|  | $\Delta z$ | $\Delta r$ | $\Delta \phi$ |
| :--- | :---: | :---: | :---: |
|  | $z$ expansion | bowing | twist |
| vs. $z$ | $\Delta z=\epsilon z$ | $\Delta r=\epsilon r\left(z_{0}^{2}-z^{2}\right)$ | $\Delta \phi=\epsilon z$ |
|  | overlap | overlap | $\mathrm{Z} \rightarrow \mu \mu$ |
|  | telescope | radial | layer rotation |
| vs. $r$ | $\Delta z=\epsilon r$ | $\Delta r=\epsilon r$ | $\Delta \phi=\epsilon r$ |
|  | cosmics | overlap | cosmics |
|  | skew | elliptical | sagitta |
| vs. $\phi$ | $\Delta z=\epsilon \cos \left(\phi+\phi_{0}\right)$ | $\Delta r=\epsilon r \cos \left(2 \phi+2 \phi_{0}\right)$ | $\Delta \phi=\epsilon \cos \left(\phi+\phi_{0}\right)$ |
|  | $\operatorname{cosmics}$ | $\operatorname{cosmics}$ | $\operatorname{cosmics}$ |

