OCTech

POL Preform Polariscope

Optical Fiber Preform

Analysis Tool

June 2022

1

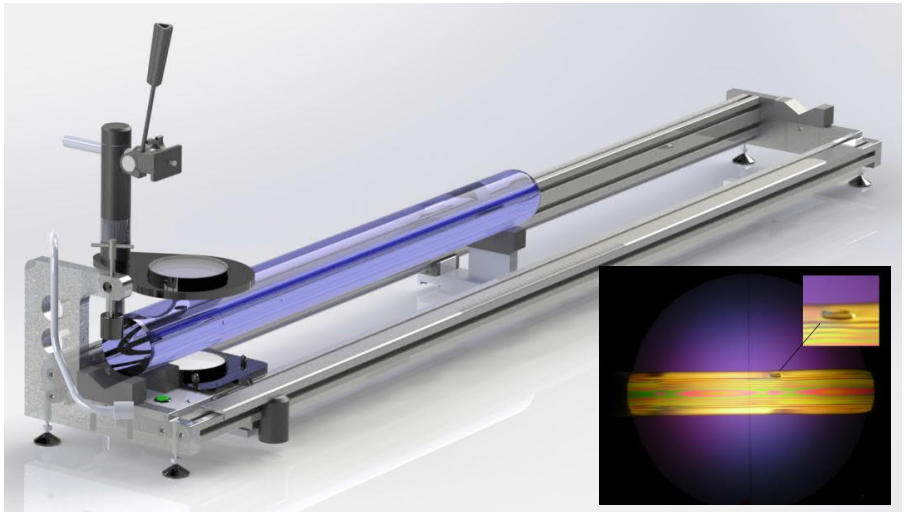
POL Preform Polariscope

Polariscope is an essential tool in optical fiber preform production:

- it provides visual analysis of core preforms prior to sleeving, finished sleeved preforms or quartz tubes / rods.
- it helps detect bubbles, inclusions, cracks, strain regions and other defects in glass structure.
- defects are detected by inserting preform between two crossed polarization filters and placing the whole assembly in a white light beam.
- to help detect small point defects, preform is also illuminated longitudinally by a bright halogen light source.

Sturdy mechanical construction ensures proper preform fixing, preventing vibrations and damage, as well as touch-free handling.

Built-in magnifying lens and gradation on the guide rail enable exact positioning of defects relative to a chosen reference point, for future introduction into process database for reference after fiber is drawn.



OPTIONS:

- UV light projection – showing glass flow and structure defects
- rare earth doping level analysis, by luminiscence of RE-doped glass

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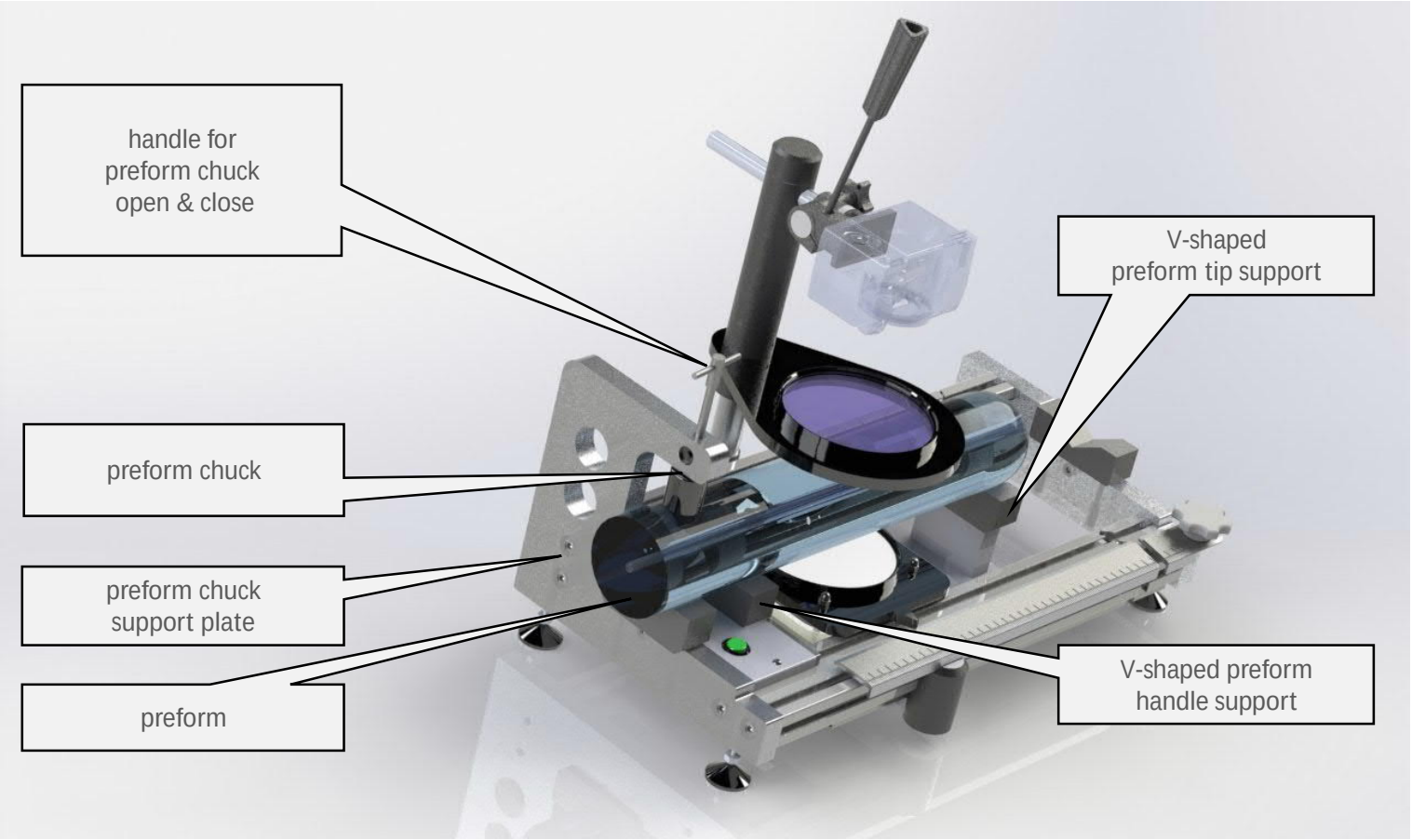
Preform chuck



NOTE: If preform is heavy or long, preform tip has to be supported by V-shaped tip support!

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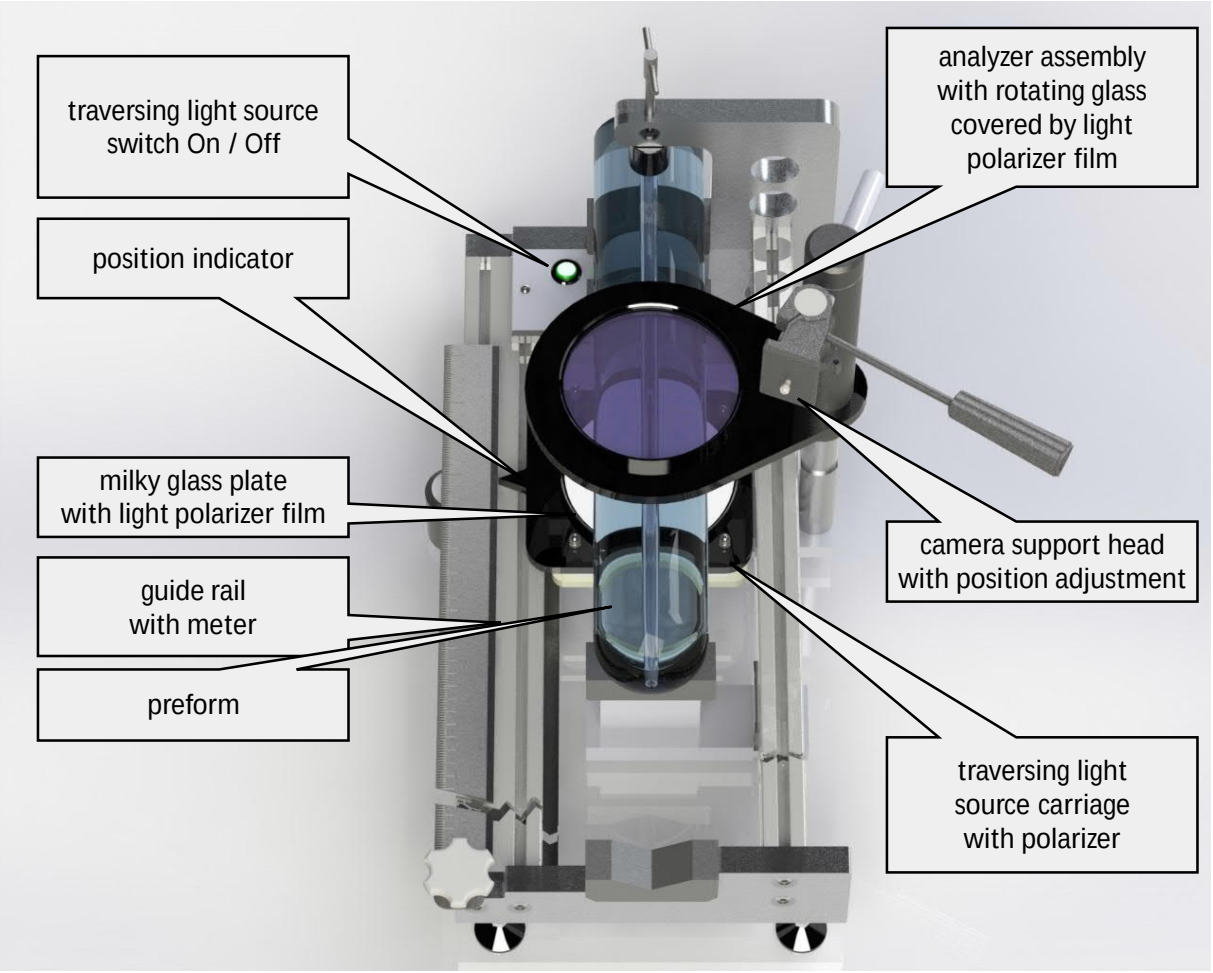
Carriage with polarized light source and analyzer



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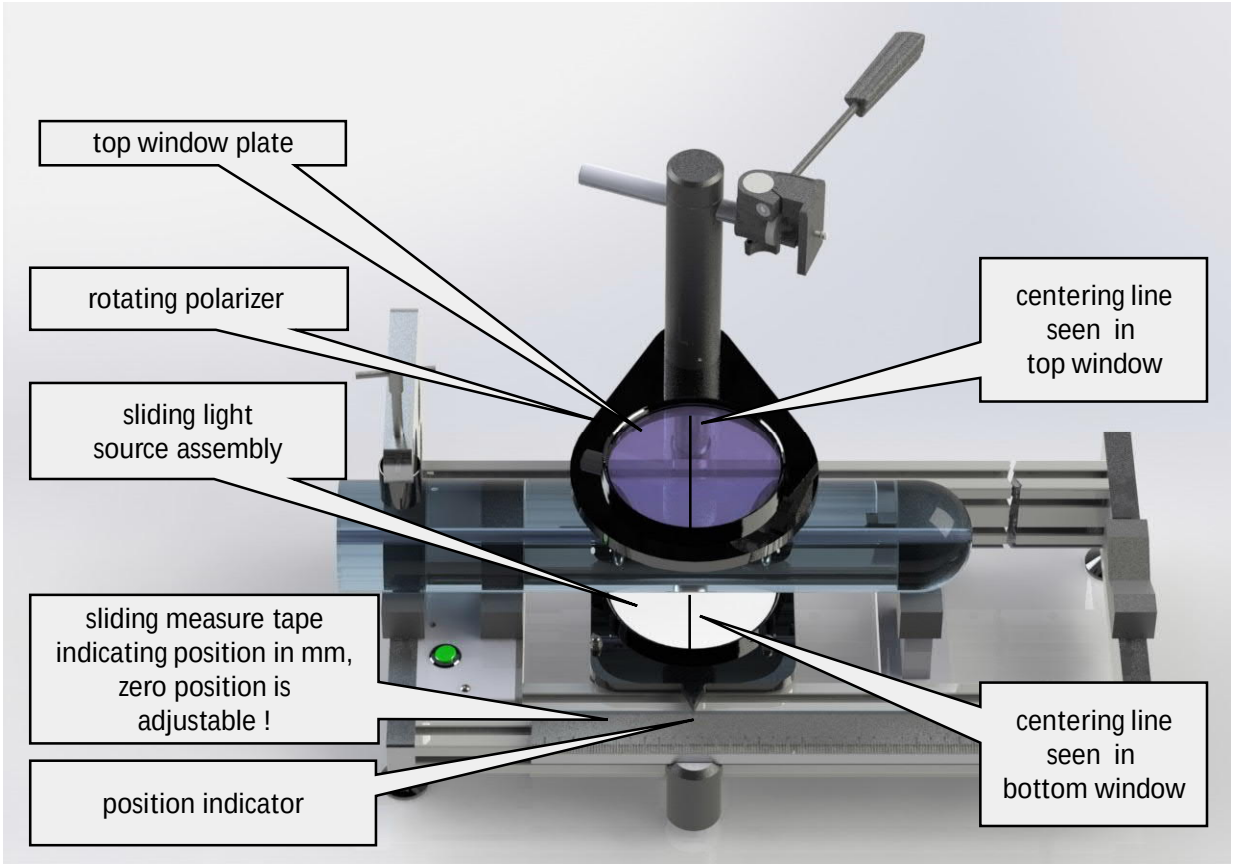
Position measurement



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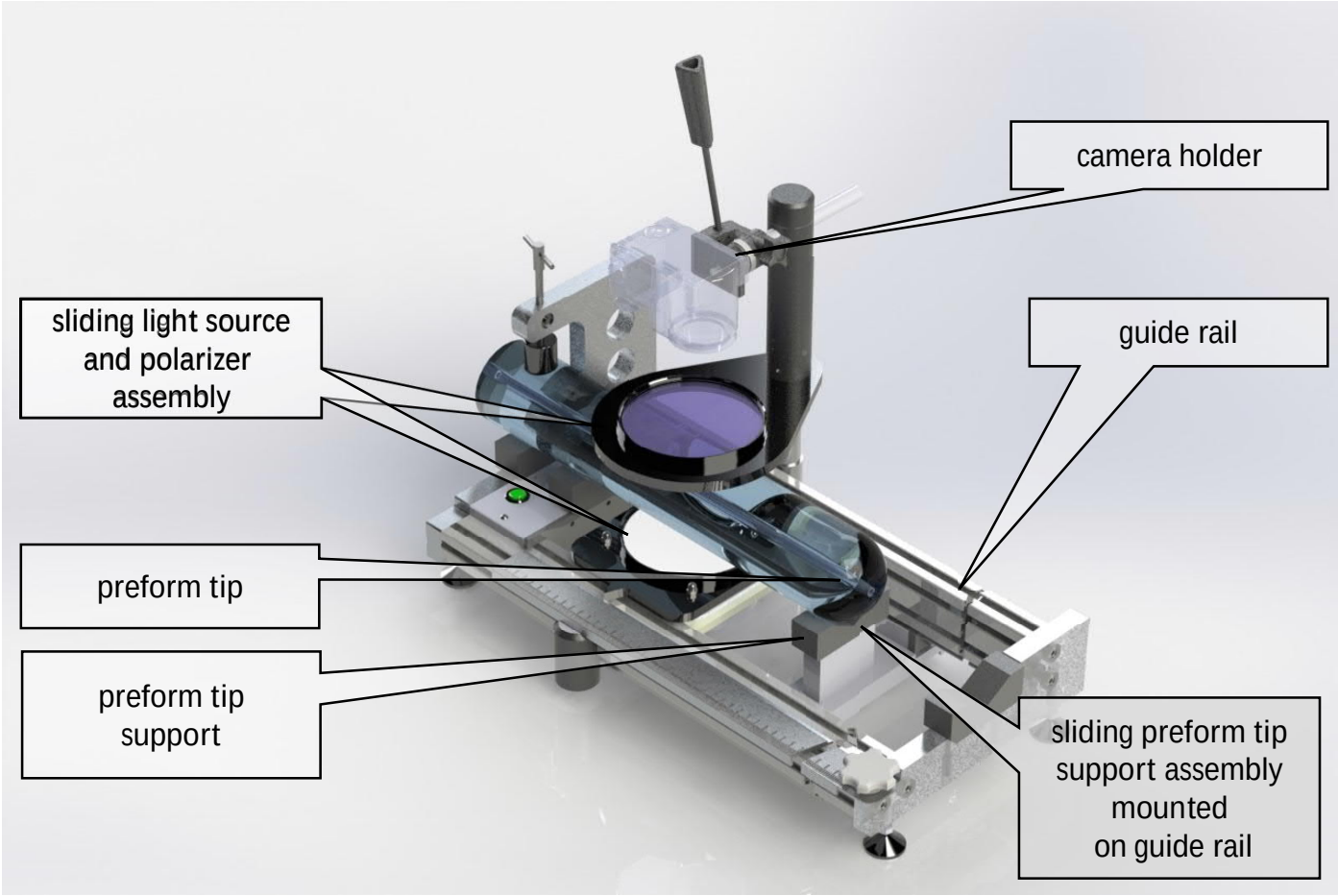
Preform tip support



6

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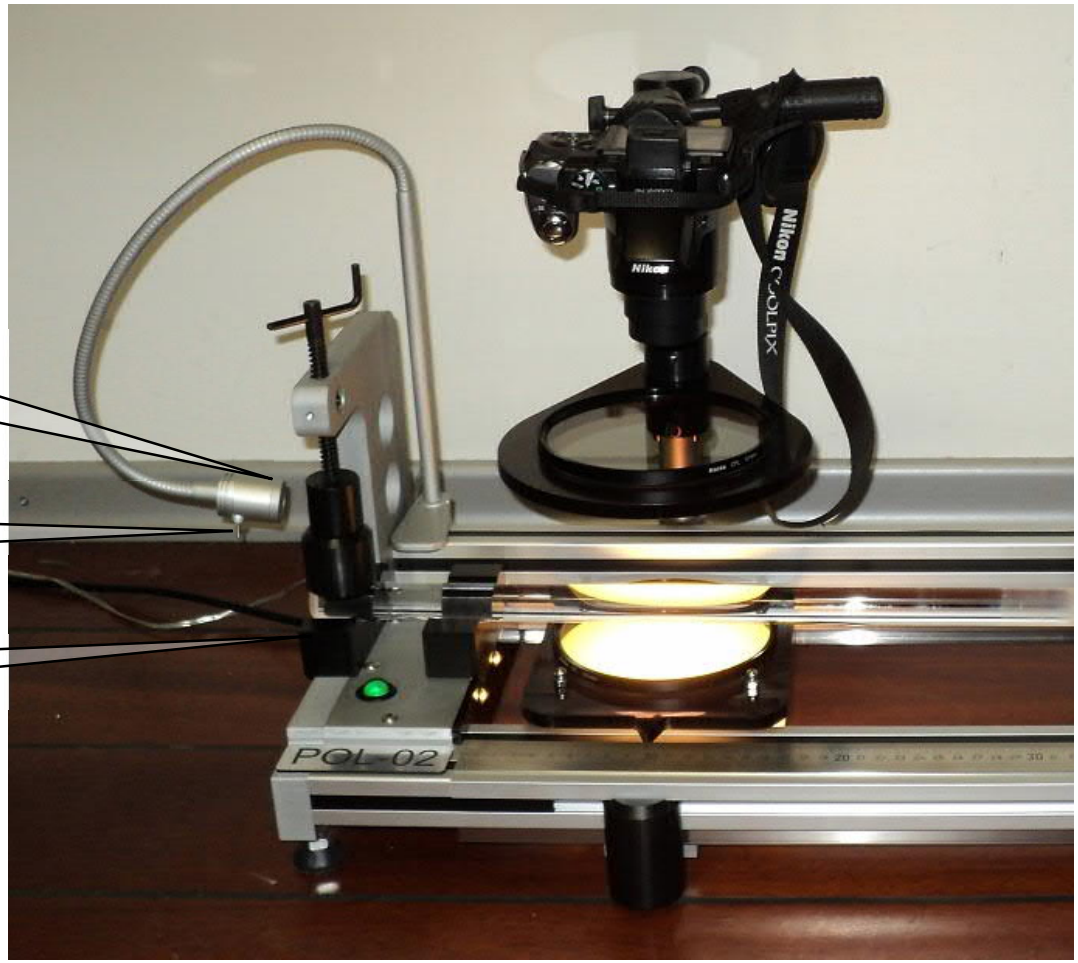
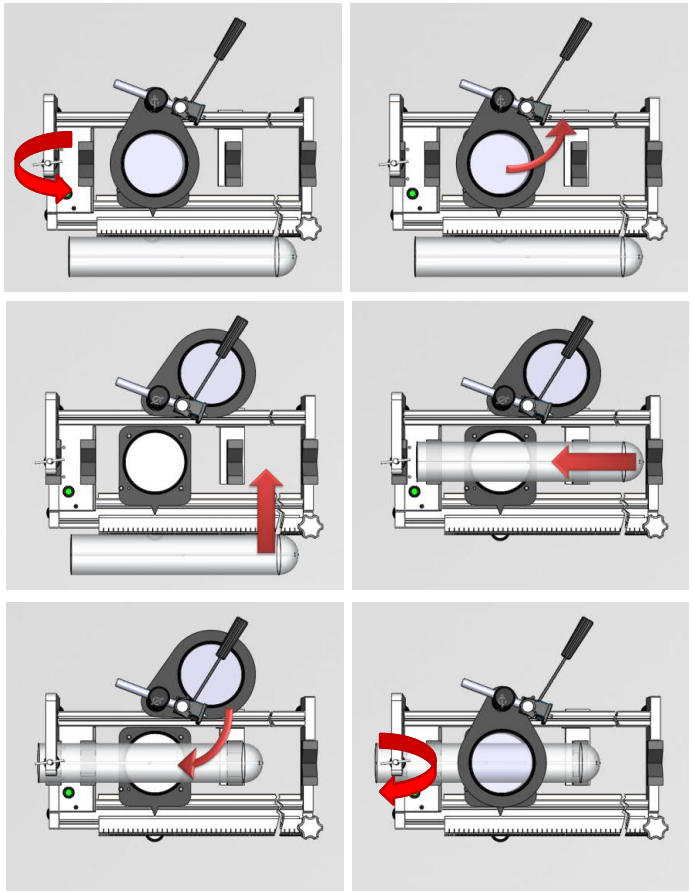
LED light source for longitudinal illumination



Fixing preform into polariscope

To fix the preform into polariscope:

- lift preform holder by turning the spindle by the handle in suitable direction
- holding preform in gloved hand, position its handle into the V-grooved preform support, keeping the reference point is to the right of the leftmost support plate
- grab the preform handle by preform holder, turning the spindle handle again
- check that preform is held properly, without danger to fall off
- preform should be aligned with the axis of the guide rail and should stand horizontally
- if preform is very long or heavy, position the preform tip support so that preform is propery supported in two points



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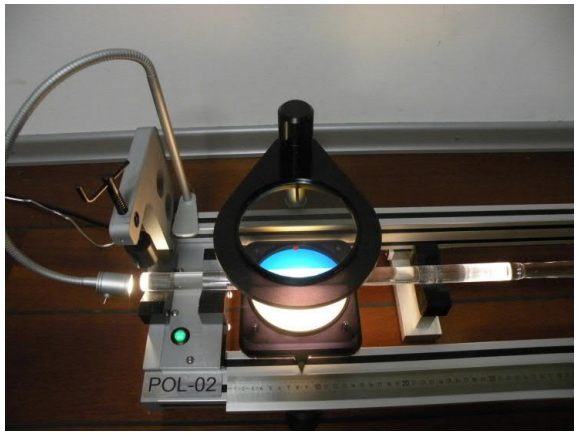
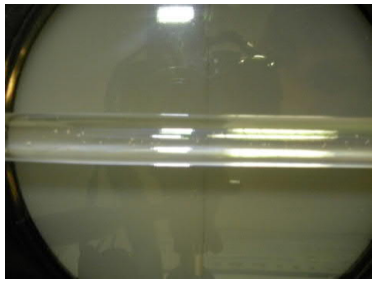
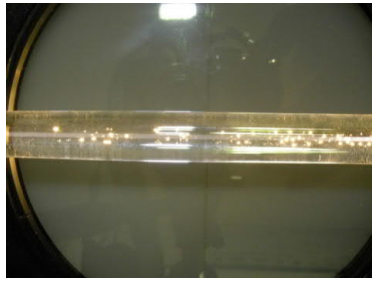
Checking for inclusions by longitudinal illumination

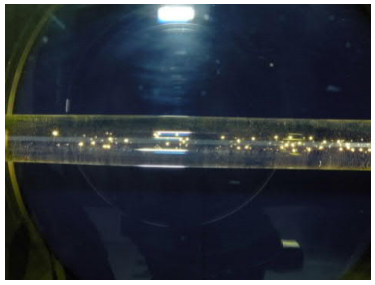
After the preform is fixed properly into polariscope:

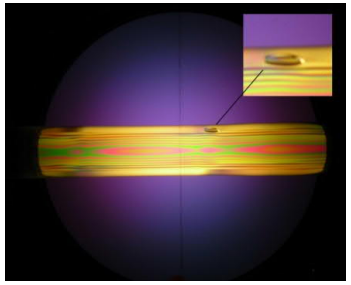
- attach the LED pigtail or fiber bundle adapter to the preform handle, so that the preform can be illuminated along its axis
- switch on the light source if it is not on yet
- turn-off the room light, if necessary







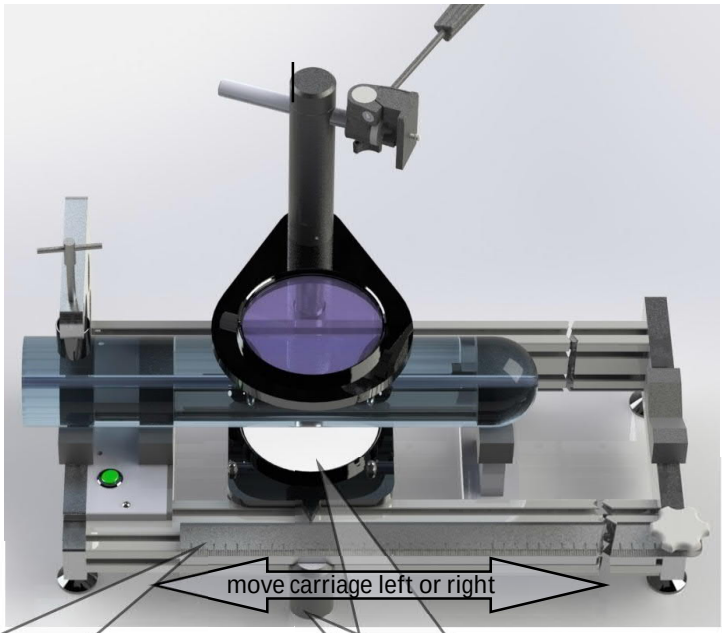




Adjusting reference position

To adjust the reference position:

- determine where is the reference position on preform using standard procedures
- slide the carriage into position over reference point
- looking through the top window and down through the preform align the position indicator with reference 0 mm position
- look at the side of the guide rail where position indicator is attached to the carriage assembly
- pushing the tape measure left or right align its zero with the indicator position
- position reference point is so determined and analysis can begin



10

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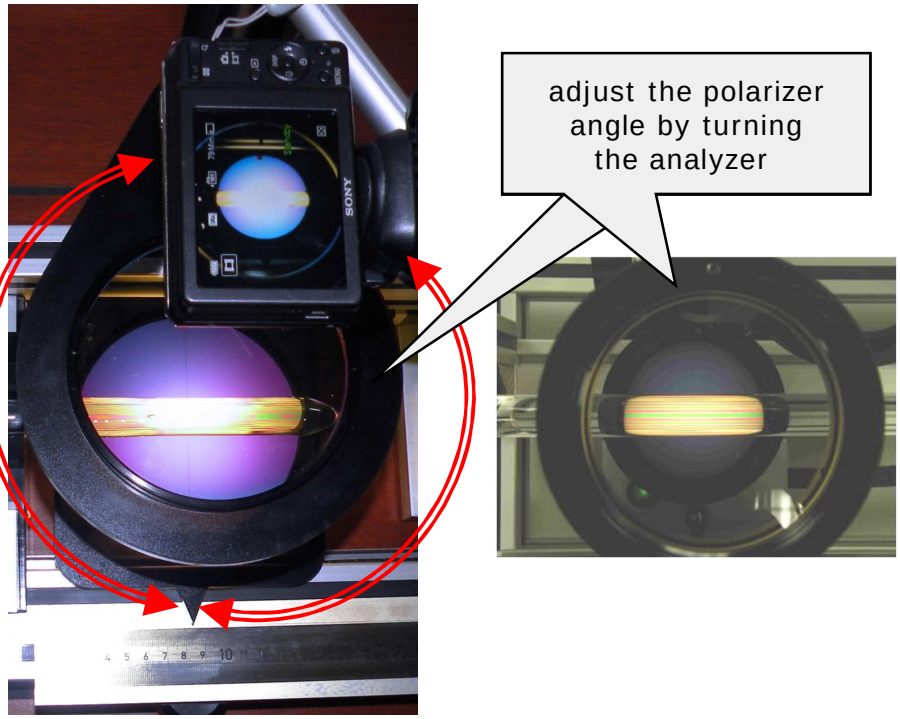
Adjusting polarization filter angle



Analyzer angle to polarizer/analyzer is changed:

- to see details in the preform structure the angle between two polarization filters has to be adjusted
- looking through the lens/analyzer assembly at the preform turning the lens support left and right by pushing at the two pins
- stop turning the lens/analyzer assembly when best detail is achieved
- the polariscope is now ready for preform analysis

11

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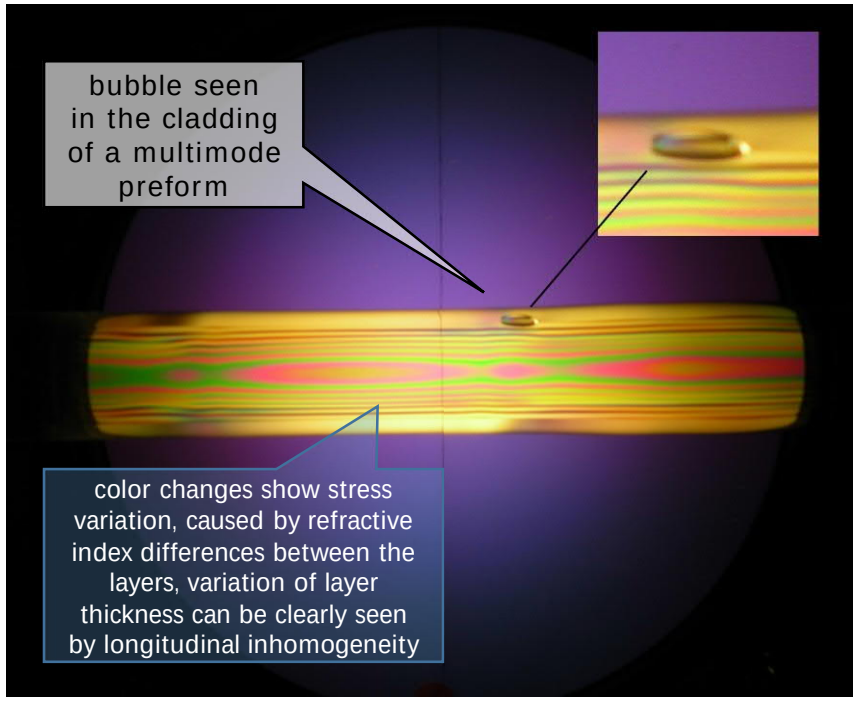
Defect detection

To detect defects:

- slide the carriage along the preform and observe the structure for defects
- defects that can be noticed through the crossed polarizers are:
  - bubbles (see right)
  - inclusions
  - cracks and scratches
  - areas of mechanical stress
- using traverse light the bubbles and inclusion are lit up (see above)
- refractive index defects are better seen without traverse light between fully crossed polarizers
- align carriage position with each defect and note type and position on the measurement form or take image with the camera



12

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Ellipticity & stress detection

How to detect ellipticity:

- ellipticity or angular preform inhomogeneity can be observed by turning preform while looking at the image through the lens
- keep preform supported and turn it in the V groove, observing changes in the visual field
- determine at which angle the colors (or intensity of shaded area with low refractive index or low stress preforms) are the strongest, this angle represents one of the principal axes of ellipticity or refractive index inhomogeneity
- leave preform in this position and mark the angle on the preform handle for preform refractive index measurement

How to detect stress:

- areas of stress in glass are detected by observation of shadowed areas in the preform, using light through crossed polarizers
- when such area is observed, stress can be confirmed by turning the polarization analyser and monitoring the rate of change of shadowed area in the preform
- stress magnitude can be determined empirically by obsrving the analyser angle of rotation, required to make shadow disappear
- stress is usually not noted as a defect that requires any action, as it is released during fiber drawing process

13

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UV light analysis

A special UV light source with projection screen is provided for analysis of flow patterns or striation marks in glass preforms (see some images below).
The light source and screen are interchangeable with the polariscope source and bottom polarizer, the top polarizer has to be removed to install UV light source.

14

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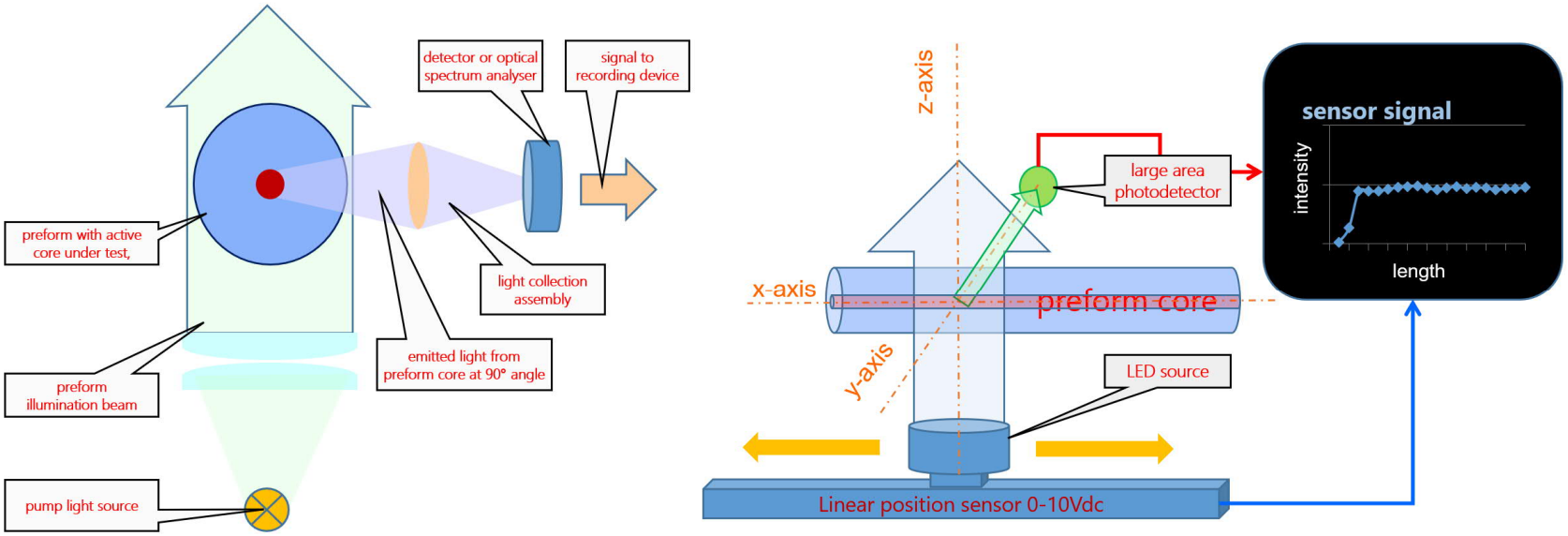
Twice perpendicular set-up

Twice perpendicular measurement set-up with a POL polariscope device can used to detect rare-earth ion luminescence intensity along the preform:

- preform is illuminated by a suitable pump light source (depending on active ion to be detected)
- preform core luminiscence is detected by optical detection system, positioned at 90°angle to preform longitudinal axis
- LED pump source carriage is connected to a magnetic position sensor
- photodetector signal is logged with position reference when moving the carriage and intensity vs. preform position is plotted, providing information about the longitudinal homogeneity of the active fiber preform



15

Thank you for your interest!

For more information and quotes please write or call our office

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16