COMMUNITY MATERIAL ASSAY DATABASE

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radiopurity.org

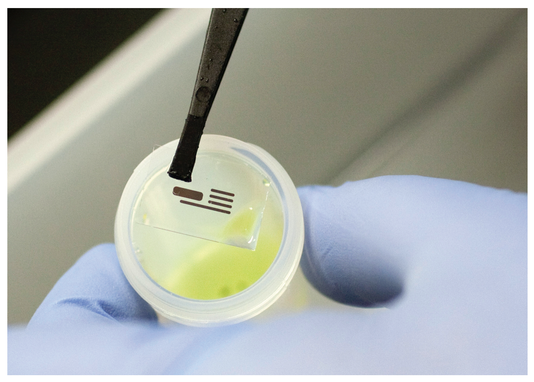
BACKGROUND

Sourcing and certifying radio-pure materials is a critical process in the construction of any low-background experiment. The aim of this project is to make the process more efficient by providing a comprehensive public database of existing measurements of material radiopurity.

The data format and software on which this database is built are open-source and **available for use by individuals, experiments and counting facilities.**

The public database contains almost **1000** measurments sourced from:

- **ILIAS database** *http://radiopurity.in2p3.fr/*
- **Borexino** *Astropart. Phys. 8 (1998)*
- **EXO** *Nucl. Instrum. Meth. A591 (2008)*
- **XENON100** *Astropart. Phys., 35 (2011)*
- **EDELWEISS** *Astropart. Phys., 47 (2013)*
- **SuperCDMS** *and* **others**



ABSTRACT

The physics community possesses a wealth of knowledge on the radiopurity of materials, which has been acquired laboriously during the design and construction of generations of low-background experiments. To the extent that this information has been shared, it has been done so through databases of limited scope or availability, through publications and through informal exchanges. The aim of the Community Material Assay Database is to consolidate these data into a single comprehensive repository, in which the data is stored in a concise and flexible data format, and is accessible through a powerful web interface. This open-source database is built using the CouchDB NoSQL database engine. Assays are encoded and stored as JSON documents, and searched and edited using a client-side AJAX web application stored within the database itself. The software can also be used as a stand-alone application by experimental collaborations or counting facilities.

DATA FORMAT

ASSAY

```
{
    "type":           "measurement",
    "grouping":       "Experiment name",
    "sample":         {...},
    "measurement":    {...},
    "data_source":    {...},
    "specification": "X.XX"
}
```

The data format is expressed in **JSON** (Javascript Object Notation, a standard widely-used format). It is **lightly-structured** and **extensible**, to accomodate user-specifc fields. User-defined fields are handled gracefully by the user interface.

Sample

```
"sample": {
  "name":         "Short description",
  "description":  "Detailed description",
  "id":           "Identification number",
  "source":       "Where it came from",
  "owner": {
      "name":       "Who owns it",
      "contact":    "Contact details"
    }
}
```

The thing being counted

Data source

```
"data_source": {
  "reference":     "Where it came from",
  "input": {
      "name":        "Who entered data",
      "contact":     "Contact details",
      "date":        []
    },
  "notes":         "Comments on entry"
}
```

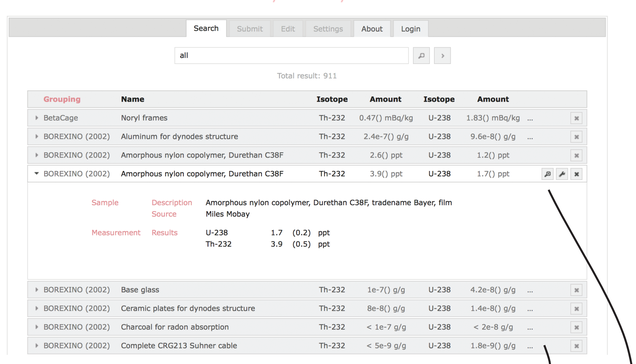
Measurement

```
"measurement": {
  "institution":      "Where the it was done",
  "technique":        "Technique that was used",
  "date":             [],
  "requestor": {
      "name":           "Who managed the assay",
      "contact":        "Contact details"
    },
  "practitioner": {
      "name":           "Who did the assay",
      "contact":        "Contact details"
    },
  "description":      "Detailed multi-line
                       description of the
                       procedure and results",
  "results": [
      {
        "isotope":    "II-AAA or II or desc",
        "type":       "meas limit range",
        "value":      [],
        "unit":       "Unit"
      },
      ...
    ]
}
```

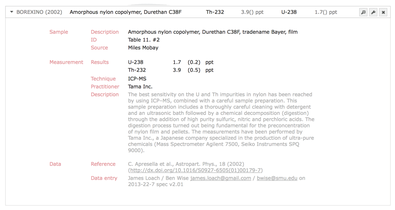
The measurement and results

INTERFACE

VIEWING



Entries can be removed from the display and moved up and down to aid comparisons

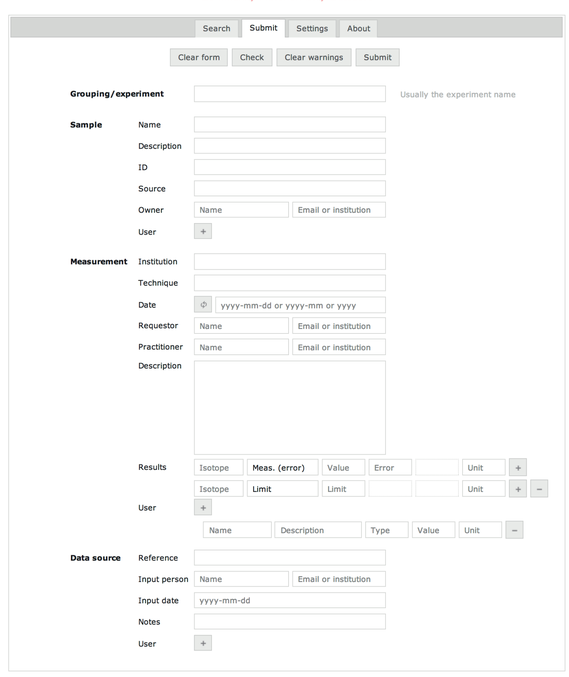


Entries can be expanded to reveal more detail

The **data viewing** part of the interface allows powerful Google-style search of the database and flexible display of results. A sortable summary can be expanded with two levels of detail. Results can be removed from the display. The code provides for other styles of view and these are under development.

The **data submission** part of the interface allows for fast and flexible entry of data. User-defined fields are supported. But this is only one way to enter data - **any language that can speak HTTP can send documents to a CouchDB.**

SUBMITTING

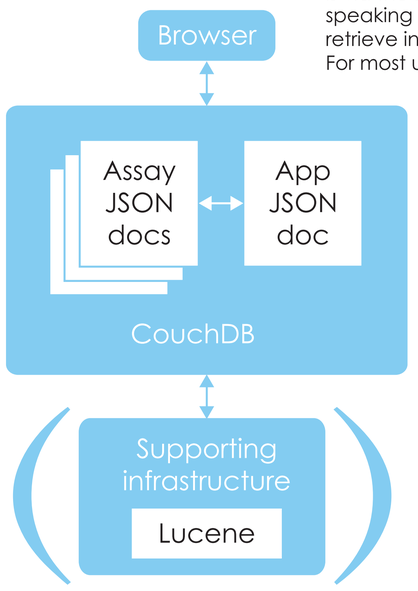


SOFTWARE

APPLICATION STRUCTURE

CouchDB relax

All communication with CouchDB is via the **HTTP protocol**. Any language speaking this protocal can send and retrieve information from the database. For most users this means a **web browser.**



The JSON document structure is so flexible that it can be used to encode the entire web application which can be stored within the database and replicated with it. The **couchapp** tool is used to build the application document from the raw HTML, JavaScript and image files.

Deployments of CouchDB benefit from supporting infrastructure to provide facilities such as **full text search.** These can be provided through open source plugins or cloud services.

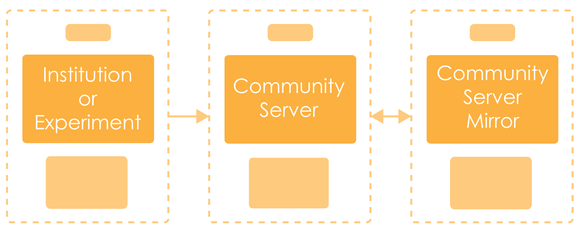
This project uses the **CouchDB** database system. CouchDB is an open source, schemaless, non-relational database for storing JSON (JavaScript Object Notation) documents.

Each document represents an assay, with the structure defined by a data format specification (see above) that is **enforced by the user interface rather than the database** itself. This allows great flexibility in the data format, and the possibility of gracefully handling of arbitrary user-defined fields.

The web application is built using **modern AJAX techniques**. The application is stored in the database in a single JSON document. It is possible for one database to store multiple alternative interfaces.

REPLICATION

CouchDB instances can copy (replicate) themselves trivially. This makes it easy to establish mirror servers, to transfer data from institutional and experiment servers to the central community database, and to install the database system.



COLLABORATION

The web application is available on github (**nepahwin/persephone**). Collaborators are welcome to help with extending its feature set. Contact: **james.loach@gmail.com**

Persephone
Supported by AARM, KIT, LBNL, SMU, SJTU & others

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