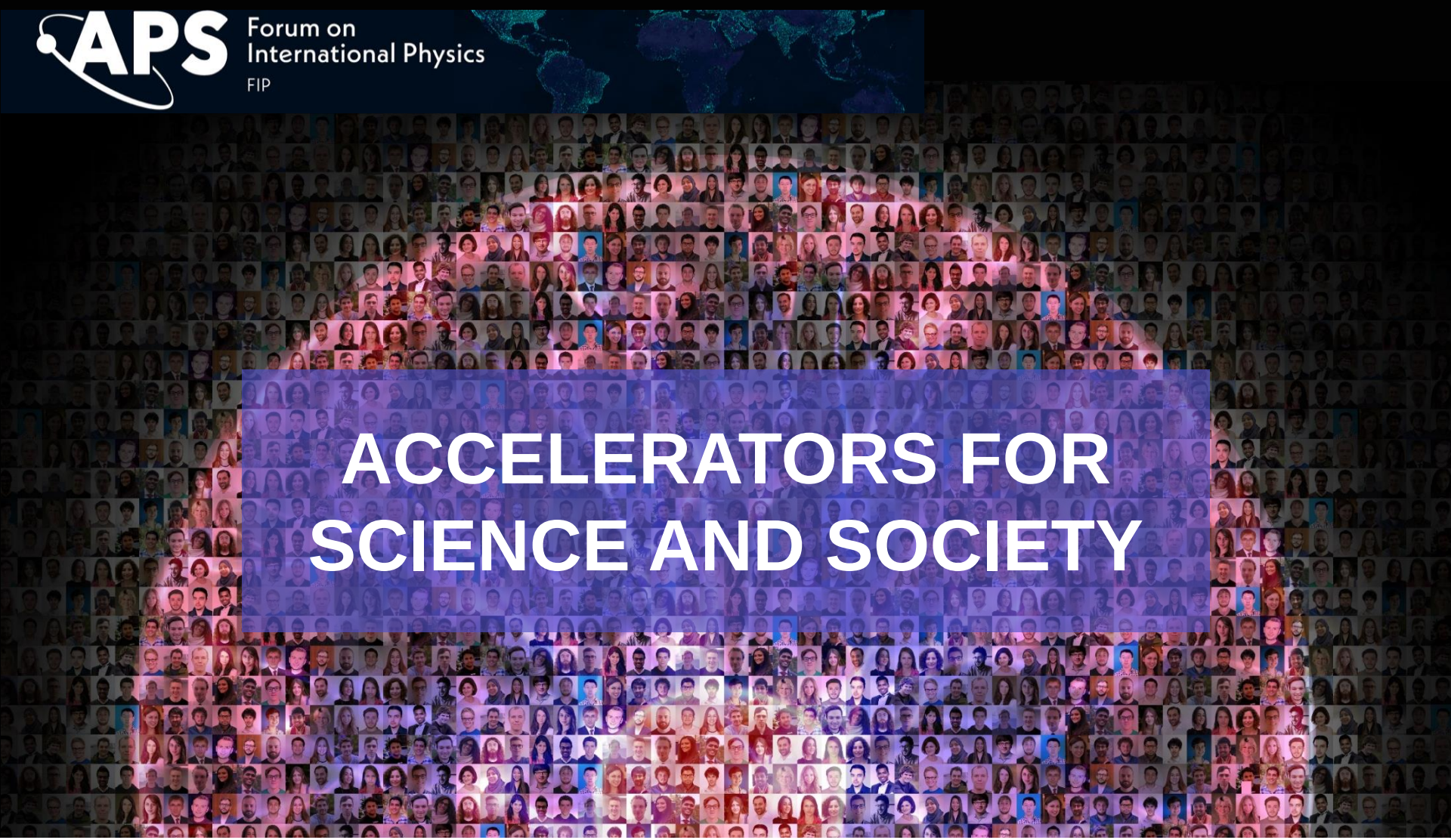


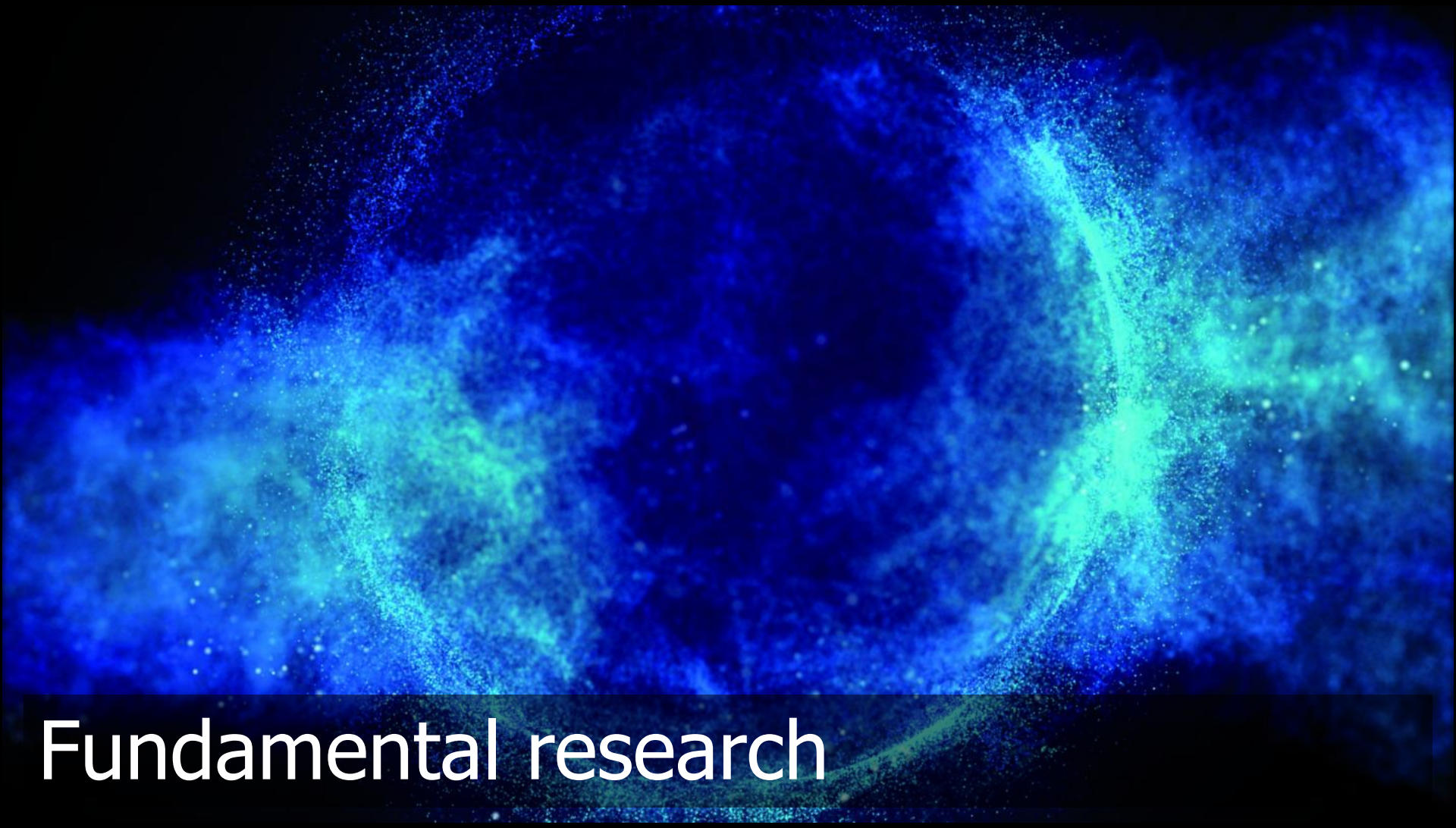
ACCELERATORS FOR SCIENCE AND SOCIETY

UNIVERSITY OF LIVERPOOL
The Cockcroft Institute of Accelerator Science and Technology

Prof Carsten P Welsch

QUASAR GROUP

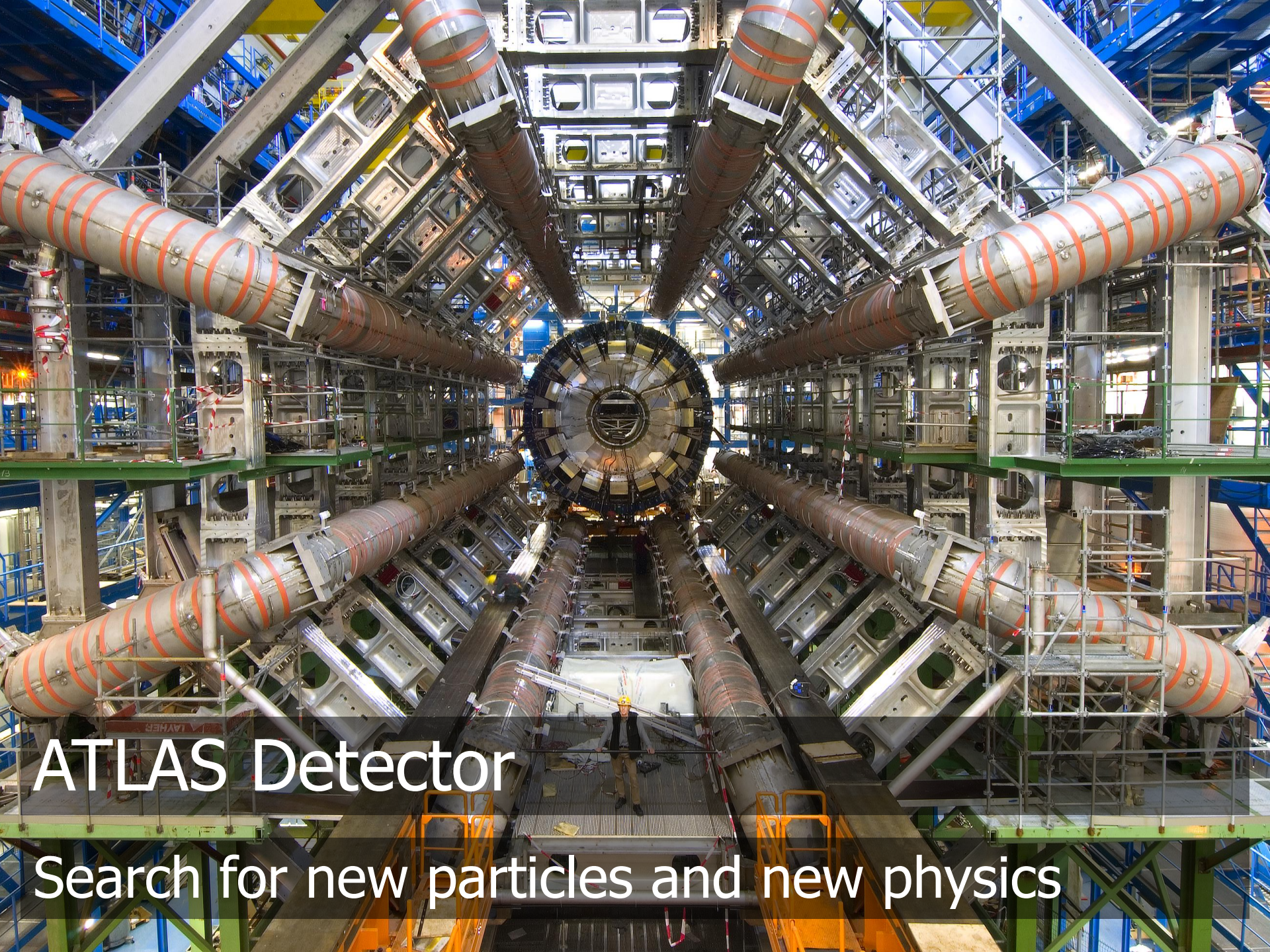
Physics Matters Online Colloquium – 30 November 2023



Fundamental research

Key to understanding the world around us

Photo: CERN


ATLAS Detector
Search for new particles and new physics


LIV.INNO
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Science and
Technology
Facilities Council
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LIVERPOOL
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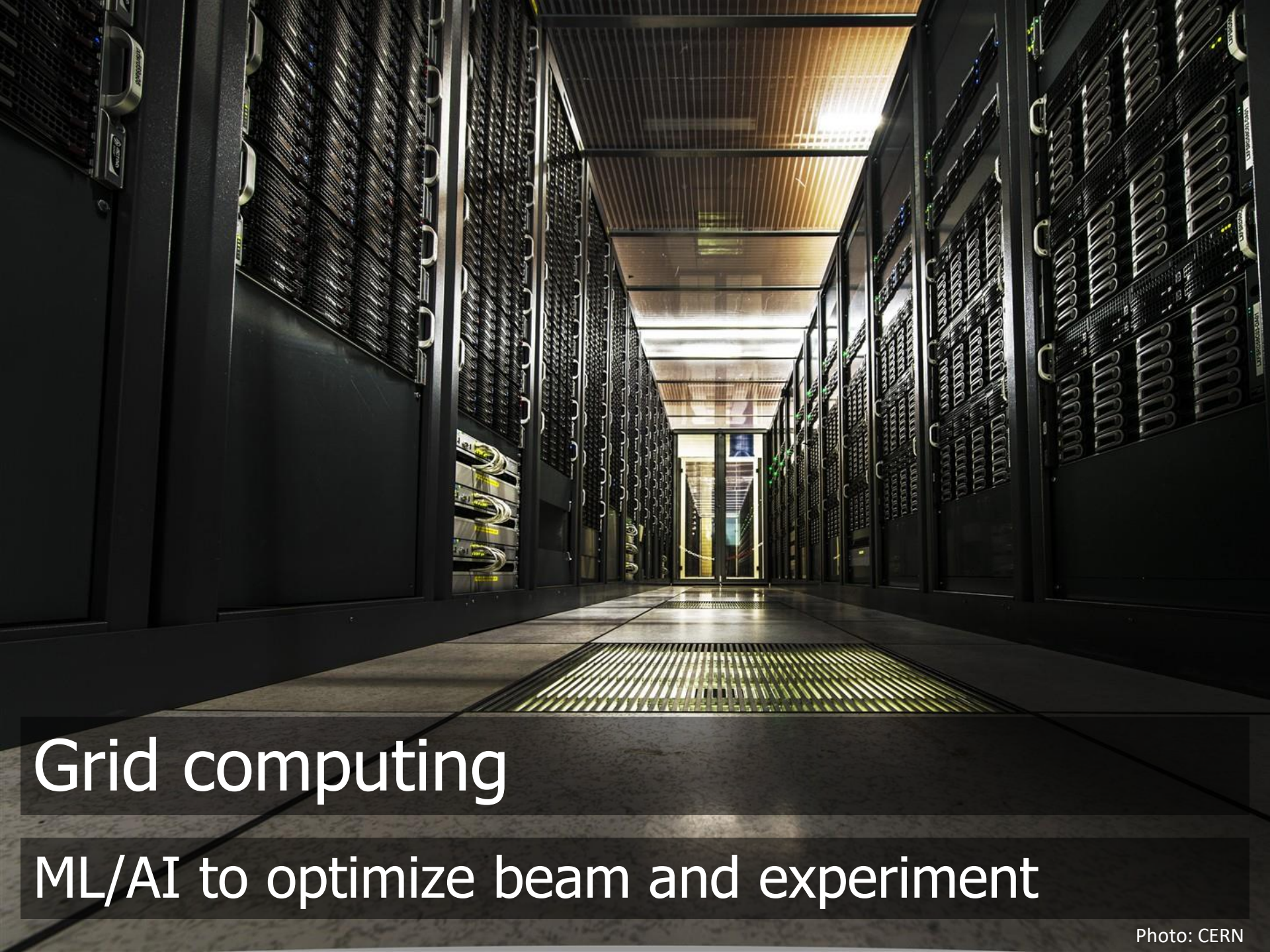
JOHN MOORES
UNIVERSITY



Grid computing

ML/AI to optimize beam and experiment

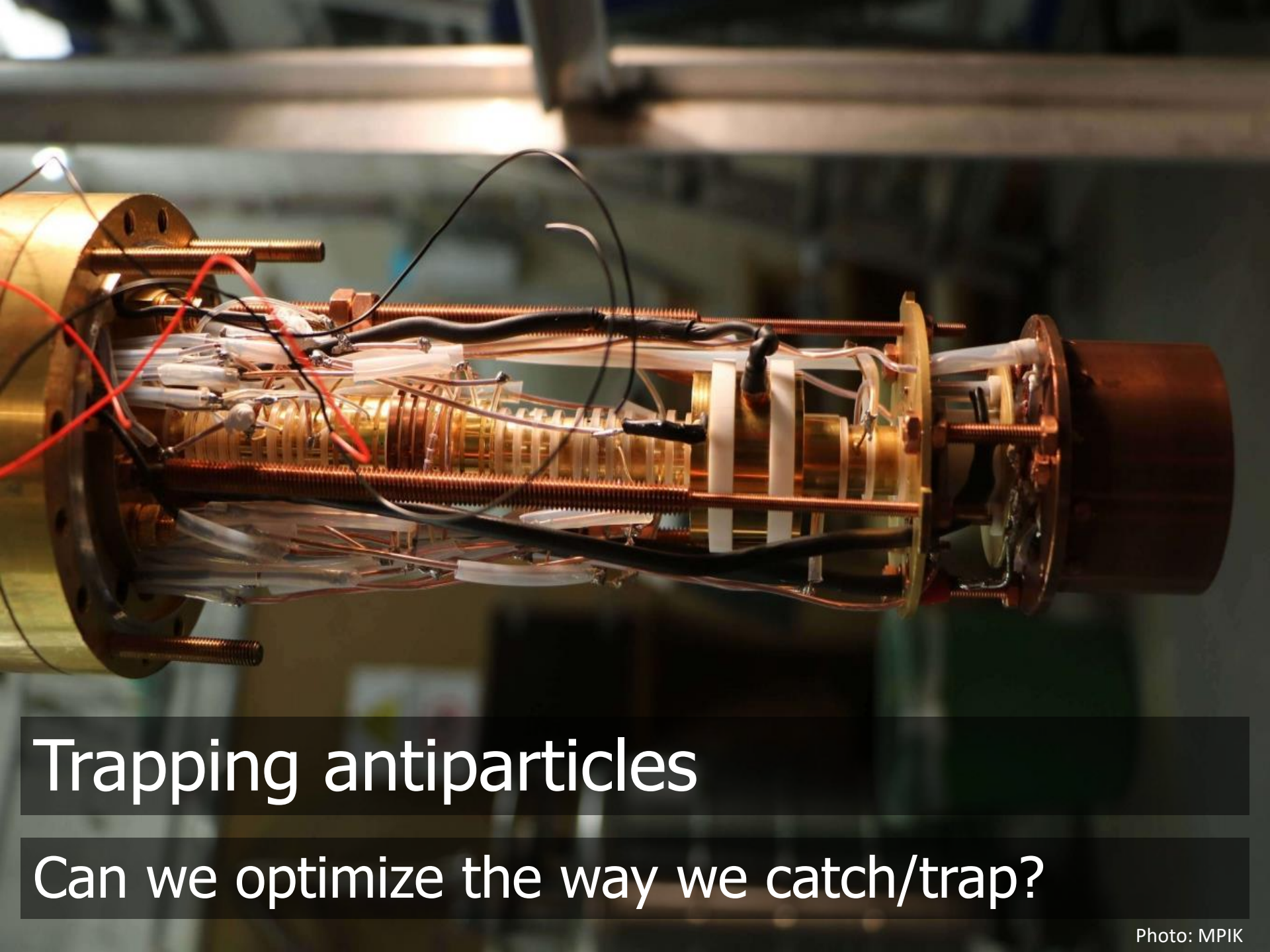
Photo: CERN

ACCELERATORS
VALIDATING
ANTIMATTER
PHYSICS

New opportunity: ELENA

How to provide and measure cold beams?

Photo: CERN



Trapping antiparticles

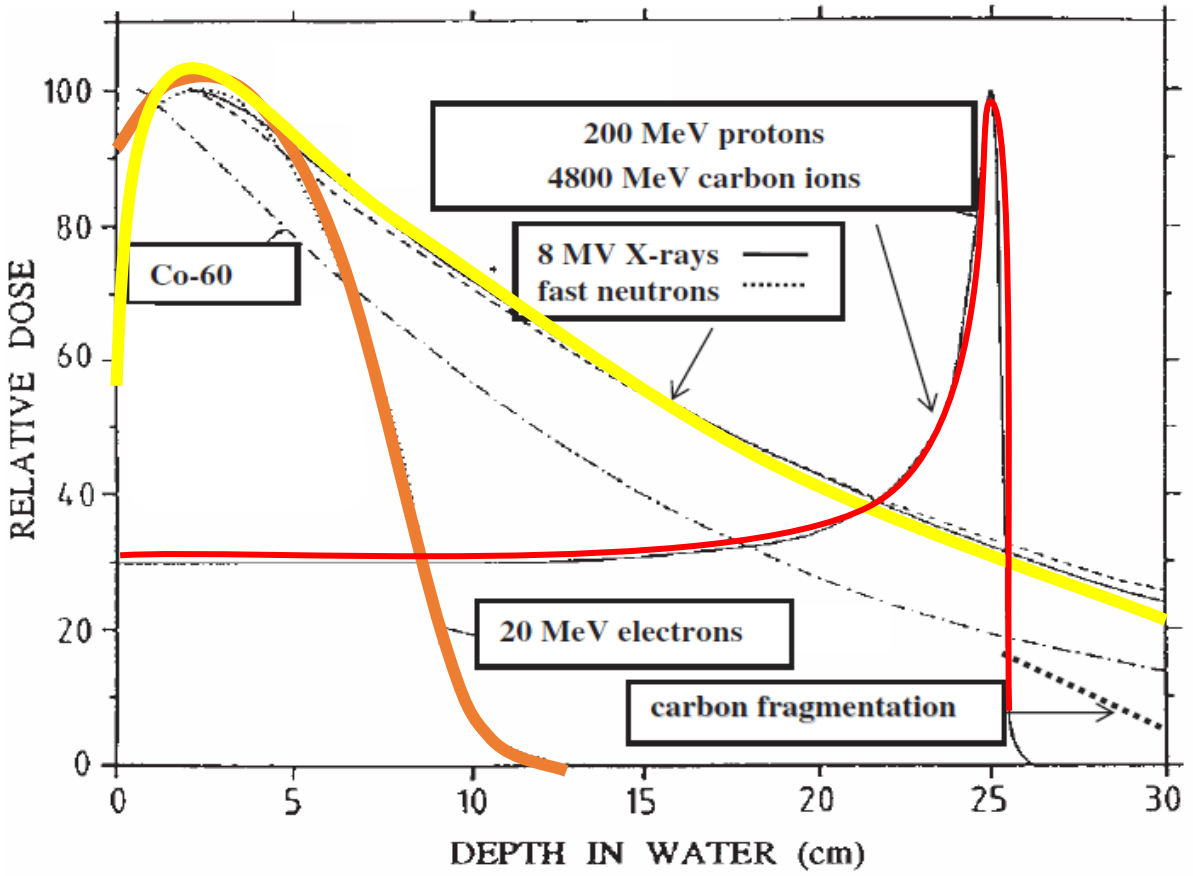
Can we optimize the way we catch/trap?

Photo: MPIK

Positron Emission Tomography

Using antimatter in clinical practice


UNIVERSITY OF
LIVERPOOL
Ion Beam Therapy
Beating cancer sooner
© Thomas Kästenbauer

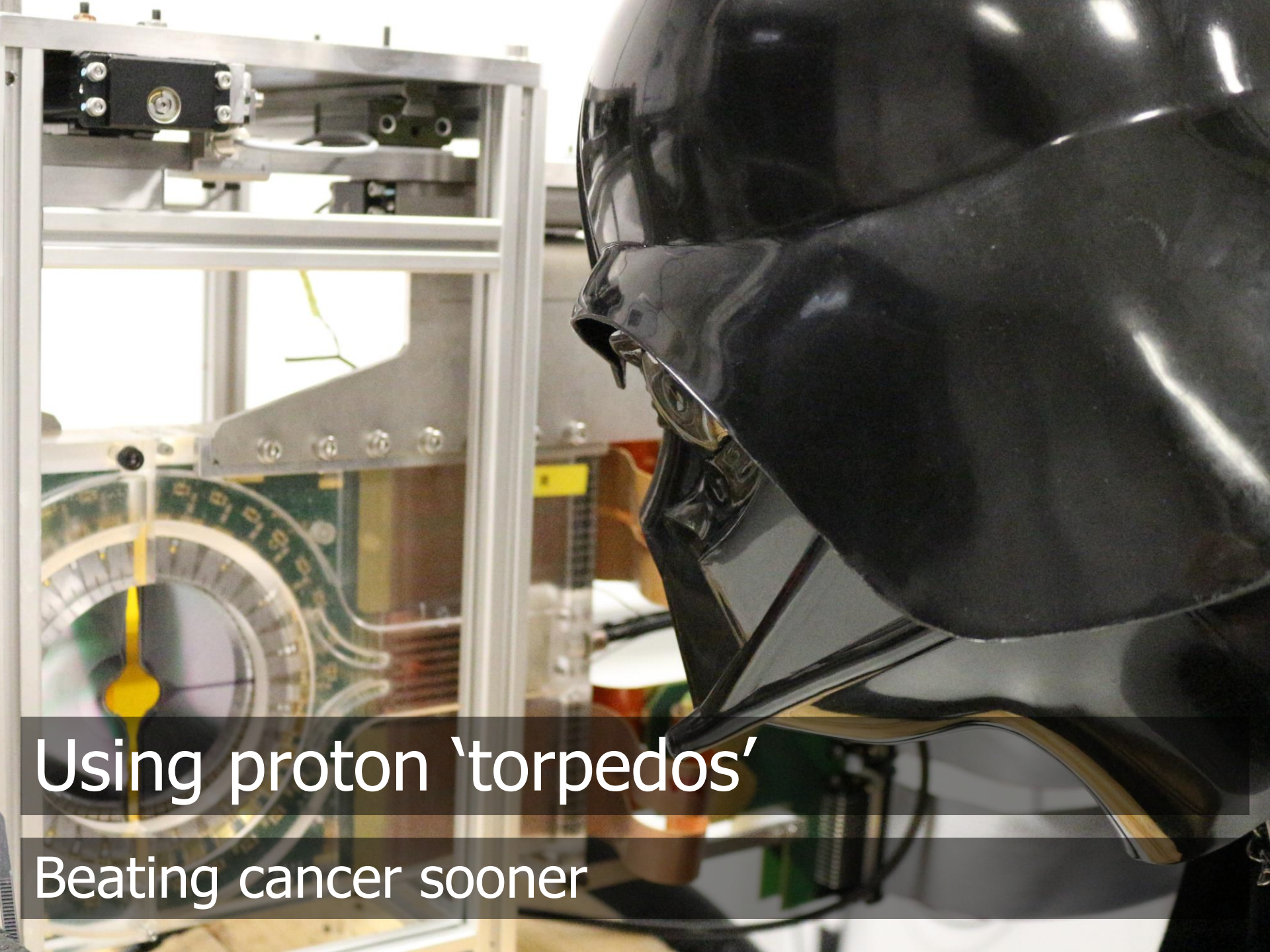


Ion Beam Therapy

Beating cancer sooner

Film: CERN


Optimization of
Medical
Accelerators



Using proton ‘torpedos’

Beating cancer sooner

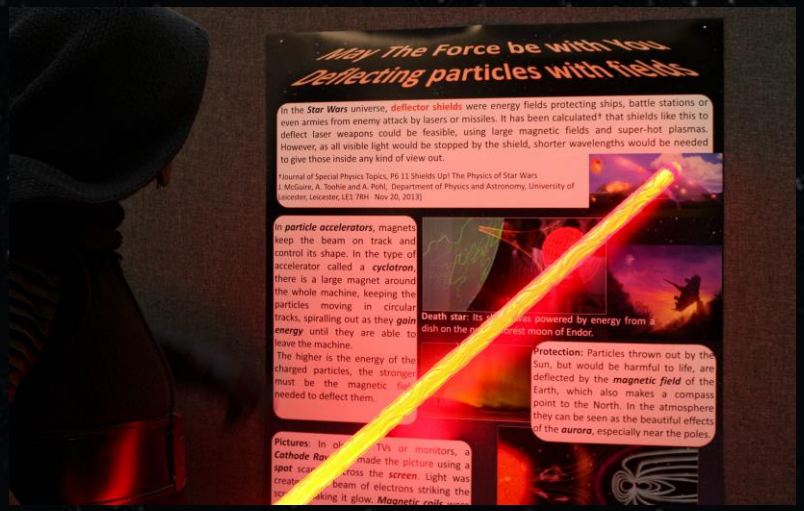
On a campus not so far, far away

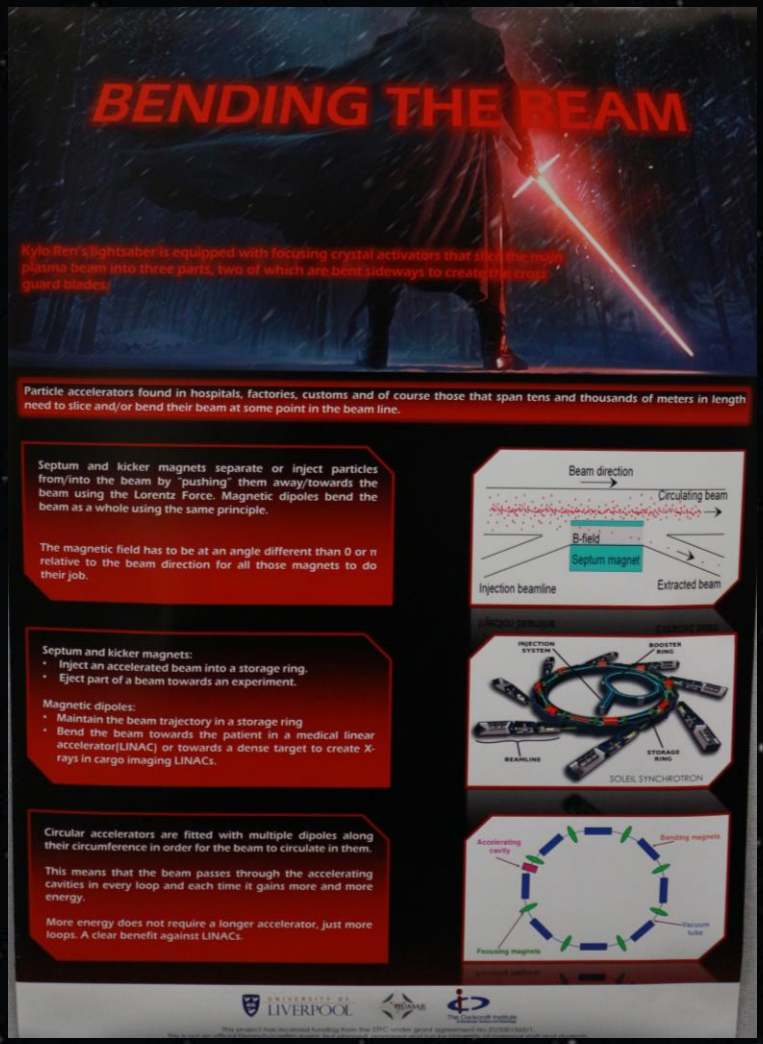
Themed demonstrations

Themed demonstrations

Themed demonstrations

Posters about accelerator R&D





Enhancing physics education

Creative Teaching & Learning

The Science Of Star Wars: Creative Physics Learning In A Galaxy That Isn't Far Far Away

Physicist and Star Wars fan Professor Carsten P Welsch explains how Star Wars fiction can help students to better understand the developments happening in accelerator science.

"Much to learn, you still have" are the famous words of Jedi master Yoda to Count Dooku when he faces his old Padawan in Attack of the Clones.

Science in School
The European journal for science teachers

ISSUE 54 | 01/09/2021 Topics Engineering | Physics | Science and society | Careers in STEM

The physics of Star Wars: introducing accelerator science

Carsten P Welsch

Science fiction can be an engaging starting point for scientific discussions. Learn how one research group is using Star Wars to introduce students to accelerator science.

Films and books create the chance to explore new experiences and science fiction is a great opportunity to create an environment in which to ask questions such as 'what if ...?' and 'how could you do that?'

These science questions emerge naturally out of discussion about the film and may even encourage the quiet film buff at the edge of the group to voice an opinion!

A number of TV series and films may have enthused your own interest in science. For us at the University of Liverpool, it has been Star Wars. Although strictly science fantasy rather than science fiction, there are a number of memorable scenes in the Star Wars films that we have used as analogies to introduce groups of young people to the concepts behind cutting-edge accelerator research.

As part of our outreach program, we created a themed workshop event with hands-on experiments and characters in costume to facilitate the discussions. The concept has worked well for all ages and abilities. We have run this as an event for several years and plan to use this winning formula again.

To capture the excitement of these 'big science' experiments, we have also created some films of our own, which

The Cockcroft Institute

focus on the people behind the science, in particular, young researchers from across the world. This diversity increases the chance that young people will see someone like themselves involved in research.

This could be replicated on a smaller scale – clips from the films are readily accessible and can be used with certain caveats: the films cannot be used to promote the event, the event must not be for-profit, and there can be no indication that the event was endorsed by Lucasfilm or Disney.

www.scienceinschool.org/2021/issue54/the-physics-of-star-wars

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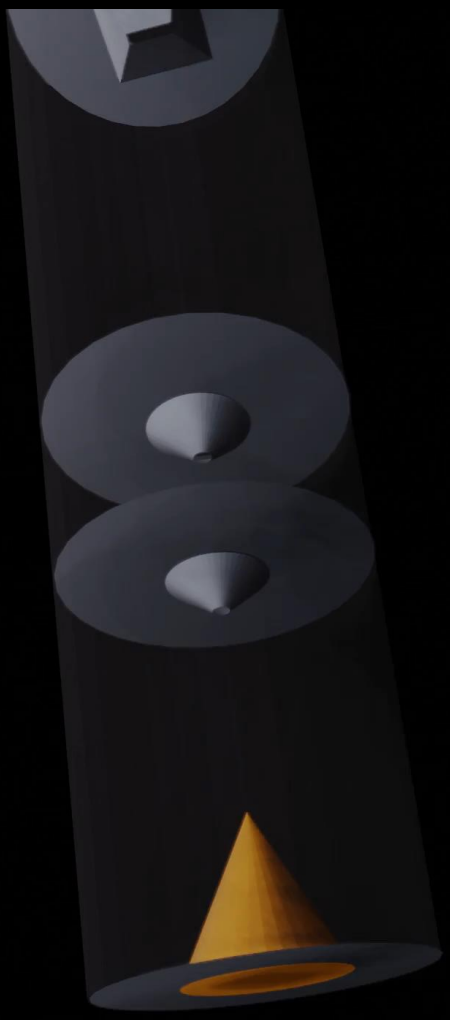
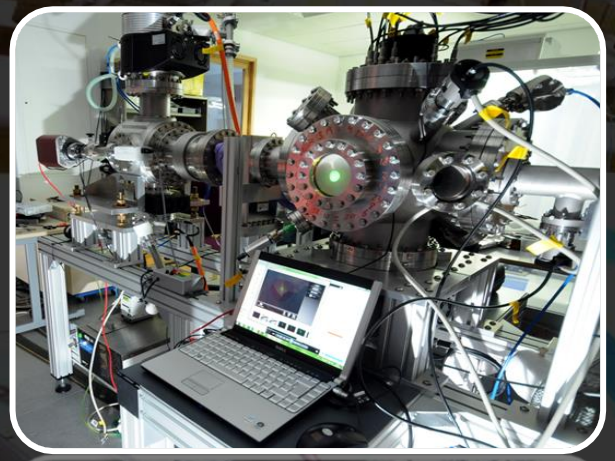
https://www.scienceinschool.org/

High Luminosity LHC

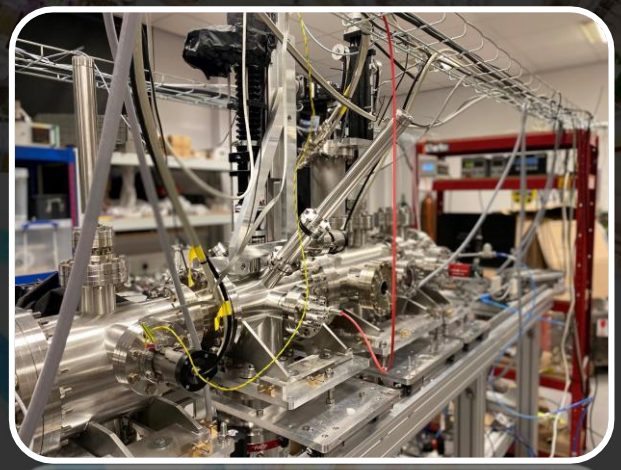
A critical update



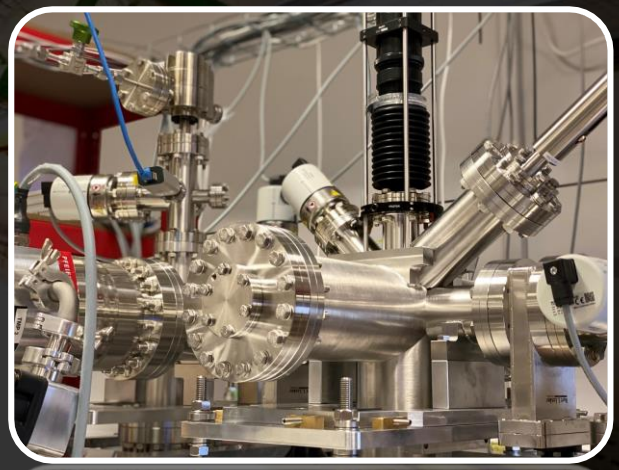

BGC
Beam Gas Curtain



Monitor for keV beams



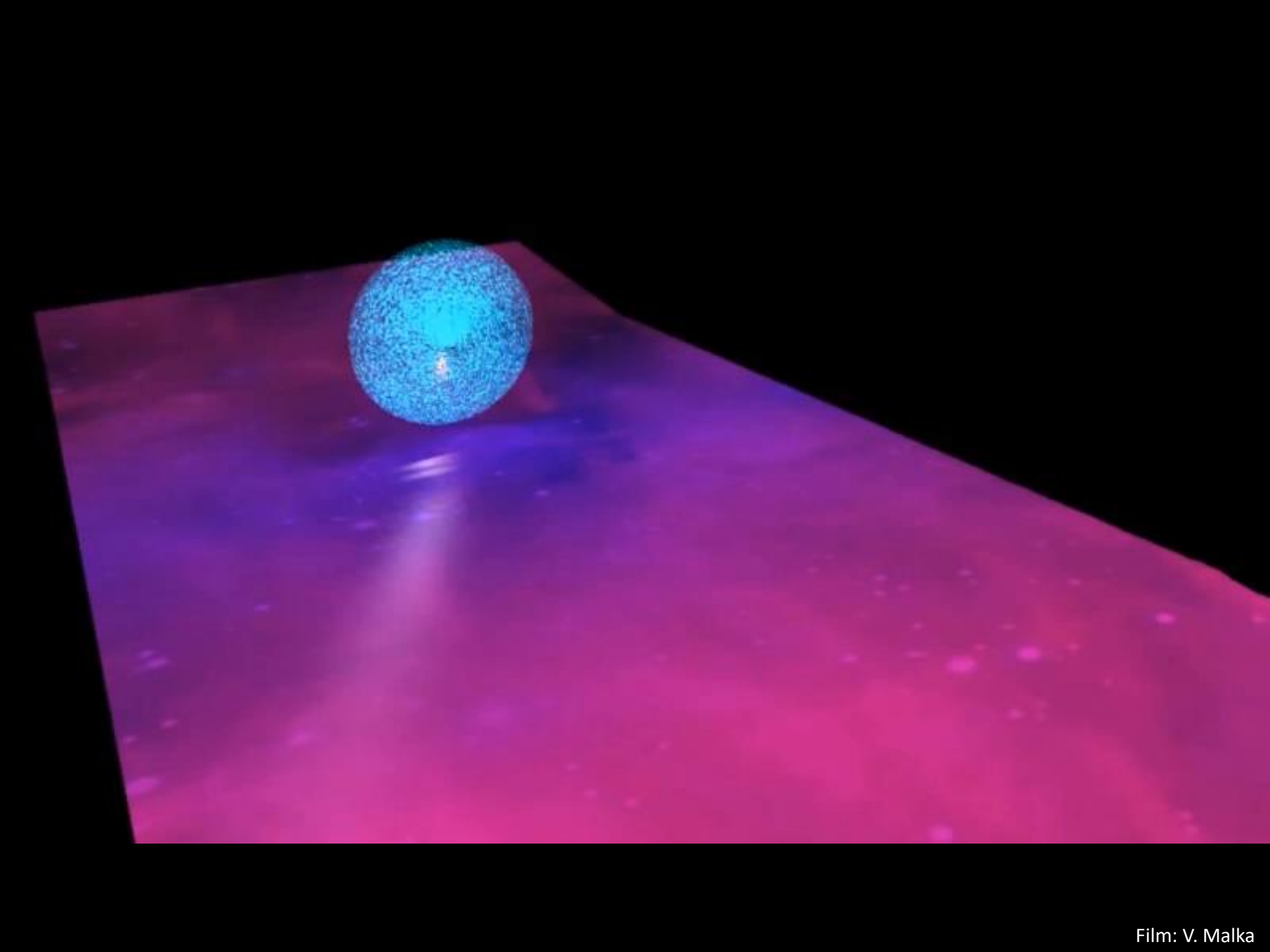
HL-LHC prototype



HL-LHC working instrument

Plasma Accelerators

Highest gradients for maximum acceleration



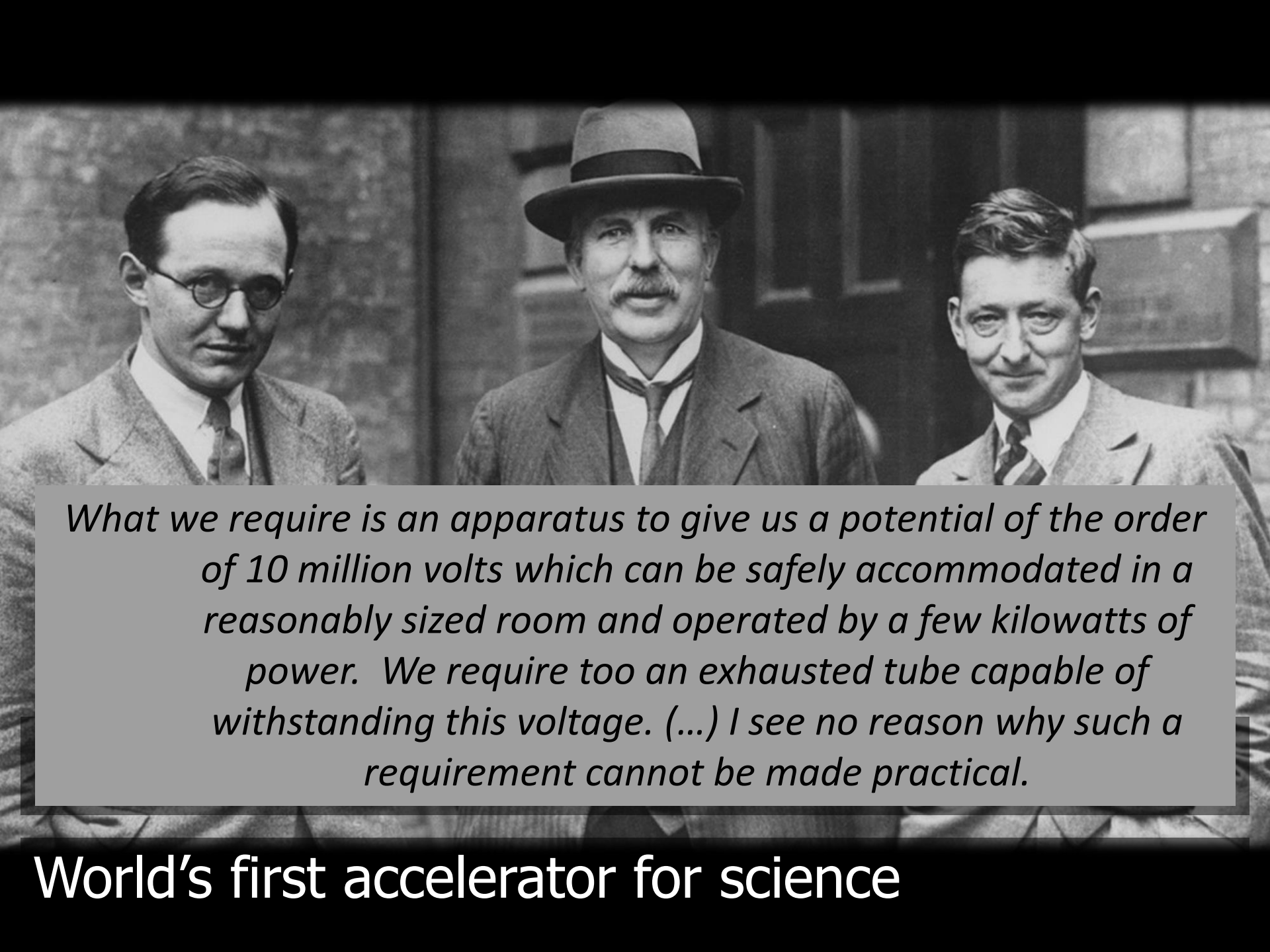
Film: V. Malka

EuPRAXIA

Unleashing the power of plasma

This nation should commit itself to achieve the goal, before this decade is out, of landing a man on the moon and returning him safely to earth.

J.F. Kennedy



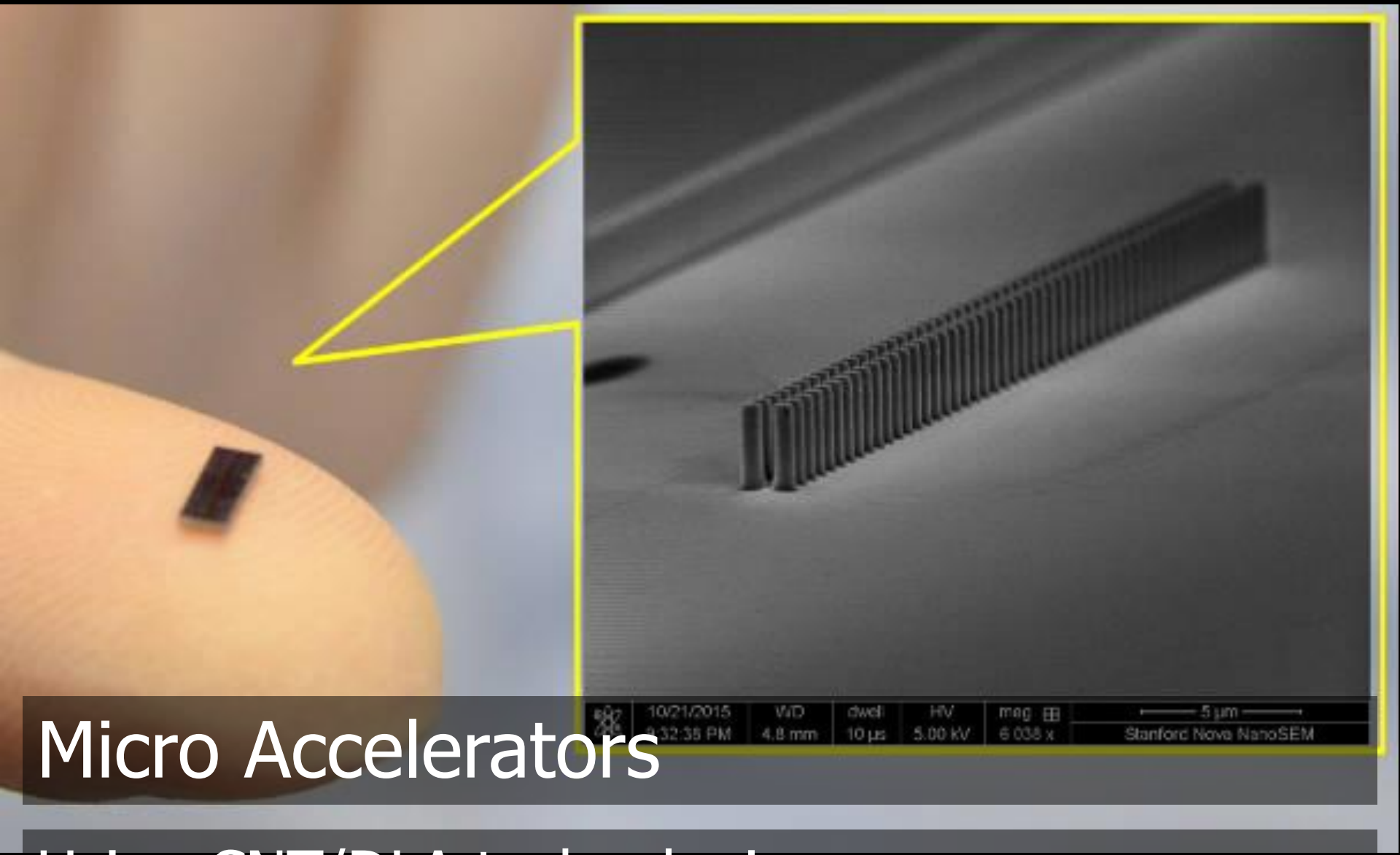
What we require is an apparatus to give us a potential of the order of 10 million volts which can be safely accommodated in a reasonably sized room and operated by a few kilowatts of power. We require too an exhausted tube capable of withstanding this voltage. (…) I see no reason why such a requirement cannot be made practical.

World's first accelerator for science

What we require is the design and construction of a laser capable of delivering pulses with a duration of 100 femtoseconds and an energy of 100 joules, at a repetition rate up to 100 Hertz and a user facility build around this technology in this decade.

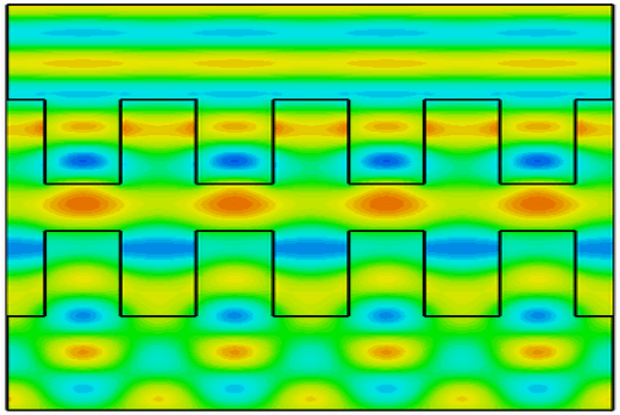
EuPRAXIA

Accelerating Innovation



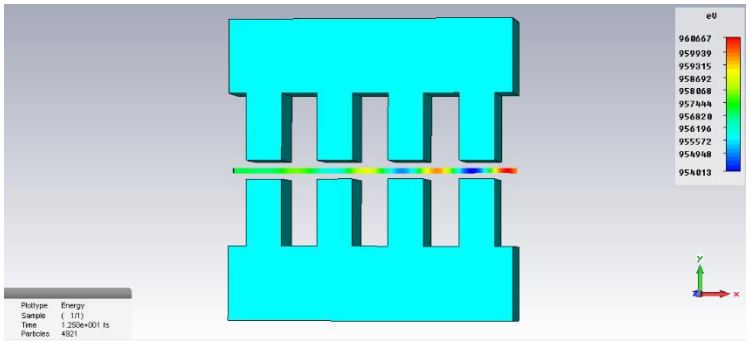
Micro Accelerators

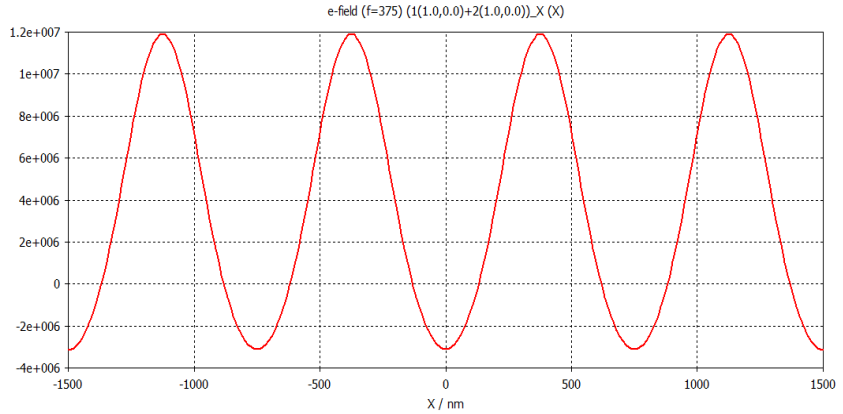
Using CNT/DLA technologies



Challenges

- Structure geometry
- Field distribution
- Optimization of accelerating gradient
- Understanding and optimization of output beam quality

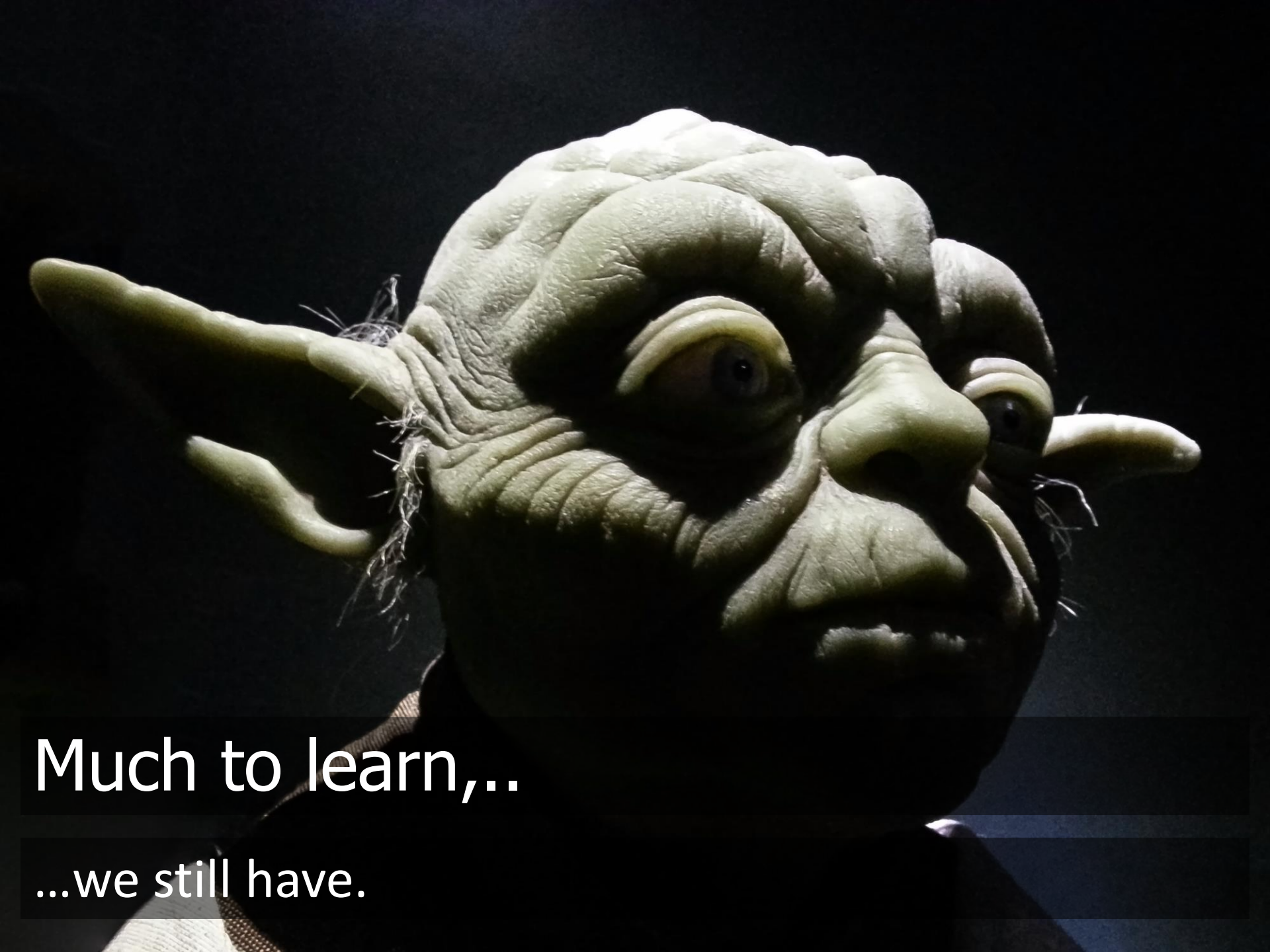





Accelerating innovation
Collaboration is key

Accelerator Research

for sCIence and soCIety


Much to learn,..
…we still have.

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APS Forum on International Physics FIP