

# Appendix C – Source Definition Script

Introduced in version 4.6, an arbitrary source shape can be specified for the BEM simulation. This is the case especially when using dome tweeters but it can also be used for a simulation of a non-flat compression driver output wavefront, or even of a complete compression driver phase plug. The only limitation is that the shape must be axi-symmetric.

The recommended procedure is as follows:

- make a cut drawing of the requested geometry with all the dimensions marked,
- based on the coordinates of all the significant points in the drawing, create a script definition file.

The geometry is defined in the z-r plane and the actual horn profile always starts at  $[0, r_0]$ .

## Script Syntax

Currently, only three basic geometrical entities are available: points, lines and circular arcs. First, all of the points must be defined. Each point is given a name (“id”) by which it is referenced further in the script. All higher graphical entities, such as lines and arcs, are created by means of previously defined points. There is also one special virtual object type called *control point*, used only to define a geometry of other elements, like centers of arcs.

Another special point, automatically defined and always identified as **WG0**, represents the first point of the horn profile. This point must be used to connect the source contour to the waveguide surface.

### Point definition:

```
point <id> <z> <r> <mesh_size>
```

<id>	Unique alpha-numerical identifier.
<z>	z-coordinate (distance from the throat) [mm].
<r>	r-coordinate, i.e. “radius” of the point (distance from the horn’s axis) [mm].
<mesh_size>	Constraint on the mesh size [mm].

### Control point definition:

```
cpoint <id> <z> <r>
```

**Line definition:**

line      <point\_1> <point\_2>   <weight>

<point\_1>      id of the starting point.

<point\_2>      id of the ending point.

<weight>      Weight of the surface's acoustic radiation (1 = full, 0 = not moving).

**Circular arc definition:**

arc      <point\_1> <center> <point\_2>   <weight>

<point\_1>      id of the starting point.

<center>      id of the central (control) point.

<point>      id of the ending point.

Arc angle must be strictly less than  $\pi$ .

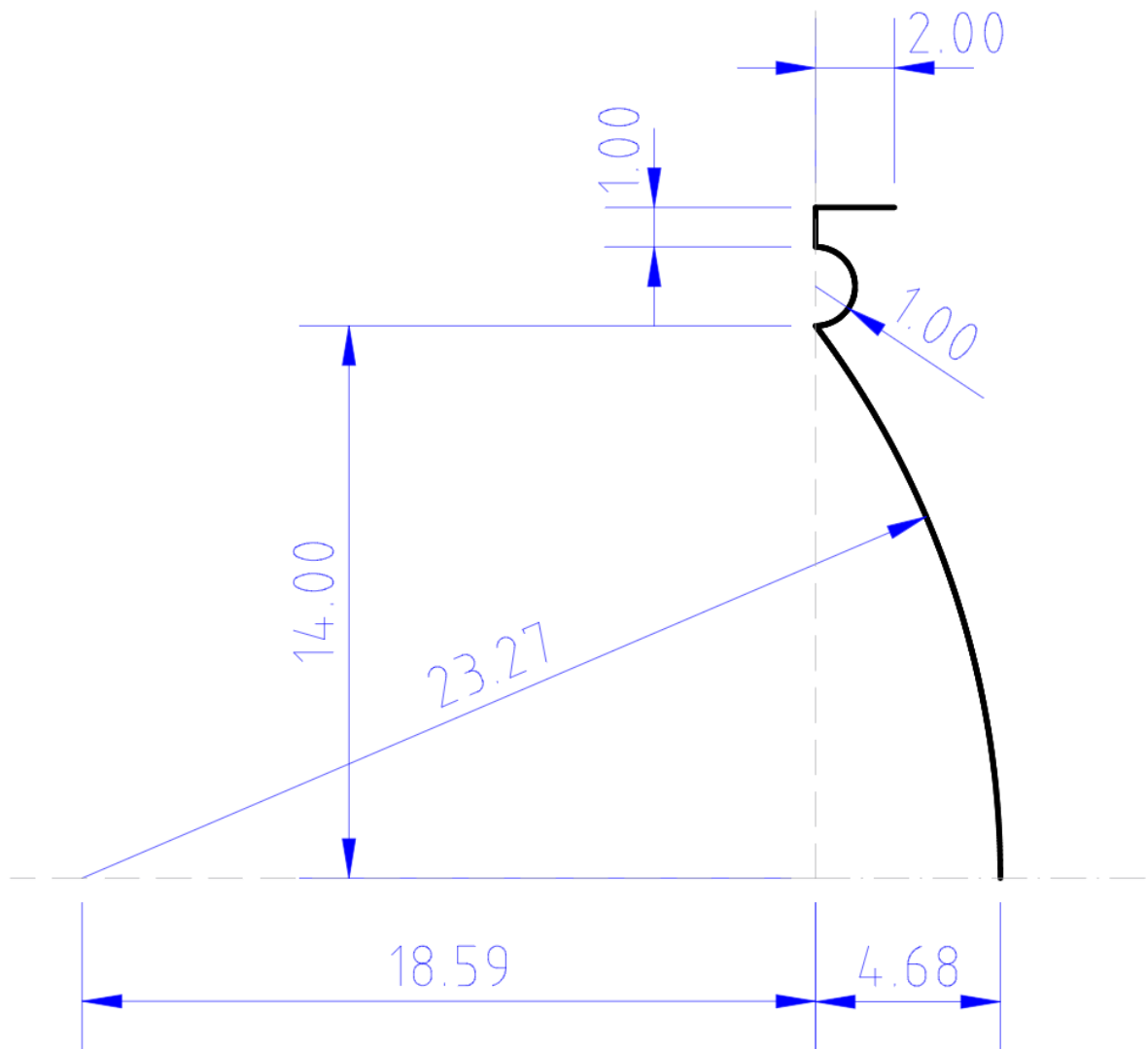
**Miscellaneous:**

zoff      <z\_offset>

Shifts the coordinates origin in the z axis direction [mm]. It must be set before the points whose coordinates it is supposed to shift - it is possible to change this value any number of times in the middle of the script if necessary.

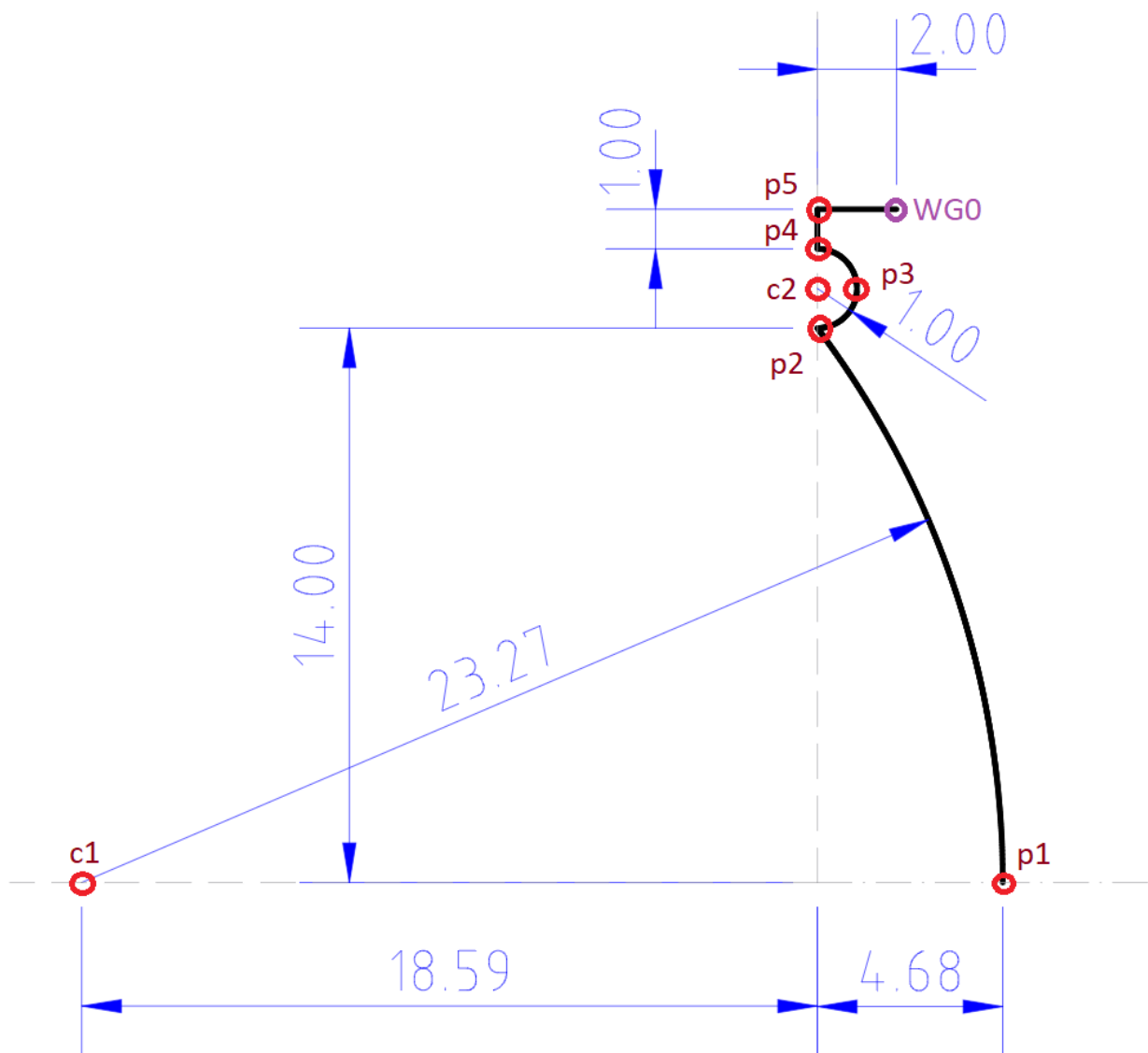
## Example

Let's say we want to define a dome tweeter as depicted on the following drawing.



There are two circular arcs as the moving parts (the diaphragm and the surround) and two lines belonging to the mounting plate.

First, we need to identify all the significant points that will allow us to construct the whole contour:



Based on the drawing we define points **p1 – p5** and two control points **c1, c2** (the centers of the arcs):

```
point    p1    4.68  0    2
point    p2    0     14   0.5
point    p3    1     15   0.5
point    p4    0     16   0.5
point    p5    0     17   1

cpoint   c1   -18.59  0
cpoint   c2    0    15
```

After we have the points we can define the arcs and the lines:

```
arc    p1 c1 p2 1.0
arc    p2 c2 p3 0.75
arc    p3 c2 p4 0.25

line   p4 p5 0
line   p5 WG0 0
```

Several things to notice here:

- The last segment of the contour is the line **p5 – WG0**. The basic contour must always be connected to the horn by using the point WG0, which is automatically defined as the first point of the actual horn profile (in this example the throat diameter is set to 34 mm, so this line is parallel to z axis as the result). This means that there can't be holes left in the surface. It doesn't mean, however, that the whole contour must be one continuous surface. It is perfectly possible to create several disjunctive objects that don't touch each other, like a phase plug in front of the diaphragm, etc.
- The last number in the arc and line definition is the weight of its acoustic radiation. By setting this value to zero we say that these are the non-moving parts.

The last important thing to take care about is the absolute coordinates of the points. That's because the horn always starts at  $z = 0$ . So far we have used the coordinates directly from the drawing – that would be wrong! If you look carefully, we need to shift the whole drawing by -2 mm in the z direction for the point WG0 to be exactly at  $z = 0$  (now it is at  $z = 2$ ). We can do this easily by using the **zoff** command.

Now we can have a look at the complete script file describing our source:

```
zoff   -2

point  p1 4.68 0 2
point  p2 0 14 0.5
point  p3 1 15 0.5
point  p4 0 16 0.5
point  p5 0 17 1

cpoint c1 -18.59 0
cpoint c2 0 15

arc    p1 c1 p2 1.0
arc    p2 c2 p3 0.75
arc    p3 c2 p4 0.25

line   p4 p5 0
line   p5 WG0 0
```

The finished mesh, based on the previous source definition script file (moving parts in red):

