

FEL Operation with the Superconducting RF Photo Gun at ELBE

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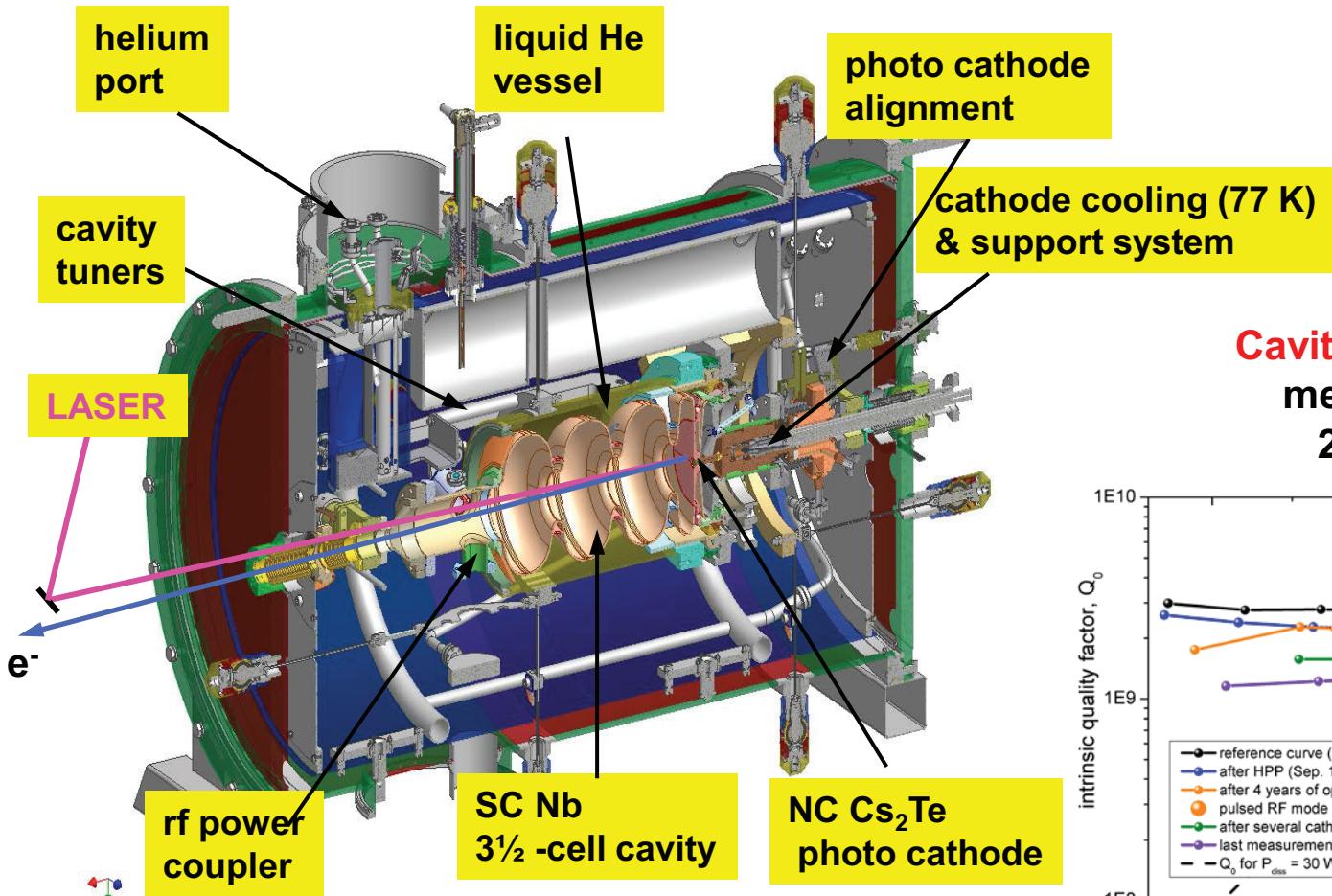
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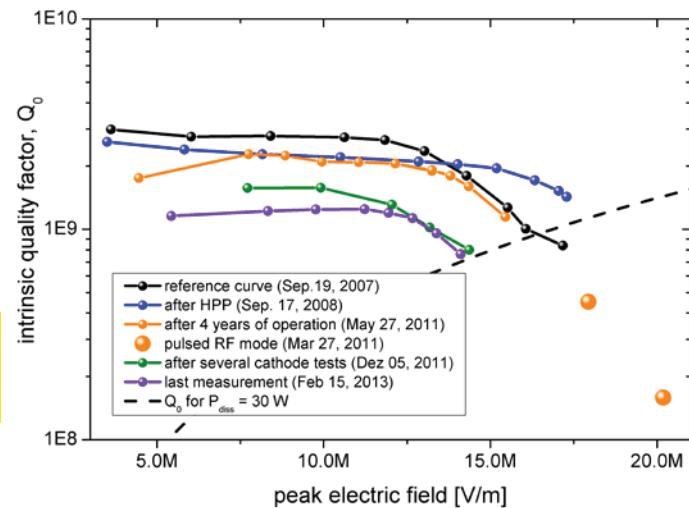


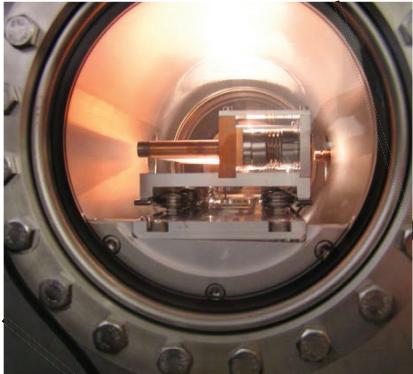
FEL 2013
August 26 - 30, 2013, New York, USA

- That is **not** a “First Lasing Talk”,
the ELBE radiation source has produced IR light for
users with two FELs since 2004.
 - It is a report on an important milestone achieved in SRF gun
research and development
 - At the ELBE linac a SRF gun is installed and operated as a
second injector
 - A second Gun with an improved SC cavity is under
construction to approach the desired design goals
 - The existing gun is used
 - for specific diagnostic development, i.e. slice emittance
 - to gain experience with “real” accelerator operation
- > injector for FEL



Cavity Performance measurements 2007 - 2013

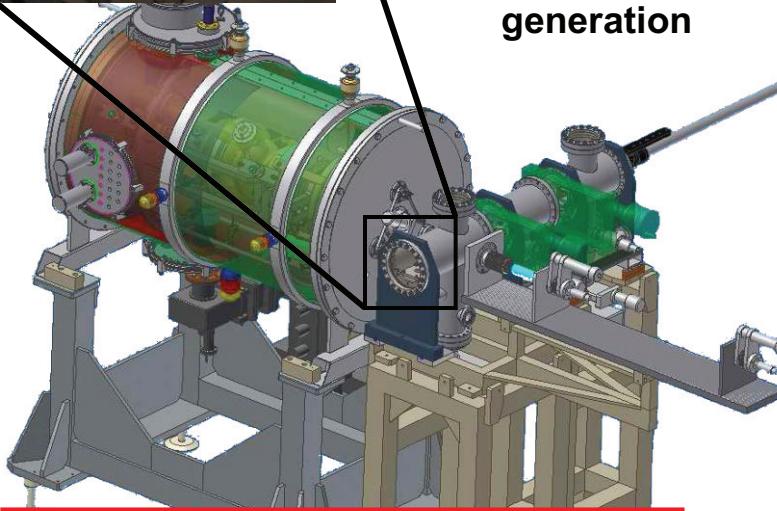
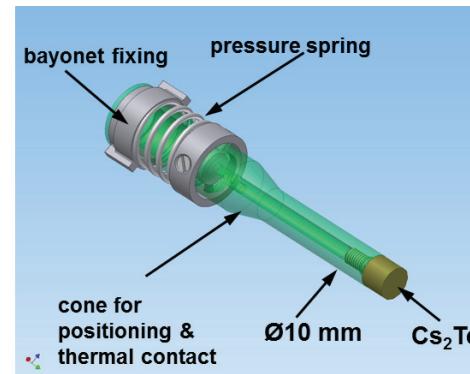




Excellent lifetime of Cs₂Te PC in SRF gun

Requirements for Transfer:

- Load lock system with $< 10^{-9}$ mbar to preserve QE $\geq 1\%$
- Exchange w/o warm-up & in short time and low particle generation



- fresh QE 8.5%, in gun 0.6%
- total beam time 600 h
- extracted charge 265 C

Cathode	Operation days	Extracted charge	Q.E. in gun
#090508Mo	30	< 1 C	0.05%
#070708Mo	60	< 1 C	0.1%
#310309Mo	109	< 1 C	1.1%
#040809Mo	182	< 1 C	0.6%
#230709Mo	56	< 1 C	0.03%
#250310Mo	427	35 C	1.0%
#090611Mo	65	< 1 C	1.2%
#300311Mo	76	2 C	1.0 %
#170412Mo	From 12.05.2012	265 C	~ 0.6 %

problems: multipacting, QE drop-down during storage

01.08.2013

Two channel laser system

- **13 MHz, 3 ps FWHM**
- **100/250/500 kHz**

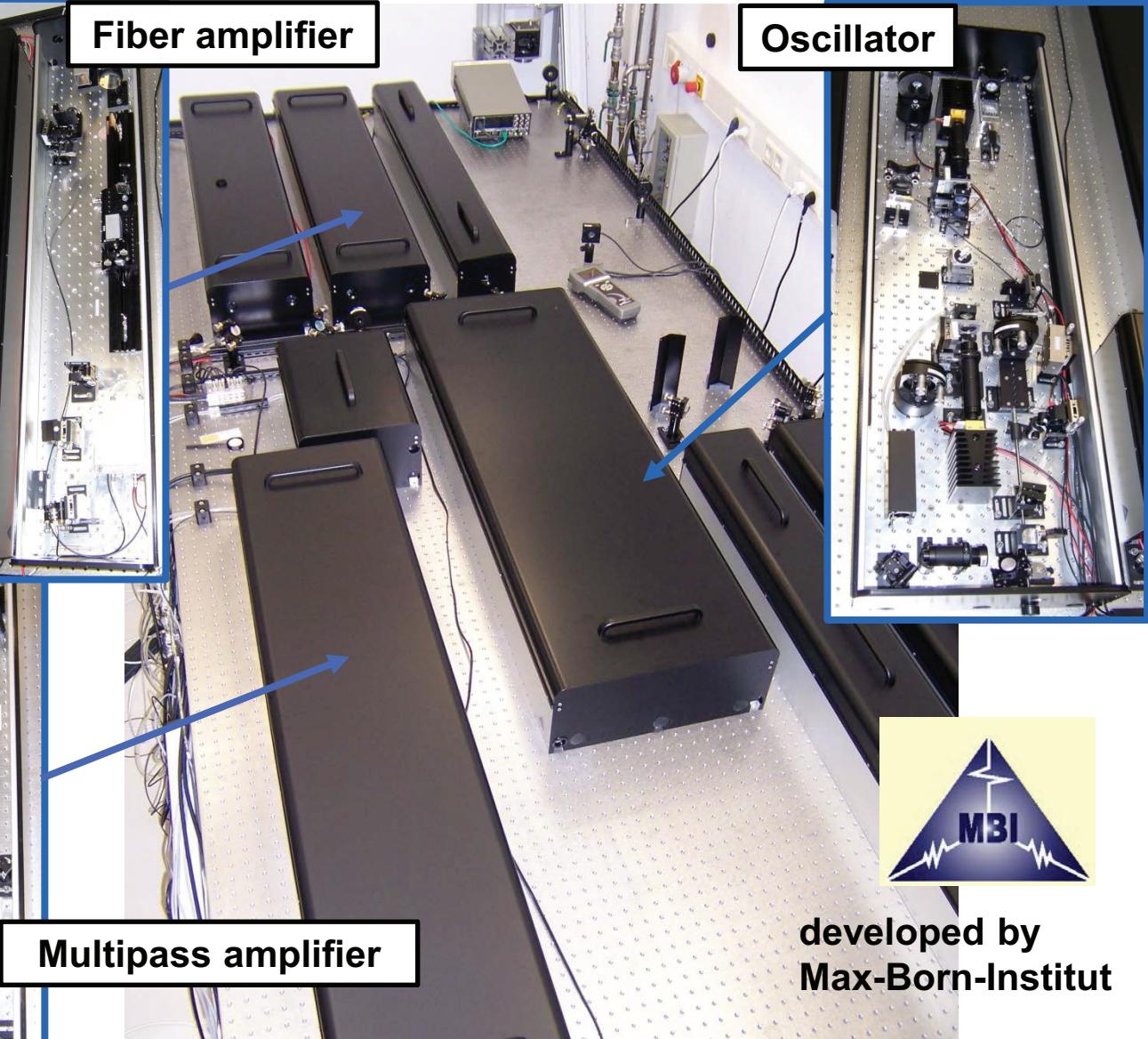
12...15 ps FWHM

temporal profile: Gaussian
power in UV: 1 W
wavelength: 258 nm
CW and burst mode

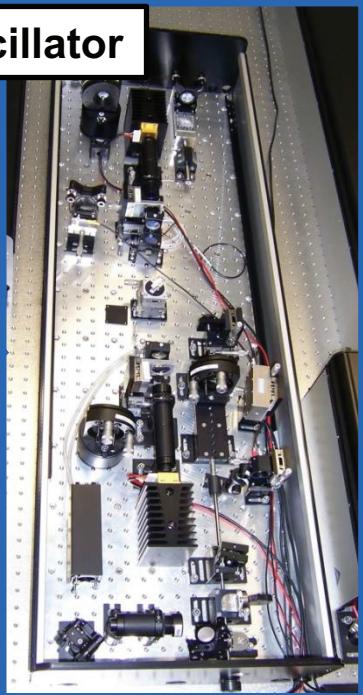


Multipass amplifier

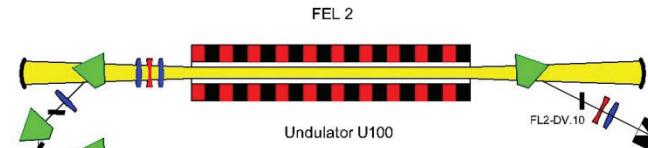
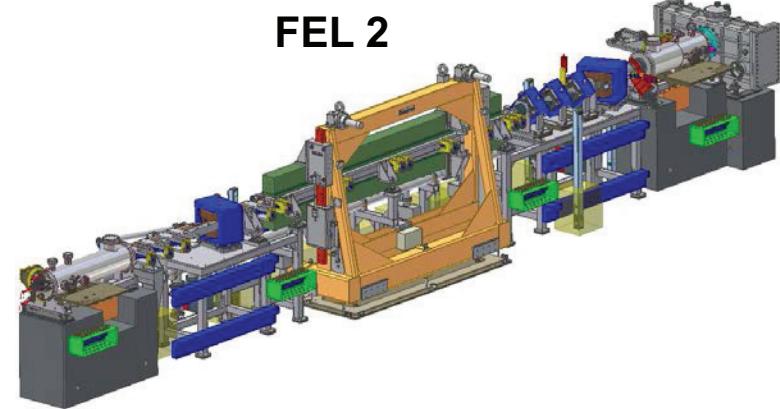
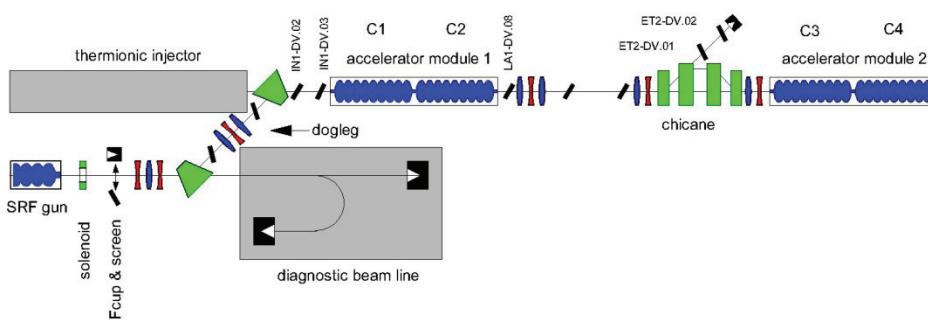
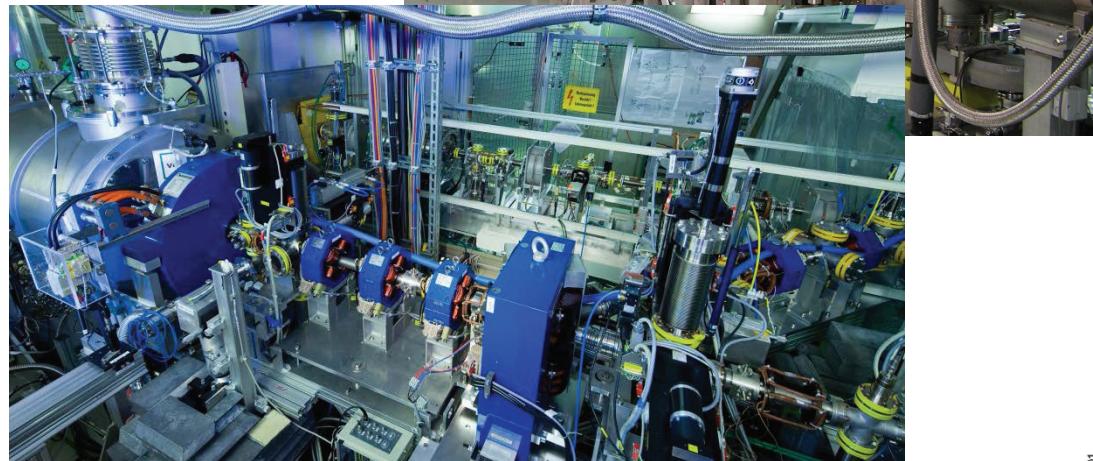
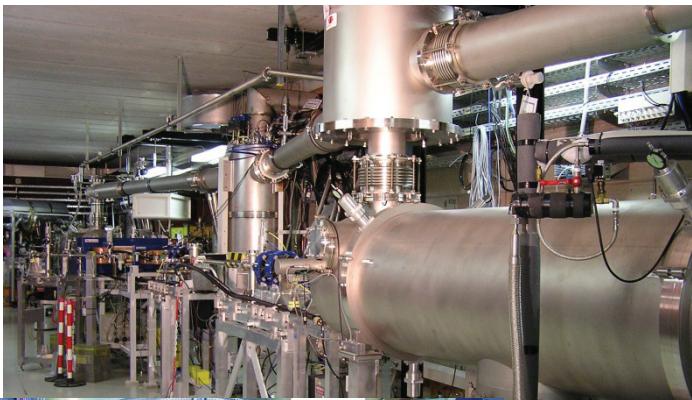
Fiber amplifier



Oscillator

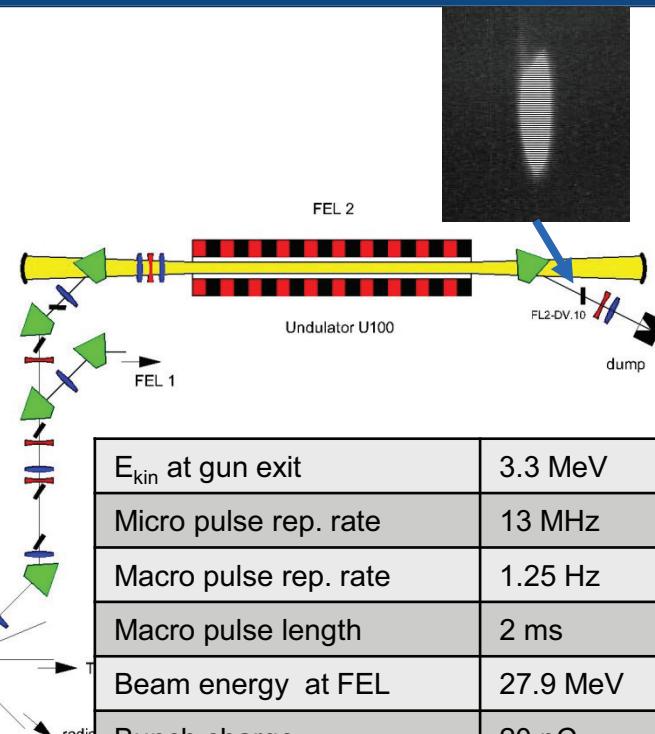
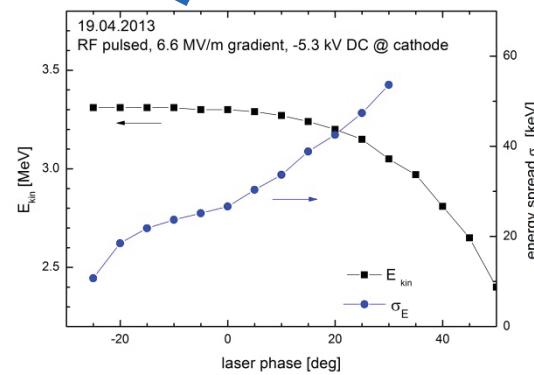
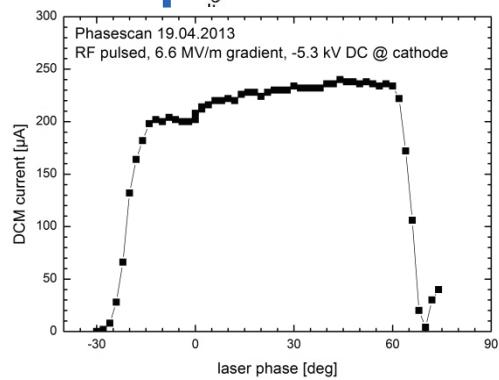
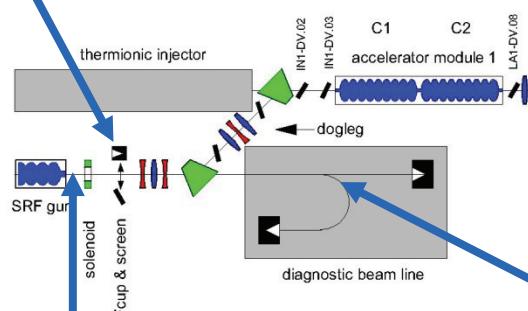
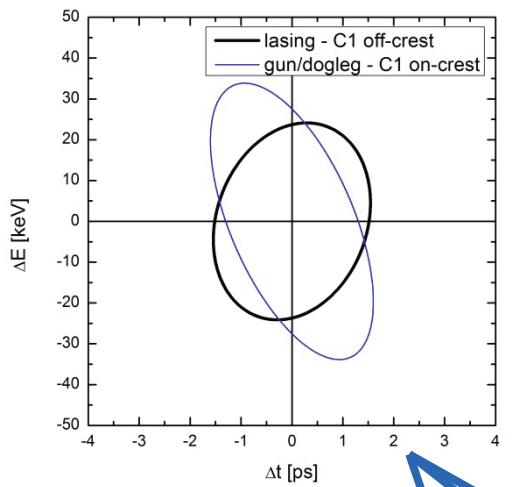
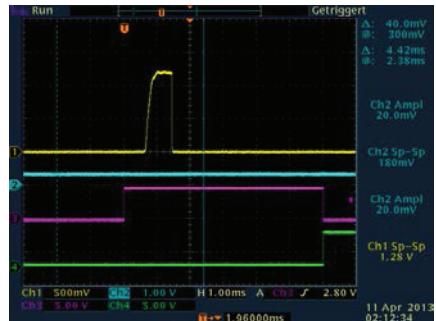


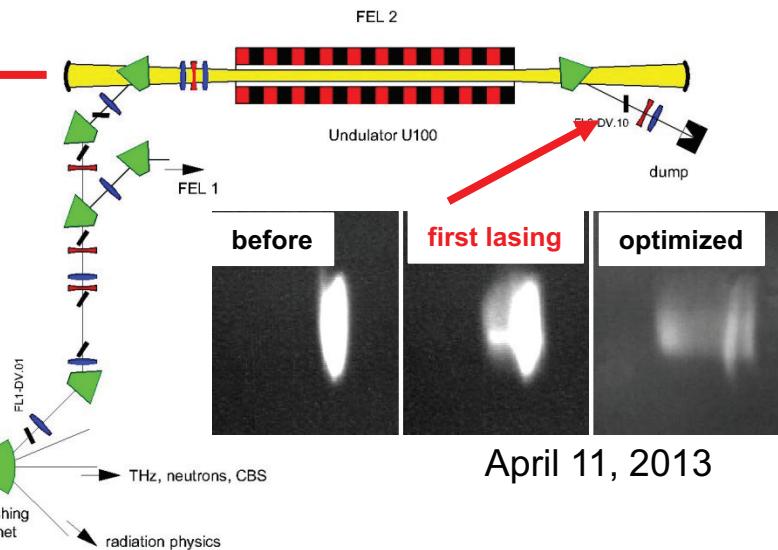
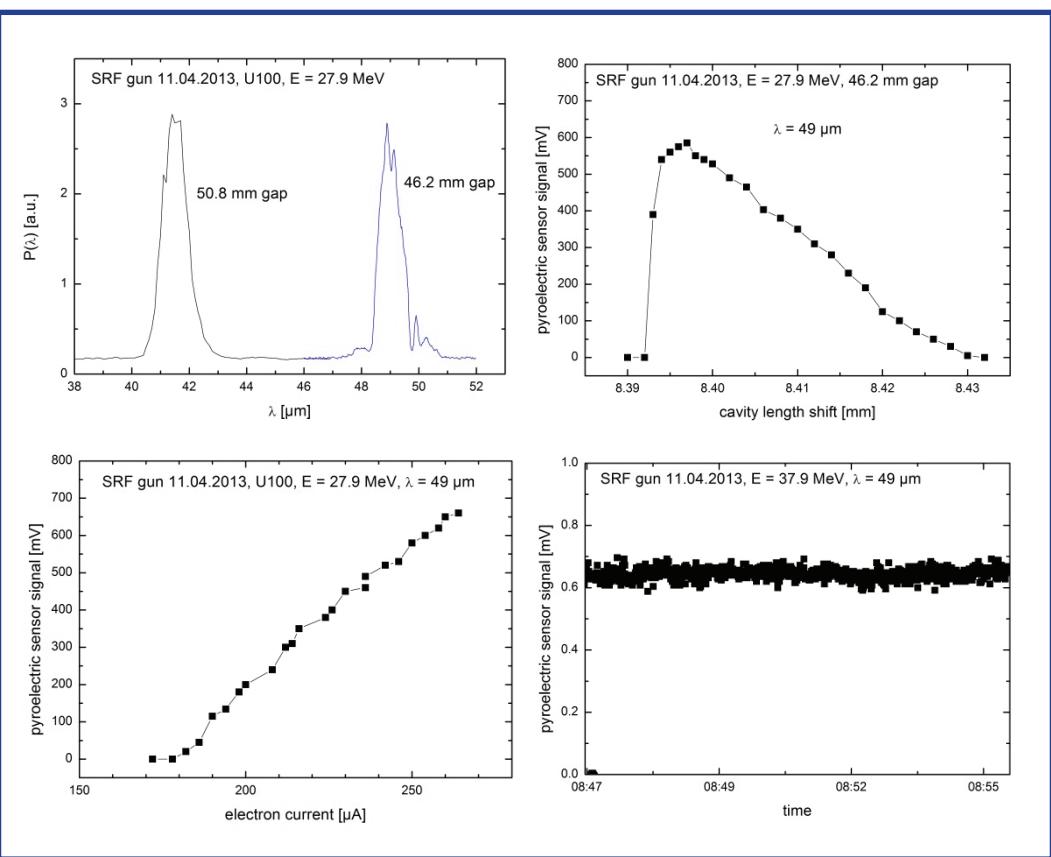
developed by
Max-Born-Institut



Undulator	
Type	Hybrid planar
Period	100 mm
Number of periods	38
Undulator parameter	0.3 – 2.7
Optical cavity	
Type	Partial waveguide
Length	11.53 m
Rayleigh length	1.8 m
Mirror material	Au/Cu
Outcoupling	Holes 2, 4.5, 7 mm

Lasing with SRF Gun – Electron Beam Parameters







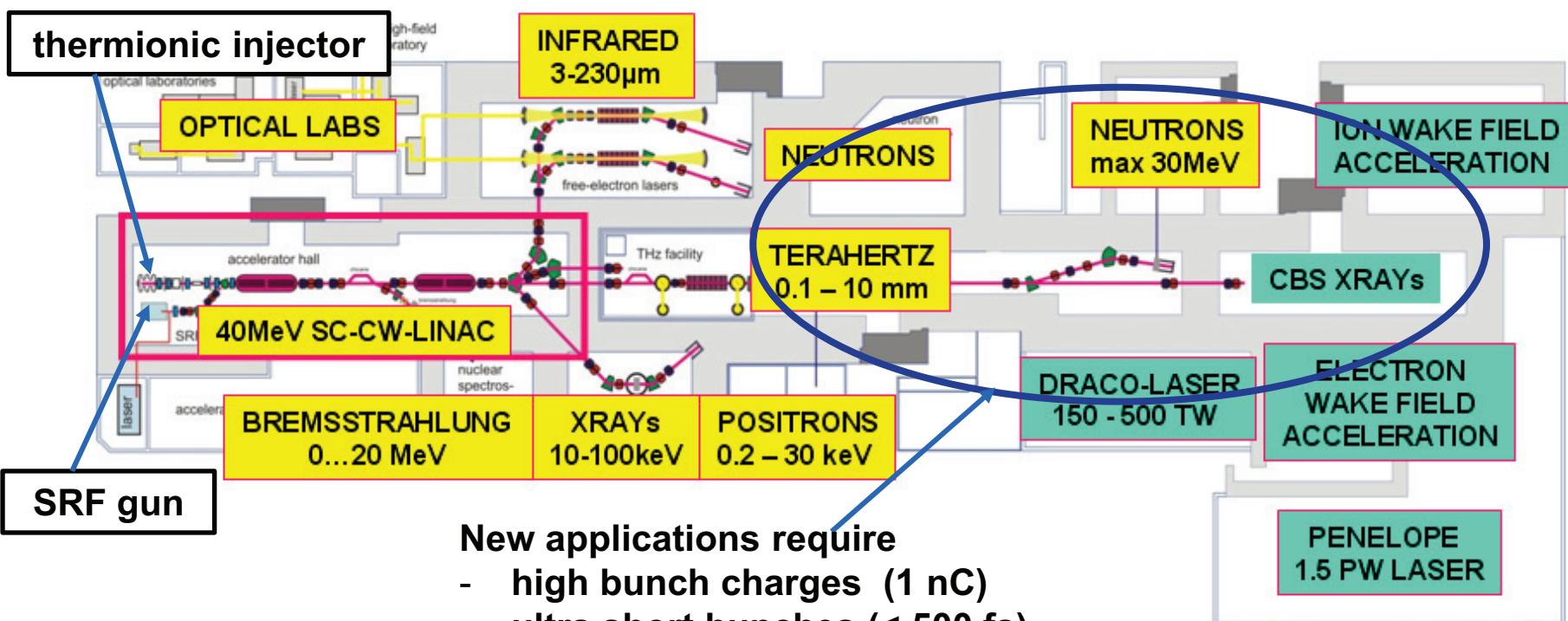
More Infos on Posters:

- Monday: MOPS076 this topic
- Thursday: TUPSO44, 92 SRF Gun
- Wednesday: WEPSO21, 25, 35 THz facility at ELBE

Acknowledgement

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ELBE User Facility



Accelerator Research an Development at ELBE: SRF Photo Gun

- First beam demonstrated with an ½-cell gun in 2002
D. Janssen et al. NIM A 507 (2003) 314
- 3½-cell gun at ELBE since 2007