



LCG MCDB

Knowledge Base of Monte Carlo Simulated Events

ACAT 2007, Amsterdam

Sergey Belov, JINR, Dubna
belov@jinr.ru

LCG MCDB group:
S. Belov, JINR
L. Dudko, SINP MSU
W. Pokorski, CERN
A. Sherstnev, Univ. of
Cambridge

<http://mcdb.cern.ch>

- **MCDB is an GENSER subproject within LCG AA Simulation project**
 - main activity is to provide configuration, book-keeping, documentation and storage for shared Monte Carlo event files
 - to keep track of the full generation chain, exploiting the competences of Monte Carlo experts and Monte Carlo authors
- **Main content of LCG MCDB**
 - shared MC event samples
 - detailed descriptions (articles) of such event samples
- **Knowledgebase** is a special kind of database for knowledge management. It provides the means for the computerized collection, organization, and retrieval of knowledge [*Wikipedia*]

- Some very precise physical generators provide *time-consuming event generation*
- To be properly used and tuned, some generators *require expert knowledge*
- Often different groups of physicists need *the same MC data*

- Some very precise physical generators provide *time-consuming event generation*
- To be properly used and tuned, some generators *require expert knowledge*
- Often different groups of physicists need *the same MC data*

**centralized storage to keep
correct and well-documented MC generated files
would be useful**

Overview of MCDB as Knowledge Base

- **The major tasks of LCG MCDB**
 - Share sophisticated MC generated samples between different groups of physicists
 - samples prepared by experts in MC generation
 - resource-intensive samples (human and/or CPU resources)
 - Provide infrastructure to keep MC samples and sample documentation
 - Facilitate communication between MC experts and users in LHC collaborations
- **The main content of LCG MCDB**
 - shared MC event samples
 - detailed descriptions (articles) of such event samples

The major features of LCG MCDB

- Powerful Web-interface with content management system for the authors of MC event samples and end-users
- Simple site navigation and powerful search engine
- Flexible and reliable authorization system based on CERN AFS/Kerberos logins and LCG Grid certificates (to manage MCDB content)
- Very structured MC event samples documentation
- Full backup of the samples and their description

The major features of LCG MCDB (cont.)

- CASTOR is the native storage for event samples
- Direct multiple files uploading from AFS/CASTOR/Grid to MCDB
- Direct file access from LCG MCDB with HTTP/CASTOR/Grid (URI)
- Application Programming Interface (API) for the LHC collaborations environment software (now C++ only)
- LHEF/HepML unification of event file format (LHEF: [hep-ph/0609017](https://arxiv.org/abs/hep-ph/0609017))

Main of MC event sample description

- **General information**
 - title
 - abstract
 - authors
 - experiment and/or groups
- **Physics process**
 - initial state
 - final state
 - QCD scale
 - process PDF
- **Event files**
 - physics process/subprocesses
 - events number
 - cross section and uncertainty
 - file name, location(s)
- **Used generator**
 - name and version
 - description
 - home page
- **Theoretical model**
 - name
 - description
 - set of parameters and their values with author's description
- **Applied cuts**

- Browse physics categories of MC event samples
- Search in MCDB using simple or complex queries
- Get full event samples documentation
- Download available MC samples
- Acquire Grid links to MC samples
- Post comments on presented information

Web interface (user area)

MCDB - MonteCarlo Database

Search this site
Advanced search

Main MENU

- Top physics
 - Exotic production
 - Single top
 - QCD tt
- QCD
 - B physics
 - multijets
- Software
- Requests
- Higgs physics
- Gauge bosons
 - Gamma and jets
 - 2gamma and jets
 - W and jets
 - WW and jets
 - Z and jets
 - ZZ and jets

FEEDBACK COMMENTS Edit Delete

Please, provide your feedback comments on the LCG MCDB project, here
published: 16th May 2005, 13:40 | author(s): Lev Doudko ..

PROCESS PP->H->ZZ->4MU Edit Delete

The event sample simulates the inclusive Higgs production with decay to four muons (viz Z-bosons). It is created by the CompHEP Monte-Carlo generator. The Higgs mass value is 500 GeV. All used physics parameters and applied cuts can be found in a prt file stored in the article.
published: 19th Sep 2005, 09:42 | author(s): Alexander Sherstnev ..

W+ AND 3 JETS Edit Delete

These events were prepared by CompHEP in a special hash-model, where 2 first quark generations are unified to one of hash-quarks. See details in the article itself.
published: 29th Sep 2005, 14:51 | author(s): Alexander Sherstnev ..

QCD Z(2TAU)+3J EVENTS WITH ALPGEN2 Edit Delete

Events for the Z+3jets production. Z-boson decays to tau lepton pair. The events were prepared with ALPGEN Monte-Carlo generator. They can be used for the MLM ME-PS matching procedure, since generated with ickkw=1. All generation parameters and cuts applied can be viewed in the qcd_2tau3j_unw.par parameter file.
published: 18th Oct 2005, 12:20 | author(s): Alexander Nikitenko ..

Login to the authors area

- Login to MCDB
- Login
- Registration
- Register as MCDB author
- Moderators list
- Help and support
- Help
- About MCDB
- Contact us

Categories

New author registration

Articles abstracts

0000228 times visited since October 2005

MCDB © 2005 Monte-Carlo Generators group, LCG, CERN

Advanced Search Query

The screenshot displays a web interface for defining search conditions. At the top, it says "Searching for Article, define conditions" with a dropdown menu set to "Experiment" and buttons for "Show Info", "[FS]", and "[M]".

There are three main sections for defining conditions, each with a close button (X):

- + Article**: Key words: "Z", Inverse: "any", Novelty: "last month", Inverse: "apply".
- Author**: Key words: (empty), Inverse: "do not use".
- + Experiment**: Inverse: "do not use".

A "Submit Query" button is located at the bottom of the configuration area.

Below the configuration area, a list of search results is shown:

- PROCESS PP->H->ZZ->4MU** (with Edit and Delete icons):
The event sample simulates the inclusive Higgs production with decay to four muons (viz Z-bosons). It is created by the CompHEP Monte-Carlo generator. The Higgs mass value is 500 GeV. All used physics parameters and applied cuts can be found in a prf file stored in the article.
published: 19th Sep 2005, 09:42 | author(s): Alexander Sherstnev
- W+ AND 3 JETS** (with Edit and Delete icons):
These events were prepared by CompHEP in a special hash-model, where 2 first quark generations are unified to one of hash-quarks. See details in the article itself.

The interface includes a taskbar at the bottom with various system icons.

Web interface (user area)

Process pp->H->ZZ->4mu

Author(s): Alexander Sherstnev
Date of publication: 2005-09-19 09:42:37, **Last correction:** 2005-09-29 14:47:24
Categories: H and Z/W
Article ID: 34

Abstract:
The event sample simulates the inclusive Higgs to four muons (viz Z-bosons). It is created by generator. The Higgs mass value is 500 GeV, and applied cuts can be found in a prt file stor

Author comments:
Process:
p,p->H->mu+,mu-,mu+,mu-
Subprocess:
G,G->mu+,mu-,mu+,mu- [cross section = 0.6

Process:
Name: pp --> mu,mu,mu,mu
PDF set: CTEQ5L
QCD scale: sqrt(S)
Model: SM, Feynman gauge
Generator: CompHEP, version: 4.2.1
Other information:
Cuts:
5 GeV < Invariant_mass_1 < 400 GeV
3 GeV < P_T(μ)
|h(μ)| < 2.4
5 GeV < Invariant_mass_2 < 400 GeV

Event files
File: events_MH500_wHCHEP_BM1.pcv
Size: 25200663 bytes
Cross section: 6.0382E-04pb
Events number: 100000
Castor Path: waiting for migration (in a few hours)
Comments: Number of mixed reweighted events = 100000 (1 subprocess)
File: prt_MH500_wHCHEP_Q2Shat (download)
Size: 2682 bytes
Cross section: 0
Events number: 0
Castor Path: waiting for migration (in a few hours)
Comments: CompHEP kinematics module

MODEL:
SM, Feynman gauge
NAME: SM, Feynman gauge
DESCRIPTION:
PARAMETERS:

PARAMETER	VALUE	DESCRIPTION
m_e	0.117	
m_b	4.85	
GG	1.21358	
m_c	1.77699	
S_W	0.48076	
M_{HIGGS}	115	
s_{12}	0.2229	
m_s	1.65	
M_{top}	174.3	
EE	0.31345	
s_{23}	0.0412	
m_μ	0.10566	
s_{13}	0.0036	
M_Z	91.1876	

[View/post comments on article](#)
[Edit article](#)

Article
Download events file
Comments to the article
Theoretical model and parameters

Web interface (expert area)

- Upload new event sample(s)
- Document event sample(s) in a new article (pre-entered information usage is possible)
- Publish new articles in User Area
- Edit previous articles and manage them
- Answer to user comments

Web interface (expert area)

Add/Edit Article link is the gate to the article template system

The screenshot displays the 'MCDB - Monte-Carlo DataBase' web interface. At the top, there are navigation tabs: 'Article creating', 'New generator', 'New process', 'New model', and 'New cut'. Below these are sub-tabs for 'General information', 'Event files', 'Generator', 'Model', 'Process', 'Cuts', and 'Preview/save'. The 'General information' tab is active, showing the following fields:

- ARTICLE TITLE:** Process pp->H->ZZ->4mu
- CATEGORIES:** A list of categories on the left, with 'H and Z/W' selected.
- GROUP:** Higgs PRS group
- EXPERIMENT:** CMS
- OTHER GROUP:** (empty)
- RESPONSIBLE PERSON:** (empty)
- GROUP DESCRIPTION:** (empty)
- PRIMARY AUTHOR:** Alexander Sherstnev, SINP MSU
- Co-AUTHORS:** Alexander Nikitenko, Imperial College, University of London; Alexander Sherstnev, SINP MSU; Anton Gusev, IHEP; Filip Moortgat 2770, CERN; Filippo Ambrogli, University and INFN Perugia; Harinder Singh Bawa, Panjab University Chandigarh; Lucia Silvestris, INFN-Bari; Mikhail Dubinin, SINP MSU; Sergey Belov, JINR; Vladimir Uzhinsky, JINR, LIT
- ABSTRACT:** The event sample simulates the inclusive Higgs production with decay to four muons (viz Z-bosons). It is created by the CompHEP Monte-Carlo generator. The Higgs mass value is 500 GeV. All used physics parameters

The interface includes a standard Windows-style taskbar at the bottom with various icons and a system tray.

Web interface (expert area)

Event files slice to manage event files attached to the article

The screenshot displays the MCDB (Monte-Carlo DataBase) web interface. The main window is titled "MCDB - Monte-Carlo DataBase" and has a navigation bar with tabs: "Article creating", "New generator", "New process", "New model", and "New cut". Below this is another set of tabs: "General information", "Event files", "Generator", "Model", "Process", "Cuts", and "Preview/save".

The "Event files" tab is active, showing a form for uploading an event file. The form includes:

- "EVENT FILE TO UPLOAD:" with a text input field and a "Browse..." button.
- "NEW NAME OF FILE:" with a text input field and an "Upload" button.
- "UPLOADED FILES:" section listing two files:
 - prt_MH500_wHCHEP_Q2Shat, 2682 bytes
 - events_MH500_wHCHEP_BM1.pev, 28200663 bytes

For each file, there are input fields for "EVENTS NUMBER:", "CROSS SECTION:", and "CROSS SECTION ERROR:", along with a "COMMENTS:" text area.

A secondary window is open, showing the details for the selected file "prt_MH500_wHCHEP_Q2Shat, 2682 bytes". The fields are filled as follows:

- EVENTS NUMBER: [empty]
- CROSS SECTION: [dropdown menu]
- CROSS SECTION ERROR: [dropdown menu]
- COMMENTS: CompHEP kinematics module

The second window also shows details for "events_MH500_wHCHEP_BM1.pev, 28200663 bytes":

- EVENTS NUMBER: 100000
- CROSS SECTION: 6.0382E-04pb
- CROSS SECTION ERROR: [dropdown menu]
- COMMENTS: Number of mixed reweighted events = 100000 (1 subprocess)

At the bottom of the interface, there is a footer: "MCDB © 2005 Monte-Carlo Generators group, LOG, CERN Username: Lev Doudko, Permission: modora".

Web interface (expert area)

MC generator and Physics Process description slices

The screenshot displays the LCG MCDB web interface, which is used for configuring Monte Carlo generators and physics processes. The interface is divided into several sections:

- Generator Configuration:** The 'Generator' tab is active, showing 'CompHEP' selected in the 'GENERATOR:' dropdown and '4.2.1' in the 'VERSION:' dropdown. A link for 'Other generator/version' is provided.
- Description:** The 'DESCRIPTION:' field contains the text: 'Old version of CompHEP with old format of event files (compatible with interface implemented to CMKIN)'. The 'HOME PAGE:' is listed as <http://theory.sinp.msu.ru/comphep>.
- Process Configuration:** The 'Process' tab is active, showing 'PP -> MU,MU,MU,MU, PDF: CTEQ5L, QCD SCALE: SQRT(S)'.
- Process List:** A list of processes is displayed, with 'pp -> mu,mu,mu,mu, PDF: CTEQ5L, QCD scale: sqrt(S)' highlighted. Other processes include 'pp -> tT+2Jet', 'ANY -> ANY', 'pp -> tau,tau,j,j,j', 'pp -> W,j,j,j', 'pp -> W+ and 3 jets', 'pp -> mu,mu,j,j', and 'pp -> tau,tau,j,j,j'.
- Search and Navigation:** A search bar with 'PDF:' and 'Search'/'Reset search' buttons is located at the bottom of the process list.
- Footer:** The footer contains the text 'MCDB © 2005 Monte-Carlo Generators group, LCG, CERN', the user 'Lev Doudko', the permission 'moderator', and the date 'Wed Nov 23 20:14:18 2005'.

Web interface (expert area)

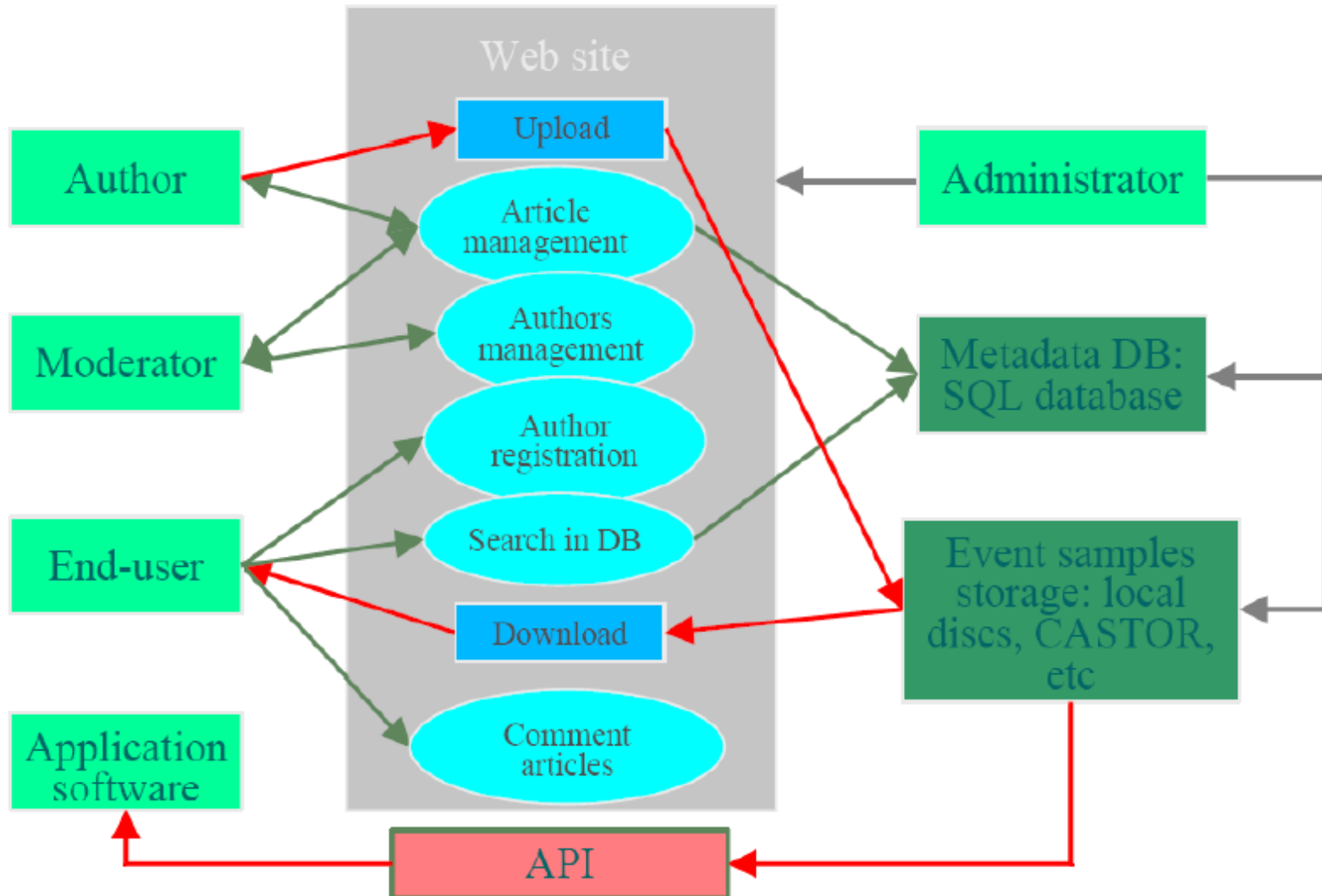
The screenshot displays the MCDB (Monte-Carlo DataBase) web interface. The main window shows the 'MODEL' section with a dropdown menu set to 'SM, Feynman gauge'. Below this, the 'NAME' is 'SM, Feynman gauge' and the 'DESCRIPTION' is empty. The 'PARAMETERS' section contains a table with the following data:

PARAMETER	VALUE	DESCRIPTION
m_s	0.117	
m_b	4.85	
GG	1.21358	
m_t	1.77699	
S_W	0.48076	
M_{HIGGS}	115	
s_{12}	0.2229	
m_c	1.65	
M_{top}	174.3	
EE	0.31345	
s_{23}	0.0412	
m_μ	0.10566	
s_{13}	0.0036	
M_Z	91.1876	

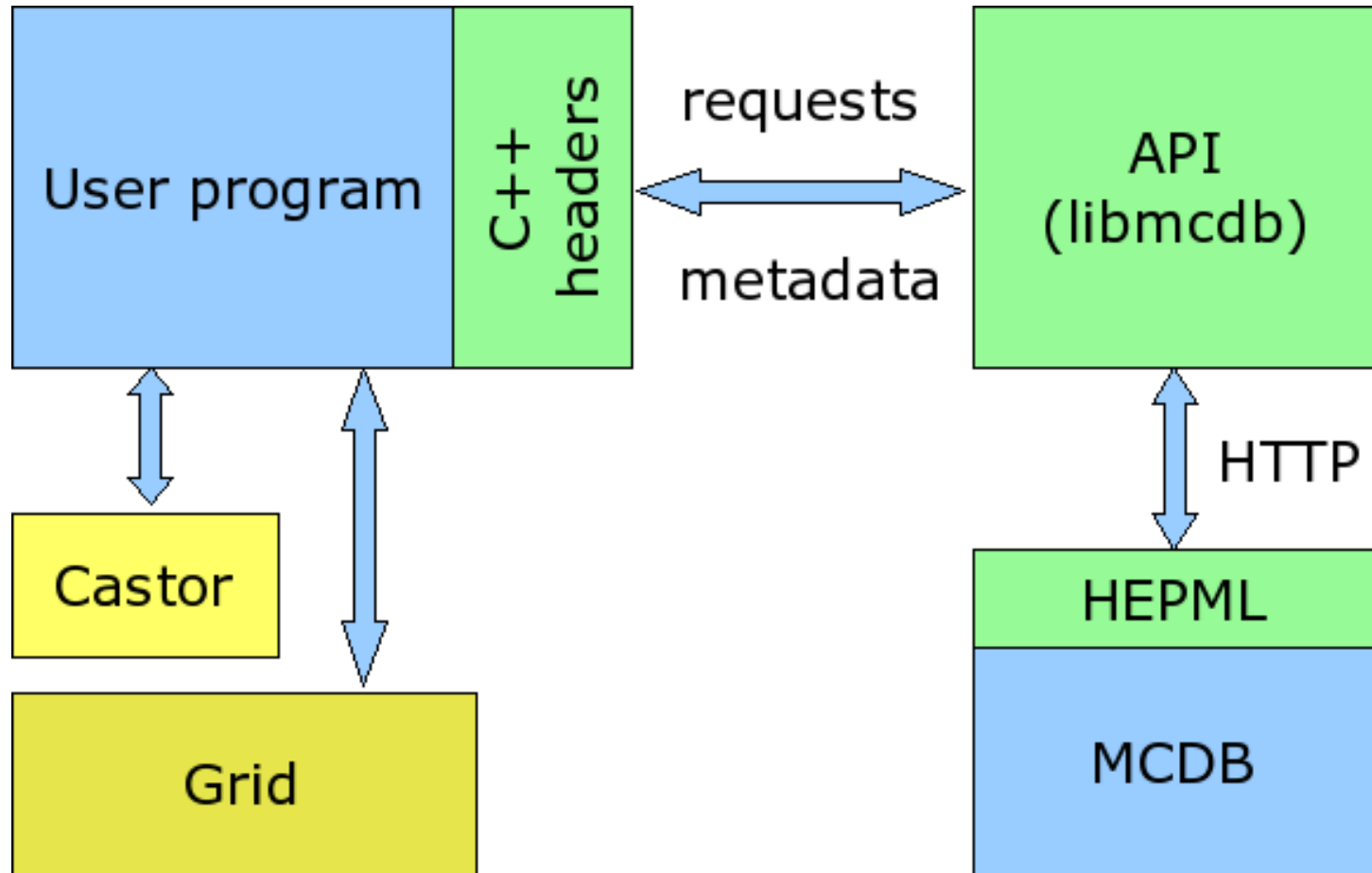
Overlaid on the right is a 'Create new set of cuts' dialog box. It features three input fields for 'MIN VALUE', 'OBJECT', and 'MAX VALUE'. The 'OBJECT' dropdown is currently set to 'other object'. Below these fields are radio buttons for 'include region' and 'Exclude region'. The dialog also includes a 'Remove' button, an 'Add cut' button, and a 'Save' button. At the bottom of the dialog, there are 'Undo' and 'Reset' buttons. The status bar at the bottom of the interface shows 'MCDB © 2005 Monte-Carlo Generators group, LCG, CERN' and the user 'Lev Doudko' with 'moderator' permissions.

Physics model parameters and applied cuts slices

MCDB project structure



MCDB API structure



- **Unified XML format of MC event files metadata**
 - to store all possible information from MC generators in XML format
 - to store generator input parameters and setup
 - an effort to fix a unified extensible way of MC events description
 - is an allowed part of LHEF standard event file header
- **Main purposes**
 - to unify MC event files description
 - to facilitate passing information from Matrix Element generators to Shower generators
 - usage in MC generators tuning and testing
- **Contributors**
 - CEDAR <http://www.cedar.ac.uk>
 - LCG MCDB <http://mcdb.cern.ch>
- **Homepage** <https://twiki.cern.ch/twiki/bin/view/Main/HepML>

- **About 20 registered MC experts**
- **About 70 articles with event samples e.g.:**
 - Top quark production (15 articles)
 - Higgs production (20)
 - Gauge bosons
 - Gamma + jets (3)
 - W + jets (7)
 - WW + jets (2)
 - Z + jets (16)
- **Generators**
 - ALPGEN
 - CompHEP
 - GlauberXS
 - MadGraph
 - ...

- Used in CMS collaboration as an official storage of a particular type of MC event samples
- API to automated access of MCDB is already deployed (C++ libraries)
- Grid-ready
- All demands and suggestions are welcome

- LCG MCDB Knowledge Base is already in use
- Developed LCG MCDB software is a new open source content management system for *high energy physics*; it could be useful in development of other projects
- Detailed documentation allows users and experts easily begin to work with LCG MCDB
- Description of MCDB was sent to CPC ([hep-ph/0703287](#))
- API for automated system access is ready and will be evolving in future

- MC experts are kindly invited to share their knowledge by means of LCG MCDB
- Any feedback from Collaborations, Users and Experts will be appreciated

LCG MCDB project site:

<http://mcdb.cern.ch>

Thank you for your attention!