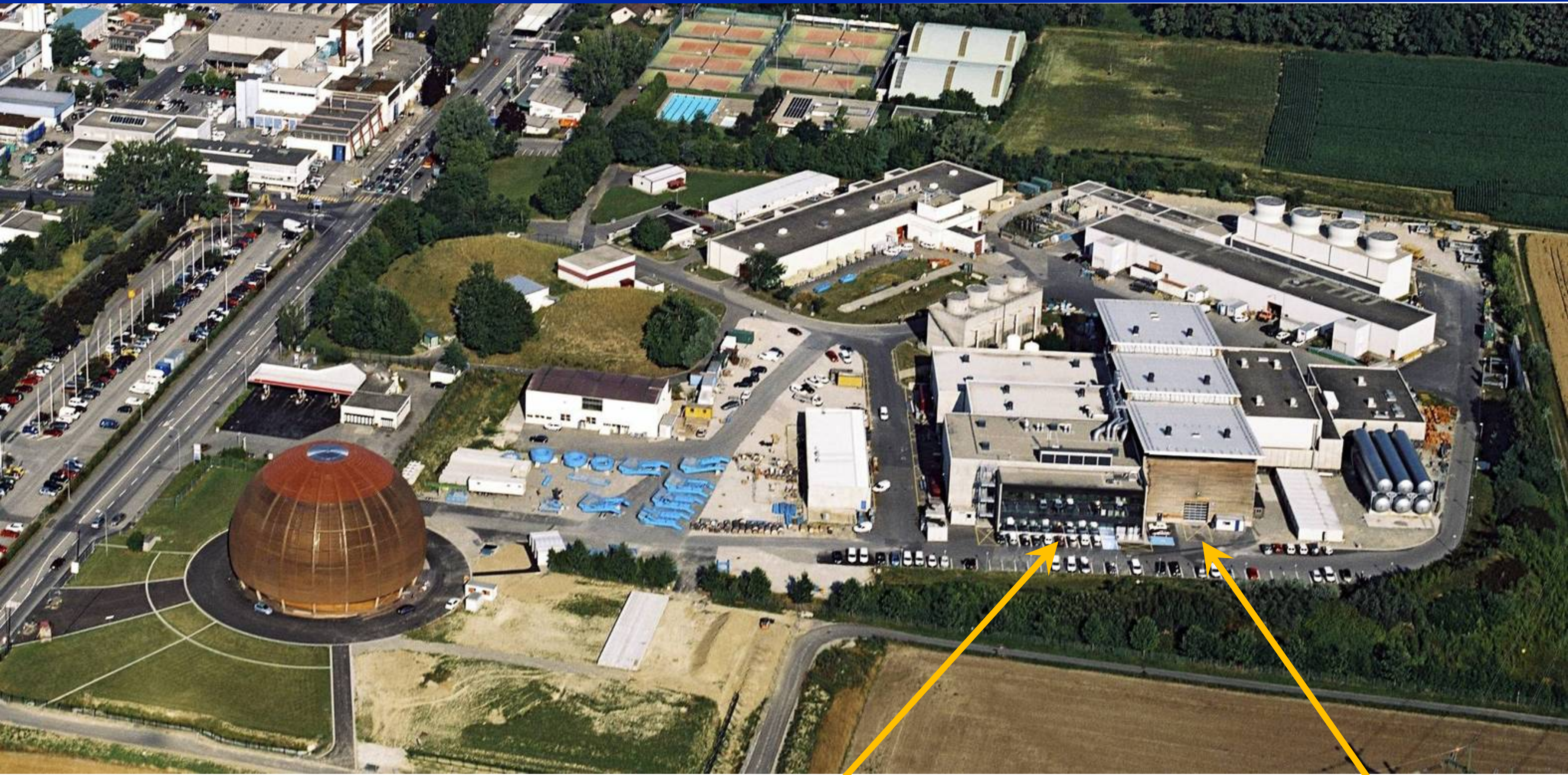
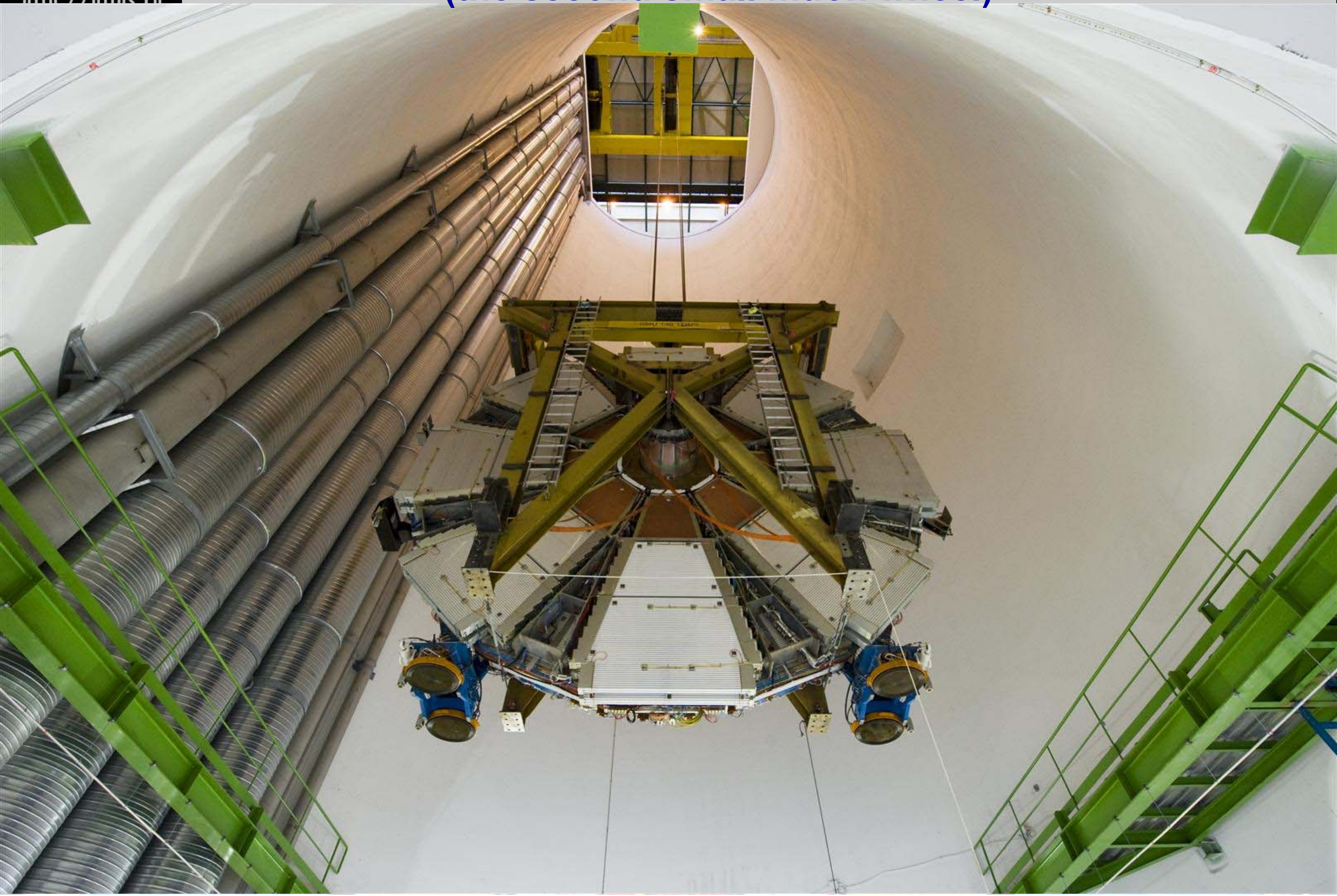
ATLAS Experiment

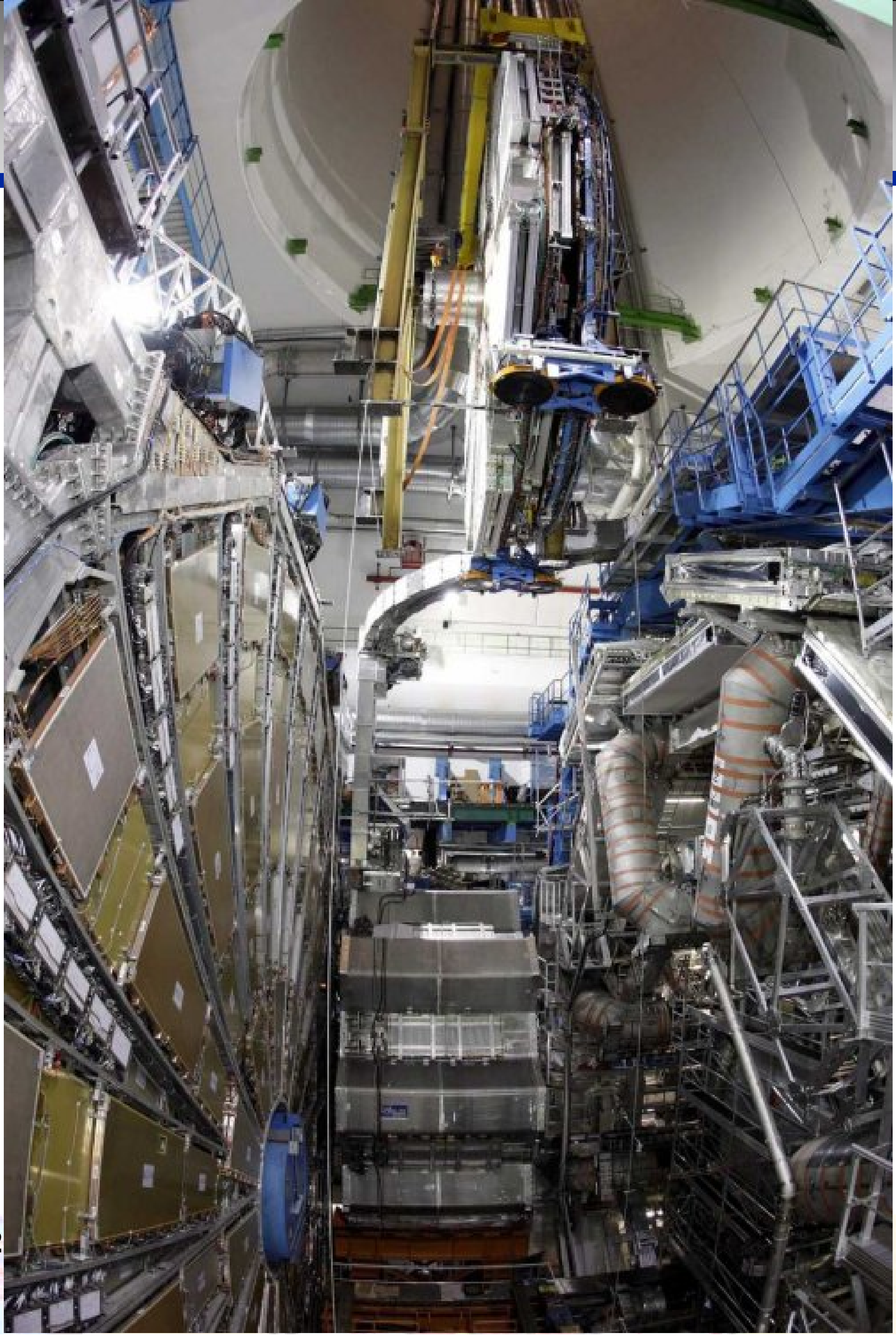


Control room

ATLAS building

Final piece of ATLAS lowered last Friday (the second small muon wheel)

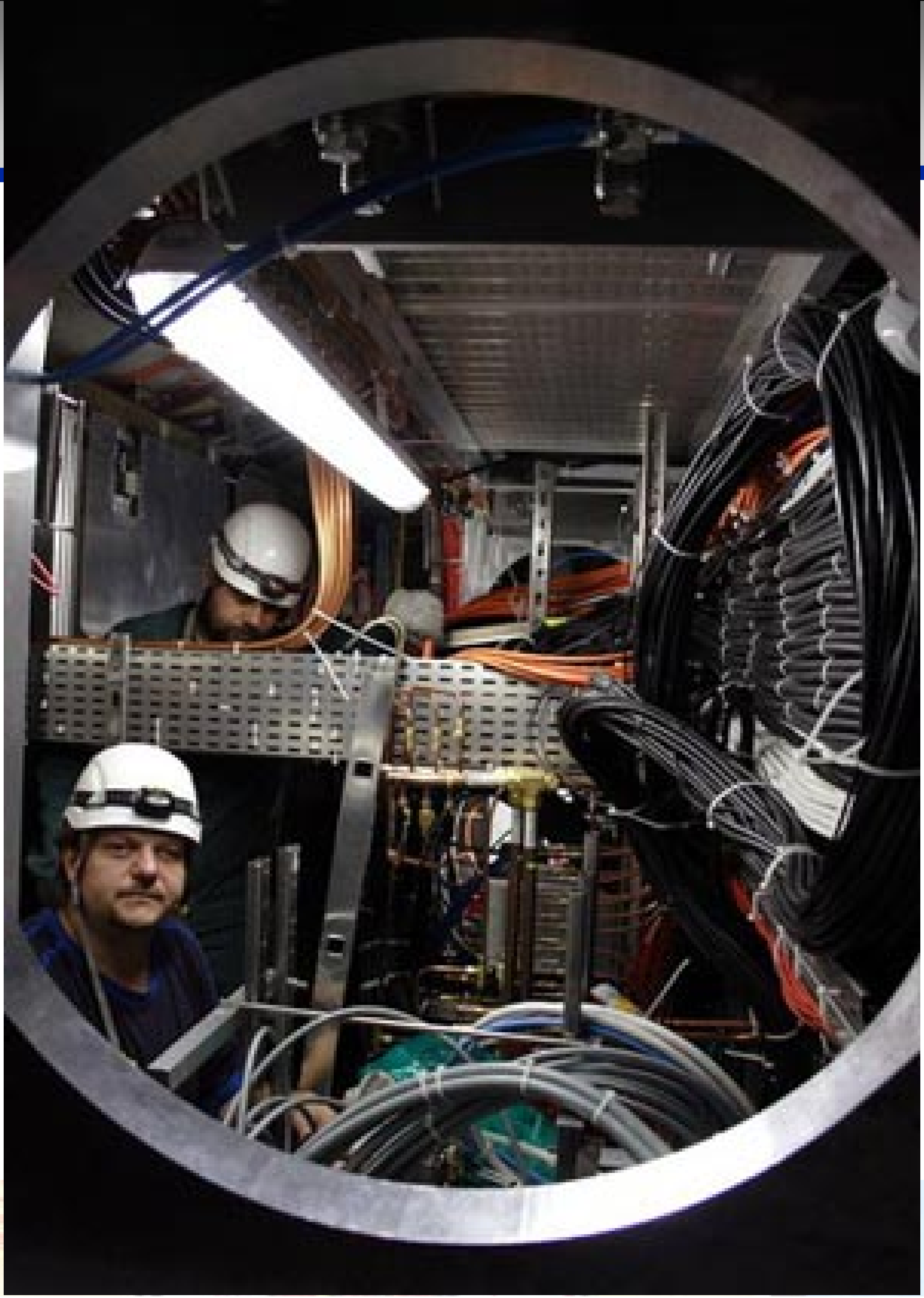




Still to be done

Connecting:

Cables,
Fibers,
Cryogenics



Celebrations

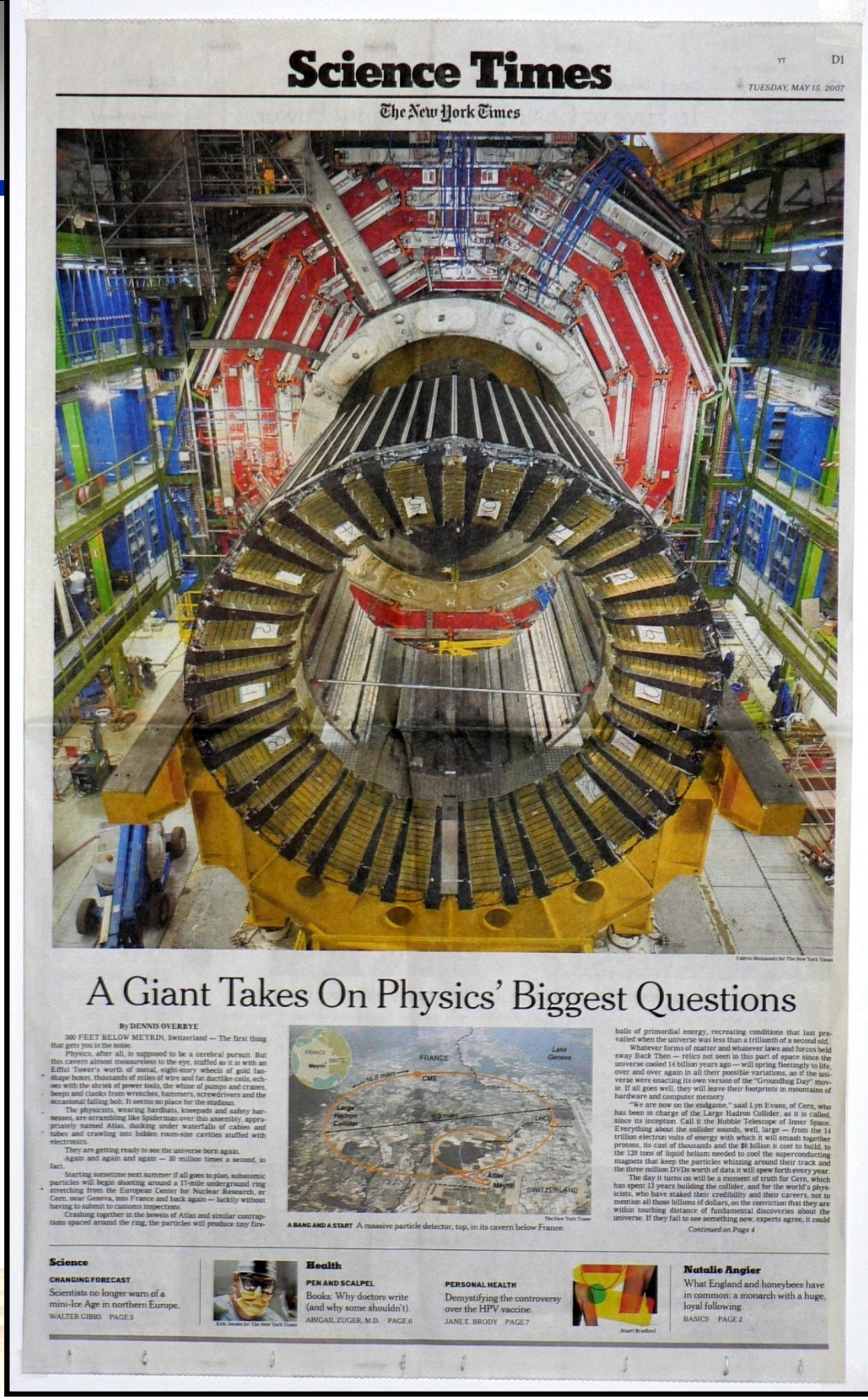
News Coverage

News media are flooding CERN well in advance of startup

"Particle physics is the unbelievable in pursuit of the unimaginable. To pinpoint the smallest fragments of the universe you have to build the biggest machine in the world. To recreate the first millionths of a second of creation you have to focus energy on an awesome scale."

The Guardian

Three full pages in New York Times



Science Times

D1

TUESDAY, MAY 15, 2007

The New York Times

Valerio Mezzanotti for The New York Times

A Giant Takes On Physics' Biggest Questions

By DENNIS OVERBYE

300 FEET BELOW MEYRIN, Switzerland — The first thing that gets you is the noise.

Physics, after all, is supposed to be a cerebral pursuit. But this cavern almost measureless to the eye, stuffed as it is with an Eiffel Tower's worth of metal, eight-story wheels of gold fan-shape boxes, thousands of miles of wire and fat ductlike coils, echoes with the shriek of power tools, the whine of pumps and cranes, beeps and clanks from wrenches, hammers, screwdrivers and the occasional falling bolt. It seems no place for the studious.

The physicists, wearing hardhats, kneepads and safety harnesses, are scrambling like Spiderman over this assembly, appropriately named Atlas, ducking under waterfalls of cables and tubes and crawling into hidden room-size cavities stuffed with electronics.

They are getting ready to see the universe born again.

Again and again and again — 30 million times a second, in fact.

Starting sometime next summer if all goes to plan, subatomic particles will begin shooting around a 17-mile underground ring stretching from the European Center for Nuclear Research, or Cern, near Geneva, into France and back again — luckily without having to submit to customs inspections.

Crashing together in the bowels of Atlas and similar contraptions spaced around the ring, the particles will produce tiny fireballs of primordial energy, recreating conditions that last prevailed when the universe was less than a trillionth of a second old.

Whatever forms of matter and whatever laws and forces held sway Back Then — relics not seen in this part of space since the universe cooled 14 billion years ago — will spring fleetingly to life, over and over again in all their possible variations, as if the universe were enacting its own version of the "Groundhog Day" movie. If all goes well, they will leave their footprints in mountains of hardware and computer memory.

"We are now on the endgame," said Lyn Evans, of Cern, who has been in charge of the Large Hadron Collider, as it is called, since its inception. Call it the Hubble Telescope of Inner Space. Everything about the collider sounds, well, large — from the 14 trillion electron volts of energy with which it will smash together protons, its cast of thousands and the $8 billion it cost to build, to the 128 tons of liquid helium needed to cool the superconducting magnets that keep the particles whizzing around their track and the three million DVDs worth of data it will spew forth every year.

The day it turns on will be a moment of truth for Cern, which has spent 13 years building the collider, and for the world's physicists, who have staked their credibility and their careers, not to mention all those billions of dollars, on the conviction that they are within touching distance of fundamental discoveries about the universe. If they fail to see something new, experts agree, it could

Continued on Page 4

FRANCE
Lake Geneva
CMS
Large Hadron Collider
Atlas
Meyrin
SWITZERLAND

The New York Times

A BANG AND A START A massive particle detector, top, in its cavern below France.

Science

CHANGING FORECAST

Scientists no longer warn of a mini-Ice Age in northern Europe.

WALTER GIBBS PAGE 3

Erik Jacobs for The New York Times

Health

PEN AND SCALPEL

Books: Why doctors write (and why some shouldn't).

ABIGAIL ZUGER, M.D. PAGE 6

PERSONAL HEALTH

Demystifying the controversy over the HPV vaccine.

JANE E. BRODY PAGE 7

Stuart Bradford

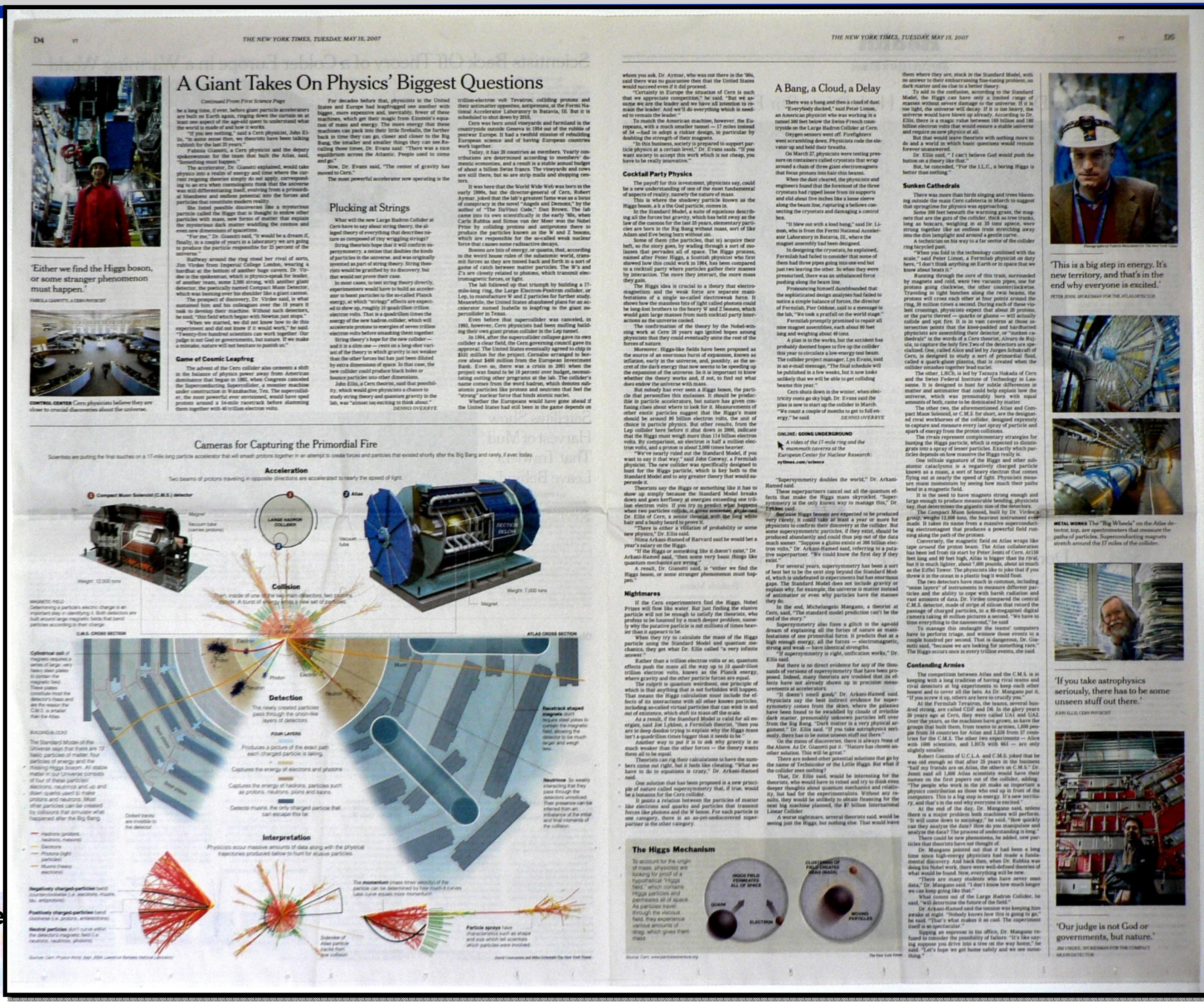
Natalie Angier

What England and honeybees have in common: a monarch with a huge, loyal following.

BASICS PAGE 2

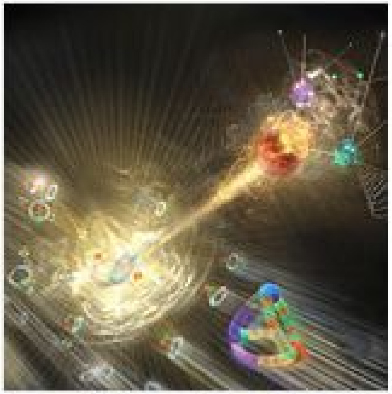
ATLAS EXPERIMENT
http://atlas.ch

New York Times



National Geographic Magazine

Interactive



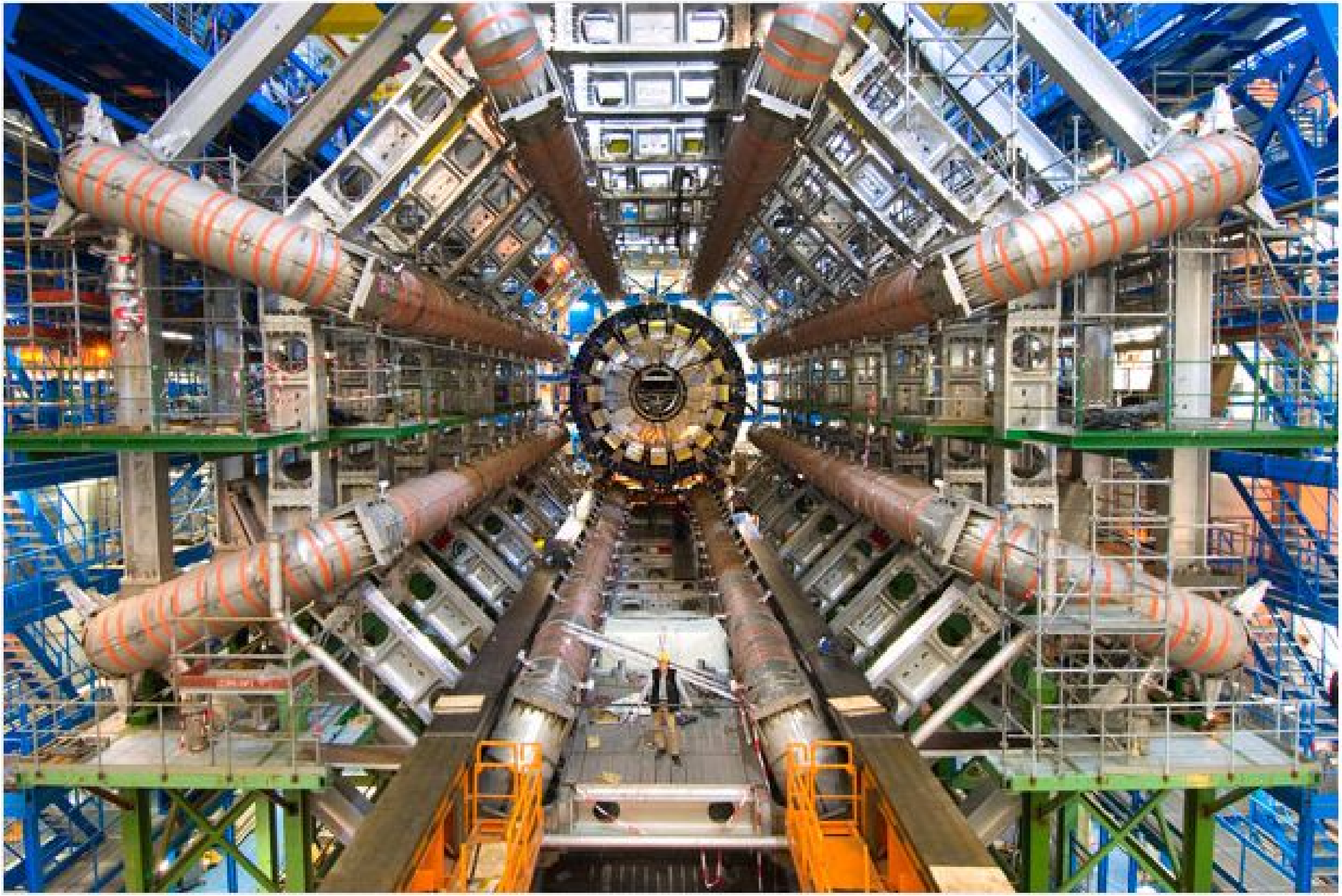
→ Go Inside the God Particle

See how physicists will use a giant atom smasher in hopes of finding the so-called God particle.

Photo Gallery

The God Particle

Published: March 2008



At the Heart of All Matter

The hunt for the God particle

National Geographic Magazine

Learn More

+ GeoPedia: Atom Smashers

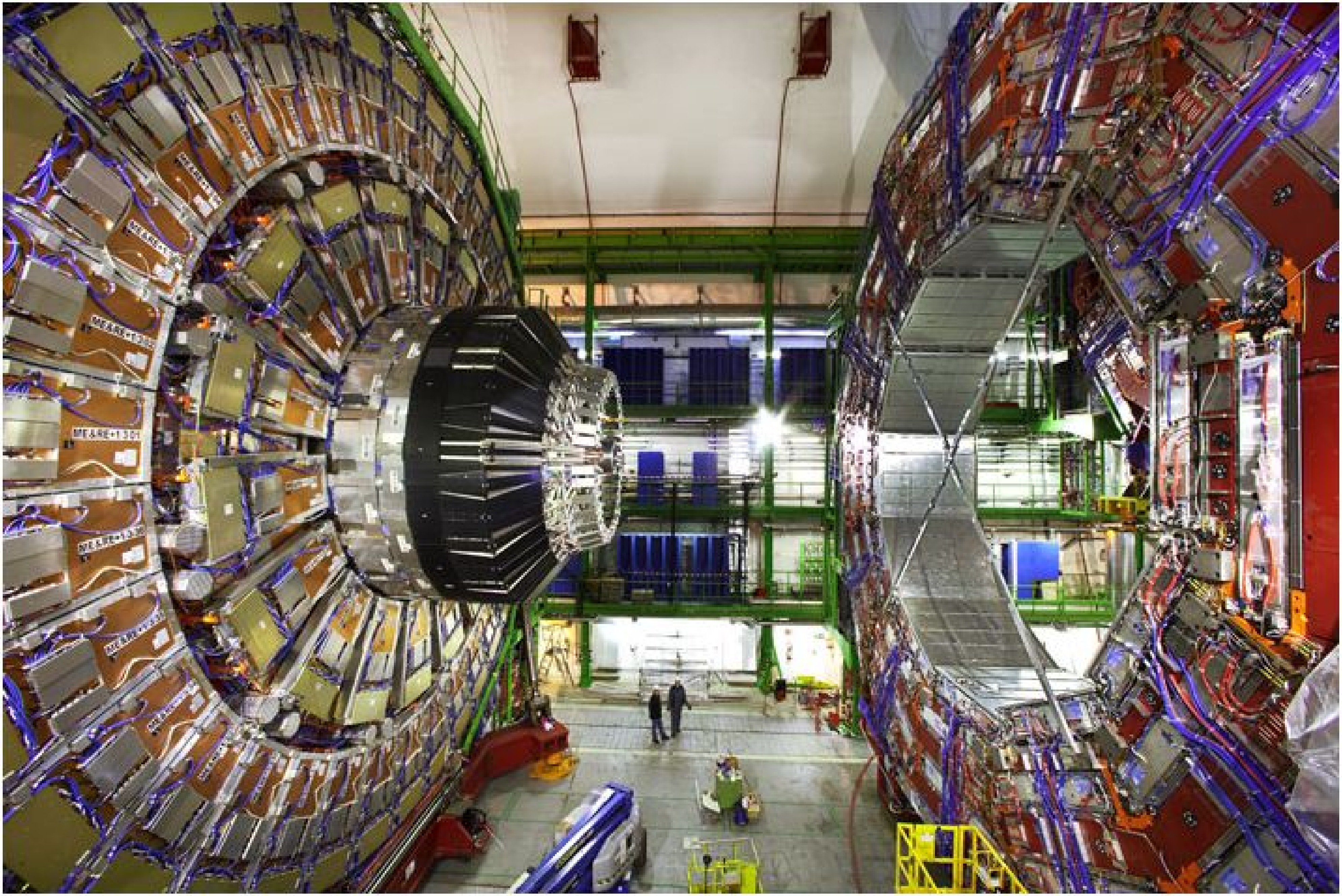
Will Europe's new giant atom smasher crack the physical universe's code?

If you were to dig a hole 300 feet straight down from the center of the charming French village of Crozet, you'd pop into a setting that calls to mind the subterranean lair of one of those James Bond villains. A garishly lit tunnel ten feet in diameter curves away into the distance, interrupted every few miles by lofty chambers crammed with heavy steel structures, cables, pipes, wires, magnets, tubes, shafts, catwalks, and enigmatic gizmos.

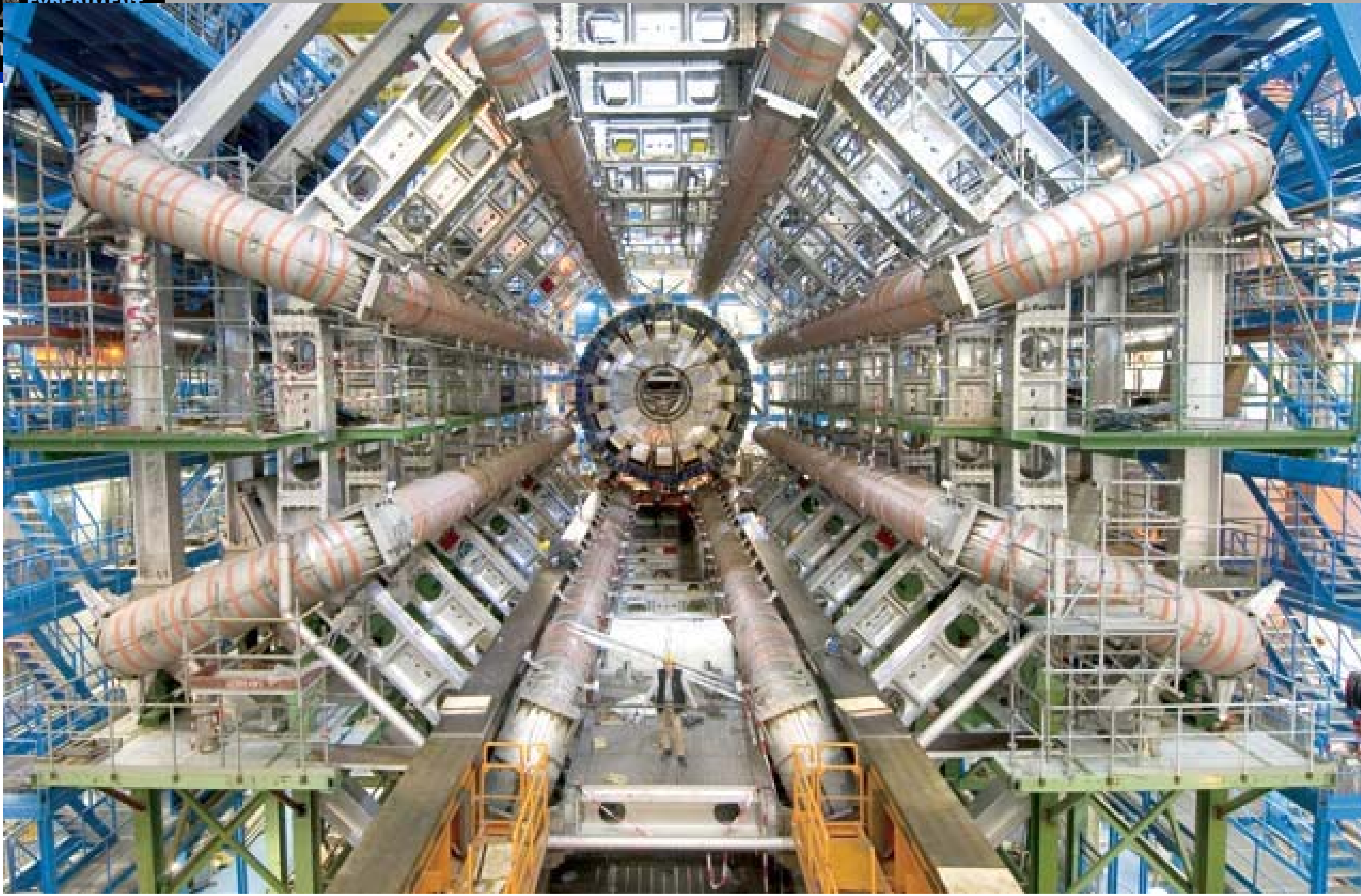
This technological netherworld is one very big scientific instrument, specifically, a particle accelerator-an atomic peashooter more powerful than any ever built. It's called the Large Hadron Collider, and its purpose is simple but ambitious: to crack the code of the physical world; to figure out what the universe is made of; in other words, to get to the very bottom of things.

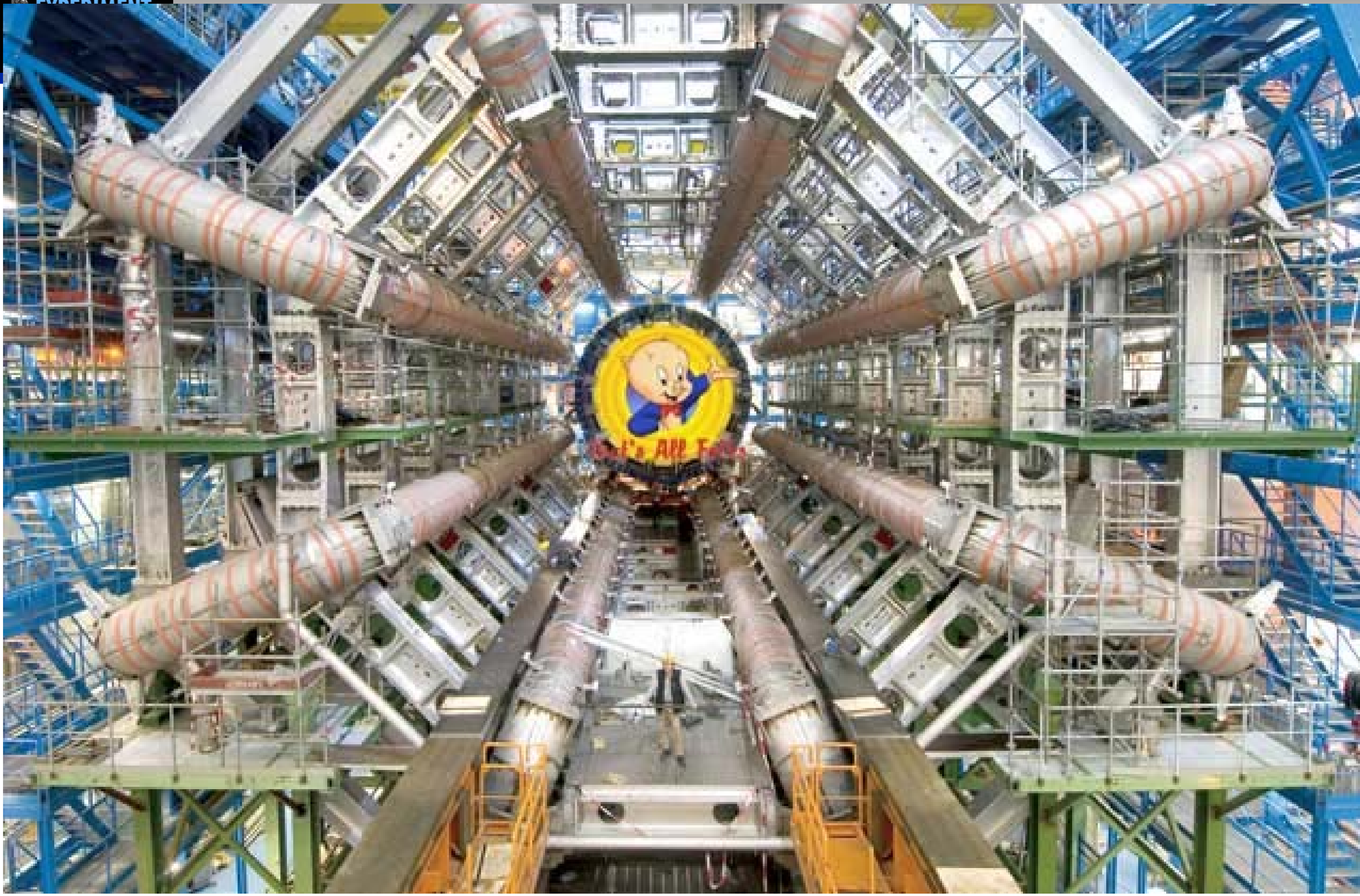
Starting sometime in the coming months, two beams of particles will race in opposite directions around the tunnel, which forms an underground ring 17 miles in circumference. The particles will be guided by more than a thousand cylindrical, supercooled magnets, linked like sausages. At four locations the beams will converge, sending the particles crashing into each other at nearly the speed of light. If all goes right, matter will be transformed by the violent collisions into wads of energy, which will in turn condense back into various intriguing types of particles, some of them never seen before. That's the essence of experimental particle physics: You smash stuff together and see what other stuff comes out.

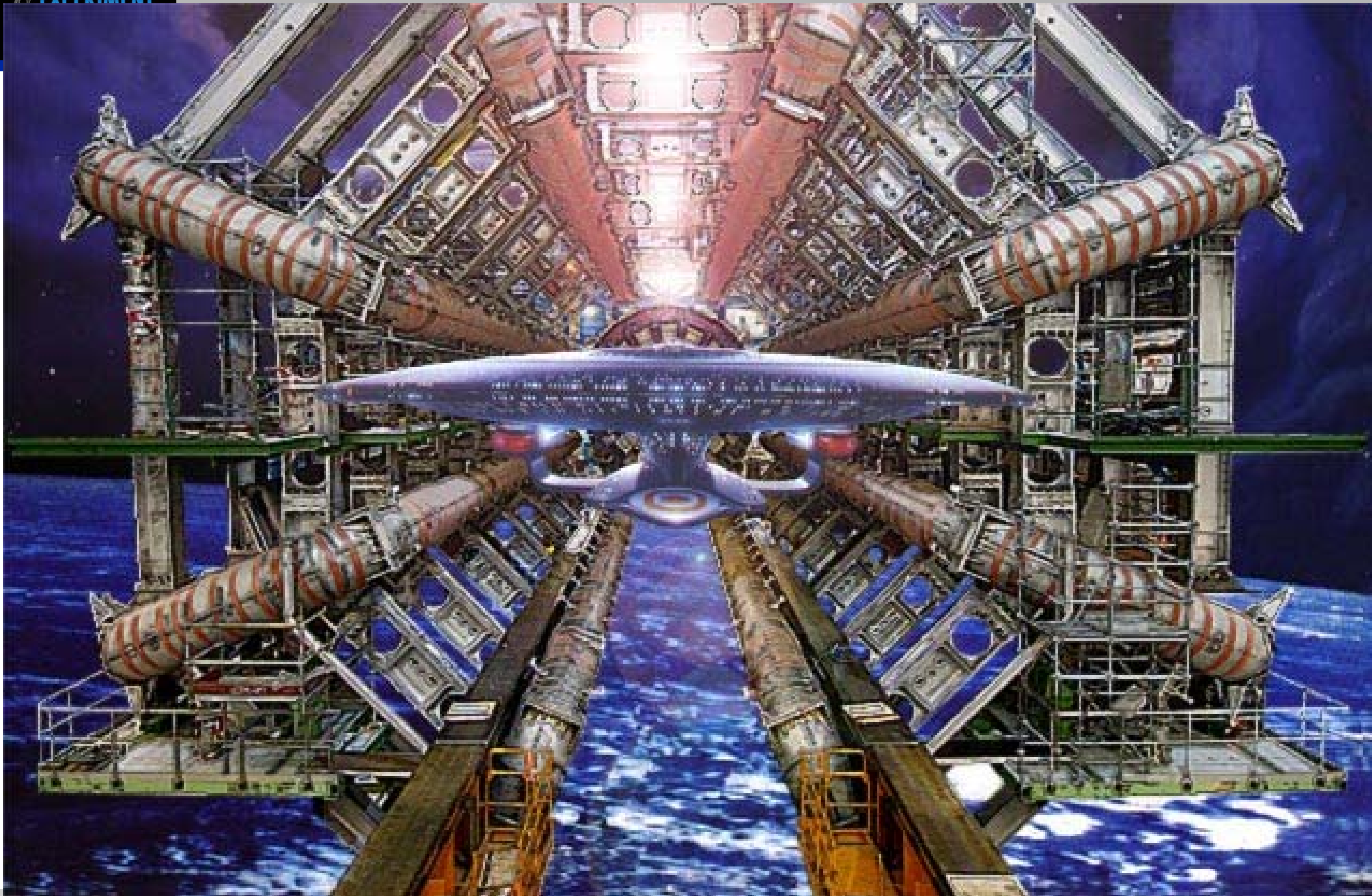
National Geographic Magazine

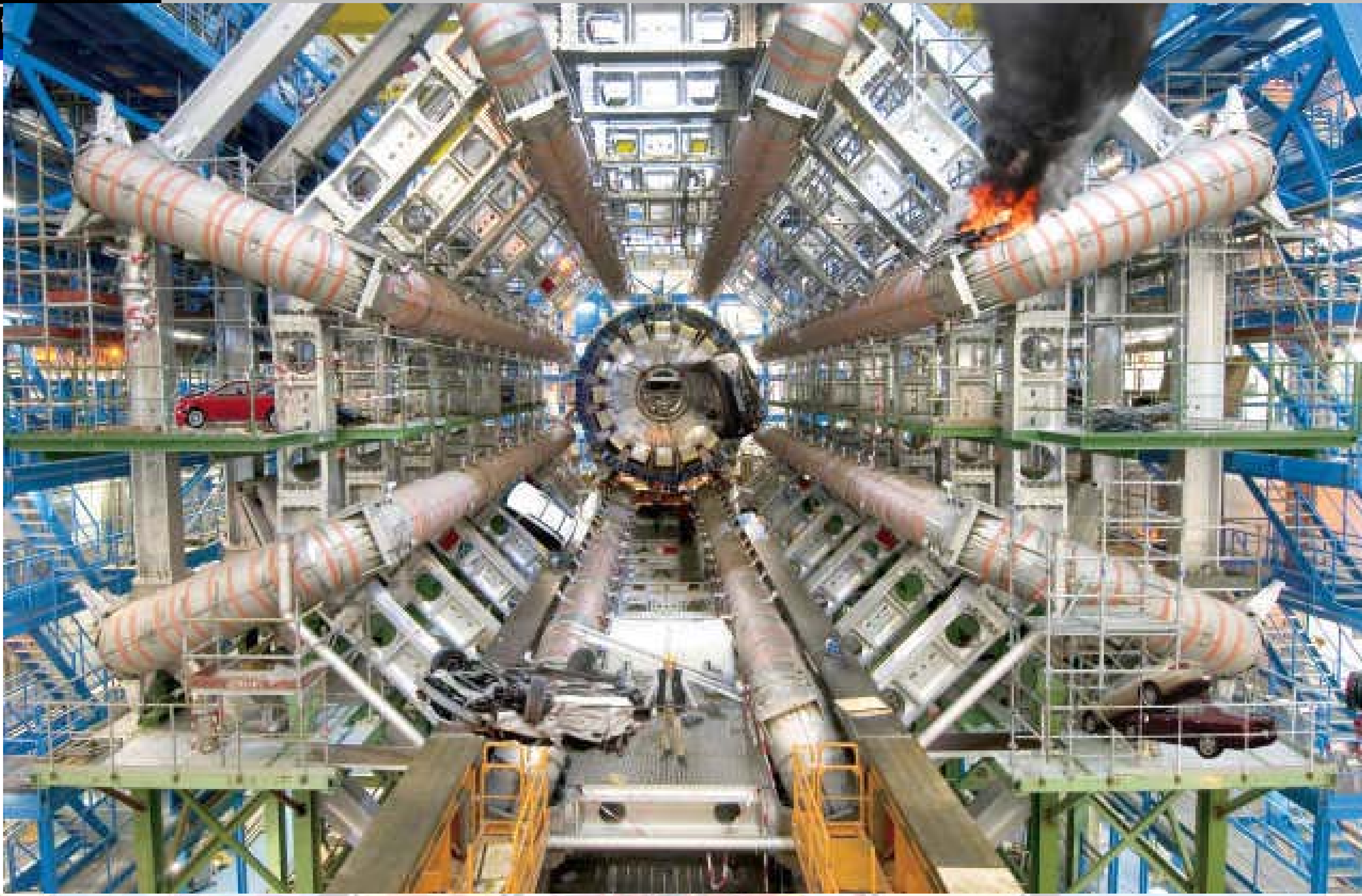


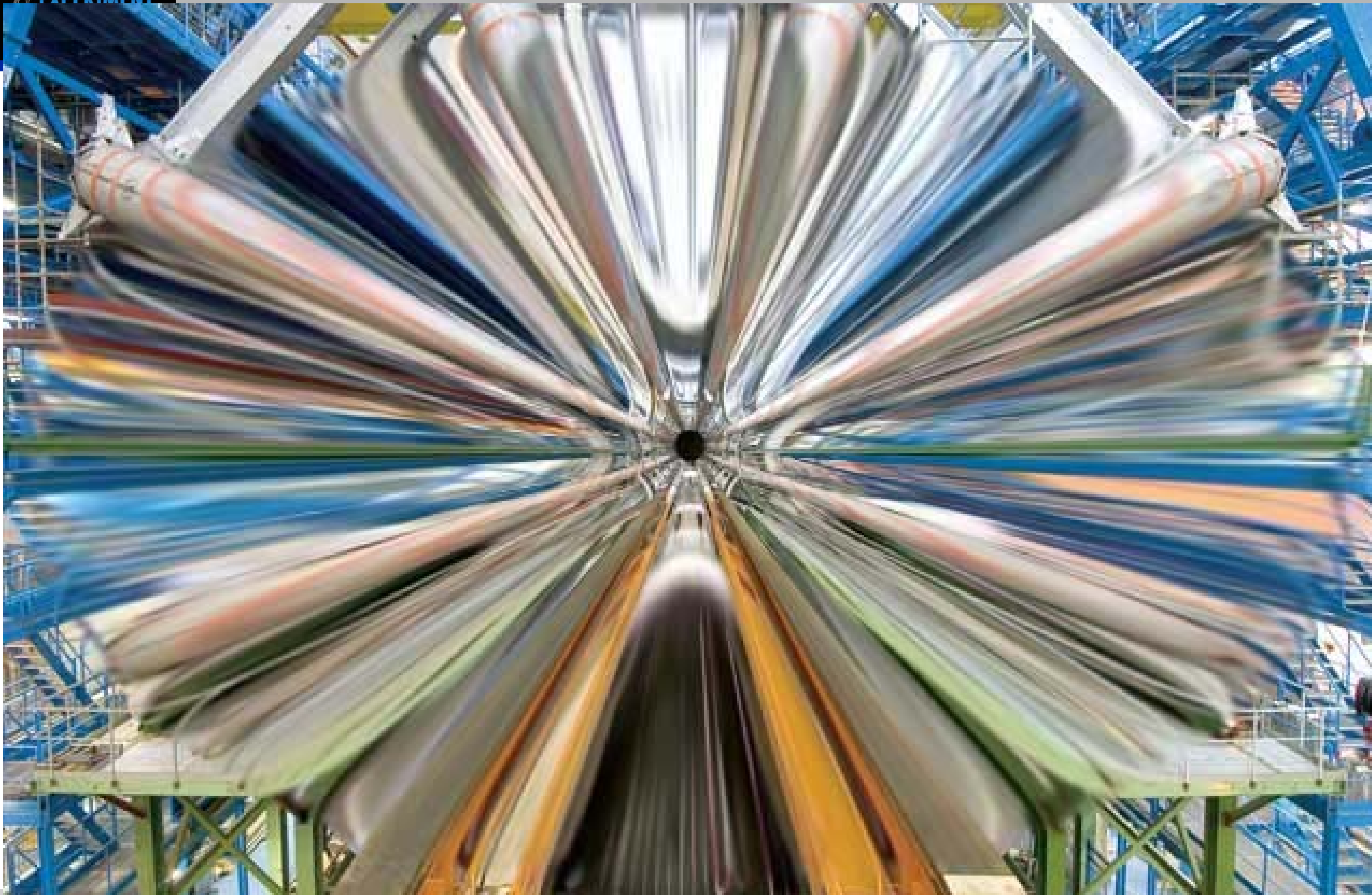
Photograph by Peter Ginter



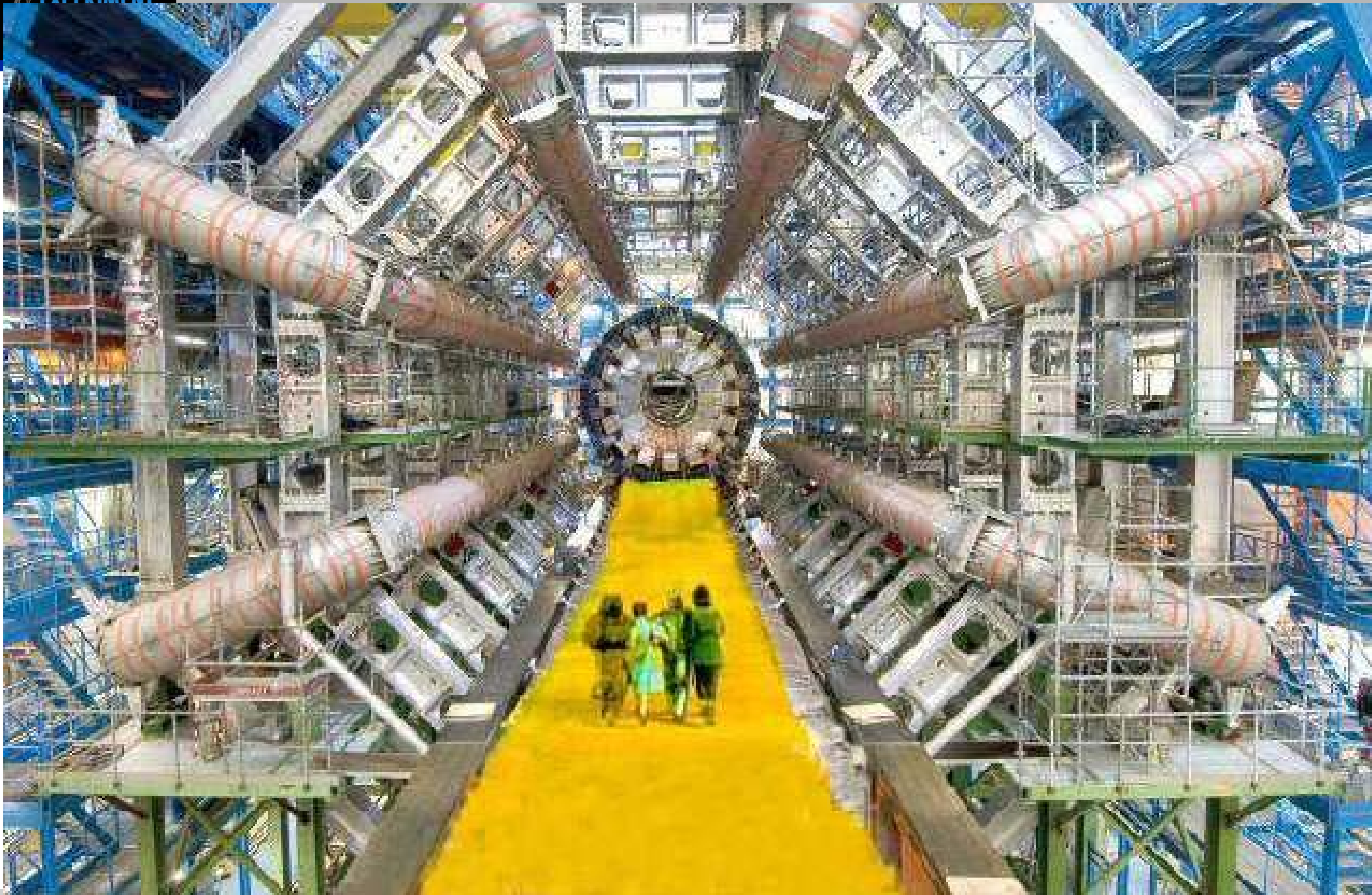




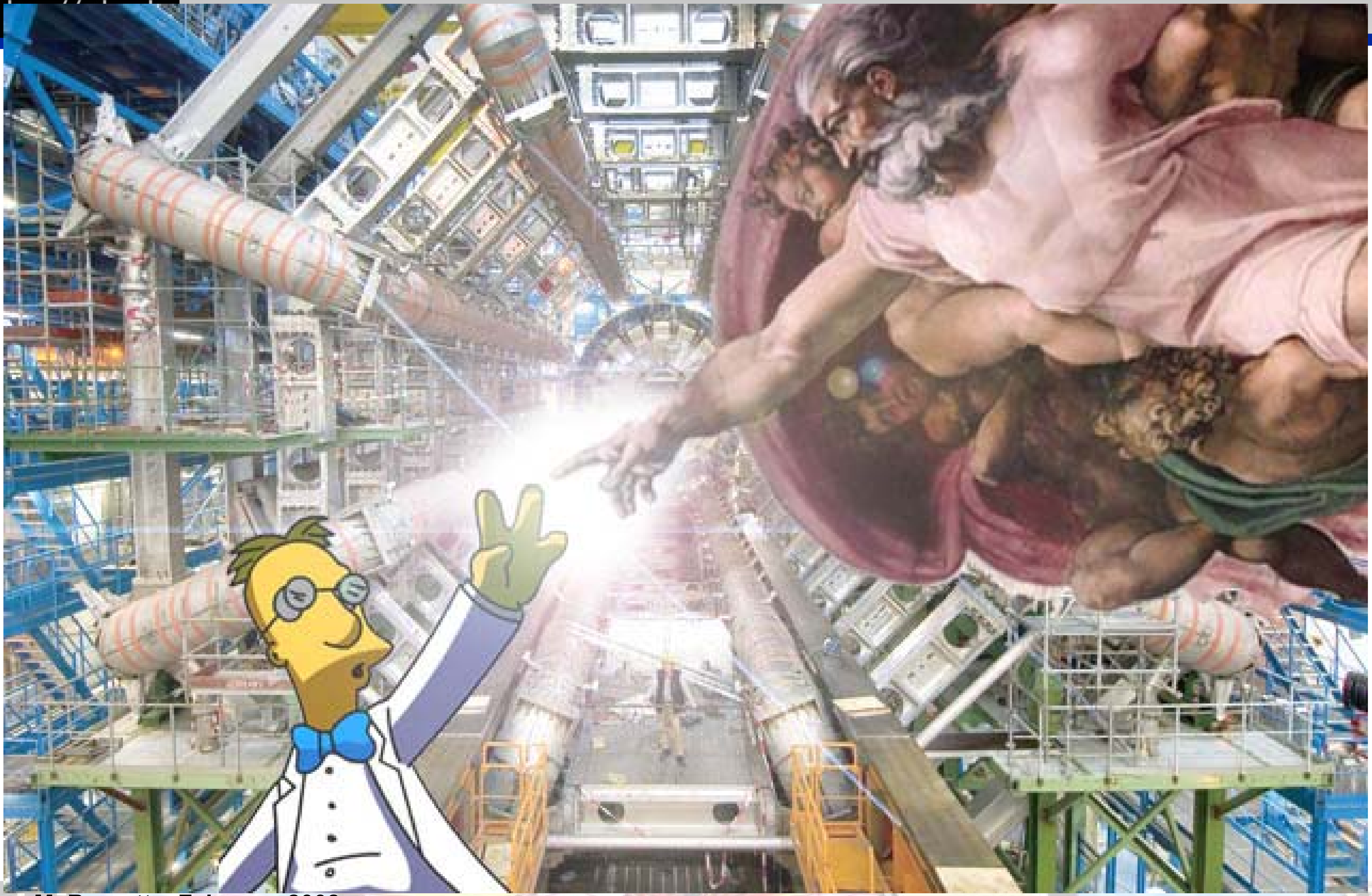




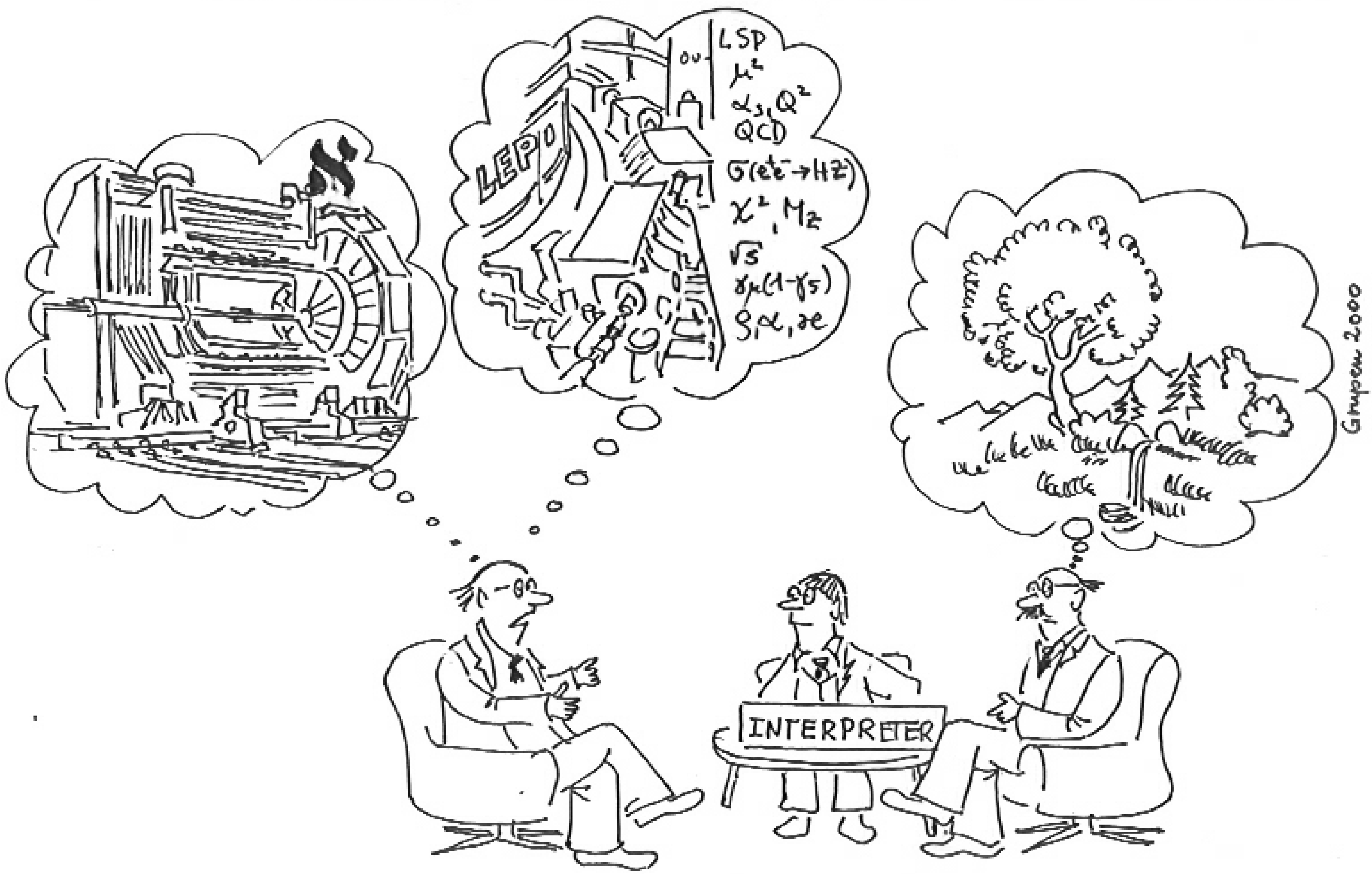

40




MIND THE GAP



And on television (shortened version)



An ATLAS expert explains the Higgs evidence to a layperson.

US-LHC Student Journalism Program

April 2-7, 2008 (overlapping Open Days)

Six teams of high school students (3 students/1 teacher) are going to CERN to report on the LHC startup. They will have all major expenses paid.

The student/teacher teams will learn about the LHC, ATLAS and CMS experiments by interviewing physicists and engineers and seeing the experiments up close.

Teams will act as news reporters to students in their home communities and across the US. These high school journalists will share the excitement with many others via blogs, websites, etc. Each will prepare a video about their visit and the LHC.

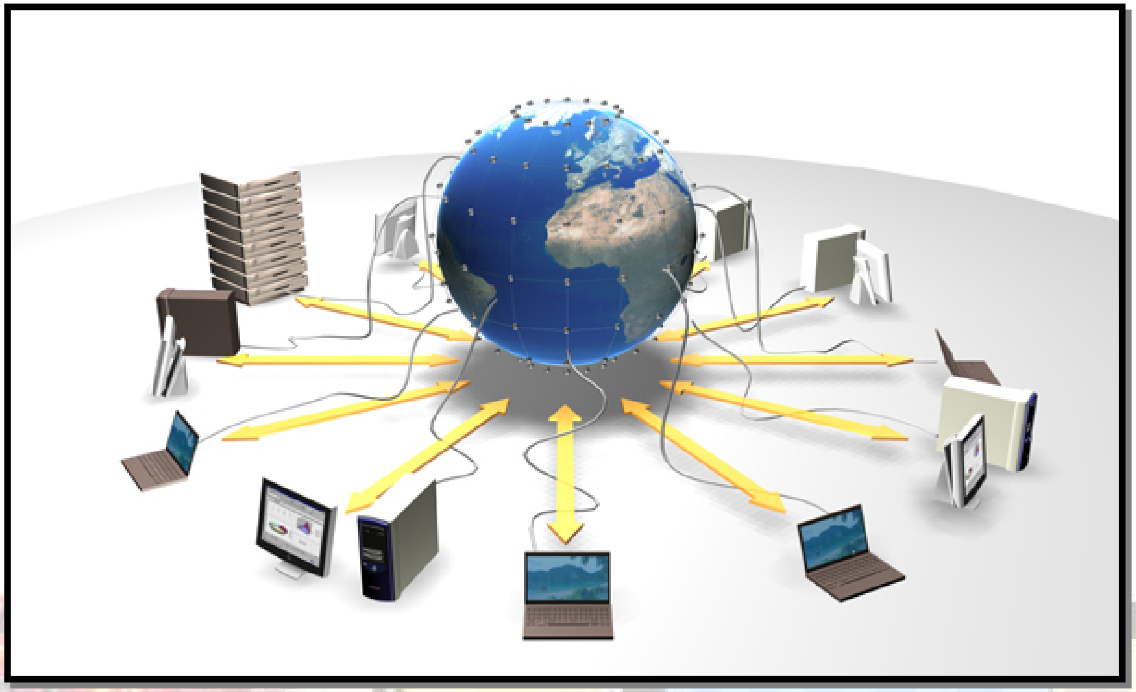
Large Hadron Collider Numbers

The biggest most sophisticated detectors ever built

Recording the debris from 600 million proton collisions per second requires building gargantuan devices that measure particles with 0.001 cm precision.

The most extensive computer system in the world

Analyzing the data requires tens of thousands of computers around the world using the Grid.



ATLAS Experiment Numbers

Weight of ATLAS detector

A hundred 747 jets (empty)

Size of ATLAS detector

About half the Notre Dame Cathedral

Superconducting wire in magnets

Is 122 km (76 miles) long,

plus 3000 km (1865 miles) of ordinary cables elsewhere.

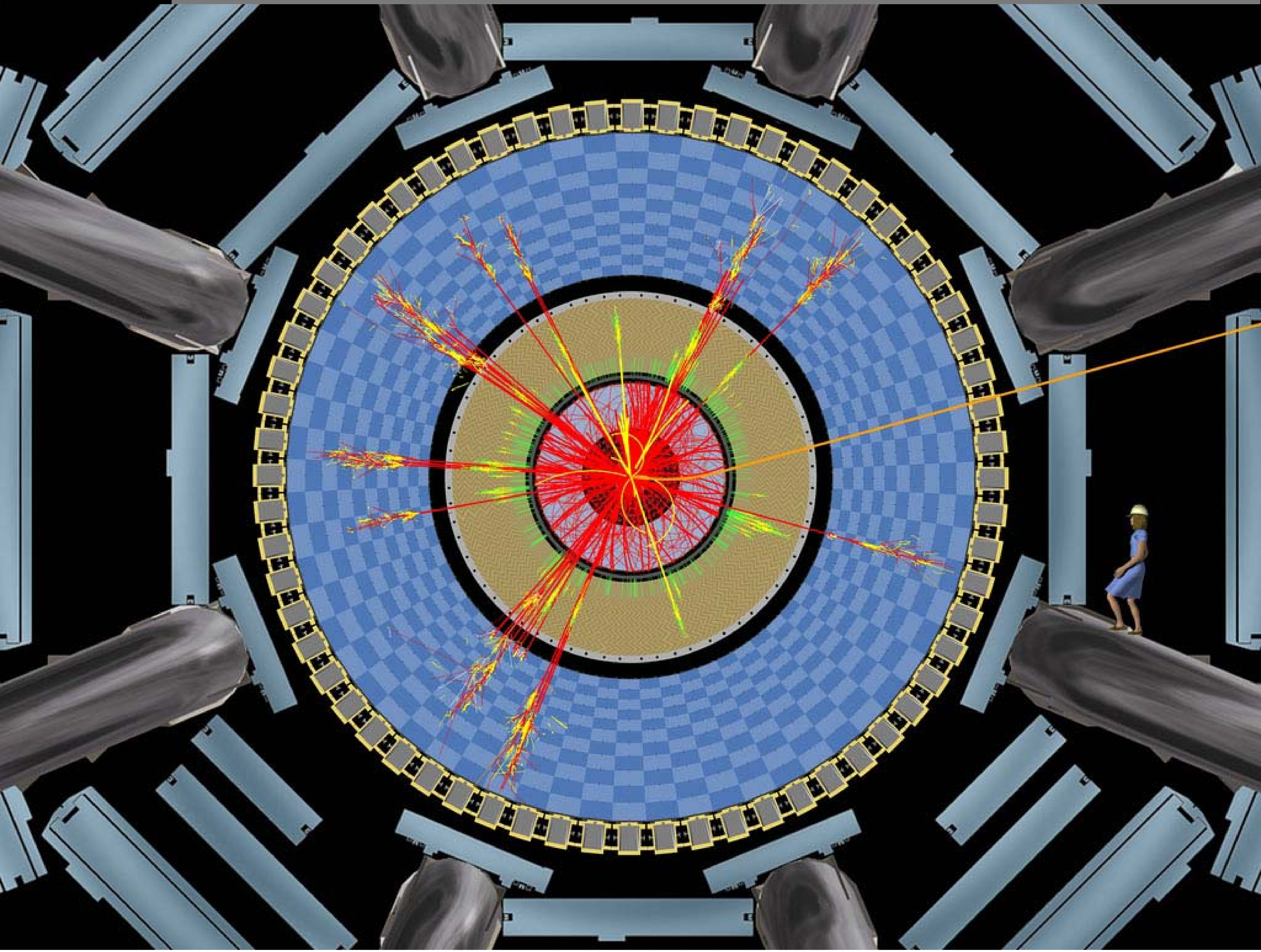
Data recorded each year

3200 terabytes, equivalent to 7 km (4 miles) of CDROMs stacked on top of each other.

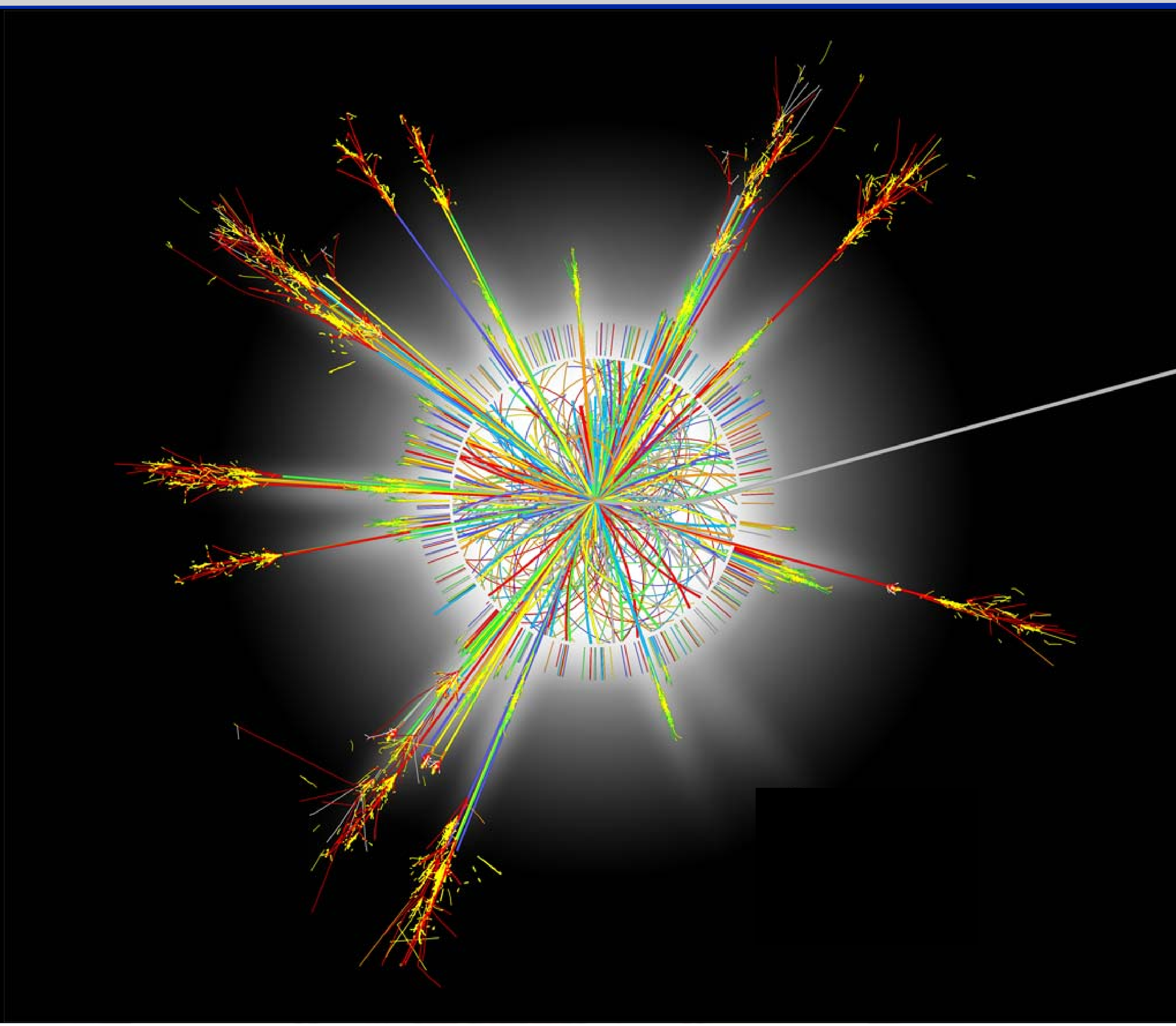
Electronic channels **About 100 million**

Who builds and operates ATLAS?

2100 scientists from 167 universities and labs in 37 countries



Microscopic Black Hole Event



Raising the Alarm

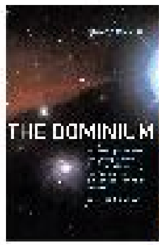
**Google News –
Just look under:
"CERN black hole"**

Press-release

Submit your news here

Raising the Alarm Over Massive and Dangerous New Experiment; Where Is the Oversight on CERN?

Monday, 04 February 2008

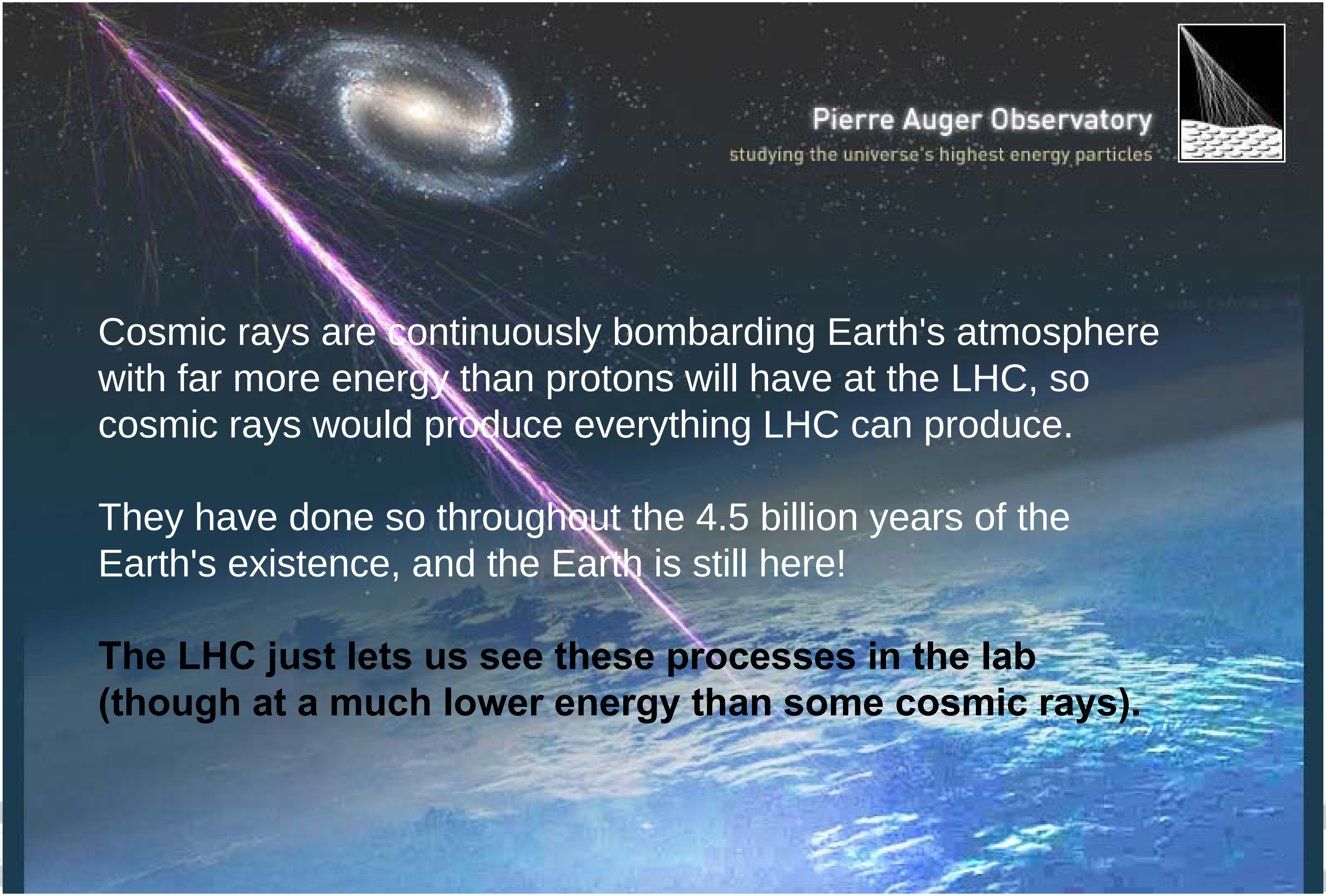


BOOKMARK

Some of the world's top scientists, including some Nobel Prize winners, are preparing to create black-hole material in a laboratory in Europe this spring. What will happen when they fire up the Large Hadron Collider (LHC)—the largest machine on earth? Will the black-hole material be stable? Will it be controllable? European Center for Nuclear Research (CERN) scientists say their experiment is safe, but how they are sure? Some opposing nuclear physicists have raised the alarm, including a Nobel laureate.
Scientists at LHC, outside of Geneva, have been planning for years to collide bundles of 10,000,000,000,000 (10 trillion) protons moving at the speed of light head-on into other bundles of 10 trillion protons. The LHC is a new type of accelerator, which will cause collisions to pile up at predetermined junctions into a huge dogpile of collisions that have the potential to build spontaneous black-holes.

The new material created by this collision is unknown to humanity. Its dynamics are unpredictable. The methods and requirements for containment are unknown, and if an accident occurs and an uncontrollable black-hole is created, scientists do not know how they will destabilize it. What if this experiment "succeeds" beyond their wildest dreams and becomes uncontainable? What if this black-hole begins progressively compacting all the matter near it? What will be the result? No one knows. Who has a plan to destabilize any voracious material created? There does not appear to be one.

Are Microscopic Black Holes Dangerous?



Cosmic rays are continuously bombarding Earth's atmosphere with far more energy than protons will have at the LHC, so cosmic rays would produce everything LHC can produce.

They have done so throughout the 4.5 billion years of the Earth's existence, and the Earth is still here!

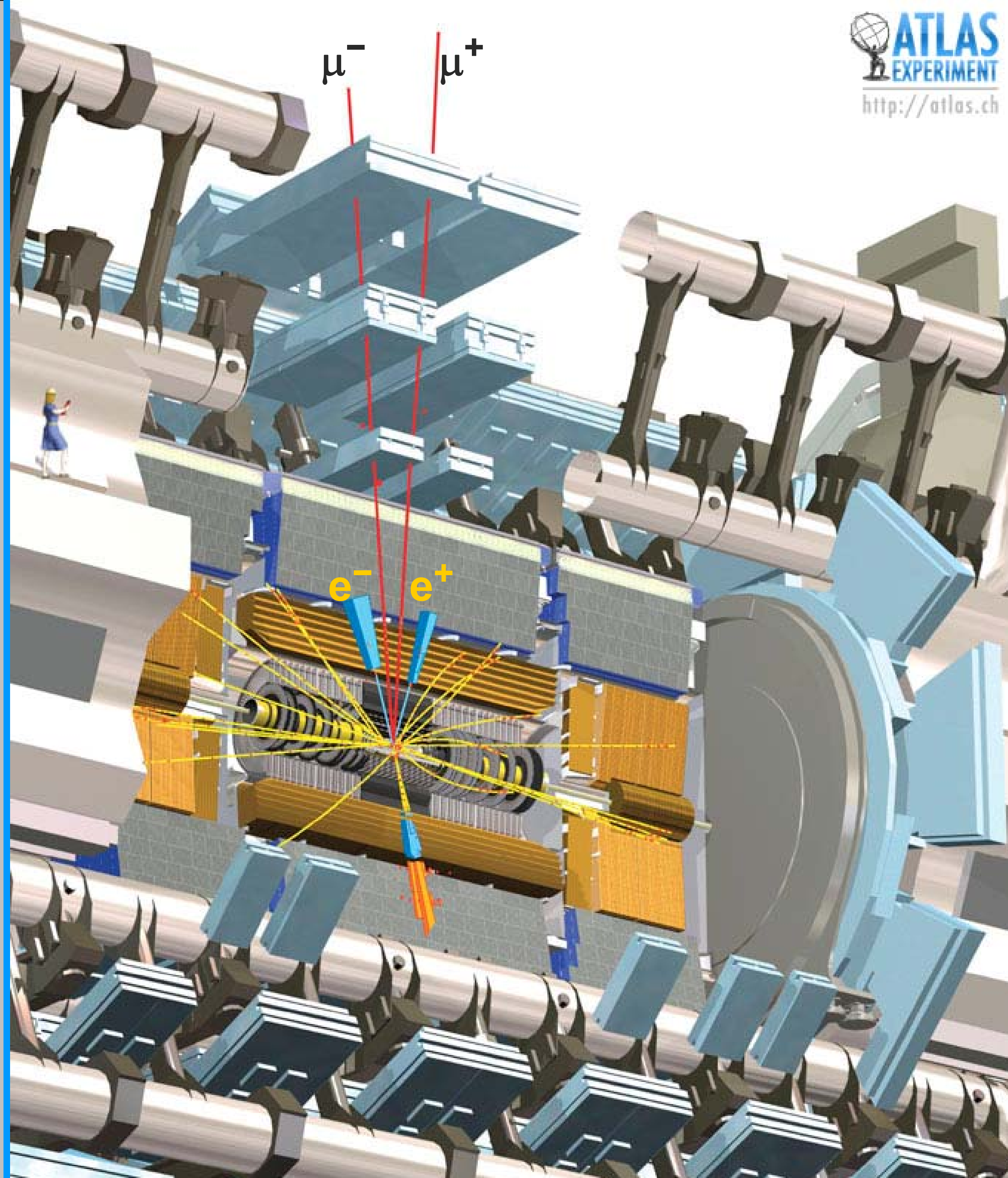
The LHC just lets us see these processes in the lab (though at a much lower energy than some cosmic rays).

How a Higgs boson event might look in ATLAS

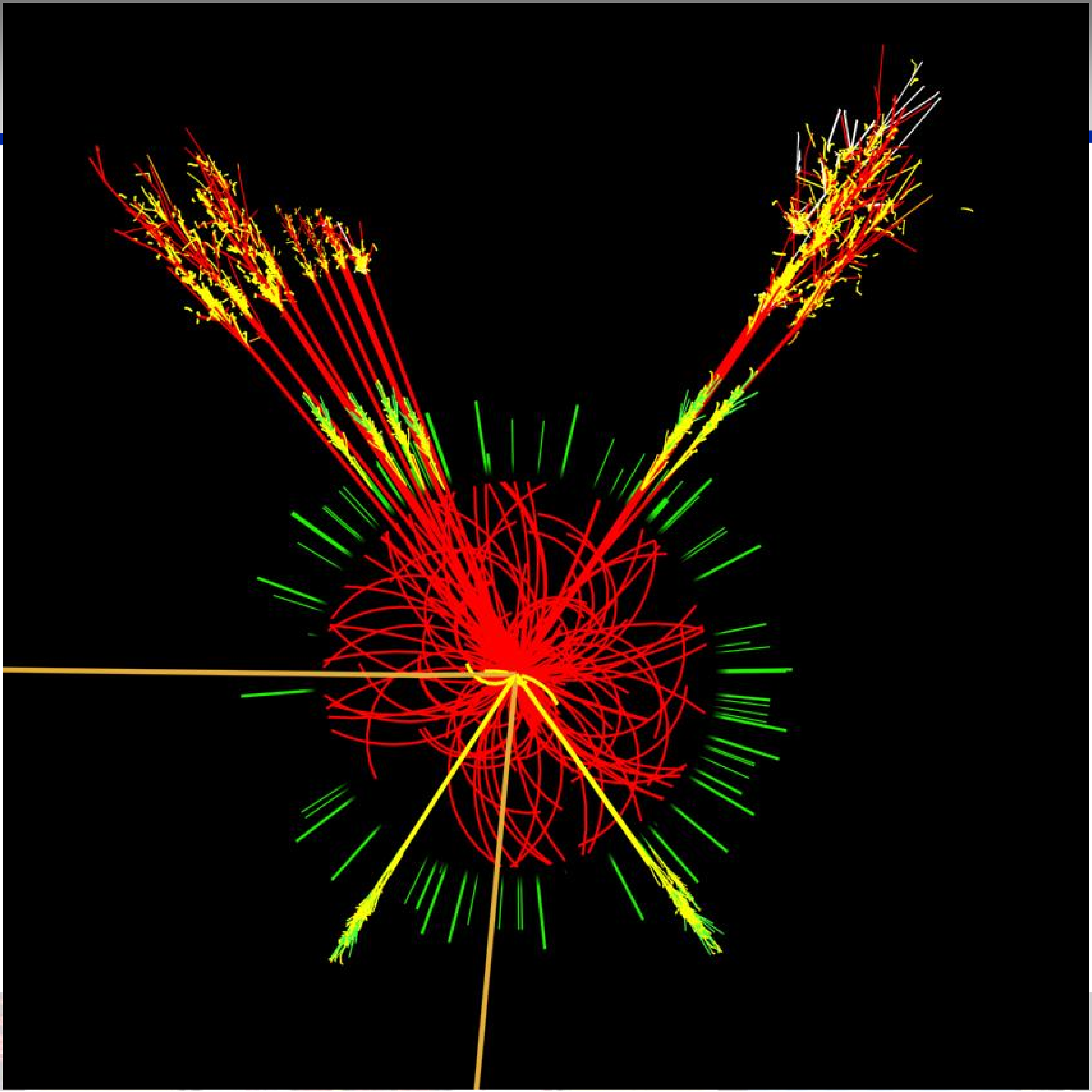
$H \rightarrow Z\ Z$

$Z \rightarrow e^- e^+$

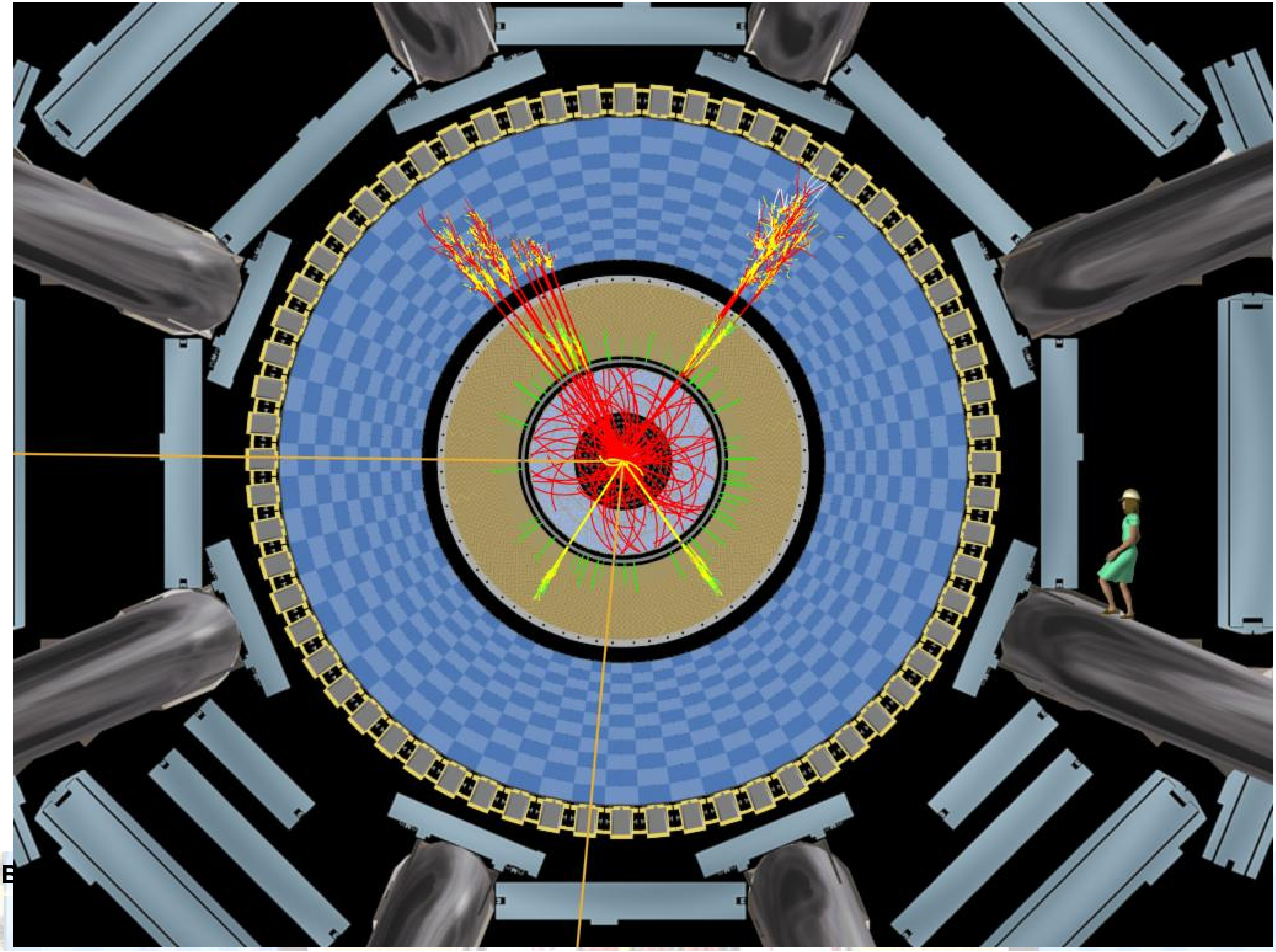
$Z \rightarrow \mu^- \mu^+$



New Higgs Event Images



New Higgs Event Images



Three Users organizations are going to DC

March 12-14

- Legislative: Capitol Hill
- Executive: OMB/OSTP
- Agencies: DOE and NSF

Please Support
High Energy Physics (HEP)
through the
Dept. of Energy Office of Science
and the
National Science Foundation

"The U.S. stands at a pivotal point in our history. Competition is heating up around the world.... The only way we can hope to compete is with brains and ideas that set us above the competition- and that only comes from investments in education and R&D." - Dec 2007

Craig Barrett, Chairman and CEO, Intel Corporation

Our Request: The early enactment of the two science appropriations bills (Energy & Water and Commerce, Justice & Science) with needed funding increases for HEP would restore the health of the nation's science program in line with the America COMPETES Act vision of doubling of support for the physical sciences.

	DOE Office of Science	For HEP	NSF	For HEP
FY07 Budget	$3.8 billion	$752 million	$5.9 billion	$85.0 million
FY08 Omnibus	$4.0 billion	$689 million	$6.1 billion	$87.4 million
FY09 Proposed	$4.7 billion	$805 million	$6.9 billion	not decided

Discovery Research for Innovation

Our tools include accelerators and detectors that serve as the ultimate microscopes.

- We work with industry and medicine to devise practical applications: for example, magnets and detectors for medical imaging.
- The requirements of our experiments push our industrial partners to develop new capabilities.
- We created the World Wide Web to manage the demand of far-flung collaborations
- We are pioneering new means to harness the power of widespread complexes of computers.

Preparing the Workforce for the 21st Century

- We promote science education for K-12 students. Our education programs receive national recognition.
- Our facilities attract scientific and technical expertise from around the world to the U.S..
- Our work inspires and attracts young people into scientific and technical careers.
- We educate a skilled workforce. Our graduates apply their skills in advanced fields from medicine and industry, to defense and finance, as well as in education and basic research. FNAL and SLAC sponsored more than 10% of all U.S. physics PhDs.

We are 5000 Scientists from U.S. Universities and Labs

Represented by Users' Organizations of the Fermi National Accelerator Laboratory (FNAL), Stanford Linear Accelerator Center (SLAC), and Large Hadron Collider (LHC) in the US

What We Do

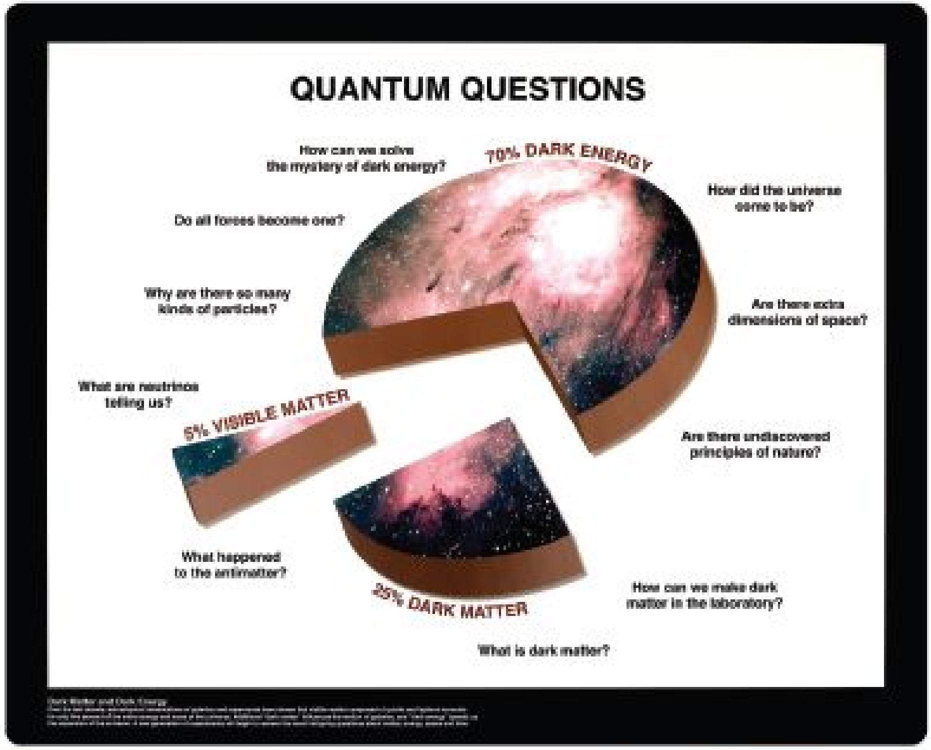
Elementary particle physics studies the nature of matter, space, time and energy. We answer questions such as:

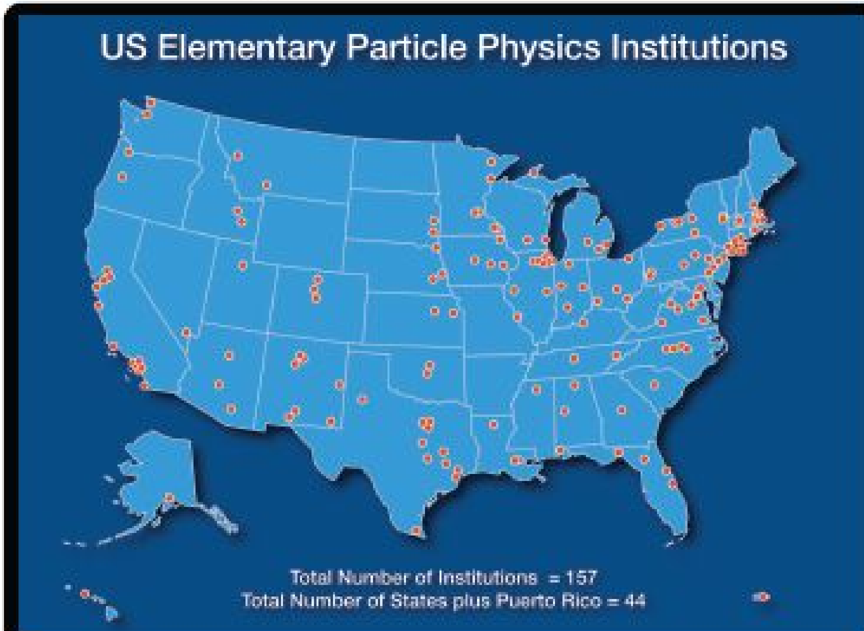
- What are the universe's fundamental constituents and forces?
- What are dark energy and dark matter?
- How did the universe lose its antimatter?
- Are there extra dimensions of space, time?

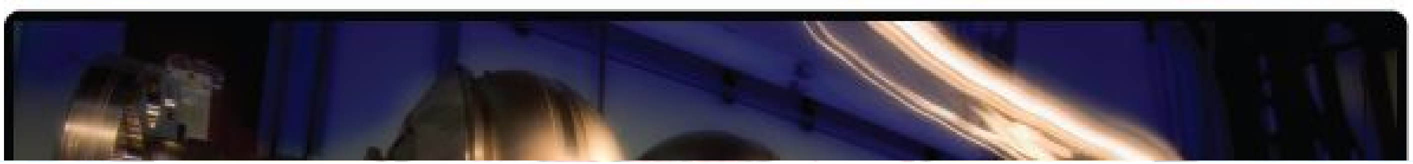
The Department of Energy's Office of Science and the NSF build and operate the world's finest suite of scientific facilities and instruments that researchers depend on to extend the frontiers of science. Each year, these facilities are used by researchers and students from universities across the country.

America COMPETES Act

We applaud the Congress for recognizing the fundamental role played by basic research in the physical sciences as expressed in the America COMPETES Act. Early enactment of these recommendations for the two science appropriations bills outside a continuing resolution would ameliorate the impact of the 2008 Omnibus Bill.


QUANTUM QUESTIONS
How can we solve the mystery of dark energy?
70% DARK ENERGY
How did the universe come to be?
Do all forces become one?
Why are there so many kinds of particles?
Are there extra dimensions of space?
What are neutrinos telling us?
5% VISIBLE MATTER
Are there undiscovered principles of nature?
What happened to the antimatter?
How can we make dark matter in the laboratory?
25% DARK MATTER
What is dark matter?


US Elementary Particle Physics Institutions
Total Number of Institutions = 157
Total Number of States plus Puerto Rico = 44



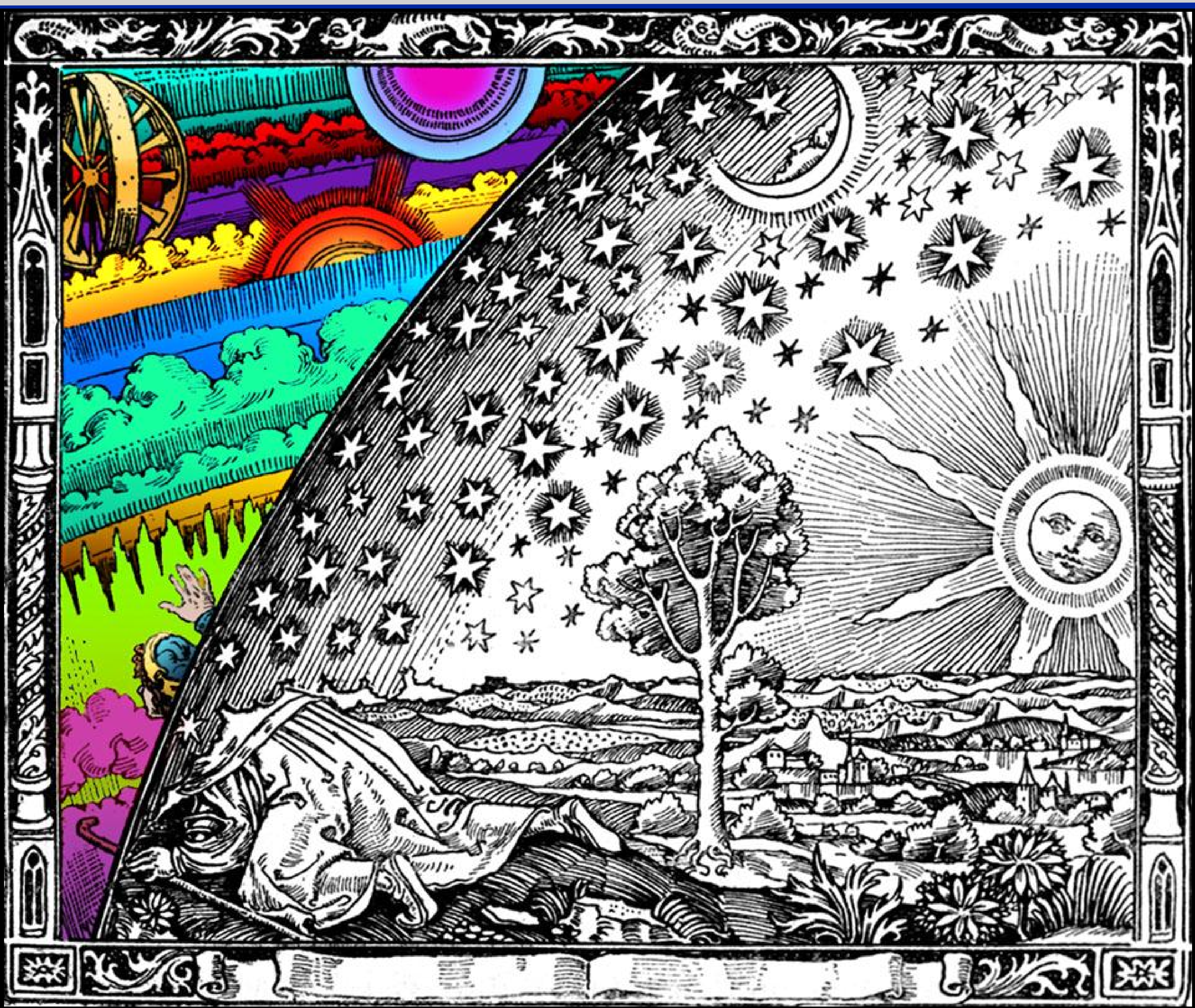
Going to DC

Our Request: The early enactment of the two science appropriations bills (Energy & Water and Commerce, Justice & Science) with needed funding increases for HEP would restore the health of the nation's science program in line with the America COMPETES Act vision of doubling of support for the physical sciences.

	DOE Office of Science	For HEP	NSF	For HEP
FY07 Budget	$3.8 billion	$752 million	$5.9 billion	$85.0 million
FY08 Omnibus	$4.0 billion	$689 million	$6.1 billion	$87.4 million
FY09 Proposed	$4.7 billion	$805 million	$6.9 billion	not decided

LHC Physics in Art and Literature

Extra Dimensions in Art



Extra Dimensions in Art

in art

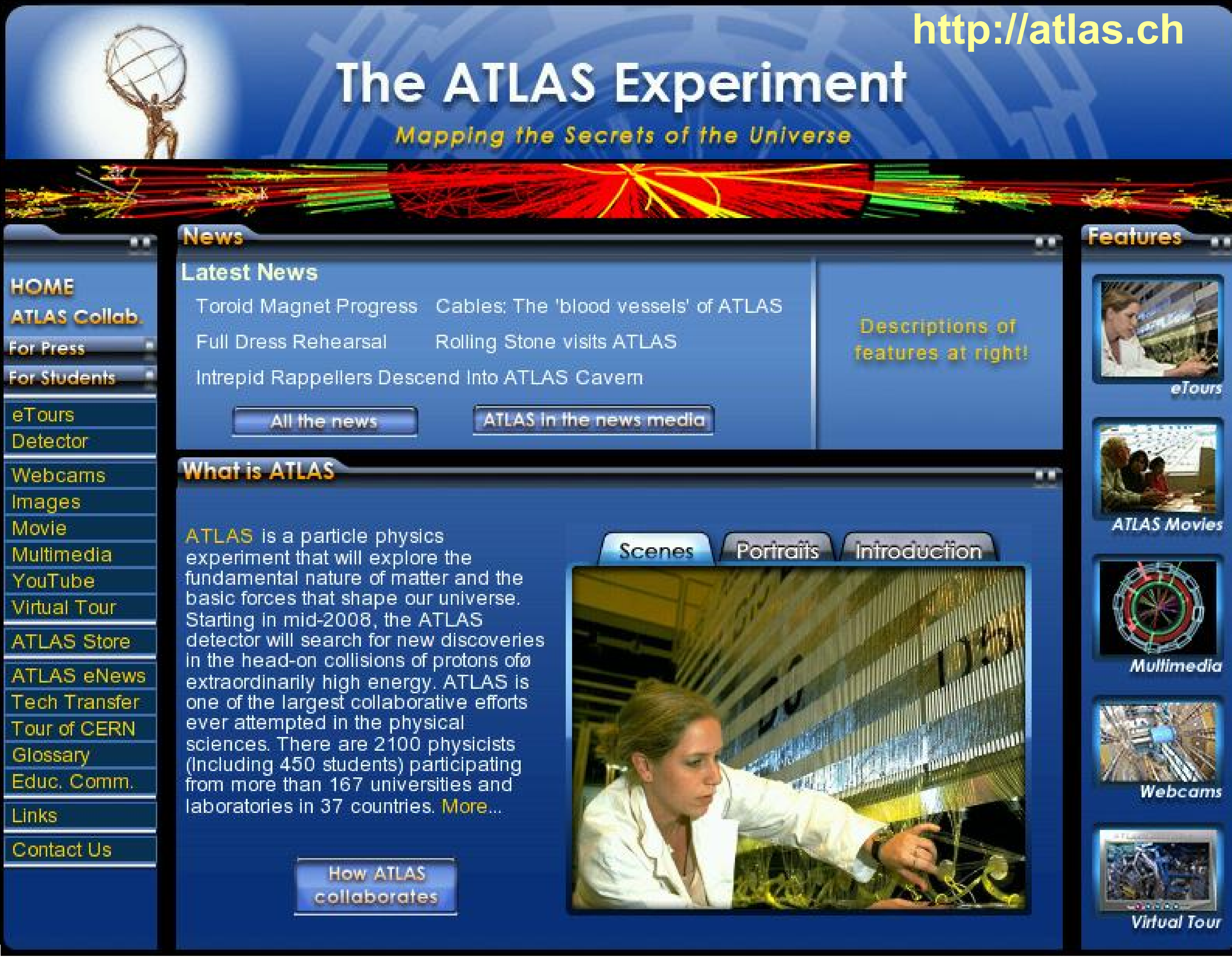
SALVADOR DALI –
TO RESEARCH OF THE 4TH DIMENSION

(Dora Maar series)

Extra Dimensions in Literature

in literature

Narnia



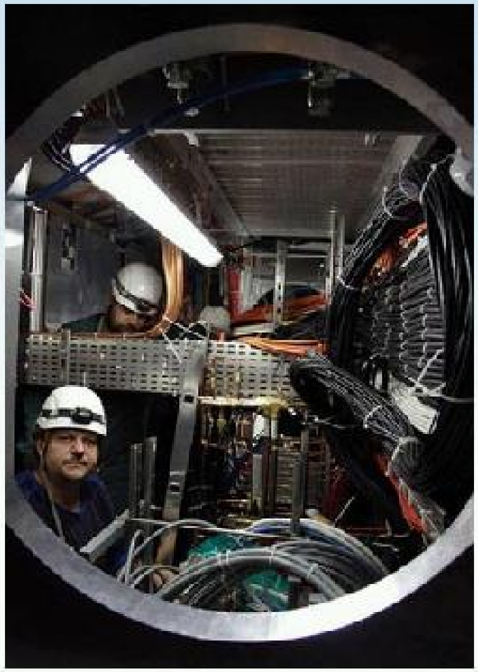
http://atlas.ch
The ATLAS Experiment
Mapping the Secrets of the Universe
HOME
ATLAS Collab.
For Press
For Students
eTours
Detector
Webcams
Images
Movie
Multimedia
YouTube
Virtual Tour
ATLAS Store
ATLAS eNews
Tech Transfer
Tour of CERN
Glossary
Educ. Comm.
Links
Contact Us
News
Latest News
Toroid Magnet Progress
Cables: The 'blood vessels' of ATLAS
Full Dress Rehearsal
Rolling Stone visits ATLAS
Intrepid Rappellers Descend Into ATLAS Cavern
All the news
ATLAS in the news media
Descriptions of features at right!
What is ATLAS
ATLAS is a particle physics experiment that will explore the fundamental nature of matter and the basic forces that shape our universe. Starting in mid-2008, the ATLAS detector will search for new discoveries in the head-on collisions of protons ofø extraordinarily high energy. ATLAS is one of the largest collaborative efforts ever attempted in the physical sciences. There are 2100 physicists (Including 450 students) participating from more than 167 universities and laboratories in 37 countries. More...
How ATLAS collaborates
Scenes
Portraits
Introduction
Features
eTours
ATLAS Movies
Multimedia
Webcams
Virtual Tour

News of The ATLAS Experiment

Mapping the Secrets of the Universe

RSS 2.0
Coming soon

Featured Story



Cables: The 'blood vessels' of ATLAS

The cables within the ATLAS detector may be thought of as the blood vessels and nervous system of the experiment; they carry power to the detector, they deliver messages to control its functions and they relay the data taken, ready for analysis. Just as blood vessels and nerves criss–cross and connect the organs and tissues of the human body, cables penetrate the whole of the ATLAS volume, reaching each and every one of its elements.

[January 2008]

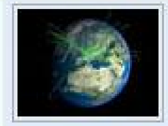
More on this story...

Other Headlines

Progress on Toroid Magnets
[December 2007]

Rolling Stone Brazil visits ATLAS
[December 2007]

Dress Rehearsal for ATLAS debut
[December 2007]

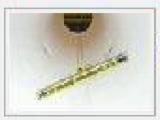


Norwegian teachers visit ATLAS
[December 2007]

Pixel detector lowered into the cavern and installation completed.
[28 June 2007]

Earlier Headlines...

ATLAS video features

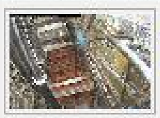


The pixel detector is lowered into the ATLAS cavern

Muon wheel

Toroid magnet

ATLAS webcams



View what's happening in the ATLAS cavern with the ATLAS webcams.

ATLAS detector overview

Learn about the different major systems of ATLAS and see how they work.

Earlier Headlines

Features

Featured ATLAS profiles

Weina Ji

The prospect of a life full of challenges is what brought Weina Ji to study physics...

Other LHC News

CERN press releases
CMS Experiment news

FAQs

View ATLAS FAQs

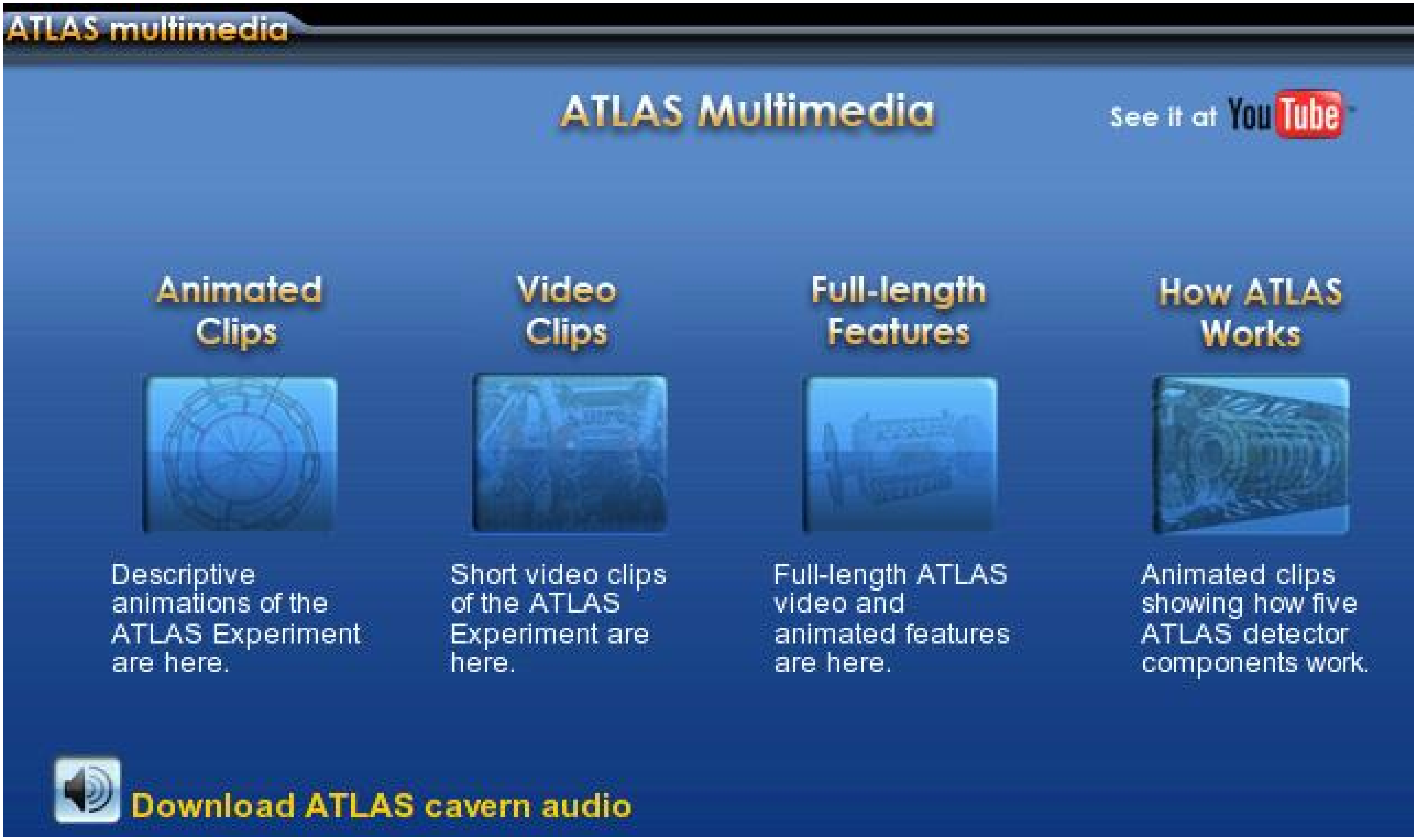
Send your question to us!
Name:

Question:

Send Reset

ATLAS in the news

ATLAS Multimedia



ATLAS on YouTube

YouTube.com/TheATLASExperiment

18 videos now.

Most viewed has 11,000 viewings.

Most have 4.5 of 5 stars ratings

Hits on ATLAS Website

Year	Hits	
1999	112,694	+++
2000	183,669	+++++
2001	287,992	++++++++
2002	390,541	++++++++++
2003	505,549	+++++++++++++
2004	519,731	+++++++++++++
2005	579,186	+++++++++++++++
2006	911,122	+++++++++++++++++++++++
2007	1,263,358	++++++++++++++++++++++++++++++++

LHC Schedule

LHC Commissioning with beam is now planned for May 2008. It will be performed in well-defined stages:

- Stage A: Initial commissioning with a single bunch moving towards 43 on 43 (moving to 156 on 156) with moderate intensities. First collisions un-squeezed; followed by partial squeeze. (LHC initial commissioning - draft project note)
- Stage B: Move to 75 ns. bunch spacing with the aim of moving to intensities around 3 - 4 10^{10} particles per bunch
- Stage C : Move to 25 ns. with the aim of moving to intensities around 3 - 4 10^{10} particles per bunch. Would need to be followed by long shutdown for installation of phase 2 collimation and additional beam dump dilutors.
- Stage D: Nominal 25 ns running pushing towards design intensity and full squeeze.

The 450 GeV Calibration Run planned for November 2007 which aimed to establish first beam collisions at a centre of mass energy of 0.9 TeV has been put on ice. However, collisions are still planned at 450 GeV as we go for 7 TeV in 2008 and the requisite commissioning described above is still valid.

The Sector test has been detailed at great length, and, although not on the present schedule, is being held in reserve should a window of opportunity develop.

LHC Schedule

Evolution of stages (necessarily speculative)

Stage	Estimated time	Comment
Stage A: establish first collisions	2 months	1 month beam time, 50% machine availability
Stage A: pilot physics	1 month	crossing angle off, max 156 bunches, might expect 10^{31} cm-2s-1 and around 3 pb-1 *156x156 at 1e32 will be a very important achievement, but just a milestone on the road toward 1e33 luminosity. No many-month long physics run with 156x156 will be planned, unless unexpected limitations are found during commissioning.*
Stage B: 75 ns - commissioning	2 weeks	Interleaved with physics
Stage B: 75 ns - physics	1 month	Gradual increase in intensity, squeeze 5 x 10^32 cm-2s-1
Stage C: 25 ns physics		Intensity limited, 10^33 cm-2s-1 would be good

LHC Commissioning

Stage A: Performance

	beta* [m]	Bunch intensity	Luminosity [$cm^{-2}s^{-1}$]	Event rate/cross
1 x 1	18	10^{10}	10^{27}	low!
43 x 43	18	$3\ 10^{10}$	$3.8\ 10^{29}$	0.05
43 x 43	4	$3\ 10^{10}$	$1.7\ 10^{30}$	0.21
43 x 43	2	$4\ 10^{10}$	$6.1\ 10^{30}$	0.76
156 x 156	4	$4\ 10^{10}$	$1.1\ 10^{31}$	0.38
156 x 156	4	$9\ 10^{10}$	$5.6\ 10^{31}$	1.9
156 x 156	2	$9\ 10^{10}$	$1.1\ 10^{32}$	3.9

NB: Nominal emittance. Note that to get to 10^{32} with 156 bunches a beam, the experiments' requested maximum ev
of around 2 is exceeded, implying the need to move to 75 ns i.e. stage B.

LHC Schedule

Stage A: How Long?

Assume we slice commissioning procedures to the minimum required to get 2 pilot++ beams to 7 TeV and collide them unsqueezed. From scratch (no sector test, no 450 GeV run):

		Ring factor	Total Time [days] both rings
1	Injection and first turn	2	4
2	Circulating beam	2	3
3	450 GeV - initial	2	4
4	450 GeV - detailed	2	5
5	450 GeV - two beams	1	1
6	Snapback - single beam	2	3
7	Ramp - single beam	2	6
8	Ramp - both beams	1	2
9	7 TeV - setup for physics	1	2
10	Physics un-squeezed	1	-
	TOTAL to first collisions		**30**
11	Commission squeeze	2	6
12	Increase Intensity	2	6
13	Set-up physics - partially squeezed.	1	2
14	Pilot physics run		

We are assuming around 30 days of beam time to get first collisions. With an operational efficiency of 50%, it would take something like 2 months elapsed time. This will be followed by a period of pilot physics interleaved with further machine development.

Stage B: 75 ns

Outline & justification

Pros & cons [ppt]

Performance

	beta* [m]	Bunch intensity	Luminosity $[cm^{-2}s^{-1}]$	Event rate/cross	%Total I
936 x 936	10	$4\ 10^{10}$	$2.3\ 10^{31}$	0.13	0.12
936 x 936	4	$4\ 10^{10}$	$5.6\ 10^{31}$	0.32	0.12
936 x 936	2	$4\ 10^{10}$	$1.1\ 10^{32}$	0.64	0.12
936 x 936	2	$6\ 10^{10}$	$2.5\ 10^{32}$	1.14	0.17
936 x 936	2	$8\ 10^{10}$	$4.5\ 10^{32}$	2.6	0.23
936 x 936	1	$6\ 10^{10}$	$5\ 10^{32}$	2.9	0.17

NB: Nominal emittance, full crossing angle

Stage 3: 25 ns

(NB limited intensity)

Performance

	beta* [m]	Bunch intensity	Luminosity [$cm^{-2}s^{-1}$]	Event rate/cross	%I total
2808 x 2808	4	$4\ 10^{10}$	$1.7\ 10^{32}$	0.32	0.35
2808 x 2808	2	$4\ 10^{10}$	$3.4\ 10^{32}$	0.64	0.35
2808 x 2808	0.55	$4\ 10^{10}$	$1.2\ 10^{33}$	2.3	0.35
2808 x 2808	2	$6\ 10^{10}$	$7.6\ 10^{32}$	1.4	0.52
2808 x 2808	0.55	$6\ 10^{10}$	$2.8\ 10^{33}$	5.2	0.52

NB: Nominal emittance, full crossing angle

LHC Commissioning

Later stage

Stage 4: 25 ns

Performance

	beta* [m]	Bunch intensity	Luminosity [$cm^{-2}s^{-1}$]	Event rate/cross
2808 x 2808	2	$8\ 10^{10}$	$1.4\ 10^{33}$	2.6
2808 x 2808	0.55	$8\ 10^{10}$	$4.9\ 10^{33}$	9.3
2808 x 2808	2	$1.15\ 10^{11}$	$2.8\ 10^{33}$	5.3
2808 x 2808	0.55	$1.15\ 10^{11}$	$1.0\ 10^{34}$	19.3

450 GeV Collisions?

Will be provided for a limited period only (2/3 shifts, maximum a weekend) during the commissioning for 7 TeV

Common view of the experiments: such a run is not required by the experiments.

However, collisions at 900 GeV would be useful, mostly for time alignment.
A short period with such beam conditions is therefore interesting, provided these beam conditions are safe (no compromise on machine & experiment protection) and stable beam conditions declared.

The experiments would not require their magnets to be ON for this short 900 GeV run.

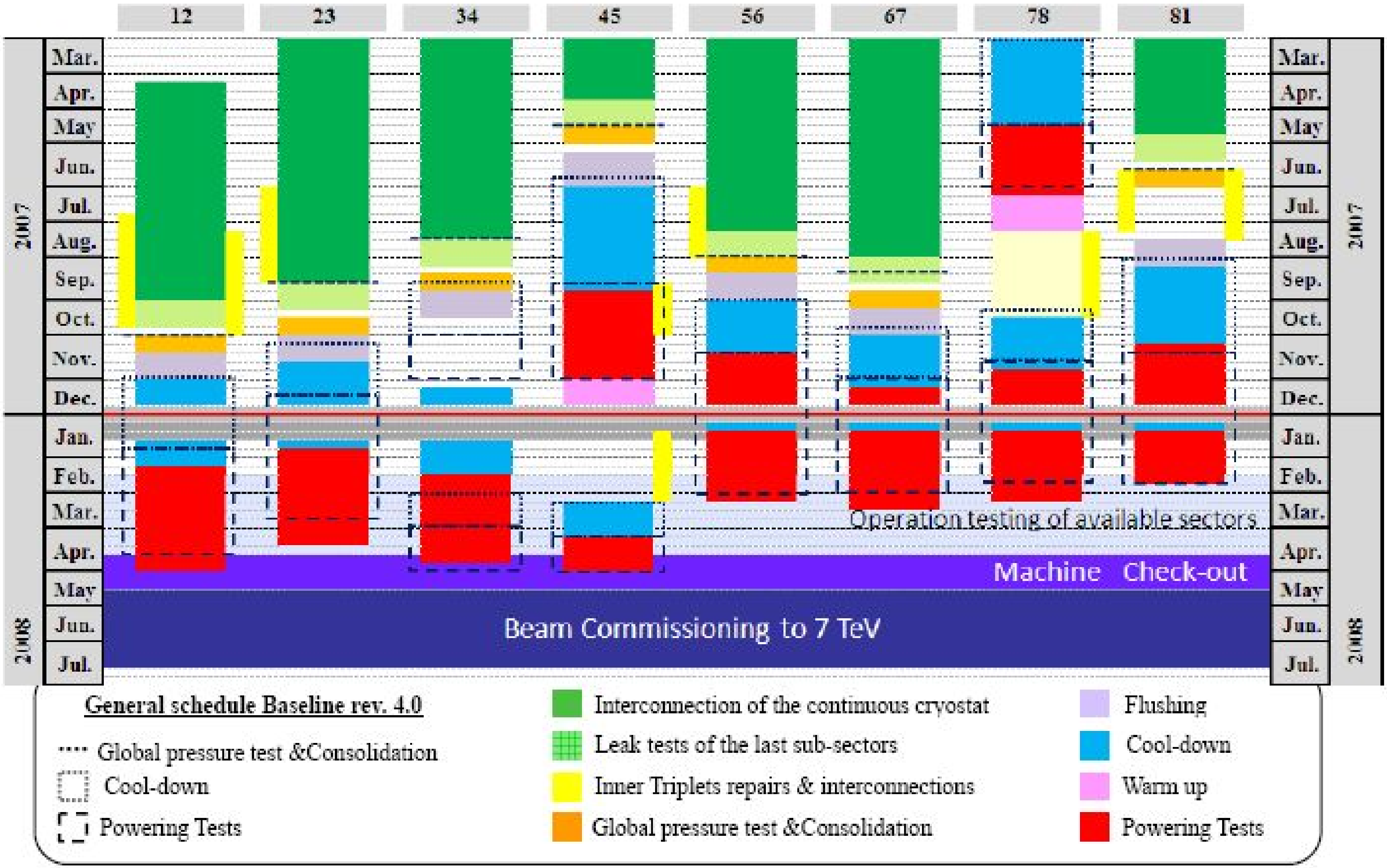
Maximum Energy ?

The general approach is that they only drop from 7 TeV if there is a problem with a magnet
(could be a weak dipole or quad causing problems as push toward11,700 A).

There are limited gains for machine protection by dropping to 6 TeV, for example.
(Factor of two reduction in quench level for an energy reduction of 10%)

Operational procedures will allow to drop from 7 TeV should they need to.

General Schedule up to date – 03 August 2007



LHC Commissioning

All the 182 commissionable SC circuits of S45 were tested

A very important first milestone is now achieved

Sector45 is commissioned at 5.3TeV

with the efforts of many high qualified people

in a tough but very friendly environment

and now…

…let's continue:

Sector56 is at 4K

ATLAS Critical Path items

Pixel Detector – Cables done, Fibers and Cryogenics remain

Tile Calorimeter – drawer refurbishment

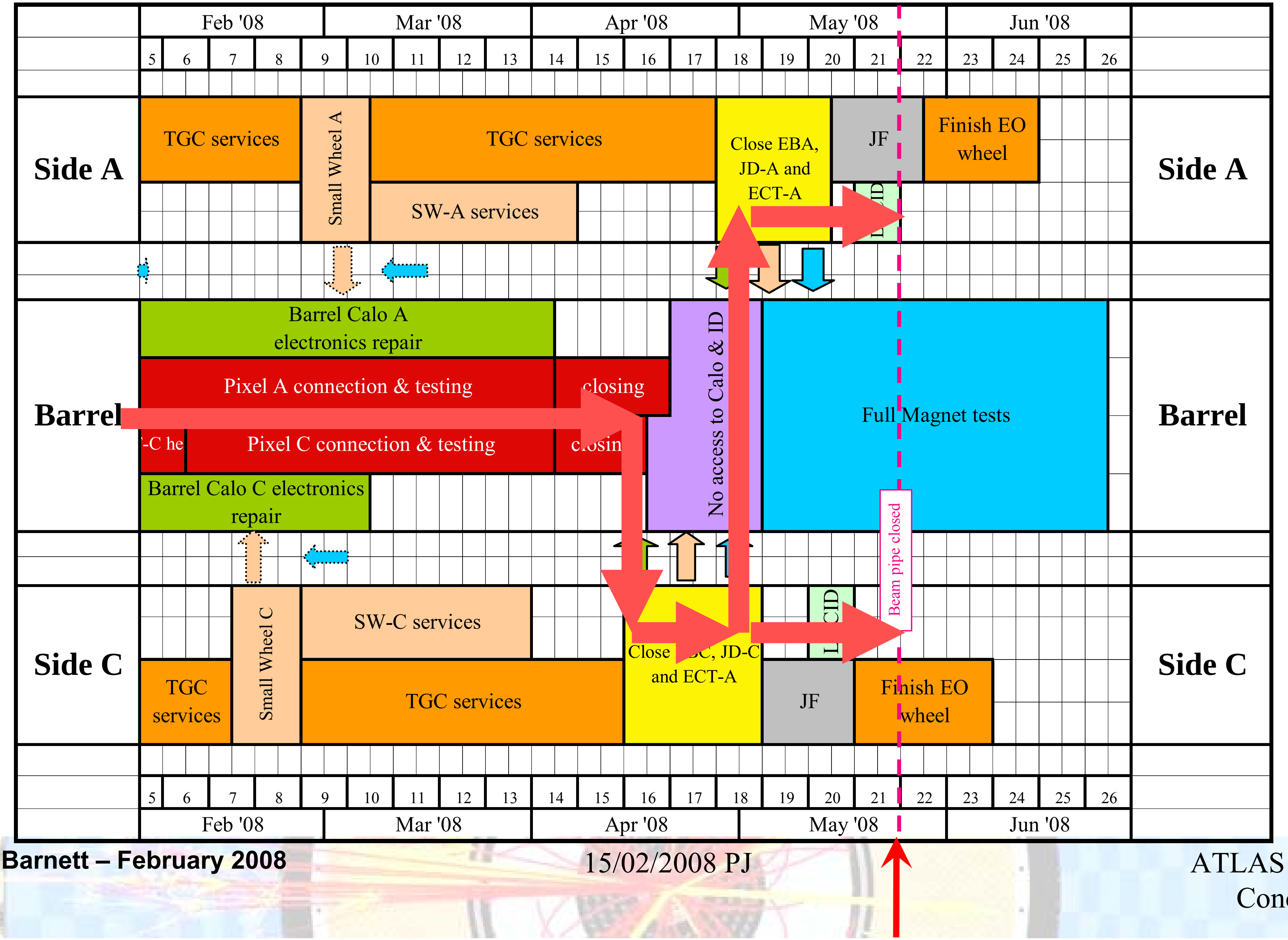
Liquid Argon Cal – Front end boards

Magnet system tests

Similar issues in CMS

Critical Path (to Closing of Beam Pipe)

From M Kotamaki



Early Conditions

Compared to design conditions

- Beam energy likely below 7 TeV.
  - 6 TeV?
  - 6.5 TeV?
- Fewer protons per bunch
- Many fewer bunches
- Head-on collisions

ATLAS EXPERIMENT http://atlas.ch

Definitions and Luminosity

Design Luminosity L:

"Initial" $L = 2\times10^{33}\ cm^{-2}\ s^{-1}$

After three years $L = 10^{34}\ cm^{-2}\ s^{-1}$

femto = 10^{-15}

pico = 10^{-12}

nano = 10^{-9}

Assume

Luminosity $L = 10^{33}\ cm^{-2}\ s^{-1}$

1 barn = $10^{-24}\ cm^2$

1 year = 3×10^7 s (but not all useable)

$10^{33} \times 10^{-24} \rightarrow 10\ \ fb^{-1}\ y^{-1}$ (if year = 1×10^7 s)

Definitions and Luminosity

Assuming $L = 10^{33}\ cm^{-2}\ s^{-1}$

1 year $\longrightarrow$ $10\ fb^{-1}$

1 month $\longrightarrow$ $1\ fb^{-1}$

1 week $\longrightarrow$ $0.2\ fb^{-1} = 200\ pb^{-1}$

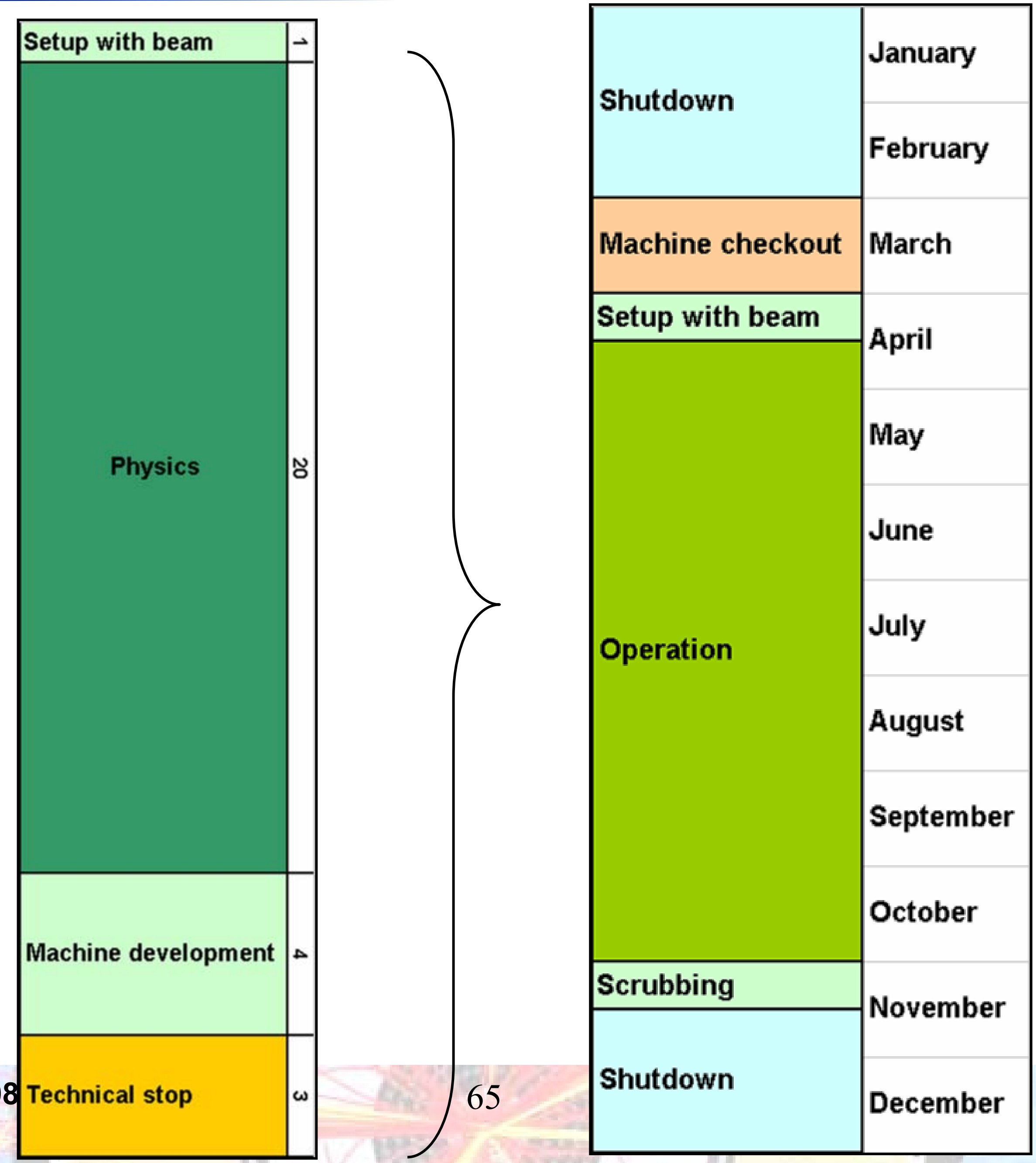
Initial 2008 run

Assuming $L = 10^{31}\ cm^{-2}\ s^{-1}$

3 months $\longrightarrow$ $0.03\ fb^{-1} = 30\ pb^{-1}$

but this is a guess.

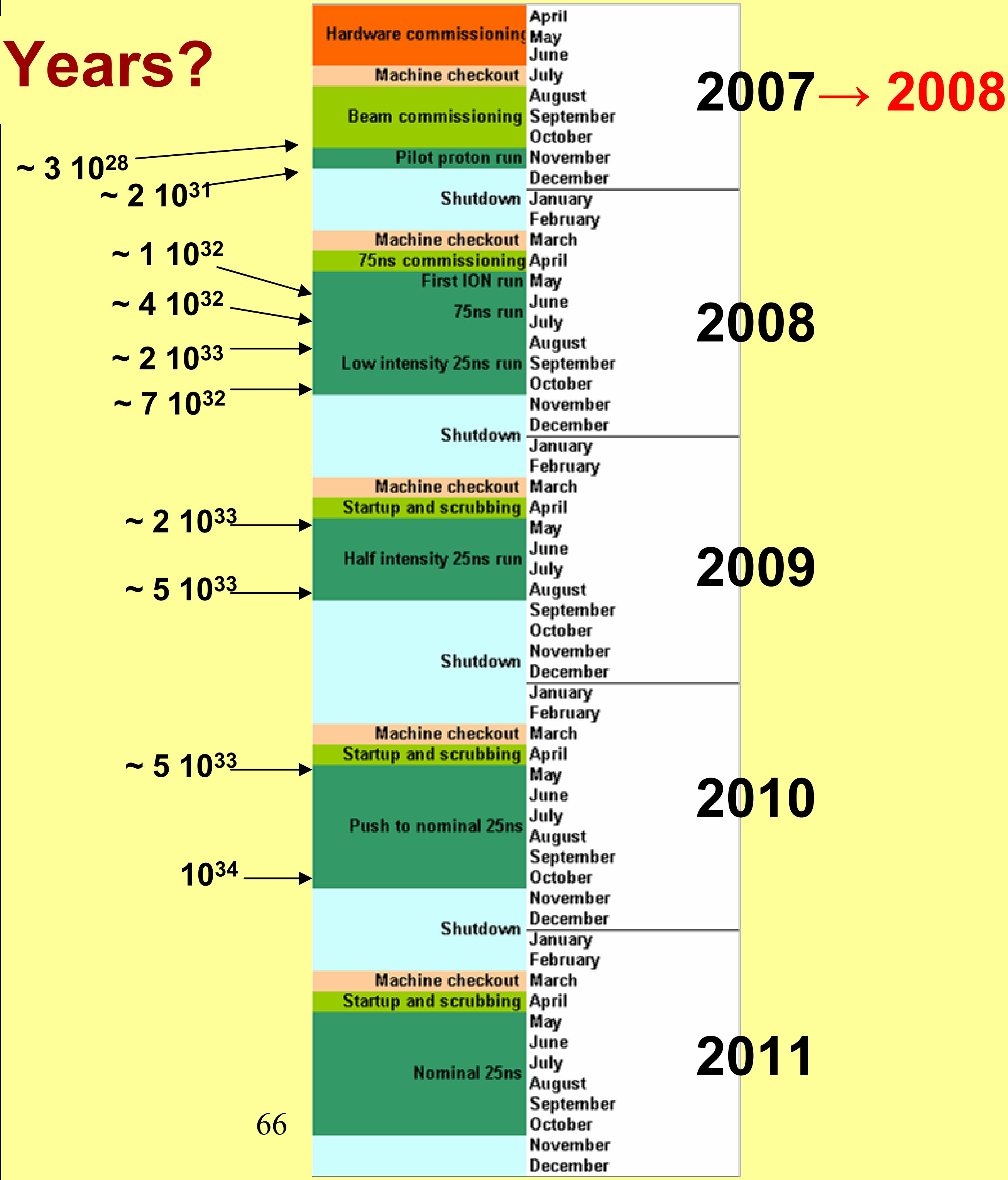
Typical Year



The First Years?

A slide I made in 2005.

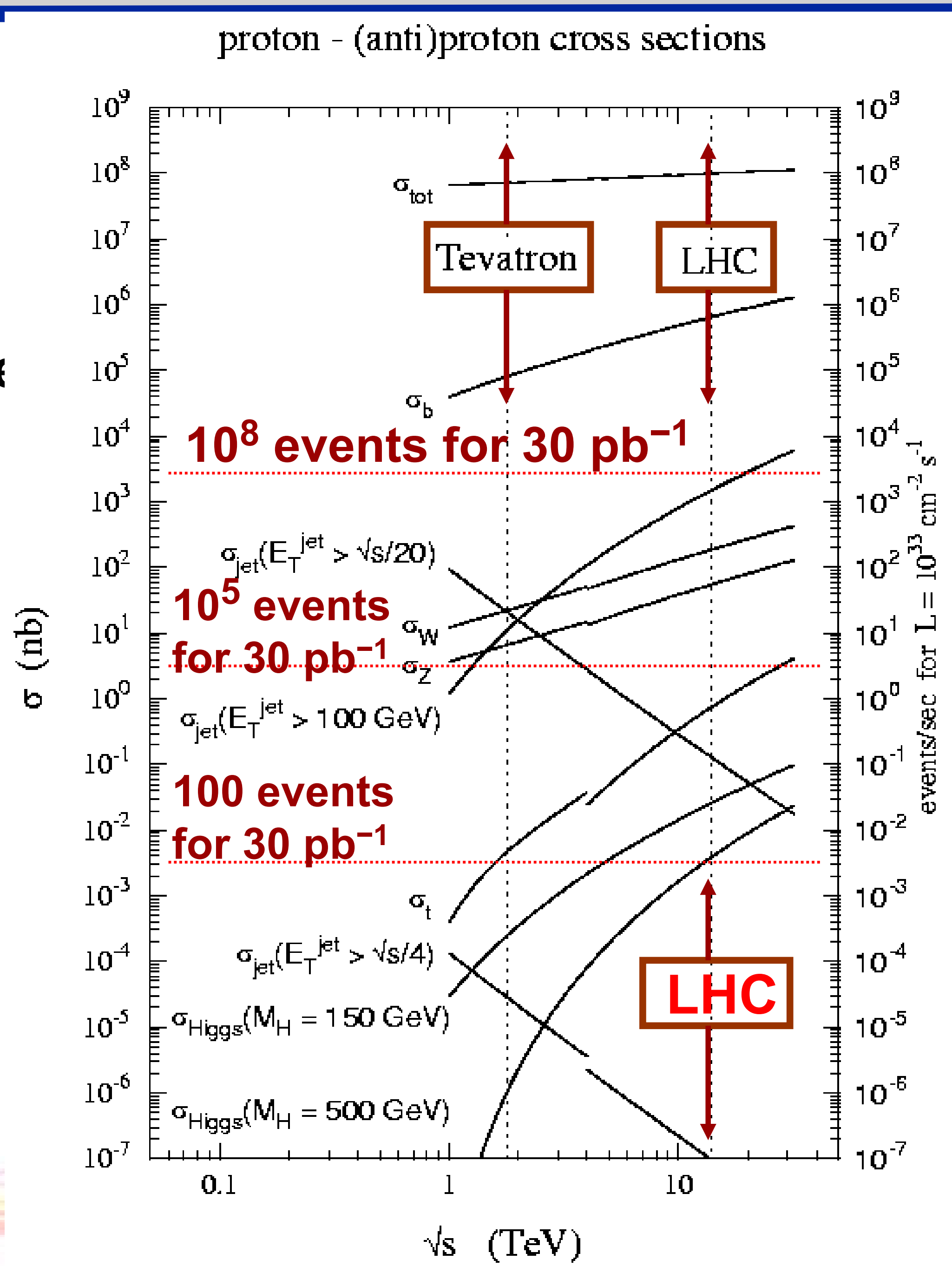
Works well if you add on one year



2008 Integrated Luminosity?

- Very hard to estimate.
- Roughly 30 pb^{-1}
- What physics can be done

These rates should be multiplied by branching ratios and efficiencies.



Some Rates for year 1 and year 2

Channel	# of Events — 30 pb^{-1} (pilot run)	# of Events — 300 pb^{-1} (year 2?)
$W \rightarrow \mu\, \nu$	200,000	2,000,000
$Z \rightarrow \mu\mu$	30,000	300,000
t tbar $\rightarrow \mu$ + X	2400	24,000
QCD jets P_T>150 GeV	30,000 (for 10% of trigger bandwidth)	300,000 (for 10% of trigger bandwidth)
Minimum bias	Trigger limited	
gluino-gluino, M~ 1TeV	30-300	300-3000

Taken from table in hep-ph/0504221

The Cynic's View

Three slides from Greg Landsberg (Brown University) who is in D0 and CMS experiments

Hadron Colliders: a Brief History

CERN $Sp\bar{p}S$

- Energy increase: x10 (ISR)
- First physics run: December 1981 (20 μb^{-1})
- First high-luminosity run: 1983 (120 nb^{-1})
- Total statistics: ~5 pb^{-1}
- Discoveries: W/Z (20 nb^{-1})
- Discovery paper: 1983
- First publication: 1981 (Particle multiplicity)
- Miscoveries: top (1984), SUSY (1985)

Fermilab Tevatron I

- Energy increase: x3 ($Sp\bar{p}S$), similar to LEP/SLC
- First physics run: Summer 1987 (20 nb^{-1})
- First high-luminosity run: 1992-1994 (15 pb^{-1})
- Total statistics: 130 pb^{-1}
- Discoveries: top (60 pb^{-1})
- Discovery paper: 1995
- First publication: 1988 (Particle p_T spectra)
- Miscoveries: quark substructure (1996)

HERA

- Energy increase: x1000 (unique beams)
- First physics run: May 1992 (25 nb^{-1})
- First high-luminosity run: 1993 (15 pb^{-1})
- Total statistics: 200 pb^{-1}
- Discoveries: none
- Discovery paper: n/a
- First publication: 1992 (σ_{tot} (γp) @ $\sqrt{s}$=210 GeV)
- Miscoveries: leptoquarks (1997)

- Run II Stats
  - Start: March 2001
  - Physics running: September 2001
  - First physics @ conferences: Summer 2002
  - First CDF publication ($M(D^{+}_{s})-M(D^{+})$): 2003
  - First DØ publication (H++ search): 2004
  - First realistic jet energy scale: 2002
  - First cross section publication: 2004 (top)
  - First precision measurement (top mass): 2005
  - First jets + ME_T paper: 2006 (?)

The Discovery of SUSY

EXPERIMENTAL OBSERVATION OF EVENTS WITH LARGE MISSING TRANSVERSE ENERGY ACCOMPANIED BY A JET OR A PHOTON(S) IN $p\bar{p}$ COLLISIONS AT $\sqrt{s}$ = 540 GeV

[PL, **139B**, 115 (1984)]

UA1 Collaboration, CERN, Geneva, Switzerland

Abstract

We report the observation of five events in which a missing transverse energy larger than 40 GeV is associated with a narrow hadronic jet and of two similar events with a neutral electromagnetic cluster (either one or more closely spaced photons). We cannot find an explanation for such events in terms of backgrounds or within the expectations of the Standard Model.

G. Landsberg

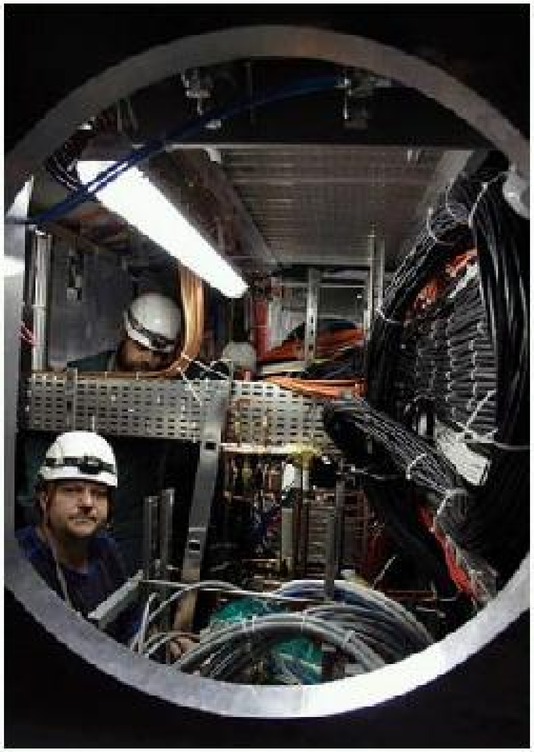
ATLAS news for the public

ATLAS | News Home

Cables: The "blood vessels" of ATLAS

January 2008

The cables within the ATLAS detector may be thought of as the blood vessels and nervous system of the experiment; they carry power to the detector, they deliver messages to control its functions and they relay the data taken, ready for analysis. Just as blood vessels and nerves criss–cross and connect the organs and tissues of the human body, cables penetrate the whole of the ATLAS volume, reaching each and every one of its elements.



Installing cabling for the Inner Detector

Even armed with the knowledge that the ATLAS detector at CERN is one of the largest particle physics experiments ever attempted, the sheer scale of the cabling system is difficult to imagine. For example, more than 25,000 optical fibre channels are used just to deliver information and crucial timing signals. Over the last two and a half years, the total number of cables fitted, excluding the local cables preinstalled on the sub–detectors, is almost 50,000. If laid end–to–end, these would stretch from Los Angeles to Boston, having a length approaching 3000km. Completing the job would have taken one person over fifty years to complete; a whole lifetime's work.

The ubiquity of the cabling system means that ATLAS developers have had to carefully consider the design of the various lines, pipes, and cables since the very outset. It would be foolish to build a city without simultaneously constructing roads for its inhabitants to get from A to B. The same holds true for these essential routes for power and information flow through the ATLAS detector.

Featured ATLAS Profile

Weina Ji

The prospect of a life full of challenges is what brought Weina Ji to study physics at the University of Nanjing, in China. However besides the intellectual stimulation that physics provides, she also describes the field as 'useful'. "The logic that you develop while learning physics can also be applied outside this particular world if later on you don't continue in this career," she says.

Having finished her physics degree, Weina is now a graduate student at the department of high energy physics at Lund University in Sweden. Her PhD thesis involves research for various projects within the ATLAS collaboration.

When she learnt about CERN as an undergraduate student, Weina was immediately drawn to its impressive international network. The desire to, at some point, take part in this world-wide effort is what brought Weina all the way from China to Sweden: "Being based at Lund offered me the chance to be closer to the construction of the Large Hadron Collider and the experiments, such as the ATLAS detector," she says.

Initially, moving from a large city in China to a small city in Sweden was a big change for Weina. But she adapted fast to her new home thanks to the friends she made with her international colleagues, and also among the Chinese community in Lund. "It's easier to get over feelings of missing home with the good friends I have here," she says. Weina and her parents also found the way to stay very close thanks to the new technologies: "We do video-conferences every week, as I see their faces, it helps me not to miss them as much as if I could not see them at all."

She also has some other personal strategies for fighting homesickness, such as reading as much Chinese literature as she can. "My favourite books are the classics," she says. One of her favourites books is the "Dream of the Red Chamber" regarded as one of the masterpieces of Chinese fiction, composed sometime in the middle of the 18th century.

Another challenge she had to overcome when she just arrived to Europe was the English language

News of The ATLAS Experiment

Mapping the Secrets of the Universe

RSS 2.0
Coming soon

Featured Story

Intrepid Rappellers Descend Into ATLAS Cavern

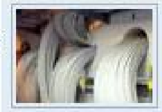
It could be a scene from a James Bond movie. But this action shot of two intrepid rappellers (abseilers) was in fact taken in the ATLAS experimental cavern one night in December. François Butin, the ATLAS experimental area manager, tells the story behind the photograph.

[February 2008]

More on this story...

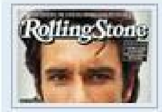
Other Headlines

Cables: The 'blood vessels' of ATLAS
[January 2008]

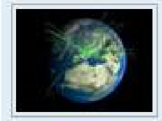


Progress on Toroid Magnets
[December 2007]

Rolling Stone Brazil visits ATLAS
[December 2007]



Dress Rehearsal for ATLAS debut
[December 2007]



Norwegian teachers visit ATLAS
[December 2007]

Earlier Headlines...

ATLAS video features

The pixel detector is lowered into the ATLAS cavern

Muon wheel

Toroid magnet

ATLAS webcams

View what's happening in the ATLAS cavern with the ATLAS webcams.

ATLAS detector overview

Learn about the different major systems of ATLAS and see how they work.

Earlier Headlines

- ATLAS remembers Turkish colleagues who perished in plane crash

Features

Featured ATLAS profiles

Read about Weina

Weina Ji

The prospect of a life full of challenges is what brought Weina Ji to study physics...

Other LHC News

CERN press releases
CMS Experiment news

FAQs

View ATLAS FAQs

Send your question to us!
Name:
Question:

Send Reset

ATLAS in the news

Featured Story

Intrepid Rappellers Descend Into ATLAS Cavern

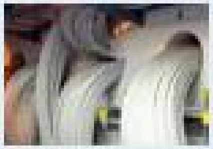
It could be a scene from a James Bond movie. But this action shot of two intrepid rappellers (abseilers) was in fact taken in the ATLAS experimental cavern one night in December. François Butin, the ATLAS experimental area manager, tells the story behind the photograph.

[February 2008]

More on this story...

Other Headlines

Cables: The 'blood vessels' of ATLAS
[January 2008]



Progress on Toroid Magnets
[December 2007]

Rolling Stone Brazil visits ATLAS
[December 2007]

Dress Rehearsal for ATLAS debut
[December 2007]

Norwegian teachers visit ATLAS
[December 2007]

Earlier Headlines...

Intrepid Rappellers Descend Into ATLAS Cavern

Feburary 2008

It could be a scene from a James Bond movie. But this action shot of two intrepid rappellers (abseilers) was in fact taken in the ATLAS experimental cavern one night in December. François Butin, the ATLAS experimental area manager, tells the story behind the photograph.

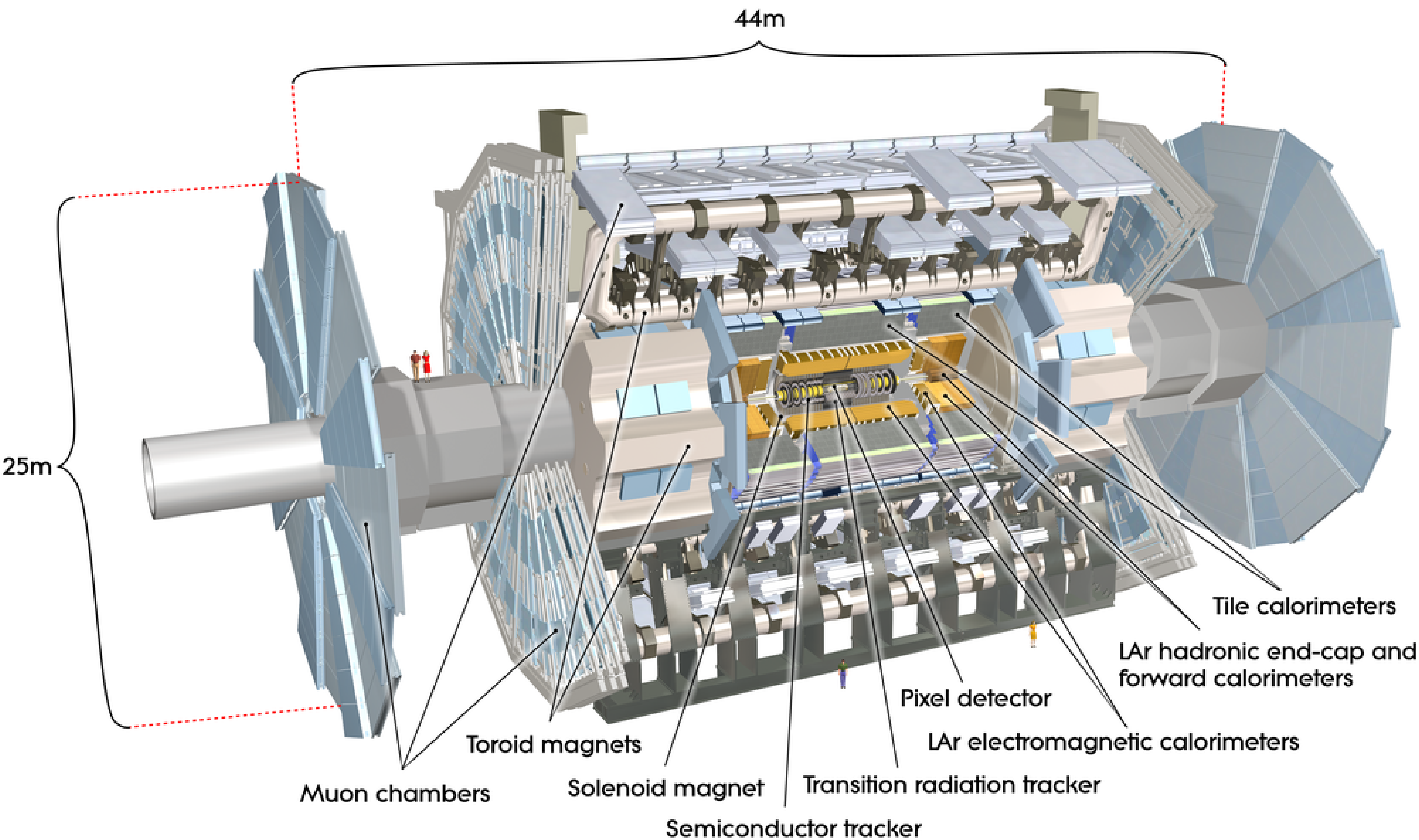
Descending into the cavern

The excavation of the ATLAS cavern began in 2000, but at that time the LHC tunnel, which now opens into the cavern, was still being used by an earlier accelerator (called LEP) and couldn't be disturbed. "In order not to lose a full year of excavation work we decided to concrete the shallow area we had excavated," he says. That concrete was later to form the cavern ceiling.

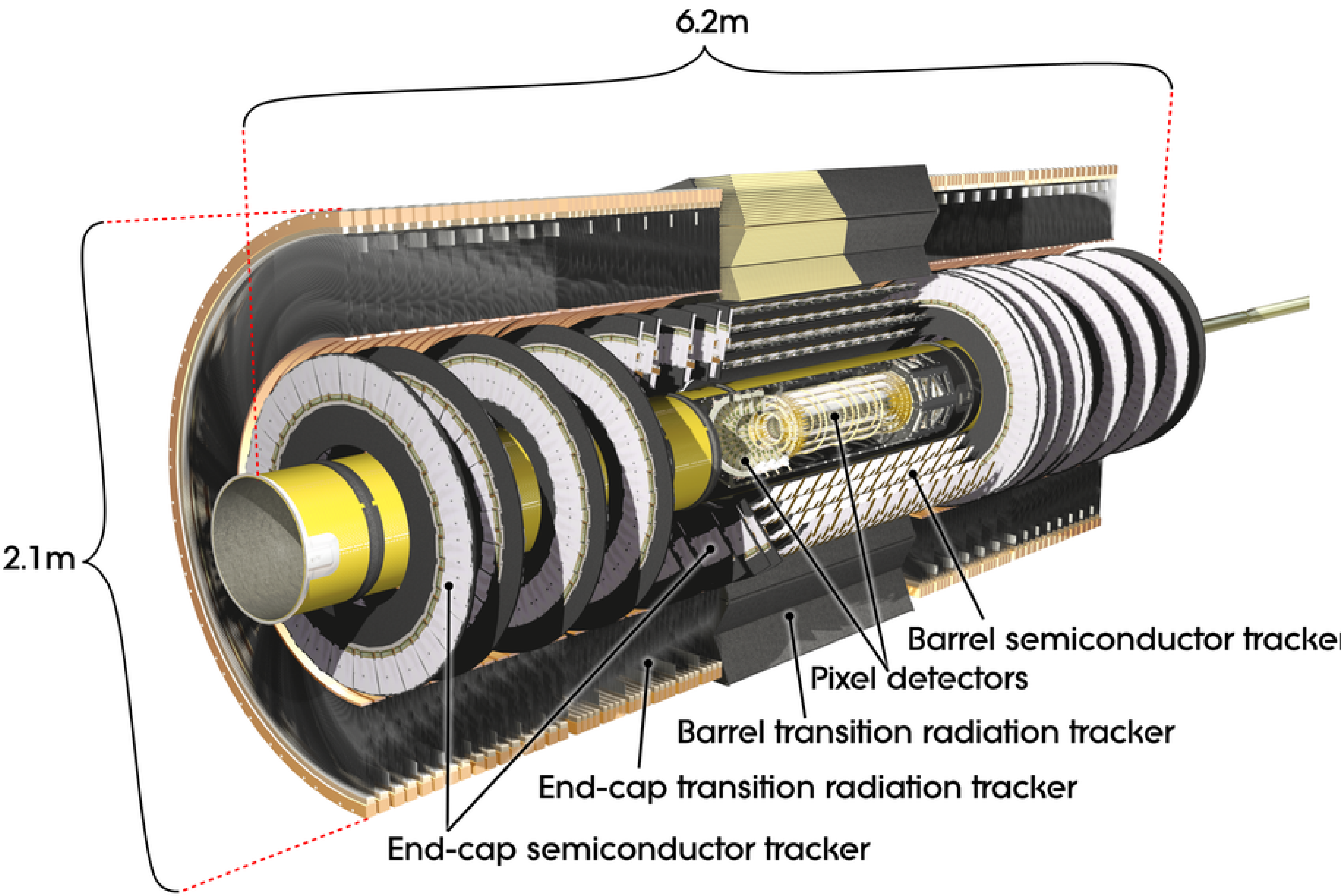
Excavation resumed in 2001 with the removal of the earth beneath the ceiling. "Nobody would build like this normally," says Butin. "It's like building the roof of your house before the walls." To prevent the concrete ceiling from collapsing as the excavation work continued, it was secured with cables to small anchoring galleries in the two access shafts that connect the cavern to the surface. Four galleries - two in each shaft - were used to support the entire cavern ceiling.

The excavation work proceeded well and the ATLAS collaboration took possession of the cavern in 2003. But a problem soon emerged. "A water leak appeared in an anchoring gallery in Side A," says Butin. "We tried to inject resin to plug the leak, but after a while the leak appeared somewhere else."

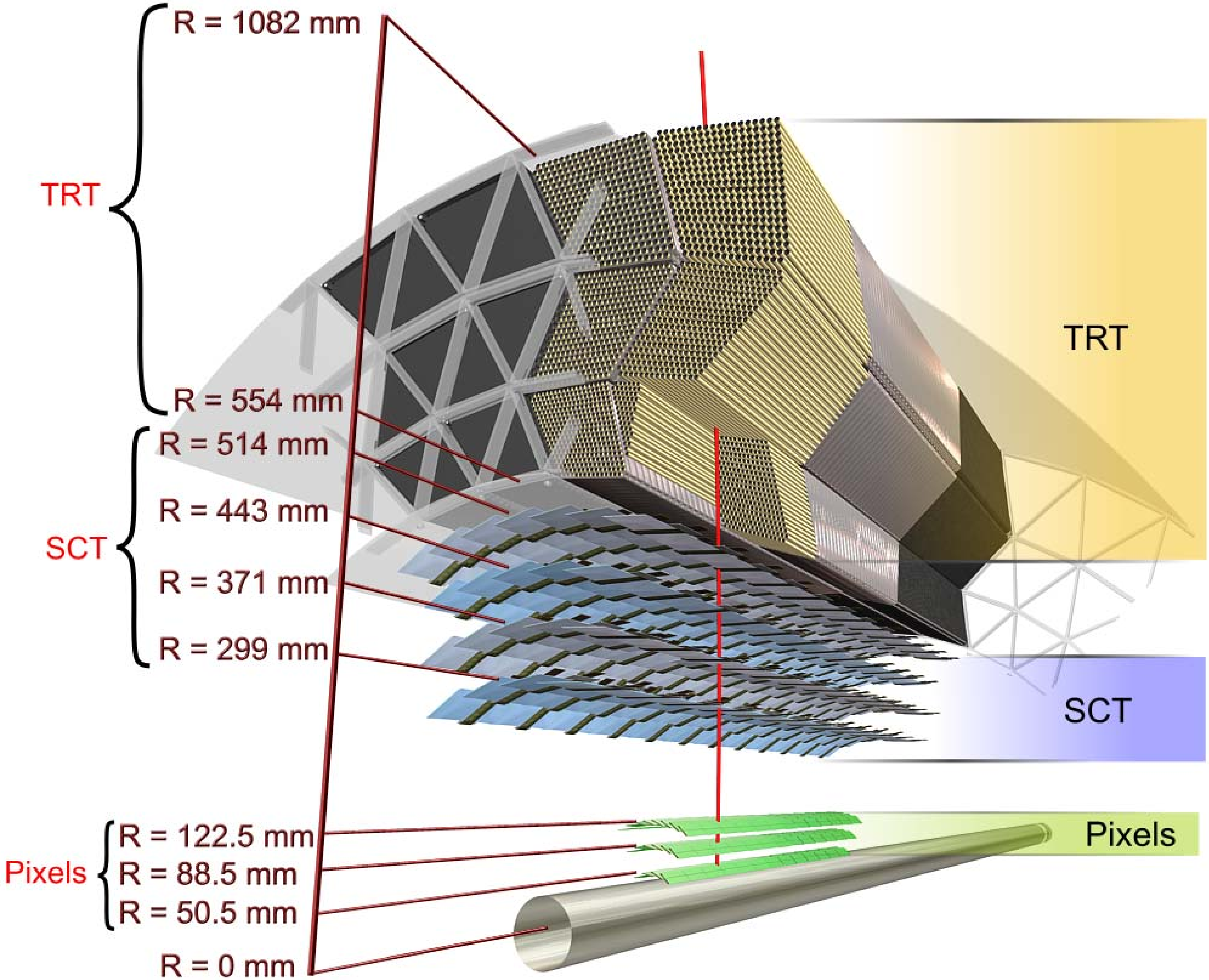
The ATLAS Detector



The ATLAS Inner Detector



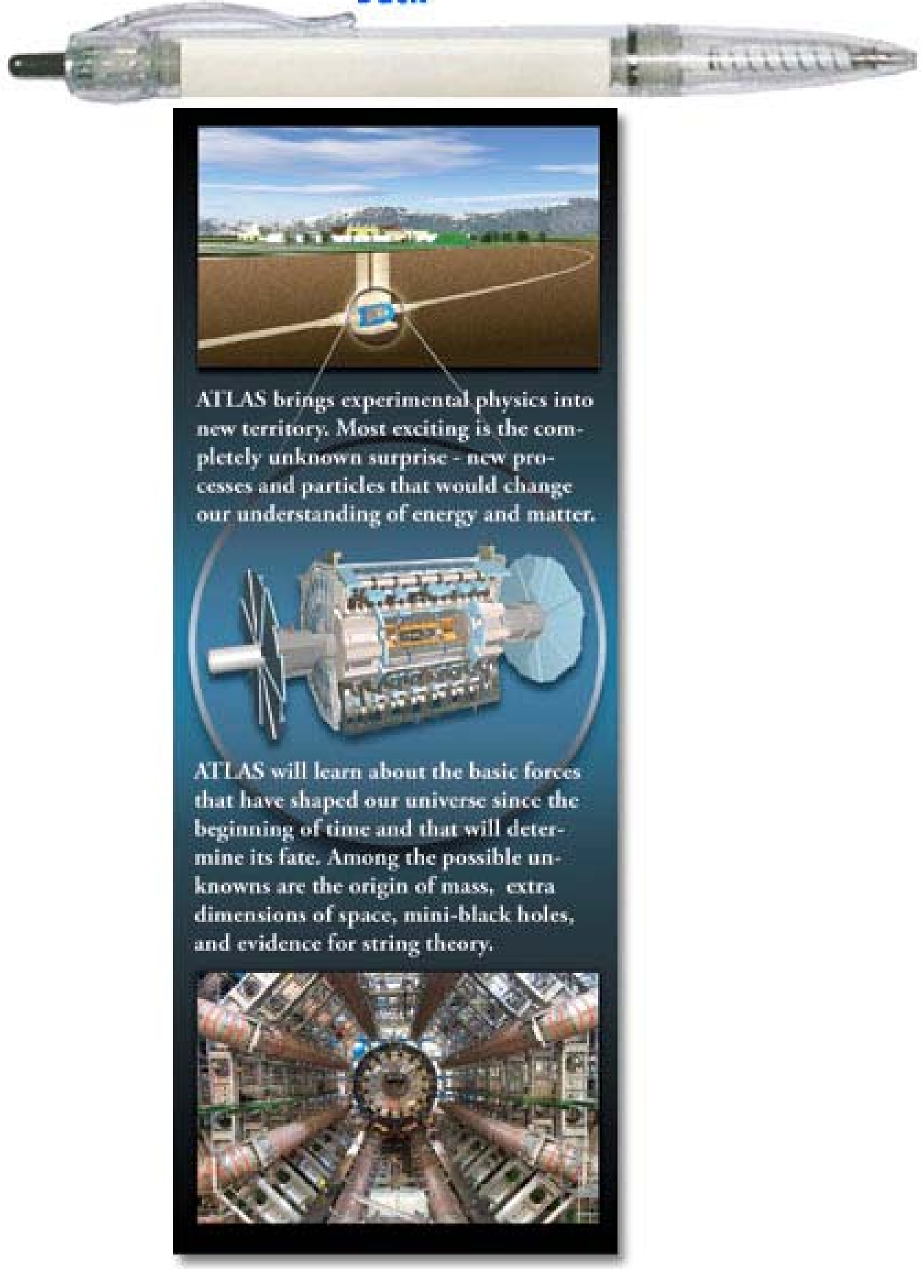
The ATLAS Inner Detector



New Scroll Pens

Front

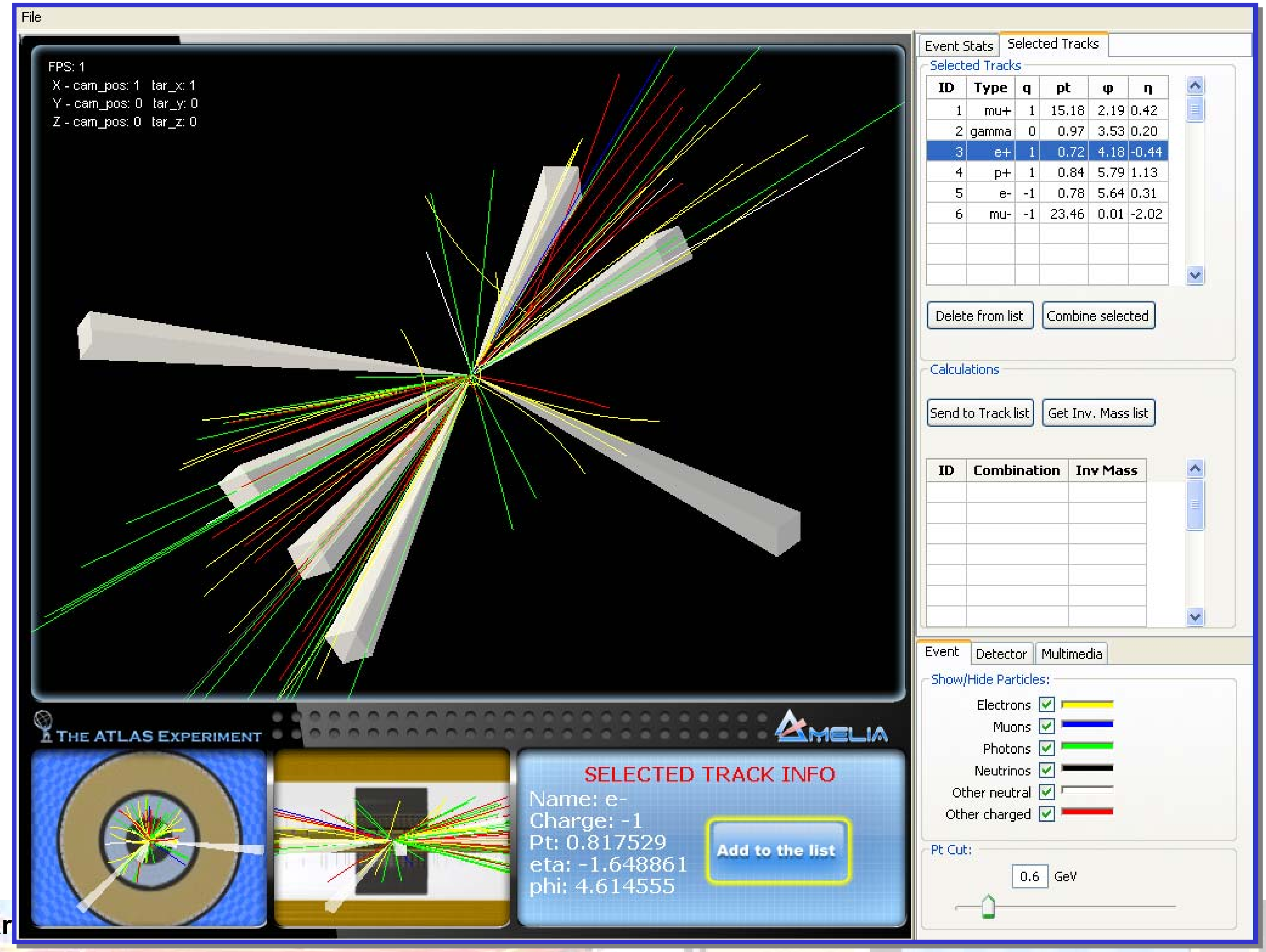
Back



Student Event Analysis (AMELIA)

Interactive event analysis for students and public

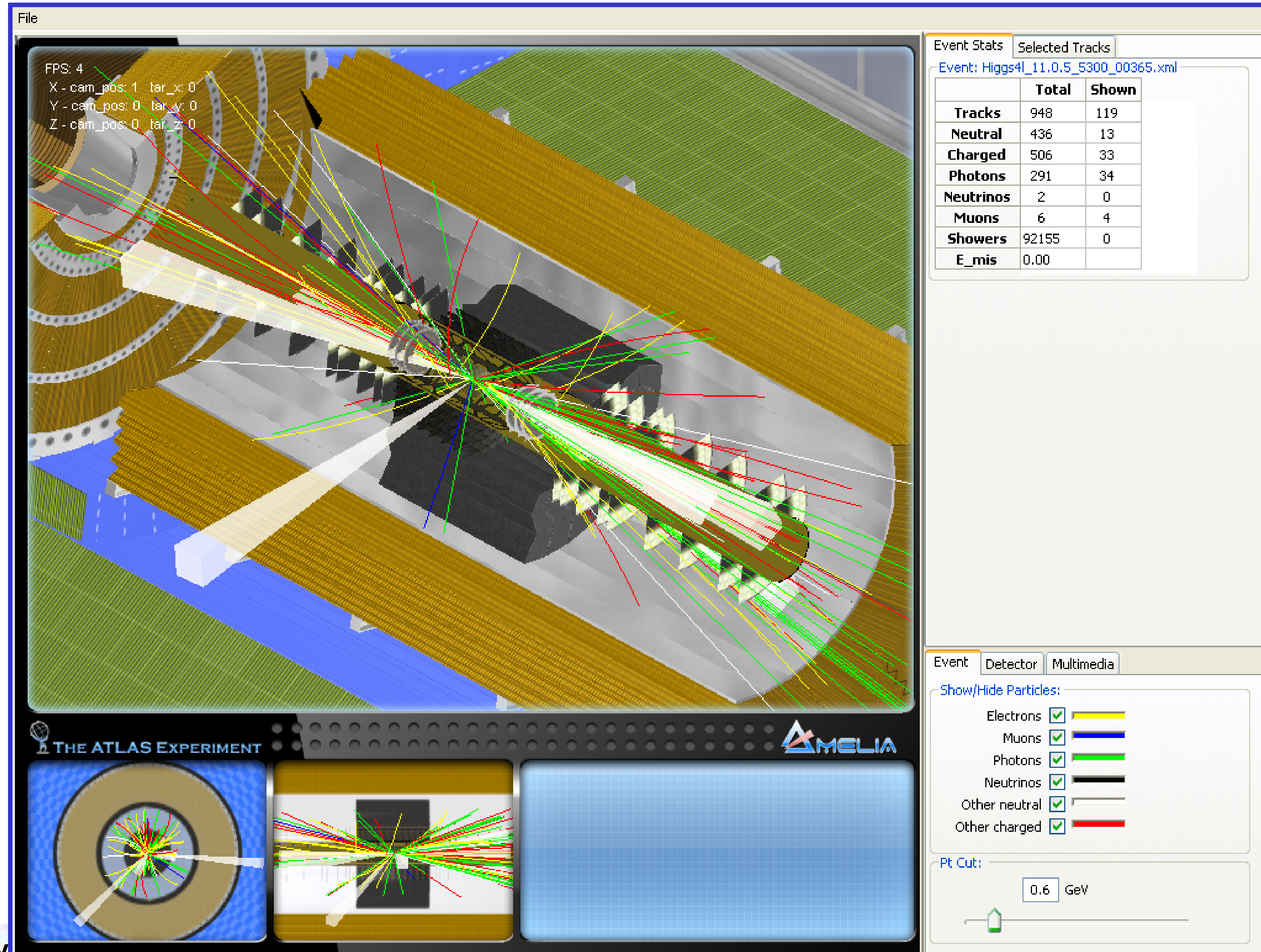
ATLAS
Multimedia
Educational
Lab for
Interactive
Analysis



Student Event Analysis (AMELIA)

Interactive event analysis for students and public

ATLAS
Multimedia
Educational
Lab for
Interactive
Analysis



The End