

Modern web tools and midas

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TRIUMF

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Introduction

- DEAP-3600 will run for 3 years
- There are not many DAQ experts
- We want the DAQ to be as simple as possible to operate, so we don't get woken at 3am

- I'll explain the technologies I've used to make the operator interfaces as user-friendly as possible

CouchDB is a JSON document store

- CouchDB is a "database" that doesn't talk SQL
- Stores everything as JSON documents
 - No defined tables, just documents referenced by IDs
- Communicates via HTTP(S)
 - HTTP GET retrieves a document or list of documents
 - HTTP PUT/POST adds or updates a document
 - HTTP DELETE removes a document
- Together, this means you can directly communicate with a database using javascript!

Example CouchDB doc

Database name Document name

```
$ curl http://<server>/deapdb/RUNINFO_quality_10698_10698 2>/dev/null | python
-m json.tool
```

```
{
  "_id": "RUNINFO_quality_10698_10698",
  "_rev": "3-9b2eb29a73dd91e307399b5565cbb3a2",
  "createdOn": 1436381299,
  "index": "quality",
  "name": "RUNINFO",
  "runBad": [
    0,
    0,
    9,
    9
  ],
  "run_range": [
    10698,
    10698
  ],
  "shiftComment": "Everything looks good",
  "shifter": "Peter Sh"
}
```

"Revision", for conflict detection

Other fields, as defined by DEAP

- CouchDB also supports querying to search for documents

DEAP-3600 loves CouchDB

- We use CouchDB for lots of things
 - Radio-purity information (for background events)
 - Data quality record for each run
 - Status of PMTs
 - Calibration source information
 - Analysis toolkit designed to read JSON too!
- We have 3 CouchDB servers, operating in "multi-master" configuration
 - Any conflicts are easily resolved by admins (though we haven't had any yet)

We use CouchDB for storing ODB settings 6

- DEAP-3600 has many different "run types"
 - We sometimes need to change hundreds of ODB settings between runs!
- ODB can dump settings as JSON, and CouchDB stores JSON documents – perfect match!
- We have a custom "run start" page
 - The operator chooses a run type
 - We load the right ODB settings from CouchDB
 - Then start the run

Custom run start page

Status Messages ELog Programs History Sequencer
CleanUp All -> ZLE All -> RAW
Run Log Expert page CurrentDTMTrigger MPOD_HV VME SCB CouchDB AARFs SHUT DOWN HV DAQ Users Start or Stop Run
Logout

Run Status

Start: Mon Jul 13 16:00:47 2015 Stop: Mon Ju

Alarms: On Restart: No Logg

Run 10862 Stopped

HV on?: 0

Run comment: Ping

Run started by: Ben

Run type: 140

Da no DQ checks are

ed

Regular start/stop buttons are disabled

Accessed like any other custom page

Equipment

Equipment +	Status	Events	Events[/s]	Data[MB/s]
EBuilder	Ended run	2481	0.0	0.000
DTM	Ended run	2481	0.0	0.000
FEV1720MTI00	Ended run	2478	0.0	0.000
FEV1720MTI01	Ended run	2478	0.0	0.000

Custom run start page – main interface

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Start/stop run

[Main DAQ page](#)

Current run

Run 10862: Stopped

High voltage status: output disabled

Next run

Run number

10863

Operator chooses from
a list of run types

Run type [Help](#)

140 - MPOD test (last changed for run 10835)

[Show historical settings too](#)

Write Data

Yes No

Comment

Ping

Custom page
supports "edit on start"
parameters too

Operator name

Ben

Custom run start page – after clicking "Start run"

Start/stop run

Main DAQ page

Current run

Run 10862: Stopped

Next run

Run number

10863

Run type [Help](#)

100 - Pulse Pattern Generator (last changed for run 10671)

Show historical settings too

Write Data

Yes No

Comment

PPG Test

Operator name

Ben

Start run

Just compare settings

After clicking "Start run", we check if the current ODB settings match the saved CouchDB settings for the chosen run type

High voltage status: output disabled

The current live DAQ settings do not match the saved CouchDB settings for this run type.

Choose how to continue:

Compare the CouchDB and live DAQ settings

Update the live DAQ with the saved CouchDB settings, then start run

Show advanced options

Operator chooses whether to update ODB or update CouchDB

Custom run start page – applying the settings

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Start/stop run

[Main DAQ page](#)

Current run

Run 10862: Stopped

High voltage status: output disabled

Next run

Run number

10863

Run type [Help](#)

100 - Pulse Pattern Generator (last changed for run 10671)

[Show historical settings too](#)

Write Data

Yes

Comments

PPG Te

Operator

Ben

Start run

Just compare settings

Updating live DAQ settings. Please wait.

EBuilder has had 2 settings changed
DTM has had 7 settings changed
FEV1720MTI00 has had 32 settings changed
FEV1720MTI01 has had 32 settings changed
FEV1720MTI02 has had 32 settings changed
FEV1720MTI03 has had 32 settings changed
FEV1740MT has had 16 settings changed
FEVETO had no settings to change

Use ODBSet to update any settings that need changing (153 in this case!)

Then actually start the run by posting a hidden form to ../.., with a cmd=Start



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We replicate bits of mhttpd

- The custom page uses javascript to replicate a lot of the mhttpd functionality
 - Get /Experiment/edit on start using ODBMCopy, so we know what extra fields to show
 - Get bits of /Runinfo, so we can show the current run status
- This is fine, but relies on Midas not changing its internal #defines

Other things we can do

- Show extra fields depending on the run type
 - Some runs use lasers, so we can ask the operator for the laser wavelength
 - Update ODB with that information, then add it to a "run configuration" CouchDB document when the run starts
- Update one of the "Status items" to include a link to the data quality plots for this run

Run Status

Start: Mon Jul 13 16:33:23 2015 Stop: Mon Jul 13 16:33:52 2015

Alarms: On **Restart: No** Data dir: /deap/dug1
/data/MidasFiles

Run 10864 Stopped

HV on?: 0

Run comment: PPG Test

Run started by: Ben

Run type: 100

Data quality link: [Click here to edit DQ info for this run](#)

Unique link
for this run



Enhance the experience when stopping a run too

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Start/stop run

Main DAQ page

Current run

Run 10864: Stopping run

Stop run

Next run

Run number

10865

Run type [Help](#)

100 - Pulse Pattern Generator (last changed)

[Show historical settings too](#)

Write Data

Data quality check for run 10864

Your name

Initial assessment of data quality
Note: analysers and offline data quality checkers will set more flags later

Comment

After clicking "Stop run", present a modal dialog for operator to add initial data quality assessment

The values are then written to another CouchDB doc

Mobile-friendly – bootstrap

- Custom pages use the bootstrap CSS framework
- Pages automatically adapt based on size of viewport
- Can easily use webpages from mobile phone
- Very little overhead to make pages look good!

The screenshot shows a mobile-optimized web interface for controlling a run. It features a clean, white background with blue and green accents. The interface is organized into sections: 'Start/stop run' with a link to the 'Main DAQ page'; 'Current run' with two red status bars indicating 'Run 10864: Stopped' and 'High voltage status: output disabled'; 'Next run' with a 'Run number' field containing '10865' and a 'Run type' dropdown menu set to '100 - Pulse Pattern Generator (last changed for run 10671)'; and 'Write Data' with radio buttons for 'Yes' (selected) and 'No'. A link to 'Show historical settings too' is also present.

Custom program page

- One of our programs requires some ODB settings
- Combine changing the ODB settings and starting the program into one webpage
- Uses ODBSet/Get and an AJAX call to `?cmd=Programs&Start=Start <program>`

Status ODB ELOG

AARF settings

To update the AARF settings, you need to stop the firing program (if it is running), make your changes, then click the "Update settings and start firing" button.

Channel to fire	<input type="text" value="Channel 19 - NECK 1 - FBKB"/>
(1-4095) Intensity (a.u.)	<input type="text" value="1130"/>

Program status

You can leave the USB connection open all the time. If you do close and re-open it, wait 15s before starting to fire, or the connection program will get confused.

You must start the firing program BEFORE starting the run, or else the ODB dump (and RAT file) will not show that the AARFs were firing.

The firing program takes a few seconds to start communicating with the AARF driver. Wait until the status is "Running and firing" before starting the run.

USB connection: Open

Close connection

Open connection

Firing program: Stopped

Stop firing

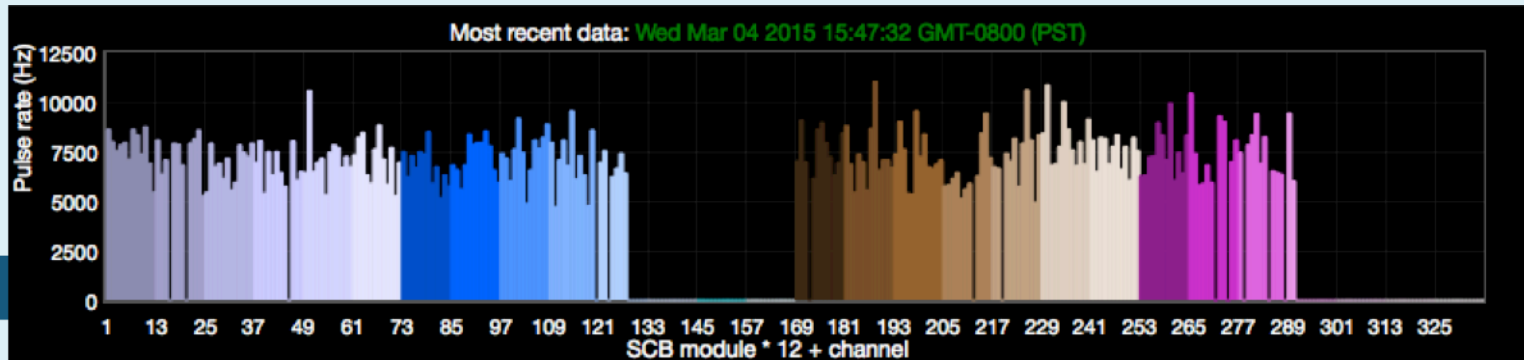
Update settings and start firing

[Having trouble opening the USB connection?](#)

[Having trouble starting the firing program?](#)

Online plots using flot.js

- Monitoring PMT pulse rates is very important
- We have automatic monitoring (using rootana) and write values to Midas history
- We will have ~300 PMTs eventually, so regular history plots are not user-friendly
- Use flot.js to give a more compact representation
- The colours correspond to other interface elements on the webpage



Midas features wishlist

- The most useful web feature would be to run a script and get the exit code/stdout/stderr back
 - Currently you can call a script, but getting the output back is not easy
 - This would allow us to control even more things from nice web interfaces rather than the command line
- Also useful would be a nicer way to operate non-C++ programs using Midas
 - Some of our devices are controlled using python
 - Currently I have a Midas C++ wrapper that spawns a process for the python program, and monitors whether it is still alive – not very elegant!

Summary

- Free CSS and JS frameworks can be used to make attractive and dynamic custom pages
 - We use jquery, flot and bootstrap
- CouchDB is a database that talks HTTP, and stores information as JSON documents
- On DEAP we've combined the two to make user-friendly web interfaces
- This should lead to fewer errors, and fewer calls to DAQ experts