# GMACS: a Wide Field, Multi-Object Spectroscopy for the Giant Magellan Telescope

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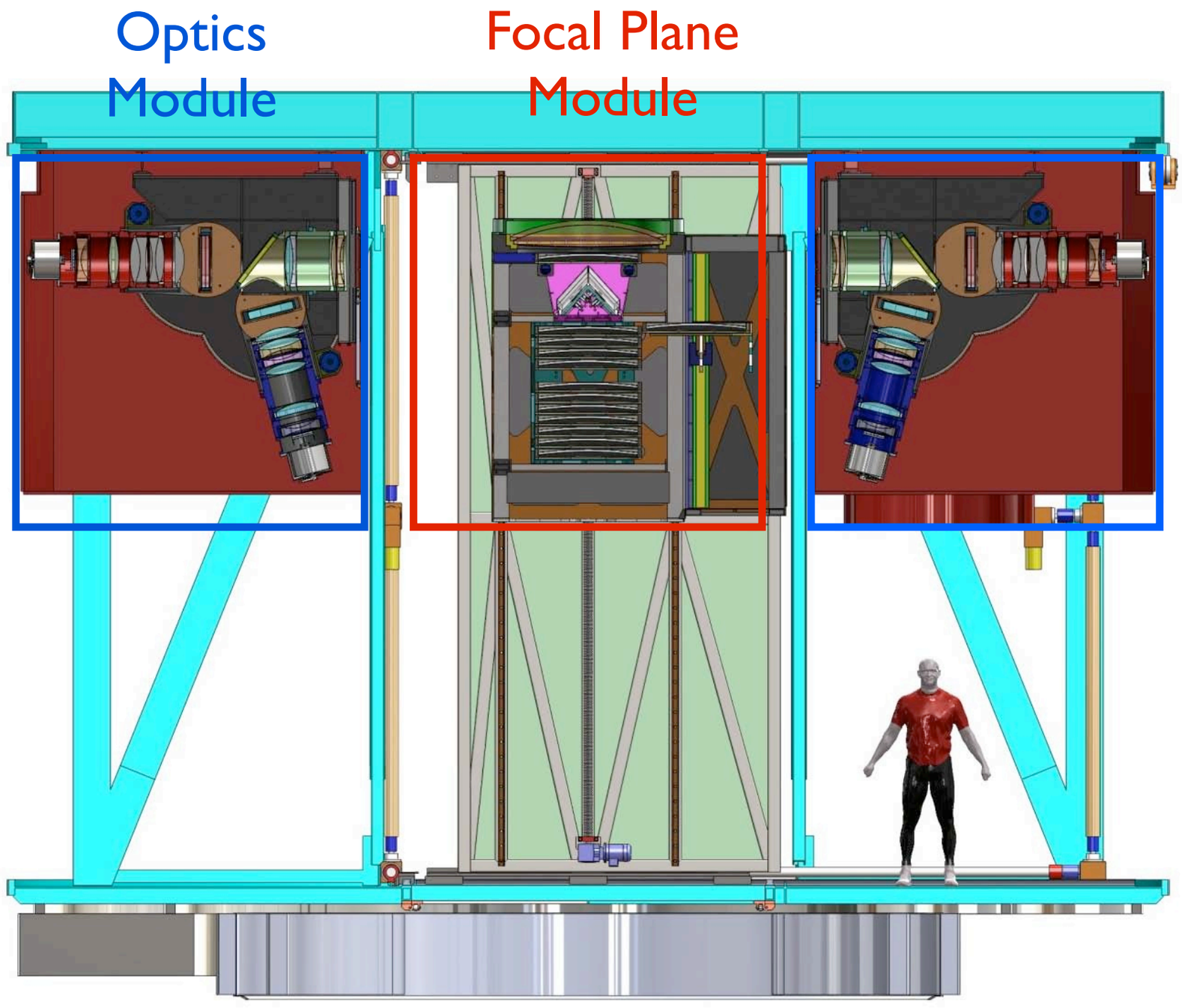
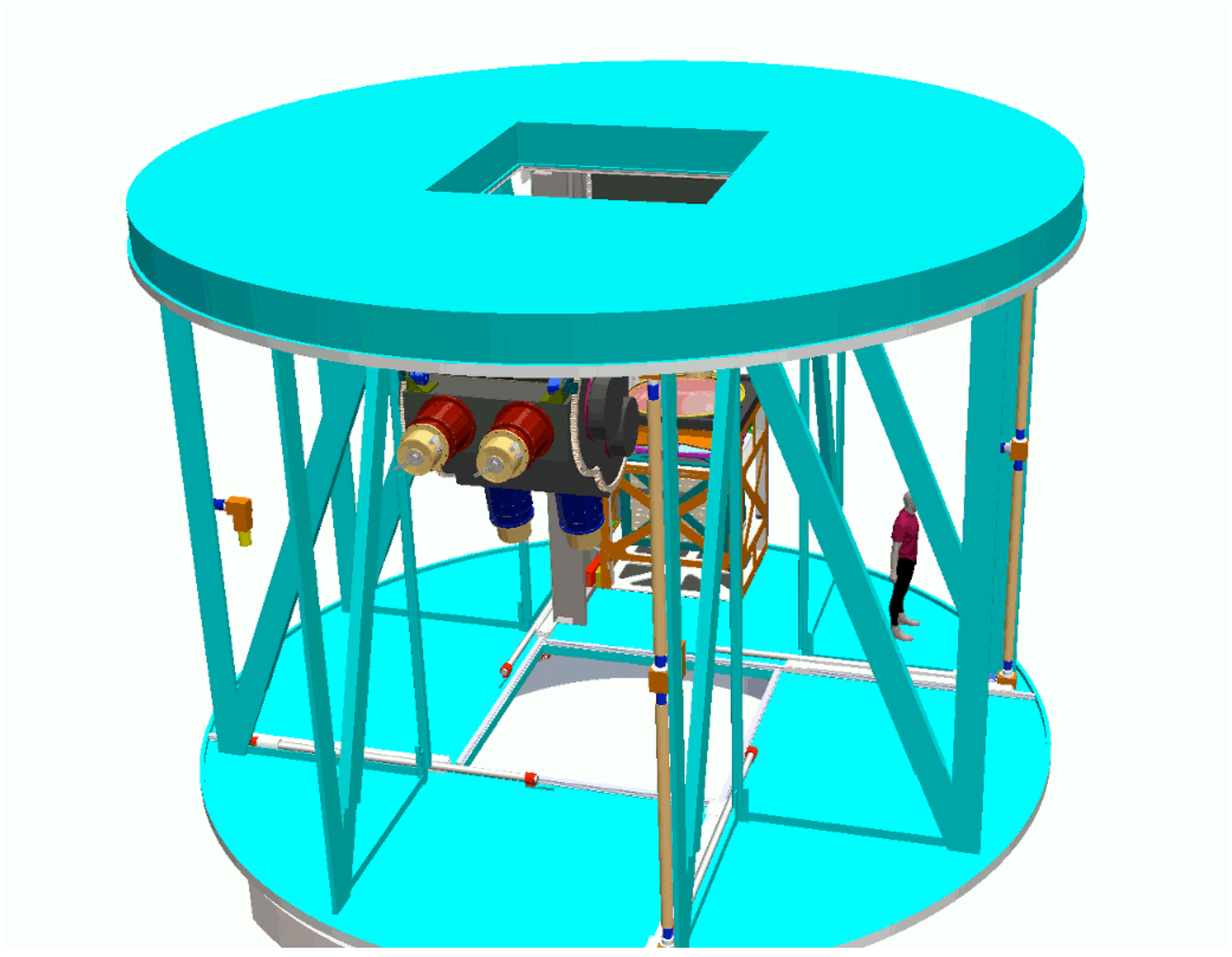
- GMACS - A spectrometer operating in the visible spectrum (0.32µm to 1µm) with the capability to observe multiple targets simultaneously
- Technical objectives of GMACS
  - High throughput: >50% at peak and no worse than 30% at any wavelength
  - Detectors with low readout noise
  - Excellent image quality: <0.2 arcsec rms over the entire detector plane
  - Accurate and precise sky subtraction using direct slits
  - Multi-object capability: focal plane masks
  - Broad wavelength coverage: at least 400-950nm (goal is 350-1100nm)
  - Moderate resolution: R~1000-5000
  - Spectral accuracy over long exposures of <0.1 resolution element

- Mechanical Design - GMACS in GIR(GMT Instrument Rotator) (1)

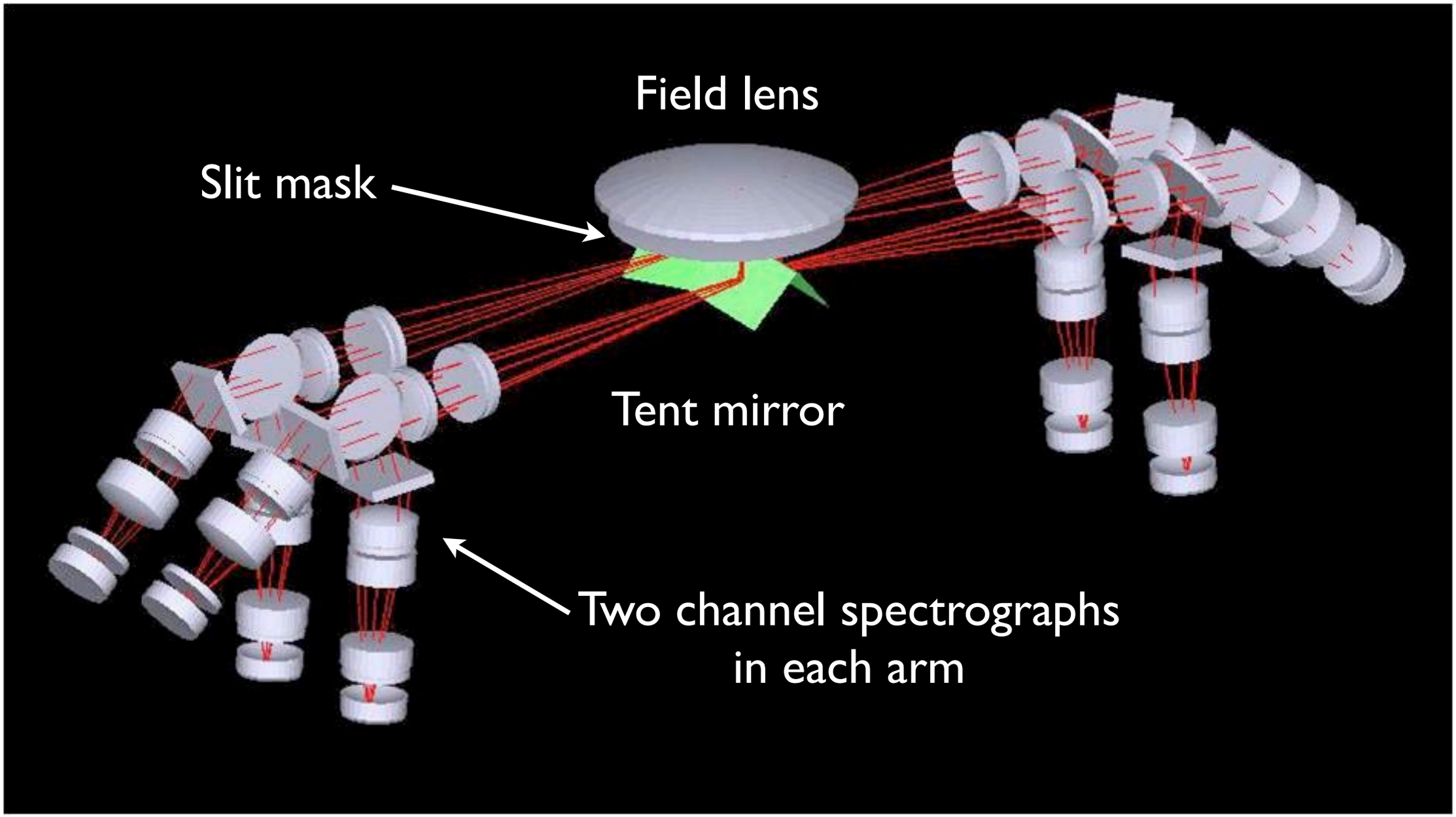



Smee et al. 2012

- Mechanical Design (2) - GMACS in GIR(GMT Instrument Rotator) (2)

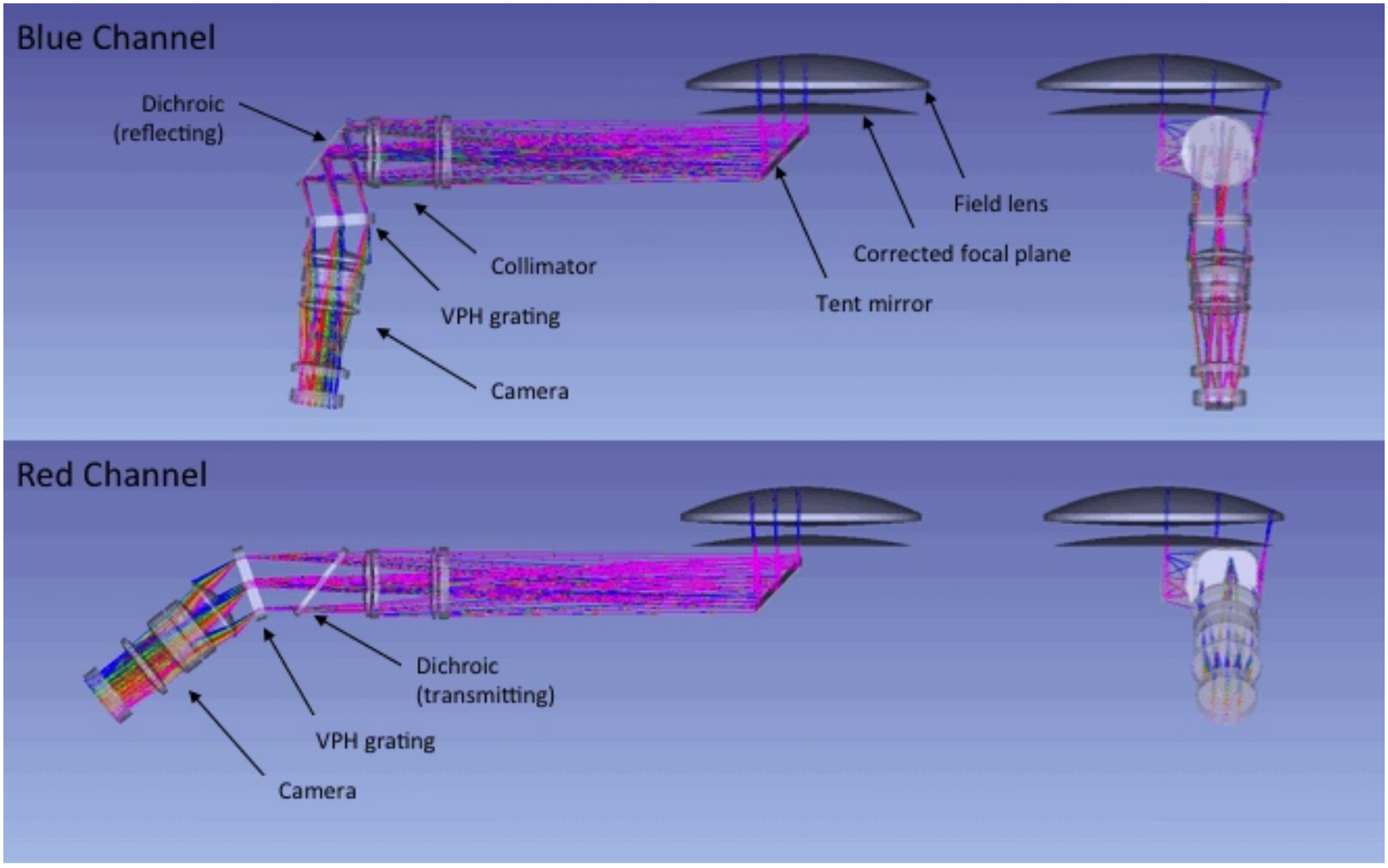


- Optics Design (1) - General optical layout of the GMACS design




Depoy et al. 2013

- Optics Design (2) - Details of each channel




Depoy et al. 2013

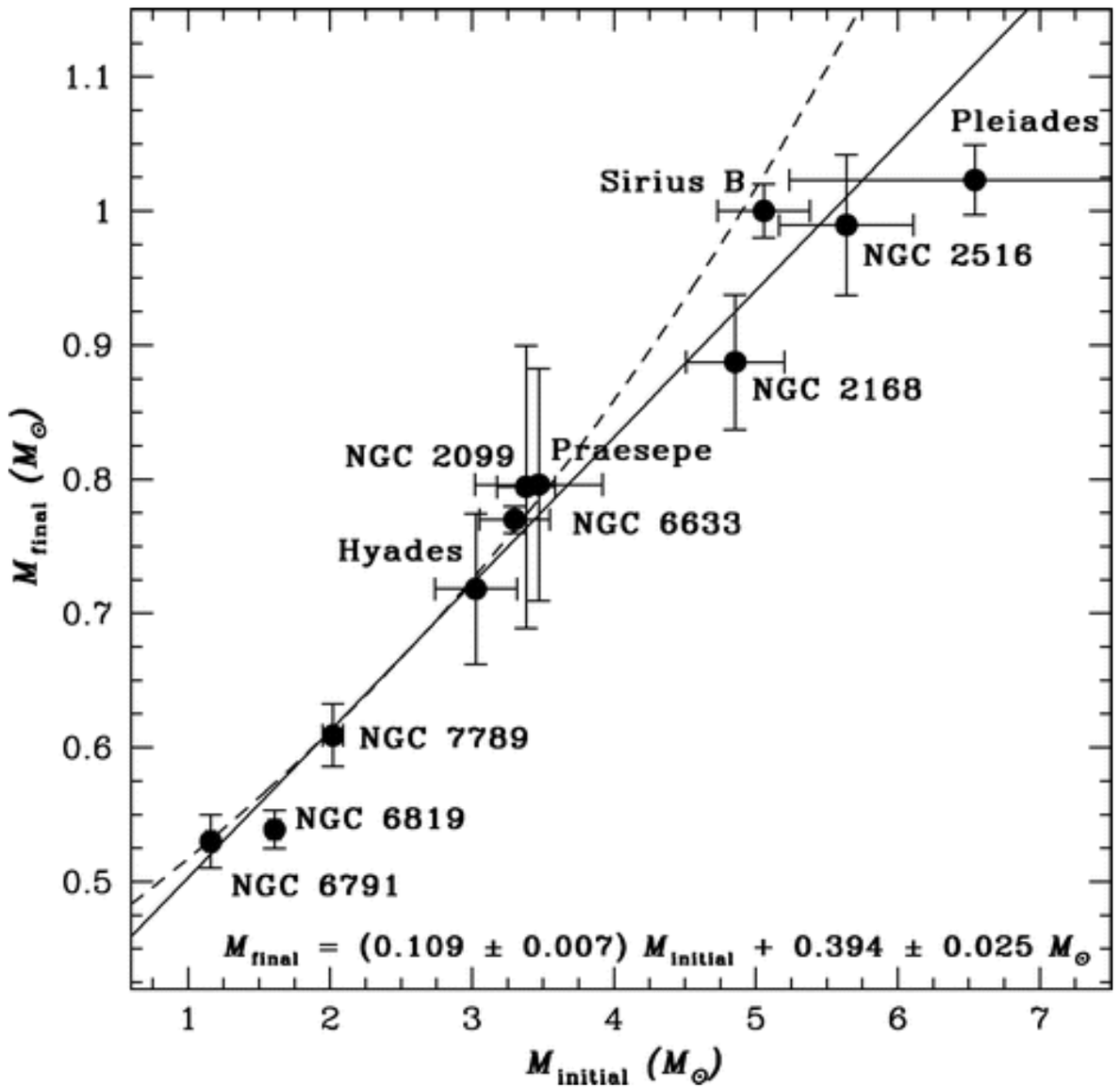
- Spectral resolution in each channel, wavelength, and resolution mode

| Blue Channel | | |
|---|---|---|
| Wavelength(nm) | R(Low Res) | R(High Res) |
| 370 | 993 | 1817 |
| 425 | 1140 | 2087 |
| 522 | 1400 | 2563/2662 |
| 595 | 1596 | 3035 |
| 670 | 1798 | 3418 |

| Red Channel | | |
|---|---|---|
| Wavelength(nm) | R(Low Res) | R(High Res) |
| 650 | 1948 | 3499 |
| 740 | 2218 | 3984 |
| 840 | 2518 | 4522/4975 |
| 875 | 2623 | 5182 |
| 1020 | 3058 | 6040 |

# White Dwarfs as a Probe of Stellar Evolution

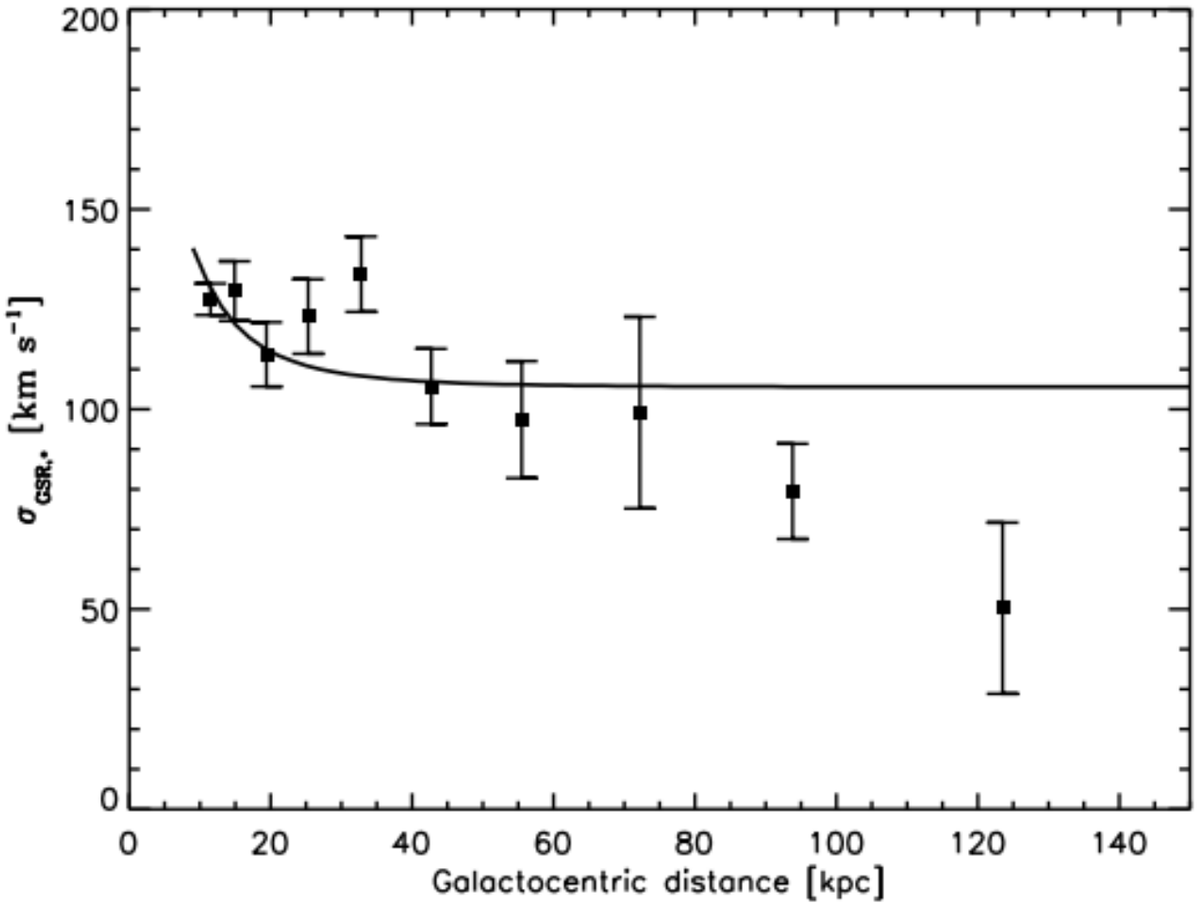
- The initial-final mass relation between initial mass of main sequence-white dwarf is important to understand stellar evolution
- The relation was derived from ~40 young open clusters
- Low mass end - evolution of low-mass populations
- High mass end - critical mass of Type II SNe
- GMT/GMACS will increase the number of WD samples
  - S/N: 30-100, g<24mag (out to 1-2.5kpc)
  - 6~10hrs with R~2000, ~10/mask




Kalirai et al. (2009)

# Constraining the Galactic Halo and Galactic Center through Spectroscopy of Galaxy Halo and Hyper-velocity Stars

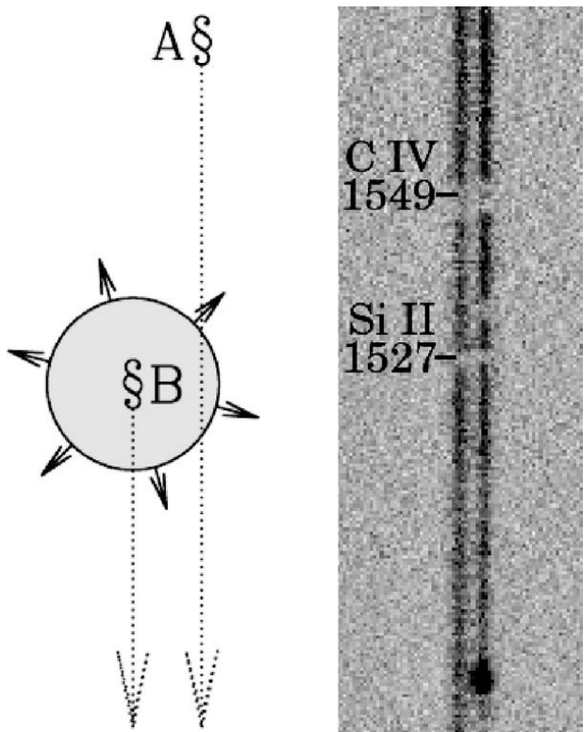
- Properties of hyper-velocity stars(HVS) provide unique tracers of the Milky Way halo and the Galactic center
- The spatial and kinematic distribution of stars in the Galactic halo enable to measure the properties of the MW dark matter halo
- GMT/GMACS will target Galactic halo F-stars under a Piggy-back program
- 1 out of 200 would be an HVS
- GMT/GMACS will be able to observe F-stars at 50-100kpc(20<g<23 mag) with S/N~5



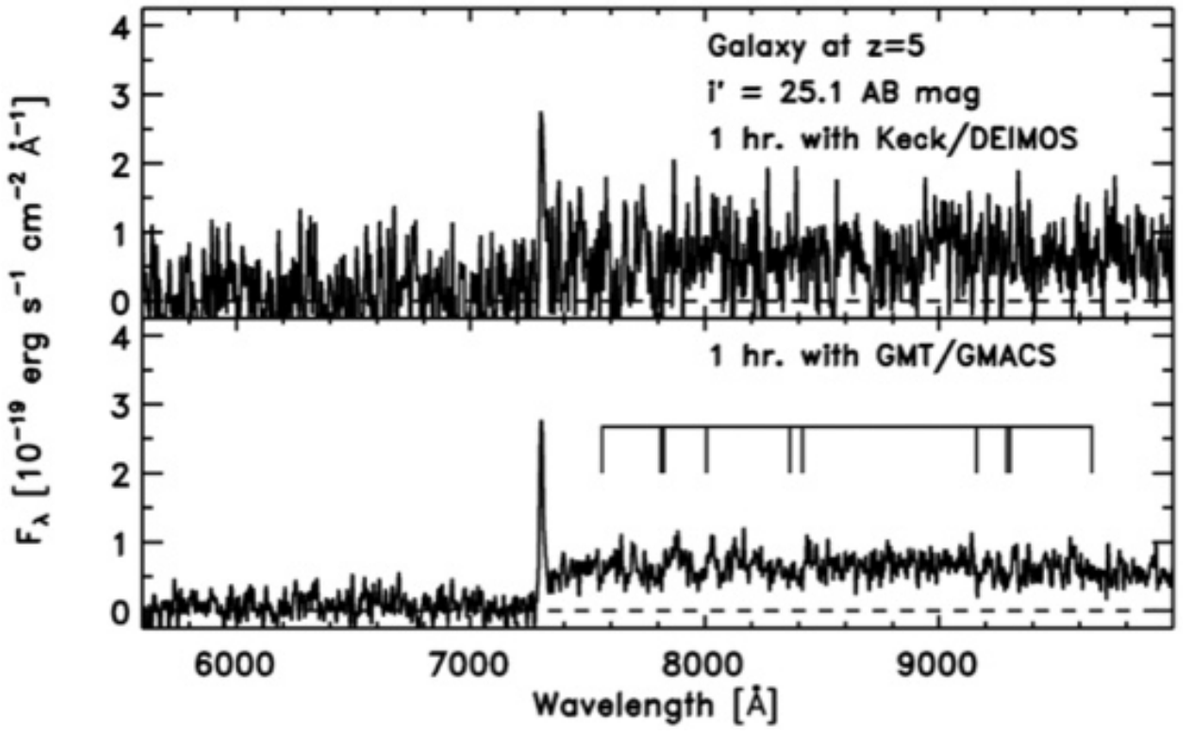

Battaglia et al. (2005)

# The evolution of the distribution of cold gas around galaxies from z=2~5

- The intervening absorption systems (e.g. LBG) provide the best constraints on the distribution of cold gas around distant galaxies
- GMACS will extent the observational limit to sub $L_*$ galaxies at z~3
- GMACS will provide more than 10 times higher S/N ratio comparing to Keck/ DEIMOS
- Surveys for LBGs at z=2~5 will constraint outflow and inflow of baryons in distant galaxies
- We can study the process of outflowing as a function of galaxy mass, luminosity, SFR, and galaxy density using GMACS

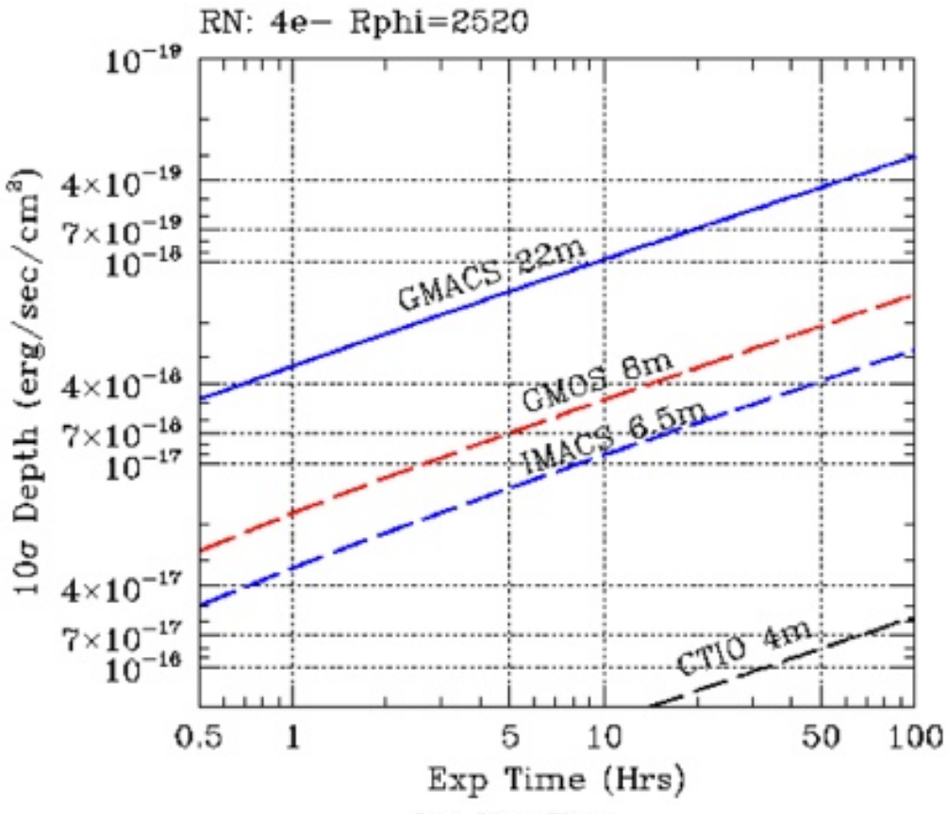


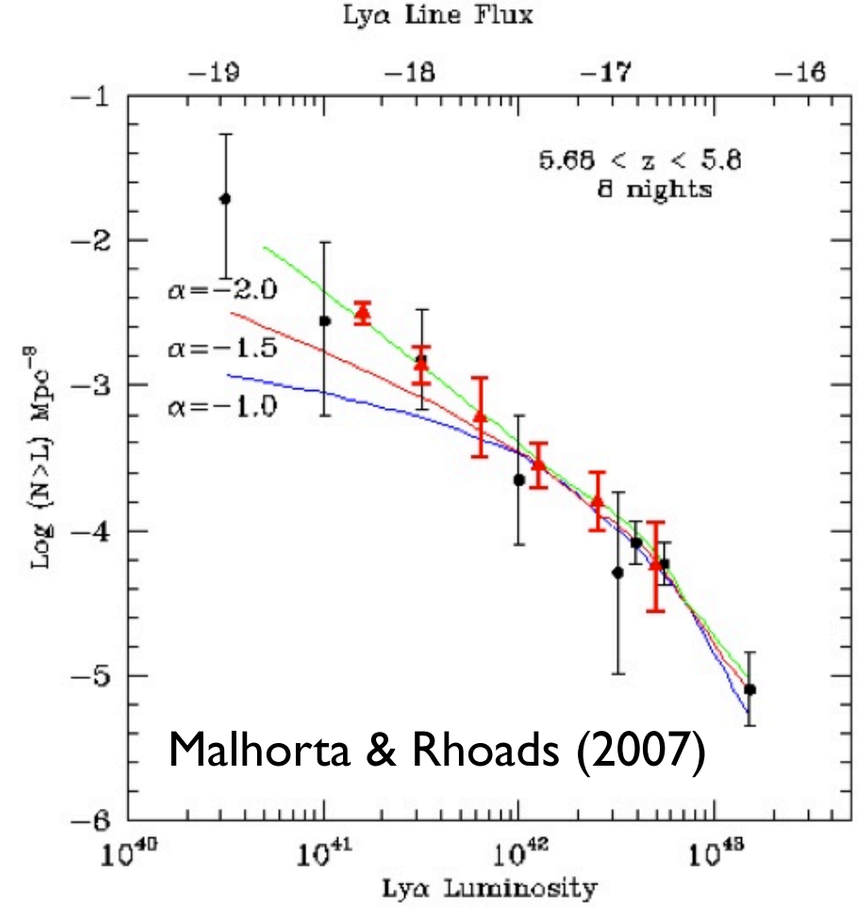

Adelberger et al. 2006



# Measuring the faint slope of the Ly-α luminosity function at z~6

- The source of reionization at z>6 remains uncertain.
- The number density of bright quasars at z~6 is not high enough to re-ionize all neutral hydrogen
- Low mass-high SFR galaxy(Ly-α) is a most likely candidate
- GMT/GMACS will provide far higher sensitivity than existing telescopes do
- One would be able to measure the faint slope of the Ly-α LF with a precision of 10% for 4 nights observing time



- Summary
  - GMACS is a spectrometer supposed to be operated in the visible spectrum (0.32m to 1m) with the capability to observe multiple targets simultaneously
  - GMT/GMACS will enable us to reach deeper and farther with taking advantage of unprecedented light-collecting power and resolution