

DMAMC tasks supported by SNL

Belkis Cabrera-Palmer
Sandia National Laboratories



Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

T&E program Review, Albuquerque
2019/07/23

SNL-supported DMAMC tasks



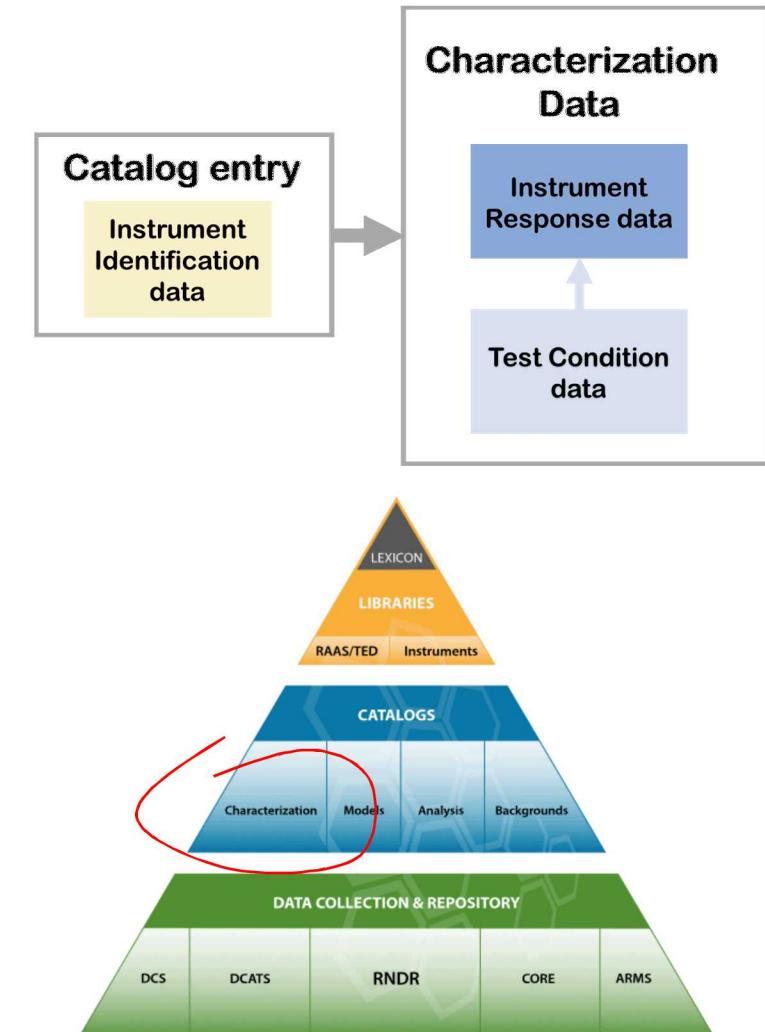
- Data Mining, Analysis and Modeling Cell (DMAMC) Management Integrated Product Team (IPT) member.
 - Sandia POC: Belkis Cabrera-Palmer
- For Analysis IPT:
 - Member of the SME working group (currently inactive)
- For Library IPT:
 - Lead the Characterization Catalog working group (also an Analysis IPT task)
 - Execute the design and development of the Characterization Catalog Web Application.
- Available to respond to stakeholder inquiries and requests for peer-review
- Proposals for long/short-term studies: goals, task breakdown and cost estimate.

Instrument Characterization Catalog “CharCat”

Definition: Online catalog containing characterization data of radiation detection instruments used and tested at CWMD test events.

The catalog contents are specific to each detector unit identified by serial number, and will include characterization data pertaining to Normalization Test Ground Truth detectors, Reference detectors and SUTs, collected during CWMD test events and projects, including legacy DNDO test events and projects.

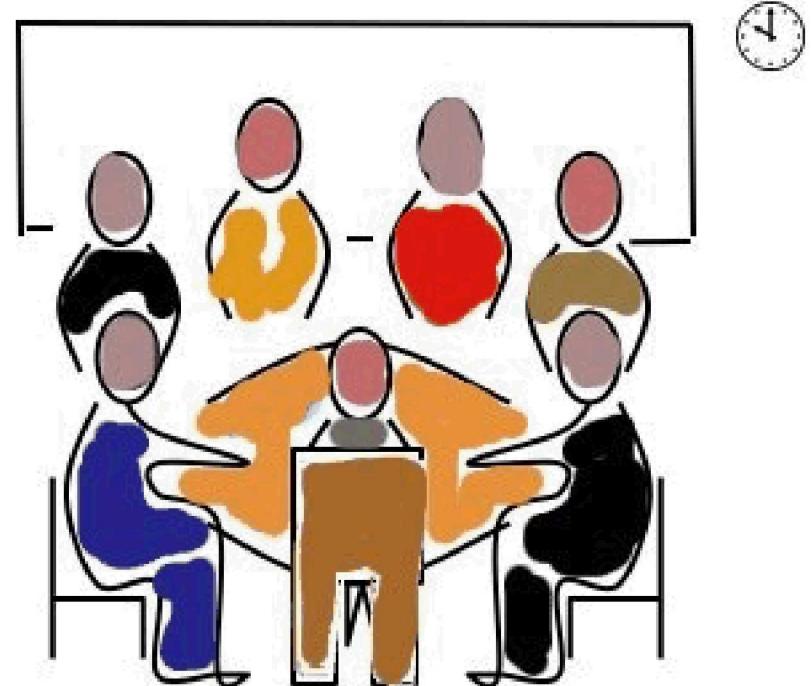
As such, this catalog aims to support test scientists and analysts at CWMD and CWMD partner organizations.



CharCat Working Group

Members:

1. CWMD: Daniel Weidinger
2. NIST: Miles McCord
3. NRL: Lee Mitchell
4. PNNL: Emily Mace, Gariann Gelston, Heather Orr, Juan Barajas
5. SNL (lead): Development Team of 3 staff and 5 student interns



CharCat WG FY18 tasks

- Use Case survey:
 - 8 written responses
 - 9 phone interviews
 - 1 CWMD Brown Bag
- Use Case Report submitted on June 2018.
- Requirements Report submitted on November 2018.
- CharCat prototype development (SNL).



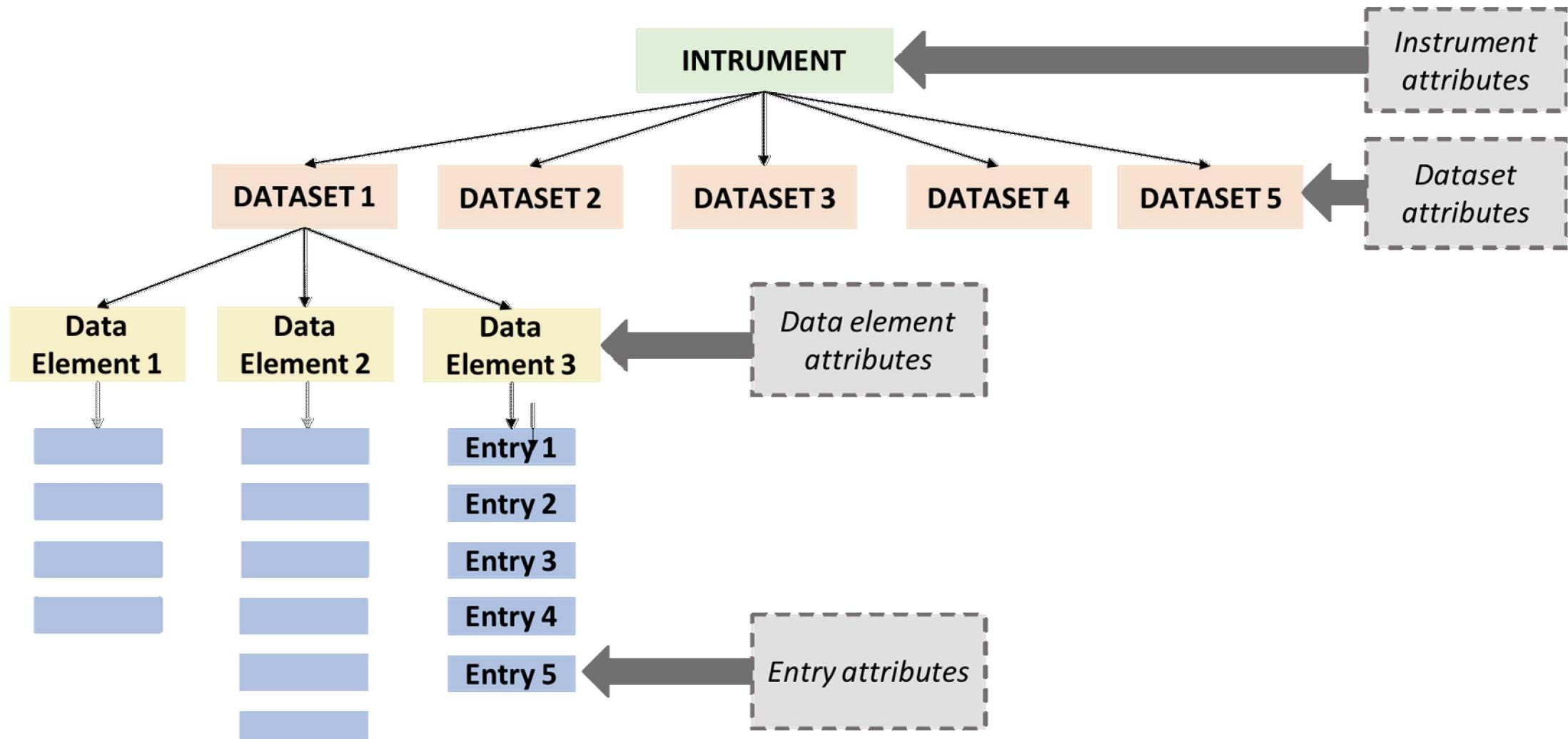
SNL CharCat FY19 Development Team

Full App development activities started on end of January 2019

1. Belkis Cabrera-Palmer (PI)
2. Matthew Wong
3. Charlie Gieseler
4. Kousuke Tachida
5. Justin Cheon
6. Arthur Zhang (2019 summer)
7. Boris Kudryavtsev (2019 summer)
8. Marton Demeter (2019 summer)

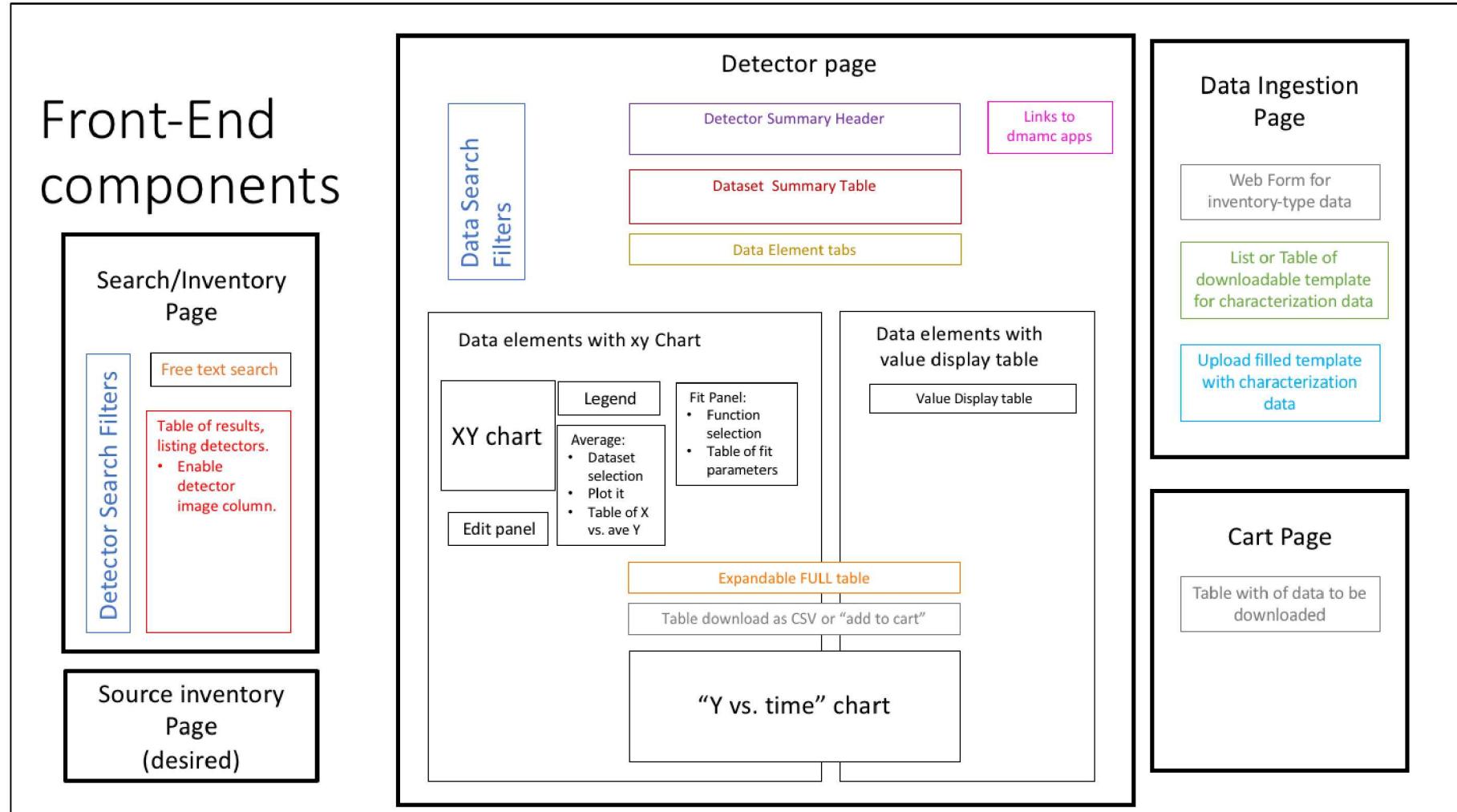


CharCat Data Organization



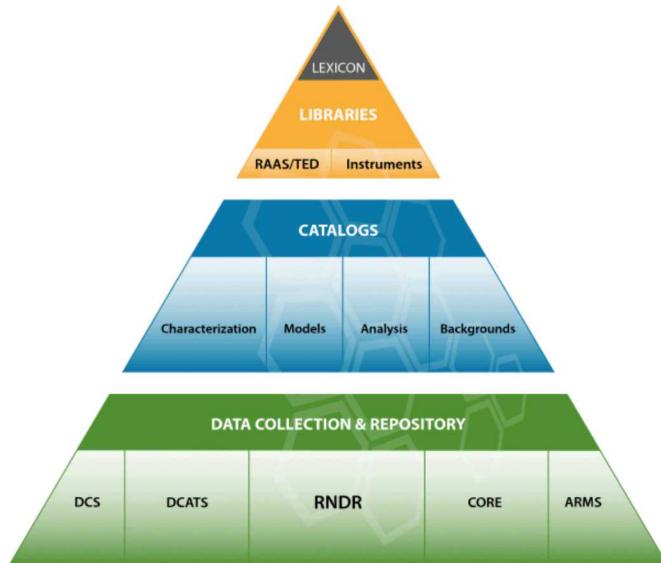
CharCat Front-End Design

- Implemented so far:
 - Search/Inventory page
 - Detector pages (mostly done)
- Currently working on the Data ingestion page
- Will not be done in FY19:
 - Source Inventory page and
 - Cart Page (though data will be downloadable as independent CSV files.)

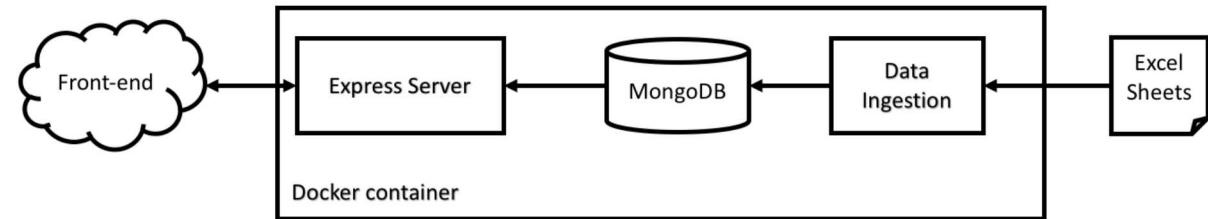


CharCat Back-End and Deployment Design

- Most back-end components have been implemented.
- Focus on ingesting data provided by test scientists via excel file templates



Back-End Components



Also working on:

- Implement cybersecurity and data protection
 - Improve security between the char-cat server and MongoDB
 - Implement OAUTH for common login into DMAMC portal
- Implement linkages to other DMAMC online tools (RNDR, RAAS, Instrument Library, ModCat)
- Understanding requirements for future deployment in AWS (potentially)

T&E week CharCat live demo

- During development, CharCat has been deployed in a SNL externally facing server at <https://hekili.ca.sandia.gov/dmamc/>
- CharCat WG members have got accounts and are able to provide regular and direct feedback on newly developed features.
- PNNL's Richard Pagh (LIPT lead) to deliver "live" demo at 2019 T&E week by logging in to CharCat.
- Next slides: screen shots of the actual CharCat Web App, highlighting implemented functionality as on July 16, 2018.

Inventory search enabled by free text typing and by filters.



Instrument Characterization Catalog

Inventory

[X](#) CLEAR FILTERS

Detector Class [▼](#)

Detector Type [▼](#)

Detector Subtype [^](#)

High

sensitivity ion chamber

BF3

Coaxial

HPGe

He3

HPGe

NaI

Manufacturer [^](#)

Reuter Stokes

LANL

ORTEC

Health

Physics Instruments

Ortec

Detector Use [▼](#)

Owner [▼](#)

Search

	Serial Number	Description	Use	Owner	Location	Number of Available Characterizations	Last Characterization	Test Participation	Last Test Participation	Last Known Operation
		Name: GEM100P4-108-HE-S Manufacturer: ORTEC Model: GEM100P4-108-HE-S Type: Gamma / Coaxial HPGe Class: Spectrometer	---	NRL	---	1	---	---	---	---
	51-TP50885A	Name: GEM100P4-108-HE-S Manufacturer: ORTEC Model: GEM100P4-108-HE-S Type: Gamma / Coaxial HPGe Class: Spectrometer	---	NRL	---	1	---	---	---	---
	50-TP50751A	Name: GEM100P4-108-HE-S Manufacturer: ORTEC Model: GEM100P4-108-HE-S Type: Gamma / Coaxial HPGe Class: Spectrometer	---	NRL	---	1	---	---	---	---
	51-TP32852A	Name: GEM100P4-108-HE-S Manufacturer: ORTEC Model: GEM100P4-108-HE-S Type: Gamma / Coaxial HPGe Class: Spectrometer	---	NRL	---	1	---	---	---	---
	121457818	Name: IDM-200 Manufacturer: ORTEC Model: IDM-200 Type: Gamma / HPGe Class: Spectrometer	Reference Detector	ORNL	---	---	---	5	Test name: RASE handheld Date: 2015-11-01T07:00:00.000Z	---
	52-TP51027A	Name: GEM100P4-108-HE-S Manufacturer: ORTEC Model: GEM100P4-108-HE-S Type: Gamma / Coaxial HPGe Class: Spectrometer	---	NRL	---	1	---	---	---	---
	52-TP50986A	Name: GEM100P4-108-HE-S Manufacturer: ORTEC Model: GEM100P4-108-HE-S Type: Gamma / Coaxial HPGe Class: Spectrometer	---	NRL	---	1	---	---	---	---
		Name: Micro-Detective HPGe Manufacturer: ORTEC	---							

[SAVE CSV](#)



Instrument Characterization Catalog

- Hovering over cell opens tool-tip with date of last update and person
- Enabled CSV file download of the whole table

Inventory

X CLEAR FILTERS

Detector Class

Detector Type

Detector Subtype

Manufacturer

Detector Use

Owner

Search

	<input type="checkbox"/> Serial Number	Description	Use	Owner	Location	Number of Available Characterizations	Last Characterization	Test Participation	Last Test
	<input type="checkbox"/> 10000254	Name: Reuter Stokes Ion Chamber Manufacturer: Reuter Stokes Model: RS-S131-200-ER0000 Type: gamma / High sensitivity ion chamber Class: Health Physics Cooler Run hours: not applicable	Measure background at test events	ORNL	Current location: ORNL Regular location: ORNL	---	---	---	5 Test name: Date: 197 Updated on 5/3/2019 by David West
	<input type="checkbox"/> 1	Name: BF3 NRDS neutron detector Manufacturer: LANL Model: NRDS Type: Neutron / BF3 Class: Coarse Neutron Spectrometer Cooler Run hours: not applicable	Normalization Test Ground Truth; Reference Detector	LANL	Current location: not available Regular location: LANL	1	Date: 2012 Scientist: Travis Grove, Cheslan Simpson Scientist institution: LANL	Lots	Test name
	<input type="checkbox"/> 2	Name: BF3 NRDS neutron detector Manufacturer: LANL Model: NRDS Type: Neutron / BF3 Class: Coarse Neutron Spectrometer Cooler Run hours: not applicable	Normalization Test Ground Truth; Reference Detector	LANL	Current location: not available Regular location: LANL	1	Date: 2012 Scientist: Travis Grove, Cheslan Simpson Scientist institution: LANL	Lots	Test name
	<input type="checkbox"/> 51-TP50885A	Name: GEM100P4-108-HE-S Manufacturer: ORTEC Model: GEM100P4-108-HE-S Type: Gamma / Coaxial HPGe Class: Spectrometer	---	NRL	---	1	---	---	---
	<input type="checkbox"/> 585216	Name: Meridian Neutron Survey Meter Manufacturer: Health Physics Instruments Model: 5085 Type: Neutron / He3 Class: Health Physics Cooler Run hours: not applicable	Normalization Test Ground Truth	CWMD	---	---	---	---	---
		Name: NRDS neutron detector							

**Micro-Detective HPGe, SN 103217545**

Use: Normalization Test Ground Truth
Manufacturer: ORTEC
Model: HPRDS3
Revision: 5085
Class: Spectrometer
Type: Gamma
Owner: CWMD

[Report errors in data](#)

- Click on an inventory detector opens the unit's characterization data page, showing:
 - Header with general detector information
 - Linkage to other DMAMC catalogs with related data
 - Table of available Characterization datasets
- Linkage to other DMAMC catalogs:
 - Instrument library with general detector specifications
 - ModCat if there is an existing model
 - RNDR for raw data
 - RAAS for related documents and reports
- User can select which dataset to inspect.
- Dataset table can be downloaded as csv file

DMAMC Linkages

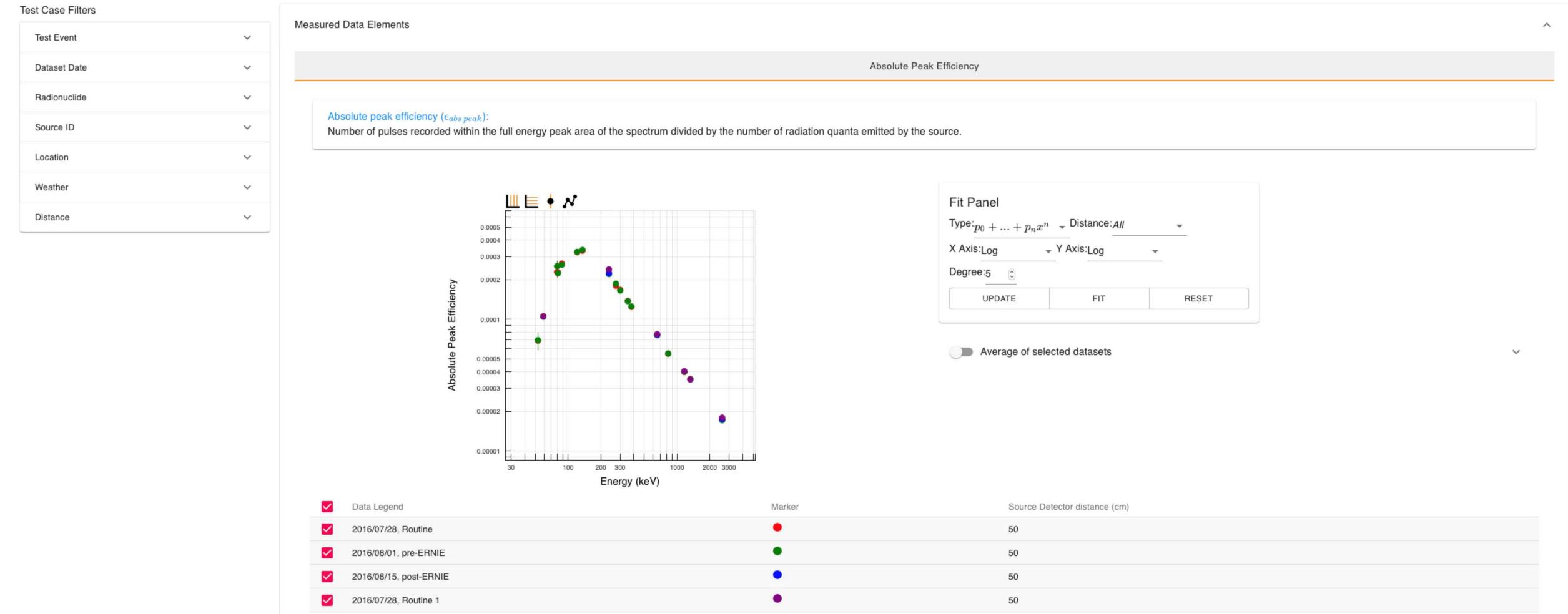
	Backgrounds Catalog
	Report Analysis and Archive System (RAAS)
	Instrument Library
	Modcat
	Lexicon
	Characterization Catalog
	RNDR

Characterization Datasets

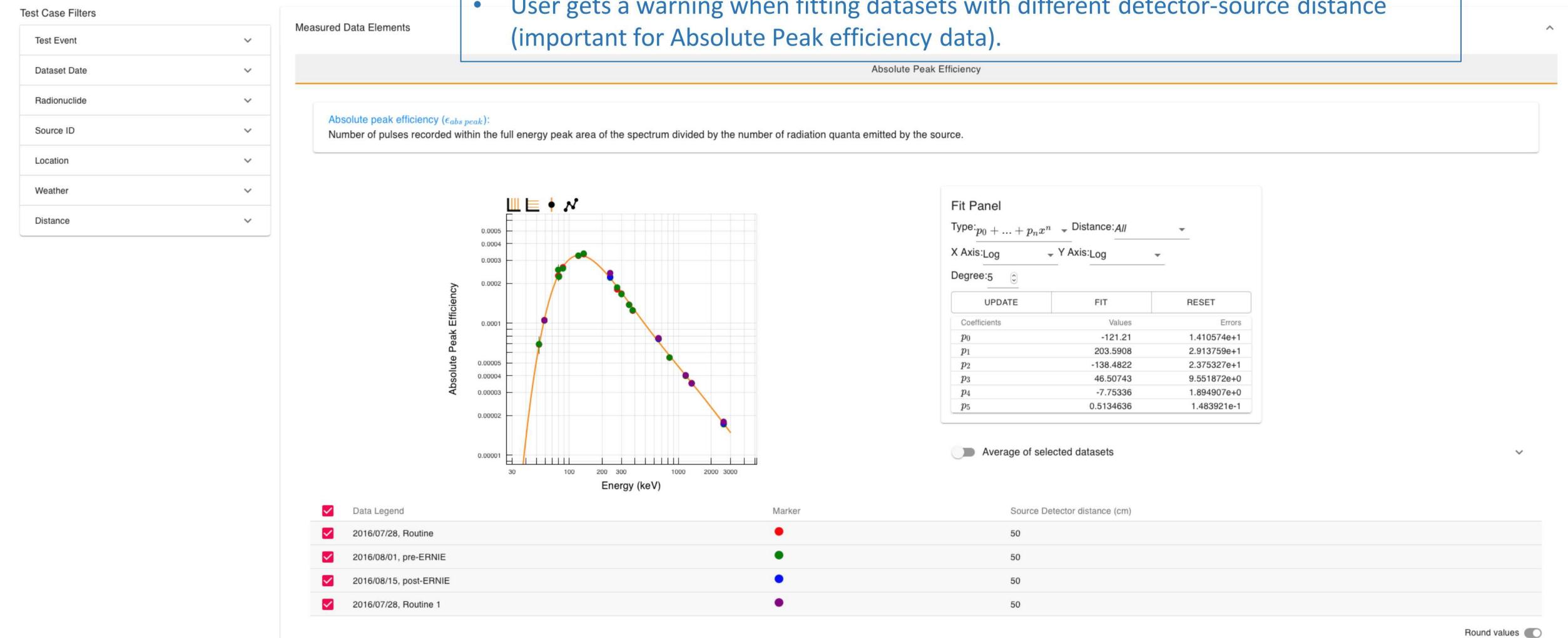
<input checked="" type="checkbox"/>	Dataset Name	Measured data elements	Start Date	End Date	Measurement Location	Test Scientist Institution	Measurement Purpose	Test Event
<input checked="" type="checkbox"/>	2016/07/28, Routine	Absolute Peak Efficiency	7/28/2016	7/29/2016	NIST	NIST	Routine characterization	---
<input checked="" type="checkbox"/>	2016/08/01, pre-ERNIE	Absolute Peak Efficiency	8/1/2016	8/1/2016	NIST	NIST	Normalization Test, ERNIE	2016/08/10 ERNIE
<input checked="" type="checkbox"/>	2016/08/15, post-ERNIE	Absolute Peak Efficiency	8/15/2016	8/15/2016	NIST	NIST	Normalization Test, ERNIE	2016/08/10 ERNIE
<input checked="" type="checkbox"/>	2016/07/29, Routine background	Background spectrum	7/29/2016	7/29/2016	NIST	NIST	Routine characterization	---
<input checked="" type="checkbox"/>	2016/08/02, pre-ERNIE background	Background spectrum	8/2/2016	8/2/2016	NIST	NIST	Normalization Test, ERNIE	2016/08/10 ERNIE
<input checked="" type="checkbox"/>	2016/08/15, post-ERNIE background	Background spectrum	8/15/2016	8/15/2016	Virginia International Gateway (VIG) Port of Virginia	NIST	Normalization Test, ERNIE	2016/08/10 ERNIE
<input checked="" type="checkbox"/>	2016/07/28, Routine 1	Absolute Peak Efficiency	2/6/2017	2/6/2017	NIST	NIST	Routine characterization	---

[SAVE CSV](#)

- The displayed data elements depend on the dataset. In this example, all the selected datasets report Absolute Peak Efficiency.
- Plot displaying Efficiency vs. Energy values of all selected datasets
- User can further select which dataset to plot.
- Plot formatting: zoom in and out, display x and y grid, display error bars, draw connecting line.



- Fit panel with several available functions
- Fit selected datasets
- Table displaying fit coefficient values and errors.
- Evaluated fit function also plotted.
- Axis can be fitted in log or linear scale.
- User gets a warning when fitting datasets with different detector-source distance (important for Absolute Peak efficiency data).

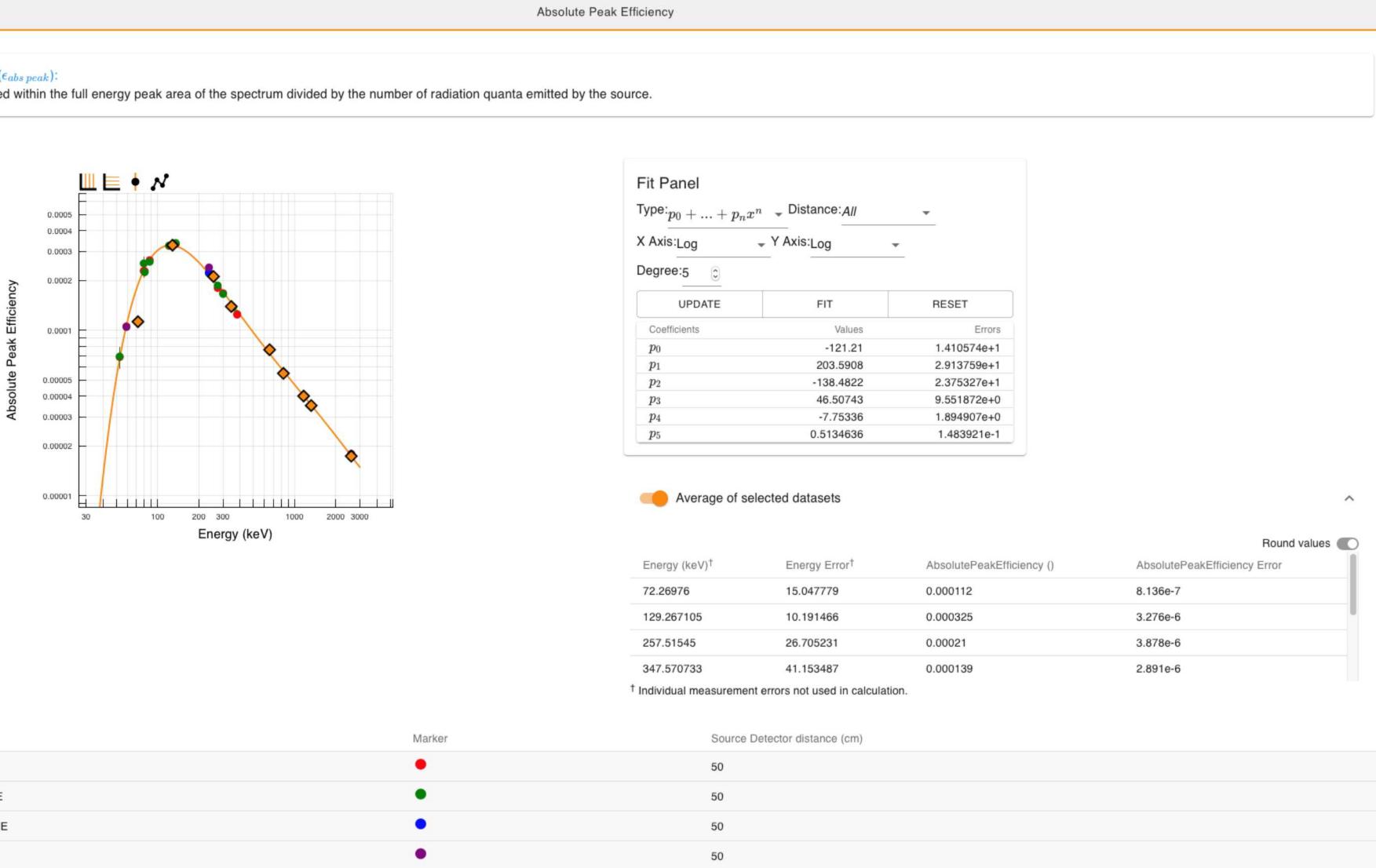


- Table displaying average of selected dataset
- Average values also display (orange diamonds with black border)
- If data errors are provided, they are considered in the average calculation.

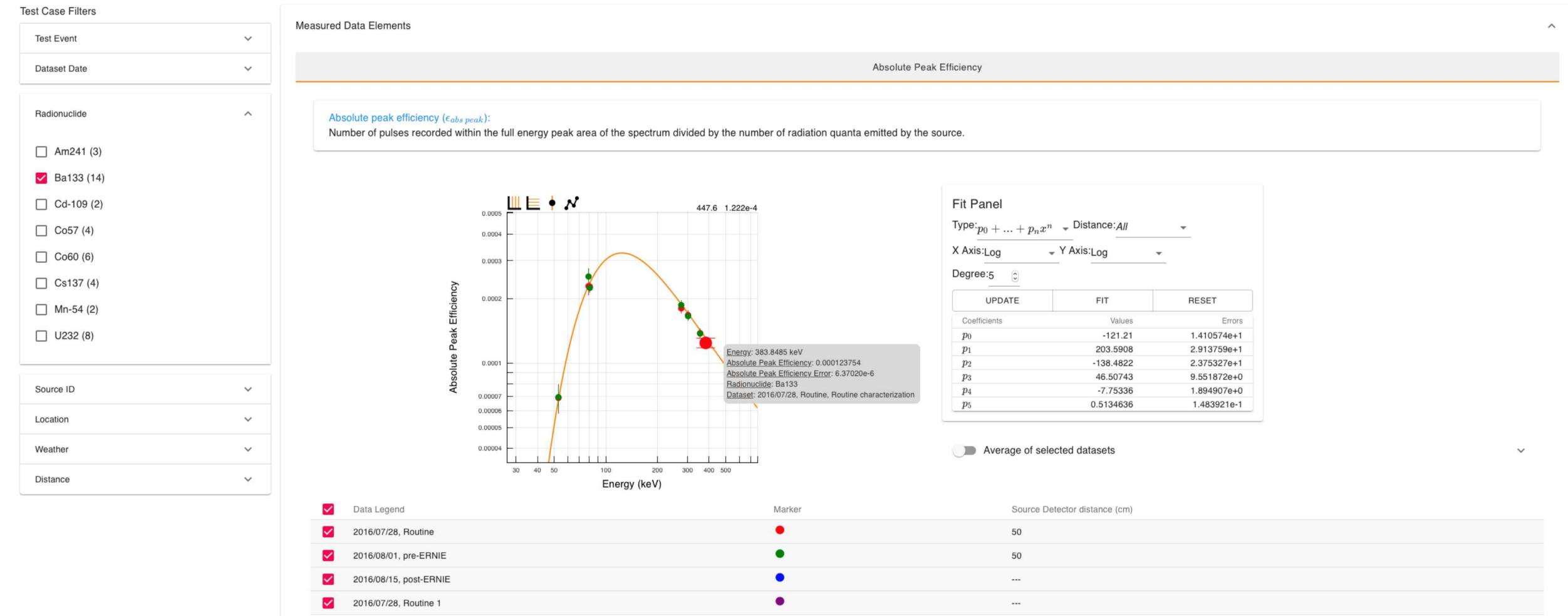
Test Case Filters

Test Event	<input type="button" value="▼"/>
Dataset Date	<input type="button" value="▼"/>
Radionuclide	<input type="button" value="▼"/>
Source ID	<input type="button" value="▼"/>
Location	<input type="button" value="▼"/>
Weather	<input type="button" value="▼"/>
Distance	<input type="button" value="▼"/>

Measured Data Elements

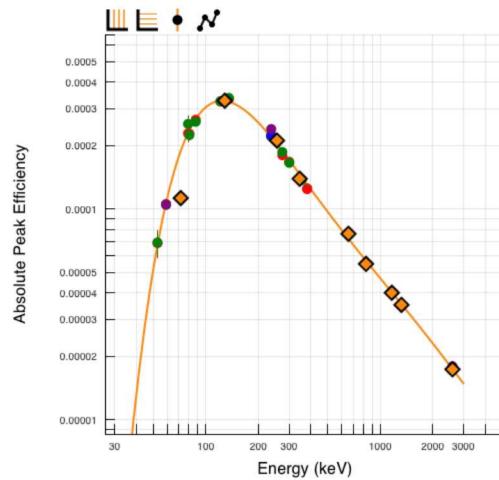


- Test case filters to further select data
- Plot, average and fits are updated according to new selection
- Hovering over plotted data point shows tool-tip with test case data



Weather

Distance



Fit Panel

Type: $p_0 + \dots + p_n x^n$ Distance: All

X Axis: Log Y Axis: Log

Degree: 5

UPDATE	FIT	RESET
Coefficients	Values	Errors
p_0	-121.21	$1.410574e+1$
p_1	203.5908	$2.913759e+1$
p_2	-138.4822	$2.375327e+1$
p_3	46.50743	$9.551872e+0$
p_4	-7.75336	$1.894907e+0$
p_5	0.5134636	$1.483921e-1$

Average of selected datasets

Round values

Energy (keV) [†]	Energy Error [†]	AbsolutePeakEfficiency ()	AbsolutePeakEfficiency Error
72.26976	15.047779	0.000112	$8.136e-7$
129.267105	10.191466	0.000325	$3.276e-6$
257.51545	26.705231	0.00021	$3.878e-6$
347.570733	41.153487	0.000139	$2.891e-6$

[†] Individual measurement errors not used in calculation.

Round values

Data Legend		Marker	Source Detector distance (cm)		
<input checked="" type="checkbox"/>	2016/07/28, Routine	●	50		
<input checked="" type="checkbox"/>	2016/08/01, pre-ERNIE	●	50		
<input checked="" type="checkbox"/>	2016/08/15, post-ERNIE	●	50		
<input checked="" type="checkbox"/>	2016/07/28, Routine 1	●	50		

Dataset	Energy	Absolute Peak Efficiency	Absolute Peak Efficiency Uncertainty	Source ID/Serial number	Radionuclide	Net Peak Counts	Net Peak Counts Uncertainty	Life
2016/07/28, Routine, Routine characterization	53.1622	0.000069	0.000011	133-A	Ba133	1029.04	149.2108	2
2016/07/28, Routine, Routine characterization	79.6142	0.000228	0.000021	133-A	Ba133	5141.88	105.922728	2
2016/07/28, Routine, Routine characterization	80.9979	0.000227	0.000012	133-A	Ba133	65162.36	273.681912	2
2016/07/28, Routine, Routine characterization	276.3989	0.000179	9.296e-6	133-A	Ba133	12099.33	130.672764	2
2016/07/28, Routine, Routine characterization	302.8508	0.000167	8.460e-6	133-A	Ba133	28938.77	173.63262	2
2016/07/28, Routine, Routine characterization	356.0129	0.000137	6.901e-6	133-A	Ba133	80939.31	283.287585	2
2016/07/28, Routine, Routine characterization	383.8485	0.000124	6.370e-6	133-A	Ba133	10509.42	107.196084	2

SAVE CSV

- Full data table displayed at the bottom of each detector page
- Download as CSV file
- Toggle to display rounded or unrounded values.



Future work: Add page for data ingestion to enable test scientists :

- Submit new characterization data for existing instrument
- Add new instrument to inventory
- Update inventory data of existing instrument

This will be done via:

- Characterization data Excel templates
- Inventory data Web form

We hope to get lots of data!!!!

The CharCat philosophy is to only display data as reported and provided by the test scientists.