Radiation protection exercises

Exercise 1: EDWORST + AUXSCORE

Exercise 2: RESNUCLE

Exercise 3: ACTOMASS

Exercise 4: Residual radiation & Mat(Decay)

Radiation Protection

Exercise 1: EDWORST + AUXSCORE

Aim of the exercise:

- Learn how to select fluence-to-dose conversion coefficients sets
- Learn how to filter contribution to effective dose rate from various particle species

1. EDWORST + AUXSCORE

Input file: **`RP-lecture-Ex_1-start.flair`**

- Geometry & beam and transport settings already created

Exercise:

1. add USRBIN scorings for prompt effective dose
   - using the mesh given in the USRBIN card in input file
   - using conversion coefficient set EDWORST
   - One USRBIN scoring for prompt effective dose from all particles
   - One USRBIN scoring for prompt effective dose from neutrons
   - One USRBIN scoring for prompt effective dose from muons (muon+ and muon-)
   - One USRBIN scoring for prompt effective dose from charged pions (pion+ and pion-)
2. run 100-200 primaries
3. plot the 3 results (in 2D-R-Z)

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Exercise 2: RESNUCLE

Aim of the exercise:

- Learn how to use RESNUCLE with DYSCORE and interpret results
- Observe effects of material impurities

2. RESNUCLE

Input file: **`RP-lecture-Ex_2-start.flair`**

- Geometry & beam and transport settings already created

Exercise:

1. add RESNUCLE scorings for Inner Concrete Wall Shielding (**`Shield1`**) and downstream stainless steel dump (**`DumpEnd`**)
   - for 10 years of cool-down time
2. run 100-200 primaries
3. analyse tab.lis file (Hint: **`cat ...tab.lis | awk '$3>0.0'`**)
4. find radionuclides with highest activity
5. create a new material by adding 3e-6 mass fraction of Europium to the concrete
6. assign this material to the **`Shield1`** region
7. run again 100-200 primaries and check impact on radionuclide inventory for the concrete region

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Exercise 3: ACTOMASS

Aim of the exercise:

- Learn how to use ACTOMASS with AUXSCORE and interpret results
- Learn how to use COMSCW user routine

3. ACTOMASS

Input file: **`RP-lecture-Ex_3-start.flair`**

- Geometry & beam and transport settings already created

Exercise:

1. Add ACTOMASS scorings
   - using the mesh given in the USRBIN card in input file
   - for 10 years of cool-down time
   - One for total activity and three for H-3 (Z=1), Na-22 (Z=11) and Fe-55 (Z=26) (using AUXSCORE)
2. Run 100-200 primaries
3. Plot the 4 results (in 2D-R-Z)

Bonus:

4. Add **`comscw.f`** file to project, compile and link the executable
5. Activate calls to **`COMSCW`** (USERWEIG card)
6. Add ACTOMASS scoring
   - using the mesh given in the USRBIN card in input file
   - for 10 years of cool-down time
   - Name: **`ACL10y`** (to match check in **`comscw.f`** routine)
7. plot the result (in 2D-R-Z) and interpret in view of the clearance values defined in **`comscw.f`**

Radiation Protection

Exercise 4: Residual radiation & Mat(Decay)

Aim of the exercise:

- Learn how to score residual radiation
- Learn how to change material configuration for residual transport

4. Residual radiation & Mat(Decay)

Input file: **`RP-lecture-Ex_4-start.flair`**

- Geometry & beam and transport settings already created

Exercise:

1. Add USRBIN scorings for residual effective dose
   - using the mesh given in the USRBIN card in input file
   - for 10 years of cool-down time
2. Run 100-200 primaries
3. Plot the result (in 2D-R-Z)
4. Change decay material of the 5 transport container regions **`TContSh1`** to **`TContSh5`** to SS316LN
   - Concrete shielding and downstream stainless steel dump can be set to AIR as well
5. Run 100-200 primaries
6. Plot the result (in 2D-R-Z) and compare to the previous result


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