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January 2004

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**IN414**  
**Experimental**  
**report**

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INFM – Mario E. Giardini

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**Note:**

IN414 in an industrial experiment. It has led to the commercial implementation of novel capillary test tubes for X-ray scattering. As such, we include as report the final specification for such tubes, including all commercial data.



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EN-KIB-S-001

# KI-BEAM

## Thin-Walled Capillary Test Tubes

### General Description

KI-BEAM tubes are thin-walled capillary test tubes, intended as a cost-effective replacement for glass capillary test tubes, microvials and microreactors, whenever biocompatibility, unbreakability ease of handling, reopenability, safe sample recovery, X-ray transparency and good optical transmission are desired. KI-BEAM tubes can be used for liquid and powder samples.

A tightly fitting PTFE disposable piston is integrated in every single tube. The piston-tube unit can therefore be handled as a microsyringe or micropipette, thus allowing full sample manipulation (filling, recovery) without the aid of external pipette systems.

KI-BEAM tubes have been tested for small-angle X-ray scattering measurements. Because of the extremely low wall thickness, tested at 1 Å wavelength, the absolute scattering from the tube is extremely low, and the tube transparency to the beam is near 100%. The consistent geometry allows excellent intertube and intratube repeatability of the scattering properties. Filled with water, the absolute scattering from the tube is significantly lower than the scattering from the water. Moreover, even at the highest fluencies available at the time this datasheet has been released (beamline ID2 at ESRF, Grenoble) no radiation damage is evident even after prolonged exposure to the beam.

The intrinsic optical translucency of the materials, combined with the low wall thickness, gives full optical access to the tube. All optical spectroscopies are therefore generally accessible.

However, the inner and outer surfaces are not manufactured to optical requirements. For optical measurements that require low optical wavefront distortion. KI-BEAM tubes are generally not suitable.

The wide range of accessible measurement techniques allows sample transfer between different measurement instruments without the need for sample removal / recovery from the tube.

KI-BEAM tubes are available in polycarbonate, ABS, PVDF and in an acrylonitrile-methyl acrylate impact- and biocompatibly-modified copolymer. They are normally available with round or square cross-section. They can be cut to length using a simple razor blade or scalpel.

Custom shapes (flat, multi-lumen) can be manufactured to custom requirements. Other customizations can be made to modify optical and X-ray transmission, tube, piston and cap materials, and to functionalize the end caps with the addition of fittings or complex structures.

Two polyethylene conical caps are provided with each tube.

**PATENT PENDING**

### Features

- Unbreakable
- Thin wall (50 and 100 µm standard thicknesses)
- Integrated piston
- X-ray transparency (typical transmission >97% @ 1 Å wavelength)
- Translucent walls, good optical access
- Round and square shape
- Pluggable and unpluggable without sample or tube damage
- Chemically stable materials

### Applications

- Liquid sample manipulation
- Liquid / powder sample storage
- spectrophotometry, fluorimetry, colorimetry
- X-ray scattering
- microreactions
- microcalorimetry

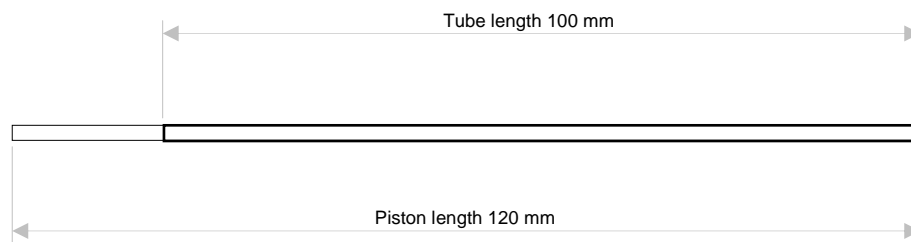
## Ordering information

### Ordering codes

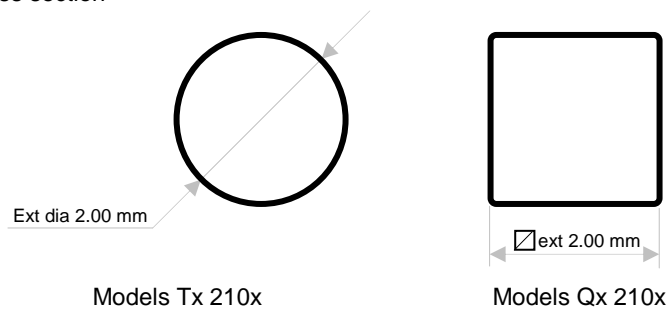
	○ Ø2 mm L 100 mm  100 µm wall thickness	○ Ø2 mm L 100 mm  50 µm wall thickness	□ 2x2 mm L 100 mm  100 µm wall thickness	□ 2x2 mm L 100 mm  50 µm wall thickness
<b>Polycarbonate</b>	TP 2101	TP 2105	QP 2101	QP 2105
<b>ABS</b>	TA 2101	TA 2105	QA 2101	QA 2105
<b>PVDF</b>	TV 2101	TV 2105	QV 2101	QV 2105
<b>Acrylonitrile-methyl acrylate cop.</b>	TB 2101	TB 2105	QB 2105	QB 2105

## Physical dimensions

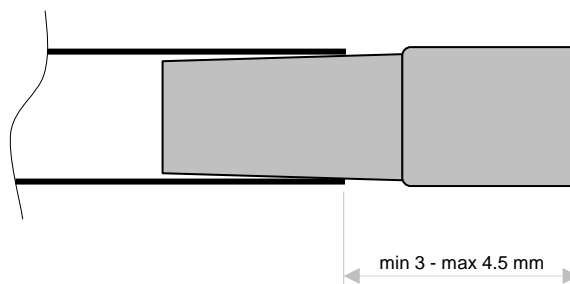
### Side view (all models)



### Tube cross section



### End cap overhang (all models)

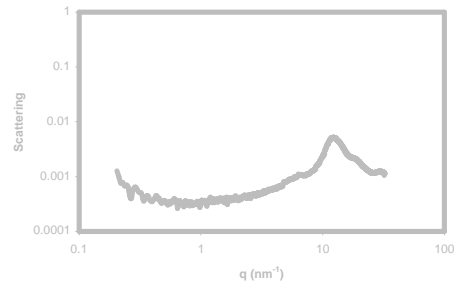


## X-ray scattering @ 1 Å wavelength

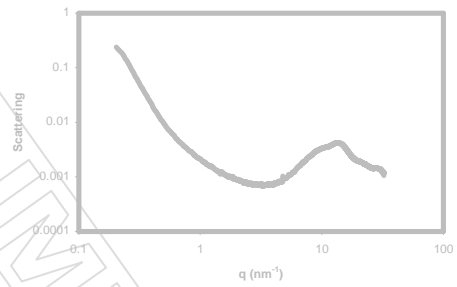
The absolute scattering by the tube, measured @ 1 Å wavelength, is reported as  $(\partial\sigma/\partial\Omega)/S$ , being normalized to the impinging beam cross-section  $S$ . All data is typical, and should not be considered as a guaranteed or certified specification, unless otherwise stated.

NOTE: PRELIMINARY DATA.

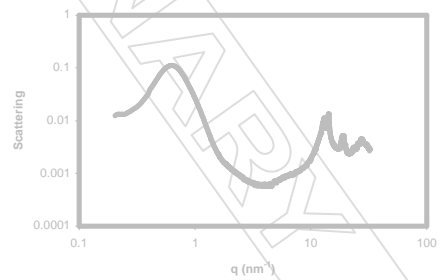
xP 2105



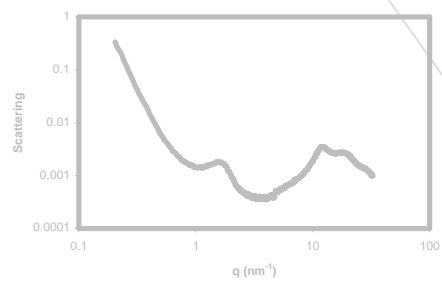
xA 2105



xV 2105



xB 2105



## Recommended operating conditions

As with all polymeric vials, operating conditions depend strongly on the sample, on the environment and on the applied stresses. The values are therefore intended as a guideline only, and specific tests are recommended before use.

### Temperature range:

Polycarbonate: -20°C to 120°C  
ABS: -20°C to 95°C  
PVDF: -20°C to 80°C  
Acrylonitrile cop.: -20°C to 105°C

## LIFE SUPPORT POLICY

KI-BEAM TUBES ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL BY ENKI S.R.L. . As used herein:

- a life support system is a device or system which is intended for surgical implant into the body, or intended to support or sustain life, and whose failure to perform can be expected to result in injury to the user.
- a critical component is any component of a system whose failure to perform can be expected to cause the failure of the system, or to affect its safety or effectiveness.



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