International cooperation schemes at the research center DESY

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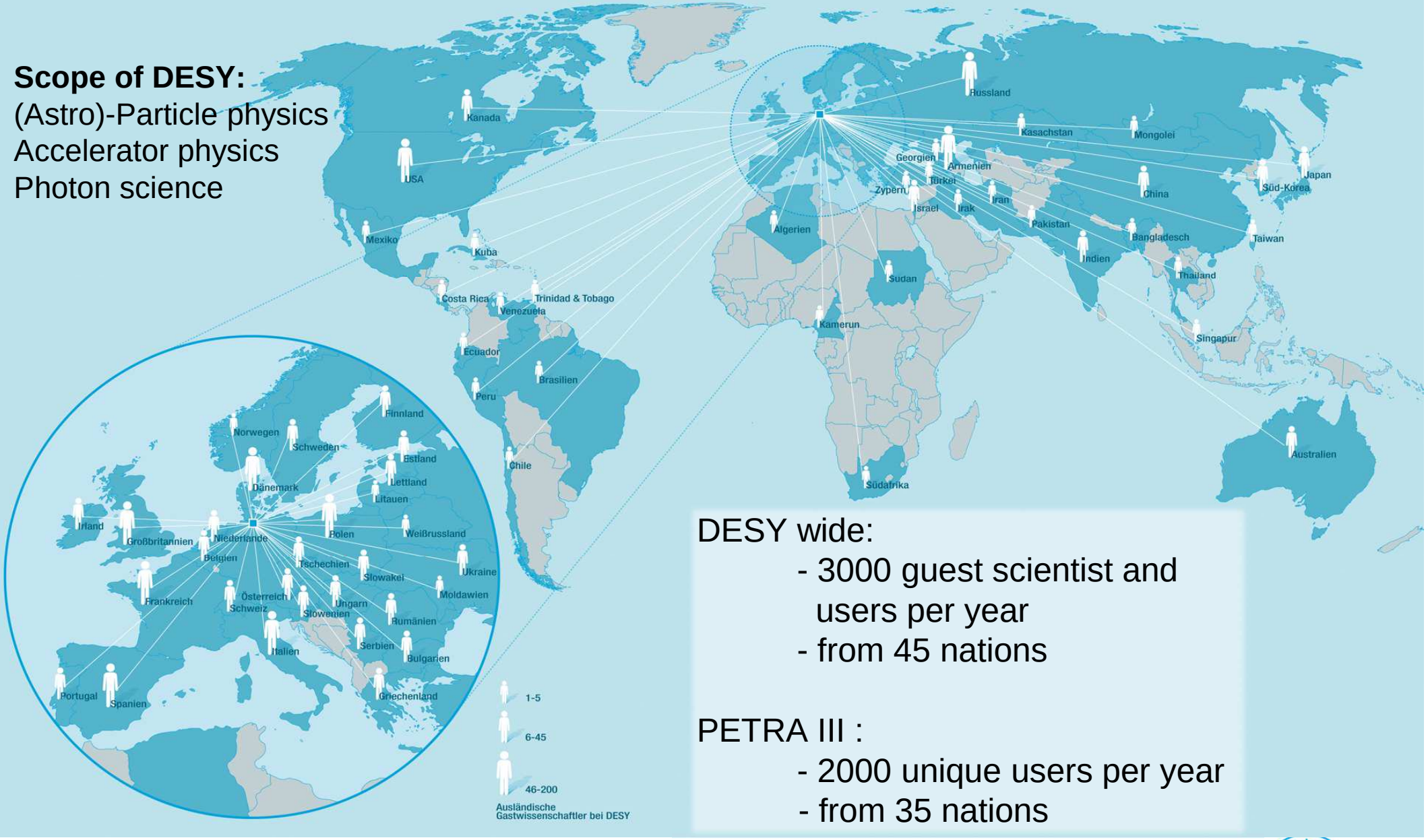
HELMHOLTZ GEMEINSCHAFT

DESY

DESY International Guest Scientists and Users

Scope of DESY:
(Astro)-Particle physics
Accelerator physics
Photon science



DESY wide:
- 3000 guest scientist and users per year
- from 45 nations

PETRA III :
- 2000 unique users per year
- from 35 nations

Cooperation @ DESY Photon Science

Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

HPI

Bernhard-Nocht-Institut für Tropenmedizin

Universitätsklinikum Hamburg-Eppendorf

DESY

EMBL

HELMHOLTZ ZENTRUM FÜR INFEKTIONSFORSCHUNG

MHH Medizinische Hochschule Hannover

JÜLICH

Karolinska Institutet

PIER

CFEL SCIENCE

European XFEL

CSSB Centre for Structural Systems Biology

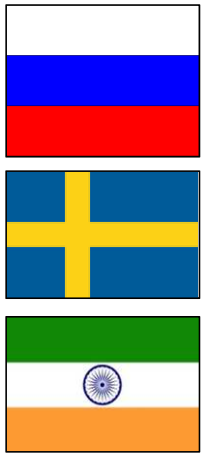
Max Planck Research Department Structural Dynamics

CAU

CHyN *UHH*

HELMHOLTZ ZENTRUM FÜR INFEKTIONSFORSCHUNG

Major International Cooperations



DESY

India @ DESY cooperation

Establish science cooperation
- nano science
- nano technology
- advanced materials research.

Install series of workshops
- scientific exchange
- educating the young scientists (concerning synchrotron methods)

- Guaranteed access for Indian users at PETRA III (Indian Review Committee)
- India contributes in hardware, software, manpower and services
  => raising Indian beamline (but Indian users delocalized)

Official signing procedure June 2011 in India

India @ DESY cooperation

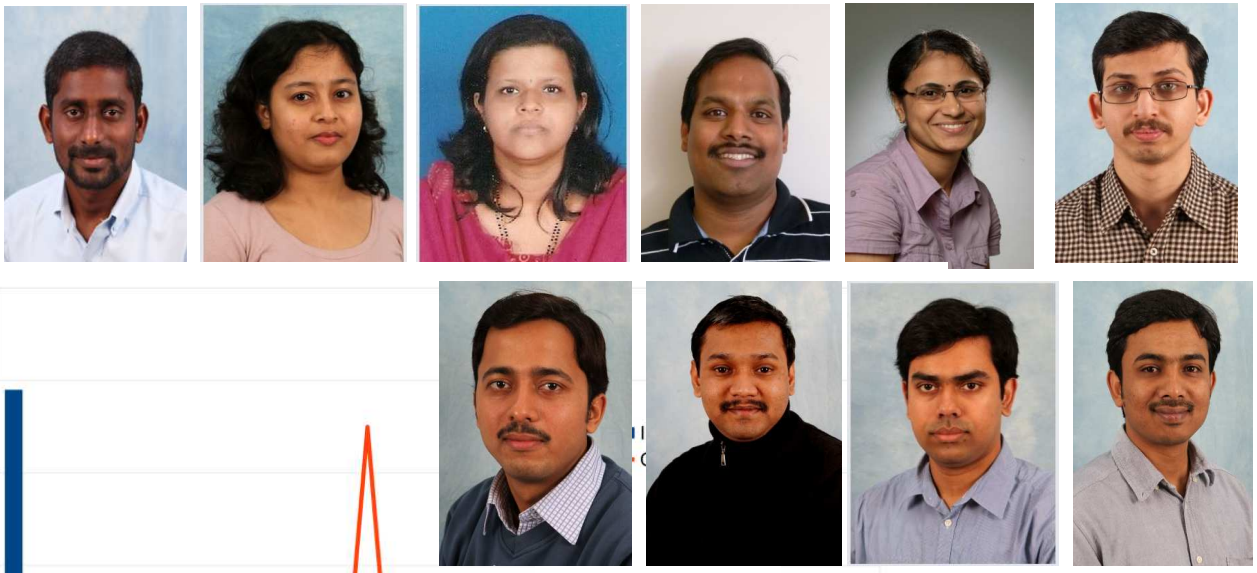
INDIA @ DESY

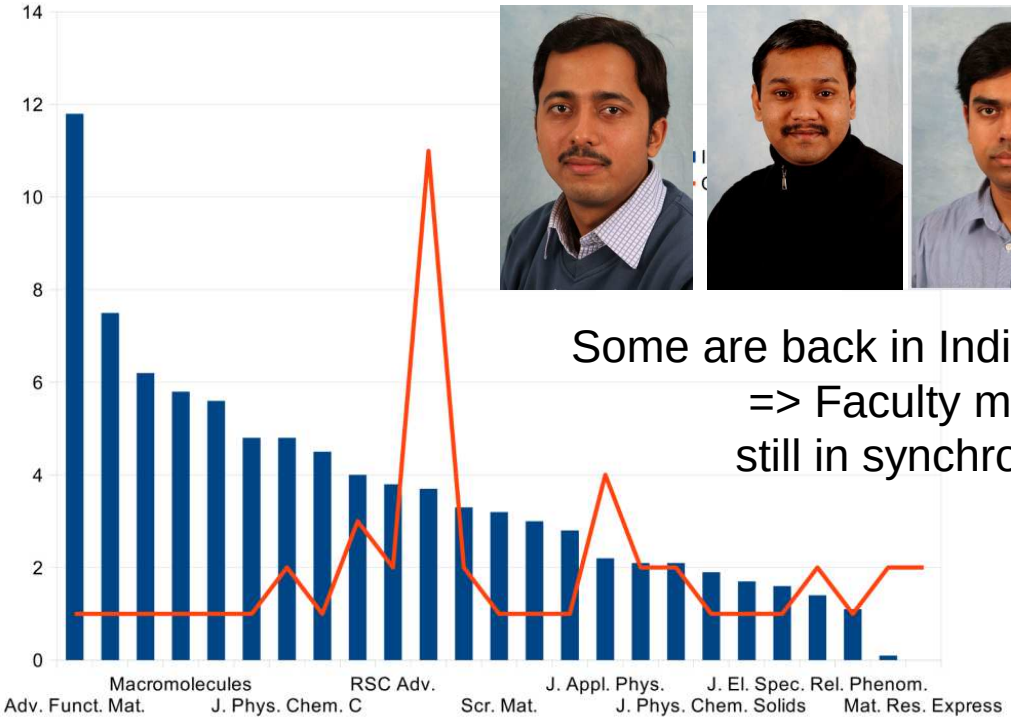
Very fruitful collaboration

Indian Publications (19 in 2015)

Journal	IF	Count
Adv. Funct. Mat.	11,8	1
Phys. Rev. Lett.	7,5	1
Carbon	6,2	1
Macromolecules	5,8	1
Scientific Reports	5,6	1
Inorg. Chem.	4,8	1
J. Phys. Chem. C	4,8	2
Langmuir	4,5	1
Soft Matter	4,0	3
RSC Adv.	3,8	2
Phys. Rev. B	3,7	11
Appl. Phys. Lett.	3,3	2
Scr. Mat.	3,2	1
J. Chem. Phys.	3,0	1
APL Materials	2,8	1
J. Appl. Phys.	2,2	4
Europhys. Lett.	2,1	2
J. Solid State Chem.	2,1	2
J. Phys. Chem. Solids	1,9	1
Appl. Phys. A	1,7	1
AIP Adv.	1,6	1
J. El. Spec. Rel. Phenom.	1,4	2
Nucl. Instr. Meth. B	1,1	1
Adv. Mat. Res.	0,1	2
Mat. Res. Express	0,0	2

Staff and guests from India (+ some more without photo)





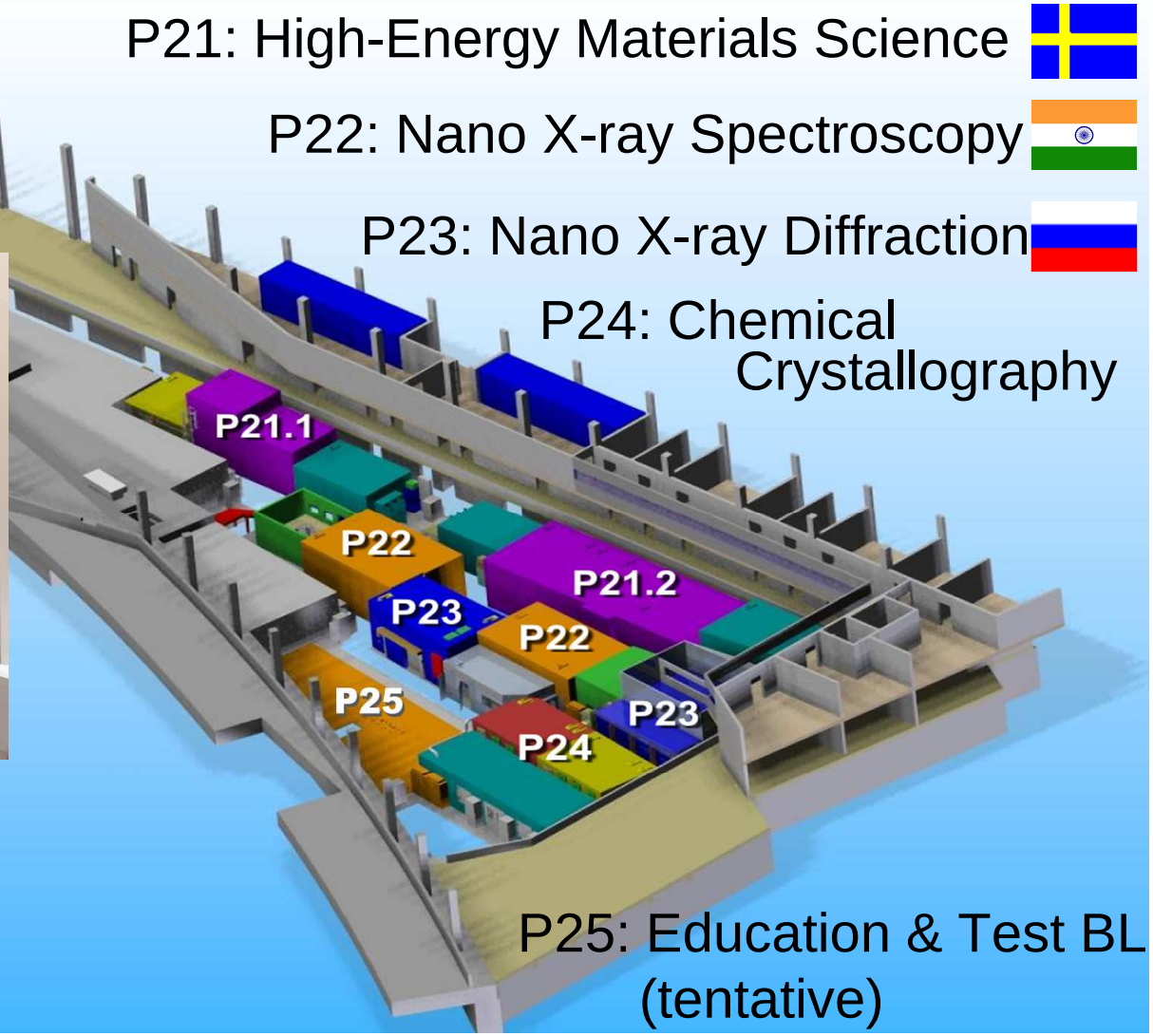
Some are back in India
=> Faculty member
still in synchrotron radiation

India @ DESY cooperation

Indian users are actually “delocalized” at PETRA and not restricted to P22

East

PETRA III extension



P21: High-Energy Materials Science

P22: Nano X-ray Spectroscopy

P23: Nano X-ray Diffraction

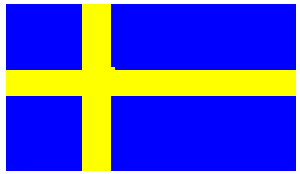
P24: Chemical Crystallography

P25: Education & Test BL (tentative)

Beamlines coming up in 2016

Sweden DESY cooperation

Lund, KTH/Karolinska, …
MAX IV, ESS, PETRA III



Forming Röntgen-Ångström Cluster

For Collaboration of Swedish and German Universities using a large scale facility (MAX IV, ESS, BESSY II, PETRA III, Flash, XFEL)

Joint German-Swedish call for applications

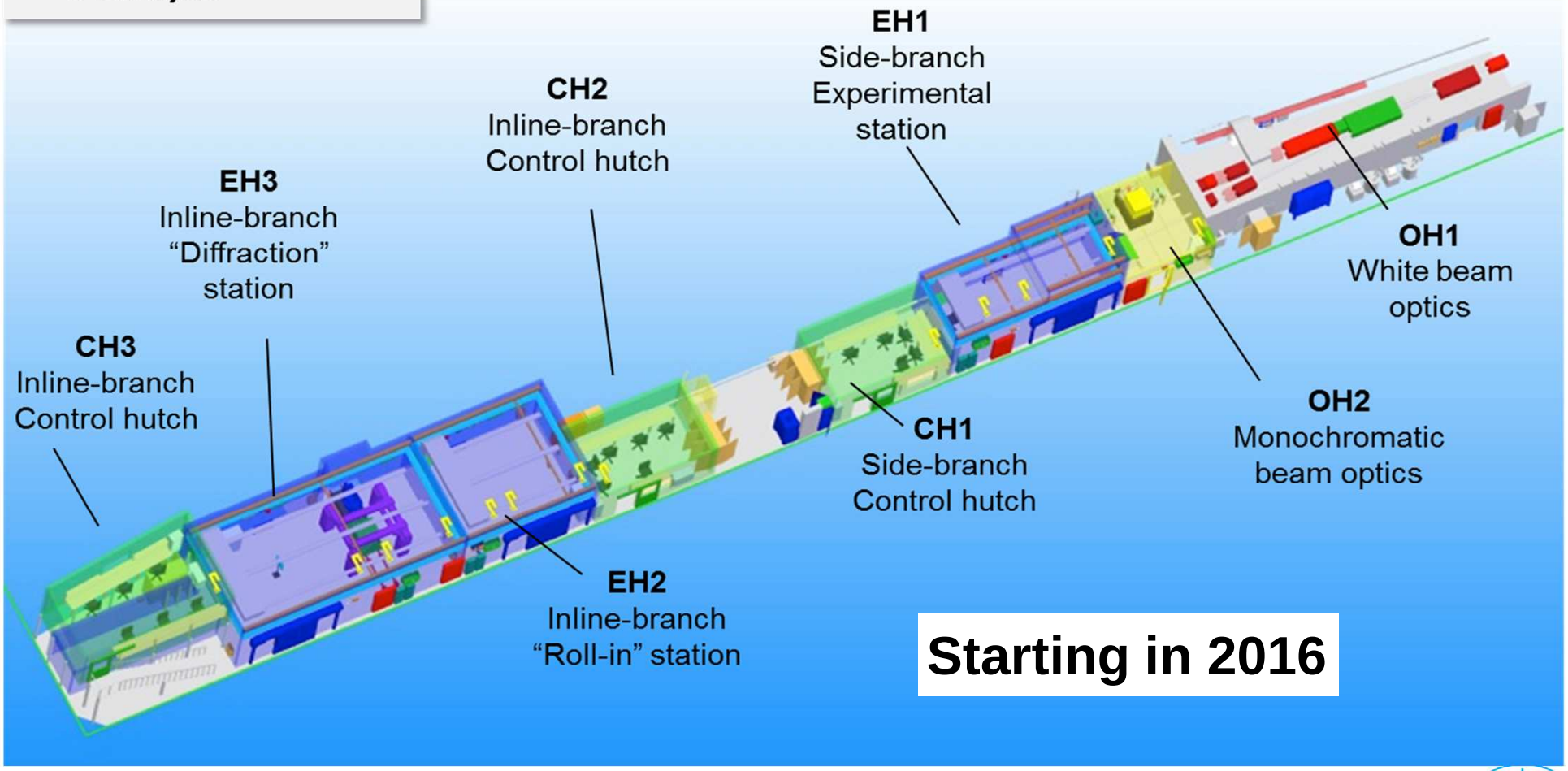
On March 12, 2015, the Federal Ministry of Education and Research (BMBF) and the Swedish Research Council launched a next coordinated German-Swedish call within the Röntgen-Ångström Cluster.

Joint projects of German and Swedish research groups can apply for funding for projects in basic research in material science and structural biology using neutrons and synchrotron radiation which serve the purpose of the Röntgen-Ångström Cluster.

Swedish Materials Science Beamline P21

Applications:
In-situ, time-resolved
- **o materials processing**
- **o physical metallurgy**
- **o energy materials**
- **o catalysis**

Sweden has excellent soft energy source : MAX IV
For high energy applications => P21
Beamline run by DESY
Swedish users go through regular proposal system



Starting in 2016

RACIRI Summer Schools (Sweden, Russia Germany)

- RACIRI - trilateral cooperation (SWE, RUS, GER) to organize new summer school to promote the next generation of scientists (www.raciri.org)
- Materials/Life Sciences – in the context of large scale research infrastructures

RACIRI SUMMER SCHOOL 2015
Advanced Materials Design at X-ray and Neutron Facilities

Federal Ministry of Education and Research

DESY

Vetenskapsrådet

- RACIRI 2013: Petergof, Russia

  Soft Matter and Nano Composites

- RACIRI 2014: Stockholm, Sweden

  Imaging with X-rays & neutrons in Life & Materials Sciences

- RACIRI 2015: Island of Rügen, Germany

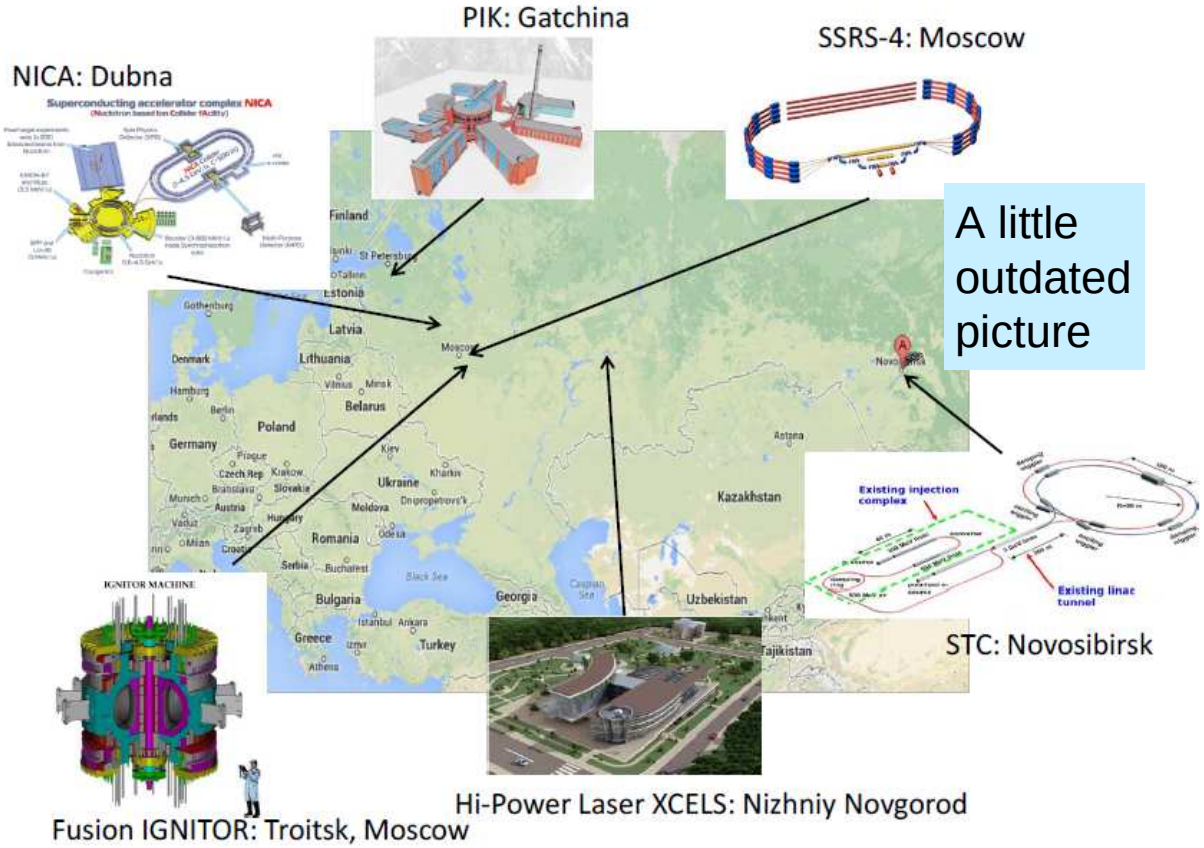
  Time-resolved and in-situ studies of materials

DESY

Ioffe Röntgen Institute (Russia, Germany)

Russian German Cooperation

- Strategic coordination of RUS-GE scientific activities at large scale facilities
- Memorandum of Understanding: DESY and Kurchatov-Institute
- Official agreement between the science ministries in May 2011



Cooperation finally lead to European Horizon 2020 project:

CREMLIN
(***Connecting Russian and European Measures for Largescale Research Infrastructures)***

Outlook for Future Cooperations: PETRA IV

4th generation synchrotron radiation source

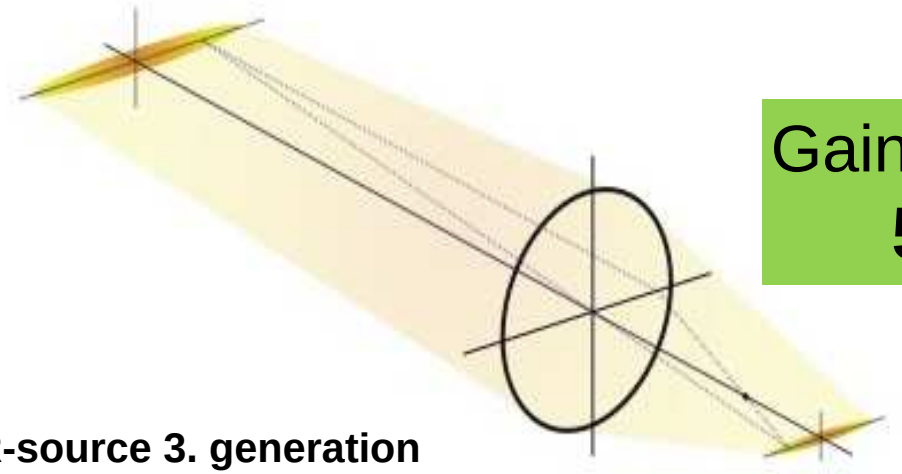
Source size
140 µm x 6 µm

asymmetric X-ray beam

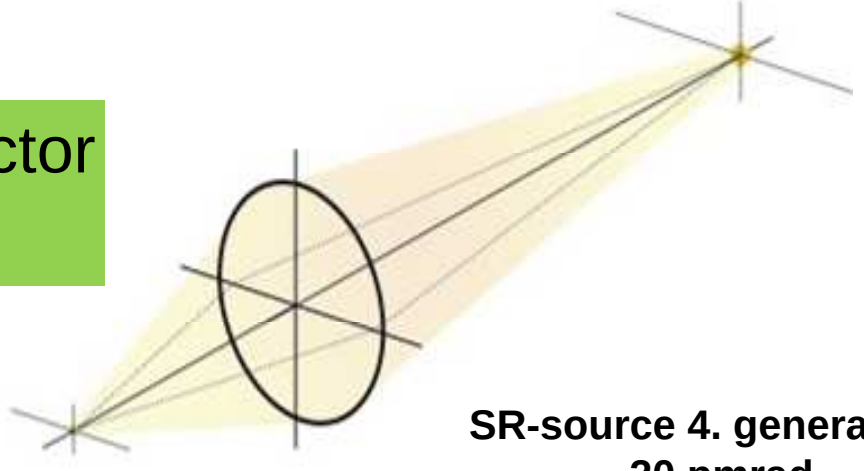
Multibend achromat / PEP-X / phase space flipping
MAX IV ESRF ??????????????????????

Source size
6 µm x 6 µm

almost round X-ray beam



Gain factor
50



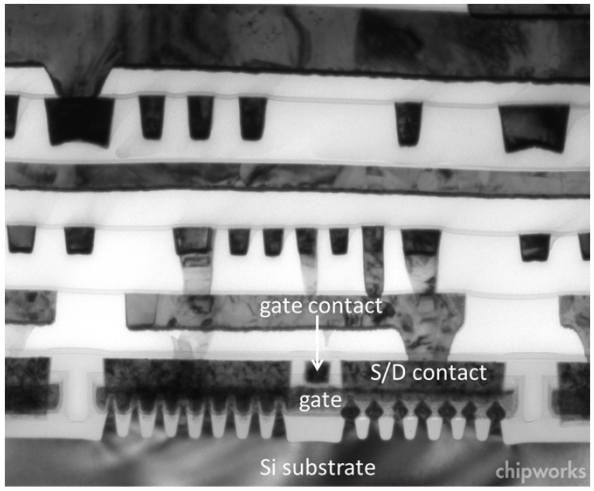
SR-source 3. generation
1000 pmrad
Max. brilliance: ~10^{20}
Coherence: ~0.1-1%

Almost round Nano-Focus

SR-source 4. generation
~20 pmrad
Max. brilliance: >10^{22}
Coherence: > 25%

PETRA IV : towards 3d microscopy with atomic resolution

Challenge: Nano-electronics in 3D

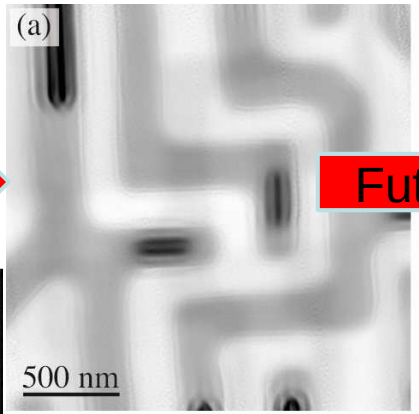


Today

PETRA III

Scanning a micro chip

At 15 nm resolution

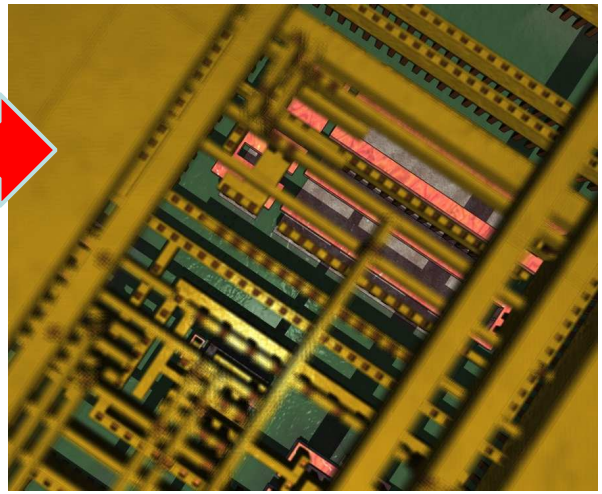


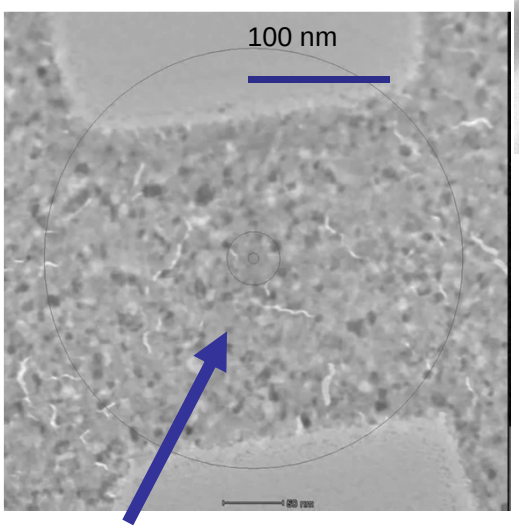
Schropp et al., Appl.Phys. Lett. 2012

Future

We need

Microscopic understanding of electrical transport in metals and semiconductors





Small distances:

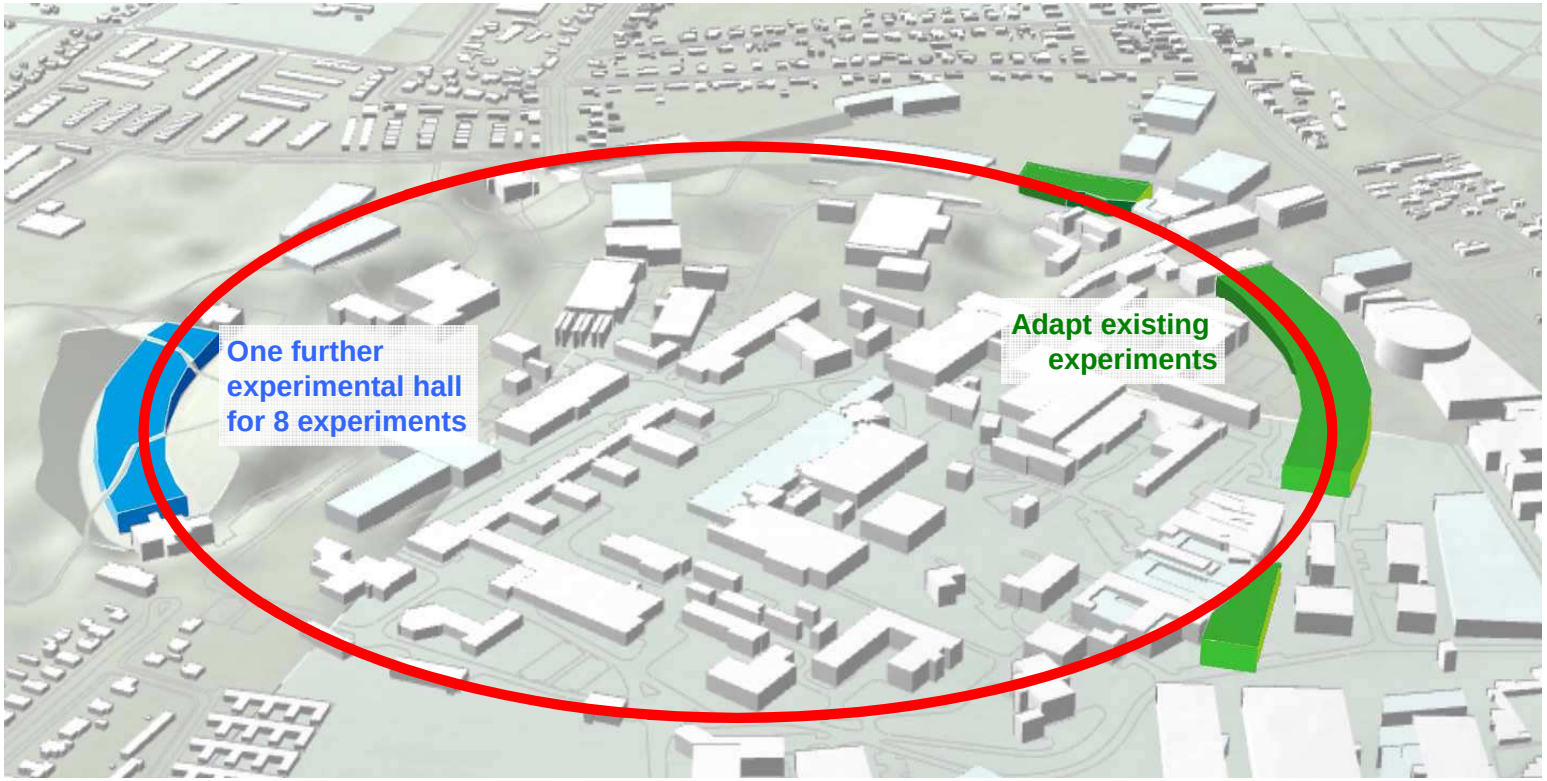
- high electrical power densities
- quantum effects ?

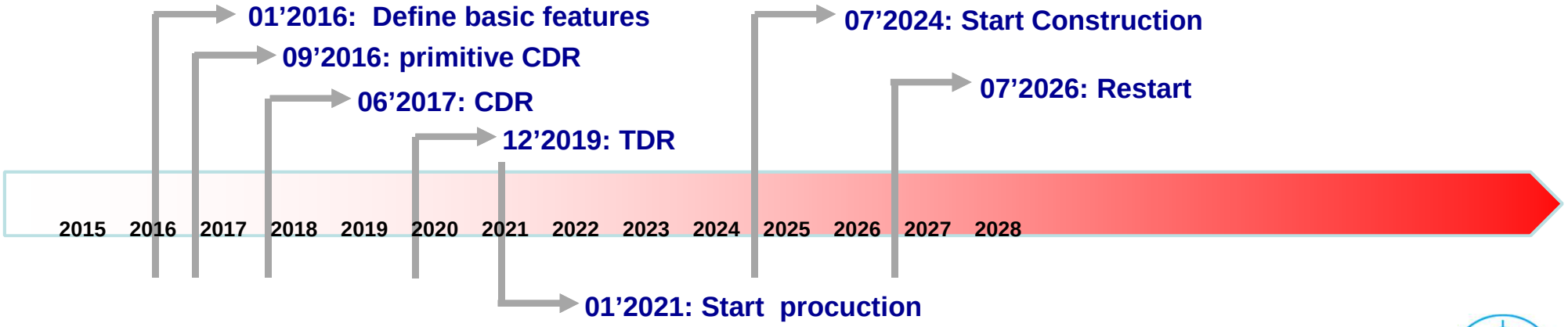
3d X-ray microscopy

< 1 nm resolution

in operando

PETRA III Extension : One further halls





Conclusion

DESY has very fruitful international cooperation

- India@DESY
- Sweden DESY cooperation
- Ioffe Röntgen institute
- coordinating CREMLIN
- running international beamlines

The future PETRA IV synchrotron offers excellent conditions for further cooperations