**Don Figer** **June 1, 1998**


## NIRSPEC Optics Design Note 24.00
## Baffles

### 1. Setting up footprint surfaces for the detector baffles

The baffles were spaced according to past experience and advice from BRO. The four detector baffles are spread out with an inch between them, placing them at 1, 2, 3, and 4 inches from the detector. The beam footprints were produced using baffle.zpl. The final autocad file contains footprints for configurations 1, 5, 7, 9, and 19, in tmakck25.zmx. These modes correspond to: 1) high-res, central order, 5) high-res, extreme order, 7) high-res other extreme order, 9) low-res, and 19) imaging. I have used a 30 arcsecond slit for the high-res mode, and a 46 arcsecond slit/field for the low-res and imaging modes.

It was difficult to set up the baffle surfaces because of the way Zemax positions elements. It puts the next element in the coordinate system of the previous element, unless decenters or tilts are used. So, the first baffle would be placed in the coordinate system of M3 (the tertiary of the TMA), including whatever tilts/decenters were accumulated up to that point. Instead, we would like the first baffle (and all others) to be perpendicular to and centered on the chief ray for the central field point (the gut ray).

I had to define a new coordinate system in order to satisfy these conditions. I did this by defining operands in a new merit function which would demand that these conditions be true. The first set of operands (REAX and REAY) demand that the new coordinate system be centered in the x and y directions on the gut ray. The second set of operands (REAA, REAB, and REAC) demand that the new coordinate system have its z-axis aligned along the chief ray for the gut ray. I let the optimization vary the tilts/decenters in the coordinate transformation between M3 and the first baffle. I allowed variations in 6 degrees of freedom, i.e. I allowed a shift in the z-distance between M3 and B1. Ultimately, this spacing was determined by the second set of operands in the merit function which demanded that the array end up exactly where it was in global coordinates in tmakck24.zmx.

The last six operands (GLCX) demand that the array be exactly where it should be in global coordinates. Notice that the location is hardwired in the targets for the operands. I had to do this because the array would naturally be placed in the coordinate system of the baffles, i.e. centered on and orthogonal to the gut ray. Instead, we know that the array has no special relation to the gut ray (at least, not in tilts), so I inserted another coordinate break which allowed variations in 5 degrees of freedom just before the array (the z-distance is fixed to 1 inch).

Here are the operands in the merit function:

```
Merit Function Listing

File : H:\LENSES\NIRSPEC\ENDTOEND\tmakck25.ZMX
Title: NIRSPEC ON KECK
Date : MON FEB 2 1998

Merit Function Value:  6.49194580E-008
```

| Num | Type | Int1 | Int2 | Hx | Hy | Px | Py | Target | Weight | Value | % Cont |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CONF | 1 | | | | | | | | | |
| 2 | REAX | 83 | 1 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.00000E+000 | 1 | -1.58352E-012 | 0.000 |
| 3 | REAY | 83 | 1 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.00000E+000 | 1 | -1.29624E-011 | 0.000 |
| 4 | REAA | 83 | 1 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.00000E+000 | 1 | -4.11152E-012 | 0.000 |
| 5 | REAB | 83 | 1 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.00000E+000 | 1 | -5.34812E-011 | 0.000 |
| 6 | REAC | 83 | 1 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1.00000E+000 | 1 | 1.00000E+000 | 0.000 |
| 7 | GLCA | 93 | | | | | | -7.18297E-001 | 1 | -7.18297E-001 | 51.595 |
| 8 | GLCB | 93 | | | | | | -6.65470E-002 | 1 | -6.65470E-002 | 0.443 |
| 9 | GLCC | 93 | | | | | | 6.92547E-001 | 1 | 6.92547E-001 | 47.962 |
| 10 | GLCX | 93 | | | | | | 2.16400E-001 | 1 | 2.16400E-001 | 0.000 |
| 11 | GLCY | 93 | | | | | | 2.36371E-001 | 1 | 2.36371E-001 | 0.000 |
| 12 | GLCZ | 93 | | | | | | 2.07034E+001 | 1 | 2.07034E+001 | 0.000 |

With these operands defined, and 11 variables set (6 for first coordinate break, and 5 for second coordinate break), we are now able to run the optimization. The merit function listing above actually shows that the new system satisfies all of our requirements.

## 2. Setting up footprint surfaces for the primary baffles

The primary baffles were set up in much the same way. There was another complication in that the beams strike the primary baffles three times: from slit to OAPC, from OAPC to echelle, and from echelle to CD. This requires that 3 Zemax surfaces be set up per baffle surface, and that they coincide in global space. We ensured this condition, again, by using operands in the merit function. Here are the operands:

```
Merit Function Listing

File : H:\LENSES\NIRSPEC\ENDTOEND\Tmakck25.ZMX
Title: NIRSPEC ON KECK
Date : TUE FEB 17 1998

Merit Function Value:  3.51183585E-010
```

| Num | Type | Int1 | Int2 | Hx | Hy | Px | Py | Target | Weight | Value | % Cont |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CONF | 1 | | | | | | | | | |
| 2 | GLCZ | 75 | | | | | | 1.95666E+001 | 1 | 1.95666E+001 | 12.338 |
| 3 | GLCZ | 57 | | | | | | 2.03187E+001 | 1 | 2.03187E+001 | 1.250 |
| 4 | GLCZ | 60 | | | | | | 2.01917E+001 | 1 | 2.01917E+001 | 1.328 |
| 5 | GLCZ | 63 | | | | | | 2.00647E+001 | 1 | 2.00647E+001 | 1.409 |
| 6 | GLCZ | 66 | | | | | | 1.99377E+001 | 1 | 1.99377E+001 | 1.492 |
| 7 | GLCZ | 69 | | | | | | 1.98107E+001 | 1 | 1.98107E+001 | 6.392 |
| 8 | GLCZ | 83 | | | | | | 1.98107E+001 | 1 | 1.98107E+001 | 11.271 |
| 9 | GLCZ | 86 | | | | | | 1.99377E+001 | 1 | 1.99377E+001 | 10.952 |
| 10 | GLCZ | 89 | | | | | | 2.00647E+001 | 1 | 2.00647E+001 | 10.637 |
| 11 | GLCZ | 92 | | | | | | 2.01917E+001 | 1 | 2.01917E+001 | 10.327 |
| 12 | GLCZ | 95 | | | | | | 2.03187E+001 | 1 | 2.03187E+001 | 10.021 |
| 13 | GLCZ | 100 | | | | | | 2.07138E+001 | 1 | 2.07138E+001 | 22.575 |
| 14 | CONF | 9 | | | | | | | | | |
| 15 | GLCZ | 100 | | | | | | 2.07138E+001 | 1 | 2.07138E+001 | 0.008 |
| 16 | GLCZ | 75 | | | | | | 1.96443E+001 | 1 | 1.96443E+001 | 0.000 |

## 3. Footprints

The final footprints have been printed out in Autocad and appended to this document.