



GEANT4
A SIMULATION TOOLKIT

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New Developments In Analysis

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g4tools @ Lund



diff -u « since last workshop »

As a reminder...

- g4tools is an automatic extraction of some code found in the softinex/inlib and namespaced “g4tools” for an embedding in Geant4.
- Pure header code. Highly portable (including iOS and Android). Easily embeddable (no “config.h” or specific build tool in the way).
- Strongly OO. No implicit management.
- Thread safe (no writable statics).
- See <http://softinex.lal.in2p3.fr>

What's new



- HDF5 introduced in 2016/2017 (see Wolongong slides) : Histos and “column-wise, single-worker” ntuples.
- g4tools/hdf5 presented in a CHEP/Sofia poster.
- Writing files is fine, but being able to read them is better !
- Work done on apps to read g4tools/hdf5 files.
- row-wise mode for // ntuple writing at the ROOT format.
Presented also in the CHEP poster.

HDF5 : apps



- ioda/1.14.x app can read g4tools/hdf5 files, show directories and objects, plot histograms and do ntuple projection. (Available on Linux, mac, Windows, iOS, Android, docker).
- **Introduce gopaw** (The “Good Old PAW” ☺) : see CHEP Sofia dedicated poster. (Linux, mac, Windows, docker). gopaw engine in ioda/1.14 (then on iOS, Android).
- Provide examples to read these files from ROOT.

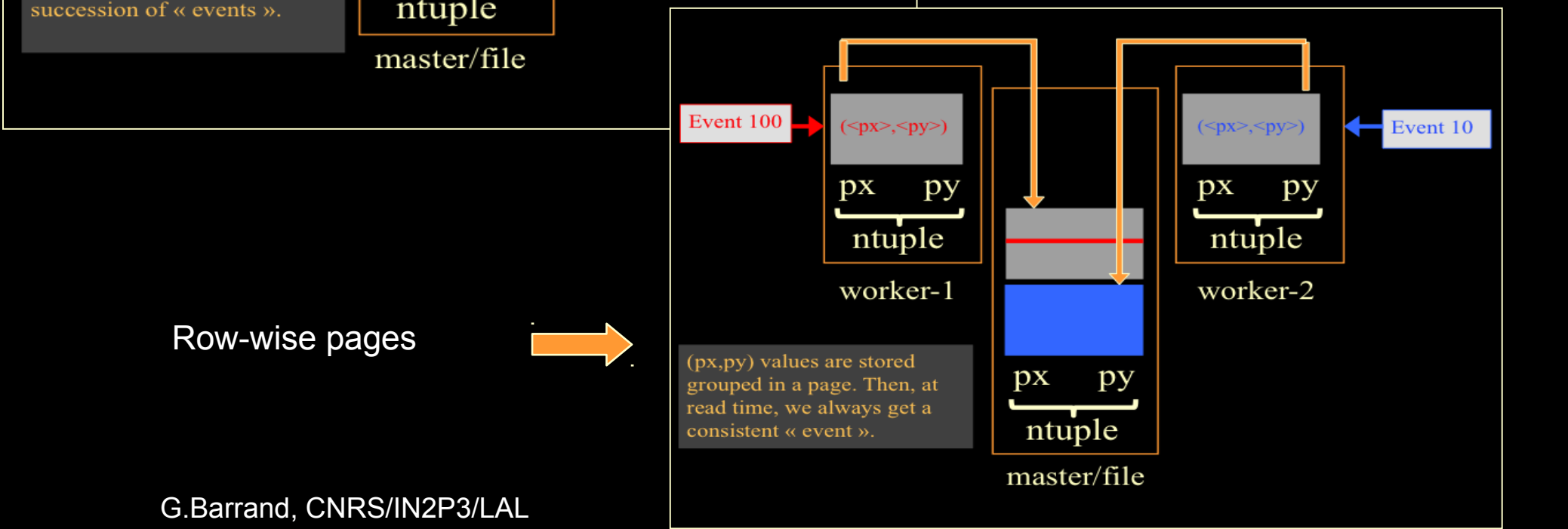
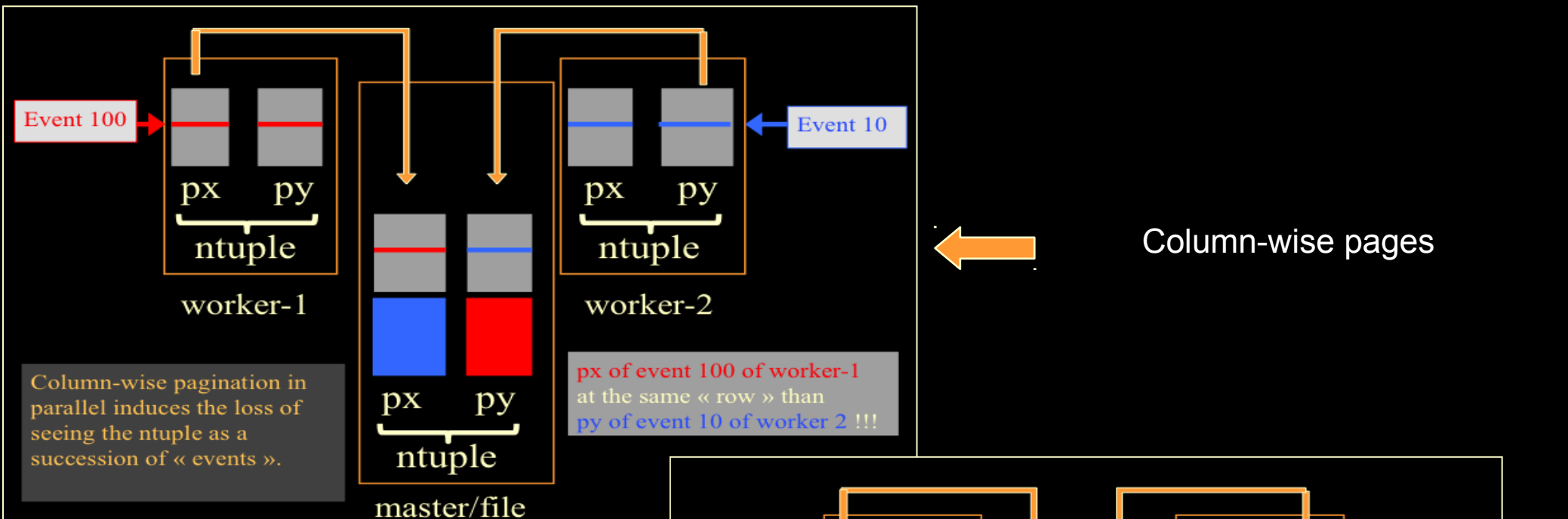
g4tools, ioda, gopaw : github



- Externalize web pages and code on Microsoft Github
- <https://gbarrand.github.io>
- <http://softinex.lal.in2p3.fr> points to github now.
- <https://github.com/gbarrand/g4tools.git>

row-wise for // ntuple...

- Writing in one master file pages per column coming from various threads/workers induce an overall lost of an “event view” of a given row at read time. (For a given row, various data in columns do not correspond to the same “event”).
- For the **ROOT format**, it is possible to restore a “row-wise” writing by keeping the effective per page logic sent from workers. (Technically, in the row-wise mode, we create one “TBranch” per ntuple).



G4analysis @ Lund

diff -u «since last workshop»

HDF5

- New **analysis/hdf5** sub-category in 10.4
- Support for HDF5 format, both G4AnalysisManager and G4AnalysisReader functions
- Added **test03/testHdf5** in geant4/tests
- Added **GEANT4_USE_HDF5** build option in Geant4 CMake configuration files
- In details presented at the Wollongong collaboration meeting

Merging Ntuples

- Introduced in 10.3 - via column-wise ntuple paging
- Row-wise merging in 10.4
 - Addressed the problem (non-conservation of events) reported in hypernews
- Modified the arguments list in the new `G4RootAnalysisManager` function for merging ntuplesactivation:

```
void SetNtupleMerging(G4bool mergeNtuples,  
                      G4int nofReducedNtupleFiles = 0,  
                      G4bool rowWise = false,  
                      unsigned int basketSize = fgkDefaultBasketSize);
```

- The default merging mode stays *column-wise* unless the `rowWise` argument is set `true` explicitly; we will switch to *row-wise* in 10.5

Merging Ntuples in MPI

- Merging in MPI plan for this year release (shifted from the last year)
- Will require adapting the operation mode of G4MPI:
 - Actually all ranks, including the master rank do event processing
 - In difference from the other merged data, which are merged to the master rank at the end of event processing, **the ntuples are merged during event processing** by sending baskets to master rank.
 - We need to define a dedicated rank which will be receiving the ntuple data from the worker ranks (like what we do with threads) and which will not run event processing.
 - To be further discussed with Koichi

My todo, wish list...



- HDF5 // : the library has facilities, explore that. (For ntuple, it is perhaps not needed to do the “per page logic” introduced for the ROOT format).
- // IO : hadoop : write/read ROOT file straight with libhdfs ?
- Have a g4tools/examples/cpp in the releases ?
- There is plotting in g4tools delivered for “batch plotting” for the moment. It would be nice to see g4tools/plots in G4/vis system...
- About visualisation : Apple annouced in June to no more support OpenGL ☹️ (in favor of their proprietary Metal)...

G4Analysis Plans

- Requested features & Wish list
 - The analysis “Executive” - a possibility to choose the output type at run time
 - Flexibility in resetting/deleting histograms
 - Writing the same histogram/profile in the same file several times (object versions)
 - Handling more files by analysis manager – already on the wish list since two years