NIRSPEC

UCLA Astrophysics Program

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Thoughts on descope options

1. **Restrict rotator motion**

This won't make the mechanism much easier to build but will help with the aberrations. The small operational cost of resetting the rotator now and again may be offset by the improved image quality, but we *must* make sure that the changeover is transparent to the user and smoothly performed. Rather than picking on $\pm 45^{\circ}$, we should look at where the image quality starts to fall apart (let's hope that's a bigger range than $\pm 45^{\circ}$!)

Reducing the spec on the alignment of the rotator is probably a good move, as long as it doesn't have too much impact on the performance. I think we need to look longer at this one and get nearer to a complete mechanical design for the rotator, so that we have a realistic idea of the achievable alignment accuracy.

2. Number of filters

Keeping the number of filters down should keep down costs. It may make it *harder* to set up properly if we are tempted into making a small module around a small wheel. We need to leave plenty of room for switches.

3. **Customized Lyot stops**

This is a good idea if we can achieve the precision required on positioning the filters. If we need to position a filter to 3% of its width, that would be 0.3% of the full turn (assuming 10 filters). Cut in half to allow for there being space between the filters and that gives us 0.15% of a turn, or 0.54°. If we have 180 teeth in the wheel (typical for a 10-position wheel) and 400 half steps per turn of the motor, that's 72,000 steps per revolution or 0.005° per step. If our repeatability is 10 steps that's 0.05°, or 100 steps would be 0.5°. Therefore it looks like this accuracy is well within what we can achieve.

4. Slit wheel

Reducing the number of slits to 10 is a good idea. Otherwise I see this mechanism getting out of hand. I am worried about wobble in a large wheel spoiling our focus.

5. Slit viewer

Reducing the field of view of the slit viewer could possibly make things easier, but does it mean another re-design? We need to solidify soon.

6. Collimated beam size

I'm not sure about this one, but if it eases some of the tolerances it would probably be a good idea. Does it affect throughput?

7. Folding or not?

Let's go for it! If we fold with two flats and the collimator in a <W' formation does that mean the collimator is no longer off-axis? Will that help performance or make it cheaper/easier to manufacture? If so that's a bonus, but I see the main benefits as reducing risk and cost in the fabrication of the vacuum chamber, and easing cryogenic problems. Folding will mean a rework of the electronics packaging, but I think the overall benefits are well worth it.

8. Gratings

Using just one grating plus the mirror will obviously save money, and it's clear that we just can't afford two. However it leaves us with the question of whether we design the mechanism to hold another grating to be acquired later, or stick to a simpler 1-axis setup with the mirror on the back of the grating. Doing the latter gives us a clear benefit from the descope, as I think the 2-axis mechanism could have turned out to be a real nightmare.

It is well worth pushing to reduce footprints where we can. The point about reducing the spread of angles into the TMA is a good one. Everything we can do to reduce the demands on the specification of the TMA is worthwhile.

9. TMA

Since it's becoming apparent the TMA is going to run off with a whole chunk of the money for optics, we should try everything we can to make it easier to make. It may be hard however to get a handle on where the breakpoints come in on difficulty/pricing *vs* performance. That's why a visit to these guys is genuinely essential.

10. Mechanical design

We definitely need to spread our effort (which is why I've been trying to get into this stuff lately). We should definitely get some of the really hard stuff done by e.g. SSG. I would be a little concerned if we were to get too much done by outside vendors, in case that used up too much of our money. We should try to get as much advice out of them as we can (for free if possible).