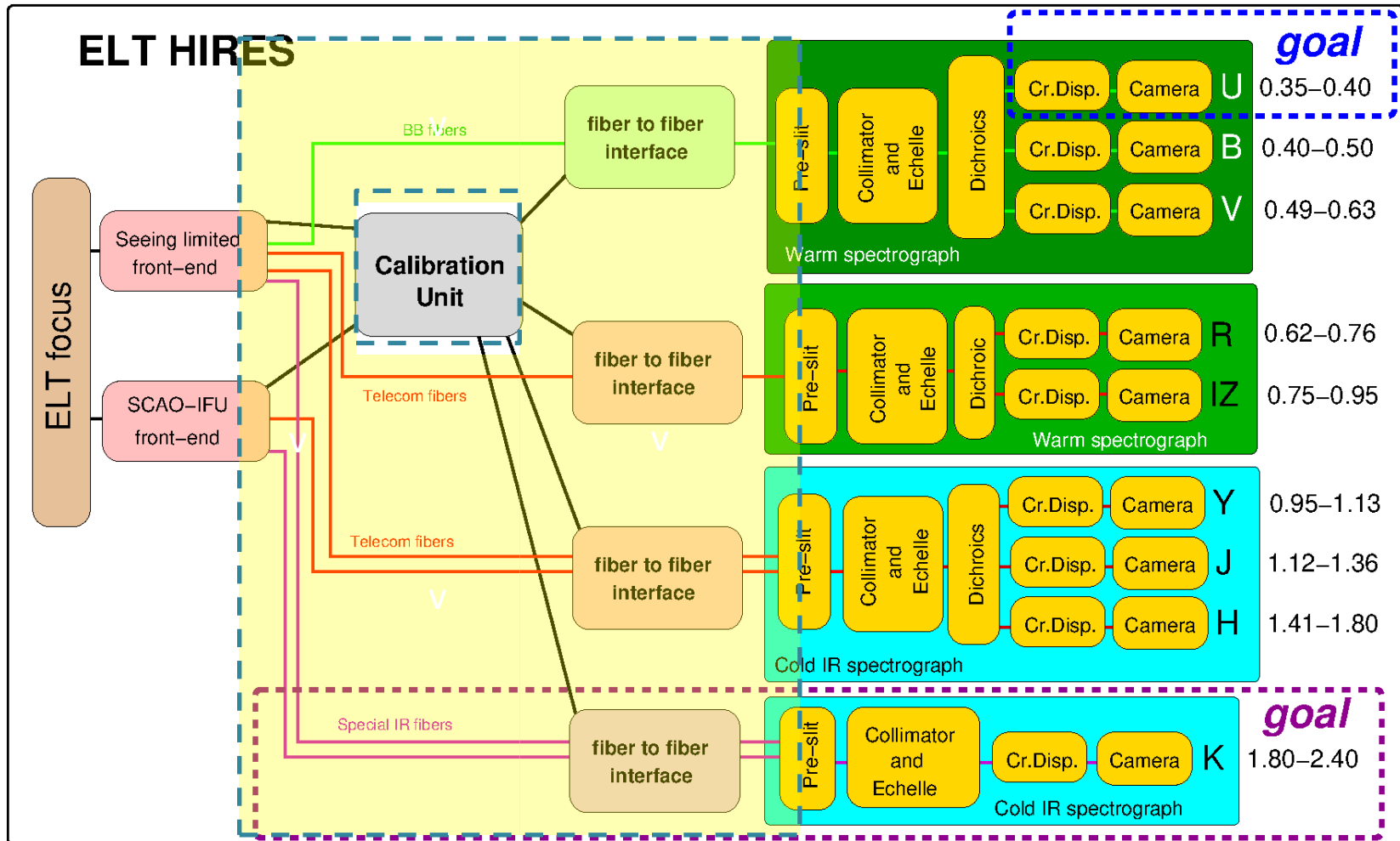


# HIRES FL (Fiber Link)

- Carries the light from the ELT focal plane to the spectrometers.
- Carries the light from the Calibration Unit to the spectrometers.
- Reorganizes the light from circular to linear geometry (slits).
- Defines the observing modes.
- Optimizes performances specific to each observing mode.

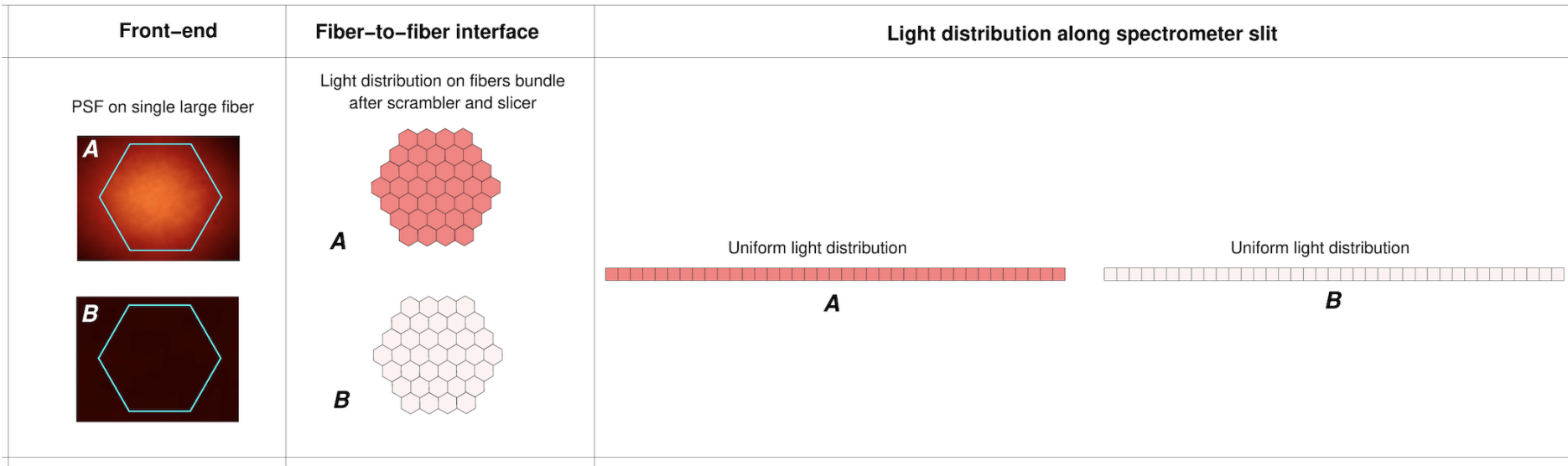
# HIRES FL

- FL is an “extended WP” and it overlaps with other WPs.



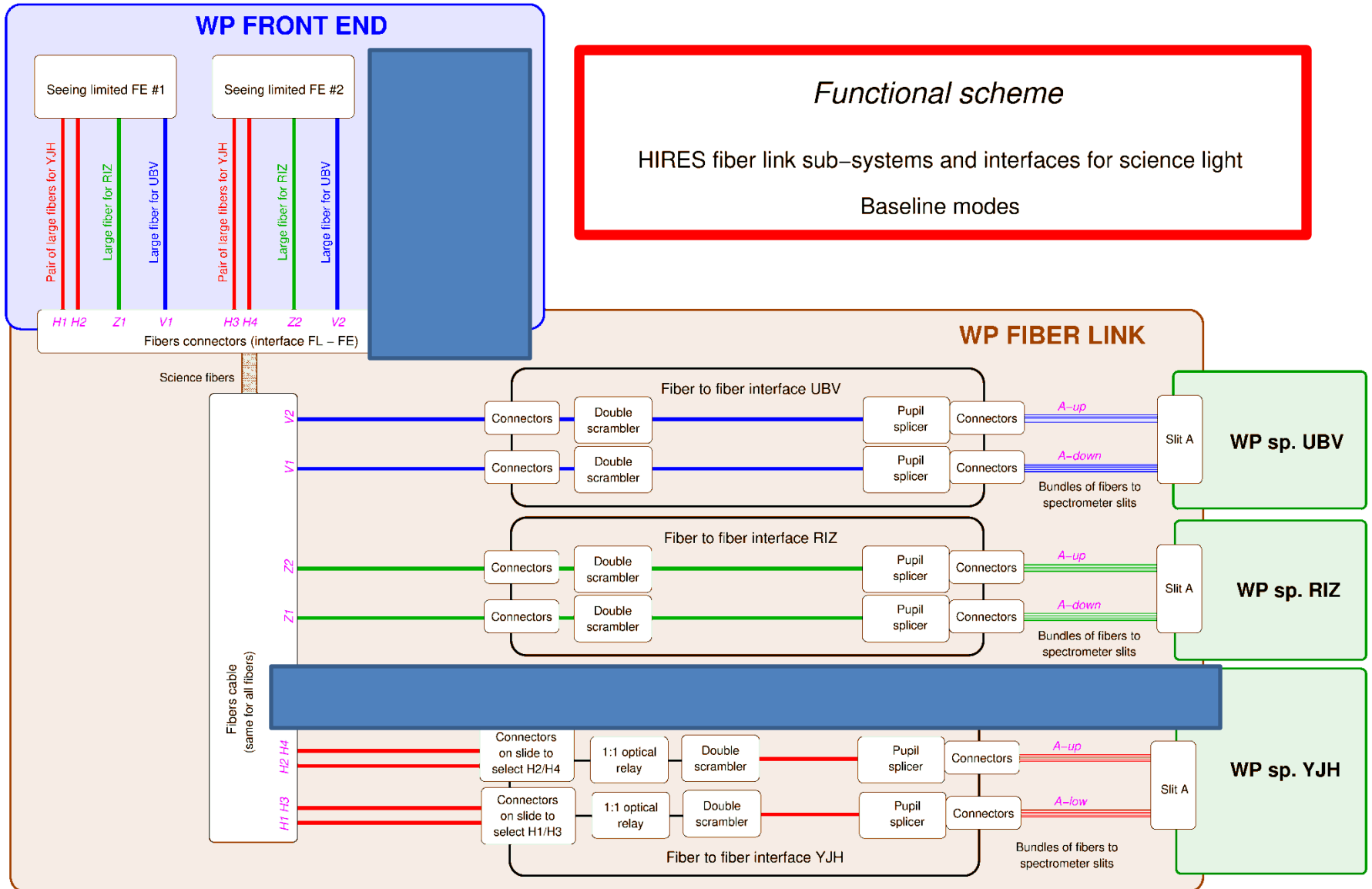
# HIRES FL

- Observing mode #1 : seeing limited HiSpFi (High Spectral Fidelity)



- Light enters a large fiber at the seeing-limited front-end.
- Light is uniformized in the fiber-to-fiber interface.
- Light is split into smaller fibers in the fiber-to-fiber interface.
- Light is reorganized along one of the spectrometer slits.

# HIRES FL



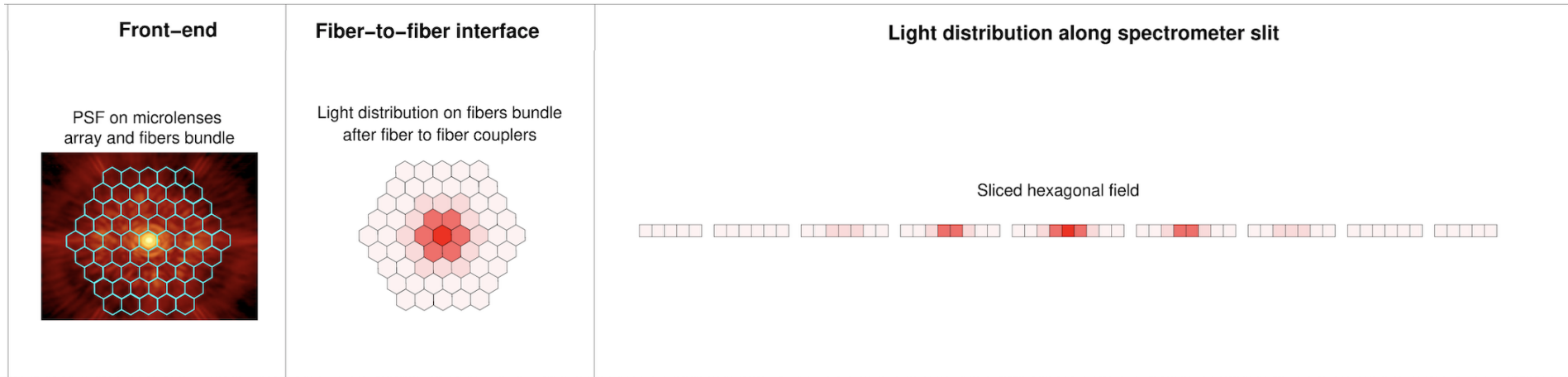
*Functional scheme*

HIRES fiber link sub-systems and interfaces for science light

Baseline modes

# HIRES FL

- Observing mode #2 : IFU, only for YJH(+K) spectrometer



- PSF is sampled by  $\sim 70$  fibers (spaxels) at the SCAO-IFU front-end.
- Light is transferred to another bundle of fibers in the F2F interface.
- Light is reorganized (sliced) along one of the spectrometer slits.

# HIRES FL



# HIRES FL some numbers

*Seeing limited HiSpFi mode*

Parameter	Value	Comment
Aperture on sky	2 x 0.75" Octagonal	Focal plane on fiber core
Size of input fibers	0.50 mm	Large fibers from FE to F2F
Length of input fibers	~150 m (RIZ & YJH) <15 m (UBV, K)	RIZ & YJH fibers go from Nasmyth platform to Coude' room
# of input fibers	6-12	Depends on K extension and strategy for A-B switching
Size of output fibers	0.083 mm 0.125" sky projected	Small fibers to spectrometer slit after F2F interface
Length of output fibers	~20 m (RIZ & YJH) <5 m (UBV, K)	
# of output fibers	230 - 400	Depends on K extension and strategy for A-B switching

# HIRES FL some numbers

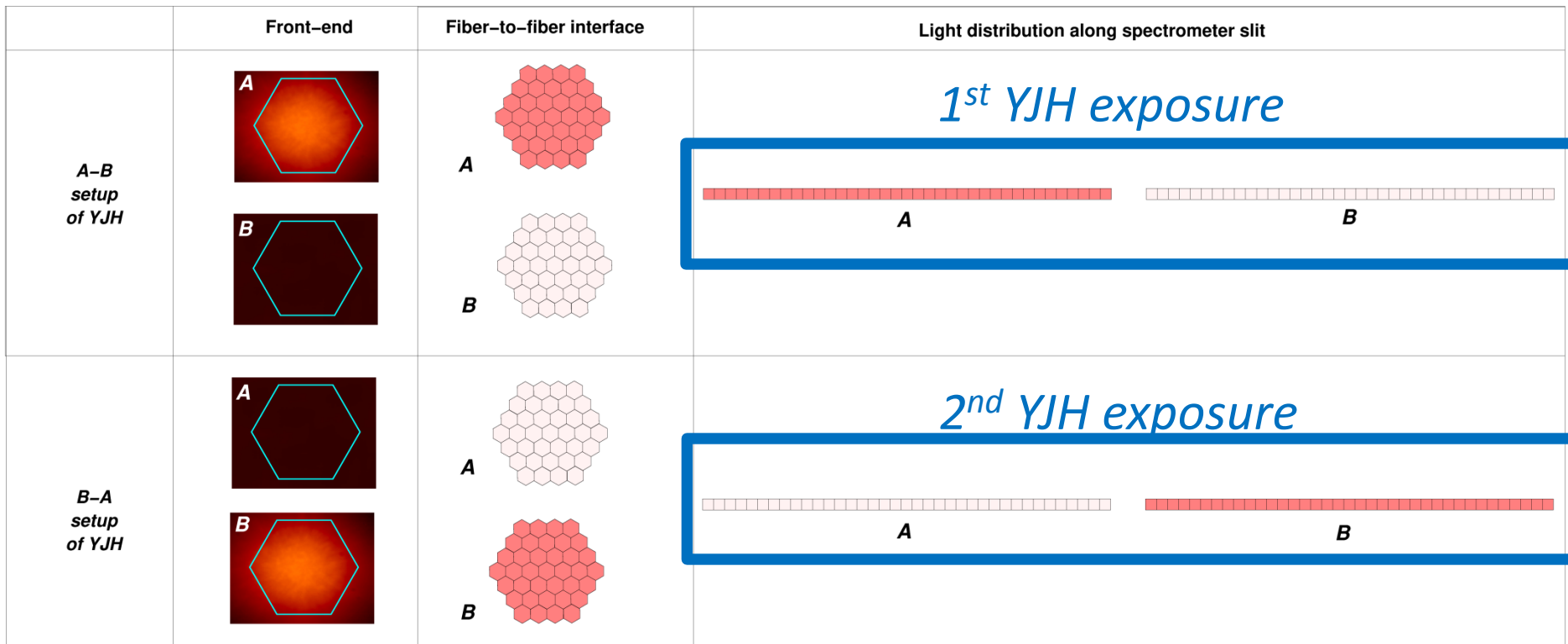
*IFU mode, only for YJH(+K) spectrometer(s)*

Parameter	Value	Comment
Number of spaxels/fibers	~70	
Aperture on sky of each spaxel/fiber	From ~5 mas to ~100 mas	Several scales selectable
Size of all fibers	0.083 mm	
Total length of fibers	~170 m (YJH) <20 m (K)	Fibers to YJH go from Nasmyth to Coude' room

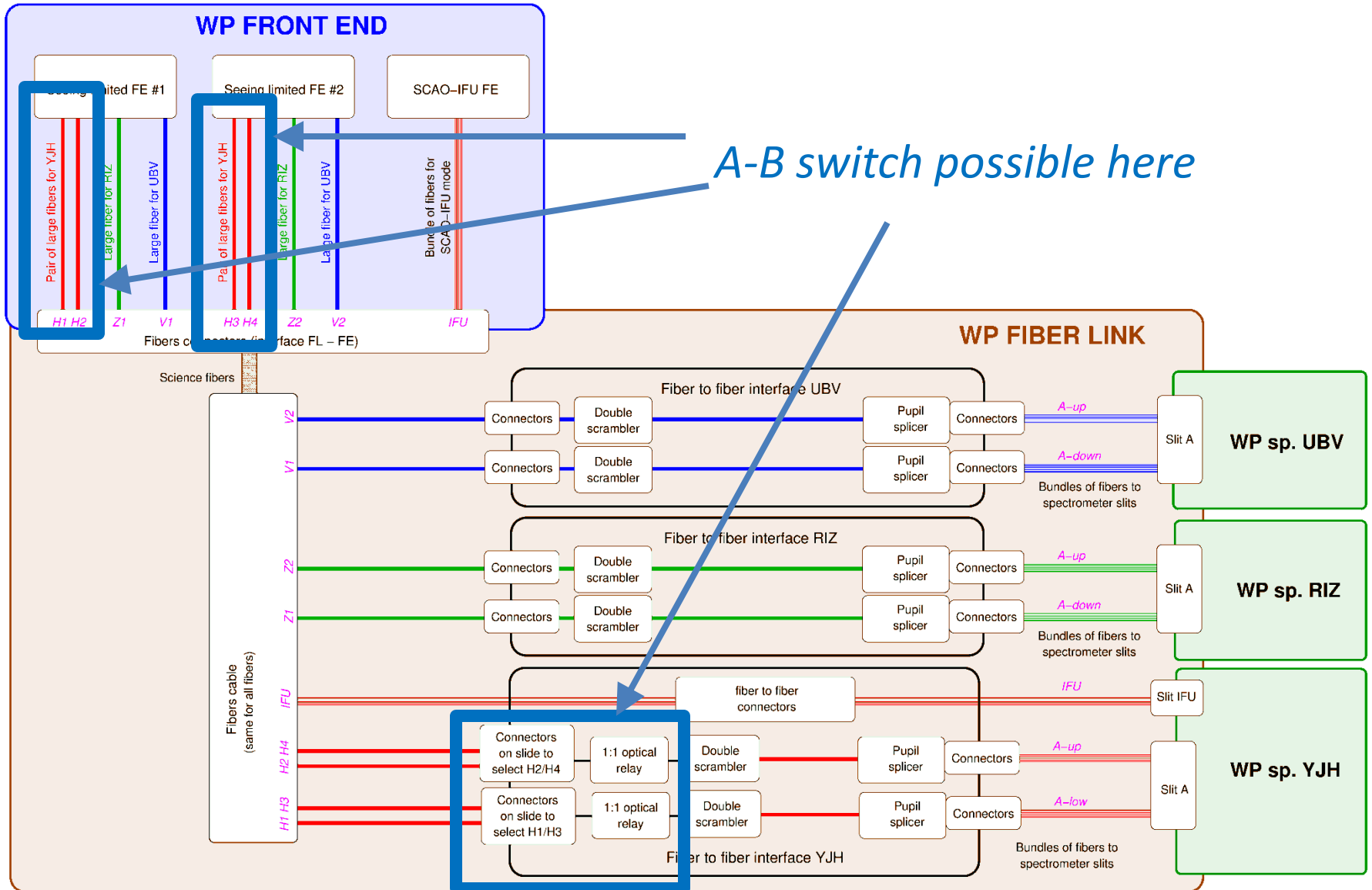


# HIRES FL open issues

- Different strategies for seeing limited observations at IR, YJH(+K) and optical (UBVRIZ) wavelengths?
- A-B switching in YJH(+K) while staring in UBVRIZ?



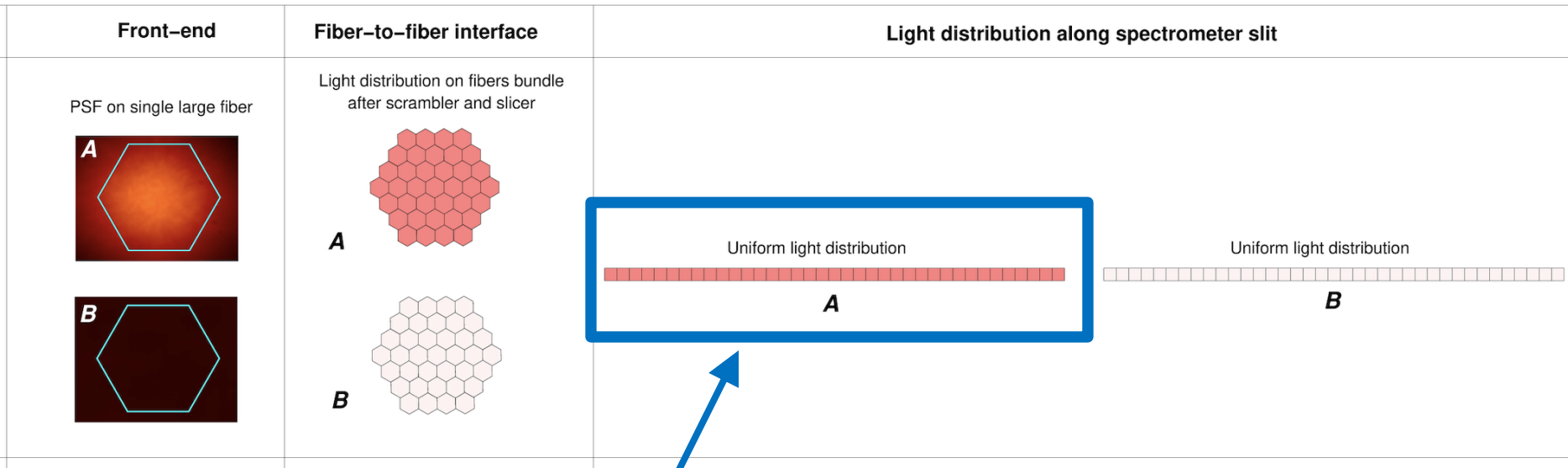
# HIRES FL open issues



*A-B switch possible here*

# HIRES FL open issues

- Extra seeing limited mode optimized for faint objects?
- In HiSpFi each resolution element is sampled by >100 pixels.
- Spectra of faint objects are dominated by detector noise.
- IFU sampling of PSF using bundle of fibers at all wavelengths?

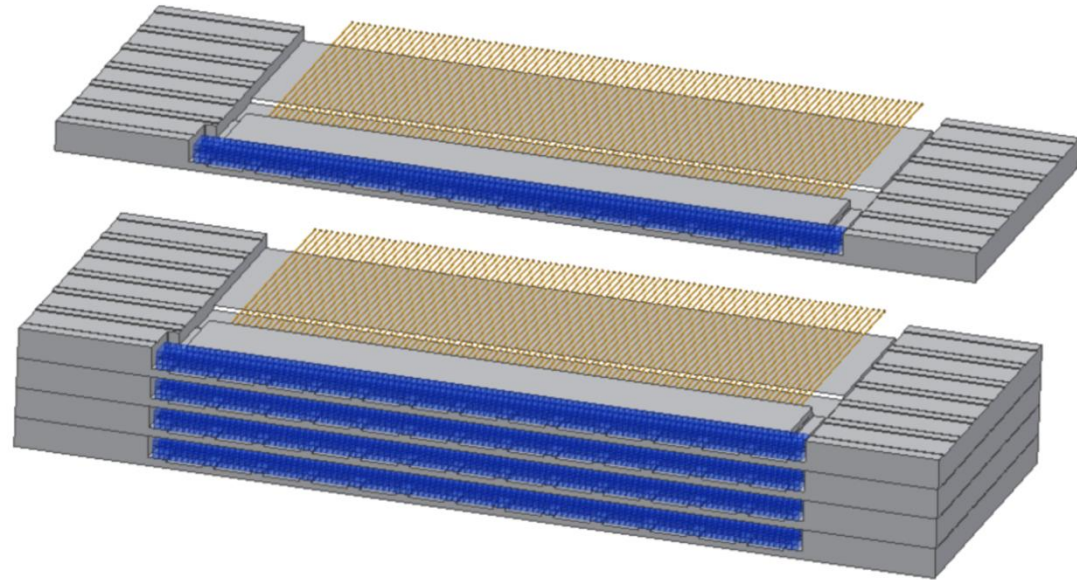
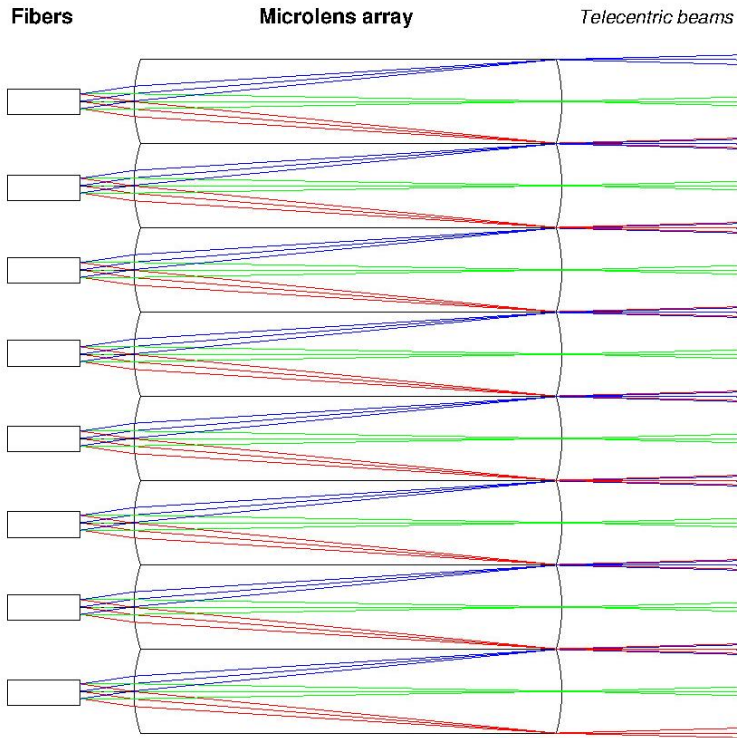


$$N_{R-element} = 140 \text{ pixels} \left( \frac{\theta_{slit}}{0.75''} \right)^2 \left( \frac{d_{pix}}{15\mu m} \right)^{-2} \left( \frac{F_{camera}}{1.4} \right)^2$$

# HIRES FL

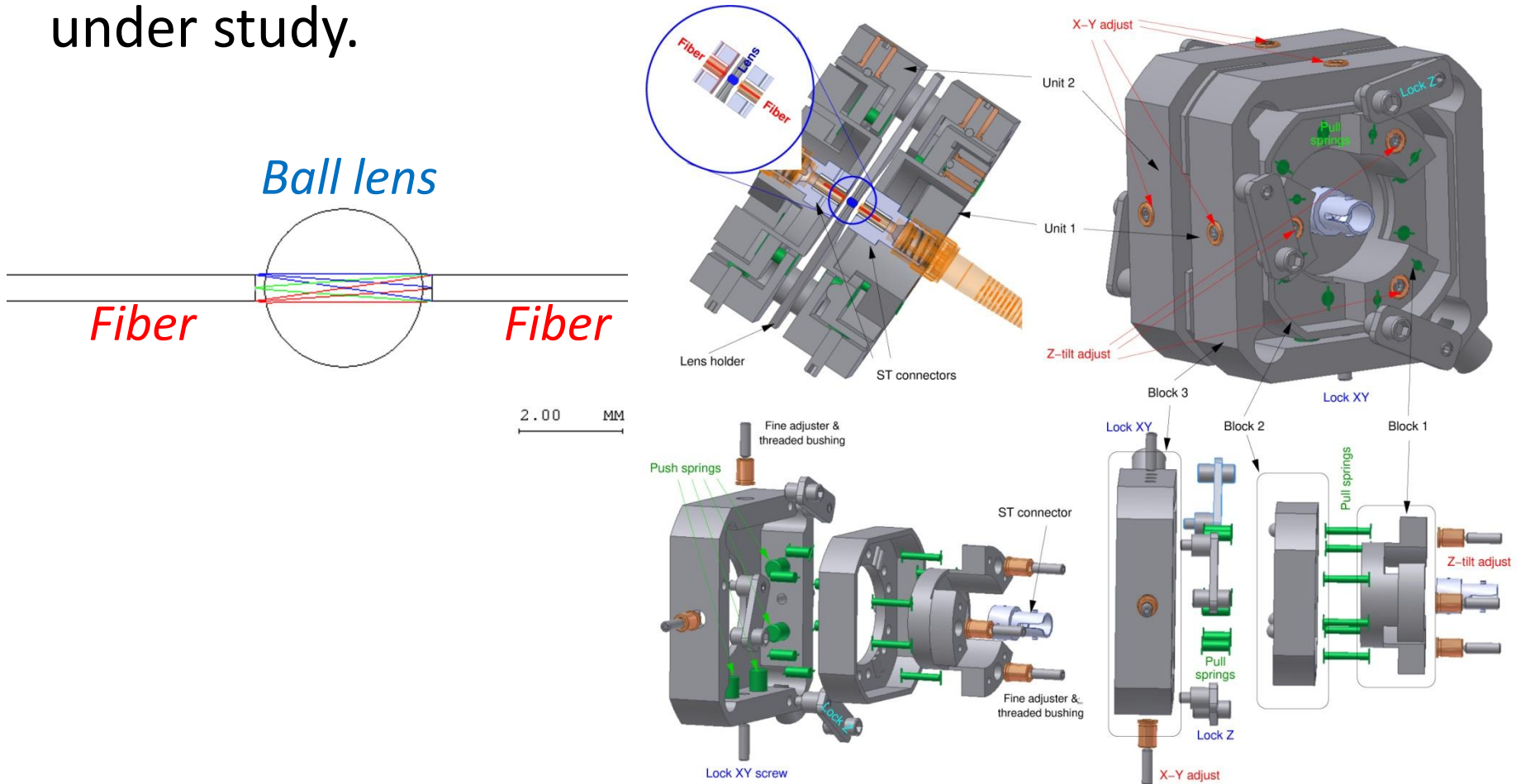
some details on fiber-slits

Slits in spectrometer: fibers + array of microlenses.  
Each row/slit corresponds to an observing mode.  
Only the fibers in a given row are illuminated each time.



# HIRES FL some details on double-scrambler

Optical double-scrambler: classical solution to get uniform illumination of slit in HiSpFi mode. Telecon-like solution under study.



*Block 1 can move in Z-tilt relative to block 2. Block 2 can move in X+Y relative to block 3. Block 3 is fixed to Lens holder*

# HIRES FL

some details on pupil splicer

Pupil splicer: uniformly redistributes the light from one large to many smaller fibers.

## Micro-solution

