Welcome to DESY

DESY at a glance

A research center of the Helmholtz Association

Deutsches **E**lektronen-**Sy**nchrotron

Founded in 1959 as a German Particle Physics Laboratory

More than 2.800 employees, including 1.100 researchers (31 % women)

More than 3.000 visiting researchers from over 40 countries annually

232 million € Basic budget 2020

90% from the Federal Government (BMBF) and 10% from the City of Hamburg/State of Brandenburg

Two sites

DESYs research areas

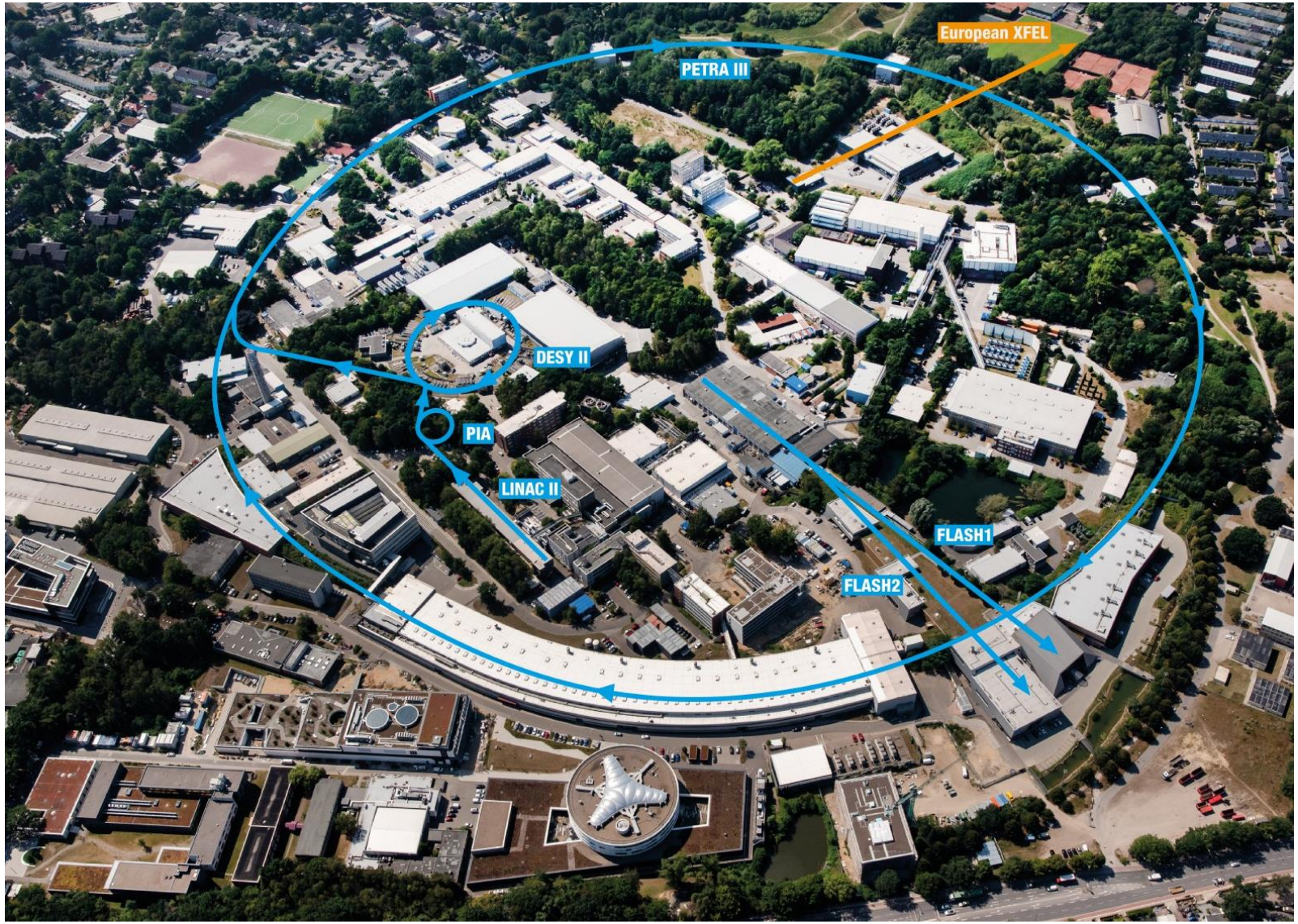
The cornerstones of DESY's mission

DESY back then

1963

DESY today

2023

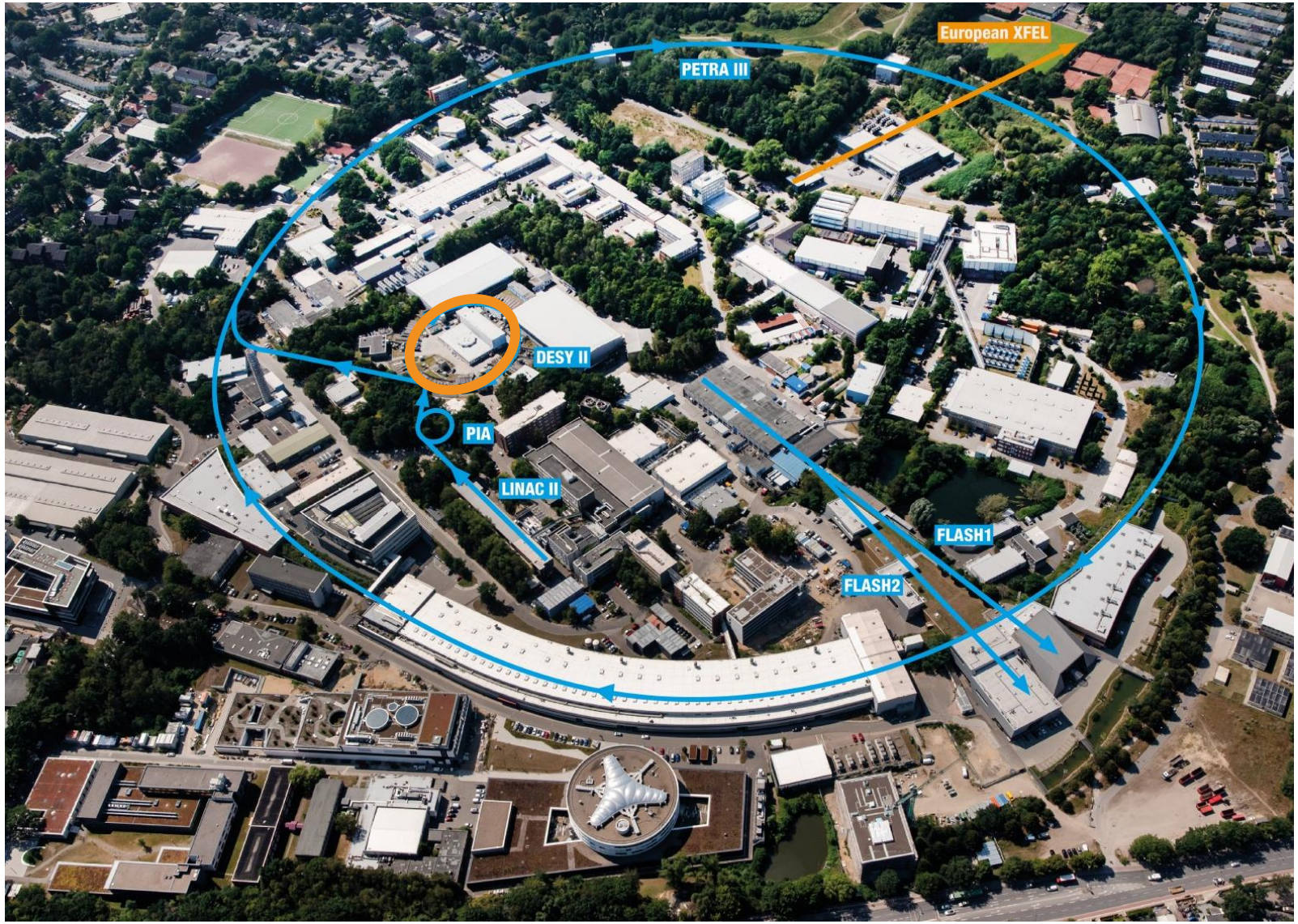


DESY today

Our facilities

DESY

- **D**eutsches **E**lektronen-**Sy**nchrotron
- Since 1964
- Circumference approx. 300 m
- Electron accelerator
- Originally used for measurements of quantum electrodynamics (particle physics)
- Today pre-accelerator & test beam for detector development

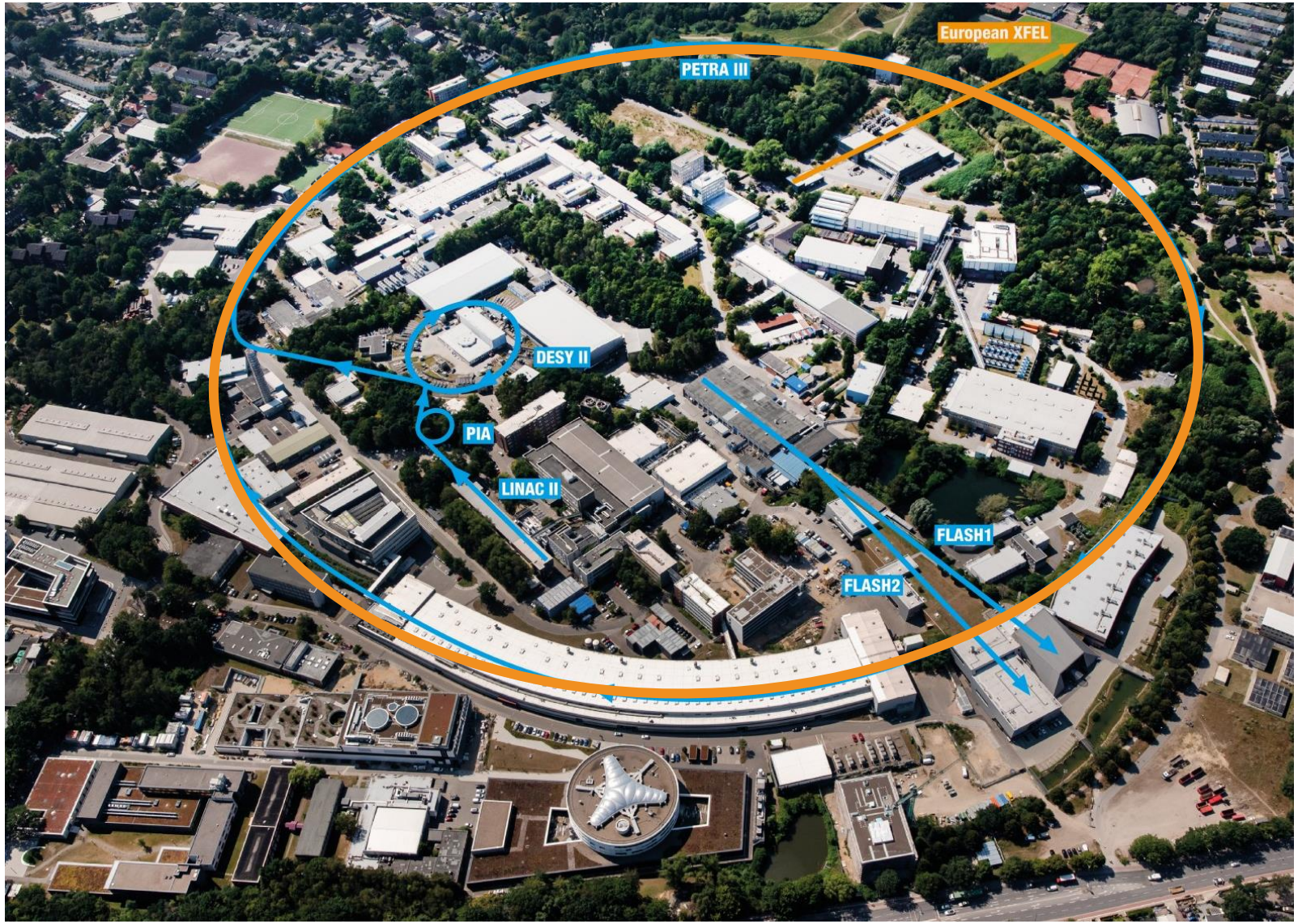


DESY today

Our facilities

PETRA III

- **P**ositron-**E**lektron-**T**andem-**R**ing-**A**nlage
- Since 1978
- Circumference approx. 2.3 km
- Originally used for collision experiments for particle physics (discovery of the gluon 1979)
- Later pre-accelerator for HERA
- Since 2010 world‘s largest storage-ring-based X-ray radiation source (PETRA III)

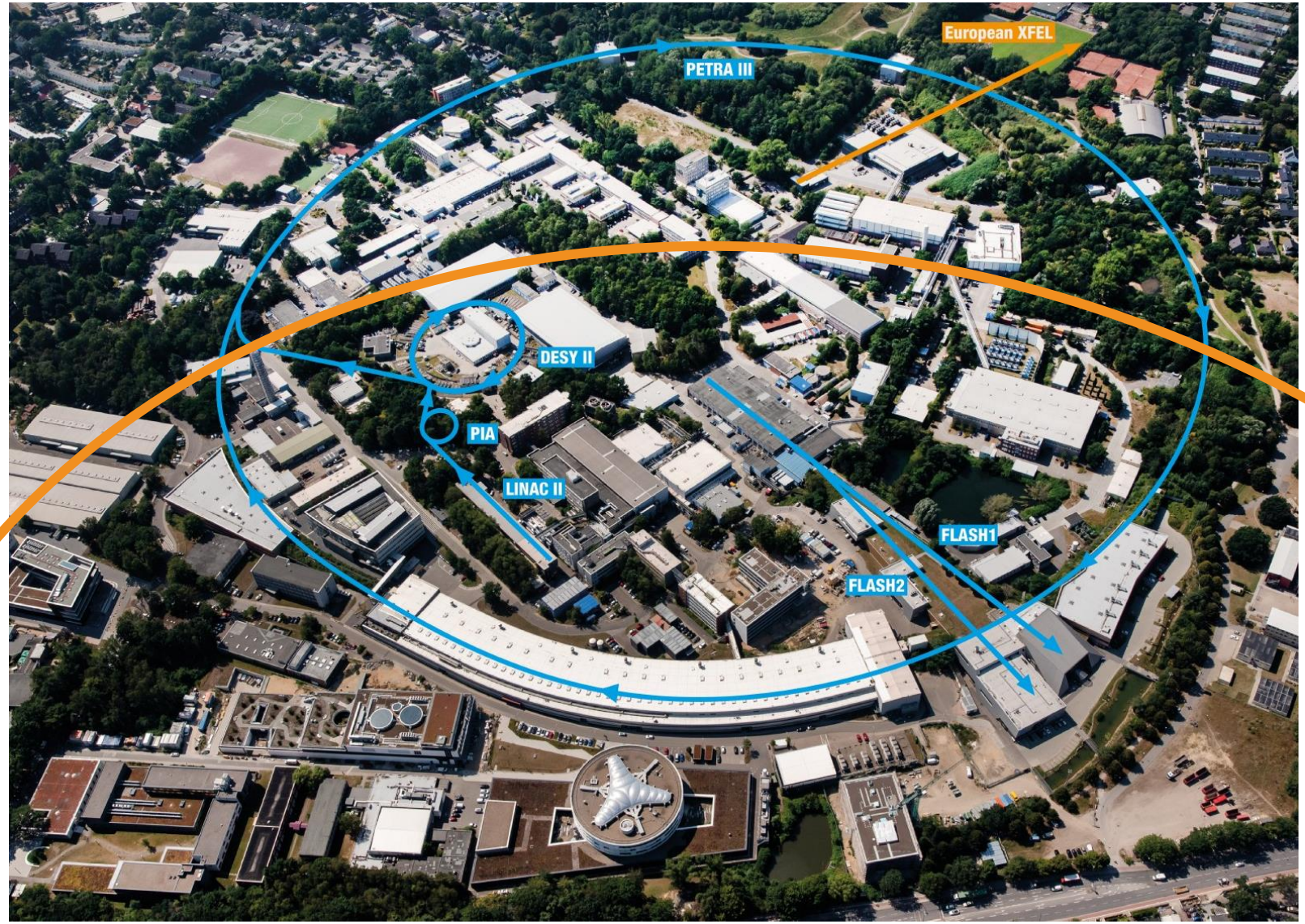


DESY today

Our facilities

HERA

- **H**adron-**E**lektron-**R**ing-**A**nlage
- From 1992 to 2007
- Circumference approx. 6.3 km
- Germany‘s largest particle accelerator
- Only electron-proton collider in the world
- Precise measurements of the proton structure

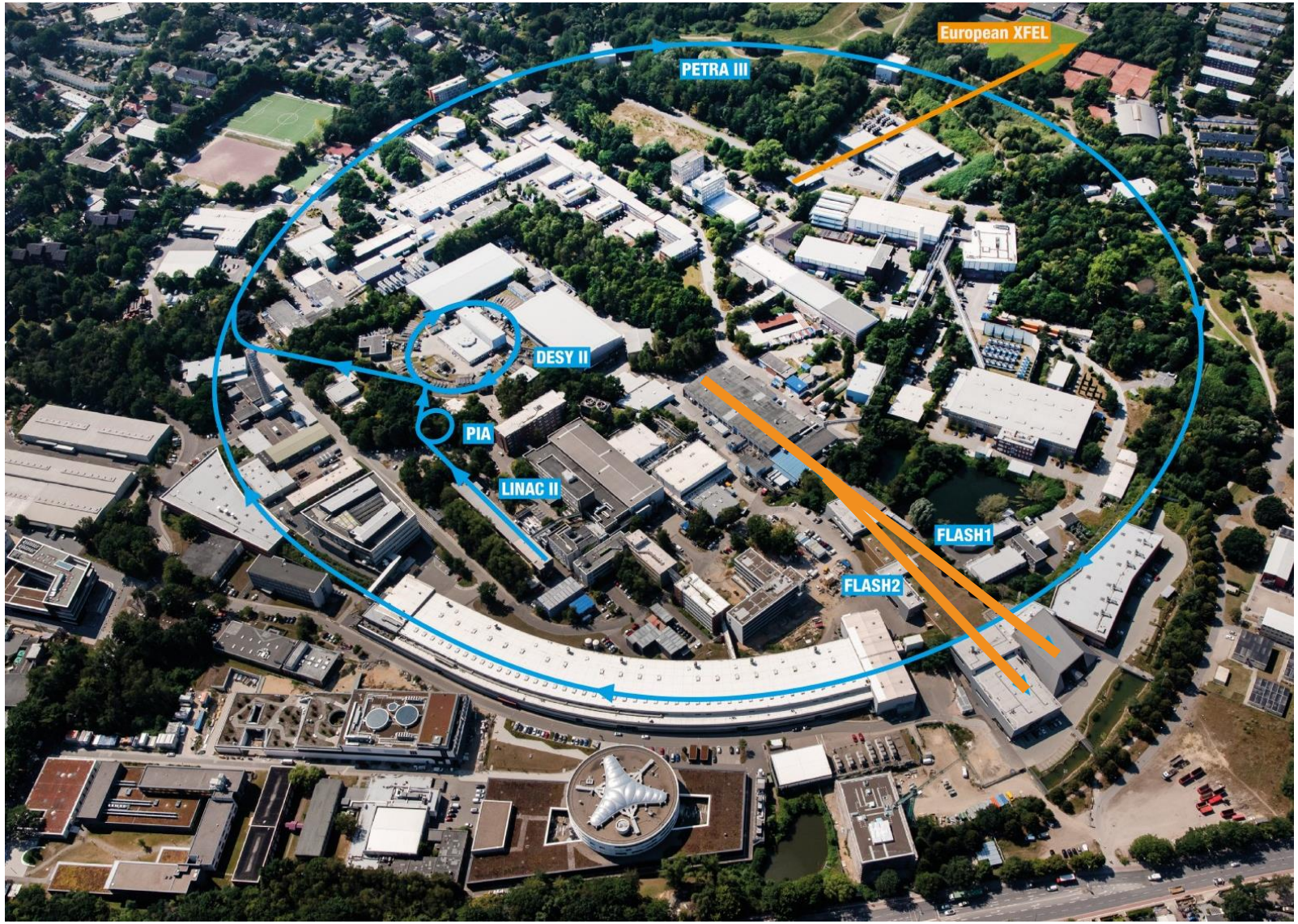


DESY today

Our facilities

FLASH

- **F**reie-Elektronen-**Las**er in **H**amburg
- Since 2005
- Length approx. 300 m
- World‘s first free-electron laser (FEL) in the X-ray range
- Originated from test facility for superconducting accelerator technology & FEL technology
- Today two separate FEL sources (FLASH1 and FLASH2) with 11 measuring stations

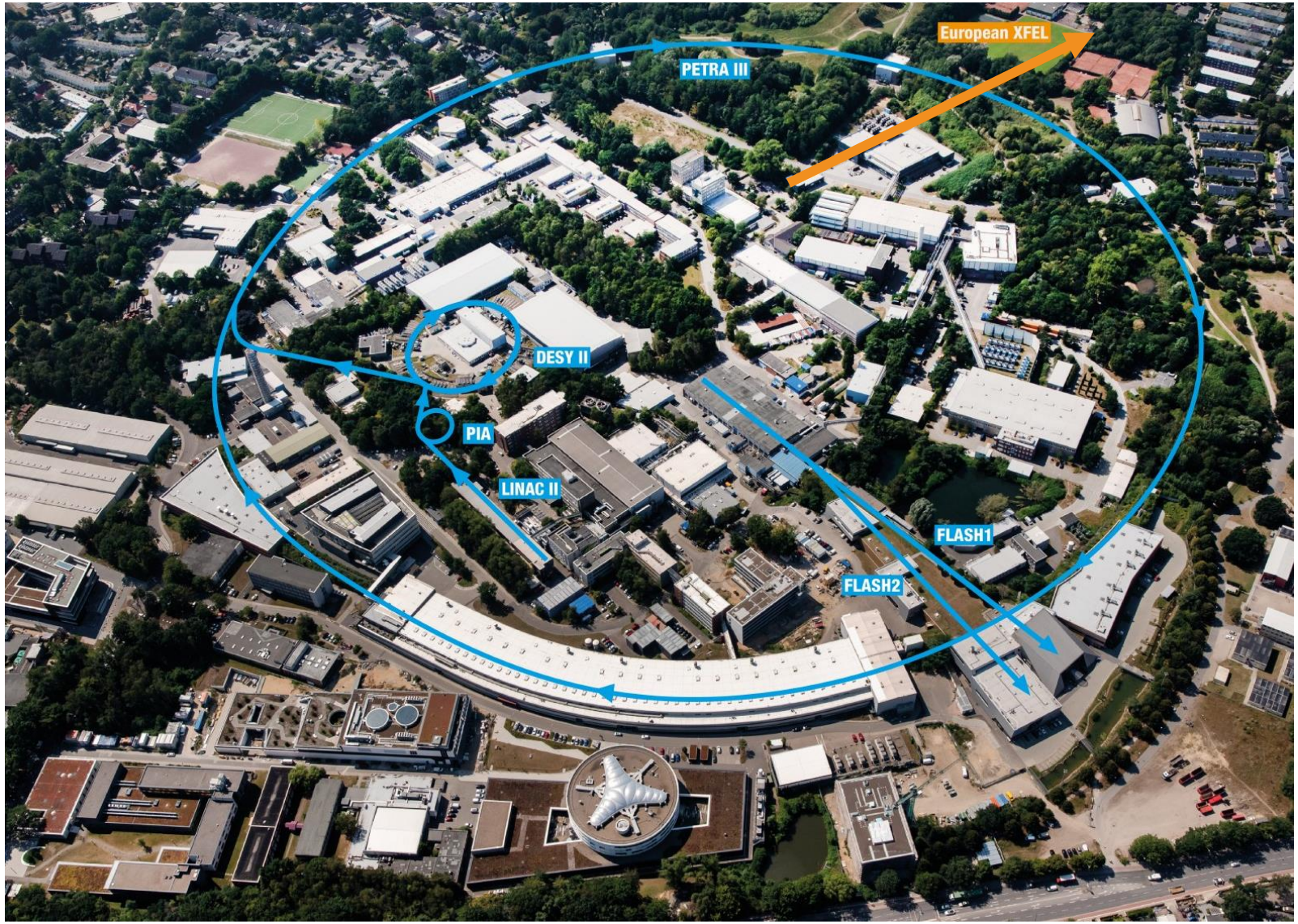


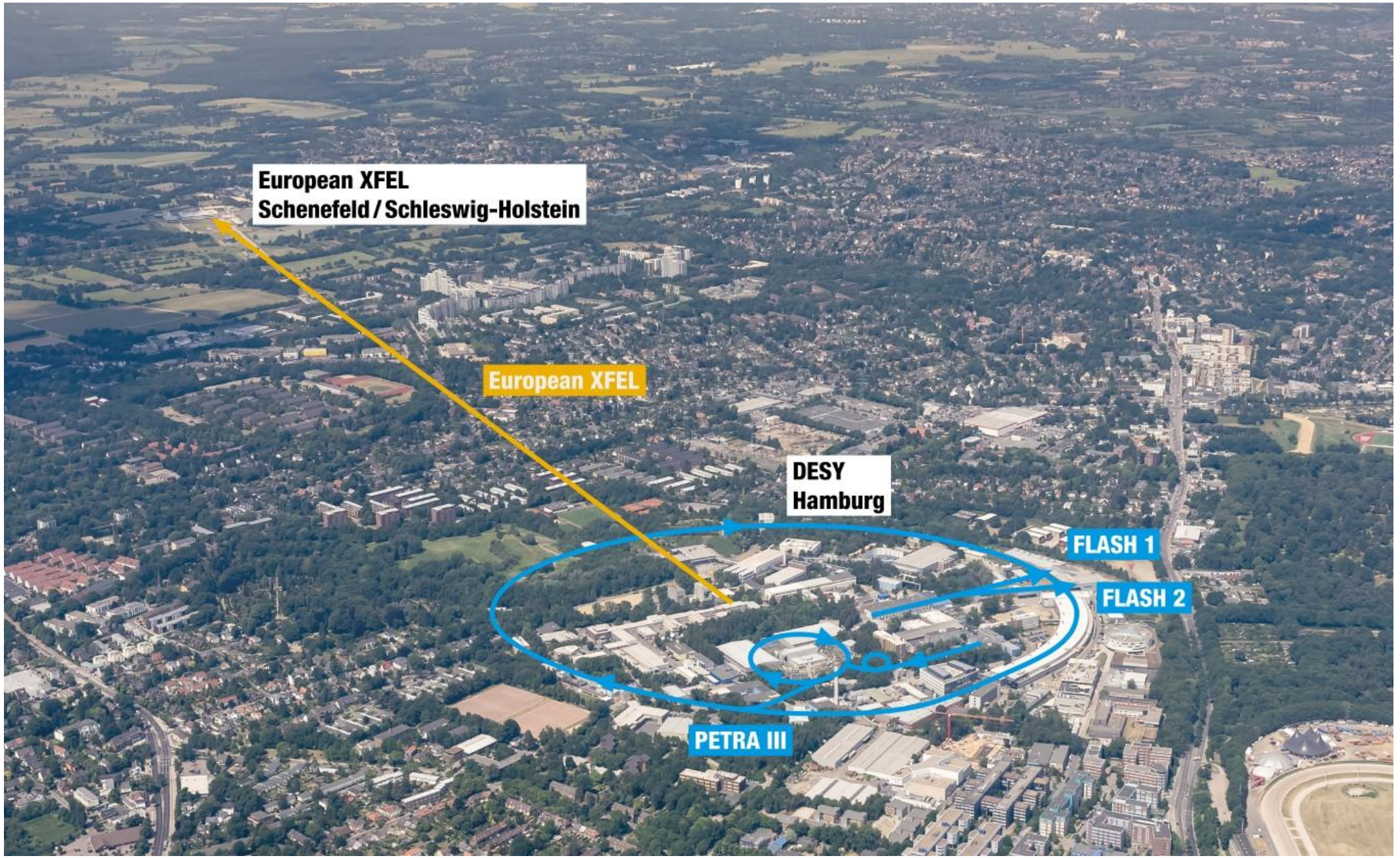
DESY today

Our facilities

European XFEL

- **X**-Ray **F**reie-**E**lektronen-**L**aser
- Since 2017
- Length approx. 3.4 km
- Construction and operation by
  European XFEL GmbH
  (non-profit, 11 countries involved,
  DESY is main shareholder)
- Generates extremely brilliant
  and ultrashort X-ray flashes
  - Wavelength: 0.05 – 4.7 nanometres
  - Pulse length: below 100 femtoseconds
  - 27,000 pulses per second

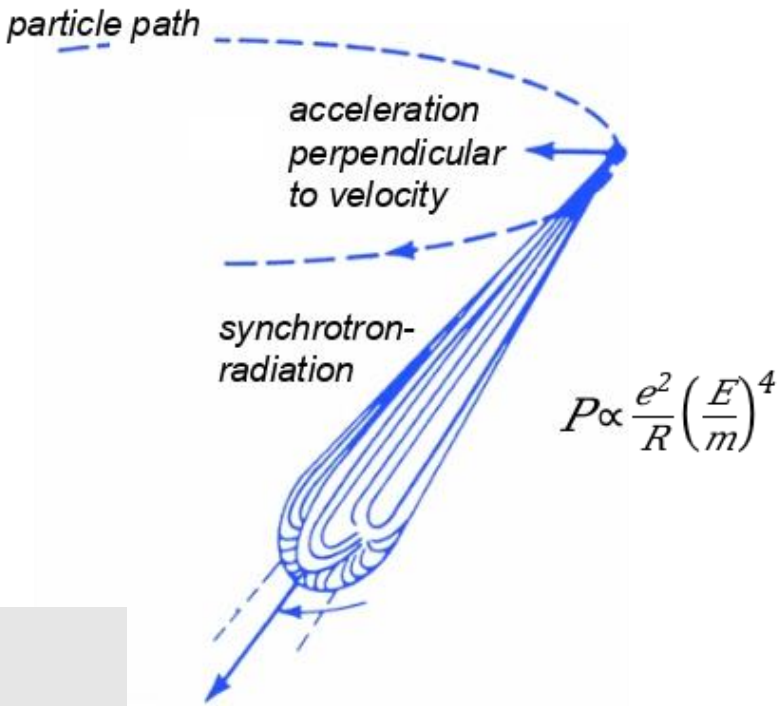


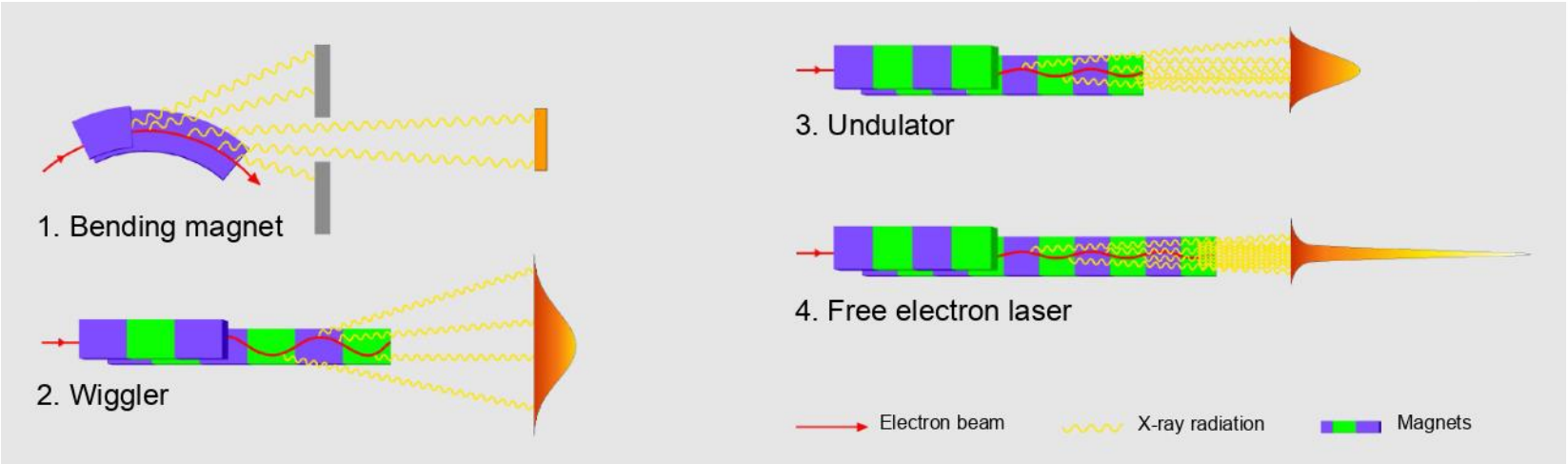

European XFEL
Schenefeld / Schleswig-Holstein
European XFEL
DESY
Hamburg
FLASH 1
FLASH 2
PETRA III

How is research done at particle accelerators?

Photon science

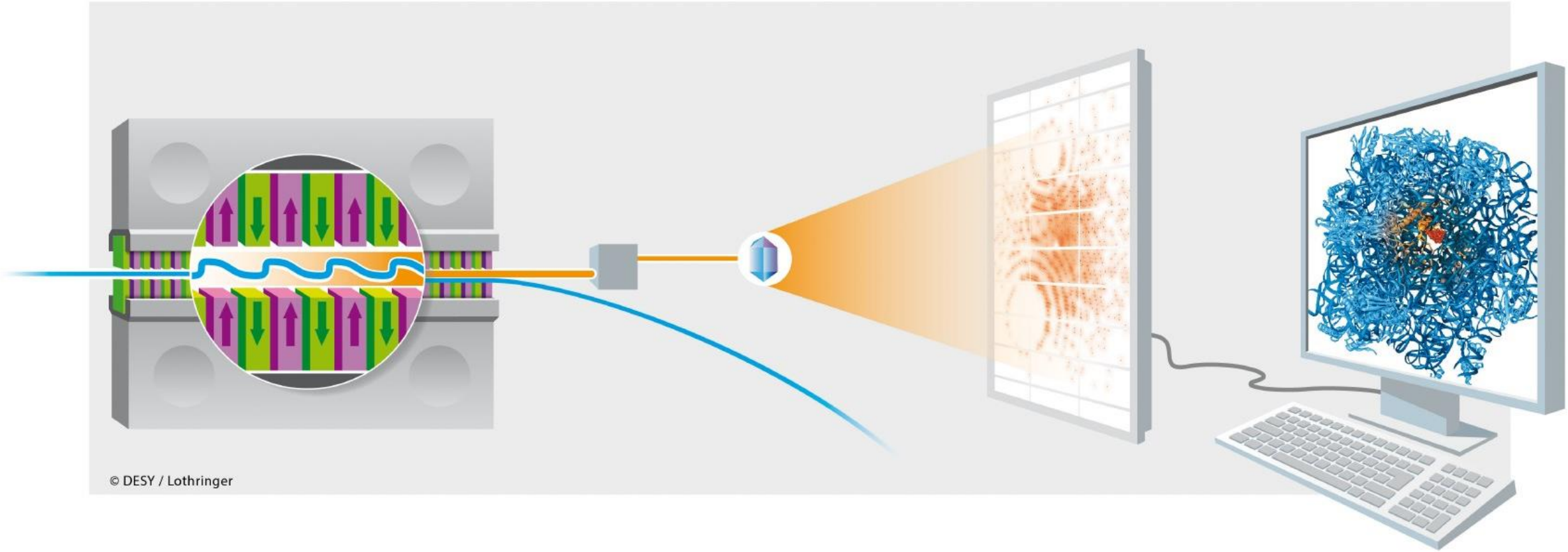
- When charged particles are deflected, they emit light
- The lighter the particle, the more light is produced
- The "synchrotron light" has excellent properties for many modern research applications





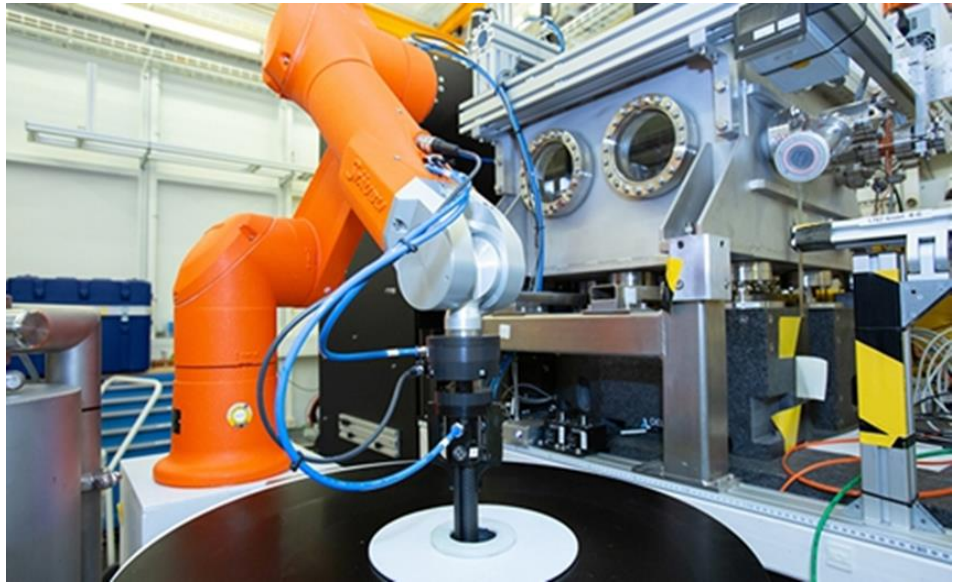
What can we do with this light?

Materials science, nano technologies, medicine, structural biology,…
e.g., diffraction experiments with crystals made of biomolecules



What can we do with this light?

Our facilities

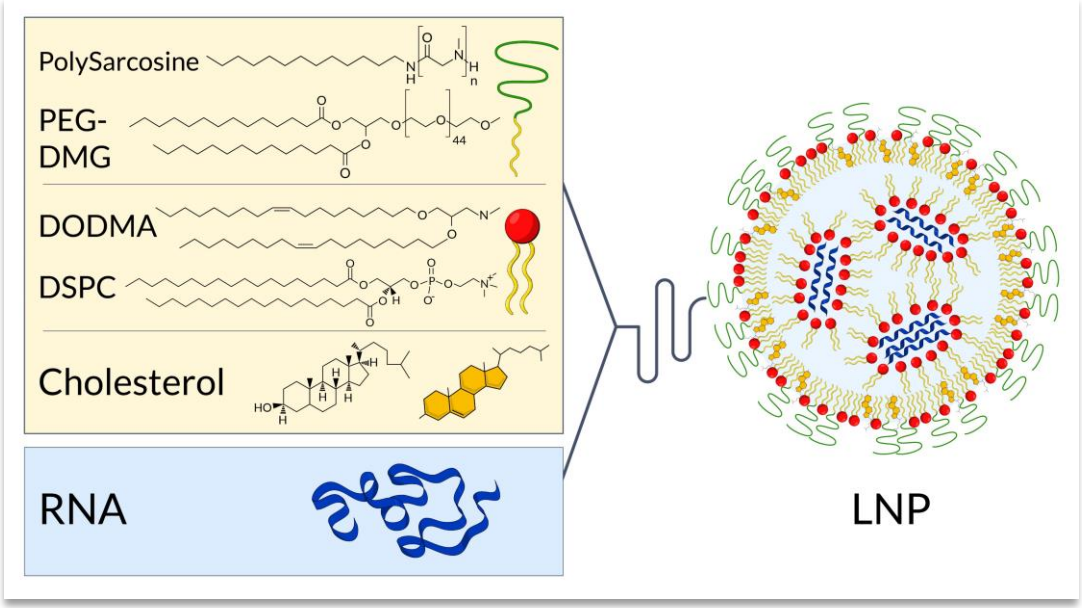


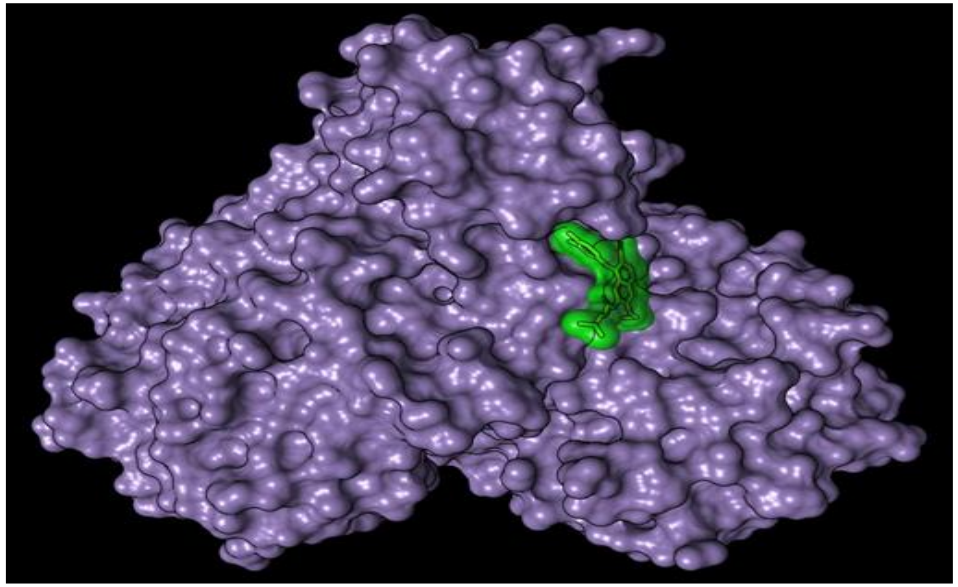
PETRA III

COVID-19

X-ray screening of over 6000 approved substances:
Investigation of binding to the viral proteins

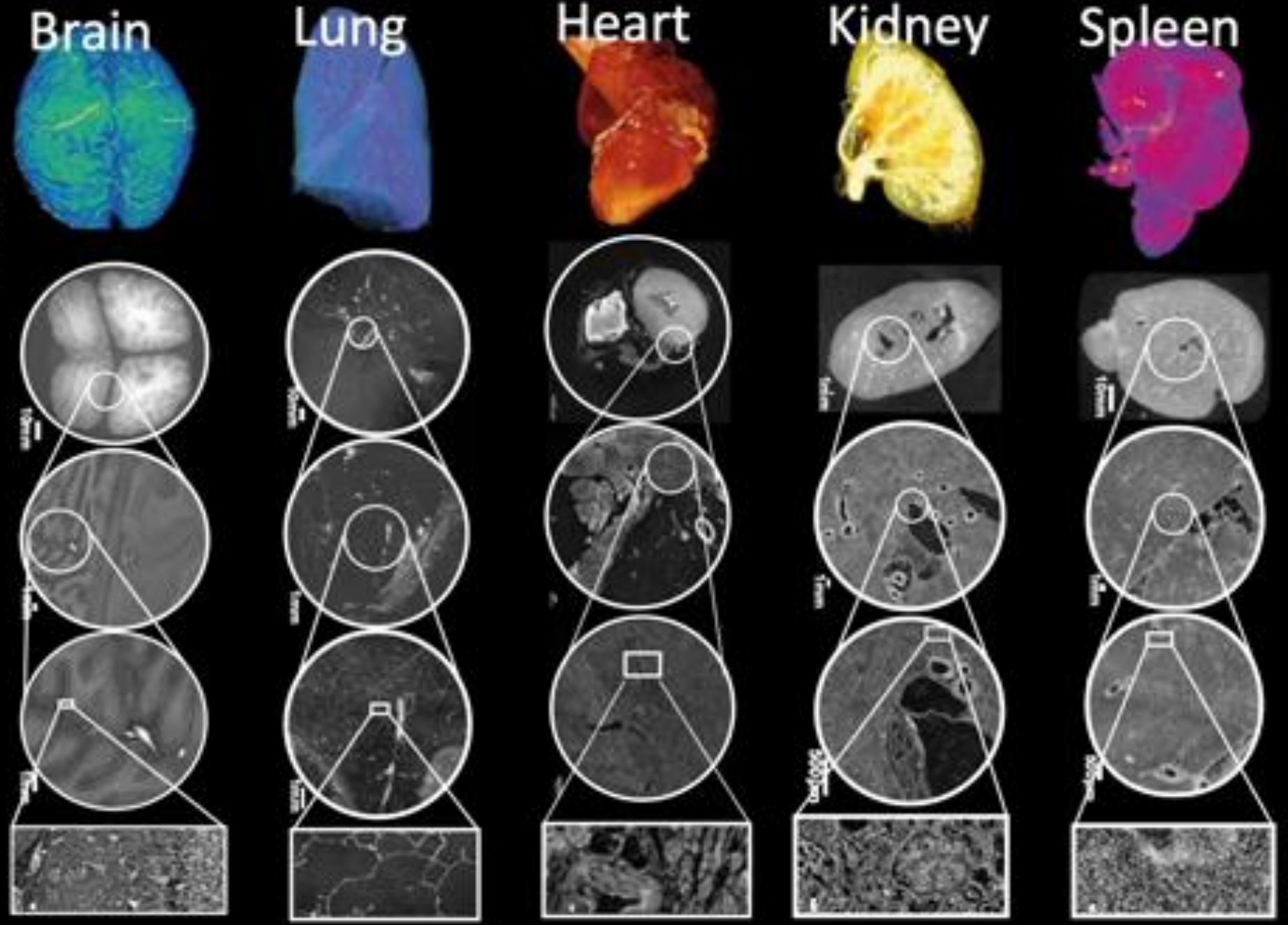
Vaccine development





HiP-CT Imaging From Cellular To Whole Organ Scale

(A UCL and ESRF led Project)

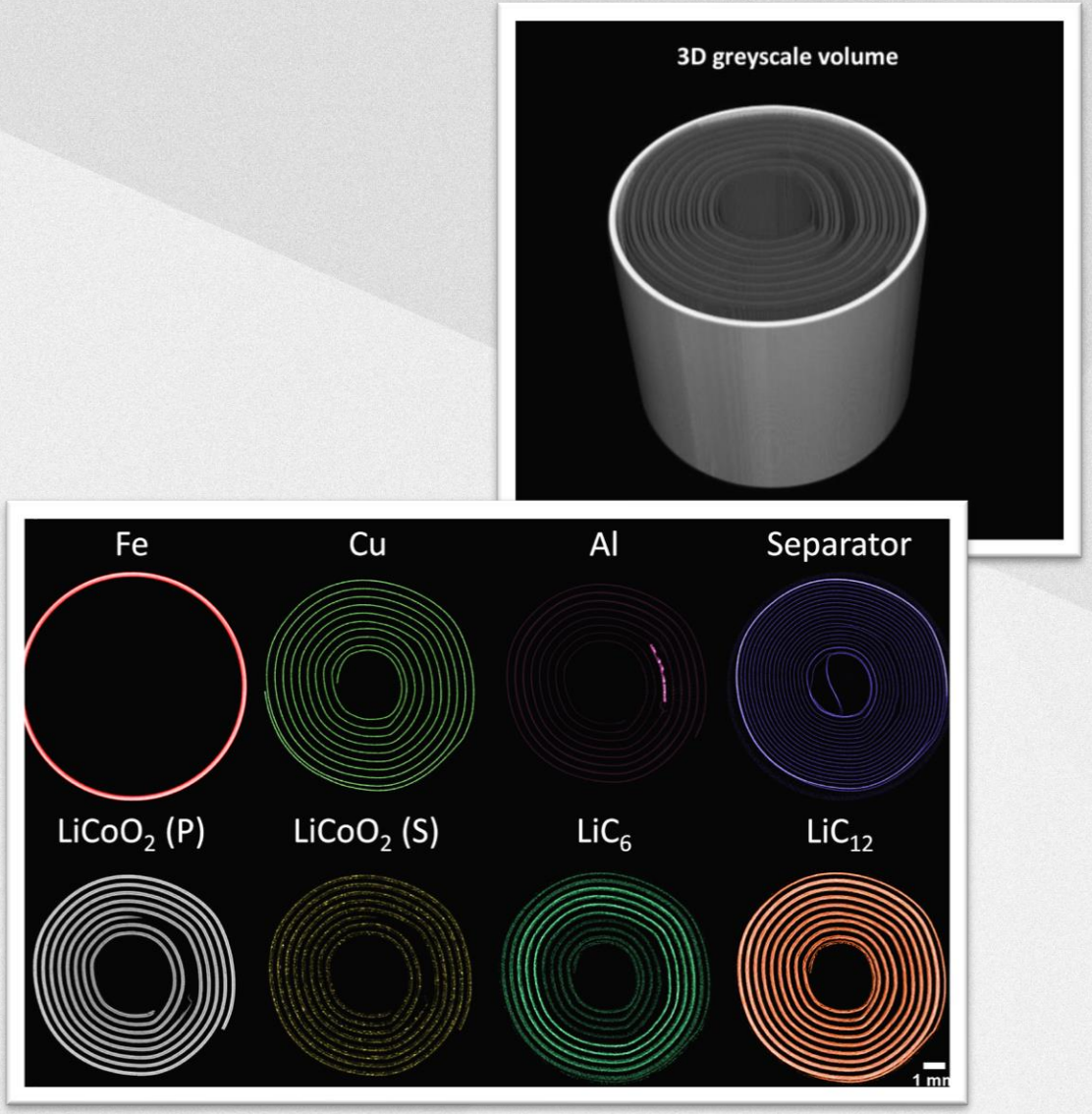


What can we do with this light?

Our facilities

PETRA III

Photon science,
Nanotechnology, energy, material science



DESY today

New ideas through modern large-scale research on one campus

PETRA III World's largest synchrotron radiation source

FLASH World's first free-electron laser

European XFEL World's largest free-electron X-ray laser

Big data centers

Test facilities for new detector technologies

Interdisciplinary research centers

Campus of cooperations

DESY is host for numerous partners

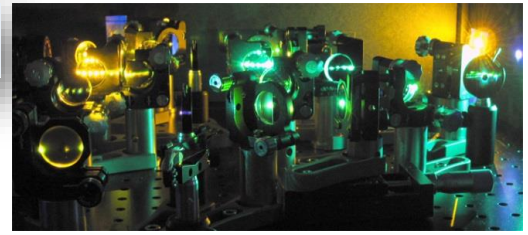
CFEL SCIENCE

CSSB Centre for Structural Systems Biology

EMBL

Helmholtz-Zentrum hereon

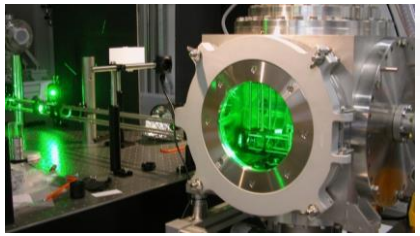
mpsd



CNS

UH

PIER



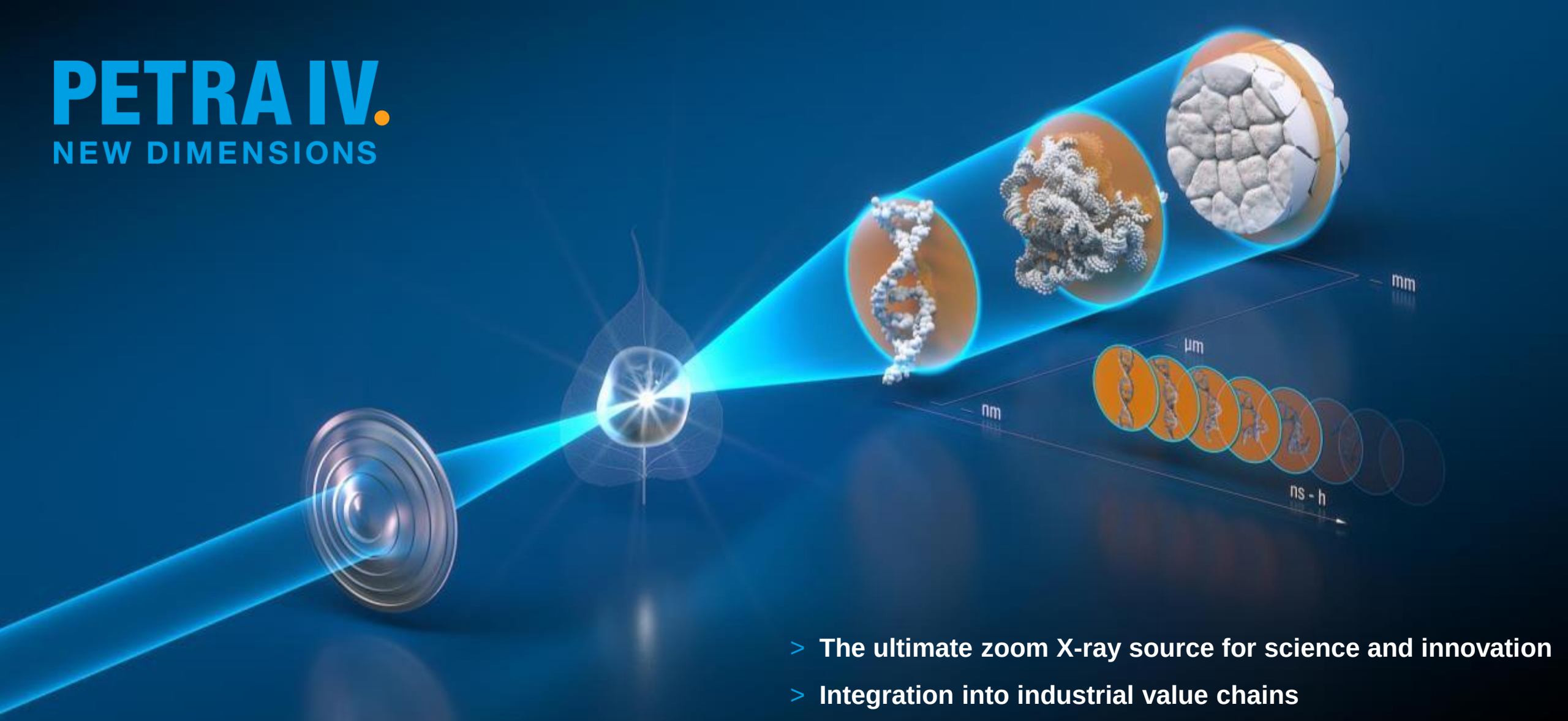
CUI THE HAMBURG CENTRE FOR ULTRAFAST IMAGING

Science City Bahrenfeld

A whole city district of science

DESY, 2040

PETRA IV.
NEW DIMENSIONS



- The ultimate zoom X-ray source for science and innovation
- Integration into industrial value chains
- Quality assurance and certification

Thank you
for
your attention