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Web Application & Validation

Hans Wenzel

20th Geant4 Collaboration Meeting

September 28, 2015



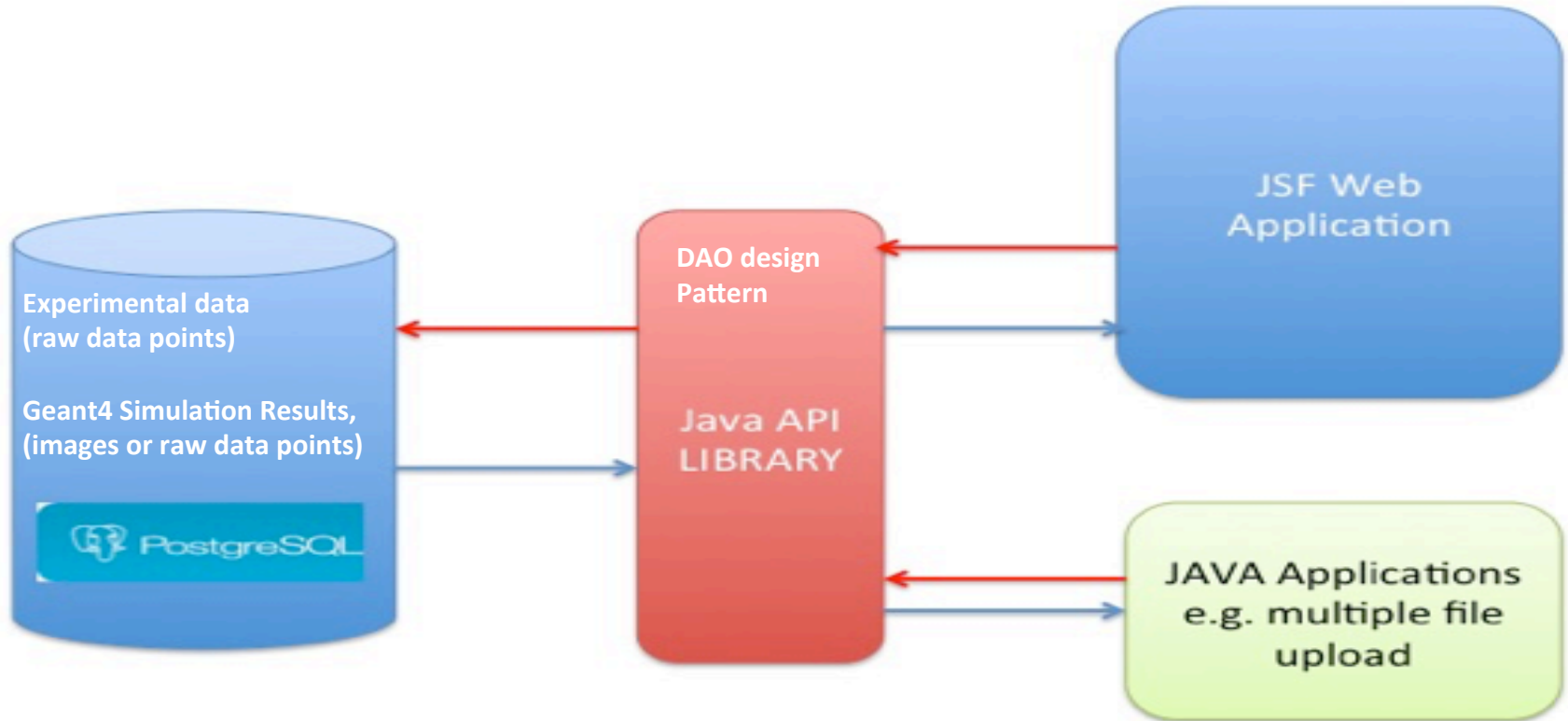
Outline

- Requirements
- Choice of technology
- Walk through
 - Statistics
 - Preserving and improving previous functionality (Display/Edit/Delete Test)
 - Different views and improvements that happened
- How to get test results in to the data base.
- To do



Requirements:

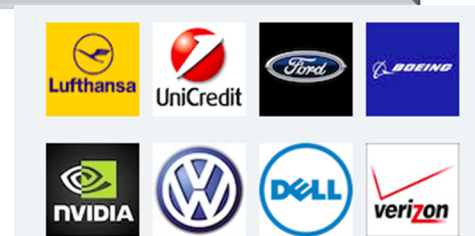
- Replace JSP based Web application while preserving and enhancing functionality
- Based on modern internet technology and industry standards.
- secure
- Provide repository:
 - to store experimental data used for validation as raw data,
 - to store simulation results as raw data and as static plots.
- Provide display web-applications which:
 - allows to select and overlay compatible tests,
 - allows to overlay experimental data,
 - allows automatic upload into repository,
 - allows to display static images,
 - Provides search functions and easy navigation.
- Modern look, meaningful search, meaningful defaults, easy to navigate menus.

Software components



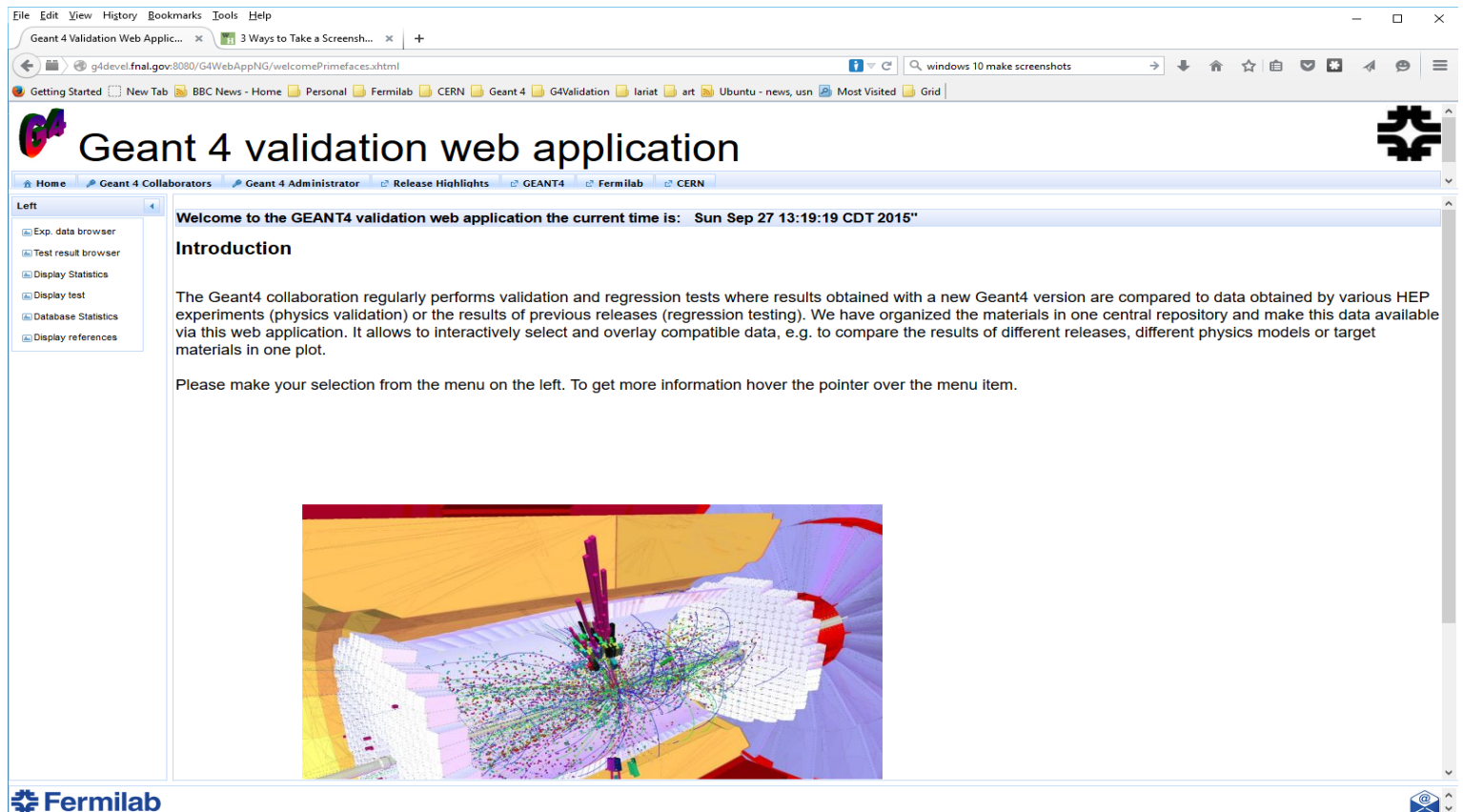
Choice of technologies

 PostgreSQL	Open source relational data base, hosted by Fermilab data base group.
	Glassfish: Web Application server hosted on fermicloud
	Primefaces JSF (Java Server Faces) based framework to create modern looking web pages (provides HTML5 support) and easy to navigate menus.
	Integrated Development Environment
	Java programming language, JAVAEE
JFREECHART	Java library used to create the graphs



Walk Through

- Geant4 Web Application:
<http://g4validation.fnal.gov:8080/G4WebAppNG/>
<http://g4devel.fnal.gov:8080/G4WebAppNG/>

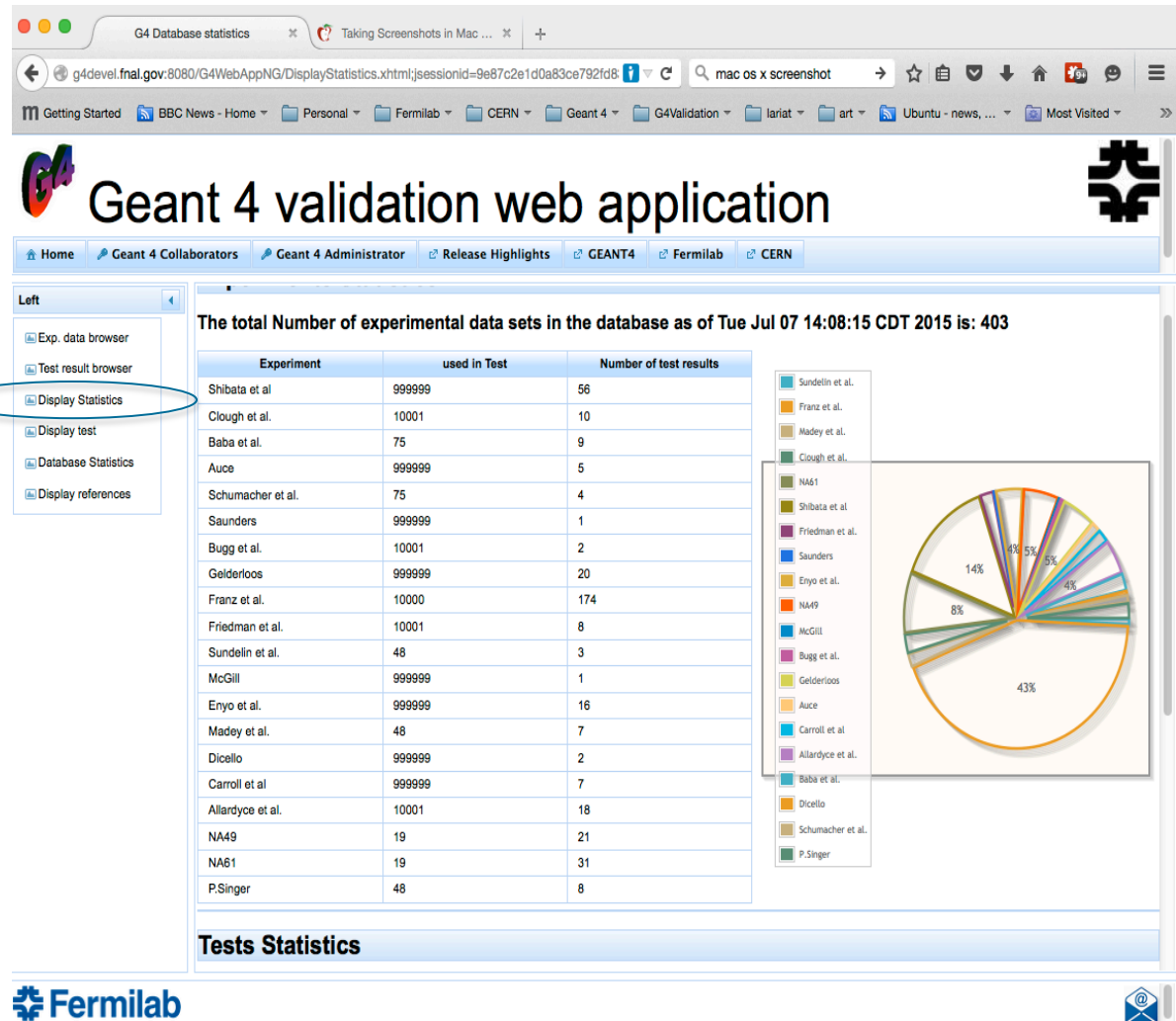


The screenshot shows a web browser window displaying the Geant4 validation web application. The browser's address bar shows the URL `g4devel.fnal.gov:8080/G4WebAppNG/welcomePrimefaces.xhtml`. The page title is "Geant 4 validation web application". The main content area features a navigation menu on the left with items like "Exp. data browser", "Test result browser", "Display Statistics", "Display test", "Database Statistics", and "Display references". The main text area contains a welcome message: "Welcome to the GEANT4 validation web application the current time is: Sun Sep 27 13:19:19 CDT 2015". Below this is an "Introduction" section with a paragraph explaining the application's purpose and a note to interact with the left menu. At the bottom of the page, there is a 3D visualization of a particle detector, likely the ATLAS detector, showing a complex structure with various colored components and a central particle track.

Statistics

Currently:

- 415 experimental data sets from 22 experiments.
- 6 test setups with 606 histograms stored as raw data.
- 9740 public test results (19 test setups) stored as images with meta data.




Display Test (selection)

File Edit View History Bookmarks Tools Help

DisplayTest x 3 Ways to Take a Screensh... x +

g4devel.fnal.gov:8080/G4WebAppNG/DisplayTest.xhtml


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Geant 4 validation web application

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Name	Description	Working Group
ATLAS	shower characteristics of ATLAS Calorimeters	LHC-feedback
CMS	shower characteristics of CMS Calorimeters	LHC-feedback
atlasbar	Test of ALTAS barrel type em calorimeter, determines response, resolution, and CPU performance	electromagnetic
test37	Test against Sandia data, electron beam in semi-infinite media.	electromagnetic
test41	Comparison with MUSCAT experiment for multiple scattering validation	electromagnetic
Hadron	Test of Physics Lists (thick targets, ion beams)	hadronic
IAEA	IAEA Benchmark of Nuclear Spallation Models	hadronic
Testfragm	Test of hadronic generators (thin targets, ion beams)	hadronic
simplifiedCalo	Test of Shower shapes using selected simplified calorimeter setups.	hadronic



Geant 4 validation web application

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Name of the Test: test41 / Comparison with MUSCAT experiment for multiple scattering validation/

Geant 4 Version Tag	Beam	Beam Energy	Beam Mom.	Reaction	Observable	Secondary	Target	Select
geant4-09-04-beta		5.0 GeV/c		muon+Li->muon+Li	Scattering angle			Select
geant4-09-04-beta		5.0 GeV/c		muon+Li->muon+Li	Scattering angle			Select
geant4-09-04-beta		5.0 GeV/c		muon+Liquid H2->muon+Liquid	Scattering angle			Select
geant4-09-04-beta		5.0 GeV/c		muon+Liquid H2->muon+Liquid	Scattering angle			Select
geant4-09-04-beta		5.0 GeV/c		muon+Fe->muon+Fe	Scattering angle			Select
geant4-09-04-beta		5.0 GeV/c		muon+CH2->muon+CH2	Scattering angle			Select
geant4-09-04-beta		5.0 GeV/c		muon+C->muon+C	Scattering angle			Select
geant4-09-04-beta		5.0 GeV/c		muon+Be->muon+Be	Scattering angle			Select
geant4-09-04-beta		5.0 GeV/c		muon+Be->muon+Be	Scattering angle			Select
geant4-09-04-beta		5.0 GeV/c		muon+Al->muon+Al	Scattering angle			Select

Display Test (display)

File Edit View History Bookmarks Tools Help

Display Test x 3 Ways to Take a Screensh... x +

g4devel.fnal.gov:8080/G4WebAppNG/DisplaySelectedTest.xhtml?selectedTest=6899

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Left

- Exp. data browser
- Test result browser
- Display Statistics
- Display test
- Database Statistics
- Display references

Responsible: V. Ivanchenko

Description: Comparison with MUSCAT experiment for multiple scattering validation

172 MeV/c muon scattering off Li 6.43 mm, Geant4 9.4beta

probability (%/rad)

θ (rad)

Legend:

- Data
- Opt0
- Urban93
- WJ-SS
- Opt3
- Single Scat

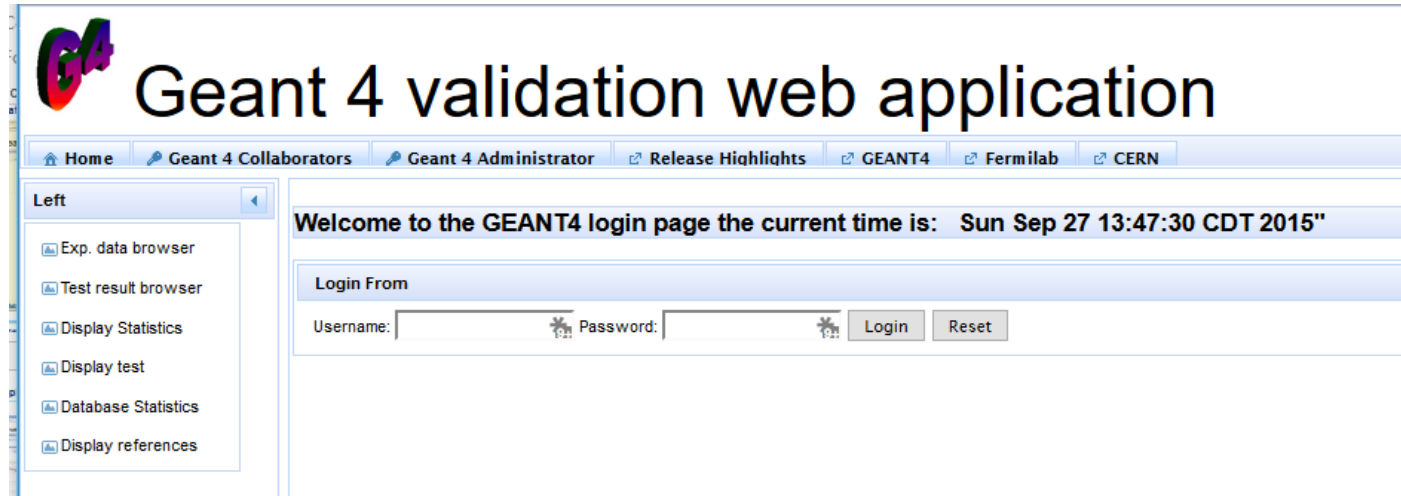
(1 - Geant4/Data) (%)

θ (rad)

Required information specific to the selected test:

Geant4 Version: geant4-09-04-beta

Edit/Delete Test



The screenshot shows the Geant 4 validation web application interface. At the top left is the Geant 4 logo. The main heading is "Geant 4 validation web application". Below this is a navigation bar with links: Home, Geant 4 Collaborators, Geant 4 Administrator, Release Highlights, GEANT4, Fermilab, and CERN. A left sidebar menu contains: Exp. data browser, Test result browser, Display Statistics, Display test, Database Statistics, and Display references. The main content area displays a welcome message: "Welcome to the GEANT4 login page the current time is: Sun Sep 27 13:47:30 CDT 2015". Below this is a "Login From" section with a "Username:" field, a "Password:" field with an eye icon, and "Login" and "Reset" buttons.



The screenshot shows the Geant 4 validation web application interface for expert pages. At the top left is the Geant 4 logo. The main heading is "Geant 4 validation web application". In the top right corner is the Fermilab logo. Below the heading is a navigation bar with links: Home, Geant 4 Collaborators, Geant 4 Administrator, Release Highlights, GEANT4, Fermilab, and CERN. A left sidebar menu contains: Exp. data browser, Test result browser, Display Statistics, Display test, Database Statistics, and Display references. The main content area has a sub-navigation bar with links: FileUpload, NewFileUpload, Display Edit Delete, and logout. Below this is the heading "Expert pages" and a paragraph: "This page provides functionality only intended for Geant 4 collaborators, this includes viewing of internal tests, uploading of new test results and editing and deleting of existing tests. To access this functions make a selection from the menu bar above."


How to edit/delete an Entry?

Reference	Description
Franz et al., Nuclear Physics AS10 (1990) 774-802	NEUTRON-INDUCED PRODUCTION OF PROTONS, DEUTERONS AND TRITONS ON COPPER AND BISMUTH

The menus below allow to edit the selected test. Press the submit button to commit the changes to the data base.

Required information specific to the selected test:

Geant4 Version:	<input type="text" value="-----P--"/>
Observable:	<input type="text" value="differential cross sect"/>
Reaction:	<input type="text" value="n [542 MeV]+ Cu -> d"/>
Secondary:	<input type="text" value="d"/>
Status:	<input type="text" value="public"/> <ul style="list-style-type: none"> internal private <li style="background-color: yellow;">public temporary
Beam:	<input type="text"/>
Beam Energy:	<input type="text"/>
Beam Momentum:	<input type="text"/>
Target:	<input type="text" value="Cu"/>
Score:	<input type="text" value="passed"/>
Scoretype:	<input type="text" value="expert"/>



j_idt49:j_idt68: Validation Error: Length is greater than allowable maximum of '20'

j_idt49:j_idt68: Validation Error: Length is greater than allowable maximum of '20'

300-300 MeV

Optional information (TAGS) provided:	
Name	Value
last-modified	<input type="text" value="2015-03-19 11:30:28"/>
Model	<input type="text" value="Bertini,BIC,INCLXX"/>

Exp. data Browser (Selection)

Reference

Title

Author	Reference	Title
Friedman et al.	E. Friedman et al., Phys. Rev. C 55, 1304 (1997)	K+ nucleus reaction and total cross sections: New analysis of transmission experiments
Allardyce et al.	B. Allardyce et al., Nuclear Physics A209(1973) 1-51	Pion Reaction Cross Sections and Nuclear Sizes
Schumacher et al.	R.Schumacher et al., Phys.Rev. C25, 2269 (1982)	Cu(y,p)X reaction at Ey=150 and 300 MeV
Baba et al.	K. Baba et al., Nucl.Phys. A306, 292 (1978)	Quasi-free pion photoproduction from carbon above 300 MeV
Singer et al.	P.Singer, Springer Tracts in Modern Physics, 71, 39 (1974)	Emission of particles following muon capture in intermediate and heavy nuclei
Wilkin et al.	C. Wilkin et al., Nuclear Physics B62 (1973) 61 - 85	A COMPARISON OF pi+ AND pi- TOTAL CROSS SECTIONS OF LIGHT NUCLEI NEAR THE 3-3 RESONANCE
Auce et al.	A. Auce, Phys. Rev C71, 064606 (2005)	Reaction cross sections for protons on C, Ca, Zr, and Pb at energies between 80-180 MeV/c
Bugg et al.	D. Bugg et al., Phys.Rev. 168 (1968) 1466-1475	Kaon-Nucleon Total Cross Sections from 0.6 to 2.65 GeV/c
test19-NA49	see further details	Analysis of soft hadronic interactions at the SPS by the NA49 pp&pA group is presented.
McGill et al.	McGil et al., Phys. Rev. C Vol.10 Number 6 (1974)	Measurements of the proton total reaction cross section for light nuclei between 20 and 48MeV/c
test19-NA61	N.Abgrall et al., Phys.Rev. C84, 034604 (2011) (NA61 Exp.)	Measurements of Cross Sections and Charged Pion Spectra in Proton-Carbon Interactions at 31 GeV/c
Shibata et al.	Shibata et al., Nuclear Physics A408 (1983) 525-558	Particle production in the target-rapidity region from hadron-nucleus reactions at several GeV
Carroll et al	A. S. Carroll et al., Phys. Rev. C Vol.14 Number 2 (1976)	Pion-nucleus total cross sections in the (3,3)resonance region
Franz et al.	Franz et al., Nuclear Physics AS10 (1990) 774-802	NEUTRON-INDUCED PRODUCTION OF PROTONS, DEUTERONS AND TRITONS ON COPPER AND BISMUTH
		ANALYSES OF PARTICLE PRODUCTION IN HADRON-NUCLEUS REACTIONS AT SEVERAL

Exp. data Browser (Display selected Experiment)

Once Experiment is selected, one is presented with a default plot based on default selection → default selected in menus, refine selection from there

Summer student
Rasheed Auguste

Geant 4 validation web application

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Reference: Franz et al., Nuclear Physics AS10 (1990) 774-802
Description: NEUTRON-INDUCED PRODUCTION OF PROTONS, DEUTERONS AND TRITONS ON COPPER AND BISMUTH

Targets: [Dropdown] **Reactions:** [Dropdown] **Beam:** [Dropdown] **Beam Energies:** [Dropdown] **Secondaries:** [Dropdown] **d#sigma/d#Omega dT [#mub/sr MeV] vs T/[MeV]**

Display plot: Yes **Logarithmic Y-Axis:** No **Display Errors:** Yes

Display data table: No **Revert to default selections:** Default Plot

Make your selections from the menus above and press Submit

Submit

Plot: d#sigma/d#Omega dT [#mub/sr MeV] vs T/[MeV]

Legend:

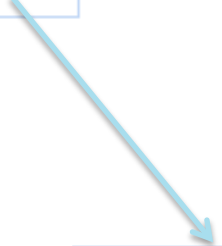
- Experimental data: n [542 MeV]+ Cu -> p @ 54 degree Target: Cu Secondary: proton
- Experimental data: n [477 MeV]+ Cu -> p @ 54 degree Target: Cu Secondary: proton
- Experimental data: n [425 MeV]+ Cu -> p @ 54 degree Target: Cu Secondary: proton
- Experimental data: n [383 MeV]+ Cu -> p @ 54 degree Target: Cu Secondary: proton

Fermilab

Exp. data Browser (buttons)

Display plot:
 Logarithmic Y-Axis:
 Display Errors:

Display data table:
 Revert to default selections:



Decription	Data Table			
	T/[MeV]	Error	d#sigma/d#OmegadT [#mub/sr MeV]	Error
Reaction: n [317 MeV]+ Cu -> p @ 54 degree Target: Cu Beam: neutron Beam Energy: 317 MeV Secondary: proton	35.0	0.0	837.5	31.1
	37.0	0.0	807.4	30.25
	39.0	0.0	706.9	27.39
	45.0	0.0	628.4	16.32
	55.0	0.0	557.1	14.64
	65.0	0.0	482.0	13.07
	75.0	0.0	380.7	10.82
	85.0	0.0	338.5	9.963
	95.0	0.0	353.7	10.51
	105.0	0.0	326.9	10.02
	115.0	0.0	294.1	9.366
	125.0	0.0	223.1	7.673
	135.0	0.0	222.9	7.902
	145.0	0.0	193.4	7.249
	155.0	0.0	157.2	6.379
	165.0	0.0	144.7	6.124
	175.0	0.0	115.2	5.347
185.0	0.0	97.0	5.027	
195.0	0.0	74.22	4.31	

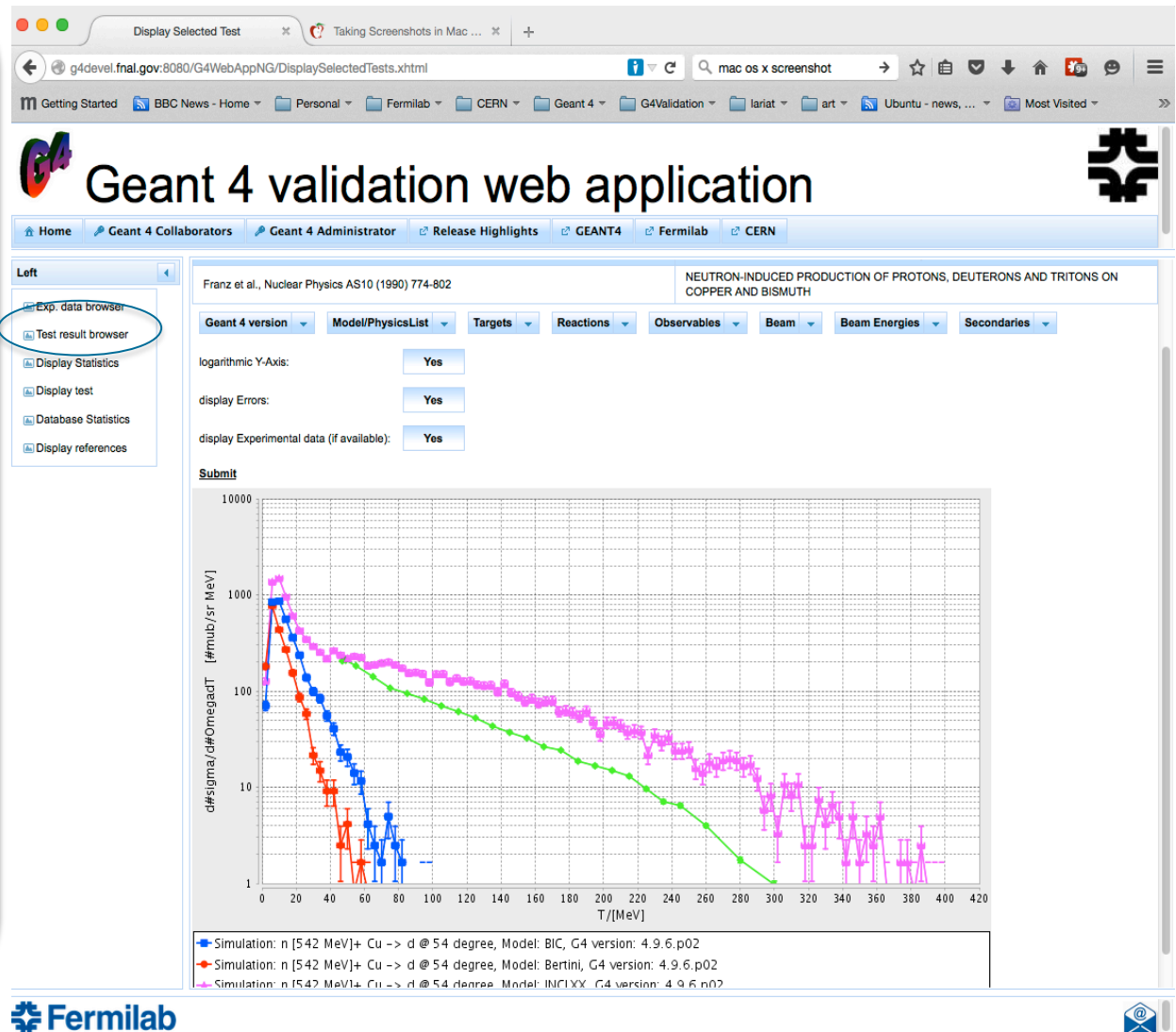
Test Result Browser

This page allows to select various Geant 4 simulations and compares the results to available experimental data. Shown on the left is neutron induced deuteron production.

Different Models:

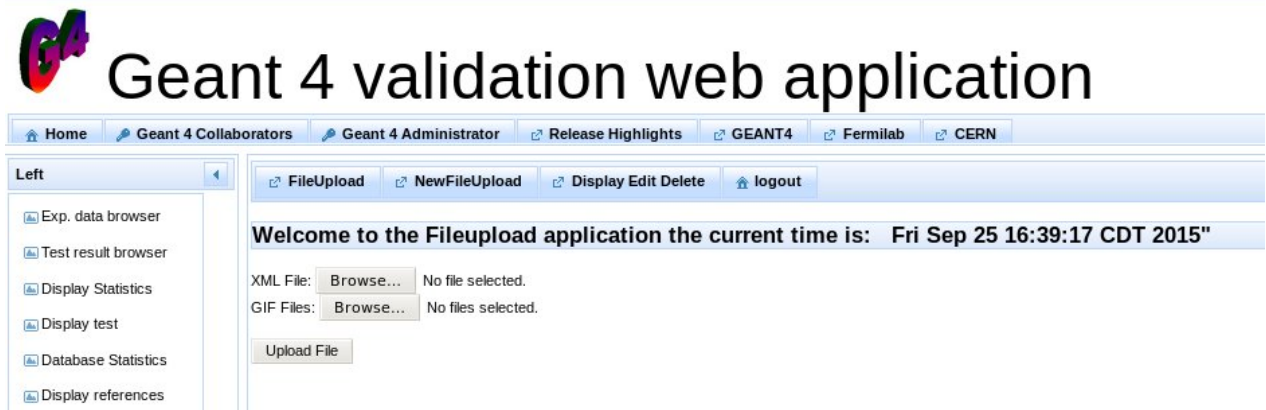
- BIC(blue),
- Bertini (red)
- INCL++(magenta)
- Experimental Data (green)

Caveats: defaults not implemented yet.



How to get data into the repository?

- Once:
 - Experimental data, case by case → construct sql statement to add to database.
- Repeatedly (automation):
 - Static Plots: (via webapplication) Authenticate as G4Expert provide xml file (template) and directory where image files can be found edit
 - Histograms: (cint script) (different template for different test) parse root file with histograms and constructs sql statement. (access to database from cern, slac)



The screenshot shows the 'Geant 4 validation web application' interface. At the top left is the Geant 4 logo. The main title is 'Geant 4 validation web application'. Below the title is a navigation bar with links: Home, Geant 4 Collaborators, Geant 4 Administrator, Release Highlights, GEANT4, Fermilab, and CERN. A secondary navigation bar contains: FileUpload, NewFileUpload, Display Edit Delete, and logout. A status bar displays: 'Welcome to the Fileupload application the current time is: Fri Sep 25 16:39:17 CDT 2015". The main content area has two sections: 'XML File: Browse...' with 'No file selected.' and 'GIF Files: Browse...' with 'No files selected.'. Below these is an 'Upload File' button. On the left side, there is a 'Left' sidebar menu with the following items: Exp. data browser, Test result browser, Display Statistics, Display test, Database Statistics, and Display references.

To do (short term)

- Implement edit delete for raw simulated data.
- Implement defaults for the test result browser.
- Search functions.
- Finalize and consolidate the tests we developed.
- Clean up data base.
- Add more experimental data and tests in raw format.

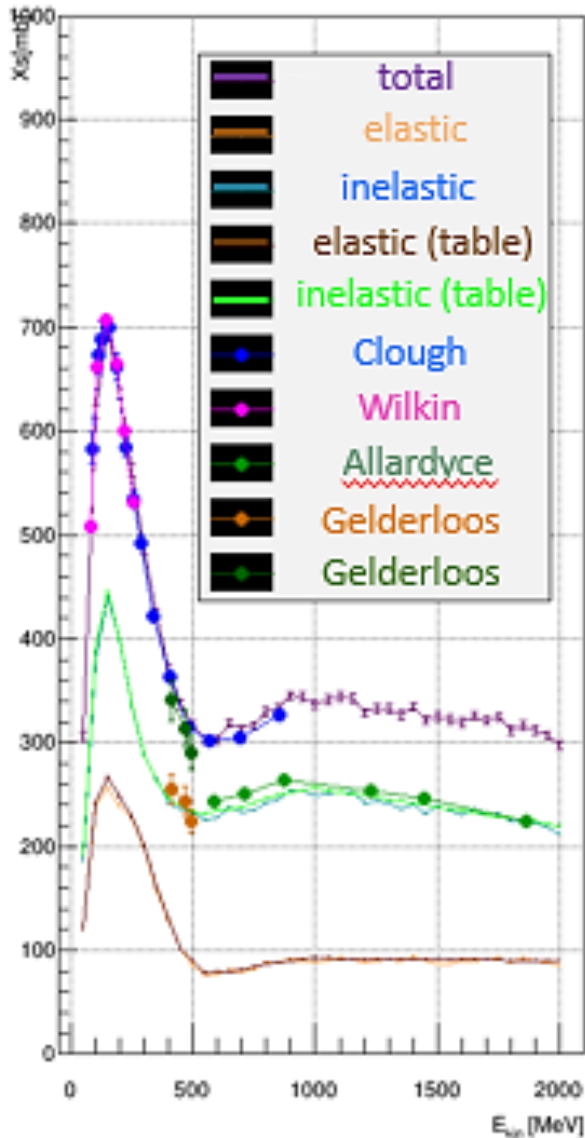
CHEP2015 proceedings:
FERMILAB-CONF-15-189-CD



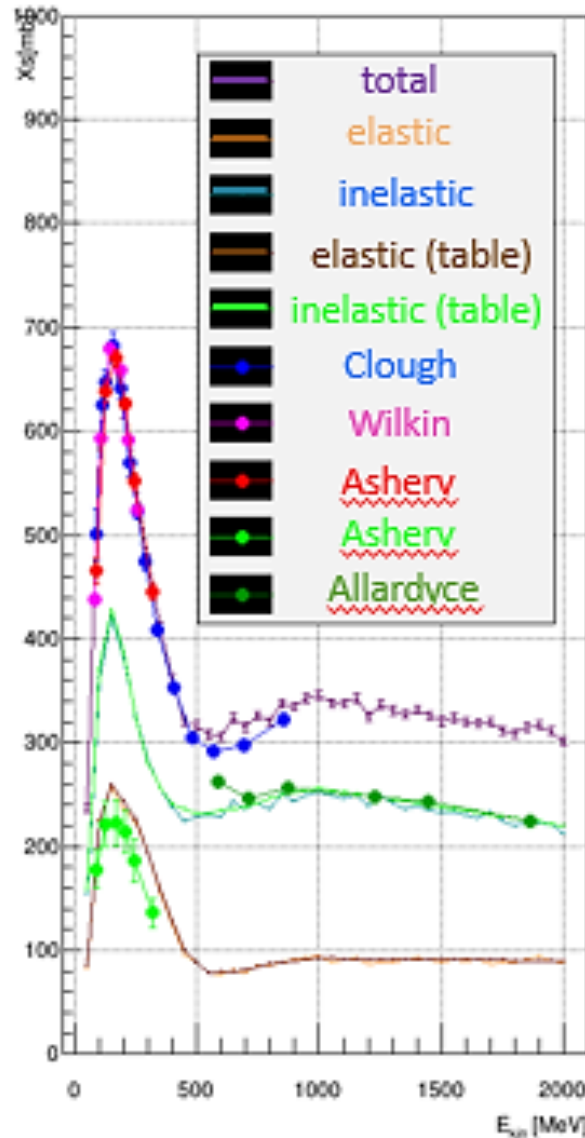
9/28/2015

BACKUP slides

π^+ on C Xs



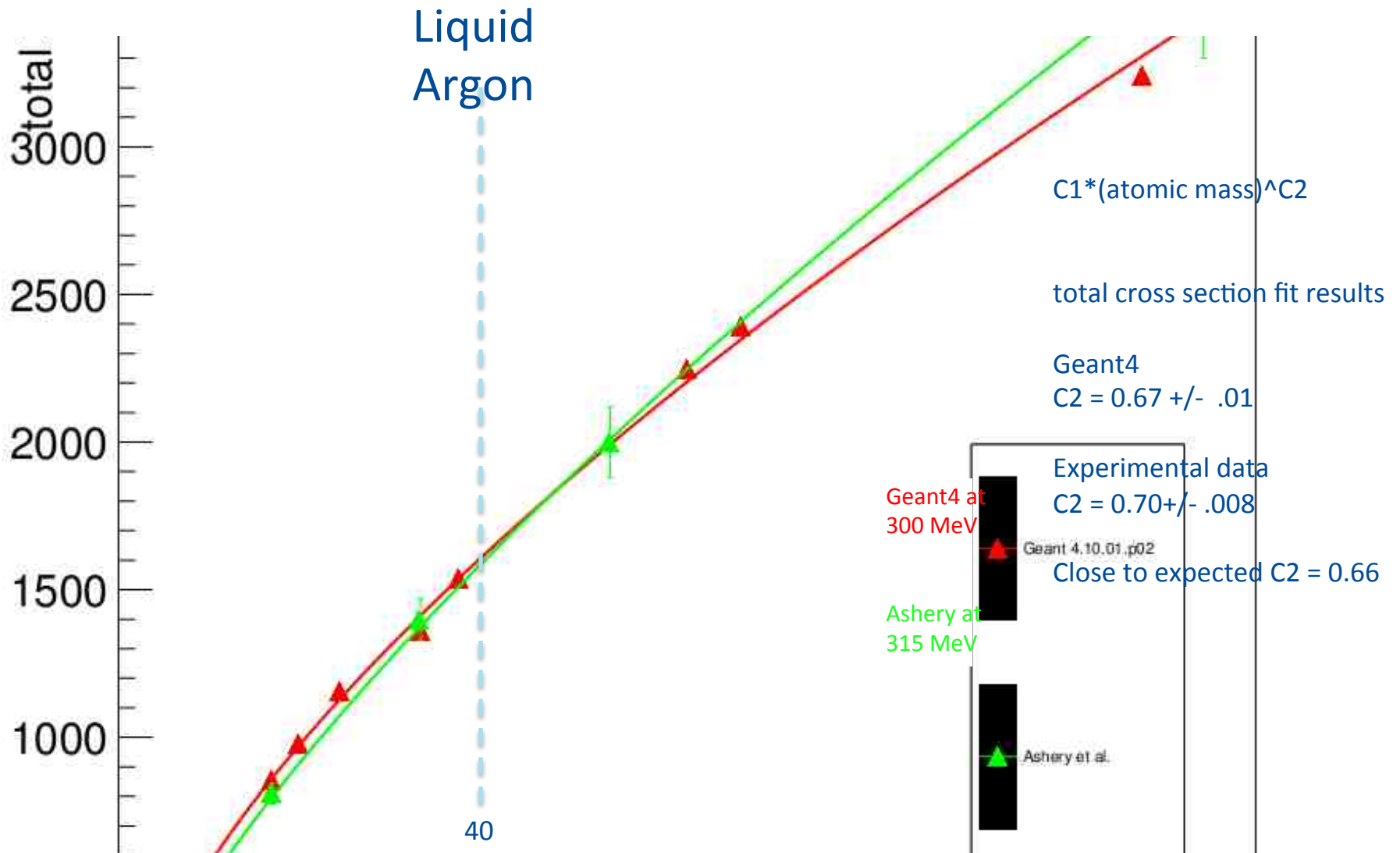
π^+ on C Xs



Geant4
Simulation
(lines) agree
nicely with
experimental
data (dots)

All
simulations
done with
G4 Version
10.01.p02

Geant4 total cross section simulation vs. data (Ashery)




Edit Test – Masked/Dictionary Entries

Reference	Description
Franz et al., Nuclear Physics AS10 (1990) 774-802	NEUTRON-INDUCED PRODUCTION OF PROTONS, DEUTERONS AND TRITONS ON COPPER AND BISMUTH

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Reaction:	<input type="text" value="n [542 MeV]+ Cu -> d"/>
Secondary:	<input type="text" value="d"/>
Status:	<input type="text" value="public"/> <ul style="list-style-type: none"> internal private <li style="background-color: yellow;">public temporary
Beam:	<input type="text"/>
Beam Energy:	<input type="text"/>
Beam Momentum:	<input type="text"/>
Target:	<input type="text" value="Cu"/>
Score:	<input type="text" value="passed"/> <ul style="list-style-type: none"> passed
Scoretype:	<input type="text" value="expert"/> <ul style="list-style-type: none"> expert





j_idt49:j_idt68: Validation Error: Length is greater than allowable maximum of '20'


j_idt49:j_idt68: Validation Error: Length is greater than allowable maximum of '20'

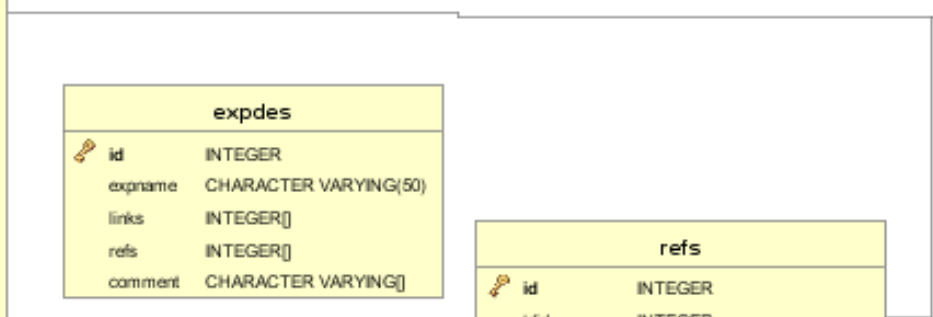
Optional information (TAGS) provided:	
Name	Value
last-modified	<input type="text" value="2015-03-19 11:30:28"/>
Model	<input type="text" value="Bertini,BIC,INCLXX"/>

xyexpdata	
 id	INTEGER
ldid	INTEGER
target	CHARACTER VARYING(50)
reaction	CHARACTER VARYING(100)
xdes	CHARACTER VARYING(50)
ydes	CHARACTER VARYING(50)
x	REAL[]
y	REAL[]
errx	REAL[]
erry	REAL[]
beam	CHARACTER VARYING(20)
beamenergy	CHARACTER VARYING(20)
beammomentum	CHARACTER VARYING(20)
secondary	CHARACTER(20)
mask	INTEGER
expdesid	INTEGER

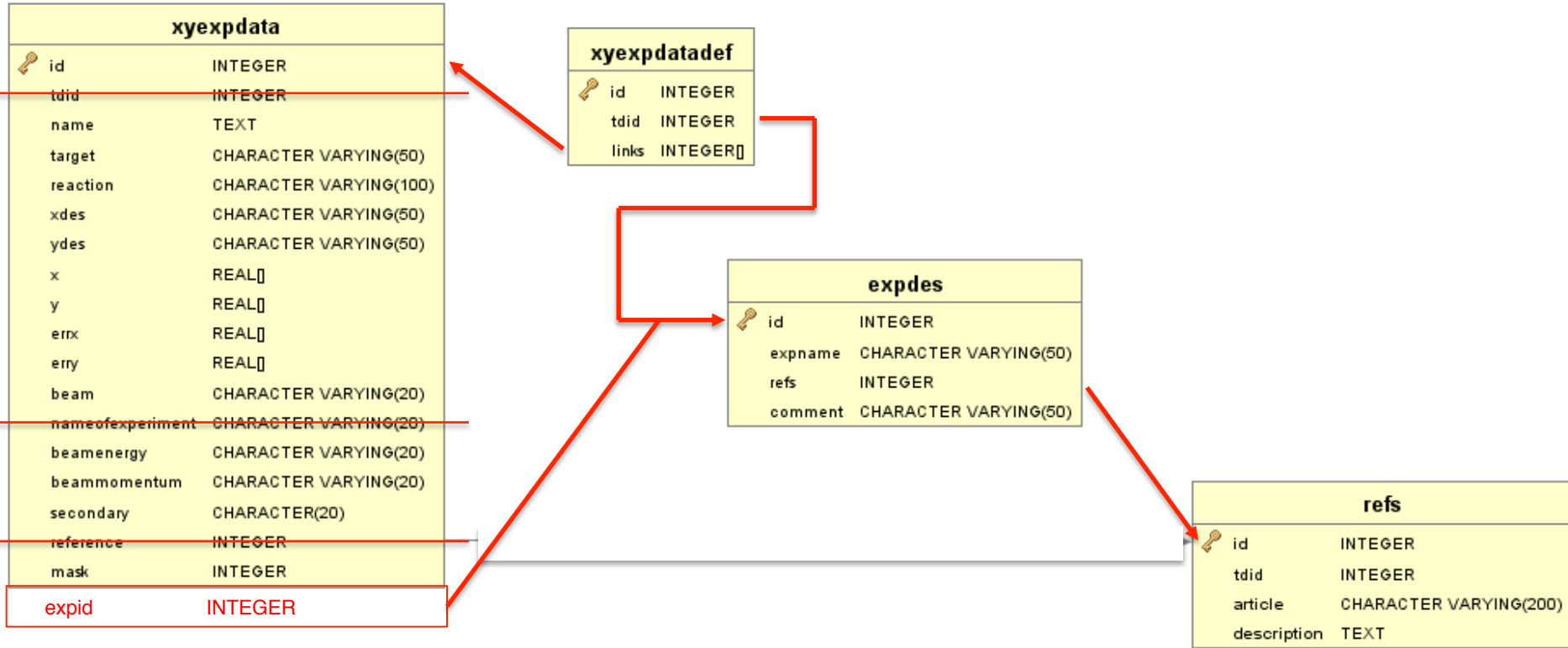
expdes	
 id	INTEGER
expname	CHARACTER VARYING(50)
links	INTEGER[]
refs	INTEGER[]
comment	CHARACTER VARYING[]

refs	
 id	INTEGER
ldid	INTEGER
article	CHARACTER VARYING(200)
description	TEXT

testdes	
 id	INTEGER
name	CHARACTER VARYING(50)
resp	CHARACTER VARYING(50)
description	TEXT
wgroup	CHARACTER VARYING(50)



Default Display – Extension of Database Schema



Replace xyexpdata elements (i.e. nameofexperiment) with reference to unique experiment description table (expdes)