FLUKA Beginners' Online Training

Answers to the questionnaire on

Geometry - Basic

Question 1

Which of the following statements is true?

A. Bodies, zones and regions can overlap.

B. Bodies can overlap, but not zones and regions.

C. **Bodies and zones can overlap, but not regions.**

D. Zones can overlap, but not bodies and regions.

E. Neither bodies, zones or regions can overlap.

Bodies are the basic geometrical objects, which are used to define zones (=sub-regions) by means of Boolean operations (subtraction and intersection). Intrinsically, intersection of different bodies and subtraction of bodies from other bodies would be meaningless if the bodies could not overlap.

Zones are combined by means of union operations to create regions. Regions are made of a single material. Zones belonging to the same region can overlap. This can even be beneficial since less boundary checks are needed if the particle remains longer in a zone.

All points in the FLUKA geometry inside the `BLCKHOLE` confinement must belong to one and only one region. Regions therefore must not overlap.

Hence the correct answer is C).

Question 2

Which of the following gives an error?

A. A region consisting of a single zone.

B. **A region without a material assignment.**

C. Use of the region names "target" and "Target" at the same time.

D. Assignment of a `BLCKHOLE` material to a region inside the geometry.

E. Use of touching surfaces for region definitions.

If no material is assigned to a region, the code stops with an error message. No default material is assumed in this case since the user might not notice that the material assignment is missing and could therefore obtain wrong results.

Answers A), B) and C) describe a legitimate use of FLUKA. The latter (`BLCKHOLE` inside the geometry) can be useful for testing purposes or to speed up the simulations, but should still be applied with caution since it can alter the results (particles vanish).

Touching surfaces (answer E) can result in a crash due to numerical reasons (see lecture "Geometry - Basic"), but this will not always be the case. Since touching surfaces do not systematically give an error, E) is not a correct answer to this question.

Question 3

What is the best way to define regions around your object?

A. Regions around objects don't have to be defined, FLUKA will take care of them.

B. **Use the bodies defining the object to define the regions around your object.**

C. Subtract the object's regions definition in parenthesis from the surrounding body.

D. **Subtract the bodies defining the object from the surrounding body.**

E. Use complementary bodies to define the regions around your object.

Since all points of the geometry inside the `BLCKHOLE` confinement must belong to one and only one region, it is mandatory that regions surrounding the prinicpal objects (e.g. a target or a beam line) are defined. FLUKA does, however, not automatically create regions missing in the geometry. Hence answer A) is not correct since this functionality does not even exist.

It is highly recommended to reuse the bodies defining the principal objects for building the surrounding region (e.g. air). Using different bodies for defining the same boundary between two regions can create numerical problems (this depends on the body type - see lecture "Geometry - Basic"). It also increases unnecessarily the number of body definitions. Note that the bodies defining the principal geometry can be finite or infinite. Answers B) and D) describe the best practice, while the use of complementary bodies as suggested in E) is discouraged.

It is also discouraged to use parenthesis in the definition of regions.

Question 4

Which of the following statements is true?

A. Flair always shows the ”Error found” warning, if there is an error in the geometry.

B. FLUKA always stops before starting the simulation if there is an error in the geometry.

C. FLUKA always stops if the currently simulated particle reaches a geometry error.

D. FLUKA won't stop if the currently simulated particle reaches a geometry error, but an error message is printed in the .err file.

E. **None of the above.**

The Flair geometry viewer can only detect a geometry error if the error is in one of the displayed view planes. It is therefore recommended to manually scan the geometry in the direction orthogonal to the view planes. Answer A) is not correct since Flair does not always show errors due to the above described reason.

FLUKA does not search for geometry errors before starting the simulation run. The program will, however, stop during particle tracking if the particle enters a part of the geometry NOT belonging to any region. On the other hand, FLUKA does not stop or print an error message if a particle enters a part of the geometry belonging to two regions (note that results will likely be wrong in this case). The answers B) to D) are hence incorrect.

Question 5

FLUKA will always stop if:

A. The location of a particle belongs to more than one region.

B. It cannot accurately determine a particle's relative position to a body.

C. A particle enters the `BLCKHOLE` region.

D. **The position of the particle does not belong to any region.**

E. A primary particle is generated exactly on a region boundary.

For additional information concerning answers A) and D) see the explanation of the previous question.

Using `BLCKHOLE` regions in the geometry is legitimate and will not stop the execution of the simulation. Hence, answer C) is wrong.

For particle tracking, it is important that the code can determine the region where a particle is currently contained. If a primary particle is created on a region boundary, the simulation can still proceed normally if the region corresponding to the particle position can be determined. This might, however, not always be the case, therefore resulting in a crash (touching surfaces can be problematic for some body types - see lecture "Geometry - Basic"). Answer E) is not correct since primary particles on region boundaries do not systematically lead to a problem.