Exercise: Magnetic Field

Advanced FLUKA Course 2019

Goal and setup

- Goal: Learn how to code magnetic fields in magfld.f
- Learn how to use usrini.f
- See the effect of settings in the MGNFIELD card

- Setup: almost the same geometry as in the geometry exercise: See ex-magfld-skeleton.inp
- Also provided: magfld_skeleton.f , usrini_skeleton.f

Magfld_skeleton.f explained

- First part: initialization (in an “if (LFIRST)” block)
  - Get and store region numbers of magnetic volumes
  - Get and store possible lattices and rotations
  - Initialize magnitude of fields, can be superseded by USRINI
- Second part: set the magnetic field components.
  - Dipole: uniform, vertical
  - Quadrupole: analytic, function of the distance from quadrupole axis ==> we need to transform the particle position to the coordinate system of the master ==> use rotations
- **To do:**
  - **Complete the initialization (look for “fill here”)**
  - **Add mag field for Dipole**

Usrini_skeleton.f explained

- Easy..
- Has a default for field intensities
- Reads them from the input if a USRINI card with SDUM=FIELDS is present
- Note: usrini.f can be called many times, for different purposes. Using the SDUM to select the purpose is very convenient
- **To do:**
  - **almost nothing.. complete the code to read the quad field from the same card in what(2)**

Input file

- Geometry: add three thin wires in the dipole pipe. Vertical (axis along y) , 100 micron radius, x=-100, z=-26.75, -26.85, -26.9. Will use them to check accuracy
- Assign Aluminum to wires, no mag field (unrealistic, but easy)
- Beam: rectangular profile in x and y (easier to check tracking accur.)
- Activate magnetic field tracking with the MGNFIELD card, with two different settings, selected by the *fast* variable (*#define fast)*
  - *Fast* settings: leave the defaults
  - Normal settings:
    - max angle 30 (suggested by manual),
    - boundaries ? ..we have 100 micron wires.. try 10micron
    - min step 0.1   (default)
- Activate usrini.f under condition (*qdif* variable)

Scoring

- Add a scoring at the end of the dipole to check transport precision. Must be very “precise”:
  - USRYIELD in angle (+ energy as second variable),
  - in between 89.9 and 90.1 degrees, 1000 bins
- Add a scoring to check if the wires are hit:
  - USRBIN by region
  - scoring energy, on the three wires
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Runs

A) Run with standard fields and with usrini-modified (as you like..) ones

- Check the “everywhere” binning (32) to visualize beam envelope and deflection

B) Run with standard fields, normal and *fast* conditions.

- Compare energy deposition in the wires in normal and fast condition
- Compare CPU time (on one of the output files for each run)
- Accuracy parameters will depend on the specific problem. Trade off between CPU and precision.

C) Run with a modifies quadrupole field. Compare beam shapes at the end of the beamline (23)