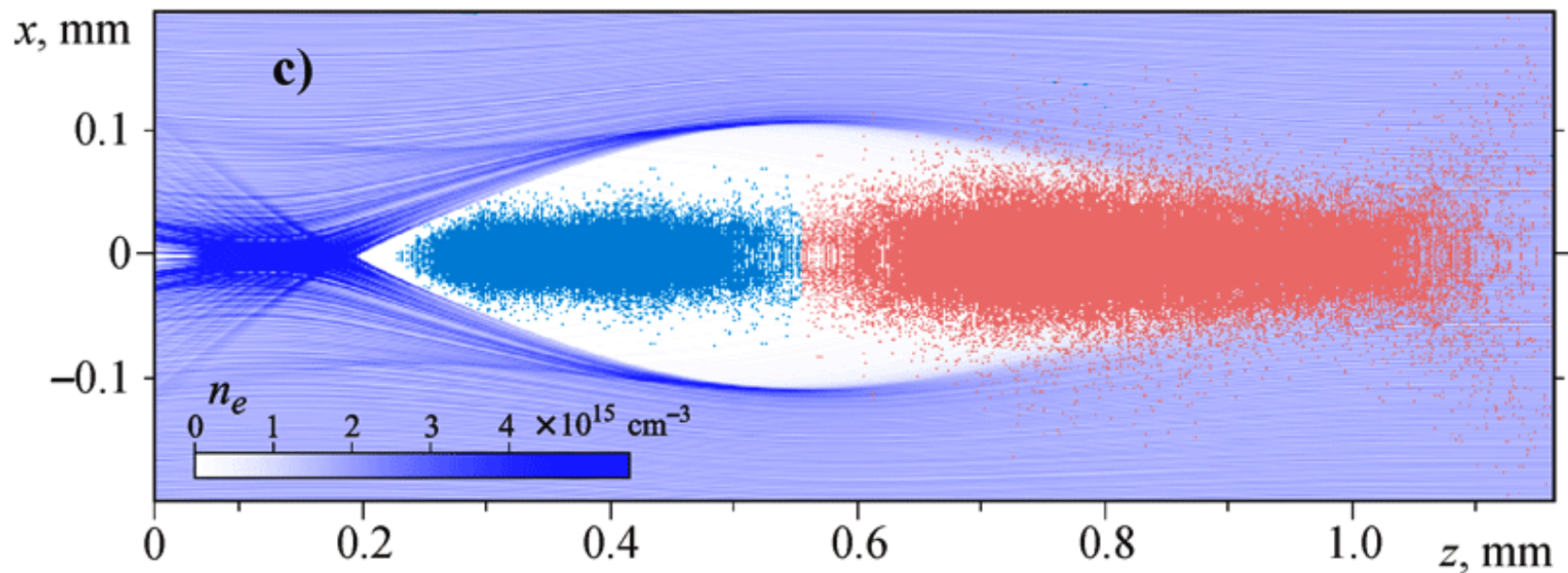
Beam to PWFA facility



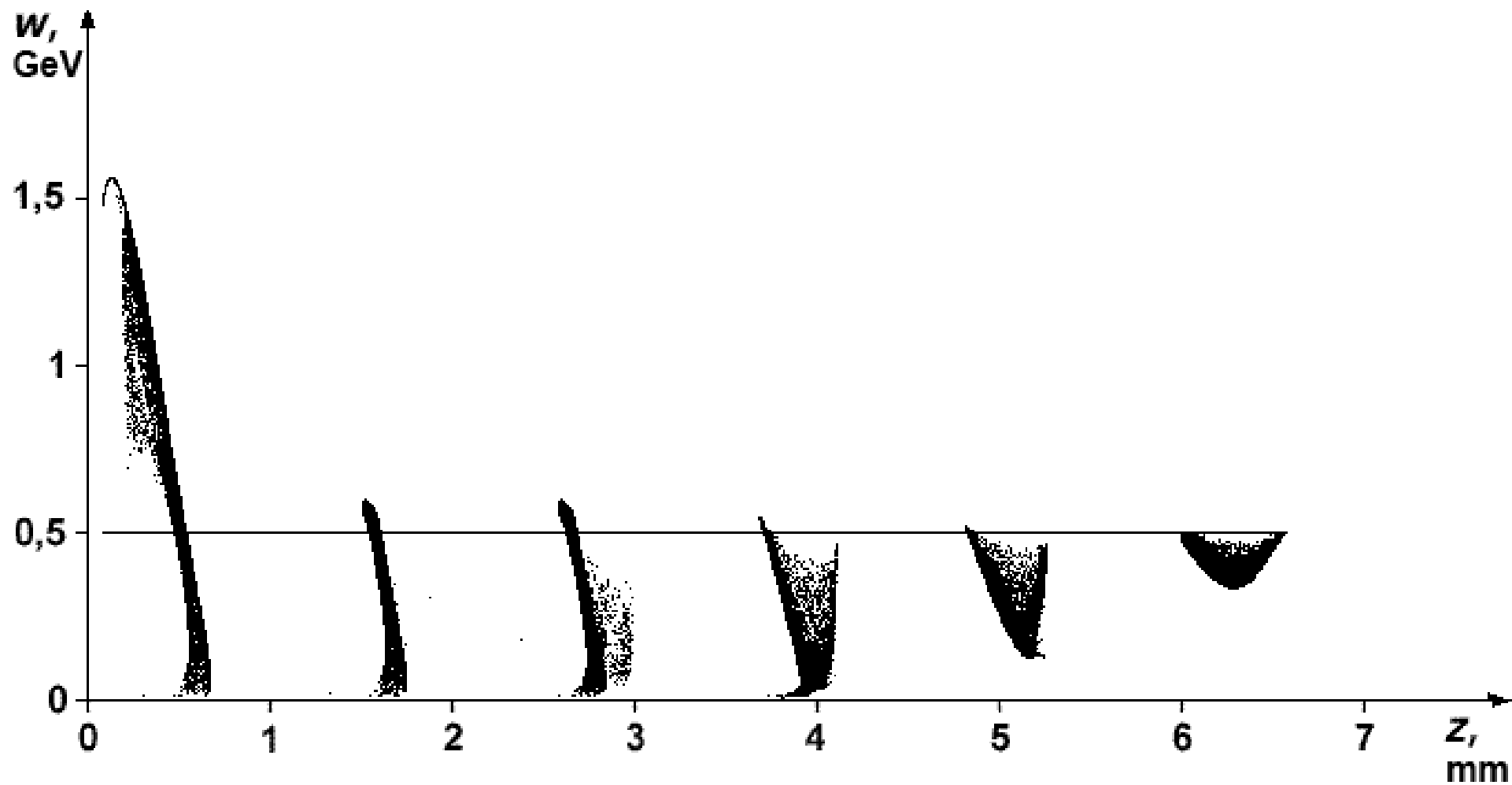
# Simulations: expected results

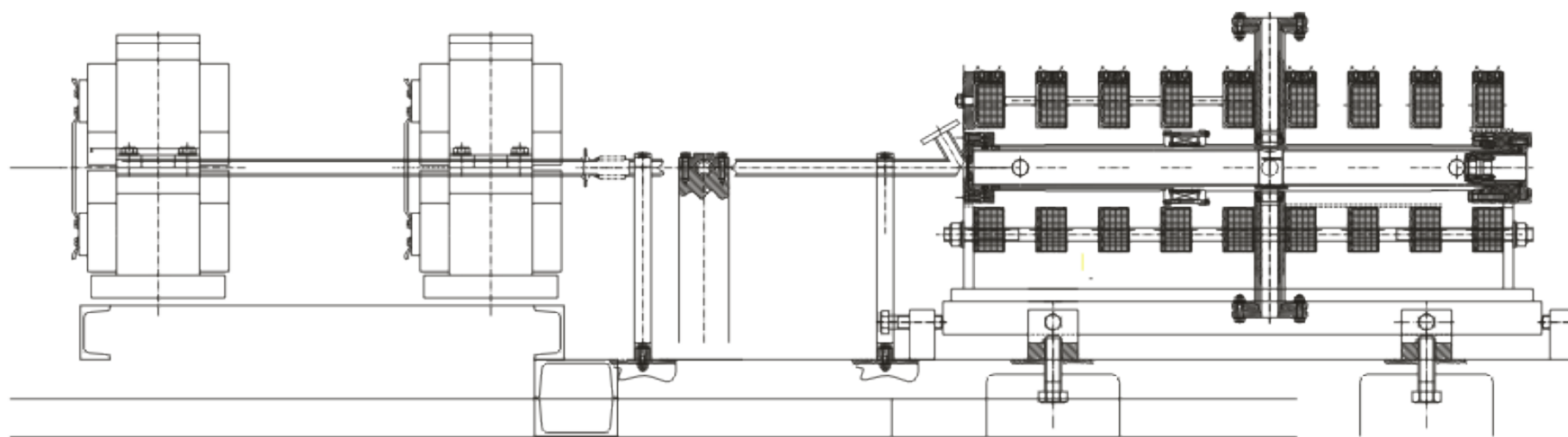
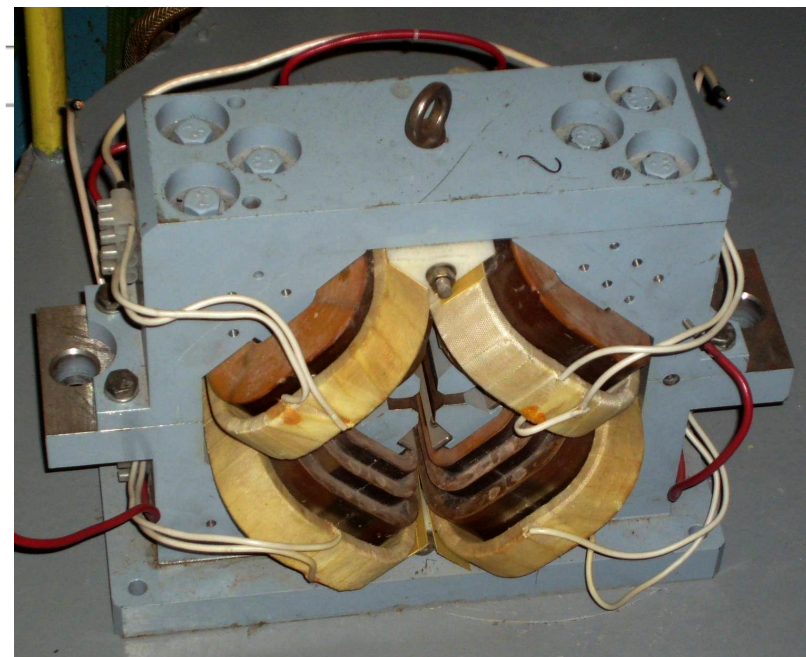
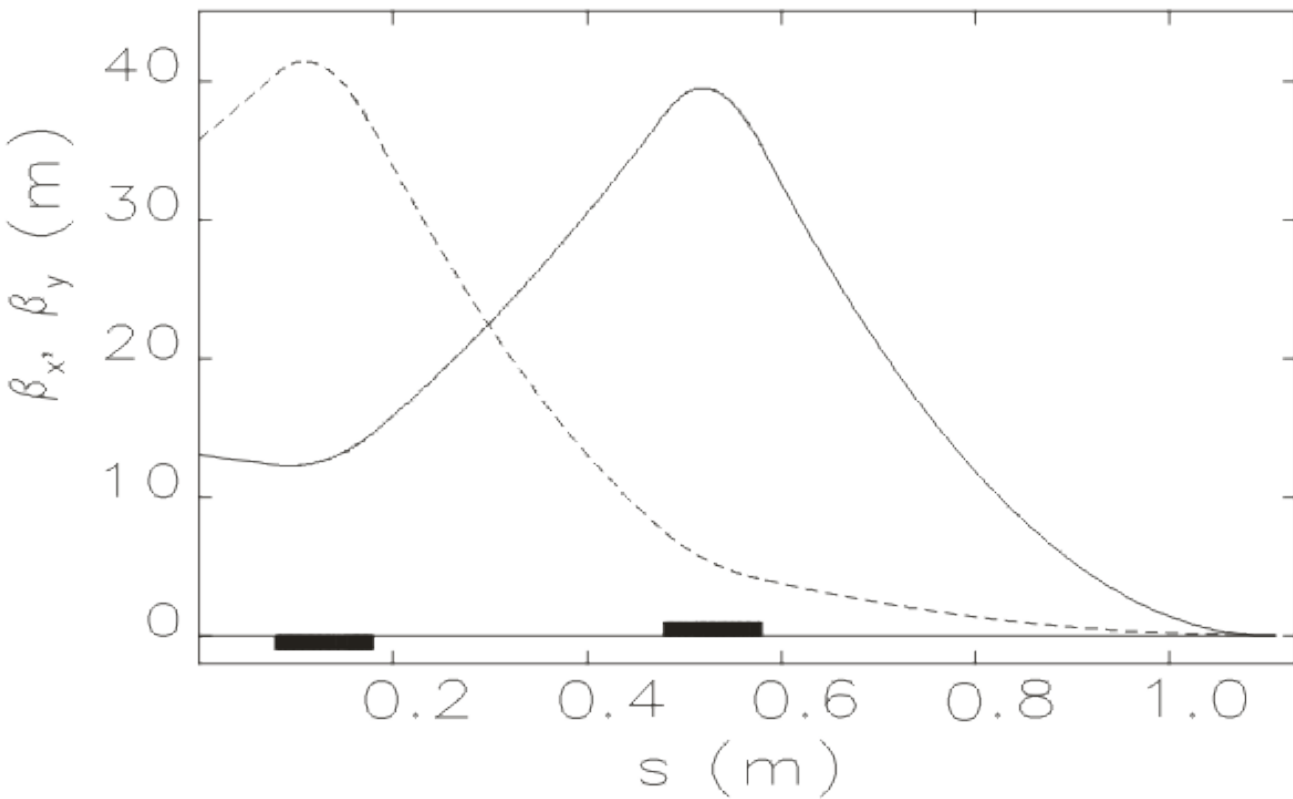


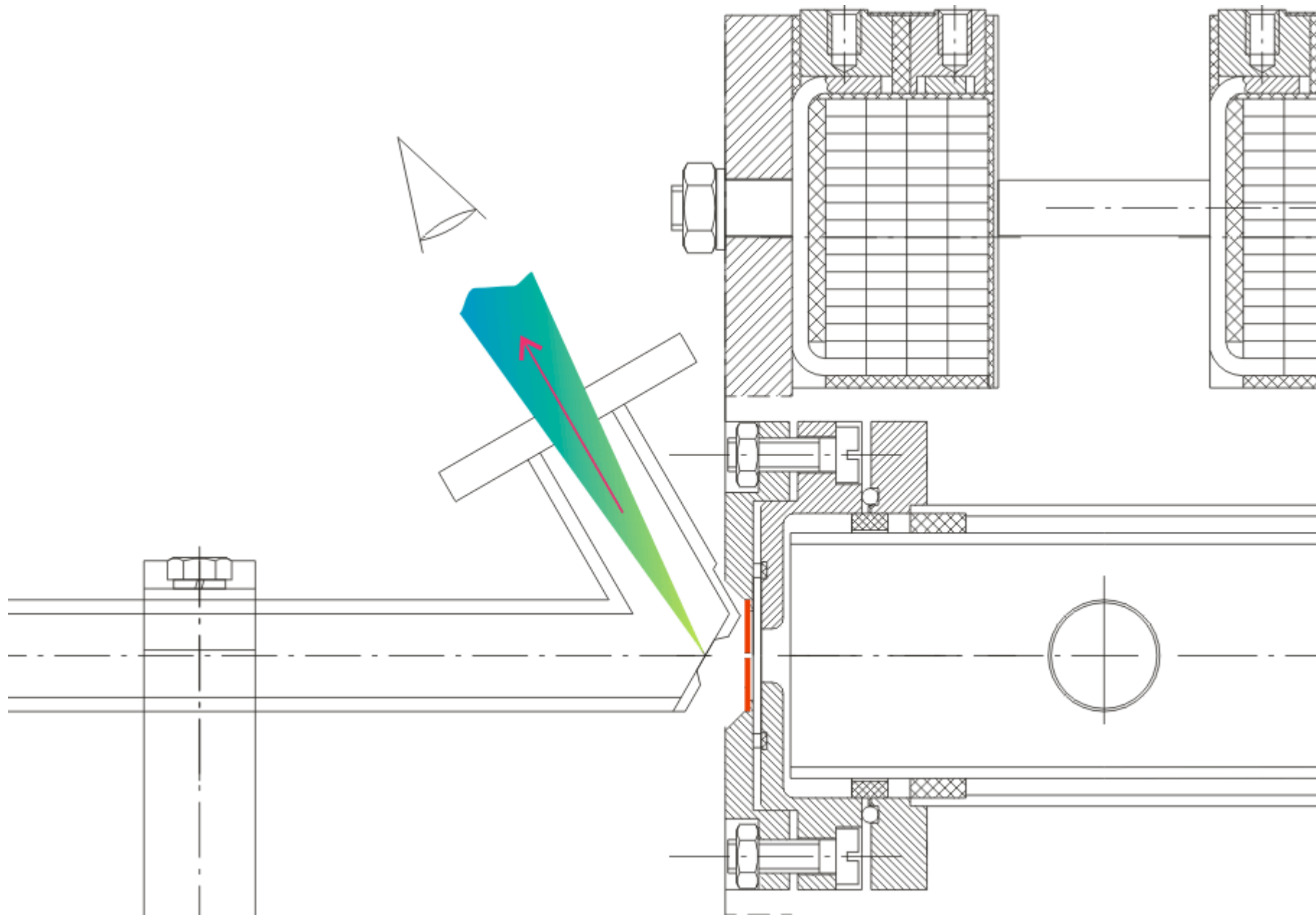
**At the midway of plasma:**



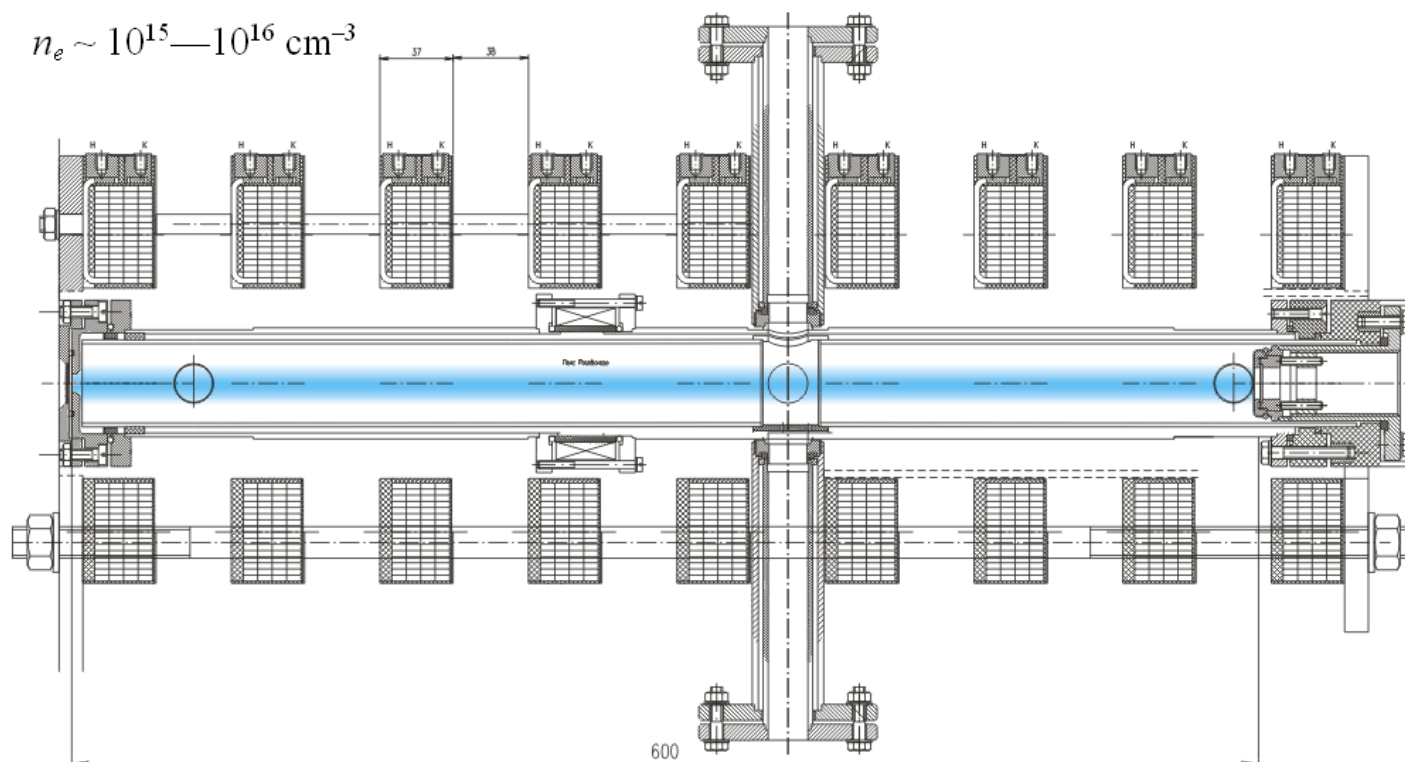
# Multibunch PWFA



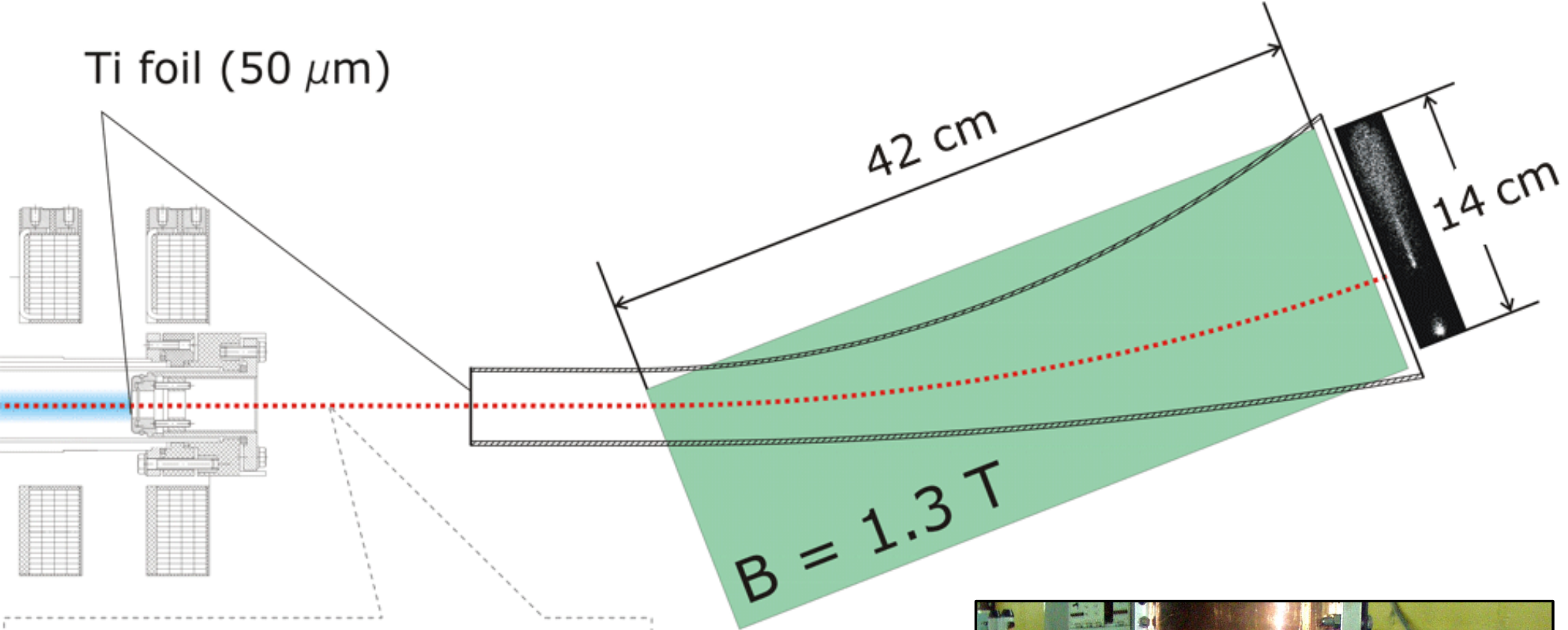




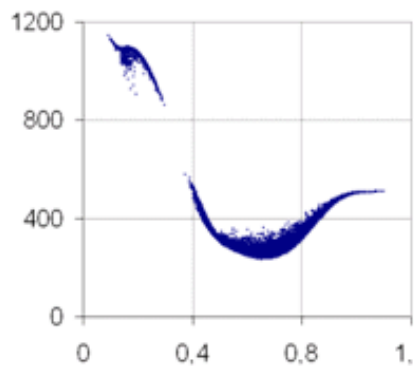
$$n_e \sim 10^{15} - 10^{16} \text{ cm}^{-3}$$



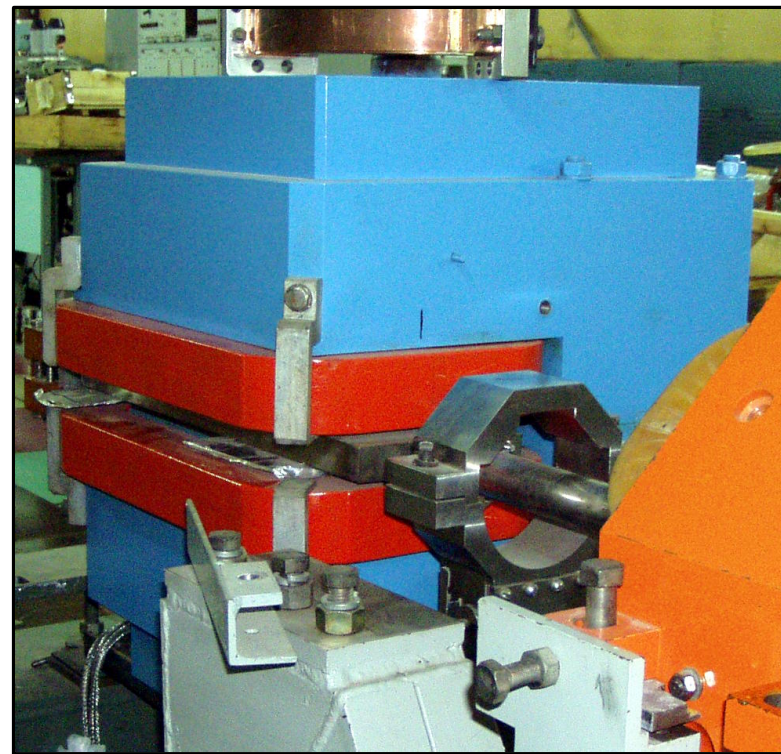
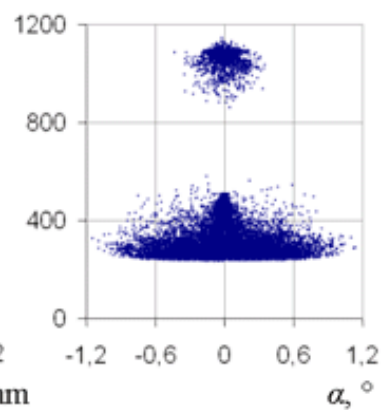
Ti foil (50  $\mu\text{m}$ )



$E, \text{ MeV}$

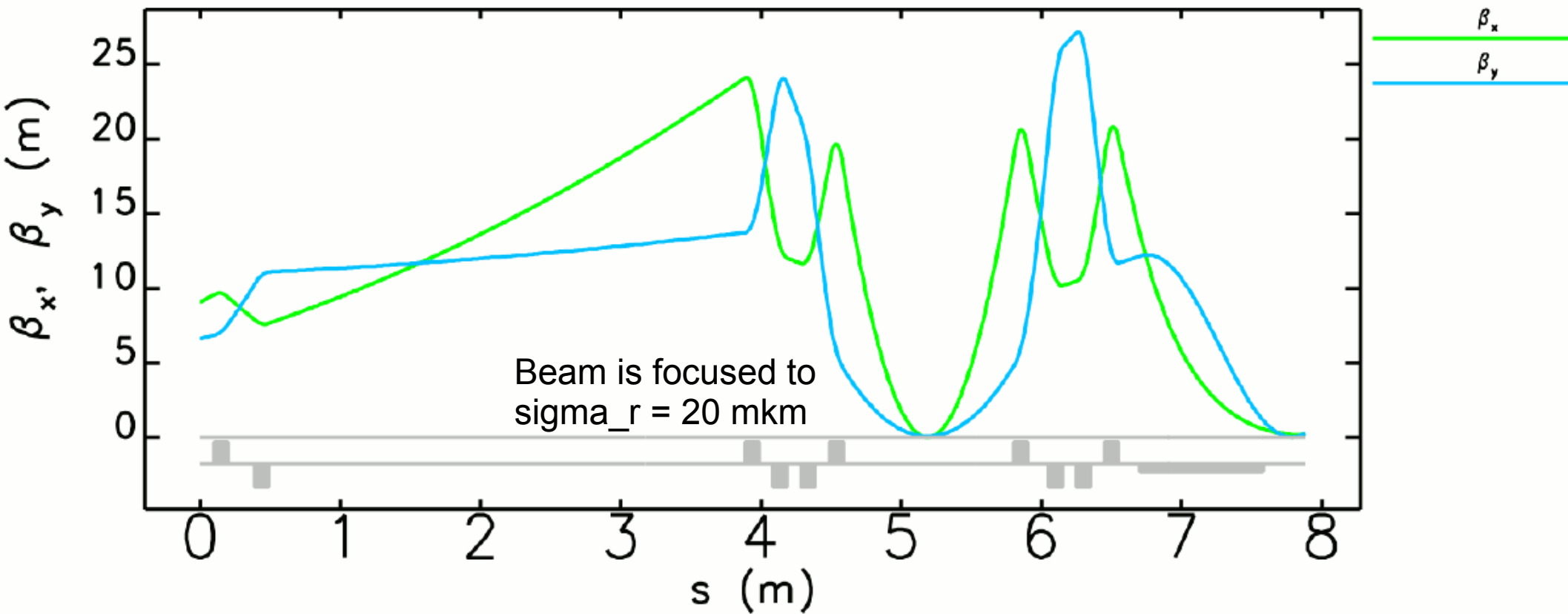
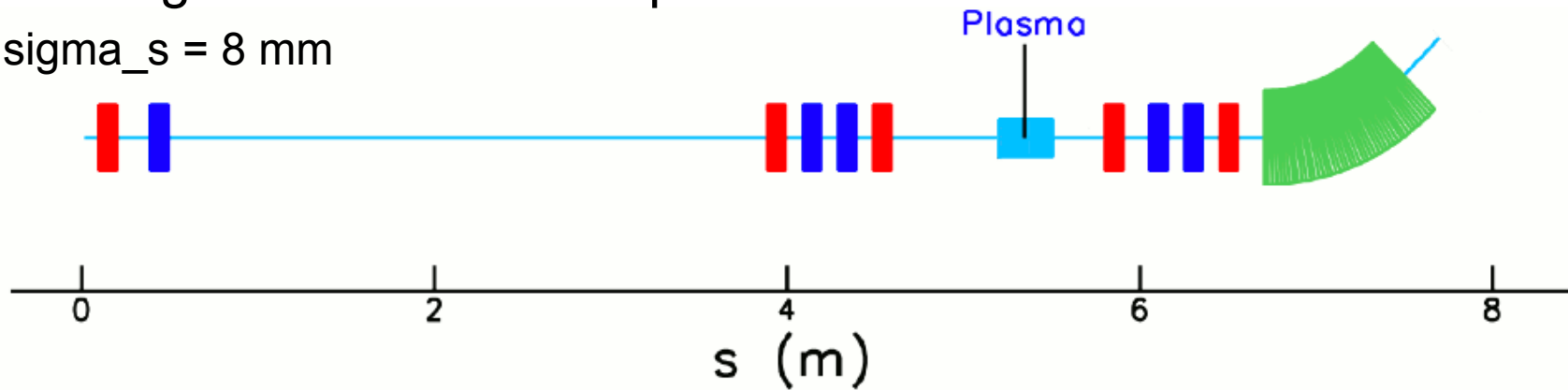


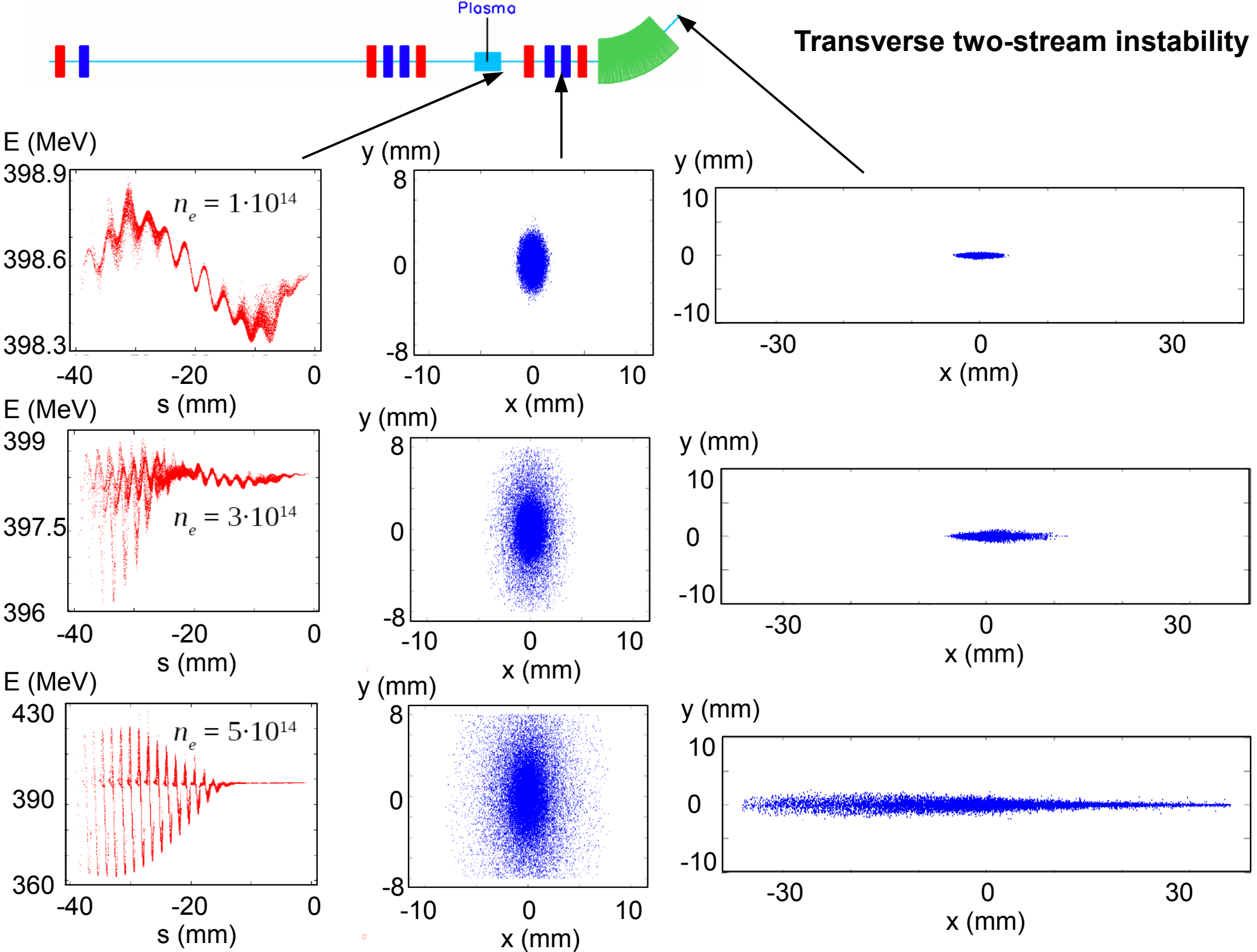
$E, \text{ MeV}$



# No longitudinal bunch compression

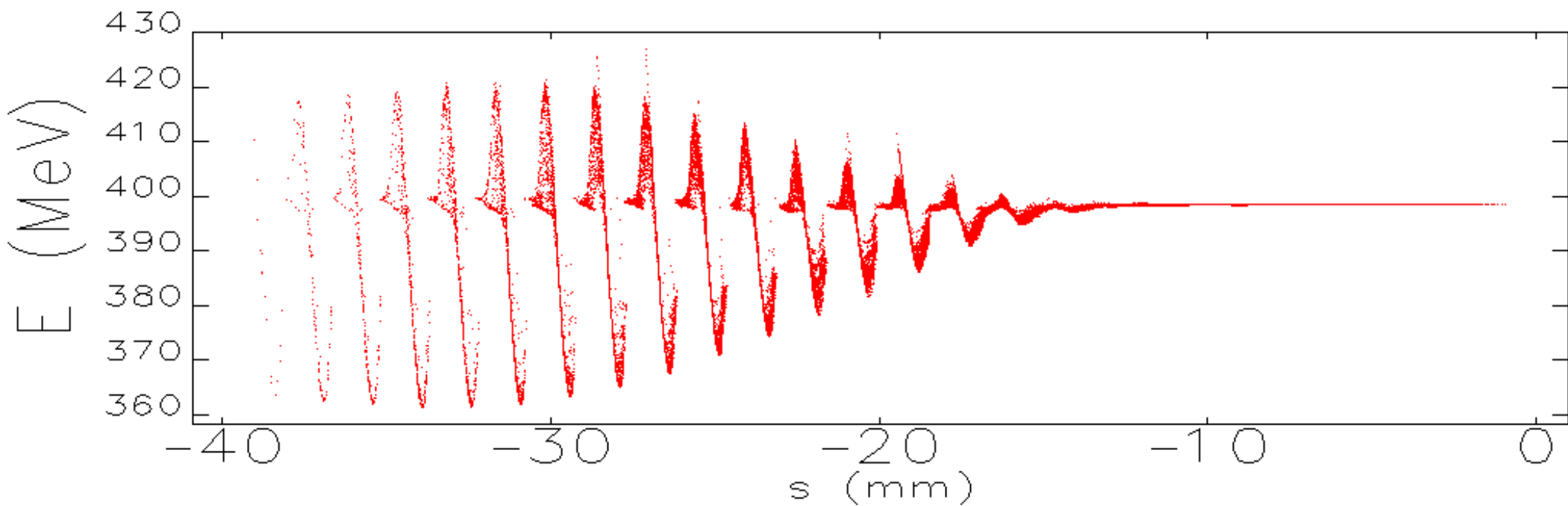
$\sigma_s = 8 \text{ mm}$



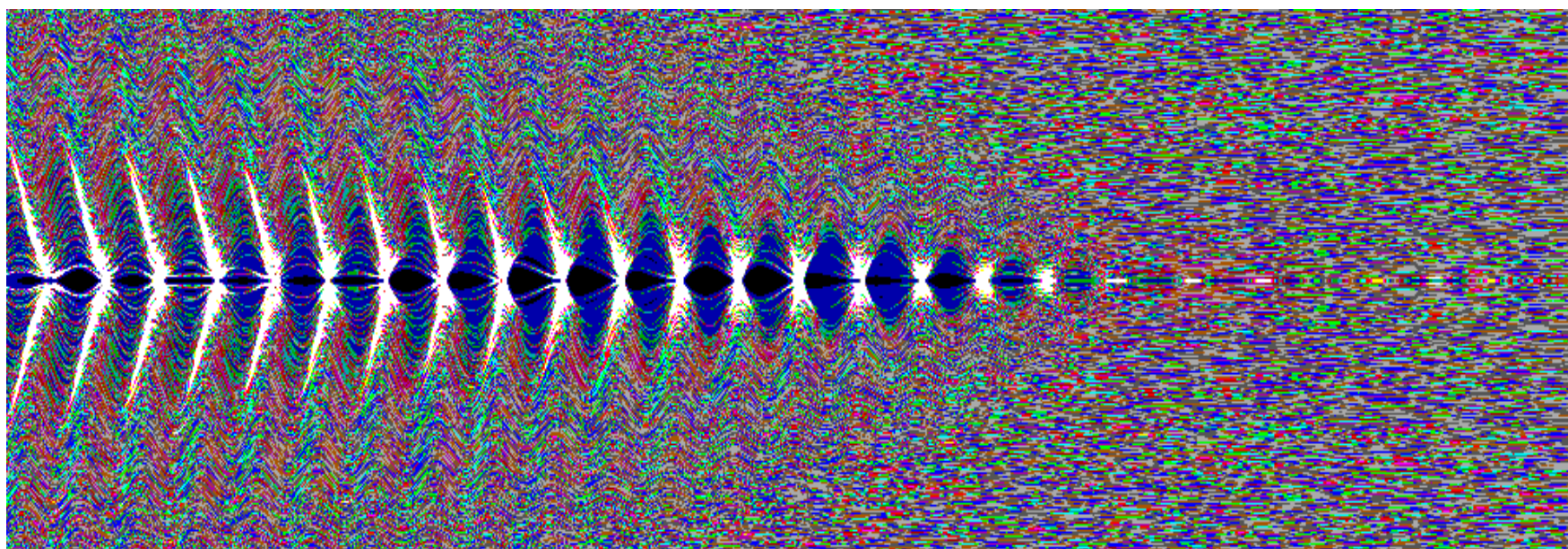




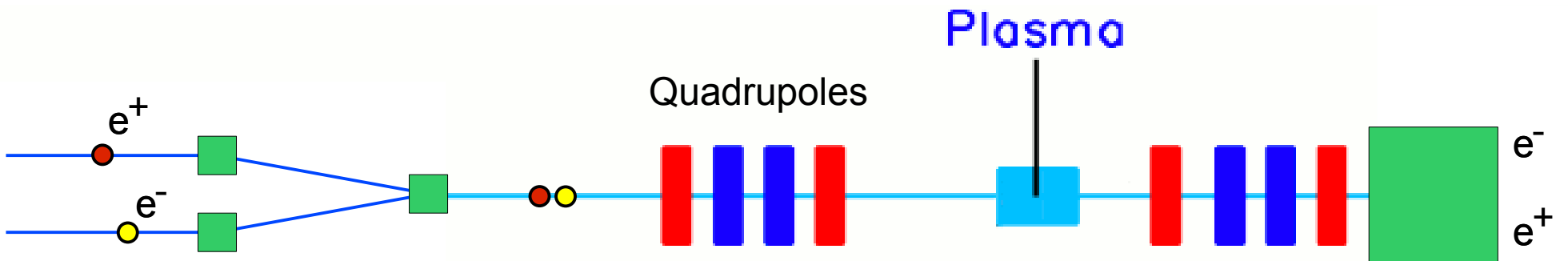
Beam particle energy vs longitudinal position:



Electron plasma density:



Electron and positron beams can be stored in the damping ring and extracted simultaneously



## Conclusion

The described facility (as well as the FACET) opens new possibilities for investigating the wakefield acceleration scheme:

- 1) the possibility of achieving high peak currents by compressing the beam in the longitudinal direction;
- 2) the possibility of forming beams with arbitrary density profiles;
- 3) the possibility of achieving long-term interaction of the beam with the plasma (up to full driver depletion);

As a result, it will be possible to demonstrate and investigate all the main regimes of the wakefield acceleration using electron or positron beam:

- 1) the effective regime, with a small energy spread and with high acceleration efficiency and high acceleration rate;
- 2) the multibunch regime, with a small number of accelerated particles but with high acceleration rate and high energy gain.

# Coherent Synchrotron Radiation effects (ELEGANT tracking):

