## Ed Wetherell

From: Peter Wizinowich

Sent: Wednesday, March 10, 2010 3:59 PM

To: Ed Wetherell

**Cc:** Kevin Tsubota; Peter Wizinowich

Subject: RE: KAON 682

One quick response on the NGS WFS dichroic. I made a call in the build-to-cost document to only provide one dichroic, so please make this change to your spreadsheet.

From: Ed Wetherell Sent: Wednesday, March 10, 2010 2:21 PM To: Peter Wizinowich Cc: Kevin Tsubota Subject: RE: KAON 682

i'm happy that someone is looking at this.

a lot of these comments point to my ongoing concern regarding immature designs and lack of communication, and possibly lack of requirements or flowdown of requirements. i've done my best to try and get answers and make reasonable assumptions, but as you can see, there is a ways to go.

see specific comments below.

ed

From: Peter Wizinowich Sent: Wednesday, March 10, 2010 11:59 AM To: Ed Wetherell Cc: Kevin Tsubota; Peter Wizinowich Subject: KAON 682

Hi Ed,

Here are a few comments on this spreadsheet:

- Many of my comments on KAON 715 extend to this document.
- In a next version should just remove the struck out items.
- Input hatch range what does 6" mean?

## 6 inches of travel on the rod-screw actuator

• Cal/sim injection fold. Could probably reduce the accuracy requirement if this stage is translated parallel to its reflective surface (don't need it accurately centered, but do want to make sure that the beam reproduces accurately). Same statement for all in/out folds.

this is what Thomas suggested

• LGS Source – How come this has zero DOF or TL DOF?

Thomas was unsure if this would be required

Input image rotator – why the light green shading on accuracy & slew rate? These have a "(1)" after them; is this for a reference? If so should be able to find the reference somewhere in this spreadsheet. It would be good to have references for many of the entries in this table.
for a starting point, these came from the existing system.

they should be confirmed for NGAO. agreed, a reference would be helpful.

• Why is the LGS WFS PnS slow Tip/Tilt and Acquisition Camera Filter Wheel in red text? There is no Acquisition Camera Filter Wheel to my knowledge – should be deleted or justified by someone.

this has been suggested and i can't seem to get closure on it. the question of how much MAGIQ we need. are the photometric filters fixed and always

## there, do we need to attenuate bright objects, etc.

- 1 mm accuracy for IF dichroic or acquisition fold is only ok if these devices move parallel to the plane of the reflective surface. Should perhaps note this assumption. Also, we would probably be fine if these devices didn't slew as fast as 50 mm/s if this were difficult.
- Acquisition focus. 0.25 mm accuracy in a f/15 beam results in an image blur (due to defocus) of 0.25mm/15/0.727mm/" = 0.023". This seems ok.
- I'm not sure why you distinguish between the TT object selection/focus and the TTFA object selection/focus. From the motion control perspective they should be the same. Since the object selection devices aren't tracking devices I don't think they need to servo in position (you had a question on this in the comments).

i'm happy to combine the sections. i think at one point it wasn't clear how similar they would all be.

the question about servoing in place will be a function of assembly balance and friction in the mechanism. when the loops open the position in the field must be maintained within ???. it is not obvious to me that this will be true.

 For the TT/TTFA object selection accuracy I would think that we would ideally want this to be good to a fraction of a diffraction limited image size, so I would suggest 3 mas which corresponds to 0.003" \* 0.727mm/" = 2 microns. I am giving you numbers as placeholders until the team gives you better numbers. Is the number I wrote here consistent with the numbers you have for the LGS WFS selection which don't need to be as good?

someone will need to look at the geometry of the arms and turn that into an angle of the actuators, the actuators have been chosen, or at least suggested. so their characteristics are known.

 For the TT/TTFA focus accuracy I would think that we would want the resultant image blur to be small compared to the image size, say 1 mas  $\rightarrow$  0.001" \* 0.727 mm/" \* 15 = 10 microns. This focus adjustment must compensate for the ADC going in or out, for instrument filter changes and for focal plane curvature so I think that you want <~ 10 mm to be safe. the suggested actuators have 20mm motion and 1um bidirectional repeatability.

not sure if those numbers are supported by the mechanical design.

 NGS WFS dichroic comment. This is only a two position device (there is only 1 optic). i understood (from jun09) that an open + 2 optics were required, one to pass < 0.8u and another to pass <1.0u. is that an outdated understanding?

- The on-sky requirements for the NGS WFS FSMs should be quite similar to those for the existing AO FSMs (although we probably would like at least a factor of a few improvement given how borderline they are for ASTRA); minimum of 60" diameter range on the sky. The motion at the device needs to change since they are in a f/46 beam (currently) instead of f/15. The plate scale at f/46 would be 2.23 mm/" instead of 0.727 mm/". This means that we need ~3x the range of motion on the stage but we gain by needing ~3x less accuracy on the positioning (this gives us the factor of a few improvement in accuracy).
- The NGS WFS lenslet accuracy will depend on the physical size of the lenslets. We need to be able to control to say ~2% of the size of an individual lenslet. In the current Keck AO system the lenslets are 200 microns implying a required positioning accuracy of 4 microns using my above criteria.
- The NGS WFS camera focus accuracy requirement for our current AO system should be good for this. You don't need much range unless Viswa also adds a pupil imaging mode; you can change the requirement on the current AO system (20 mm would be safe I think).
- The NGS WFS assy focus accuracy will depend on the f/# feeding the NGS WFS. If it is f/46 you could loosen the current AO system accuracy requirement by a factor of ~3. This focus adjustment must compensate for similar things as the LOWFS focus but now you are at a different f/#. So, you may need 30 mm of focus range if you are at f/46.

Sorry I am rushing on this and haven't been too methodical. Do you have specific questions you would like help on?

Peter