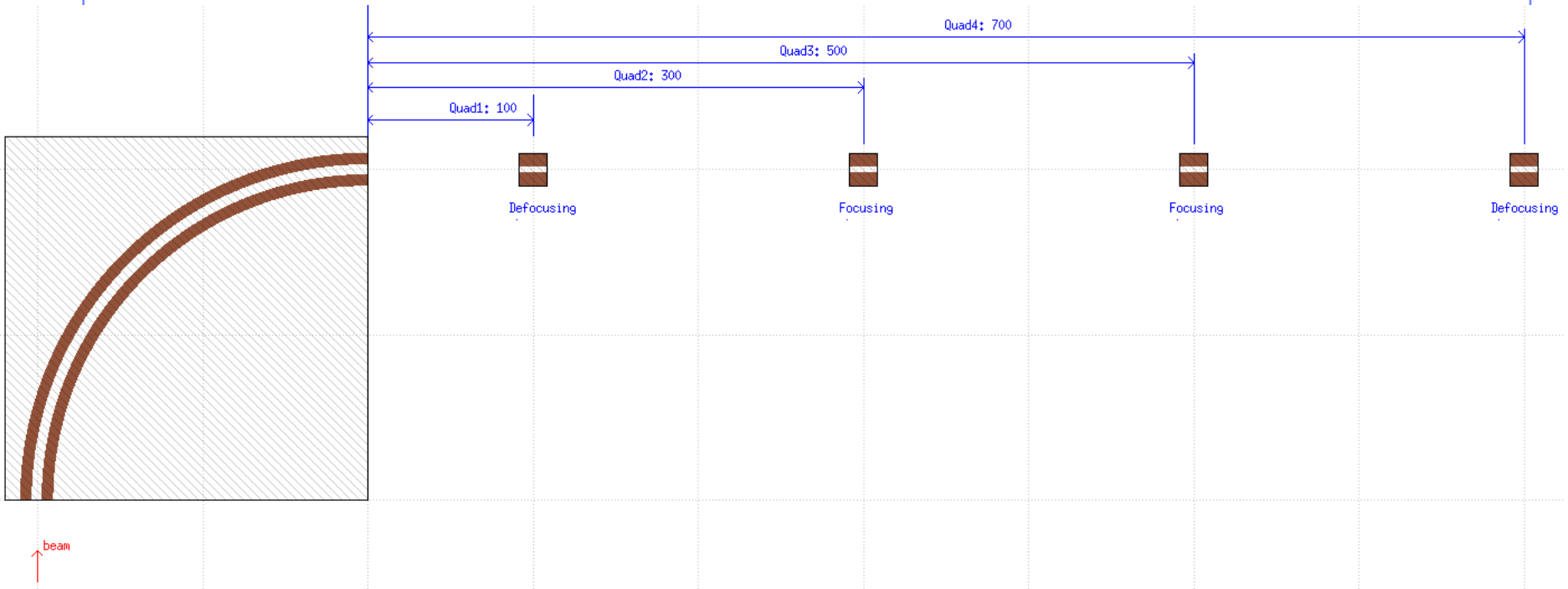
Exercise 5: Two-Steps Method

FLUKA Advanced Course

Exercise 5 - Layout



Exercise 5

- Goal

  Evaluate the **contribution** to the energy deposition in a Beam Loss Monitor (BLM) **from direct losses inside** a quadrupole, via the two-steps method:

  1. Shoot a dispersive beam, and dump the position of particles lost in all the quadrupoles;

     → through the **fluscw** routine;

  2. Read the map of particles, and score the energy deposition in the BLM;

     → through the **source** routine;

- Requirements
  - Re-use the geometry of the accelerator line you built and the magfld.f routine (if needed, take the solution of the geometry exercise);
  - Implement the BLM:

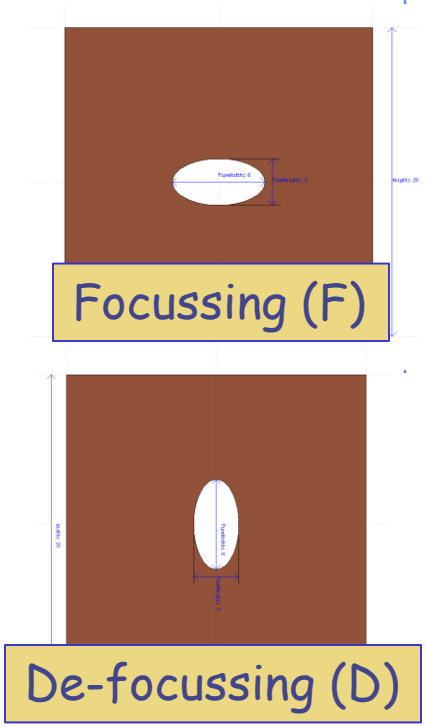
    Cylindrical Ionisation Chamber, filled with Nitrogen:

    R=5.0 cm; Length=60.0;

    10.0 cm far from the beam trajectory, 1.5 m downstream of the third quadrupole;

- General settings:
  - **DEFAULTS** to **PRECISIO**;
  - Do not forget the **magfld** routine!!

Exercise 5 – first step



- Give a Gaussian distribution in momentum to the beam:

  σ=0.01 GeV/c;

  → p_{max}=1.1 GeV/c (i.e. +10σ)→ $E_{k,max}$=508 MeV;

  → p_{min}=0.9 GeV/c (i.e. -10σ) → $E_{k,min}$=362 MeV;

- Speed up the simulation (**EMF** switched off, **PART-THR** at 300MeV);
- Change the magnetic configuration of the quadrupoles from DFFD to FDDF (key point: **ROT-DEFI** cards, describing the rotation about the *z*-axis by 90 degs);
- Set the yoke of the quadrupole (i.e. the iron part) to **BLCKHOLE**!
- Scoring:
  - Link the **rdfluscw.f** routine, in order to dump the characteristics of the beam particles lost; before linking, have a look at the routine, in order to check what it does!
  - **USRBDX** card, scoring beam particles lost in the quadrupoles, i.e. leaving the vacuum inside, and thus hitting the metal part (now to blackhole!) of the magnet;
  - **USERWEIG** card, in order to activate the routine (linking is not sufficient!);
- Run 1 cycle, increasing the number of primaries (e.g. 25'000);

Exercise 5 – second step

- Bring back the material of the quadrupole yoke to **IRON**!!
- Source:
  - Link the **rdsource.f** routine, in order to read the file with the losses;

    before linking, ***modify*** the routine, in order to load only losses in the **third** quadrupole:

    check that the **longitudinal** position of each primary read in the file matches the longitudinal position of the quadrupole (just an **IF** statement making use of **WHASOU(n)** parameters fed through the **SOURCE** card as below)
  - **SOURCE** card, to activate the source routine (linking is not sufficient!!):

    WHAT(1)=99.0 (logical unit);

    WHAT(2,3)=z_{min}, z_{max}; (interval for rejection criteria)
  - **OPEN** card, where you set the filename (status of file: "**OLD**");
- Scoring:
  - **USRBIN** card, scoring **Energy deposition** by region and lattice, i.e. special binning with **WHAT(1)=8.0**;

    it can be plot through Flair: remember to **superimpose** a geometry plot with the concerned geometry;
  - Pay attention to the normalisation factor!