Impacts of no ADC in GMOS

What we can do to minimize the effect on imaging and spectroscopy?
This is to raise awareness among the science staff (including observers, contact scientists, queue coordinators and NGOs) about the implications on blue imaging and (especially) spectral data taken in the absence of an ADC on either GMOS.

Neither GMOS has ever had an ADC and this is not appreciated enough among the Gemini user community. Staff have not been given adequate guidance to help Pis deal with this and compromised data has been delivered.

This is NOT a discussion as to whether or not either GMOS should eventually have an ADC. This is a discussion for how we deal with the current configuration (better than we have been).
• What GMOS configurations are potentially impacted
• How are blue imaging and blue spectral data affected (with examples)
• How do contact scientists identify when data will be adversely affected
• What observing strategies can mitigate the effect; what advise should NGOs and CSs be giving to PIs
• What amount of scheduling constraints (how tight) will the QC s allow without reducing the programs chances at being observed and how does this correlate with ranking band
• What OT enhancements can we implement (will we implement) to make the third and fourth items easier
• What can PIs do after the fact to "correct" their data, are there tools available
• Public Webpages will have to be amended to include as much of this information as possible
Differential Atmospheric Refraction on Mauna Kea (330 nm – 1.03 μm)
Models include only differential refraction with airmass
All refraction is relative to 500 nm
Assumes seeing disk is 0.3” with no refraction
No appreciable elongation for i-band at most airmasses, only displacement
Airmass 1.05, 1.5, 2.0
i-band filter wavelength range 706-850 nm
Models include only differential refraction with airmass

- All refraction is relative to 500 nm
- Assumes intrinsic image quality is 0.3"
- Appreciable elongation at even low airmass in g-band
- u-band not modeled but would be even more severe
- Airmass 1.05, 1.5, 2.0
- g-band filter wavelength range 398-552 nm
Imaging - Mauna Kea (models) - cont.

- Models include only differential refraction with airmass
- All refraction is relative to 500 nm
- Assumes intrinsic image quality is 0.6"
- Elongation only becomes a problem at fairly high airmass
- u-band not modeled but would be even more severe
- Airmass 1.05, 1.5, 2.0
- g-band filter wavelength range 398-552 nm
Spectroscopy - Mauna Kea (data)

Airmass 1.41
PA 100 deg
Parallactic angle 91 deg
Spectroscopy - Mauna Kea (data)

Airmass 1.28
PA 205 deg
Parallactic angle 97 deg
Spectroscopy - Mauna Kea (models)
Spectroscopy - Mauna Kea (models)

Light Loss due to Refraction on Mauna Kea (0.95" longslit, 0.3" seeing)

- 15 deg off parallactic angle
- 30 deg off parallactic angle
- 45 deg off parallactic angle
- 90 deg off parallactic angle

Fractional Light Lost vs. Wavelength (Å)

Airmass: 1.05, 1.10, 1.20, 1.50, 2.00
Spectroscopy - Mauna Kea (models)

Light Loss due to Refraction on Mauna Kea (0.80” longslit, 0.3” seeing)

- 15 deg off parallactic angle
- 30 deg off parallactic angle
- 45 deg off parallactic angle
- 90 deg off parallactic angle

Fractional Light Lost vs. Wavelength (Å) for different Airmasses (1.05, 1.10, 1.20, 1.50, 2.00)
Spectroscopy - Mauna Kea (models)

Light Loss due to Refraction on Mauna Kea (0.80'' longslit, 0.9'' seeing)

15 deg off parallactic angle
- Airmass:
  - 1.05
  - 1.10
  - 1.20
  - 1.50
  - 2.00

30 deg off parallactic angle
- Airmass:
  - 1.05
  - 1.10
  - 1.20
  - 1.50
  - 2.00

45 deg off parallactic angle
- Airmass:
  - 1.05
  - 1.10
  - 1.20
  - 1.50
  - 2.00

90 deg off parallactic angle
- Airmass:
  - 1.05
  - 1.10
  - 1.20
  - 1.50
  - 2.00

Wavelength (Å)
What observing strategies can mitigate the effect; what advise should NGOs and CSs be giving to PIs

- For imaging only airmass constraints can help; g-band and u-band IQ20 obs especially affected
- For spectroscopy, wavelengths < ~ 450 nm affected; narrow slits especially affected. Use the widest slit the science will tolerate.
- Longslit obs may be able to observe at parallactic angle but not always possible due to lack of guide stars
- Custom tilted longslits combined with airmass constraints (?)
- MOS position angle fixed once the mask is designed; consider parallactic angle and guide star when choosing position angle and possible airmass constraints
- For spectroscopy airmass restrictions depend on shortest wavelength covered by spectral setup and total wavelength coverage, as well as slit width (and position angle for MOS)
- VLT VIMOS does not allow PI to choose position angle (fixed at 90deg), Gemini does not want to impose this restriction.
- Keck Deimos not really used below 500 nm; PIs choose position angle appropriate for time of night mask is observed
Parallactic Angle Example in GMOS OT Library

<table>
<thead>
<tr>
<th>Target Environment</th>
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</thead>
<tbody>
<tr>
<td>Use this component to enter the base position and wave front sensor targets for this observation.</td>
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<table>
<thead>
<tr>
<th>Type</th>
<th>Tag</th>
<th>Name</th>
<th>RA</th>
<th>Dec</th>
<th>Dist</th>
<th>Mag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td></td>
<td>ExampleTarget</td>
<td>03:35:20.721</td>
<td>11:20:24.10</td>
<td>0</td>
<td>R=21</td>
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<tr>
<td>OWFS-1</td>
<td>3.5692064E7</td>
<td>03:35:06.683</td>
<td>11:19:50.72</td>
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<td>13.26U, 11.99...</td>
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<td>11:19:37.08</td>
<td>1.3</td>
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<tr>
<td>OWFS-3</td>
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<td>11:23:42.97</td>
<td>4.36</td>
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<table>
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<tr>
<th>Selected Target</th>
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<tbody>
<tr>
<td>Use this component to select the target for this observation.</td>
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<table>
<thead>
<tr>
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<th>RA</th>
<th>Dec</th>
<th>Dist</th>
<th>Mag</th>
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<tbody>
<tr>
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<td>11:20:24.10</td>
<td>Resolve</td>
<td>SIMBAD Names via CADC</td>
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<th>Tracking Details</th>
<th>Nonsidereal Details</th>
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<tbody>
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<td>milli-arcsecs/year</td>
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</tr>
<tr>
<td>Dec 0.0</td>
<td>milli-arcsecs/year</td>
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</table>

Save | Close
Parallactic Angle Example in GMOS OT Library - cont.

**Program Note**

Enter notes for the operator/astronomer here.

**Title**

OBSEIVE AT MEAN PARALLACTIC ANGLE

**Note**

Observe at mean parallactic angle.

Set the PA appropriately depending on when the observation is scheduled and use the corresponding OWFS guide star.

OWFS-2 is faint, guide at 100Hz if necessary.

OWFS1: PA=330-260 can be used for parallactic angle range (80,150) and (-100,-30)

OWFS2: PA=235-210 can be used for parallactic angle range (30,55) and (-150,-125)

OWFS3: PA=79-88 can be used for parallactic angle range (79,88) and (-101,-92)
Elevation & parallactic angle OT plot
Mauna Kea, Dec = 73 deg
Elevation & parallactic angle OT plot
Mauna Kea, Dec = 21deg
Discussion

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