

Details on carrying out the LEO-fit method using the PSI Toolkit

Under the LEO-fit tab the first step is to choose “get beam and PSD properties”. For this step, we chose scattering low gain (SCLG) for the scattering channel to be used and split low gain (SPLG) for the split detector channel to be used. The split detector helps determine the position of an individual rBC-containing particle within the laser beam. We used the default “minimum peak height to be considered” of 1600 with 40 “points before the peak center to be considered”. Upon completion of this step, a “LEO_BeamShapeStats” plot should display a perfect Gaussian response with a shown split detector position. A second output of the PSI-TK is a plot titled “LEO_BeamFWHM_and_SplitTime_Graph”. The full width at half maximum for our analysis was approximately 8 μs with a split point to beam center delay time of approximately 4 μs . The second step is to perform the “LEO trace analysis”. The fast LEO fit with 3 points was used for our analysis using the SPLG channels for PSD split position. For this section, the PSI-TK will prompt the selection of the “BeamAndCalib” folder within the “LEO” folder of the IGOR Pro data browser. We only fit the scattering low gain data and split low gain data by selecting the “fit SCLG” and “fit SPLG” boxes in the PSI-TK. We concurrently selected “run LEO post processing,” which causes “verification of optical sizing” to be performed at this time. The broadband high gain broadband low gain combined signal (BHBL) for the “incandescence channel for BC cores” was selected along with $RI=2.26+1.26i$ for rBC cores and $RI=1.50+0i$ for “Mie data for coated BC core” based on previous literature (Taylor et al., 2014; Moteki et al., 2010; Dahlkötter et al., 2014; Gao et al., 2007). Excellent linear agreement should be found on the PSI-TK outputted plot entitled “LEO_verification_SCLG_vs_SCLG.” If

necessary, adjustments can be made based on the given SP2 configuration and the “slope fudge factor”.

References

See main body