# Online Reconstruction - CM44

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# Why do we need a new Online Reconstruction framework?

The old Online reconstruction:

- Based on the open source python package Celery
- Used in MICE since 2010.

Even during Step I the old framework was set to process 1 of every 20 spills.

The installation of the two trackers and the EMR revealed big problems:

- Dramatic increase in the amount of raw data to be processed.
- Addition of new complex reconstruction algorithms.

The result was:

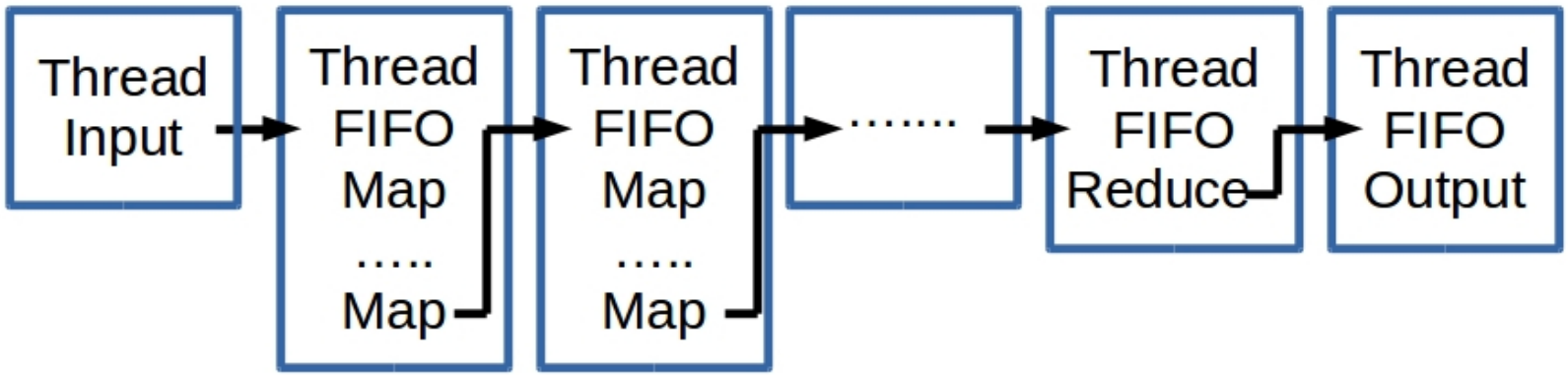
- A huge increase in the processing time needed to reconstruct a single spill.
- The Online reconstruction became unstable.

# Divide and conquer

Parallel computing: the large problem can be divided into smaller ones, which are then solved at the same time.

How does this work

- MAUS is used as a third party. All original MAUS maps and reducers are used without changing anything.
- The data processing is driven by a bunch of classes written c++11.
- Conveyer-like implementation of the job distribution.
- The code allows for a single-thread or a multi-thread processing.



# First tests in December

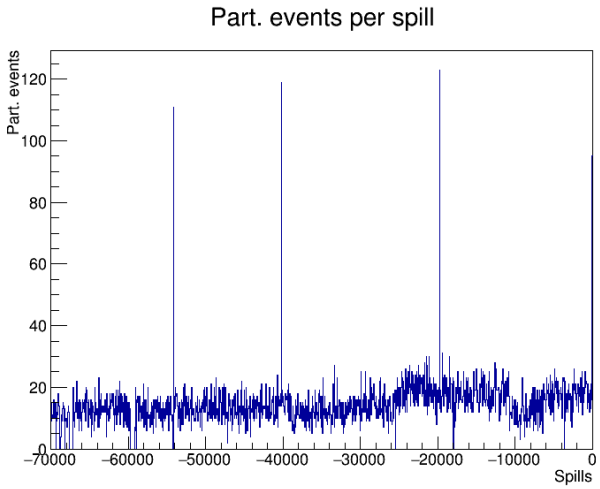
The new framework for the Online reconstruction was tested during the data-taking in December.

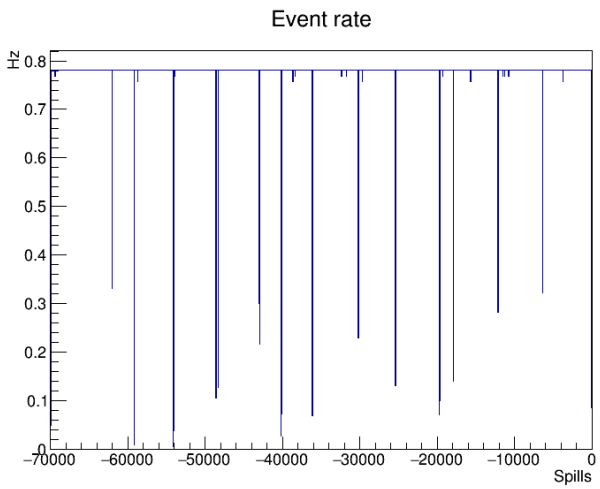
The new and the old frameworks had run in parallel on two different computers.

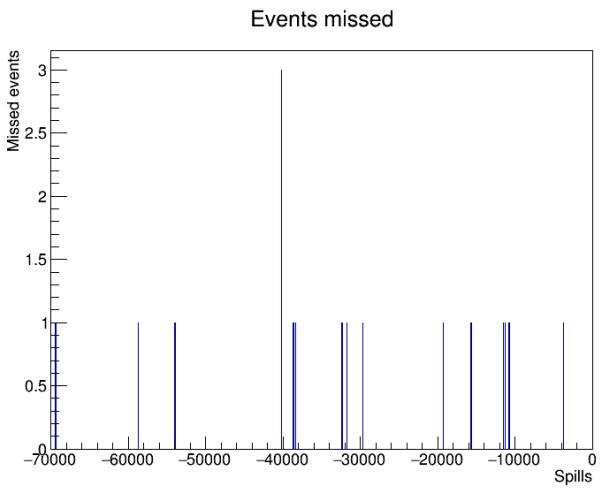
The new Online reconstruction was found to be much faster than the data-taking process, although this wasn't a definitive proof since DS was OFF and the rate was very low.

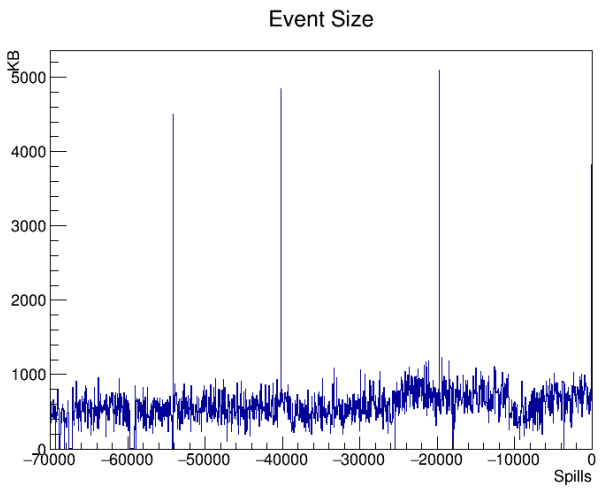
# More sophisticated tests in February and March

A special reducer, monitoring the Online reconstruction, has been developed. On the histograms: spill 0 is the last processed spill and the older spills have negative Id numbers.

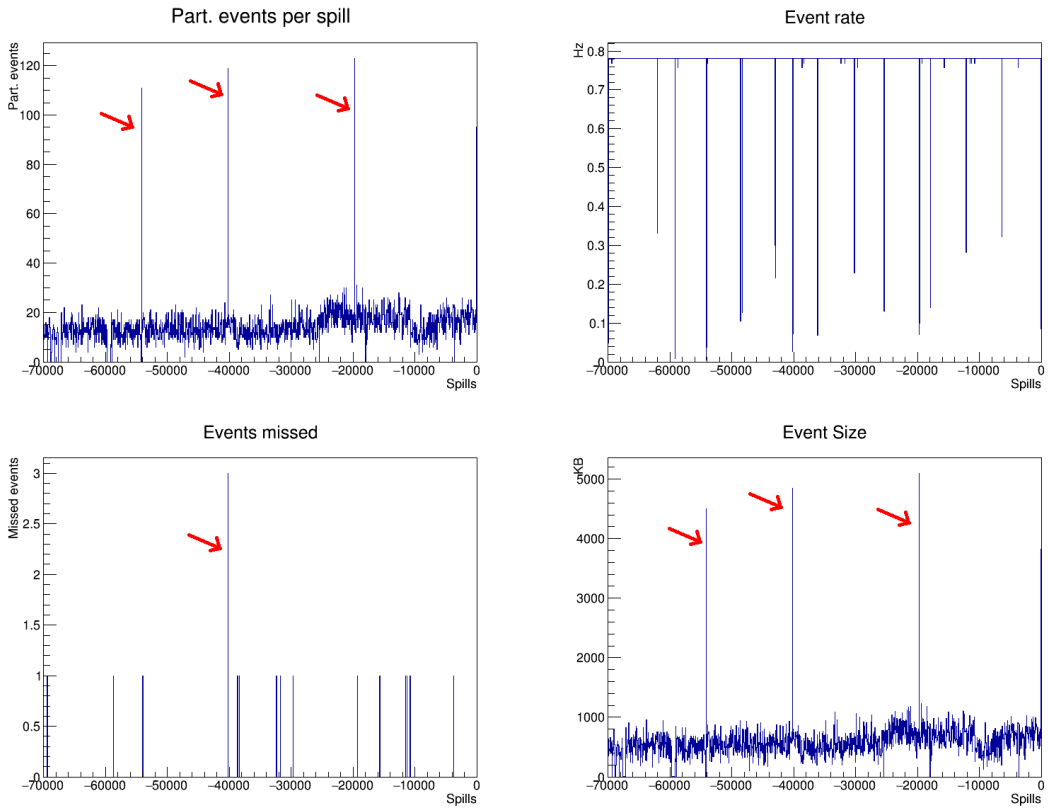


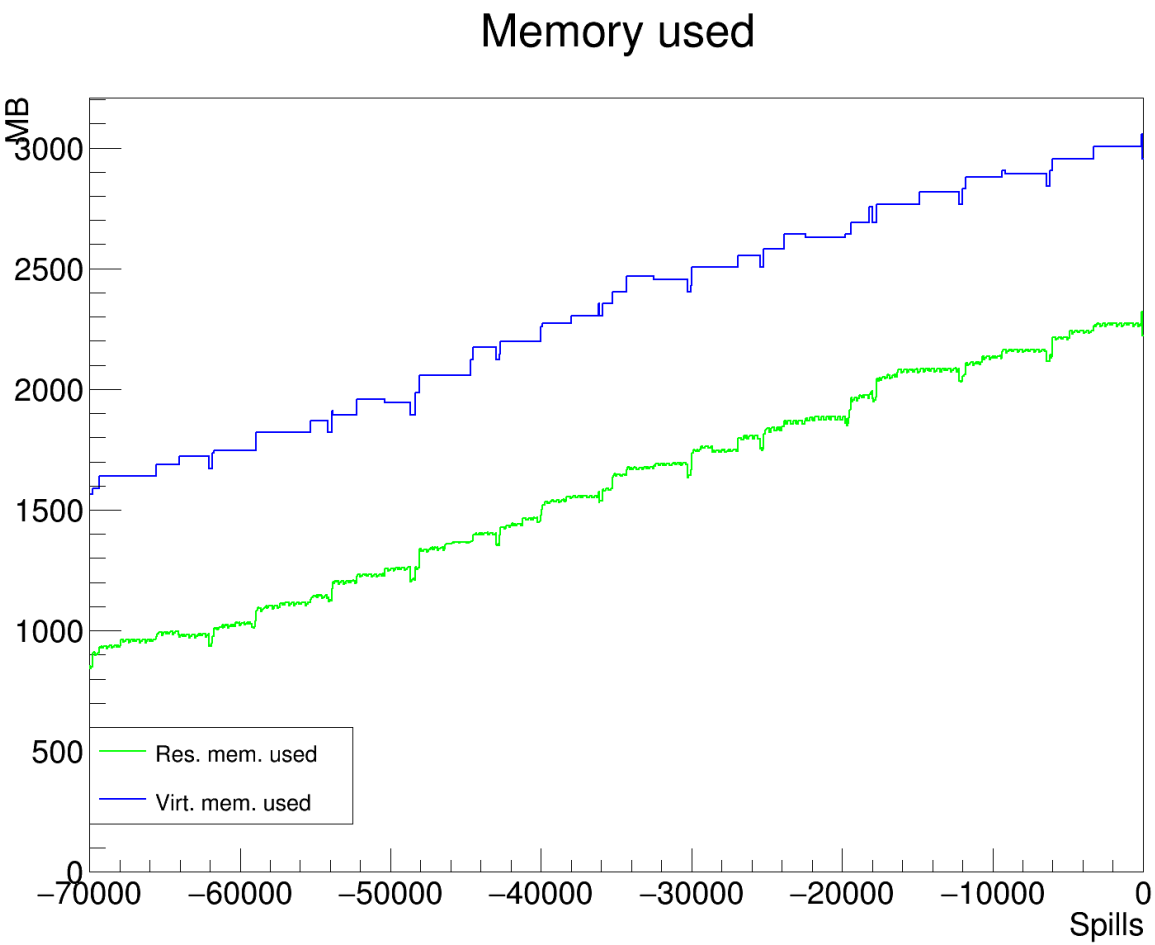



# More sophisticated tests in February and March




Pion Ref. runs taken at the beginning and at the end of the day. The Online reconstruction starts having problems when the DAQ event size is bigger than $\sim 6$ *GB*. Investigations have shown that most probably this is a network issue. Will investigate further, during the shutdown period.

# Software framework for fast data processing (mic11)




We still have a slow memory leak ($\sim 1$ *GB* for 24 hours of continuous data-taking).

# The Online Reconstruction daemon

- A background process checks periodically (every 30 s.) if the main online reconstruction process still runs. If because of some reason, the reconstruction process is dead, the daemon will restart it.
- The daemon also checks the memory consumed by the main process. If the memory usage exceeds 16 GB the main process will be restarted.
- If needed the Online Reconstruction can be stopped manually by running the script **stop_processing.sh**. This will stop the main process and will kill the daemon.

# Disk space problem

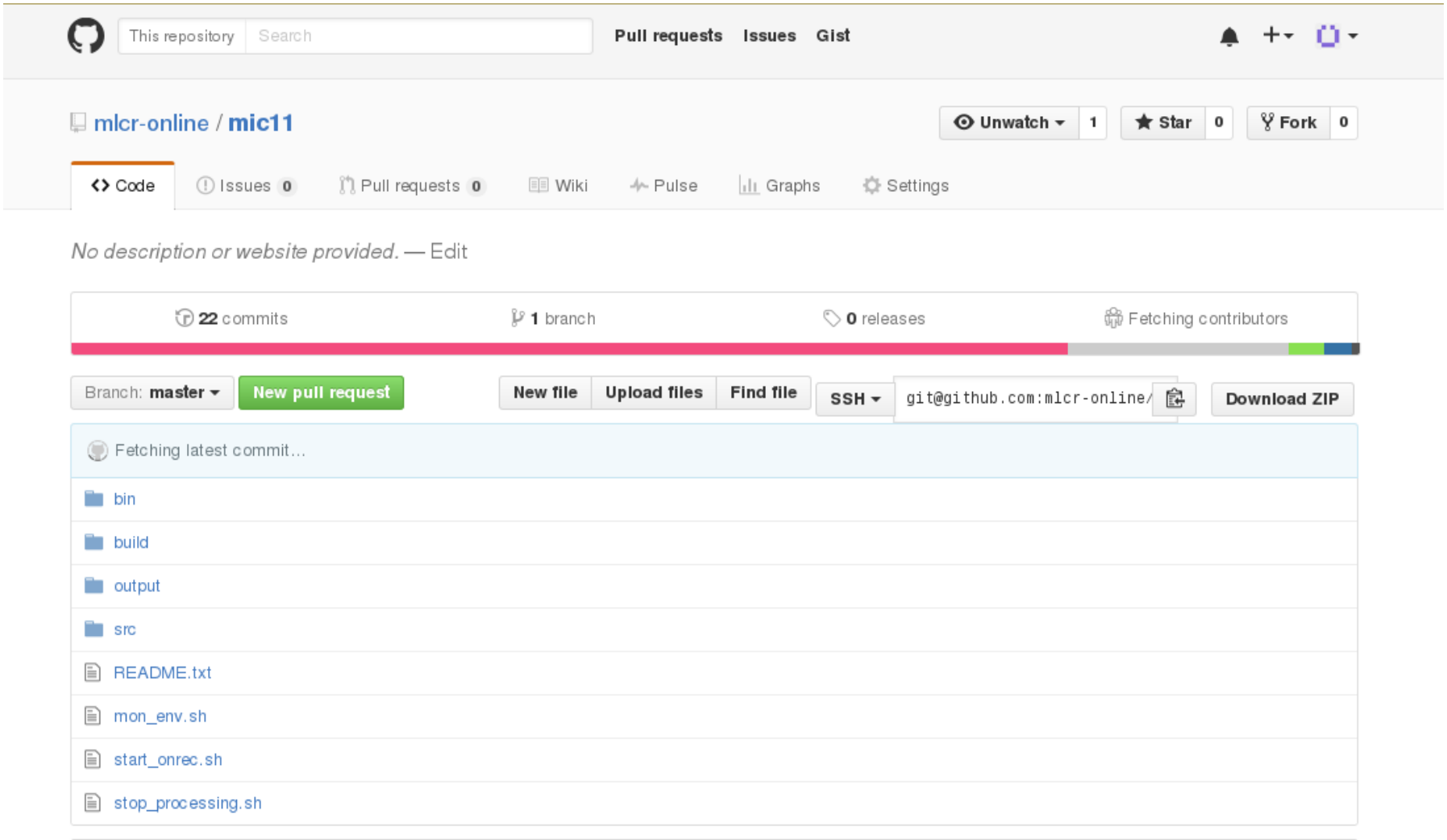
- Currently the Online Reconstruction produces histograms, but also outputs the reconstructed data (MAUS Data Structure) into a root files. This essentially duplicates the work done by the Offline reconstruction.
- However the OnRec computers are not suitable for storing data for a long period, due to the very limited storage space available. As a result, OnRec 02 runs out of disk space after few weeks of data-taking, causing malfunctioning of the Online reconstruction.

Tow possible solutions:

- Turn Off the output.
- Develop a proper management for the output root files.

# The source code is hosted on GitHub

https://github.com/mlcr-online/mic11



# Conclusion

- New framework for the Online reconstruction has been developed.
- Tested successfully during the last two running periods.
- Couple of minor issues have to be addressed, but in general the Online reconstruction is in a good shape and is ready for Step IV.