Progress with B & E Examples Work Plan

I. Hrivnacova, IJCLab Orsay (CNRS/IN2P3)

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Outline

- Proposal for Coding Guidelines Update
- Clang tools - survey of interest in using them in examples
- Status of Work Plan Items

Coding Guidelines

- Defined in 2011
- Following the coding guidelines is requested when adding a new example
  - Most of the guidelines are checked semi-automatically
- The list of violators (examples files) is available on the wiki page:
  - https://twiki.cern.ch/twiki/bin/view/Geant4/ApplyingCodingGuidelines
  - Updated once per year
- Some guidelines need to be updated to cope with new C++11,14,17 recommendations
- The proposal for the update
  - https://gitlab.cern.ch/ihrivnac/geant4-dev/-/blob/examples-guidelines-update/examples/.doxygen/coding_guidelines_2021.md (link)
- Further improvements can be achieved using clang-format, clang-tidy
  - The possible benefits will be discussed on the next slides

Coding Guidelines Update - 1

Name conventions

1. **Class names** are defined within a single namespace, specific to each example. Eg. B1, B2, etc. for the basic examples. Class names without a prefix can be still defined in the categories where this convention is already in use.*

> 2. **Class member functions** start with an upper case letter.
> 3. **Class data members** start with a prefix `"f"` followed with an upper case letter. This convention makes easier to understand the code.
> 4. **Local variables and functions argument names** start with a lower case letter except for the names starting with known acronyms in capital case letters.

Class Names in a Namespace

- Already applied in all basic examples
- Using namespaces simplifies reusing of the code without loosing the robustness
  - The namespace prevents from name clashes without polluting global namespace
- Currently two conventions are in use:
  - Class names without prefix: EM, Hadronic, …
  - Classes with a prefix: field, runAndEvent, optical, ...
- Proposal:
  - New examples in the categories using classes without prefix will continue with this convention
  - New examples in the categories using classes with prefix will be use new convention (a namespace instead of class name prefix)
  - The existing examples with classes with prefix will be gradually moved to new convention

Coding Guidelines Update - 2

Coding rules

1. Declare **overriding virtual functions** in the header files with keyword `override`.
2. **Initialize class data members** using default member initializer in the class definition (.hh). Both initialization with braces or assignment are possible. This prevents from use of uninitialized values.

> 3. Do not introduce dummy functions or classes if they have no use in the example.

4. All **UI commands** commands defined in the example should be used in the cdash test macro(s).

Coding Guidelines Update - 3

Style rules

Consider clang-format ?

Was 80 characters, but we set 100 in the check script

1. **Avoid using long lines** (more than 100 characters) where possible.

2. **Avoid using tabulators**.
3. Each function implementation in the .cc file should be preceded by the agreed separator line.
4. Avoid using more than one empty lines or personalized separators in the code.

Coding Guidelines Update - 4

Documentation

1. Each example is provided with a `README` text file and its modified version `.README.txt` for automatic generation of the Web documentation with Doxygen. The latter differs from the former only by the modifications needed for a correct representation of the file on the Web.
2. The files with C++ code start with a standard header including Geant4 copyright and a file description. The comment lines with a file description start with `///` (instead of standard `//`) in order to be recognized by Doxygen, on the first line followed by the keyword `\file`.
3. Each class contains a description of the class functionality placed just before a class definition in the class header file (.hh) The comment lines with a class description start with `///` (instead of standard //) in order to be recognized by Doxygen.

Introduced with the macro review effort

4. All macros provided with the example should be documented in `README`.

Coding Guidelines Update - 5

Application conventions

> 1. It is recommended to define materials with using NIST manager unless there is a specific reason for explicit material definition.
> 2. It is recommended to use the physics list classes and physics builders provided in Geant4 unless there is a specific reason for using an explicitly defined physics list.

3. `G4UIExecutive` should be instantiated at the same beginning of `main()` if interactive mode is enabled, just after arguments processing if present. This makes possible to handle the output and eventual exception via the Geant4 UI since the beginning of running example.

Applied in all extended examples last year

Clang Tools - 1

- Clang-format
  - https://clang.llvm.org/docs/ClangFormat.html
  - Tool for formatting code, configurable formatting style
  - Can enforce some guidelines which we have already in place: long lines, tabulation
  - Cannot be applied for a subset of features only, eg. just for our guidelines
  - Need to achieve an agreement on the configuration (`.clang-format`)
    - May be different from the one in geant4 top directory
- If we agree on its use in common:
  - Proposal for a configuration and its result can be circulated (via a git branch) and when (if) an agreement is achieved, the agreed `.clang-format` can be committed in the examples directory and applied to all basic and extended examples

Clang Tools - 2

- Clang-tidy
  - https://clang.llvm.org/extra/clang-tidy/
  - Tool providing an extensible framework for diagnosing and fixing typical programming errors, like style violations, interface misuse, or bugs that can be deduced via static analysis.
  - See also presentation by Ben Morgan on Monday C++11/14/17 Hackathon parallel session (slides)
  - The checks can be defined via `.clang-tidy` configuration file or can be applied one by one
- If we agree on its use in common:
  - A discussion item can be open in git to agree on a start list of the checks, we can also adopt the same configuration file as for Geant4 code development

WG Group Wiki

https://twiki.cern.ch/twiki/bin/view/Geant4/NoviceExtendedExamples

TWiki > Geant4 Web > NoviceExtendedExamples
(2018-04-10, IvanaHrivnacova)

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N&E Examples WG

- Adding A New Example
- Macros and Tests Review
- Obsolete Features
- Applying Coding Guidelines
- Examples Doxygen Documentation
- Status of Examples MT Migration
- List of Extended Examples

- The link to Wiki pages is available from the WG Web page
- Access is restricted to Geant4 developers

Work Plan 2021 - 1

- New examples:
  - Biasing category: example illustrating the development(s) in generic biasing: "DXTRAN" MCNP-like option and “implicit capture”.
  - visualisation/movie: example illustrating how to create a movie - DONE
  - New hadronic example for testing decays of heavy particles – Hadr10 – DONE
  - New extended example to demonstrate more of the scoring functionalities.
- Existing examples improvements:
  - *Biasing category*: Resolve the overlap in biasing B02/B03 and GB03 examples which implement the same use case
  - *Electromagnetic & Hadronic* categories: updating selected examples with usage of G4Accumulable.
  - *errorpropagation* category: Porting Geant4e to MT.
  - *Medical category*: Extend the DICOM reader with the RT Dose format.

Work Plan 2021 - 2

- Existing examples improvements (cont.):
  - *Medical/dna* category: try to include new cross-sections for gas materials in the already existing icsd example
  - *Basic/B4*: remove visTutor - DONE
- Code review:
  - Continue with the macros and tests review: make sure that provided macros cover all commands implemented in example and the cdash test covers all important example use cases. - In progress: DONE for optical examples
  - Migrate examples using local SteppingVerbose class to usage of new stepping verbose class, G4SteppingVerbose2: DONE in 31 examples; local stepping verbose in 18 examples
- Coding guidelines:
  - Review the status and update the table on the Wiki page. - DONE
  - Finish the examples not yet completed (dicomReader) - To be done for 11.0?