DESY and General Issues for National Laboratories

Meeting of the CERN Council Strategy Group

- DESY Strategy
  - Accelerators
  - Particle Physics
  - Astroparticle Physics
  - Photon Science

- General Issues for National Laboratories

Zeuthen, 2 May 2006

Deutsches Elektronen-Synchrotron

Member of the Helmholtz Association

Mission: Development, construction, operation and scientific exploitation of accelerators

Provide access for national and international users

Internationally used, nationally funded Research Institute

Base-Budget:	165 MEuro (2005)
Staff:	1560 in Hamburg and Zeuthen
Users:	3000 (1500 from abroad)

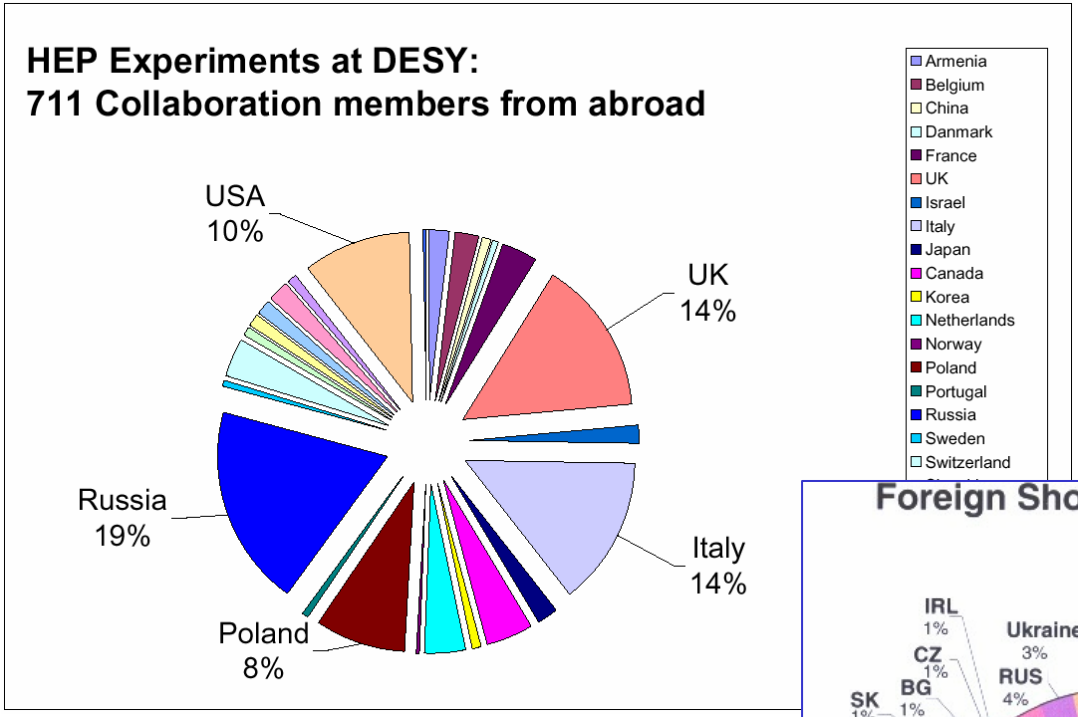
Programme oriented funding:

Five year programme planning, strategic review -> funding

DESY

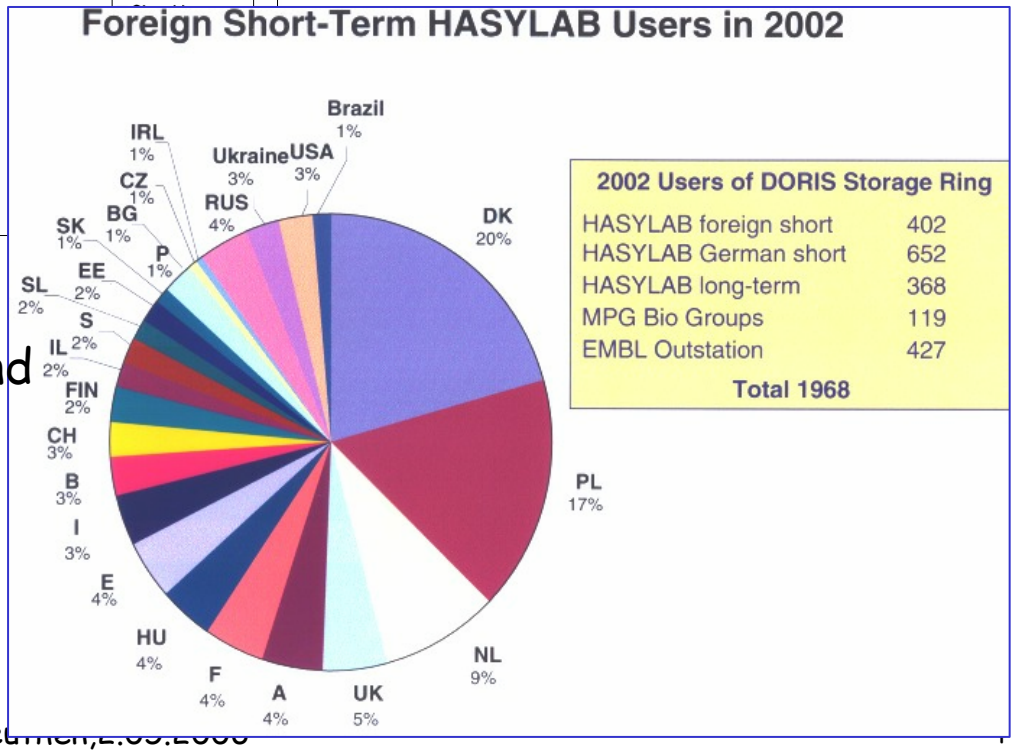
- DESY has a long successful history in three areas of basic science and high tech :
  - Particle physics (one of 5 laboratories world wide),
  - Research with X-rays (synchrotron radiation) and
  - Accelerator development.
- These topics stimulate each other and constitute the basis for the future of the laboratory.

Internationality at DESY



3000 users, 1500 from abroad

Particle physics: 711 scientists from abroad



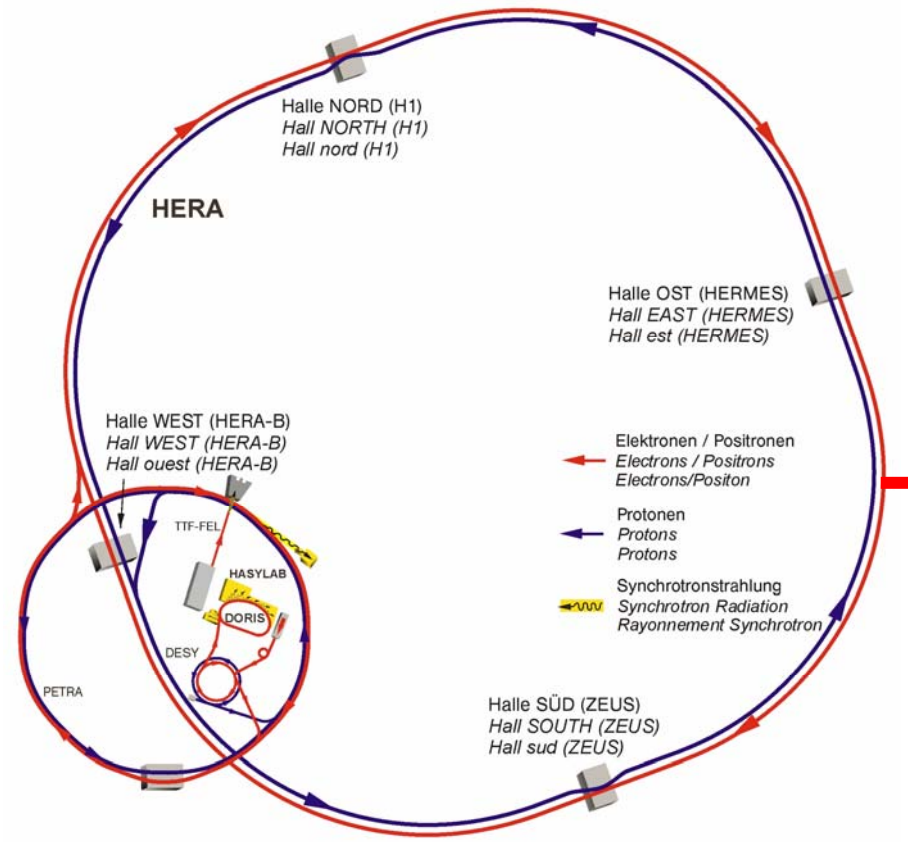
- Many PhD students and post docs
- Scientists come, because they find unique research facilities
- Close international co-operation across political boundaries has a long tradition

1. Strategy for Accelerator Development

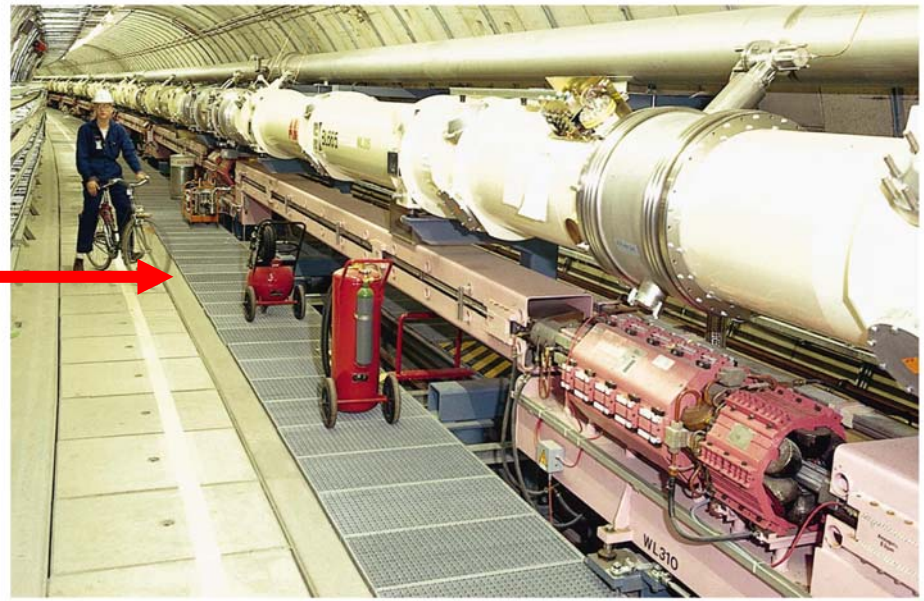
- Strategy is driven by science needs
- Further strengthening of know-how in accelerators:
  - SCRF development
  - RF Gun development
  - Operation of synchrotron light sources
  - SC linac operation
  - VUV-FEL operation
  - XFEL operation
  - Remote accelerator operation and controls (Global Accelerator Network)
- Exploiting the synergy between projects and technologies

DESY's Accelerators - today

DESY operates today 16 km of accelerators



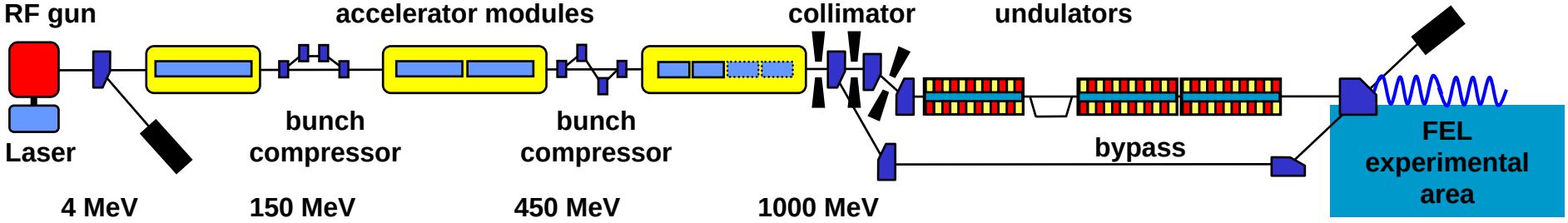
HERA built with major contributions from Italy, France, Poland, China etc.



The VUV-FEL (FLASH) as Prototype for the XFEL/ILC

Built with substantial international contributions, in operation since 1996

Second stage (TTF2) has been commissioned, user operation started



Newest Record: First Lasing at 13 nm

27.4.2006

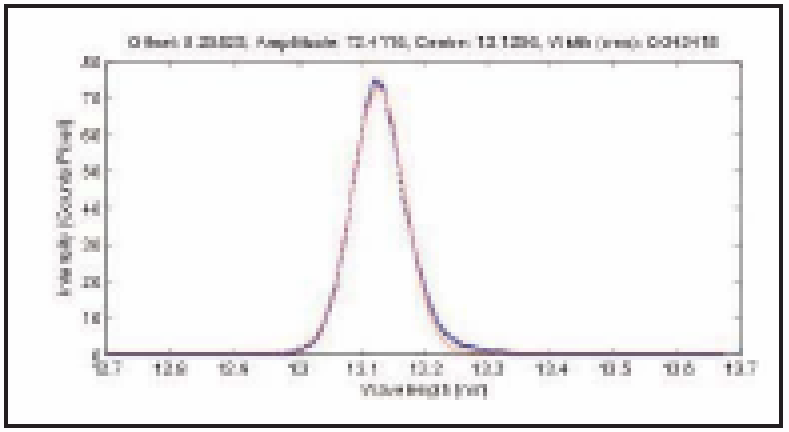
Five accelerator modules

Beam energy of 700 MeV

Laser flashes with a wavelength of 13.1 nm

Design value of 6 nm planned with a sixth module (which willbe installed in the second quarter of 2007

Then possible to accelerate the electron bunches to 1 GeV and to generate wavelengths of 6 nm.



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2. Strategy for Particle Physics

Strategy:

- remain a leading and attractive particle physics lab
- maintain a strong theory group in particle physics

- HERA running until mid 2007
  data analysis (far) beyond 2009

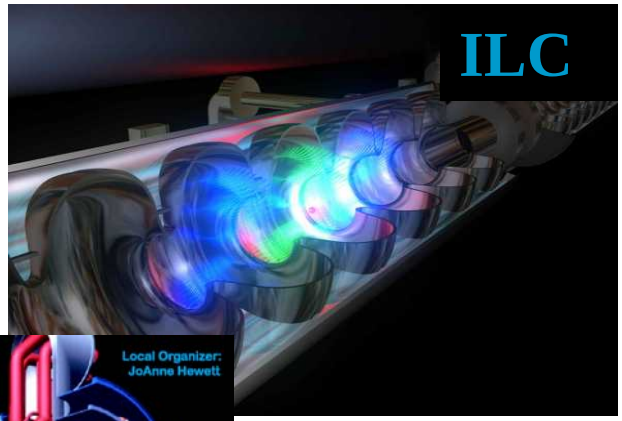
- ILC centre at DESY (central role through all phases
  and in all aspects)

- keep particle physics expertise in the time between HERA and the ILC → participation in LHC

- fulfill role towards German Universities in particle physics

Participation in the LHC

- Natural continuation of HERA programme
- Ideal preparation for physics at the ILC
- Synergy also with/for DESY theory group



TIER2
Analysis Centre
for
ATLAS and
CMS

Active
participation
in
ATLAS and
CMS

International Linear Collider

- Technology decision in 2004 selected the TESLA Technology for the ILC
- DESY key people in the GDE
- Baseline design configuration:
  - Many of the baseline design of the Main Linac correspond to the TESLA TDR (except gradient)
  - The VUV-FEL and XFEL construction and operation experience are our main input
- The Baseline was finalised in December
- Reference Design Report with costing to be ready end 2006
- Substantial EU funding (EuroTeV, EuDet, CARE)

3. Strategy for Astroparticle Physics

Experimental astroparticle activities are presently mainly located in Zeuthen

Theory in HH: Linking particle physics and cosmology

Experimental Scientific Focus: Origin of high energy cosmic rays, through neutrino messengers

- Analysis of data from Baikal and Amanda
- 2. year deployment of Icecube successfully finished
- Collaboration started planning of operation phase

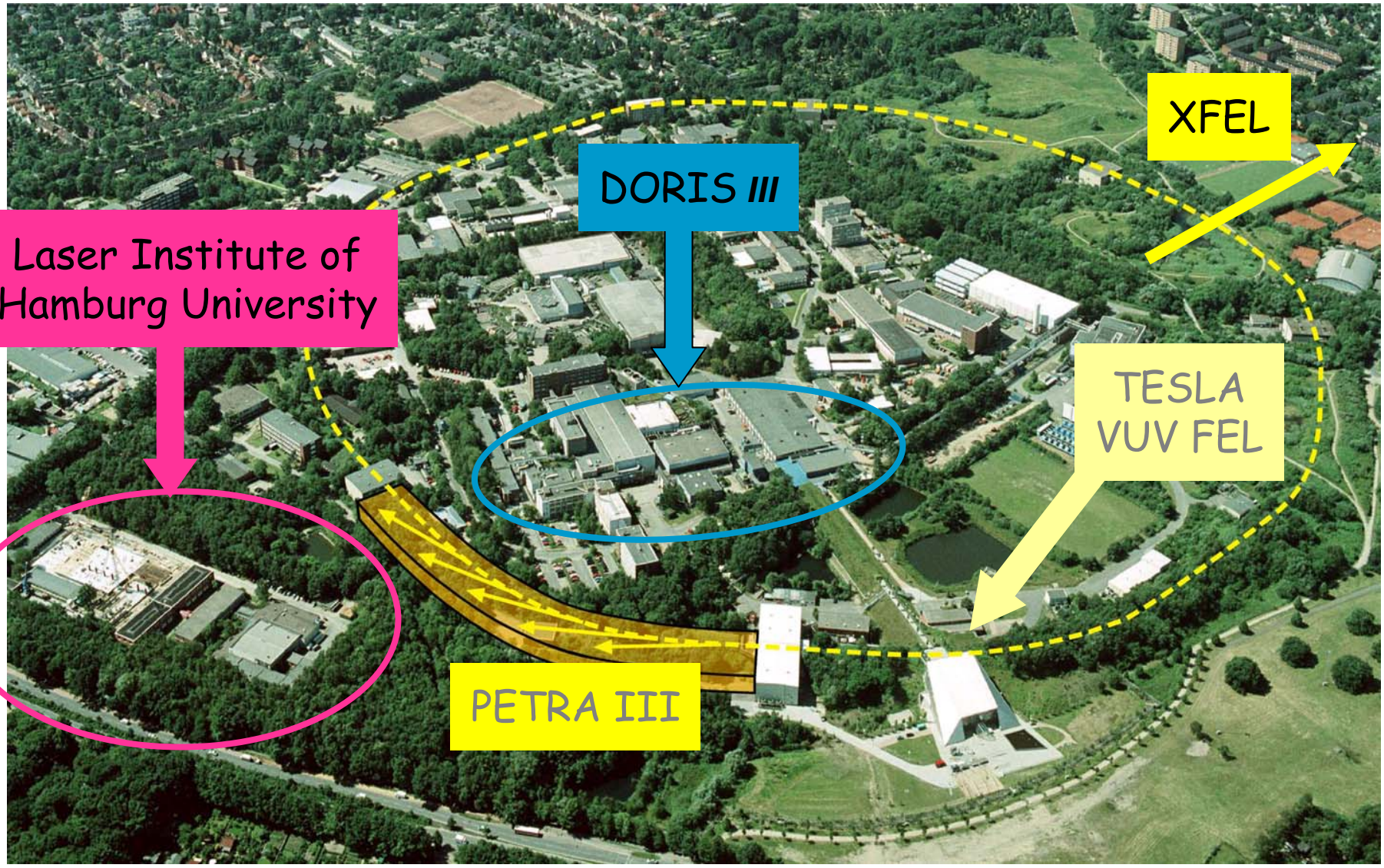
New: Combination of neutrino and high energy photon signals (multi-messenger principle)

Close collaboration with German universities

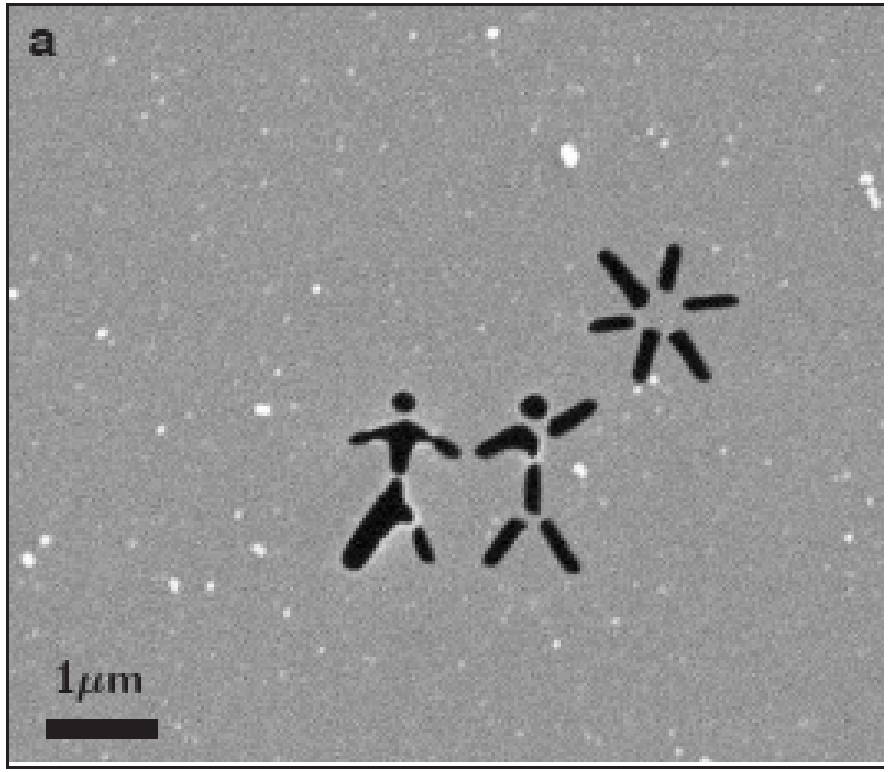
Strategy for Research with Photons

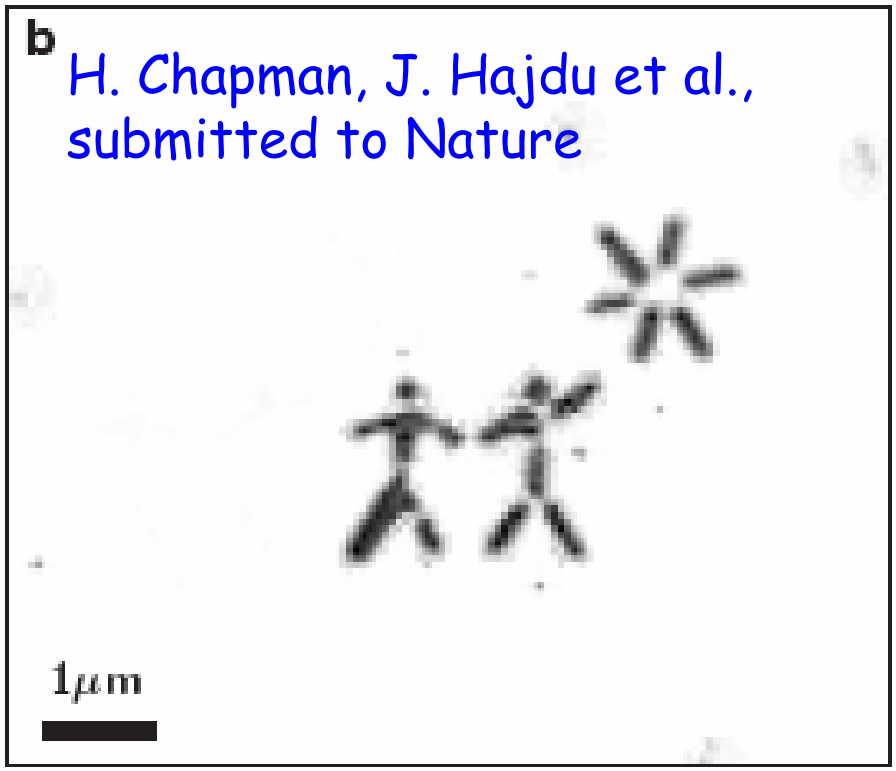
- Make leading edge research in physics, chemistry, material science, biology etc. possible through unique light sources:
  - VUV-FEL - FLASH
  - PETRA III
  - Participation in European XFEL
  - DORIS (Evaluation in 2007)
- FLASH, PETRA and the XFEL are or will be unique facilities on a world scale

Research with Photons at DESY



Flash Imaging at 32 nm at FLASH





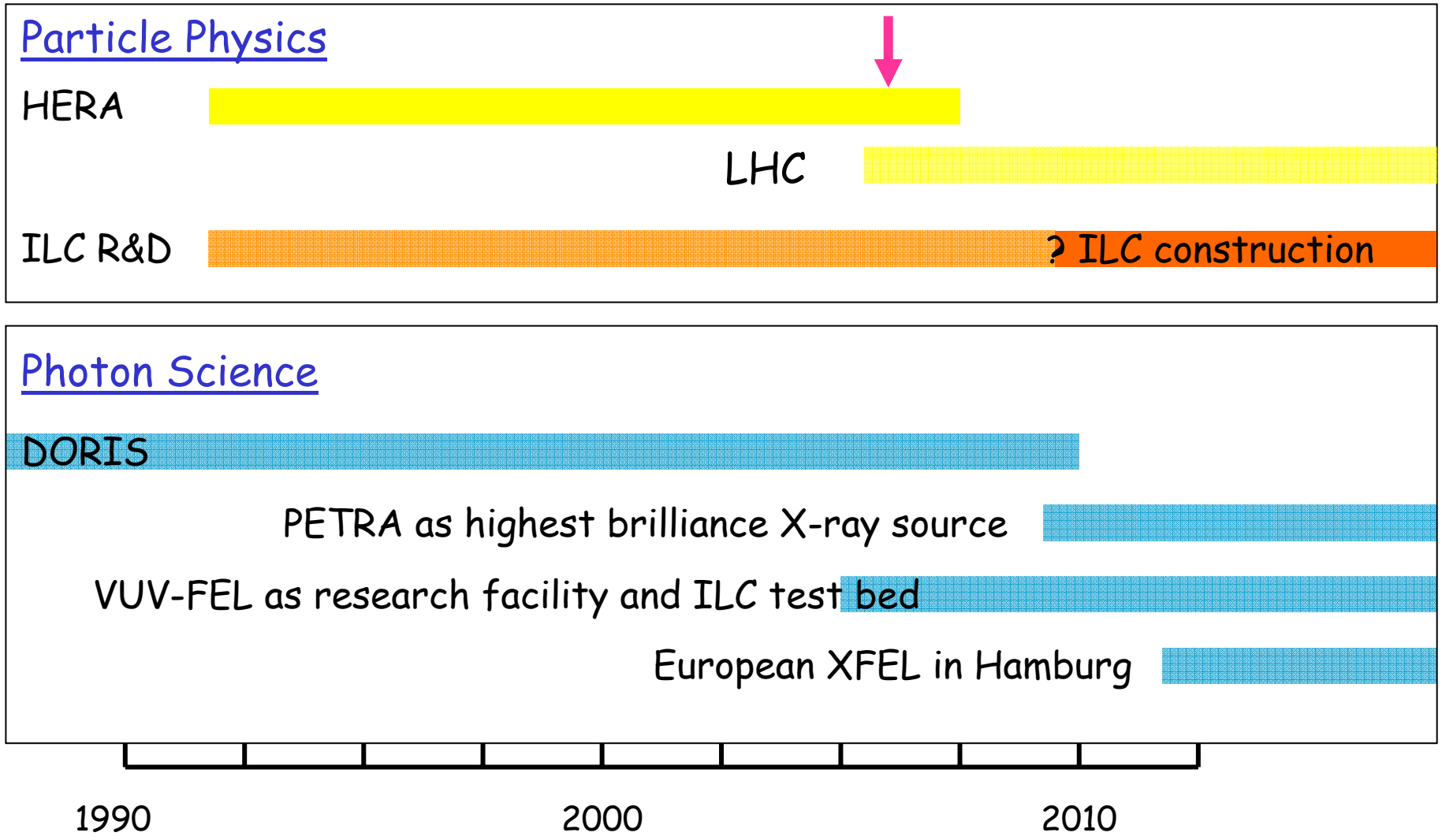
SEM image of test sample

Reconstructed image

Resolution estimated to 62 nm

Image fully reconstructed, with high resolution and no sign of destruction

Research Facilities at/with Involvement of DESY



Conclusion DESY

- DESY has a strong programme in accelerator based science, with many synergies linking its three areas of competence: accelerators, particle physics and photon science

- DESY will continue to be a strong partner for German universities and in international projects

General Issues for National Laboratories - 1

- Provide base for accelerator science in collaboration with universities and other research centres
  - Accelerators development is vital for science
  - Accelerators R&D requires
    - substantial infrastructure,
    - long time lines and long term commitment
    - specialised technology (e.g. cryogenics, RF) etc
  - This makes this work difficult at universities
  - Best approach is close collaboration of universities and research centres (National Labs)

General Issues for National Laboratories - 2

- Provide base for experiment related high tech aspects
- Provide base for high power computing

  - High technology which is applied in modern experiments (e.g. CAD, engineering, chip design, production and testing, project management) requires
    - specialised expertise and
    - long-term engagement
  - GRID computing requires large installations, maintenance, software development, long-term engagement etc

Strong link between universities and National Labs will be the most effective combination of skills and needs

National Labs can serve as a kind of **amplifiers for the national programs**, allowing researchers to do much more than they could in their own universities alone.

General Issues for National Laboratories - 3

- Coordinating role
- Be "hub" for national/regional participation in international projects

  - For an effective participation of a country in global or international projects (LHC, ILC, neutrino factories etc) a coordinated, focused approach will enhance the scientific impact of a country. A National Lab can help in this coordination.
  - One model for a visible participation in a global project is the Global Accelerator Network. National Labs can play the role of a regional "hub" in such an approach.

General Issues for National Laboratories - 4

- Link to other science using accelerators
  - Many of the National Labs have a **broader mission** than just HEP
  - there is an opportunity to develop synergies and connections with non-HEP applications (like light sources, neutron sources, astronomy, non-HEP computing) from which more than one field of science can profit.

ERF: European Association of National Research Facilities Laboratories

- Founded in April 2006
- The mission of the association is to promote cooperation between the individual European national research facilities laboratories;
- the individual organisations remain independent but via the association agree to cooperate and initiate joint efforts on agreed initiatives.
- The initiating associates are:

  Societe Civile Synchrotron Soleil (FR), Elettra – Societa Sincrotrone Trieste (IT), Deutsches Elektronen-Synchrotron DESY (DE), MAX-Lab (SE), GANIL (FR), PSI - Paul Scherrer Institut (CH), FOM Institute Rijnhuizen (NL), Max Born Institute (MBI) (DE), Hahn-Meitner-Institut Berlin (HMI) (DE), CCLRC (UK)

Conclusion on the Role of National Laboratories

- National Laboratories play in many ways a key role for the future of particle physics in Europe and for science development in general.
- Their key strength lies in all areas which require a long term commitment, substantial infrastructure and specialised know-how
- National Labs are at their best in close collaboration (networks) with universities and other laboratories, such as CERN.