

Developing Dynamic Websites for Tevatron Lattice Function Database and SIST Database

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ABSTRACT

Dynamic websites were designed and implemented for Tevatron Lattice Functions and the Summer Internships in Science & Technology for Minority Students (SIST) Database. The websites were written using HTML, PHP, and MySQL. The SIST Database Website will provide authorized users with secure access to update and to view their own personal contact information and SIST administrator's complete access to all personal contact information. The Tevatron Lattice Functions Database Website will provide authorized users with secure access to insert, update, and view data collected from the lattices in the Tevatron and will be used to calculate crucial beam parameters.

1. INTRODUCTION

Databases are extremely useful for handling large amounts of information; however, interactively handling the data can be tedious and requires knowledge of the operations of the database server. While it is true that MySQL, the database server used throughout this project, is simple to work with, it is also true that its operations are time consuming and error-prone. For this reason, it is necessary to design web accessible databases. These types of applications are seen every day on the web. For instance, when users are asked for their personal information in order to register with a website, they are inserting their data into the website's database without using the specific commands of the database server. It is this idea that is the basis for this project.

In the present study, a website that gives users the ability to view data and authorized users the ability to insert, update, and view data in the Tevatron Lattice Function database will be developed. In doing so, this will provide scientist with easily accessible data in a timely manner. Additionally, a website will be developed to give authorized users the ability to insert, update, and view their personal information in the SIST Database.

2. MATERIALS & METHODS

The Tevatron Lattice Functions and SIST databases were already established; however, in the process of designing a dynamic website for users to interactively deal with the data and information in the databases, several factors were taken into consideration. Among these factors were computer software and security. Once those were addressed, the actual programming took place.

2.1 Computer Software

The first factor that needed to be addressed was the type of computer software that should be used. Since the databases were already in MySQL, the computer language of choice needed to be compatible. Additionally, the computer language needed to be fairly easy to learn. The computer software of preference was PHP: Hypertext Preprocessor (PHP). The computer language, PHP, was fundamental in developing the website because it is a scripting language that can be embedded into HTML, meaning that it can be combined with HTML in the same script. PHP also has good support for MySQL. Moreover, PHP has been specifically designed for security.

2.2 Security

It is important that only those who are authorized to make changes to the database can do so; therefore, security was a main factor. Security mechanisms, such as passwords and username login, had to be developed and each page was executed using a PHP “session”. The idea of a session is that it will identify a particular user and manage that user’s information during his or her stay at a website. This process is done by storing user information in a cookie on the Web browser. This method provides the most security. To develop the user login mechanism a table was added into the SIST database for the user’s username and password. For the SIST database, in addition to developing the new table, I also had to assign each patron a password and a username. I simply assigned the patron’s first and last name with an underscore between each for the username. For the password, I assigned the last 4 digits of the patron’s telephone number. Furthermore, a mechanism that prompts the patron to change their password was also added. In addition to developing a login prompt to adhere to privacy, another issue to be addressed was how information was being passed from one page to the other. In PHP, there are several methods to pass information from page to page including GET, POST. There were often times when the GET method could not be used because GET variables are passed as part of the URL, which displays the data, and it can only allow a certain amount of information that could be passed. In those instances, the choice of passing data was using the POST method, which passes variables as part of the HTTP protocol.

3. RESULTS

Two dynamic websites were developed, the Tevatron Lattice Function Database Website and the SIST Database Website. The URL’s for the SIST Database Website and Tevatron Lattice Function Database Website are <http://tomato.fnal.gov/sist/db/login.php>

and <http://tomato.fnal.gov/lattices/> respectively. Accessing the Tevatron Lattice Function Database Website shows all the relevant lattice function values in the Tevatron. Any user on the Web can view these data; however, only authorized users can edit these values. If a user edits the table, the next page shows the user the row he or she clicked on to edit then gives the user the ability to input changes. Once submitted, the program returns back to the initial table. A flow chart of the program can be seen in Appendix A. The PHP script for the editable page can be seen in Appendices B and C. Images of parts of the table and editable page can be seen in Appendices D and E respectively.

SIST Website begins with a login screen. If it were the user's first time logging in, the user is prompted to change his or her password. Once logged in the user is taken to his or her page with personal information in the database and has the ability to edit the information there if need be. In addition to having a patron log in, there is also an administrator login. Once successfully logged in a SIST administrator can view all database entries. A flow chart of this program can be seen in Appendix F. The PHP script for changing a password can be seen in Appendices G and H. A display of the data in the database and the editable page can be seen in Appendices I and J respectively.

4. DISCUSSION

The SIST Database Dynamic Website and the Tevatron Lattice Functions Database Dynamic Website are important to the productivity of SIST administrators and scientists. A dynamic website responds to different parameters, often have interfaces where administrators can manage site's content, have a "memory", allowing for user registration and log-in, e-commerce, and similar processes, and are easier to maintain, upgrade, and build upon. It is obvious that dynamic websites are more functional than

static websites. Static websites are those that consist of HTML files linked together. When a static web page is called, the server sends the HTML data to the Web browser; however, when a dynamic web page is called the information is processed on the server side then sent to the Web browser as if it were only HTML file. A diagram of these interactions can be seen in Appendix K.

SIST, an acronym for Summer Internships in Science & Technology for Minority Students, is a program that was developed to expose historically underrepresented groups to science and technology. There are many professors from different colleges and universities who are affiliated with SIST across the United States, and it is important that the administrators have the correct contact information for each of these affiliates so that they could receive SIST updates. Consequently, a database had to be developed to hold all of this information. However, the information in the database is subject to change at any time. The SIST Database Website allows those who are affiliated with SIST to update their own information. Not only does this keep contact information up to date but it is also lessens the stress on the administrators when trying to contact an affiliate.

Tevatron lattice functions are values that pertain to the lattices in the Tevatron. The lattice is the pattern of bending and focusing of magnets in an accelerator. Scientists use these values on a daily basis when calculating the emittance of the proton and antiproton beam, which is crucial to understanding the luminosity of the beam. The emittance is given by:

$$\varepsilon = \frac{w^2}{\beta(s)} \quad , \quad (1)$$

where w is the width between each beam while in a detector and $\beta(s)$ is the beta function as a function of the position in the Tevatron. Using the value of the emittance

the luminosity can be calculated. Luminosity is the number of interactions seen by the experiments, it is given by:

$$L = K \frac{N_p N_{\bar{p}}}{\beta^* \epsilon} \quad , \quad (2)$$

where K is a constant specific to the Tevatron, N_p and $N_{\bar{p}}$ is the number of protons and anti- protons respectively, β^* is the beta function at the interaction point, and ϵ is the emittance. Even though the luminosity can be calculated analytically, there are devices in the CDF and $D\phi$ experiments that actually measure the value of the luminosity. In order to improve the performance of the Tevatron, it is necessary to be able to measure the beam parameters that affect the luminosity. In order to increase the luminosity, one can attempt to reduce the emittance, but one must be able to measure it in order to know how to change it.

The width of the beams in the Tevatron is measured regularly by a device called the ‘‘Flying wire’’. One must know the value of the Beta-function at the flying wire to obtain the emittance. Since the emittance is the same everywhere in the Tevatron at any time, measuring the emittance at the Flying Wire is the same as measuring the emittance at the interaction point.

The value of $\beta(s)$ is thought to be constant, from day to day, but the ability of the Tevatron scientist to measure it is always improving. Moreover, scientist may choose to change $\beta(s)$ to improve the luminosity. For these reasons, there needed to be a website where these values could be updated regularly.

5. CONCLUSION

Dynamic websites have been developed for SIST Database and Tevatron Lattice Function Database. Now, with the SIST Database Website, professors from across the U.S. who are affiliated with SIST are able to view and edit their own personal information. In the future, a new feature that allows previous SIST participants to give an update on their whereabouts can be added to the SIST Database Website. The Tevatron Lattice Function Database Website has created a central repository for information used by many scientists and engineers at Fermi National Accelerator Laboratory.

ACKNOWLEDGMENTS

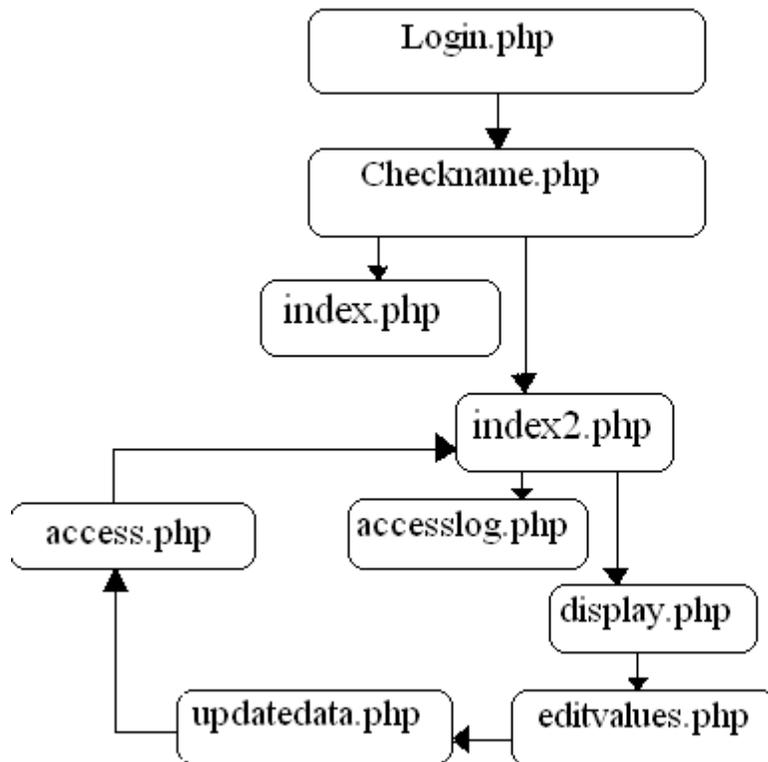
I would like to thank Dr. Elliott McCrory for his guidance throughout this research project. I would also like to thank Vaia Papdimitriou, Timofei Bolshakov, Megan Singleton, and Barbara Singleton for their contribution to the completion of the project. I also wish to thank Ms. Dianne Engram and the SIST Committee for presenting me with this opportunity and Equal Employment Opportunity for funding this program.

REFERENCES

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APPENDIX A

Tevatron Lattice Function Database Website



APPENDIX B

```
<?php
session_start();
if(!isset($_SESSION['username']) && strcmp($_POST['username'],
"tevatron")!=0){
    header("Location: index.php");
}
?>

<html>
<HEAD>
<LINK REL=STYLESHEET HREF="/lattices/main.css" TYPE="text/css">
</head>
<body>

<form action="processupdatedata.php" method="POST">
    <table cellpadding="2" border>
    <?php

include "/home/http/lattices/functions.php";

openMyDatabase();

$id= $_GET['id'];

$headers = 0;
$type = "Measured";
$query = "SELECT * FROM Lattice WHERE type=" . $type . " and id=" . $id . """;

$data = mysql_query($query) or die("Select from table Lattice, type " . $type . "
Failed: " . $query);
$numRows = 0;
while ( $row = mysql_fetch_array($data, MYSQL_ASSOC) ) {
    $numRows++;
    echo "<tr>";
    if ( $header == 0 ) {
        $header = 1;
        foreach ( $row as $item => $value ) {
            if(strcmp($row['EndDate'], '0000-00-00')!= 0 &&
                strcmp($item, "id") != 0 &&
                strcmp($item, "type") != 0 &&
                strcmp($item, "StartDate") != 0 &&
```

APPENDIX C

```
    strcmp($item, "EndDate") != 0 &&
        strcmp($item, "Location") != 0 &&
        strcmp($item, "Name") != 0 &&
        strcmp($item, "CaseValue") != 0 &&
        strcmp($item, "Energy") != 0 &&
        strcmp($item, "Machine") != 0 &&
        strcmp($item, "Position") != 0)
{
    $query1= "INSERT INTO accesslog SET DateOfAccess= NOW(), IDOfRow=
" . $row['id'] ."";
    $query2= "UPDATE accesslog SET " . $item."_OLD="" . $value . "" WHERE
IDOfRow="" . $row['id'] . """;
    mysql_query($query1) or mysql_query($query2) or die("query failed " .
$query1 . 'or'. $query2 ." : " . mysql_error());
}
}
foreach ( $row as $item => $value ) {
    if(strcmp($item, "id") == 0 ||
        strcmp($item, "type") == 0 ||
        strcmp($item, "StartDate") == 0 ||
        strcmp($item, "EndDate") == 0 ||
        strcmp($item, "Location") == 0 ||
        strcmp($item, "Name") == 0 ||
        strcmp($item, "CaseValue") == 0 ||
        strcmp($item, "Energy") == 0 ||
        strcmp($item, "Machine") == 0 ||
        strcmp($item, "Position") == 0)
{
    echo "<input type='hidden' name="" . $item . "" value="" . $value . "">\n";
    echo "<tr><th>" . $item . "</th><td>" . $value . "</td><td>" . $value .
"</tr>\n";
} else {
echo "<tr><th>" . $item . "</th><td>" . $value . "</td><td><input type='text'
name="" . $item . "" value="" . $value . "" size='20'></tr>\n";
}
}
}
}
?>
<tr><td colspan="3" align="center">
    <input type="submit" value="Update Database"></td></tr>
</body></table></html>
```

APPENDIX D

Tevatron Lattice Functions - Microsoft Internet Explorer

Address: <http://tomato.fnal.gov/lattices/index.php?simple=1&type=Measured&supress=0>

Tevatron Lattice Functions

Data type: "Measured"
Sorted by id

- See the full, coupled lattice functions
- Comments column: Suppress or slow
- See this table: as XML or as Excel-ready file (right-click "Save Target As" and call it something.tab).
- Start over with:
 - "Measured" lattice parameters
 - "Design" lattice parameters
 - "Gold" lattice parameters
 - Old OSDAPhysics lattice parameters
- Examine the design lattice from the Tevatron Department

Reference: BeamDocs no. 1465, by Valeri Lebedev.

id	StartDate	EndDate	Location	Case	E	Machine	AlfaX1	BetaX1+BetaX2	AlfaY2	BetaY1+BetaY2	DspX	DspY	Comments
7	2004-05-13	2005-08-09	FW_E11_Horiz	5	150	Tevatron	4.79069	8907.875	-5.0278	9995.6184	287.714	3.30429	From BeamDocs #1465 by Lebedev and Valishev, 18 Nov 2004
8	2004-05-13	2005-08-05	FW_E11_Vert	5	150	Tevatron	4.731	8694.817	-5.08522	10216.5258	284.164	3.26658	hello audience
9	2004-05-13	2005-08-05	FW_E17_Horiz	5	150	Tevatron	1.48054	6966.774	-1.12419	5324.409	449.963	-10.62	From BeamDocs #1465 by Lebedev and Valishev, 18 Nov 2004
10	2004-05-13	2005-08-05	SyncLight_Proton	15	980	Tevatron	1.00314	6045.161	0.437542	10234.372	192.156	19.1855	From BeamDocs #1465 by Lebedev and Valishev, 18 Nov 2004
11	2004-05-13	2005-08-05	SyncLight_PBar	15	980	Tevatron	0.60429	3984.3558	0.288569	9455.453	150.89	22.069	From BeamDocs #1465 by Lebedev and Valishev, 18 Nov 2004
12	2004-05-13	2005-08-05	Bend_C11_B	15	980	Tevatron	0.514034	3674.8894	0.254993	9335.693	143.504	22.7453	From BeamDocs #1465 by Lebedev and Valishev, 18 Nov 2004
13	2004-05-13	2005-08-05	FW_E11_Horiz	15	980	Tevatron	4.74505	8857.08	-3.06489	6046.997	271.154	11.2686	From BeamDocs #1465 by Lebedev and Valishev, 18 Nov 2004
14	2004-05-13	2005-08-05	FW_E11_Vert	15	980	Tevatron	4.68639	8647.7	-3.10316	6186.817	267.688	11.2937	From BeamDocs #1465 by Lebedev and Valishev, 18 Nov 2004
15	2004-05-13	2005-08-05	FW_E17_Horiz	15	980	Tevatron	1.42312	6774.977	-1.23236	4277.669	505.713	0.78367	From BeamDocs #1465 by Lebedev and Valishev, 18 Nov 2004
16	2003-12-04	2004-05-12	FW_E11_Horiz	5	150	Tevatron	4.79069	8907.875	-5.0278	9995.6184	287.714	3.30429	A combination of BeamDocs #1465 and OSDAPhysics Code suggesting that some of the beta functions are slightly different.
17	2003-12-04	2004-05-12	FW_E11_Vert	5	150	Tevatron	4.731	8694.817	-5.08522	10216.5258	284.164	3.26658	A combination of BeamDocs #1465 and OSDAPhysics Code suggesting that some of the beta functions are slightly different.
18	2003-12-04	2004-05-12	FW_E17_Horiz	5	150	Tevatron	1.48054	6966.774	-1.12419	5324.409	449.963	-10.62	A combination of BeamDocs #1465 and OSDAPhysics Code suggesting that some of the beta functions are slightly different.
19	2003-12-04	2004-05-12	SyncLight_Proton	15	980	Tevatron	1.00314	6045.161	0.437542	10234.372	192.156	19.1855	A combination of BeamDocs #1465 and OSDAPhysics Code suggesting that some of the beta functions are slightly different.
20	2003-12-04	2004-05-12	SyncLight_PBar	15	980	Tevatron	0.60429	3984.3558	0.288569	9455.453	150.89	22.069	BUTTERCUP
21	2003-12-04	2004-05-12	Bend_C11_B	15	980	Tevatron	0.514034	3674.8894	0.254993	9335.693	143.504	22.7453	A combination of BeamDocs #1465 and OSDAPhysics Code suggesting that some of the beta functions are slightly different.
22	2003-12-04	2004-05-12	FW_E11_Horiz	15	980	Tevatron	4.74505	6527.98	-3.06489	6046.997	236.69	11.2686	A combination of BeamDocs #1465 and OSDAPhysics Code suggesting that some of the beta functions are slightly different.
23	2003-12-04	2004-05-12	FW_E11_Vert	15	980	Tevatron	4.68639	8647.7	-3.10316	10016.657	267.688	5.8691	A combination of BeamDocs #1465 and OSDAPhysics Code suggesting that some of the beta functions are slightly different.
24	2003-12-04	2004-05-12	FW_E17_Horiz	15	980	Tevatron	1.42312	7015.907	-1.23236	4277.669	528.612	0.78367	A combination of BeamDocs #1465 and OSDAPhysics Code suggesting that some of the beta functions are slightly different.
25	2001-01-01	2003-12-03	FW_E11_Horiz	5	150	Tevatron	4.79069	8907.875	-5.0278	9995.6184	287.714	3.30429	HELLO
27	2001-01-01	2003-12-03	FW_E17_Horiz	5	150	Tevatron	1.48054	6966.774	-1.12419	5324.409	449.963	-10.62	hi
28	2001-01-01	2003-12-03	SyncLight_Proton	15	980	Tevatron	1.00314	6045.161	0.437542	10234.372	192.156	19.1855	PLEASE WORK!!
29	2001-01-01	2003-12-03	SyncLight_PBar	15	980	Tevatron	0.60429	3984.3558	0.288569	9455.453	150.89	22.069	HEEL
30	2001-01-01	2003-12-03	Bend_C11_B	15	980	Tevatron	0.514034	3674.8894	0.254993	9335.693	143.504	22.7453	PLEASE WOR
31	2001-01-01	2003-12-03	FW_E11_Horiz	15	980	Tevatron	4.74505	8857.08	-3.06489	6046.997	271.154	11.2686	NO
32	2001-01-01	2003-12-03	FW_E11_Vert	15	980	Tevatron	4.68639	8647.7	-3.10316	6186.817	267.688	11.2937	WORK lova girl
33	2001-01-01	2005-07-11	FW_E17_Horiz	15	980	Tevatron	1.42312	6774.977	-1.23236	4277.669	505.713	0.78367	hey, how ya doin.
46	2005-08-05	0000-00-00	SyncLight_Proton	15	980	Tevatron	0.800738	6225.95	0.306553	10756.501	176.037	16.8997	Created Fri Aug 5 17:56:52 CDT 2005
47	2005-08-05	0000-00-00	SyncLight_PBar	15	980	Tevatron	0.462748	4604.852	0.176222	10001.343	142.625	16.4863	Created Fri Aug 5 17:56:52 CDT 2005
48	2005-08-05	0000-00-00	FW_E11_Horiz	15	980	Tevatron	5.20867	10393.16	-4.04554	7736.1375	257.604	3.84317	Created Fri Aug 5 17:56:52 CDT 2005
49	2005-08-05	0000-00-00	FW_E11_Vert	15	980	Tevatron	5.14374	10147.52	-4.09411	7912.555	254.325	3.95576	Created Fri Aug 5 17:56:52 CDT 2005
50	2005-08-05	0000-00-00	FW_E17_Horiz	15	980	Tevatron	1.50476	7299.96	-1.24343	4900.961	511.993	11.9421	Created Fri Aug 5 17:56:52 CDT 2005
51	2005-08-05	0000-00-00	CDF_IP	15	980	Tevatron	0.0437548	31.97576	0.0277248	37.262588	1.73821	1.59736	Created Fri Aug 5 17:56:52 CDT 2005
52	2005-08-05	0000-00-00	D0_IP	15	980	Tevatron	0.0450688	35.7606	0.00852916	40.02015	1.21896	2.03044	Created Fri Aug 5 17:56:52 CDT 2005
53	2005-08-09	0000-00-00	FW_E11_Horiz	5	150	Tevatron	4.79069	8907.875	-5.0278	9995.6184	287.714	3.30429	hello audience

Retrieved 35 records of data type Measured

Username:
 Password:

Security, Privacy, Legal

APPENDIX E

http://tomato.fnal.gov/lattices/updatedata.php?id=12 - Microsoft Internet Explorer

File Edit View Favorites Tools Help Links Fermilab Dictionary Windows

Back Forward Stop Home Search Favorites Media Print Mail News RSS

Address http://tomato.fnal.gov/lattices/updatedata.php?id=12 Go

Google Search Web Site popups allowed AutoFill Options

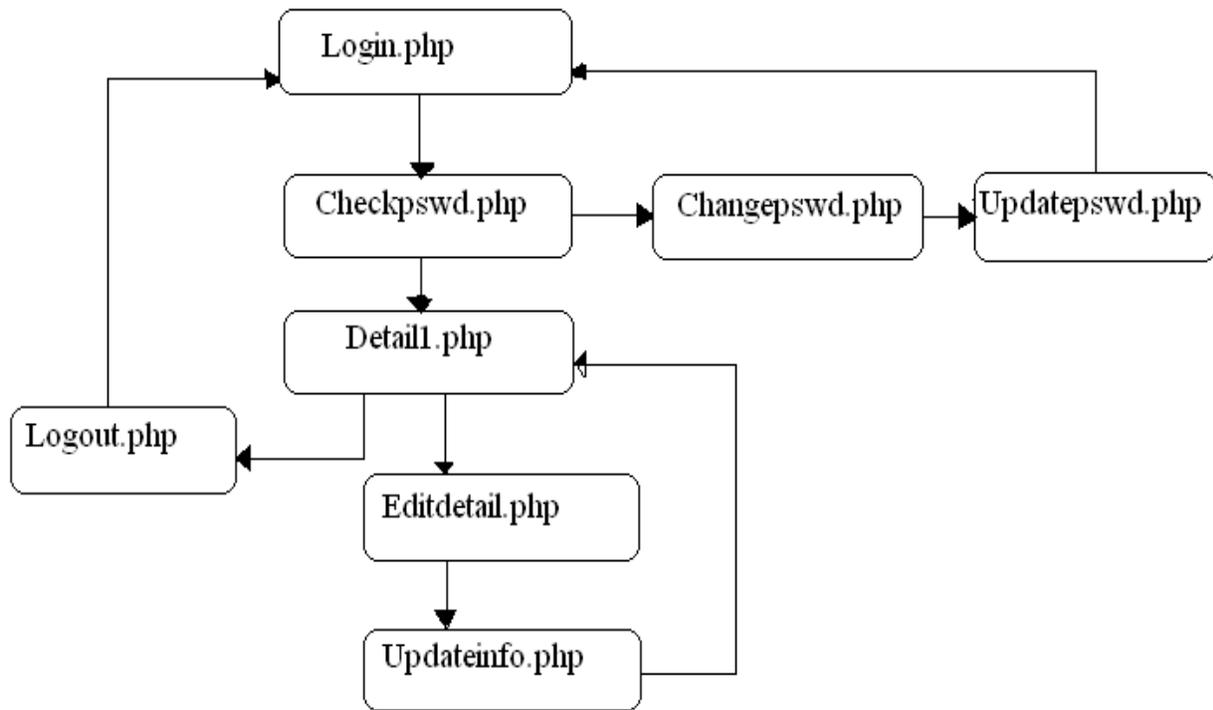
id	12	12
type	Measured	Measured
StartDate	2004-05-13	2004-05-13
EndDate	2005-08-05	2005-08-05
Location	Bend_C11_B	Bend_C11_B
Name	BBENDC11B	BBENDC11B
Case Value	15	15
Energy	980	980
Machine	Tevatron	Tevatron
Position	317365	317365
BetaX1	3611.48	3611.48
AlfaX1	0.514034	0.514034
BetaY1	635.433	635.433
AlfaY1	-0.0603438	-0.0603438
Nu_1	-0.418636	-0.418636
BetaX2	63.4094	63.4094
AlfaX2	-0.0177248	-0.0177248
BetaY2	8700.26	8700.26
AlfaY2	0.254993	0.254993
Nu_2	-0.239549	-0.239549
U	0.0468664	0.0468664
DspX	143.504	143.504
DspXp	-0.0242851	-0.0242851
DspY	22.7453	22.7453
DspYp	0.00239887	0.00239887
Qx	10.42055	10.42055
Qy	10.27878	10.27878
M56	-908.515	-908.515
Comments	From BeamDocs #1465 by Lebedev and Valishev, 18 Nov 2004	From BeamDocs #1465

Update Database

Done Internet

APPENDIX F

SIST Database Website



APPENDIX G

```
<?php

include "/home/http/sist/db/administrators/functions.php";

session_start();
openMyDatabase();

$id= $_SESSION['id'];
$row = getRowFromTable($id, "Usernames");

$message = NULL;

if(isset($_POST['username'])) {
    $u = $_POST['username'];
} else {
    $message = '<p>You forgot to enter your username!</p>';
} if(isset($_POST['pswd'])) {

    $p = $_POST['pswd'];
} else {
    $message = '<p>You forgot to enter your existing password!</p>';
} if(isset($_POST['pswd1'])) {
    if($_POST['pswd1'] == $_POST['pswd2']) {
        $np = $_POST['pswd1'];
    }
    else

        $message = '<p>Your new password did not match the confirmed new
password!</p>';
}

if($u && $p && $np) {

    $npswd= crypt($np,"aa");
    $query = "UPDATE Usernames SET Password='\" . $npswd . "\" WHERE ID= \" . $id.
\";\";
    $result = mysql_query($query);
    if (mysql_affected_rows() == 1) { if($result){
```

APPENDIX H

```
$query = "INSERT INTO access (ID, DateOfAccess, AccessType) VALUES ('" .  
$id . "', NOW(), 'MODIFY');";  
  
$result = mysql_query ($query) or die("query failed " . $query . " : " .  
mysql_error());  
    echo "<p><b>Your password has been changed.$query</b></p>";  
    echo "<a href='http://tomato.fnal.gov/~marlas/SISTAffiliates/login.php'> Login  
With New Password </a>";  
exit();  
    }  
    }  
    header("Location: detail1.php");  
}  
?>
```

APPENDIX I

The screenshot shows a Mozilla browser window with the address bar displaying `http://tomato.fnal.gov/sist/db/detail1.php`. The page header features the Fermilab logo and the text "SIST Database". Below the header, there are links for "SIST Home" and "Fermilab Home Page".

Database Info For Clint McCrory

If you are not Clint McCrory, [click here](#).

ID:	1
First Name:	Clint
Last Name:	McCrory
Middle Initial:	
Suffix:	
Title:	Professor
Department:	Department of Mathematics
University:	University of Georgia
Address 1:	
Address 2:	
City:	Athens
State:	GA
Zipcode:	30602-7403
Email:	clint@math.uga.edu
Date Entered in Database:	0000-00-00
Phone:	706-542-2576
Fax:	
Provisional:	TRUE

[Logout](#)

Security, Privacy, Legal

APPENDIX J

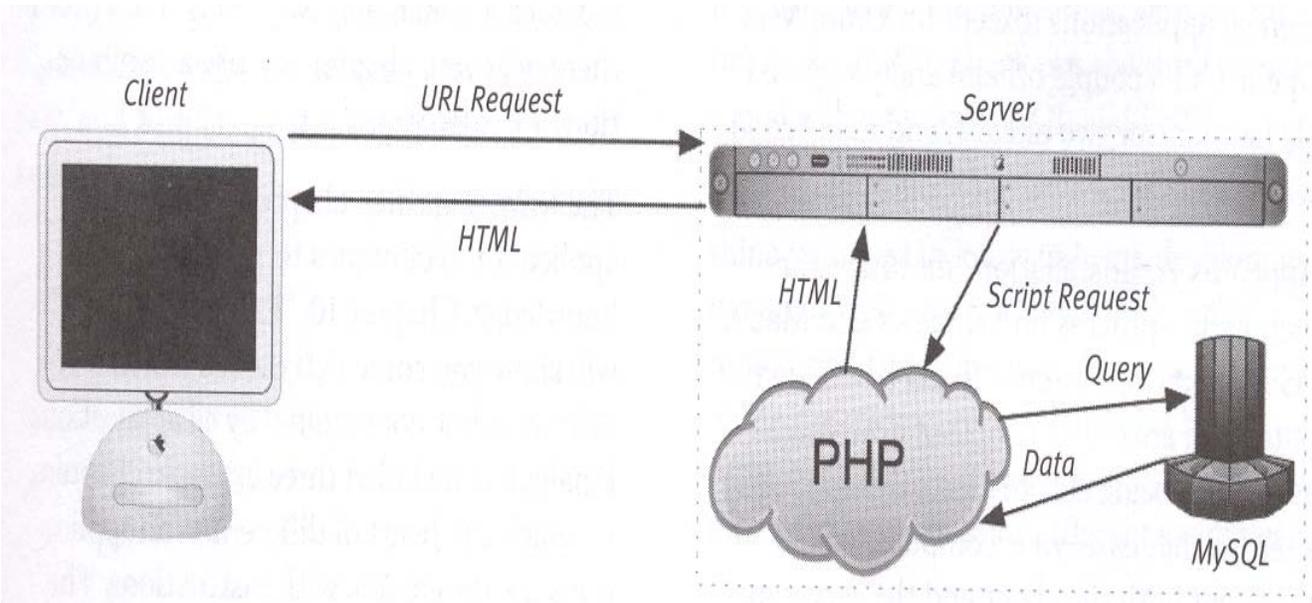
The screenshot shows a Mozilla browser window with the address bar containing `http://tomato.fnal.gov/sist/db/edarr.php?`. The page header features the Fermilab logo and the text "SIST Database". Below the header, there are two links: "SIST Home" and "Fermilab Home Page".

The main content is a form for editing user details. The form fields are as follows:

ID:	1
First Name:	Clint
Last Name:	McCroy
Middle Initial:	
Suffix:	
Title:	Professor
Department:	Department of Mathematics
University:	University of Georgia
Address 1:	
Address 2:	
City:	Athens
State:	GA
Zipcode:	30602-7403
Email:	clint@math.uga.edu
Date Entered in Database:	0000-00-00
Phone:	706-542-2576
Fax:	

Below the form is a "submit changes" button. At the bottom of the page, there is a link for "Security, Privacy, Legal".

APPENDIX K



PHP and MySQL For Dynamic Web Sites

