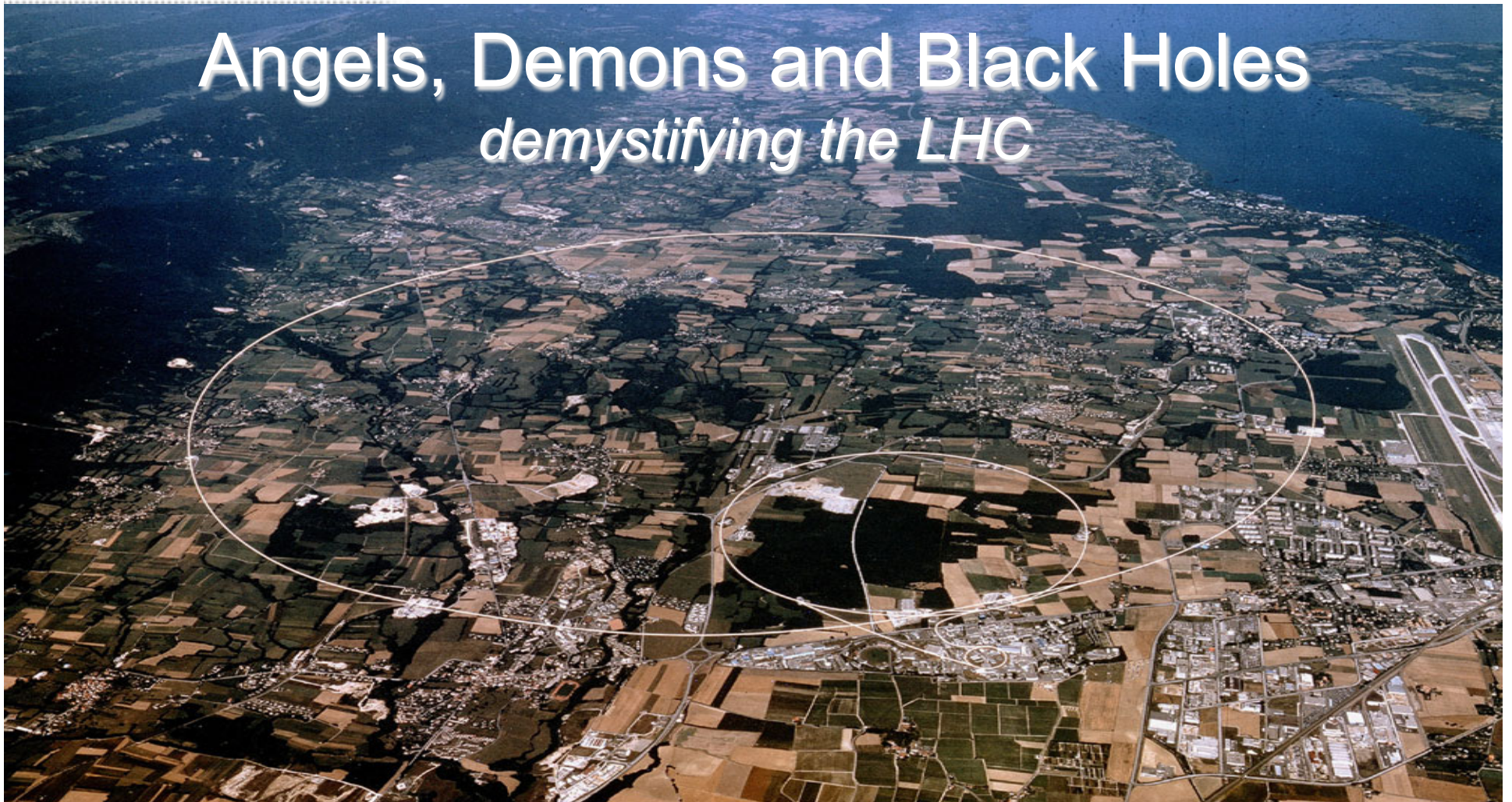




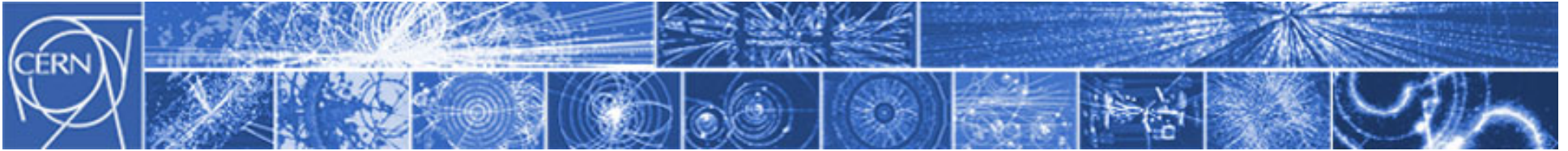
CERN

European Organization for Nuclear Research
Organisation Européenne pour la Recherche Nucléaire

Angels, Demons and Black Holes *demystifying the LHC*

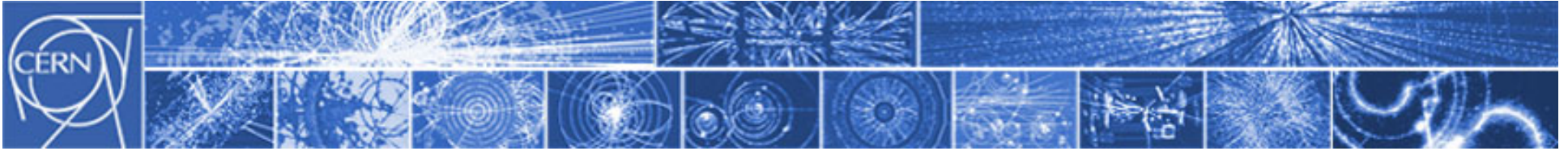


Dr James Gillies, Head of communication, CERN

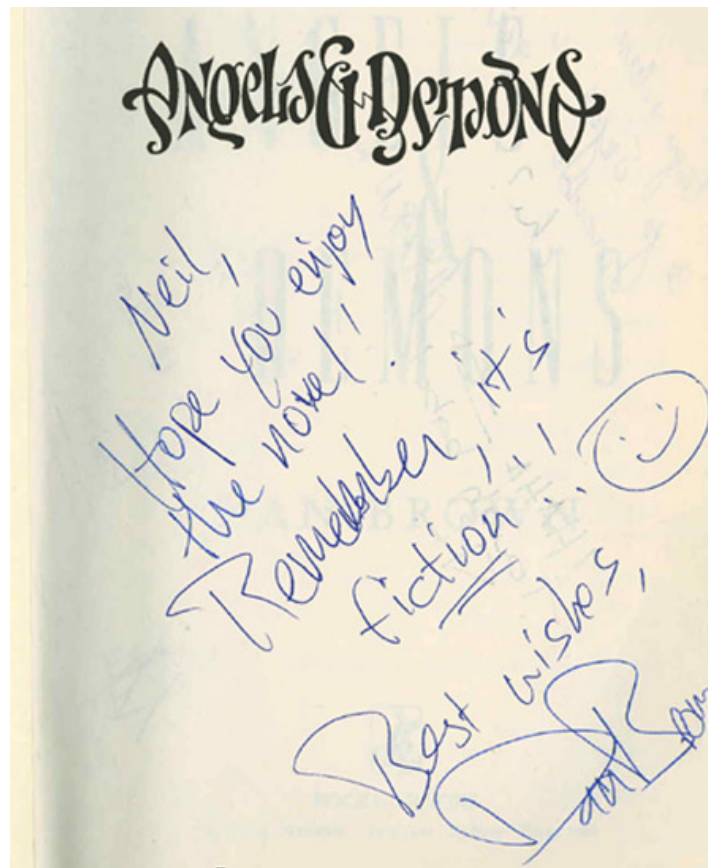


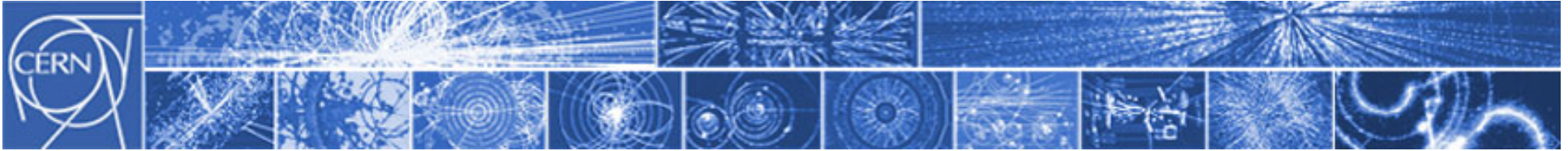
Risk...





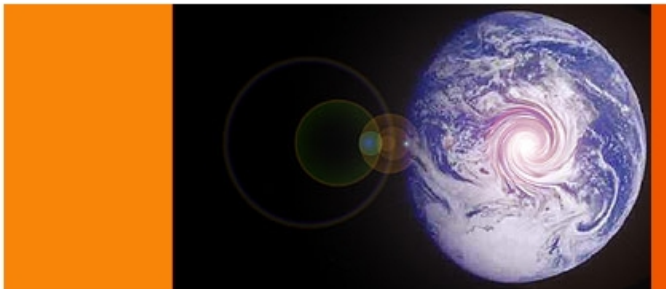
... this arrived on my desk in 2000





... and then came End Day...

FRIDAY FRIDAY



End Day

- Home
- End Day: Mega-Tsunami
- End Day: Comet Attack
- End Day: Killer Virus
- End Day: Supervolcano

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Documentaries & Arts

End Day: End of the Universe

Deep within the bowels of a particle accelerator on the East Coast of the US, an extraordinary experiment is being prepared. Scientists are pursuing their quest to understand the nature of matter itself. On the streets, the public holds a protest to stop their work...

Fact!

Scientists are experimenting with the very nature of reality itself; building ever larger and more powerful particle accelerators in what could turn out to be a game of total annihilation.

In a 600 million dollar laboratory, within a vast ring of magnets miles across, atoms can be made to travel at the speed of light then crashed to create particles that haven't existed since the Big Bang ... and possibly some that have never existed at all.

Scientists accept that black holes can be created but these are small enough to evaporate before they can suck in all surrounding matter. They have also calculated the precise risk of another terrifying possibility: a phase change of space-time leading to the complete breakdown of the universe as we know it.

But most frightening of all is the creation of a group of strange quarks called 'dangerous strangelets'. These are so dense they could burrow to the centre of the Earth, transforming everything they touch into anti-matter, condensing our planet into a tiny lifeless sphere.

They are experimenting right now...

Do you feel safe?

Fiction?

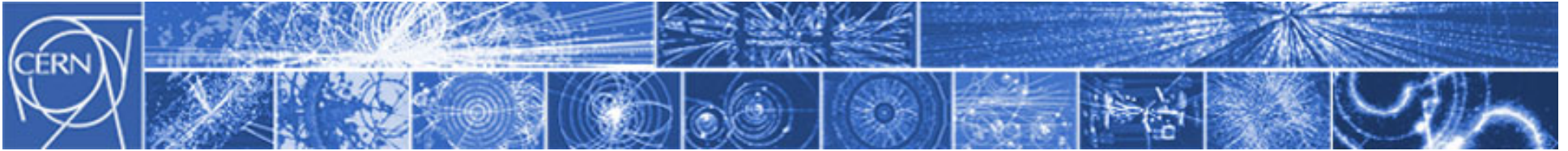
It's **End Day** and within a deep underground chamber physicists have briefly created exotic particles and space-time warps by violently smashing atoms.

But something unforeseen happens. 'Strangelets' appear. Suddenly, the normal laws of physics cease to apply. Reality warps and alters. Atoms are transformed into totally new forms of matter.

The singularity burrows into the Earth, twisting the atomic structure of the surrounding rocks as it falls into the planet's centre.

A wave of total destruction expands outwards, consuming everything in its path. Life ends. The Earth vanishes...

The universe as we know it ceases to exist.



The story of one day...

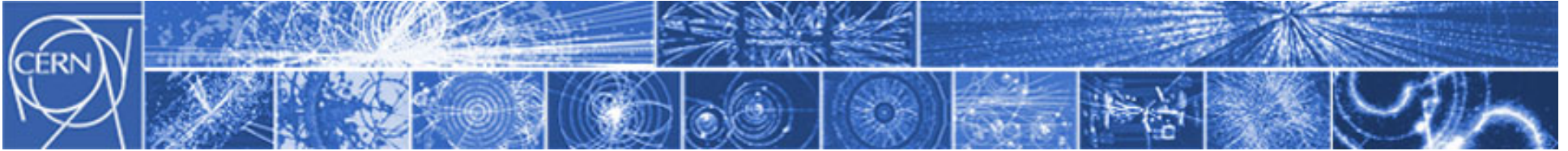
T*R 09:59:48:21
BBC Science
End Day
UK Tx Version
01/LSG A995W/71

12 Dur: 55'58"

16:9 Anamorphic
14:9 Caption Safe

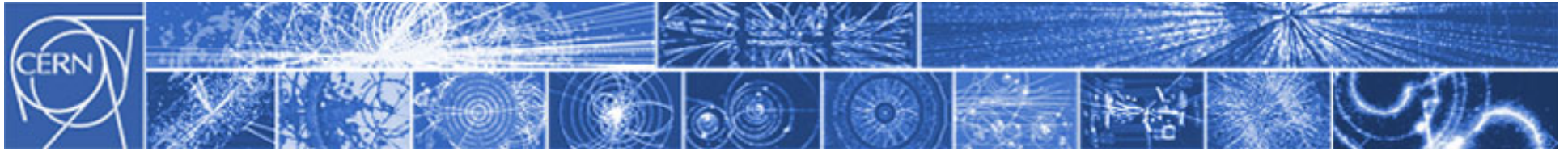
nats
10 Soho Square London W1V 6NT
Tel: 020 7 287 9900
Fax: 020 7 287 8636

18th October 2004

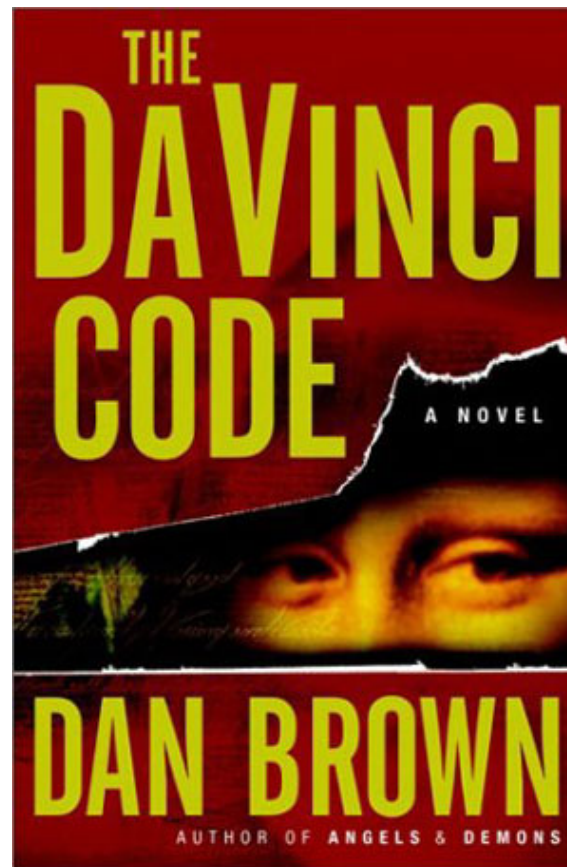


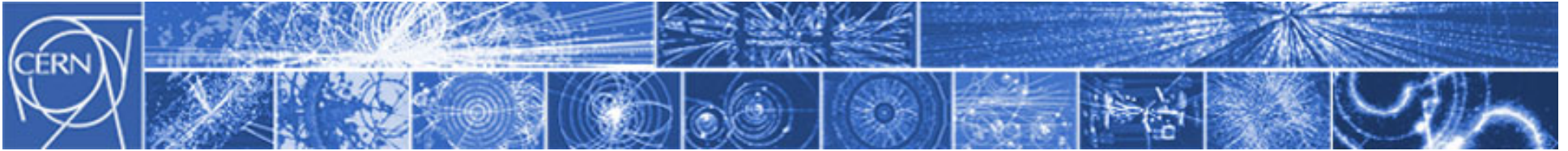
Reassuring physicist...





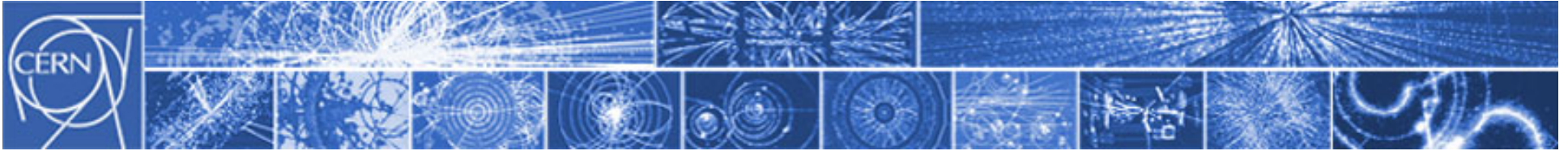
... and then came The Da Vinci Code





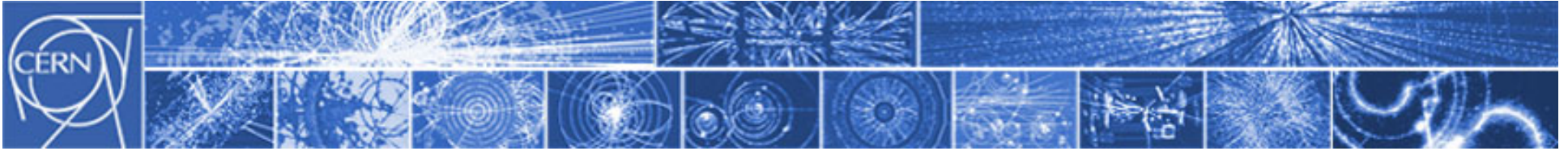
It was time for CERN to act!





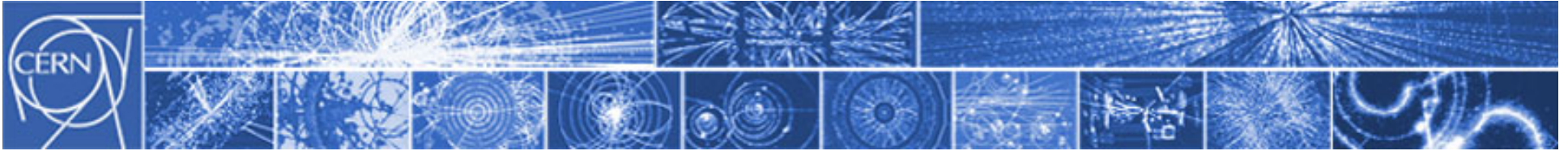
True or false?

- | | |
|---|---|
| CERN has a space plane. | X |
| CERN makes antimatter. | ✓ |
| Georges Charpak played frisbee. | X |
| Antimatter could solve the energy crisis. | X |
| Antimatter is used in PET scanners. | ✓ |
| PET scanners are developed at CERN. | ✓ |



2007: a visit from Ron Howard...





...led to a contract with Sony...

WORKING DRAFT 24-01-08 - without prejudice

AGREEMENT

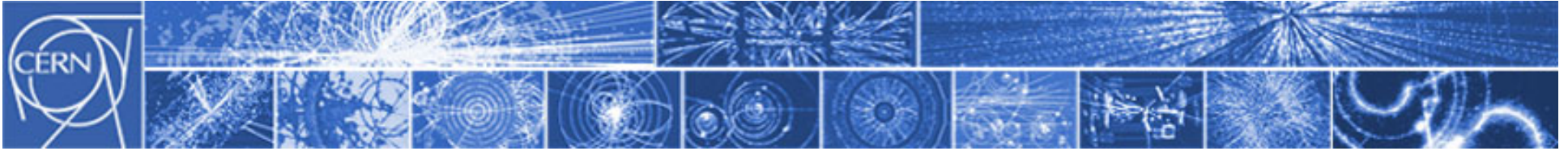
BETWEEN

OBELISK PRODUCTIONS LIMITED
(OBELISK)

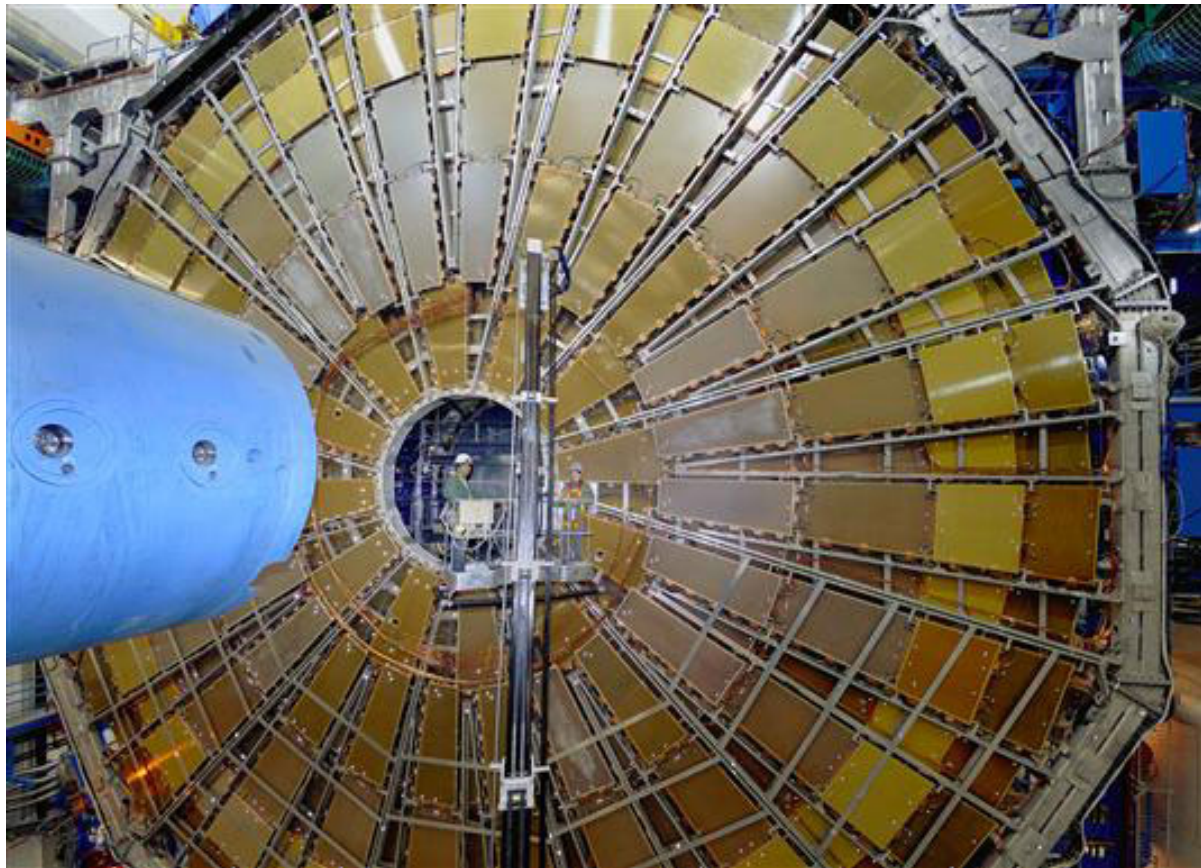
AND

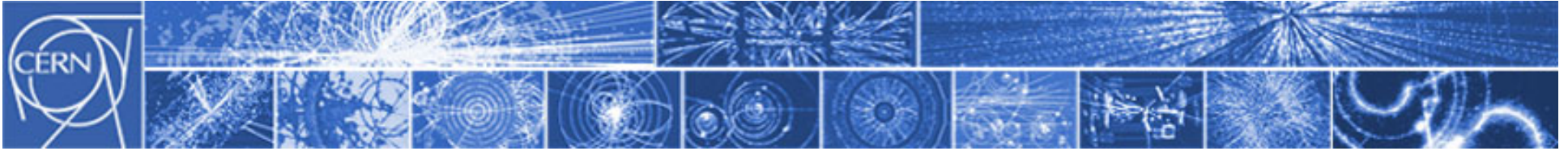
THE EUROPEAN ORGANIZATION
FOR NUCLEAR RESEARCH
(CERN)

2008



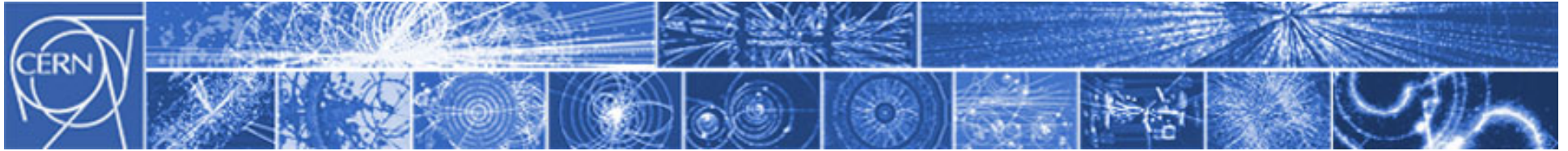
...some filming...





...and a big media junket at CERN





We did tie-ins with the launch, and we're on the BluRay disk

ANGELS & DEMONS.
Lecture Nights
THE SCIENCE REVEALED

HOME
ABOUT THE SERIES
SCHEDULED LECTURES
RESOURCES AND LINKS

RESOURCES FOR LECTURERS
OFFICIAL ANGELS & DEMONS WEB SITE

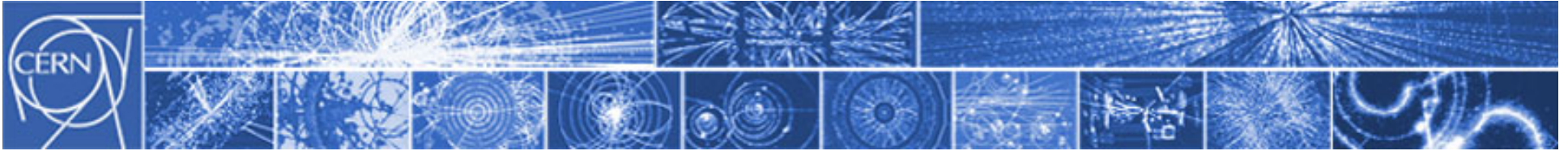
This May will see the world premiere of *Angels & Demons*, an action-packed thriller based on Dan Brown's best-selling novel that focuses on an apparent plot to destroy the Vatican using a small amount of antimatter. In the book and the movie, that antimatter is made using the Large Hadron Collider and is stolen from the European particle physics laboratory CERN. Parts of the movie were actually filmed at CERN. It's not every day that a major motion picture places particle physics in the spotlight, especially one starring Tom Hanks and directed by Ron Howard. Through a series of public lectures, the particle physics community is using this opportunity to tell the world about the real science of antimatter, the Large Hadron Collider and the excitement of particle physics research.

Visit the links above to locate a lecture in your area, learn more about the science behind *Angels & Demons*, or volunteer to give a lecture.

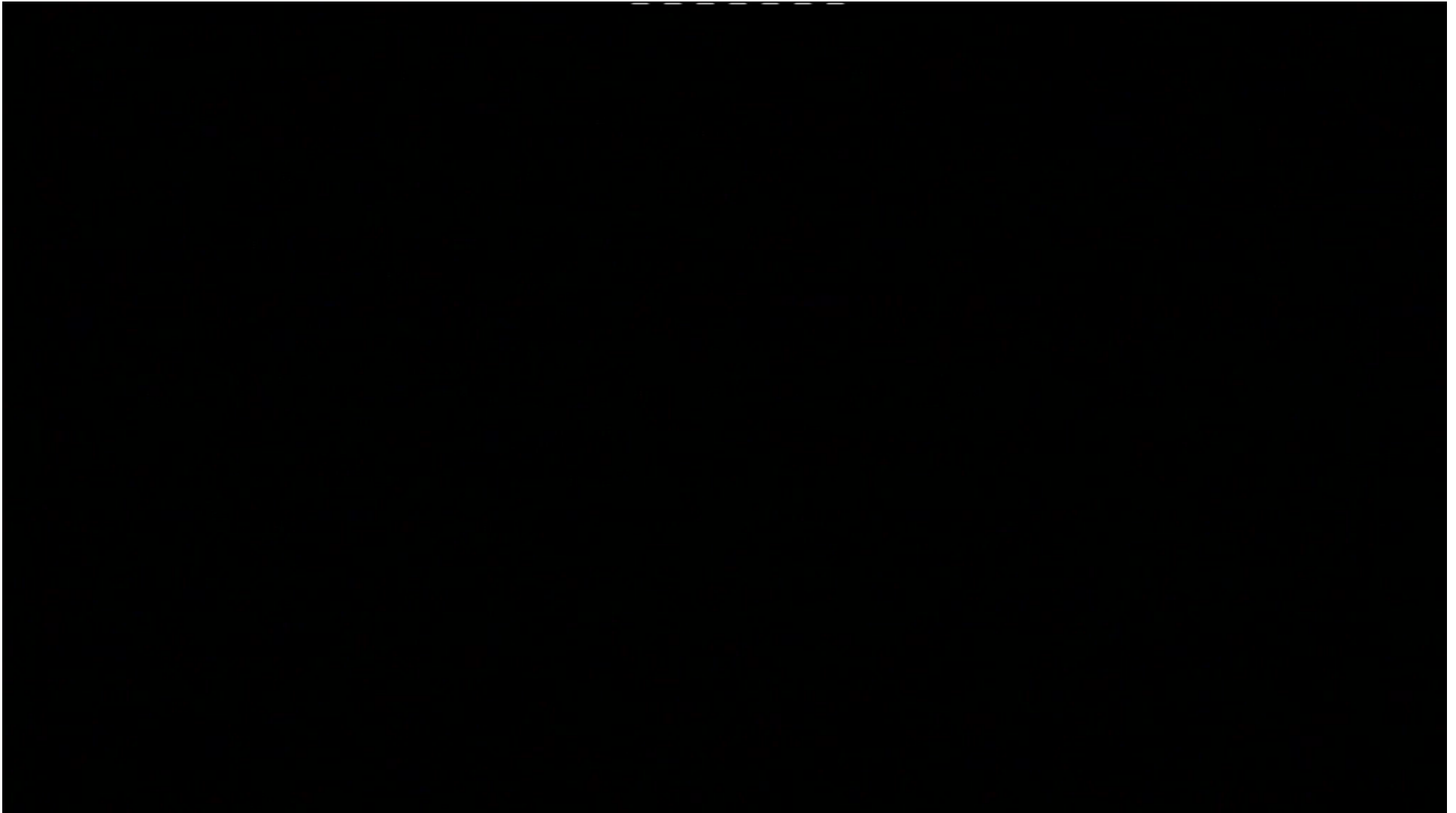
For more information, contact [Elizabeth Clements](#) or [Katie Yurkewicz](#).

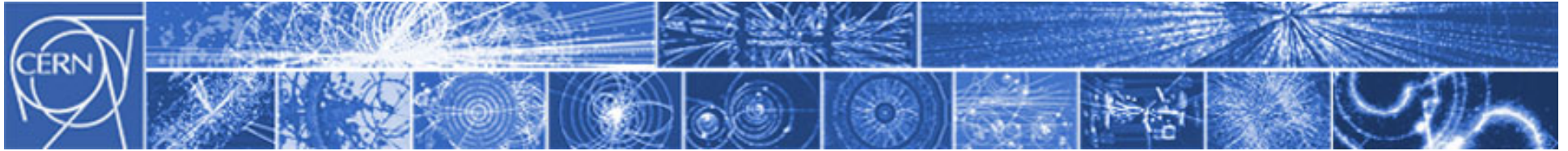
US/LHC CERN Fermilab U.S. DEPARTMENT OF ENERGY National Science Foundation

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Antimatter – according to Hollywood

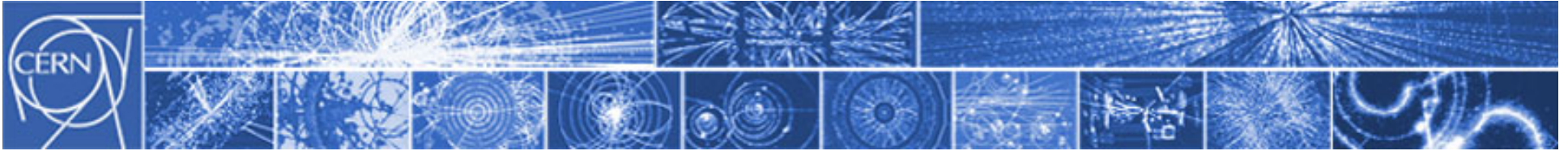




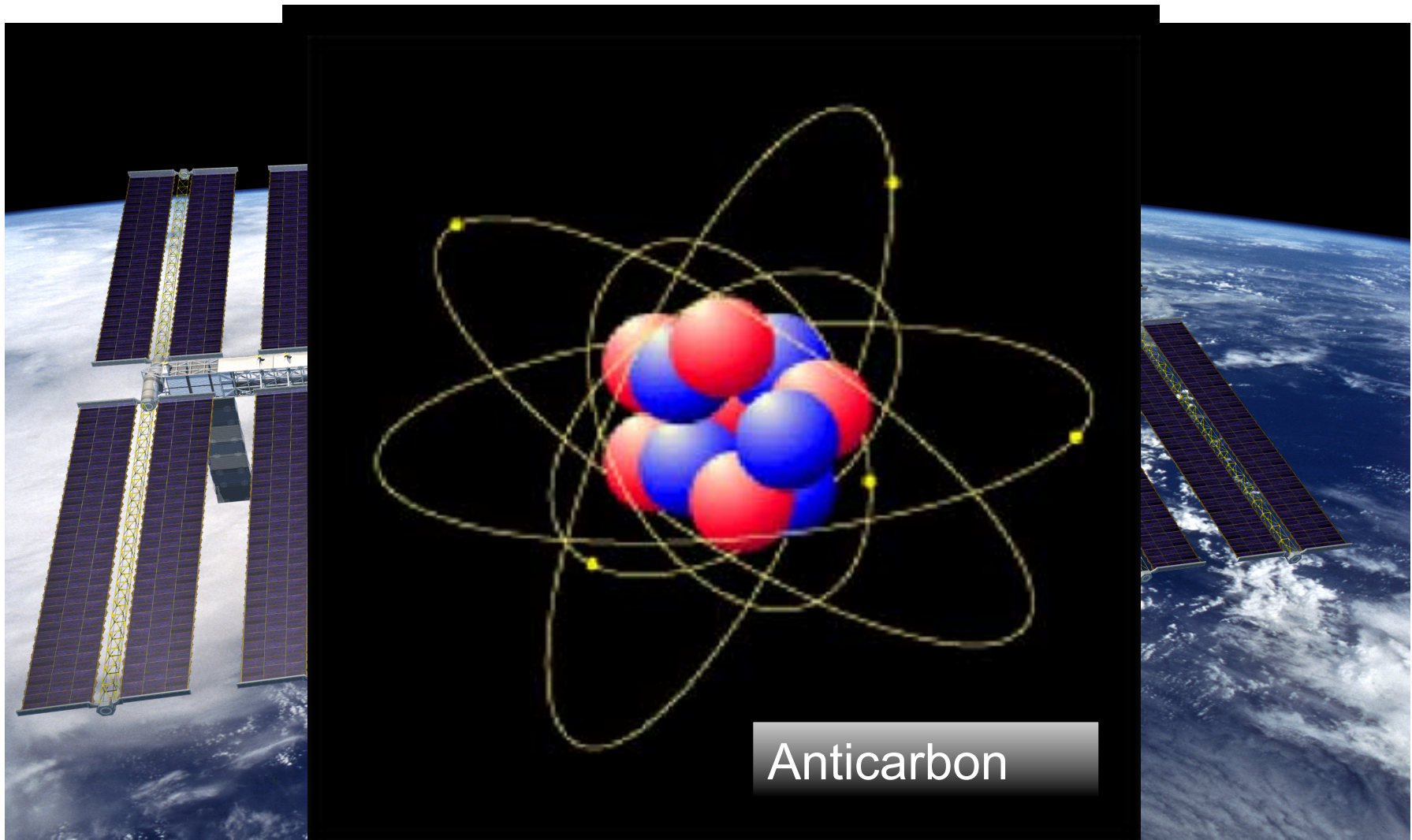
What's wrong with that clip*?

- | | |
|--|--------------------|
| Particles leave visible tracks in air. | ✗ |
| Antimatter is produced in the LHC. | ✓ |
| How much do we produce per year? | 1 nanogramme |
| How long would it take to produce the quantity held in a canister in the film? | ~250,000,000 years |
| The control room overlooks the experiment. | ✗ |
| Physicists really say such things. | ~✓ |

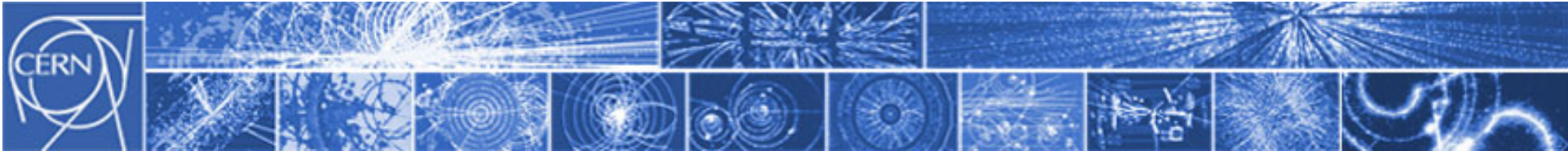
*There's a prize for the best answers to these questions!



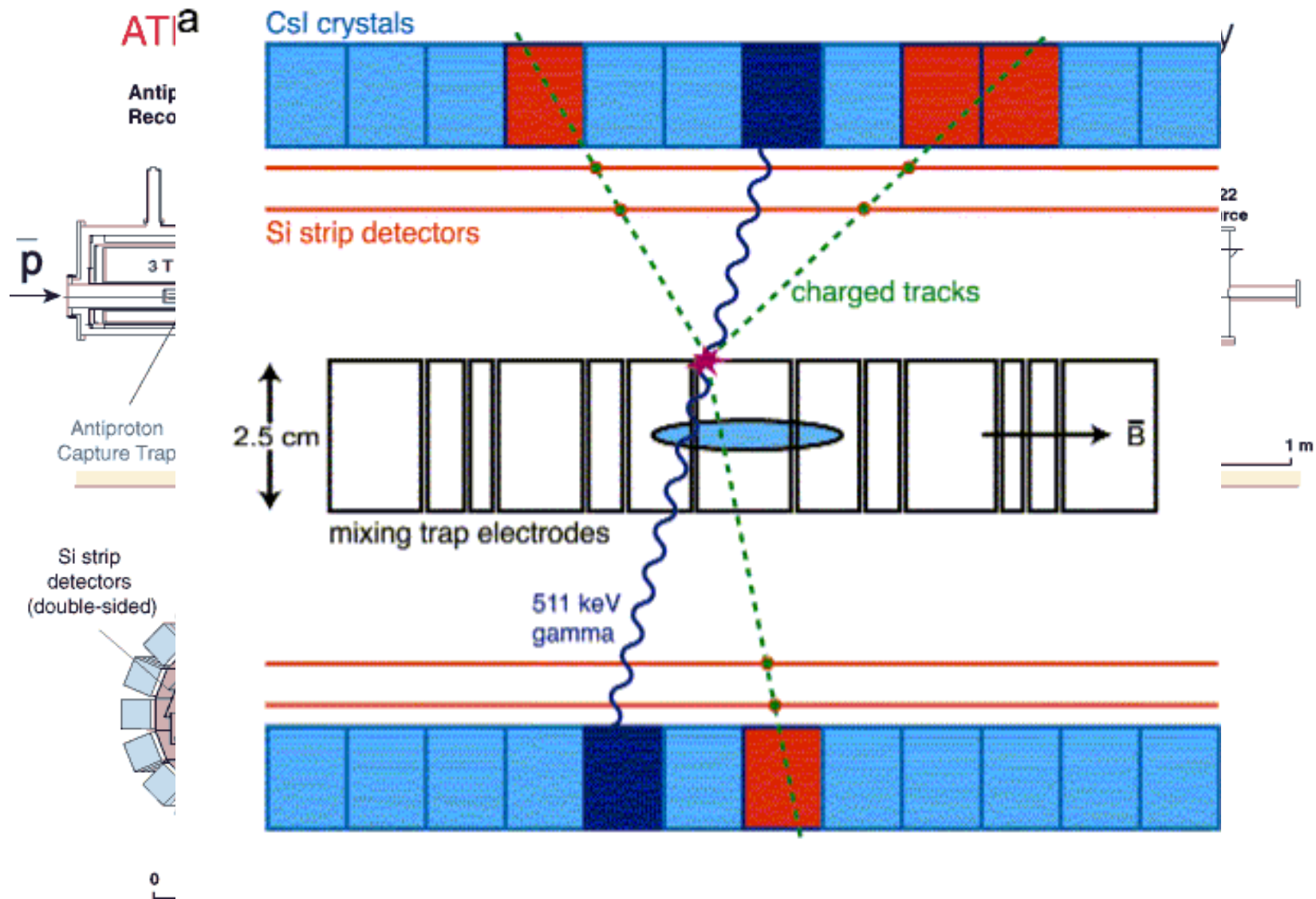
The reality of antimatter research... in space

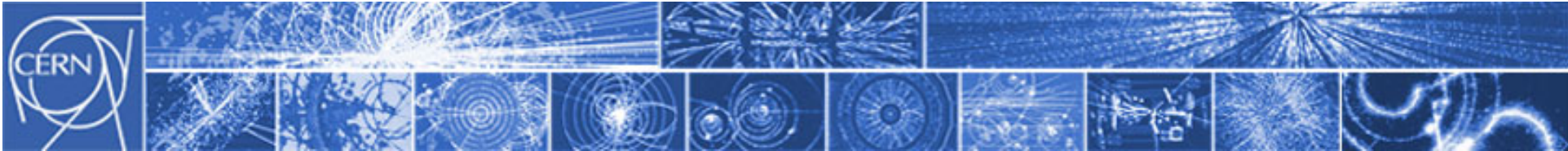


Anticarbon

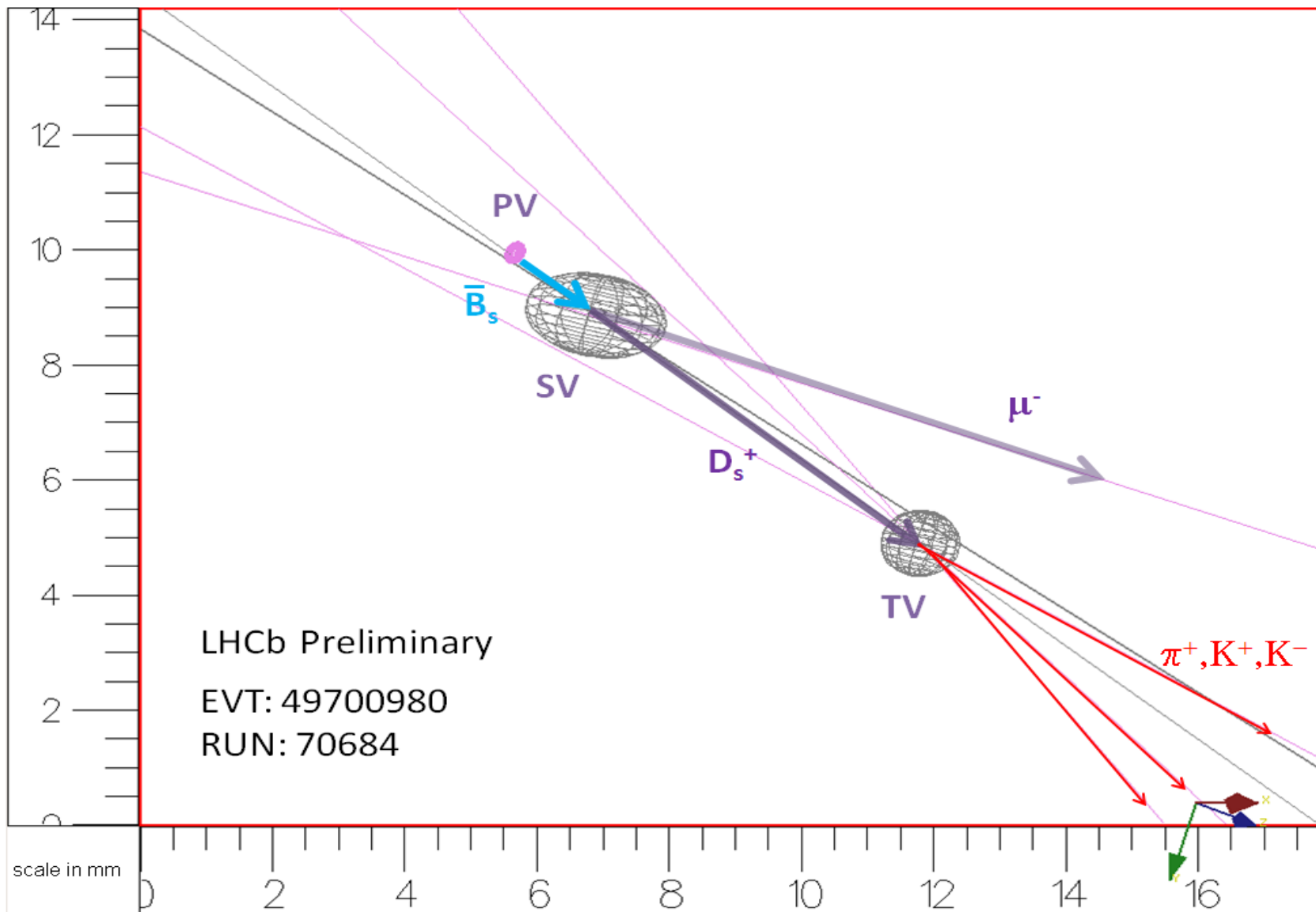


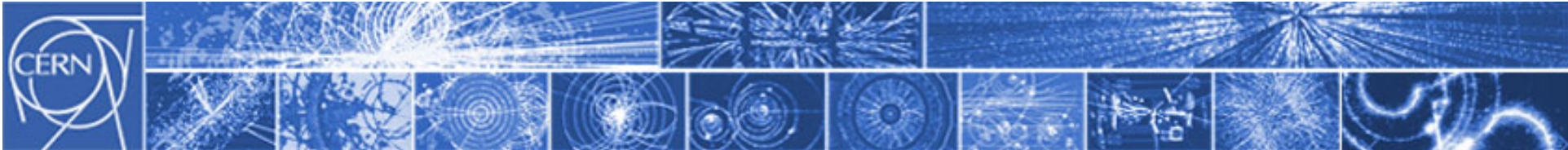
The reality of antimatter research... at the Antiproton Decelerator



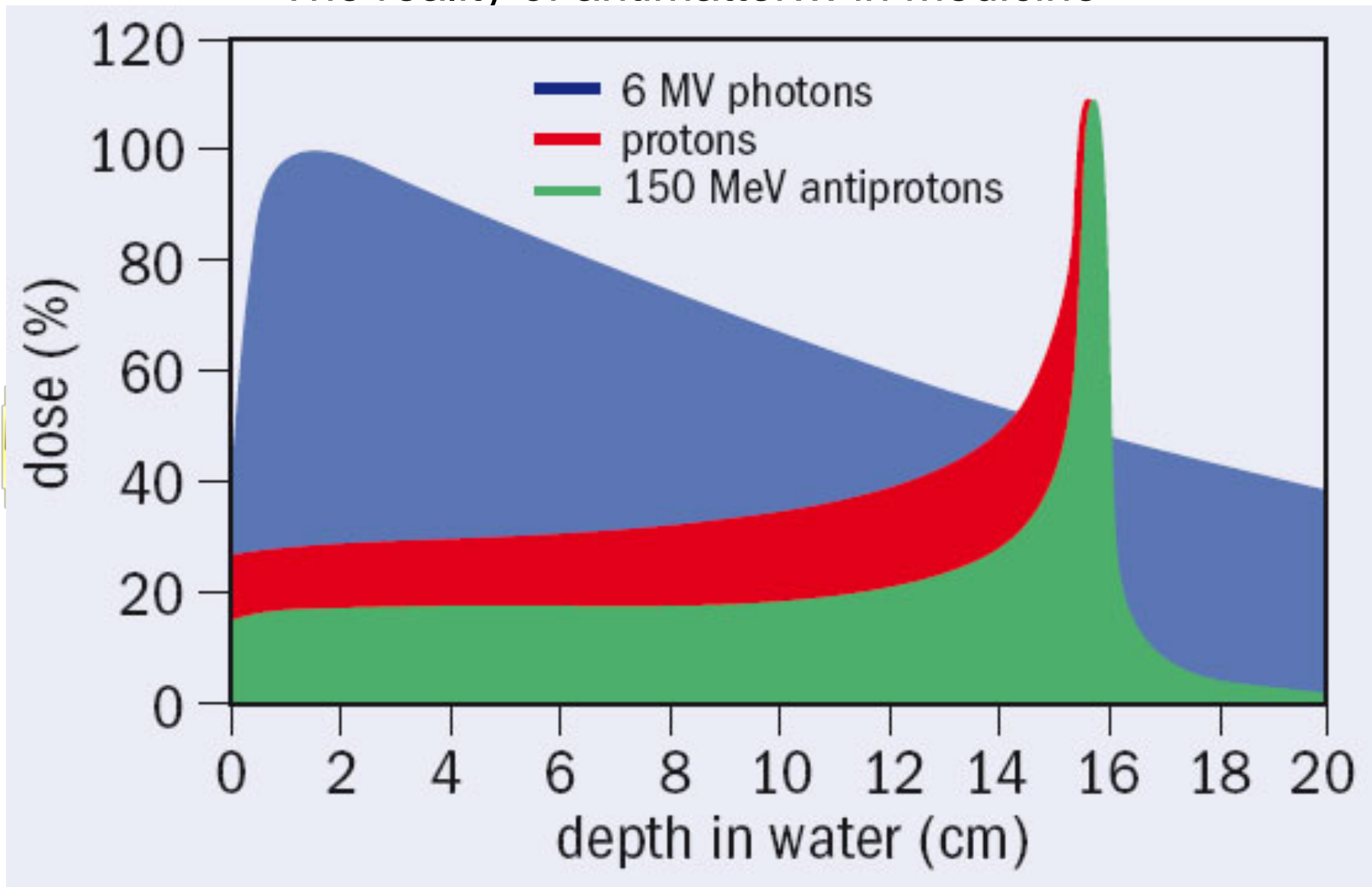


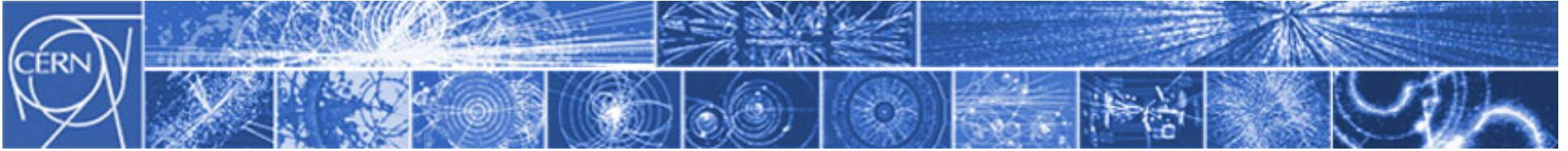
The reality of antimatter research... at the LHC



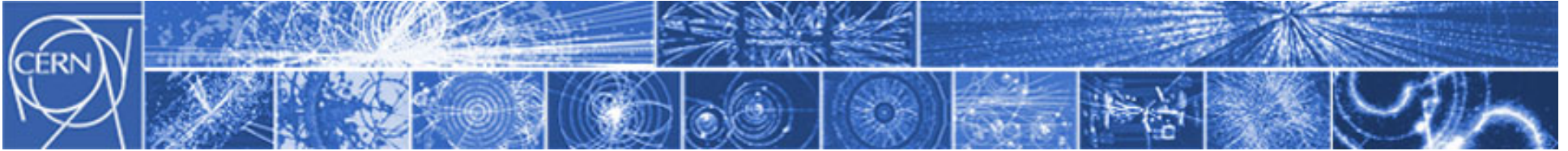


The reality of antimatter... in medicine



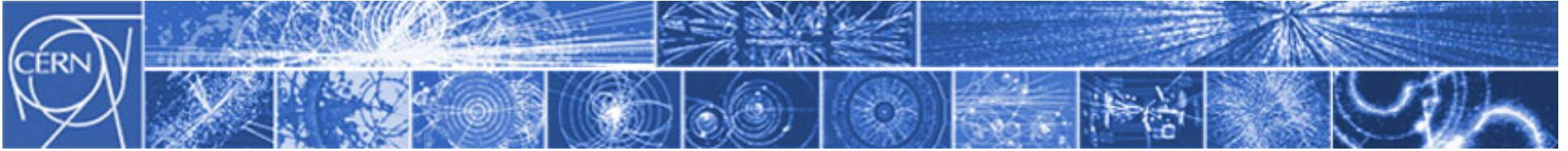


What about Black Holes?

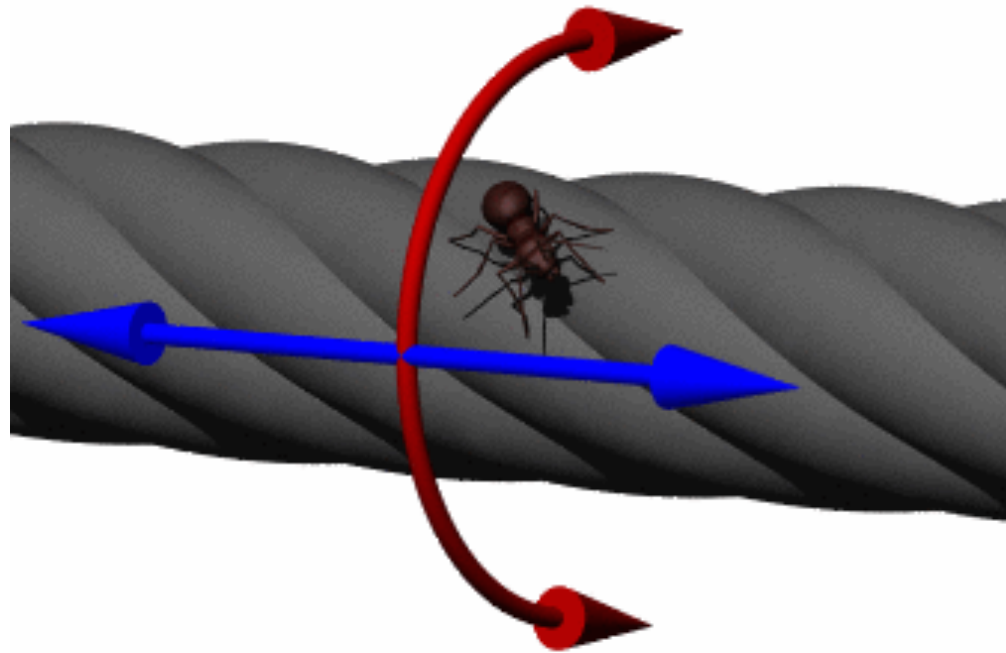


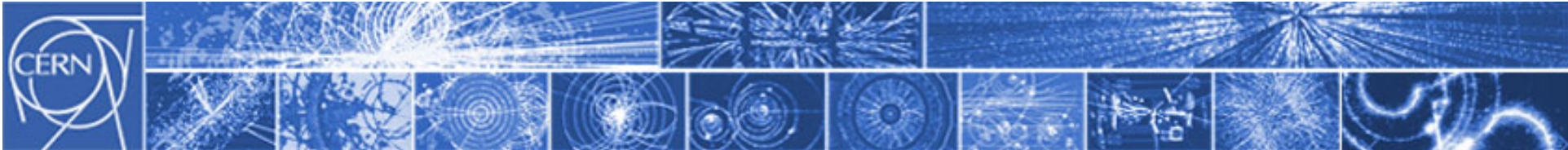
Defying gravity

Interaction	Relative strength
Strong	1
Electromagnetic	1/137
Weak	10^{-6}
Gravity	10^{-39}

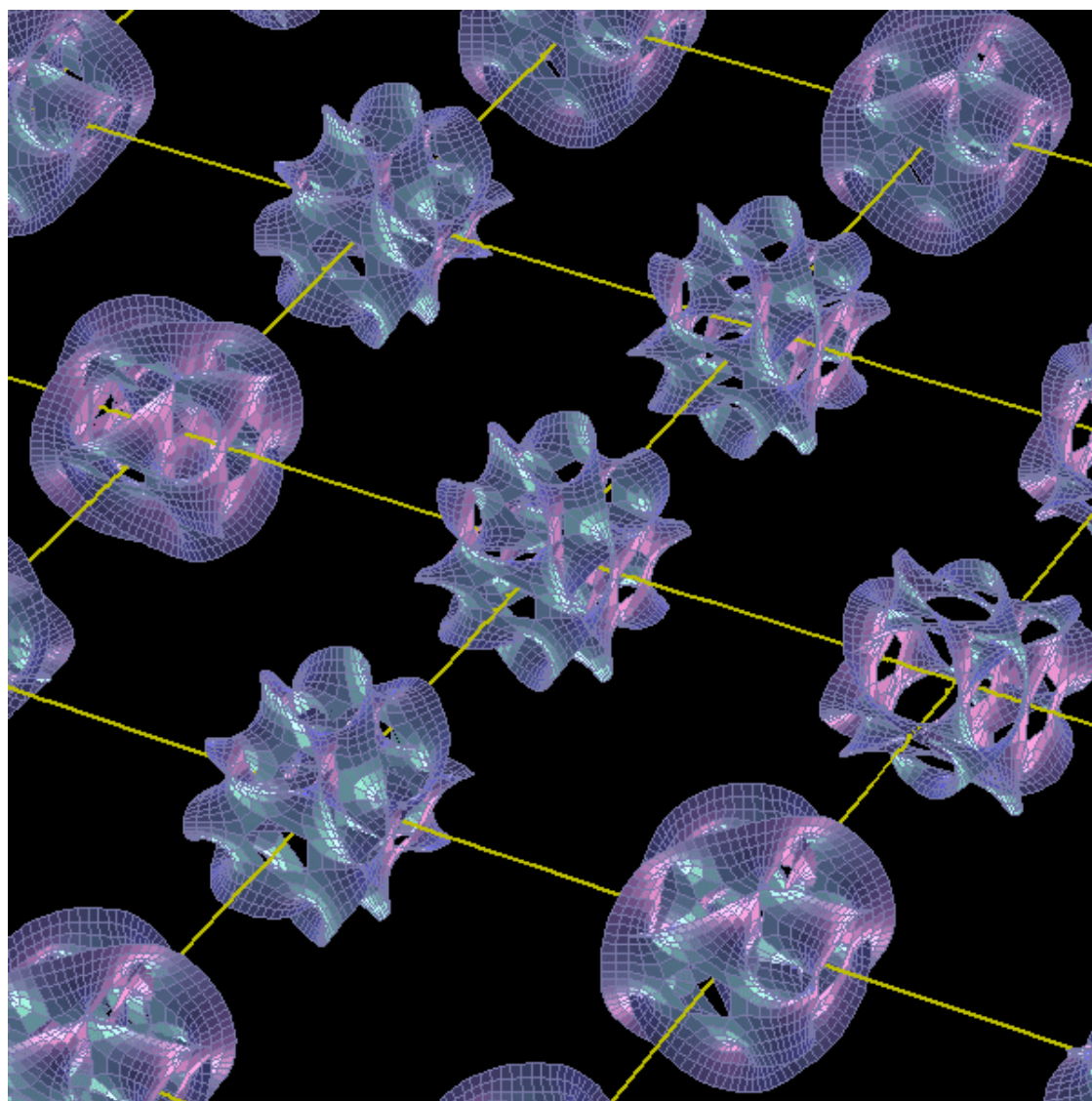


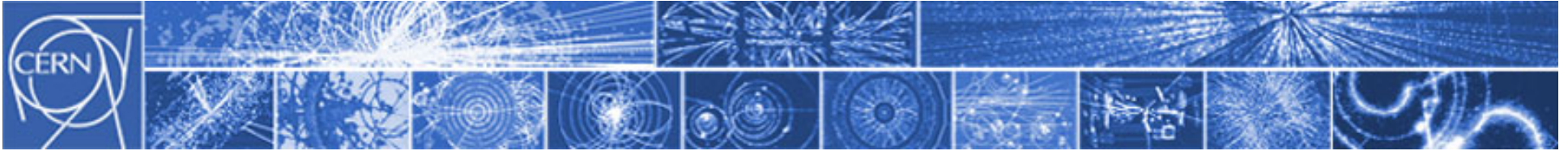
The Science of Black Holes





The Science of Black Holes





The Lion, the Witch and the Black Hole

Lateral Thoughts: James Gillies

physicsworld.com

The perilous world of the wardrobe

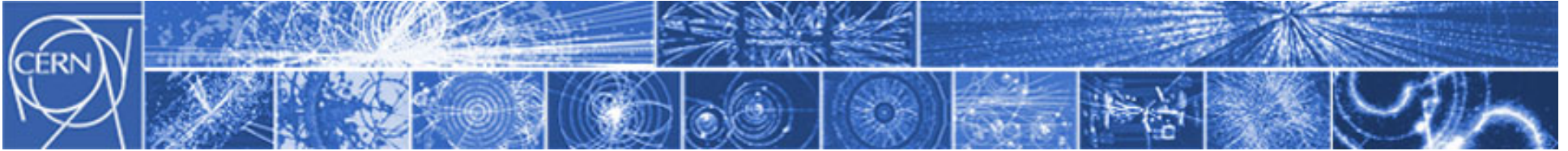
Last spring a man called Walter Wagner claimed that if you can conceive of two possible outcomes to an event, then the probability of each one happening is 50:50. His pronouncement came in an episode of *The Daily Show*, a US satirical news TV programme, but he was not trying to be funny. Wagner, a plaintiff in a 2008 court case in Hawaii that tried to prevent CERN from switching on the Large Hadron Collider (LHC), has long believed that experiments at the collider could cause the world to go up in a puff of smoke. And the probability of this happening, as conceived by Wagner, is one in two. Scary.

Happily for the continued existence of the world, statistics is not so simple a science as Wagner's interpretation would suggest. True, if you flip a coin, the chances that it will land on heads or tails are indeed 50:50, unless the coin is loaded. But what about the LHC? What are the real chances of it creating a world-eating black hole?

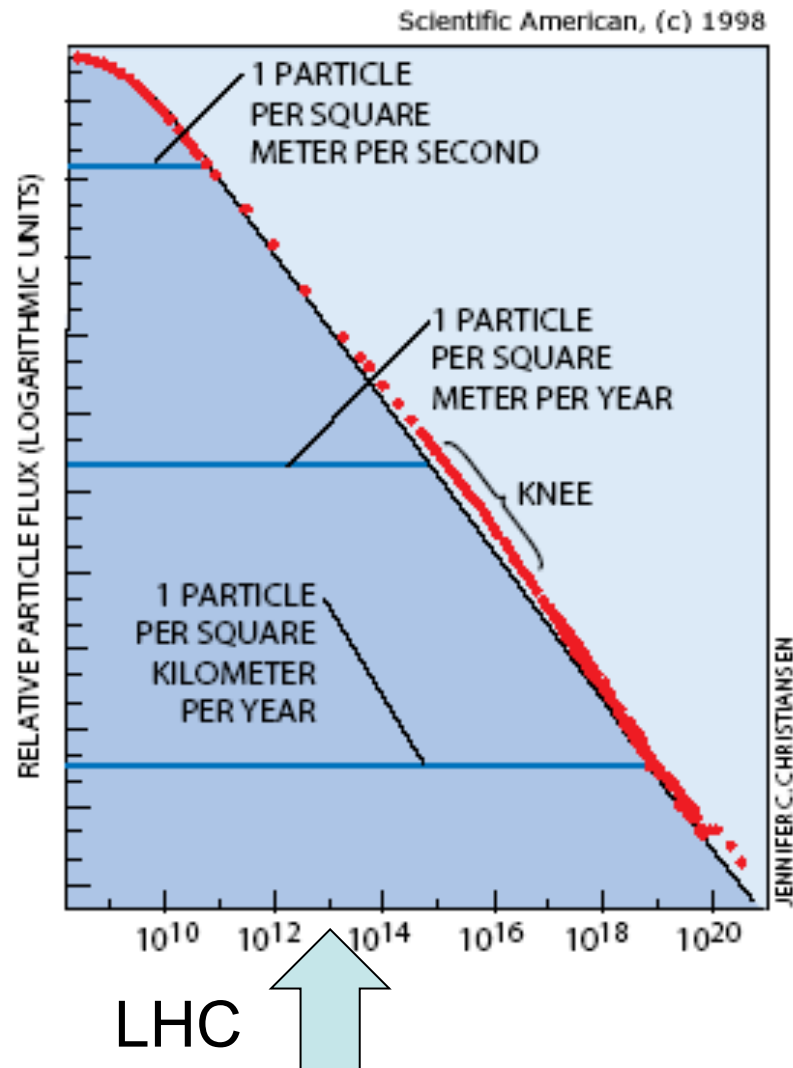
First, let's consider a truly dangerous object: wardrobes. Yes, wardrobes. I am not thinking of the dangers of being trapped by falling furniture, which are undoubtedly real,

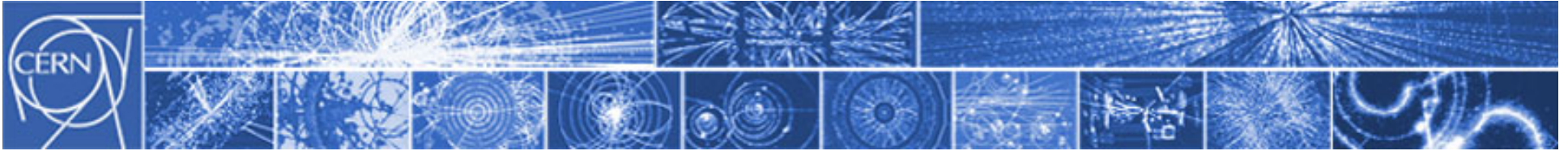


Photolibrary



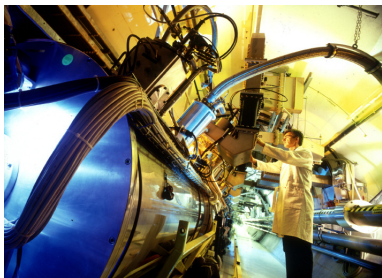
The Cosmic Ray Spectrum





They' ve always been there..

Year	Machine	Web	Hype
------	---------	-----	------



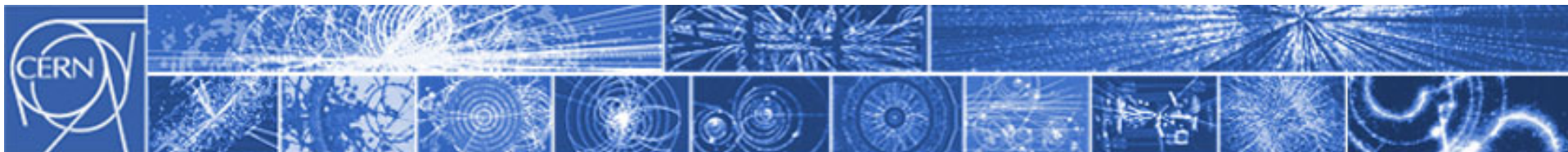
1989	LEP	None	None
------	-----	------	------



1999	RHIC	Web 1.0	Little
------	------	---------	--------



2008	LHC	Web 2.0	Lots
------	-----	---------	------



50/50


Daily Show Does CERN

 Stumble! Like? 

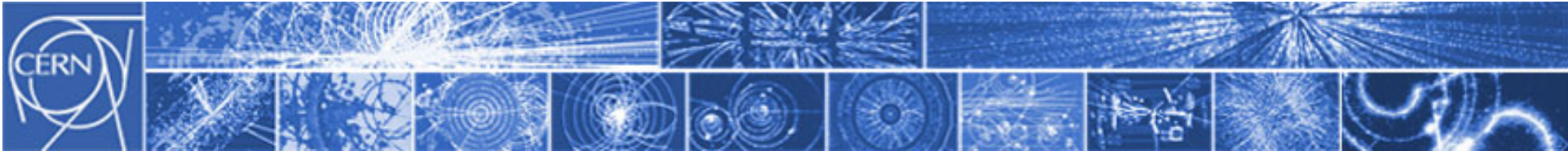
If you watch the Daily Show, you know the ~~inane~~ humor of John Oliver, one of the regular "correspondents" on the show. My colleagues at CERN tell me that he's visiting CERN now, filming one of his inimitable segments on the LHC and the experiments, to be aired "some time after April 21". Personally, I can't wait to see it - he is always funny and usually pretty sharply barbed. He apparently rode an LHC dipole



magnet like Slim Pickens rode the bomb in Dr. Strangelove, and asked one of our guys "is there anything you do here that's *not* boring?" His video spots are always edited tightly to get the maximum laugh quotient. Anyway, here he is in the CMS cavern, earlier today (thanks to my student Matt Searle for the photo!)

 ShareThis

April 8th, 2009 by John in [Miscellany](#), [Science and the Media](#) | [14 comments](#) | [RSS feed](#) | [Trackback >](#)





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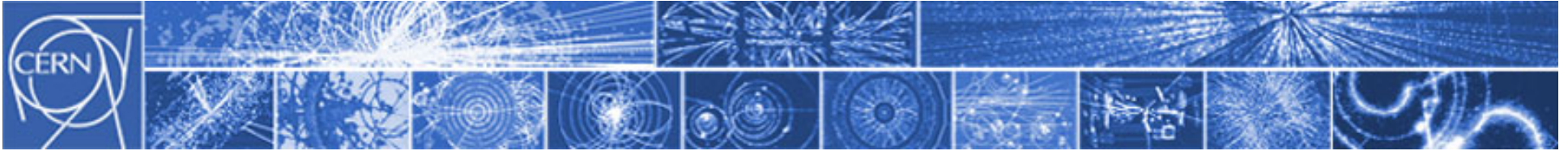
- Why the LHC
- How the LHC works
- The LHC Experiments
 - ALICE
 - ATLAS
 - CMS
 - LHCb
 - TOTEM
 - LHCF
- Computing
- The safety of the LHC**
- Facts and figures
- LHC Milestones

The safety of the LHC

The Large Hadron Collider (LHC) can achieve an energy that no other particle accelerators have reached before, but Nature routinely produces higher energies in cosmic-ray collisions. Concerns about the safety of whatever may be created in such high-energy particle collisions have been addressed for many years. In the light of new experimental data and theoretical understanding, the LHC Safety Assessment Group (LSAG) has updated a review of the analysis made in 2003 by the LHC Safety Study Group, a group of independent scientists.

LSAG reaffirms and extends the conclusions of the 2003 report that LHC collisions present no danger and that there are no reasons for concern. Whatever the LHC will do, Nature has already done many times over during the lifetime of the Earth and other astronomical bodies. The LSAG report has been reviewed and endorsed by CERN's Scientific Policy Committee, a group of external scientists that advises CERN's governing body, its Council.

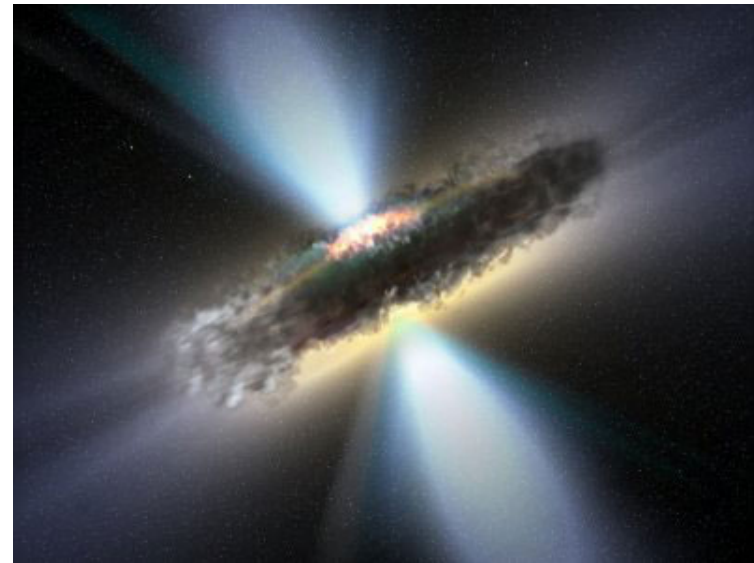
The following summarizes the main arguments given in the [LSAG report](#). Anyone interested in more details is encouraged to consult it directly, and the technical scientific papers to which it refers.



Would we do the same again?

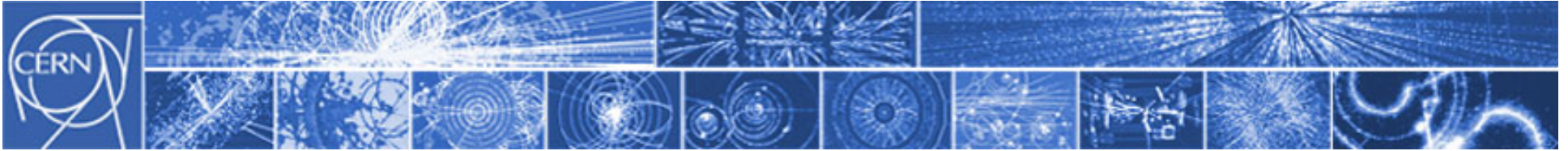


CERN in fiction...



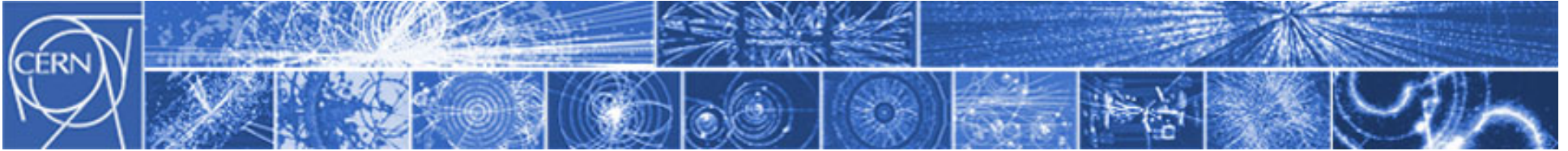
CERN in fiction dressed up as fact...

Both helped us tell our story.
With hindsight, we'd have treated them in a similar way.

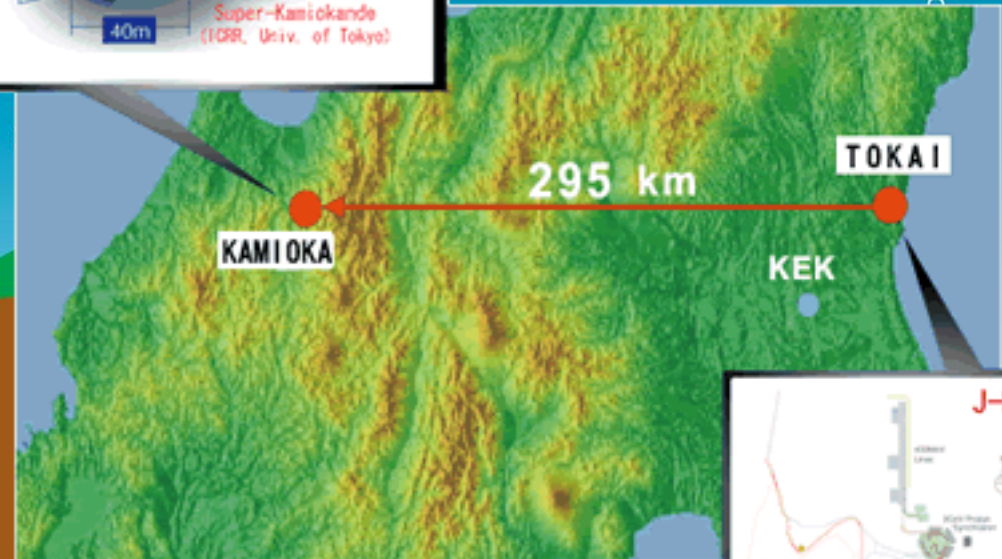
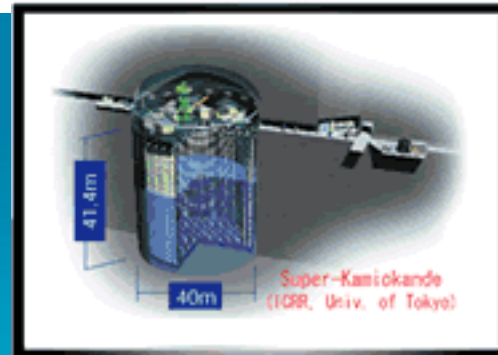


Was Einstein wrong?

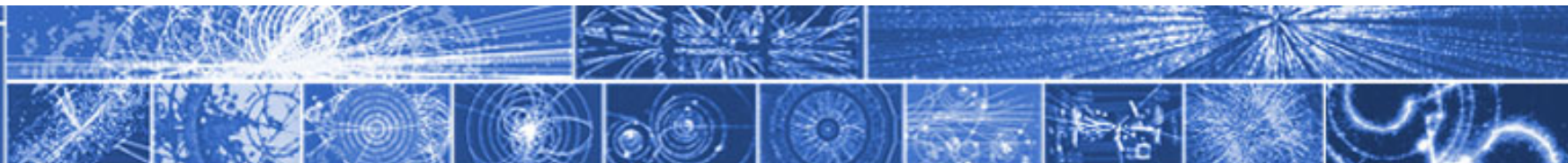




OPERA measurement



732km – 20 metres
2.4ms – 60ns
20 parts per million..



Thanks for listening!

