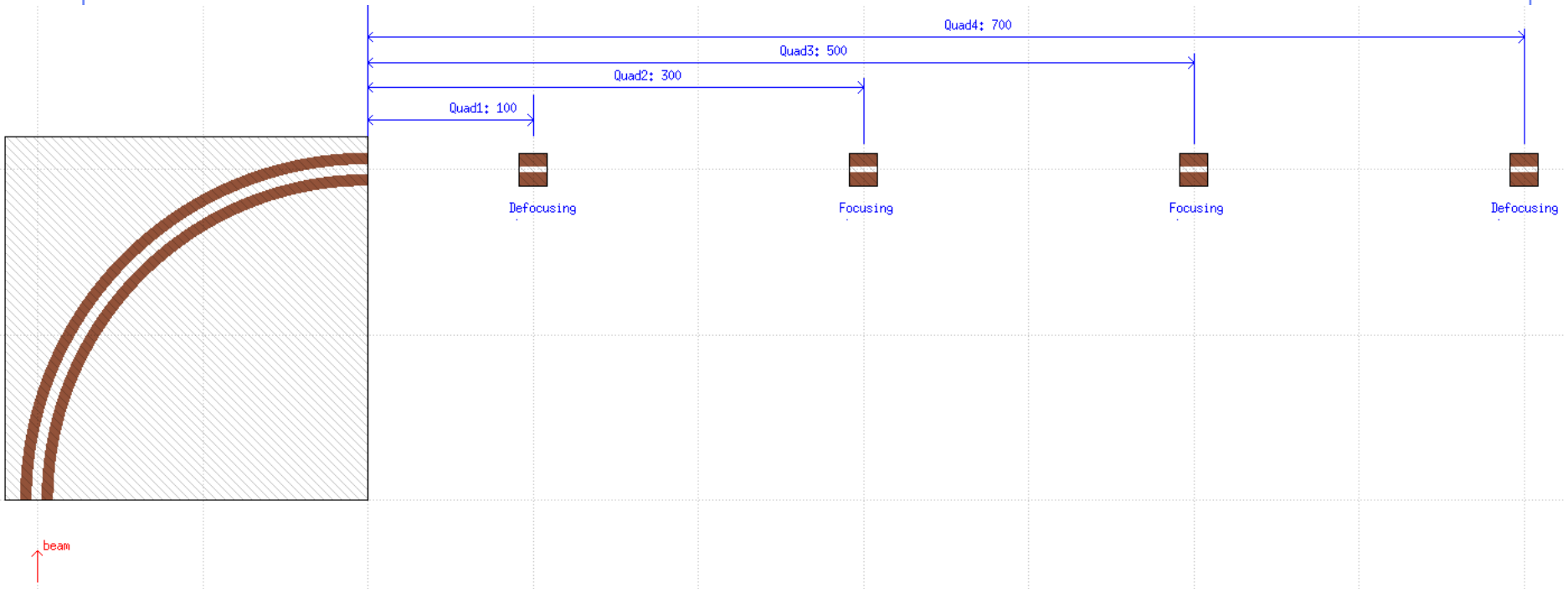
Exercise 3: Geometry

FLUKA Advanced Course

Exercise 3 - Layout



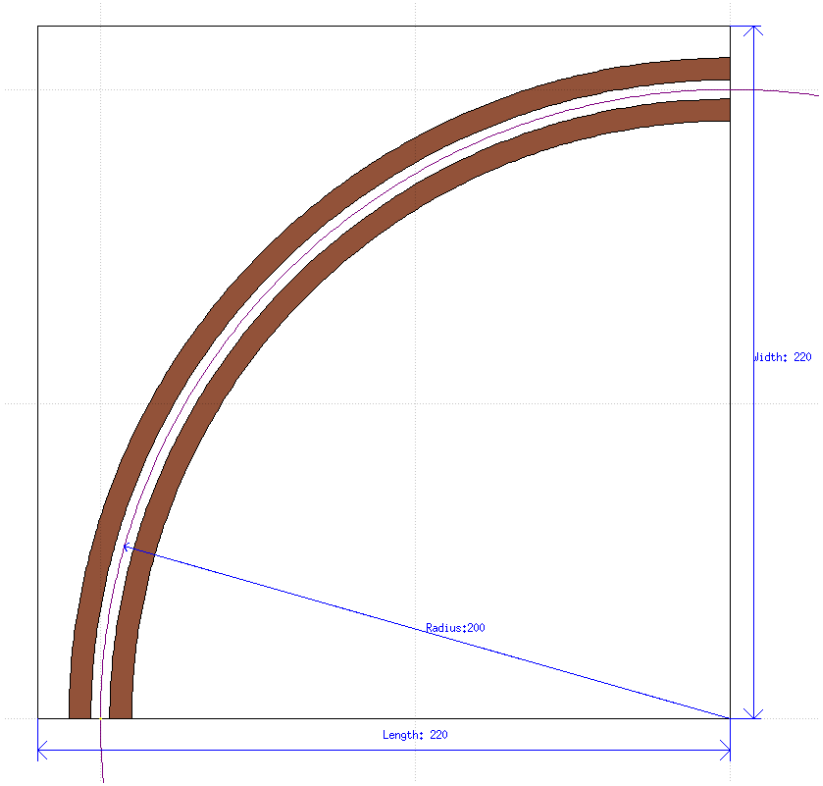
Exercise 3a

- Goal

  Build the geometry of a *warm dipole*

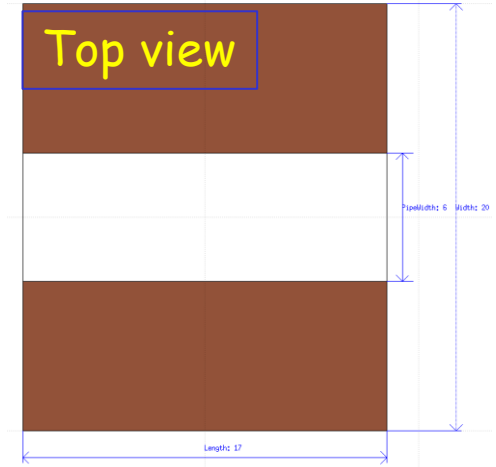
- Tips & Suggestions

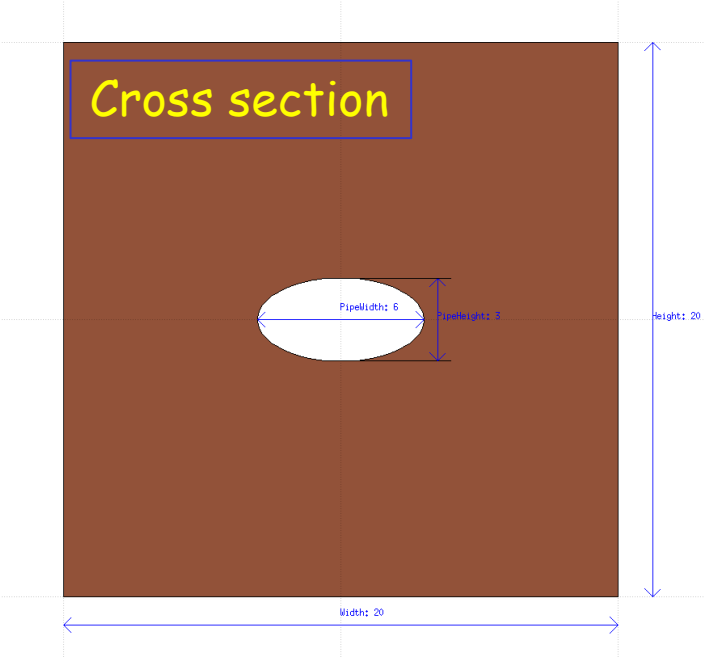
  - Use the 'dipole_*' 'technical drawings' you are given, superimposed to the geometry (create dedicated layers in the Geometry Editor);
  - Surround the model with a 'finite' body as bounding box, but use 'infinite' bodies as much as possible for the inside;
  - The vacuum region inside the dipole will be set as magnetic at a later stage;



Exercise 3b

- Goal
  Build the geometry of a *warm quadrupole*
- Tips & Suggestions
  - Superimpose the 'quad_*' 'technical drawings' to the geometry as dedicated layers;
  - Surround the model with a 'finite' body as bounding box, but use 'infinite' bodies as much as possible for the inside;
  - The quadrupole you are going to model is a Focussing one (i.e. it focuses the beam on the horizontal plane), featured by a beam pipe wider than higher;
  - Centre the model around (0,0,z), in order to simplify the routine for magnetic fields;
  - The vacuum region inside the quadrupole will be set as magnetic at a later stage;





Exercise 3c

- Goal

  Build the geometry of a small *accelerator line*

- Requirements
  - The accelerator line is composed by a dipole and four quadrupoles - see 'geometry_*' 'technical drawing';
  - The beam will go through the dipole and the four quadrupoles: choose the most suitable reference system!
  - The sequence of quadrupoles is *Defocussing–Focussing – Focussing-Defocussing*; the Defocussing quadrupole can be obtained inserting a rotation by 90 degrees about the longitudinal axis;
- Tips & Suggestions
  - Re-use the elements you have modelled so far; in particular:
    - put the model of the dipole directly along the beam line;
    - put the model of the quadrupole in a separated portion of the geometry, fully surrounded by **BLCKHOLE**, through a $start_translat directive;

Exercise 3c (II)

- Tips & Suggestions (continued)

  use the lattice capability of Fluka in order to create the four replica;

  the magnetic field in the quadrupole will be set at a later stage;

  - Recipe for lattices:

    For each replica of the quadrupole:

    1. Clone the bounding box of the quadrupole model, including the $start_translat directive (remember to assign a new and unique name!);
    2. Build the correct sequence of transformations, i.e. the one moving particles from the replica to the model;
    3. Assign the transformation to the body through a $start_transform directive, but in the opposite direction - remember the '-' sign;
    4. Create the region and the **LATTICE** card (remember to assign new and unique names!);

Exercise 3d

- Goal

  shoot the beam through the entire beam line, and check the evolution of the beam position/profile in selected points;

- Requirements
  - Beam settings:
    - 10 GeV/c protons , shot upstream of the dipole;
    - Gaussian beam: $\sigma_x = \sigma_y = 1$mm, with no divergence;
  - Magnetic settings: dipole field on (**ASSIGNMA** and **MGNFIELD** cards), so that particles follow the curvature of the pipe:

    $$B[T] = p[GeV/c] / (0.2998 * \rho[m])$$

  - insert three **USRBIN** scorings of BEAMPART fluence:
    1. upstream of the dipole (but downstream of the position where the beam is generated);
    2. downstream of the dipole;
    3. downstream of the quadrupoles – 200cm downstream of the last one;