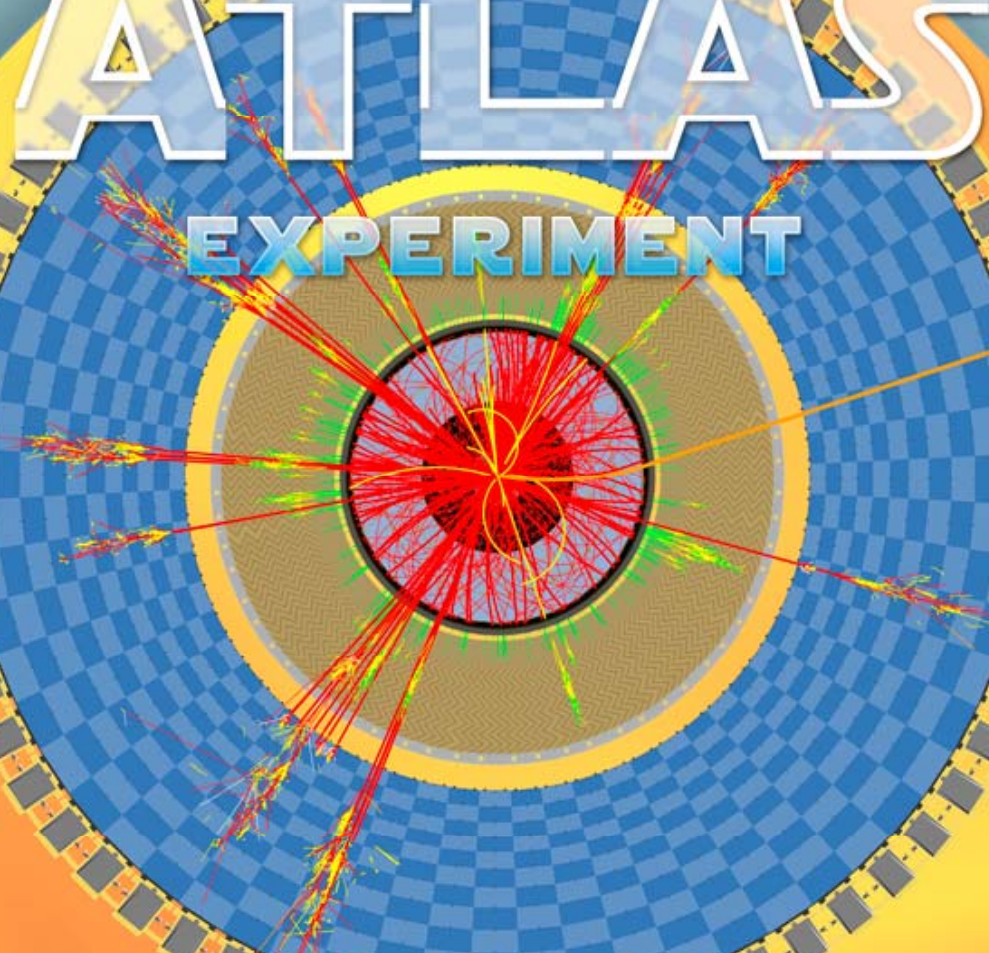


# THE ATLAS EXPERIMENT



# ATLAS Education and Outreach

**Michael Barnett**  
LBNL  
October 2008



**September 10** ☺


**A fantastic success!**

**September 19** ☹

**Where goes outreach now?**



# Newly Revised Homepage



## 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
- Blogs
- Contact Us

Latest News

**Incident in LHC will cause delay**  
 ATLAS is not affected and continues to take cosmic-ray data to commission and tune the detector, awaiting further developments.

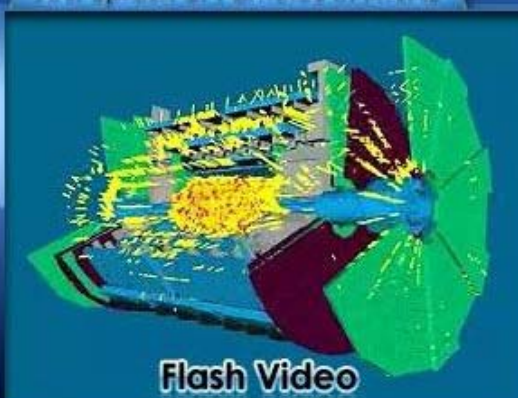
**First Beam and First Events in ATLAS (Sept. 10)**  
 ATLAS experimenters celebrated today as the first beams circulated the Large Hadron Collider in both directions. While everyone was cheering in the LHC control room... [More](#)

Have concerns?

**What is ATLAS**

ATLAS is a particle physics experiment at the Large Hadron Collider at CERN. Starting later in 2008, the ATLAS detector will search for new discoveries in the head-on collisions of protons of extraordinarily high energy. ATLAS will learn about the basic forces that have shaped our universe since the beginning of time and that will determine its fate. Among the possible unknowns are the origin of mass, extra dimensions of space, microscopic black holes, and evidence for dark matter candidates in the universe.


First Splash of Particles in ATLAS




Flash Video

- What is the schedule of ATLAS?
- Who are the 2500 physicists in ATLAS?
- What is the LHC?
- How big is ATLAS?
- How much data will be recorded?
- Why is there so much excitement?
- Are students involved?


**Features**




eTours




ATLAS Videos



Multimedia

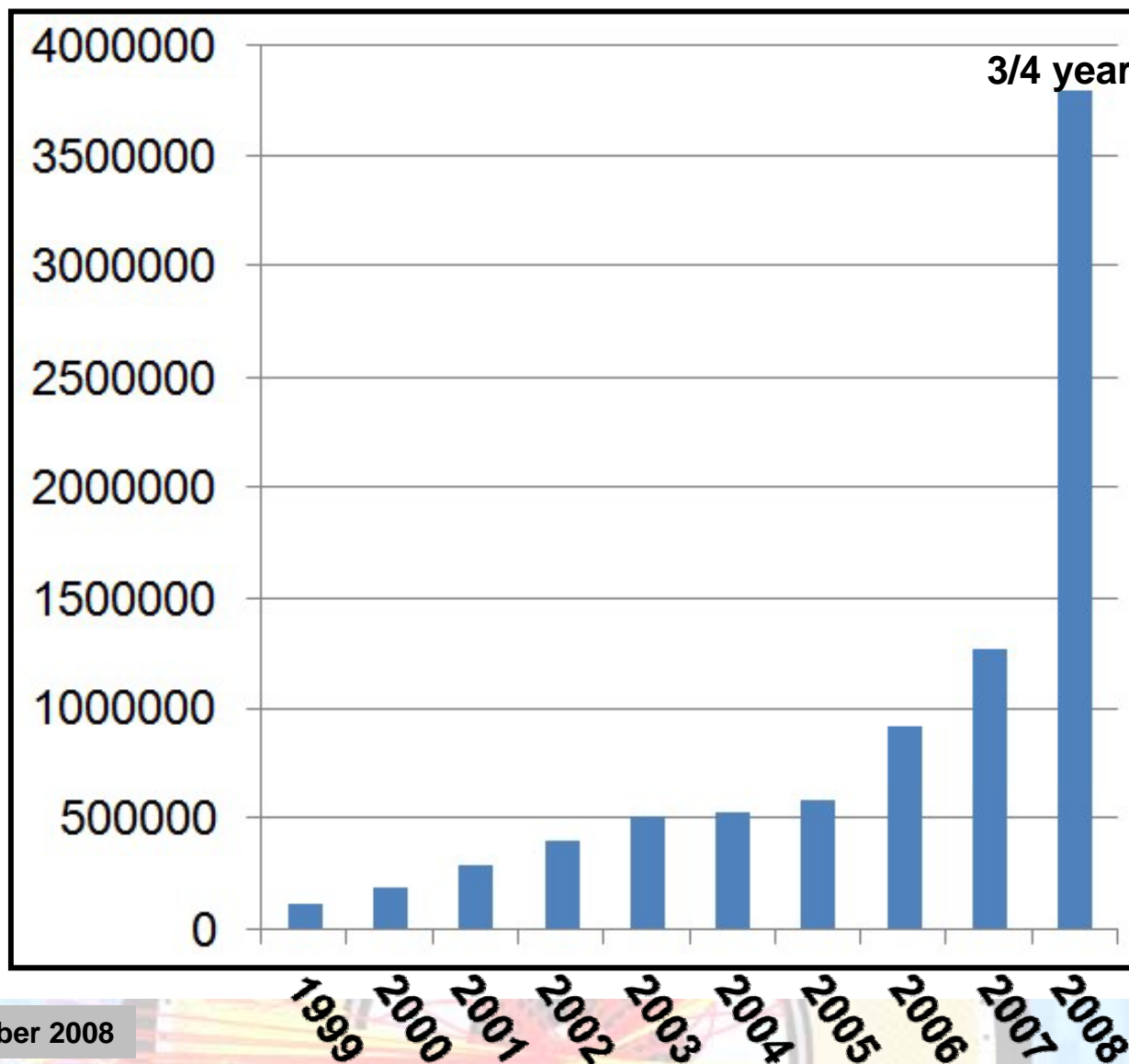


Webcams



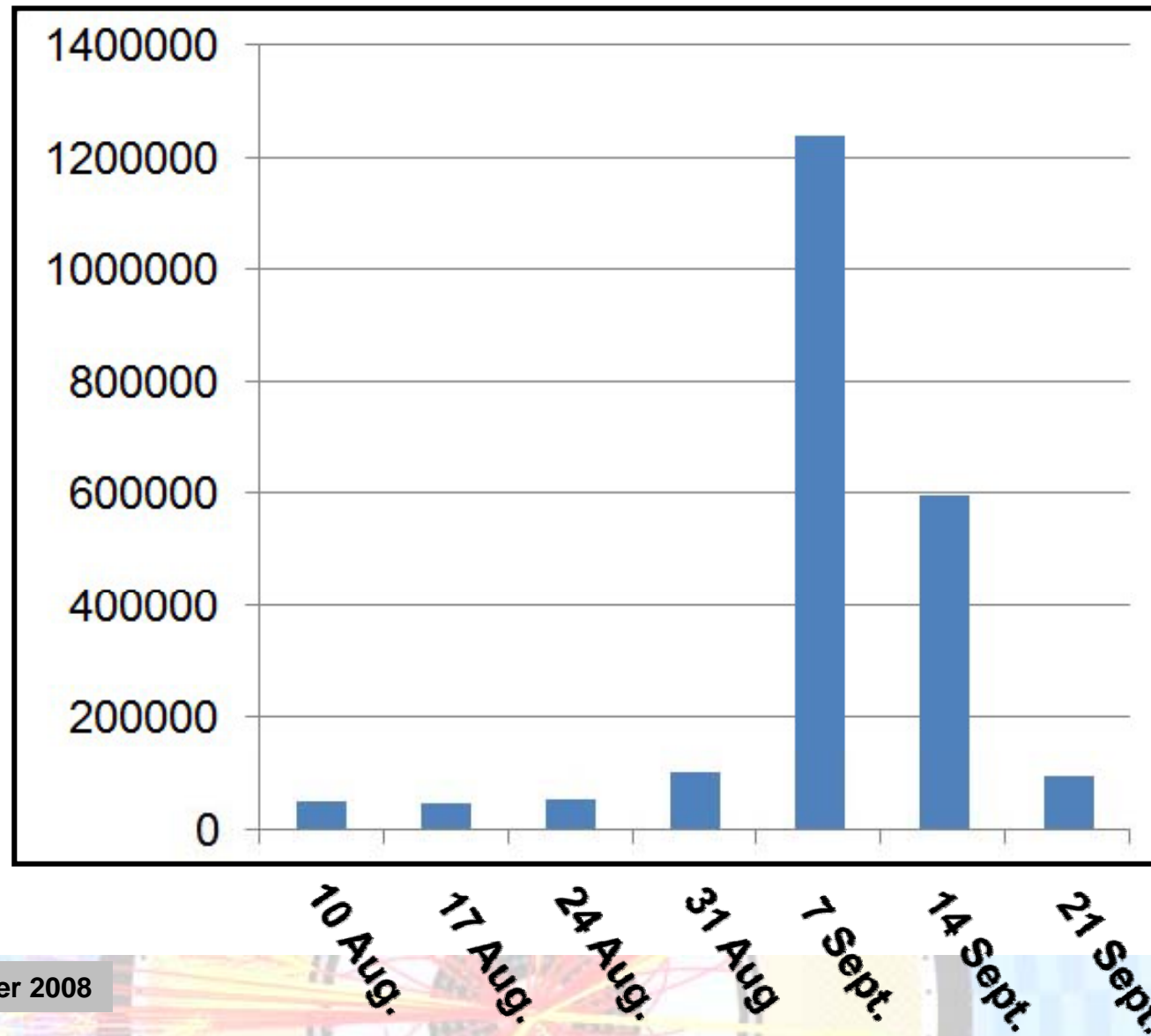
Virtual Tour

# Hits on ATLAS Website



# Hits on ATLAS Website

Hits for  
weeks  
starting  
...





# News Page under Revision



## News of The ATLAS Experiment

Mapping the Secrets of the Universe

RSS 2.0 

[Home](#) [ATLAS Collab.](#) [Press Page](#) [Contact Us](#) [Images](#) [Multimedia](#) [ATLAS eNews](#)

### Featured Stories



#### Incident in LHC will cause delay

[September 2008]

ATLAS is not affected and continues to take cosmic-ray data to commission and tune the detector, awaiting further developments.

[More on this story...](#)



#### Football and modern art for ATLAS

[September 2008]

This time the outside ATLAS overview week was held in a somewhat unusual venue for a physics meeting. All the plenary sessions were organized inside the VIP area of the famous soccer stadium "Stade de Suisse" just outside the city center of Bern.

[More on this story...](#)



#### First beam and first events in ATLAS

[September 10 2008]

ATLAS experimenters celebrated today as the first beams circulated the Large Hadron Collider in both directions. While everyone was cheering in the LHC control room, the cheers were echoed in the ATLAS and other control rooms, and in several auditoriums around CERN.

ATLAS video  
features

News media coverage

Technology transfer

Images

FAQs

Detector overview

ATLAS events

# Readers ask us about safety

## Are you concerned?

Many people have written to us recently with concerns about the forthcoming experiments at the LHC. These have often come from things they have read on blogs or in the news media.

We have seen concerns about a variety of topics. Here we focus on the most common concern - that the LHC might produce microscopic black holes. But the nature of the answer is quite similar for all these concerns.

As you might guess, the physicists at the Large Hadron Collider have given considerable thought to this subject. If there really were danger, we would be as concerned as anyone else. We all have families and want to be certain that everything we do is perfectly safe. Detailed studies reviewed by highly respected independent bodies have concluded without doubt that the LHC and its experiments are absolutely safe. You can read about it at:  
<http://public.web.cern.ch/public/en/LHC/Safety-en.html>

We are starting the LHC because there is no danger.  
Let us explain.



# Blogs



## The ATLAS Experiment

*Mapping the Secrets of the Universe*



### Blogs

#### Blogs about the ATLAS Experiment

[The Student Blog for the Large Hadron Collider - Hampton University](#)

[Monica Dunford - University of Chicago](#)

[Peter Steinberg - Brookhaven National Laboratory](#)

[Adam Yurkewicz - SUNY Stony Brook](#)

[Seth Zenz - Lawrence Berkeley National Laboratory](#)

[HOME](#)

[ATLAS Collab.](#)

[For Press](#)

[For Students](#)

[eTours](#)

[Detector](#)

[Webcams](#)

[Images](#)

[Movie](#)

[Multimedia](#)

[YouTube](#)

# Public Talks

## ATLAS Multimedia - Public Talks



Brian Cox: An inside tour of the world's biggest supercollider



Cern Podcast: Science and Religion



The ATLAS Experiment - Mapping the Secrets of the Universe

See it at [YouTube](#)

# Images – Ease of Use



The screenshot shows the ATLAS Experiment website interface. At the top left is the ATLAS logo and URL. The main header features the text "The ATLAS Experiment" and the tagline "Mapping the Secrets of the Universe". Below the header are two navigation buttons: "ATLAS Home" and "'Best' ATLAS photos". The main content area is titled "ATLAS Detector Photos" and contains a grid of 14 image thumbnails, each with a caption below it. The thumbnails are arranged in four rows: the first row has three thumbnails; the second, third, and fourth rows each have three thumbnails; and the fifth row has a single thumbnail on the left. The thumbnails show various parts of the ATLAS detector, including the full detector, magnets, calorimeters, inner detector, muon chambers, collaboration members, the detector site, control room, logos, events, TDAQ, and visits to ATLAS.

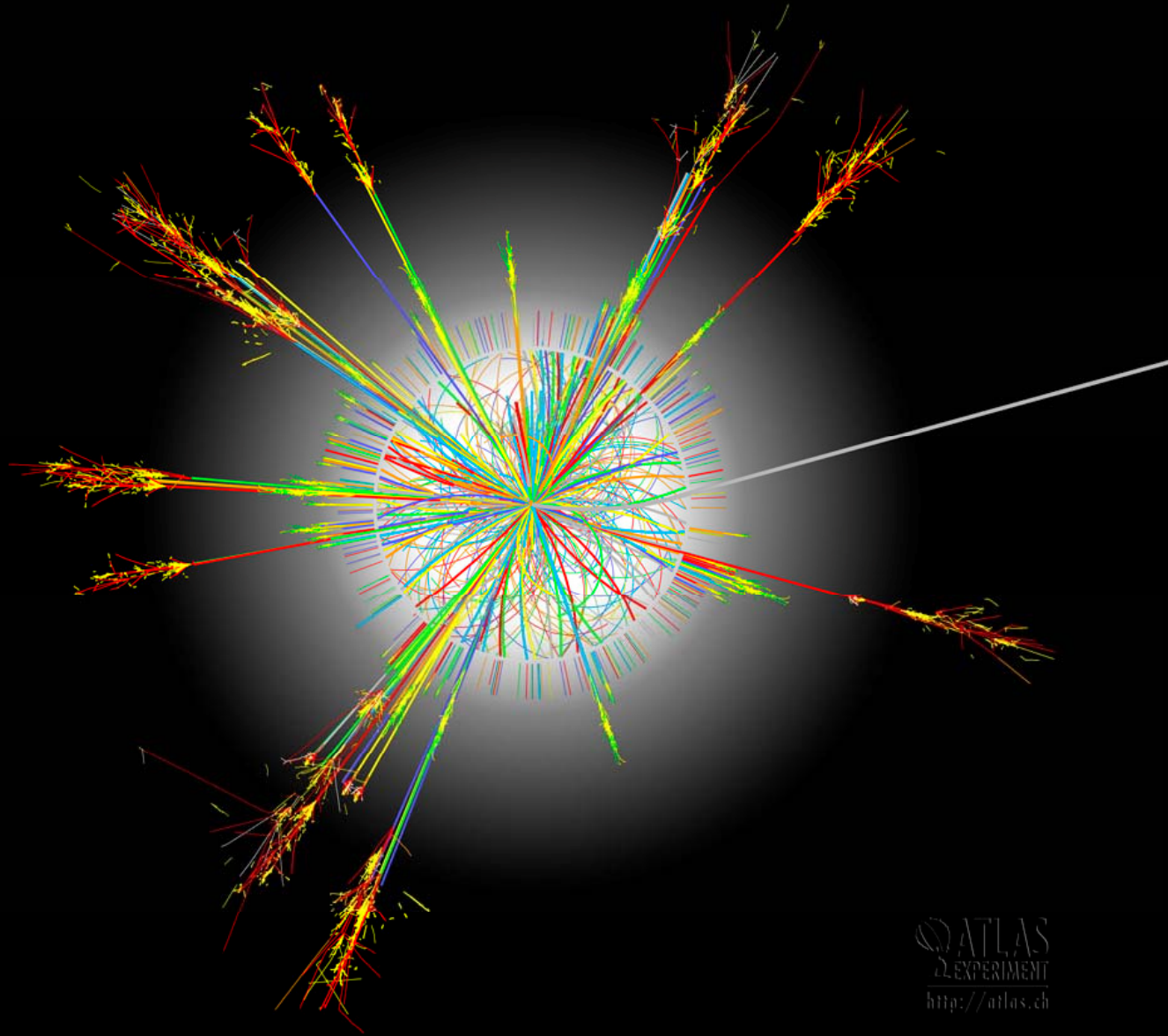
**ATLAS Home**    **"Best" ATLAS photos**    **ATLAS Detector Photos**

		
<b>Full Detector</b>	<b>Magnets</b>	<b>Calorimeters</b>
		
<b>Inner Detector</b>	<b>Muon Chambers</b>	<b>Collaboration</b>
		
<b>Detector Site</b>	<b>Control Room</b>	<b>Logos</b>
		
<b>Events</b>	<b>TDAQ</b>	<b>Visits to ATLAS</b>
		





# Event Images



# ATLAS Store

## ATLAS Store

ATLAS Brochures



ATLAS Clothing



ATLAS DVD



ATLAS Fact Sheets



ATLAS Posters



ATLAS Puzzle



3D Viewer



# ATLAS Pop-up Book

## ATLAS Store

ATLAS Brochures



ATLAS Clothing

ATLAS DVD



**In progress, a book with a world-class pop-up book artist.**

ATLAS Fa



**It should be done before LHC runs. It covers ATLAS, the Big Bang and some physics.**

Puzzle



3D Viewer





# Special Section for Students

## ATLAS for students

**RAL** - This event analysis exercise is a project by the Rutherford Appleton Laboratory, UK.

**HYPATIA** - (Hybrid Pupil's Analysis Tool for Interactions in Atlas) is a project by the University of Athens, Greece.

**LPPP** - Lancaster Particle Physics Package is a project by the University of Lancaster, UK.

**AMELIA** - A Berkeley based program is under construction and will be linked here when completed.

Find out what bloggers are saying about ATLAS - [Blogs](#)

See the [latest news](#) about ATLAS.

Learn more about particle physics at [The Particle Adventure](#).

Learn more about the ATLAS Experiment and the LHC by taking an [eTour](#).

View movies, animations and video clips of the ATLAS Experiment in the [multimedia section](#).

# Films Made by Students in April

## ATLAS Multimedia - Student Films



Centennial High School, Circle Pines, Minnesota - "What is CERN?"



Payson High School, Payson, Utah - "CERN Experience"



J Frank Dobie High School, Houston, Texas - "CERN"




Lincoln High School, Tallahassee, Florida - "ATLAS vs. CMS"



South Houston High School, South Houston, Texas - "CERN Revealed"

# ATLAS Multimedia

## ATLAS Multimedia

Also available at  YouTube

### Animated Clips



Descriptive animations of the ATLAS Experiment.

### Video Clips



Short video clips of the ATLAS Experiment.

### Full-length Features



Full-length ATLAS video and animated features.

### How ATLAS Works



Animated clips showing how five ATLAS detector components work.

### Student Films



American student films featuring LHC footage.

### Public Talks



Public talks about the ATLAS Experiment.

### The LHC Rap



The Large Hadron Collider Rap.



[Download ATLAS cavern audio](#)



[PowerPoint files here](#)



# ATLAS on YouTube

[YouTube.com/TheATLASExperiment](http://YouTube.com/TheATLASExperiment)

**ATLAS has “Director” status**

**20 videos.**

**Top one has 87,000 viewings.**

**Total is 370,000 viewings.**



# The ATLAS Experiment

Mapping the Secrets of the Universe

<http://atlas.ch>

[Videos](#) | [Favorites](#) | [Playlists](#) | [Groups](#)

The ATLAS Experiment

Subscribe



**TheATLASExperiment**

Style: News

Joined: **June 19, 2007**

Last Sign In: **21 hours ago**

Videos Watched: **1,370**

Subscribers: **655**

Channel Views: **49,652**

▲ DIRECTOR

ATLAS is a particle physics experiment that will explore the fundamental nature of matter and the basic forces that shape our universe. Starting in late-2008, the ATLAS detector will search for new discoveries in the head-on collisions of protons of extraordinarily high energy. ATLAS is one of the largest collaborative efforts ever attempted in the physical sciences. There are 2500 physicists (including 700 students) participating from more than 169 universities and laboratories in 37 countries.

Visit <http://atlas.ch>

Name: **ATLAS**

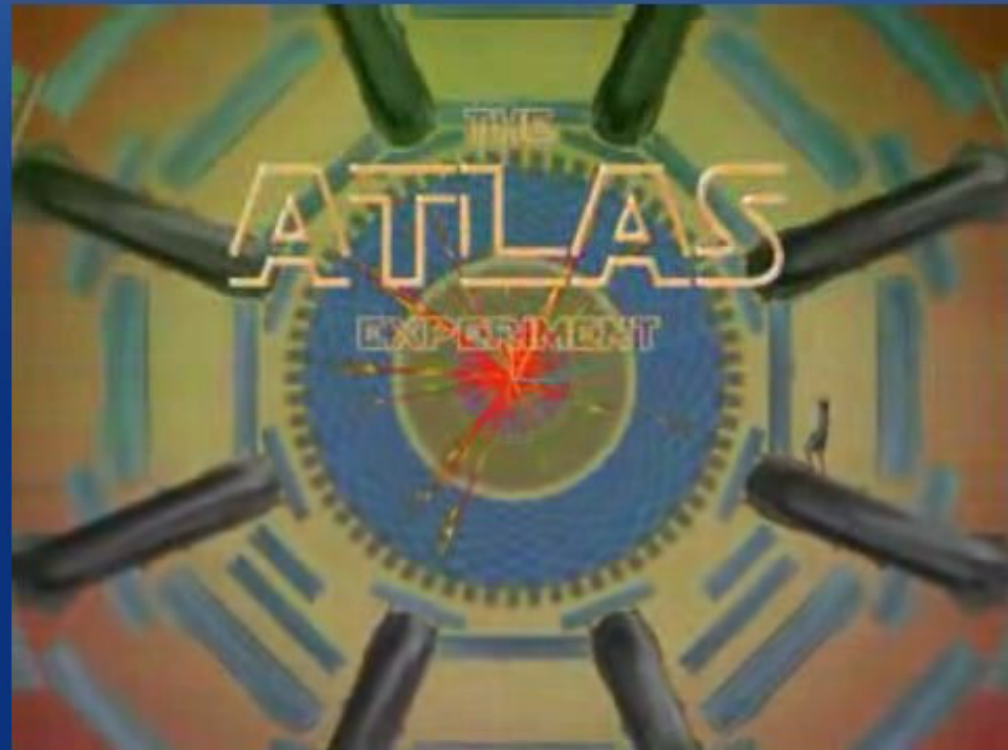
City: **Geneva**

Hometown: **CERN**

Country: **Switzerland** 🌐

Website: <http://atlas.ch>

[Report profile image violation](#)



0:25 / 9:46



**[ATLAS - Episode 2 - The Particles Strike Back \(Part 1\)](#)**

From: [TheATLASExperiment](#)

Views: 53,926

Comments: [95](#)





### Protons Accelerate in LHC and Co...

Added: 1 year ago  
Views: 86,983

00:30 ★★★★★



### ATLAS - Episode 1 -A New Hope

Added: 1 year ago  
Views: 70,311

07:13 ★★★★★



### ATLAS - Episode 2 - The Particles...

Added: 1 year ago  
Views: 53,974

09:45 ★★★★★



### Aftermath of Proton Collision in...

Added: 1 year ago  
Views: 50,247

00:05 ★★★★☆



### ATLAS - Episode 2 - The Particle...

Added: 1 year ago  
Views: 28,601

04:24 ★★★★★



### A Sweeping View of the ATLAS Det...

Added: 1 year ago  
Views: 15,537

00:15 ★★★★★



### The ATLAS Experiment -

Added: 1 year ago  
Views: 13,837

09:52 ★★★★★



### The ATLAS Experiment -

Added: 1 year ago  
Views: 10,554

08:51 ★★★★★



### Moving the Calorimeter into

Added: 1 year ago  
Views: 6,846

00:10 ★★★★★



### From Space to LHC to the ATLAS D...

Added: 1 year ago  
Views: 5,555

00:45 ★★★★★



### Riding a Toroid Magnet into the ...

Added: 1 year ago  
Views: 5,545

01:30 ★★★★★



### The Last Element of ATLAS Descen...

Added: 2 months ago  
Views: 3,785

05:46 ★★★★★



### The Black Eyed Peas visit ATLAS

Added: 1 year ago  
Views: 2,850

00:14 ★★★★☆



### The ATLAS Crawl - A short journe...

Added: 1 year ago  
Views: 2,215

02:03 ★★★★★



### Zooming into the ATLAS Detector ...

Added: 1 year ago  
Views: 2,188

00:42 ★★★★★





# Viewings of ATLAS videos

## Episode I:

<http://www.youtube.com/watch?v=E-nmH1p8FFo>

<http://www.youtube.com/watch?v=WzjWR5yfocl>

<http://www.youtube.com/watch?v=mFcloW9THCc>

<http://video.google.com/videoplay?docid=-6100983867038968260>

## Episode II:

<http://www.youtube.com/watch?v=MzcATqu5NtY>

<http://www.youtube.com/watch?v=iQ3ssreUtcw>

<http://www.youtube.com/watch?v=AhD2KnoDQtM>

<http://video.google.com/videoplay?docid=-7584323938136764789>

<http://www.youtube.com/watch?v=Y-WsNXVS54g>

[http://www.metacafe.com/watch/yt-b1afeb9Fp4o/the\\_atlas\\_experiment\\_cern\\_3/](http://www.metacafe.com/watch/yt-b1afeb9Fp4o/the_atlas_experiment_cern_3/)

<http://www.asterpix.com/console/?avi=9105221>

<http://www.asterpix.com/console/?avi=9105261>

**A quick search yielded:  
34k & 21k & 26k hits**

## The ATLAS movie:

<http://www.youtube.com/watch?v=CV8Lw-jcNT4>

<http://www.youtube.com/watch?v=xu1WB-Wqj7M>

<http://video.google.com/videoplay?docid=5499972978779896816>

[http://www.metacafe.com/watch/yt-CV8Lw-jcNT4/atlas\\_experiment\\_1/](http://www.metacafe.com/watch/yt-CV8Lw-jcNT4/atlas_experiment_1/)

[http://www.metacafe.com/watch/yt-t0ZqV5u-z6o/the\\_atlas\\_experiment\\_mapping\\_the\\_secrets\\_of\\_the\\_universe\\_1/](http://www.metacafe.com/watch/yt-t0ZqV5u-z6o/the_atlas_experiment_mapping_the_secrets_of_the_universe_1/)

<http://www.asterpix.com/console/?avi=9112821>

# Four Million Viewings

**You Tube** Worldwide (All) | English barnett891 | (0) | Account | QuickList (0) | Help | Sign Out

Broadcast Yourself™ Home Videos Channels Community

Videos  [advanced](#)

## Large Hadron Rap



0:21 / 4:49

**Rate:** ★★★★★ 15,515 ratings **Views:** 3,479,919

From: [alpinekat](#)   
Added: July 28, 2008  
[\(more info\)](#)

Rappin' about CERN's Large Hadron Collider! Links b...

URL

Embed

▶ **More From: alpinekat**

▼ **Related Videos**

-  **CERN in 3 minutes**  
03:34 From: CERNTV  
Views: 966,478
-  **The CERN black hole**  
00:38 From: BrainReleaseValve  
Views: 2,685,322
-  **The LHC-- the end of the world again? (rhetorical)**  
06:16 From: existentialistcat  
Views: 223,993
-  **McDonald's: The Rap**  
02:49 From: GoRemy

# Episodes (Animations)

**Translations into French, German, and Italian are in progress or completed for Episodes 1 and 2.**

**Are or will be on our website.**

**A DVD with multiple languages will be produced.**



## The Physics of ATLAS and CMS (animated film)

Project is funded and is being prepared for development

An outline exists:

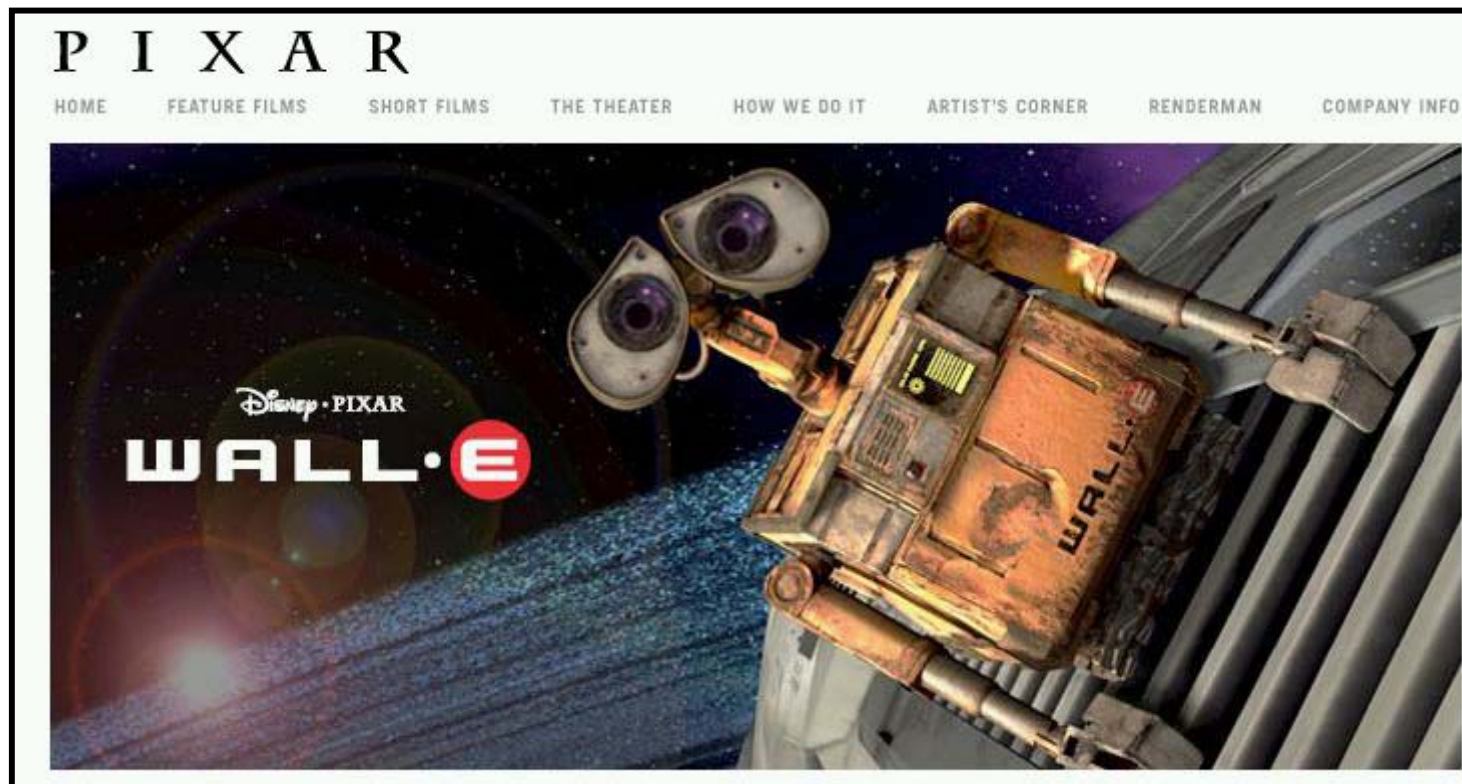
**From the Big Bang to Dark Matter, Extra Dimensions, Higgs, Microscopic Black Holes, New Forces, etc.**

A team of producers and advisors has been formed:  
includes E. Johansson, P. Watkins, J. Pequeno, M. Barnett,  
R. Ruchti, M. Bardeen.

Deadline for completion: **~February 2009**

# Close Encounters with the Universe

**Pixar** is playing an advisory role.



# Student Event Analyses

**Four variations on having high school students analyze ATLAS events**

Lancaster	(V. Kartvelishvili)	✓
HYPATIA	(C. Kourkouvelis, Athens)	✓
RAL	(M. Wielers)	✓
AMELIA	(M. Barnett, LBNL)	

✓ <http://atlas.ch/students.html>

**Many tested at Masterclasses**



# HYbrid Pupil's Analysis Tool for Interactions in ATLAS

C.Kourkoumelis (UoA)  
D.Fassouliotis "  
D.Vudragovic (Belgrade)  
S.Vourakis (UoA)

<http://hypatia.phy.bg.ac.yu/>

And linked from the ATLAS outreach page

<http://atlas.ch/students.html>



ATLAS Hybrid pupils' analysis tool for interactions in ATLAS - version 2.0.0-2 - Invariant Mass Window

File View Histograms Preferences Help

File Name	ETMis [GeV]	Track	P [GeV]	+/-	Pt [GeV]	$\phi$	$\eta$	M(lv) [GeV]	M(2l) [GeV]	M(4l) [GeV]
JiveXML_5104_20650.xml	46.619	Tracks 7	5.6	-	2.8	4.224	-1.323	22.214	16.021	27.984
		Tracks 13	13.6	-	5.0	3.418	1.651	24.536		
		SimChargedTrack 58	3.2	+	2.7	6.133	-0.539	17.058	5.519	
		SimChargedTrack 60	6.9	+	3.1	4.202	-1.433	23.368		
JiveXML_5104_20651.xml	15.262	SimChargedTrack 1	55.3	-	14.9	5.162	1.987	29.544	18.428	29.916
		SimChargedTrack 27	1.8	+	1.1	5.899	-1.137	7.974		
		Tracks 0	1.6	-	1.6	5.992	0.045	9.525	10.878	
		Tracks 2	49.0	-	13.2	5.161	1.988	27.783		

## Most recent full Version of HYPATIA

HYPATIA - Canvas Window

HYPATIA - Track Momenta Window

Previous Event Next Event Insert Track Delete Track  Enable Color Coding

Event: JiveXML\_5104\_20651.xml Run: 5104 Event: 20651  
 ETMis: 15.262 GeV  $\phi$ : 2.420 rad ( Collection : MET\_Final )

Reconstructed Simulated Physics Objects

Track	P [GeV]	+/-	Pt [GeV]	$\phi$	$\theta$
Tracks 0	1.56	-	1.56	5.992	3.096
Tracks 1	4.64	+	3.02	1.235	0.862
Tracks 2	48.97	-	13.17	5.161	1.843
Tracks 4	3.05	+	1.77	1.127	0.949
<b>Tracks 5</b>	<b>8.85</b>	-	<b>5.36</b>	<b>1.364</b>	<b>0.920</b>
Tracks 6	1.81	+	1.06	5.896	0.947
Tracks 12	1.03	+	1.03	6.116	3.047

HYPATIA - Control Window

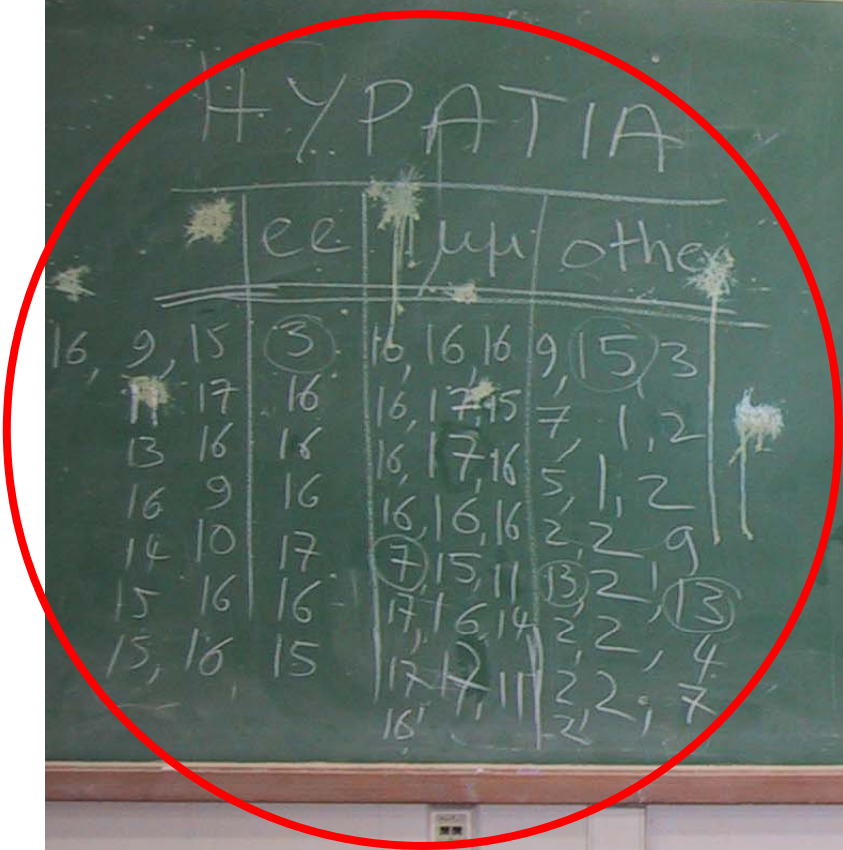
Parameter Control Interaction and Window Control Output Display

Projection Data Cuts InDet Calo MuonDet Objects Geometry

Data	Name	Value
Status	<input checked="" type="checkbox"/> InDet	
	<input checked="" type="checkbox"/> Calo	
	<input checked="" type="checkbox"/> MuonDet	
	<input checked="" type="checkbox"/> Objects	
	<input type="checkbox"/> Status	

# MASTERCLASS MARCH 2008 @ UoA

HYPATIA				DELPHI				1954	
ee		μμ		μμ		ττ		qq	82
16, 9, 15	3	16, 16, 16	9, 15, 3	2	8	5	8	8	82
11, 17	16	16, 17, 15	7, 1, 2	1	7	3	4	6	79
13, 16	18	16, 17, 16	5, 1, 2	4	10	5	4	6	86
16, 9	16	16, 16, 16	2, 2, 9	2	4	6	1	6	87
14, 10	17	7, 15, 11	13, 2, 13	5	2	4	7	5	81
15, 16	16	17, 16, 14	2, 2, 4	4	8	4	3	5	83
15, 16	15	17, 17, 11	2, 2, 7	8	0	4	3	5	85
		18	2	4	5	4	4	5	88
				5	4	4	3	5	89
				4	4	4	3	5	90
				5	4	4	3	5	82
				5	4	4	3	5	83







## Five sections of the latest version

### Pool

Colliding balls, energy and momentum conservation, mass ratio

### Annihilation

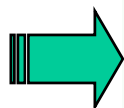
Fixed target, colliding beams, pair production, thresholds

### Magnetic field

Curvature measurement, particle identification

### Lifetime

Kaon decay, invariant mass and lifetime measurements

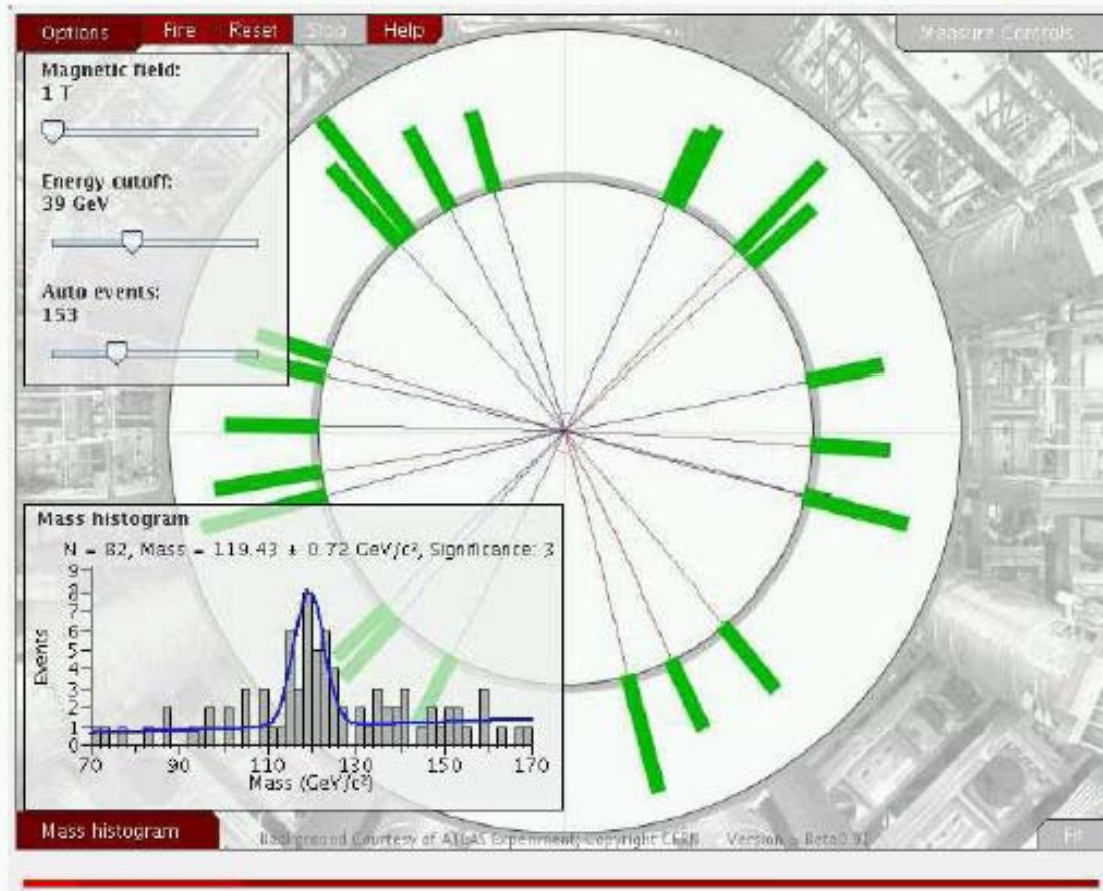


### Higgs

LHC, Higgs, detectors, measurement. . .

# Lancaster Particle Physics Package

## Screenshot of the Higgs applet



Please give it a try! Email addresses for feedback:

[info@lancs.ac.uk](mailto:info@lancs.ac.uk), [Andre.Sopczak@cern.ch](mailto:Andre.Sopczak@cern.ch), [Vakhtang.Kartvelishvili@cern.ch](mailto:Vakhtang.Kartvelishvili@cern.ch)

# RAL ATLAS Exercise

Based on:

- Electron, muon and jet identification
- Classification of events into the categories  $W \rightarrow e\nu$ ,  $W \rightarrow \mu\nu$ ,  $Z \rightarrow ee$ ,  $Z \rightarrow \mu\mu$ , background from jet production
- **Search** for  $H \rightarrow 4l$   
(one event in the complete dataset)
- Calculate ratio  $W \rightarrow e\nu / W \rightarrow \mu\nu$ ,  $Z \rightarrow ee / Z \rightarrow \mu\mu$ ,  $W/Z$
- Each group analyses (at least) 20 events via Atlantis

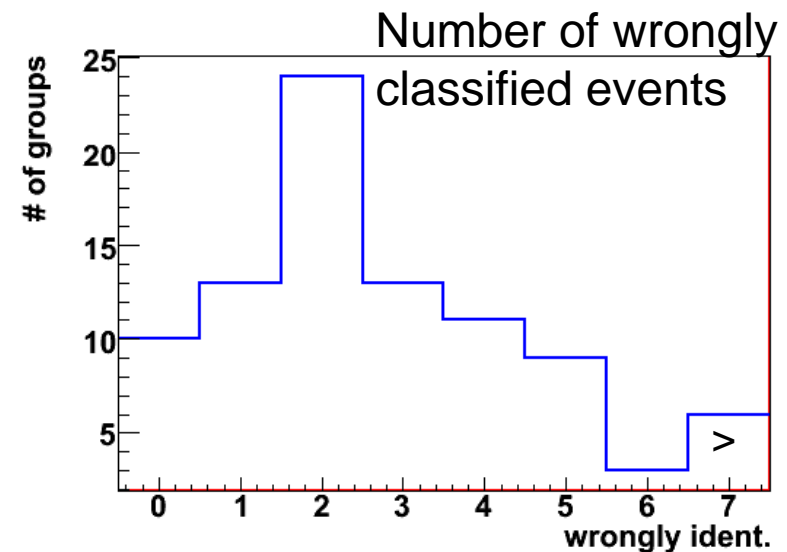


# RAL ATLAS Exercise

Put statistics together and measure ratio

$W \rightarrow e\nu / W \rightarrow \mu\nu$ ,  $Z \rightarrow ee / Z \rightarrow \mu\mu$ ,  $Z/W$

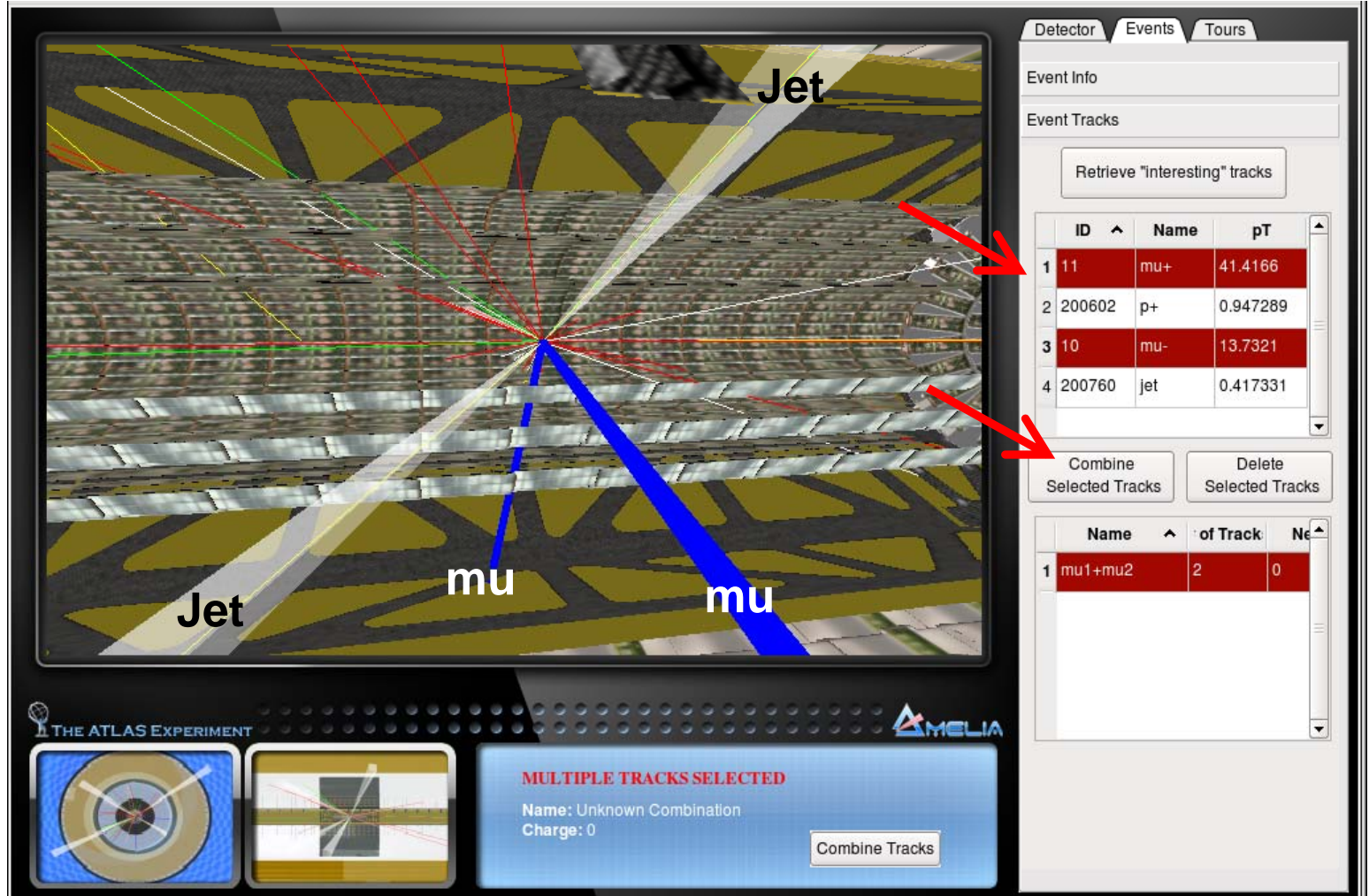
- The ratio  $W \rightarrow e\nu / W \rightarrow \mu\nu$ ,  
 $Z \rightarrow ee / Z \rightarrow \mu\mu$  was typically correct
- $W/Z$  was always too low  
(~4-5 rather than 10)



# Student Event Analysis (AMELIA)

Interactive event analysis for students and public

ATLAS Multimedia Educational Lab for Interactive Analysis



The screenshot displays the AMELIA software interface. The main window shows a 3D visualization of the ATLAS detector with several tracks originating from a central point. Two tracks are highlighted in blue and labeled 'mu', while two others are highlighted in grey and labeled 'Jet'. The interface includes a control panel on the right with tabs for 'Detector', 'Events', and 'Tours'. The 'Events' tab is active, showing 'Event Info' and 'Event Tracks'. A table lists selected tracks with columns for ID, Name, and pT. Below the table are buttons for 'Combine Selected Tracks' and 'Delete Selected Tracks'. A status bar at the bottom indicates 'MULTIPLE TRACKS SELECTED' with details for the combination: 'Name: Unknown Combination' and 'Charge: 0', along with a 'Combine Tracks' button.

ID	Name	pT	
1	11	mu+	41.4166
2	200602	p+	0.947289
3	10	mu-	13.7321
4	200760	jet	0.417331

Name	of Track	Ne	
1	mu1+mu2	2	0

# ATLAS Schedule?

- What is the schedule of ATLAS?

## ATLAS Schedule 2008 and forward

10 Sept. – First splashes of particles in the ATLAS detector as LHC circulates first beams (in both directions). No collision events were planned, but the particles in the detector were used to debug and setup the detector.

October 2008 - early Spring 2009 – LHC is shutdown due to incident in the tunnel (described elsewhere) and then the planned winter shutdown. During parts of this period, ATLAS will use cosmic ray events to commission and tune the detector. The winter shutdown was planned for cost savings and improvements to LHC and ATLAS.

Early Spring 2009 – Startup of LHC and later first event collisions (colliding a beam with a given energy with the counter-rotating beam of the same energy). Previous world record is 2 TeV. This will lead to several months of intensive data taking before next winter shutdown. First papers with early results may come in late summer 2009.

Next 15-20 years – Continued data taking with publication of results on an ongoing basis.



# COSMIC LOG

Web MSNBC Cosmic Log

## ABOUT COSMIC LOG

Quantum fluctuations in space, science, exploration and other cosmic fields... served up regularly by MSNBC.com science editor Alan Boyle since 2002.



Alan Boyle covers the physical sciences, anthropology, technological innovation and space science and exploration for MSNBC.com. He is a winner of the AAAS Science Journalism Award, the NASW Science-in-Society Award and other honors; a contributor to "A Field Guide for Science Writers"; and a member of the board of the Council for the Advancement of Science Writing.

Check out Boyle's biography or send a message to Cosmic Log via [cosmiclog@msnbc.com](mailto:cosmiclog@msnbc.com).

## COURTS WEIGH DOOMSDAY CLAIMS

Posted: Tuesday, September 02, 2008 4:10 PM by Alan Boyle



J. Pequenão / CERN / ATLAS

This artist's conception simulates the particle tracks that could be left behind by the creation and decay of a black hole in the Large Hadron Collider's ATLAS detector. The researcher with a hardhat is shown only to give a sense of scale.

Sept. 10  
coverage

M. Barnett – October

# Sept. 10 Coverage



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### First beam 2008




September 10th was an international day of celebration, as the largest physics experiment ever attempted, the LHC, passed its first beam around the massive 27 kilometer track 100 meters below the Swiss-French countryside at CERN in Geneva, Switzerland. The LHC is a physics experiment 15 years in the making which will accelerate small particles called protons to the highest energies ever produced in a lab, and smash them together at high speed to emulate the conditions of the universe moments before the big bang.

The hope is that these extreme conditions will shed some light into an area previously invisible to physicists, and fill in the missing pieces of the puzzle as to why the universe works the way it does. It is not clear what the LHC will discover as physicists search for new physics at ATLAS, but the success of the first beam on September 10th marked the beginning of a very exciting time for everyone


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## Video: Large Hadron Collider Fires Up Partying Physicists

By Alexis Madrigal  September 11, 2008 | 6:51:42 PM Categories: [Large Hadron Collider](#)



SAN FRANCISCO -- When the Large Hadron Collider was turned on yesterday near Geneva, Switzerland, physicists around the world watched and celebrated.

And then they went to parties where they could let their hair down and bask in the glow of the new toy on which a generation of physics depends.

Your fearless Wired Science team attended one of these parties on neutral ground between the competitive physics departments of Stanford and Berkeley here in San Francisco.

We asked theoretical physicists and their experimentalist buddies to tell us why the LHC matters and what the world's biggest, most awesome machine means to them.

### See Also:

- [Large Hadron Collider: Best and Worst Case Scenarios](#)
- [First Beam Circles Large Hadron Collider Track](#)
- [Atom Smasher Reveals New Aspect of Memeverse](#)
- [Large Hadron Collider Begins Testing](#)
- [Top 10 Amazing Physics Videos](#)

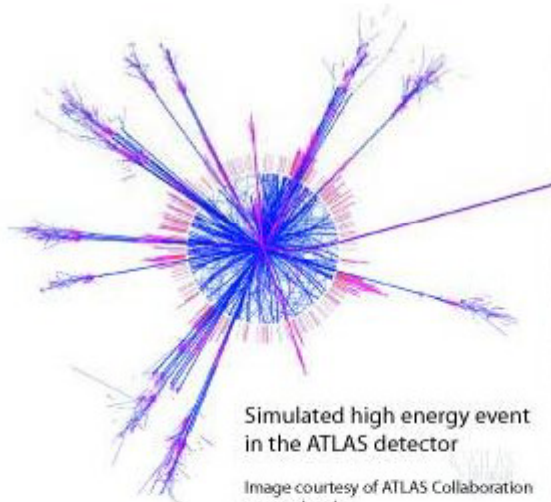
M. Barnett – October 2008

*Video: [Wired.com/Alexis Madrigal](http://Wired.com/AlexisMadrigal). Apologies for the occasionally shaky video. We had to use our special physicist-friendly handycam.*



# Sept. 10 Coverage

## Cracking Open the Universe



Simulated high energy event  
in the ATLAS detector

Image courtesy of ATLAS Collaboration  
[www.atlas.ch](http://www.atlas.ch)

**James Brau**  
Knight Professor of Natural Science  
**Graham Kribs**  
Assistant Professor of Physics  
**Eric Torrence**  
Associate Professor of Physics

UO particle physicists will explain the new physics discoveries expected with the start-up of the Large Hadron Collider in Geneva, Switzerland.

7:00 pm, Friday, September 12, 2008  
150 Columbia Hall, 1215 E. 13th Ave.  
346-4898 for details

Introduction - J. Brau

[pdf...keynote](#)

Physics - G. Kribs

[pdf...keynote](#)

Experiments - E. Tor

[pdf...keynote](#)

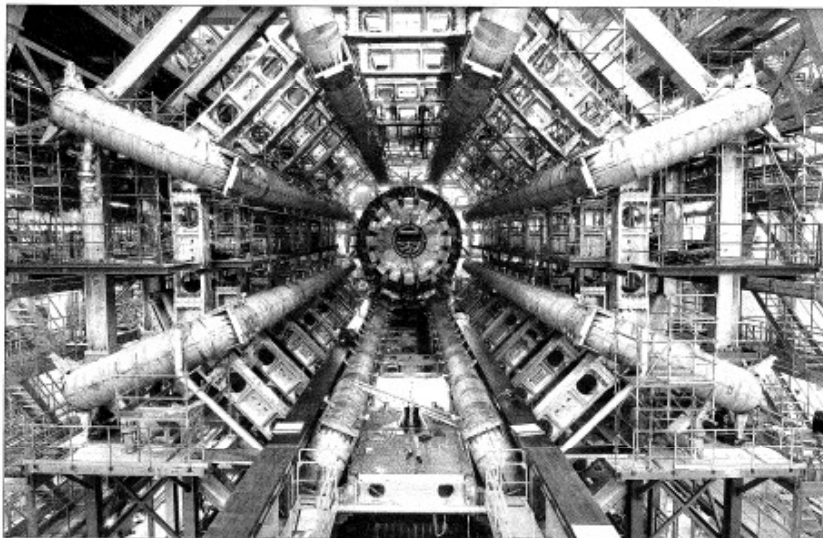
Closing - J. Brau

[pdf...keynote](#)





University of Oregon scientists join in monumental physics experiments that begin today



The ATLAS Experiment at CERN

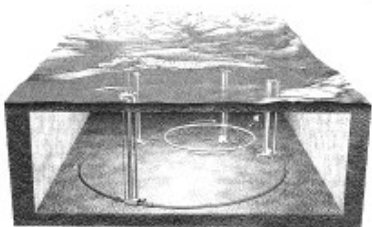
Eight toroidal magnets can be seen on the huge ATLAS detector with the calorimeter before it is moved into the middle of the detector. The calorimeter will measure the energies of particles produced when protons collide in the center of the detector as part of the Large Hadron Collider experiments.

## In search of the Big Bang

By GREG BOLT  
The Register-Guard

Among physicists eager to explore new territory, their ship sails today. Early this morning two beams of protons began racing in opposite directions around a 17-mile track at speeds just a fraction below that of light. Later, scientists will cross the beams and hurl the subatomic particles into each other, triggering swarms of micro collisions that for an infinitesimal moment will resemble the first instants of the Big Bang.

These brief flashes of light are expected to illuminate a new world, one that scientists hope will reveal the fundamental landscape of nature. *Register-Guard*



This computer-generated image shows the location of the 17-mile-long Large Hadron Collider tunnel (in blue) on the Switzerland-France border. The four main experiments will be conducted in underground caverns connected to the surface.

the Friday night speakers. Braus said that when the collider is up to full speed — something that won't happen until next year — a new age of exploration will begin. It will be to physics what finding a whole new continent would be to a geographer.



Jim Braus

any back, that will be enough force to split apart bits of matter

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# Sept. 10 Coverage

## OPINION

GUEST VIEWPOINT

# Particle physics worth the investment

By JIM BRAU

Some 14 billion years ago, a volume smaller than a single atom contained the entire visible universe. Today, the glorious structure of nature fills an incomprehensibly large region of space. And this fall, the United States loses its lead in the study of how it all happened as the Large Hadron Collider in Europe overtakes Fermilab, near Chicago, on the particle physics energy frontier.

Following a decade and a half of construction, the LHC opens operations this fall. Designed to find and study the Higgs boson, this new particle collider replaces Fermilab as the leading particle physics facility in the world with an energy seven times higher. Housed in a 17-mile underground tunnel near Geneva, Switzerland, at the European particle physics laboratory, CERN, the LHC will empower physicists from all over the world to explore the fundamentals of energy and matter.

Particle physics seeks to understand the building blocks of the universe — quarks, leptons and likely other particles not yet discovered — to reveal the processes of its rapid expansion, the formation of stars, planets and galaxies, and its destiny, whatever that may be.

Earlier experiments have revealed the relationship between the familiar electromagnetic force and the less

well-known weak nuclear force. Electricity, magnets, electrical storms and light are some of the manifestations of electromagnetism. The weak force creates radioactive decay. The LHC will search for the Higgs boson, or a substitute, thought to be the missing link.

Another discovery could be dark matter. First detected in the 1930s in the motion of galaxies in clusters and found in the 1950s in the rotation of galaxies, dark matter also affects the Big Bang remnant of microwaves filling the sky. But its identity is unknown.

Other breakthroughs are possible at the LHC — including extra dimensions of space, micro black holes, or other unexpected phenomena.

The United States once was host to highly productive particle accelerators. Even before World War II, the creative drive of E.O. Lawrence pushed accelerator technology. Cal-Berkeley accelerators inspired others, until the two workhorses of U.S. particle physics were constructed in the 1960s: the Stanford Linear Accelerator and the Fermilab proton accelerator.

Decades of research at Stanford, Fermilab and other American accelerator laboratories produced numerous discoveries, some rewarded with Nobel Prizes. But support for the U.S. program has been shrinking for more than a decade. Particle physics has stopped at Stanford, and Fermilab plans to shut down its collider as the

European model makes it obsolete. U.S. scientists have played an important role in construction of the LHC and the design of its experiments. After the termination of the superconducting super collider in Texas in 1993, the Department of Energy and the National Science Foundation provided support for American scientists involved in building the LHC.

Several events are planned in the United States to monitor first-beam attempts in Switzerland — which will occur in the morning in Geneva and after midnight in the United States.

Fermilab will hold a "pajama party," and attendees will follow events in Switzerland via a live satellite feed.

On Sept. 12 at the University of Oregon (Columbia Hall, Room 150), a panel of physicists engaged in the scientific program of the LHC will present a program describing progress on the collider, physics objectives and experiments designed to find the physics.

The International Linear Collider is now being developed by a global collaboration. It presents an important and very attractive opportunity for the U.S. to host what will likely be the premier international facility in this field. American leadership could make this attractive next facility a reality, but the American will has yet to materialize.

Many people think that these endeavors in fundamental science are

interesting, but not very relevant to everyday life. It's time to rethink the relevance.

Benefits from fundamental pursuits in physics affect us every day. Accelerators abound in hospitals and clinics. Radiation diagnostic techniques are critical to medical treatment. Accelerators developed for fundamental investigations in physics are now used to study materials, chemicals and biological substances.

In addition, the World Wide Web was invented at CERN to facilitate communication between scientists. These are just some of many ways that work in fundamental physics affects everyday life.

We can marvel at the beginning of operations at the LHC and anticipate transformative discoveries of the fundamental forces of nature and the properties of the universe. But American particle physicists are doing their science in Europe, and they wonder if the energy frontier will ever return to U.S. soil.

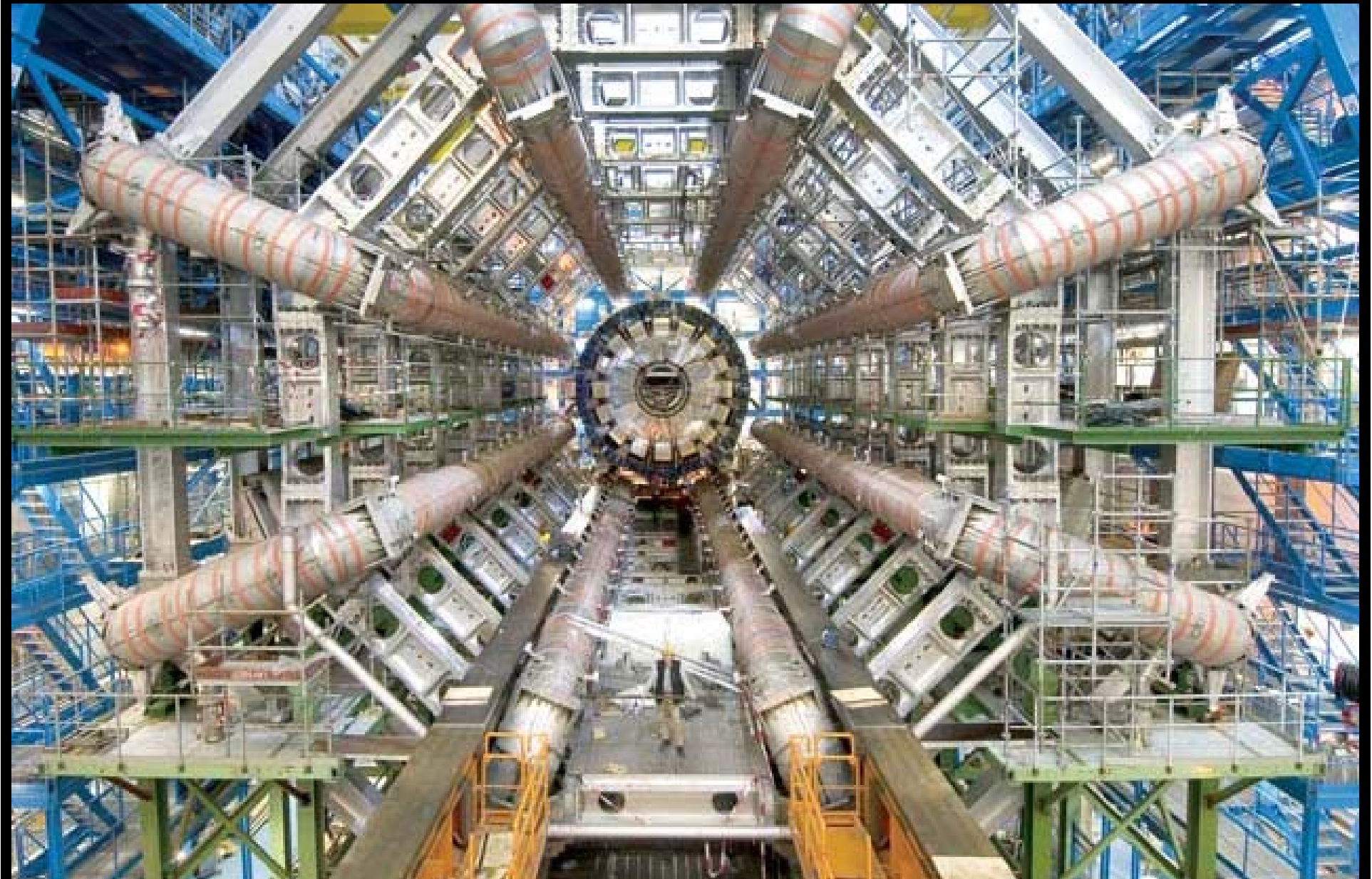
*Jim Braus has been a professor of physics at the University of Oregon since 1966. He is the Knight Professor of Natural Science, director of the UO Center for High Energy Physics, co-chairman of the World Wide Study for Future Linear Colliders and a fellow of the American Physical Society.*

M. Barnett – October 2008

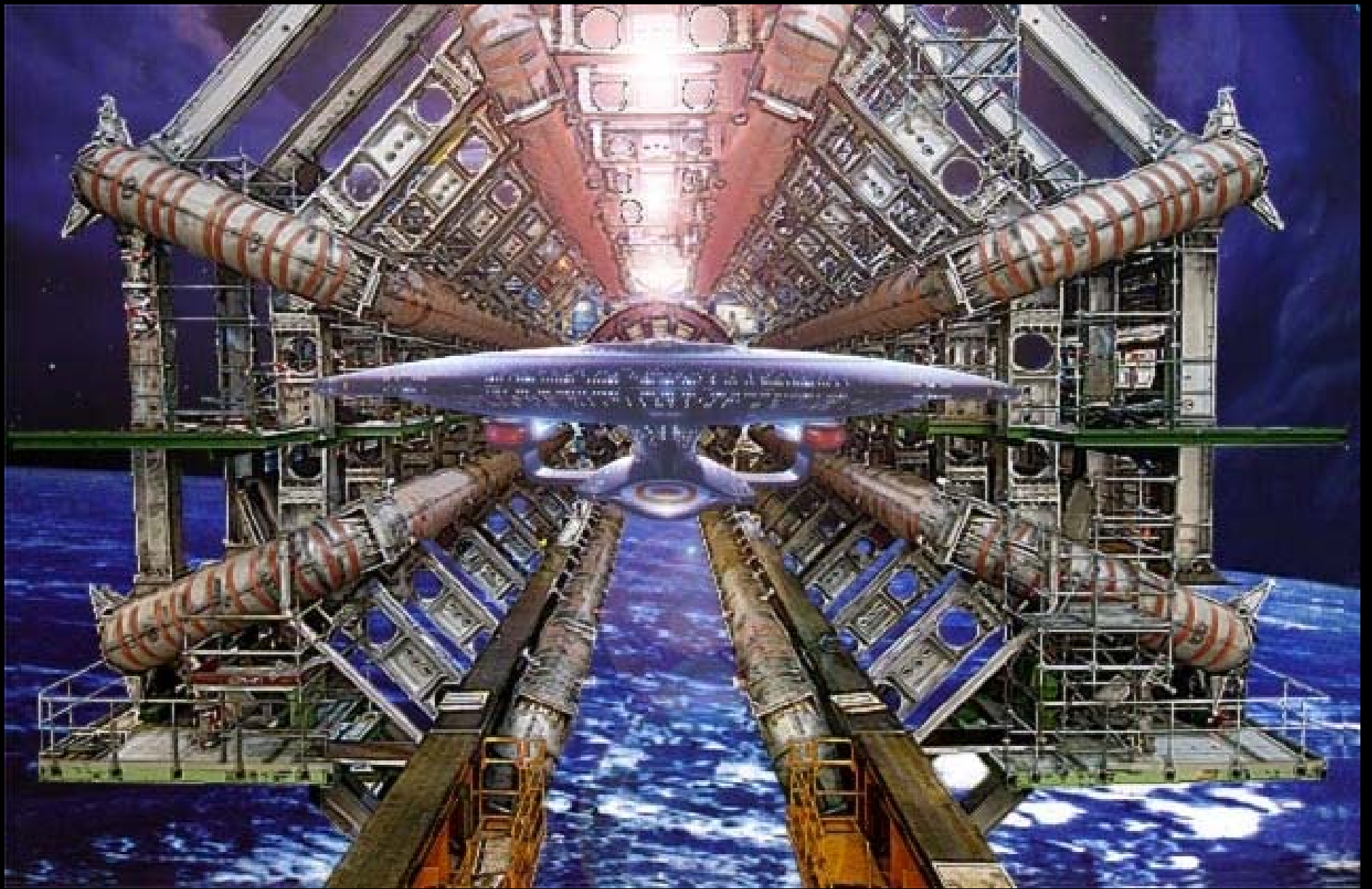
**If time allows...**



## Website Challenged People to Photoshop this Image



Star Trek: To boldly go where no experiment has gone before





## Classical view: The Standard Model



## The LHC Tube: Mind the Gap





## The Wizard of Oz: Follow the Yellow Brick Road



# The End