OH Suppression Near IR Spectroscopy for the LBT

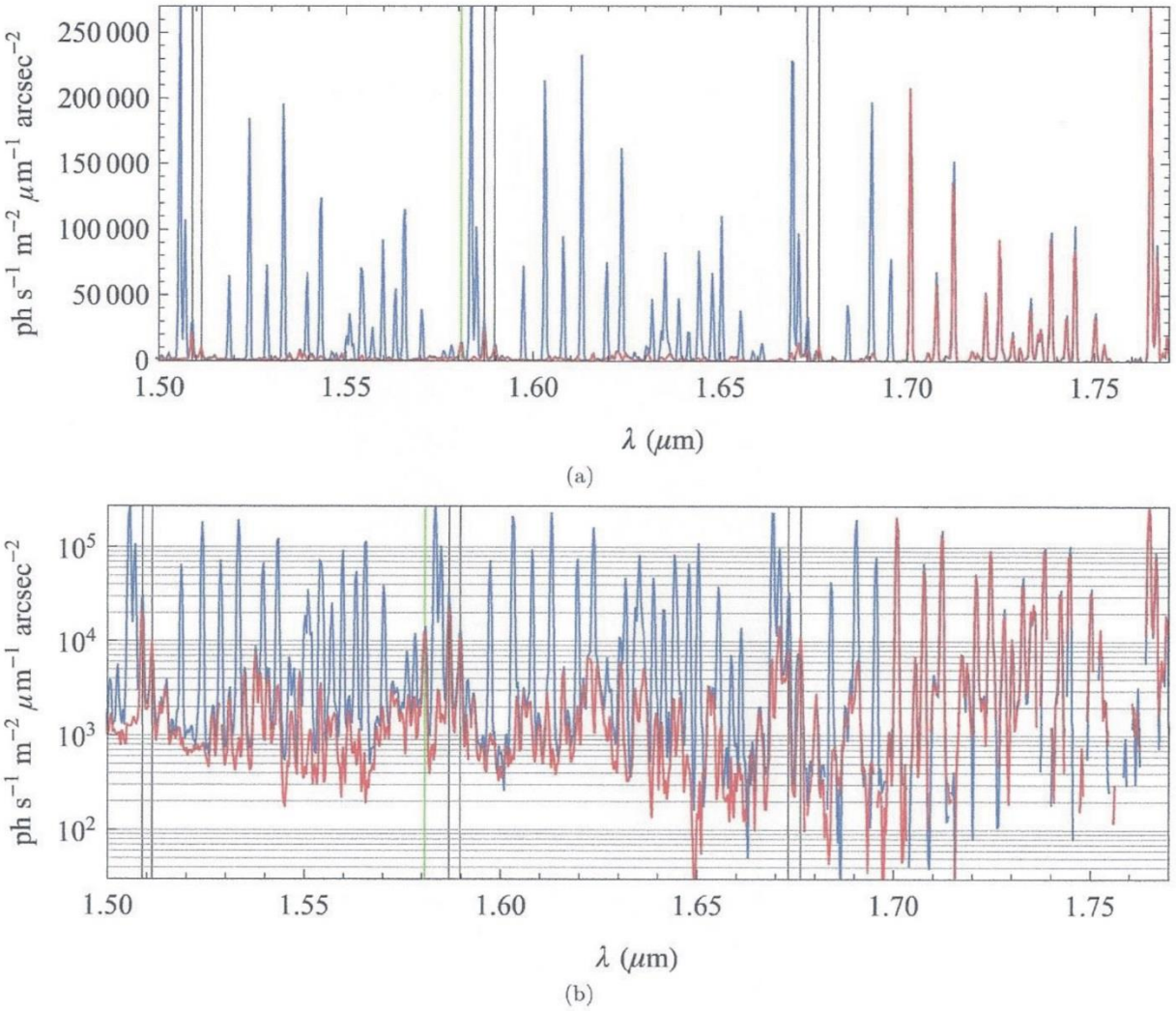
Rodger I. Thompson

LBTC Users Meeting March 23-23, 2014
Tucson Arizona

Concept Introduction

- Provide a low resolution R~500 near infrared spectrometer for faint object spectroscopy at the LBT.
- Utilize the excellent LBT AO system to minimize the size of the spectrometer.
- Employ Bragg Grating Fibers (BGF) to suppress the intense OH emission lines that have been the perpetual bane of low resolution near IR spectroscopy.
  - BGFs have been developed in Australia
  - AIP is also developing the capacity to manufacture BGFs
- Fibers can be placed to utilize both mirrors of the LBT.

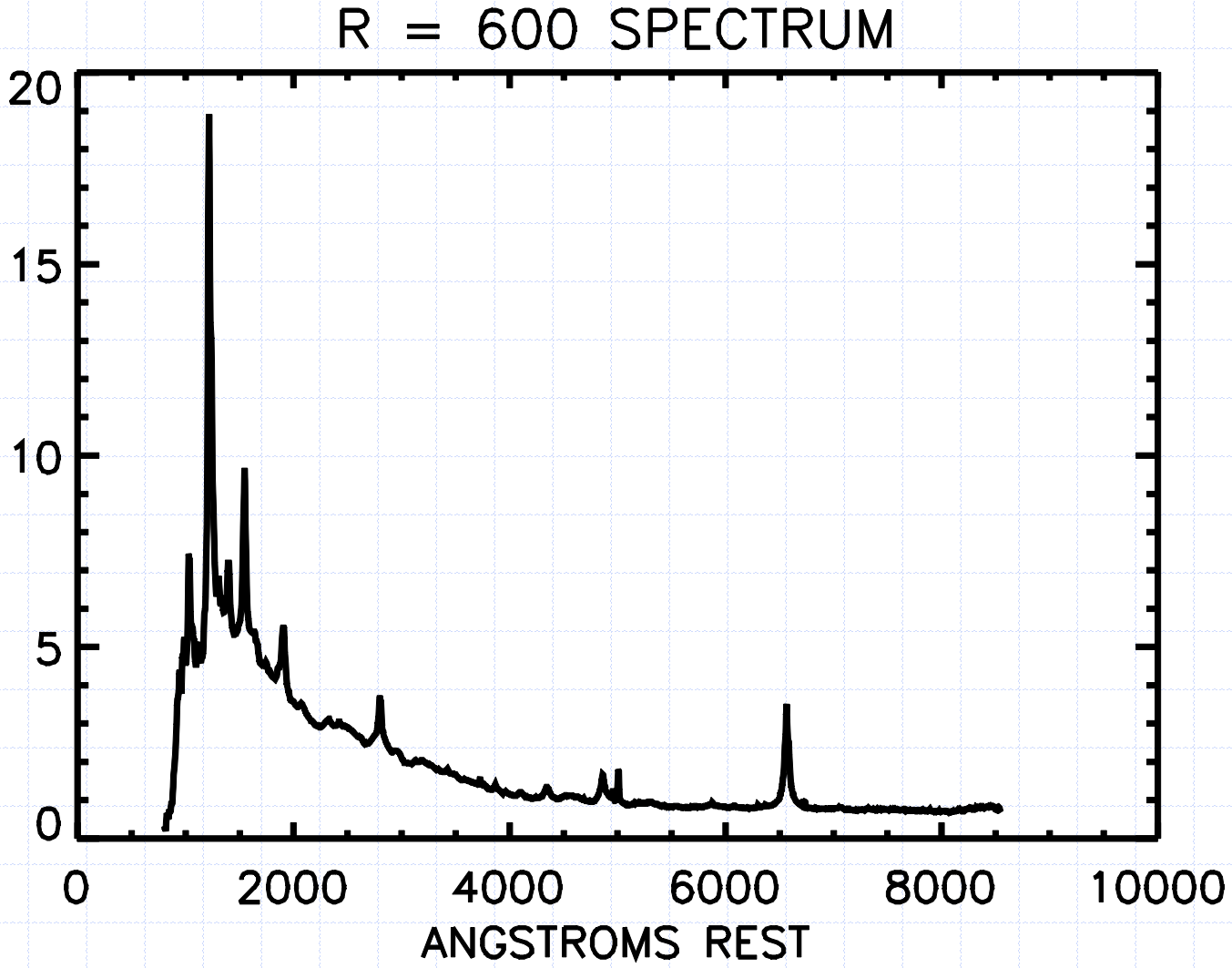
Example of OH Supression



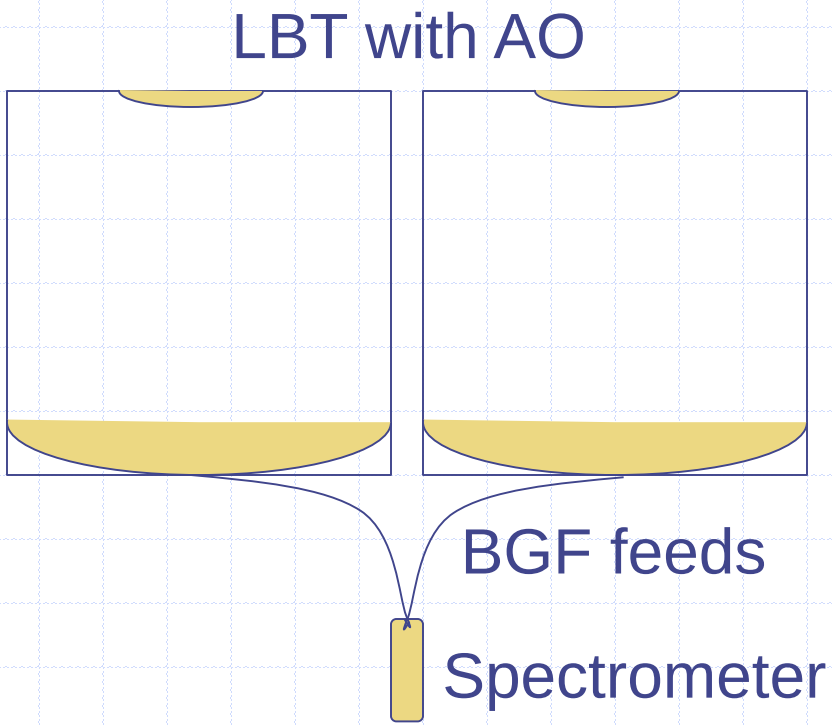
Some Science Cases

- Optical rest frame spectroscopy of QSOs
- AGN spectroscopy
- Brown Dwarf studies at greater galactic distance
- Possible exoplanet differential spectroscopy
- Spectroscopy of distant small solar system objects

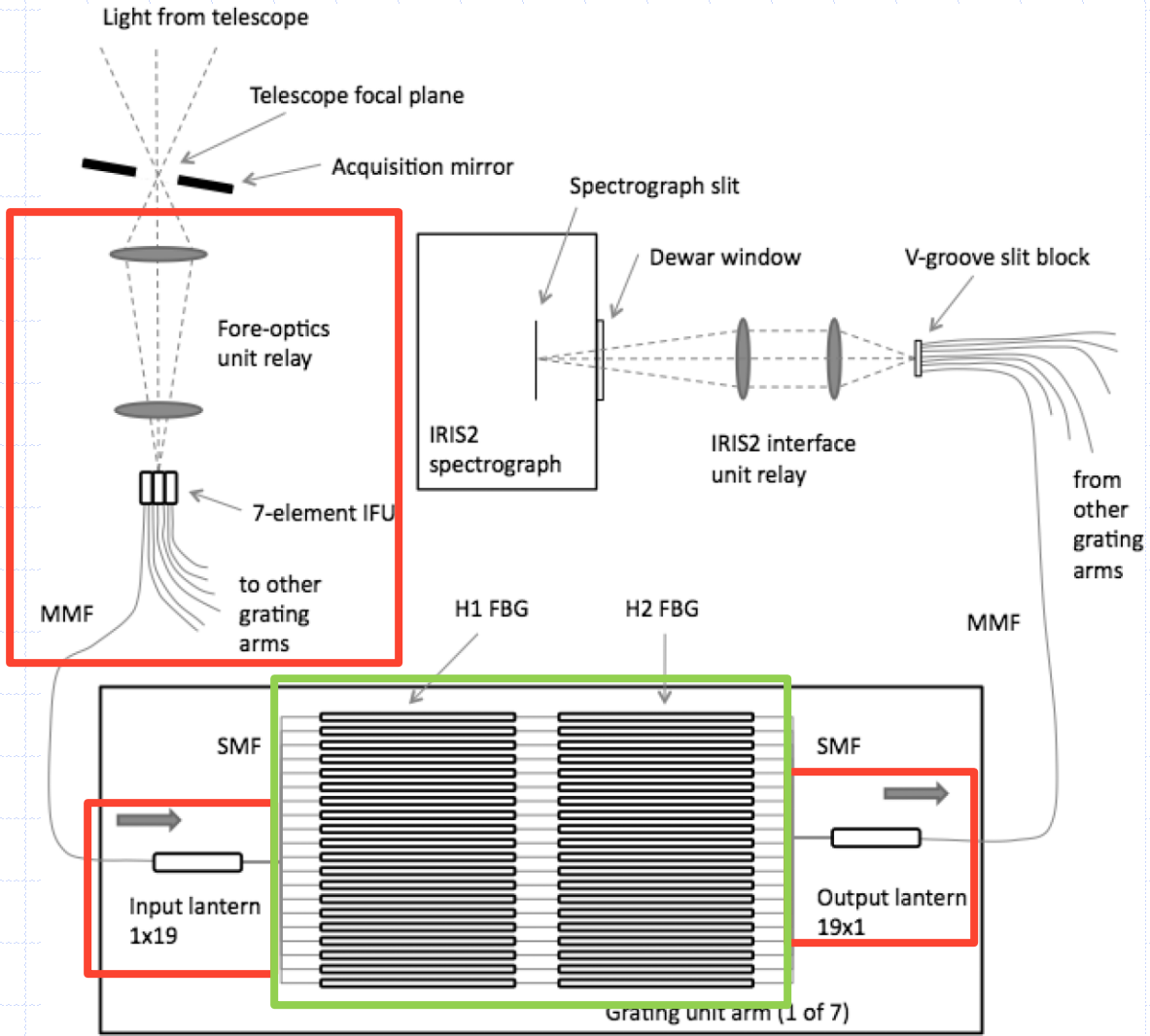
Template QSO Spectrum at R=600 @ 3000 Ang. rest



Schematic Concept



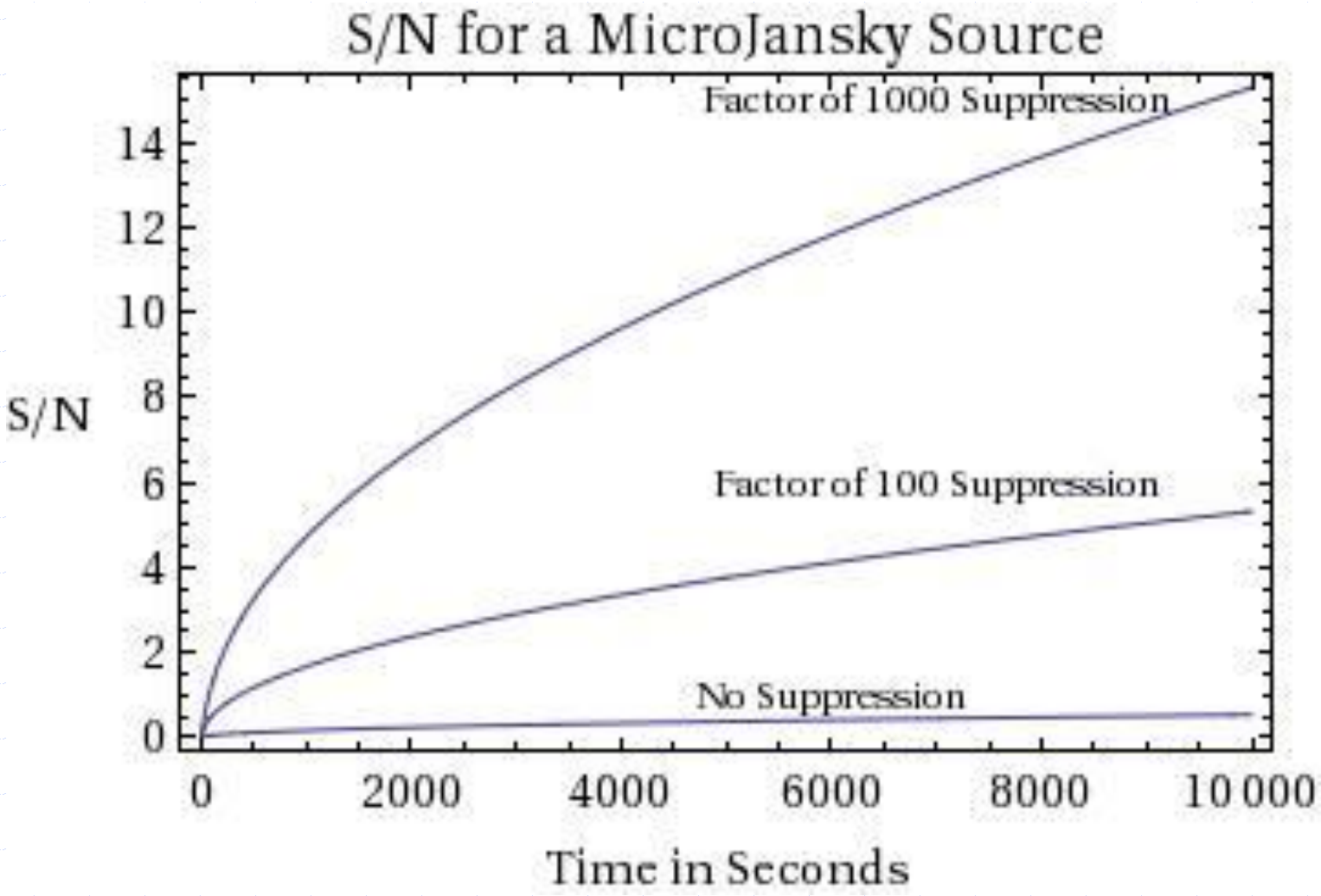
GNOSIS Spectrometer (Bland-Hawthorn et al.)



Not Needed

Two Needed

Performance (23.9 H_{AB} Mag.)



Implementation with new instrument

- Use existing 21 gr./mm grating
  - 5.5^{o} blaze angle
  - 5” x 6” ruled area
- Use HR2G detector from JWST
- Custom collimators and camera
- 2 feed fibers with OH suppression sections
- Detachable fiber mount at LBTI focus?
- Spectrometer size ~2’x2’x4’

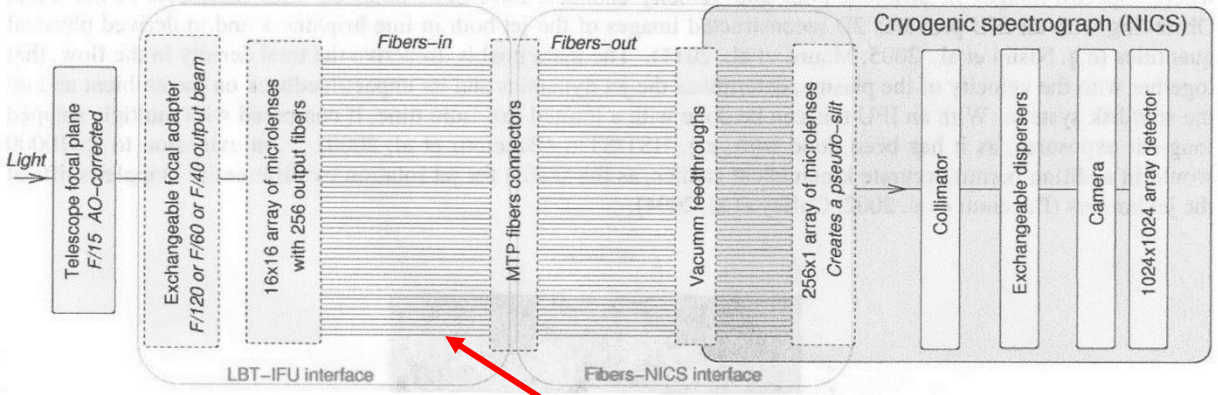
Additional Implementation Components

- Leach Controler
- Data acquisition computer
- Interface to LBT
- Quick look data display
- Data reduction pipeline
- Mechanical interface
  - detachable

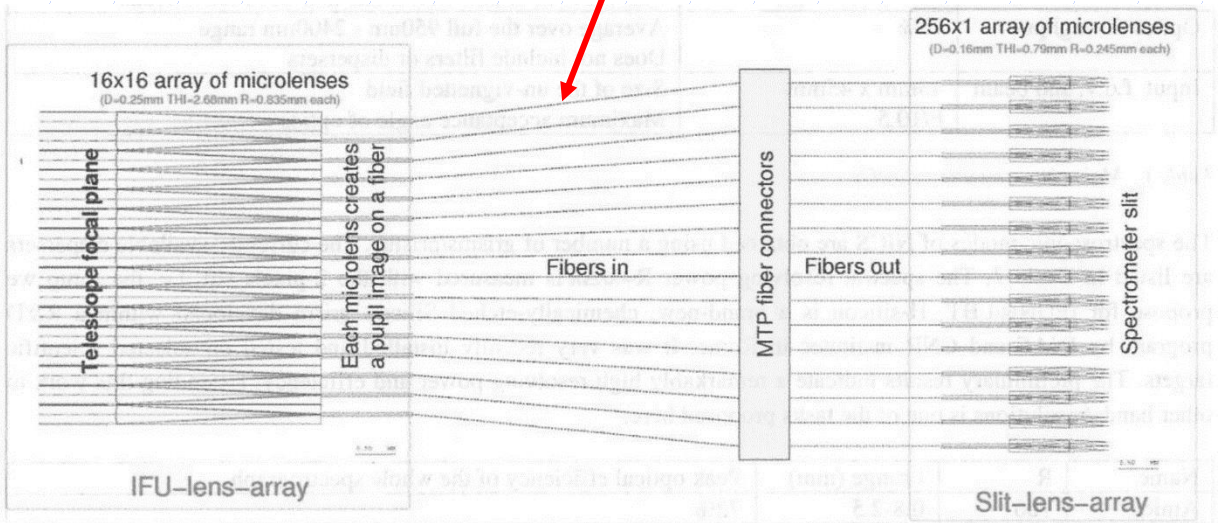
Other Implementation Opportunities

- iFUN@LBT
  - Integral Field Unit with NICS at LBT
  - Utilizes and existing spectrometer being decommissioned from TNG
  - Proposed instrument for LBT led by INAF
  - Multi-fiber (256) fed near infrared spectrometer
- Rule an OH suppression section on one of the fibers

Implementation in NICS



Replace one fiber with a BGF



Advantages

- Enables a new scientific capability not matched at any other telescope
- Low Cost
- Small size
- Can be expanded to be an integral field instrument

Uncertainties

- Previous experience (GNOSIS Bland-Hawthorn) had unexplained high background.
  - Some information that is was spectrometer rather than fiber related.
- BGF source
  - AIP has a laboratory under development and is interested in participating,
  - Previous industry source no longer interested in low volume sales.

Instrument Status

- Instrument development on hold pending more information on BGFs, their performance and availability.
- Many components, other than BGFs, already in hand.
- Since the instrument is low cost and not permanently installed it should be able to start at any time.
- A unique and powerful concept but not quite ready for prime time.