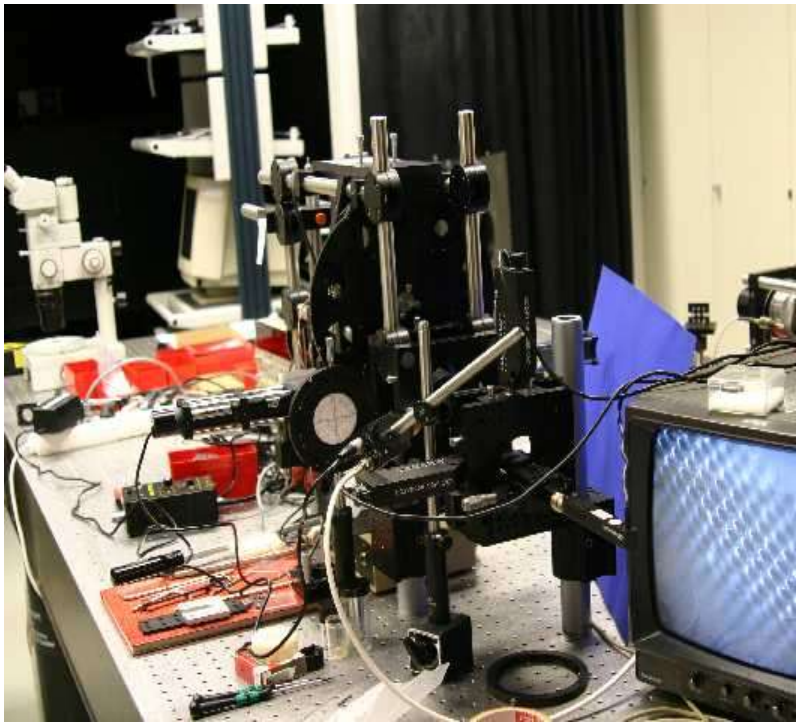
Measuring the properties of fibers:

Alchemy or Science ?



Outline:

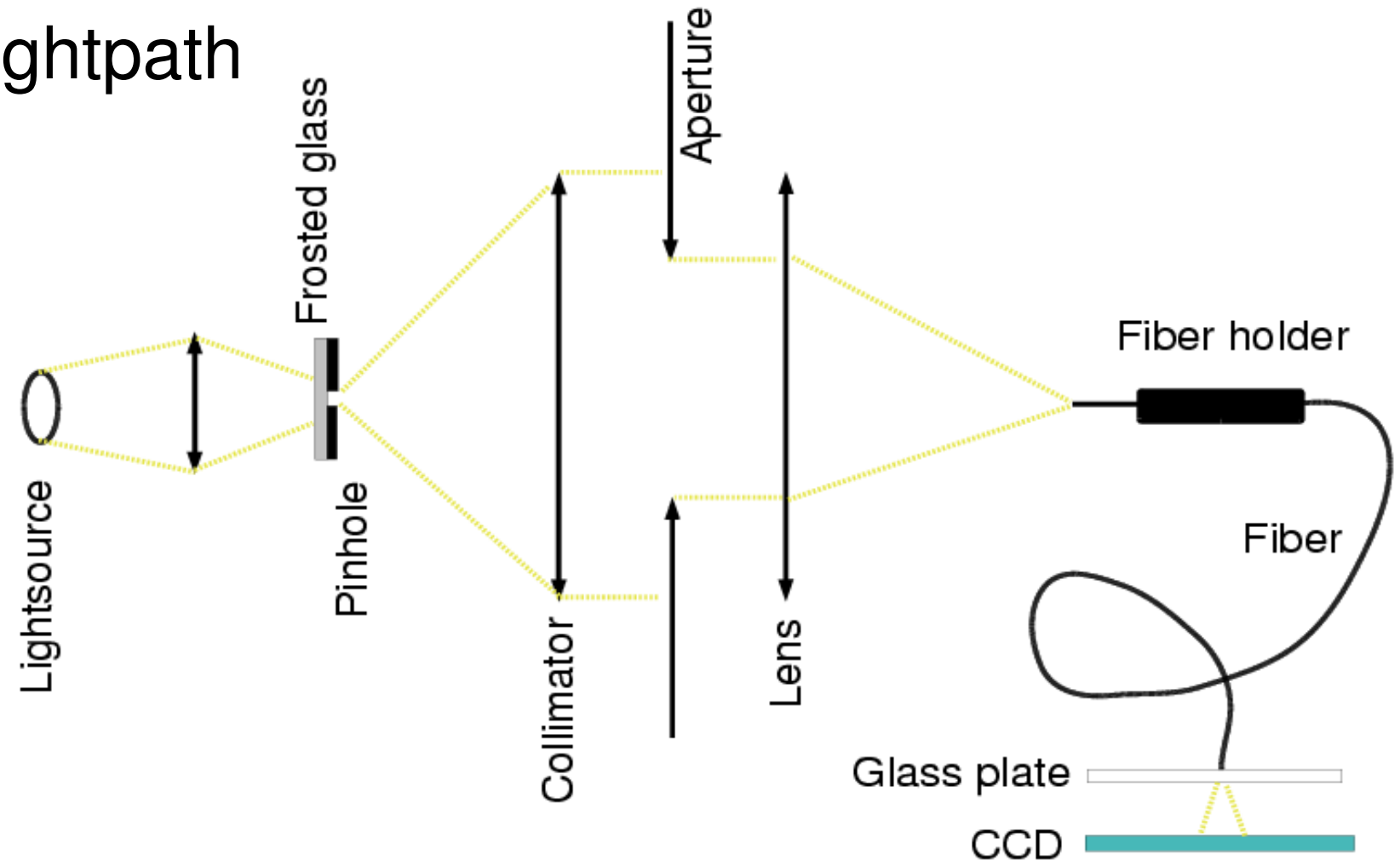
- The Potsdam fiber testbench
  - Hardware
  - Software
- Alignment system
- Data reduktion and analysis
- First results
  - Reproducibility
  - First IFU tests

Intention:

- Measure FRD of single fibers **and** IFUs
- Reach high degree of automation (VIRUS)
- Robust, „astronomer proof“ design

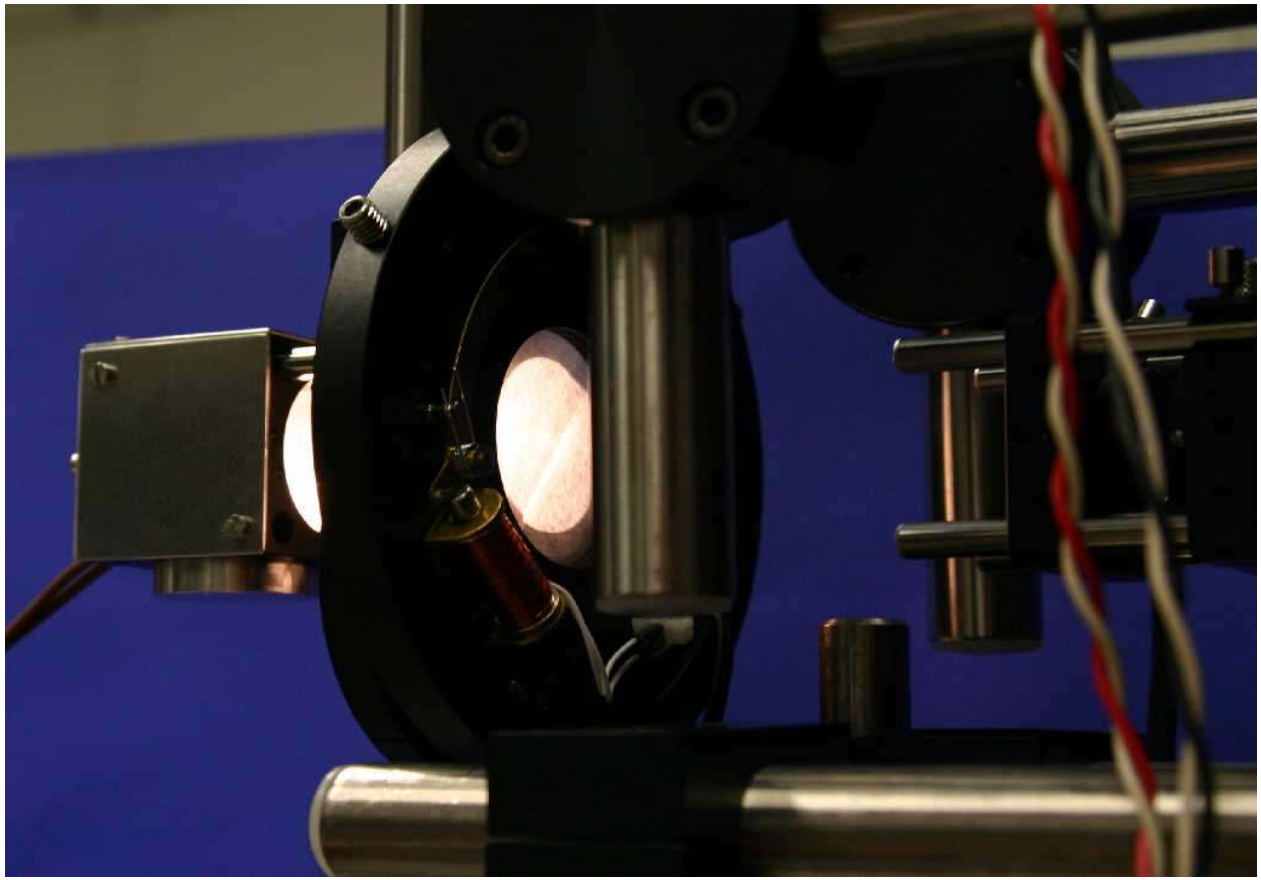
The Potsdam fiber testbench

- Lightpath



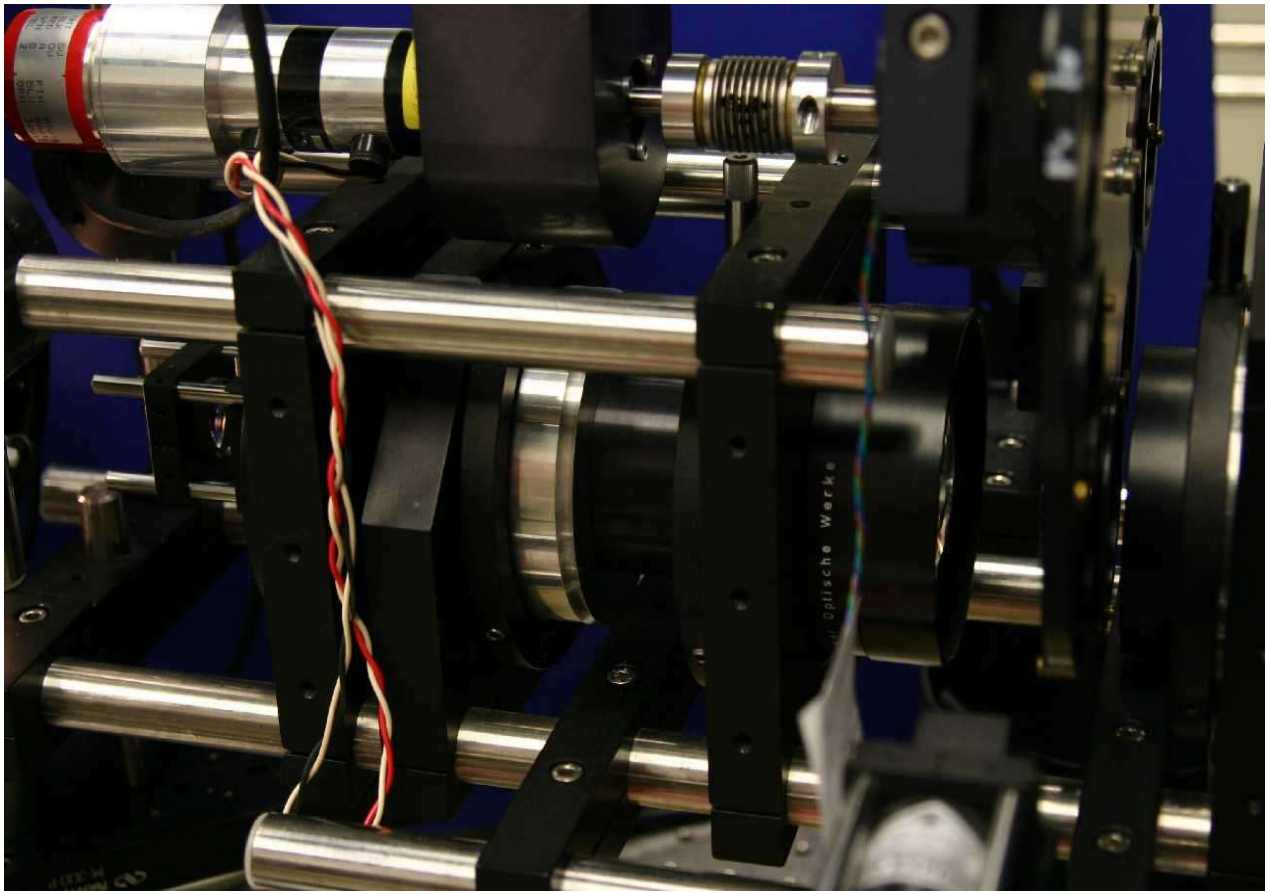
Hardware:

- Light source, filter wheel and shutter



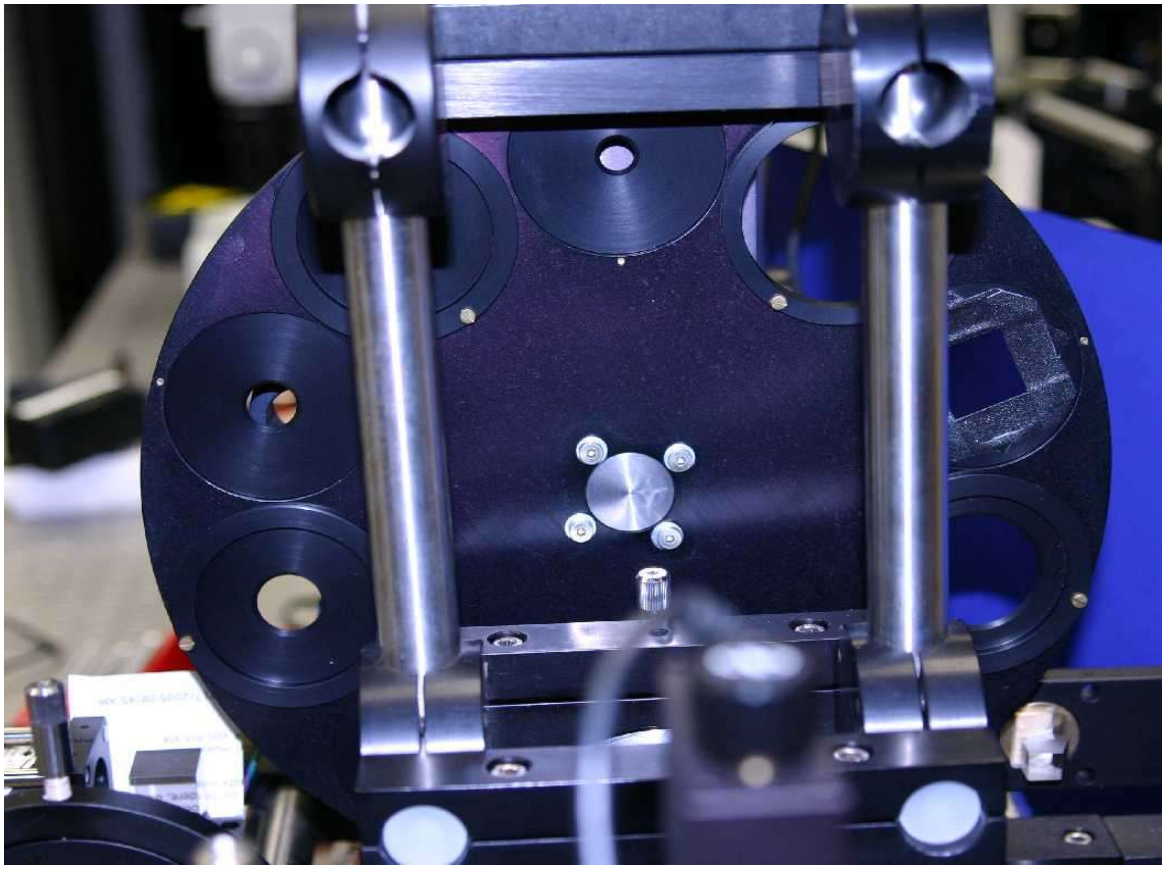
Hardware:

- Collimator section



Hardware:

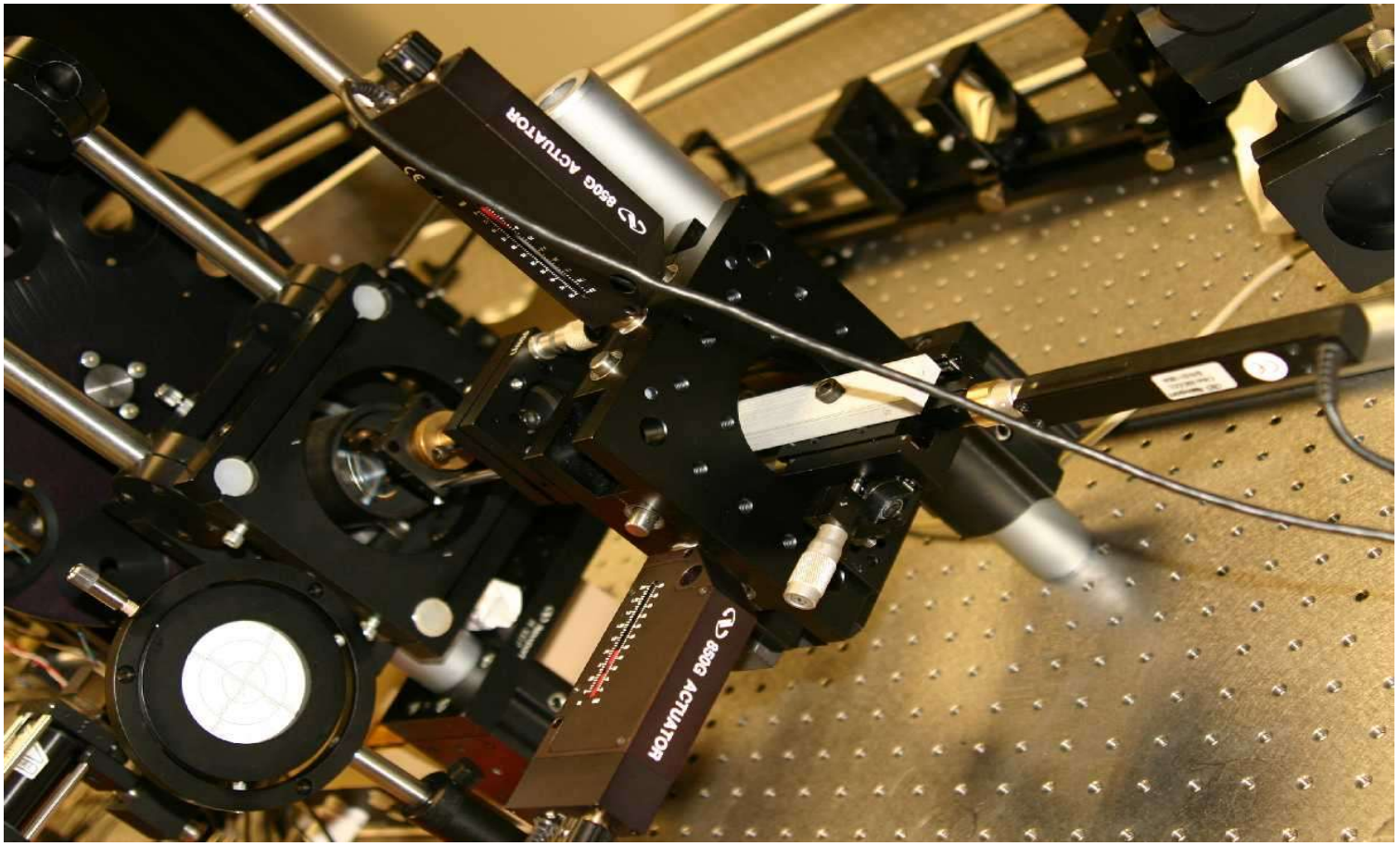
- Aperture wheel



10 Apertures
from f=2 ...12

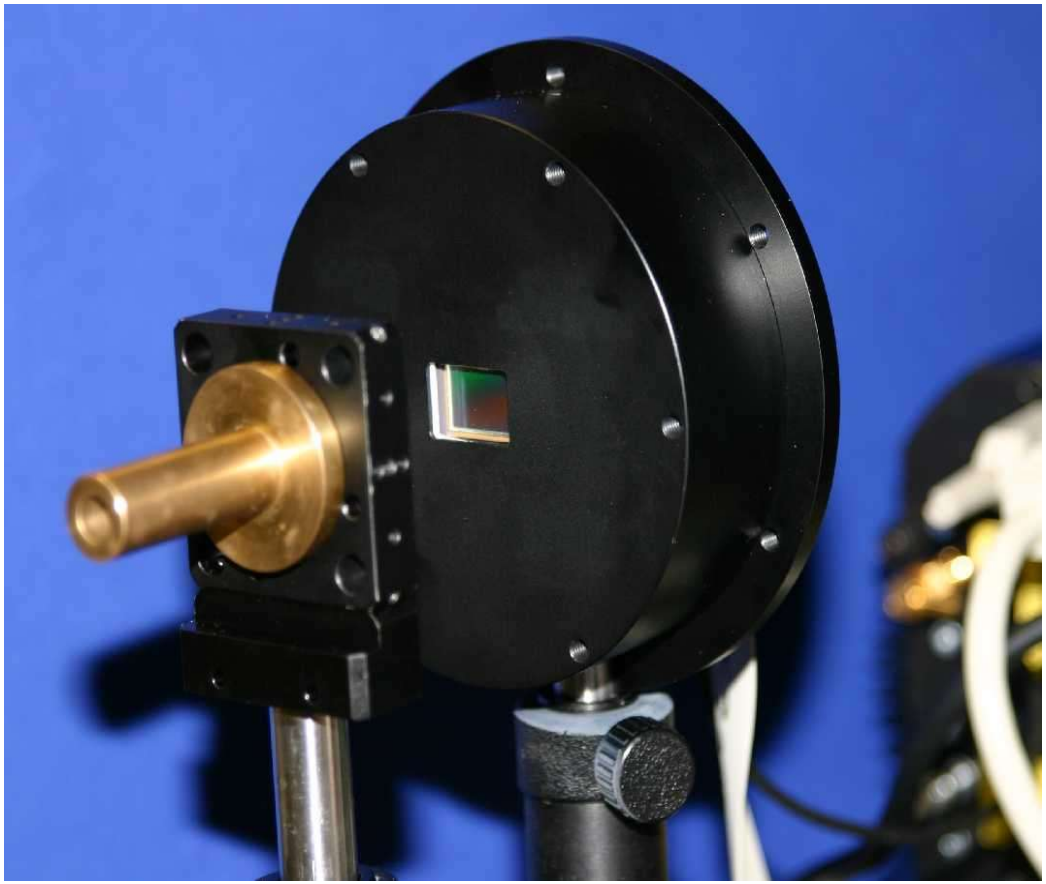
Hardware:

- Fiber entrance positioning system



Hardware:

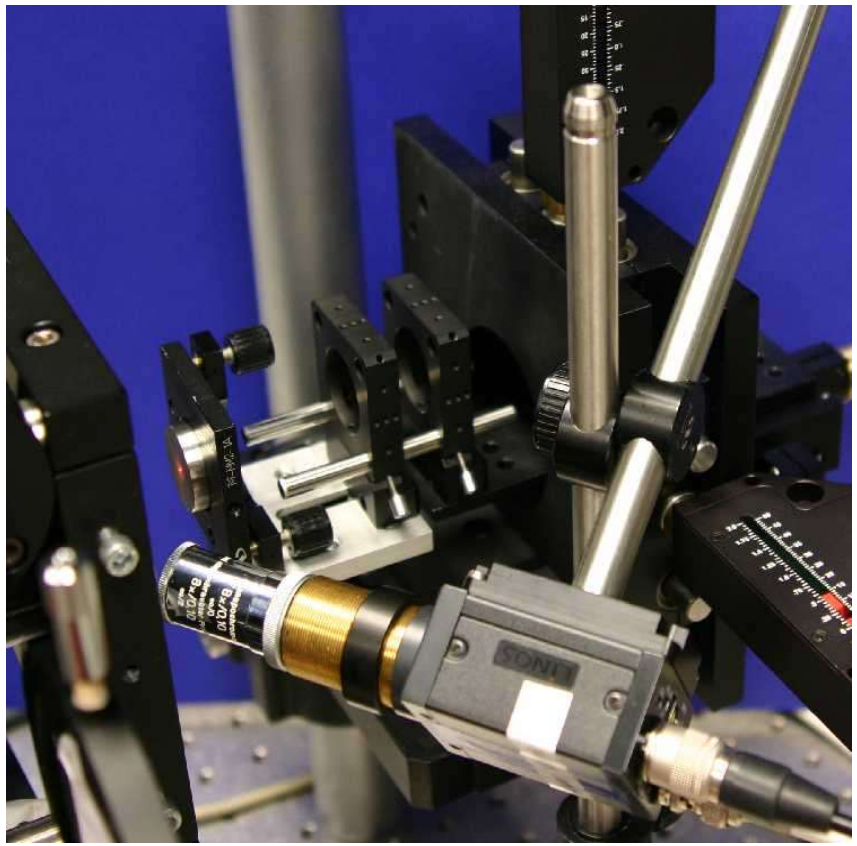
- CCD camera

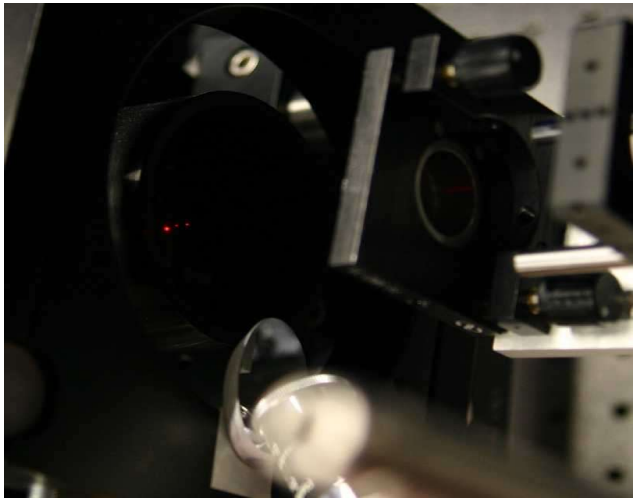


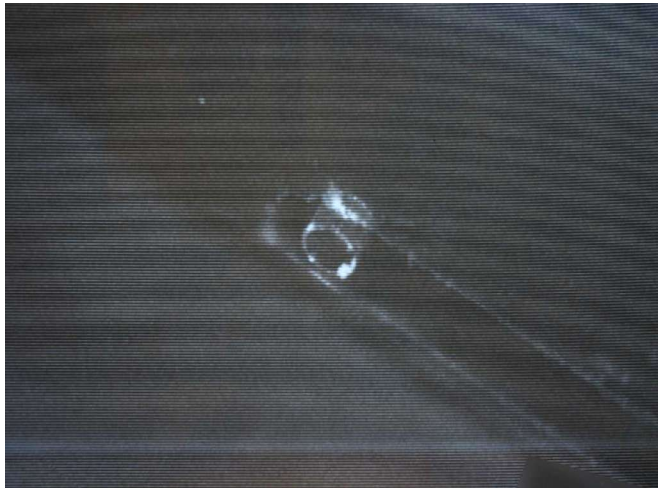
Kodak
KAF3200E
2184x1472 pix
6.8µ

Hardware:

- IFU-head viewing system





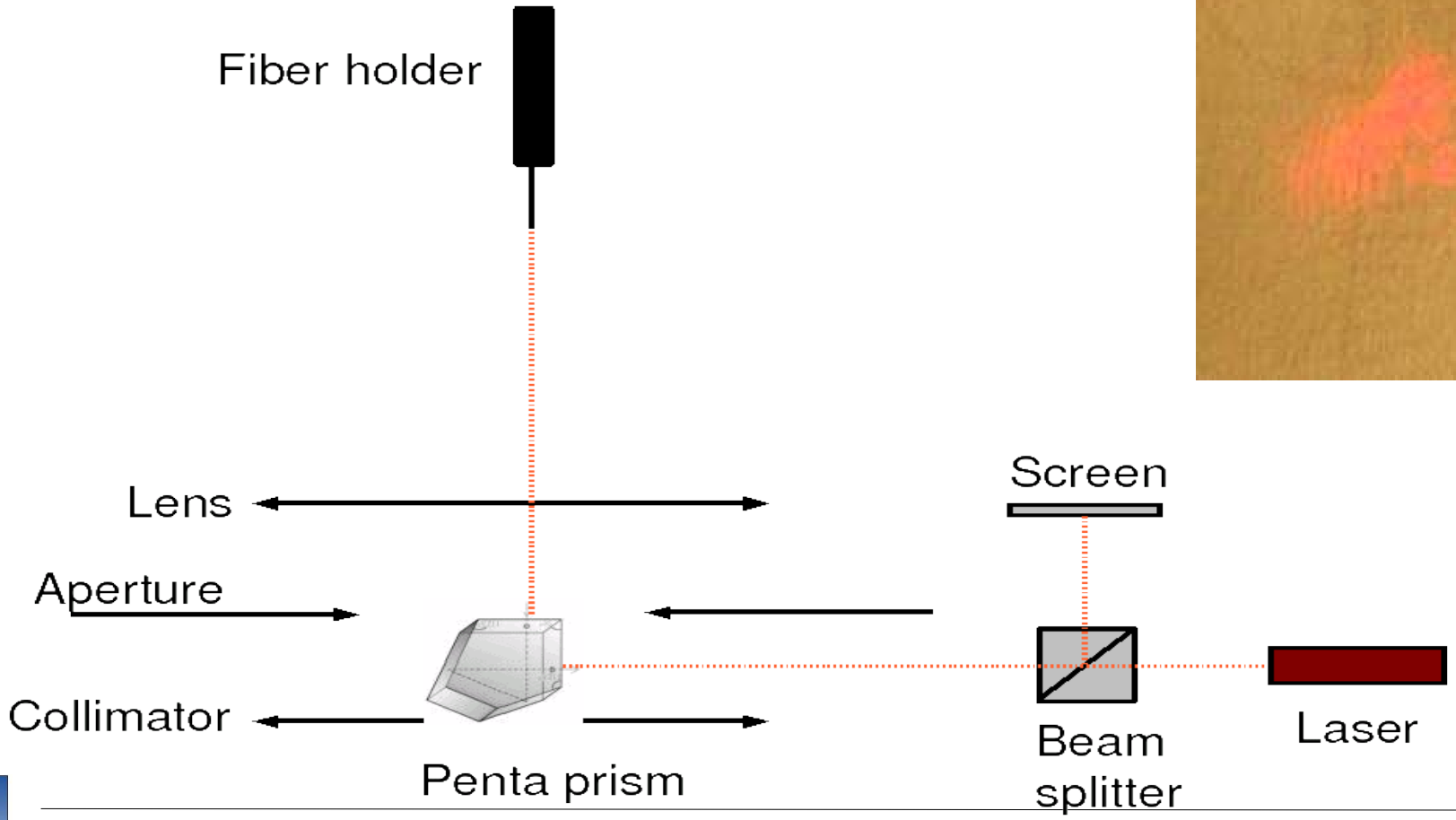


Software:

- The Potsdam fiber testbed controller: PFTC
  - IDL script controls:
    - Camera (shutter)
    - Aperture wheel
    - IFU-head position
  - Three modes: *single fiber*, *IFU auto* and *IFU man*
    - Automatic positioning for regular IFUs (2 positions need to be given .. system does the rest)
    - Manual positioning for less regular IFUs

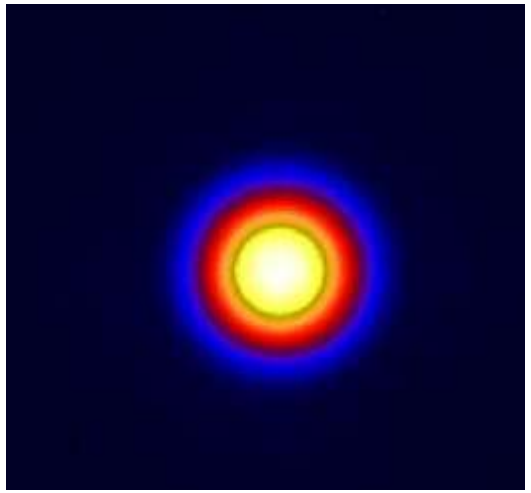
Alignment:

- Fiber alignment laser system



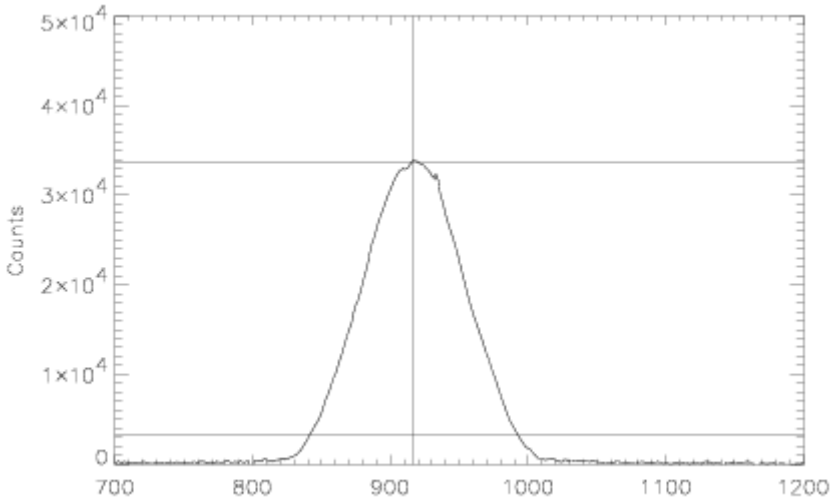
Data reduction and analysis:

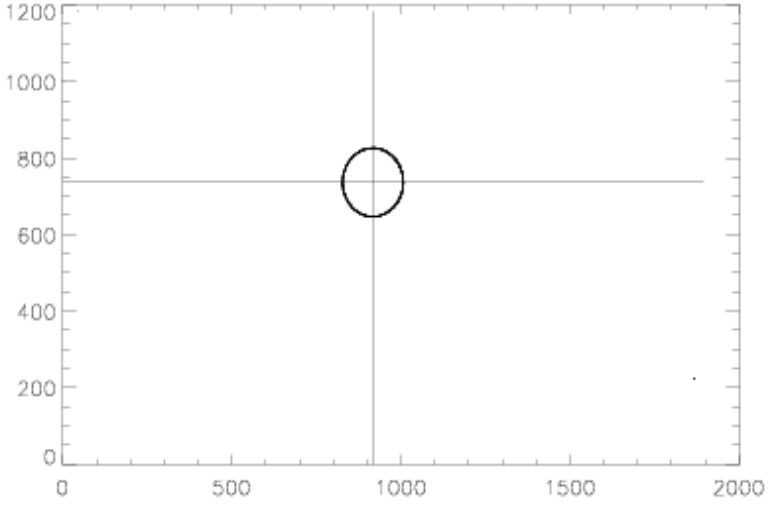
- From spot to f-number
  - Bias substraction (mean of 5 bias exposures)
  - Determin spot center
  - Determin central intensity I_0
  - Get ring of 9-11% I_0
  - Account for glass plate (0.33mm)
  - Calculate f-number



Data reduction and analysis:

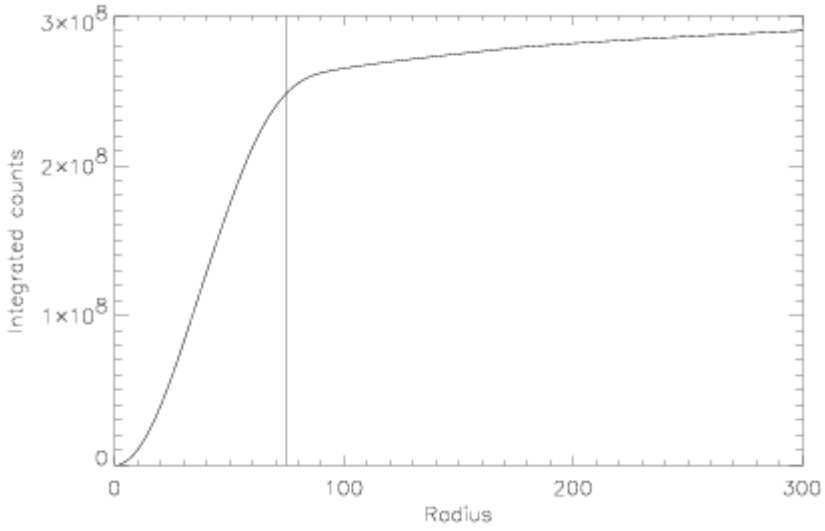
- Why radius definition through intensity?
  - CCD produces „hot“ pixels for yet unknown reason
  - Circle well defined ($\sigma_{Radius} < 2\%$)
  - Excentrisity => Fiber output misalignment





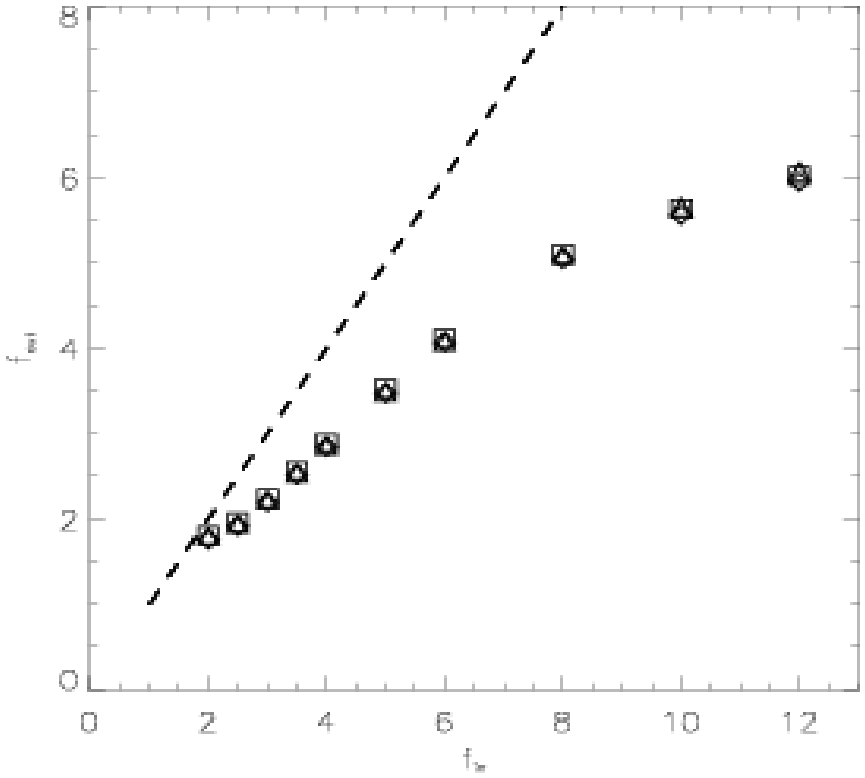
Data reduction and analysis:

- Incircled intensity:
  - 94-97% inside 1.5∗r(0.1*I_0)



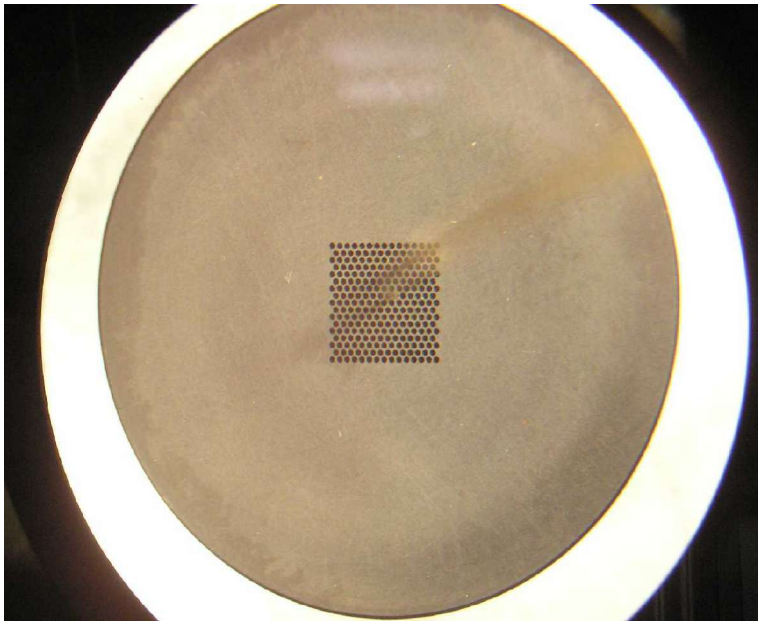
First results: Reproducibility

- One single fiber ... measured three times
  - Fiber completely removed, turned and readjusted



First results: Two different IFUs

Potsdam

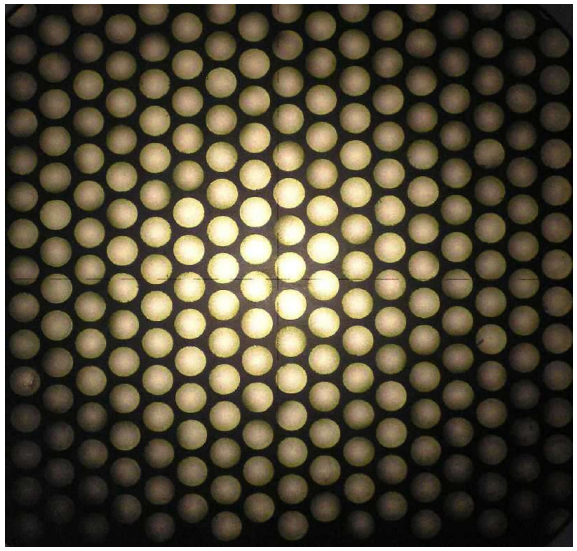


Austin

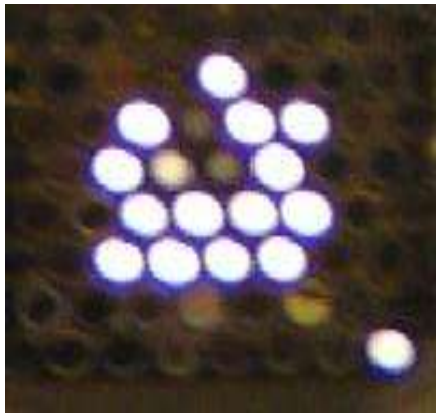
First results: Two different IFUs

- How regular are they?

σr = 3.6 μ



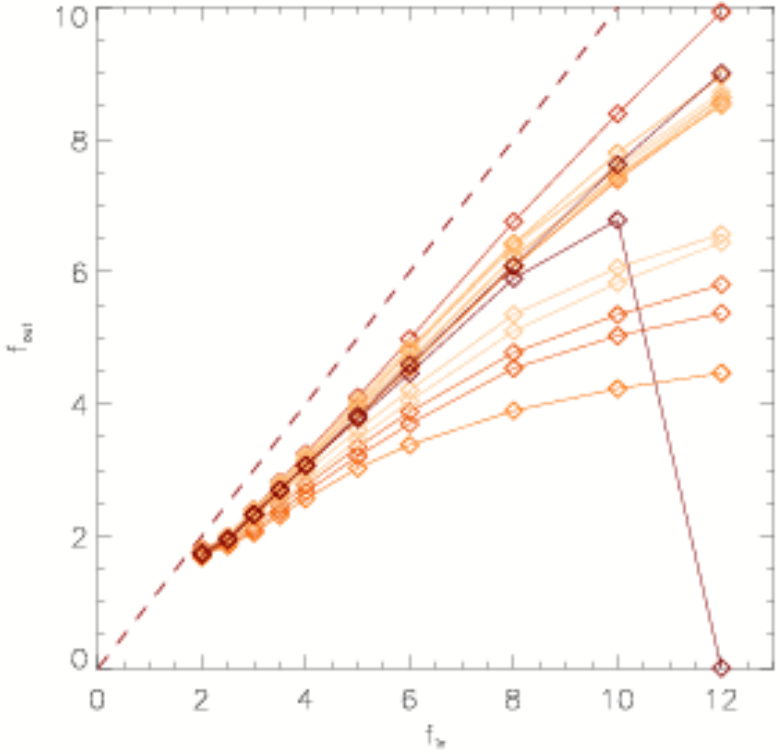
σr = 3.5 μ



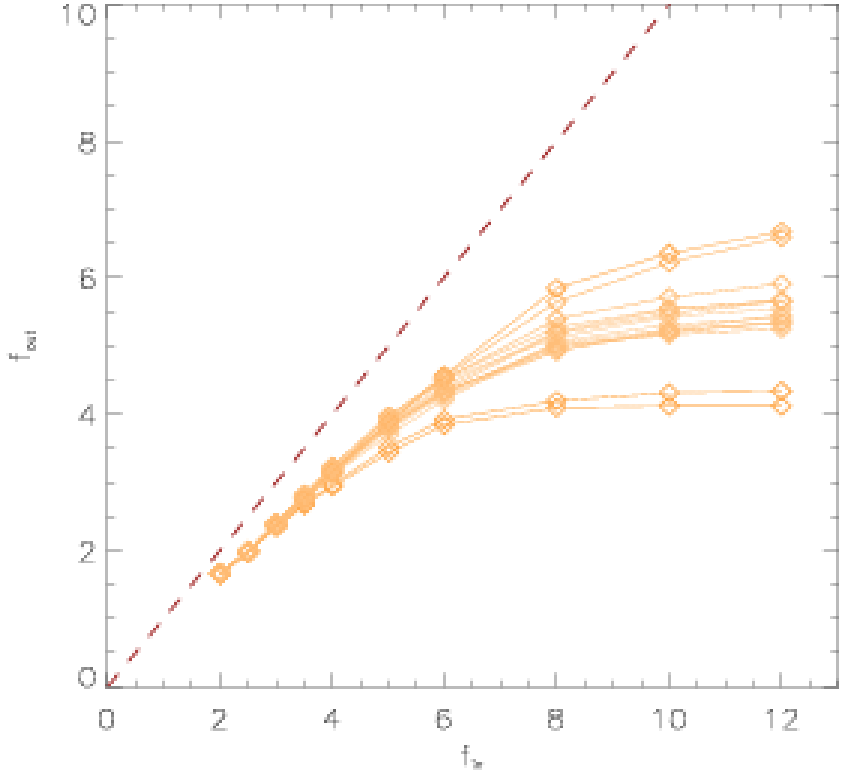
First results: Two different IFUs

FRD

Potsdam (unpolished)



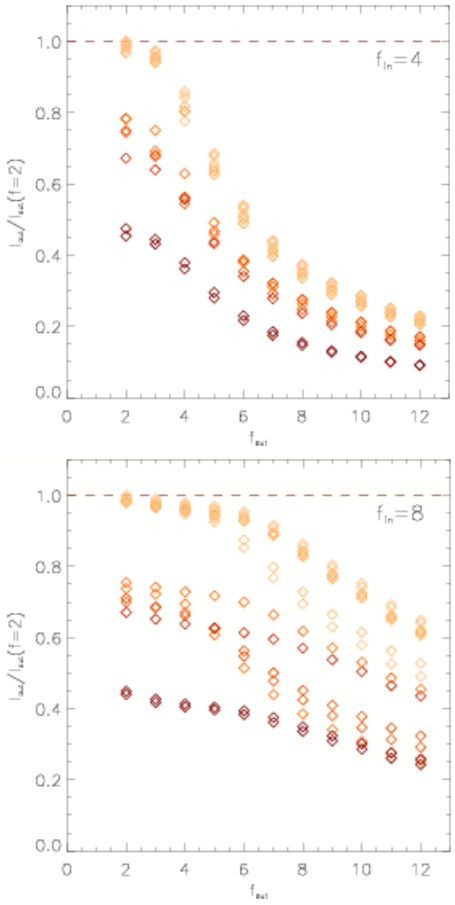
Austin (polished)



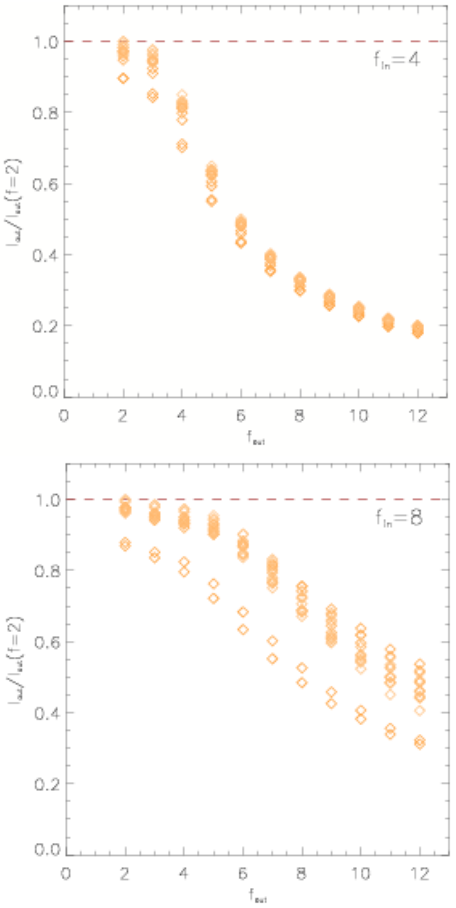
First results: Two different IFUs

Light within f-number (normalized to f=2)

Potsdam

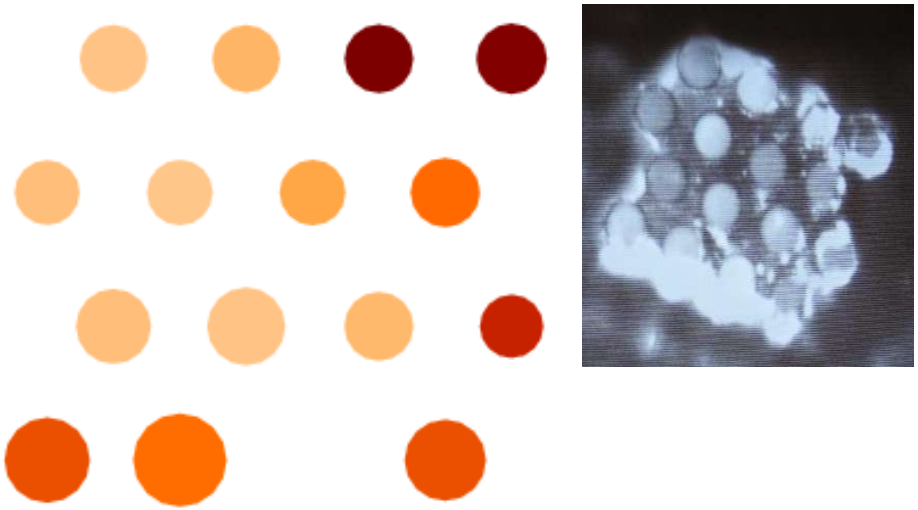


Austin



First results: Two different IFUs

Potsdam (unpolished)



- less FRD
- varying throughput

Austin

- higher FRD
- very homogenious

Ongoing research:

- Measure a set of approx 20 fibers and build up IFU and slitlet „step-by-step“
- Use fibers of different length
- Tube 200+ fibers and test FRD and throughput
- Test fibers in motion

Acknowledgment:

- Martin Roth, Emil Popow, Andreas Kelz, Thomas Fechner and Ute Tripphahn

- All of you for your patience !

This talk will be made available online soon:

www.usm.uni-muenchen.de/people/fug/