Exploration of DM and ML at Arronax GIP

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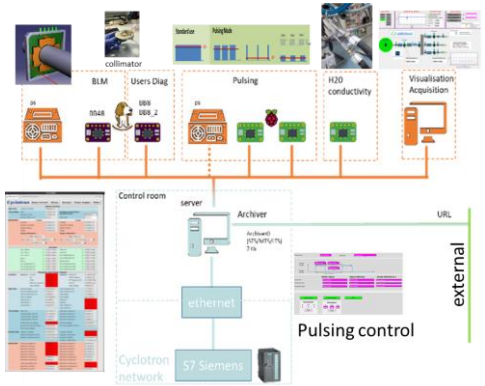
DM and ML at Arronax GIP

Cyclotron C70 multi-ions

EPICS Data collection:

- Accelerator
- Beam Diagnostics (BLM, collimators,H_0)
- Environment Diags (ambiance,water, gaz,..)



- Small team, local computers, limited Diags & Dvts
- Data mining and Machine Learning for production of radionucleides
  - Offline Data coming from Accelerators mainly (<5Hz) with the new data acquisition (EPICS based)
- Dealing with time series data
  - Two extremes case studies interesting for us: short timing and long duration irradiation
- Can we identifies
  - Specifics breakdowns?
  - Settings that lead to breakdowns? Or even target damages
  - Inadapted operation? Secure production?

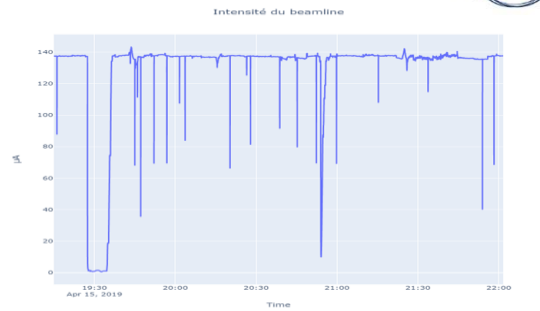
DM and ML at Arronax GIP

- Significant events:
  - Machine breakdowns (beam intensity), fluctuations, (drifts not here)
- Monovariable to multivariable later on
  - From source to RF variables
  - Some first studies (IPAC'23 : "Exploration DM & ML at Arronax")
- Today (M2 student):
  - Machine learning: here blind
    - Do we learn something?
    - Models:

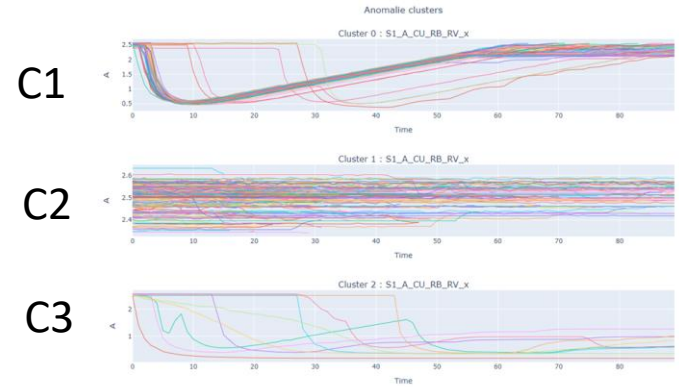
```
# Dictionnay of models to train
models_to_train = {
    'KNN' : KNN(n_jobs = -1),
    'LOF' : LOF(n_jobs = -1),
    'CBLOF' : CBLOF(n_jobs = -1),
    'IForest' : IForest(n_jobs = -1),
    'GMM' : GMM(),
    "SVM" : OCSVM()
}
```

  - Active learning (just started):
    - Basic knowledge but specialist not as input yet

Data



Clusters identification

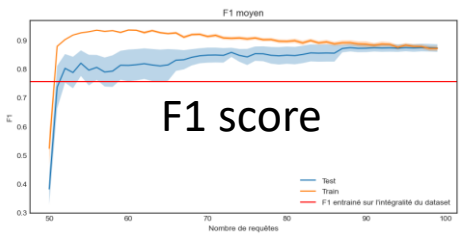


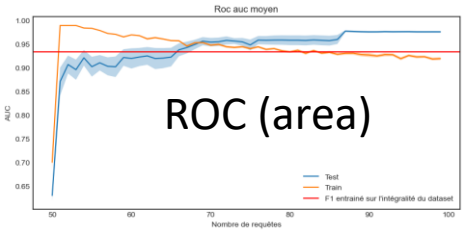
C1

C2

C3

Testing model active learning: CBLOF, 2 s windows





PhD student starting in October 2023