HiRes - Status and next steps

Hamburg – September 17th 2007

LAMOST-HiRes

Status of the design

and next steps

HiRes: Outline

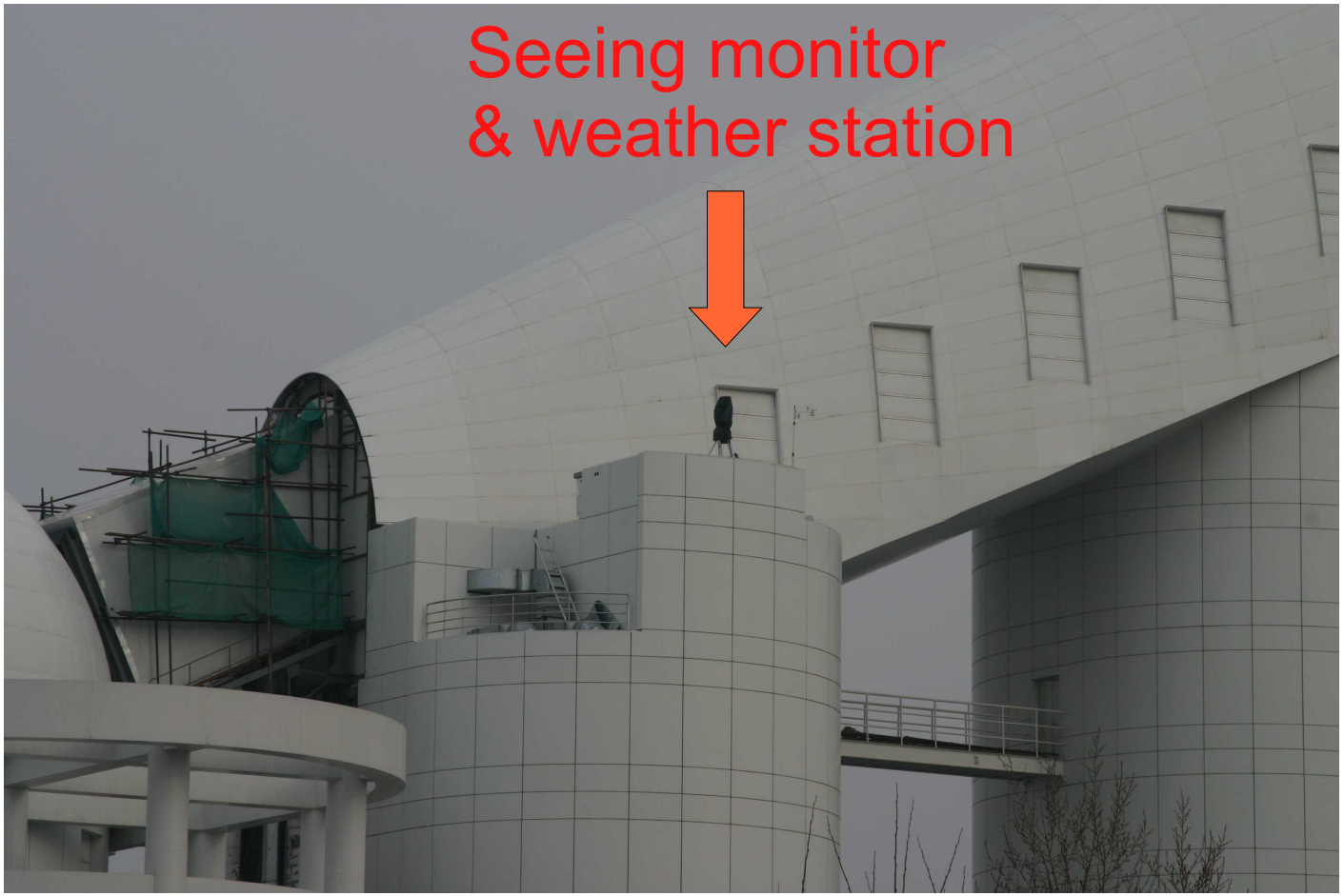
- Site conditions
- Fiber input
- Slit viewing & fiber link test system
- Calibration light system
- The spectrograph
- Instrument control & Interfaces

FPU: Site conditions – Seeing (1)

- Entrance aperture depends on seeing and LAMOST spot quality.
- Seeing measurements now available!
- Spot quality seems to be good according to the first tests in the “small system”!

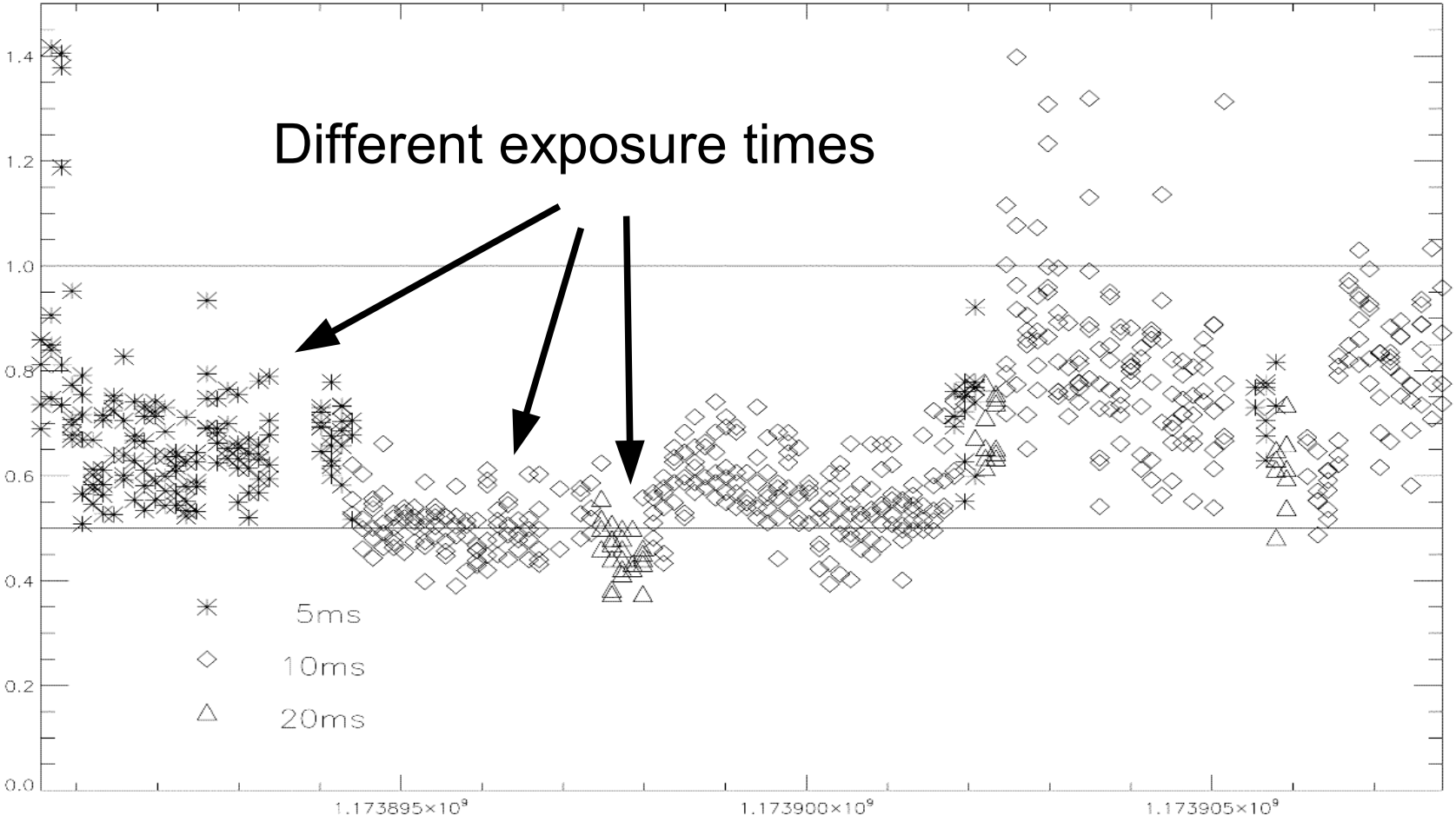
FPU: Site conditions – Seeing (2)

- March 2007: Seeing monitor set up
- 11 nights out of 25 nights ob-served

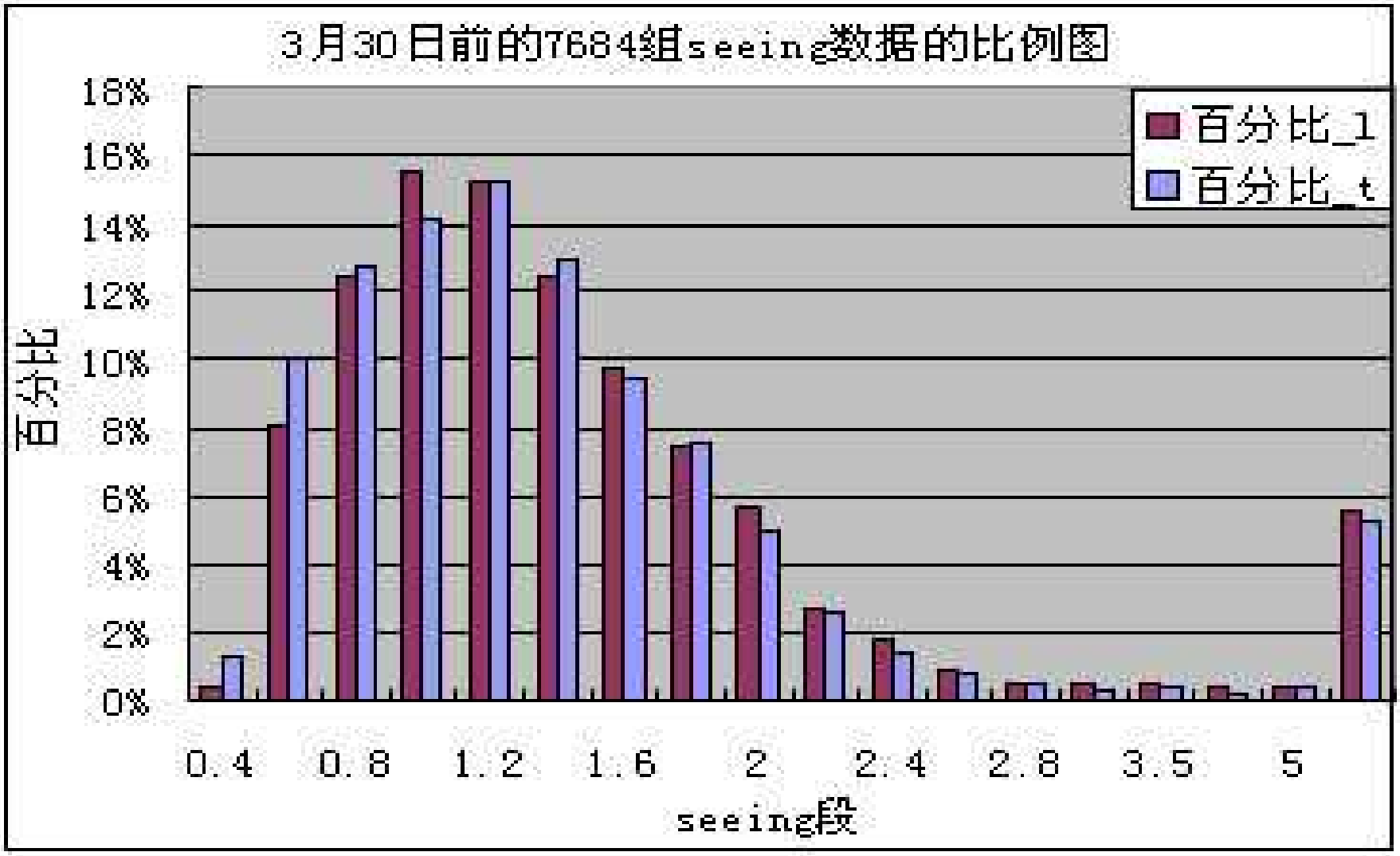


FPU: Site conditions – Seeing (3)

- First n(l)ight.



FPU: Site conditions – Seeing (4)



FPU: Site conditions – Seeing (5)

- Hires seeing limit: 1.2"
- LAMOST spot quality (D80=1.5")*: 1.0"
- Dome seeing (guess): 1.0"
- **Total: 1.85"**
- **Value chosen: 2.0"**
  - Conservative estimate!
  - 200µm entrance diaphragm

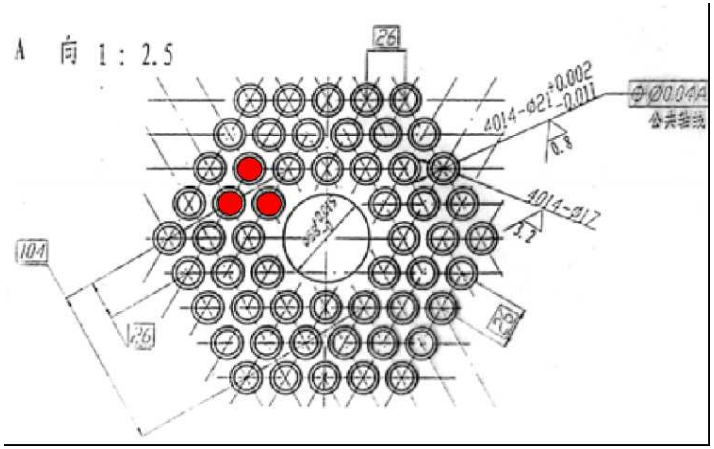
* D80 ≈ 1.53 FWHM ≈ 3.59σ

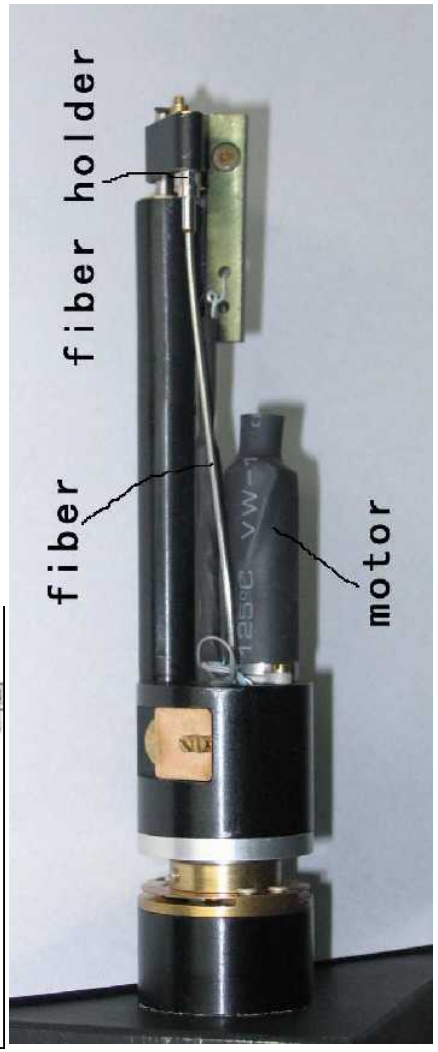
FPU: Purpose

- The Fiber Positioning Unit
  - Puts the fiber to the object.
  - Holds the micro optical system for f-ratio conversion
  - Holds the entrance diaphragm, defining the fiber f-ratio

FPU: Concept now different

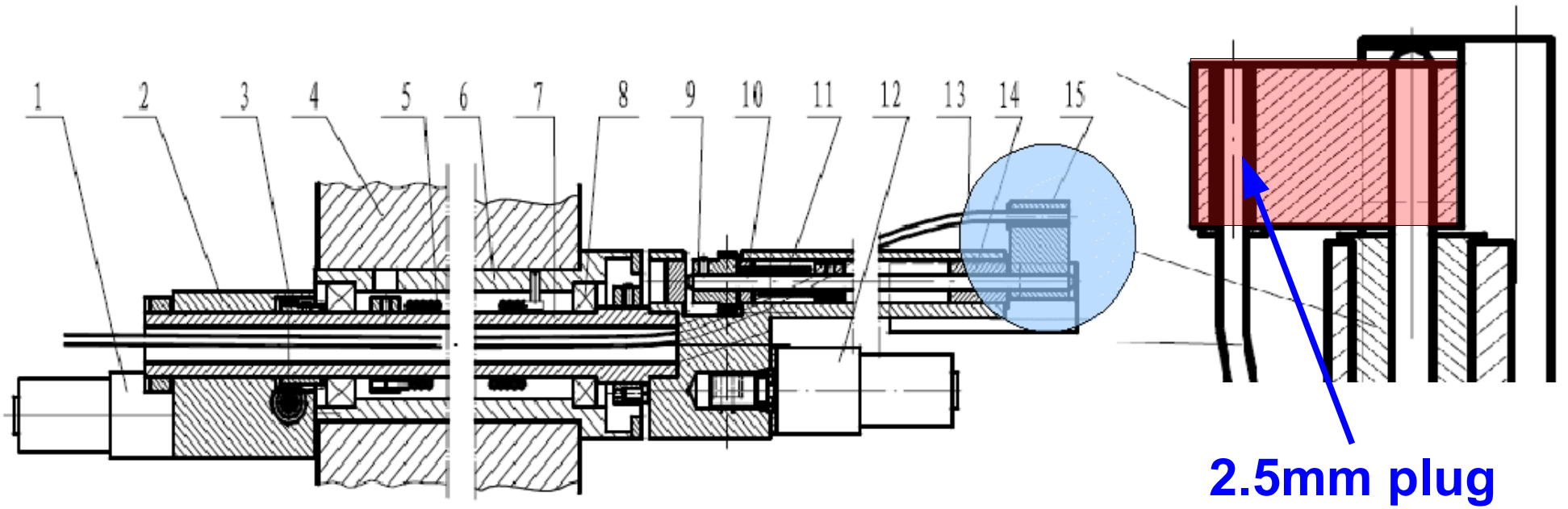
- We use the same fiber positioners as LAMOST-LRS.
- 3 units near the field center (good image quality)
- Influence on “normal” LAMOST operation: 3/4000=0.075%
- No internal guiding possible!





FPU: Mechanics (1)

- “Only” the fiber plug is adopted to HiRes needs

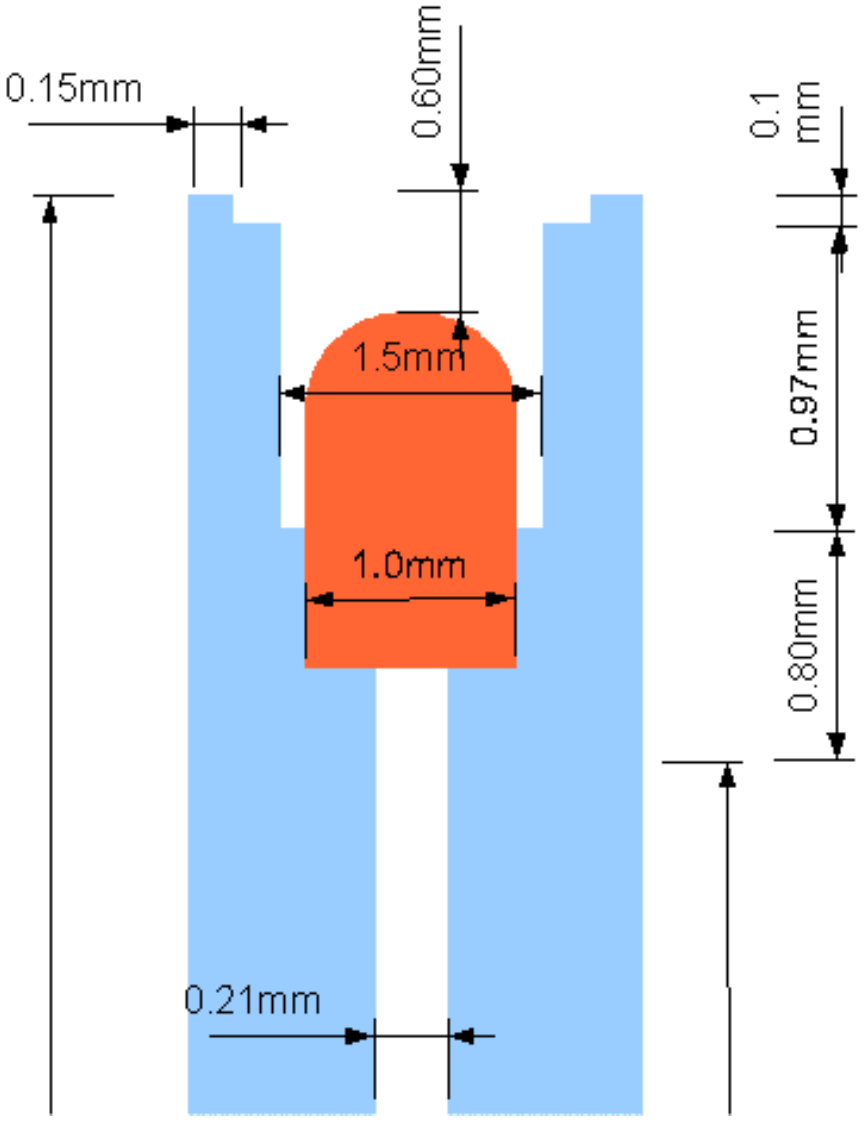


1—Central revolving stepping motor; 2—Central revolving speed-down mechanism; 3—Central revolving gear; 4—Focal plate; 5— Central wrest Spring; 6—Sleeve; 7—Hollow shaft; 8—Central ball bearings; 9—Eccentric revolving gear; 10—Eccentric shaft; 11—Eccentric wrest Spring; 12—Eccentric revolving stepping motor; 13—Optical fiber; 14 Eccentric bears; 15—optical fiber support.

2.5mm plug with micro optical system (3-3.5mm)

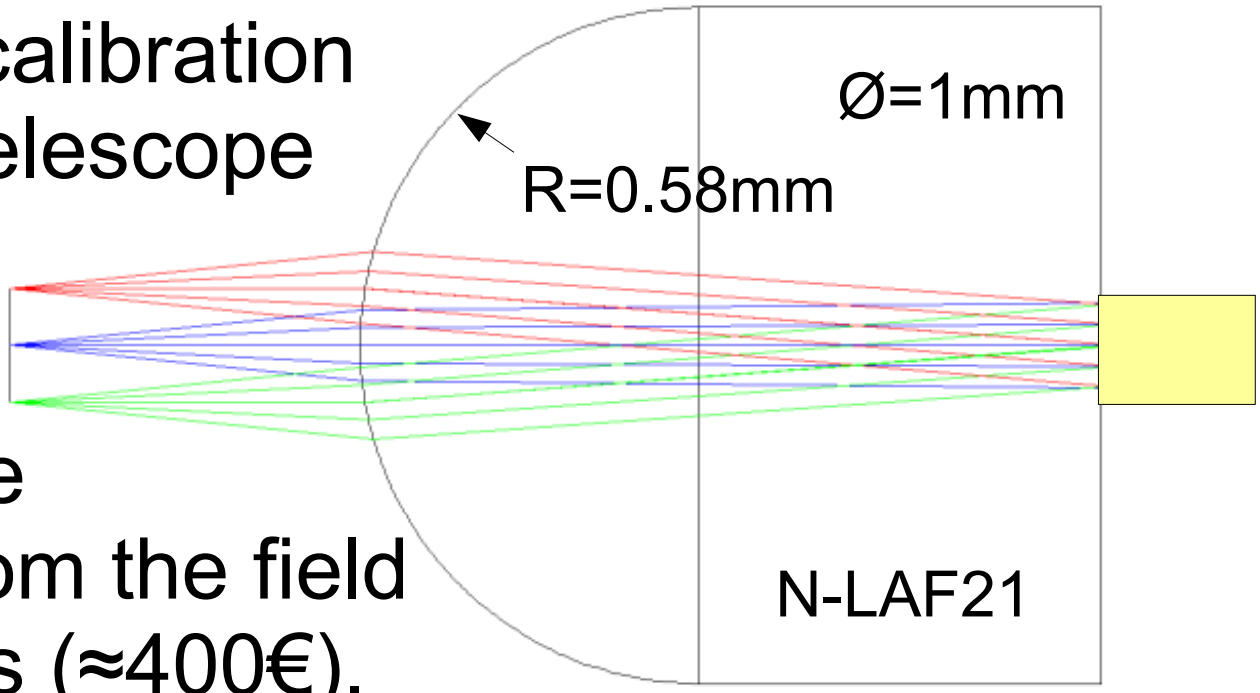
FPU: Mechanics (2)

- Realy small!
- There is a first sample:
  - Verification of sizes?
  - Verification on centering?
- How can the diaphragm be produced?
  - Thickness?
  - Precission?
- **First sample exists!**



FPU: Optics

- Position in focal plane is converted to f-ratio.
- Good seeing → small spot on the spectrograph slit
- Illumination for calibration "easy" (simple telescope simulator does the job).
- We have a lense manufacturer from the field of medical optics (≈400€).

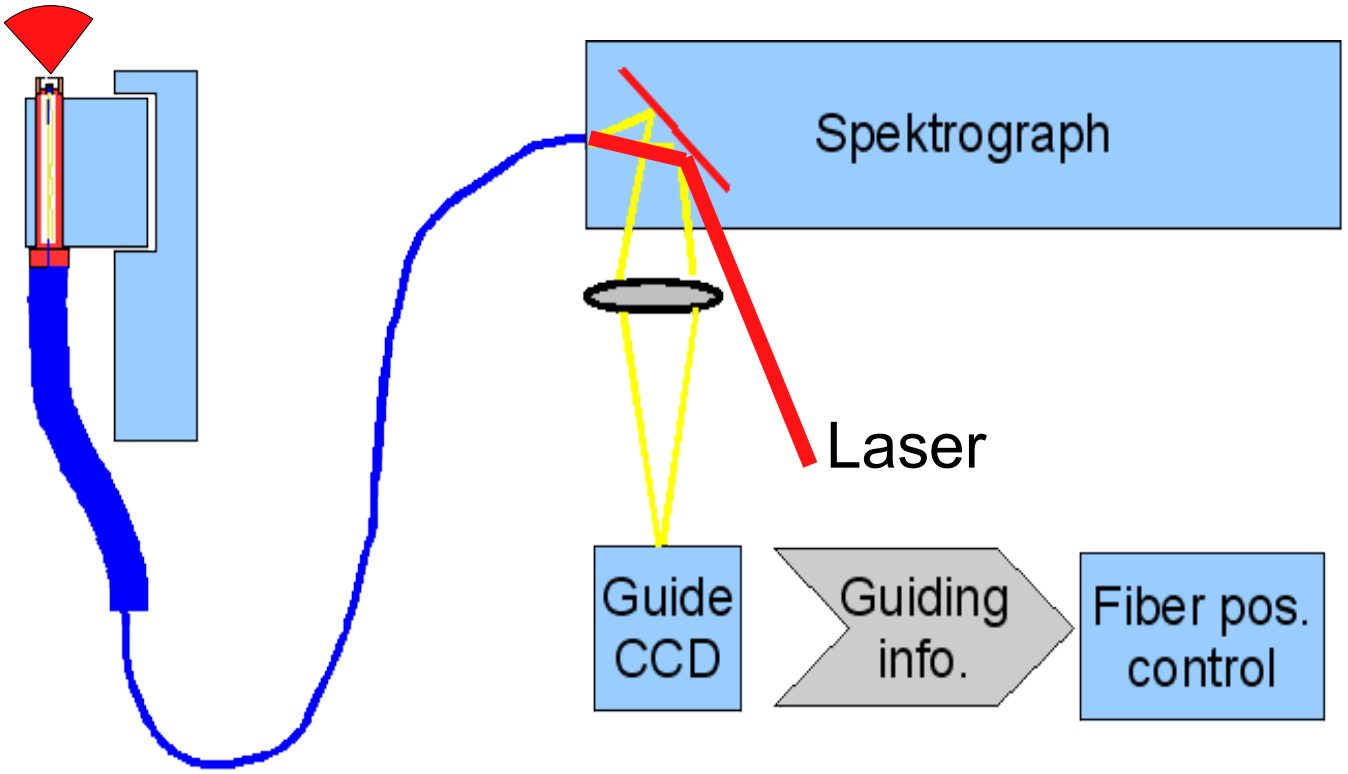


Slitview: Purpose

- Fine acquisition after star is “on” fiber.
  - To maximize throughput
- Spectrograph input alignment.
  - We have 3 fibers available
    - 1 unsliced
    - 1 with slicer
    - 1 spare
- Exposure time estimation.
- System can/will be used for fiber test and FRD measurement.

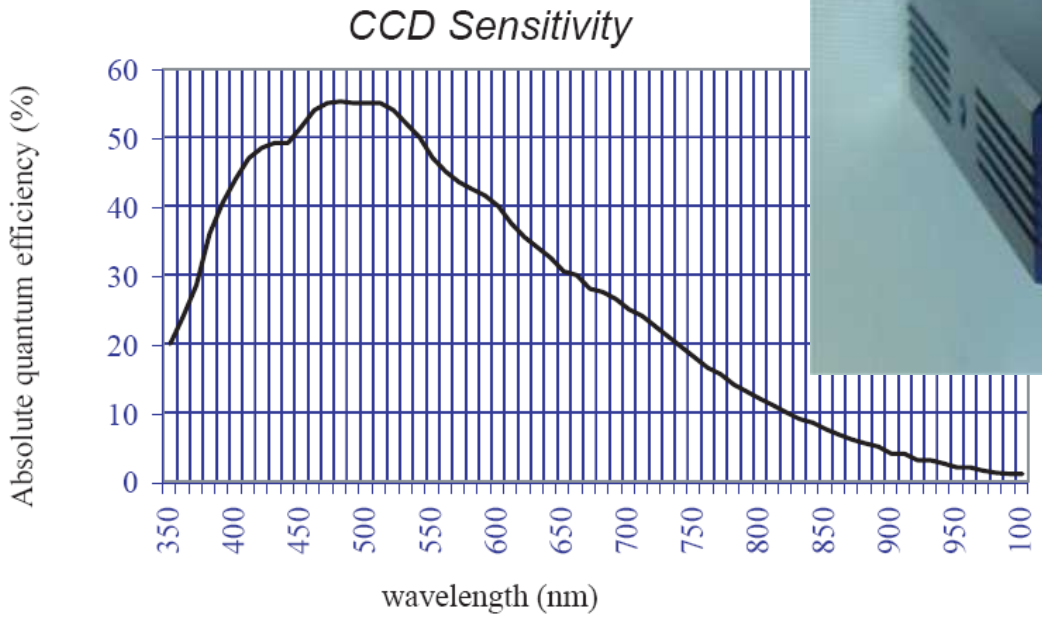
Slitview: Fine acqisition (1)

- Fine acquisition prior to exposure (iterative).
- Image spectrograph slit to CCD via fold mirror.
- Estimate exposure time from countrate.
- Use this setup to couple laser for fiber position control.



Slitview: Fine acquisition (2)

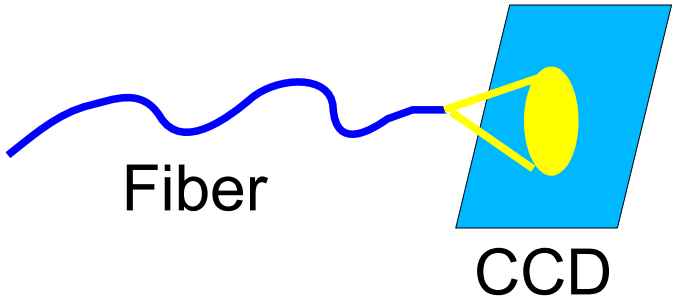
- Commercial CCD camera.
  - Allows integration of light.
  - Can be used to measure FRD of science fibers.
  - E.g. Apogee - Alta



15x15x8cm

Slitview: Fiber test

- Step by step design:
  Seeing → Fiber input
  → Fiber output
  → Spectrograph input
- Output light distribution to be measured.
- Simple setup to determine FRD.

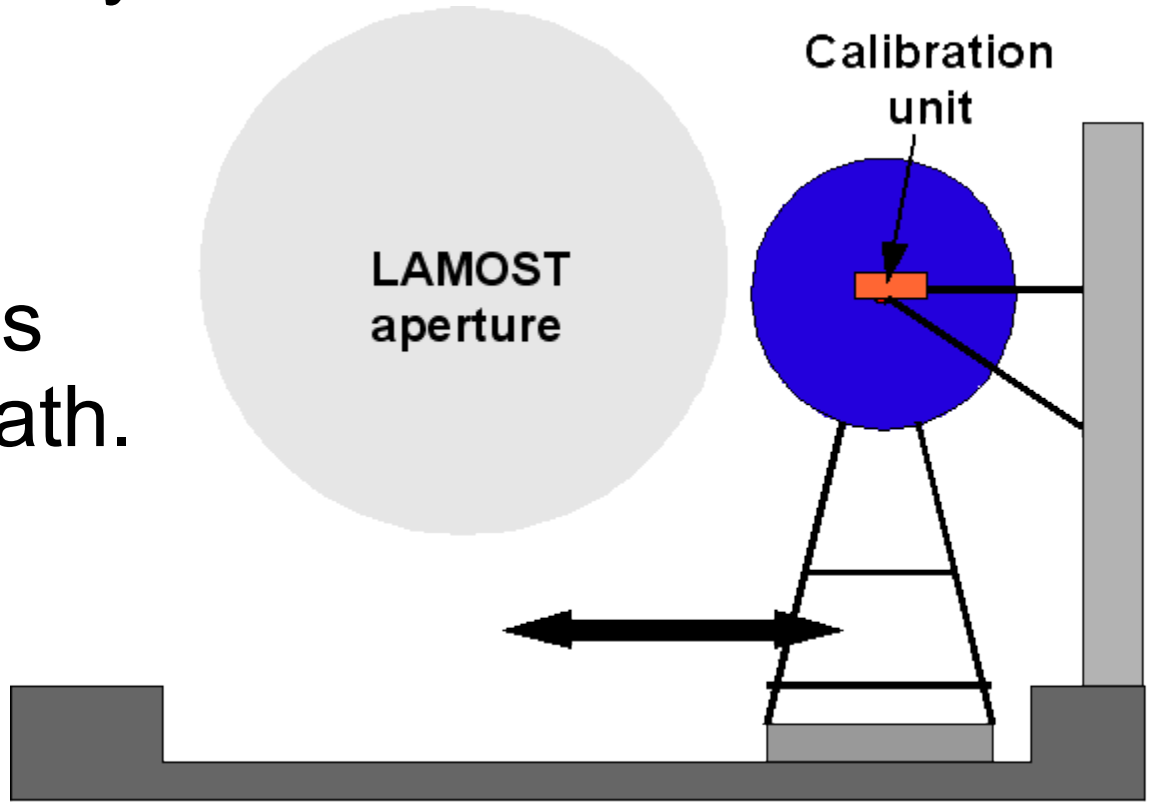


CAL-Unit: Purpose

- Provide calibration light through fiber link.
  - Flatfield light.
  - ThAr wavelength calibration light.

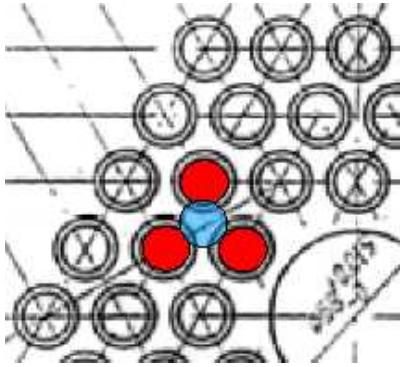
CAL-Unit: General

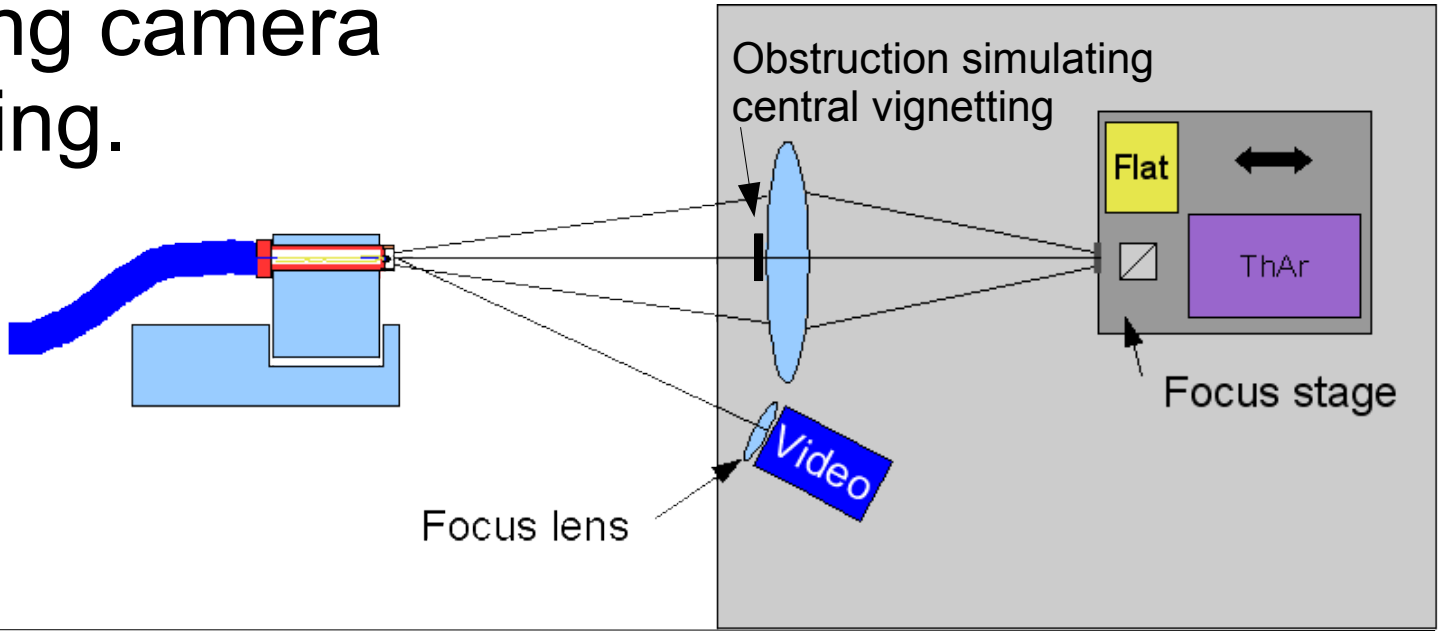
- Put unit on the “wall” in “co-focus” position of the focal plane.
- Space and weight very relaxed.
- Distance to fibers ≥ 10cm
- No active cooling as it is beside beam path.



CAL-Unit: Mechanics

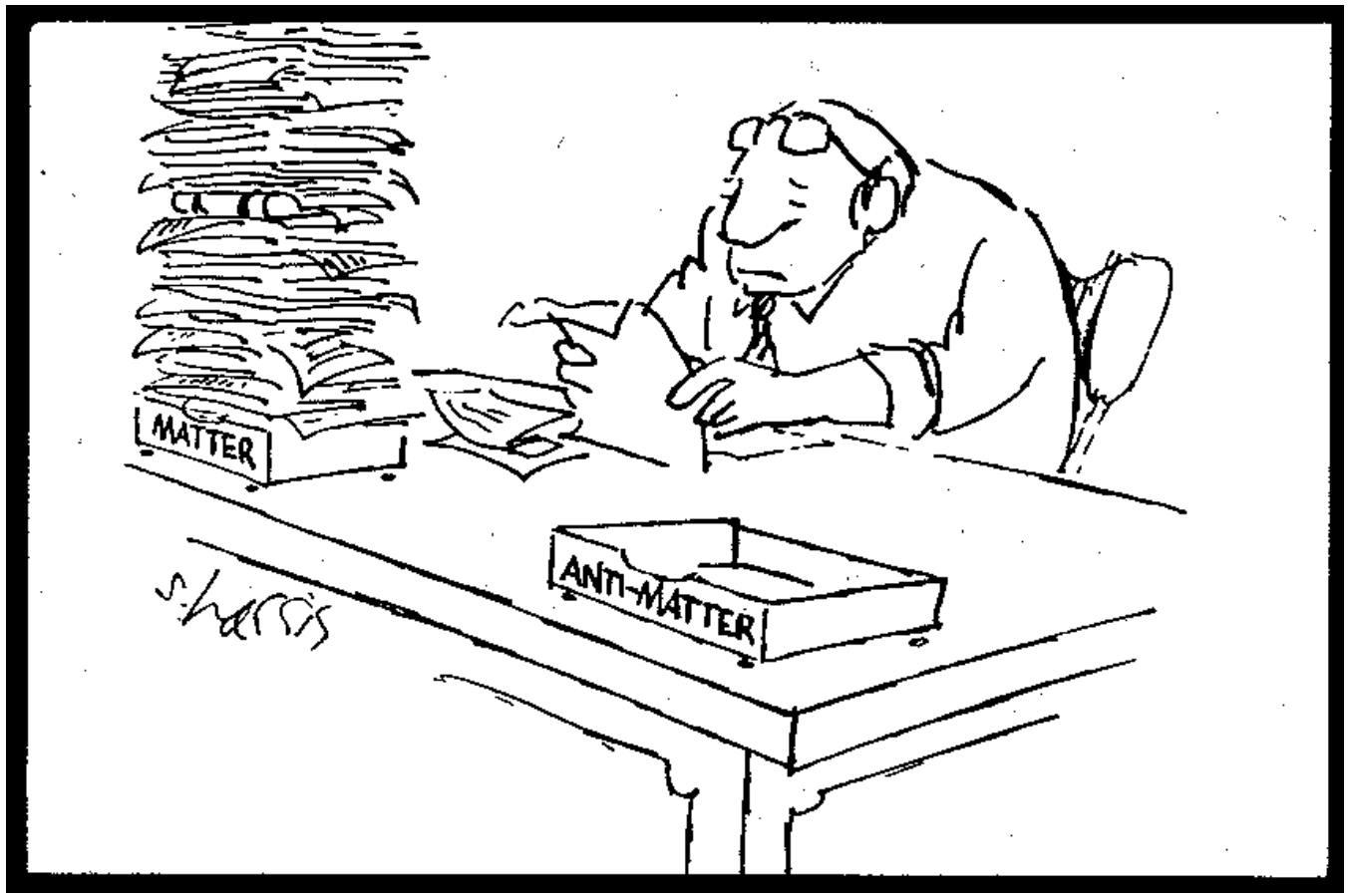
- Flatfield and ThAr source on one focus stage.
- Diffuser disk as “object”.
- Simple off the shelf duplet for imaging.
- Obstruction simulates focal plane vignetting.
- Fiber viewing camera for positioning.





Spectrograph: Purpose

- I wont tell you ...

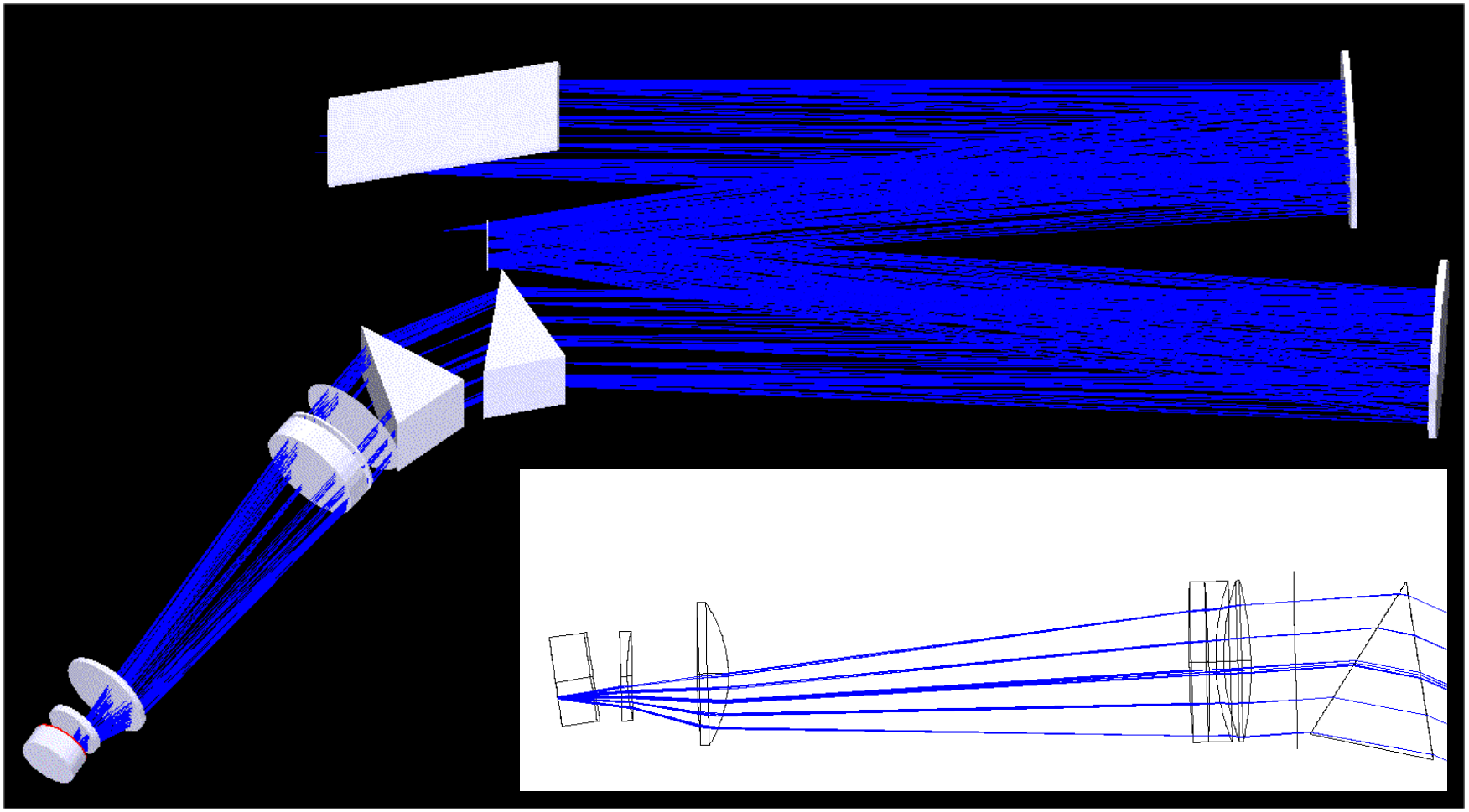


Spectrograph: Some changes

- R2 -> R2.88 Echelle grating.
  - Larger entrance slit (less slit losses).
  - Larger field of view and camera diameter (to keep spectral overlap in the red).
- Chinese glasses are now used where possible.

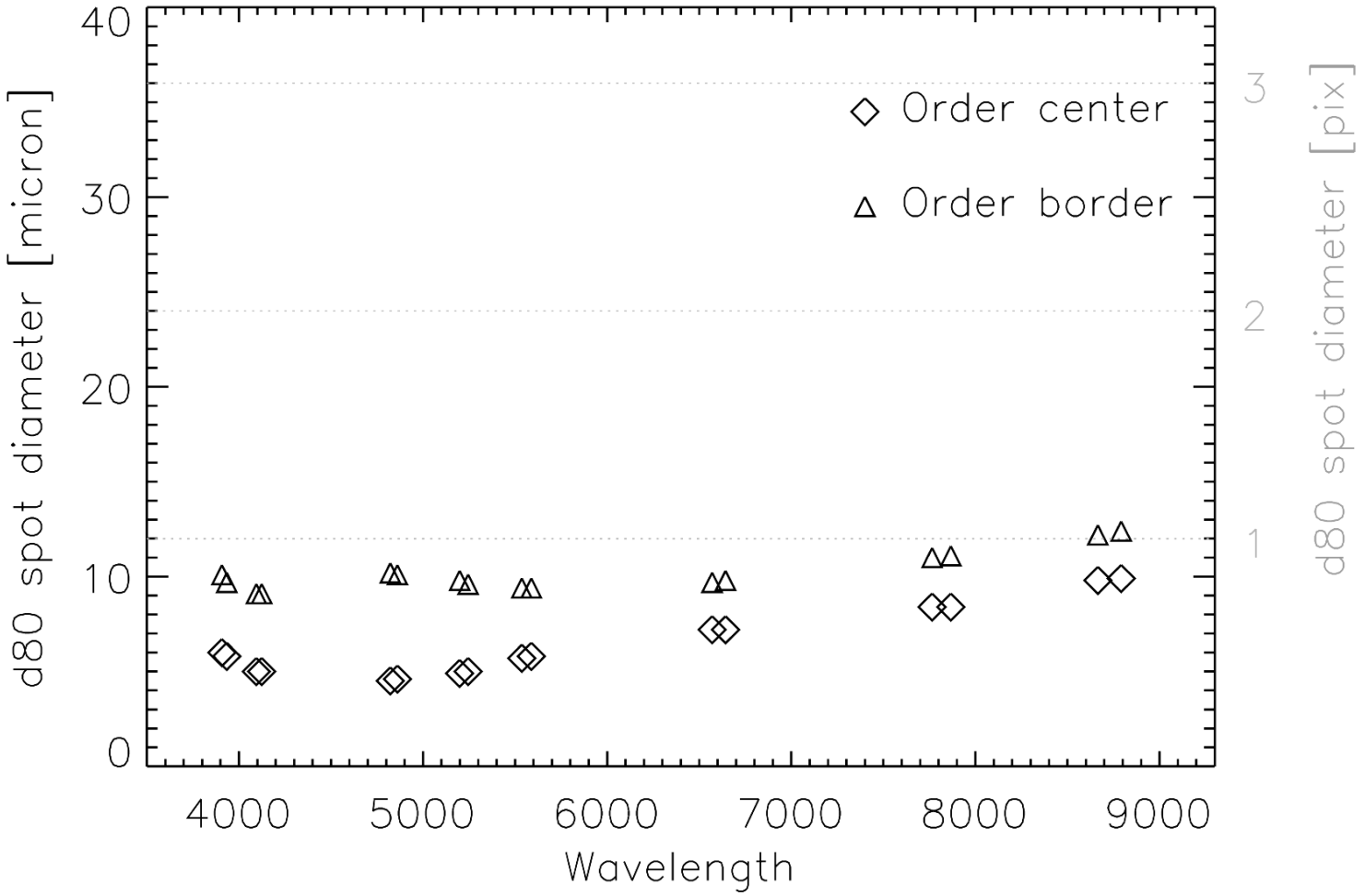
Spectrograph: Optics (1)

- Spectrograph design itself ready



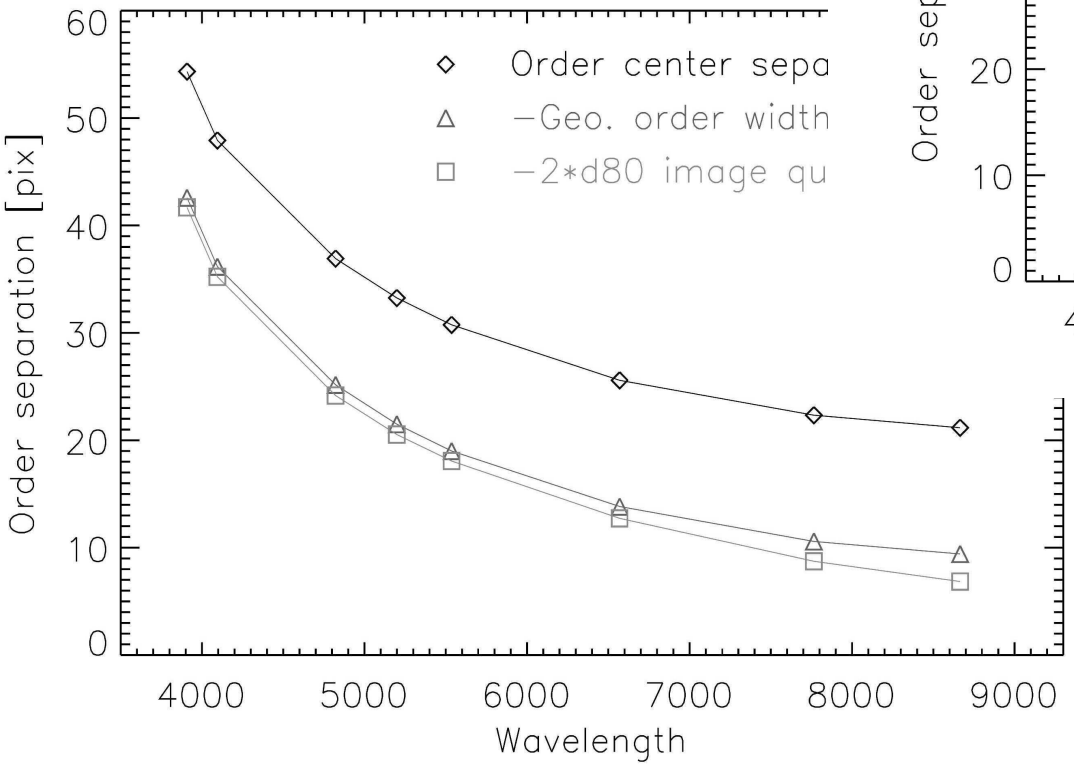
Spectrograph: Optics (2)

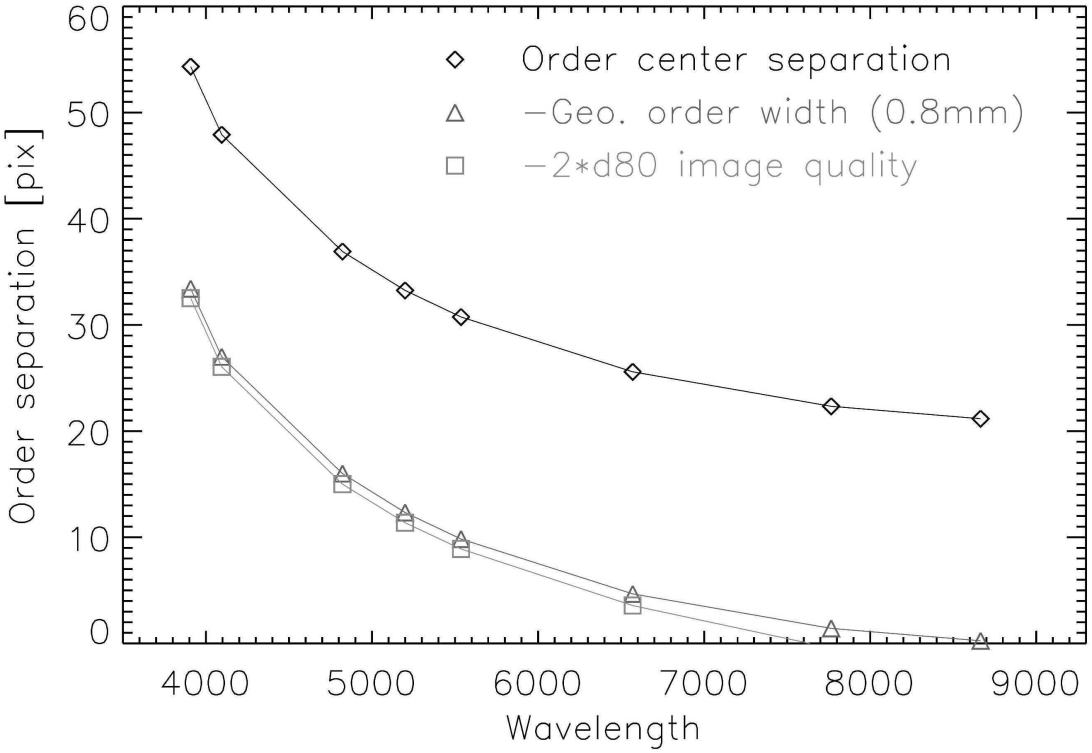
- Optical quality (better than 1pix everywhere)



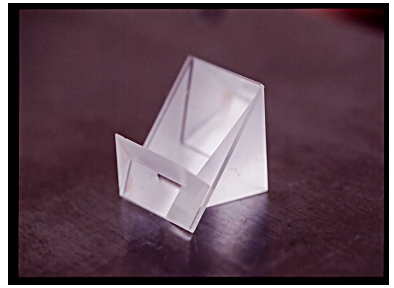
Spectrograph: Image slicer (1)

- 2 slices work up to 6800Å.
- Hα covered.



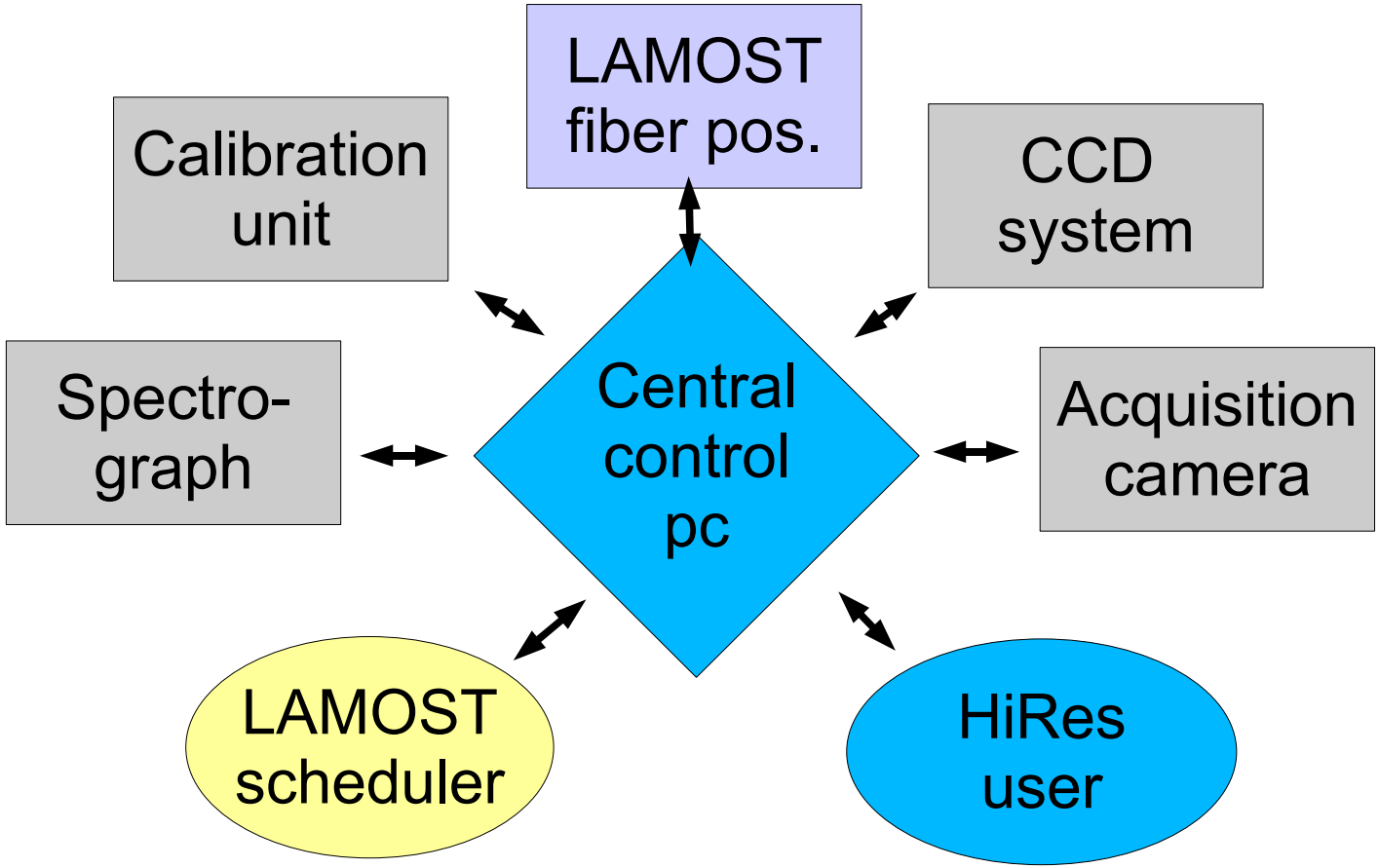


We started to work on a slicer design.



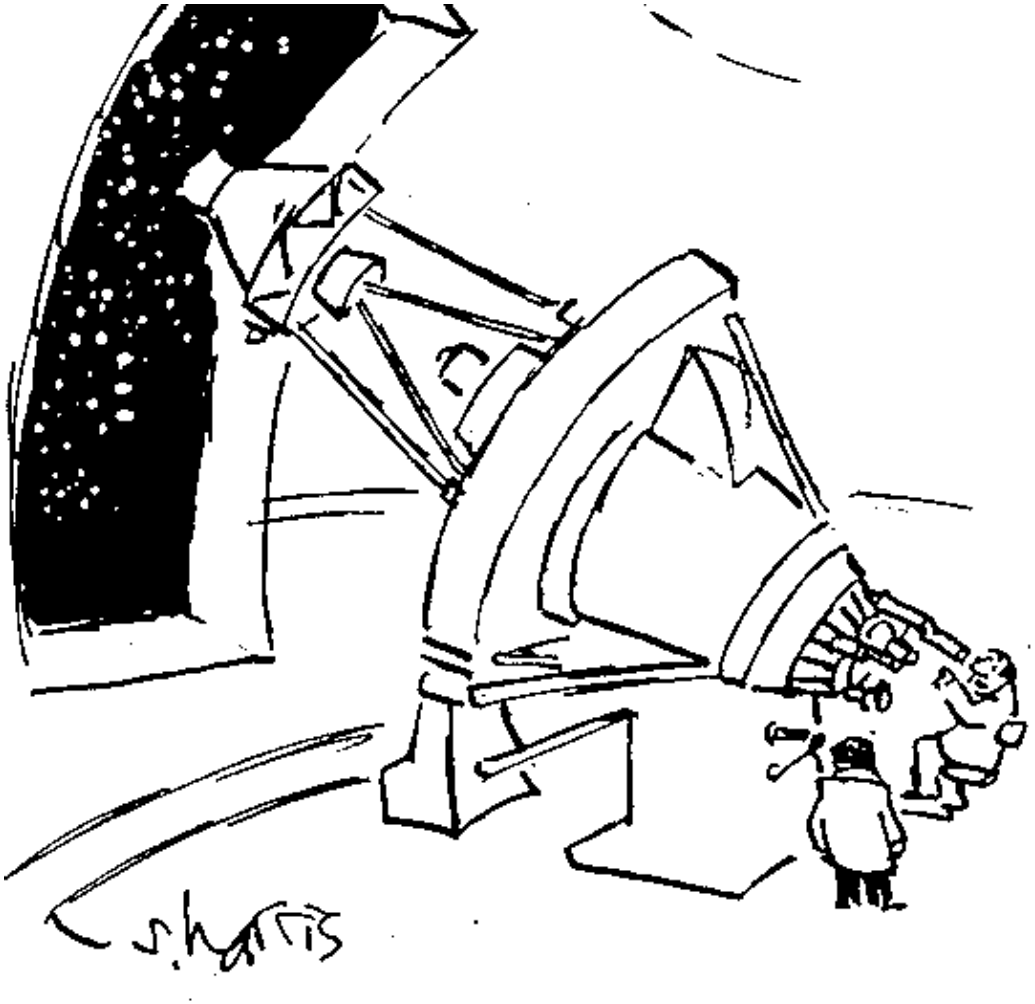
System control: Interfaces

- There are many interfaces to satisfy.



HiRes: The team says “Thank you!”

- Thats why we need good spectrographs!
- This talk will be available online soon. www.grupp-astro.de



“Actually they all look alike to me.”