Fluka Exercise – Day 2

Hands on Fluka
Ex03 – LATTICE

- **GOAL**: complete the setup geometry with 4 quadrupoles and a phantom. Magnetic field for steering and focusing will be implemented in the next exercise;

- **Recipe for Lattice**:
  - Create a simplified prototype of quadrupole in a separate region of the geometry enclosed inside a blackhole boundary (called “Parking”) away from the main geometry (for example at $z=10000$).
  - A RCC with a hole is sufficient for the quadrupole prototype (avoid touching surfaces);
  - Clone the prototype body 4 times (assign different names...);
  - Assuming the coordinate $s$ running along the proton beam-axis, the entrance faces of quadrupole replicas should be located at $s[cm]=-800, -450, 350, 750$. (Note that for $z>0$ $s=z$ while for $z<0$ the beam line is inclined by 20 degree). Create 4 transformations (ROT-DEFI) which bring each replica over the prototype.
  - Use the geometrical directives $\texttt{start\_transform}$ to place the replica bodies in their locations. As now you move the body (and not the particle) from the parking to the beam-line use the inverse transformation: $-[\texttt{ROT-DEFI\_name}]$;
  - **Don’t forget the LATTICE cards**;
Recipe for the VOXELS (Phantom):

- The Phantom is defined with VOXELS. A brain egg-like structure is already available in the file head.vxl (generated with the program in ex03-LatticeAndVoxels/head/writect.f)

Warning: Geoedit cannot see (yet) inside LATTICE and VOXELS which will therefore be represented by the containing boxes.
Ex03  \textbf{LATTICE and VOXEL}

- Some hints for the VOXEL position and materials
- 1 x 1 x 1 cm\(^3\) VOXELs

Example of ASSIGNMATs for the different regions (search the DB):
- "VOXEL": Vacuum;
- "VOXEL01": Air (implicitly defined)
- "VOXEL02": Skin, human (W&W type 2)
- "VOXEL03": BONECOMP (implicitly def.)
- "VOXEL04": Brain (ICRP)
- "VOXEL05": Brain (ICRP)
- "VOXEL06": Brain (ICRP)
- "VOXEL07": Borated (\(^{10}\text{B}\)) brain.
• $^{10}$B: You must create a single isotope material. Name the element BORON-10 to automatically load the low energy neutron cross sections;
• For the borated brain make a new compound. Set a mass composition of 70% Brain – 30% $^{10}$B (even though it’s unrealistic!!!)
• Useful scoring to be inserted:
  ■ Score the energy deposition and the neutron fluence in the VOXELs;
  ■ Adapt the USRBIN binning to the VOXEL structure;