# 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


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",
}
```

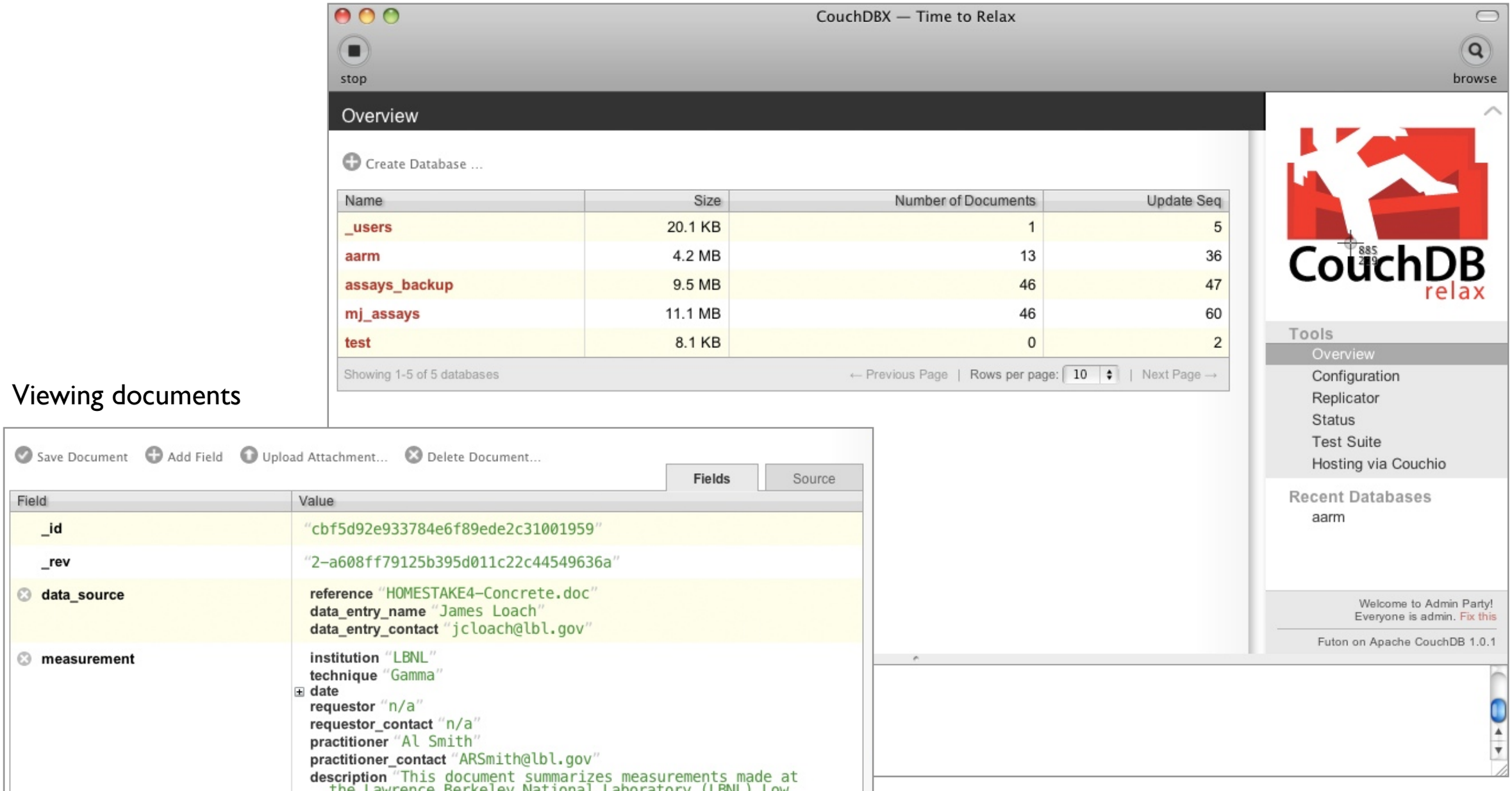
- **Scheme free** so document structure can be vary
- Data aggregated and displayed with **views**
- Web applications can be stored as documents
- Distributed
- Interact with database via HTTP with Python, PERL, C++ etc.

See the wikipedia article...

Search


Cloud hosting

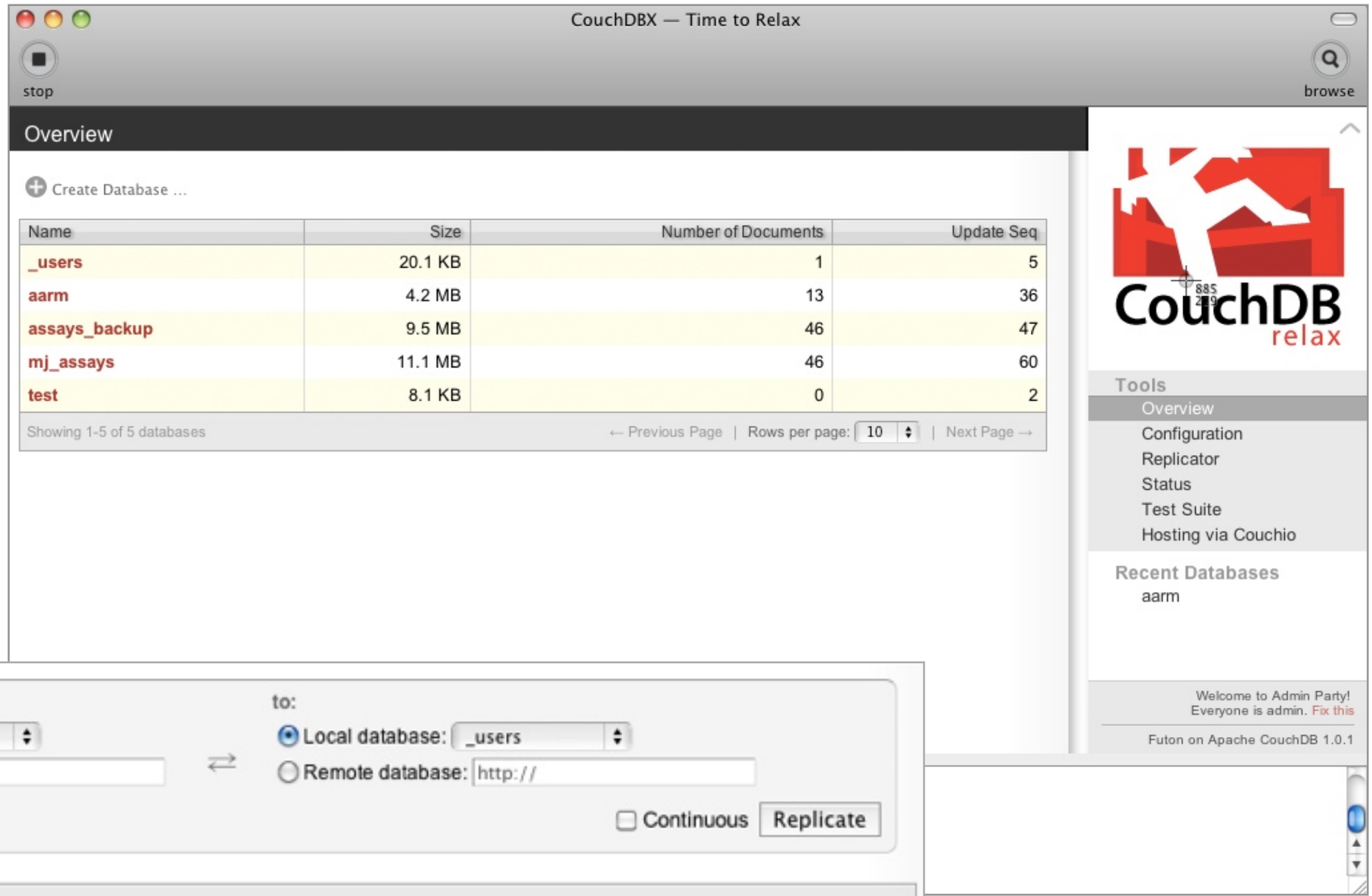

# Management interface (native)




Futon main window

Viewing documents

# Management interface (native)

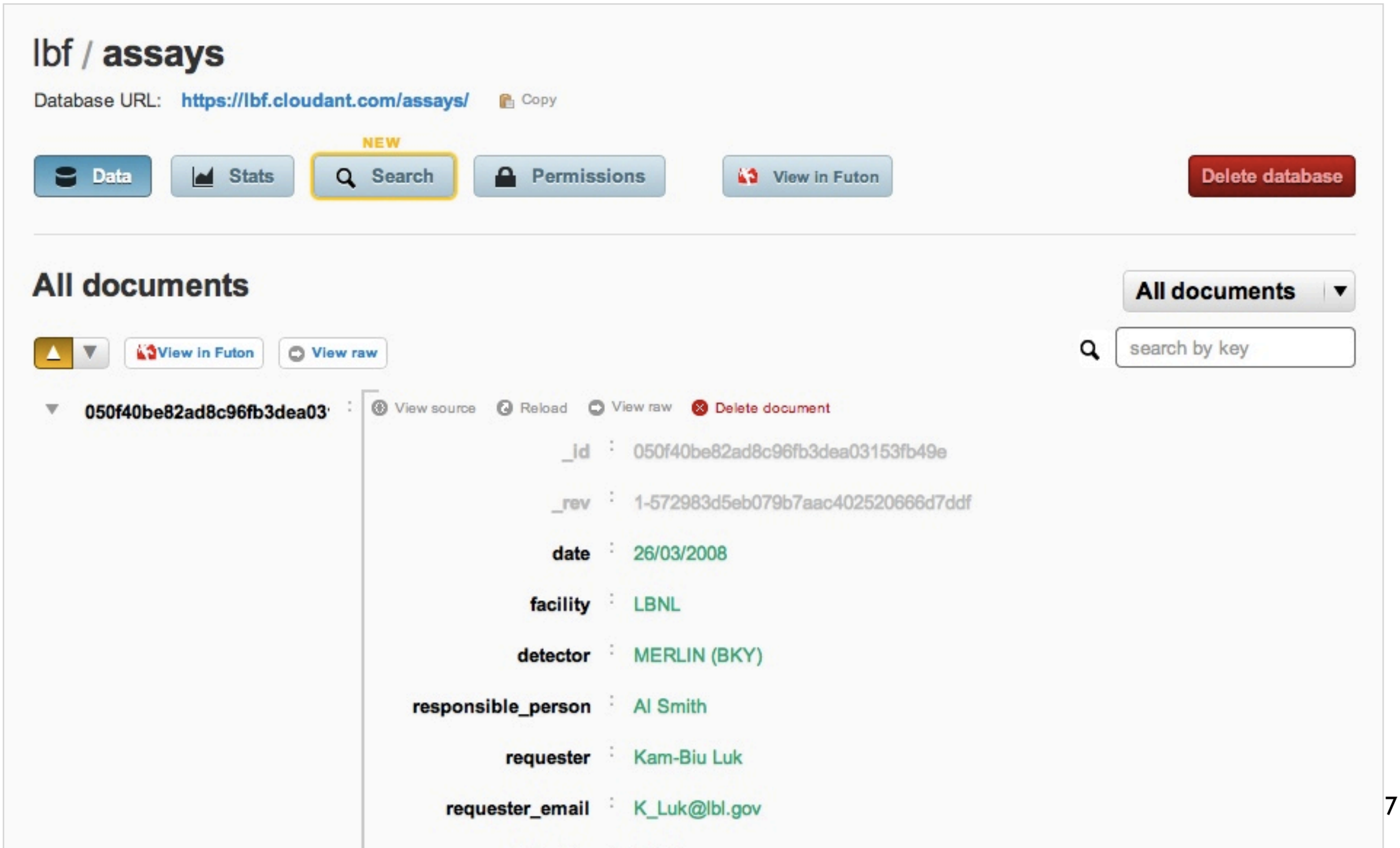



Futon main window

Replication

# Management interface (cloud)

www.cloudant.com (also see www.couchbase.com)



# What is an assay?

## Sample

The thing that is being counted

Name | Description | Source | Owner | Tags

## Data source

Where the data came from and who entered it

Reference | Data entry person

## Measurement

The measurement and its results

Institution | Technique | Requestor | Practitioner | Description

| Results | Isotope | Value | Error | Unit |
|---|---|---|---|---|
| | Isotope | Limit | c.l. | Unit |
| | ... | | | |

This concept must be expressed in terms of fields and rules

# Fields & rules

## Fields

```
{

   "type":           "measurement",

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

}
```

## Rules

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

```
"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":"" }
   ]

}
```

```
"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
rock
Detail
Expand
Persephone v0.2 (demo for AARM)

# Searching


Search
Submit
Feedback
Instructions
Preferences
rock
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)

# Searching

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 |

# Searching

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<br>Th 1.59 (0.03) ppm<br>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 |

# Data entry

Search | Submit | Feedback | Instructions | Preferences

Submit for approval | Check | Clear warnings | Clear form

**Sample**

| | |
|---|---|
| Name | Brief description |
| Description | Detailed description |
| Source | |
| Owner | |
| Tags | Tags separated by spaces |
| Mass | |
| Geometry | |

**Measurement**

| | |
|---|---|
| Technique | |
| Institution | Where it was counted |
| Date | mm/dd/yyyy |
| Requester | Name / Email or institution |
| Practitioner | Name / Email or institution |
| Description | Detailed description |

# Feedback

Search | Submit | Feedback | Instructions | Preferences

Send feedback

Feedback

Name: Full name

Email: Email address

Comment: Feedback

Persephone v0.2 (demo for AARM)

# Instructions

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**

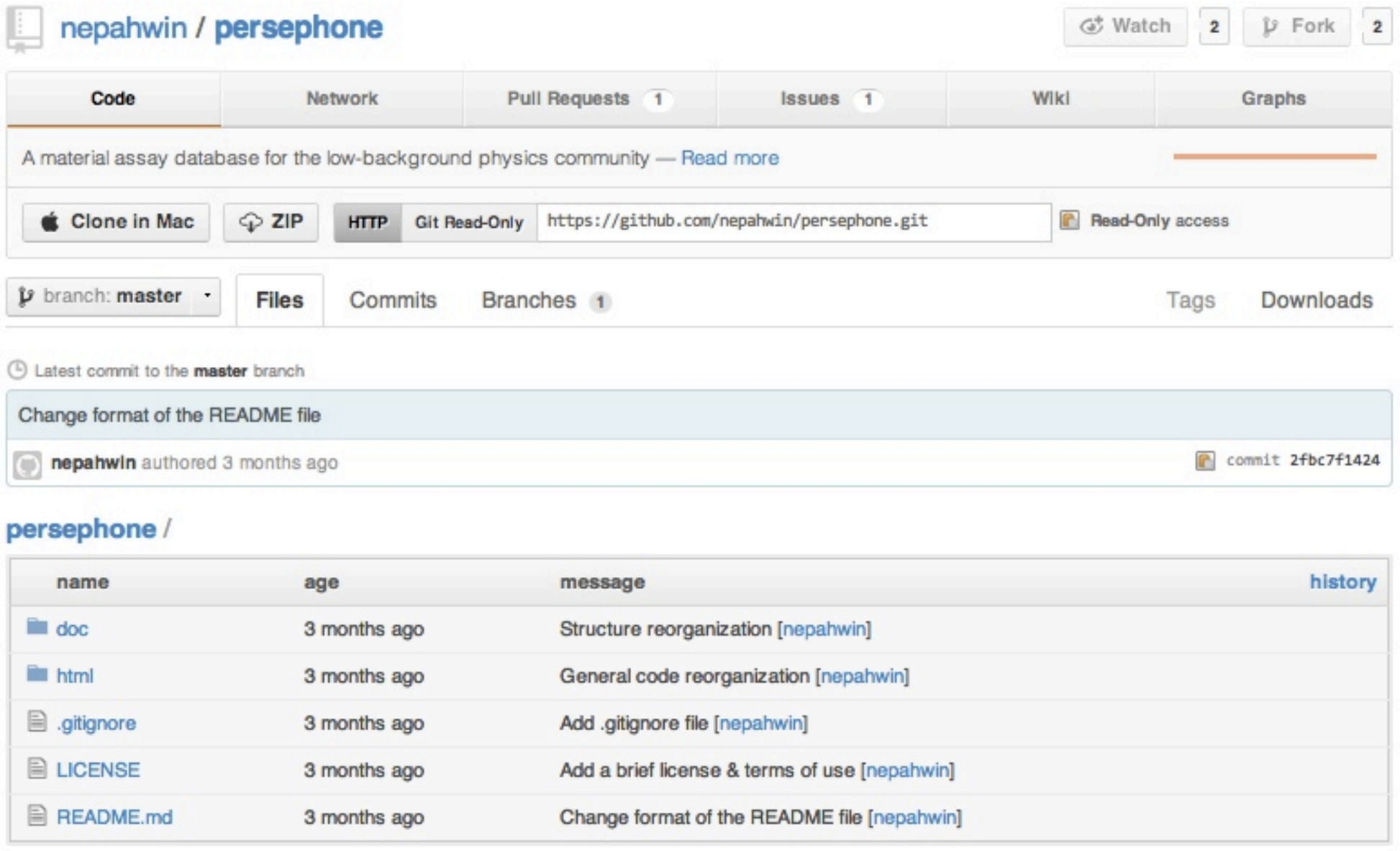
Data should be entered into the search form as indicated.

Grayed out field names are optional.

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

Persephone v0.2 (demo for AARM)

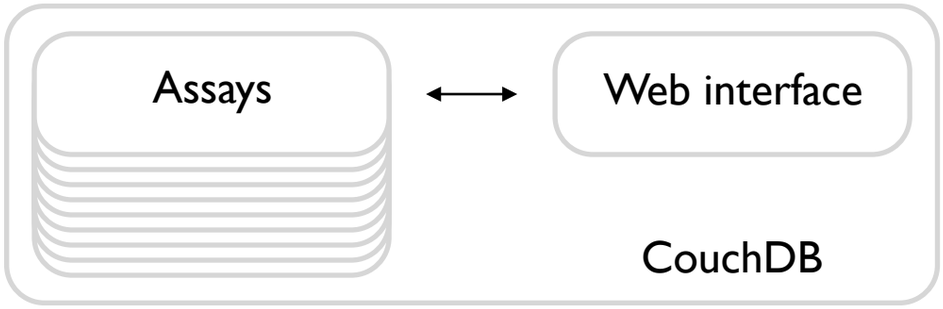
# Repository




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