1 The Implement of Sbend in OPAL-t

Sbend is a sector bending magnet. To describe a sbend, we use the parameters: entrance angle $E1$, exit angle $E2$, orbit radius ρ , gradient $K1$. Fig. 1 and Fig. 2 give the view of Sbend with $B > 0$ and $B < 0$.

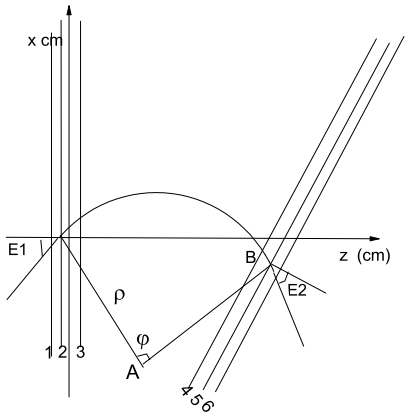

Figure 1: Sbend with $B > 0$

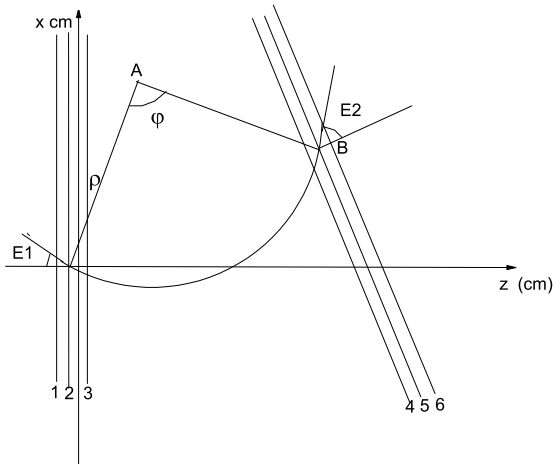

Figure 2: Sbend with $B < 0$

1.1 The Local Coordinate

At the entrance of the Sbend, a local coordinate is set as shown in Fig. 1 and Fig. 2. The point $z = 0$ means the element edge. The region between Line 1 and Line 3 is the entrance fringe field region, the region between Line 4 and Line 6 is the exit fringe field region and the region between Line 3 and Line 4 is main field region with field gradient.

1.2 The Fringe Field

The fringe field of Sbend is described using three linear equations. For the entrance pole face,
Line1: $z = zbegin\_entry$,
Line2: $z = polynomial\_entry$,
Line3: $z = zend\_entry$.
For the exit pole face,
Line4: $z = k_3 x + b_3$,
Line5: $z = k_{34} x + b_{34}$,
Line6: $z = k_4 x + b_4$.

In most cases, the slope of the exit pole face $k_3 = K_{34} = k_4$, and is given in the input file as EXITANGLE. Other parametars are given in the fieldmap file.

If $B > 0$, $k_{34} = \tan(\phi - E1 - E2)$,
$b_{34} = \rho \sin(\phi - E1) + \rho \sin E1 - k_{34}[\rho \cos(\phi - E1) - \rho \cos E1]$.

If $B < 0$, $k_{34} = \tan(\phi - E1 - E2)$,
$b_{34} = \rho \sin(\phi - E1) + \rho \sin E1 - k_{34}[-\rho \cos(\phi - E1) + \rho \cos E1]$.

1.3 The Field Map 1DProfile1

(First line)
string: 1DProfile1
integer: The number of Enge coefficients for entry fringe field.
integer: The number of Enge coefficients for exit fringe field.
float: gap heigth [cm]
(Second line)
float: $zbegin\_entry$ [cm]
float: $polynomial\_entry$ [cm]
float: $zend\_entry$ [cm]
integer: not used here
(Third line)
float: b_3 [cm]
float: b_{34} [cm]
float: b_4 [cm]
integer: not used here
The following lines are the coefficients of the Enge function.

1.4 The Field Gradient

The parameter $K1$ in the description of Sbend is the field gradient n, where n is defined by the equation

$$B_y(x,0,t) = B_y(0,0,t)(1 - nx/\rho + ...), \tag{1}$$

and

$$B_x(x,0,t) = B_y(0,0,t)(-ny/\rho), \tag{2}$$

2 The Result

Fig. 3 shows the comparison of envelope IW2 line between opal-t, transport and measurements.

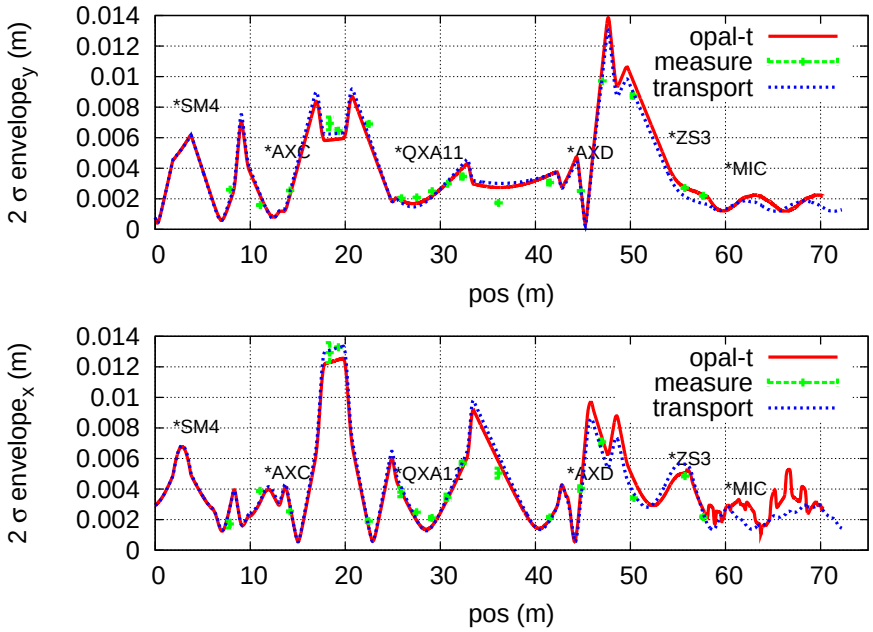

Figure 3: The comparison of envelope between opal-t, transport and measurements.