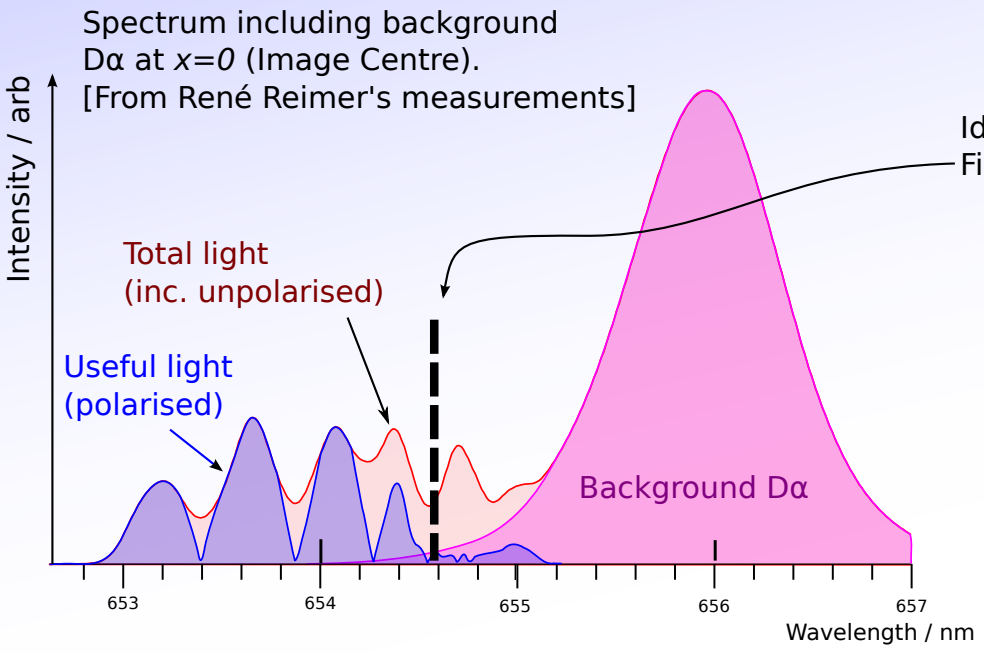
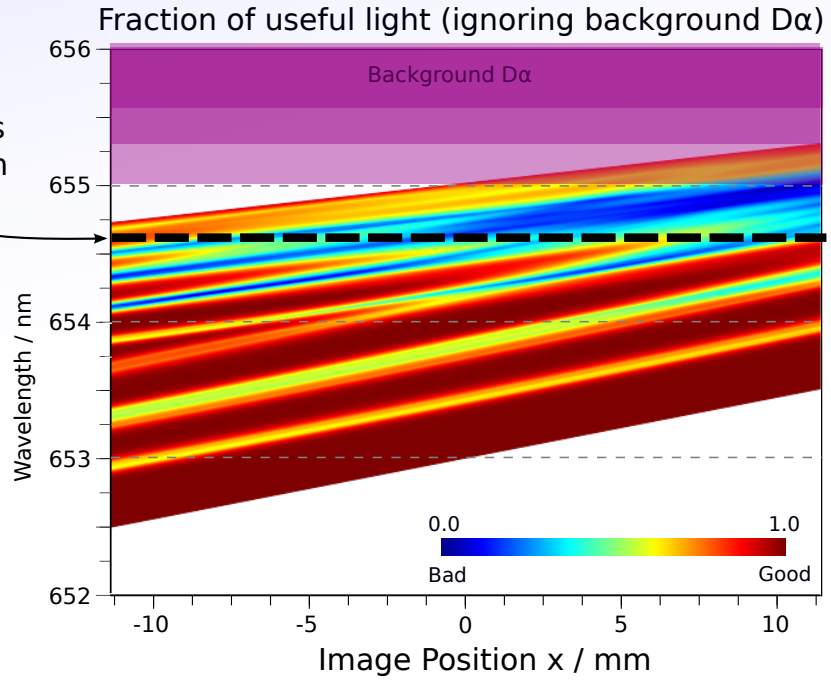
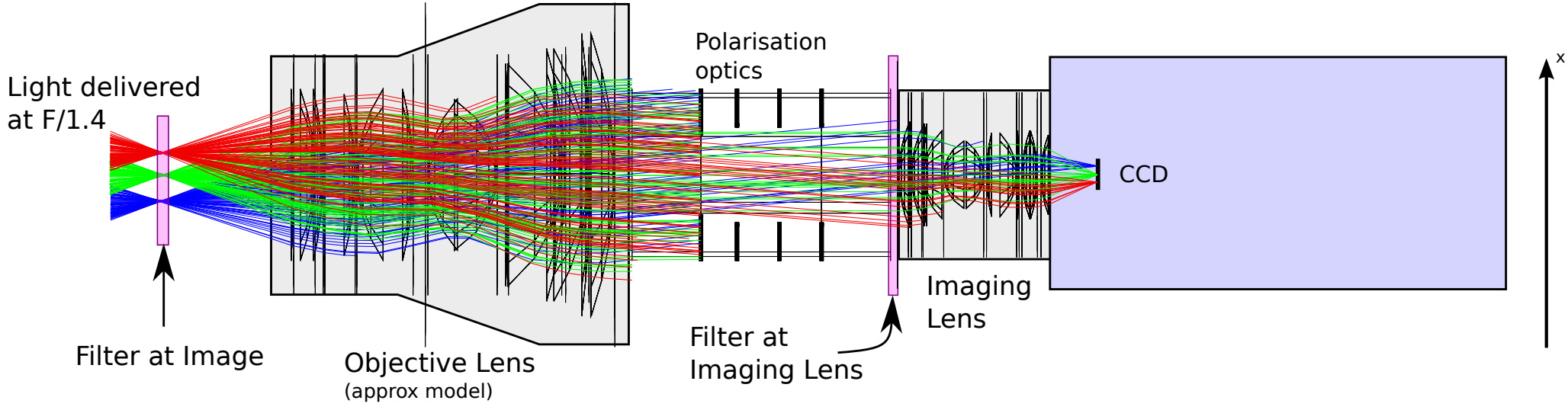
Oliver Ford, IPP Greifswald

IMSE Design - Spectrum and Filter





Filter can be placed at intermediate image plane, or on the front of the imaging lens (in the parallel rays):



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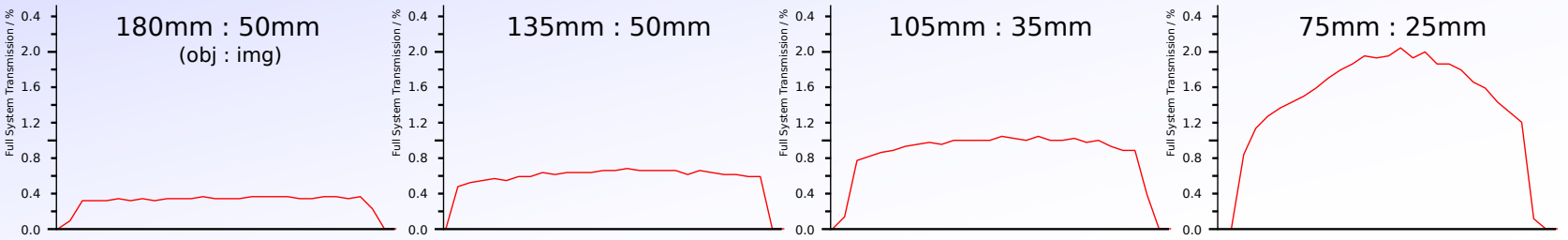
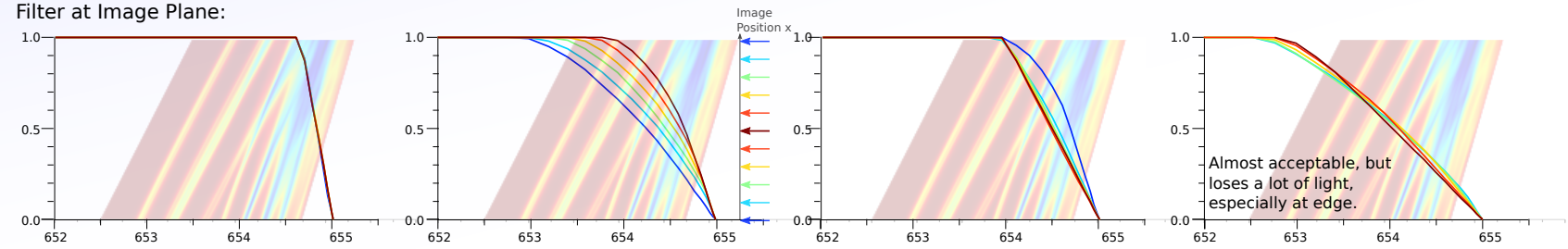
IMSE Design - Throughput and filter shift (ray-tracer)

Throughput of light, and angle of light through the filter depends on the pair of lenses.

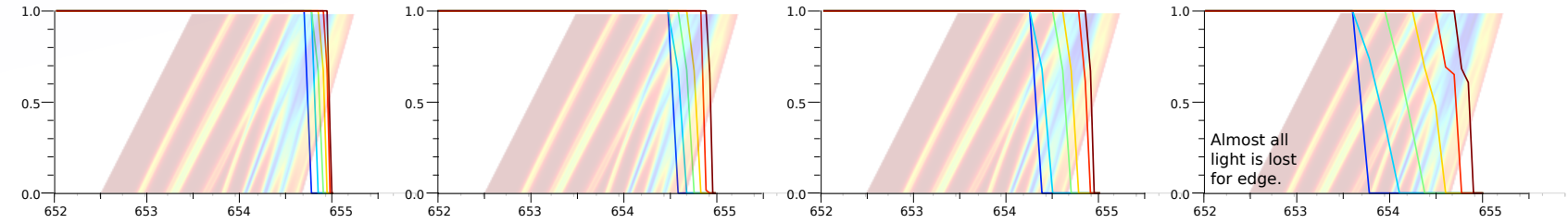
(It depends on the exact model of the lens, not just the focal length and F/#)

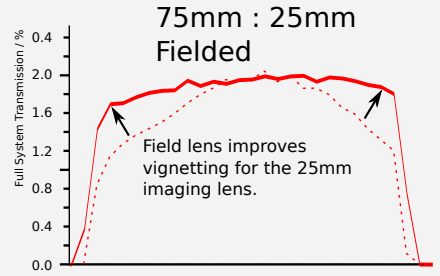


Filter at Image Plane:

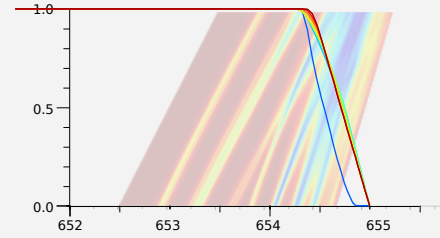


Filter at Imaging Lens:





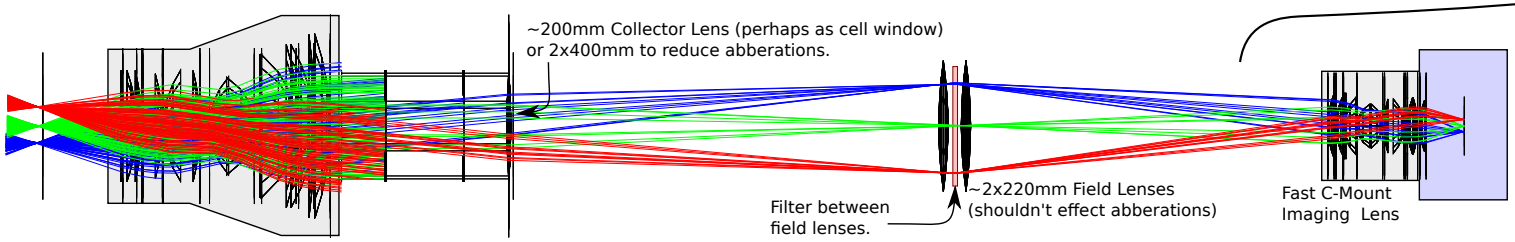
Inbetween field lenses:

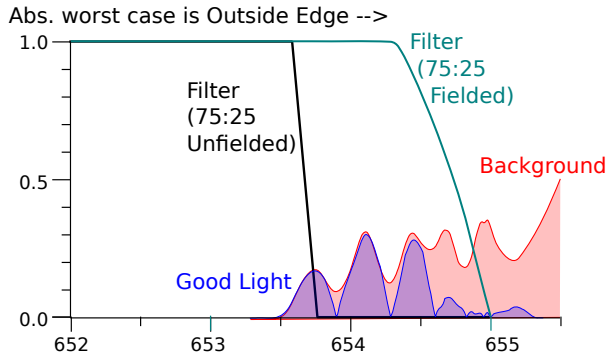


Significant improvement for the filter, and now with the possiblity of tuning it by tilting it.

However, it requires a bigger filter.

75:25 gives ~3x more light than 135:50 but angles are too big for filter, and most/all light is lost at edge channel.
In reality vignetting was also higher and edge of image is entirely lost (can only see ~19mm of fibre plane)
Fielding the light after the cell into the imaging lens (should) solve the vignetting and It also helps with the filter a lot:





For the fielded case at the very edge, it integrates up to about 66% of the good light under the filter which is 66% * 1.6% = 1% of collected light, this is already > 2x the safe 135:50 case, and we're still at ~3x for the rest image :)

But... abberation after plates hurts our fringe contrast so the collector lens needs to be good (without being a camera objective lens)

IMSE Design - Throughput and vignetting (lab)

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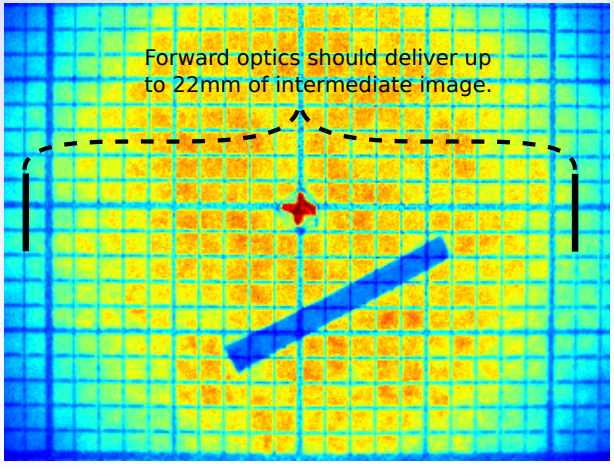
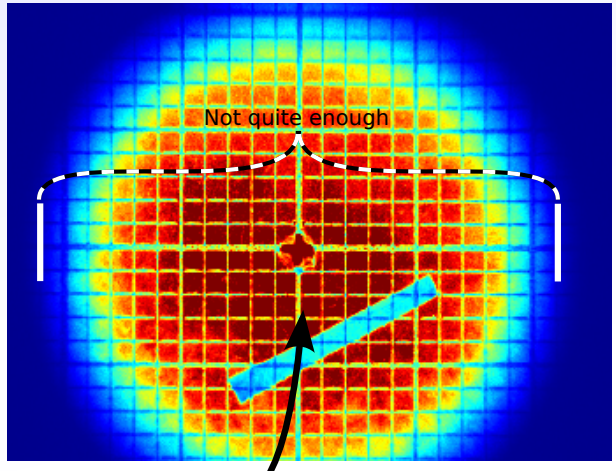
In the lab, the situation is similar, but a bit worse:

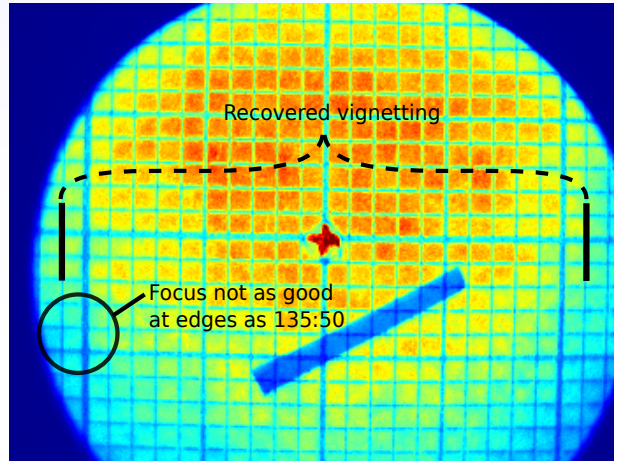
135:50



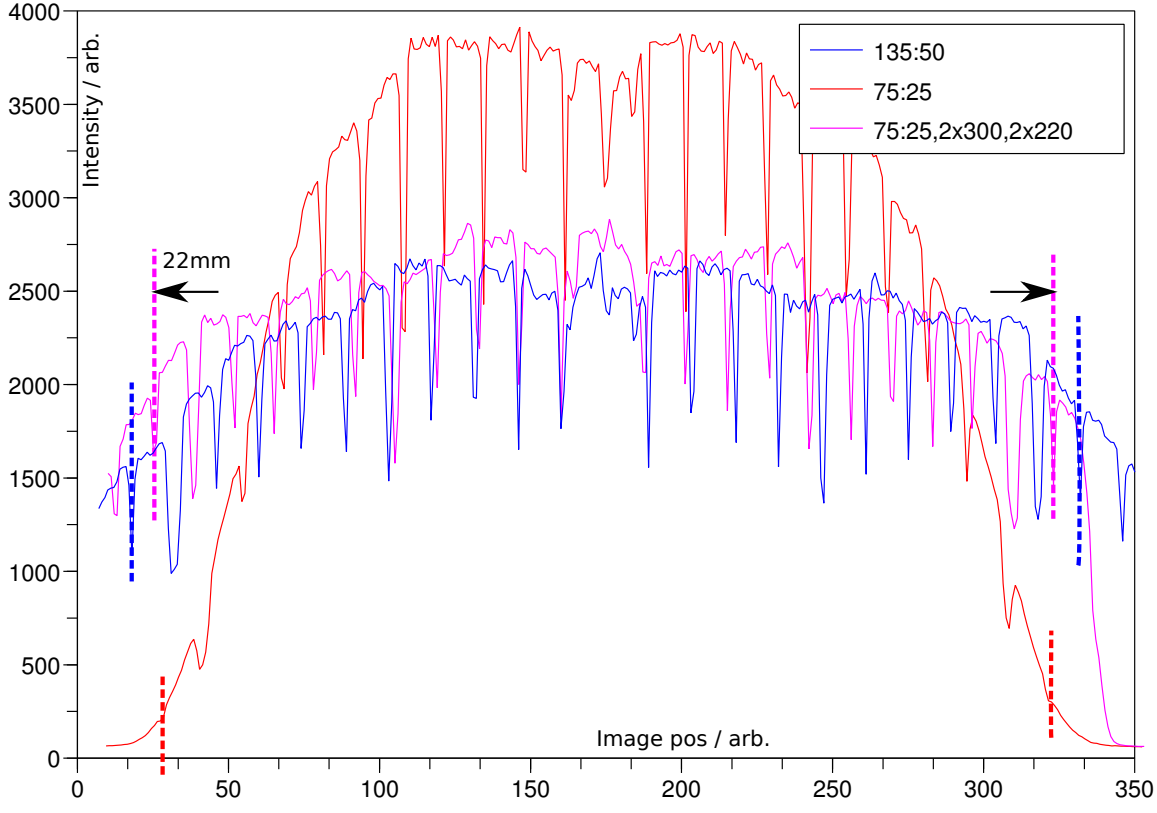
75:25



75:25 +2x300mm collectors,
+2x220mm fields



75:25 gives only a 50% increase in light in centre (1.5x as much as the 135:50) and the vignetting loses too much of the edge. The graph paper is at first image plane and we probably need to see 22mm of it.



Fielding fixes vignetting for 75:25 but uses 4 lenses. They are uncoated old lenses that were sitting in a cupbaord since 1960. All 4 lenses together only transmit ~60% of original intensity (measured) and leaves light level almost exactly back where we started.

However, with coated optimised lenses coupled withthe improvement in the filter angles, it will improve the S/N by at least 50%.