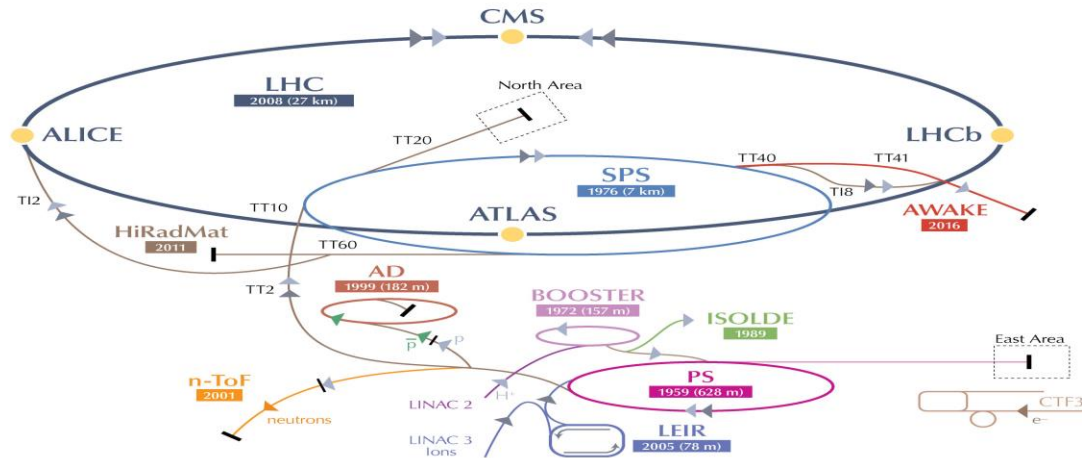


Symposium "**Science and Peace**" to celebrate the 60th anniversary of the first Council session

Council, accelerators, medical applications, technology transfer, and the World Wide Web

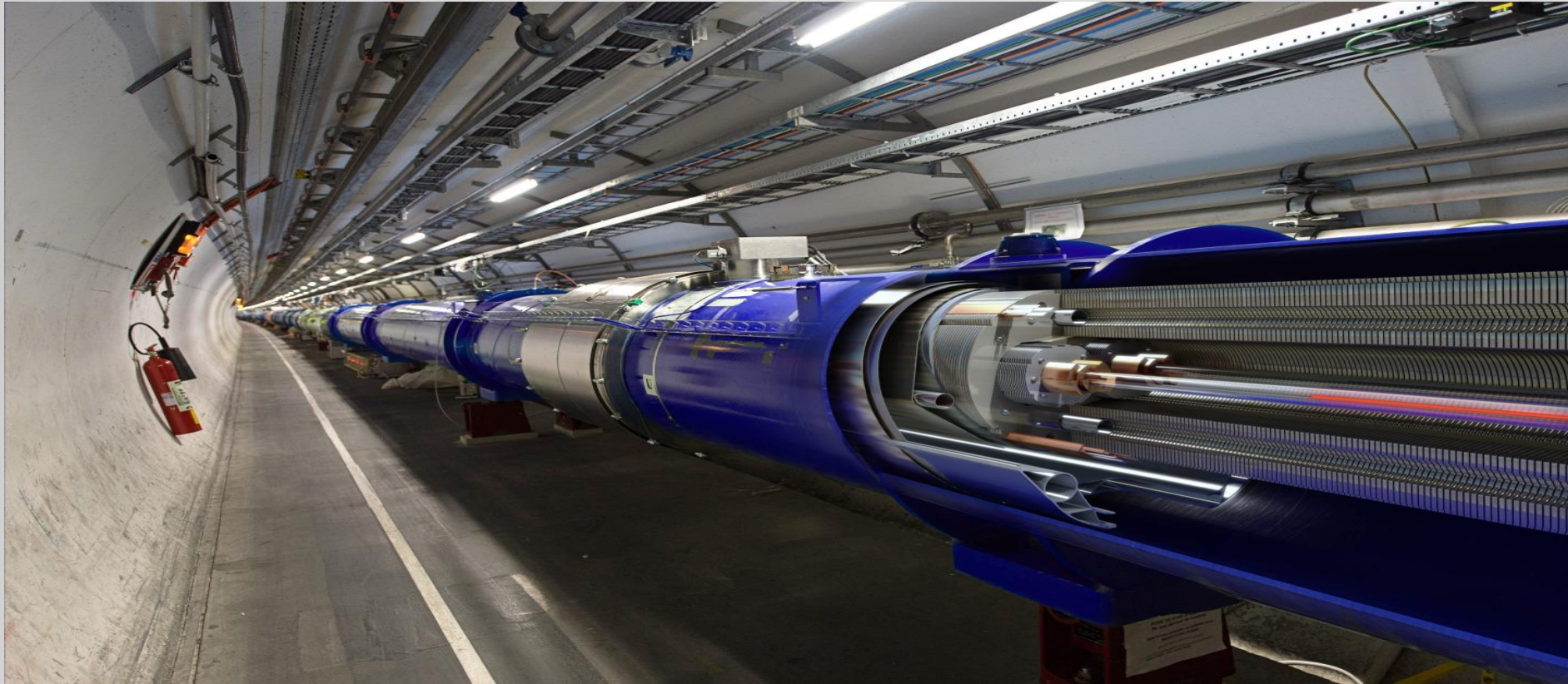
Accelerators

John Adams “The Development of CERN, 1970 to 1980”, Annual Report 1980, p.25

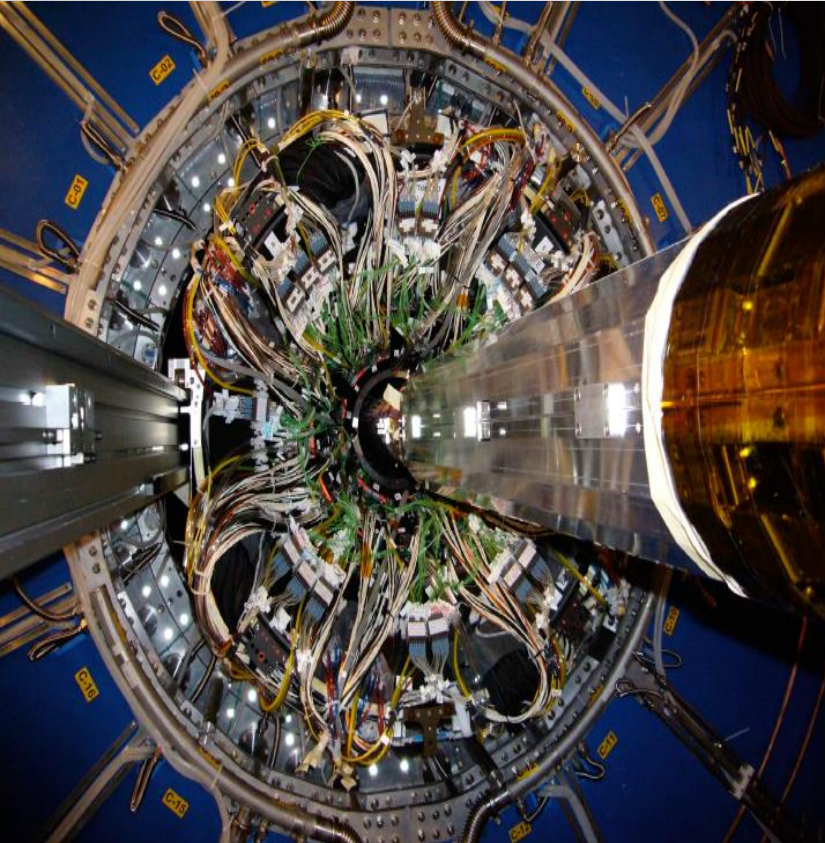


The latest development of the LEP Project is to use the PS and SPS machines as the injector for LEP, once again demonstration the ingenuity of the machine builders and the wisdom of keeping all the machines together on one site.

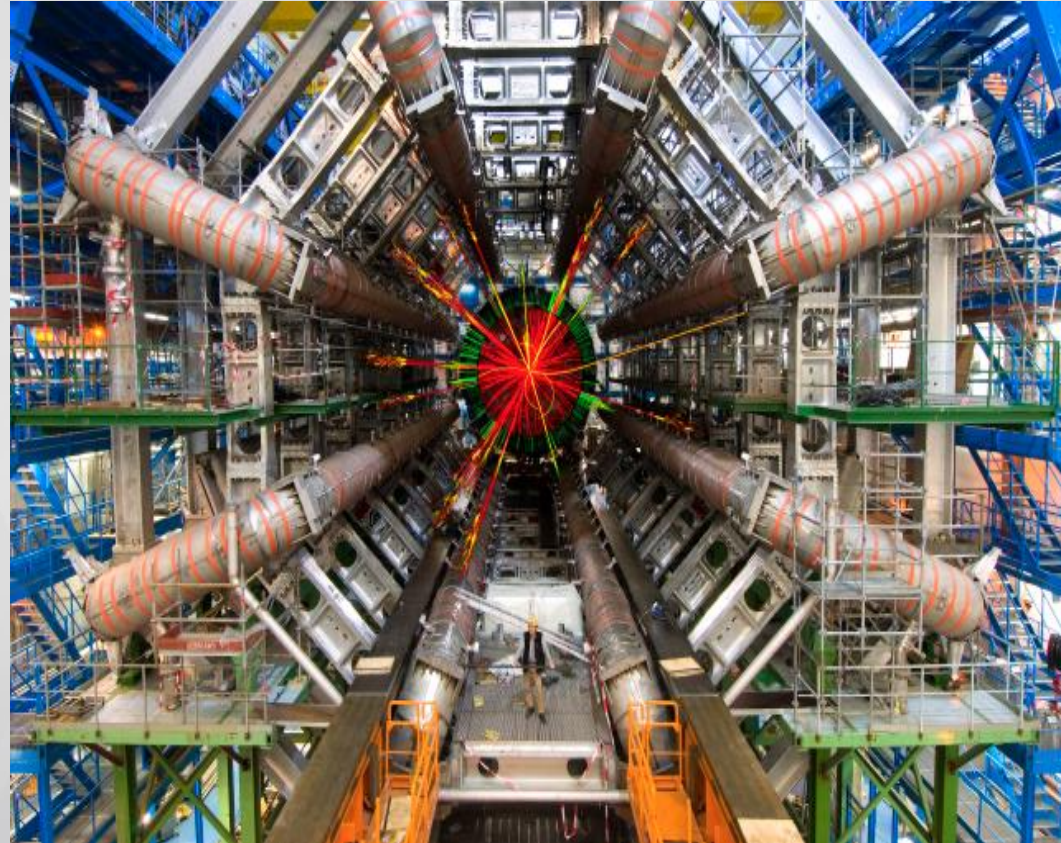
Accelerators



Detectors



9/17/2014



Horst Weninger

Accelerators



Accelerators by the Numbers

World wide inventory of accelerators, in total 15,000. The data have been collected by W. Scarf and W. Wieszczycka (See U. Amaldi Europhysics News, June 31, 2000)

Category	Number
Ion implanters and surface modifications	7,000
Accelerators in industry	1,500
Accelerators in non-nuclear research	1,000
Radiotherapy	5,000
Medical isotopes production	200
Hadron therapy	20
Synchrotron radiation sources	70
Nuclear and particle physics research	110

Courtesy: Introduction to Accelerators USPAS, January 2009
Stuart Henderson Jeff Holmes Yan Zhang

nuclear and particle physics, material physics, chemistry, biology, medicine

Medical treatment of cancers

Production of medical isotopes

Sterilization

Ion Implantation

Security: cargo inspection, ...

There is active, on going on

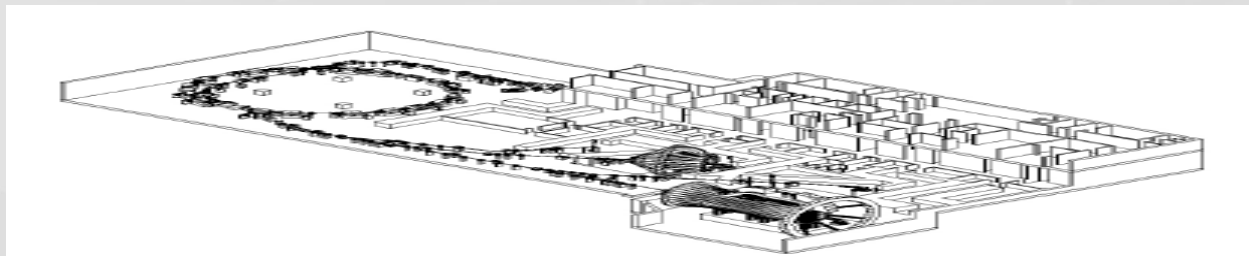
Transmutation of nuclear waste **MYRRHA**

Generating power more safely in sub-critical nuclear reactors (Thorium)

Medical Applications

HIT (and Marburg) Ion Beam Therapy Centres - GSI development
CNAO and MedAustron CERN PROTON-ION MEDICAL MACHINE STUDY

PIMMS 2000
(coordinated by
CERN) has led to:



fondazione CNAO

Treatment centre in Pavia, Italy.

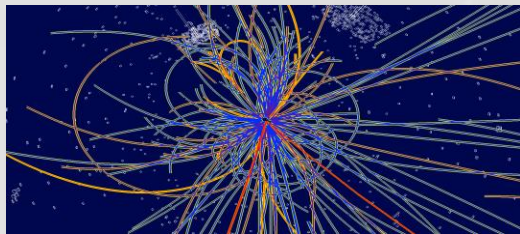
First patient treated with Carbon ions in November 2012

ebg MedAustron

Treatment centre in Wiener Neustadt, Austria,
foundation stone in 2011, installation moved to
MedAustron at beginning of 2012, first patient in 2015

Medical Applications

The Physics toolbox

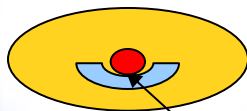


Detecting particles

Accelerating particle beams



Large-scale computing (Grid)



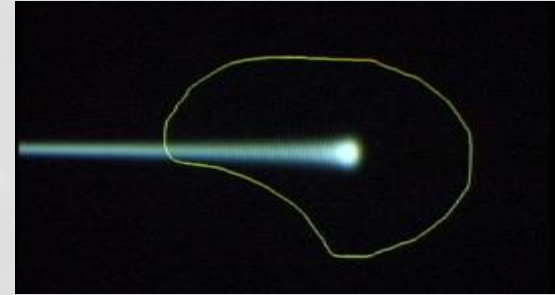
CANCER

And...collaboration

Medical Applications

ENLIGHT: Importing CERN collaboration philosophy into a medical environment

- Create common multidisciplinary platform
- Cancer treatment
- Identify challenges
- Share knowledge
- Share best practices
- Harmonise data
- Provide training, education
- Innovate to improve
- Lobbying for funding



Medical application

L'OCDE s'inquiète des risques de pénurie d'isotopes médicaux

Isotope shortage to get worse with closing of more reactors

Radiobiological research with ion beams Ulli Köster / ILL-Grenoble

<https://indico.cern.ch/event/215087/contribution/9/material/slides/0.pdf>

shortage of R&D isotopes – will affect many patients
research facilities must help usual production technologies :

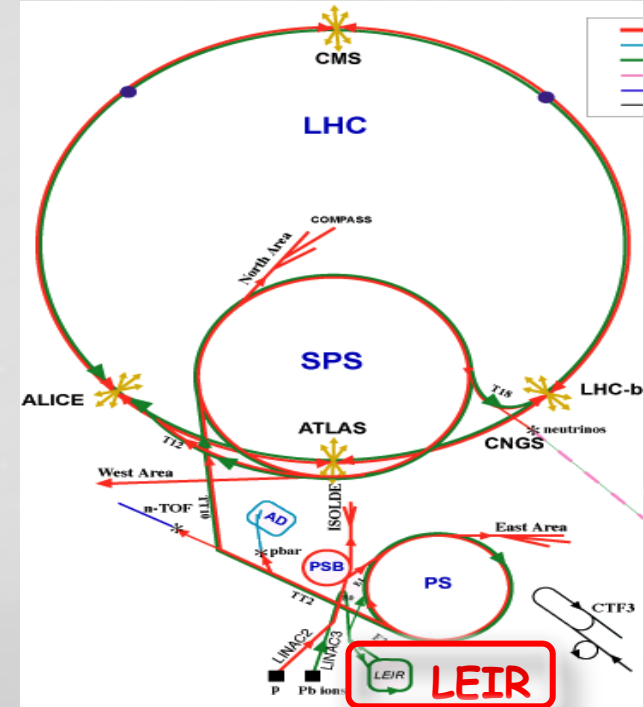
- the quest to study the optimum isotopes -

A plea for radiobiological research at ISOLDE and for LEIR

Medical application



Bio-LEIR



Biomedical facility at CERN using LEIR:

- radiobiology
- fragmentation of ion beam
- Dosimetry
- Detector development - test of instrumentation

Technology Transfer

In June, the Organisation for Economic Co-operation and Development (OECD) published their Global Science Forum (GSF) report: www.oecd.org/sti/sci-tech/CERN-case-studies.pdf

Case study: Medical Applications

“The Impacts of Large Research Infrastructures on Economic Innovation and on Society, Case Studies at CERN” Stefan Michalowski at OECD.

The report praises the longevity of CERN, which allows it to “recycle” its infrastructure for new projects, and described CERN manpower as a “great asset” for the organization, which can be deployed in response to strategic “top down” decisions or to initiatives that arise in a “bottom up” mode.

Technology Transfer

Basic research - science - creates new technologies and innovations -
but also depends on innovation and new technologies for scientific progress.

1994 CERN introduced a pro-active TT policy now accelerated by Knowledge Transfer

CERN has a long history of technology transfer related to the development of accelerators, detectors and computing. A most successful technology transfer mechanism functions through the people - scientists, engineers and students from collaborating university institutes -, CERN has increased its educational effort and technical training, profiting from a worldwide competence network in the universities and in high-tech industries.

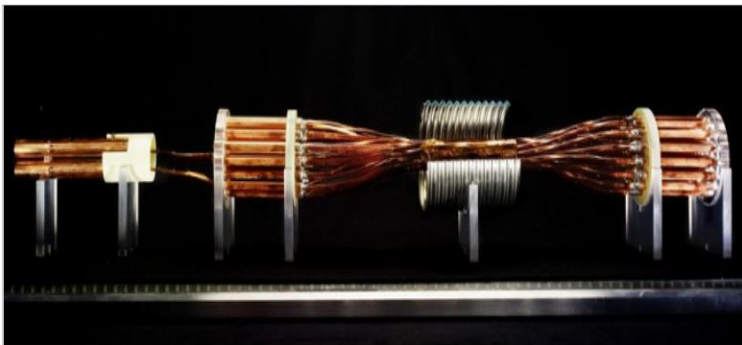
<http://www.researchgate.net/publication/250165463> TECHNOLOGY TRANSFER AND EDUCATION IN PARTICLE PHYSICS AT CERN

Technology Transfer

CERN Accelerating science

- [Sign in](#)
- [Directory](#)

Technology Portfolio



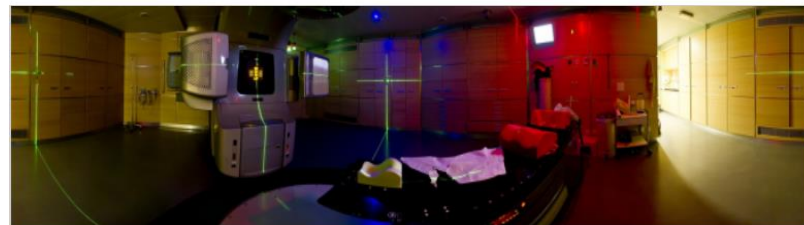
All CERN technologies listed below are available for licensing and/or research collaborations with industry or institutes.

[View all available technologies »](#)

CERN Accelerating science

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Life Sciences



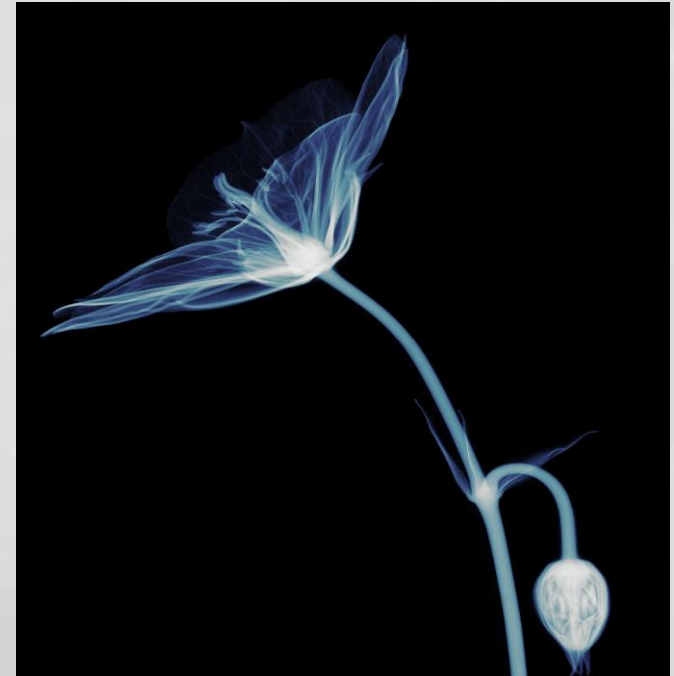
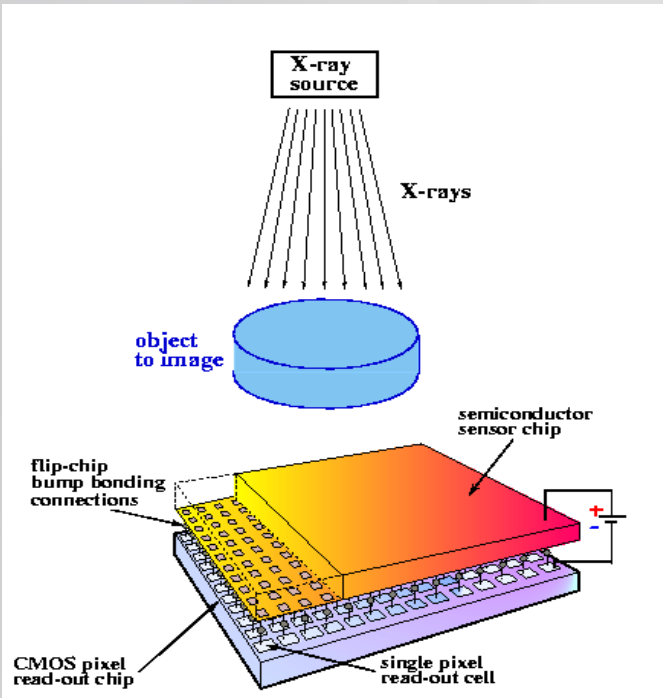
CERN is involved in a range of activities connected to life sciences, including medical imaging, particle therapy, radiobiology, e-health and training of young researchers in these multidisciplinary fields.

The Life Sciences section provides advice to the CERN community on these topics, and is actively involved in various projects. The section also promotes public awareness on CERN's initiatives in the life sciences domain.

You are welcome to contact the [Life Sciences Section](#) for more information.

Technology Transfer

MEDIPIX success story



Technology Transfer

Medipix 3.0

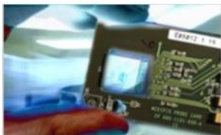
CERN Accelerating science

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- Directory

Medipix2

Description

The Medipix2 ASIC is a high spatial, high contrast resolving CMOS pixel read-out chip working in single photon counting mode. It can be combined with different semiconductor sensors which convert the X-rays directly into detectable electric signals. This represents a new solution for various X-ray and gamma-ray imaging applications.



The core concept of the Medipix2 chip was originally invented for pattern recognition in tracing of particles in the LHC. Since then the technological platform has evolved and is being developed in different application specific directions.

Area of expertise

Electronics

Applications

- Life Sciences
- Digital Autoradiography
- Astrophysics
- Various X-ray and gamma-ray imaging applications
- Neutron imaging
- Diffraction analysis

Timepix + Si



ESA/ ISS

University of Canterbury, Christchurch, New Zealand CEA, Paris, France CERN, Geneva, Switzerland, DESY-Hamburg, Germany Albert-Ludwigs-Universität Freiburg, Germany, University of Glasgow, Scotland, UK Leiden University, The Netherlands NIKHEF, Amsterdam, The Netherlands Mid Sweden University, Sundsvall, Sweden IEAP, Czech Technical University, Prague, Czech Republic ESRF, Grenoble, France Universität Erlangen-Nürnberg, Erlangen, Germany University of California, Berkeley, USA VTT, Information Technology, Espoo, Finland ISS, Forschungszentrum Karlsruhe, Germany University of Houston, USA Diamond Light Source, Oxfordshire, England, UK Universidad de los Andes, Bogota, Colombia University of Bonn, Germany AMOLF, Amsterdam, The Netherlands ITER, Cadarache, France Technical University of Munich, Germany

DEVELOPMENT OF INTEGRATED CMOS CIRCUITS AND SILICON PIXEL DETECTORS IN THE CERN-LA PROJECT 1988/89

Carlos Granja Institute of Experimental and Applied Physics Czech Technical University in Prague

World Wide Web

DG Carlo Rubbia reports to FC

In 1993 CERN put the World Wide Web software in the public domain and the web was allowed to flourish.

World Wide Web



<http://home.web.cern.ch/about/updates/2014/03/world-wide-web-born-cern-25-years-ago>

Inria accueille le premier bureau W3C en France

En vue de renforcer ses relations avec l'industrie et la recherche européenne, le Consortium World Wide Web (W3C) annonce la création d'un bureau France, accueilli par Inria.

First International Conference on the World-Wide Web May 25-26-27 1994, CERN, Geneva

Darmstadt, Germany, April 10-14 1995, organised by the Fraunhofer Gesellschaft.

The Tsunami of data from LHC experiments could not have been handled without the LHC-GRID, a natural extension of web-based Internet technology regrouping computer centre hardware.

Quotation:

Bob Jones,
CEO of
CERN
Openlab

The World Wide Web provides seamless access to information that is stored in many millions of different geographical locations. The Grid is an infrastructure that provides seamless access to computing power and data storage capacity distributed over the globe. The grid now extends into the Cloud, and today a European Cloud Computing Partnership starts with big science teaming up with big business.

World Wide Web

CERN Openlab and GRID

Bob Jones



This year, the CERN openlab Summer Student programme hosts 23 students from 17 different nationalities for 9 weeks.

Undergraduate and graduate students in Computer Science and Physics have come from all over the world for a summer internship at CERN working on specialized advanced computing projects with applications in High Energy Physics.

Thank you for listening

your support for research

and CERN's ambitious programs