



STAX project:

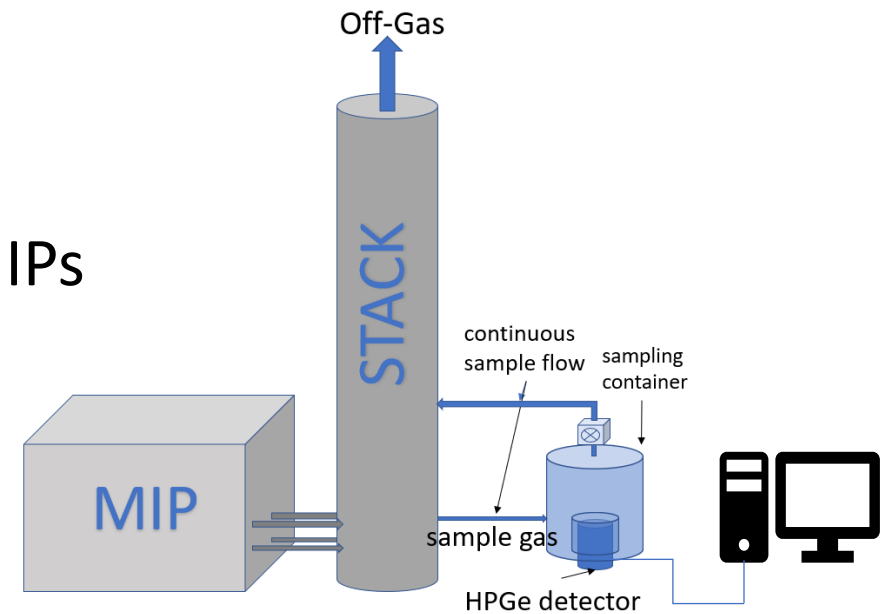
Data processing and viewing software

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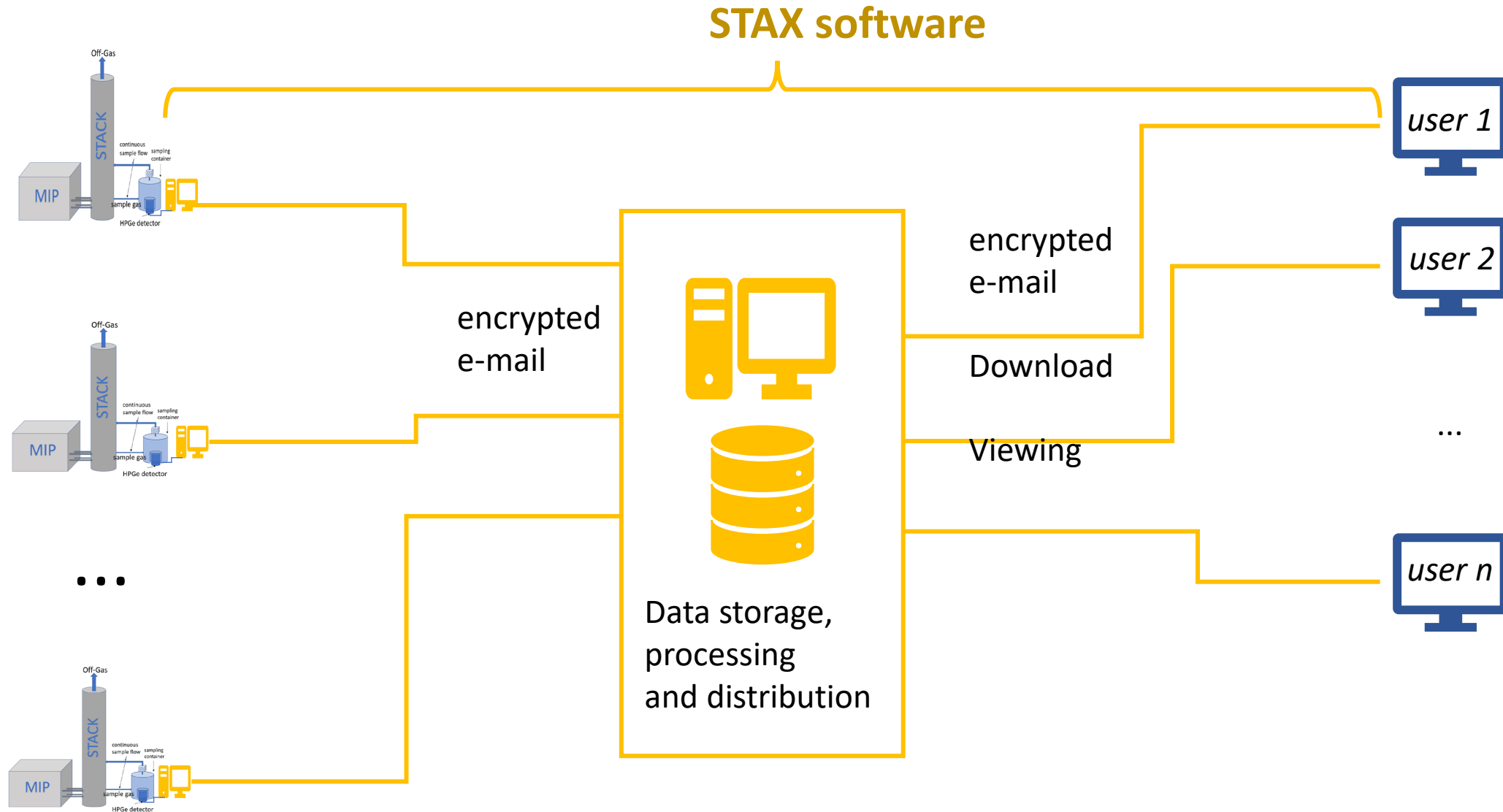
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STAX overview

- The STAX (Source Term Analysis of Xenon) is an experimental network to detect and quantify radioxenon emissions from medical isotope production (MIP) facilities
- Measurement is performed at the stack of MIPs using high resolution gamma spectroscopy detection systems (HPGe detectors)
- Data are transferred via email to a central data processing server



STAX network configuration



STAX data software

- Software has been developed to manage STAX processes from data back-end to front-end:

Data retrieval and
formatting

Data transmission
and distribution

Network monitoring

Data processing and
storage

Data analysis and
visualization

- Data viewing is via a web-based user interface
- Currently hosted at stax.isti.com but will soon be moved to staxdata.net
- Access is limited to authorized users only

STAX data types

Automatic Time Series (ATS) Data

Summary of daily results:

Time series data of emission values

State-of-Health (SoH) Data

Data on status of system operation:

- Temperature
- Pressures
- Power data
- ...

Spectrum (PHD) files (optional)

High resolution gamma spectrum in STAX1.0 format

(similar to IMS2.0 format)

Alerts

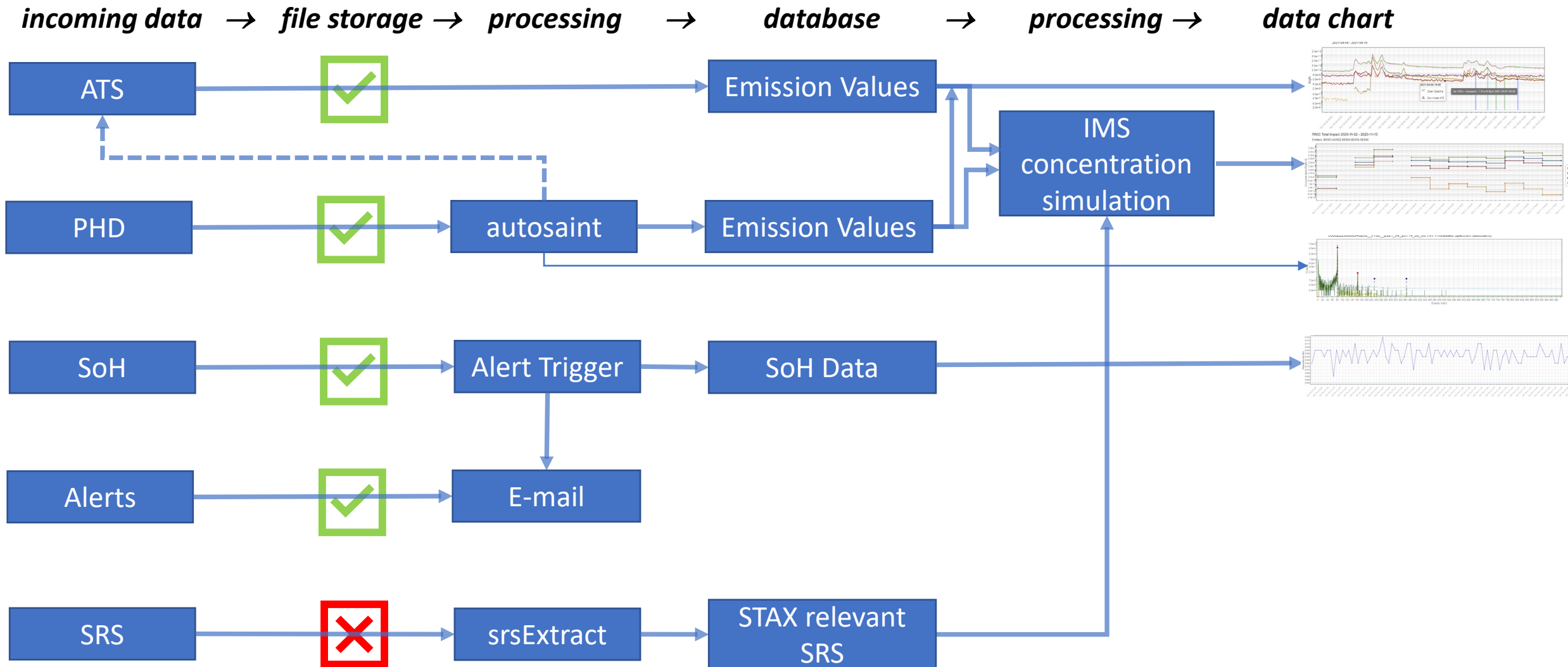
Alert messages sent from the station

STAX - SRS

Atmospheric Transport Modelling results:

Source receptor sensitivity data that link emitting facilities to IMS stations

STAX data processing overview






STAX data viewing software overview


- Interface to browse and download received data messages
- Overview on facilities available to the user
- Dashboard overview of operational status of available facilities
- Data charts to view raw and processed data
- State-of-Health data viewing chart

STAX data administration software overview

 Alerts

 Maintenance

 Users

 Settings

- Setting and viewing alerts
- Log of maintenance activities
- Managing user accounts
- General Settings

User administration

- Access can be set facility specific

Owned Facilities	?	Assigned Facilities	?	Available Facilities
		04-05-2021 AUS02/ANSTO AUSTRALIA (-34.05087, 150.97886)	22-10-2019 BES01/Stack building BELGIUM (50.45131, 4.53155)	30-04-2021 SES03/Forsmark F1 SWEDEN (60.40265, 18.1752833333333) 30-04-2021 SES04/Forsmark F2 SWEDEN (60.4038333333333, 18.1734333333333) 30-04-2021 SES05/Forsmark F3 SWEDEN (60.40535, 18.1608166666667)

- Facility owner can set message send delays to allow for data review

Owned Facilities	?	Assigned Facilities	?	Available Facilities
04-05-2021 AUS02/ANSTO AUSTRALIA (-34.05087, 150.97886)		22-10-2019 BES01/Stack building BELGIUM (50.45131, 4.53155)		30-04-2021 SES03/Forsmark F1 SWEDEN (60.40265, 18.1752833333333) 30-04-2021 SES04/Forsmark F2 SWEDEN (60.4038333333333, 18.1734333333333) 30-04-2021 SES05/Forsmark F3 SWEDEN (60.40535, 18.1608166666667)

SoH Alerts

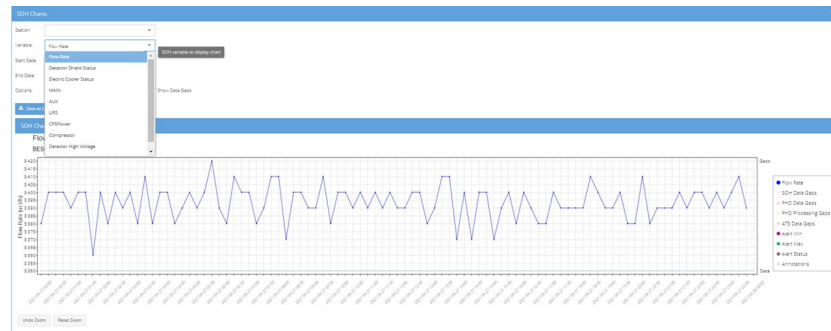
- Levels or ranges for SoH values to trigger alerts can be set by STAX administrators
- Alerts are send via email to assigned users
- No data reception automatically triggers alerts

The screenshot displays the 'SOH Alerts' configuration page in the STAX interface. The top navigation bar includes 'General' and 'SOH Alerts', with the latter being the active tab. Below this, a row of station identifiers (SES05, SES04, SES03, BES01, AUS02) is shown, with 'BES01' selected. A sub-tab 'BES01 CP5Power' is also active. The main configuration area contains the following fields:

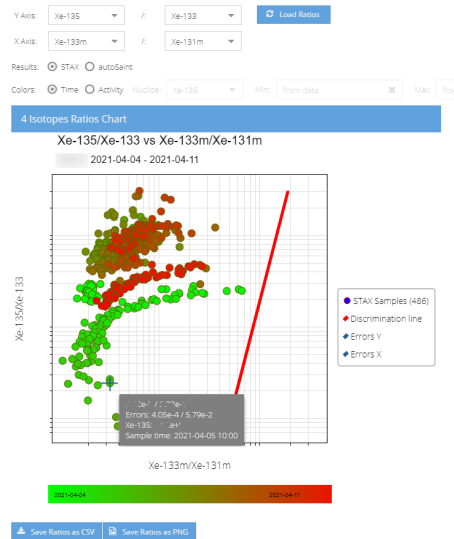
- Alert Name:** BES01 CP5Power
- SOH Variable:** CP5Power
- Level:** Critical (highlighted in red)
- Trigger:** Maximum
- Expression:** $\{val\} \geq \{max\} - \{hysteresis\}$
- Maximum value:** 120
- Hysteresis:** 0
- Delay (minutes):** 0
- Active:** ☒
- Send Email:** ☐
- Message:** $\{station\} \{name\}$ is at $\{val\}$ which is $\{level\}$ according to $\{trigger\}$ rule $\{expr\}$ at $\{time\}$

Stax system data viewing charts

State of Health Data



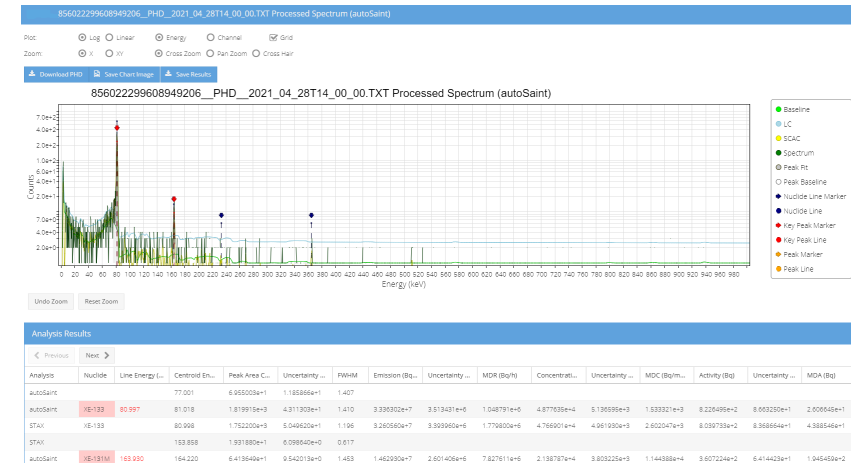
Isotopic ratio



Emission values



Spectrum Plot



ATM based concentration simulations

IDC SRS

```
7.91 47.92 20201105 06 20201106 06 0.1300000E+16 336 1 1 0.50 0.50 "DEX33"  
47.50 7.50 1 0.7280151E+02  
coordinates srs  
....
```

For each STAX facility:
If facility coordinates match SRS coordinates,
a STAX SRS entry is created

srs extract

DEX33 CollectionStop: 2020-11-30 06:00:00 SamplingPeriod: 86400.0

Facility	StartDate	StartTime	StopDate	StopTime	srsValue
...					
STX99	2020-11-25	23:00:00	2020-11-26	00:00:00	1.14377e-20
...					

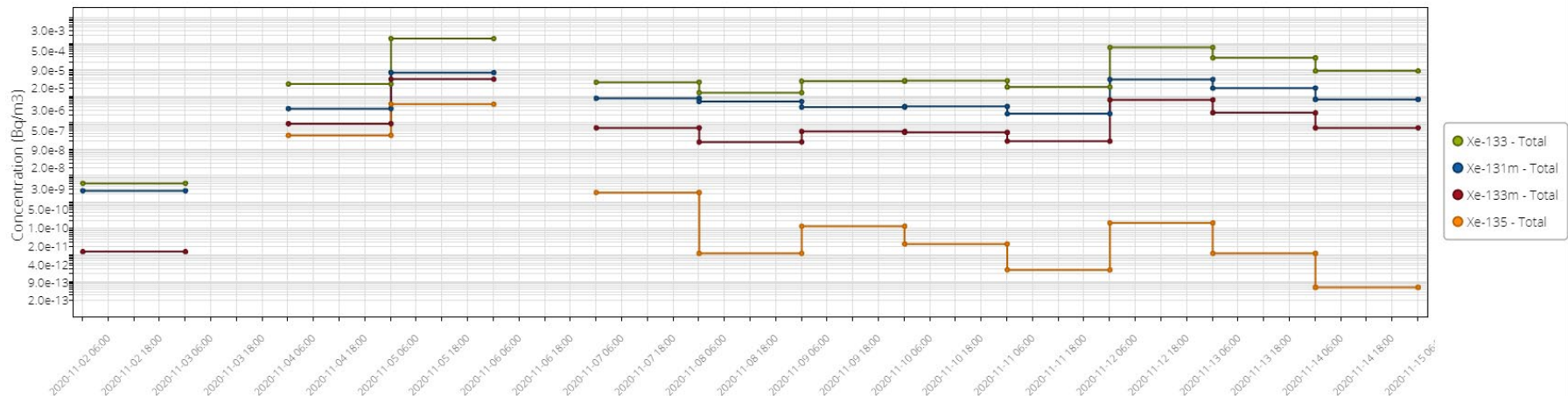
X

Emission Values
(+ decay correction and in-growth)

STAX SRS

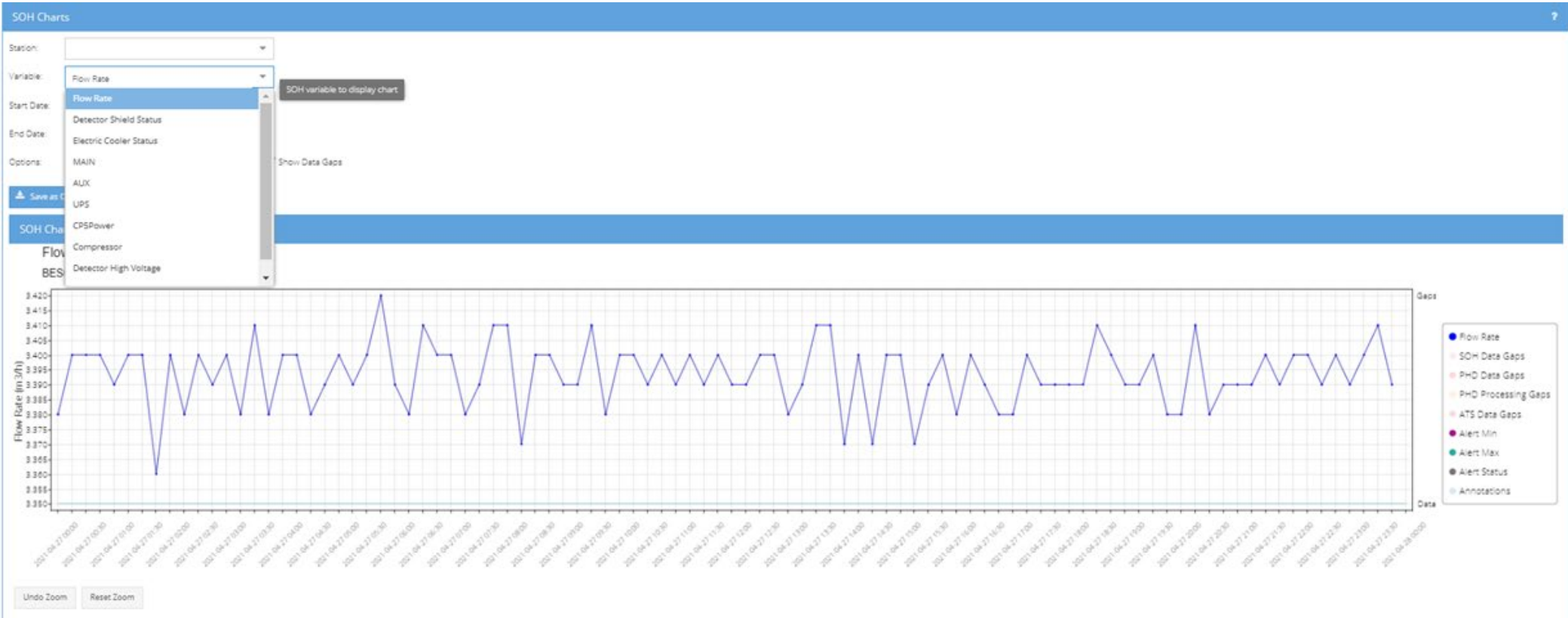
RN33 Total Impact 2020-11-02 - 2020-11-15

Emitters:



Questions ?

State of Health Data



Emission values

Data Charts

Radioisotope releases

Impact on IMS Noble Gas Monitoring

Station:

Nuclide: Xe-133m Xe-135 Xe-133 Xe-131m

Start Date: 2021/04/04

End Date: 2021/04/10

Options: ☒ Log ☐ Linear ☒ Line ☐ Points Size:

Zoom: ☒ X ☐ XY ☒ Cross Zoom ☐ Integral ☐ Pan Zoom

Data Analysis: ☒ STAX Station ☒ autoSaint ☐ MDR ☒ Differences > 2xError

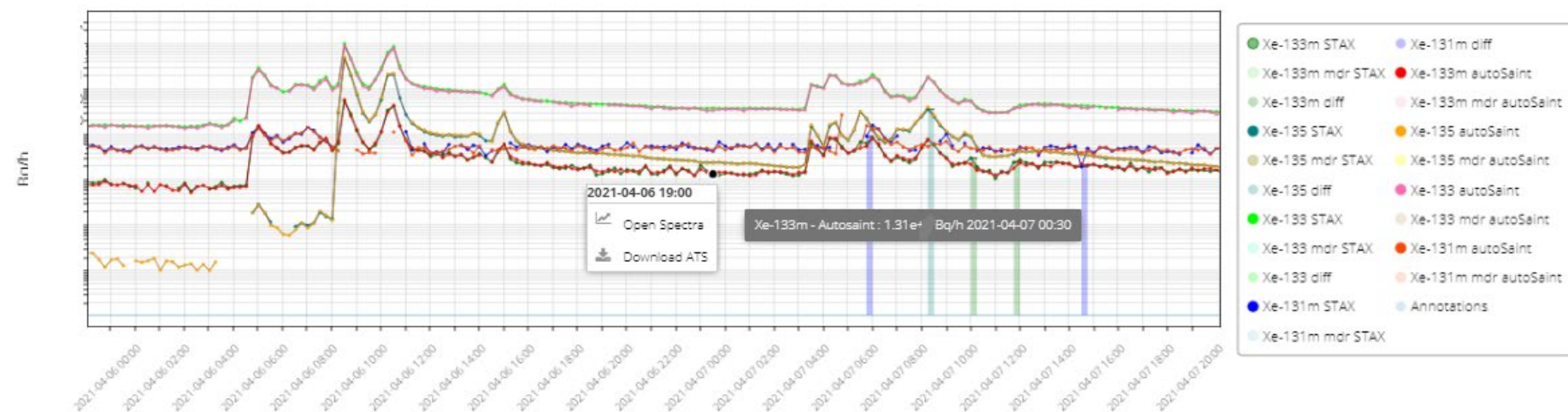
Emissions integral for time interval 2021-04-05 23:28 - 2021-04-07 20:43

Nuclide	STAX	STAX / All	Autosaint	Autosaint...	Duration
Xe-133m	Bq	175 / 181	Bq	179 / 181	45.2 hours
Xe-135	Bq	153 / 181	Bq	172 / 181	45.2 hours
Xe-133	Bq	181 / 181	Bq	173 / 181	45.2 hours
Xe-131m	Bq	148 / 181	Bq	173 / 181	45.2 hours

Emissions Chart

Xe-133m,Xe-135,Xe-133,Xe-131m Emissions

2021-04-04 - 2021-04-10



Isotopic ratio

Y Axis: Xe-135 / Xe-133 Load Ratios

X Axis: Xe-133m / Xe-131m

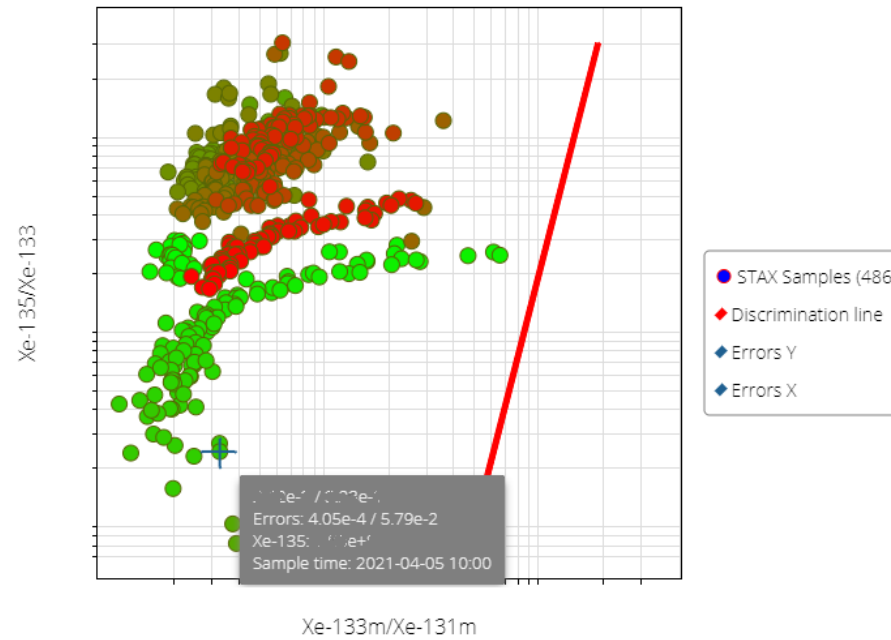
Results: ☒ STAX ☐ autoSaint

Colors: ☒ Time ☐ Activity Nuclide: Xe-135 Min: from data Max: from data

4 Isotopes Ratios Chart

Xe-135/Xe-133 vs Xe-133m/Xe-131m

2021-04-04 - 2021-04-11



2021-04-04

2021-04-11

Save Ratios as CSV

Save Ratios as PNG

Spectrum Plot

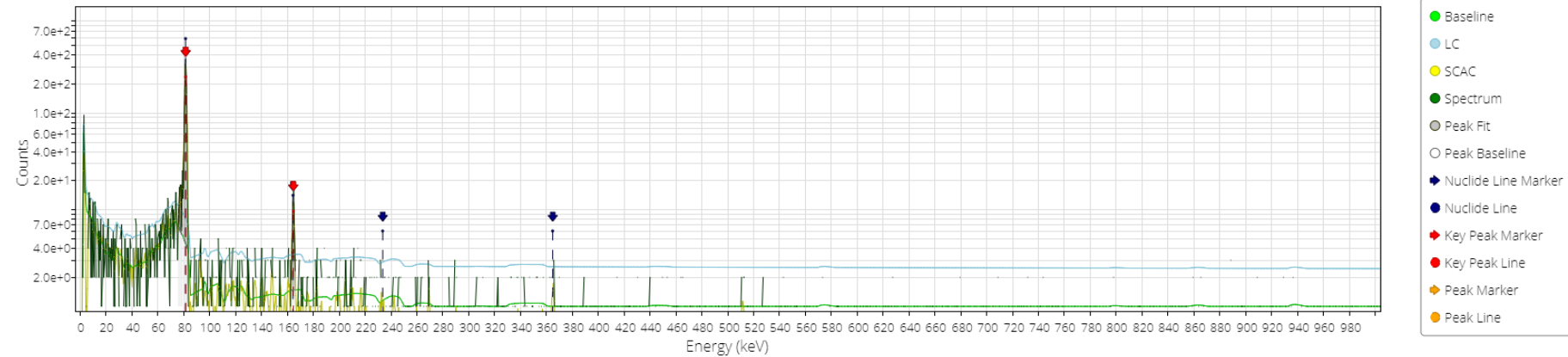
856022299608949206__PHD__2021_04_28T14_00_00.TXT Processed Spectrum (autoSaint)

Plot: ☒ Log ☐ Linear ☐ Energy ☐ Channel ☒ Grid

Zoom: ☒ X ☐ XY ☐ Cross Zoom ☐ Pan Zoom ☐ Cross Hair

[Download PHD](#) [Save Chart Image](#) [Save Results](#)

856022299608949206__PHD__2021_04_28T14_00_00.TXT Processed Spectrum (autoSaint)



[Undo Zoom](#) [Reset Zoom](#)

Analysis Results

[< Previous](#) [Next >](#)

Analysis	Nuclide	Line Energy (...)	Centroid En...	Peak Area C...	Uncertainty ...	FWHM	Emission (Bq...	Uncertainty ...	MDR (Bq/h)	Concentrati...	Uncertainty ...	MDC (Bq/m...	Activity (Bq)	Uncertainty ...	MDA (Bq)
autoSaint			77.001	6.955003e+1	1.185866e+1	1.407									
autoSaint	XE-133	80.997	81.018	1.819915e+3	4.311303e+1	1.410	3.336302e+7	3.513431e+6	1.048791e+6	4.877635e+4	5.136595e+3	1.533321e+3	8.226495e+2	8.663250e+1	2.606645e+1
STAX	XE-133		80.998	1.752200e+3	5.049620e+1	1.196	3.260560e+7	3.393960e+6	1.779800e+6	4.766901e+4	4.961930e+3	2.602047e+3	8.039733e+2	8.368664e+1	4.388546e+1
STAX			153.858	1.931880e+1	6.098640e+0	0.617									
autoSaint	XE-131M	163.930	164.220	6.413649e+1	9.542013e+0	1.453	1.462930e+7	2.601406e+6	7.827611e+6	2.138787e+4	3.803225e+3	1.144388e+4	3.607224e+2	6.414423e+1	1.945459e+2