

**PETRA IV.**  
NEW DIMENSIONS

# The Ultimate 3D X-Ray Microscope

General Project Information

S. Klumpp  
on behalf of the project team  
Hamburg, June 15<sup>th</sup>, 2022

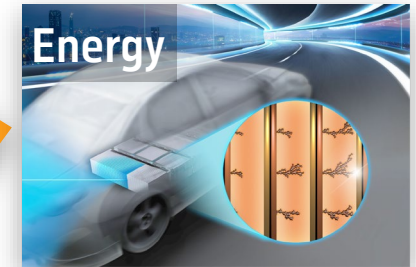
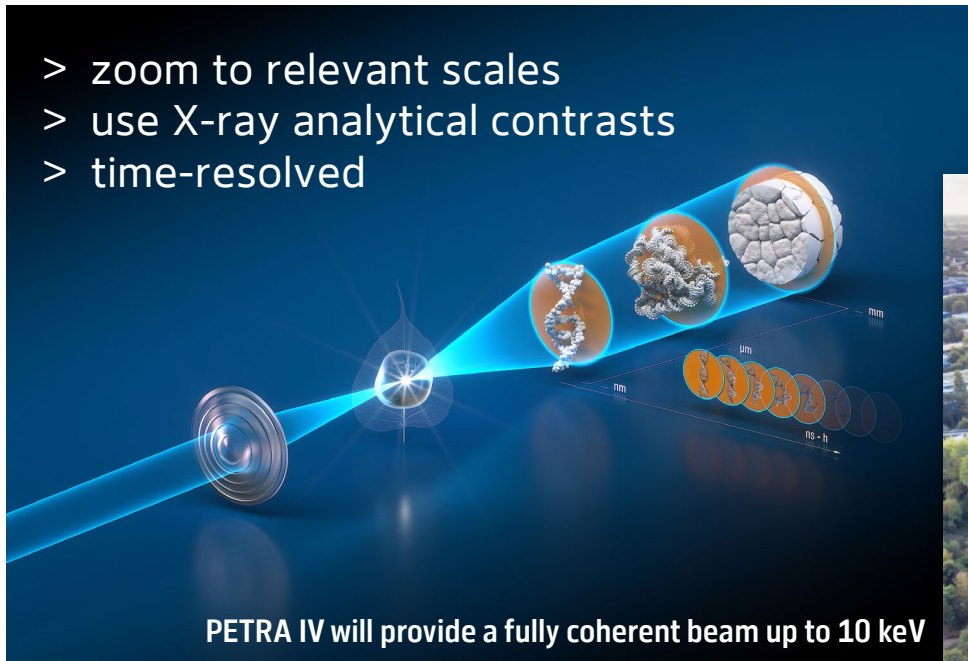
HELMHOLTZ



# Science Case

Providing a ultimate 3D X-Ray Microscope to address scientific and technological challenges of our society  
Cross-scale view of structure and function of complex Chemical, Biological, and Physical Processes

- > zoom to relevant scales
- > use X-ray analytical contrasts
- > time-resolved

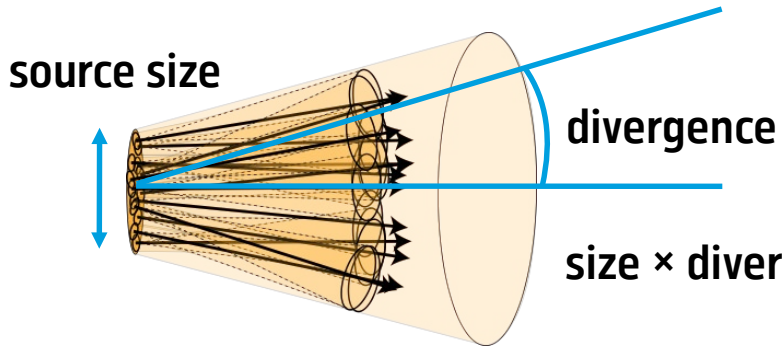


- contributions to grand challenges
- all fields of science
- academia and industry

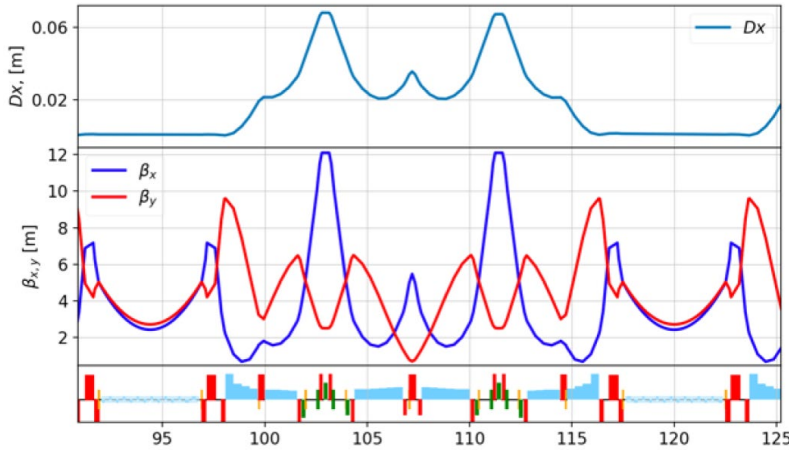


# H6BA Lattice: Getting the Electron Beam Round

## H6BA lattice design for PETRA IV: Brilliance plot for different Undulators

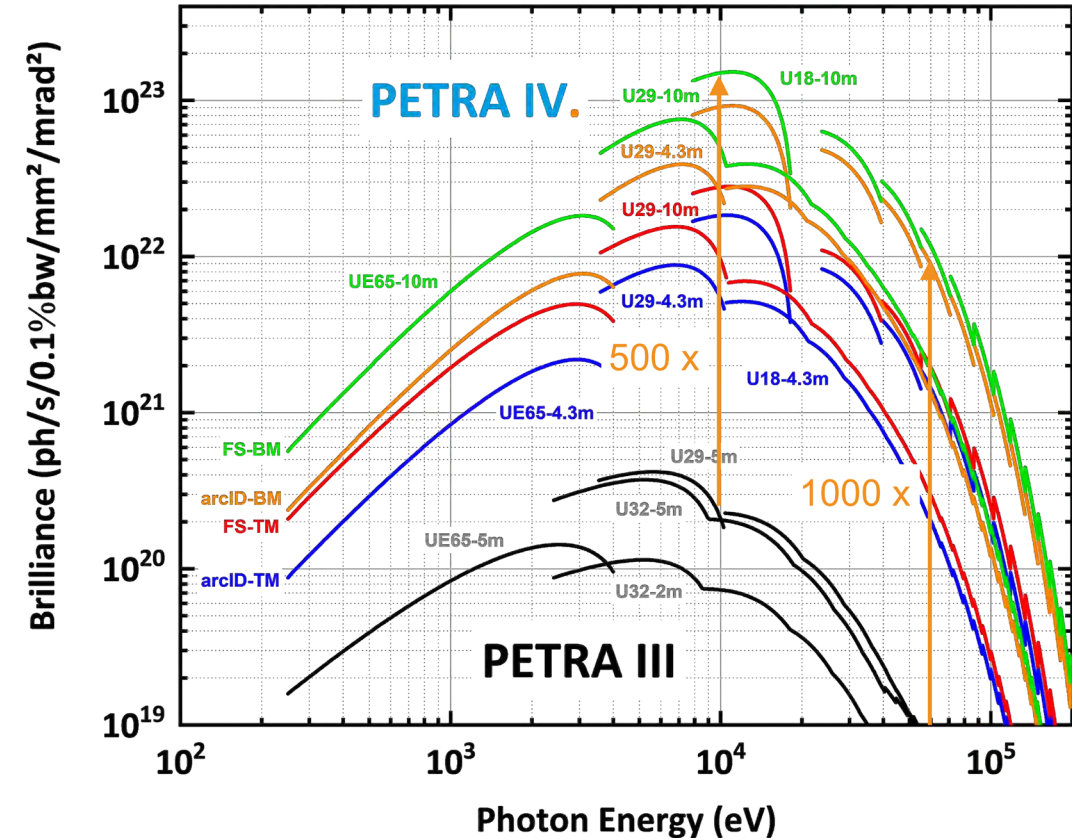


N: number of bending magnets around the ring



6 bend achromat:

- > ~ 3 times more bending magnets than PETRA III
- > ~ 27 times lower bare emittance

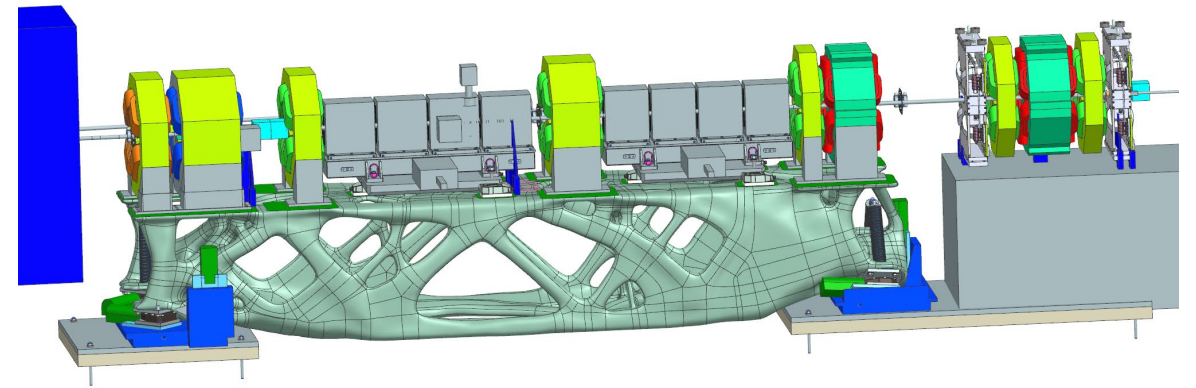
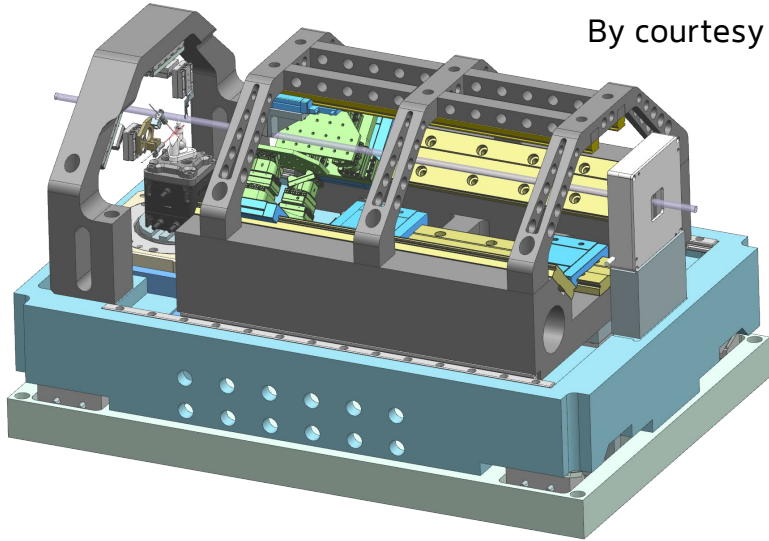




# Ultimate Performance

because of innovative engineering Design

By courtesy of R. Döhrmann (FS-PETRA)



By courtesy of N. Koldrack (MEA)

## Development of ultra-stable Sample Environment

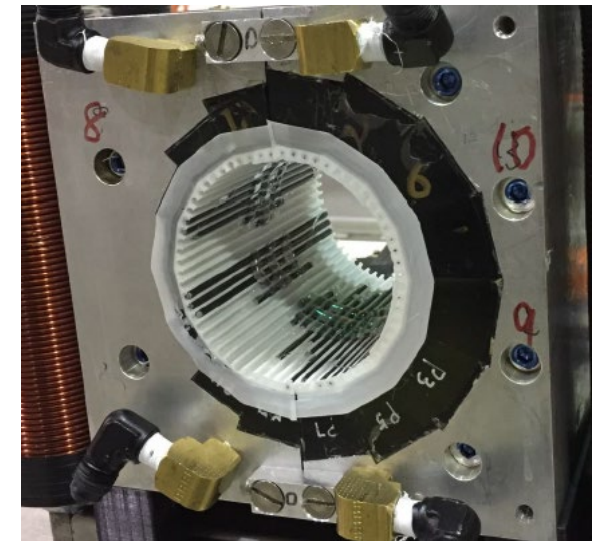
- Development of concepts and components, integration of appropriate sensors and development of control algorithms
- Development and adaptation of new manufacturing technologies to produce ultra-precise and optimised components for the experimental environments (e.g. 3D micro- and precision printing (SLM), high-precision wire erosion, etc.)

## Weight Reduction by using Bionic Design

- Reduced usage of material
- Optimised vibrational behaviour

## Sustainable Solutions for Novel Magnets Concepts

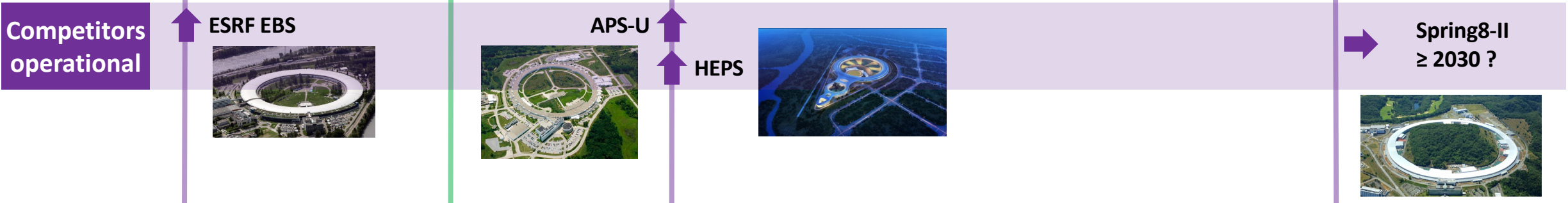
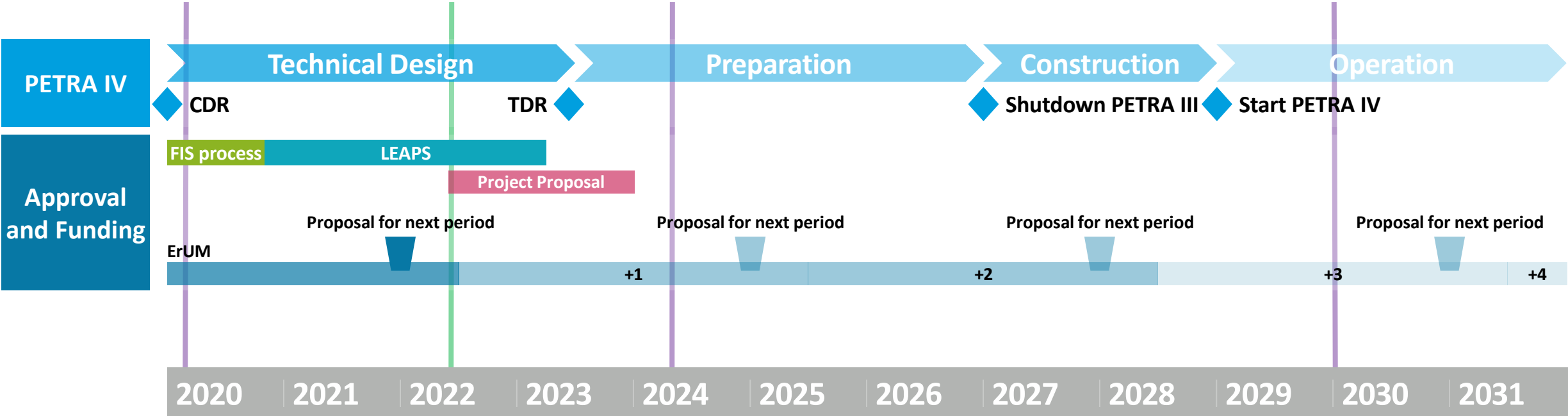
- Novel design for magnetic element based on permanent magnetic material are extended to multipoles and combined function magnets
- Sustainability via significant reduction of the power consumption



Halbach combined function magnet  
By courtesy of A. Schöps / M.Tischer (FS-US)

# Timeline of the PETRA IV. Project

## Project Overview including Commissioning of Competitors



## Contact

**DESY.** Deutsches  
Elektronen-Synchrotron

[www.desy.de](http://www.desy.de)

Dr. Stephan Klumpp  
Head of the PETRA IV Project Support Office  
[stephan.klumpp@desy.de](mailto:stephan.klumpp@desy.de)  
+49 40 8998 6638