Pyrate update

SABRE Italia Meeting
1-2 March 2023, Roma “La Sapienza”
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State of the art

- Two different **DAQs**:
  - **SABRE North DAQ**
    - Working with digitizer CAEN V1720;
    - Needs modification to be used for the full-scale experiment;
  - **SABRE South DAQ**
    - Actually working with digitizer CAEN V1730, but it can work also with V1720.
    - It is designed for the full-scale experiment.
- Two different **reconstruction software**:
  - **Chimera**
    - Used for data acquired with the SABRE North DAQ;
    - Fully validated with PoP and PoP-dry data;
  - **Pyrate**
    - Pretty flexible, in principle can be used both for data acquired with the SABRE North and SABRE South DAQs;
    - Needs some coding to be ready to use and has to be validated.

Future goal

Converge to the same DAQ and reconstruction software → SABRE South DAQ and Pyrate.

Require a joint North/South effort

Pros

- The SABRE South DAQ is already designed for the full-scale experiment;
- The SABRE South group has expertise in developing and maintain the DAQ (such expertise is currently missing in the SABRE North group);
- Same analysis tools for the SABRE physics phase.

Cons

- Pyrate is not ready to use (a non-negligible amount of work is still needed);
- Pyrate needs to be validated;
- Not many people are working on this on the South side (up to now only Peter McNamara);
- We are few people and we have little time to work on that.

Pyrate code

- Pyrate can be downloaded from:
  https://bitbucket.org/darkmatteraustralia/pyrate/src/CrystalTesting/
  (bitbucket access needed, ask Federico Scutti);
- We are using the branch CrystalTesting;
- To setup Pyrate on the LNGS cluster:
  ```
  source /nfs/sabre2/software/root-v6.22.08-install-py3/bin/thisroot.sh
  PATH=/nfs/sabre2/software/python3.7-install:/nfs/sabre2/software/python3.7-install/bin:$PATH
  export LD_LIBRARY_PATH=$ROOTSYS/lib:$PYTHONDIR/lib:$LD_LIBRARY_PATH
  export PYTHONPATH=$ROOTSYS/lib:$PYTHONDIR/lib/python3.7/site-packages/:$PYTHONPATH
  export LD_LIBRARY_PATH=/nfs/sabre2/software/python3.7-install/lib:$LD_LIBRARY_PATH
  ```
- To run pyrate:
  ```
  source setup.sh
  pyrate -j ../scripts/CrystalReco.yaml
  ```
  - In CrystalReco.yaml you can set the path of the file you want to process, and the config file containing the list of the variables that need to be calculated.

What has been done

- I built two equivalent NaI-33 datasets (one processed with Pyrate and the other with Chimera) which can be used to make comparisons between the two reconstruction software;
- Each dataset contains 6 runs of 24 h each and it is acquired in Hall B into the new copper shielding.
- You can find them at the following paths:
  - **Pyrate dataset:** /nfs/sabre2/data/AustralianDAQ_NaI-33/ProcessedFiles/CrystalProcessed_16-21Sept2022.root
  - **Chimera dataset:** /nfs/sabre2/data/SABRENorth/flat_output/Flat_HallB_new_6days.root

- If you need **raw files** instead, you can find them at:
  - **Files to be processed with Pyrate:** /nfs/sabre2/data/AustralianDAQ_NaI-33 (from 16 to 21 September);
  - **Files to be processed with Chimera:** /nfs/sabre2/data/SABRENorth/HallB_new/NaI-033/daq (from run 30 to 35).

What should be done

- Make comparisons of variables reconstructed with Pyrate and Chimera to validate the Pyrate code, and take note of what is missing or need to be modified;
  - To do this, the two NaI-33 datasets reconstructed with Pyrate and Chimera should be used;
  - Results can be collected in a shared document with Peter at the following link: https://docs.google.com/presentation/d/1kBs98Qg5EhCMqjzcvYJHyxEjqoloXxT7ApkvLLCg_WA/edit?usp=sharing
- Implement missing variables and eventually fix bugs;
- Some notes from our preliminary work (September 2022):
  - Variable "DeltaTrigger" which computes the time difference between two consecutive triggers is missing (used in minimal cuts):
    - We could use the Timestamp of the events and the Difference algorithm, or we need to implement a new algorithm;
  - Event ID is missing → important to find a way to make it progressive as multiple files news to be added together to form a dataset.