Application of PROOF system to optimization processes of physical analysis for the MPD experiment

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Outline

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What Is PROOF?

“PROOF, is an extension of ROOT enabling interactive analysis of large sets of ROOT files in parallel on clusters of computers or many-core machines.” (https://root.cern.ch/proof)
What Is PROOF?

To analyze data using PROOF, user has to write macro called selector. It contains files:

- Selector.C
- Selector.h
// MpddstSelector.h

class MpddstSelector : public TSelector{
/* Place to define list of TTree branches, and functions */
}

TSelector functions

- **Begin()** - executed on master at the beginning
- **SlaveBegin()** - executed on workers at the beginning
- **Init()** - executed on worker when getting new Tree
- **Process()** - executed on worker for every entry
- **SlaveTerminate()** - executed on worker at the end
- **Terminate()** - executed on master at the end
void MpddstSelector::Init(TTree *tree) {
  ...
}

Bool_t MpddstSelector::Notify() {
  return kTRUE;
}

void MpddstSelector::Begin(TTree *){} 

void MpddstSelector::SlaveBegin(TTree *){} 

Bool_t MpddstSelector::Process(Long64_t entry){} 

void MpddstSelector::Terminate(){}
How we run physical analysis

root [ 0 ] TProof::Open ( " " )

root [ 1 ] TChain* myChain = new TChain ( " cbmsim " )


....... you can add more file to myChain

root [ 3 ] myChain->SetProof()

But that's a lot of code to write

So I needed to:

- write macro which can read any quantity of data, and load it into TChain object
- write script which starts ROOT, run PROOF session implement variable, run macros, and so on….

Now it is in just one command (./runAnalyze.sh).
Results - data quality

Analysis result using PROOF

Analysis result using classic macro
Results

Time of processing dependence on number of events

**simple macro**

**complex macro**
Results

Speed up ratio = time of processing in classic batch approach / time of processing using PROOF
Results

Efficiency improvement is clearly dependence on number of workers, but it seems to be limited.
Results

MpddstSelector

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Plans for the future

● Developing system adjusting number of workers
● Creating Multi-Tier Master-Worker Architecture
Multi-Tier Master-Worker Architecture

Summary

● Processing of physical data is now much faster (from 2 to almost 16 times faster).
● It can be even faster.
● It can take less computer resources.
● It is still a lot of to do.
Thank you for your attention!

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