New Novice & Extended Examples

I. Hrivnacova, IPN Orsay

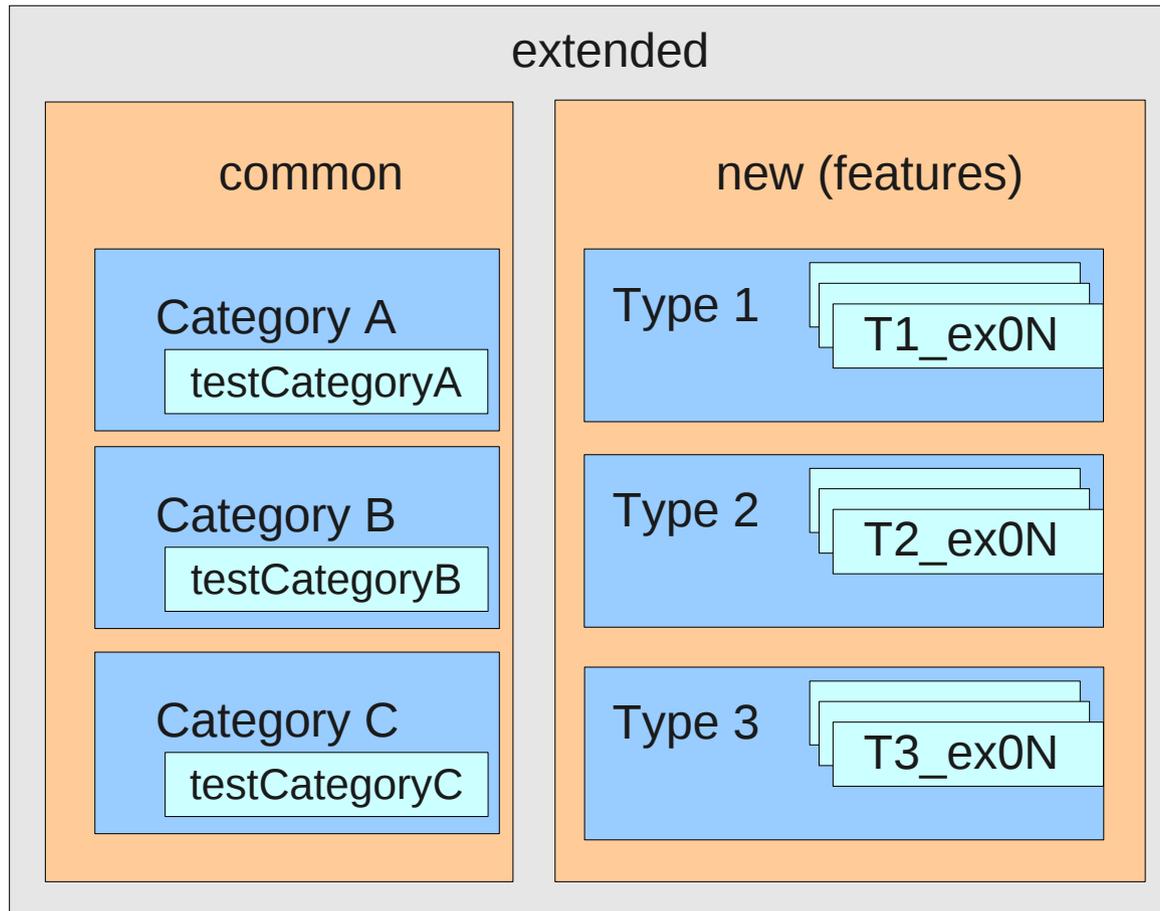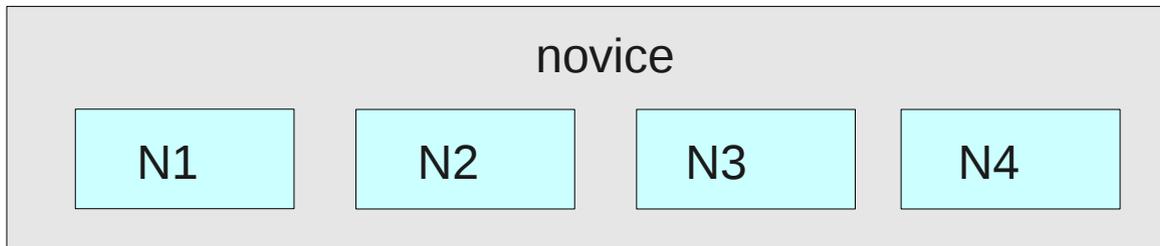16th Geant4 Collaboration Meeting, 19 - 23 September, SLAC

Outline

- Motivation

- Novice examples

  - Classification of features present in novice examples

  - New novice examples

  - Documentation

- Extended examples

  - Repository with common classes

  - First new and re-written extended examples

- Outlook

Motivation

- Novice examples:
  - Too heavy - some of them maybe too difficult for novice users
  - Can be reduced: in number of examples and also in complexity
- Extended examples
  - No code sharing – many code duplications: the same classes are cut/pasted from one example to another
  - The requirement for stand-alone examples makes more difficult for the user to find the important parts of the code for a demonstrated feature
    - Eg. extended/field/field03 example demonstrates definition of magnetic field on **18 classes** while only **3 are relevant** to magnetic field
  - With code sharing: we can reduce the code size to be maintained and underline the features which are demonstrated

New Concept

novice

| N1 | N2 | N3 | N4 |

extended

common

Category A
testCategoryA

Category B
testCategoryB

Category C
testCategoryC

new (features)

Type 1
T1_ex0N

Type 2
T2_ex0N

Type 3
T3_ex0N

Novice & Extended
Examples
Coding Guidelines

1. Name conventions

1.1. Classes in common use names starting with the prefix 'EG4'; if there are more than one classes of the same name, then all classes names are followed by a number: (00), 01, 02, 03 ..., The number 00 should be used for helper classes which are not supposed to be directly usable in user application, eg. physics list with geantino only.

1.2. Classes in extended examples (features) use names with a prefix, specific to the demonstrated feature and different from the one reserved for classes in common, or names without a prefix.

1.3. Class member functions start with an upper case letter.

1.4. Class data members start with a prefix "f" followed with an upper case letter. This convention makes easier to understand the code.
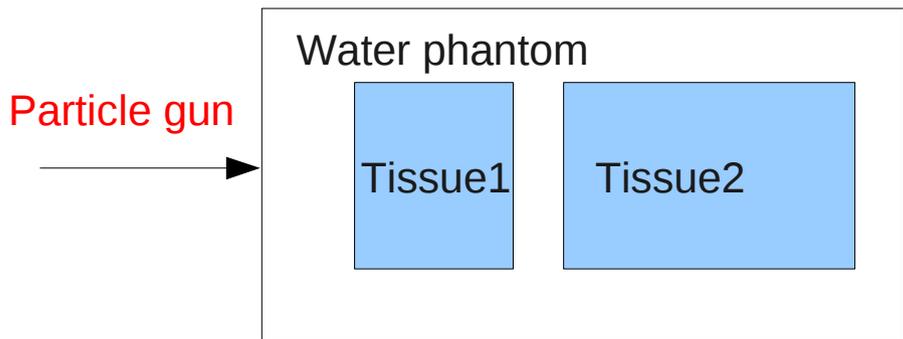
1.5. Local variables and functions argument names start with a lower case letter except for the names starting with ...
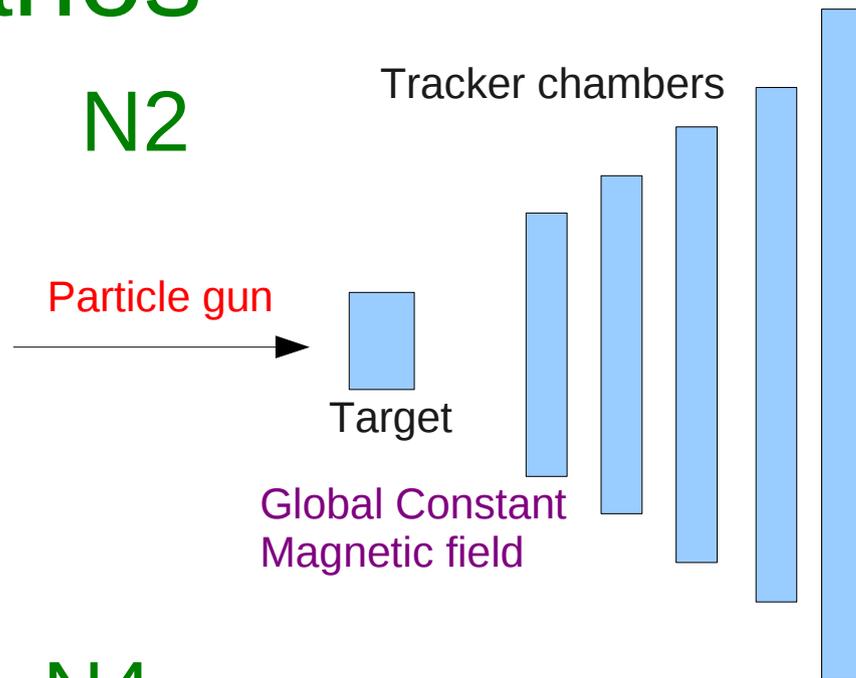
Novice Examples

- Revision of the current novice examples:
  - A document with a summary of features demonstrated:
    - http://geant4.web.cern.ch/geant4/collaboration/working_groups/novice_extended_examples/novice_examples_features.pdf
  - Classification of the features: whether they should stay in novice or should be moved in extended examples
    - Two versions of document, the later one:
    - http://geant4.web.cern.ch/geant4/collaboration/working_groups/novice_extended_examples/novice_examples_features_classification_v2.pdf
  - "New novice examples group":
    - I.H., Peter Gumplinger, Michel Maire and Paul Guye
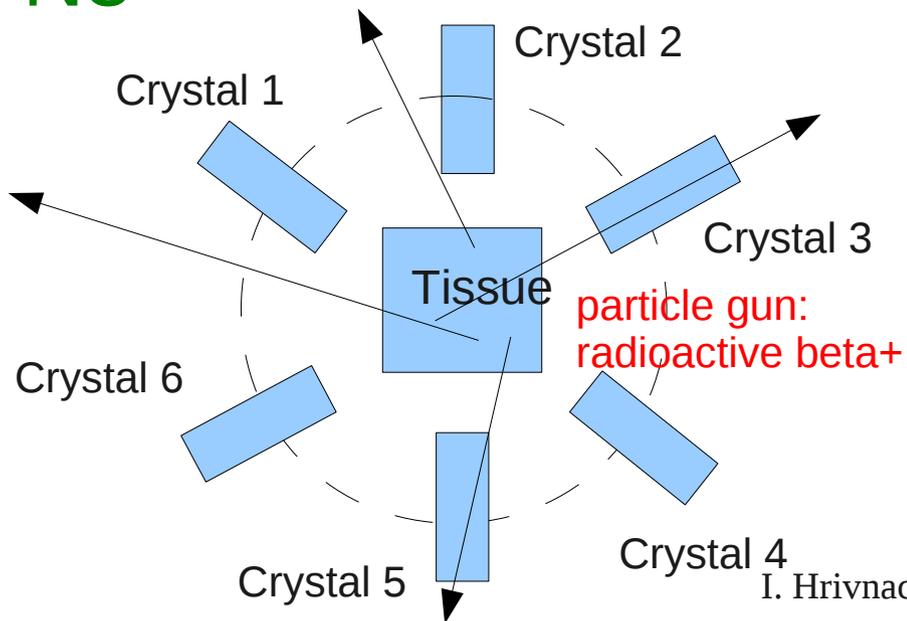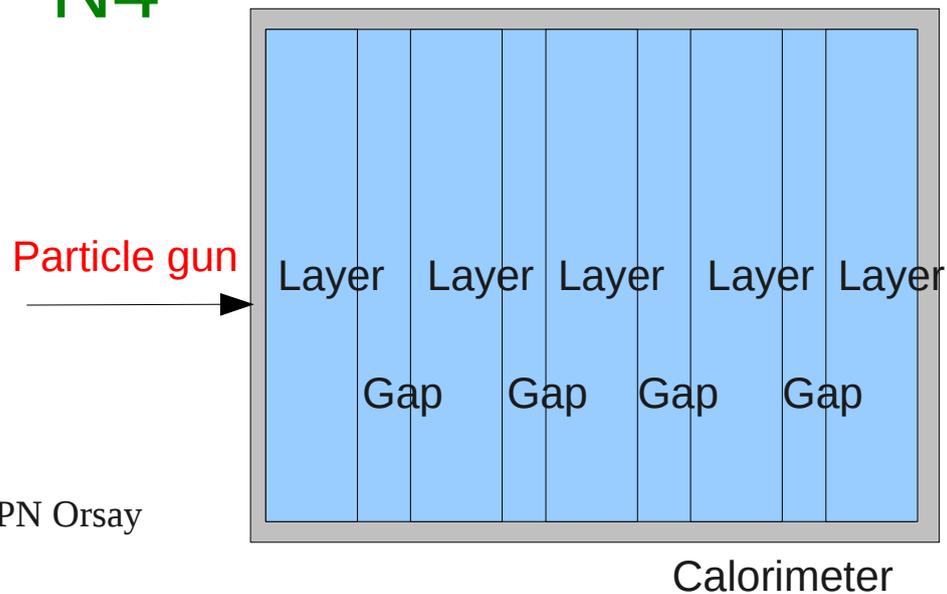
Novice Examples
Scenarios

N1

Water phantom

Particle gun →

Tissue1   Tissue2

N2

Tracker chambers

Particle gun →

Target

Global Constant
Magnetic field

N3

Crystal 2

Crystal 1

Tissue

Crystal 3

particle gun:
radioactive beta+

Crystal 6

Crystal 5   Crystal 4

N4

Particle gun →

Layer Layer Layer Layer Layer

Gap Gap Gap Gap

Calorimeter

I. Hrivnacova, IPN Orsay

Novice Examples
Features

N1:

- Box (phantom), Sphere (tissue1), Cons (Tissue2)
- PVPlacement, only translation
- Scoring within Tissue1,2 via Stepping action
- PL: QGSP_BERT

N2 (a,b):

- Tubs (Target), Tubs (Tracker),
- PVPlacement, only translation (a)
- PVParameterised (b)
- Global constant magnetic field
- Scoring within Tracker via Hits and SDs
- PL: QGSP_BERT + G4StepLimiter

N3:

- Box (Tissue), Trd (Crystals),
- PVPlacement with rotation (within a circle) and PVReplica as alternative
- Scoring within Crystals via Scorers
- PL: Modular physics list with builders from Geant4

N4 (a,b,c,d):

- Box (Calorimeter, Layer, Gap)
- PVReplica
- Scoring within Layer, Gap in 4 ways: User actions(a), User data object (b), Hits and Sds (c), Scorers (d)
- Histograms, ntuples with new analysis tool
- PL: QGSP_BERT
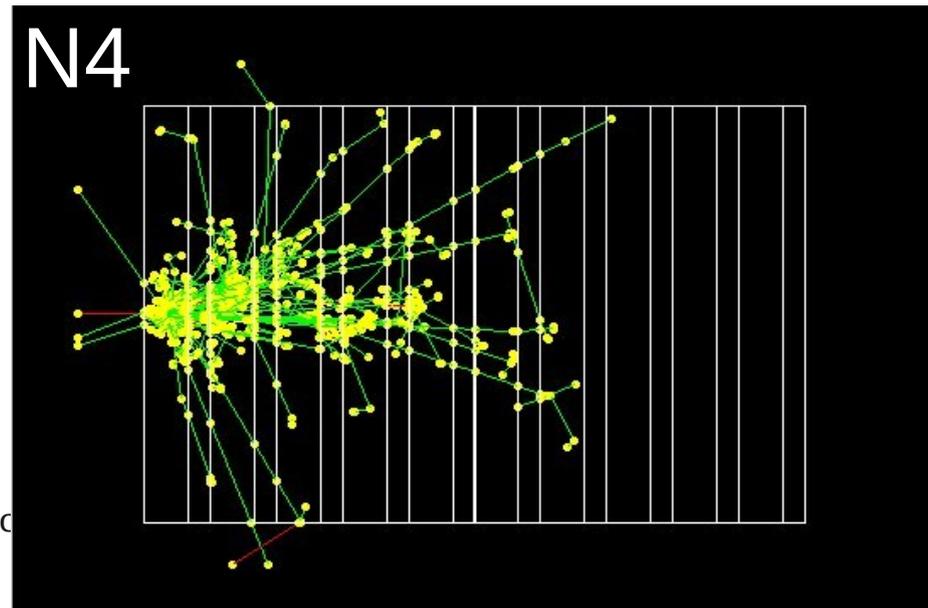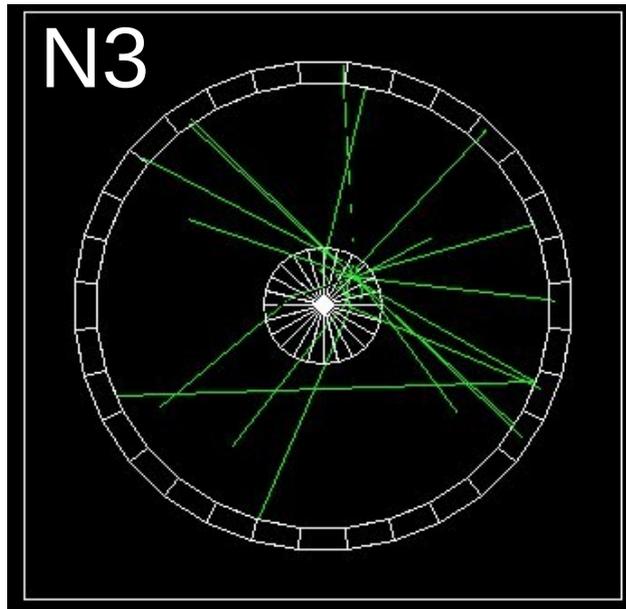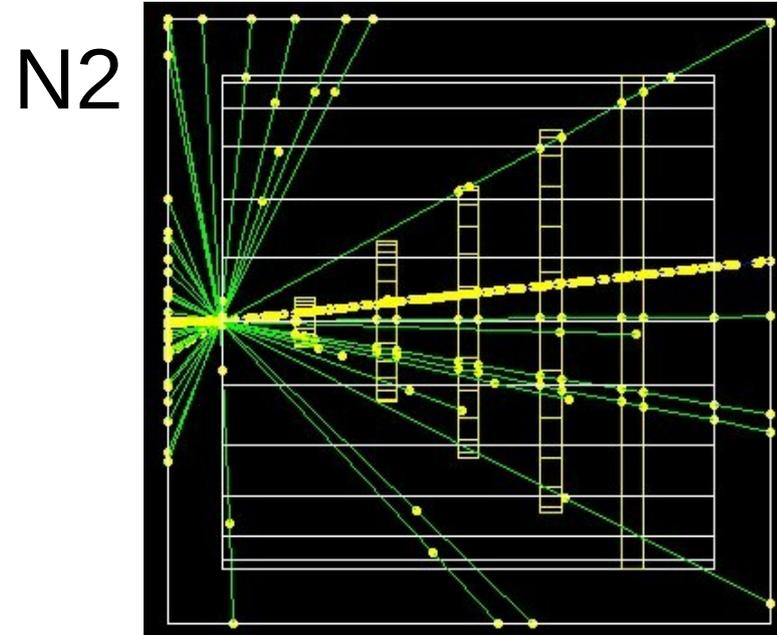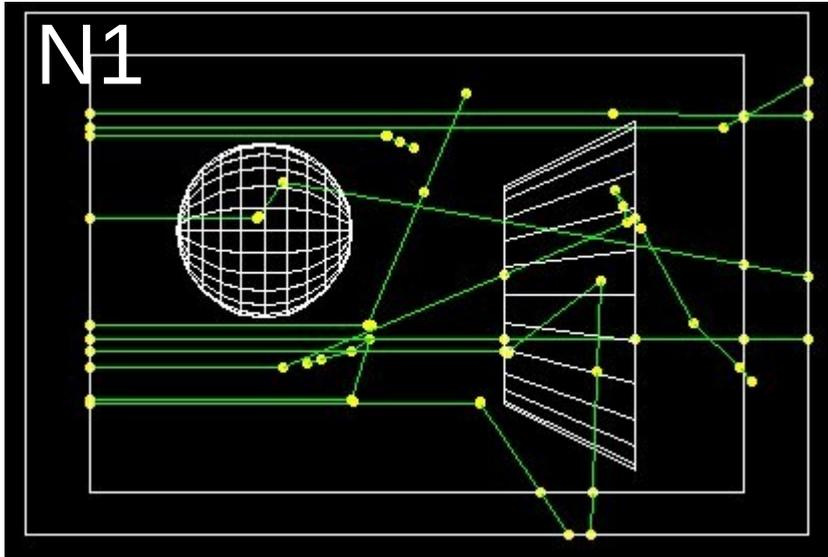
Implementation

Issues, Missing

- Issues:
  - Visualization with OGLIX (default) – some solids invisible (sphere)
  - Geometry N3: when filling full circle with trapezoids, then placement with rotation is not the best choice (one can use PVReplica or divided polygon)

- Not (yet) included:
  - Regions with production cuts
  - Local magnetic field (?)
  - Explicitly defined physics list (?)
  - General particle source
  - Stacking action (to kill neutrinos)

What Has Changed

- 7 examples -> 4

- Naming: N0X -> NX

  - In order to avoid confusion with the old novice examples

- Some examples have several variants:

  - N2: two detector constructions; N4: four ways of scoring

  - Each variant is a stand-alone example, the class name includes the option if the class has modifications related to the demonstrated option:

    – In N4a: N4aEventAction, N4aSteppingAction, N4DetectorConstruction, N4PrimaryGeneratorAction, N4RunAction, ...

    – In N4b: N4bEventAction, N4bSteppingAction, N4bRunData, N4DetectorConstruction, N4PrimaryGeneratorAction, N4RunAction, ...

- Analysis code in N4 example – with use of new analysis tools

Extended Examples

- New directories (added in extended_branch):
    - common:
        - Common classes, scripts
    - new
        - New "feature" examples: two brand new one to demonstrate use of common classes, one re-written example (pythia6Decayer)

Extended Examples
Common Classes (1)

- analysis:
    - EG4HbookManager
- detectorConstruction:
    - Two detector construction classes with a messenger for each:
        - 1: with only a world volume (box shape)
        - 2: with a box placed in a world (of box shape)
    - The dimensions/materials can be set in the class constructors or via interactive commands
- primaryGenerator:
    - Two primary generator classes:
        - 1: with G4ParticleGun
        - 2. with G4GeneralParticleSource
    - The default particle properties (type, energy, position, momentum) can be set in the class constructors or via interactive commands

Extended Examples
Common Classes (2)

- userActions
  - One event action and one run action class, both with a messenger
  - Implement setting verbose level, event modulo printing, option to save and read random number status, option for automatic (time-based) random seeds for each run

New Extended Examples (1)

- Materials/mat01

  - Mat01DetectorConstruction class only, all other classes from common

  - To get classes from common repository:

    – make setup

    – This will call the provided script copy_files.sh which calls a general script from common in this way:

      - $SCRIPTS_DIR/copy_files.sh DetectorConstruction 02 messenger

        – Will copy EG4DetectorConstruction02.hh,cc and EG4DetectorConstruction02Messenger.hh,cc files

    – The selection of classes via generic names, the version and specific keywords

    – One can easily interchange the available class versions

- Geometry/transform

  - Demonstrates various ways how to define 3D transformations

  - TrDetectorConstruction, TrDetectorConstructionMessenger classes

New Extended Examples (2)

- Decay/pythia6Decayer:
  - The existing example eventgenerator/pythia/decayer6/ re-written with use of classes from common
  - 14 *.hh files, 3754 LOC in old => 7 *.hh files, 1934 LOC in new

Documentation

- Automatically generated with Doxygen:
  - http://www.stack.nl/~dimitri/doxygen/index.html
- From:
  - Source code
  - Adapted README files (.README)
  - Configuration files in novice_branch/.doxygen
- See Demo

Geant4 examples

Main Page	Related Pages	Modules	Namespaces
Classes	Files		Q⁻ Search

Geant4 Examples

This module collects three sets of user examples aimed to demonstrate to the user how to make correct use of the GEANT4 toolkit by implementing in a correct way those user-classes which the user is supposed to customize in order to define his/her own simulation setup.

One set of examples is oriented to "novice" users and covering many basic general use-cases typical of an "application"-oriented kind of development. An "extended" set of examples is covering various use-cases and may require some additional libraries besides of Geant4. This set covers some specific use cases for actual detector simulation. An "advanced" set of examples covers the use-cases typical of a "toolkit"-oriented kind of development, where real complete applications for different simulation studies are provided; may require additional third party products to be built.

Most of the examples can be run both in interactive and batch mode, and input macro files (*.in) and reference output files (*.out) are provided. Novice and most of the extended examples are considered part of the system testing suite for validation of the official releases of the GEANT4 toolkit. Novice examples and some of the extended and advanced examples are also used as "acceptance"-tests for the release process.

See more on each examples category pages:

- Geant4 Novice Examples
- Geant4 Extended Examples

Generated on Fri Sep 9 2011 for Geant4 examples by **doxygen** 1.7.4

Outlook

- New novice examples

  - Only a few more features need to be added

  - Need to finalize run and visualization macros

  - The "old" novice examples not included in the new set can be moved to extended and then processed together with the other extended ones

  - Will be ready for the December release

- New extended examples

  - First common classes available; the set can be extended according to the needs

  - Scripts for examples building with use of common classes

  - To be done: the revision of existing examples, migration to use of common classes, applying coding convention, adding new features not yet covered

  - The new examples can coexist with the old one, those which are ready can go in the December release

Discussion

Issues, Missing

- Issues:
  - Visualization with OGLIX (default) – some solids invisible (sphere)
  - Geometry N3: when filling full circle with trapezoids, then placement with rotation is not the best choice (one can use PVReplica or divided polygon)

- Not (yet) included:
  - Regions with production cuts
  - Local magnetic field (?)
  - Explicitly defined physics list (?)
  - General particle source
  - Stacking action (to kill neutrinos)

Extended Examples

- Assigning the existing extended examples to WG members
    - See new text document (extended_examples_assignments.txt)
- A wish list
    - New features not yet demonstrated in any example
    - Code snippets that are commonly asked in the user forums.
        - Like the recent question how to "know the parent particle name" of a track
- A deprecated list
    - Examples to be removed or completely re-worked (if they are too complicated)