

XENONnT Offline Monitoring

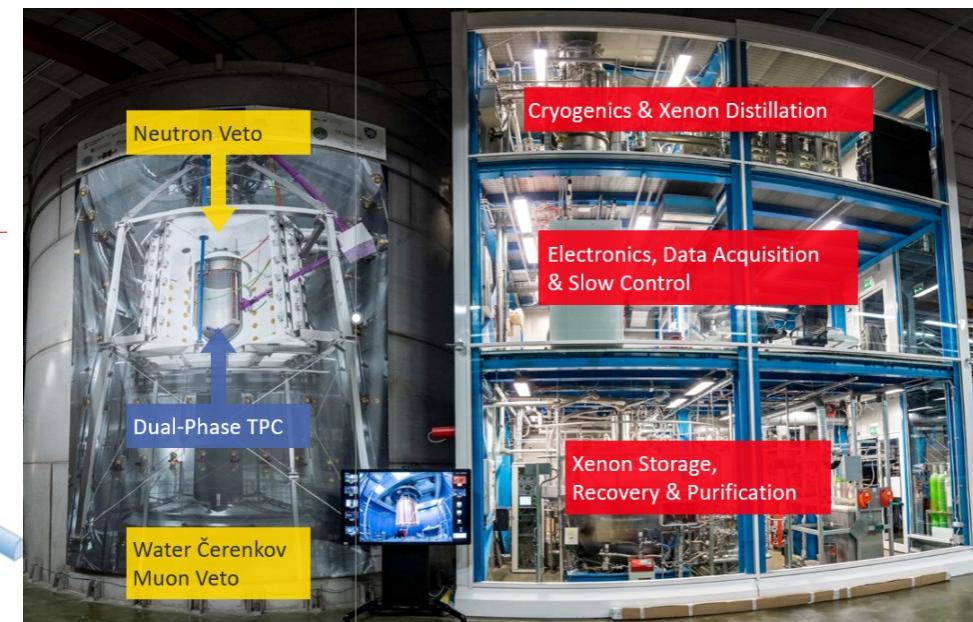
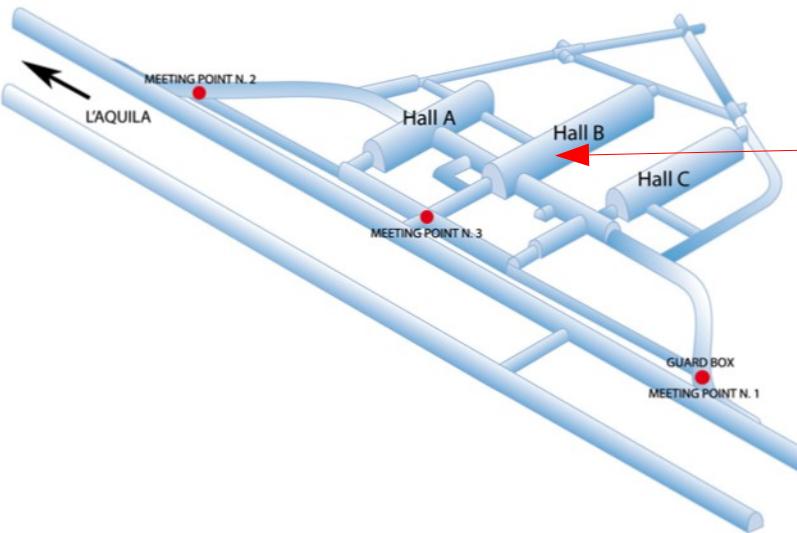
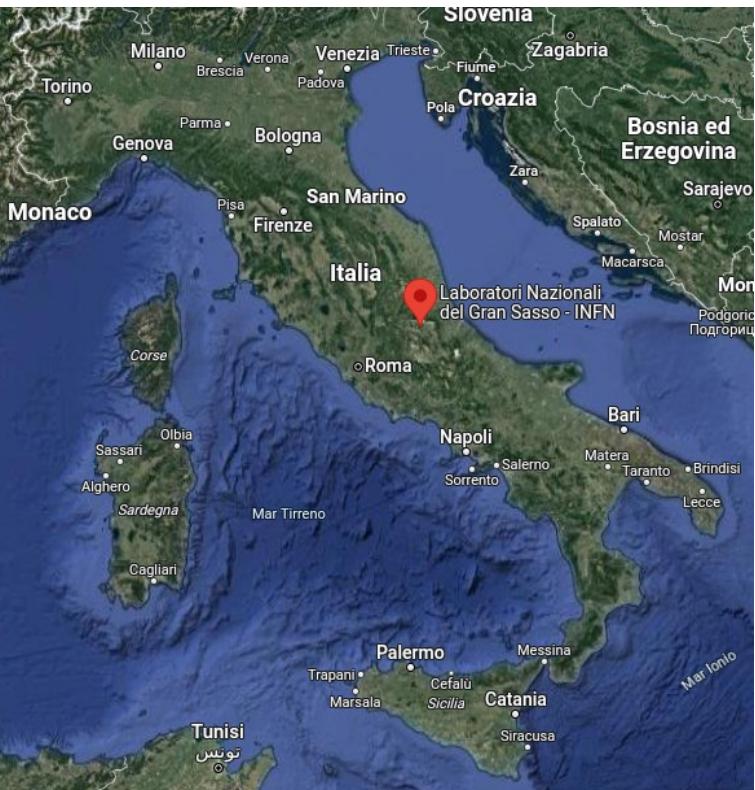
23 june 2023

Quentin Pellegrini, LPNHE

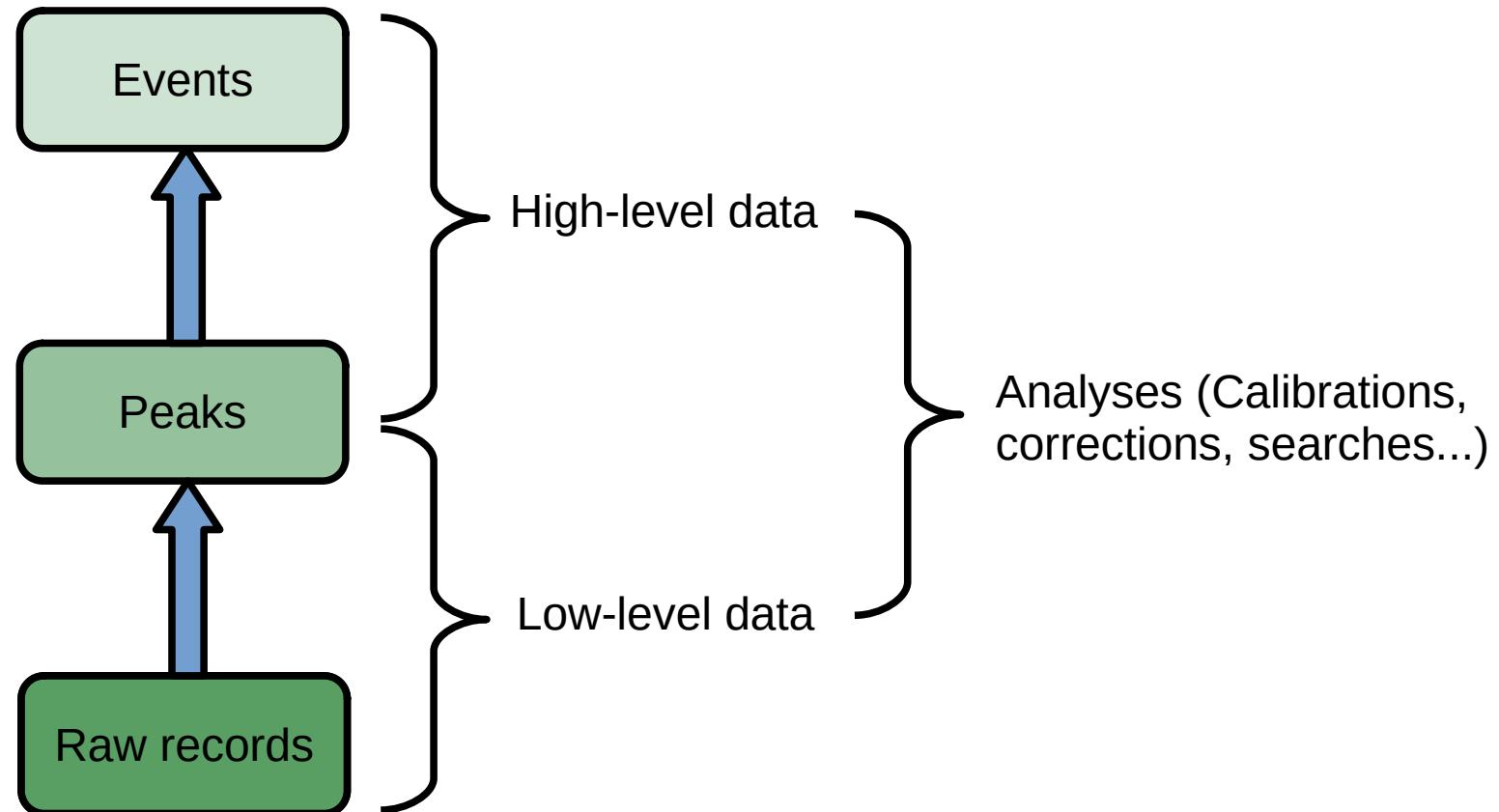
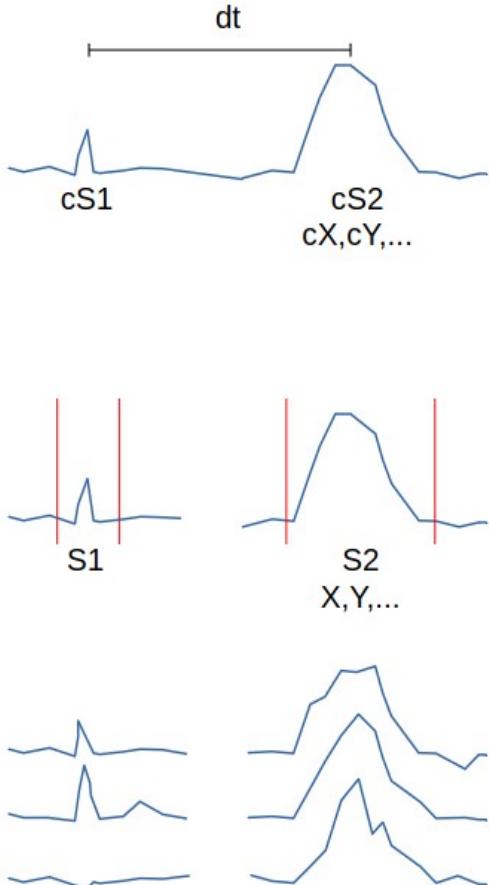
Summary

- Data management on XENONnT
- XENONnT Offline Monitoring (XOM)

XENONnT



Data structure



data processing performed by **strax software**

XENONnT monitoring analyses browse most of datatype set
 → **Source of complexity**

Data Flow

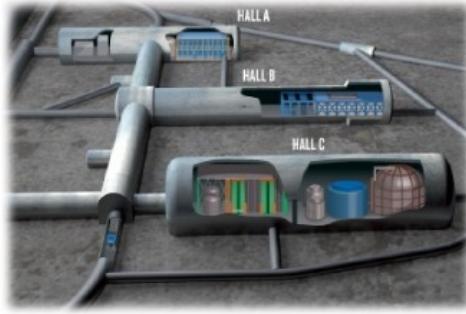
Run DB : Data base for runs (name, tags, location, availability...)

52896	tpc,muon_veto,neutron_veto	background_linked	2023-06-17 21:34 05:00:03
52895	tpc,muon_veto,neutron_veto	background_linked	2023-06-17 16:33 05:00:03
52894	tpc,muon_veto,neutron_veto	background_linked	2023-06-17 11:32 05:00:03

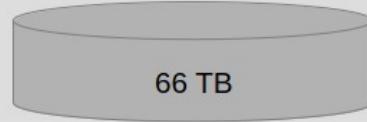
[_sr1_preliminary](#)
[phase1](#)

[_sr1_preliminary](#)
[phase1](#)

[_sr1_preliminary](#)
[phase1](#)



DAQ Event Builders
LNGS underground



Datamanager
LNGS on surface



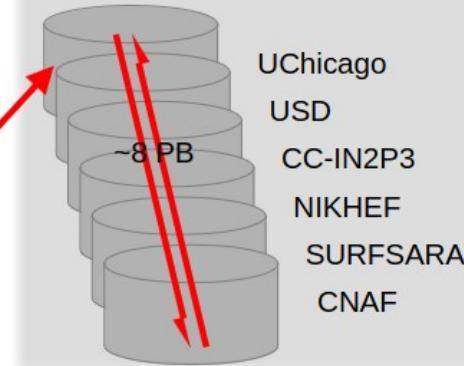
Data flow handled by aDMIX (github.com/XENONnT/admix)
 and Rucio (rucio.cern.ch)

Average rate (including calibrations) : 1 PB / year

Redundancy x2 for raw data:

- disks+tapes (current science run)
- tapes+tapes (previous runs)

US and EU GRID sites
Raw data



UChicago RCC "Midway" GRID
Processed data



Monitoring needs data from multiples sites
 → **Data availability complexity**

XENONnT Monitoring Status



XENON monitoring



Detector Condition	Data Acquisition	Data Processing	Data Storage
Detector KPIs Detector Condition	DAQ crates Data Acquisition	Bootstrax Data Processing	Data Availability Data Storage
DST Detector Condition	DAQ Hosts Data Acquisition	Corrections Data Processing	Data Manager Data Storage
GdPlant Detector Condition	DAQ Status Data Acquisition	EB core temperatures Data Processing	Data Transfer Data Storage
GdPlant - Chiller Detector Condition	Data Rates per Channel Data Acquisition	NVeto Online Monitor Data Processing	Rucio Usage Data Storage
Purity Monitor Detector Condition	PMT Monitor Data Acquisition	PMT gain evolution Data Processing	
RAD Detector Condition		TPC Online Monitor Data Processing	
Water Loop Plant Detector Condition		Xedocs Data Processing	

XENONnT Monitoring Status



XENON monitoring



Detector Condition	Data Acquisition	Data Processing	Data Storage
Detector KPIs	DAQ crates	Bootstrax	Data Availability
Detector Condition	Data Acquisition	Data Processing	Data Storage
DST	DAQ Hosts	Corrections	Data Manager
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GdPlant	DAQ Status	EB core temperatures	Data Transfer
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Detector Condition	Data Acquisition	Data Processing	Data Storage
Purity Monitor	PMT Monitor	PMT gain evolution	
Detector Condition	Data Acquisition	Data Processing	
RAD		TPC Online Monitor	
Detector Condition		Data Processing	
Water Loop Plant		Xedocs	
Detector Condition		Data Processing	

XENONnT Monitoring Status

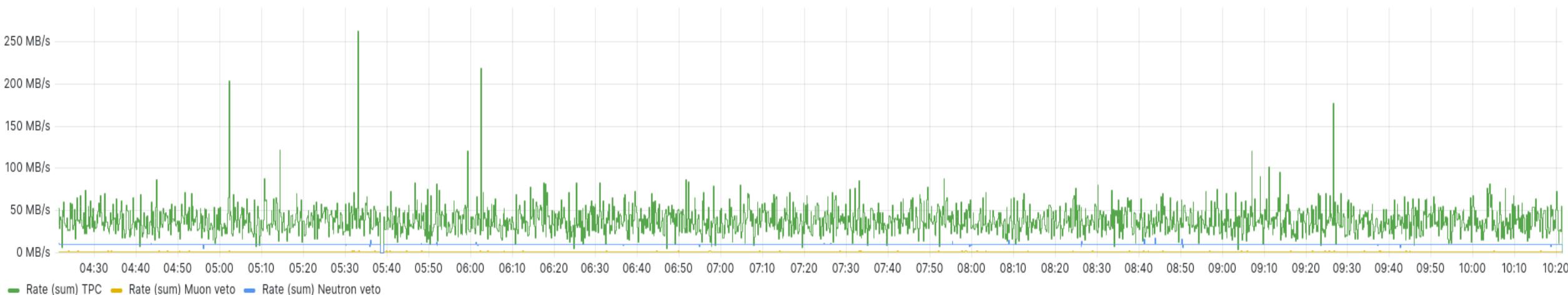


XENON monitoring

Home > Dashboards > Data Acquisition > DAQ Status ⭐ 🔍

Add ▾ 📁 ⚙️ Last 6 hours CEST 🔍 5s ▾ ⌂

Sum data rates



Reader state

TPC	Running
Neutron veto	Running
Muon veto	Running

04:30 05:00 05:30 06:00 06:30 07:00 07:30 08:00 08:30 09:00 09:30 10:00

Run mode

TPC	background_linked
Neutron veto	background_linked
Muon veto	background_linked

04:30 05:00 05:30 06:00 06:30 07:00 07:30 08:00 08:30 09:00 09:30 10:00



XENONnT Monitoring Status



XENON monitoring

Chicago/Houston

21:26:59

-05:00 CDT

New York/Indianapolis

22:26:59

-04:00 EDT

Rome

04:26:59

+02:00 CEST

Tel Aviv

05:26:59

+03:00 IDT

Beijing

10:26:59

+08:00 HKT

Tokyo

11:26:59

+09:00 JST

Detector Condition

Detector KPIs

Detector Condition

DST

Detector Condition

GdPlant

Detector Condition

GdPlant - Chiller

Detector Condition

Purity Monitor

Detector Condition

RAD

Detector Condition

Water Loop Plant

Detector Condition

What about Analyses ?!

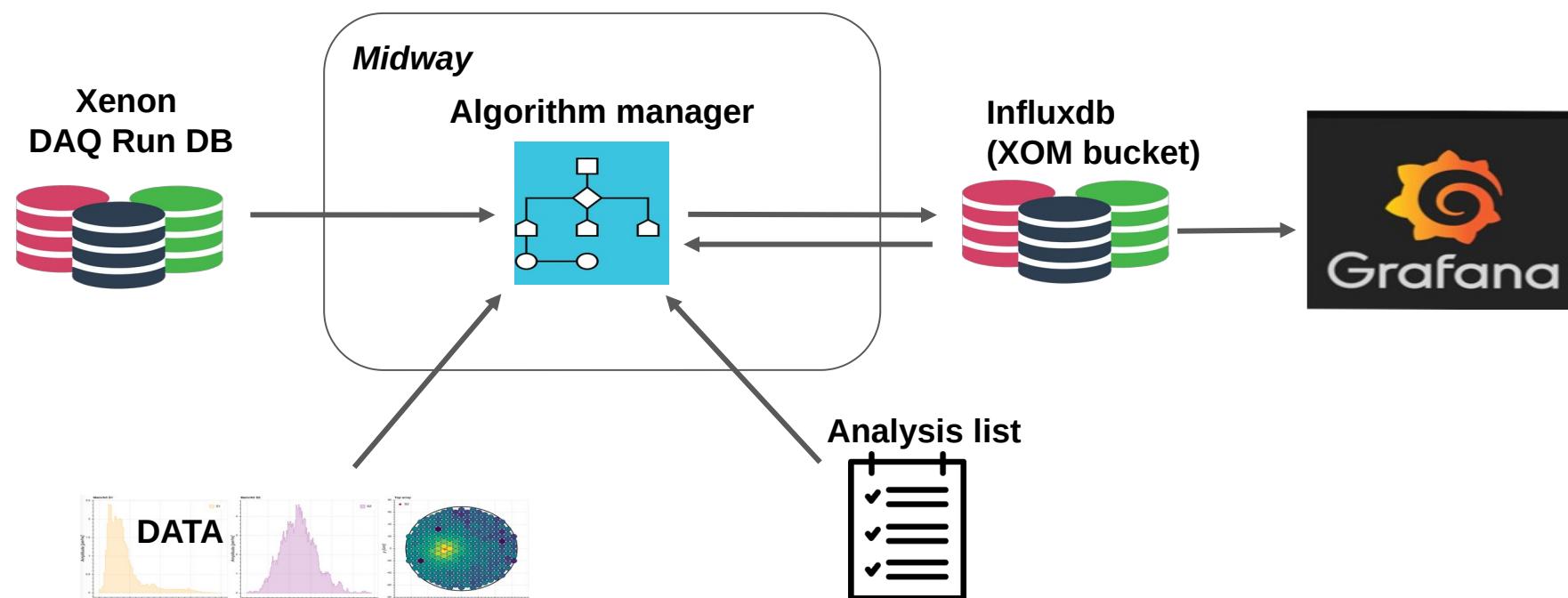
XOM !

XENONnT Offline Monitoring (XOM)

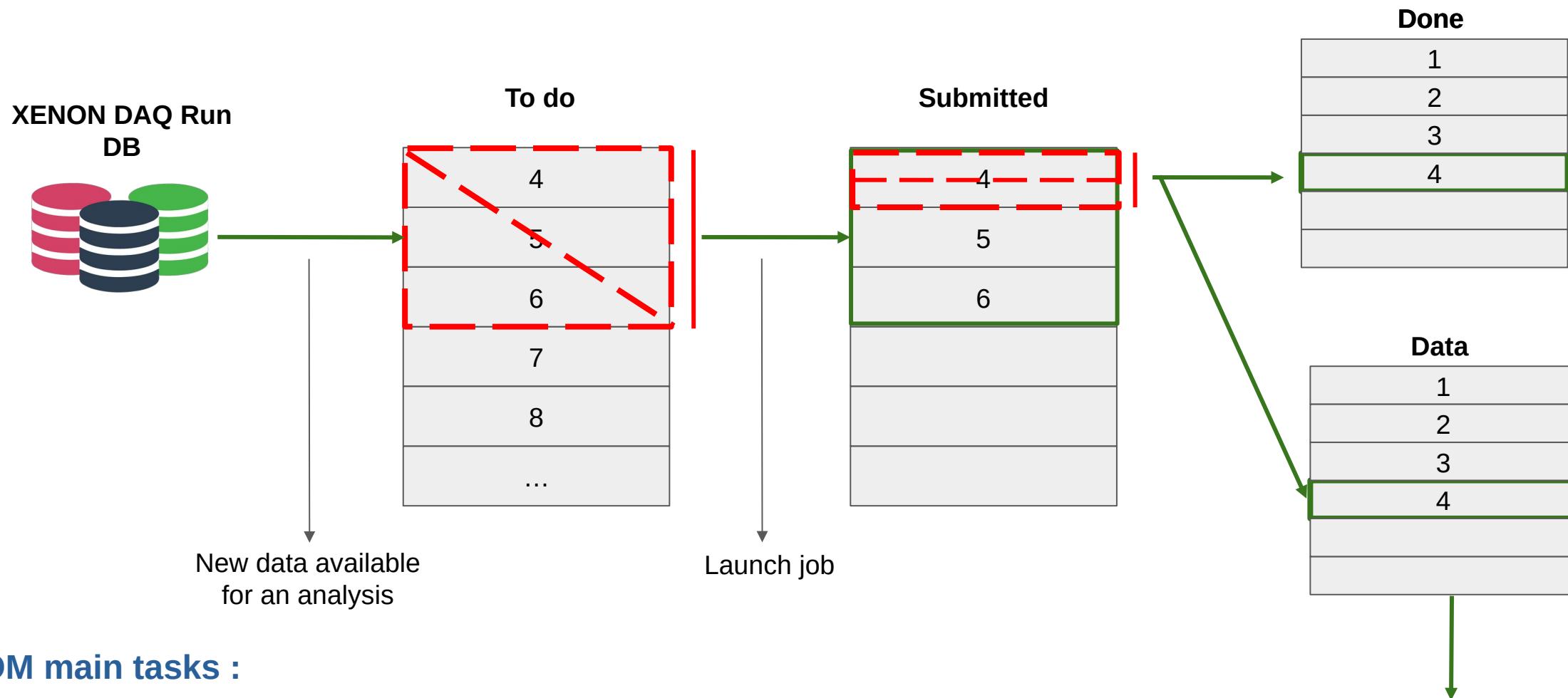
Recent Tool developed within the xenon team (LPNHE) by **Romain Gaior** and me.

Allows automatically running analyses as new data appaears (independantly of complexity, data type...)

Analysis results are displayed in XENON Grafana



Xenon Offline Monitoring (XOM)



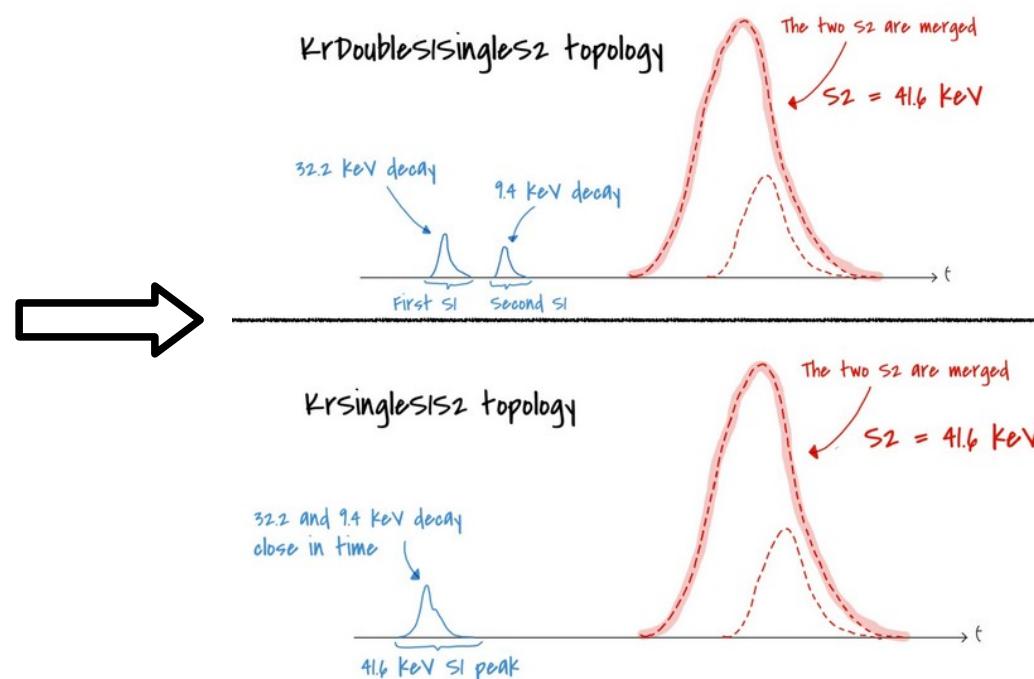
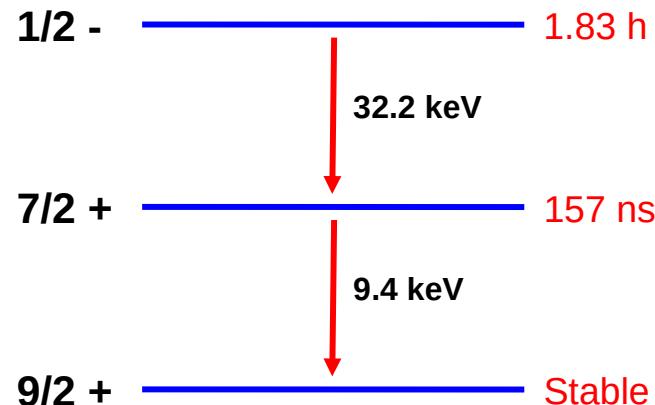
XOM main tasks :

- Check data availability for analyses
- Generate and follow analysis jobs



An example !

Kr83m bimonthly calibration



Parameters

$$LY = \frac{S_1}{E}$$

$$CY = \frac{S_2}{E}$$

$$S_2(E) = S_2(0)e^{-\frac{\Delta t}{\tau_e}}$$

LY (9.4, 32.2)
CY (41.6)
Electron lifetime

LY (41.6)
CY (41.6)
Electron lifetime

Krypton Calibration Script :

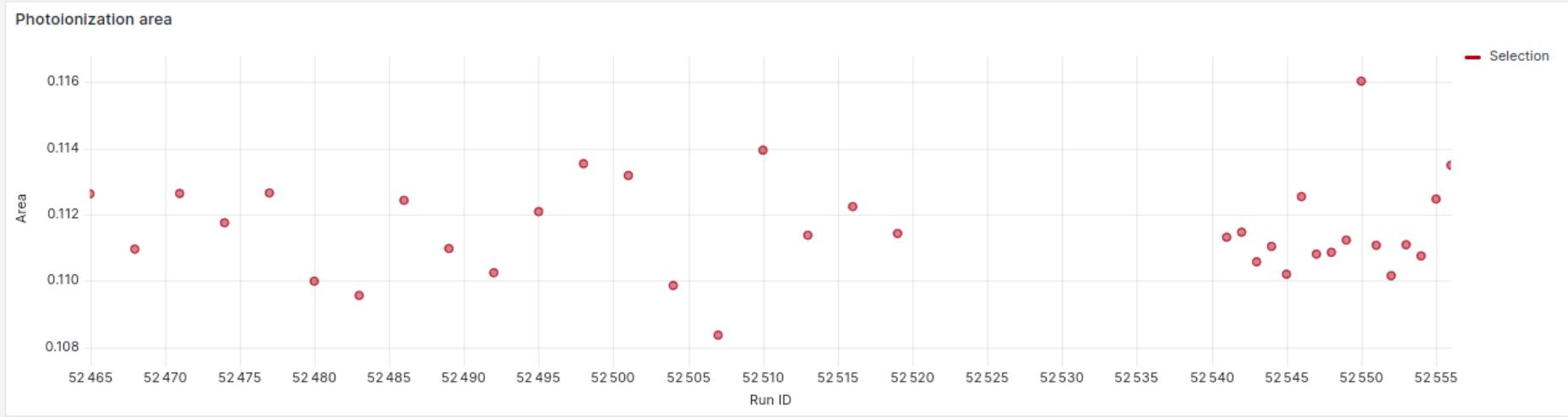
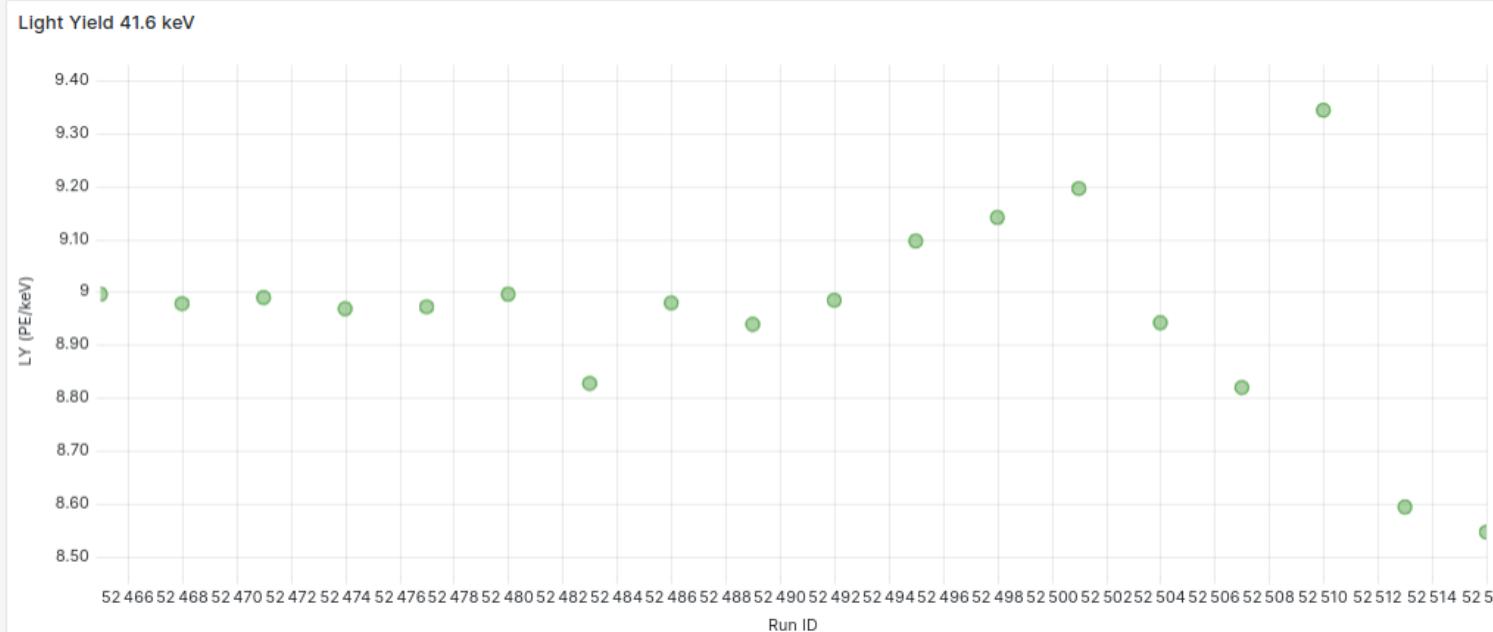
- Data selection for a Krypton run thanks to **Maxime Pierre**
- Calcul of the mean via simple mean or gaussian fit
- Compute LY, CY



XENON

XOM and Grafana

☰ Home > Dashboards > XOM > Demonstrator ⭐ 🔍



Conclusion

- XOM is currently running four analyses (Krypton LY, Event number, Scada, Photoionization area)
- New analyses are coming soon (Muon and neutron veto...)
- We will improve XOM robustness as new analyses are added
- XOM will centralize and automate analysis for monitoring
- It is an excellent tool to test data availability and data quality
- XOM responds to a strong need for XENON collaboration
- Data base management and Graphana
- Data availability, analysis context and diversity
- Visibility, responsibilities and interactions in XENON



Thank you for your attention

23 june 2023

Xenon Offline Monitoring (XOM)

proc_compare.py

Load analysis_list

If new_run in rundb:

For analysis in analysis_list:

If new_run is good for analysis:

Add entry in TODO db

proc_runner.py

Load analysis_list

For analysis in analysis_list:

Check data availability (st.select_run)

Store the list of run available

For entry in TODO db:

If running number of jobs < limit:

If data is available:

Submit the job to do

Add entry in the SUBMITTED db

Delete entry in the TODO db

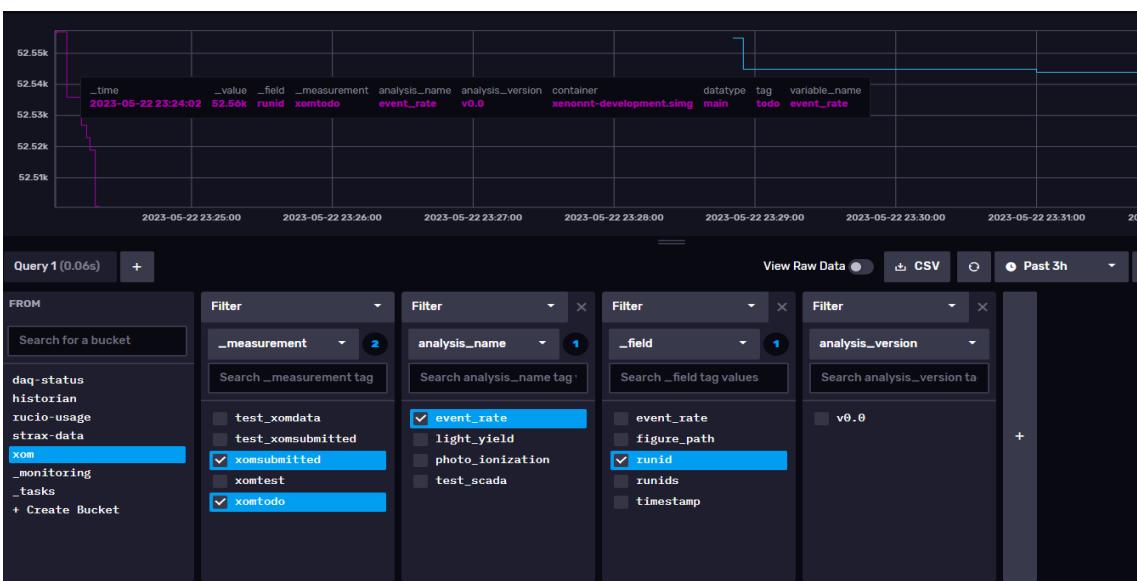
For entry in SUBMITTED db:

Check status of the job

If finished:

Add entry in DONE db

Delete entry in the SUBMITTED db



import xomlib

main(run_id):

#load the data

st = cutax.xenonnt_online(_rucio_local_path='/project/lgrandi/rucio', include_rucio_local = True)
st.storage += [strax.DataDirectory('/project2/lgrandi/xenonnt/processed', provide_run_metadata=True)]

do whatever interesting

data processing here

create a xom object with the analysis result

xomresult = xomlib.Xomresult(analysis_name="photo_ionization",
analysis_version = "v0.0",
variable_name='area',
variable_value=area,
runid=int(run_id),
data= {"area":area, "rate":rate})

simply adds a message in the log

save the result in the DB with the correct format

xomresult.xom_message(success=True)

xomresult.save()