Parallel navigation

<u>Use Cases</u>

- Fast simulation and shower parameterization
- Geometric importance biasing
- Scoring and tallies (fluxes and doses), Readout geometry
- Parallel tracking geometries (support structures) (?)

<u>Current scenario</u>

- Parallel navigation is possible for the case of fast-simulation and importance-biasing. Both allow for tracking in either the tracking (mass) geometry or parallel (ghost) geometry (superimposed to the tracking one). Independent navigators are defined and associated to specialized processes regularly registered to the *G4ProcessManager*.
- In the case of fast-simulation, more than one geometry can in principle be assigned to the same navigator.
- *Limitations*:
  - Cannot be applied in presence of magnetic-field (field applied only to the tracking geometry and main navigation)
  - Cannot be applied in concurrent manner (problems of mutual competition and with *G4Transportation*)

Parallel navigation

- The new design proposal aims to overcome the limitations above and provide a generic and universal way for handling navigation in parallel geometries, where more than one navigator (and geometry) can be invoked and centrally controlled such that the final evaluation of the step to take (including eventually integration in field) is made taking into account the existence [or not] of specialized processes applied [or not] to parallel geometries.

  http://geant4.web.cern.ch/geant4/working_groups/geometry/docs/
      parnav/parallel-navigation.html

Fast simulation envelopes

- The first step, which is sort of independent from the realization of a parallel navigation scheme, but is required in order to assure the consistency with some aspects of the existing design, is to "merge" the concept of 'envelopes' used in fast-simulation and 'regions' associated to logical volumes.

- A *G4Region* can be easily extended to cover also the concept of an 'envelope', the result is mainly an implementation detail which requires adapting the current mechanism for the scanning of the materials to consider the case of the existence of logical-volumes with NULL material pointer assigned.

  – *Solution*: Material scanning is not performed if the region is attached to a parallel world.

Creation of parallel geometry

- Creation of parallel geometry and auto-generation of the parallel world.
  - Creation of the navigators should not be exposed to the user.
  - Navigators are created and registered at the time the parallel geometry is created and registered.
- Steps for the user are the following:
  1. Create a parallel geometry;
     - The creation of the world volumes for parallel geometries should be delegated to an utility which will assure that the created world is consistent with the mass-geometry's one (same size, same solid, no material assigned, ...).

G4VUserDetectorConstruction ● ——1——n—— G4VUserParallelWorld
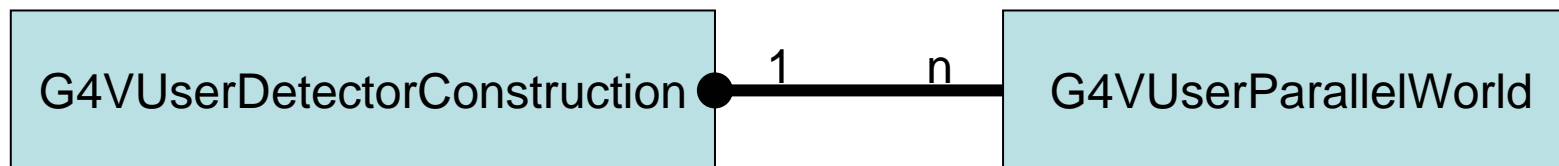
Creation of parallel geometry

- Steps for the user are the following:

    2. Instantiate a process, specifying the name of the parallel world;

        - The *G4TransportationManager* takes care of limiting a step for boundaries of all existing parallel worlds. But the user still has to define a process which takes care of his/her interest, e.g. fast simulation, scoring in parallel geometry, etc.

        - The *G4TransportationManager* will provide a way to return a navigator, given a pointer to a registered world:

            G4TransportationManager::
                GetNavigator(G4VPhysicalVolume* world)

        - A process cannot have more than one navigator.

    3. Assign the process to particles.