Testing the Assembled Camera

D. L. Burke

Camera Calibration Workshop
BNL
October 18, 2005

Integrated Camera Test and Calibration

When …

Camera is completed and sitting in SLAC assembly room.
Electronics and DAQ working.
Peripherals (shutter, filters, etc) in place and working.

Goal

Verify we are ready to ship the Camera to the mountain.

Method

Run the camera as if it were taking data on the telescope!

Images to Record and Analyze

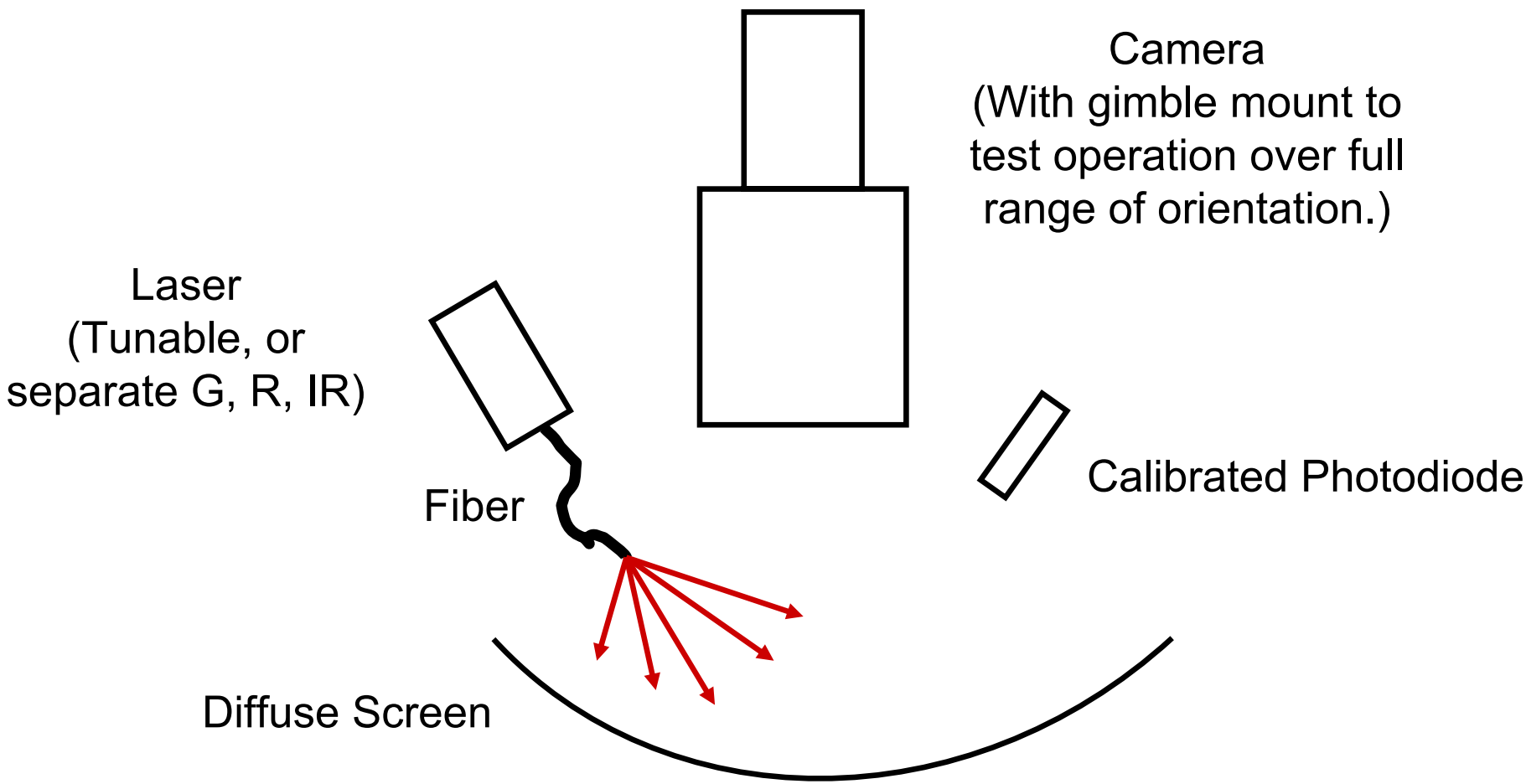
Bias frames – zero exposure time.
Darks (long and short) – shutter closed.
Flats – illuminated screen monitored with photodiode.
Laser “stars”.

Flat Field and Integrated Response

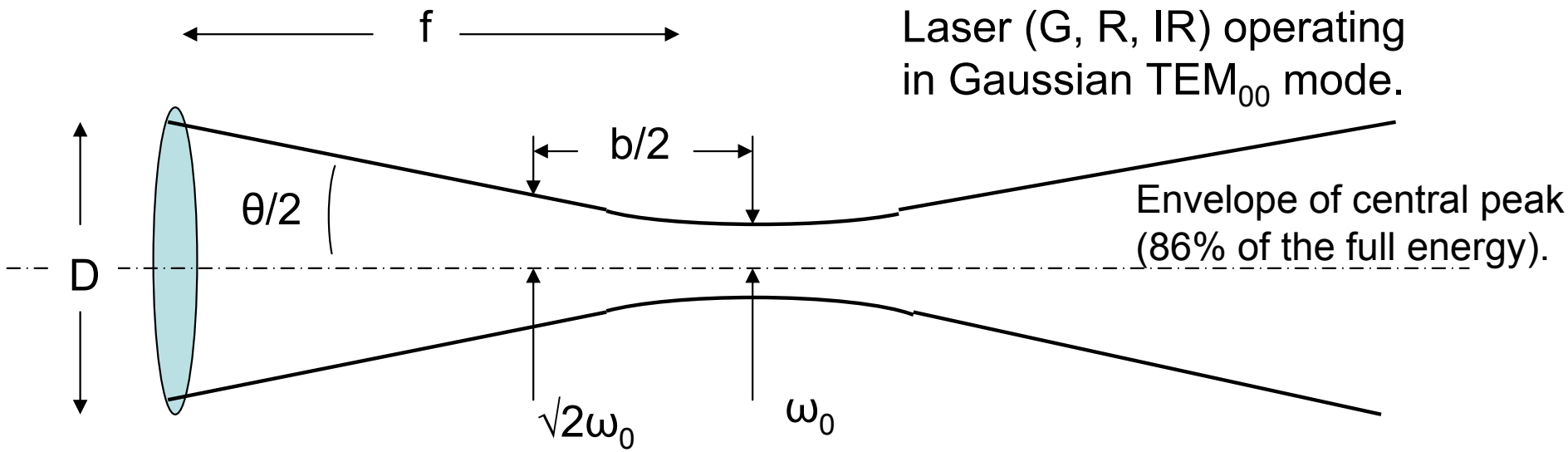
(e.g. Fringing Tests)

Coordinate with Telescope Team

Match as closely as possible the dome-flat calibration technique and parameters that will be used on the mountain (e.g. Stubbs):



Focusing a Laser Beam



Laser (G, R, IR) operating in Gaussian TEM_{00} mode.

Envelope of central peak (86% of the full energy).

Formulae:

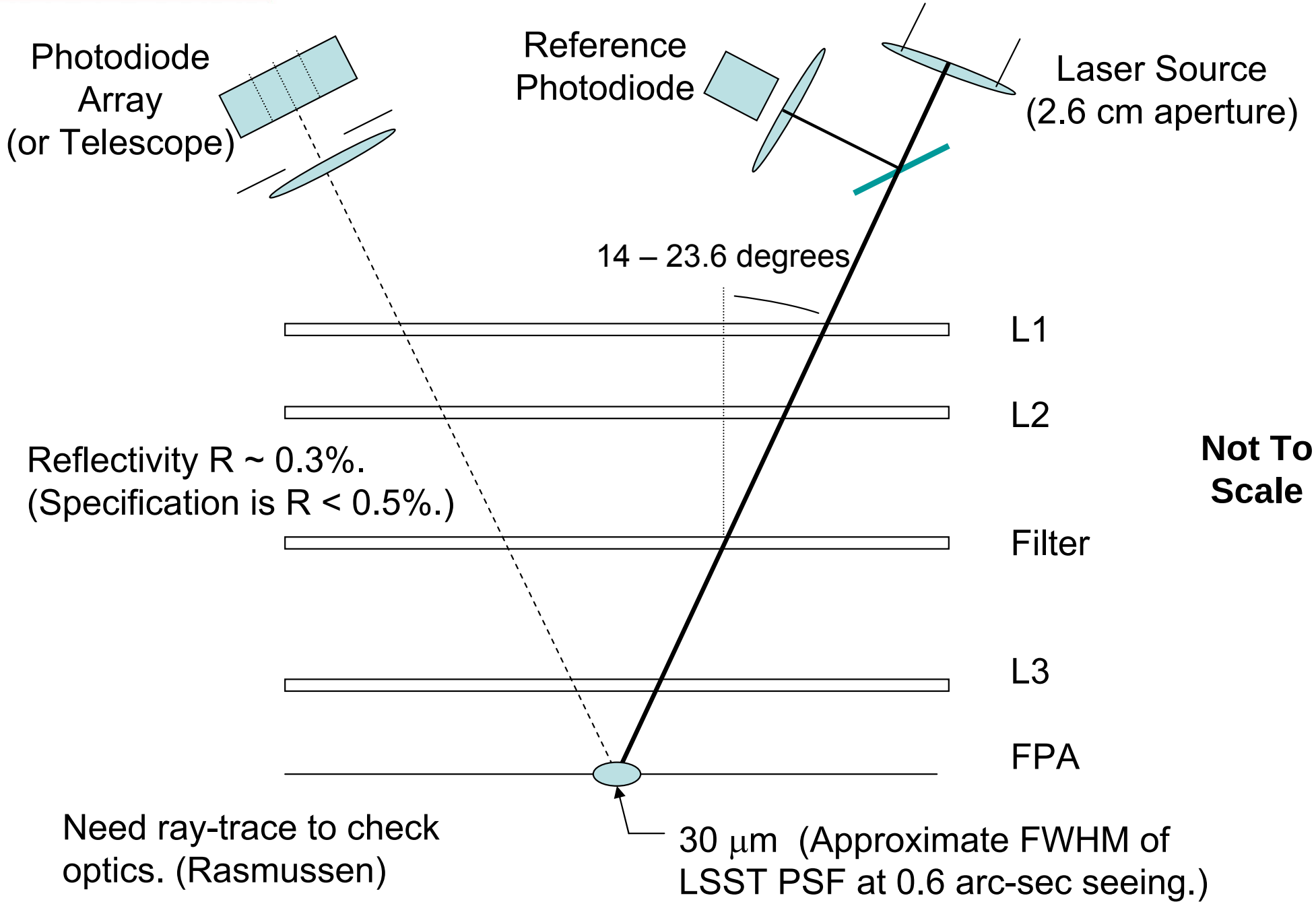
$\theta = 1.27\ \lambda/2\omega_0$

$b = 2\pi\ \omega_0^2 / \lambda$

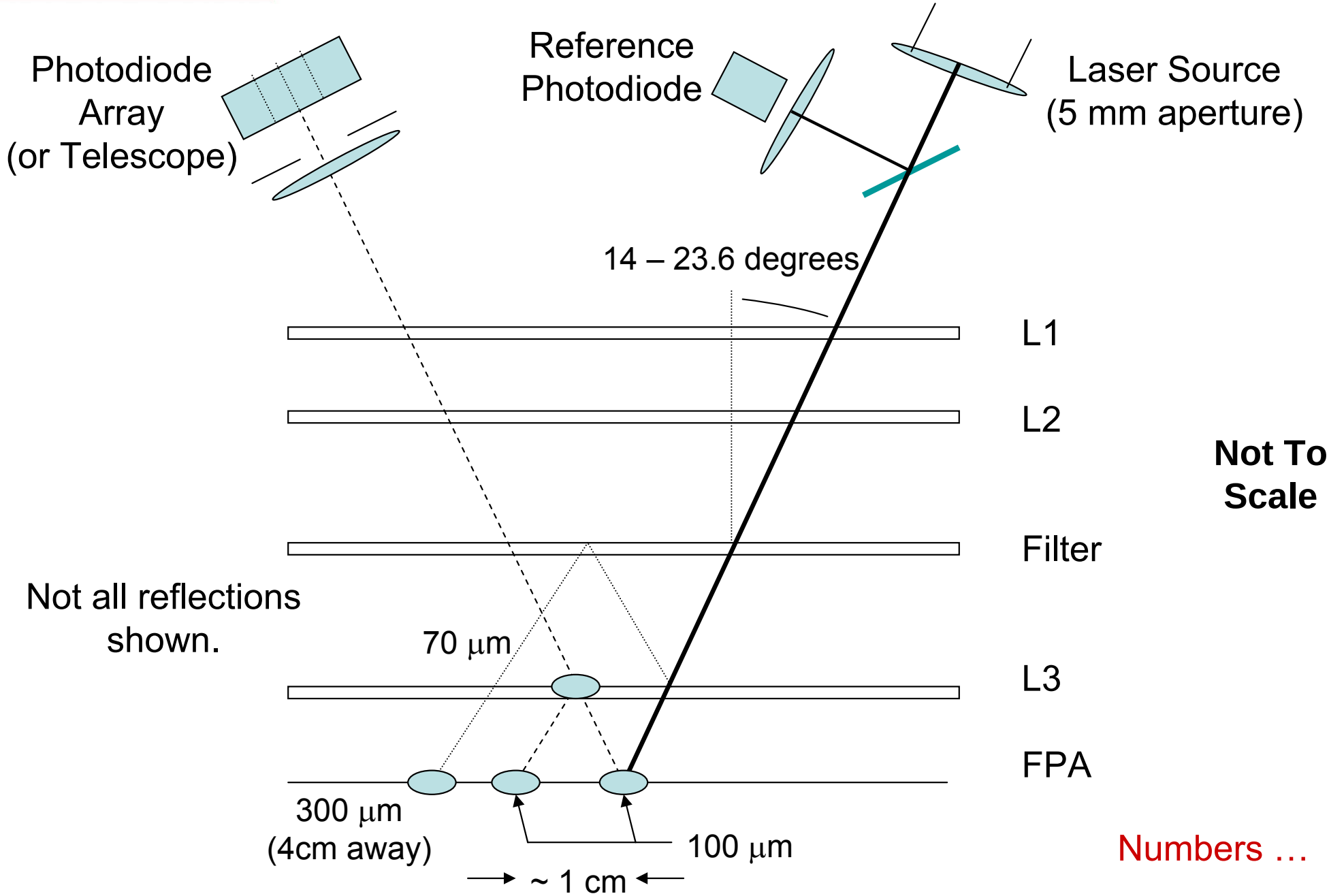
Numbers:
(f = 1.2 meters; λ = 0.5 μm)

$2\omega_0$ (μm)	b (cm)	D (cm)
30	0.3	2.6
60	1.1	1.3
140	6.2	0.5

Laser "Star" Schematic



Ghosting Test Schematic



Numbers …

Some Numbers and a Possible "Run Plan"

Input Specifications

R < 0.5% Take 0.3%, for example → intensity after two reflections is reduced by factor of 10^{-5}.

CCD Full Well > $0.7 \bullet 10^5$ electrons.

Read Noise ≈ 5 electrons.

So if we just saturate a pixel at the primary spot, then get ~ 1 electron at corresponding pixel a centimeter or so away.

Will want to run with primary spot saturated (maybe a sequence something like: unsaturated pulse, saturated pulse, dark frame).

Use LSST cadence of two 15 second exposures every 32 seconds.

Stack images – an LSST field stack of ≈ 240 images every hour – a data analysis challenge!