[A-SPEC] Fiber Cable & Interface Control Software

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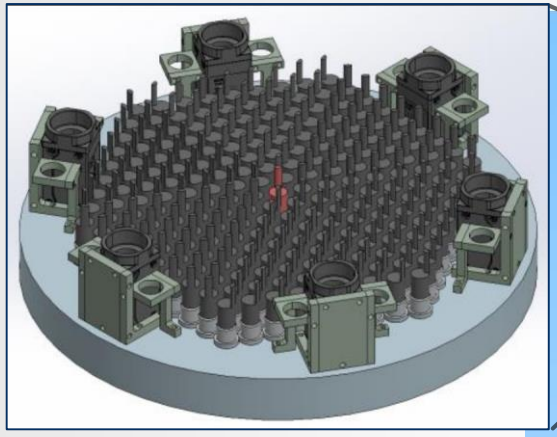
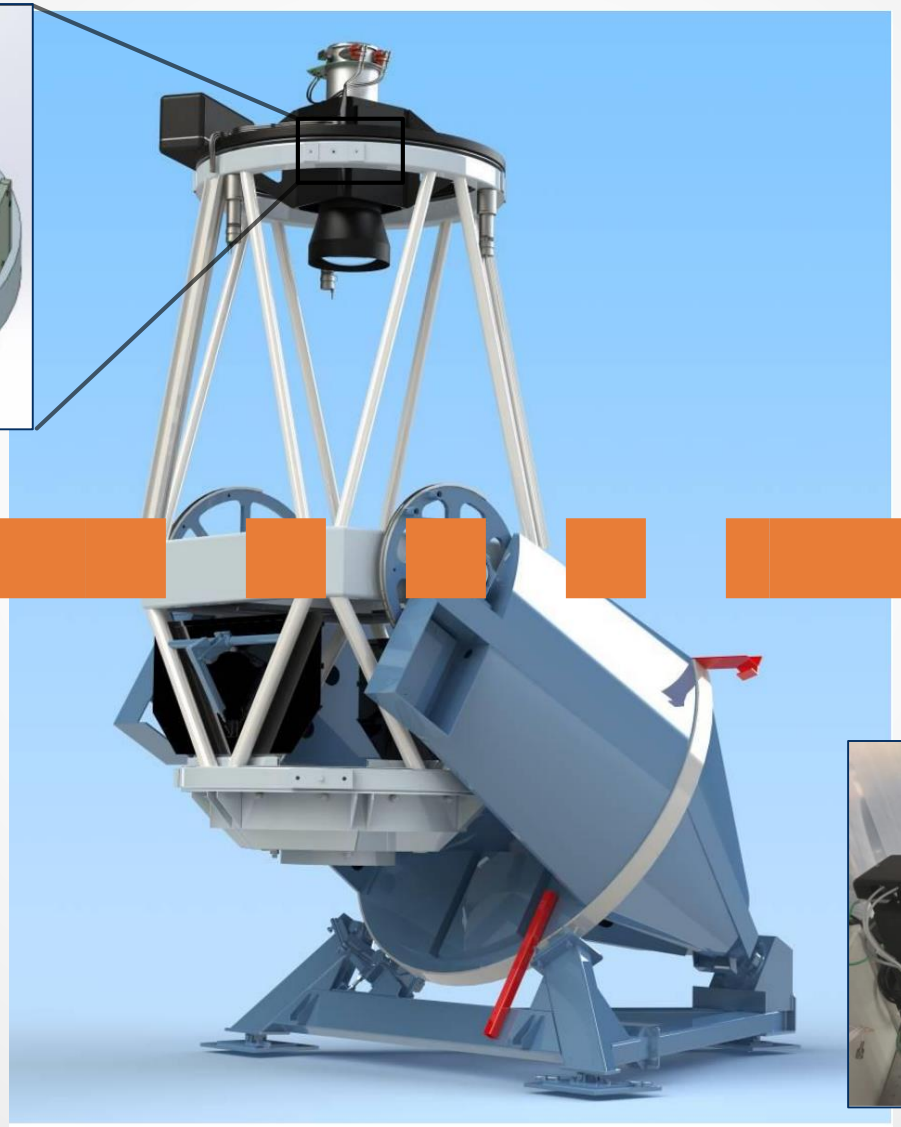
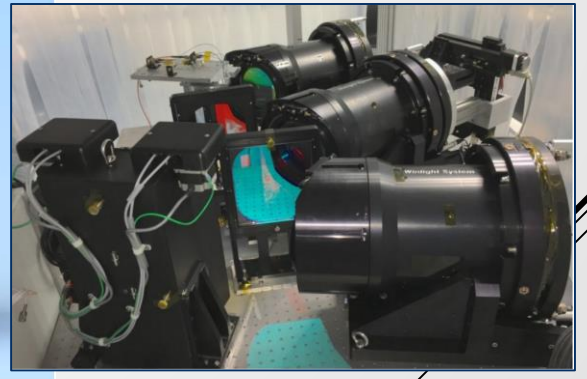
Feb. 14th, 2022 @ 2022 Survey Science Group Workshop

Fiber Cable?

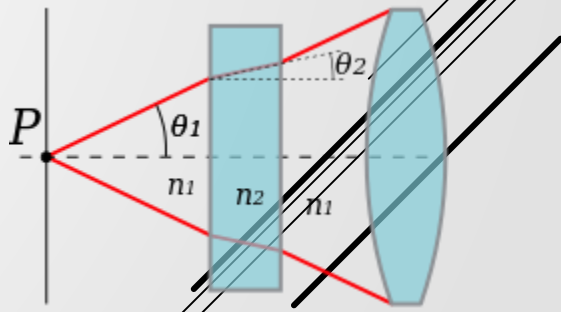






Fiber Requirements

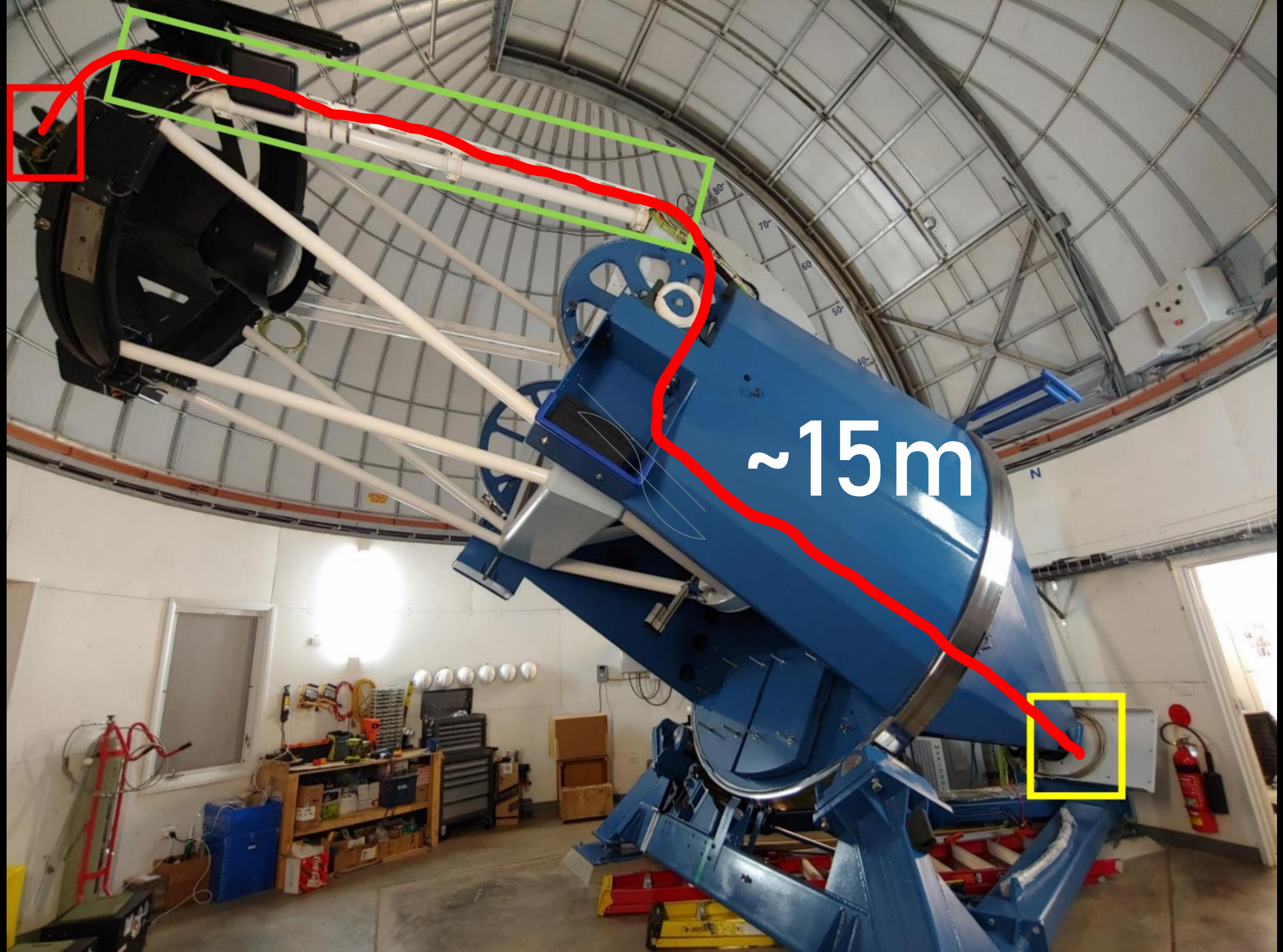
- Core diameter: 75 um
  - 3 arcsecs at the focal plane
  - Suitable angular size for observing main science targets
  - Suitable spectral resolution: $R > 1{,}900/2{,}100$ (blue/red)
- Numerical aperture (NA): ~0.22
  - Similar to the input beam from KMTNet WFC
  - Minimizing the additional fore-optics
  - Minimizing the focal ratio degradation (FRD)



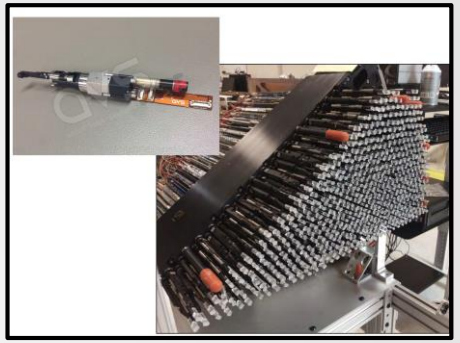
$$\mathrm{NA} = n_1 \sin\theta_1 = n_2 \sin\theta_2$$

Cable Routing

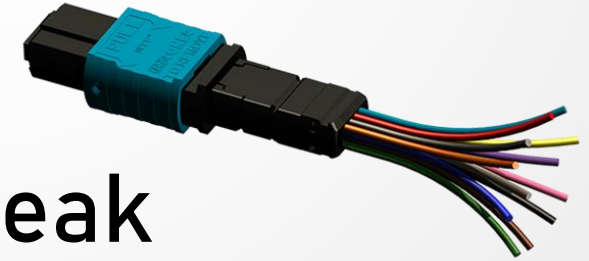
- #1. Same to KMTNet LAN cable route
  - 30~35m, depending on spectrograph position
  - Installation time: ~4 hours.
    - Cannot assemble/disassemble frequently
    - Possible damage by structures
- #2. Adding external cable rack (e.g. Gemini)
  - Need additional design & manufacture
  - May give additional pressure/distortion to the telescope


~15m

Cable Connection

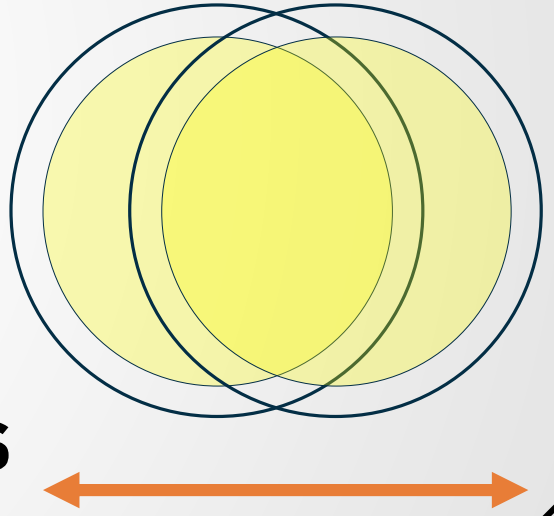


- Rationale
  - Focal plate should be changed per year for non-A-SPEC observations
  - Cable cannot be (completely) disassembled from the telescope that frequently
- Consideration
  - Minimize light loss and break
  - Easy for installation & maintenance



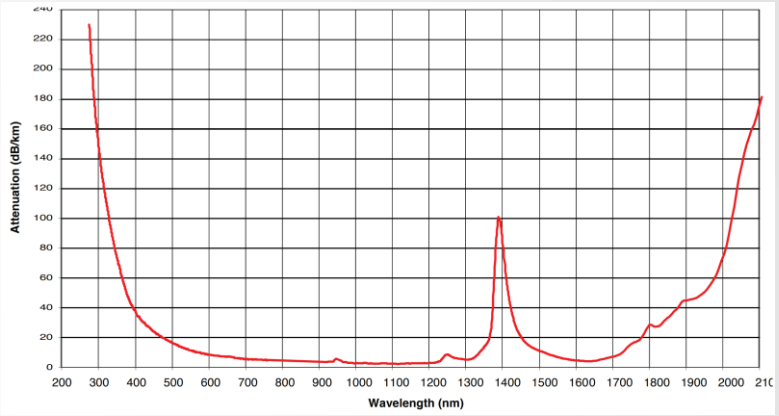
Fiber Requirements - 2

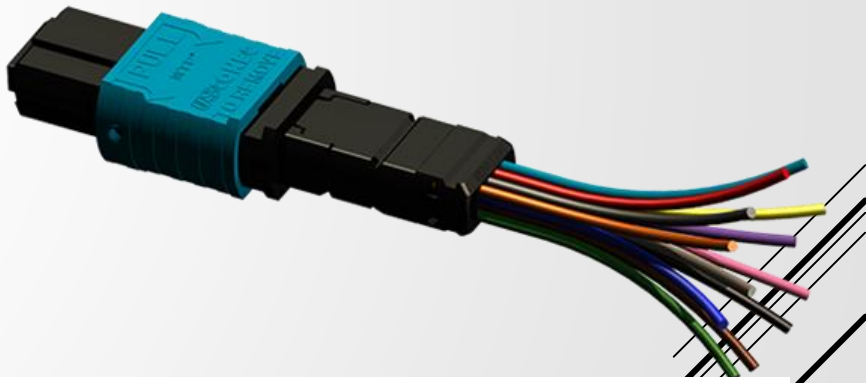
- Cladding diameter: 125um
  - Most fiber connectors use 125um-diameter holes
  - Smaller cladding diameter will change the alignment within the connector, which leads the light loss when two fiber cores contact.



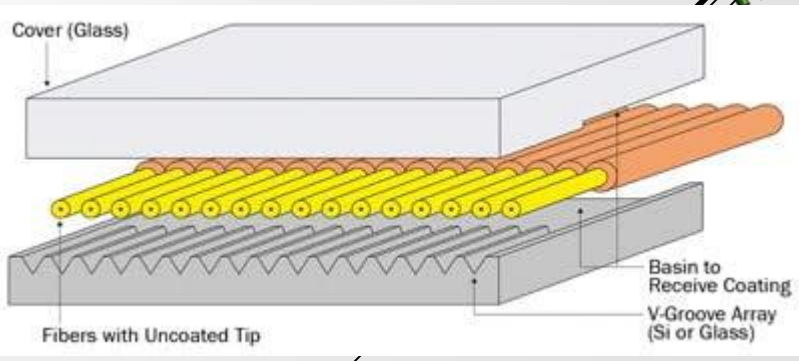
Fiber Cable: To-Dos in 2022

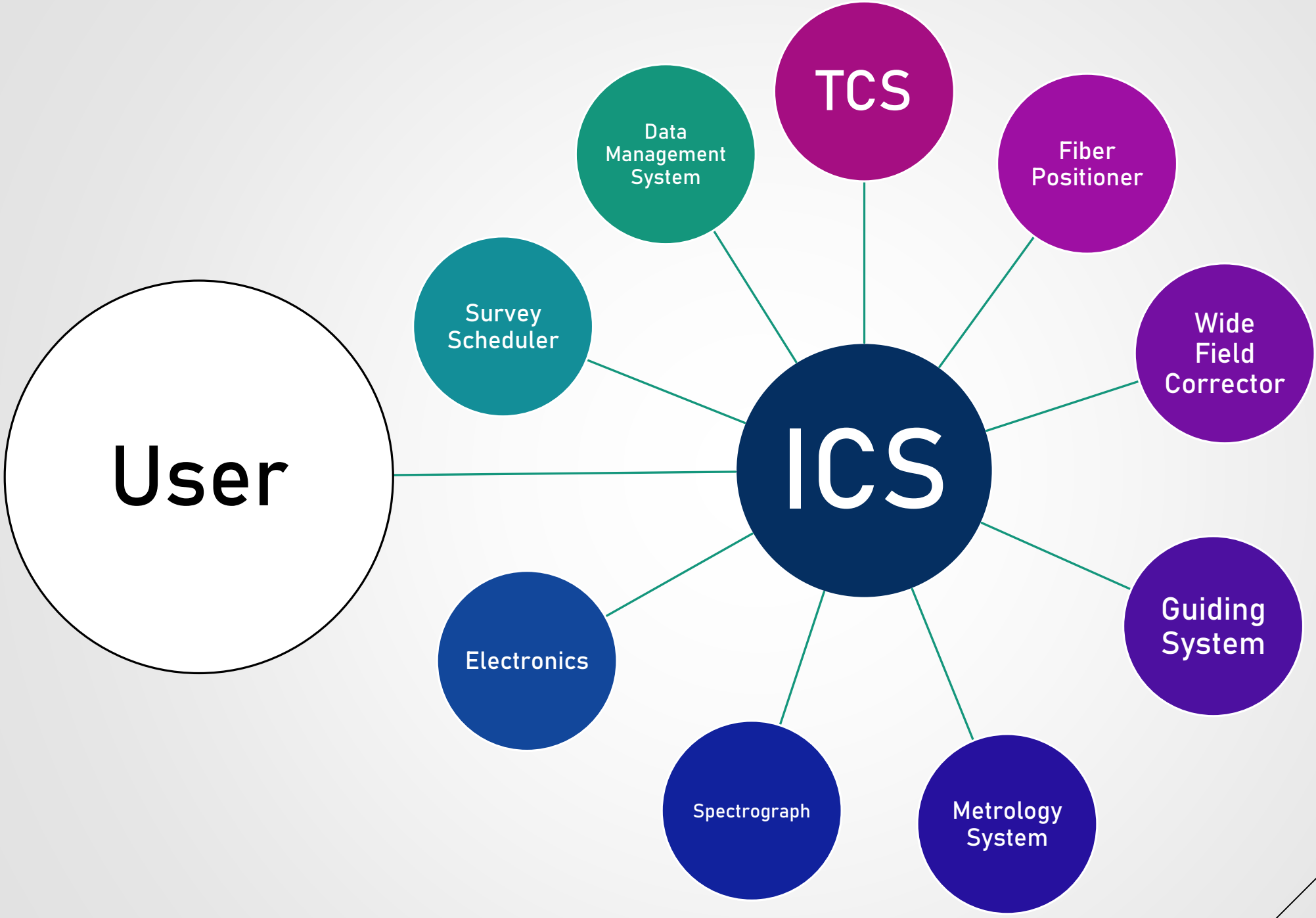
- Finalize fiber model & cable connection method w/ KMTNet & AAO (Feb-Apr 2022)



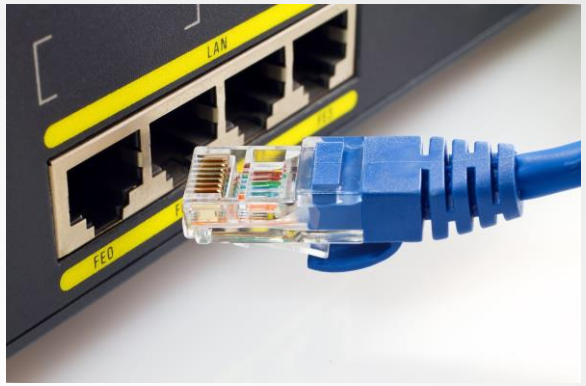


- Start procurement for manufacturing fiber cable (late 2022)




User
ICS
TCS
Data Management System
Survey Scheduler
Fiber Positioner
Wide Field Corrector
Electronics
Guiding System
Spectrograph
Metrology System

Data Transfer



- Hardware: EtherCAT
- Database for small-size parameters: redis
  - Already used in KMTNet for parameter monitoring
  - Real-time memory-resident database
  - Supports most modern programming languages
  - Very simple command sets (GET/SET [key])

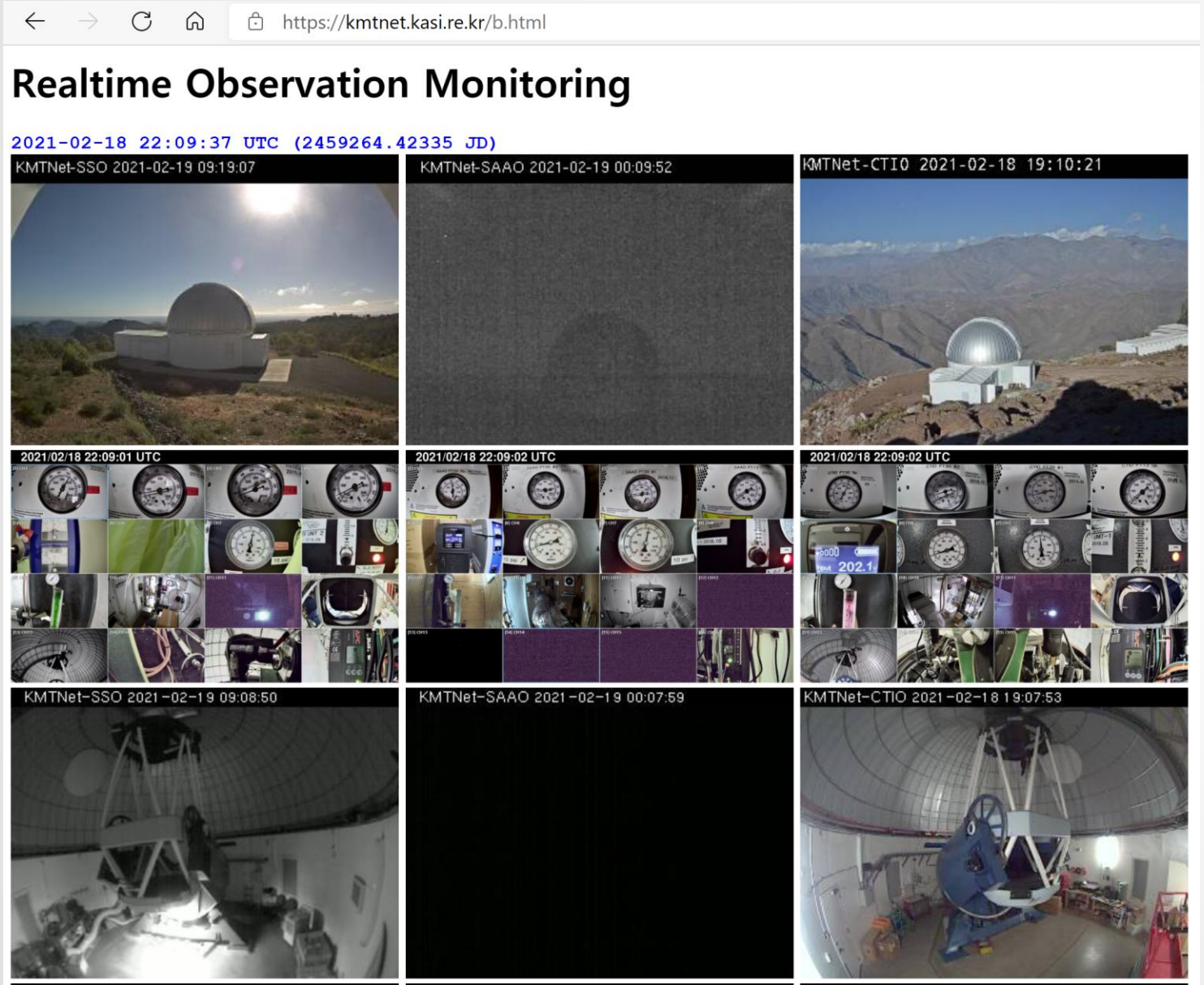
Operating System

- CentOS has been widely used, but…
  - CentOS will change its role from downstream to upstream of (commercial) RedHat from Dec. 2020
  - CentOS Linux 7 expires in Jun. 2024;
    CentOS Linux 8 expired in Dec. 2021;
    Later ones (CentOS Streams) may be unstable.
- Possible alternatives: Rocky Linux / AlmaLinux

Graphic User Interface (GUI)

- GUI Language: Qt (+ C++/Python)
- 2 GUI sets for 3 different user types
  - Operator (+Engineer) mode
    - Mostly for on-site operators to perform the observation
    - Engineer mode at commissioning & emergency case is hidden
  - Monitoring mode
    - For scientists to monitor the observation

GUI: Monitoring Mode



A similar system to web-based KMTNet monitoring mode

GUI: Operator Mode

- Need to allow step-by-step operations
  - E.g. Sending field information
    → Telescope slewing & positioner allocation
    → Guiding & metrology measurement
    → Start exposure
- Need to allow adding comments at any time
- Should be EASY & mostly AUTOMATIC!

KSPEC GUI ver 0.0

Observation Information

Date/LST: Wed, 24 Nov 2021 10:11:29 | UTC: 10:11:29 | Initialize

Observer: M. Hyun, S. Chun, S.W. Hong | Data Path: C:/Data/kspec/ut211124/

Project ID: KSPEC_N0027391 | P.I.: J.W. Kim | Load

RA: | Dec.:

Exp. Time (sec): 900 | Repeat: 4

Note: Revisit target (Observed in Sep. 10, 2021, bad weather)

Comment | Last Save : Obslog_20211124.txt (10:11:21) | Save

Guide1 Lost at LST 10:11:20

Slew → Guiding → Focusing → Positioning → Ready

10:07:32 Telescope slewing….
10:10:10 Fiber Alignment Done!
----------Ready For Exposure----------
10:11:10 Start Exposure ! (Project ID : KSPEC_N0027391)
(Humidity : 70%, Air Mass : 1.232)

Last Save : kspec_20211106_00264.fits (10:08:27)

Stop

Start Exposure

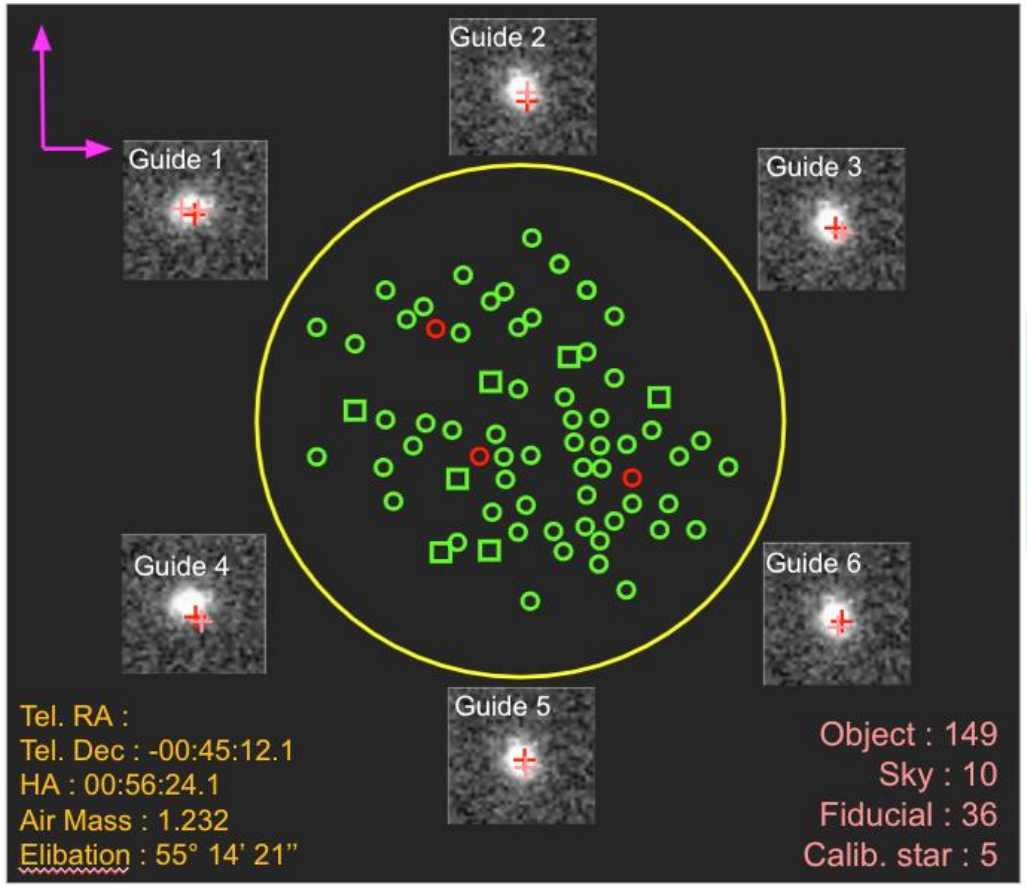
Monitoring Window

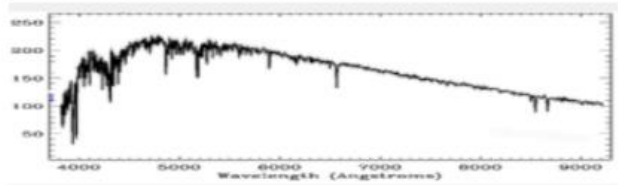
KSPEC

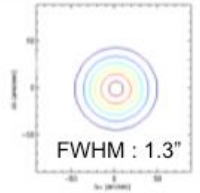
Camera | Humidity (%): 70 | Goto Parking

TCS / IP | Focus: 17028

CCD Temp. (°C): -120 | Dome Lamp | On | Off







ICS: To-Dos in 2022

- Refine operator GUIs by clarifying Operation Concept Definition Document

- Define functions for interfacing different operations

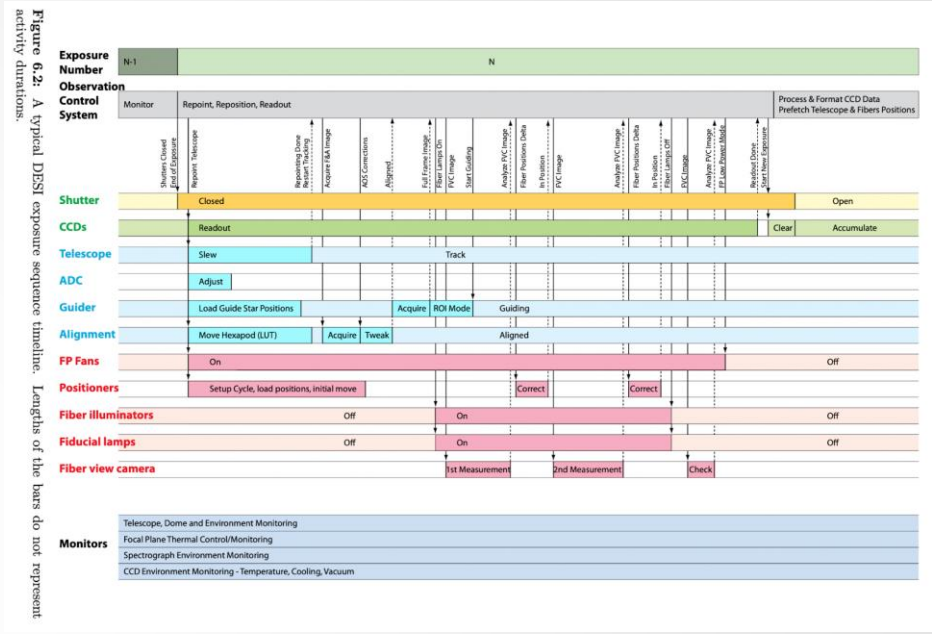


Figure 6.2: A typical DESI exposure sequence timeline. Lengths of the bars do not represent activity durations.