Hellma® Analytics
High Precision in Spectro-Optics

TRAYCELL 2.0

INNOVATIVE SOLUTION FOR THE **UV/VIS ANALYSIS OF DNA, PROTEIN AND MICRO VOLUME SAMPLES**

INHALT

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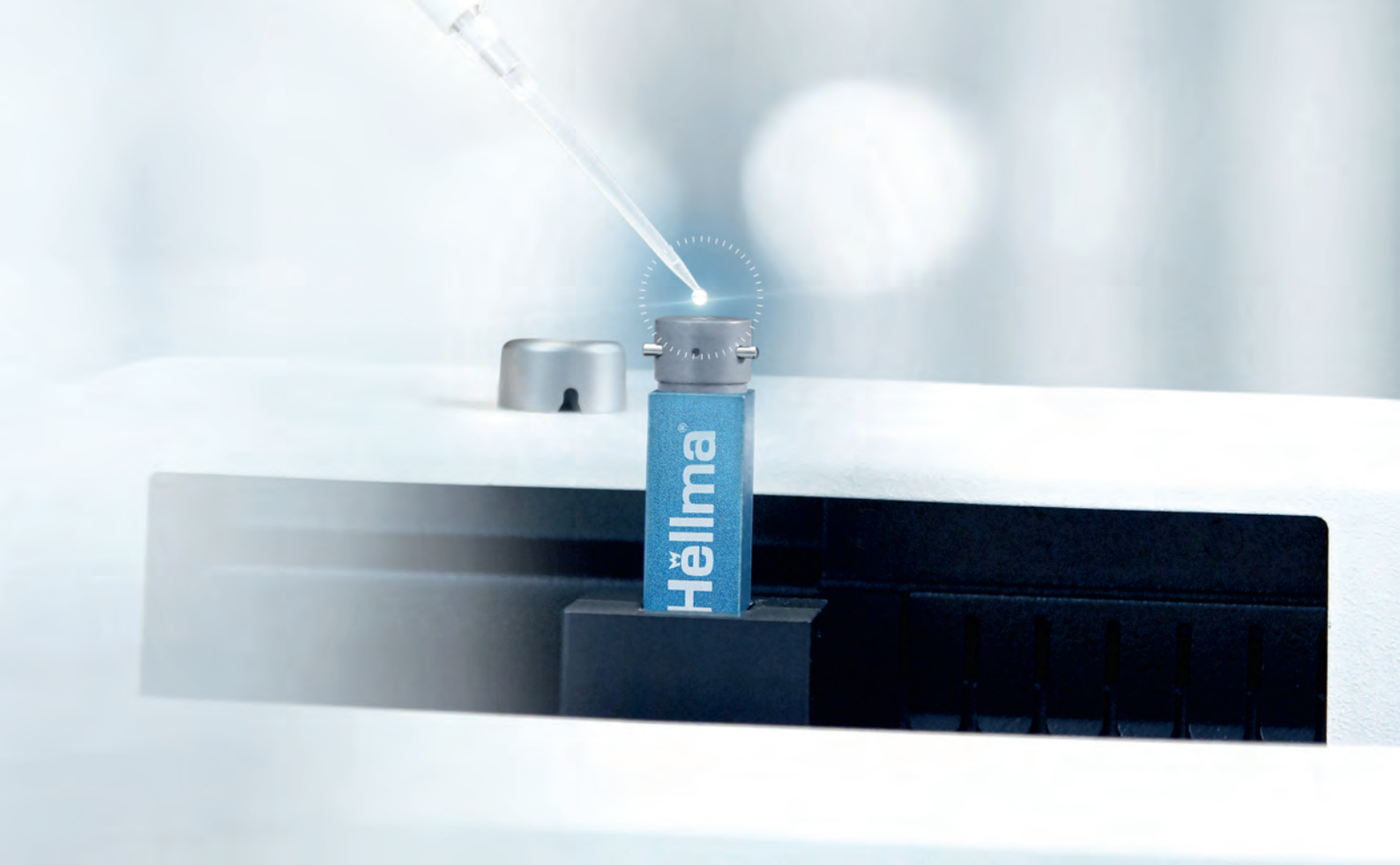
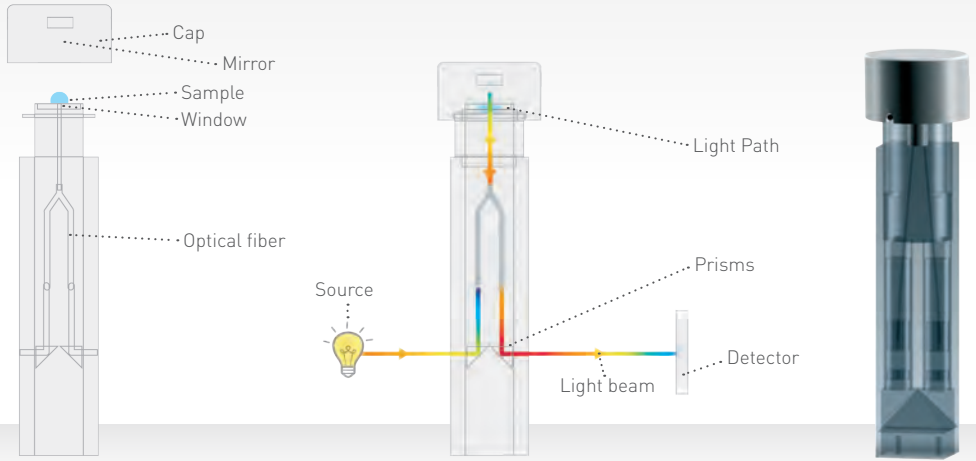

Hellma

1. PRODUCT DESCRIPTION

High tech, tiny footprint, patented operating principle

The TrayCell comprises a fiber-optic measuring cell and a cap with an integrated mirror. A small drop (0.7 µl – 10 µl) of sample is pipetted onto the window and the cap is then placed on top. The precisely defined spacing between the window and the mirror inside the cap ensures that the optical path length is accurate and remains constant. It is therefore impossible for the path length to change, rendering costly calibrations and readjustments unnecessary. Light is guided through the sample via prisms and fiber-optic waveguides, reflected by the mirror and then guided back out of the TrayCell to the detector via the waveguides.



2. LIEFERUMFANG / DELIVERY CONTENT

Produkt-Nr. 105830-A3-V1-40

- A 1 × TrayCell 2.0 mit 8,5 mm Zentrumshöhe
- B 1 × Deckel mit 1,0 mm Schichtdicke (Faktor 10)*, Artikel-Nr. 665-1016-1-40
- C 1 × Deckel mit 0,2 mm Schichtdicke (Faktor 50)*, Artikel-Nr. 665-1016-0.2-40
- D 1 × Adapter für 20 mm Zentrumshöhe
- E 1 × Adapter für 15 mm Zentrumshöhe
- F 1 × Schraubendreher für Zentrumshöhen-Adapter
- G 1 × Aufbewahrungsbox

Optional erhältliches Zubehör

1 x Deckel mit 0,1 mm Schichtdicke (Faktor 100)*, Artikel-Nr. 665-1016-0.1-40

1 x Deckel mit 2,0 mm Schichtdicke (Faktor 5)*, Artikel-Nr. 665-1016-2-40

Product-No. 105830-A3-V1-40

- A 1 x TrayCell 2.0 with 8.5 mm center height
- B 1 x cap with 1.0 mm path length (factor 10)*, Article-No. 665-1016-1-40
- C 1 x cap with 0.2 mm path length (factor 50)*, Article-No. 665-1016-0.2-40
- D 1 x adapter for 20 mm center height
- E 1 x adapter for 15 mm center height
- F 1 x screwdriver for center height adapter
- G 1 x storage box

Optional Accessories

1 x cap with 0.1 mm path length (factor 100)*, Article-No. 665-1016-0.1-40

1 x cap with 2.0 mm path length (factor 5)*, Article-No. 665-1016-2-40

* bezogen auf 10 mm Schichtdicke * based on 10 mm path length

Abbildung zeigt Produkt-Nr. 105830-A3-V1-40
Picture shows Product-No. 105830-A3-V1-40

3. PRODUCT FEATURES

- Strictly defined, precise path lengths misadjustment impossible
- Path lengths in standard model: 1.0 mm and/or 0.2 mm
- Additional path lengths: 2.0 mm and 0.1 mm (optional)
- Extremely small sample volumes: 0.7 µl – 10 µl
- Large measuring range from approx. 6 – 8,500 ng/µl (dsDNA)* and approx. 0.1 – 100 mg/ml (protein)*
- No need to dilute samples
- Cap prevents evaporation of samples
- Sample with low surface tension can be measured
- Easy recovery of samples by pipetting
- Excellent reproducibility
- Quick and easy to clean
- Highly flexible
- Suitable for all current spectrophotometers

Examples for use:

- Determining the purity and concentration of proteins (direct measurement or using colorimetric assay)
- Determining the purity and concentration of DNA/RNA
- Determining labeling efficiency for microarray experiments
- All microvolume, spectrophotometric measurements (0.7 µl – 10 µl) in the UV/Vis range from 210 nm to 1,100 nm

* depending on the spectrophotometer used and the sample type (see example in chapter 6. Measuring range)

4. SAFETY INFORMATION

The TrayCell is solely intended for use in spectrophotometers, e.g. for determining the concentration of analytes in liquids.

The light path of the spectrophotometer is diverted within the TrayCell such that the beam emanating from the light source is able to escape upwards if the mirrored cap is not positioned on the TrayCell.

Before each measurement, ensure that the mirrored cap is in place on the TrayCell.

The TrayCell must not be stored at temperatures below 4 °C or above 50 °C.

There is a risk of corrosion if aggressive cleaning products and disinfectants are used.

Do not use corrosive cleaning agents, aggressive solvents or abrasive polishes.

The TrayCell consists of quartz glass and metal components, and must therefore be handled with care. After use, return the TrayCell to the storage box and ensure that this is closed. The TrayCell can easily tip over in an upright position, which can result in damage. You should therefore always place the TrayCell on a lint-free pad or in the storage box.

5. OPERATION

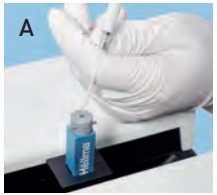
- The TrayCell is a fiber-optic, microvolume measuring cell and was developed for the UV/Vis analysis of proteins and DNA/RNA. To enable its use in a majority of spectrophotometers, the TrayCell's dimensions are the same as those of a standard cuvette.
- First check the center height required for your spectrophotometer and ensure that the TrayCell is set to the correct center height.

- The TrayCell is supplied with a center height of 8.5 mm. If you need to adjust the center height, please use the relevant adapter. This is supplied with appropriate screws. Screw the adapter into the pre-drilled holes on the TrayCell from below.

- Position the TrayCell in the cuvette holder with the window facing in the direction of the light path. We recommend placing the Hellma logo at the front. Always insert the TrayCell in the same direction.
- Maximum TrayCell performance is achieved when the light beam that passes through the measuring chamber has a diameter below 4 mm.
- The TrayCell must be correctly inserted into the cuvette holder for measurements to be performed. Please ensure that the TrayCell is firmly seated in the cuvette holder and does not wobble! It should then remain in the cuvette holder for the duration of all sample measurements and cleaning processes carried out within a measurement series.
- The TrayCell should not be moved at all (removed and re-inserted) during a series of measurements.

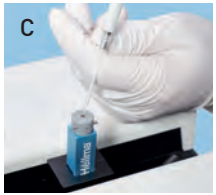
5. OPERATION

- Please note that the empty TrayCell has an absorbance of around 1. To correct this characteristic absorbance, first carry out a reference measurement with the solvent in which the sample was dissolved.
- You can then start taking measurements with the sample.
- Please note that the cap must be correctly positioned on the TrayCell before you start measuring!
- If necessary, the sample can be recovered by pipetting once the measurements are complete.
- Finally, clean the window and the mirror inside the cap.



Pipette sample onto window.

Position cap. Start measurement.



Remove cap and recover sample if necessary.

Clean window and cap (TrayCell remains in spectrophotometer).

Pipette new sample onto window.

Attention: Place the cap in such a way that the pins are in the notches of the cap.

6. MEASURING RANGE

- By employing a variety of caps, and thus path lengths, the necessity to dilute samples is significantly reduced, which allows the concentration range to be significantly increased as a result.

Example of use: Nucleic acid quantitation

- A solution's ratio of absorbance at 260 nm (A260) is used to determine its nucleic acid content. The following calculation derived from the Beer-Lambert law is used here:

Concentration [ng/µl] = absorbance (260 nm) x sample-specific factor x virtual dilution factor

- The sample-specific factor indicates the specific absorbance of a material or molecule at a certain wavelength. For example, dsDNA with a concentration of 50 ng/µl at 260 nm exhibits a specific absorbance of 1 at a path length of 10 mm. Owing to the varying path lengths possible in the TrayCell, the virtual dilution factor must also be taken into account. This is given as a factor for each cap.

(See listed values for each path length on the next page)

On our website you can download a helpful Excel tool, with which you can calculate the concentrations of nucleic acids and proteins:
www.hellma.com/traycell-en

6. MEASURING RANGE

- Absorption measurements at a wavelength of 260 nm on different nucleic acid samples show the mean dynamic range of concentration as a factor of the optical path length and the absorption thresholds of 0.025 – 1.7 as follows:

NUCLEIC ACIDS	SAMPLE-SPECIFIC FACTOR**	2.0 mm cap (factor 5) [ng/µl]*	1.0 mm cap (factor 10) [ng/µl]*	0.2 mm cap (factor 50) [ng/µl]*	0.1 mm cap (factor 100) [ng/µl]*	Total measuring range [ng/µl]*
dsDNA	50	6 – 425	13 – 850	63 – 4250	125 – 8500	6 – 8500
ssDNA	37	5 – 315	9 – 629	46 – 3145	93 – 6290	5 – 6290
ssRNA	40	5 – 340	10 – 680	50 – 3400	100 – 6800	5 – 6800
Oligomers	30	4 – 255	8 – 510	38 – 2550	75 – 5100	4 – 5100

* typical concentration values that can be measured using an average spectrophotometer

** sample-specific factor of nucleic acid samples = concentration (ng/µl) at an absorbance of 1

Sample volume required	6 – 10 µl	3 – 5 µl	0.7 – 4 µl	0.7 – 3 µl

6. MEASURING RANGE

Example of use: Protein quantitation

- A solution's absorbance at 280 nm (A280) is often used to determine its protein content. Alternatively, proteins can also be measured through absorbance at 230 nm or in colorimetric assays. The following calculation derived from the Beer-Lambert law is used to perform direct measurements at 280 nm:

$$\text{Concentration [mg/ml]} = \frac{1}{\text{sample specific factor}} \times \text{absorbance (280 nm)} \times \text{dilution factor}$$

- The sample-specific factor indicates the specific absorbance of a protein at a certain wavelength. For example, BSA (bovine serum albumin) with a concentration of 1 mg/ml at 280 nm and a path length of 10 mm exhibits a specific absorbance of 0.64. Owing to the varying path lengths possible in the TrayCell, the virtual dilution factor must also be taken into account. This is given as a factor for each cap.

(See listed values for each path length on the next page)

On our website you can download a helpful Excel tool, with which you can calculate the concentrations of nucleic acids and proteins:
www.hellma.com/traycell-en

6. MEASURING RANGE

Absorption measurements at 280 nm on different protein samples show the mean dynamic range of concentration as a factor of the optical path length and the absorption thresholds of 0.025 – 1.0 as follows:

PROTEINS	SAMPLE-SPECIFIC FACTOR**	2.0 mm cap (factor 5) [mg/ml]*	1.0 mm cap (factor 10) [mg/ml]*	0.2 mm cap (factor 50) [mg/ml]*	0.1 mm cap (factor 100) [mg/ml]*	Total measuring range [mg/ml]*
BSA (bovine serum albumin)	0.64	0.2 – 7.8	0.4 – 15.6	2.0 – 78	3.9 – 156	0.2 – 156
IgG (bovine gamma globulin)	1.4	0.1 – 3.6	0.2 – 7.1	0.9 – 36	1.8 – 71	0.1 – 71
Lysozyme	2.64	0.05 – 1.9	0.1 – 3.8	0.5 – 19	0.9 – 38	0.05 – 38

* typical concentration values that can be measured using an average spectrophotometer
** sample-specific factor of protein samples = absorbance (A280) at a concentration of 1 mg/ml

Sample quantity required	6 – 10 µl	3 – 5 µl	0,7 – 4 µl	0,7 – 3 µl

7. CLEANING AND MAINTENANCE

- Always clean the TrayCell with a lint-free cloth or swab.
- Please observe the following when cleaning the TrayCell:

Do not immerse the TrayCell in water or cleaning solutions
Do not clean the TrayCell in an ultrasonic cleaner
Do not use abrasive cleaning agents

- Depending on the sample, use a 60% isopropanol solution, ethanol or ultrapure water to clean the TrayCell. If necessary, the TrayCell can be wiped clean with the solvent used to dissolve the sample.
- The TrayCell consists of quartz glass and metal components, and must therefore be handled with care. While the quartz glass components and the PTFE coating are highly resistant to laboratory cleaning agents, attention must be paid to ensure that no caustic or corrosive cleaning agents are used on metal components.
- After use and cleaning, return the TrayCell to the storage box supplied and ensure that this is closed.

8. STABILITY OF TRAYCELL MATERIALS

At room temperature, the TrayCell measuring head, including the cap, is resistant to many organic solvents, acids up to pH ≥ 2 and alkaline solutions up to pH ≤ 10.

The TrayCell measuring head is resistant to the following chemical compounds at room temperature:

- Acetone (up to 5%)
- Acetonitrile
- Benzene
- Toluene
- Phenol (up to 1%)
- Carbon tetrachloride
- Chloroform
- Dichloromethane
- Methanol
- Ethanol
- Butanol
- n-Propanol
- Isopropyl alcohol
- Ethers
- Hexane
- HEPES
- MES
- MOPS
- Saline buffers, e.g. PBS,
  Citrate or borate buffer in a pH range from 4 – 10
- Low (!) concentrations of acids and alkaline solutions

9. TRANSPORT AND STORAGE

- Only transport and store the TrayCell in the storage box supplied.
- Do not store the TrayCell at temperatures below 4 °C or above 50 °C.

10. TECHNICAL SPECIFICATIONS

TYPE	105.830-UVS		
Product No.	**105830-A3-V1-40**	**105830-A1-V1-40**	**105830-A2-V1-40**
Path length*	0.2 mm (factor 50) 1.0 mm (factor 10)	1.0 mm (factor 10)	0.2 mm (factor 50)
Window material	High Performance Quartz Glass		
Width x depth	12.5 mm x 12.5 mm		
Height**	61.5 mm (center height 8.5 mm) 68 mm (center height 15 mm) 73 mm (center height 20 mm)		
Volume	0.7 - 10 µl		
Max. temperature	50 °C		
Center height***	8.5 mm, 15 mm or 20 mm		
Fiber optics	built in not exchangeable, low solarization 210 nm – 1.100 nm		

* Path length = path length accuracy +/- 0.02 mm, factor = dilution factor compared to a 10 mm cuvette
** Height = Total height including cap
*** The center height can be adjusted using the adapters supplied

11. TECHNICAL SPECIFICATIONS: CAP

TYPE	665-1016			
Product No.	**665-1016-0.1-40**	**665-1016-0.2-40**	**665-1016-1-40**	**665-1016-2-40**
Path length*	0.1 mm, factor 100	0.2 mm, factor 50	1.0 mm, factor 10	2.0 mm, factor 5
Description	Cap made of stainless steel with an integrated mirror made of quartz glass with an aluminum mirror layer			
Window material	High Performance Quartz Glass			

* Path length = path length accuracy +/- 0.02 mm, factor = dilution factor compared to a 10 mm cuvette

12. FAQ

1. **Where should I pay special attention when inserting the TrayCell?** As is the case when using cuvettes, you should be careful to ensure that the TrayCell stands straight and stable in the beam path. To achieve the best possible reproducibility of measurement values, we recommend always inserting the TrayCell in the same direction, with the Hellma logo facing the front, and leaving it in the holder between measurements.

2. **When do I use which cap?** The smaller the path length, the higher the concentrations of samples that can be measured within the linearity range of the spectrophotometer or sample testing system. In contrast to the customary cuvettes with their 10 mm path length, the 1 mm path length cap offers a 'dilution factor' of 10, and the cap with a 0.2 mm path length even provides a 'dilution factor' of 50. This factor therefore indicates the extent of dilution that would be necessary in a conventional cuvette (virtual dilution factor).

3. **How do I clean the TrayCell?** The TrayCell consists of quartz glass and metal components, and must therefore be handled with care. While the quartz glass components are highly resistant to laboratory cleaning agents, no caustic or corrosive cleaning agents should be used on metal components. We recommend using lint-free swabs or lint-free lab cloths for cleaning. Samples can be recovered beforehand using a pipette, and the remainder is then wiped away using a swab or lab cloth. Depending on the sample, use a 60 % isopropanol solution, ethanol or ultrapure water to clean the TrayCell. If necessary, final cleaning may be performed with a solvent used for the sample.

4. **In which wavelength range can I take measurements?** The TrayCell is characterized by its use of low solarization fiber optics. It permits a measuring range of between 210 and 1,100 nm.

5. **How do I use the TrayCell in a double beam spectrophotometer?** It is not possible to simply use a second TrayCell and follow the usual procedure for taking reference measurements in a double beam spectrophotometer. The differences in the optical characteristics of the fibers are too big to allow any sensible comparisons to be drawn. Baseline correction is sufficient in the majority of cases, however, making such comparisons is unnecessary for standard measurements. If you need to improve the signal-

to-noise ratio, we recommend reducing the reference beam to an intensity of around 20%. This can easily be achieved using a simple hole aperture in the reference beam path.

6. **What is the concentration range covered?** Depending on the sample being analyzed (double-stranded or single-stranded DNA or RNA, oligomers, etc.) we see nucleic acid concentration ranges from around 6 to 8,500 ng/µl for an absorbance range of 0.025 – 1.7 (see Chapter 6: Measuring Range). In the case of proteins, measurements should only be taken up to a maximum absorbance of 1, since the scattering above this level would no longer ensure linearity as defined by the Beer-Lambert law. For a protein with an absorbance of 1 at a concentration of 1 mg/ml, the concentration range with a TrayCell would be 0.1 – 100 mg/ml. This concentration range varies depending on the specific absorption coefficients of the individual proteins (see chapter 6. Measuring Range).

7. **What is the maximum absorbance I can measure?** The maximum absorbance that can be measured is limited by the linearity range of the spectrophotometer used. The highest performance spectrophotometers available on the market permit measurements up to a maximum absorbance of 10. Statements in the literature referring to far greater absorbance ratios should be understood as theoretical values. These 'theoretical' absorbance ratios indicate the results that could be expected if we were able to measure undiluted samples in cuvettes with 10 mm path lengths. When using a path length of 0.2 mm (factor 50), the absorbance range of a spectrophotometer with a linear measuring range up to 1.7 would equate to a 'theoretical' absorbance of up to 1.7 x 50 (factor) = 85 in a 10 mm cuvette.

8. **Can I measure highly-concentrated proteins?** The ability to measure highly-concentrated samples is determined by the linear absorbance range of the spectrophotometer used. The type of sample being measured also plays a role, as proteins, for example, can only be measured correctly up to an absorbance of 1. By using different path lengths with the TrayCell, even highly-concentrated proteins can be measured.

9. **Can I measure samples with a low surface tension?** Yes. As the window is slightly indented and measurements are performed in the horizontal plane, the liquid is unable to escape. To achieve the best results, we recommend using the cap with the 0.2 mm path length where possible, or the 0.1 mm path length cap that is available as an optional accessory.

10. **My measurement values fluctuate, what can I do?** Check that a sufficiently large sample quantity has been pipetted onto the window. The volume should be equivalent to the minimum quantity recommended for a given path length. Some pipettes are not precise enough for transferring small sample volumes. If in doubt, increase the sample volume a little. In the case of very low volumes, we recommend pipetting samples directly onto the mirror inside the cap. Check whether the spectrum is showing a high noise level, that could cause the measurement signal to fluctuate. Provided that the concentration and/or absorbance of the sample lies within the measuring range, an extended integration period will improve the measurements.