EuroFEL
FREE ELECTRON LASERS OF EUROPE

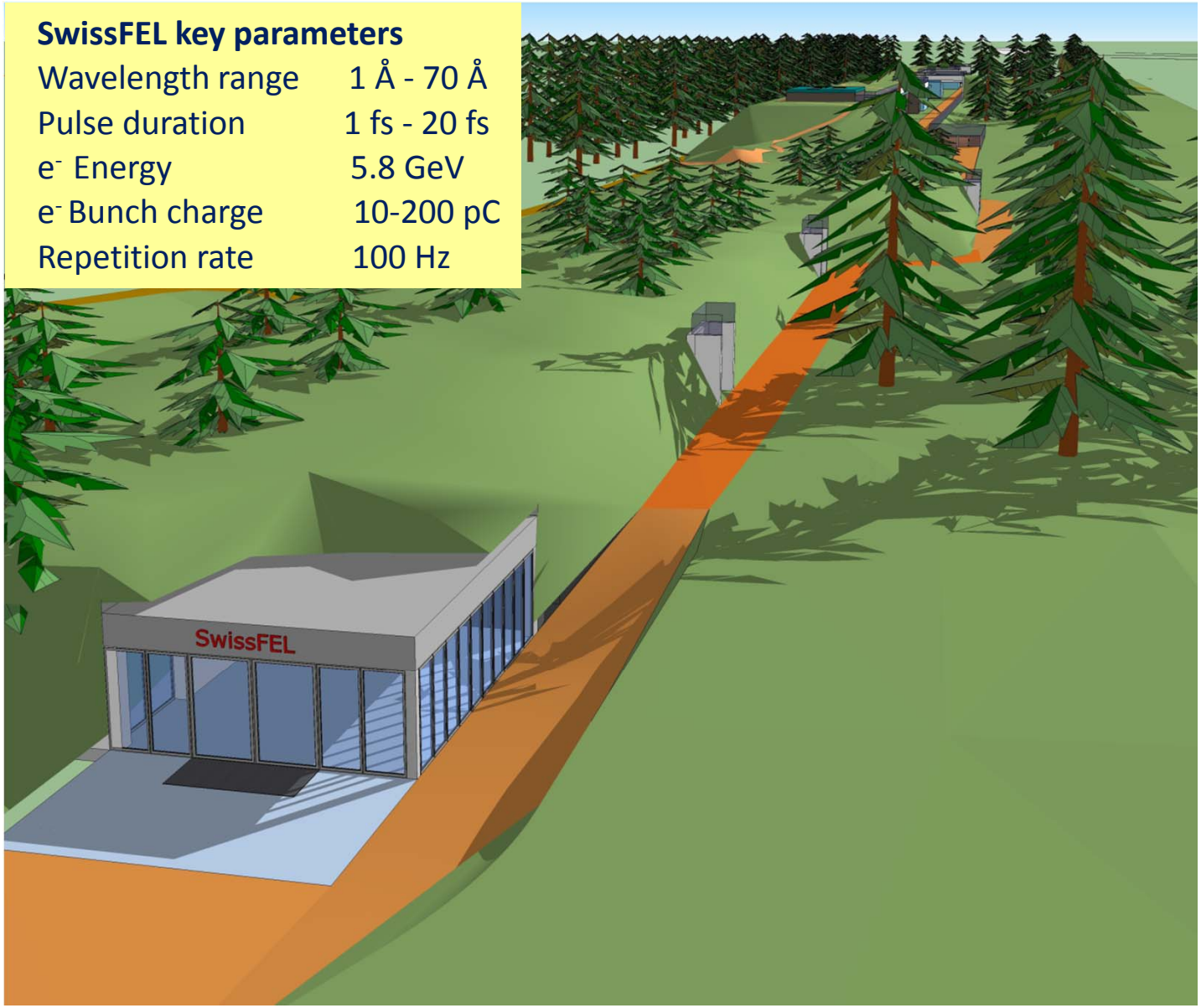
SwissFEL Status & Plans

R. Abela

SwissFEL, the next large facility of PSI

SwissFEL key parameters

Wavelength range	1 Å - 70 Å
Pulse duration	1 fs - 20 fs
e^- Energy	5.8 GeV
e^- Bunch charge	10-200 pC
Repetition rate	100 Hz



SwissFEL Rational I

- Research capabilities of X-ray FEL ideal complement for PSI's existing synchrotron light source and spallation neutron source research facilities
- European XFEL will not provide enough beam time for users in Europe
- Europe has with FLASH, FLASH II, FERMI@ELETTRA and maybe SPARX, NLS already good coverage for soft X-ray FEL's

⇒ ***hard X-ray FEL***

SwissFEL Rational II

SwissFEL is build as a national facility in a small country

Total cost have to fit in a limited financial frame

$$\lambda = \frac{\lambda_U}{2\gamma^2}\left(1+\frac{K^2}{2}\right)$$

$$\varepsilon_N \approx \gamma \frac{\lambda}{4\pi}$$

$$\varepsilon_N \approx 1\,\mu\mathrm{m}\sqrt{q_B[\mathrm{nC}]}$$

$$N_\epsilon \propto \gamma$$

- Lowest beam energy technically possible
- Small period undulators with low K values
- Low q_B charge
- Normal conducting linac technology

SwissFEL Rational III

We want to build 1st phase of SwissFEL 2013-2016

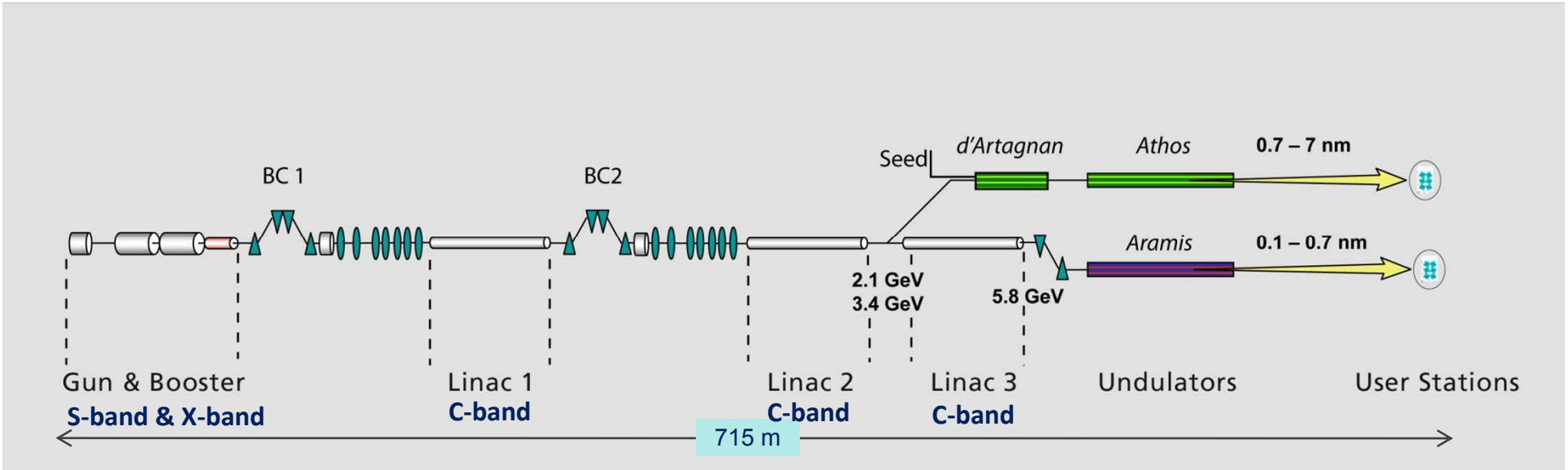
⇒ Robust baseline design with components based on proven technologies.

⇒ Scientific focus rather on good time resolution than on photon hungry experiments

Site constraints

- Power consumption < 5 MW
- Overall length < 900m

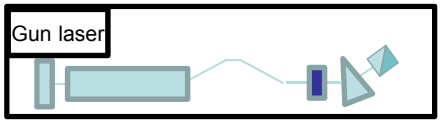
SwissFEL layout



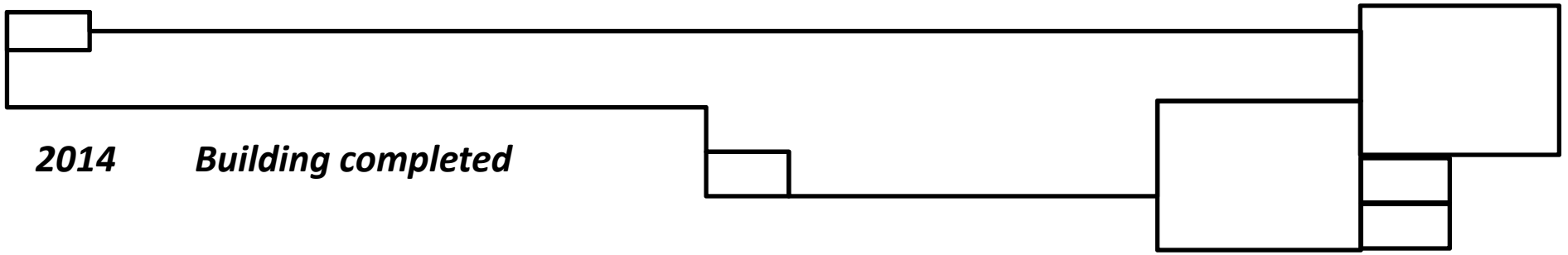
Aramis: 1-7 Å hard X-ray SASE FEL,
In-vacuum , planar undulators with variable gap.

Athos: 7-70 Å soft X-ray FEL for SASE & Seeded operation .
APPLE II undulators with variable gap and full polarization control.

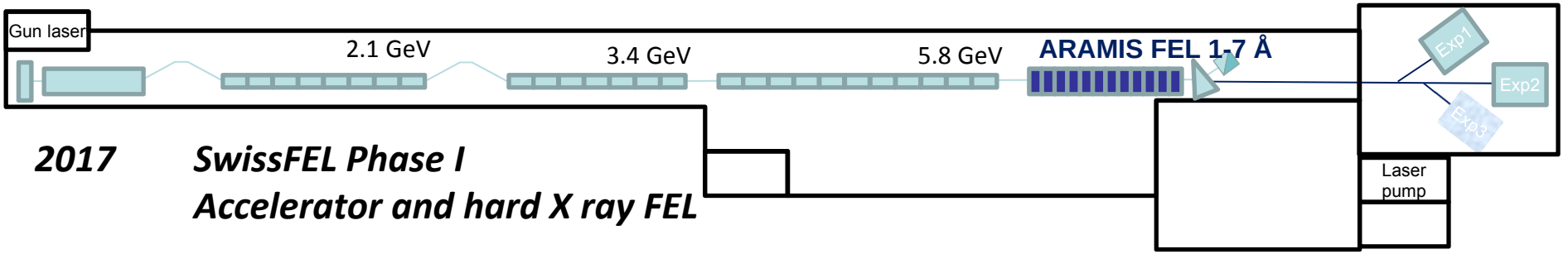
SwissFEL Milestones



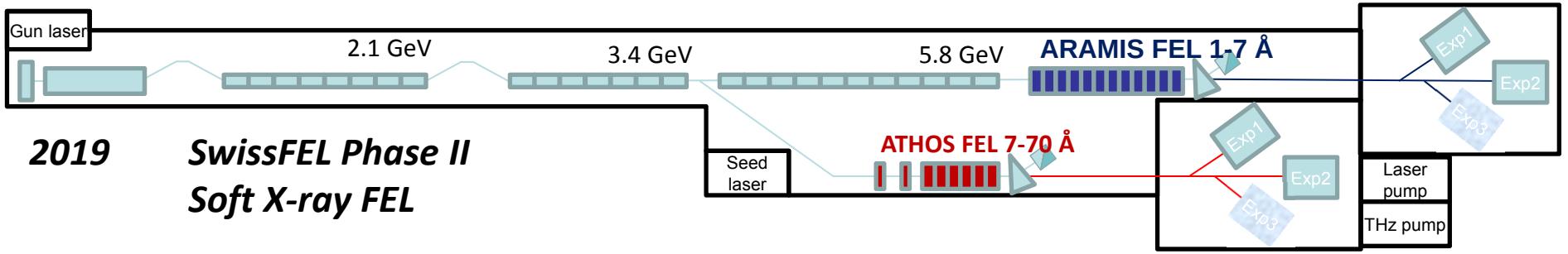
2010 **250 MeV Injector facility**



2014 **Building completed**

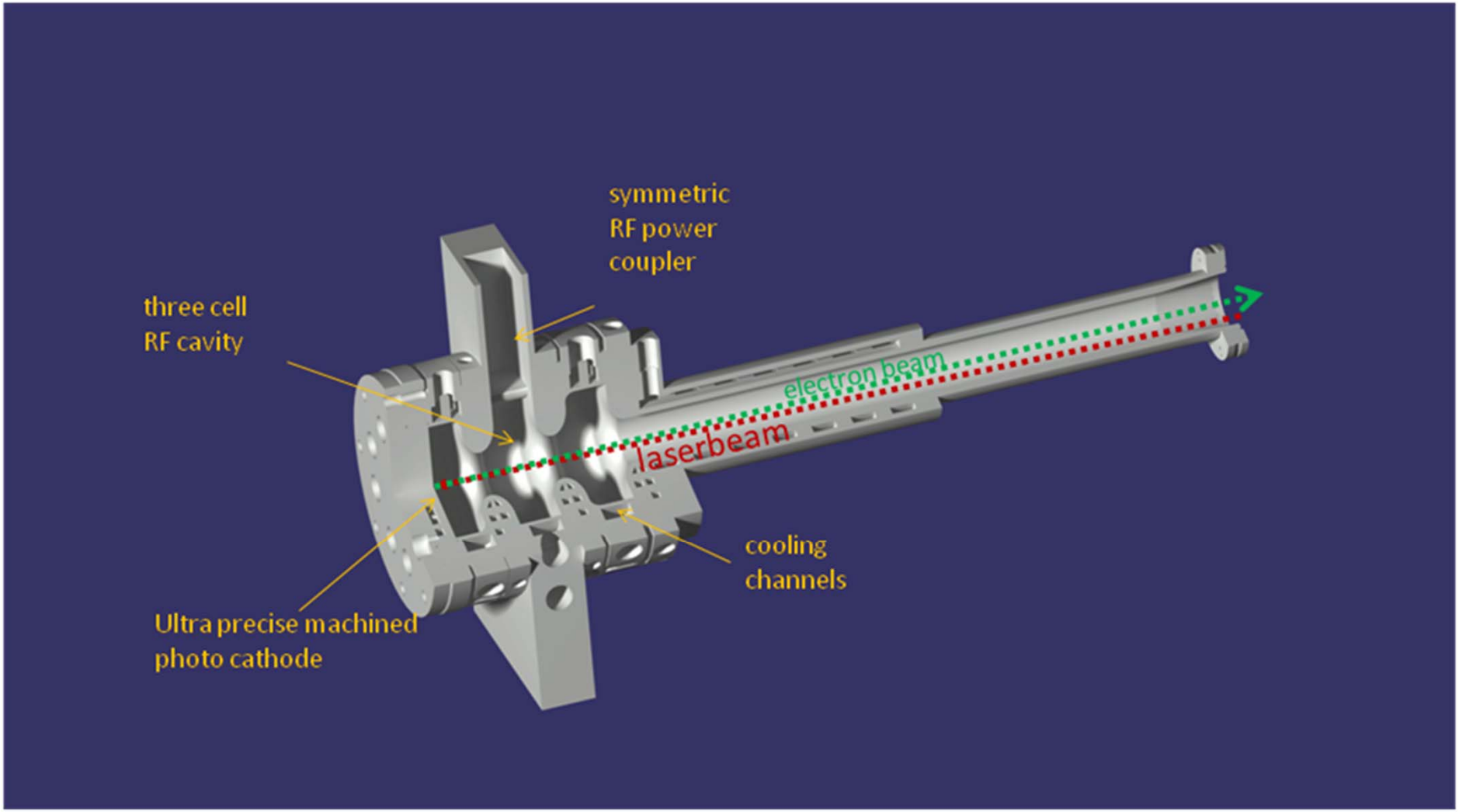


2017 **SwissFEL Phase I**
Accelerator and hard X ray FEL

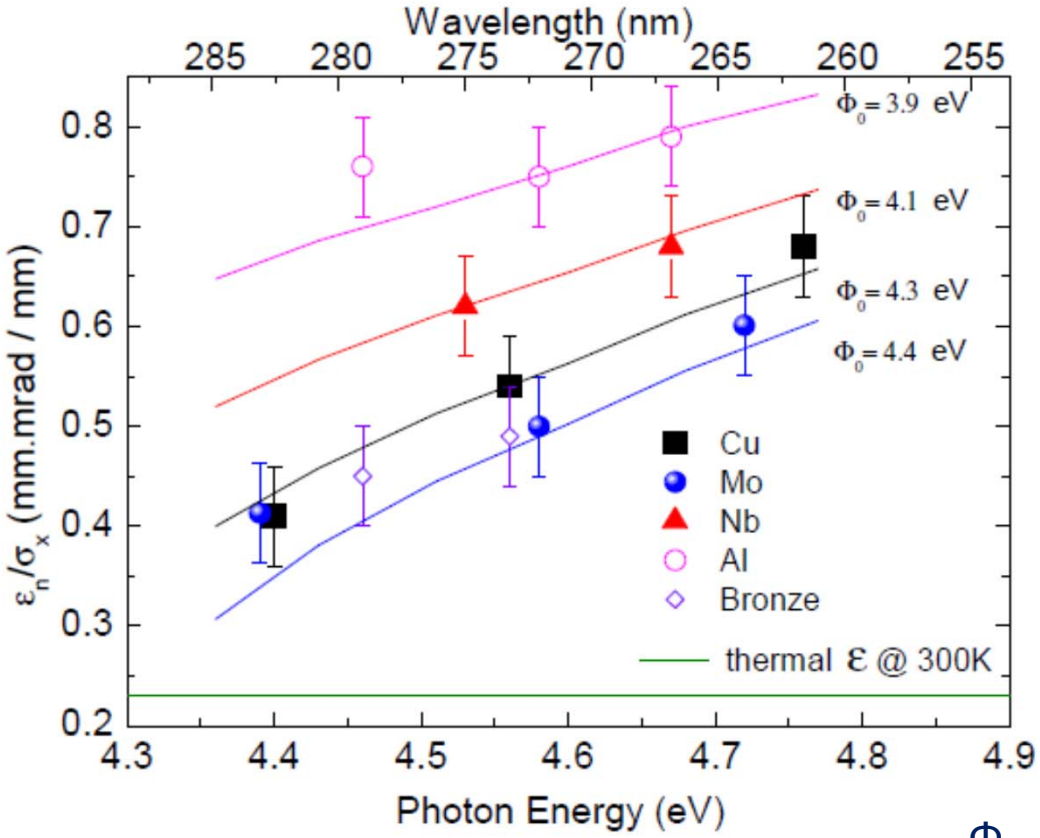


2019 **SwissFEL Phase II**
Soft X-ray FEL

New SwissFEL gun for test in 250 MeV injector 2012



Intrinsic Emittance versus Laser Wavelength



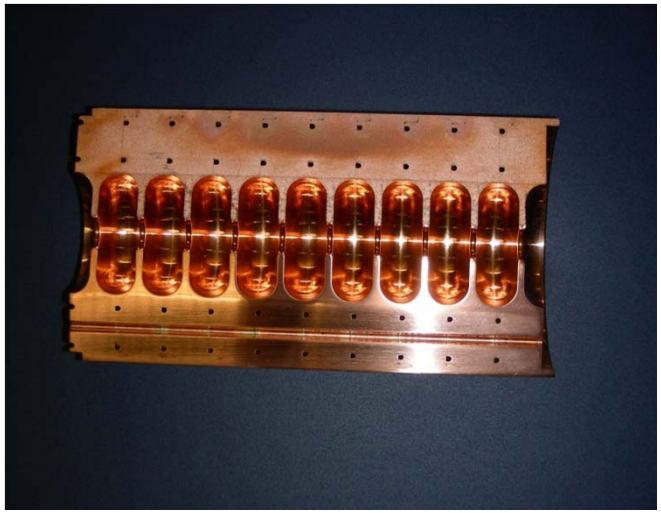
Phys. Rev. Lett.104, 234802 (2010)

$\Phi_{literature} \sim \Phi_{Fitted} + 0.3eV$

Fig. 6. Normalized intrinsic emittance/mm for different cathode materials at different laser photon energies with theoretical curves (solid lines) given by eq. (1) for different work functions (thermal effects not included). Thermal emission at room temperature is displayed as well (green line). The error bars result from deviation between pepperpot and solenoid measurements.

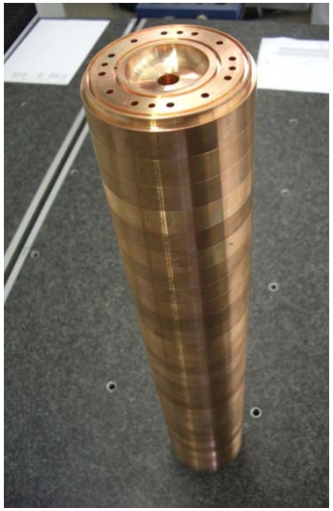
C-Band structure prototyping

Ultra-Precision Machinig



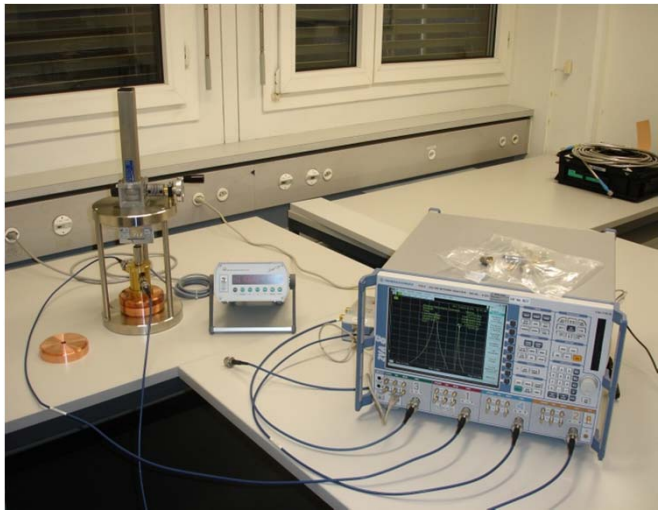
10 cell stack

Brazing



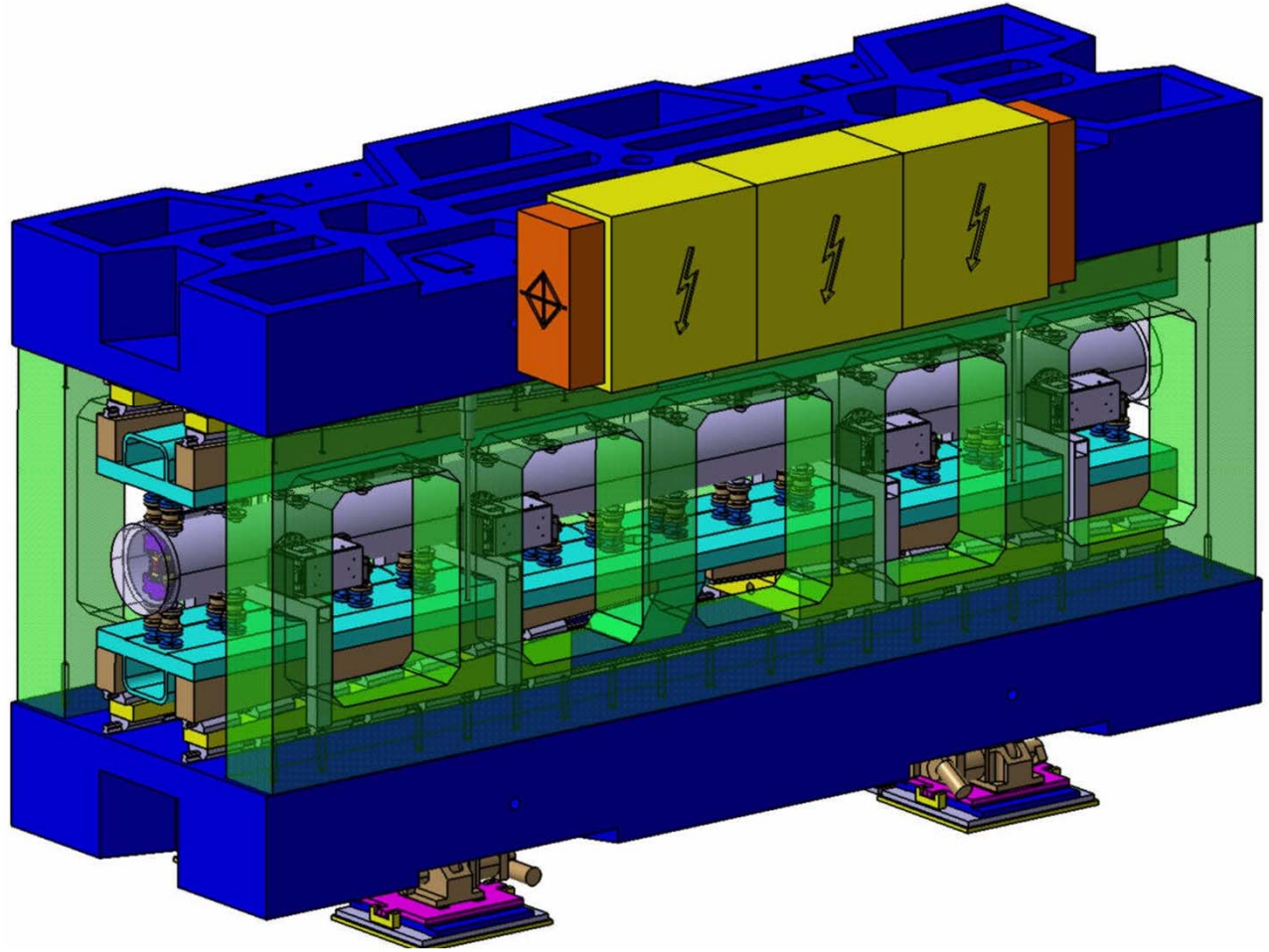
29 cell stack

RF-Measurements



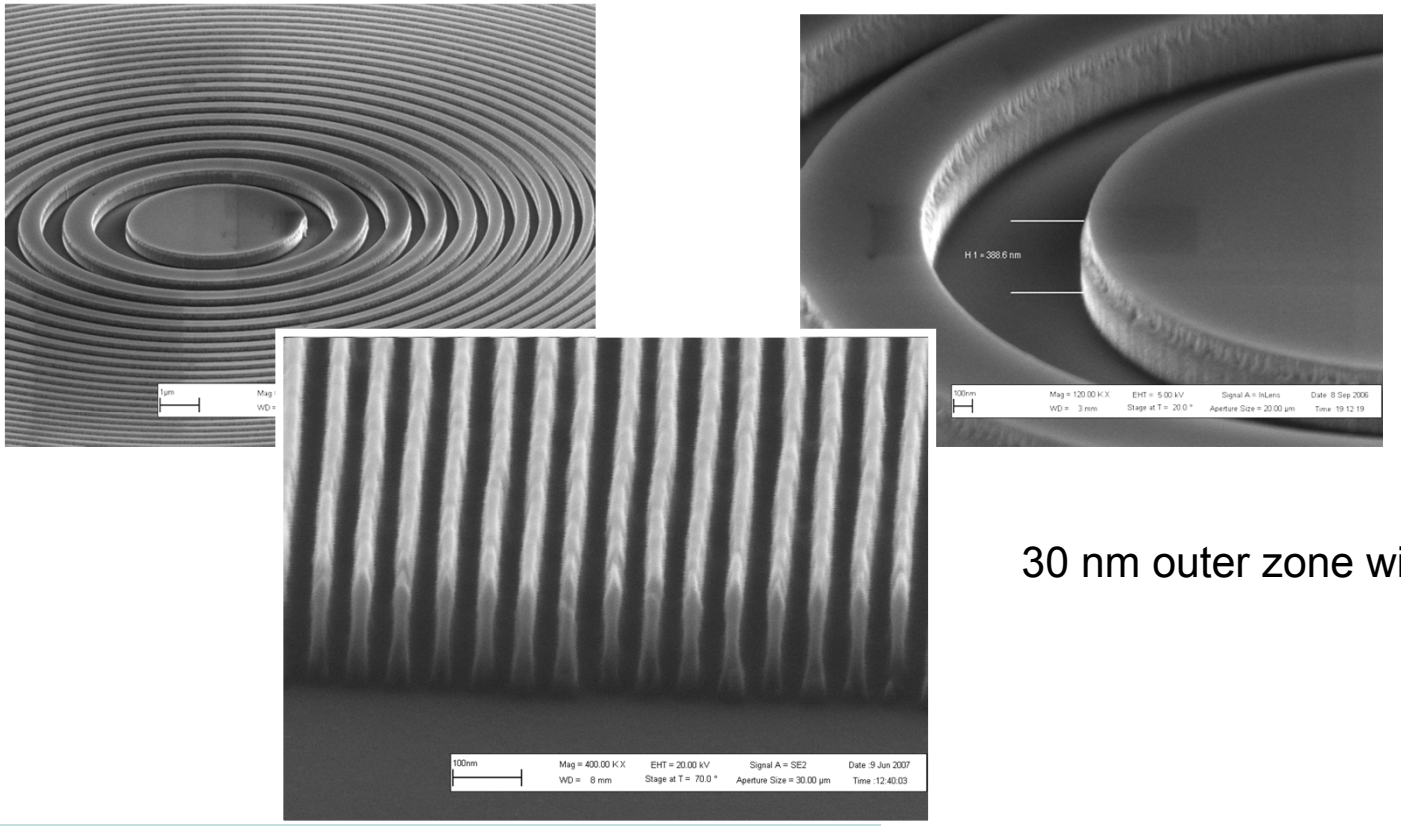
RF measurement of single cell

Undulator Development



X-Ray Optics

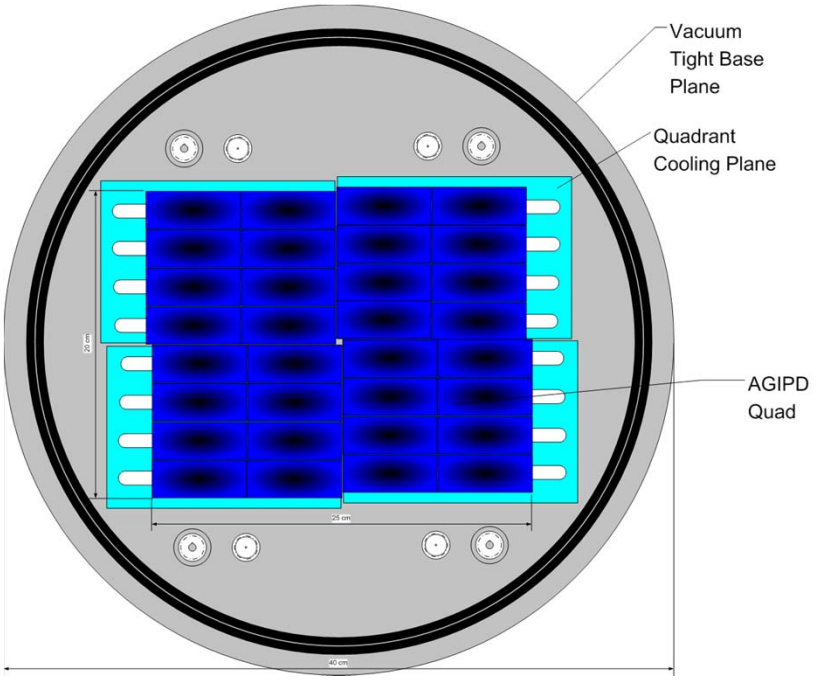
Silicon Fresnel zone plattes for high heat load



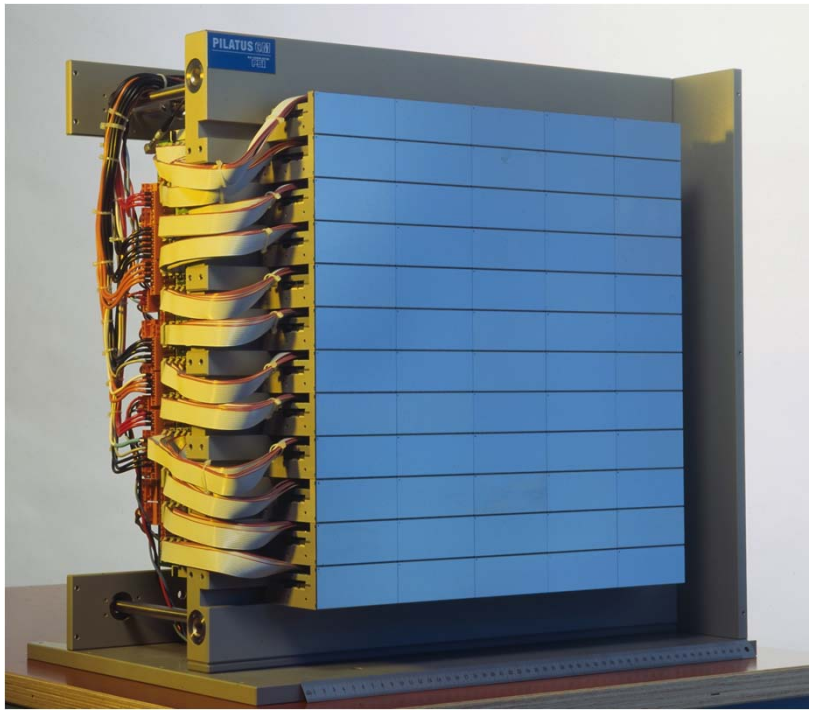
30 nm outer zone width

J. Vila-Comamala, K. Jefimovs, J. Raabe, B. Kaulich, C. David
Silicon Fresnel zone plates for high heat load x-ray microscopy,
Microelectronic Engineering **85** No. 5-6 (2008) p. 1241 – 1244

Detector Development



PIXEL Detector for SwissFEL
and European XFEL

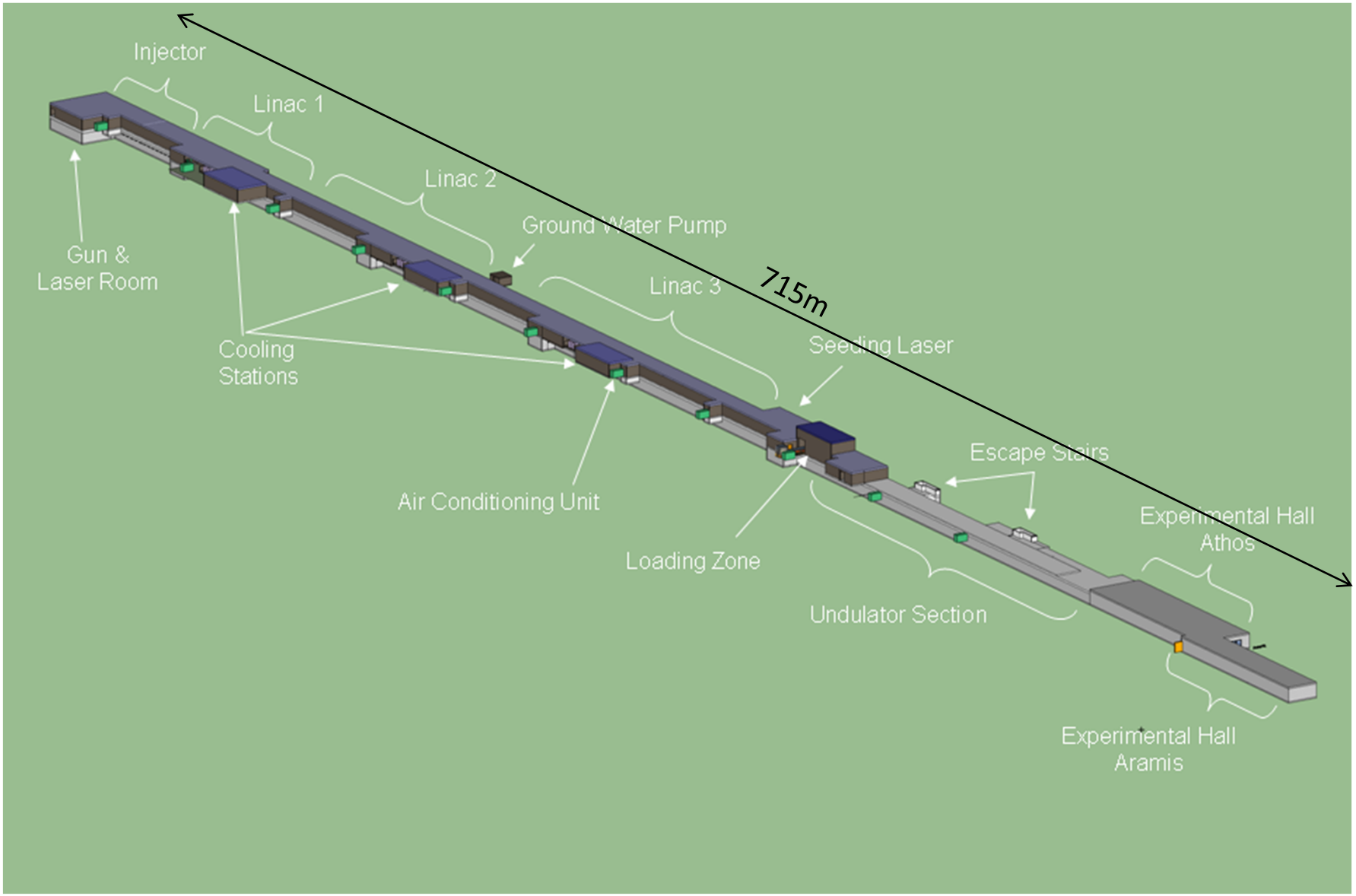


PIXEL Detector at the SLS

DECTRIS

… and many small local industries

SwissFEL Building Layout



SwissFEL construction site

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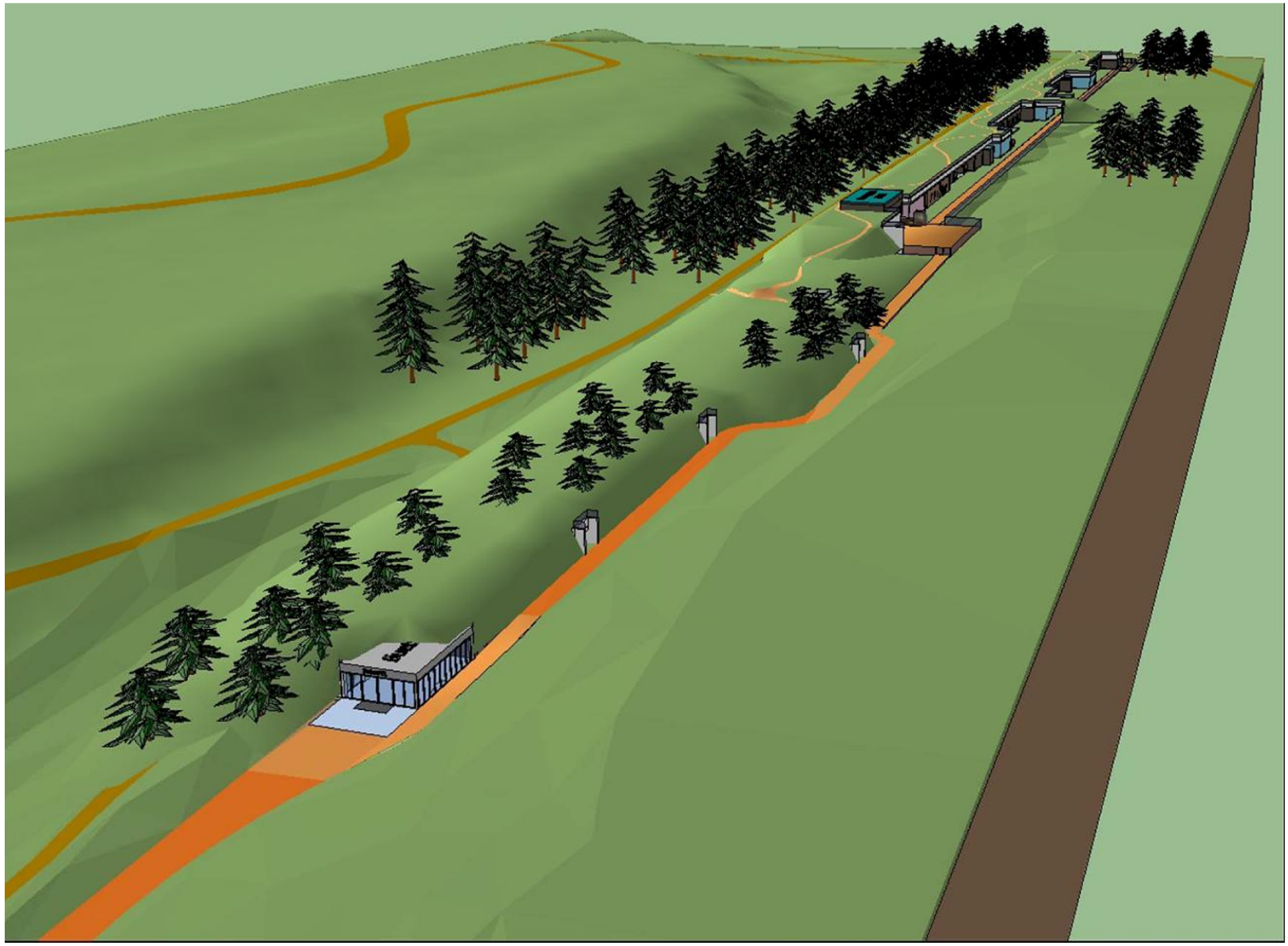
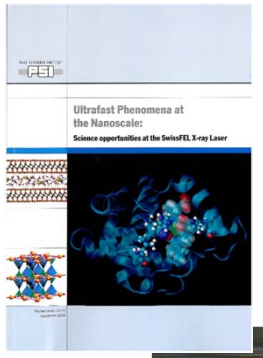
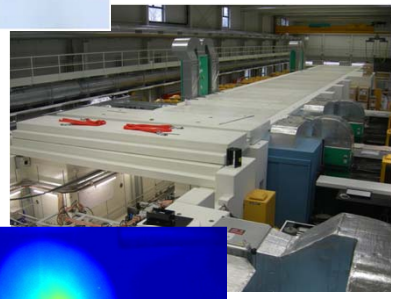
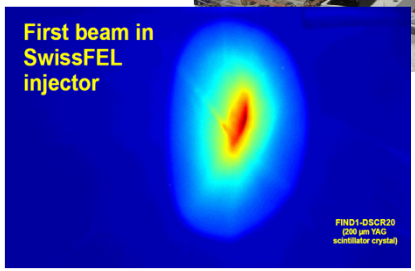


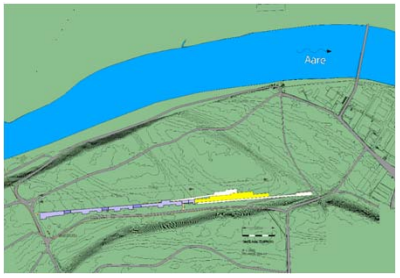
SwissFEL Milestones

Scientific Case:	September 2009
Local community:	January 2010
ETH Board:	March 2010
Start „Bewilligungsverfahren“:	March 2010
250 MeV injector:	First beam March
2010	
Inauguration 250 MeV inj.	August 24th, 2010
Documents for BFI:	October 2011
Parliament decision:	2012
Start of construction:	2013
Aramis operation:	2017
Athos operation:	2019









http://fel.web.psi.ch