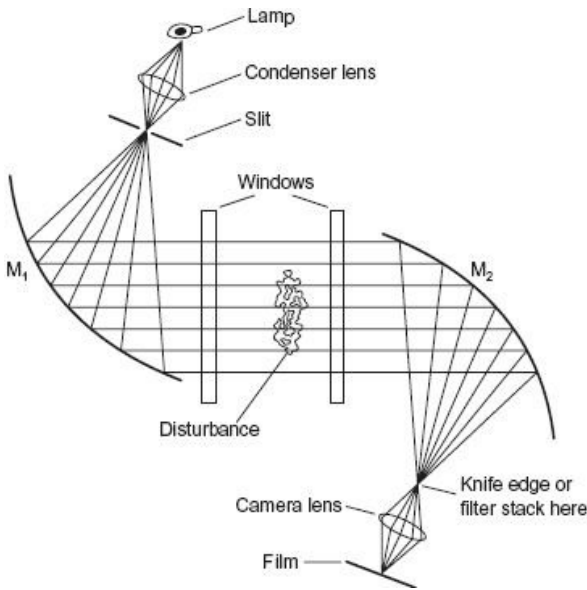


18A.IndexOfRefraction

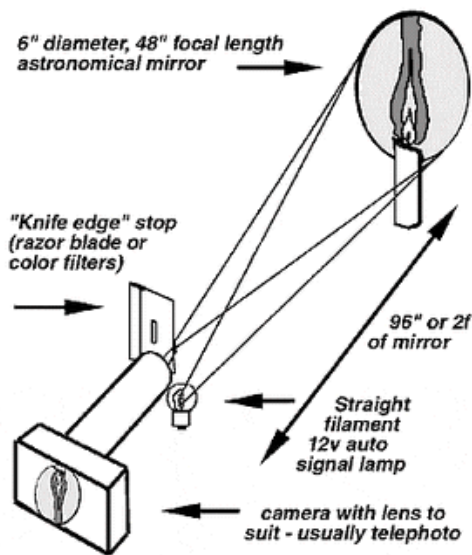
2

Monday, November 14, 2016 7:50 AM
Today: Finish Refractive Index Methods,
Then back to dyes; Light Emitting Fluids

Z fold with mirrors; saves space, cost. Want space between mirrors to be $3 \times f$
Either spherical or parabolic mirrors work.

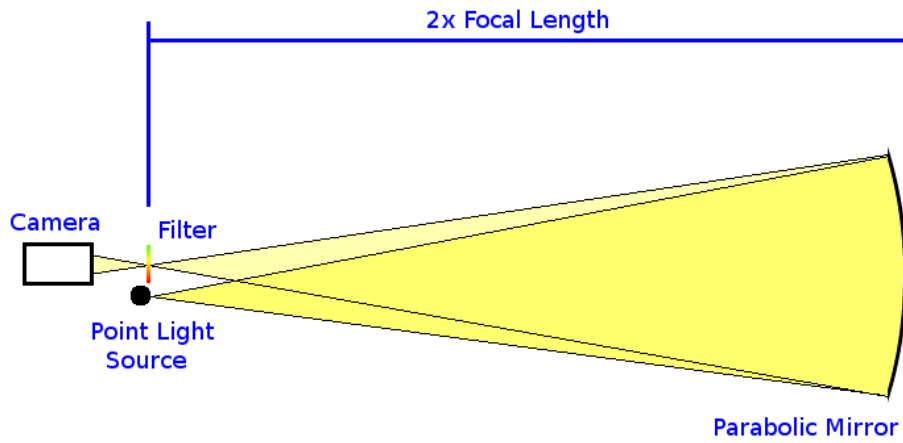


Pasted from
<http://2.bp.blogspot.com/_JUESvkRXuK0/SQZ0JdkMBAI/AAAAAAAAABPk/OGvKULVzNJ4/s320/schlieren.gif>

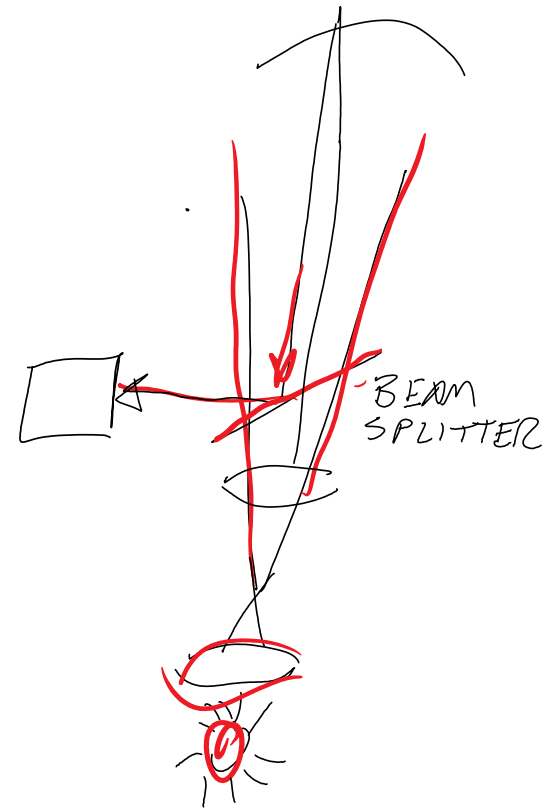
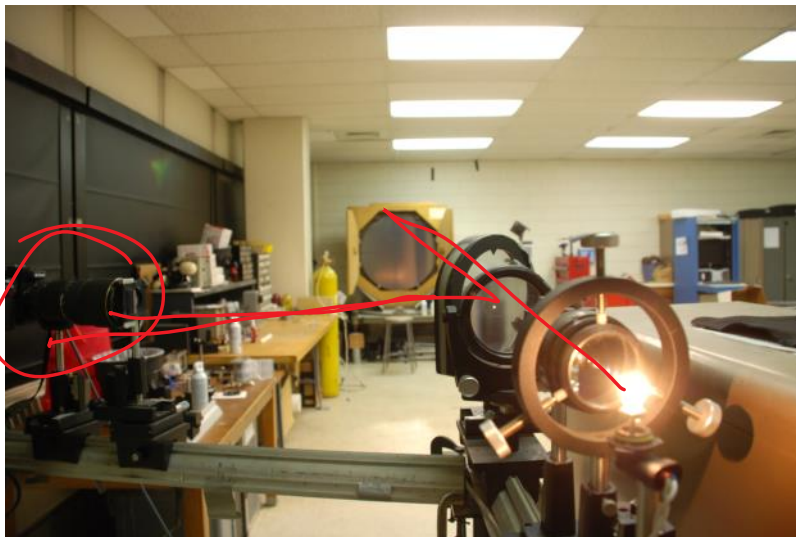


Single mirror system

Pasted from
<<http://www.ian.org/Schlieren/SchlierenDiagram.png>>



<https://m.youtube.com/watch?v=BPwdIEgLn5Q> Smarter Every Day; high speed video of shock waves from bullets



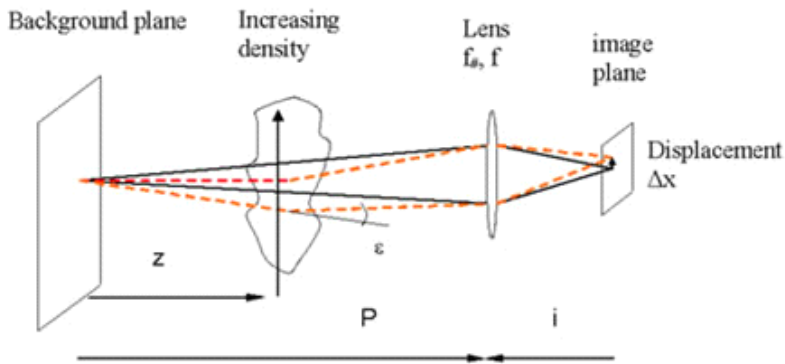
Gas Dynamics lab at Penn State University
Prof. Gary Settles, author of

Schlieren & Shadowgraph Techniques, Corrected. (Springer, 2001).

<file:///C:/Users/hertzber/Documents/01CLASSES/FlowVis/MiscImages/Settles/SchlierenVisit/DSC_0324.AVI> My visit in March 2011

BOS = Background Oriented Schlieren

Uses patterned background instead of mirror, any random lighting. View of background will be distorted by η field. Take two images and do cross correlation, like PIV.

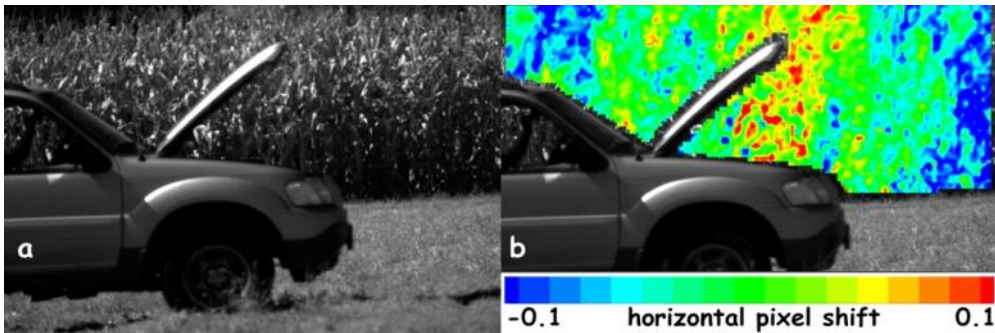


http://www.dlr.de/as/en/desktopdefault.aspx/tabid-183/251_read-2726/

<http://www.mne.psu.edu/psgdl/Res-Optical.html>

The thermal plume generated from a hot truck engine is visualized against a background of corn. The (a) original image is compared to one recorded 7 ms later to determine the (b) horizontal pixel shift. The contour plot of horizontal pixel shift in a BOS image is optically equivalent to a vertical knife-edge cutoff in traditional schlieren.

Pasted from <http://www.mne.psu.edu/psgdl/Res-Optical.html>

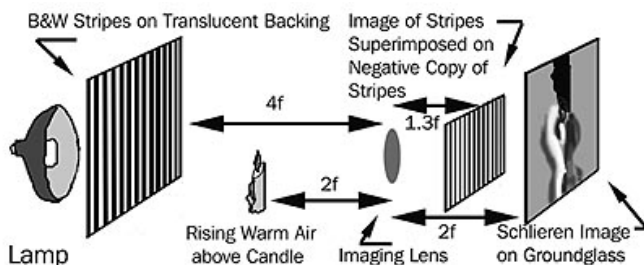


Hargather, Michael, and Gary S. Settles. "BACKGROUND-ORIENTED SCHLIEREN VISUALIZATION OF HEATING AND VENTILATION FLOWS: HVAC-BOS. Paper 266." In *ISFV14 - 14th International Symposium on Flow Visualization*, 1–8. EXCO Daegu, Korea, 2010.

Hargather, Michael John, and Gary S. Settles. "Natural-background-oriented Schlieren Imaging." *Experiments in Fluids* 48, no. 1 (January 1, 2010): 59–68. doi:10.1007/s00348-009-0709-3.

Focusing schlieren

<http://people.rit.edu/andpph/text-schlieren-focus.html>



<https://www.youtube.com/watch?v=DYx2xLLrUyg> ice cube in a fishtank, by Spectabit:

<http://www.spectabit.com/index.php/product-types>

Now, an even simpler method, using an encoded light field:

Light Field Background Oriented Schlieren Photography (LFBOS)

<http://www.cs.ubc.ca/nest/imager/tr/2011/LFBOS/>

Klemkowsky, Jenna N., Timothy W. Fahringer, Christopher J. Clifford, Brett F. Bathel, and Brian S. Thurow. "Plenoptic Background Oriented Schlieren Imaging." *Measurement Science and Technology* 28, no. 9 (2017): 095404. <https://doi.org/10.1088/1361-6501/aa7f3d>.

In Zotero library.

We have two sets of 4" diameter mirrors; would love to see 3D stereoscopic schlieren.