# PETRA IV. Project Progress Meeting

*@ DESY. Hamburg*

*27 November 2023*

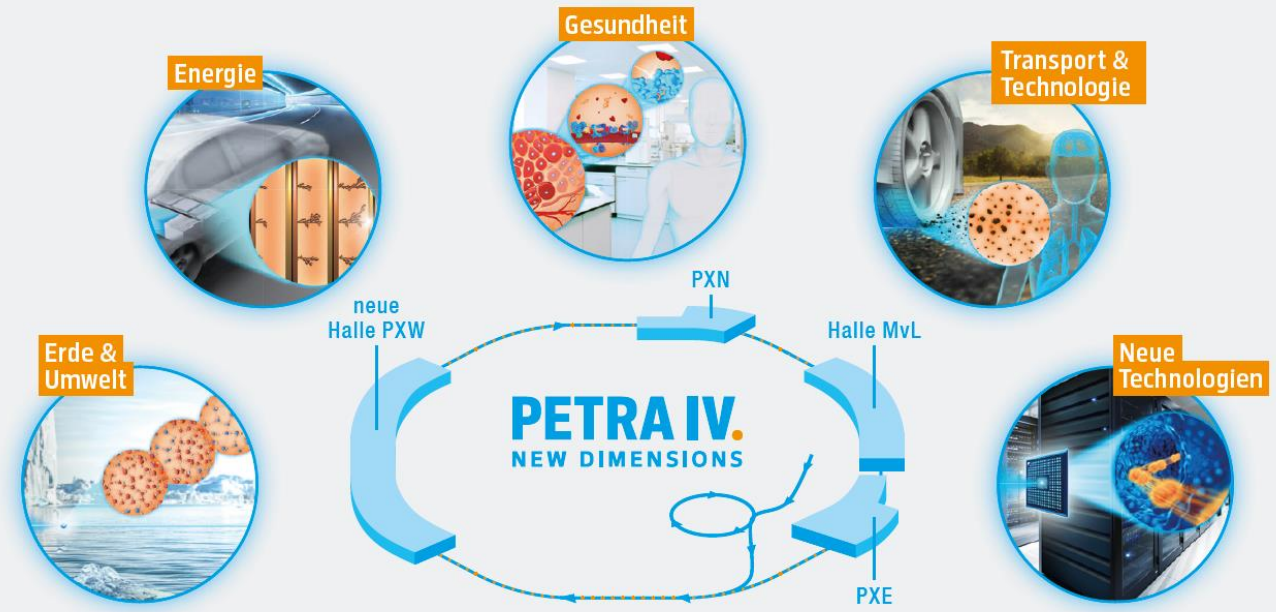
# Welcome!

PETRA IV.
NEW DIMENSIONS

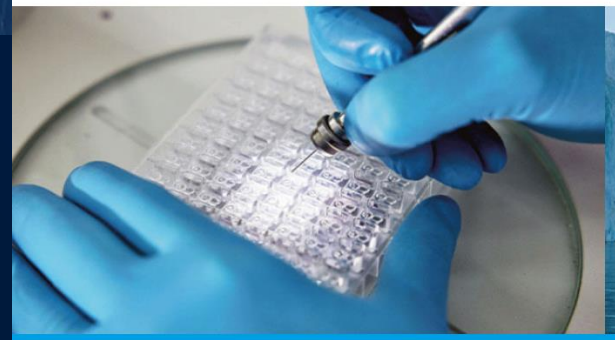
**Wim Leemans**
Director Accelerator Division

# PETRA IV.

## The Lab´s Top Priority Project

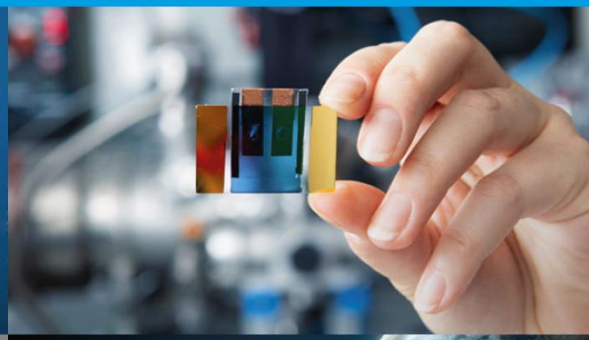




PETRA IV.
NEW DIMENSIONS



# Zukunftsprojekt PETRA IV.

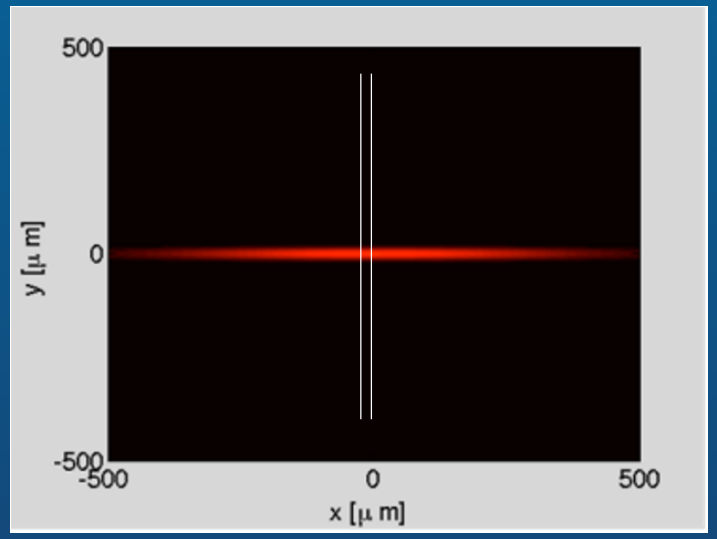
Die nationale Röntgenlichtquelle zur Transformation von Forschung und Innovation



# PETRA IV. Advancing into the quantum world

## PETRA III

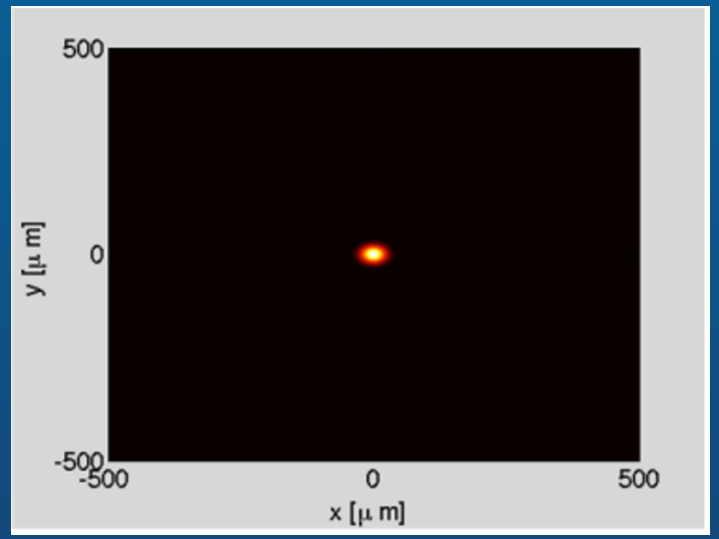
The best X-ray source for more than a decade
but no suitable microscope
for
investigations on the quantum scale




Electron beam
in the PETRA III ring

## PETRA IV

World-leading X-ray microscope
for
design and control of materials
on the quantum scale




Electron beam
in the PETRA IV H6BA ring

**≥ 500-fold (!)**
increase in performance

→ Disruptive new insights
→ Innovations on the nanoscale

# PETRA IV. – Securing innovation potential

PETRA IV NEW DIMENSIONS

**PETRA IV will be the most powerful high-energy synchrotron radiation source**

| | | | | | |
|---|---|---|---|---|---|
| Performance 4th Generation | | | | | |
| Performance 3rd Generation | | | | | |
| Start of operation 4th Generation | 2020 | 2025 | 2025 | 2028 | 2029 |
| Location | ESRF-EBS Grenoble | APS-U Chicago | HEPS Beijing | Spring-8-II Hyogo | PETRA IV Hamburg |

# Breaking news: 44 M€ for pre-projects towards PETRA IV.

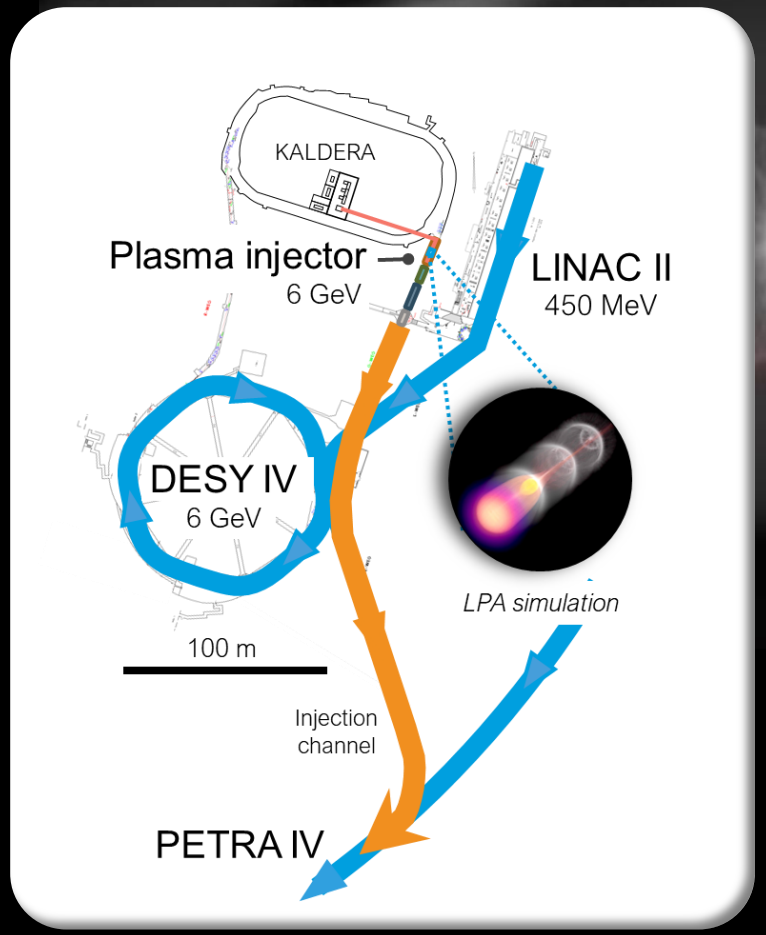
As a result of the Budget Committee for the 2024 federal budget:

DESY is receiving:
40 M€ from federal budget
+ 4 M€ co-financing from the City of Hamburg in pre-project funding, especially for innovative and energy saving injector prototype and the transformation of the business model

The start of a new era of cutting-edge research is assured!

# DESY. Our “Moonshot” project: Plasma Injector for PETRA IV.

## Innovative, energy-saving accelerator technology

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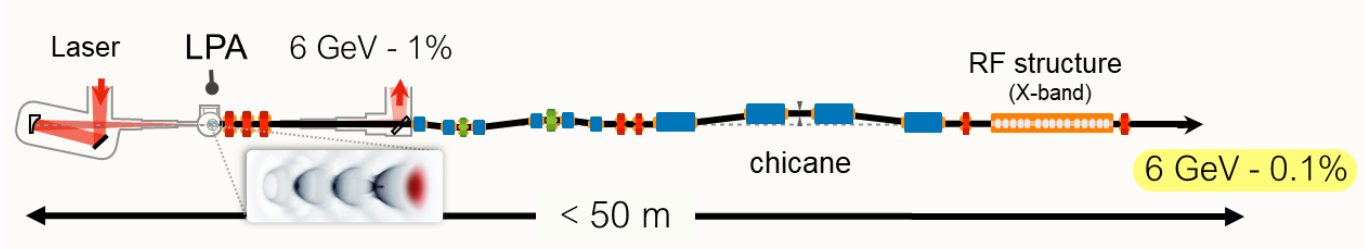
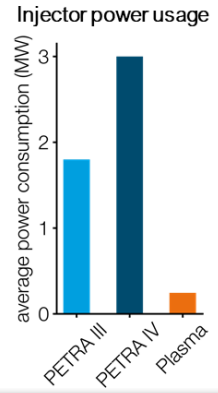
NEW DIMENSIONS

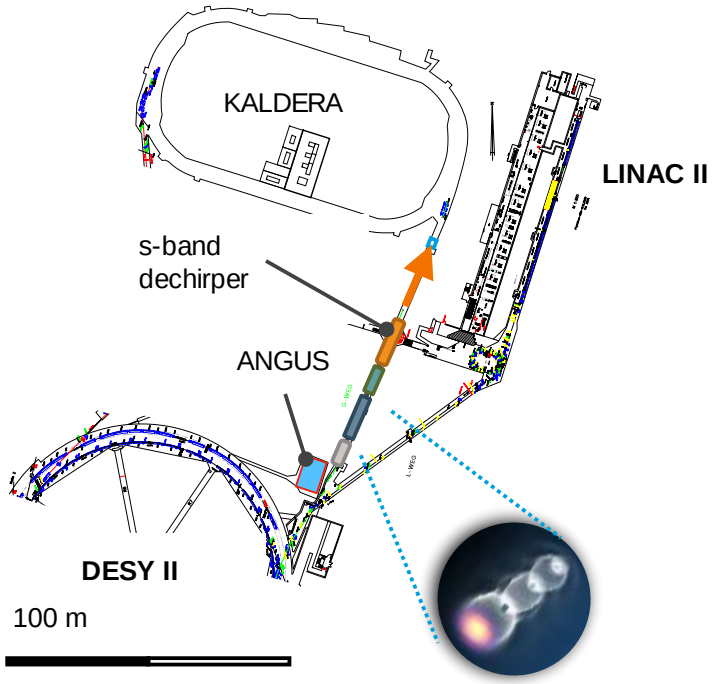
### *Plasma injector schematic*



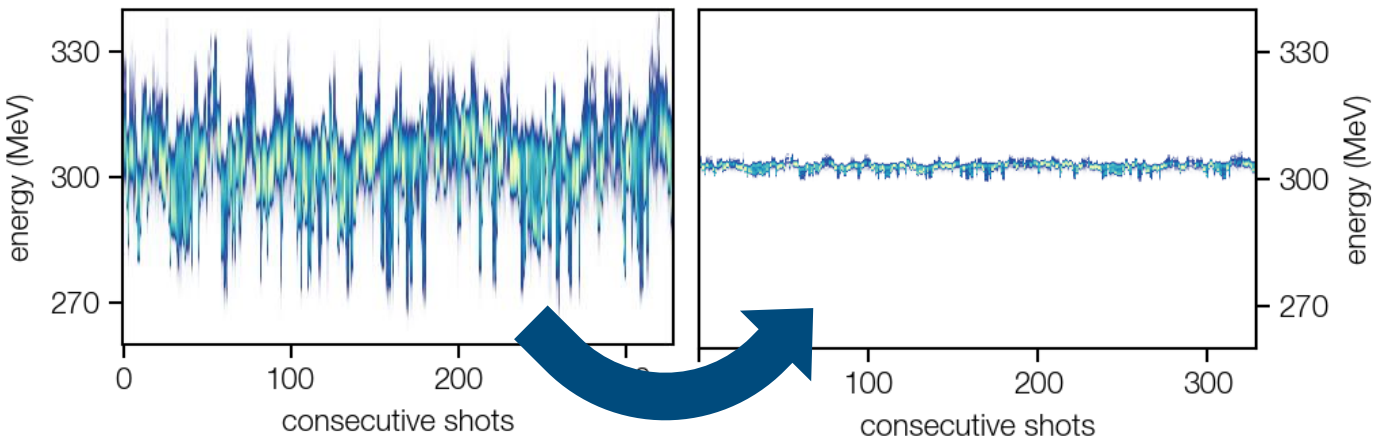
# DESY. First step: proof-of-principle experiment at LUX

## Energy compression beamline for permille level energy spread beams from a laser plasma accelerator




*LUX Plasma Accelerator*

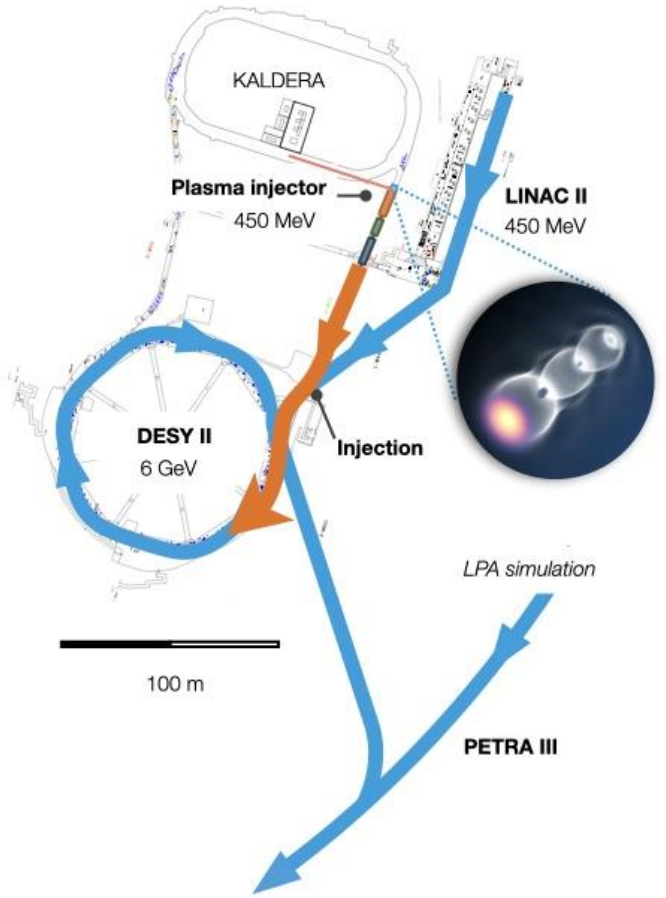
**The experimental setup for the dechirper is under construction**




**with RF on: factor 10 reduction**

# A plan is in preparation to validate readiness of plasma injector

## Key challenge is the laser technology: 24/7 operations at >99% availability



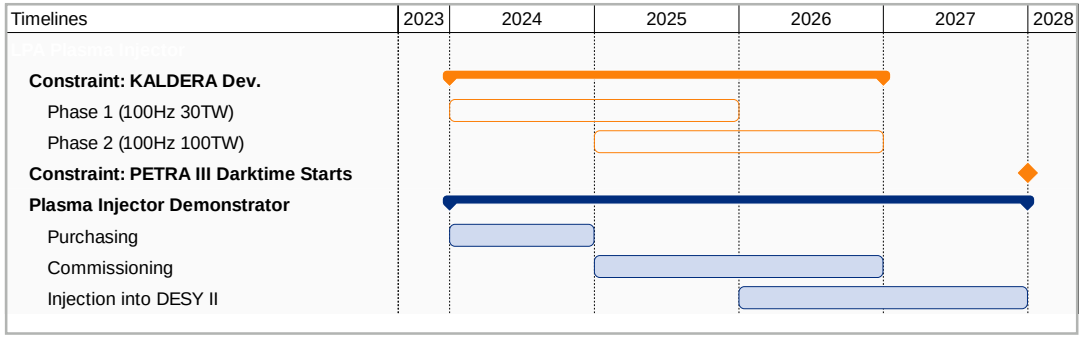

### Fully functional technology demonstrator:

- Diode-based drive laser (KALDERA) & laser guiding channels
- RF-dechirper to reduce energy spread and jitter

### Inject into DESY II / PETRA III while it is still running

- Filling and top-up: 450 MeV LPA driven by KALDERA
- Learn, where we need to improve, especially the laser

### Start already next year, funded by PIV pre-project:



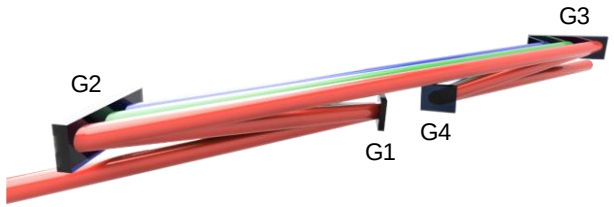

*Preliminary: needs to be compatible with FLASH and other shutdowns*

# KALDERA: 100 TW LPA drive laser at up to kHz repetition rate

## High repetition rate is key to active stabilisation

**New laser lab**

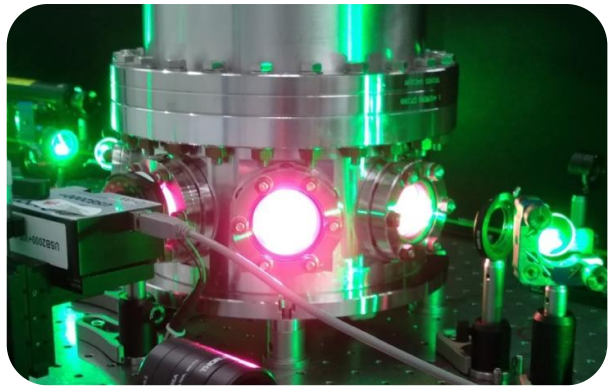
- Since end 2022
- Laser development in full swing




**Addressing key challenges**

Example: Novel pulse compressor concept to support kW-level average power

*C. Werle et al., Opt. Express 31, 37437 (2023)*



**Timeline**

- First laser light in 2024
- First electrons @100Hz in 2025
- Upgrade to 450MeV in 2025
- Upgrade to kHz by 2026

# Our projects must be managed carefully

## Identification of key personnel that gets overbooked/overloaded is crucial

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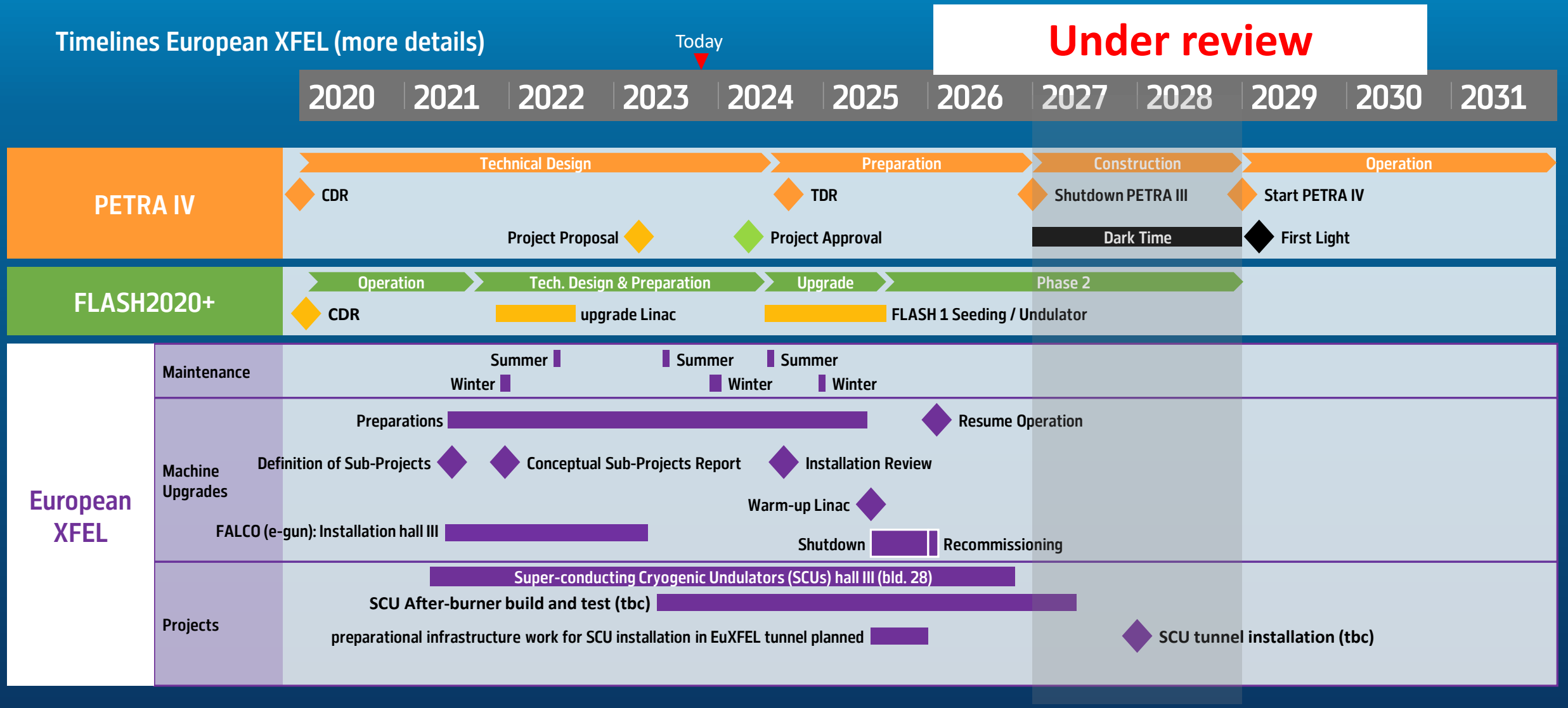
### Timelines European XFEL (more details)



# Renewing the aging infrastructure on campus – key projects for modernisation

**Technical Groups such as MKK, MPC, MKS, …**

**Refurbishments by our technical groups include:**

- **Main stations A/B**
- **Cooling towers, test transmitter hall, …**
- **Energy consumption reduction and sustainability**

# Readiness for PETRA IV.

**Assessment of personnel needs to ensure adequate staffing**

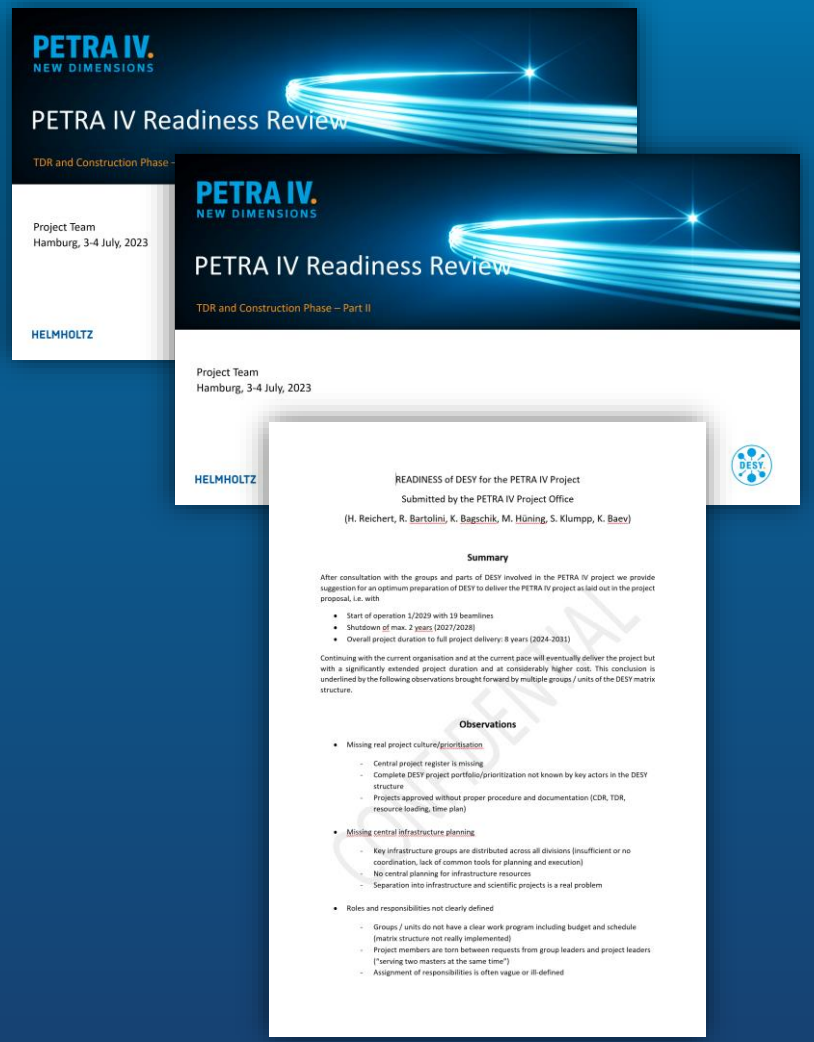
- Some of the technical groups require urgent (re)strengthening
- Reach out to us if you are interested in contributing!

**Preparing DESY for PETRA IV and gaining efficiency in executing projects**

# Readiness Review - TDR and Construction Phase

**With big thanks to Frank Eints!**

## Goal: Analysis to propose measures




## Documents:

- PETRA IV Readiness Review – TDR and Construction Phase – Part I + II
- READINESS of DESY for the PETRA IV Project

## Procedure

- **Analysis** of the documents
- **Mapping** of finding, root cause and impact
- **Review** of proposed measures (PETRA IV Project Team)
- **Proposal for implementation** of a compact catalogue of measures

# Summary (I) – For DIR and Division Leadership

**A set of key measures have been identified that can be acted upon in the months to come**

- **Create a central DESY Project Management Office (PMO) including Quality Management (QM)**
  - ⇨ Core team of 4-5 people with certified project and QM credentials
  - ⇨ Lead the development of multi-project management capabilities and DESY wide QM
  - ⇨ Introduce and establish central PM and QM software solutions
  - ⇨ Develop uniform templates and processes
  - ⇨ Train and support PM and QM competences to grow the cadre of PM&QM-capable personnel

- **Streamline administrative processes, budgetary controls and procurement processes**
  - ⇨ Major overhaul planned in V
  - ⇨ Digital processes and improved services

- **Enforce strong matrix model**
  - ⇨ Establish R2A2 model an**d work with project team to ensure enforcement**
  - ⇨ Transparency of resource allocations

# Summary (II) – For PETRA IV Project Team

**A set of key measures have been identified that can be acted upon in the months to come**

- **Create a robust QM programme**
  - ⇨ Reports directly to the project leadership team
  - ⇨ Planning, development, implementation and maintenance of a QM system for the PETRA IV project on the basis of ISO 10006: Guide for quality management in projects
- **Define Roles, Responsibilities, Authority and Accountability (R2A2)**
  - ⇨ Establish milestones with Group Leaders, signed off by Division Leadership
- **Standardize components and software where possible: create catalogues of components with specs and prices**
  - ⇨ Create templates and provide written instructions for procurement (CfT templates & examples)
- **Empower (sub-)project managers**
  - ⇨ Establish Cost Account Managers (CAM) for local budget follow-up & control
  - ⇨ Establish a culture of accountability (written reports & documentation)

# Topics for the next DESY FIAC

PETRA IV. NEW DIMENSIONS

**We need to start preparing the topics for the next DESY Facility and Infrastructure Committee meeting**

# Thank you, Dieter!


We all need to pull together now!
PETRA IV.
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Let’s create the future together!
DESY.