radiopurity.org
Community Material Assay Database

Demonstration and Details of the

COMMUNITY MATERIAL ASSAY DATABASE

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BACKGROUND

Searches for rare events require experiments constructed of radiopure materials. Information on the radiopurity of materials is currently shared in a fragmented fashion, through publications, electronic databases and informally.

During the discussion session of **LRT 2010**, participants reiterated the need for a centralized database of material assay data. After reviewing other database efforts we developed the **Community Material Assays Database**, based on software developed for the **LBNL Low Background Facility** and the **Majorana Collaboration**.

This first version of the database includes historical data from measurements reported in the following database and papers:

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

A low-background counting system:
Peruna - XIA Alpha Particle Counter @SMU

ABSTRACT

The physics community has a wealth of knowledge about the radiopurity of materials used to design and construct experiments requiring ultra-low backgrounds. It is currently shared through various databases, publications, and informally. The aim of this Community Material Assay Database is to consolidate these data into a single concise and comprehensive repository, and to provide a robust interface to interact with the data. This database is built on the NoSQL CouchDB database system, and incorporates a concise, flexible data structure. A web interface provides users with several methods for searching, viewing and submitting data. The initial implementation of this database contain data obtained from various international sources, such as the ILIAS project, and publications from the EXO and XENON100 collaborations. The database is accessible at **http://radiopurity.org**

DATA FORMAT

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

ASSAY

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

Sample

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

Details of the thing being counted

Data source

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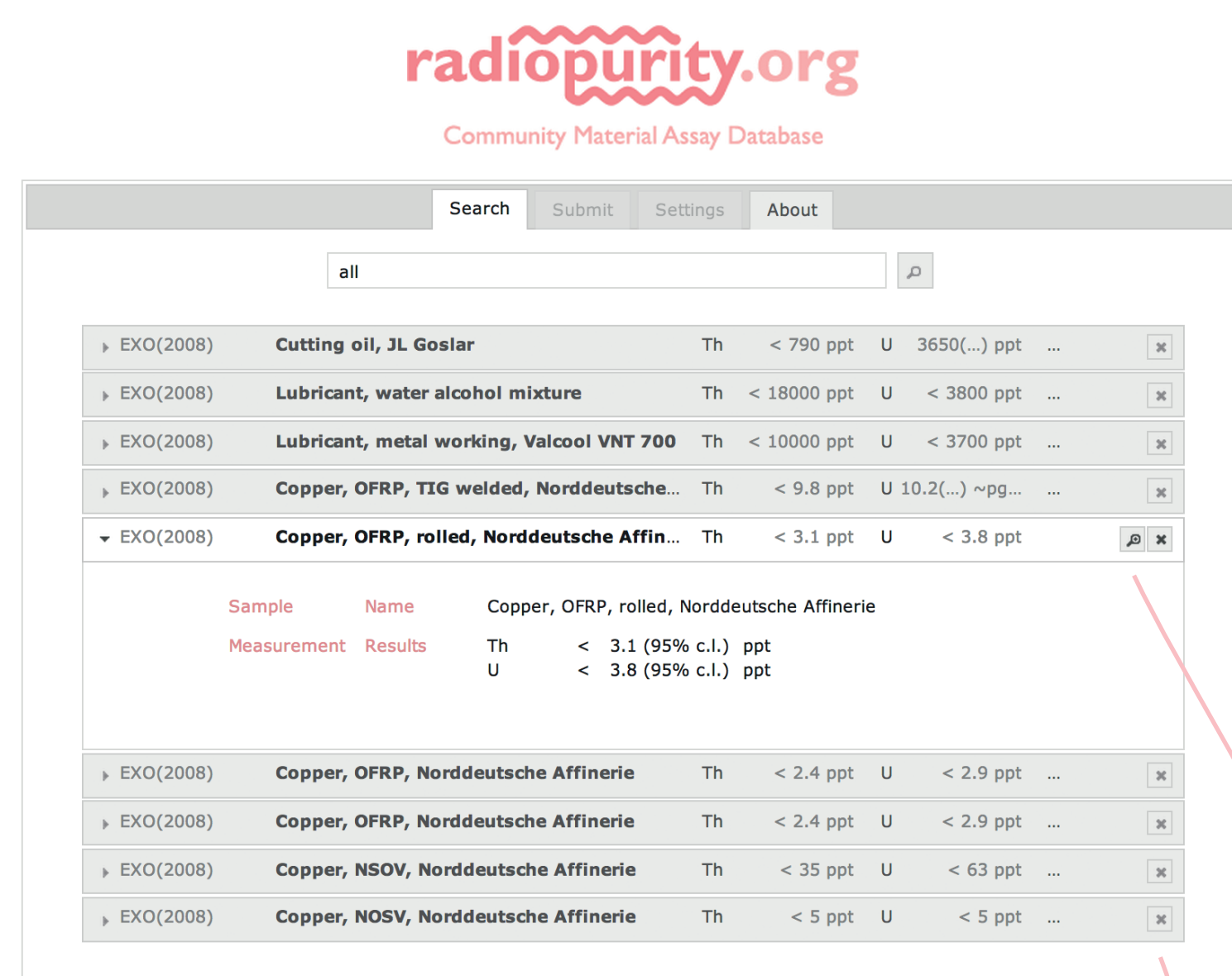
Measurement

```
"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"
    },
    ...
  ]
}
```
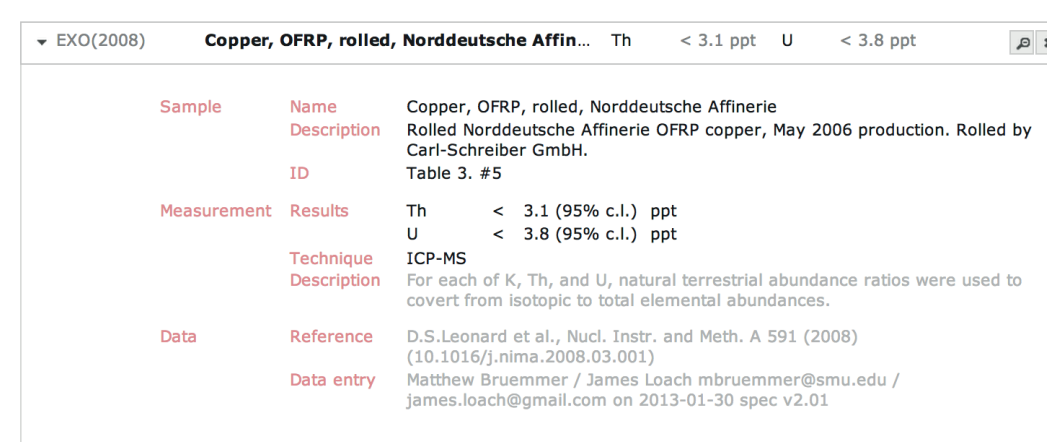
Details of the measurements and results

SOFTWARE

INTERFACE

VIEWING

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**.

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

Entries can be expanded to reveal more detail

SUBMITTING

SOFTWARE
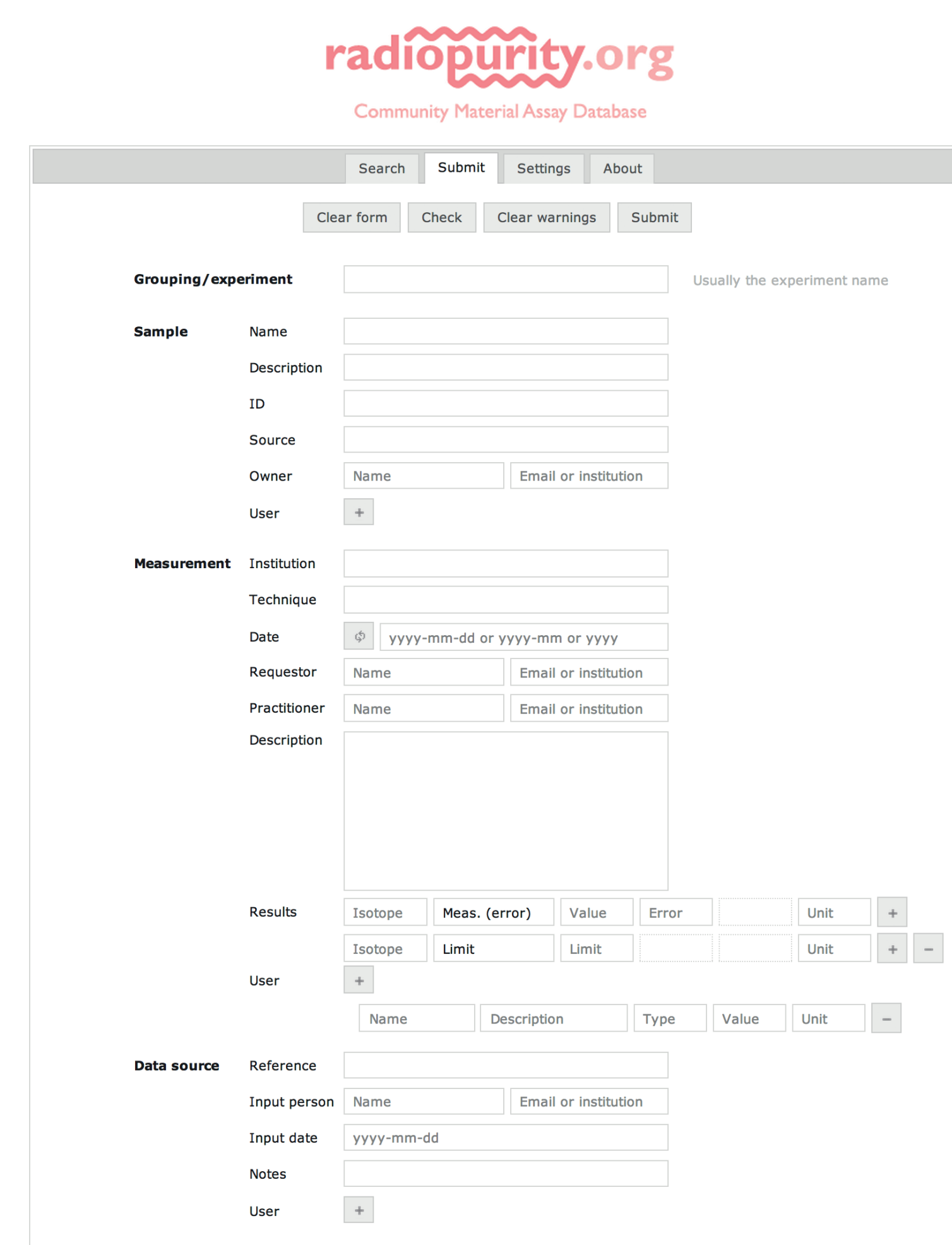
APPLICATION STRUCTURE

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

Browser

Assay JSON docs | App JSON doc

CouchDB

Supporting infrastructure

Lucene

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.

Institution or Experiment → Community Server ↔ Community Server Mirror
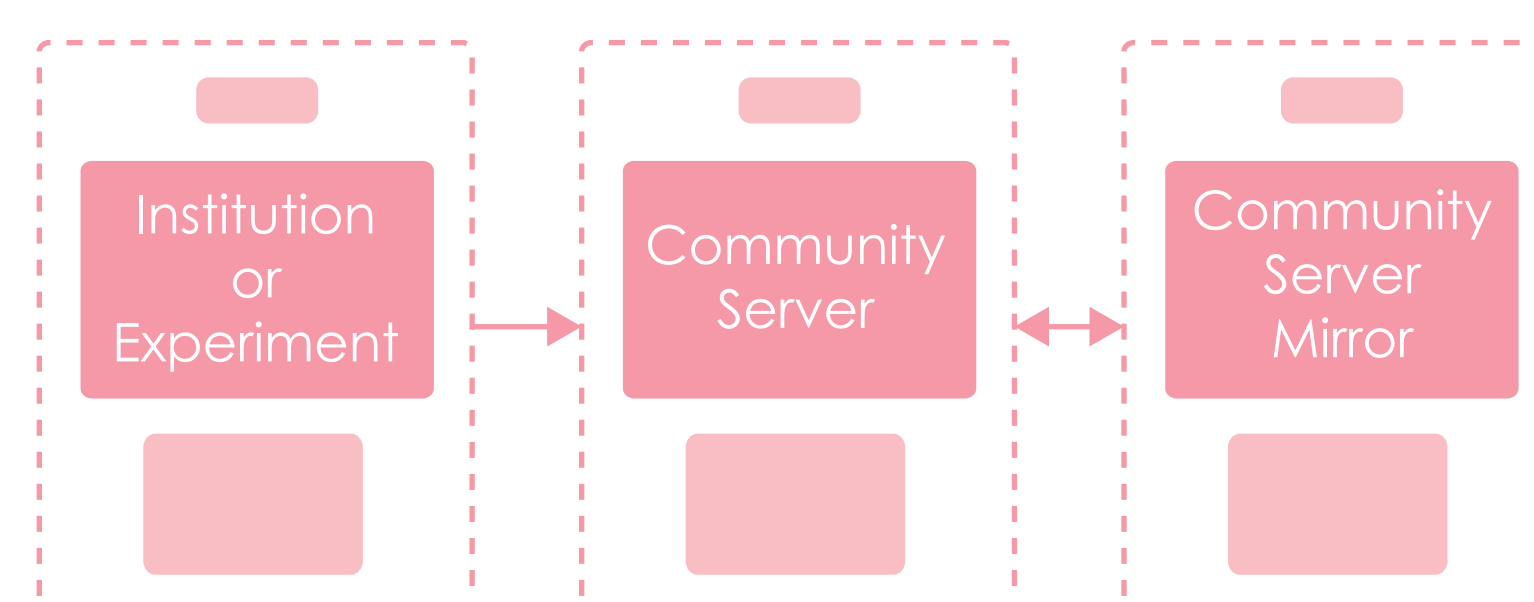
COLLABORATION

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