



# Material Assay Database

## Structure & Organization

James Loach, LBNL

# This talk

- Design principles
- Database engine
- Data format
- User interface
- Implementation

# Design principles

## Data format

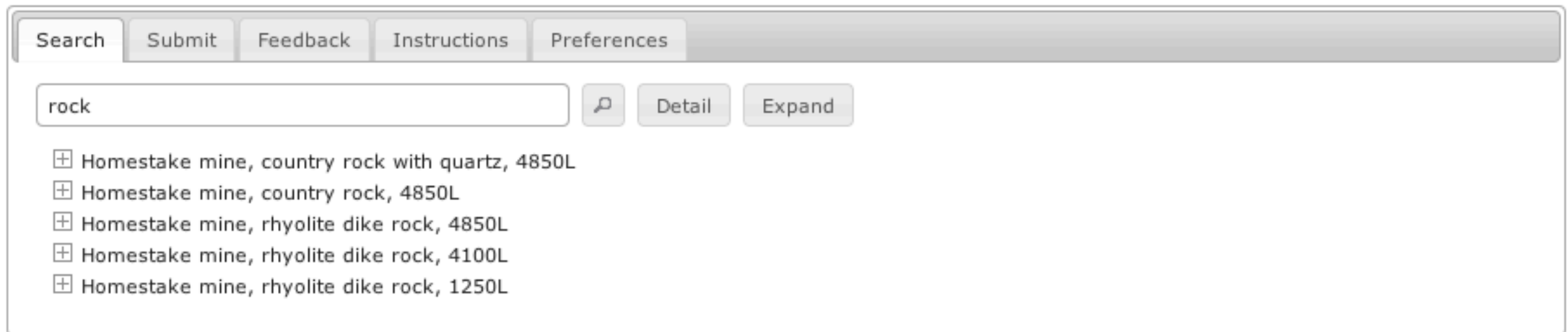
- Concise and structured
- Comprehensive and flexible

## Database engine

- Open source
- Lightweight

## User interface

- High quality
- Powerful search and display
- User/admin model



The screenshot shows a web interface with a navigation bar at the top containing links: Search, Submit, Feedback, Instructions, and Preferences. Below the navigation bar is a search bar containing the text 'rock'. To the right of the search bar are three buttons: a magnifying glass icon, 'Detail', and 'Expand'. Below the search bar is a list of search results, each preceded by a square icon with a plus sign. The results are:

- Homestake mine, country rock with quartz, 4850L
- Homestake mine, country rock, 4850L
- Homestake mine, rhyolite dike rock, 4850L
- Homestake mine, rhyolite dike rock, 4100L
- Homestake mine, rhyolite dike rock, 1250L

MAJORANA / LBNL LBF have developed a  
system on these principles

# CouchDB



Open source non-relational database

- Stores a flat collection of JSON documents

```
"sample": {  
  "name":      "Fused silica",  
  "description": "Corning 7940, lot 56667",  
  "source":    "Mark Optics Ltd.",  
  "owner":     "LBNL LBF",  
}
```

- **Scheme free** so document structure can be vary
- Data aggregated and displayed with **views**
- Web applications can be stored as documents
- Distributed
- Interact with database via HTTP with Python, PERL, C++ etc.

Search



Cloud hosting



See the wikipedia article...



# Management interface (native)

Viewing documents

The screenshot displays the CouchDBX management interface, titled "CouchDBX — Time to Relax". The main content area shows an "Overview" section with a table of databases:

Name	Size	Number of Documents	Update Seq
<b>_users</b>	20.1 KB	1	5
<b>aarm</b>	4.2 MB	13	36
<b>assays_backup</b>	9.5 MB	46	47
<b>mj_assays</b>	11.1 MB	46	60
<b>test</b>	8.1 KB	0	2

Below the table, it says "Showing 1-5 of 5 databases" and provides navigation links: "← Previous Page", "Rows per page: 10", and "Next Page →".

On the right side, there is a sidebar with the CouchDB logo and the word "relax". Below the logo, there is a "Tools" section with links: Overview, Configuration, Replicator, Status, Test Suite, and Hosting via Couchio. Under "Recent Databases", the database "aarm" is listed.

At the bottom of the sidebar, there is a message: "Welcome to Admin Party! Everyone is admin. [Fix this](#)" and the version "Futon on Apache CouchDB 1.0.1".

The bottom part of the screenshot shows a detailed view of a document. It has a header with actions: "Save Document", "Add Field", "Upload Attachment...", and "Delete Document...". Below this is a table with two columns: "Field" and "Value".

Field	Value
<b>_id</b>	"cbf5d92e933784e6f89ede2c31001959"
<b>_rev</b>	"2-a608ff79125b395d011c22c44549636a"
<b>data_source</b>	reference "HOMESTAKE4-Concrete.doc" data_entry_name "James Loach" data_entry_contact "jcloach@lbl.gov"
<b>measurement</b>	institution "LBNL" technique "Gamma" date requestor "n/a" requestor_contact "n/a" practitioner "Al Smith" practitioner_contact "ARSmith@lbl.gov" description "This document summarizes measurements made at the Lawrence Berkeley National Laboratory (LBNL) Low Background Facility (LBF) in preparation ..." results count_length "58201 sec" data_file "23838" detector "MERLIN(BKY)"
<b>sample</b>	name "Homestake mine, rhyolite dike rock, 4850L" description "HST-18, rhyolite dike at 4850L, 5/09"

Futon main window

# Management interface (native)

The screenshot shows the CouchDBX management interface. The main window displays a table of databases with the following data:

Name	Size	Number of Documents	Update Seq
<b>_users</b>	20.1 KB	1	5
<b>aarm</b>	4.2 MB	13	36
<b>assays_backup</b>	9.5 MB	46	47
<b>mj_assays</b>	11.1 MB	46	60
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At the bottom of the sidebar, there is a message: "Welcome to Admin Party! Everyone is admin. [Fix this](#)" and "Futon on Apache CouchDB 1.0.1".

Overlaid on the bottom left is a "Replication" window. It has two sections: "Replicate changes from:" and "to:". Both sections have a radio button for "Local database:" (selected) and a text input for "Remote database:". The "from" section has "\_users" in the local database dropdown and "http://" in the remote database input. The "to" section also has "\_users" in the local database dropdown and "http://" in the remote database input. There is a double-headed arrow between the two sections. At the bottom right of the replication window, there is a checkbox for "Continuous" and a "Replicate" button.

Below the replication window is an "Event" section with the text "No replication".

Replication

Futon main window

# Management interface (cloud)

www.cloudant.com

(also see www.couchbase.com)

The screenshot shows the Cloudant management interface for a database named "lbf / assays". At the top, the database URL is "https://lbf.cloudant.com/assays/" with a "Copy" button. Below this are several action buttons: "Data", "Stats", "Search" (highlighted with a yellow border and a "NEW" tag), "Permissions", "View in Futon", and a red "Delete database" button. The "All documents" section is visible, showing a list of documents. The first document is selected, showing its key "050f40be82ad8c96fb3dea03" and a dropdown menu with options: "View source", "Reload", "View raw", and "Delete document". The document's JSON content is displayed on the right, showing fields like "\_id", "\_rev", "date", "facility", "detector", "responsible\_person", "requester", and "requester\_email".

**lbf / assays**

Database URL: <https://lbf.cloudant.com/assays/> Copy

**NEW**

Data Stats Search Permissions View in Futon Delete database

---

**All documents** All documents ▼

View in Futon View raw

search by key

▼ **050f40be82ad8c96fb3dea03** : View source Reload View raw Delete document

**\_id** : 050f40be82ad8c96fb3dea03153fb49e

**\_rev** : 1-572983d5eb079b7aac402520666d7ddf

**date** : 26/03/2008

**facility** : LBNL

**detector** : MERLIN (BKY)

**responsible\_person** : Al Smith

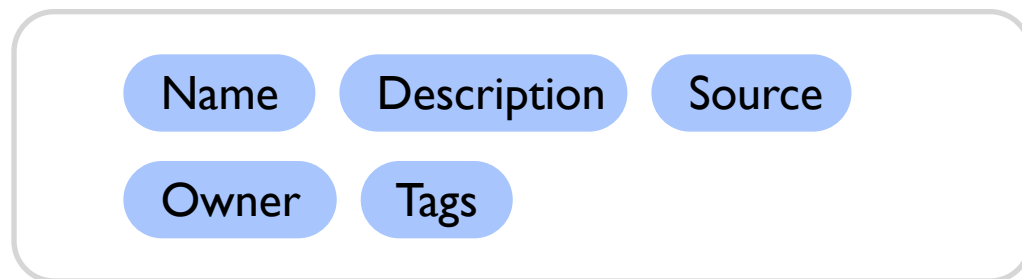
**requester** : Kam-Biu Luk

**requester\_email** : K\_Luk@lbl.gov

# What is an assay?

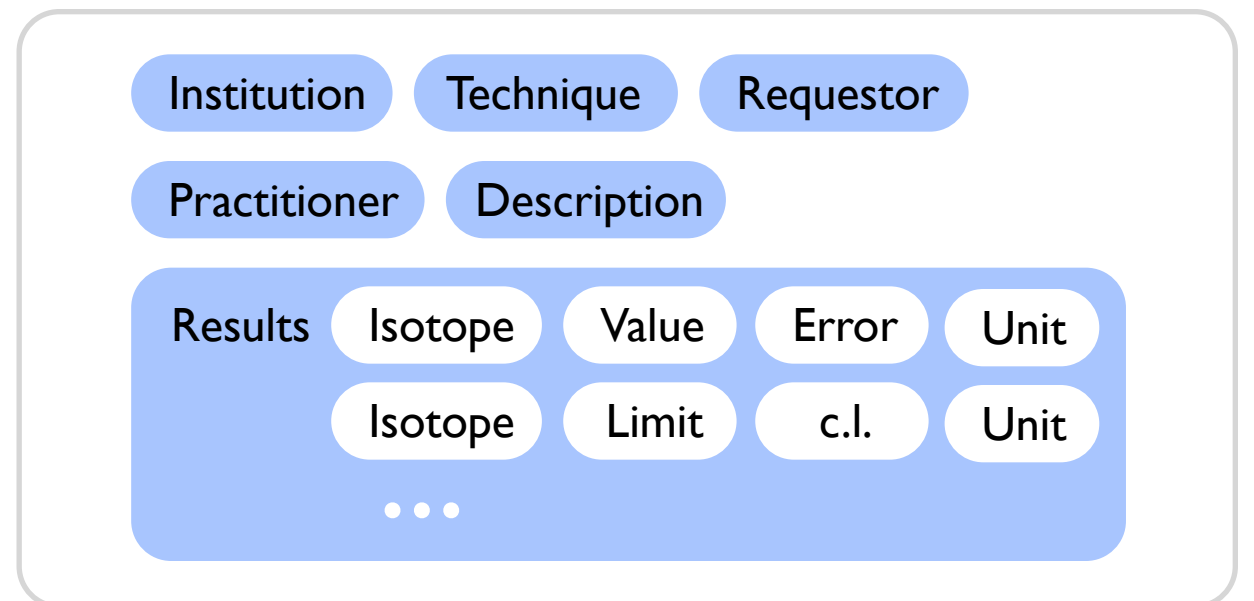
## Sample

The thing that is being counted



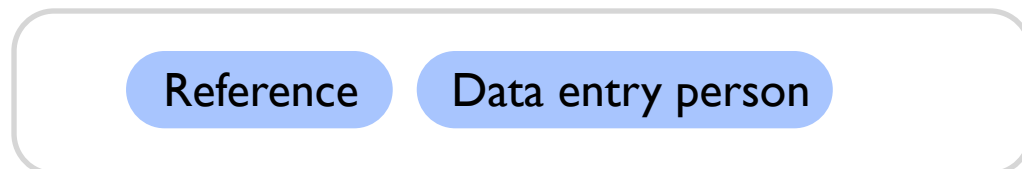
## Measurement

The measurement and its results



## Data source

Where the data came from and who entered it



This concept must be expressed in terms of fields and rules



# Fields & rules

## Fields

```
{  
  "type": "measurement",  
  "sample": { },  
  "measurement": { },  
  "data_source": { }  
}
```

```
"sample": {  
  "name": "",  
  "description": "",  
  "source": "",  
  "owner": "",  
  "tags": [ "", "", "", ... ]  
}
```

```
"measurement": {  
  "institution": "",  
  "technique": "",  
  "date": "",  
  "requestor": "",  
  "requestor_contact": "",  
  "practitioner": "",  
  "practitioner_contact": "",  
  "description": "",  
  "results": [  
    { "isotope": "", "value": "", "error": "", "unit": "" },  
    { "isotope": "", "limit": "", "c.l.": "", "unit": "" }  
  ]  
}
```

## Rules

Date	YYYY-MM-DD
Isotope name	238U, U-238
Unit	ppm, ppt, mBq/kg, ...
Contact	name@email.com

```
"data_source": {  
  "reference": "",  
  "data_entry_name": "",  
  "data_entry_contact": ""  
}
```

JSON data format

# Extendability

In non-relational databases  
the field structure need not be fixed

```
"sample": {  
  "name": "",  
  "description": "",  
  "source": "",  
  "owner": "",  
  "tags": [ "", "", "", ... ]  
}
```

```
"sample": {  
  "name": "",  
  "description": "",  
  "source": "",  
  "owner": "",  
  "tags": [ "", "", "", ... ],  
  "geometry": "",  
  "mass": "",  
  "color": "",  
  "storage box": ""  
}
```

Core

Extension

But the best way to harness this power?

Option A : Extendable format

Option B : Extendable specification

Option C : Filtered replication

# User interface

## Viewer

- Search form
- Submission form
- Flexible data display
- Data export

## Management

- Approval
- Editing / deleting

Write in HTML/JavaScript

Store as a CouchDB document

Multiple interfaces are allowed,  
provided they respect the data specification



Searching

Search	Submit	Feedback	Instructions	Preferences
<input type="text" value="rock"/>				
<input type="button" value="Detail"/> <input type="button" value="Expand"/>				

Persephone v0.2 (demo for AARM)

[Search](#) [Submit](#) [Feedback](#) [Instructions](#) [Preferences](#)

[🔍](#) [Detail](#) [Expand](#)

- ☐ Homestake mine, country rock with quartz, 4850L
- ☐ Homestake mine, country rock, 4850L
- ☐ Homestake mine, rhyolite dike rock, 4850L
- ☐ Homestake mine, rhyolite dike rock, 4100L
- ☐ Homestake mine, rhyolite dike rock, 1250L

Persephone v0.2 (demo for AARM)



Search

Submit

Feedback

Instructions

Preferences

rock

Detail

Expand

Homestake mine, country rock with quartz, 4850L

Sample	Description	HST-19-7/09 (sample 2), country rock, 1/3 to 1/2 quartz, 4850 vent drift		
	Results	U	0.77 (0.01)	ppm
		Th	1.59 (0.03)	ppm
		K	0.92 (0.01)	pct

Homestake mine, country rock, 4850L

Sample	Description	HST-19-7/09 (sample 1), country rock, 4850 vent drift		
	Results	U	4.42 (0.02)	ppm
		Th	8.76 (0.06)	ppm
		K	2.49 (0.01)	pct

Homestake mine, rhyolite dike rock, 4850L

Sample	Description	HST-18, rhyolite dike at 4850L, 5/09		
	Results	U(early)	8.58 (0.01)	ppm
		U(late)	8.16 (0.04)	ppm
		Th	10.59 (0.01)	ppm
		K	3.97 (0.02)	pct
		Eman	5	pct

Homestake mine, rhyolite dike rock, 4100L

Sample	Description	HST-17, rhyolite dike at 4100L (near Yates Shaft), 4/09		
	Results	U(early)	9.53 (0.12)	ppm
		U(late)	8.57 (0.05)	ppm
		Th	11.4 (0.1)	ppm
		K	7.60 (0.02)	pct

Search

Submit

Feedback

Instructions

Preferences

rock

Detail

Expand

☐ Homestake mine, country rock with quartz, 4850L

Sample	Description	HST-19-7/09 (sample 2), country rock, 1/3 to 1/2 quartz, 4850 vent drift
	Source	Homestake mine
	Owner	LBNL
	Tags	Homestake samples
	Geometry	S6MB (full)
Measurement	Technique	Gamma
	Institution	LBNL
	Date	7 / 2009
	Requestor	n/a (n/a)
	Practitioner	Al Smith (ARSmith@lbl.gov)
	Description	This document summarizes measurements made at the Lawrence Berkeley National Laboratory (LBNL) Low Background Facility (LBF) in preparation for converting the Homestake Mine facilities into a deep underground experimental facility for the Nuclear Sciences. All analyses have been performed using a high-resolution HPGe detector gamma-ray spectrometer, to identify and quantify all gamma-emitters in sample materials. Except for surface samples which may contain radionuclides from mid 20th century atmospheric nuclear weapons testing, the gamma-emitters of significance are the natural terrestrial radionuclides (U,Th,K): the uranium series, the thorium series, and potassium. The following list summarizes results obtained from bulk samples collected from the underground workings of the mine as these areas have become accessible, starting in September 2007.
	Count length	82801 sec
	Data file	24113
	Detector	MERLIN(BKY)
	Results	U      0.77 (0.01) ppm Th      1.59 (0.03) ppm K      0.92 (0.01) pct
Data	Reference	HOMESTAKE4-Concrete.doc
	Entry by	James Loach (jcloach@lbl.gov)

☐ Homestake mine, country rock, 4850L

Sample	Description	HST-19-7/09 (sample 1), country rock, 4850 vent drift
--------	-------------	---

Search
Submit
Feedback
Instructions
Preferences

Submit for approval
Check
Clear warnings
Clear form

### Sample

Name	<input type="text" value="Brief description"/>		
Description	<input type="text" value="Detailed description"/>		
Source	<input type="text"/>		
Owner	<input type="text"/>		
Tags	<input type="text" value="Tags separated by spaces"/>		
Mass	<input type="text"/>		
Geometry	<input type="text"/>		

### Measurement

Technique	<input type="text"/>		
Institution	<input type="text" value="Where it was counted"/>		
Date	<input type="text" value="mm/dd/yyyy"/>		
Requester	<input type="text" value="Name"/>	<input type="text" value="Email or institution"/>	
Practitioner	<input type="text" value="Name"/>	<input type="text" value="Email or institution"/>	
Description	<input type="text" value="Detailed description"/>		

Search

Submit

Feedback

Instructions

Preferences

Send feedback

Feedback

Name

Full name

Email

Email address

Comment

Feedback

Persephone v0.2 (demo for AARM)

[Search](#) [Submit](#) [Feedback](#) [Instructions](#) [Preferences](#)

**Searching**

Search returns documents containing one or more of the search terms.

You can alter this default behavior using wildcards and operators such as:

- "rhyolite dike rock"
- rhyolite AND rock
- rhyolite OR rock
- 4??0L

By default results are presented in a concise form. Click 'Detail' to show the full detail.

Enter 'all' to show all documents.

**Submitting**


Data should be entered into the search form as indicated.

Grayed out field names are optional.

Submitted data is not immediately searchable. The moderator must sign off on each document.



# Repository

 **nepahwin / persephone**

[Watch](#) **2** [Fork](#) **2**

Code

Network


Pull Requests **1**


Issues **1**

Wiki

Graphs

A material assay database for the low-background physics community — [Read more](#)


 Clone in Mac

 ZIP

HTTP

Git Read-Only

<https://github.com/nepahwin/persephone.git>

 Read-Only access

branch: **master**


Files

Commits



Branches **1**

Tags






Downloads

 Latest commit to the **master** branch

Change format of the README file

 **nepahwin** authored 3 months ago  commit 2fbc7f1424

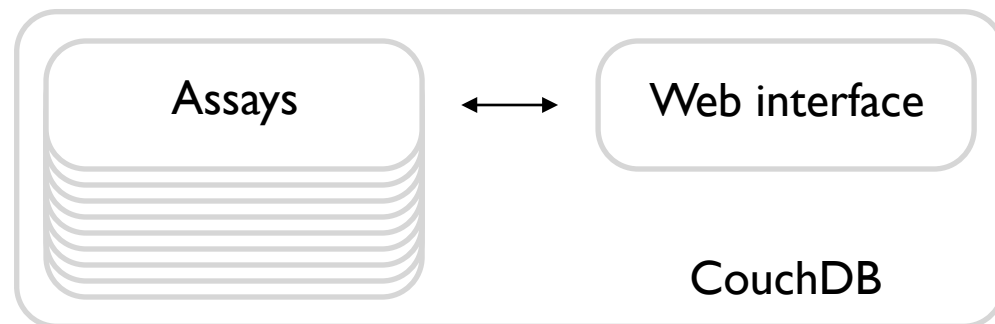
**persephone /**

name	age	message	history
 doc	3 months ago	Structure reorganization [ <a href="#">nepahwin</a> ]	
 html	3 months ago	General code reorganization [ <a href="#">nepahwin</a> ]	
 .gitignore	3 months ago	Add .gitignore file [ <a href="#">nepahwin</a> ]	
 LICENSE	3 months ago	Add a brief license & terms of use [ <a href="#">nepahwin</a> ]	
 README.md	3 months ago	Change format of the README file [ <a href="#">nepahwin</a> ]	

github.com/nepahwin/persephone

# Implementation

## Database



The two things we give to the community :

- Data specification
  - a document
- Web interface
  - a piece of code that knows the contents of the document

## Usage

Database can exist in many instances :

- Central institution
  - big collection of assays for public query
  - mirrored worldwide
  - mirrored to laptops, cell phones
- Collaboration
  - restricted collection of assays for private query
- Counting institution
  - restricted collection of assays for private query

# The way forward

- Write the data specification
- Finish the v1.0 coding
- Port some existing datasets
- Release!

This is not a huge amount of work