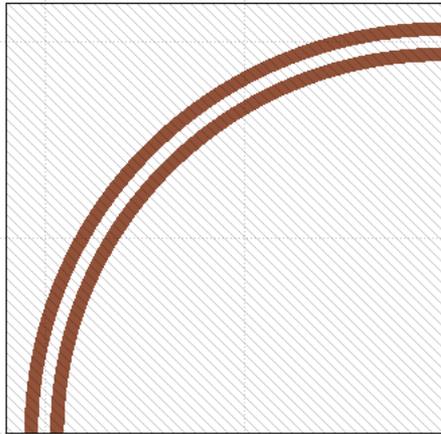
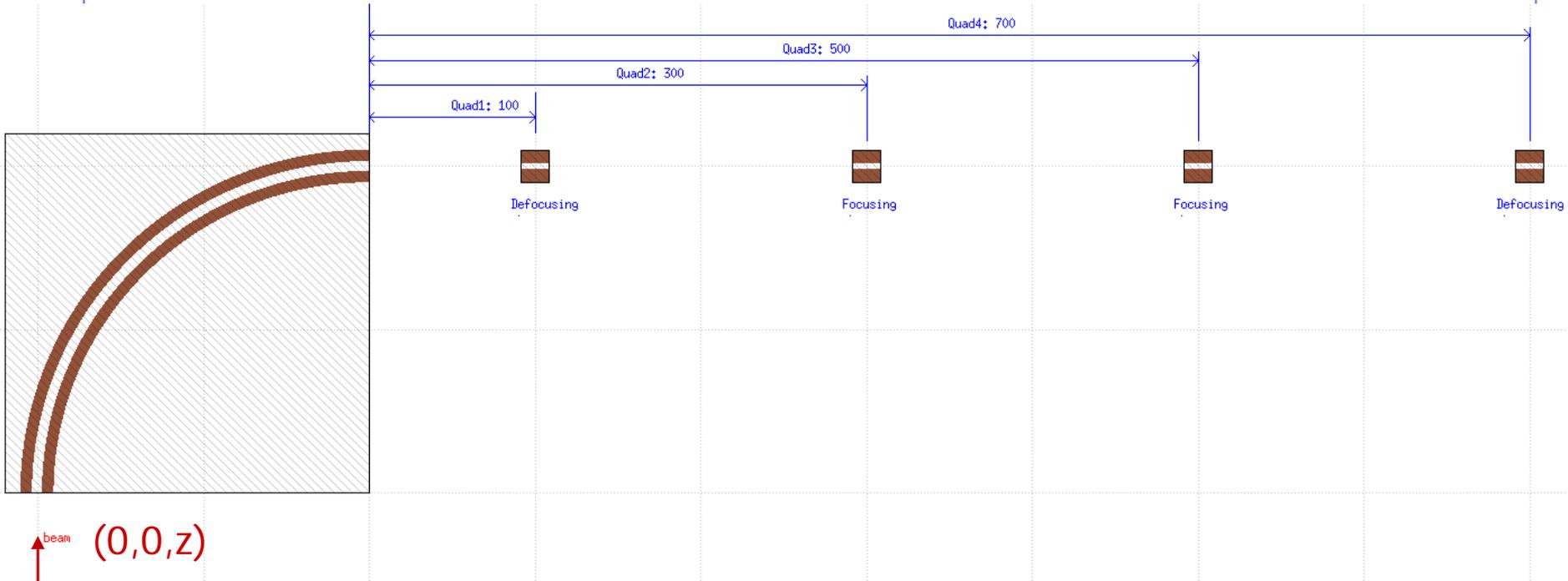




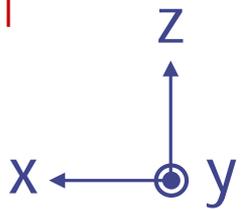
Exercise 3: Geometry

Advanced FLUKA Course

Exercise 3 - Layout



beam $(0,0,z)$



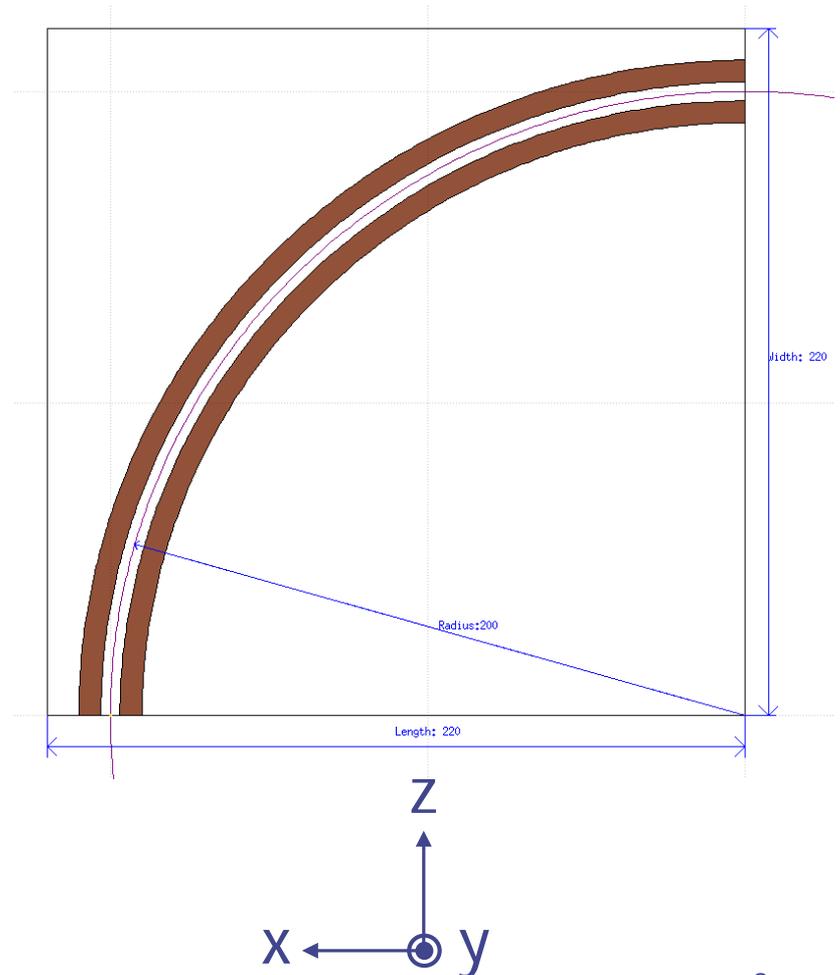
Exercise 3a

- Goal

Build the geometry of a *warm dipole*

- Tips & Suggestions

- Put the model of the dipole directly in its final position along the line;
- 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;



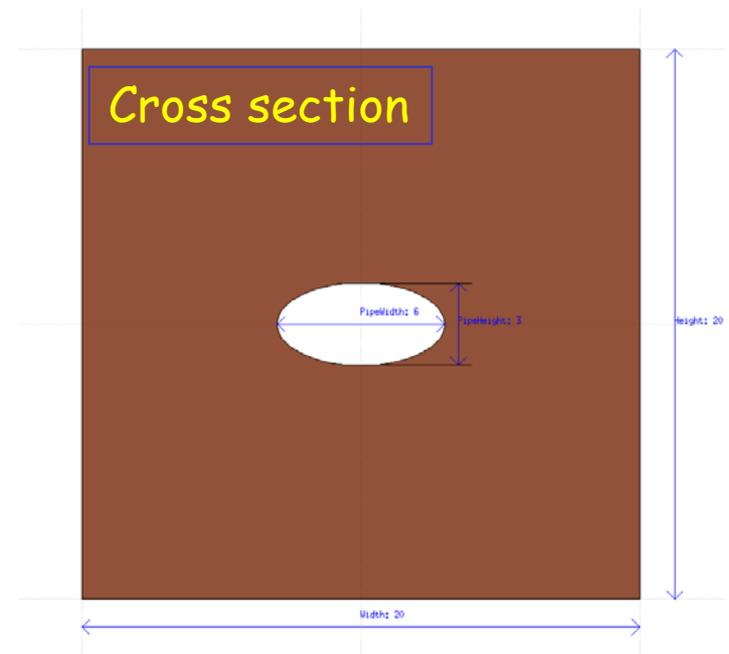
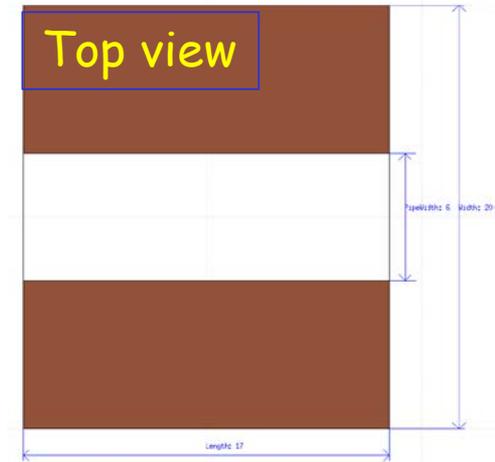
Exercise 3b

- 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 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:

- ◆ 1 GeV/c protons , shot upstream of the dipole;
- ◆ Gaussian beam: $\sigma_x = \sigma_y = 1\text{mm}$, with no divergence;

- Magnetic settings: dipole field on (**ASSIGNMA** and **MGNFIELD** cards), so that particles follow the curvature of the pipe:

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

- 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;