

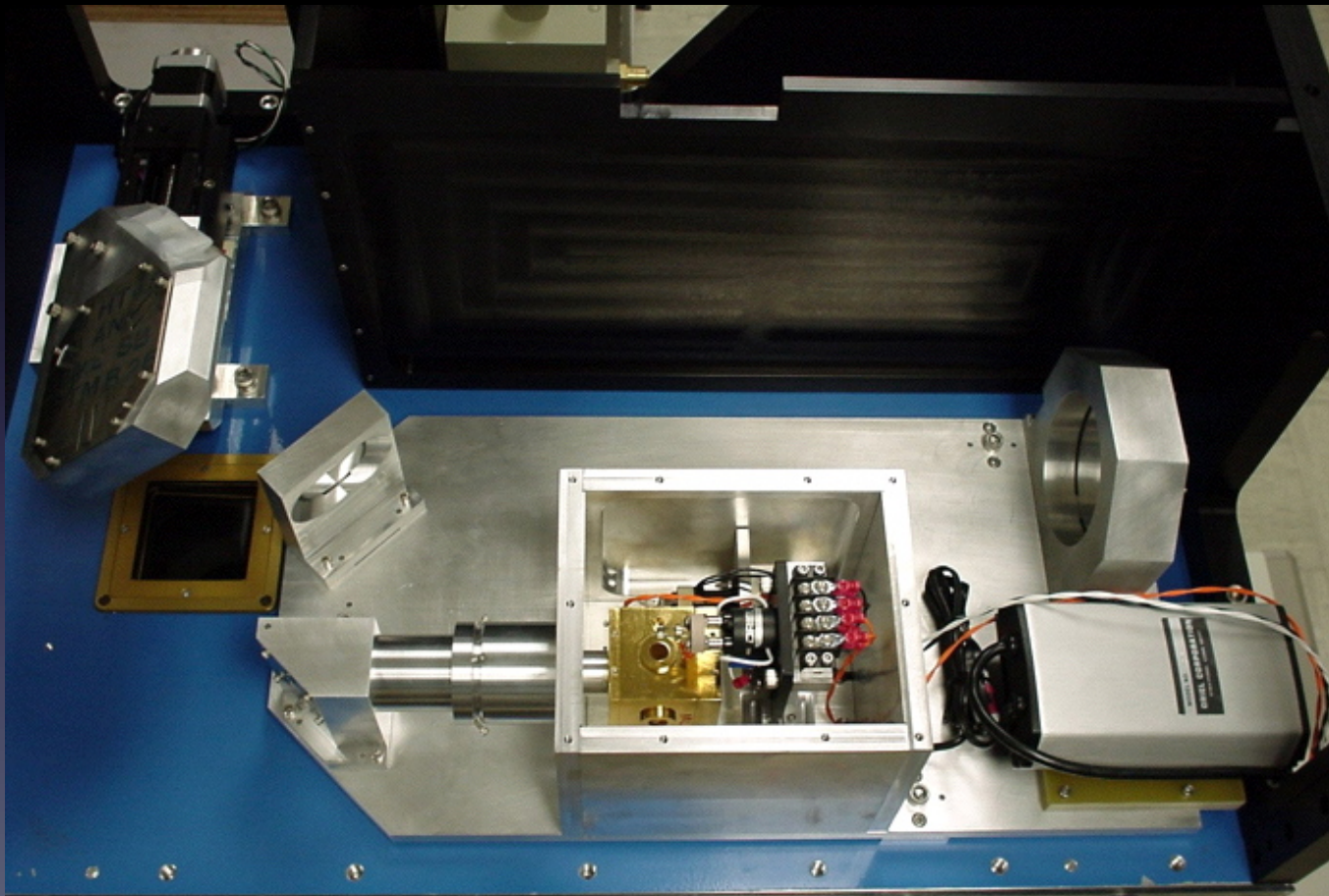
Calibration System

High-level design requirements

1. Arc line wavelength reference > 6 lines per order (TBD), otherwise use telluric features
2. Precision RV ≈ 10 m/s with $^{13}\text{CH}_4$ gas cell
3. Flat field S/N > 1000, 1% uniformity across field of longest slit
4. Integrations times less than a few minutes
5. Illumination optics mimic f/38.3 beam from telescope and be achromatic 1.1-5.4 μm
6. Fit in 0.5 m x 0.5 m (wide) x 0.3 m (high) box in front of cryostat entrance window
7. Shield optics from stray light
8. Minimize moving parts
9. Temperature control of gas cell ± 0.5 K

Calibration System

Based on SpeX design

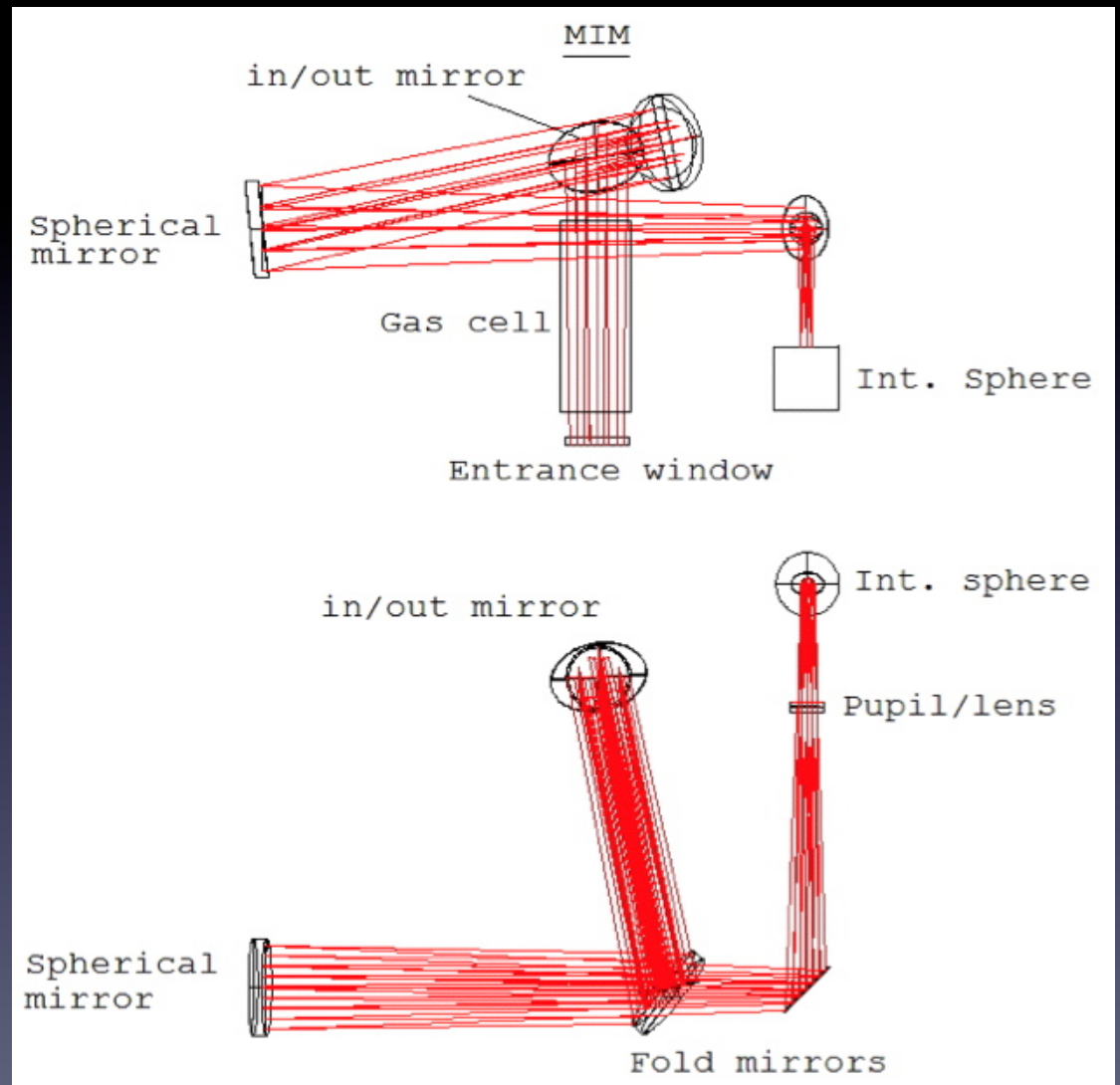


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Calibration System

Optical layout

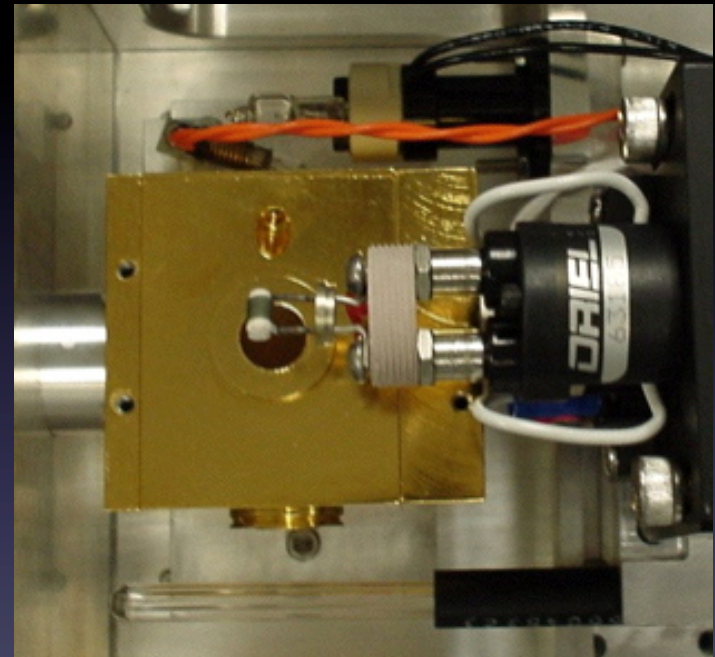
- Magnified image of IS exit port re-imaged onto TFP at $f/38.3$
- Pupil re-imaged onto internal pupil



Calibration System

Components

- Illumination optics
- Integrating sphere
- Flat field: 10 W QTH lamp (3200 K)
- Flat field: IR source (1100 K)
- Optical concentrators for flat field lamps
- Arc lamp: Th-Ar
- $^{13}\text{CH}_4$ gas cell



Data Reduction System

Fundamental requirements

- Extract spectra from raw cross-dispersed spectral images (following flat fielding, bias subtraction, bad pixel replacement and linearity correction)
- Wavelength calibrate extracted spectra
- Remove instrument signature (preserve spectral shape)?
- Merge individual orders into continuous spectra
- Remove telluric contamination

Data Reduction System

Based on Spextool, the GUI-based DR tool for SpeX

Differences:

- User-selected central wavelength requires more automated order tracing rather than look-up table
- Pseudo-Littrow illumination (tilted spectral lines) will require resampling of spectra
- A0V telluric star technique not so easily implemented
- Consider use of ATRAN model to remove telluric features

The designers of Spextool, Bill Vacca and Mike Cushing, will build the DR tool for iSHELL