

A new Information Architecture, Website and Services for the CMS Experiment

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CHEP 2012, New York





x 4000 people ... for many decades

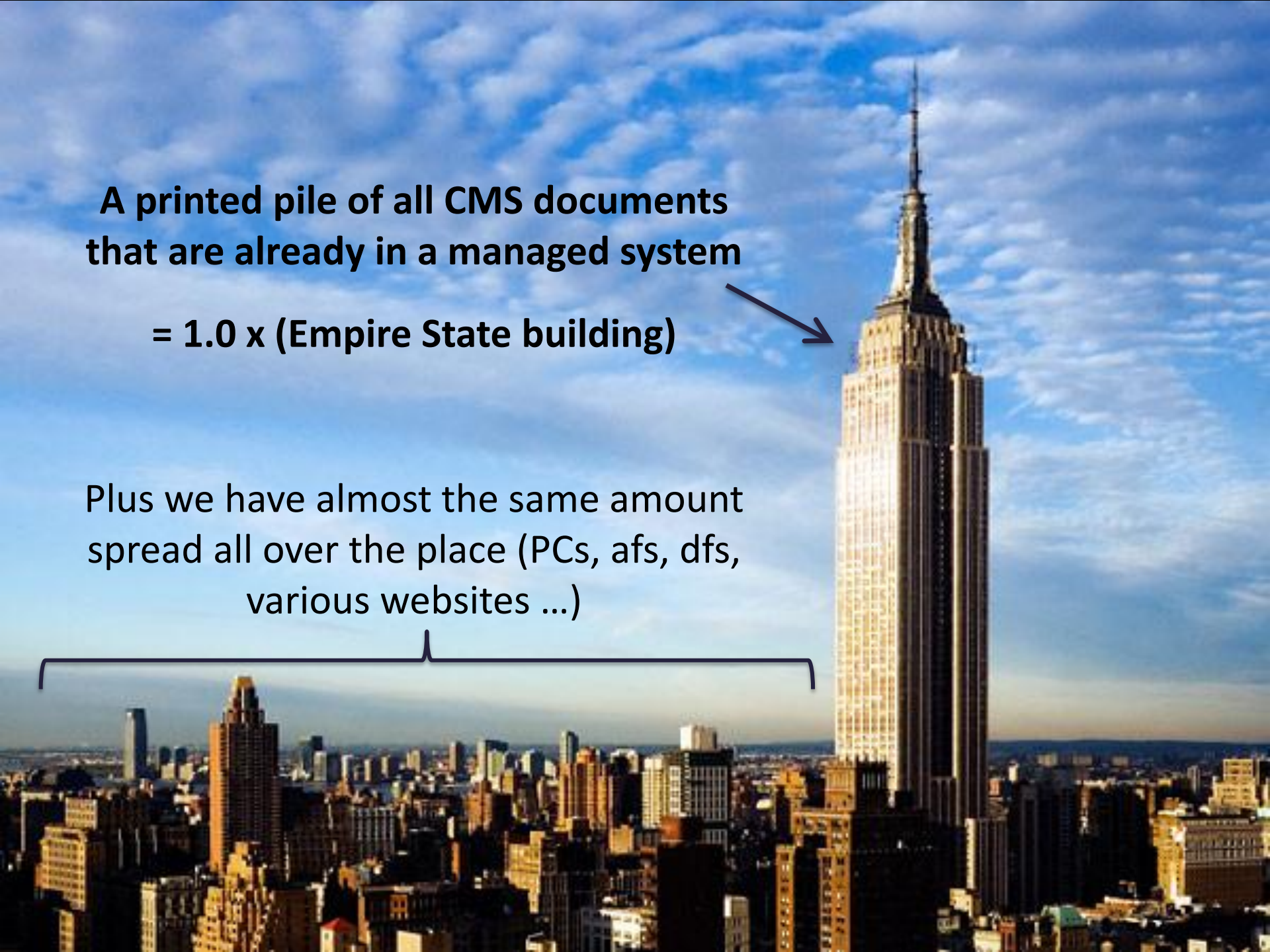


**A printed pile of all CMS documents
that are already in a managed system**

= 1.0 x (Empire State building)



Plus we have almost the same amount
spread all over the place (PCs, afs, dfs,
various websites ...)



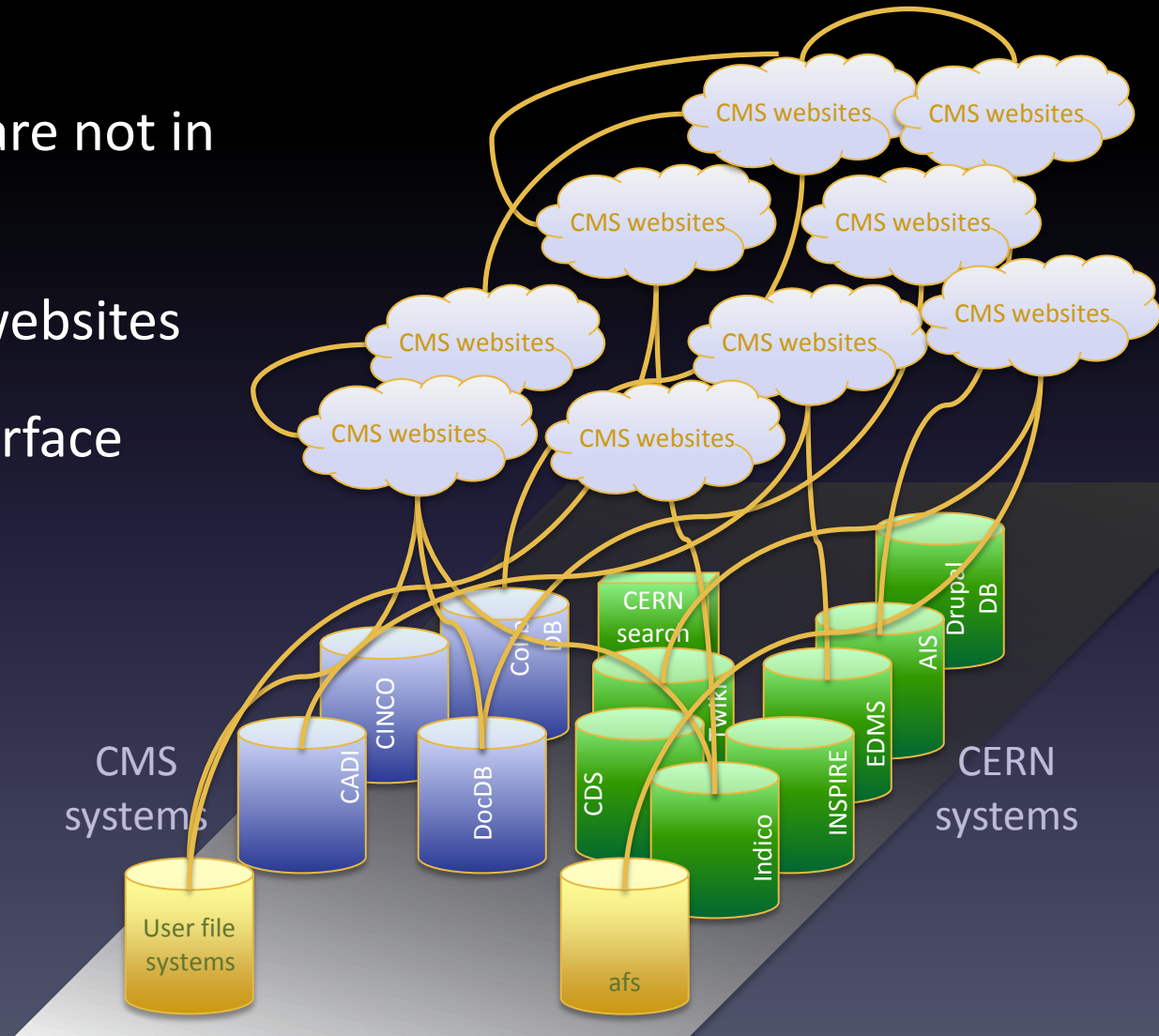
No. of CMS Documents, May 2012

Document database	379,219
Indico (Meetings)	205,206
DocDB (Miscellaneous documents)	128,948
CDS (Photographs)	12,252
CDS (Papers, reports, notes)	11,720
EDMS (Engineering drawings & data)	8,105
CADI (Papers & notes in preparation)	7,513
CINCO (Conference contributions)	5,475
Wiki or file system	325,957
Twiki (Web attachments)	118,644
Twiki (Web pages)	25,820
User disks (Misc. PDF, tex, MS office)	100,000
Group afs (Misc. PDF, tex, MS office)	81,493
Grand Total	705,176



Information Architecture Challenges (Jan 2010)

- > 50% of documents are not in a document database
- > 500 “official” CMS websites
- No coherent user interface
- No overall navigation
- No overall search



Goal 1:

Manage all CMS documents in a document database

Goal 2:

Create a coherent web interface to all CMS information

Goal 1: Manage all CMS documents in a document database

- CERN systems

- CDS: papers, notes, photos
- EDMS for engineering
- Indico for meetings ...

- CMS systems

- CADI: physics analysis
- CINCO: conferences

- Fermilab's DocDB

- For everything else

This screenshot shows the 'Document Addition' form in the DocDB interface. At the top, there is a search bar with the text 'Search by title, author, topic or by id:DocID' and buttons for 'Search' and 'Advanced search'. Below the search bar are navigation tabs: 'Browse topics', 'Submit document', and 'Help'. The main section is titled 'Document Addition' and includes links for 'Admin area', 'My preferences', 'Email notifications', 'Limit my groups', and 'Logout'. A message states 'Often uploading a lot of files? Find out more about our bulk upload tool' with a link and a 'Show extra fields' button. The form contains input fields for 'Title' and 'Abstract', each with a question mark icon. Below these is a 'Notes and Changes' section with a question mark icon. The 'Local file upload' section includes a 'File' input field with a 'Browse...' button, a 'Description' input field, and a 'Main?' checkbox. There are three more 'File' input fields with 'Browse...' buttons. A note says 'Make sure you supply a format everyone can view (e.g. PDF)'. The 'Document type' section has a dropdown menu and a grid of radio buttons for various document types: Other, Audio, Publication, Video, Note, Poster, CMS-Note, Technical Drawing, Figure/Photo, Manual, Report, TDR, Talk, Organigram, Proceedings, Technical Data, Approved figure, Minutes, and Archive.

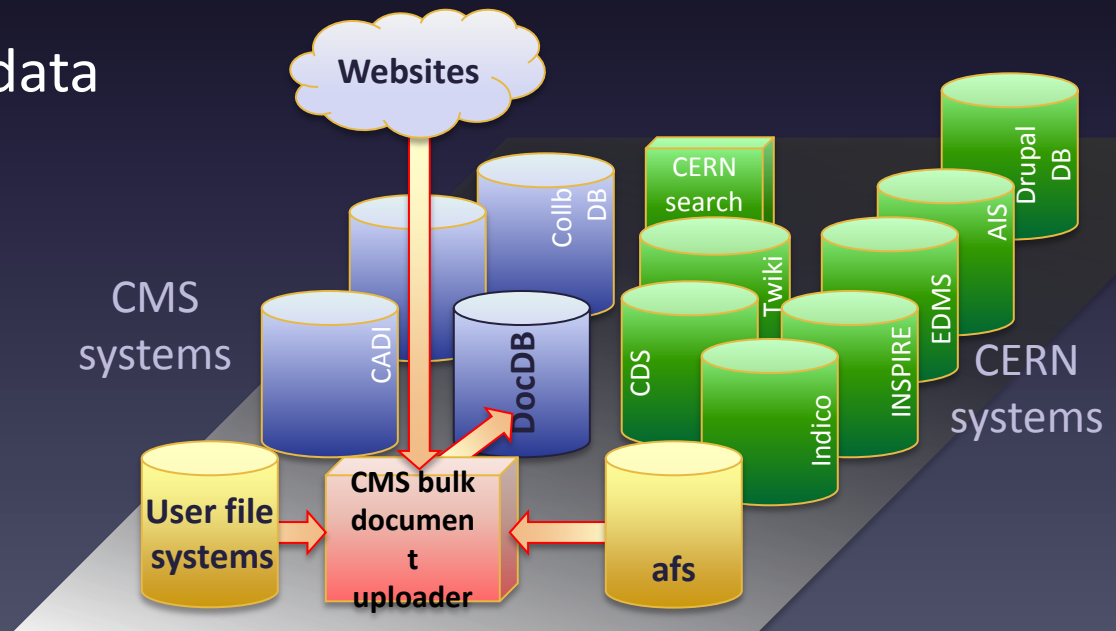
This screenshot shows the 'List of Topics' page in the DocDB interface. It features the same search bar and navigation tabs as the previous screenshot. The main content is a 'List of Topics' section with links for 'Admin area', 'My preferences', 'Email notifications', 'Limit my groups', and 'Logout'. The topics are organized into several categories: 'Admin tags (DocDB)' (Archive of CCS, Archive of CPT, Archive of PRS, Archive of Website, Organigram, TDR, To be completed), 'CMS Management' (Collaboration Board, Communications Group, Finance Board, Internal Reviews, LHCC Reports / Reviews, Management Board, Official Documents), 'Computing' (Computing Documentation, Computing Integration, Computing Planning, Computing Policies, Computing Resources, Computing: Analysis, Operations, Computing: Data Operations, Computing: Facilities, Computing: User Support), 'ECAL' (ECAL DPG, ECAL Facilities, ECAL Lab Test Systems, ECAL Management, ECAL Pre-Installation, ECAL Upgrades, PS Operations, Technical Coordination), 'HCAL' (HB, HE, HO, HCAL CASTOR Detector, HCAL DPG, HCAL Electronics, HCAL Electronics Integration Centre, HCAL Engineering and Design, HCAL Installation, HCAL Management, HCAL PS Operations, HCAL Test Beams, HCAL Upgrades, HCAL to be completed, HF, Laser and LED, Publications), 'Muon' (Muon Alignment, Muon Cathode Strip Chamber (CSC), Muon DPG, Muon Drift Tubes (DT), Muon Management, Muon Resistive Plate Chamber (RPC), Muon To Be Completed), 'Offline' (Core Software, Data and Workflow Management, Offline Coordination, Offline Database, Offline Integration, Offline PH Software Group, Offline Project Office, Offline Resources, Offline SLHC Upgrades), 'Physics' (Physics Analysis Groups, Physics Object Groups, Task Forces and Working Groups), 'Technical and Run Coordination' (Beam Monitoring and Luminosity, Common Electronics, DCS, Infrastructure Projects, Magnet, Run Coordination, Safety, TC Planning), 'Tracker' (CMS Tracker Upgrades, Detector Performance Group, Pixels, Silicon Strip Infrastructure, Silicon Strip Operations, Silicon Strip System, Tracker Management, Tracker to be completed), 'Trigger and DAQ' (DAQ, Higher Level Triggers (HLT), L1 Trigger), and 'Upgrades' (Computing, Software, and Physics, General Technical Information, Management and Planning, Research and Development, Upgrades Technical Proposal).

DocDB:
Perl, mySQL
Linux file
system

Goal 1: Manage all CMS documents in a document database

Created a “bulk document upload” tool to find documents on file systems and websites and import into DocDB

- Scripts search for documents
(helped by web crawlers)
- Try to auto-extract metadata
(title, author, date, etc.)
- Make thumbnail images



Goal 1: Manage all CMS documents in a document database

- User web interface
 - Choose documents to keep
 - Add metadata
- Script does bulk import to DocDB
 - XML import interface

CERN State of the Web questionnaire & DocDB Bulk upload tool (beta) [come, Taylor, Lucas. Documentation / Change password / Log out](#)
[Evaluate a website](#) [View/Change existing reports](#) | [File Batches](#) [DocDB Documents](#)

Home > Documents > File Batches

Select File Batch to change Add File Batch +

Search 673 results (2133 total)

2011 2012

Action: Go 0 of 100 selected

	Time	Web path	Status	Edit	List users
<input type="checkbox"/> See NOT yet Processed files in Batch					
<input type="checkbox"/> Media/Publications/Brochures/CMSbrochure/	March 16, 2011, 3:54 p.m.		New (to process)	Edit	lapka
<input type="checkbox"/> Christoph - OOCourse	March 14, 2011, 11:58 a.m.		New (to process)	Edit	christoph
<input type="checkbox"/> Christoph - html/talks/talkdata	March 14, 2011, 11:47 a.m.		New (to process)	Edit	christoph
<input type="checkbox"/> FRANK GUIDO top level of folder	March 10, 2011, 4:01 p.m.		New (to process)	Edit	frank,erik,guido,test
<input type="checkbox"/> FRANK GUIDO PP1_Motherboard	March 10, 2011, 3:54 p.m.		New (to process)	Edit	
<input type="checkbox"/> FRANK GUIDO PowerDist	March 10, 2011, 3:54 p.m.		New (to process)	Edit	
<input type="checkbox"/> FRANK GUIDO HMX_IDs	March 10, 2011, 3:54 p.m.		New (to process)	Edit	
<input type="checkbox"/> FRANK GUIDO Documentation for Safety Inspection	March 10, 2011, 3:54 p.m.		New (to process)	Edit	
<input type="checkbox"/> FRANK GUIDO DataSheets	March 10, 2011, 3:54 p.m.		New (to process)	Edit	
<input type="checkbox"/> FRANK GUIDO CaenEASyRackBuilder	March 10, 2011, 3:54 p.m.		New (to process)	Edit	
<input type="checkbox"/> /afs/cern.ch/cms/cmsinfo/html/Resources/Website/Media/Videos - movies	March 10, 2011, 3:54 p.m.		New (to process)	Edit	
<input type="checkbox"/> /Resources/Website/Media/Publications/Posters - docs	March 10, 2011, 3:54 p.m.		New (to process)	Edit	
<input type="checkbox"/> /Resources/Website/Media/Publications/PhotoBook - docs	March 10, 2011, 3:54 p.m.		New (to process)	Edit	
<input type="checkbox"/> /Resources/Website/Media/Publications/ComicBook - docs	March 10, 2011, 3:54 p.m.		New (to process)	Edit	
<input type="checkbox"/> /Resources/Website/Media/Publications/Brochures - docs	March 10, 2011, 3:54 p.m.		New (to process)	Edit	
<input type="checkbox"/> /Resources/Website/Media/Presentations - docs	March 10, 2011, 3:54 p.m.		New (to process)	Edit	
<input type="checkbox"/> /Resources/Website/Media/CMSintheMedia - docs	March 10, 2011, 3:54 p.m.		New (to process)	Edit	
<input type="checkbox"/> /Resources/Website/Collaboration	March 10, 2011, 3:54 p.m.		New (to process)	Edit	
<input type="checkbox"/> /afs/cern.ch/cms/MUON/cscTrigger/html/ucla/tmb2004	March 9, 2011, 3:54 p.m.		New (to process)	Edit	
<input type="checkbox"/> /afs/cern.ch/cms/MUON/cscTrigger/html/ucla	March 9, 2011, 3:54 p.m.		New (to process)	Edit	

bash,
Python
django,
mySQL,

Diagram illustrating the CMS detector components and data processing flow:

- ROCs (Readout Channels)
- Basestrips
- Calorimeter (CMS_BPIX_layout.jpg)
- Tracker (CMS_BPIX_layout.jpg)
- Carbon fiber support (CMS_BPIX_layout.jpg)
- Aluminum cooling pipes (CMS_BPIX_layout.jpg)
- 53 cm (CMS_BPIX_layout.jpg)
- Calorimeter (CMS_BPIX_layout.jpg)
- Tracker (CMS_BPIX_layout.jpg)
- Carbon fiber support (CMS_BPIX_layout.jpg)
- Aluminum cooling pipes (CMS_BPIX_layout.jpg)
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- Tracker (CMS_BPIX_layout.jpg)
- Carbon fiber support (CMS_BPIX_layout.jpg)
- Aluminum cooling pipes (CMS_BPIX_layout.jpg)
- 53 cm (CMS_BPIX_layout.jpg)

Abstract Topics: edit DOCUMENT INFO

Download the file

/afs/cern.ch/cms/Tracker/html/Andrea_poyer/doku by rusace01

Goal 1:

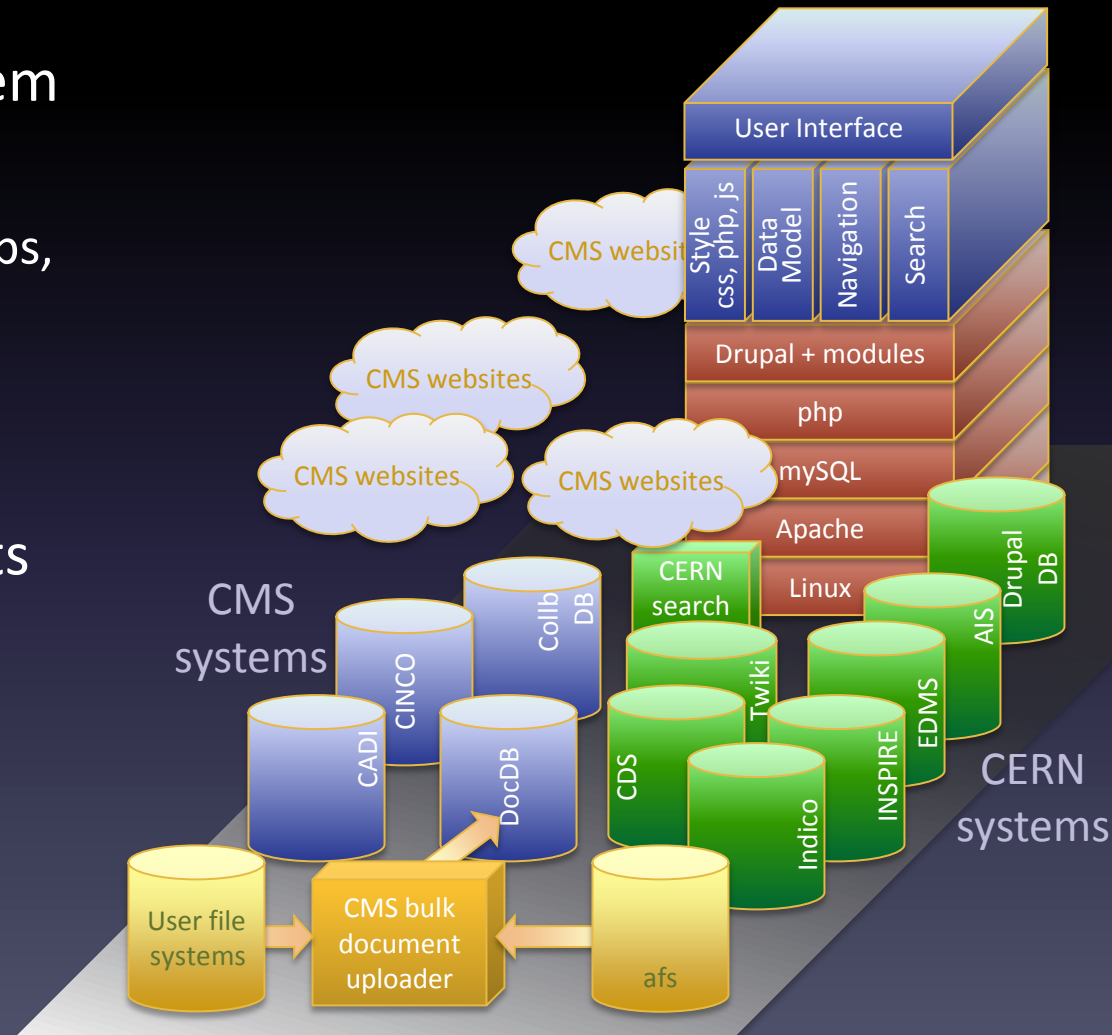
Manage all CMS documents in a document database

Goal 2:

Create a coherent web interface to all CMS information

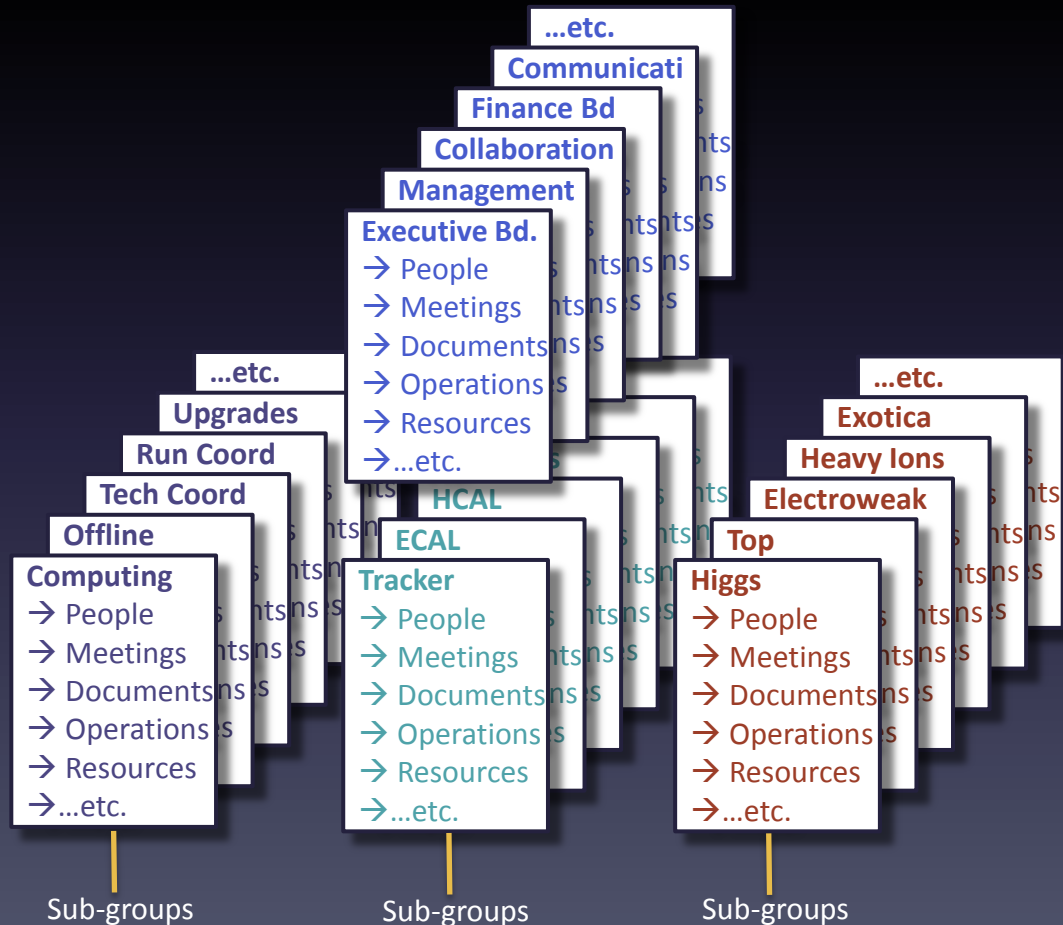
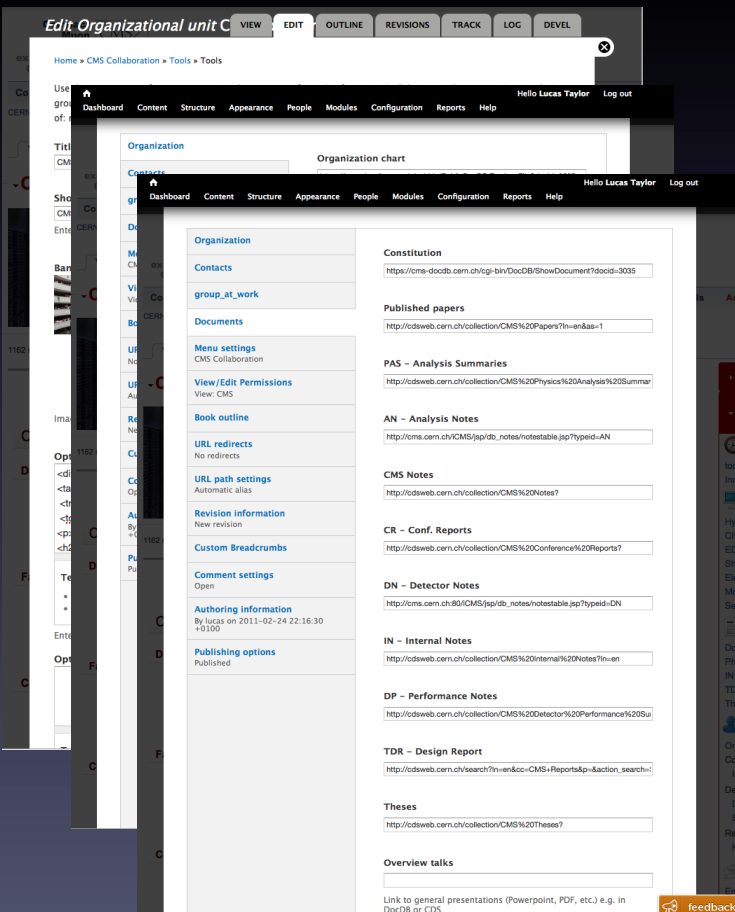
Goal 2: Create a coherent web interface to all CMS information

- Use open-source Drupal Content Management System
 - Now a CERN service
 - Integrated with SSO, e-groups, DB and web services, etc.
- CMS layer with distinct parts
 - Style customizations
 - Data model
 - Navigation
 - Search



Goal 2: Create a coherent web interface to all CMS information

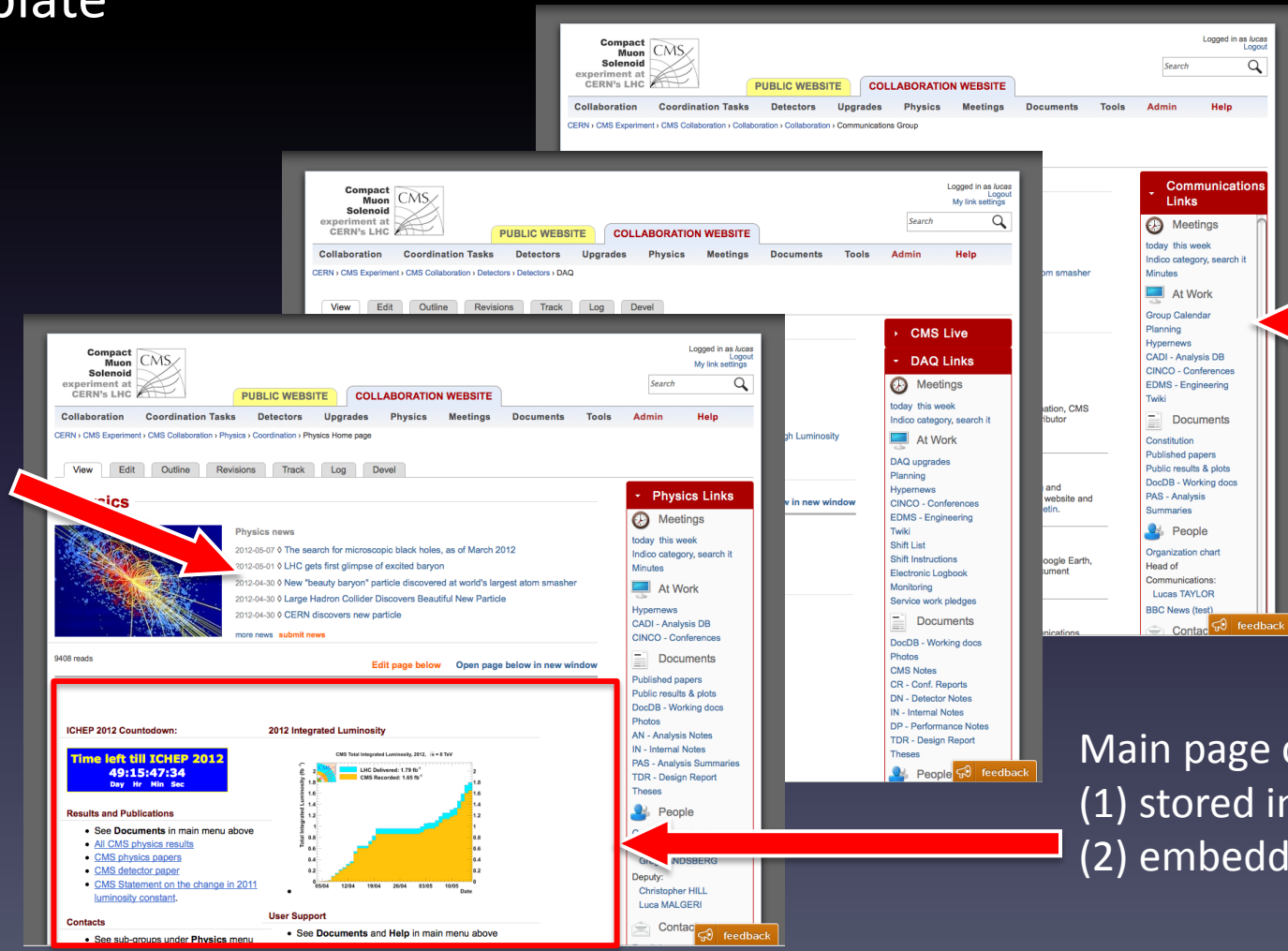
- Data model based on CMS “organisational units”
 - Each with similar set of data and links



Goal 2: Create a coherent web interface to all CMS information

- Build web pages for each organisational unit from a standard template

News, if tagged to be of interest to org. unit



Sidebars show metadata specific to each org. unit

Main page content is either (1) stored in Drupal or (2) embedded via an iframe

Goal 2: Create a coherent web interface to all CMS information

- Build site-wide menus from “organisational unit” structure

Dashboard Content **Structure** Appearance People Modules Configuration Reports Help

Hello Lucas Taylor Log out

MENU LINK	ENABLED	OPERATIONS
DT Upgrades	✓	edit delete
RPC Upgrades	✓	edit delete
BRM Upgrades	✓	edit delete
Physics	✓	edit delete
Coordination	✓	edit delete
Physics Home page	✓	edit delete
Physics Results	✓	edit delete
LHC Physics Centre	✓	edit delete
Procedures & Guidelines	✓	edit delete
Generators	✓	edit delete
Statistics Committee	✓	edit delete
Physics Perf. and Dataset	✓	edit delete
Analysis Groups	✓	edit delete
B Physics	✓	edit delete
Exotica	✓	edit delete
Forward Physics	✓	edit delete
Heavy Ions	✓	edit delete
Higgs	✓	edit delete
Standard Model	✓	edit delete
SUSY	✓	edit delete
TOP	✓	edit delete
Physics Objects	✓	edit delete
Tracking	✓	edit delete
B-Tagging	✓	edit delete
e/gamma	✓	edit delete
Jets/MissET	✓	edit delete
Tau-ID	✓	edit delete

feedback

Compact Muon Solenoid experiment at CERN's LHC

PUBLIC WEBSITE **COLLABORATION WEBSITE**

Collaboration Coordination Tasks Detectors Upgrades Physics - Meetings Documents Tools Admin Help

CERN > CMS Experiment > CMS Collaboration > Physics > Coordination > Physics Home page

View Edit Outline Revisions Track Log De

Physics

Physics news

- 2012-05-01 The search for microscopically small particles
- 2012-05-01 LHC gets first glimpse of excited baryon
- 2012-04-30 New "beauty baryon" particle discovered at world's largest accelerator
- 2012-04-30 Large Hadron Collider Discovers Beautiful New Particle
- 2012-04-30 CERN discovers new particle

more news submit news

9410 reads

Edit page below Open page below in new window

ICHEP 2012 Countdown:

Time left till ICHEP 2012
49:15:18:05
Day Hr Min Sec

Results and Publications

- See Documents in main menu above
- All CMS physics results
- CMS physics papers
- CMS detector paper
- CMS Statement on the change in 2011 luminosity constant.

2012 Integrated Luminosity

CMS Total Integrated Luminosity, 2012, $\sqrt{s} = 8$ TeV

Total Integrated Luminosity (fb⁻¹)

LHC Delivered: 1.79 fb⁻¹
CMS Recorded: 1.65 fb⁻¹

User Support

- See Documents and Help in main menu above

https://cms.web.cern.ch/org/higgs under Physics menu

Logged in as Lucas Log out My link settings

Search

Analysis Groups

- B Physics
- Exotica
- Forward Physics
- Heavy Ions
- Higgs
- Standard Model
- SUSY
- TOP

Physics Objects

- Tracking
- B-Tagging
- e/gamma
- Jets/MissET
- Tau-ID
- Muons

Physics Links

- Meetings
- is week
- category, search it

Minutes

At Work

Hypernews

- CADI - Analysis DB
- CINCO - Conferences

Documents

- Published papers
- Public results & plots
- DocDB - Working docs
- Photos
- AN - Analysis Notes
- IN - Internal Notes
- PAS - Analysis Summaries
- TDR - Design Report
- Theses

People

- Organization chart
- Physics Coordinator: Greg LANDSBERG
- Deputy: Christopher HILL, Luca MALGERI

Contact

feedback

Goal 2: Create a coherent web interface to all CMS information

- Create different views from the same Drupal metadata

The image displays two screenshots of the CMS website interface, illustrating the goal of creating a coherent web interface to all CMS information.

Left Screenshot: Shows the "Compact Muon Solenoid experiment at CERN's LHC" logo and the "PUBLIC WEBSITE" tab. The main content area is titled "CMS Operations" and lists various links under categories like BEAM RADIATION MONITORING, BRM UPGRADES, CASTOR, CATHODE STRIP CHAMBERS, CMS CALENDAR, CMS COLLABORATION, CMS GLOSSARY, CMS PRESENTATIONS FOR THE PUBLIC, CMS TV, COMMON INFRASTRUCTURE FOR UPGRADES, COMMUNICATIONS GROUP, COMPUTING, COMPUTING AND SOFTWARE HELP, COMPUTING FOR UPGRADES, CSC UPGRADES, DAQ, DAQ UPGRADES, DETECTOR PERFORMANCE GROUPS - DELETE, DOADB - FIND DOCUMENTS, and DOADB - STORE DOCUMENT.

Right Screenshot: Shows the "Compact Muon Solenoid experiment at CERN's LHC" logo and the "PUBLIC WEBSITE" tab. The main content area is titled "Documents Index - Ordered by CMS Group". It lists various document categories and links, including: AUTHORSHIP COMMITTEE, AWARDS COMMITTEES, B PHYSICS, B-TAGGING AND VERTEXING POG, BEAM RADIATION MONITORING, BOOK A CERN MEETING ROOM, BRM UPGRADES, CADI - CMS ANALYSIS DATABASE INTERFACE, CASTOR, CATHODE STRIP CHAMBERS, CB ADVISORY GROUP, CINCO - CONFERENCE MANAGEMENT SYSTEM, CMS CALENDAR, CMS COLLABORATION, CMS CONSTITUTION, RULES AND GUIDELINES, CMS DETECTOR, CMS DOCUMENTATION, CMS EVENTS TODAY, and CMS GLOSSARY. A search bar is visible in the top right corner.

Goal 2: Create a coherent web interface to all CMS information

- Single CMS search bar
- Search done by underlying systems
- Results shown in tabs
- Access control by target systems

The screenshot displays the CMS Compact Muon Solenoid experiment website. At the top, there is a navigation bar with tabs for 'PUBLIC WEBSITE' and 'COLLABORATION WEBSITE'. Below this is a secondary navigation bar with links for 'Collaboration', 'Coordination Tasks', 'Detectors', 'Upgrades', 'Physics', 'Meetings', 'Documents', 'Tools', 'Admin', and 'Help'. A search bar is located in the top right corner, showing the user is logged in as 'lucas' and has a search history entry 'tejinder virdee'. The main content area is titled 'Search results' and features a tabbed interface for different search categories: 'Web' (CMS portal, Wiki, CERN search, Google), 'People' (XWho etc), 'Indico' (meetings), 'CDS' (public documents), 'DocDB' (Miscellaneous documents), 'EDMS' (Engineering documents), and 'Other' (miscellaneous). Below the tabs, there is a section for 'See results from:' with filters for 'All fields', 'Title only', 'Author', 'Abstract only', and 'Doc.ID only'. A link to 'open results in new window' is also present. The search results are displayed in a table with columns for 'CMS-doc-#', 'Title', 'Author(s)', 'Topic(s)', and 'Last Updated'. The table lists several documents, including presentations, management board news, and various reports, with authors like Tejinder Virdee, Daniel R. Green, and Joseph Robert Incandela. The table is currently showing results for the 'All fields' filter.

Compact Muon Solenoid experiment at CERN's LHC

Logged in as lucas
Logout

tejinder virdee

PUBLIC WEBSITE COLLABORATION WEBSITE

Collaboration Coordination Tasks Detectors Upgrades Physics Meetings Documents Tools Admin Help

CERN > CMS Experiment > Search > Content > Search

Search results

Web: CMS portal, Wiki, CERN search, Google
People: XWho etc
Indico: meetings
CDS: public documents
DocDB: Miscellaneous documents
EDMS: Engineering documents
Other: miscellaneous

See results from: All fields Title only Author Abstract only Doc.ID only open results in new window

Admin area My preferences Email notifications Limit my groups Logout

Search Results

CMS-doc-#	Title	Author(s)	Topic(s)	Last Updated
4171-v1	Presentation for public - ECIS, The Hague	Tejinder Virdee	Presentations for Outreach	15 Apr 2011
3895-v1	CMS Management Board (MB) News (2001 and 2003)	Tejinder Virdee	Management Board	11 Mar 2011
3956-v1	Archive of CMS Weeks News	Tejinder Virdee	CMS Management	11 Mar 2011
3964-v2	Archive of CMS Weeks News	Tejinder Virdee	CMS Management	11 Mar 2011
3980-v1	The PPC-QF Decision for VFCAL Requirements and Detector Performance	Daniel R. Green <i>et al.</i>	HCAL Management	07 Mar 2011
3046-v26	CMS Calendar -- current calendar plus previous versions	Various Authors <i>et al.</i>	CMS Management Official Documents	26 Apr 2012
2597-v24	CMS Management Board Organigram	Joseph Robert Incandela	Finance Board Publications Committee CMS Management Conference Committee Management Board Official Documents Collaboration Board	26 Apr 2012
3778-v5	CMS Extended Executive Board (XEB) Organigram	Joseph Robert Incandela <i>et al.</i>	CMS Management Management Board Official Documents Organigram	20 Apr 2012
4225-v1	CMS General Poster	David Barney <i>et al.</i>	Publications for Outreach	06 Mar 2012
5836-v1	CMS Photo Book "The Compact Muon Solenoid Experiment at the LHC"	Sergio Cittolin <i>et al.</i>	Publications for Outreach	10 Feb 2012
5411-v4	CMS event displays of 4 lepton events	Thomas McCauley <i>et al.</i>	Physics Higgs Communications Group Images for Outreach E/Gamma (Electrons and Photons) Physics Analysis Groups Outreach and	19 Aug 2011

Goal 2: Create a coherent web interface to all CMS information

- Public site focus is fresh news
 - Text, images, links, etc.
 - Keywords, groups/topics
 - Author / editor workflow
- Email notifications, RSS, Twitter, FB, G+ ...
- Promote to home page or features slider
- Push to selected CMS groups

The screenshot displays the CMS Public Website interface. At the top, a navigation bar includes links for Dashboard, Content, Structure, Appearance, People, Modules, Configuration, Reports, and Help. The user is logged in as Lucas Taylor. The main header features the CMS logo and a search bar. Below the header, a secondary navigation bar lists various sections: Collaboration, Coordination Tasks, Detectors, Upgrades, Physics, Meetings, Documents, Tools, Admin, and Help. The main content area is titled 'Physics' and features a 'Physics news' section with a list of recent updates, including the search for microscopic black holes and the discovery of a new particle. A 'Time left till ICHEP 2012' countdown timer is also present. The right sidebar contains a 'Physics Links' section with links to Meetings, At Work, Documents, and People. The bottom of the page includes a 'Historical links' section and a feedback button.

Goal 2: Create a coherent web interface to all CMS information

- Interactive Google maps view of CMS
- Interactive view of CMS papers
- Embedded video and images

The screenshot displays the CMS Public Website interface. At the top, the CMS logo and navigation tabs for 'PUBLIC WEBSITE' and 'COLLABORATION WEBSITE' are visible. Below the navigation bar, the 'CMS Videos' section is highlighted, featuring a video player for 'Google Science Fair 2012: Where...' and a description of the video content. To the right, a 'Multimedia' sidebar lists various resources including 'Movies', 'Photographs', 'Images of collisions', 'Books, brochures, fact sheets and posters', and 'Presentations'. Each resource is accompanied by a small thumbnail image. On the far right, a vertical column of yellow arrows points to specific resources, labeled 'YouTube CDS', 'CDS', 'CDS', 'CDS DocDB', and 'DocDB'.

Compact Muon Solenoid
experiment at CERN's LHC

CMS

Search

PUBLIC WEBSITE **COLLABORATION WEBSITE**

CMS People **Detector** **Physics** **Education** **Jobs** **Contact CMS** **Help**

CERN > CMS Experiment > CMS Videos

CMS Videos

The videos below are grouped into playlists, and will play sequentially when started. In order to browse all videos in a given playlist, click on the playlist button located on the video player toolbar:

Find more videos at the CMS YouTube channel and the CERN Document Server (CDS).

Overview of CMS and CERN

Google Science Fair 2012: Where **Like** **Share** **More info**

Archana Sharma
Physicist, CERN

0:41 / 2:34

• These videos provide a brief overview of CERN, LHC and CMS.

Physics

What is a Higgs Boson? **Like** **Share** **More info**

• A look at some of the physics goals of CMS, including the hunt for the Higgs boson and the search for Supersymmetry (or SUSY).

Multimedia

Movies

YouTube CDS

Photographs

CDS

Images of collisions

CDS

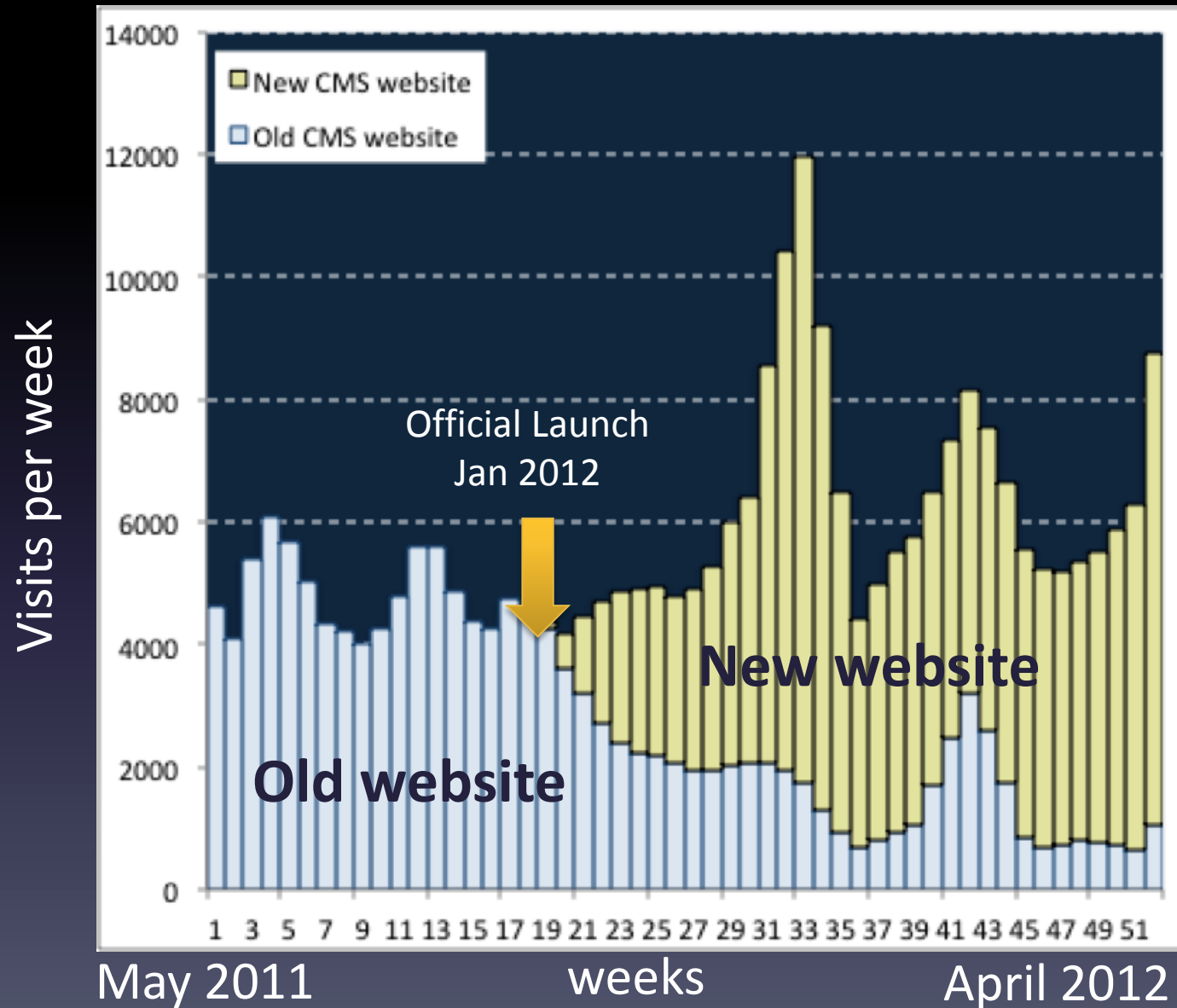
Books, brochures, fact sheets and posters

CDS DocDB

Presentations

DocDB

Migration to new CMS public site was smooth and rapid



What next ?

- Indico feeds for meetings and Google calendars
- Live LHC and CMS operations displays
- Find and import about 180k existing documents
- Make more coherent interfaces to document systems
- Allow users to manage more of the content
 - Without compromising data model, style, and navigation
- Develop strategy to manage 144,000 Twiki pages & files

Do the benefits justify the costs?

1 FTE

CMS effort working to
improve CMS
information systems

**Linux, html,
css, php, js,
persistence**

Skills required

18 months

Time to achieve what
was described in this talk

2 FTE

CMS-wide effort saved by
reducing time looking for
information by 1 min per
person per day

1 FTE

Effort saved per 1% gain in
CMS meeting efficiency
(15,000 meetings, 50,000
docs per year)

1 M\$

Rough cost of 1% of
data-taking inefficiency
(CMS ave. eff. is 91%)

Conclusions

- **Goal 1:** Manage all documents in a document database
 - Ensure that crucial CMS information is not lost
 - Users will help ... if easy-to-use tools are provided
- **Goal 2:** Create coherent web interface to all information
 - Use a Content Management System – Drupal is good enough
 - Keep the data model simple and the navigation coherent
 - To make an effective user transition, embed or link to external content if you have to
- Resources needed are modest relative to the benefits