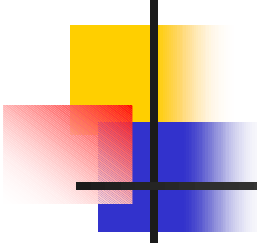




# School Projects at the Physics Frontline

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- From the electron to high energy particle collisions
- The ATLAS experiment
- From the laboratory to the Milky Way
- Stockholm House of Science
- Conclusions



# From the electron to high energy particle collisions

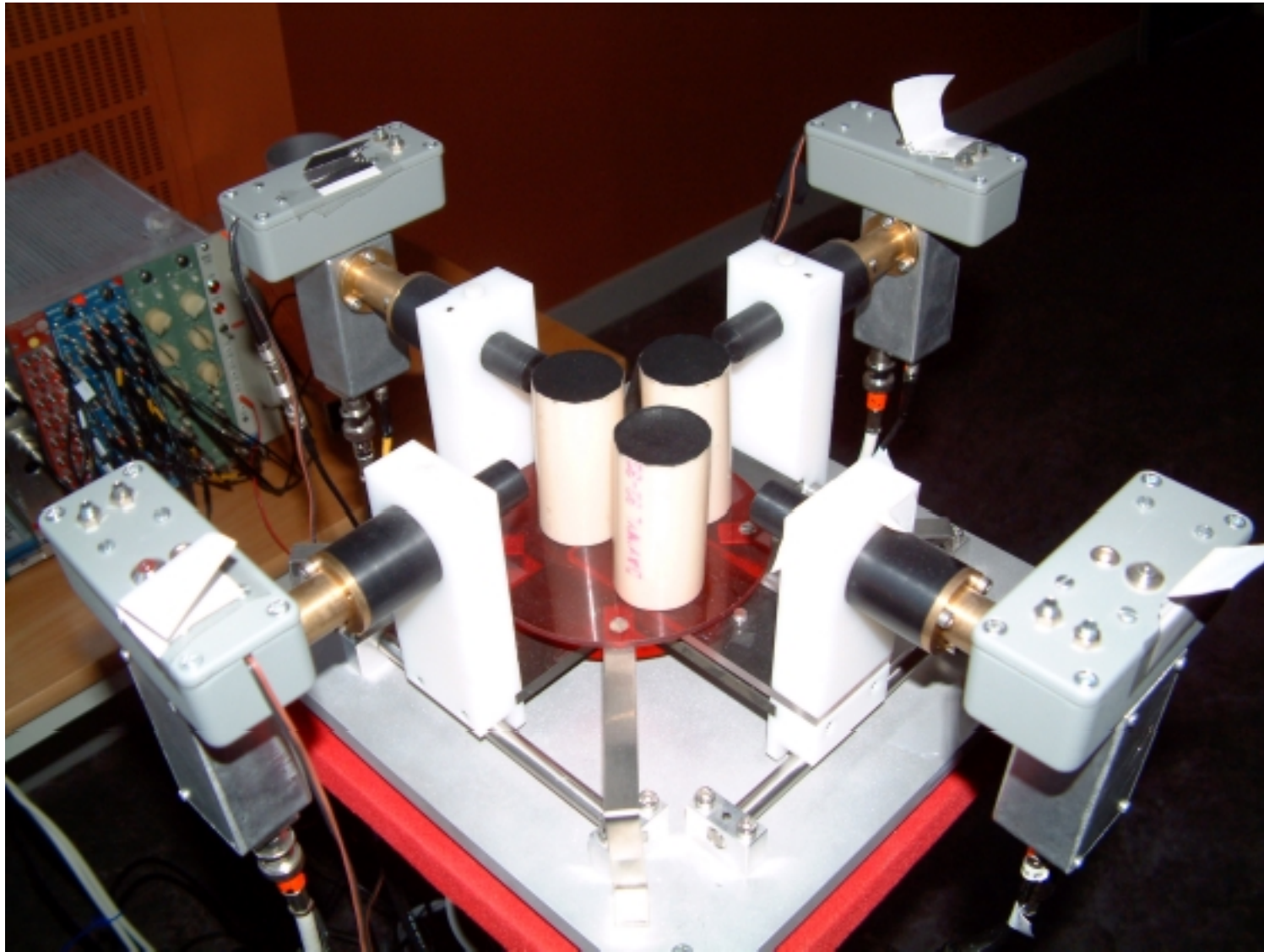
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- JJ Thomson
- Millikan
- PET (Positron emission tomography)
- LEP, DELPHI and the Standard Model
- What is next?









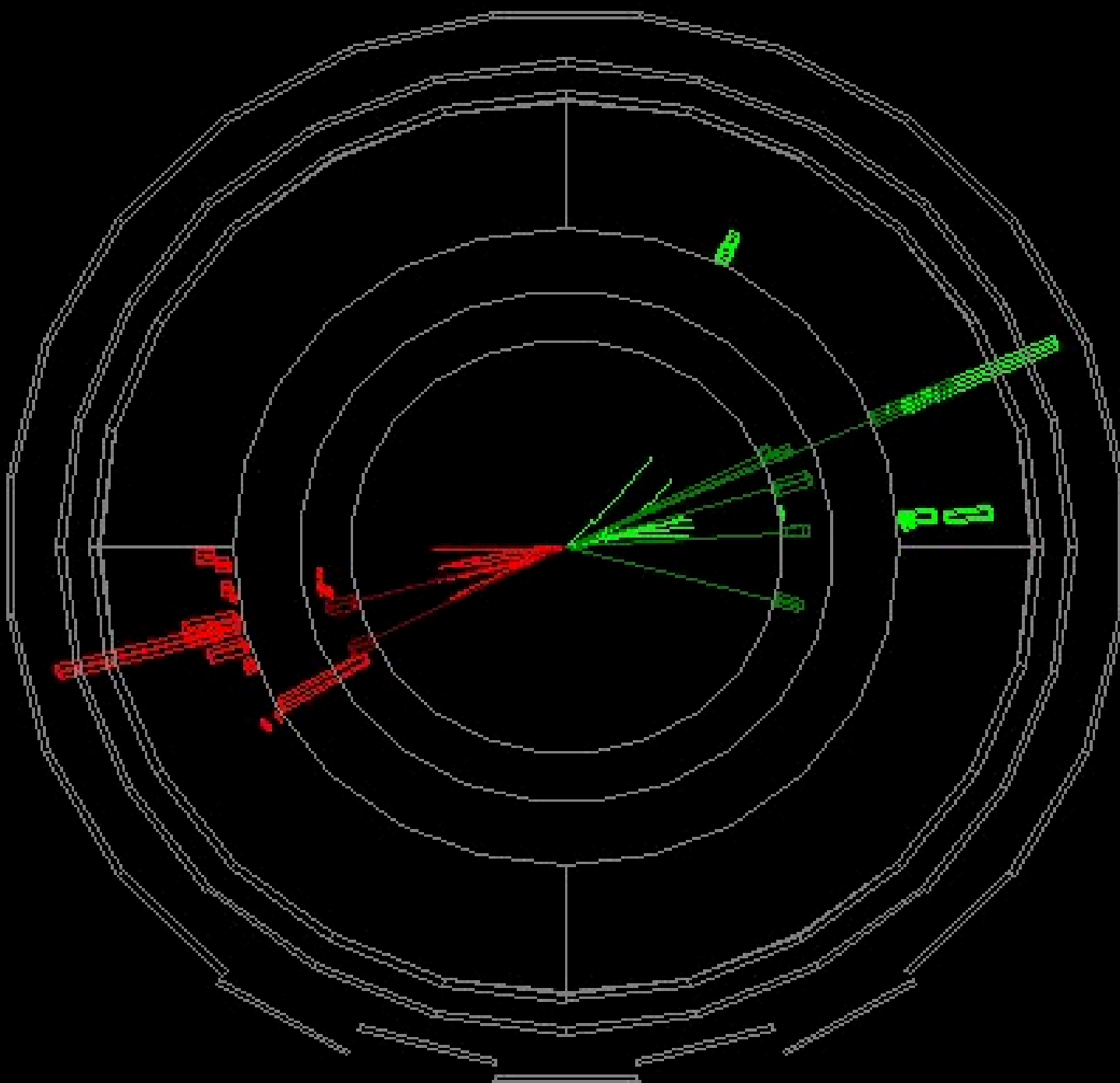




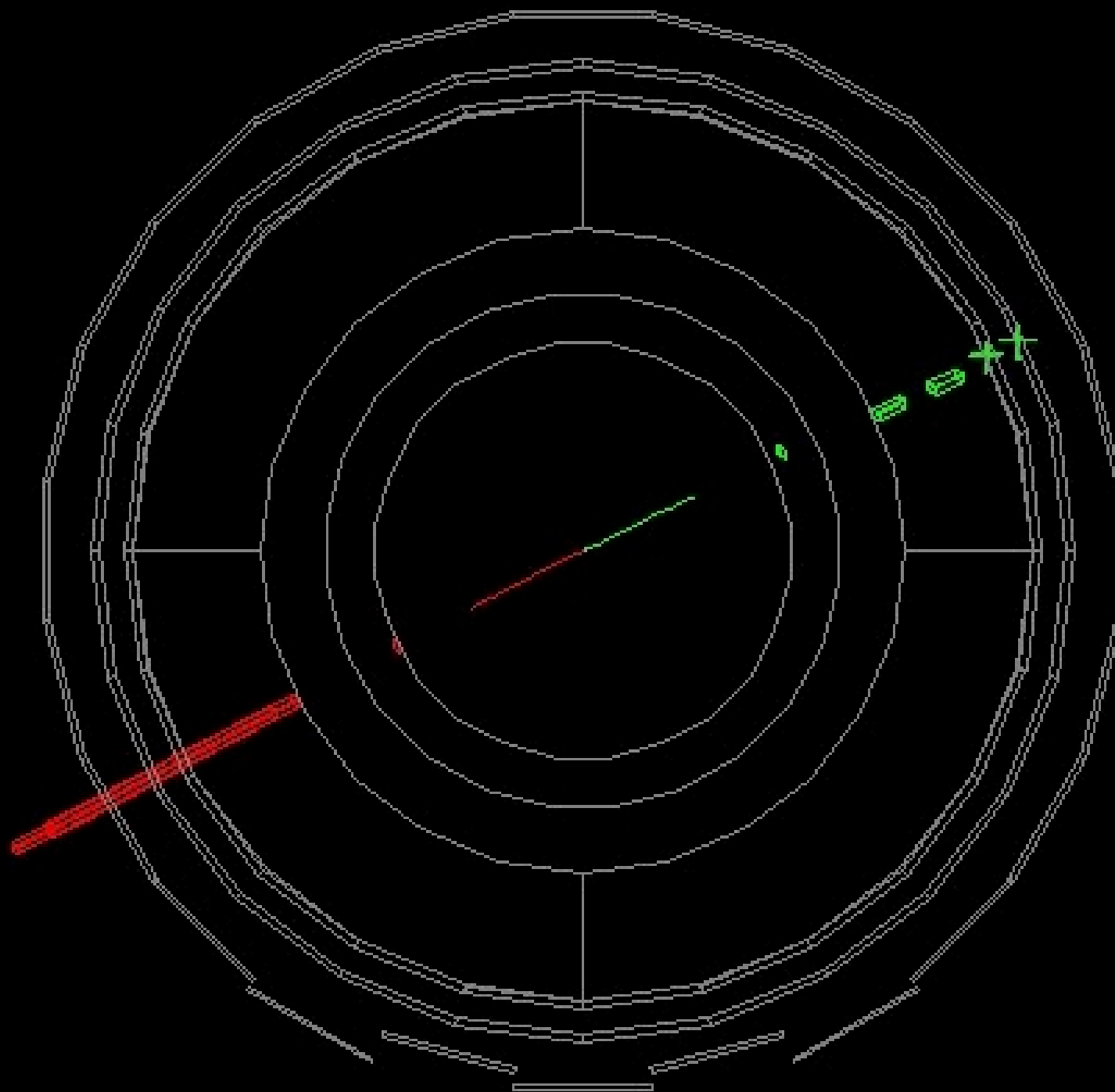
# Hands on CERN

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- Give teachers and students a chance to “take part” in a scientific experiment
- Demonstrate what is a modern physics experiment
  - World wide collaboration
  - High technology
- Explore the fundamental particles
- Explore the fundamental forces









# Physics at yesterday's frontline

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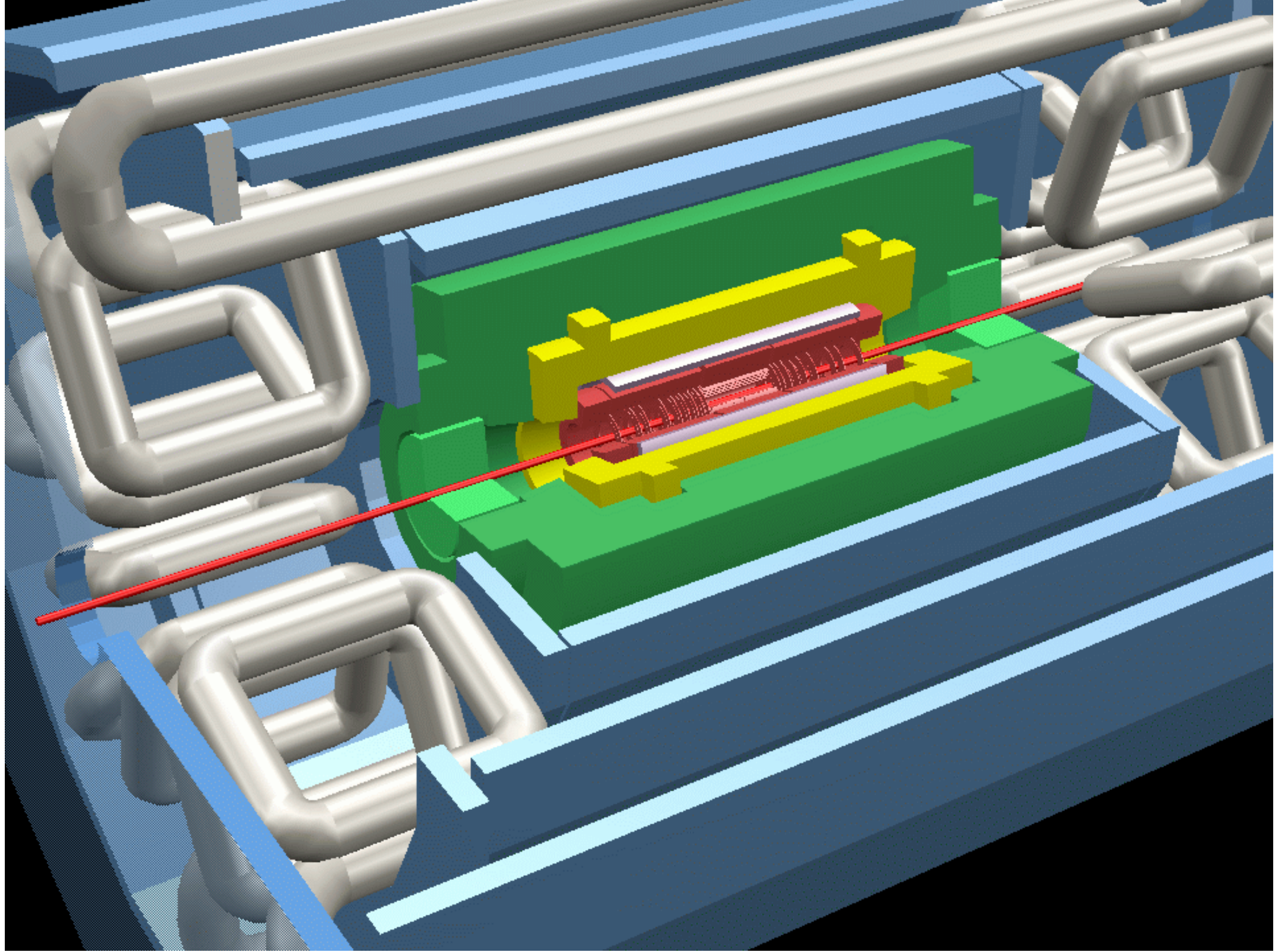
- The Physics of the Standard Model
  - The DELPHI Experiment
  - The LEP accelerator at CERN
- [Http://hands-on-cern.physto.se](http://hands-on-cern.physto.se)



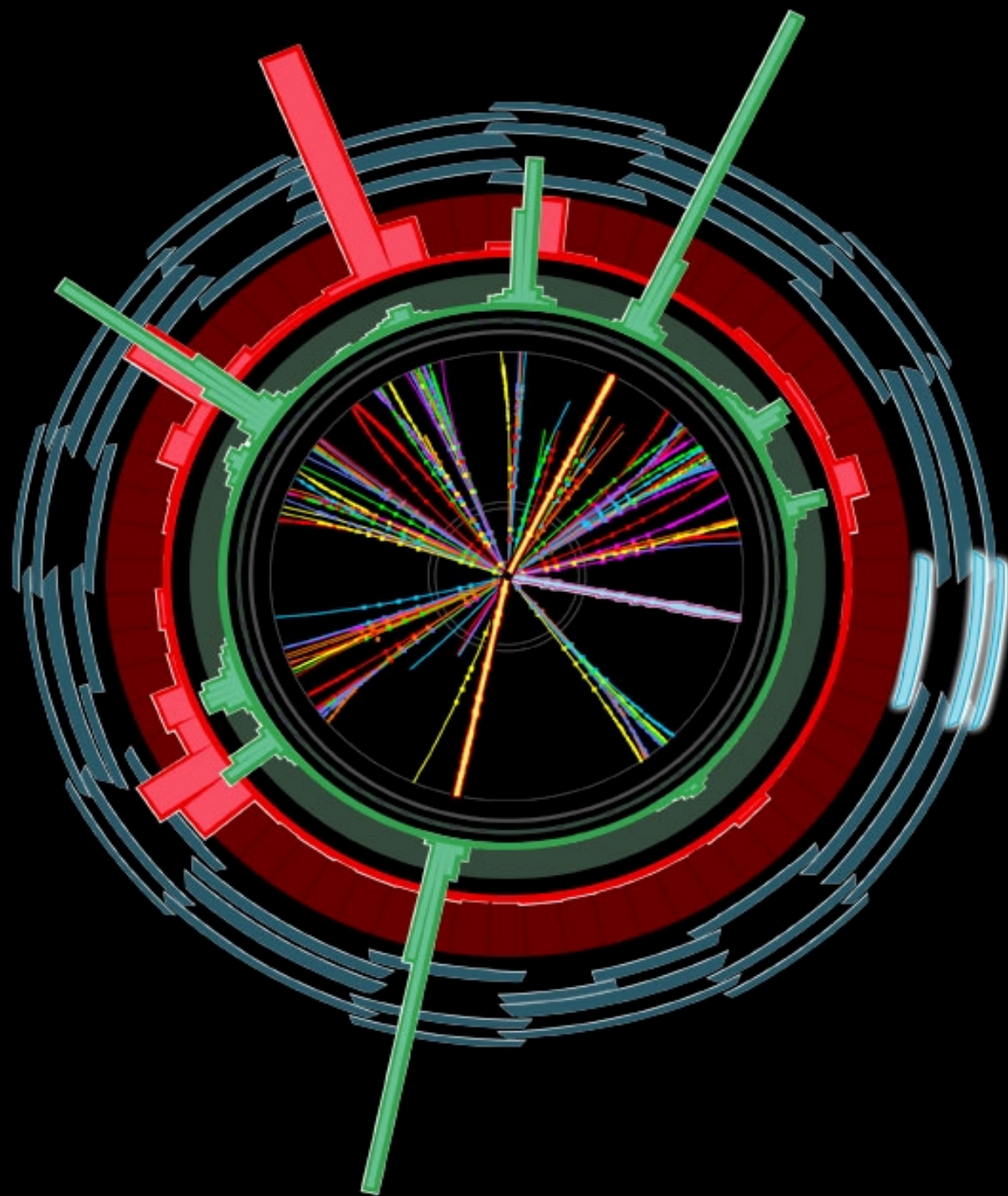
# Physics at tomorrow's frontline

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- The ATLAS experiment at LHC
- Proton-proton collisions at 14 TeV energy
- World wide collaboration
- Data taking around 2007









# ATLAS Outreach

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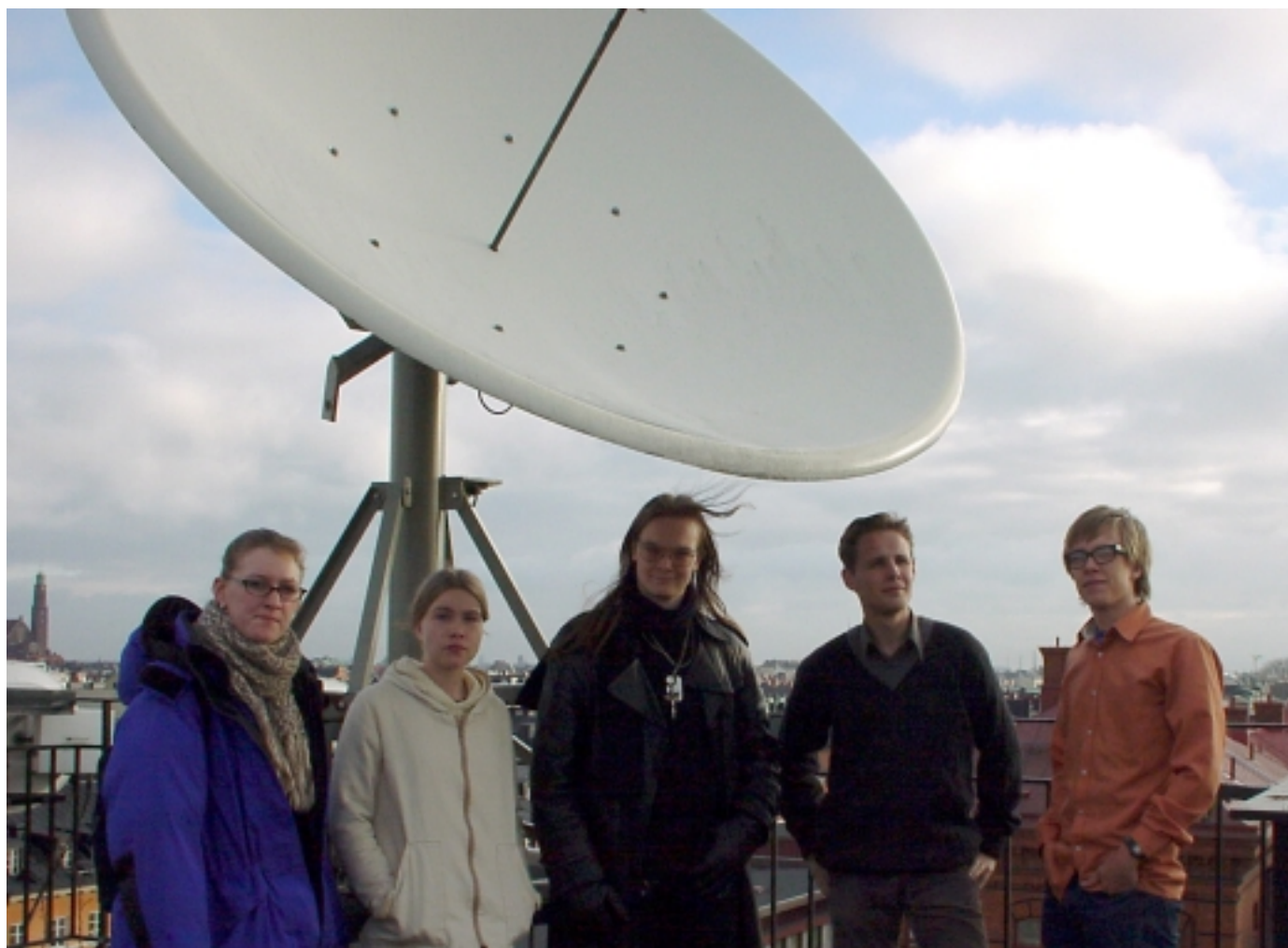
- Information material
  - Brochures
  - Public webpages
  - ATLAS video is a great success
    - Translated to around 9 languages
    - Made into a CD
    - Four awards

# From the lab to the Milky Way



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- Radioactivity and cosmic rays
- The radio telescope
- The spiral structure of the galaxy
- Dark matter





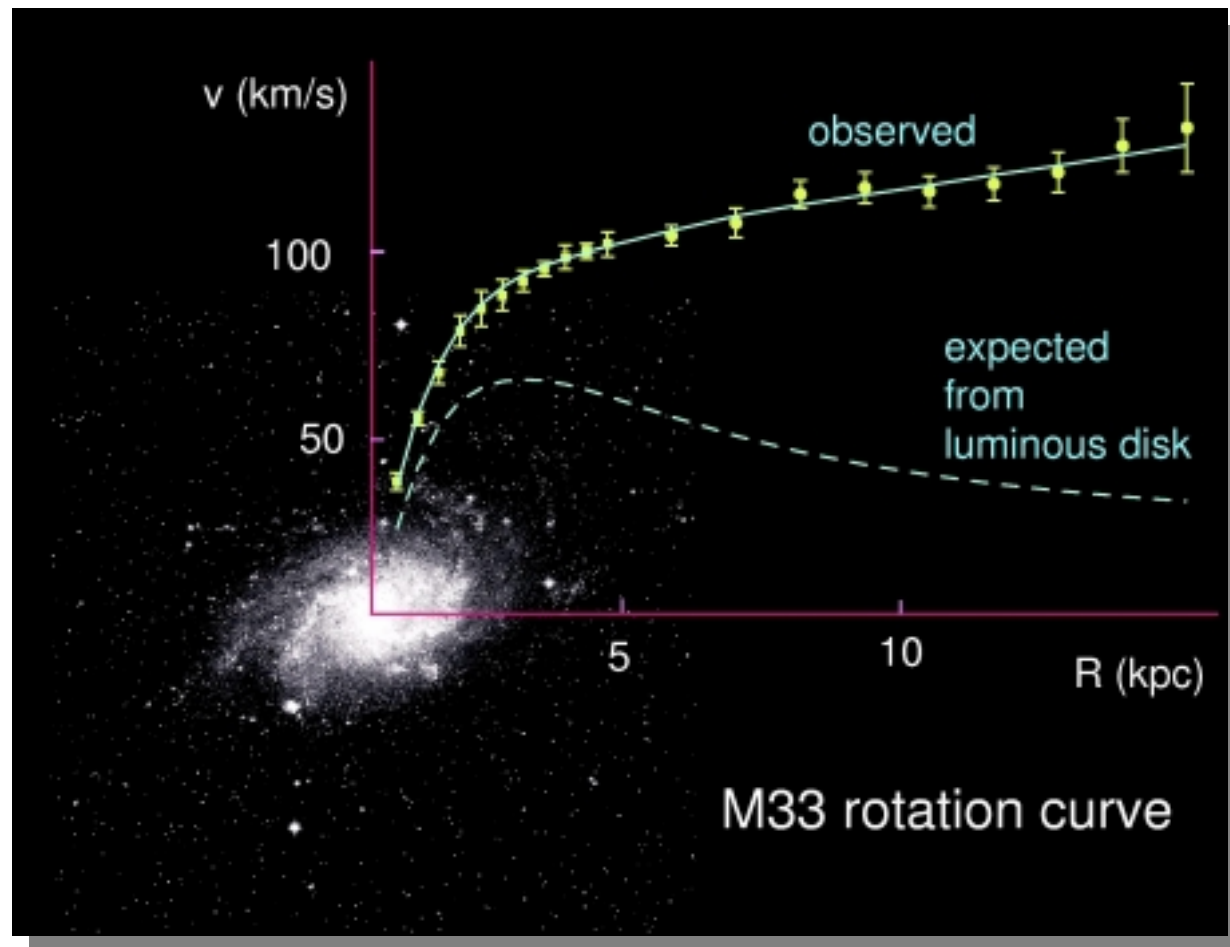


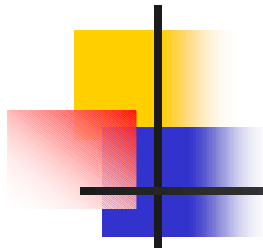
Spiral Galaxy NGC 4414



Hubble  
Heritage

# Galaxy rotation curves





# The House of Science

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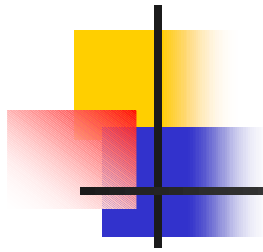
- At the new Albanova University Centre
  - Stockholm University
  - Royal Institute of Technology
- Laboratories for:
  - Physics
  - Astronomy
  - Biotechnology
- Complemented with:
  - Observatory











# Frontline science for schools

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- Conclusions
  - Frontline research - part of the school education
  - A stimulator for further studies
  - The House of Science :
    - New concept in science education
    - A platform for outreach activities



# Summary

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Modern science like particle physics and astronomy makes school physics much more exciting





# Some publications

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- 1. Hands on CERN - a Particle Physics Education Project utilising the Internet, K.E. Johansson and T.M. Malmgren, Physics Education 34/5(1999)286-293
- 2. Astronomy and particle physics research classes for secondary school students, K.E. Johansson, Ch. Nilsson, J. Engstedt and Aa. Sandqvist, American Journal of Physics. Vol. 69, No. 5, May 2001, p. 577
- 3. Stockholm Science Laboratory for Schools, K.E. Johansson and Ch. Nilsson, Physics Education 34/6(1999)345
- 4 Experiments in Modern Physics for the General Public, K.E. Johansson and Ch. Nilsson, Physics Education 35/4(2000)256
- 5 The physics of 'Copenhagen' for students and the General Public, L. Bergström, K.E. Johansson and Ch. Nilsson, Physics Education. Physics Education 36/5 (2001)388



# Web addresses

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- 1. Hands on CERN home page:
  - <http://hands-on-cern.physto.se>
- 2. DELPHI home page:
  - <http://www.cern.ch/Delphi/Welcome.html>
- 4. ATLAS home page:
  - <http://www.atlasexperiment.org>
- 5. House of Science homepage (in Swedish and under development)
  - <http://vetenskapslab.physto.se/>