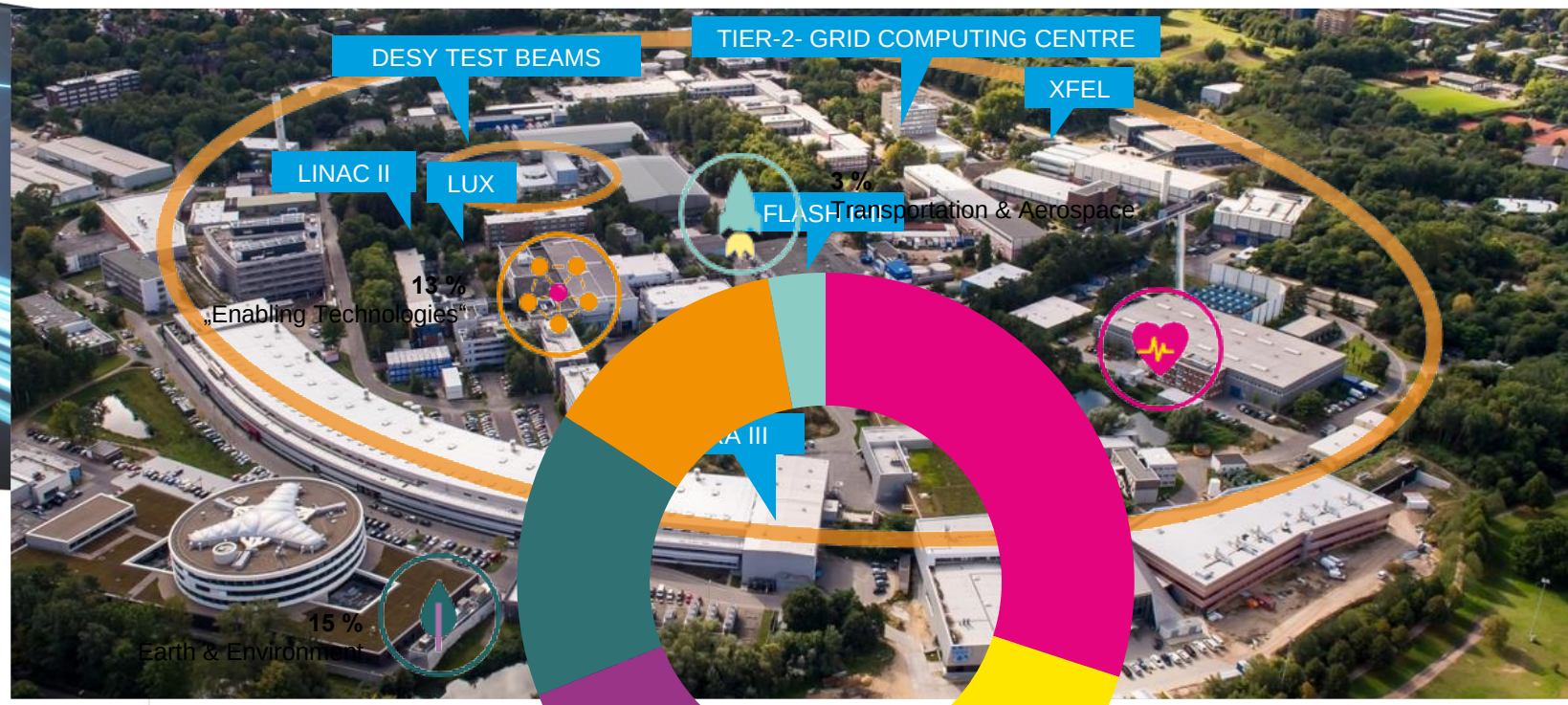
t Laser Technology at



13 %
„Enabling Technologies“

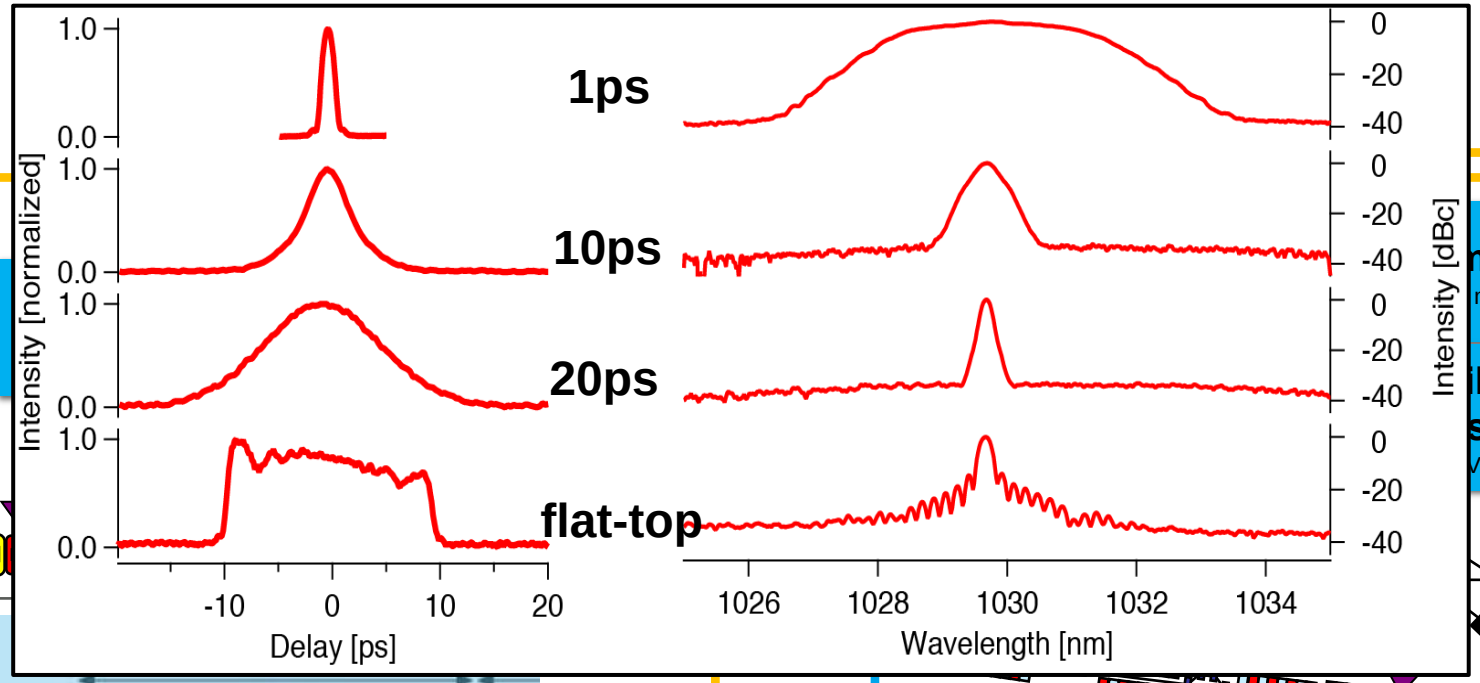
3 %
Transportation & Aerospace

15 %
Earth & Environment

17 %
Key Technologies

22 %
Energy

Ultrafast Lasers are Essential for X-ray Free Electron Lasers



(1) Photocathode lasers
10 µJ | UV
1 - 20 ps flat-top

np – probe lasers
mJ | tunable | 10 fs

ible pump – probe
se generation
V – MIR – THz | > 10 µJ | fs

Timing tool
NIR pp-laser / FEL XUV
cross-correlator

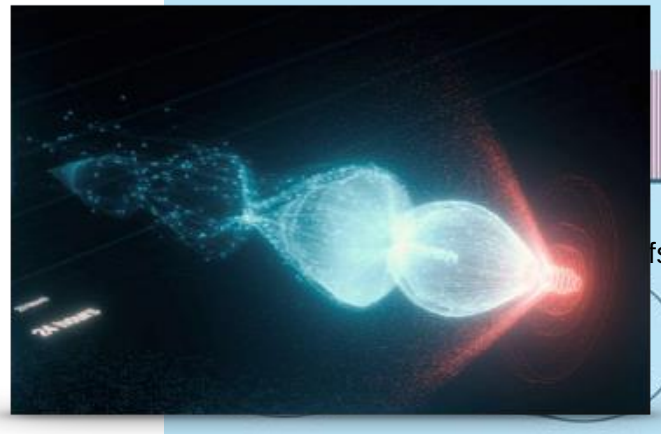
Electron Gun

Science Experiments

Future:
Laser Plasma Accelerator

X-ray pulse

need:
kHz drive laser
few J
few 10s of fs



(4) Modulation laser for advanced FEL schemes
1 mJ | 5 fs | 100 mrad CEP stable

Ultrafast Laser Systems:
- 24/7 remote controlled operation
- > 99 % availability
- Up to 5 kW power (average in 1ms burst)

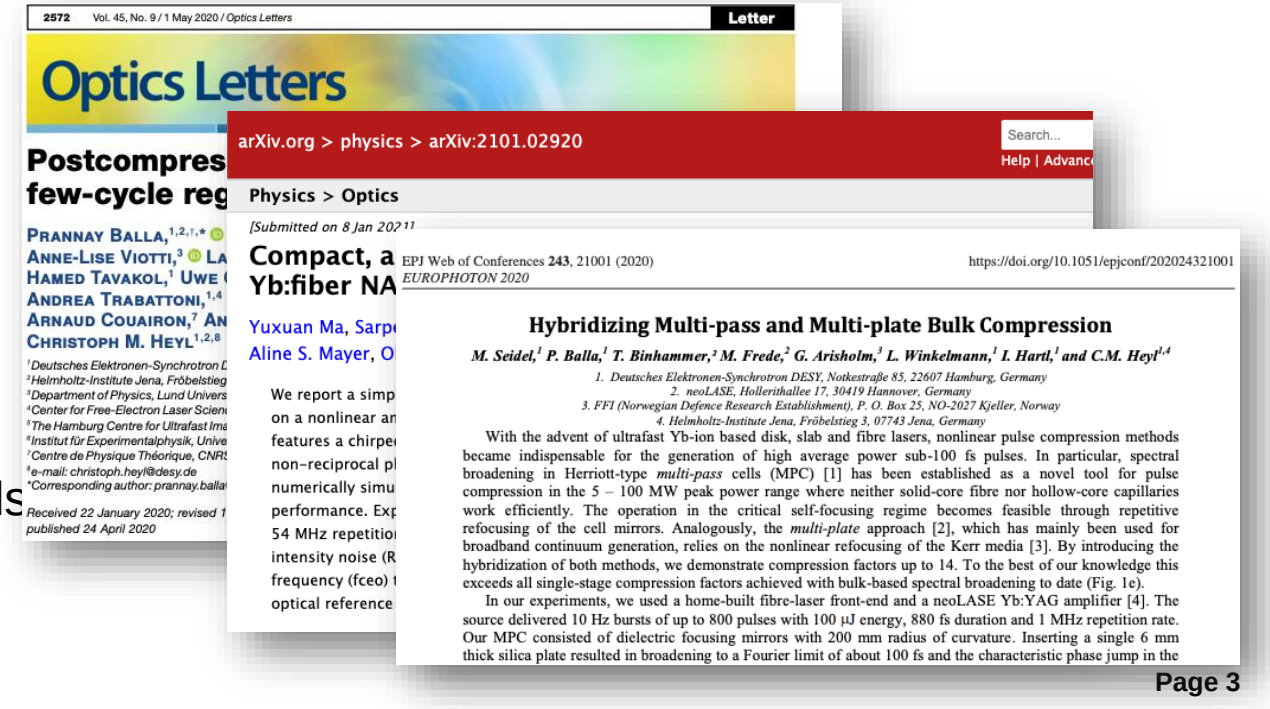
Ultrafast Optics at DESY

What we need

- Low timing jitter oscillators, fiber amplifiers
- mJ / MHz power amps (ps, Yb:YAG)
  kW average power kHz green pump lasers
- Wavelength conversion/ tuning techniques (VUV to THz). Power scaling of those techniques (OPCPA)
- Speciality PM-fibers and fiber components
- Spatial and temporal pulse shaping technology
- Active drift stabilization (energy, pointing, timing)
- High damage threshold, dispersion engineered coatings and optics (NIR + UV to MIR)
- High damage threshold, high power components (optics, isolators, shutters, ….)
- Control interface compatible with industry standards
- Service by in-house staff as much as possible

What we have / can provide

- Feedback on long-term performance
- Joint developments with industry
- Technology transfer to industry
- Excellently educated students which are looking for a job in industry



DESY Ultrafast Laser Spin-Offs

CLASS 5 Photonics

Extreme Power at Extreme Wavelengths

→ High-Power OPCPAs
- < 10 fs … 100 fs
- 200 nm – 16 µm
- 100 W

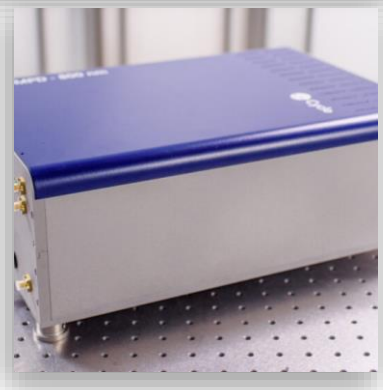
→ Bright EUV/Soft X-Ray sources

www.class5photonics.com
Forschungscampus Bahrenfeld
Notkestr. 85, Bldg 200
22607 Hamburg, Germany

Cycle

www.cyclelasers.com

- DESY spinoff for ultrashort pulse laser products
- Founded in 2015 by Prof. Kaertner, 15 employees
- Develops femtosecond lasers and laser-RF-synchronization systems
- Worldwide installations at FEL facilities/synchrotrons (SLAC, FERMI, SACLA, SINAP, DICP)
- Supplier to ESA for ground station timing



Science City Bahrenfeld

Interdisciplinary hub of excellent science, business and education

- Industry Beamlines
- Innovation Centres
- Space for Entrepreneurs
- Interdisciplinary Research
- Bridging Science and Industry
- Mordern workplace & Urban Setting