

Outlook on outreach

3rd Workshop on Data Preservation and Long Term Analysis in HEP

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Dec 8th, 2009

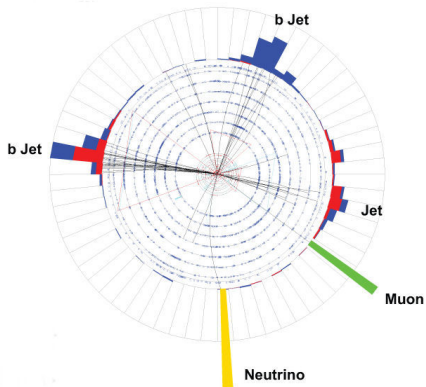


OUTLINE

- 1 MOTIVATION (THE HOOK)
- 2 AUDIENCE
- 3 CURRENT MODELS
- 4 CURRENT EFFORT
- 5 SUMMARY

MOTIVATION

- Particle physics complexity is increasing.
- Difficult to explain to the public.
- Students have gaps in their experience.
- **Can HEP data be used to attack these issues?**



- Our audience.

AUDIENCE

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 - General public.

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 - High school students.
 - *Technically savvy public (Slashdot crowd).*

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 - *Computing course?*
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 - Future particle physicists.
 - *Useful for theorists?*

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 - Future particle physicists.
 - *Useful for theorists?*
- All present different challenges.

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 - General public.
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 - Particle physics course.
 - *Computing course?*
 - *Statistics course?*
 - Future particle physicists.
 - *Useful for theorists?*
- All present different challenges.
- First step, focus on one group.
- Effort in this will naturally filter to other groups.

- CPEP
- Contemporary Physics Education Project.
- Demos and information.
- Classroom materials.

<http://www.cpepweb.org/>

The screenshot shows the homepage of the Contemporary Physics Education Project (CPEP) website. The browser address bar displays "http://www.cpepweb.org/". The website header features the CPEP logo and navigation tabs for "Fundamental Particles and Interactions", "Plasma Physics and Fusion", "The History and Fate of the Universe", and "Nuclear Science". A news section highlights a recent event: "CPEP Fellow George Siemon wins Nobel Prize". Below the news, a paragraph describes the project's mission. The main content area is organized into four thematic boxes: "FUNDAMENTAL PARTICLES AND INTERACTIONS", "PLASMA PHYSICS AND FUSION", "THE HISTORY AND FATE OF THE UNIVERSE", and "NUCLEAR SCIENCE". Each box contains a collage of related images and text. At the bottom of the page, there are buttons for "JOIN THE MEETING LIST" and "CONTACT US".

PHYSICS EDUCATION

- CPEP
- Contemporary Physics Education Project.
- Demos and information.
- Classroom materials.
- Particle adventure.

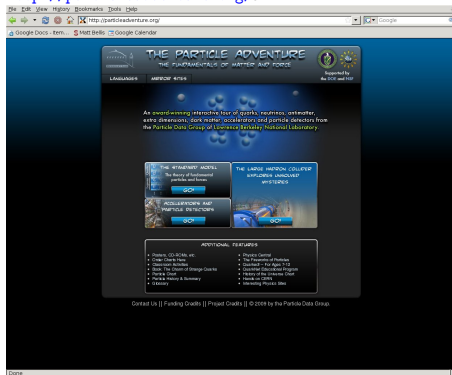
<http://www.cpepweb.org/>
<http://particleadventure.org/a>

The screenshot shows a web browser displaying the Particle Adventure website. The page has a dark blue background with a central graphic of blue spheres. The main heading is "THE PARTICLE ADVENTURE" with the subtitle "THE FUNDAMENTALS OF MATTER AND FORCE". Below this, it says "An award-winning interactive tour of quarks, neutrons, antimatter, extra dimensions, dark matter, accelerators and particle detectors from the Particle Data Group of Lawrence Berkeley National Laboratory". There are two main interactive buttons: "THE STANDARD MODEL" and "THE LARGE HADRON COLLIDER AND RELATED WONDERS". Below these are two columns of "ADDITIONAL FEATURES" with various links like "Physics Central", "The Particle of Interest", "Dark Matter", etc. At the bottom, there is a footer with "Contact Us", "Funding Credits", "Project Credits", and "© 2008 by the Particle Data Group".

PHYSICS EDUCATION

- CPEP
- Contemporary Physics Education Project.
- Demos and information.
- Classroom materials.
- Particle adventure.
- **What we're proposing is complementary to these projects.**

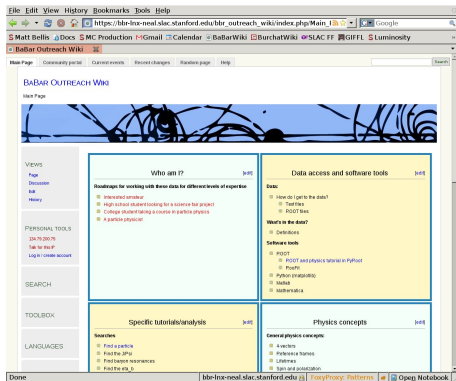
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BABAR (HEP?) OUTREACH WIKI

https://bbr-lnx-neal.slac.stanford.edu/bbr_outreach_wiki/index.php/Main_Page

- Wiki (Mediawiki)
- Only accessible from SLAC right now...this will change.



The screenshot shows a web browser window displaying the BABAR Outreach Wiki main page. The browser's address bar shows the URL: https://bbr-lnx-neal.slac.stanford.edu/bbr_outreach_wiki/index.php/Main_Page. The page features a header with the text "BABAR Outreach Wiki" and a decorative image of a particle detector. The main content area is organized into several sections:

- Who am I?**: A section for users to identify themselves, with sub-sections for "Roadmaps for working with these sites for different levels of expertise" and "Interested reader".
- Data access and software tools**: A section for users to find data and software, with sub-sections for "Data", "Who's in the data?", and "Software tools".
- Specific tutorials/analysis**: A section for users to find tutorials and analysis tools, with sub-sections for "Searches" and "Find a particle".
- Physics concepts**: A section for users to find physics concepts, with sub-sections for "General physics concepts" and "4 vectors".

The browser's status bar at the bottom shows the URL bbr-lnx-neal.slac.stanford.edu and the text "Done".

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BABAR (HEP?) OUTREACH WIKI

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- Data (samples), tutorials, lectures.
- Try this out in Stanford undergraduate particle physics course.
 - Pat Burchat

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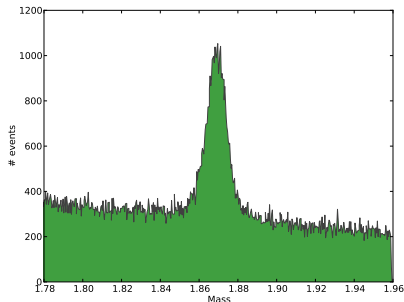
- Who am I?** (blue header): A section for newcomers, with sub-sections for "Interested onlooker", "High school student looking for a science fair project", and "College student taking a course in particle physics".
- Data access and software tools** (yellow header): A section for data and software, with sub-sections for "Data" (How do I get to the data?, Test files, ROOT files), "Who's in the data?", "Databases", "Software tools" (ROOT, ROOT and physics format in Physics, Java, Python (matplotlib), Media), and "Mathematics".
- Specific tutorials/analysis** (yellow header): A section for tutorials and analysis, with sub-sections for "Searches" (Find a particle, Find the J/psi, Find decay resonances, Find the etc.)
- Physics concepts** (blue header): A section for physics concepts, with sub-sections for "General physics concepts" (4 vectors, Feynman's Tables, Unitless, Spin and production).

The left sidebar contains navigation links: Views (Page, Discussion, All, History), PERSONAL TOOLS (Log in, Log out, Create account), SEARCH, TOOLBOX, and LANGUAGES. The browser's status bar at the bottom shows "Done" and the URL.

BABAR (HEP?) OUTREACH WIKI

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- Wiki (Mediawiki)
- Only accessible from SLAC right now...this will change.
- Data (samples), tutorials, lectures.
- Try this out in Stanford undergraduate particle physics course.
 - Pat Burchat
 - Text files
 - Python (matplotlib)
 - <http://matplotlib.sourceforge.net/>
 - Make mass plots, cut and count, etc.



- Recent discussion with Galaxy Zoo folks.

The screenshot shows the Galaxy Zoo website in a web browser. The browser's address bar displays "http://www.galaxyzoo.org/". The website header features the "GALAXY ZOO" logo with a red "2" in the top right corner. Below the logo is a navigation menu with links for "Home", "The Story So Far", "The Science", "How To Take Part", "Classify Galaxies", "FAQs", "Zoo Media", "Blog", "FAQ", and "Contacts". The main content area is divided into two columns. The left column contains a welcome message: "Welcome to Galaxy Zoo, where you can help astronomers explore the Universe" and a news item: "New, more detailed images added - see here for details". The right column features a "Classifier Log In" section with a "Click here to log in" button and a "Change language" section with options for "English" and "Français". Below these is a "Latest News" section with a link to "Did in the queue? - Scaling Galaxy Zoo". The footer of the website includes the text "Done" on the left and "FoxyProxy: Patterns" and "Open Notebook" on the right.


- Recent discussion with Galaxy Zoo folks.
- Hanny van Arkel and her discovery.

The screenshot shows a web browser displaying a CNN.com article. The browser's address bar shows the URL: <http://www.cnn.com/2008/TEC/space/08/07/space.discovery/index.html>. The page features a navigation bar with categories like HOME, WORLD, U.S., POLITICS, and a search bar. The main content area is titled "EDGE of DISCOVERY" and contains the following text:

Armchair astronomer discovers unique 'cosmic ghost'

By Brandon Frazier
CNN

CNN — Hanny van Arkel was peering over photos of galaxies on the internet in August 2007 when she stumbled across a strange object in the night sky: a bright, gaseous mass with a gaping hole in its middle.



van Arkel is a 25-year-old schoolteacher in Hoopster, the Netherlands, not an astronomer. But her starting find — a mysterious and unique object some observers are calling a "cosmic ghost" — has captured astronomers and even caught the attention of the people who ran the Hubble Space Telescope, who have agreed to take a closer look next year.

"The discovery really shows how strong amateur has come of age in the internet world," said Bill Keel, professor of physics

STORY HIGHLIGHTS

- Using the web, a Dutch schoolteacher has discovered a strange astronomical object.
- The find illustrates how many amateur astronomers are contributing to science.
- The Galaxy Zoo project encourages the public to join in astronomy research online.
- Hubble Space Telescope has agreed to take a closer look at the object next year.

Next Article in Technology

THE FIRST EVER IS CONVERTIBLE

GALAXY ZOO

- Recent discussion with Galaxy Zoo folks.
- Hanny van Arkel and her discovery.
- Phone conversation:
 - Chris Lintott (Oxford, Galaxy Zoo)
 - Michael Barnett (LBL, PDG/Atlas outreach)
 - Justin Albert (Victoria, BaBar)
 - Homer Neal (SLAC, BaBar)

The screenshot shows the Galaxy Zoo website in a browser window. The browser's address bar displays "http://www.galaxyzoo.org/". The website header features the "GALAXY ZOO" logo with a magnifying glass icon and the number "2" in the top right corner. Below the logo is a large banner with the text "GALAXY ZOO UNDERSTANDING COSMIC MERGERS" and "By colliding galaxies on your computer, you can help us trace the past, present and future of Galaxy Zoo mergers". To the right of the banner is a colorful image of a galaxy merger with the text "How Do Galaxies Merge?" and a button that says "HELP US SOLVE THE PUZZLE". Below the banner is a navigation menu with links: Home, The Story So Far, The Science, How To Take Part, Classify Galaxies, FAQs, Zoo Media, Blog, FAQ, and Contacts. The main content area has a heading "Welcome to Galaxy Zoo, where you can help astronomers explore the Universe" and a sub-heading "New, more detailed images added - see here for details". The text below explains that the Galaxy Zoo has cataloged almost a quarter of a billion galaxies and is now adding a second dimension to its catalog. It mentions that more than 350,000 people have taken part in Galaxy Zoo so far, producing a wealth of valuable data and sending telescopes on Earth and in space chasing after their discoveries. It also mentions that the "How To Take Part" link is now live and that the "Story So Far" link has been added to the site. The footer of the website includes the text "Done" and "FoxyProxy: Patterns" and "Open Notebook".

GALAXY ZOO

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- Hanny van Arkel and her discovery.
- Phone conversation:
 - Chris Lintott (Oxford, Galaxy Zoo)
 - Michael Barnett (LBL, PDG/Atlas outreach)
 - Justin Albert (Victoria, BaBar)
 - Homer Neal (SLAC, BaBar)
- Justin set up a CERN group.
 - pub-interface-HEP-data
- Galaxy Zoo (Event Zoo) approach may not be the right one for HEP...but that's only *my* opinion.

The screenshot shows the Galaxy Zoo website in a browser window. The URL is http://www.galaxyzoo.org/. The page features a large header with the 'GALAXY ZOO' logo and a navigation menu. A central banner reads 'By colliding galaxies on your computer, you can help us trace the past, present and future of Galaxy Zoo mergers' and includes a 'How Do Galaxies Merge?' section with a 'HELP US SOLVE THE PUZZLE' button. Below the banner, there is a 'Welcome to Galaxy Zoo' section and a 'Classifier Log In' section with a 'Click here to log in' button. The page also includes a 'Latest News' section and a 'Done' status bar at the bottom.

- Masterclass (Manchester)

<http://www.hep.manchester.ac.uk/u/masterclass/masterclass2009/>

File Edit View History Bookmarks Tools Help

http://www.hep.manchester.ac.uk/u/masterclass/masterclass2009/

Matt Bellis Docs MC Production Gmail Calendar BaBarWiki BurchatWiki SLAC FF GIFFL Luminosity

Manchester Particle P...

MANCHESTER

The University of Manchester

Particle Physics Masterclass 2009

Manchester Masterclass

Welcome

Welcome to the University of Manchester Particle Physics Masterclass Website

- Contact Us
- Maps and Directions
- Registration
- Programme

The Masterclass is a one day event specifically designed for sixth form students and their teachers and run by practising researchers from our Particle Physics group. The nationwide programme of Masterclasses began in 1997 and has proved to be stimulating and informative for thousands of students and hundreds of schools. This event is primarily intended for those students taking modules which include particle physics at 'A' or 'AS' level, but is also open to any physics student or teacher interested in studying or teaching the subject. The Masterclass will consist of a mixture of talks given by researchers in the Particle Physics group and hands-on practical sessions.

Our next Masterclasses will be held on April 2nd and 3rd 2009 at the School of Physics and Astronomy's Schuster Laboratory. ***This year we will have to charge a nominal fee of £5 per head to cover the cost of catering.***

For more information, and to register to attend, please use the links to the left of the page. If you have any questions, please contact us.

Masterclasses are organised throughout the UK by the High Energy Particle Physics Group of the Institute of Physics.

Done FoxxyProxy: Patterns Open Notebook

OTHER GROUPS

- Masterclass (Manchester)
- Quarknet (NSF/DOE, Fermilab)

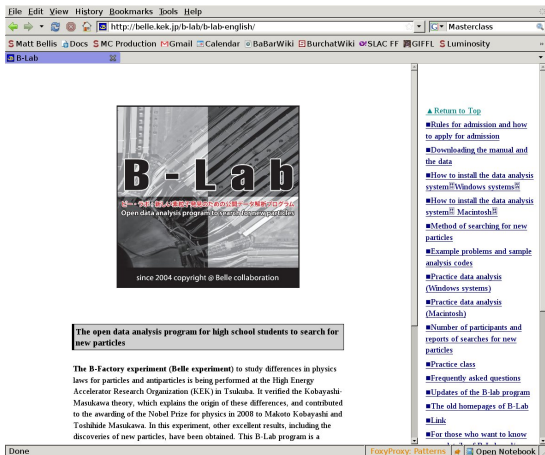
<http://www.hep.manchester.ac.uk/u/masterclass/masterclass2009/>
<http://quarknet.fnal.gov/>

The screenshot shows a web browser displaying the QuarkNet website. At the top, there is a navigation bar with 'File', 'Edit', 'View', 'History', 'Bookmarks', and 'Tools Help'. The address bar shows 'http://quarknet.fnal.gov/'. Below the browser window, the website content is visible. It features a large blue starburst graphic with the number '10' and the text 'QuarkNet: The science connection you've been waiting for!'. To the left of this graphic is a link 'Meet top_year teachers!'. Below the main heading, there are three sections: 'The Opportunity', 'The Players', and 'The Questions'. At the bottom, there are three columns of links: 'LHC & Fermilab Links', 'For Teachers', and 'For Students'. The 'LHC & Fermilab Links' column includes links to CERN, ATLAS, CMS, Fermilab, CDF, and DZERO. The 'For Teachers' column includes links to QuarkNet Classroom, Cosmic Ray e-Lab, Online Resources, QuarkNet Blog, Presentations at the 2009 AAP/TAAS, Chicago meetings, Contact us!, Join us!, and Kudos for QuarkNet. The 'For Students' column includes links to Cosmic Ray Studies, Run II Website, Webcasts, Analyze the data, Measuring Single Photons, Discovering New Particles, Applying Qm's Law, The Particle Adventure, The Top Quark, and Online References. At the bottom right, there is a 'Project Overview' link and a 'Kudos for QuarkNet' link. The browser's status bar at the bottom shows 'Done' and 'FoxyProxy: Patterns'.

OTHER GROUPS

- Masterclass (Manchester)
- Quarknet (NSF/DOE, Fermilab)
- B-Lab (Belle)

<http://www.hep.manchester.ac.uk/u/masterclass/masterclass2009/>
<http://quarknet.fnal.gov/>
<http://belle.kek.jp/b-lab/b-lab-english/>



File Edit View History Bookmarks Tools Help

http://belle.kek.jp/b-lab/b-lab-english/ Masterclass

Matt Bellis Docs MC Production Gmail Calendar BaBarWiki BurchatWiki SLAC FF GIFFL Luminosity

B-Lab

B - Lab
Open data analysis program for high school students to search for new particles
since 2004 copyright © Belle collaboration

The open data analysis program for high school students to search for new particles

The B-Factory experiment (Belle experiment) to study differences in physics laws for particles and antiparticles is being performed at the High Energy Accelerator Research Organization (KEK) in Tsukuba. It verified the Kobayashi-Maskawa theory, which explains the origin of these differences, and contributed to the awarding of the Nobel Prize for physics in 2008 to Makoto Kobayashi and Toshihide Maskawa. In this experiment, other excellent results, including the discoveries of new particles, have been obtained. This B-Lab program is a

Return to Top

- Rules for admission and how to apply for admission
- Downloading the manual and the data
- How to install the data analysis system (Windows systems)
- How to install the data analysis system (Macintosh)
- Method of searching for new particles
- Example problems and sample analysis codes
- Practice data analysis (Windows systems)
- Practice data analysis (Macintosh)
- Number of participants and reports of searches for new particles
- Practice class
- Frequently asked questions
- Updates of the B-lab program
- The old homepages of B-Lab
- Link
- For those who want to know

Done FoxyProxy: Patterns Open Notebook

OTHER GROUPS

- Masterclass (Manchester)
- Quarknet (NSF/DOE, Fermilab)
- B-Lab (Belle)
- I2U2 (NSF/DOE, LIGO, CMS)
- All seem to be targeting grades 6-12.

<http://www.hep.manchester.ac.uk/u/masterclass/masterclass2009/>
<http://quarknet.fnal.gov/>
<http://belle.kek.jp/b-lab/b-lab-english/>
<http://www18.i2u2.org/>



The screenshot shows a web browser window displaying the I2U2 website. The browser's address bar shows the URL <http://www18.i2u2.org/>. The website has a navigation bar with tabs for "I2U2 Home", "e-Labs", and "I-Labs". Below the navigation bar, there is a header image featuring the text "I2U2" in a stylized font, with a background of blue and orange arrows and binary code. The main content area contains the following text:

I2U2 Home **e-Labs** **I-Labs**

I2U2 Home **About Us** **DIR 6-12**

Interactions in Understanding The Universe, (I2U2) an "educational virtual organization," strengthens the education and outreach activities of scientific experiments and U.S. universities and laboratories. I2U2 creates and maintains an infrastructure and common fabric to develop hands-on laboratory course content and provide an interactive learning experience that brings tangible aspects of each experiment into an accessible "virtual laboratory" setting for education at different levels and in various venues. The I2U2 collaboration of scientists, computer scientists and educators directly addresses the urgent national priority to grow and sustain the scientific workforce, and to promote the public's appreciation of and support for the complex collaborations of our national scientific programs.

I2U2 labs take two similar but distinct shapes. "e-Labs," delivered as Web-based portals accessible in the classroom and at home, are implemented with the ever-expanding capabilities of Web-based media. "I-Labs," delivered as interactive interfaces typically located within science museums and similar public venues, leverage the latest advances in display technology and human-computer interaction, and bring the experiences and appreciation of scientific investigation and inquiry to the wide audience of informal education. These laboratories break new ground by using the Grid for education in the same way that science uses the Grid. I2U2 reaches communities underrepresented in science and continuously assesses the impact of this approach on science education. I2U2 collaborators use existing partnerships with underserved populations to prototype and evaluate the labs.

  This project is supported in part by the National Science Foundation and the Office of High Energy Physics in the Office of Science, U.S. Department of Energy. Opinions expressed are those of the authors and not necessarily those of the Foundation or Department.

Done [FoxyProxy: Patterns](#)  Open Notebook

CURRENT EFFORT

- Outreach Wiki
- Tools and demos:

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- Tools and demos:
 - Other plotting visualization packages?
 - Conversation from 2nd workshop at SLAC.
 - Rene Brun: “gcc benefitted when there was more competition from other compilers (icc, egcs, etc).”

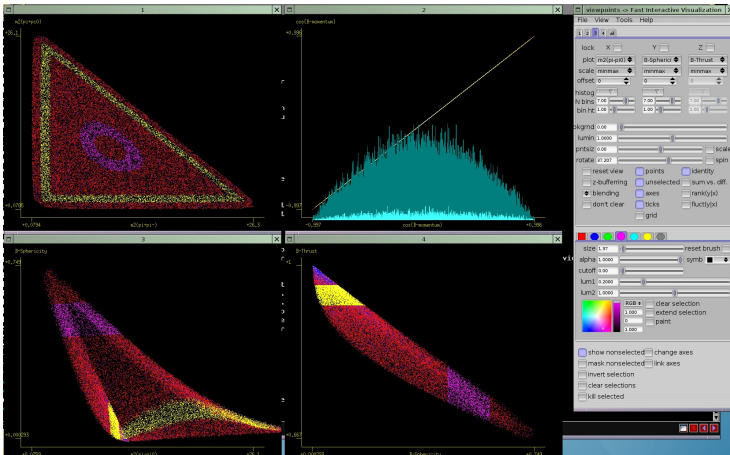
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 - What I heard: “ROOT would benefit from competition (outside ideas).”
 - Viewpoints. (NASA)

CURRENT EFFORT

<http://astrophysics.arc.nasa.gov/~pgazis/viewpoints.htm>

http://www.slac.stanford.edu/~bellis/viewpoints_demo.html



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- File formats.
 - Data for students.

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- File formats.
 - Data for students.
 - Experimenting with LASS data (30+ years old!)
 - Revived by David Aston (SLAC/LASS)
 - http://www.slac.stanford.edu/~bellis/data_formats.html

DATA FORMATS

- File formats.
- Consider documentation.
 - Having a good `man` around can be a lifesaver.

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 - Better yet, a **well** organized **man**.

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 - Huge boon to always have documentation at fingertips.
 - Imposed pseudo-requirements on programmers.

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 - Huge boon to always have documentation at fingertips.
 - Imposed pseudo-requirements on programmers.
 - FITS (Flexible Image Transport System)
 - Used in astro community.
 - Header with information about the image.
 - Many implementations: Fortran, C/C++, Perl, Python, Java, etc.
 - Can even read with **gimp** or **Photoshop**.
 - I want a file format that carries its own documentation around with it.

DATA FORMATS

- How can I learn from this?
- Try converting LASS data.

DATA FORMATS

- How can I learn from this?
- Try converting LASS data.
 - Fixed target SLAC experiment.
 - 11 GeV K^+/K^- beams on hydrogen target.
 - 1977-1978, 1981-1982
 - $\sim 100\text{M}$ triggers.
 - David Aston (SLAC) revived the data.
 - “ The original format (in fact, still is the format, since the files are just straight bit-copies of the originals) is IBM VBS – “Variable Blocks Spanned” – format, processed with VM/CMS; big-endian with IBM’s mainframe floating point format (not IEEE).”

DATA FORMATS

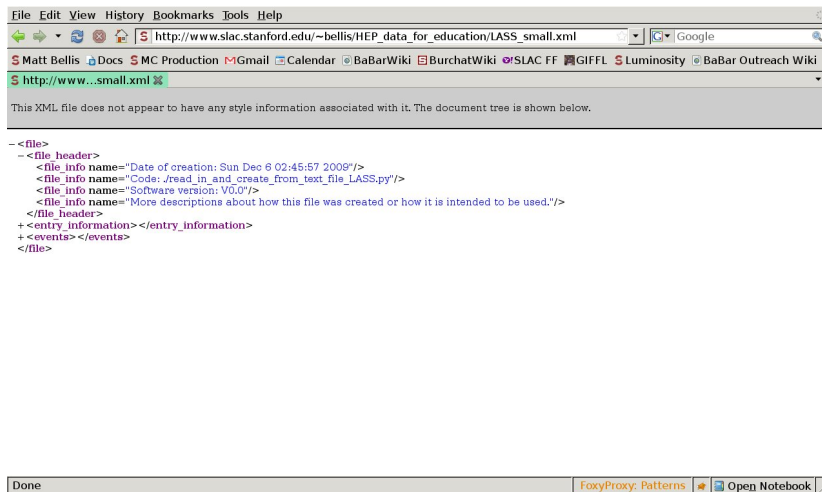
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 - David Aston (SLAC) revived the data.
 - “ The original format (in fact, still is the format, since the files are just straight bit-copies of the originals) is IBM VBS – “Variable Blocks Spanned” – format, processed with VM/CMS; big-endian with IBM’s mainframe floating point format (not IEEE).”
 - David gave me text files...

LASS TEXT FILES

```
new EVENT: run event hw & sw triggers    9550    3    18    8E18
Topology : 1
Vertices tracks: 1 5
  Primary vtx: x y z d^2    -0.763999999 -0.40200001  81.5400009  0.0351999998
Beam charge px py pz : 1 -0.00964925718  0.00366006303  10.9029951
tracks/charge px py pz :
3  0.00761500327  0.309128046  8.70612812
5  0.133273423  -0.16253081  0.656466305
2  0.0946368724  -0.149057582  0.53865546
-1 -0.0939974785  0.214401409  0.689579844
Topology : 2
Vertices tracks: 2 4
  Primary vtx: x y z d^2    -0.786000013 -0.375999987  80.5699997  0.0177999996
Beam charge px py pz : 1 -0.00964925718  0.00366006303  10.9029951
tracks/charge px py pz :
3  0.00738755707  0.309133559  8.70612812
2  0.0962994769  -0.147988901  0.53865546
0  0.037703827  0.0509431213  1.34604621
  Secondary vtx: x y z d^2    -0.858938336 -0.303011149  81.9899979
0.00257943221
daughters/charge px py pz :
5  0.13265042  -0.163039669  0.656466305
-1 -0.094946593  0.213982791  0.689579844
new EVENT: run event hw & sw triggers    9550    91    18    CE1C
Topology : 1
Vertices tracks: 1 5
```

Convert to XML...

LASS XML FILES



File Edit View History Bookmarks Tools Help

http://www.slac.stanford.edu/~bellis/HEP_data_for_education/LASS_small.xml

Matt Bellis Docs MC Production Gmail Calendar BaBarWiki BurchatWiki SLAC FF GIFFL Luminosity BaBar Outreach Wiki

http://www...small.xml

This XML file does not appear to have any style information associated with it. The document tree is shown below.

```
-<file>
- <file_header>
  <file_info name="Date of creation: Sun Dec 6 02:45:57 2009"/>
  <file_info name="Code: ./read_in_and_create_from_text_file_LASS.py"/>
  <file_info name="Software version: V0.0"/>
  <file_info name="More descriptions about how this file was created or how it is intended to be used."/>
</file_header>
+ <entry_information></entry_information>
+ <events></events>
</file>
```

Done FoxyProxy: Patterns Open Notebook

LASS XML FILES

File Edit View History Bookmarks Tools Help

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  <file_info name="More descriptions about how this file was created or how it is intended to be used."/>
</file_header>
- <entry_information>
- <entry name="run_num">
  <Name>run_num</Name>
  <Units>NO UNITS</Units>
  <Short_description>Run number</Short_description>
  <Long_description>Run number</Long_description>
</entry>
- <entry name="event_num">
  <Name>event_num</Name>
  <Units>NO UNITS</Units>
  <Short_description>Event number</Short_description>
  <Long_description>Event number within a given run</Long_description>
</entry>
- <entry name="hw_trigger">
  <Name>hw_trigger</Name>
  <Units>HEX</Units>
  <Short_description>Hardware trigger</Short_description>
  <Long_description>Hardware trigger</Long_description>
</entry>
- <entry name="sw_trigger">
  <Name>sw_trigger</Name>
  <Units>HEX</Units>
```

Done FoxyProxy: Patterns Open Notebook

LASS XML FILES

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File Edit View History Bookmarks Tools Help
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http://www...small.xml
</file_header>
+ <entry_information> </entry_information>
- <events>
  - <event>
    <header run_num="9550" event_num="3" hw_trigger="24" sw_trigger="36376"/>
    - <beams>
      <beam beam_tv_map="1100" beam_charge="1" beam_X="-0.00964926" beam_Y="0.00366008" beam_Z="10.90299510"/>
      <beam beam_tv_map="2100" beam_charge="1" beam_X="-0.00964926" beam_Y="0.00366008" beam_Z="10.90299510"/>
    </beams>
    - <vertices>
      <vertex vertex_tv_map="1000" vertex_chi2="0.03520000" vertex_X="-0.76400000" vertex_Y="-0.40200001" vertex_Z="81.54000090"/>
      <vertex vertex_tv_map="2000" vertex_chi2="0.01780000" vertex_X="-0.78600001" vertex_Y="-0.37599999" vertex_Z="80.56999970"/>
      <vertex vertex_tv_map="2100" vertex_chi2="0.00257943" vertex_X="-0.85893834" vertex_Y="-0.30301115" vertex_Z="81.98999790"/>
    </vertices>
    - <vertex_map_info>
      <v_map topology="1" vertex_type="0" num_tracks_with_vertex="4"/>
      <v_map topology="2" vertex_type="0" num_tracks_with_vertex="3"/>
      <v_map topology="2" vertex_type="1" num_tracks_with_vertex="2"/>
    </vertex_map_info>
    - <tracks>
      <track track_info="1000" track_id="3" track_X="0.00761500" track_Y="0.30912805" track_Z="8.70612812"/>
      <track track_info="1000" track_id="5" track_X="0.13327342" track_Y="-0.16253081" track_Z="0.65646631"/>
      <track track_info="1000" track_id="2" track_X="0.09463687" track_Y="-0.14905758" track_Z="0.53985546"/>
      <track track_info="1000" track_id="-1" track_X="-0.09399748" track_Y="0.21440141" track_Z="0.68957984"/>
      <track track_info="2000" track_id="3" track_X="0.00738756" track_Y="0.30913356" track_Z="8.70612812"/>
      <track track_info="2000" track_id="2" track_X="0.09628948" track_Y="-0.14798890" track_Z="0.53985546"/>
      <track track_info="2000" track_id="0" track_X="0.03770383" track_Y="0.05094312" track_Z="1.34604621"/>
      <track track_info="2100" track_id="5" track_X="0.13265042" track_Y="-0.16303967" track_Z="0.65646631"/>
      <track track_info="2100" track_id="-1" track_X="-0.09494659" track_Y="0.21398279" track_Z="0.68957984"/>
    </tracks>
  </event>
  - <event>
    <header run_num="9550" event_num="91" hw_trigger="24" sw_trigger="52764"/>
  </event>
Done FoxyProxy: Patterns Open Notebook
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DATA FORMATS

- Can we replicate this in ROOT?
- Suggestion from Rene Brun: `GetUserInfo` in `TTree`.

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- Define my own standard: `TList`'s of `TString`'s

DATA FORMATS

- Can we replicate this in ROOT?
- Suggestion from Rene Brun: GetUserInfo in TTree.
- Uses TList to hold anything derived from TObject.
- Define my own standard: TList's of TString's
 - 0th entry: Information about the file.
 - 1st entry: Defines what information is held for each entries.
 - 2nd – n^{th} entry: Information about the TTree entries.
- Only store int's, float's and arrays of these in the TTree.
- Provide PyRoot script to dump information.

LASS ROOT FILES

```
> ./dump_header_info.py -h
Usage: dump_header_info.py [options]

Options:
  -h, --help            show this help message and exit
  -a, --all             Dump all the information
  -t TREE_NAME, --tree-name=TREE_NAME
                        Name of the TTree object
  -i INFO, --info=INFO  Append these choices for specific information to dump
                        out. Note that only the # of the information is
                        necessary. e.g: -i 0 -i2
```

LASS ROOT FILES

```
> ./dump_header_info.py LASS_small.root
Information about how this file was generated
Date of creation: Sun Dec 6 02:45:58 2009
Code: ./read_in_and_create_from_text_file_LASS.py
Software version: V0.0
More descriptions about how this file was created or how it is intended to be used.

Description of entries in header
0: Name
1: Units
2: Short description
3: Long description
```

LASS ROOT FILES

```
> ./dump_header_info.py LASS_small.root -a
Information about how this file was generated
Date of creation: Sun Dec 6 02:45:58 2009
Code: ./read_in_and_create_from_text_file_LASS.py
Software version: V0.0
More descriptions about how this file was created or how it is intended to be used.

Description of entries in header
Name
Units
Short description
Long description

run_num
      Name: run_num
      Units: NO UNITS
Short description: Run number
Long description: Run number

event_num
      Name: event_num
      Units: NO UNITS
Short description: Event number
Long description: Event number within a given run

hw_trigger
      Name: hw_trigger
      Units: HEX
Short description: Hardware trigger
Long description: Hardware trigger
```

- ROOT looks promising.
- Use LASS as test-bed and try to revive entire dataset ($\sim 1\%$ so far).
- Still exploring and would welcome suggestions.

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- Still exploring and would welcome suggestions.
- I'm just throwing this out there...
- Could ROOT's file format be separated like FITS?
- Could this become a standard for the community?
- Could require *any function in the analysis chain to return documentation for storage in the data stream.*
- Could require *unit testing models with all functions.*
- Could allow more flexibility to adapt to new languages, hardware, etc.

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 - Education and outreach Wiki.
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 - Set up something that can be maintained by small, distributed core group.

Thanks for your time

BACKUP SLIDES

- History of particle physics.
- Repository?

1) Last week we learned about the prediction of a 4th flavour of quarks and the development of the CKM matrix.

Go to the website

www.slac.stanford.edu/BaBar_data and download some sample of bulk events.

Look up the primary hadronic decay modes of the D meson.

Find evidence of the D meson.

UNIVERSITY COURSES

- History of particle physics.
- The BaBar dataset contains much of this history,
- Repository?

2) The $\Upsilon(4S)$ is a vector meson and is produced in a polarized state in e^+e^- colliders.

Predict the angular distribution if this state decays to two spin-0 particles.

Go to the website

www.slac.stanford.edu/BaBar_data and download the appropriate skimmed sample for this problem.

Reconstruct B mesons in the $J/\psi K$ final state.

Plot the angular distribution. Does this agree with your prediction?

- Put the data in people's hands.

GENERAL PUBLIC/HIGH SCHOOL STUDENTS

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GENERAL PUBLIC/HIGH SCHOOL STUDENTS

- Put the data in people's hands.
- Let people look for new particles.
- New correlations?
- Encourage people to send back their plots.
 - Forum?
 - **Plot of the month?**
 - Have physicists to comment on the most interesting ones?

TRAINING GROUND

- Could HEP data be used as a training ground?
- Online school?
- Summer program?

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- Perfect for theorists looking for experimental experience.
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 - Measure branching fractions.
 - Extract spin information.
 - Measure $\sin(2\beta)$

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- Summer program?
- Perfect for theorists looking for experimental experience.
- **Do an analysis start to finish?**
 - Measure branching fractions.
 - Extract spin information.
 - Measure $\sin(2\beta)$
- Needs a well-calibrated dataset (BaBar, others?) and an analysis flow chart,
- **Could you do a publishable analysis in a summer school?**

- National Virtual Observatory.
- *Access to real data!*

<http://www.us-vo.org>

The screenshot shows the homepage of the National Virtual Observatory (NVO). At the top, there is a navigation bar with links for 'File', 'Edit', 'View', 'History', 'Bookmarks', 'Tools', and 'Help'. Below this is a search bar and a list of open tabs including 'Google Docs - Item...', 'Matt Bellis', and 'Google Calendar'. The main content area features the NVO logo and the tagline '...the Universe at your fingertips'. A welcome message reads: 'Welcome to the New NVO Home Page! We welcome your feedback on the new site. Discover, retrieve, and analyze astronomical data from archives and data centers around the world.' The page is organized into several sections: 'Need help? Not sure how to start?' with a 'Getting Started with NVO' link; 'Collect all data at a given position' with a 'SkyOutline' link; 'Cover matches between catalog entries and your position' with an 'Inventory' link; 'Query databases and cross-match object lists' with a 'Open SkyQuery' link; 'Find data collections and catalogs by searching their descriptions' with a 'Directory' link; 'Integrate data from multiple positions and datasets' with a 'VIM' link; 'Query the VO from the command line' with a 'VO-CLI' link; 'Current tool failures in the VO suite: formal used by VO applications' with a 'Table Tools' link; and 'Do more with NVO' with a 'Data Analysis & More' link. On the right side, there is a 'What's New?' section with a 'New Version' link and a 'Community' section with a 'Helping Out' link. At the bottom, there is a search bar with the text 'search the NVO website' and a footer with links for 'Privacy Policy', 'Public Data Access Policy', and 'Acknowledging NVO'.

- National Virtual Observatory.
- *Access to real data!*
- Sloan Digital Sky Survey

<http://www.us-vo.org>

<http://www.sdss.org/education/>

The screenshot shows a web browser window displaying the Sloan Digital Sky Survey website. The browser's address bar shows the URL <http://www.sdss.org/education/>. The website header features the Sloan Digital Sky Survey logo and the tagline "Mapping the Universe". A navigation menu on the left includes links for Home, SDSS Data, Science, Press, Releases, Education, Image Gallery, Legacy Survey, SEGUE, Supernova Survey, Collaborations, Publications, SDSS-III, and Contact Us. The main content area is titled "SDSS Education and Outreach" and includes a sub-section "Tools for Educators" with several bullet points: SkyServer, American Museum of Natural History's Science Bulletin feature, World Wind, COSMOS, the SDSS/RC3 Atlas, and Galaxy Zoo. A small photograph of people at a science exhibit is visible in the bottom right corner of the page.

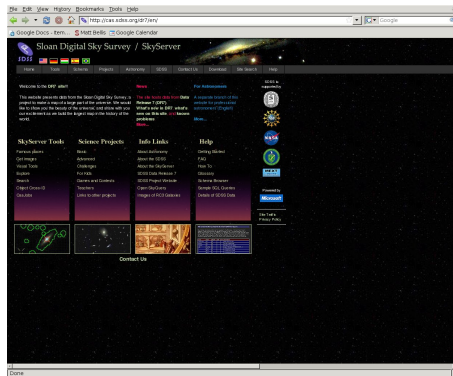
PHYSICS EDUCATION

- National Virtual Observatory.
- *Access to real data!*
- Sloan Digital Sky Survey
- SDSS SkyServer

<http://www.us-vo.org>

<http://www.sdss.org/education/>

<http://cas.sdss.org/dr5/en/>



PHYSICS EDUCATION

- National Virtual Observatory.
- *Access to real data!*
- Sloan Digital Sky Survey
- SDSS SkyServer
- Large Synoptic Survey Telescope

<http://www.us-vo.org>

<http://www.sdss.org/education/>

<http://cas.sdss.org/dr5/en/>

<http://www.lsst.org/lsst/public/outreach>

The screenshot shows the LSST website's 'Education and Public Outreach' section. The page features a navigation menu on the left with categories like PUBLIC, SCIENTISTS, and GALLERY. The main content area includes a search bar, a photo of children looking through a telescope, and a section titled 'Audience as broad as possible!' with a list of target groups: Public, Students and Teachers, Formal/Informal Venues, and Amateur Astronomers. Below this is a 'Goals of the Program' section.

Large Synoptic Survey Telescope
The world's largest, deepest eye in the night sky

Education and Public Outreach

The Education and Public Outreach (EPO) programs for the LSST are as ambitious as the telescope itself. We intend to actively involve our audience in LSST's mission of mapping the structure of all matter in our extraordinary, dynamic Universe. Using the principles of Backward Design, described in *Understanding by Design* (Wiggins and McTighe), we have begun to conceptualize our EPO program using a [LSST template](#). Subscribe to the quarterly [LSST E-News](#) to keep up to date.

Audience as broad as possible!

- Public
- Students and Teachers
- Formal/Informal Venues
- Amateur Astronomers

Goals of the Program