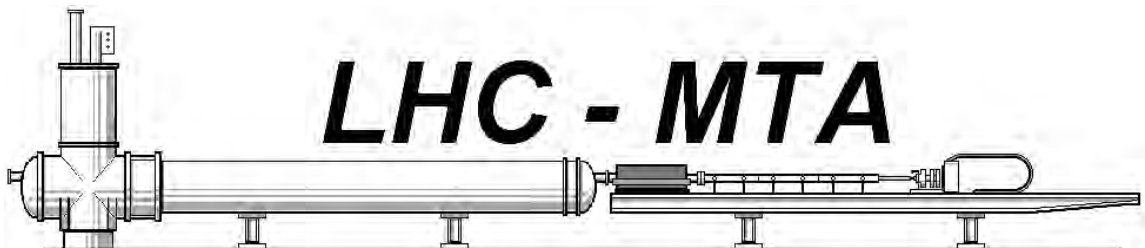


# Data Analysis Project for the LHC Series Magnets Field Quality Measurements

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# Magnet Tests and Results

## Tests in charge

- ☞ Tests of Dipoles ( $\approx 1200$ ) at CERN warm and cold conditions.
- ☞ Tests of SSS ( $\approx 500$ ) at CERN warm and cold conditions.
- ☞ Tests of Correctors ( $\approx 8000$ ) in industry warm and cold conditions.
- ☞ Tests of Correctors ( $\approx 500$ ) at CERN warm and cold conditions.

## Analysis results & LHC Database (Digested data)

- ☞ Summary of magnet tests results will be provided in the electronic document **MAGNET TEST TRAVELLER** (PDF).
- ☞ Summary of magnet tests digested data will be provided in the **REFERENCE VIEW** available from the Manufacturing and Test Folders (MTF).
- ☞ Magnet tests digested data are provided through **REFERENCE TABLES** and committed after approbation to the LHC database.

# Overview of the Data Analysis Project

## Field Quality Tests Requirements

- ☞ Dipoles and Quadrupoles
  - ⇒  $\approx 1\,200$  Dipoles + 500 SSS.
  - ⇒  $\approx 1\,000$  measurements per Dipole or SSS.
  - ⇒  $\approx 20\,000\,000$  magnetic measurements.
  - ⇒  $> 200$  GB Database.
- ☞ Correctors
  - ⇒  $\approx 8\,000$  magnets.
  - ⇒ Number of measurements is negligible.
  - ⇒ Many variety of correctors.

## Data Analysis Project

- ☞ Analysis Cluster
  - ⇒ 5 PCs Twin PIII 600 MHz running Linux.
  - ⇒ WWW Analysis Servers.
- ☞ Analysis Tools
  - ⇒ 15 Modules ( $\approx 150\,000$  lines of code).
  - ⇒ Analysis on the fly (rate of  $\approx 1\,800$  meas./sec).
- ☞ Automatic Analysis
  - ⇒ Database rate  $\approx 80$  meas./sec (5 min/magnet).
  - ⇒  $< 10$  min for full magnet field analysis.
- ☞ Interactive Analysis
  - ⇒ Fast, reliable.
  - ⇒ Available on the web.

# Sites

Bloc 4  
Short Magnets  
Test Site



CAT (India)  
WWW support

Industry  
Short Magnets  
Test Site

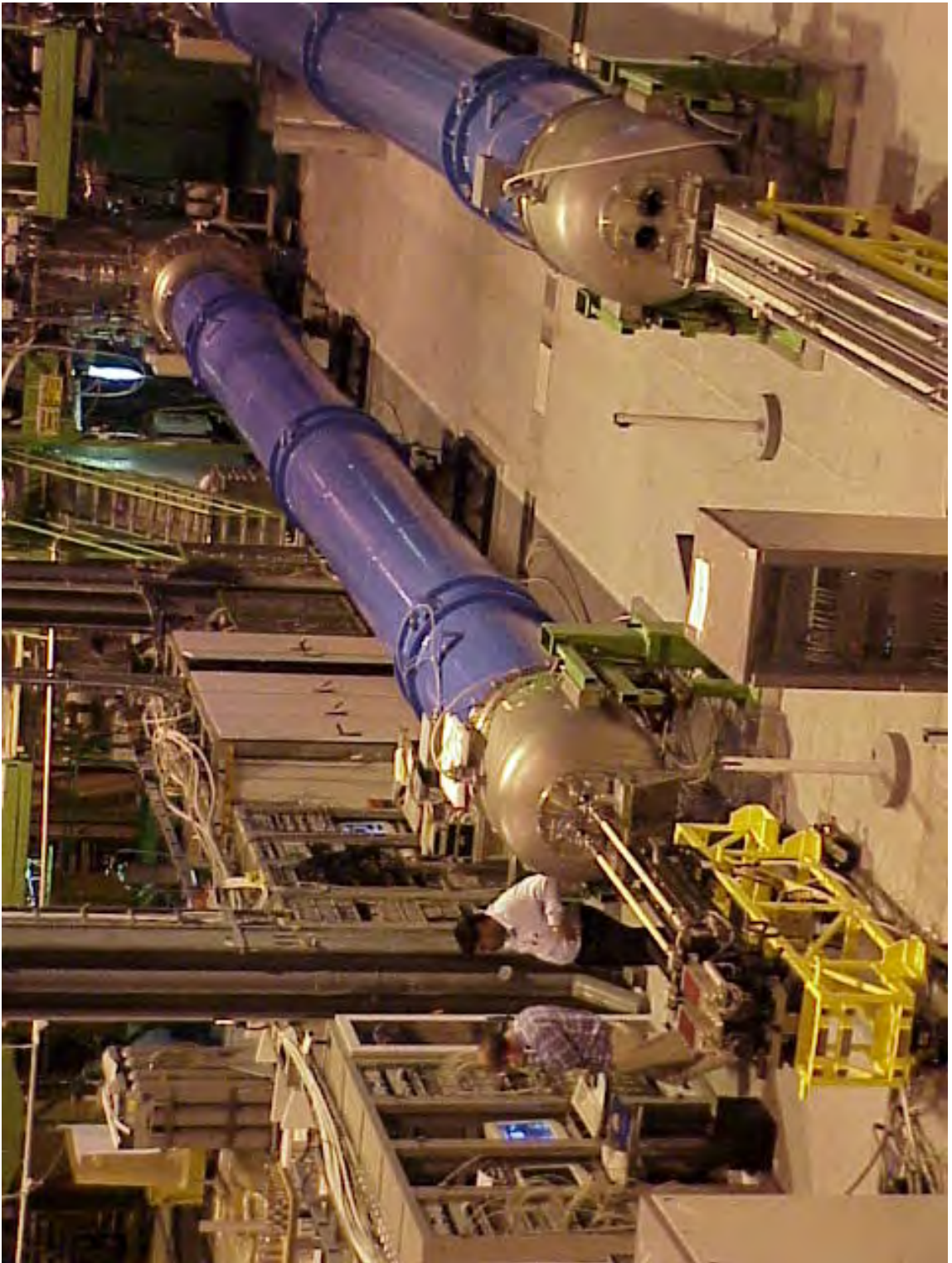
SM18  
& SMA18  
Long Magnets  
Test Site

Bld. 35  
Database Server

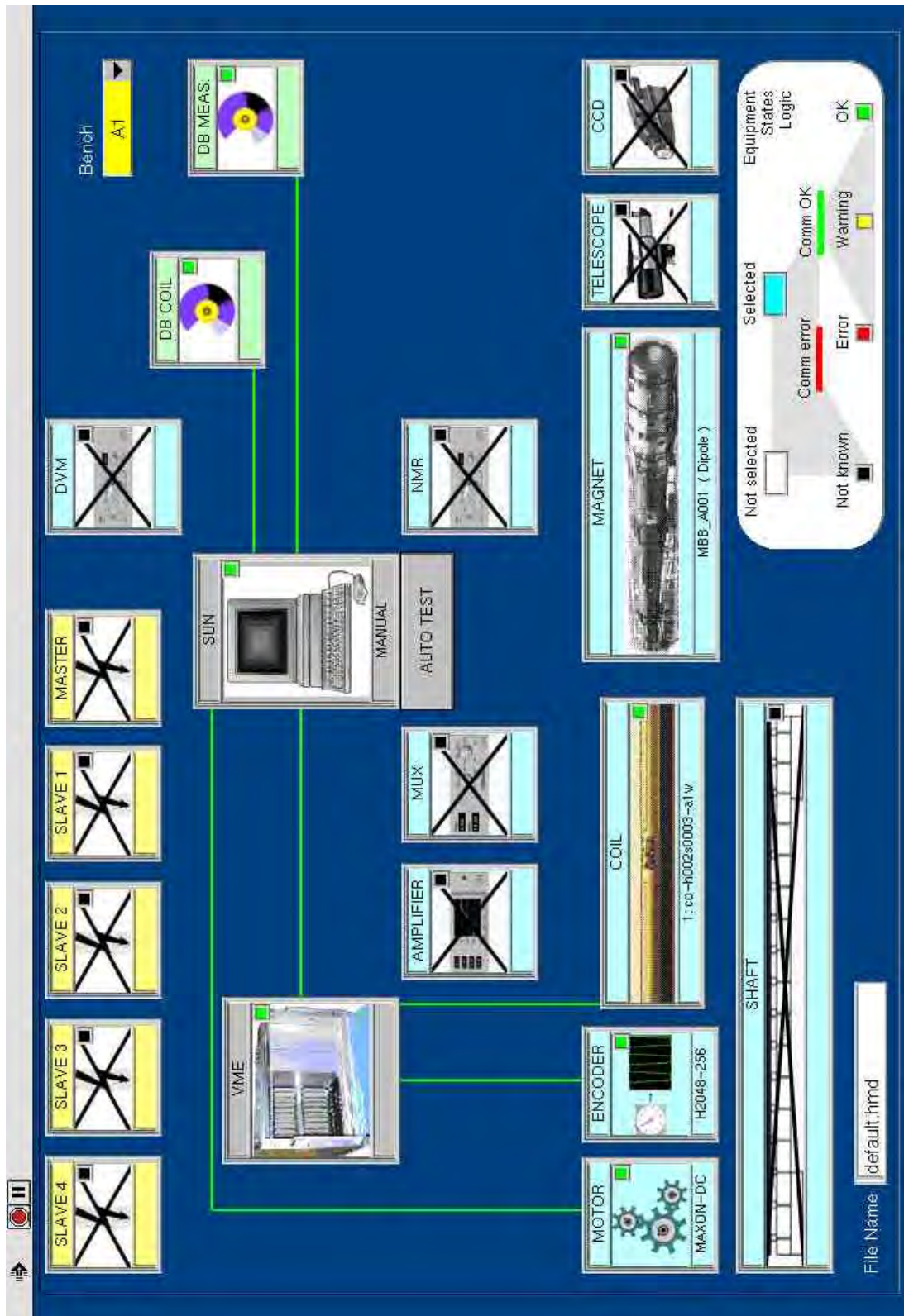
Bld. 30  
LHC/MTA

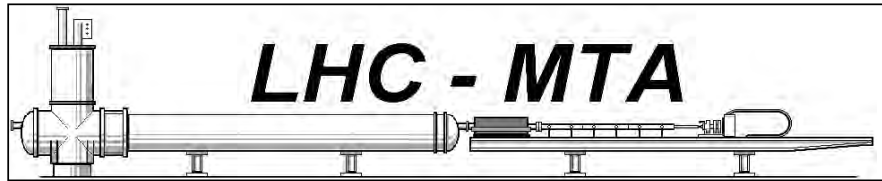
Bld. 513  
Analysis Servers

## Test Benches and Magnets



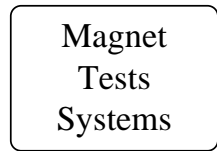
# Magnetic Measurement Program





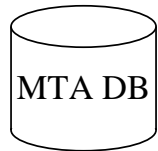
# Data Flow Chart

@CERN (B4, SM18) & @Industry



(LabView)

Test Instrumentation Traveller  
Test Instrumentation Data

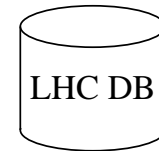


(raw data 0.5TB)

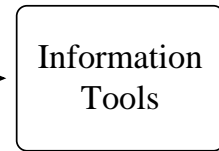


(LabView, Excel, C, Web)

Magnet Test Traveller  
Magnet Reference Data



(digested data 1GB)



← Tests & Measurements

→ Analysis & Data Reduction →

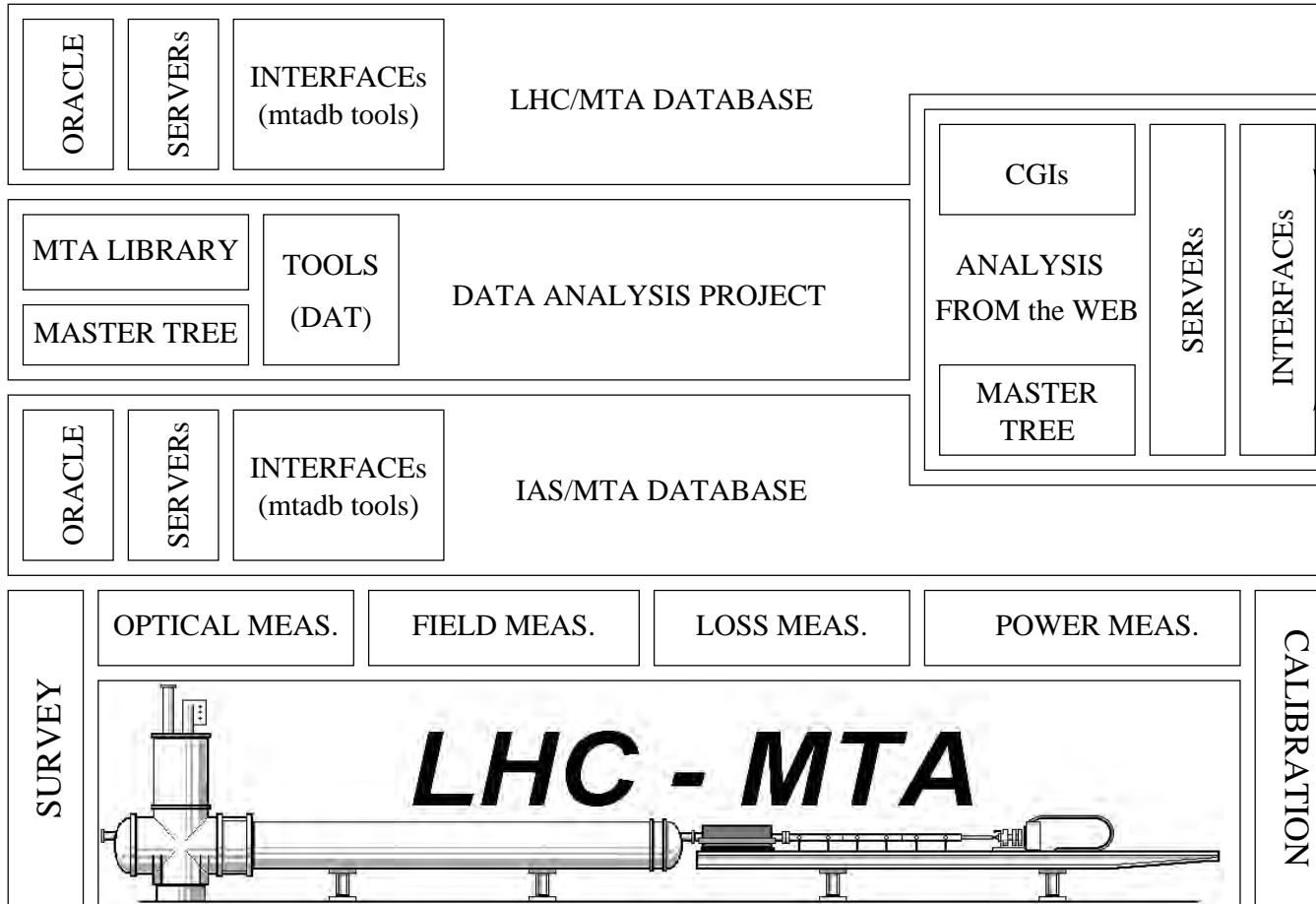
←

Provider side

→

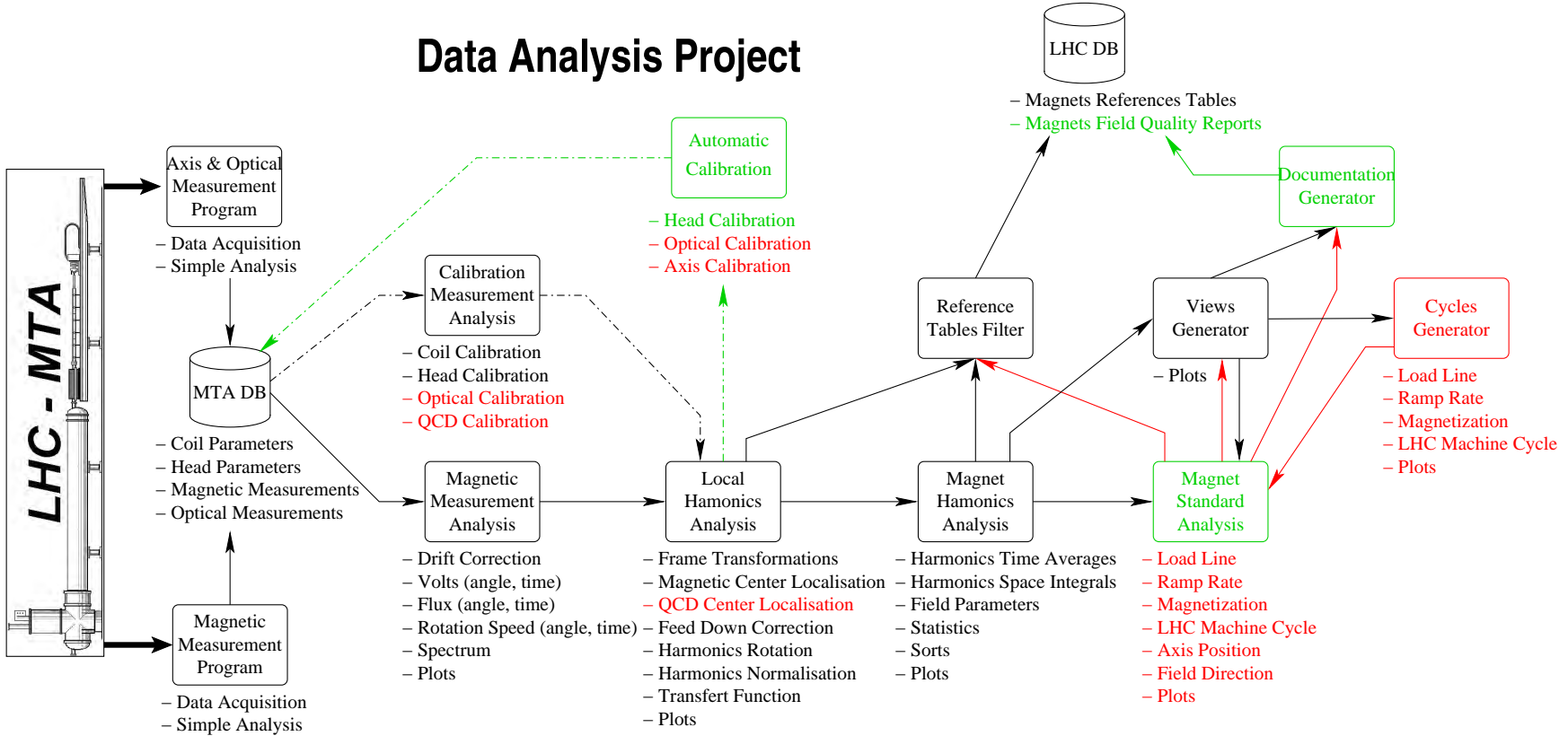
Client side

# Data Analysis Project





# Data Analysis Project



# DAP Analysis Menus

**LHC - MTA**  
Data Analysis Tools

MTA Database Access

- Data Catalog
- Data Retrieval
- Management

Coil Calibration

- Coil Factors Analysis
- Head Calibration Analysis

Local Field Analysis

- Magnetic Field Analysis (Flux, Volts, ...)
- Field Harmonics Analysis



Magnet Field Analysis

- Harmonics Filters Analysis (averages & integrals)
- View Analysis
- Standard Analysis

LHC Database Access

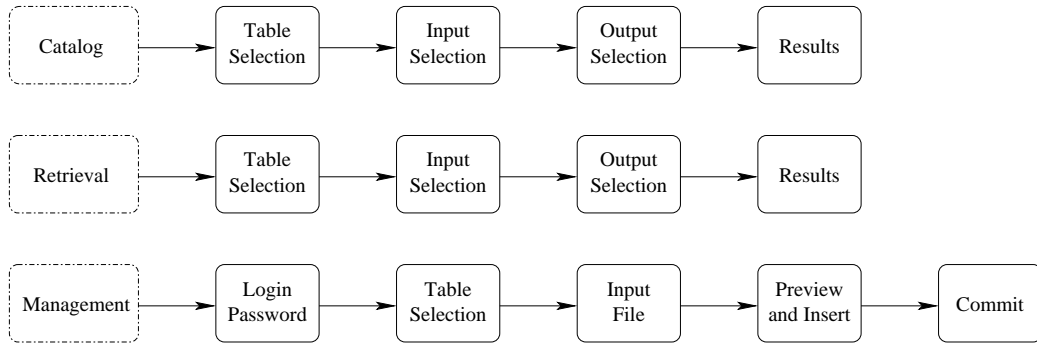
- Reference Data Catalog
- Reference Data Retrieval
- Management

At any moment, you can click on the help icon in the upper right corner of the window.  
This will bring up a new window containing contextual help.

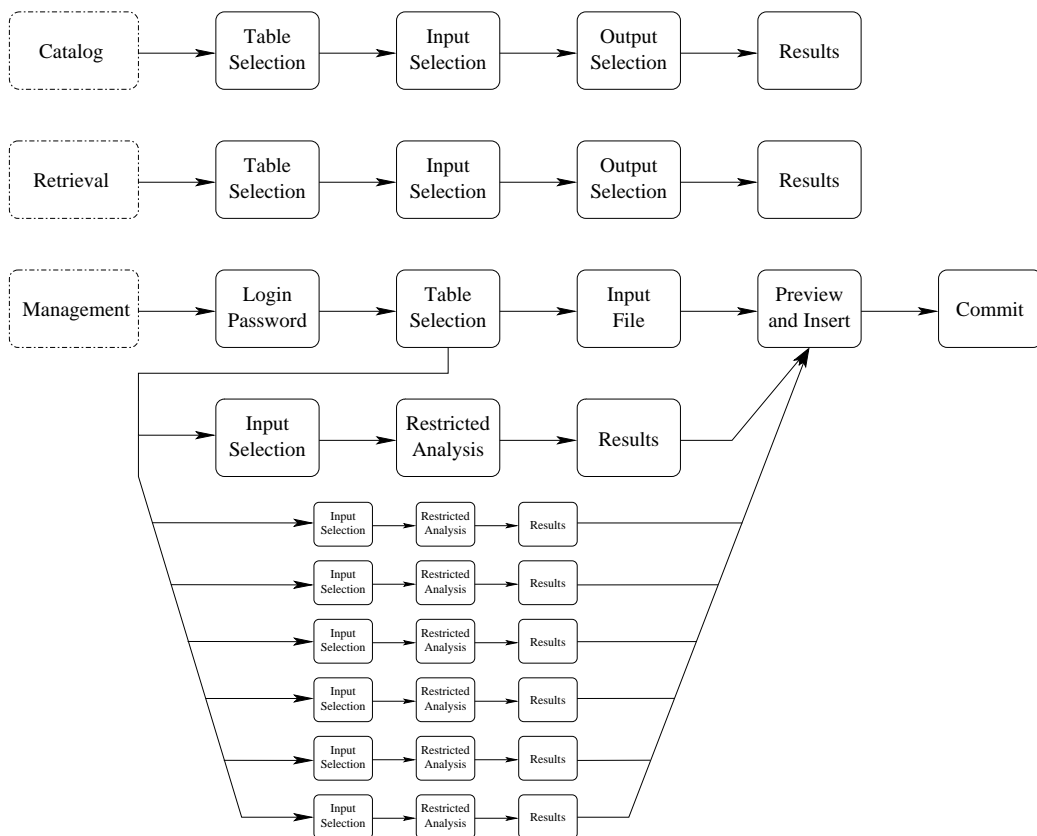
LHC/MTA/IFM Last update Mon July 2 11:15:00 2001  
Contact the [Webmaster](#) -  (MRTG statistics)  
Break out of frame: 

# Data Analysis Site Map

## MTA Database Access

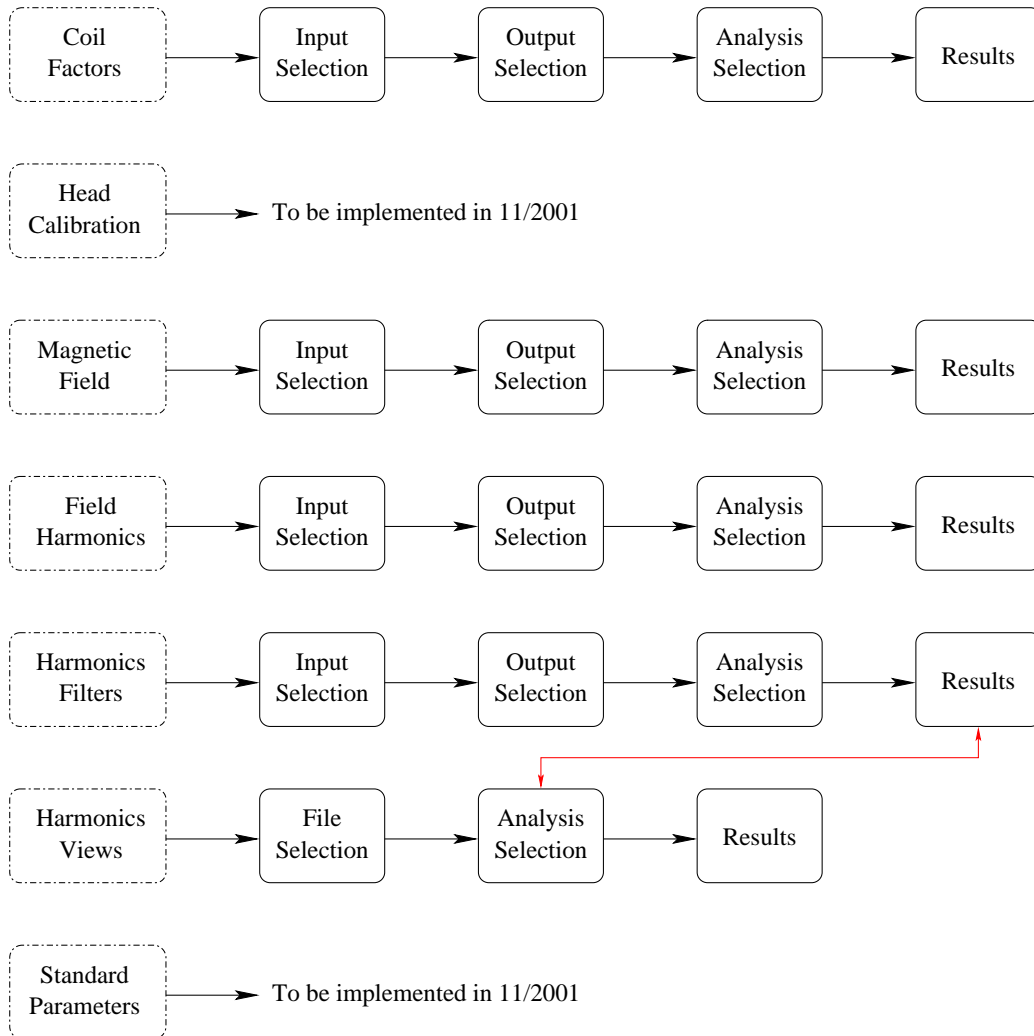


## LHC Database Access

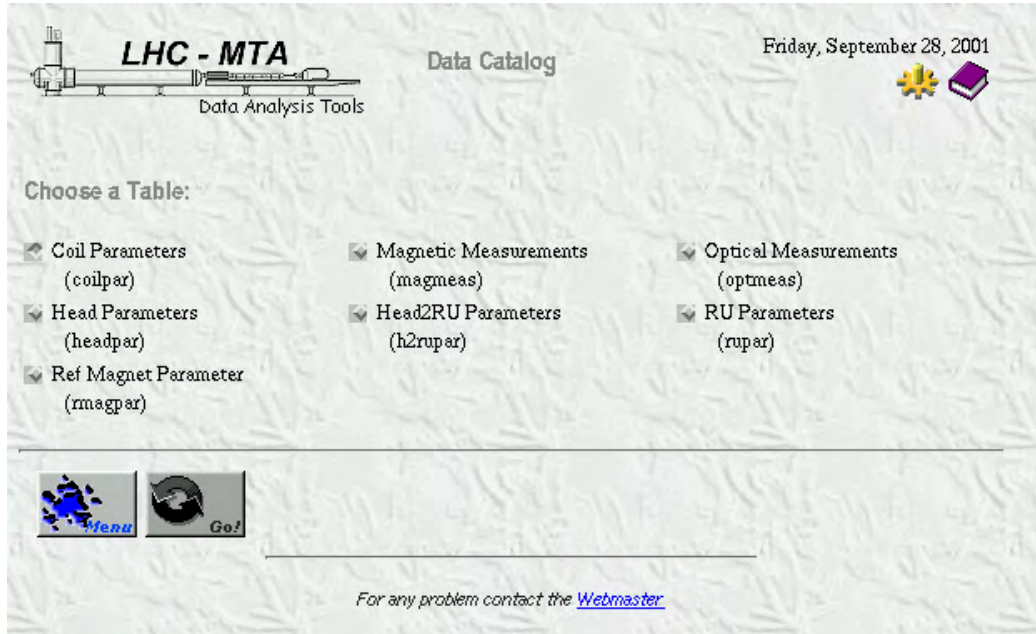


# Data Analysis Site Map

## Analysis



# DAP Catalog Table Selection





The screenshot shows a web interface for the LHC - MTA Data Catalog. At the top left, there is a logo for LHC - MTA Data Analysis Tools. The title "Data Catalog" is centered at the top, and the date "Friday, September 28, 2001" is on the top right. Below the title, there are icons for a gear and a book. The main content area is titled "Choose a Table:" and contains a list of nine tables, each with a checked checkbox and its name in parentheses: Coil Parameters (coilpar), Head Parameters (headpar), Ref Magnet Parameter (rmagpar), Magnetic Measurements (magneas), Head2RU Parameters (h2rupar), Optical Measurements (optmeas), and RU Parameters (rupar). At the bottom left, there are two icons: one for "Menu" and one for "Go?". At the bottom center, there is a link: "For any problem contact the [Webmaster](#)".

**LHC - MTA**  
Data Analysis Tools

**Data Catalog** Friday, September 28, 2001

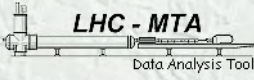
Choose a Table:

- Coil Parameters (coilpar)
- Head Parameters (headpar)
- Ref Magnet Parameter (rmagpar)
- Magnetic Measurements (magneas)
- Head2RU Parameters (h2rupar)
- Optical Measurements (optmeas)
- RU Parameters (rupar)

For any problem contact the [Webmaster](#)


# DAP Catalog Coil Input Query



**LHC - MTA**  
Data Analysis Tools






Data Catalog - Coil Parameter

Friday, September 28, 2001




Current options status

<b>Input options</b> Query: Number of records:	<b>Output options</b> N/A
--	------------------------------

Please specify input options for the Data Catalog

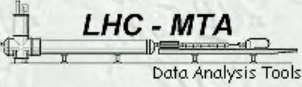
**Please select coil properties**

<input type="checkbox"/> Head number <a href="#">Index of Heads</a>	From <input style="width: 50px;" type="text" value="21"/>	To <input style="width: 50px;" type="text"/> (optional)	
<input type="checkbox"/> Sector number	From <input style="width: 50px;" type="text"/>	To <input style="width: 50px;" type="text"/> (optional)	
<input type="checkbox"/> Calibration date <a href="#">Browse... [test listing]</a>	From <input style="width: 50px;" type="text" value="Saturday"/> <input style="width: 50px;" type="text" value="1"/>	To <input style="width: 50px;" type="text" value="Friday"/> <input style="width: 50px;" type="text" value="28"/>	(optional)
	<input type="button" value="Copy above Date"/>	@ <input style="width: 50px;" type="text" value="2000"/> : <input style="width: 50px;" type="text" value="00"/> : <input style="width: 50px;" type="text" value="00"/> : <input style="width: 50px;" type="text" value="00"/>	
	@ <input style="width: 50px;" type="text" value="2001"/> : <input style="width: 50px;" type="text" value="23"/> : <input style="width: 50px;" type="text" value="59"/> : <input style="width: 50px;" type="text" value="59"/>		
<input type="checkbox"/> Center offset	From <input style="width: 50px;" type="text"/>	To <input style="width: 50px;" type="text"/> (optional)	
<input type="checkbox"/> Extra parameters	<input style="width: 100%;" type="text"/>		
For help on available keys, click on 			
<b>Maximum records from database:</b> <input style="width: 50px;" type="text"/> (0 for all)			
<input type="checkbox"/> Estimate number of records			



For any problem contact the [Webmaster](#)

# DAP Catalog

## Coil Output Keys Selection




 **LHC - MTA**  
Data Analysis Tools

Data Catalog Friday, September 28, 2001

**Current options status**

<b>Input options</b> Query: <i>head_number = 21</i> Maximum records from database: Number of records: <b>14</b>	<b>Output options</b> N/A
--	------------------------------

Please specify which keys should be retrieved

**Options**

<input checked="" type="checkbox"/> Show number of records
<input checked="" type="checkbox"/> Dump output to file

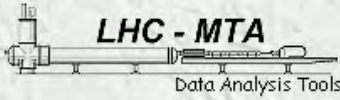
**Coil Parameter keys** - Click on ▲ ( ▼ ) to add a key in ascending (descending) order

Head number	▲ ▼
Sector number	▲ ▼
Calibration date	▲ ▼
Center offset	▲ ▼
Contraction factor	▲ ▼

```
head_number+,  
sector_number+,  
calibration_date+,  
center_offset+
```

For any problem contact the [Webmaster](#)


# DAP Catalog Coil Results



**LHC - MTA**  
Data Analysis Tools






Data Catalog

Friday, September 28, 2001





**Current options status**

Input options	Output options
Query: <i>head_number = 21</i>	Keys: head_number+, sector_number+, calibration_date+, center_offset+
Maximum records from database:	Show number of records: yes
Number of records: <b>14</b>	Dump output to file: no

**Catalog results**

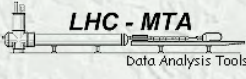
Head number	Sector number	Calibration date	Center offset	Number of records
021	0001	01/01/2000 00:00:00	15.779	1
021	0203	01/01/2000 00:00:00	14.519	1
021	0405	01/01/2000 00:00:00	13.259	1
021	0607	01/01/2000 00:00:00	11.999	1
021	0809	01/01/2000 00:00:00	10.739	1
021	1011	01/01/2000 00:00:00	9.479	1
021	1213	01/01/2000 00:00:00	8.219	1
021	1415	01/01/2000 00:00:00	6.959	1
021	1415	18/01/2000 00:00:00	6.959	1
021	1617	01/01/2000 00:00:00	5.699	1
021	1819	01/01/2000 00:00:00	4.439	1
021	2021	01/01/2000 00:00:00	3.179	1
021	2223	01/01/2000 00:00:00	1.919	1
021	2425	01/01/2000 00:00:00	0.659	1

For any problem contact the [Webmaster](#).



# DAP Analysis


## Harmonics Input Query



**LHC - MTA**  
Data Analysis Tools






Harmonics Filters

Friday, September 28, 2001





Current options status


<b>Input options</b>	<b>Output options</b>
N/A	N/A
<b>Analysis options</b>	
N/A	

Please specify input options for the Harmonics Filters Analysis

Please select magnet properties

Magnet name	<input type="text"/> <a href="#">Browse...</a>	
Magnet type	Dipole	
Aperture number	1	
Measurement date	From: Thursday 27 September 2001 @ 00 : 00 : 00 <a href="#">Browse...</a> ( <a href="#">get listing</a> )	
	Copy above Date	To: Friday 28 September 2001 @ 23 : 59 : 59
Run type	axis	
Coil position	From: <input type="text"/> [m]	To: <input type="text"/> [m] (optional)
Set current	From: <input type="text"/> [A]	To: <input type="text"/> [A] (optional)
Set ramp rate	From: <input type="text"/> [A/s]	To: <input type="text"/> [A/s] (optional)
Extra parameters	<input type="text"/>	For help on available keys, click on 
<b>Maximum records from database:</b> <input type="text" value="50000"/> (0 for all)		
<input type="checkbox"/> Estimate number of records		

# DAP Analysis Magnet Browser

**LHC - MTA**  
Data Analysis Tools

Magnet Browser

Select a magnet type:

Select a magnet series:

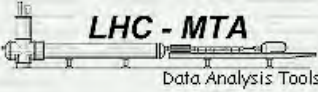
---


**Results**

(Each magnet name is followed by the number of records that are related to it)

[HCMBB\\_A001-01000001](#) (38964)    [HCMBB\\_A001-01000002](#) (30753)    [HCMBB\\_A001-02000001](#) (22324)  
[HCMBB\\_A001-03000001](#) (32094)

# DAP Analysis Date Browser



Date Browser 

Date format is dd / mm / yyyy @ hh : mm : ss

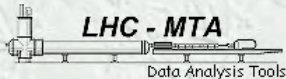
Use these values > From  /  /  @  :  :

To  /  /  @  :  :

Magnet name	Measurement date	Measurement type	Set current	Set ramp rate	Number of records
HCMBB_A001-02000001	<a href="#">26/07/2001 06:33:56</a>	machine_cycle	376.7391	75.3338	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:34:40</a>	machine_cycle	760	-0.002203	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:35:05</a>	machine_cycle	760	-0.004555	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:35:33</a>	machine_cycle	760	0.01616	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:36:00</a>	machine_cycle	760	0.021522	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:36:27</a>	machine_cycle	760	-0.003776	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:36:54</a>	machine_cycle	760	0.002411	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:37:21</a>	machine_cycle	760	-0.009745	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:37:48</a>	machine_cycle	760	0.013054	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:38:14</a>	machine_cycle	760	0.00028	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:38:42</a>	machine_cycle	760	0.005194	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:39:08</a>	machine_cycle	760	0.00799	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:39:36</a>	machine_cycle	760	0.010717	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:40:03</a>	machine_cycle	760	-0.004875	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:40:30</a>	machine_cycle	760	0.015381	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:40:56</a>	machine_cycle	760	-0.000847	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:41:23</a>	machine_cycle	760	-0.005199	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:41:50</a>	machine_cycle	760	0.013905	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:42:18</a>	machine_cycle	760	-0.010892	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:42:45</a>	machine_cycle	760	-0.009747	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:43:12</a>	machine_cycle	760	-0.000175	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:43:38</a>	machine_cycle	760	-0.012165	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:44:06</a>	machine_cycle	760	-0.002212	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:44:32</a>	machine_cycle	760	0.000465	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:45:00</a>	machine_cycle	760	-0.006956	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:45:27</a>	machine_cycle	760	-0.007084	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:45:54</a>	machine_cycle	760	-0.008835	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:46:21</a>	machine_cycle	760	-0.004248	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:46:48</a>	machine_cycle	760	0.009916	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:47:15</a>	machine_cycle	760	0.016774	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:47:42</a>	machine_cycle	760	-0.001029	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:48:09</a>	machine_cycle	760	-0.004394	12
HCMBB_A001-02000001	<a href="#">26/07/2001 06:48:36</a>	machine_cycle	760	-0.000662	12

# DAP Analysis



## Harmonics Output Selection



**LHC - MTA**  
Data Analysis Tools

Harmonics Filters






Friday, September 28, 2001

---

**Current options status**

<p><b>Input options</b></p> <p>Input source: Database          Query: <i>magnet_name = 'HCMBB_A001-02000001' AND magnet_type = '1' AND run_type = 'machine_cycle' AND measurement_date &gt;= '26/7/2001 6:33:56' AND measurement_date &lt;= '26/7/2001 7:40:55'</i>          Maximum records from database: 50000          Number of records: <b>1764</b></p> <p><b>Analysis options</b></p> <p>N/A</p>	<p><b>Output options</b></p> <p>N/A</p>
---	---

Please specify output options for the Harmonics Filters Analysis

**Format**

Output format	<input checked="" type="checkbox"/> Formatted output <input type="checkbox"/> Raw output
Number of harmonics	<input type="text" value="15"/> (Default Value: 15)

**Output options**

<input type="checkbox"/> <b>Print output on results page</b>	Maximum lines on results page: <input type="text" value="100"/>	Maximum fields per line: <input type="text" value="10"/> (0 for all)
<input type="checkbox"/> <b>Dump output to file</b>	Maximum records in file: <input type="text" value="0"/> (0 for all)	<input type="checkbox"/> <b>Compress results file</b>
<input type="checkbox"/> <b>Sort output results</b>		
<input type="checkbox"/> <b>Plot results</b>		

Sort keys - Click on ▲ ( ▼ ) to add a key in ascending (descending) order

Bench name	▲▼	Set ramp direction	▲▼	Measurement sectors	▲▼
Magnet name	▲▼	Mid current	▲▼	Field position var	▲▼
Magnet type	▲▼	Mid ramp rate	▲▼	Field length var	▲▼
Aperture number	▲▼	Mid time	▲▼	Set current var	▲▼
Measurement date	▲▼	Temperature	▲▼	Set ramp rate var	▲▼
Measurement type	▲▼	X center	▲▼	Mid current var	▲▼
Run type	▲▼	Y center	▲▼	Mid ramp rate var	▲▼
Run id	▲▼	Transfer function	▲▼	Mid time var	▲▼
Field position	▲▼	Type of analysis	▲▼	Temperature var	▲▼
Field length	▲▼	Number of harmonics	▲▼	X center var	▲▼
Reference radius	▲▼	Main harmonic	▲▼	Y center var	▲▼
Set current	▲▼	Number of measurements	▲▼	Transfer function var	▲▼
Set ramp rate	▲▼	Measurement duration	▲▼		

Reset Selection

Magnet name+,  
Aperture number+,  
Measurement date+,  
Field position+

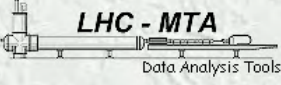
**Plot options**

<input type="checkbox"/> Plot normal and skew harmonics on the same plot		
<input type="checkbox"/> Show plots as thumbnails	Maximum thumbnails: <input type="text" value="20"/>	The remaining plots will be shown as normal icons
<input type="checkbox"/> Do not put X and Y labels on plot		
<input type="checkbox"/> Plot in black and white		
<input type="checkbox"/> Print title on plot	<input checked="" type="checkbox"/> Automatic title (deduced from the magnet name, the aperture number, the sector number and the set current)	<input type="checkbox"/> Set title to: <input type="text"/>
<input type="checkbox"/> Generate EPS plot (default is PNG)		

For any problem contact the [Webmaster](#)

# DAP Analysis


## Harmonics Analysis Selection



**LHC - MTA**  
Data Analysis Tools

Harmonics Filters

Friday, September 28, 2001








---

**Current options status**

Input options	Output options	Sort Keys :	Plot options
Input source: Database Query: <i>magnet_name = 'HCMBB_A001-02000001' AND magnet_type = '1' AND run_type = 'machine_cycle' AND measurement_date &gt;= '2617/2001 6:33:56' AND measurement_date &lt;= '2617/2001 7:40:55'</i> Maximum records from database: 50000 Number of records: <b>1764</b>	Format: Formatted Print output on page: no Dump output to file: yes (all records) Compress file: no Number of harmonics: 15	For analysis output: Magnet name+, Aperture number+, Measurement date+, Field position+	Plot results: no

**Analysis options**


N/A

Please specify analysis options for the Harmonics Filters Analysis

Standard Analysis

Advanced Analysis

**Compute harmonics filters with**  [Advanced options](#)

<input type="checkbox"/> <b>Time average</b>				
<input type="checkbox"/> <b>Space integral</b>	<input type="checkbox"/> Use extended integral	<input type="checkbox"/> Use uniform integral	<input type="checkbox"/> Use body integral	<input type="checkbox"/> Use bounding integral
<input type="checkbox"/> <b>Shift field position</b>	<input type="text" value=""/> [m]			

If none of the above is selected, Harmonics will be converted to filter format


**Options**



<input type="checkbox"/> <b>Set current tolerance to</b>	<input type="text" value=""/> [A]		
<input type="checkbox"/> <b>Set position tolerance to</b>	<input type="text" value=""/> [m]		
<input type="checkbox"/> <b>Set magnet body selection to</b>	<input type="checkbox"/> Sectors <input type="checkbox"/> Positions	from: <input type="text" value=""/>	to: <input type="text" value=""/>

**Optional harmonics analysis commands**

<input type="checkbox"/> <b>Force harmonics analysis</b>	<input type="text" value=""/>	Default commands are: HARM+ CLOC+ FDWN+ ROT+ NORM
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# DAP Analysis Harmonics Results

 **LHC - MTA**  
Data Analysis Tools

Friday, September 28, 2001  
 






**Harmonics Filters**






**Current options status**


Input options	Output options	Sort Keys :	Plot options
Input source: Database Query: magnet_name = 'HCMBE_A001-02000001' AND magnet_type = '1' AND run_type = 'machine_cycle' AND measurement_date >= '26/7/2001 6:33:56' AND measurement_date <= '26/7/2001 7:40:55' Maximum records from database: 50000 Number of records: <b>1764</b>	Format: Formatted Print output on page: no Dump output to file: yes (all records) Compress file: no Number of harmonics: 15	For analysis output: Magnet name+, Aperture number+, Measurement date+, Field position+	Plot results: no

**Analysis options**

Advanced analysis : SSUM+SHIFT(8.8)

 [mtareult.tst](#) (File Size: 303043 bytes)

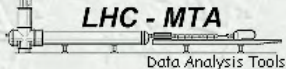
For any problem contact the [Webmaster](#).







# DAP Analysis

## View Input/Output Selection



**LHC - MTA**  
Data Analysis Tools

View Page

Friday, September 28, 2001  
 




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**Current options status**

Input options	Output options	Sort Keys :	Plot options
Input source: Database Query: <i>magnet_name = 'HCMBB_A001-02000001' AND magnet_type = '1' AND run_type = 'machine_cycle' AND measurement_date &gt;= '26/7/2001 6:33:56' AND measurement_date &lt;= '26/7/2001 7:40:55'</i> Maximum records from database: 50000 Number of records: <b>1764</b>	Format: Formatted Print output on page: no Dump output to file: yes (all records) Compress file: no Number of harmonics: 15	For analysis output: Magnet name+, Aperture number+, Measurement date+, Field position+	Plot results: no

**Analysis options**




Advanced analysis : SSUM+SHIFT(8.8)

Please specify parameters for View Analysis

**Format of output file**       Formatted output       Raw output

**Axis:**

<b>X</b>	<input type="text" value="Date"/>	Field shortcuts 	Warning: Only Real and Date fields can be specified for axes
<b>Y</b>	<input type="text" value="Im"/>	Field shortcuts 	
<b>Y2</b>	<input type="text"/>	Field shortcuts 	

**Label:**

<input checked="" type="checkbox"/> <b>X</b>	<input type="text"/>	(Default is axis name)
<input checked="" type="checkbox"/> <b>Y</b>	<input type="text" value="I [A]"/>	
<input checked="" type="checkbox"/> <b>Y2</b>	<input type="text"/>	

**Title**

**Multi**       [Harmonic Filters Table](#)

**Sort input data before processing**

**Plot views**

Sort keys - Click on ▲ ( ▼ ) to add a key in ascending (descending) order

Bench name	▲ ▼	Set ramp direction	▲ ▼	Measurement sectors	▲ ▼	<input type="button" value="Reset Selection"/> Magnet name+ Aperture number+ Measurement date+
Magnet name	▲ ▼	Mid current	▲ ▼	Field position var	▲ ▼	
Magnet type	▲ ▼	Mid ramp rate	▲ ▼	Field length var	▲ ▼	
Aperture number	▲ ▼	Mid time	▲ ▼	Set current var	▲ ▼	
Measurement date	▲ ▼	Temperature	▲ ▼	Set ramp rate var	▲ ▼	
Measurement type	▲ ▼	X center	▲ ▼	Mid current var	▲ ▼	
Run type	▲ ▼	Y center	▲ ▼	Mid ramp rate var	▲ ▼	
Run id	▲ ▼	Transfer function	▲ ▼	Mid time var	▲ ▼	
Field position	▲ ▼	Type of analysis	▲ ▼	Temperature var	▲ ▼	
Field length	▲ ▼	Number of harmonics	▲ ▼	X center var	▲ ▼	
Reference radius	▲ ▼	Main harmonic	▲ ▼	Y center var	▲ ▼	
Set current	▲ ▼	Number of measurements	▲ ▼	Transfer function var	▲ ▼	
Set ramp rate	▲ ▼	Measurement duration	▲ ▼			

**Plot options**

<input type="checkbox"/> Plot Error Bars for Y Axis	<input type="checkbox"/> Plot Error Bars for X Axis
<input type="checkbox"/> Zoom to range Xmin: <input type="text"/>	Xmax: <input type="text"/>
<input type="checkbox"/> Show plots as thumbnails Maximum thumbnails: <input type="text"/>	The remaining plots will be shown as normal icons
<input type="checkbox"/> Do not put X and Y labels on plot	
<input type="checkbox"/> Plot in black and white	
<input type="checkbox"/> Print title on plot	<input type="checkbox"/> Automatic title (Default is View Title)
	<input type="checkbox"/> Set title to: <input type="text"/>

For any problem contact the [Webmaster](#)





# DAP Analysis View Results

**LHC - MTA** View Results Friday, September 28, 2001  
Data Analysis Tools




**Current options status**


Input options	Output options	Sort Keys :	Plot options
Input source: Database Query: <i>magnet_name = 'HCMBB_A001-02000001' AND magnet_type = '1' AND run_type = 'machine_cycle' AND measurement_date &gt;= '26/7/2001 6:33:56' AND measurement_date &lt;= '26/7/2001 7:40:55'</i> Maximum records from database: 50000 Number of records: <b>1764</b>	Format: Formatted Print output on page: no Dump output to file: yes (all records) Compress file: no Number of harmonics: 15	For analysis output: Magnet name+, Aperture number+, Measurement date+, Field position+ For view input: Magnet name+, Aperture number+, Measurement date+	Plot results: no

**Analysis options**  
**Advanced** analysis : SSUM+SHIFT(8.8)

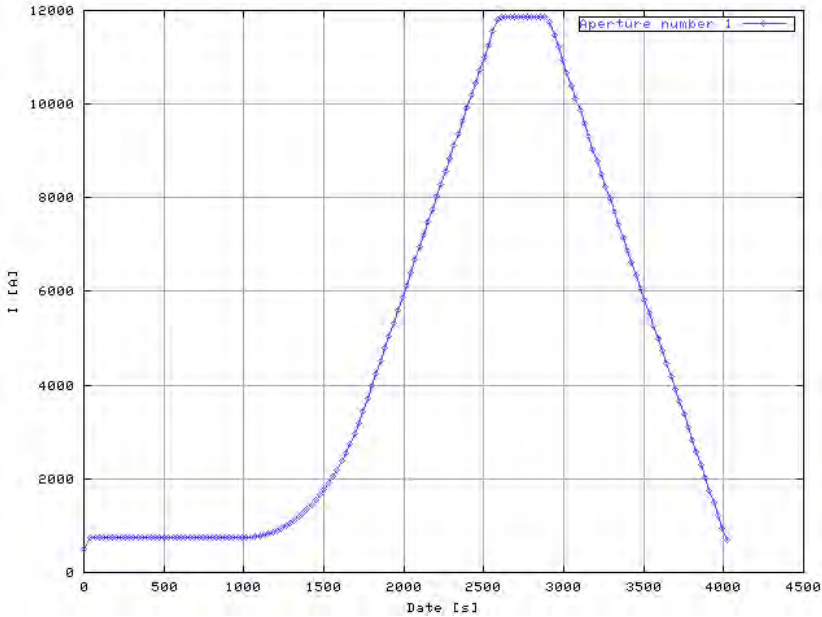
View Results are

  
[mtaview-1.png](#)

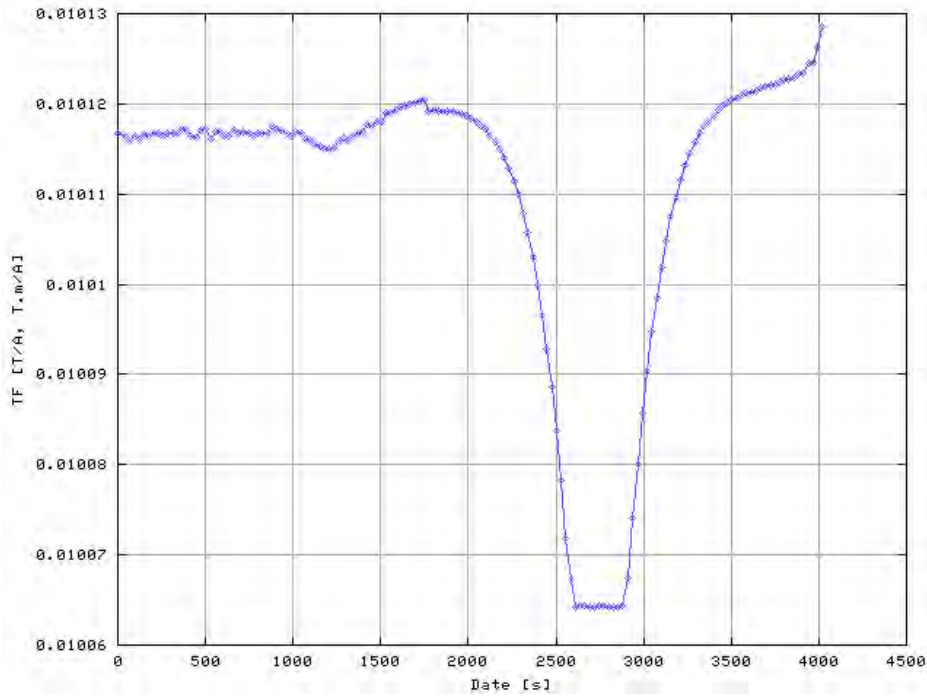
*For any problem contact the [Webmaster](#).*

## LHC Current Cycle

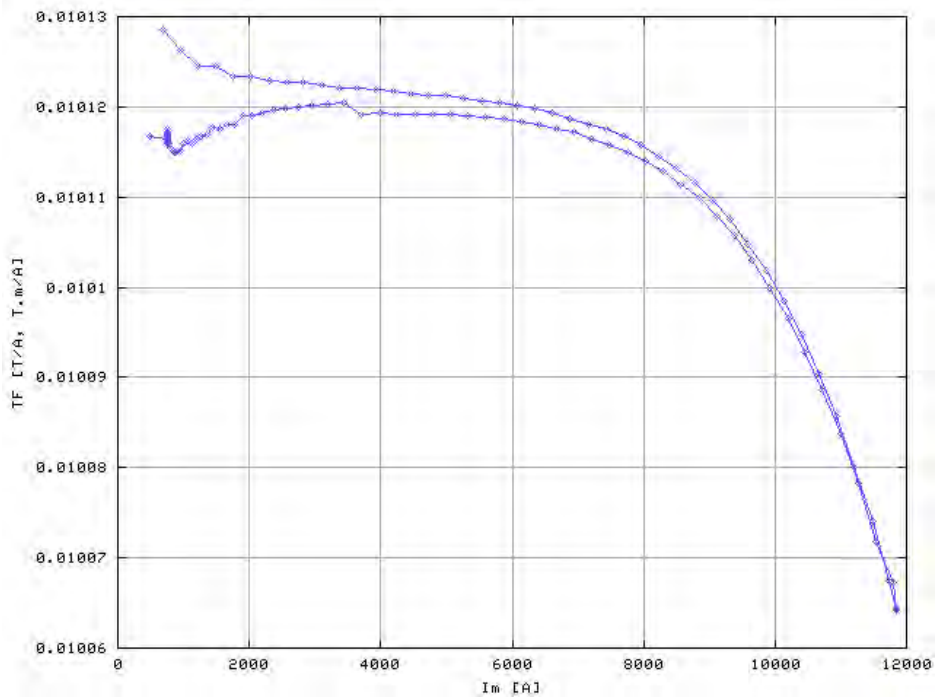


# DAP Analysis

## Transfer Function vs Time

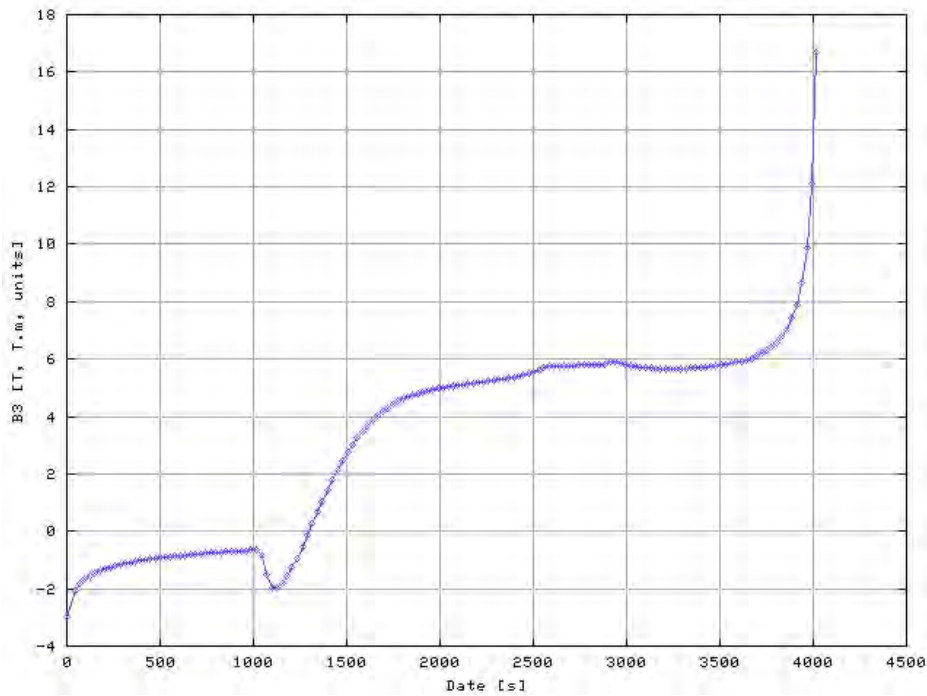


## Transfer Function vs Current

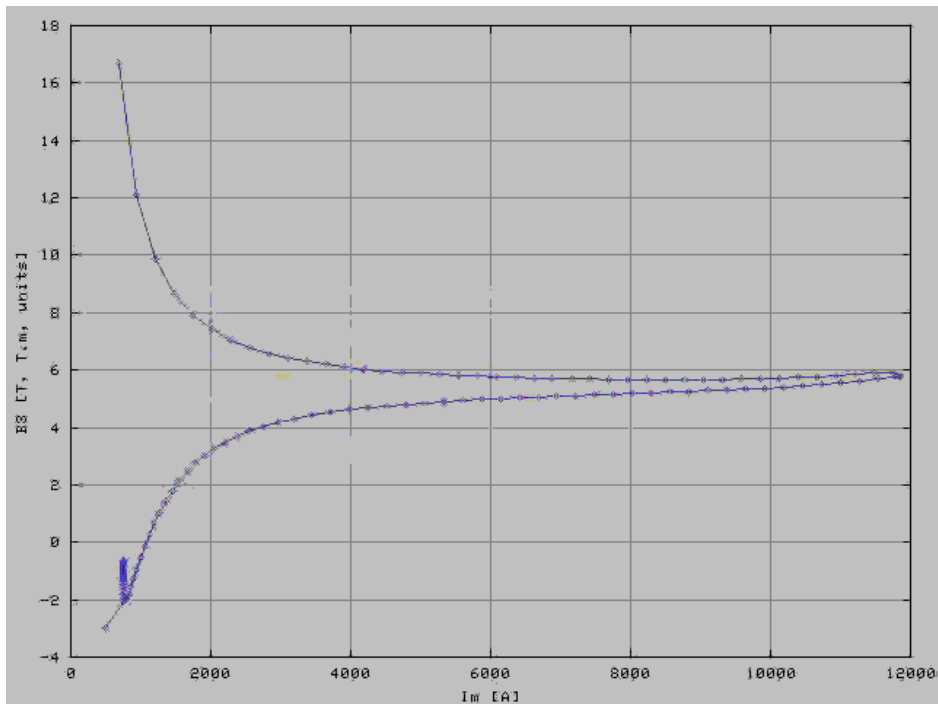


# DAP Analysis

## $B_3$ vs Time



## $B_3$ vs Current



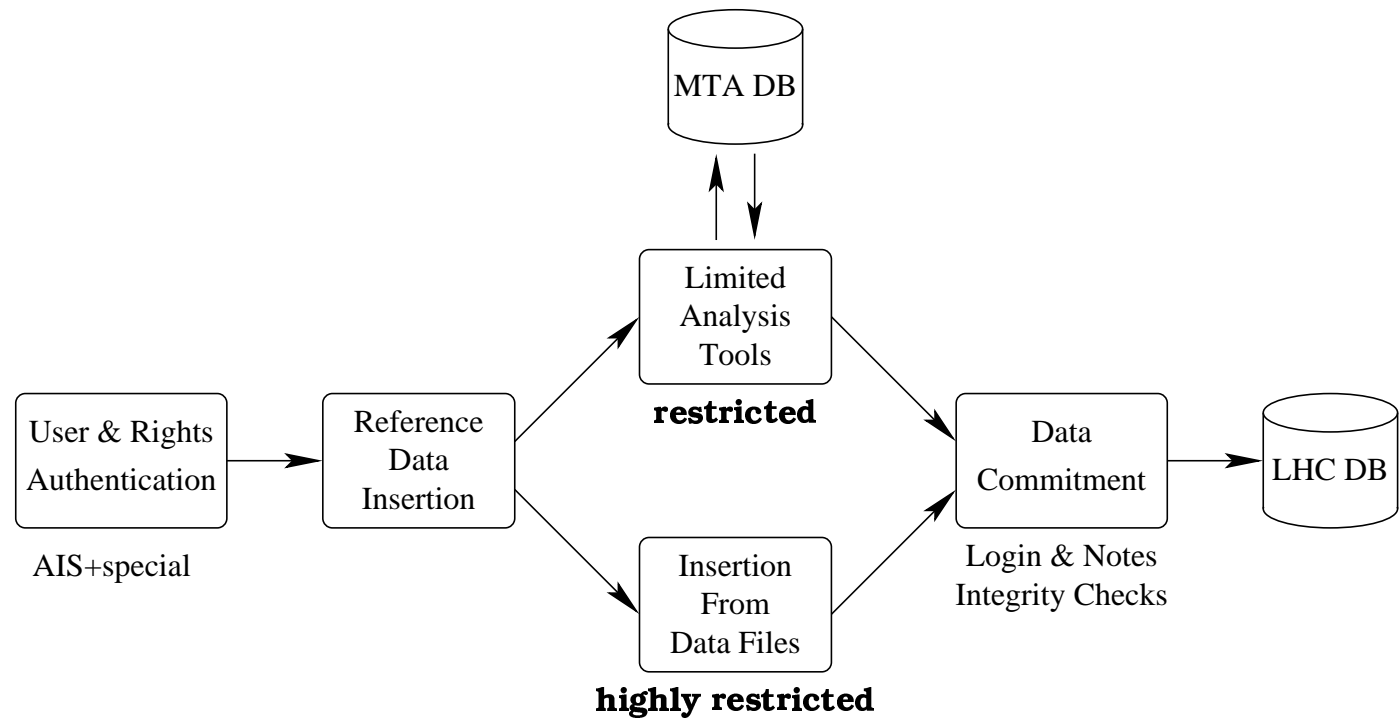
# DAP Analysis

## The Magnetic Field Model

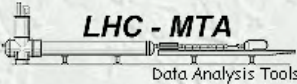
$$\begin{aligned}
B_n(t, I, dI/dt) &= B_n^{DC} + B_n^{ACS} + B_n^{ACL} \\
&= B_n^{res} + B_n^{geo} + B_n^{dis} + B_n^{mag} + B_n^{sat} + B_n^{edd} + B_n^{dec} + B_n^{sna} \\
&= \alpha_n^{res} + \alpha_n^{geo} I + \alpha_n^{dis} I^3 \\
&\quad \pm \alpha_n^{mag} \left(\frac{I}{I_c}\right)^{n_0} \left(1 - \frac{I}{I_c}\right)^{n_1} \\
&\quad + 1 + \frac{1}{\pi} \left[ \arctan\left(\frac{I - I_n^1}{\Delta I_n^1}\right) + \arctan\left(\frac{I - I_n^2}{\Delta I_n^2}\right) \right] \\
&\quad + \alpha_n^{edd} \frac{dI}{dt} \\
&\quad + \sum_{k=1}^3 \alpha_n^{dec k} \left(1 - \exp\left(-\frac{(2k-1)^2(t-t_0)}{\tau_0}\right)\right) \\
&\quad + \sum_{k=1}^2 \alpha_n^{sna k} \exp(\beta_n^k (I - I_{inj}))
\end{aligned}$$

- Extracts 21 parameters per magnet field harmonic
- Needs 1 LHC Machine Cycle and 1 Ramps Cycle  
( $\approx 3000$  rotating coils measurements,  $\approx 2$ h)
- Estimates Transfer Function within 1 unit  
(limited by the measurement system accuracy)
- Estimates  $B_3$  within 0.05 unit (will be improved)  
(limited by the knowledge of  $I(t)$  and sampling rate)
- Estimates other harmonics better than 0.01 unit  
(better than LHC tolerances)

# Reference Data Commitment




# DAP Analysis Reference Table Analysis and Output Selection (Highly Restricted)



**LHC - MTA**  
Data Analysis Tools





Data Insertion

Friday, September 28, 2001



**Current options status**

Input options	Output options
Query: <code>magnet_name = 'HCMBB_A001-02000001' AND magnet_type = '1' AND run_type = 'machine_cycle' AND measurement_date &gt;= '26/7/2001 6:33:56' AND measurement_date &lt;= '26/7/2001 7:40:55'</code> Maximum records from database: 50000 Number of records: <b>1764</b>	N/A

Please specify output options for the Data Insertion Analysis

**Format**

Output format	<input checked="" type="checkbox"/> Formatted output <input checked="" type="checkbox"/> Raw output
---------------	--

**Output options**

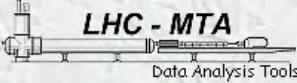
<input checked="" type="checkbox"/> Calculate time average	
<input checked="" type="checkbox"/> Shift field position	I <input style="width: 50px;" type="text"/> [m]
<input checked="" type="checkbox"/> Print output on results page	Maximum lines on results page: <input style="width: 30px;" type="text" value="100"/> Maximum fields per line: <input style="width: 30px;" type="text" value="10"/> (0 for all)
<input checked="" type="checkbox"/> Plot results	



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For any problem contact the [Webmaster](#).







# DAP Analysis Reference Table Results

 **LHC - MTA**  
Data Analysis Tools






Data Insertion Friday, September 28, 2001  


**Current options status**

Input options	Output options
Query: <code>magnet_name = 'HCMBB_A001-02000001' AND magnet_type = '1' AND run_type = 'machine_cycle' AND measurement_date &gt;= '26/7/2001 6:33:56' AND measurement_date &lt;= '26/7/2001 7:40:55'</code> Maximum records from database: 50000 Number of records: <b>1764</b>	Format: Formatted Print output on page: no Calculate time average: no Shift field position: 8 8 Plot results: no

**Analysis results**

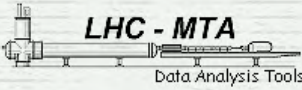




    

  
[mtareult.tsf](#) (File Size: 292616 bytes)

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For any problem contact the [Webmaster](#).

# DAP Analysis Reference Table Commit

 <span style="float: right;">Data Insertion </span>	
<b>Please provide login and eventual additional information (notes) for the insertion of the following file:</b>	<b>File format: Formatted</b> <b>Size: 292616</b> <b>Number of records: 149</b> <b>Insertion into table: f_int_harm</b>
<b>Login</b>	Ideniau
<b>Notes</b>	<input type="text" value="For test"/>
<b>Number of records to display in preview</b>	<input type="text" value="10"/>
<div style="display: flex; justify-content: space-around;">  </div>	
<small>For any problem contact the <a href="#">Webmaster</a></small>	