One of the critical components of a PIV system is the laser light sheet. It is not uncommon for a very wide light sheet to be required. Standard cylindrical lenses offer a convenient method for expanding the laser light sheet into a sheet.

In order to increase the beam divergence angle of a PIV light sheet, a combination of cylindrical lenses may be used in succession. The collimated beam diameter \( t \), focal length of the lenses \( f \), and distance separating the lenses \( s \), all have an impact on the resultant light sheet divergence angle \( \alpha_2 \).

The final angle of divergence is given by \( \alpha_2 \). The following expressions can be derived from the above diagram:

\[
\alpha_1 = \tan^{-1}\left(\frac{\sqrt{2}}{-f_1}\right) \\
\alpha_2 = \tan^{-1}\left(\frac{(s-f_1)\tan(\alpha_1)}{-f_2}\right) = \tan^{-1}\left(\frac{1(s-f_1)}{2f_1f_2}\right)
\]

The table below gives example values for the associated parameters and the resulting angles of divergence for both cylindrical lenses in varying order (note: the separation distance, \( s \), and beam diameter, \( t \), used here are based on a typical 15 Hz pulsed Nd:YAG laser and TSI "bayonet-mount" light sheet optics).

<table>
<thead>
<tr>
<th>( t ) [mm]</th>
<th>( s ) [mm]</th>
<th>( f_1 ) [mm]</th>
<th>( f_2 ) [mm]</th>
<th>( 2\alpha_1 ) [deg]</th>
<th>( 2\alpha_2 ) [deg]</th>
</tr>
</thead>
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