



Status of Biasing Examples

Parallel session 2B

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Wollongong Collaboration Meeting
September 2017



Example GB05

Example GB05: splitting by cross-section

- › Example GB05 introduces a new technique:
 - « splitting by cross-section »
 - Supposed to be an invention
- › Purpose of this example is twofold:
 - Introduce a new technique...
 - Illustrates the flexibility of the generic biasing “framework” to allow such invention:
 - › By demonstrating in this case the easy access to physics process cross-sections
 - › Together with the fact these cross-sections have been updated by the biasing machinery
- › Principle of the technique:
 - In geometry importance biasing slice thicknesses are chosen to « work well » for a given particle specie:
 - › Split enough so that the flux does not decay in the shield
 - › Not split too much to avoid a divergence in the (unweighted) flux
 - In the « splitting by cross-section » a physics-like process is introduced which:
 - › competes with other processes
 - › PostStepDolt splits the track (by 2)
 - › « cross-section » value is the physical absorption cross-section one
 - Eg : for neutrons, this is « Decay + nCapture + neutronInelastic »
 - Technique is applied to tracks moving forward
 - › Others are killed by Russian roulette

Code snapshots

- › Decision taking on biasing to apply:
 - Here, a decision at the beginning of the step
 - Decision taken by a « biasing operator »
 - Which decides of a « biasing operation » and sets it up

```
G4VBiasingOperation* GB05B0ptrSplitAndKillByCrossSection::
ProposeNonPhysicsBiasingOperation(const G4Track* track,
                                   const G4BiasingProcessInterface* )
{
    ...
    G4double totalCrossSection(0.0);
    for ( size_t i = 0 ; i < fProcesses.size() ; i++ ) {
        G4double interactionLength = fProcesses[i]->GetCurrentInteractionLength();
        if ( interactionLength < DBL_MAX/10. )
            totalCrossSection += 1./interactionLength;
    }
    if ( totalCrossSection < DBL_MIN ) return nullptr;
    G4double totalInteractionLength = 1./totalCrossSection;
    fSplitAndKillByCrossSection->SetInteractionLength( totalInteractionLength );
    return fSplitAndKillByCrossSection;
}
```

Code snapshots

- › These processes have been selected at construction time:

```
void GB05DetectorConstruction::ConstructSDandField()
{
...
    GB05B0ptrSplitAndKillByCrossSection* biasingOperator =
    new GB05B0ptrSplitAndKillByCrossSection("neutron");
    biasingOperator->AddProcessToEquipoise("Decay");
    biasingOperator->AddProcessToEquipoise("nCapture");
    biasingOperator->AddProcessToEquipoise("neutronInelastic");
...
}
```

- › And put under biasing control, wrapping them, with biasing physic constructor:

```
G4GenericBiasingPhysics* biasingPhysics = new G4GenericBiasingPhysics();
biasingPhysics->Bias("neutron");
physicsList->RegisterPhysics(biasingPhysics);
```

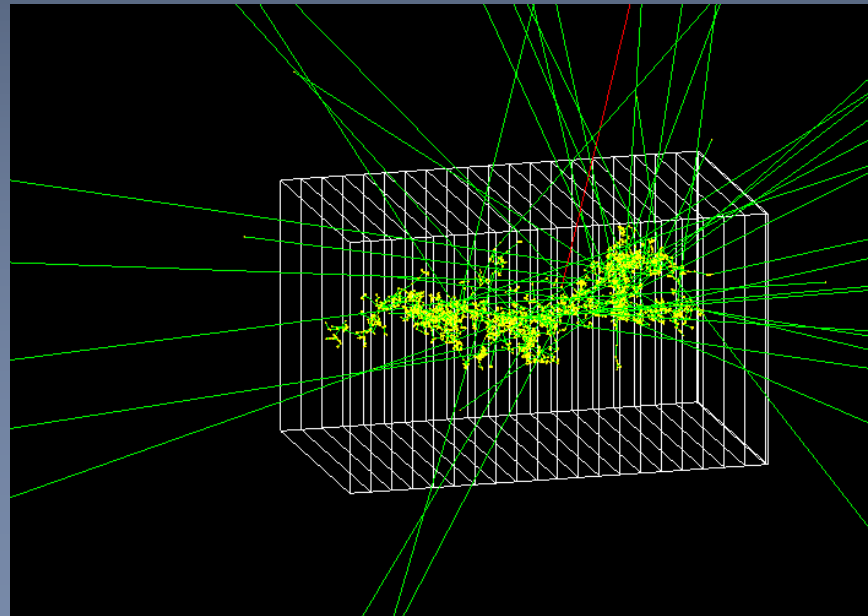
- › This makes in particular processes interaction length updated by the biasing machinery at the beginning of the step (by the first wrapper):
 - making physics quantities (eg: cross-sections) easily available to developer
- › Offload a lot of internal Geant4 technicalities from the biasing developer !



Example GB06

Parallel Worlds

- > Ability of using parallel worlds in generic biasing introduced in 10.3
- > Example extended/biasing/GB06: illustrate the usage of this
 - With the classical shield problem
 - Using a geometry-based importance splitting
- > Geometry:
 - Mass geometry : a single block of concrete
 - Parallel world : define the slices
 - > Importance of slices being a function of their copy number



Incident neutron in concrete block with biasing activated. Slices on this figure are in the parallel geometry



Planned examples &
ongoing activity

On going activities

- › Comment : of course, we're late...
- › Implicit capture:
 - Option to “preserve” –say- a neutron, preventing absorption of it to happen
 - › Hence favoring long travel distances
 - All the tools to do this should be available
 - Having an example of this is still planned for this year
- › DXTRAN:
 - This the “deterministic transportation” à la MCNP
 - Under development, but more difficult
 - Example is also still plan for this year, but more in danger
- › B02/B03 and GB03 overlap:
 - These examples address the same use case: importance-based geometry biasing
 - › Overlap is “natural” as generic biasing aimed at being... generic
 - Hence offering –in a same approach- what previously existing options provided
 - No progress so far
 - › Situation will likely stays like this
 - Situation got even worse: ;)
 - › Example GB06 (parallel geometry) overlaps also with B03 !