

Relativistic Electron Beam Dynamics in Crystals and Related Electrodynamic Processes

Welcome

8.-10.12.2025 @ DESY (Hamburg, Germany)

Gero Kube
Hamburg, 8.12.2025

HELMHOLTZ



Deutsches Elektronen Synchrotron (DESY)

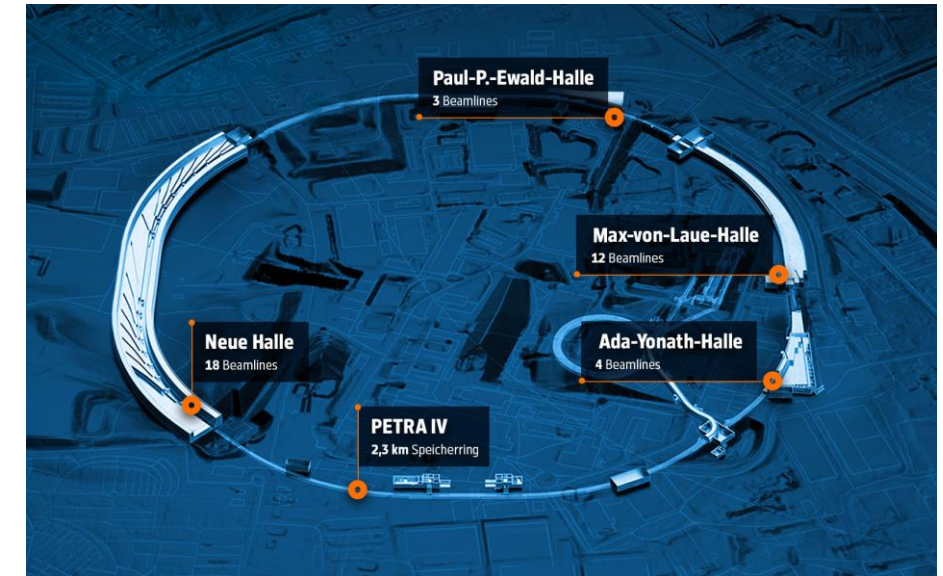
Areal View (2023)



PETRA IV @ DESY

Overview

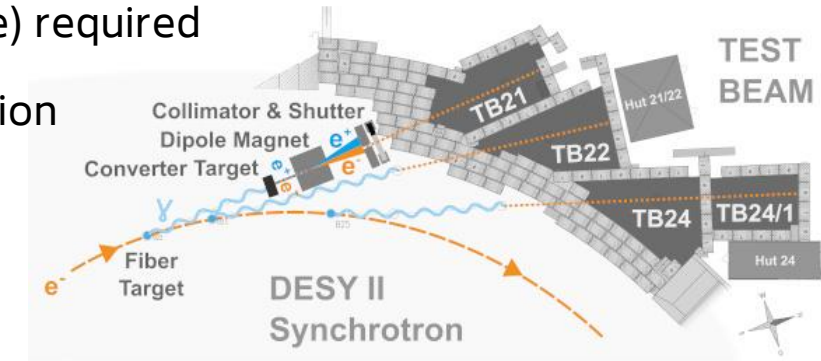
- conversion of 3rd generation light source PETRA III
→ diffraction limited 4th generation light source PETRA IV
- project start
 - expected for 2027
 - project costs ~ 1.7 bio. EUR
 - dark time PETRA III: 01/2030
 - commissioning of PETRA IV: mid 2032
- budget
 - review panel visit under auspices of German Scientific Council
→ event took place last week
→ feedback received: very positive



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Intention

- conversion to PETRA IV → new injector chain (smaller emittance / beam size) required
- at present: injector (DESY II booster synchrotron) used for test beam generation
→ probably not possible with new injector (heat load on target)



- discussion with A. Mazzolari (INFN Ferrara) during RREPS 19
→ possibility of crystal channeling based extraction
- visit of A. Sytov (INFN Ferrara) 4 months later

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THE EUROPEAN
PHYSICAL JOURNAL C

Regular Article - Experimental Physics I

First design of a crystal-based extraction of 6 GeV electrons for the DESY II Booster Synchrotron

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- Russian attack on Ukraine (02/2022)



- DESY offered support for Ukrainian scientists
- joint DFG research project, designed for duration of 2 years, started 01/2024

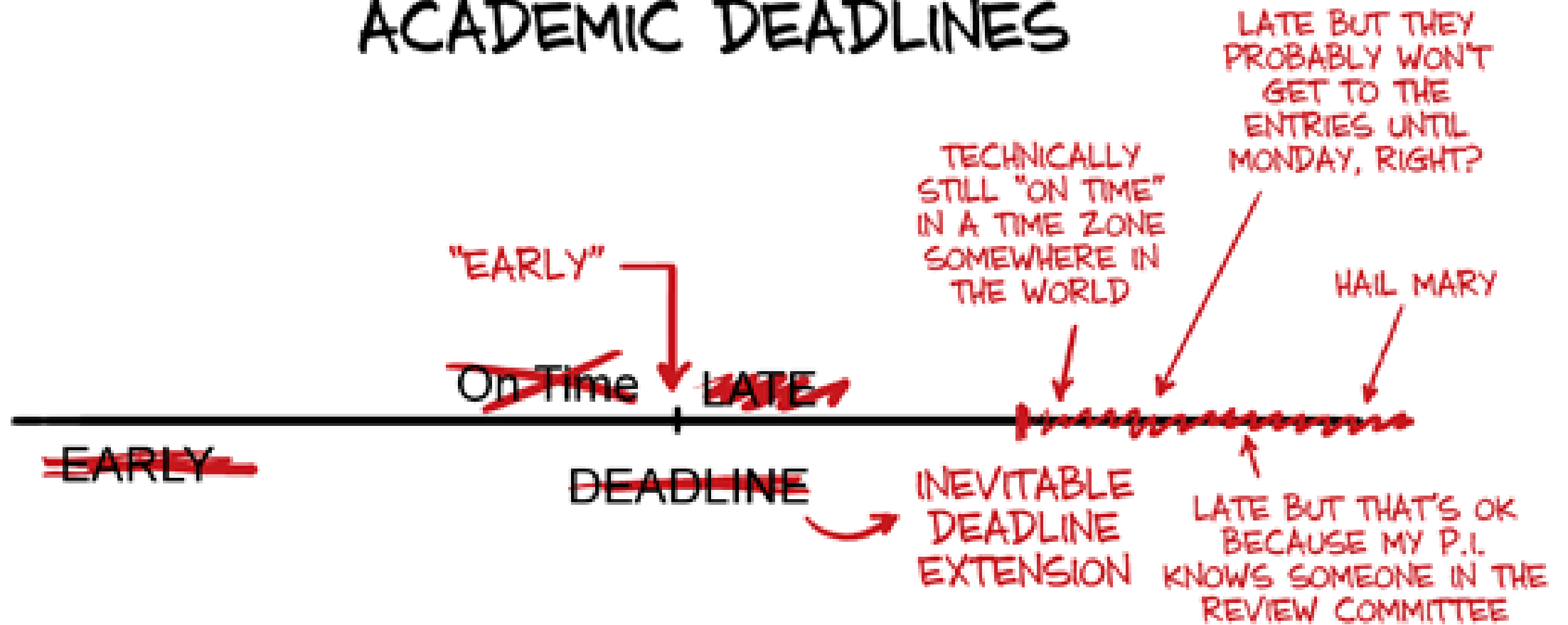
Pilot Study of a Crystal-based Extraction for 6 GeV Electrons at DESY

- workshop, summarizing the achievements



follow-up project initiated

ACADEMIC DEADLINES



Workshop Program

MON, DECEMBER 8		
3:00 PM → 6:00 PM Monday Session		
3:00 PM	Introduction to Workshop & Welcome Speaker: Gero Kube (DESY (MDI))	15m
3:15 PM	X-ray transition radiation by multi-GeV electrons in a thin target placed in an external magnetic field (theoretical studies) Speaker: Sergii Trofymenko (KIPT)	15m
3:30 PM	Observation of Transition and Parametric X-Ray Radiation from a Relativistic Electron Beam in a Stack of Silicon Crystal Plates Speaker: Yury Cherepennikov (INFN Laboratori Nazionali di Frascati)	30m
4:00 PM	Accurate account of screening in X-ray characteristic radiation. Moseley law and its extension to individual term energies Speaker: Miccola Bondarenko (KIPT)	30m
4:30 PM	Search for resonant transition radiation from a periodic multilayer target with degraded periodicity at the Mainz Microtron MAMI Speaker: Sergey Stokov (DESY (MDI))	30m
5:00 PM	Coherent optical transition radiation from short electron bunches with non-gaussian charge distribution Speaker: Alexander Potylitsyn (Institute of Applied Problems of Physics (NAS), Yerevan)	30m
5:30 PM	General Discussion	20m

TUE, DECEMBER 9		
9:00 AM → 6:00 PM Tuesday Session		
9:00 AM	Introduction to the DFG Project Speaker: Sergii Fomin (DESY (MDI) and KIPT)	15m
9:15 AM	Collaboration between DESY and Ukraine Speaker: Martin Sandhop (DESY (DIB))	15m
9:30 AM	Advanced Applications of Bent and Straight Crystals for High-Energy Particle Beams Speaker: Marco Romagnoli (University and INFN Ferrara)	30m
10:00 AM	ELBEX Project @ XFEL Speaker: Marcel Stanitzki (DESY (FTX))	15m
10:15 AM	Channeling Experiments with Electrons and Positrons at MAMI Speaker: Werner Lauth (Inst. of Nucl. Phys. (Univ. Mainz))	30m
10:45 AM	COFFEE BREAK	30m
11:15 AM	Optimal parameters for efficient electron deflection at the DESY II accelerator using a bent crystal Speaker: Igor Kyrylin (KIPT)	30m
11:45 AM	Simulations with Geant4 G4ChannelingFastSimModel and BDSim Speaker: Alexei Sytov (University and INFN Ferrara)	30m
12:15 PM	Ionization energy loss of several-GeV electrons and positrons in straight and bent crystals Speaker: Sergii Trofymenko (KIPT)	30m
12:45 PM	Calculation of the dechanneling length of electrons in Si crystal using 3D binary collision model Speaker: Maksym Malovytsia (KIPT)	30m
1:15 PM	LUNCH BREAK	1h
2:15 PM	Quantum effects near the top of the channeling potential barrier Speaker: Miccola Bondarenko (KIPT)	30m
2:45 PM	Beam diagnostics inside a crystal: How to separate coaxial reflections of parametric X-ray radiation and diffracted X-ray transition radiation in space Speaker: Alexander Shchagin (DESY and KIPT)	15m
3:00 PM	Suppression of relativistic electron bremsstrahlung in a crystal due to multiple scattering on atomic chains Speaker: Sergii Fomin (DESY (MDI) and KIPT)	30m
3:30 PM	COFFEE BREAK	30m



amorphous targets



DFG project core program

Workshop Program

WED, DECEMBER 10		
9:00 AM → 3:00 PM Talks		
9:00 AM	Differential cross section of fast charged particle scattering by periodic atomic planes in the eikonal approximation Speaker: Viktoriia Omelchemko (KIPT)	30m
9:30 AM	tbc Speaker: Vahan Kocharyan (Institute of Applied Problems of Physics (NAS), Yerevan)	30m
10:00 AM	German-Ukrainian Core of Excellence "Plasma-Spin-Energy" Speaker: Andriy Styervoyedov (Max Planck Institute of Microstructure Physics, Halle)	30m
10:30 AM	Future Lepton Colliders Speaker: Maxim Titov (CEA Saclay, Ifu)	30m
11:00 AM	COFFEE BREAK	30m
11:30 AM	General Discussion	1h 30m

➡ further important topics

Special Session

TUE, DECEMBER 9			
4:00 PM	SPECIAL SESSION		🕒 2h
7:30 PM → 9:50 PM	Dinner		🕒 2h 20m



➡ dedicated to 80th birthday of Alexander Potylitsyn

- collection of photos & stories from A.P. & you
- compiled into a slide show
- you will see your names

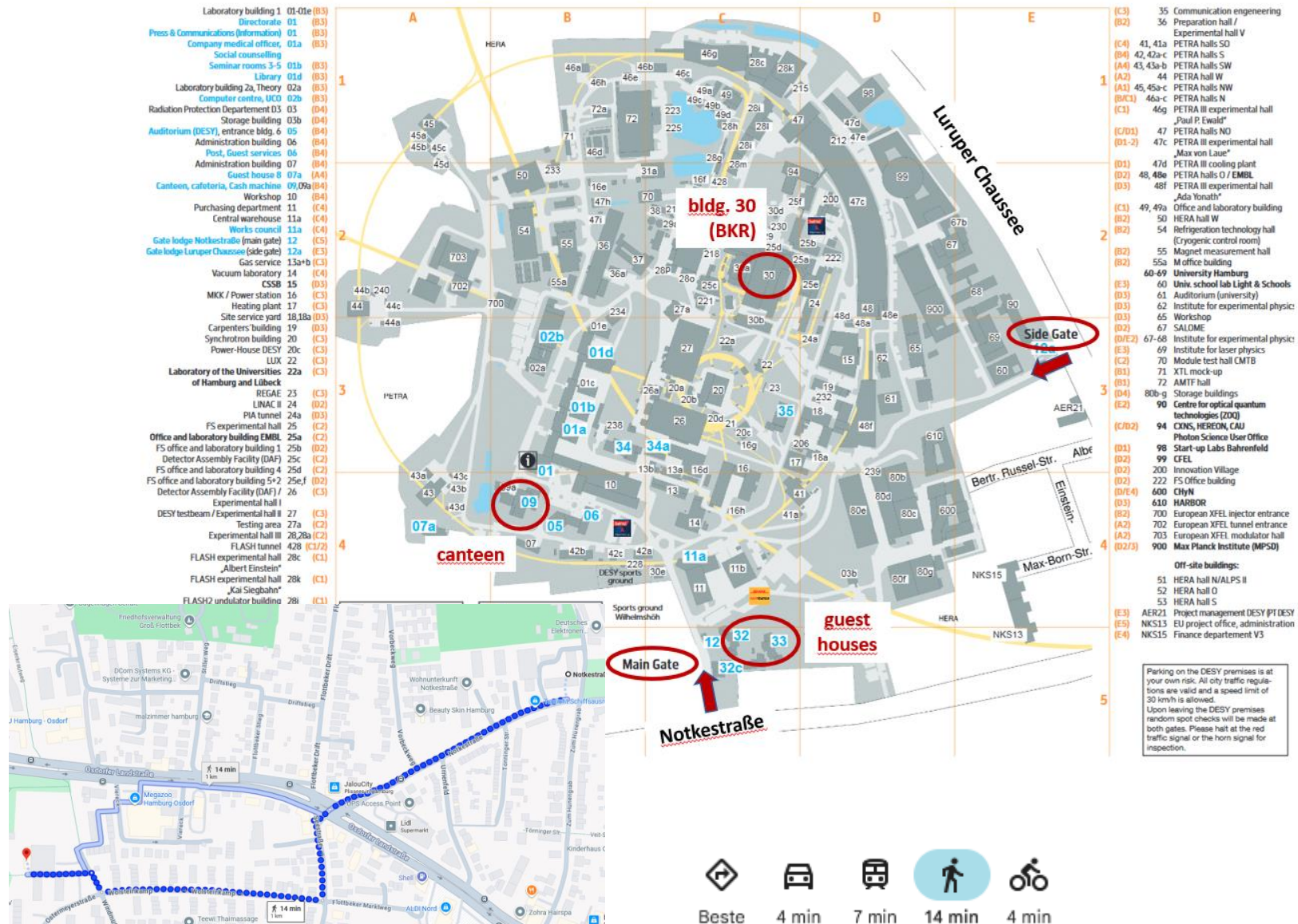
→ ask you to comment and congratulate



General Announcements

Location and Info

- seminar room
 - Seminar Room 505 in bldg. 30
- WLAN
 - eduroam and Science-Hotspot
- coffee breaks
 - in front of seminar room
- lunch
 - in DESY canteen
- workshop dinner
 - Tuesday 9.12. @ 19:30
 - Tennisclub Vier Jahreszeiten e.V.
Windmühlenweg 55



Acknowledgements

- thanks for your participation, wish you a pleasant workshop
- special thank to **Natalia Potylitsina-Kube, Serguei Fomin** and **Artëm Novokshonov** for their support in organizing this workshop

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