



# IMSE Design - Lenses.

Looking around the lab, and around the web for generally available lenses.

Zoom (adjustable focal length) lenses tend to not be fast enough for imaging side.

We can use one for the objective side though, if it's fast enough and sees the full 35mm virtual image area.

Objective:

| f          | f/# | Req f/# |
|------------|-----|---------|
| 75         | 1.4 | 2.5     |
| 85         | 2.1 | 2.9     |
| 100        | 1.2 | 3.3     |
| 17.5 - 105 | 1.8 | 3.5@105 |
| 135        | 2.0 | 4.5     |
| 180        | 4.5 | 6.0     |
| 300        | 9.0 | 10.0    |

Imaging:

| f  | f/#  | Req f/# |
|----|------|---------|
| 25 | 0.85 | 0.83    |
| 25 | 0.95 | 0.83    |
| 28 | 1.4  | 0.93    |
| 35 | 1.2  | 1.2     |
| 50 | 1.4  | 1.6     |
| 75 | 1.4  | 2.5     |

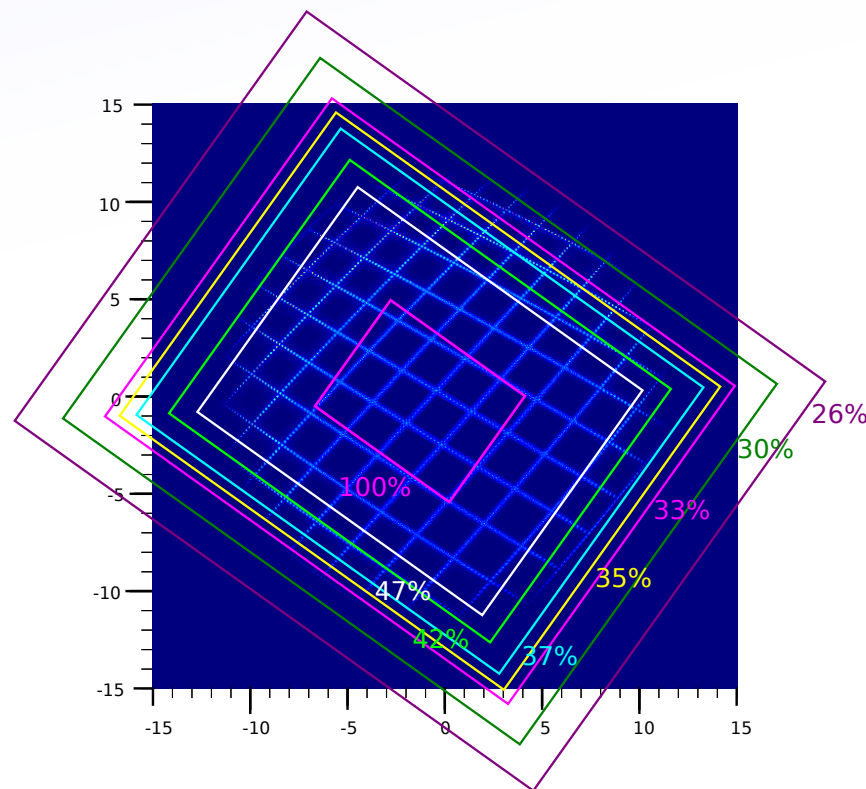
We have a box for this.

Things we'd need to buy.  
Things which are not ideal.  
Things which are really bad.

Some combinations:

| fo     | fo/# | fi  | fi/# | M   | θmax | Ac (throughput) | Ae (vignetting) |
|--------|------|-----|------|-----|------|-----------------|-----------------|
| 75     | 1.4  | 25  | 0.85 | 33% | 9.2o | 30%             | 80%             |
| 75     | 1.4  | 25  | 0.95 | 33% | 9.2o | 24%             | 78%             |
| 85     | 2.1  | 25  | 0.95 | 30% | 8.1o | 19%             | 81%             |
| 100    | 1.2  | 35  | 1.2  | 35% | 6.9o | 17%             | 85%             |
| 105(Z) | 1.8  | 35  | 1.2  | 33% | 6.5o | 15%             | 86%             |
| 105(Z) | 1.8  | 50  | 1.4  | 48% | 6.5o | 16%             | 87%             |
| 135    | 2.0  | 35  | 1.2  | 26% | 5.1o | 9.1%            | 89%             |
| 135    | 2.0  | 50  | 1.4  | 37% | 5.1o | 9.6%            | 89%             |
| 180    | 4.5  | 50  | 1.4  | 28% | 3.8o | 5.4%            | 92%             |
| 180    | 4.5  | 75  | 1.4  | 42% | 3.8o | 5.4%            | 92%             |
| 300    | 9.0  | 100 | 1.2  | 33% | 2.3o | 2.0%            | 95%             |

Lens speed limited.  
Cell limited.



Conclusions:

- Vignetting should not be a problem.
- Can change fringe frequency by ~4x without changing plates, but at cost of either bad filter shift or low throughput.
- The 180mm/4.5 lens would be really handy, the 35mm/1.2 necessary.
- 5.1o looks the best middle ground to aim at.

- Throughput for sensible θmax is only 5 - 10%. Limited by 30mm aperture only for θmax < 5.1o. Increasing crystal size to 35mm aperture would give:

| fo  | fi  | Ac(30mm) | Ac(35mm) |
|-----|-----|----------|----------|
| 135 | 50  | 9.6%     | 13%      |
| 180 | 50  | 5.4%     | 7%       |
| 300 | 100 | 2.0%     | 2.7%     |

So bigger plates are not worth the price.