

The contribution of polar angle offset to relative error on luminosity can be estimated using approximate formula :

$$\Delta\mathcal{L}/\mathcal{L} \approx 2 \Delta\theta / \theta_{min} \quad (1)$$

The size of  $\Delta\theta$  solely due to uncertainty of LumiCal z position and inner radius r can be estimated using straightforward obtainable formula :

$$\Delta\theta = (R_{min} \Delta z - z_{nom} \Delta r) / z_{nom}(z_{nom} + \Delta z) \quad (2)$$

Where  $R_{min}$  is inner radius of LumiCal and  $z_{nom}$  is nominal distance from interaction point along z axis. Combining (1) and (2), and setting consecutively uncertainties  $\Delta z$  and  $\Delta r$  to zero, one calculates upper limits for their size independently.

Results of these calculations are collected in the table 1.

	Required $\Delta\mathcal{L}/\mathcal{L}$	$z_{nom}$ [mm]	$R_{min}$ [mm]	$\theta_{min}$ [rad]	$\Delta\theta_{max}$ [rad]	$\Delta z_{max}$ [mm]	$\Delta r_{max}$ [mm]
ILC GigaZ	$\leq 10^{-4}$	2500	80	0.032	$1.6 \times 10^{-6}$	$< 0.125$	$< 4 \times 10^{-3}$
ILC 500GeV	$\leq 10^{-3}$	2500	80	0.032	$1.6 \times 10^{-5}$	$< 1.25$	$< 4 \times 10^{-2}$
CLIC 3TeV	$\leq 10^{-2}$	2500	100	0.040	$2 \times 10^{-4}$	$< 12.5$	$< 0.5$