

BioRef: The Reflectometer for Biological Applications (V18) at BER II

Helmholtz-Zentrum Berlin für Materialien und Energie *

Instrument Scientist:

- Dr. Marcus Trapp, Helmholtz-Zentrum Berlin für Materialien und Energie
phone: +49 30 8062-43020, email: marcus.trapp@helmholtz-berlin.de

Abstract: The time-of-flight neutron reflectometer BioRef is dedicated to the investigation of solid-liquid interfaces, in particular for soft matter applications. The possibility to mount a FTIR-ATR to the sample stage offers the possibility of combined *in-situ* measurements.

1 Introduction

BioRef is a time-of-flight neutron reflectometer with strong focus on soft matter applications, in particular at solid-liquid interfaces in the context of biological model systems under physiological conditions, including non-equilibrium situations. The instrument was built in joint effort of Ruprecht-Karls-Universität Heidelberg (RKU) and HZB within the “BMBF Verbundforschung” funding scheme. Unique features of BioRef are the chopper system, which allows for focusing on a selected Q-range in order to support fast kinetic studies, and the availability of simultaneous *in-situ* infra-red (IR) spectroscopy measurements. The latter complement the structural information provided by neutron reflectivity (NR) with information on the molecules’ conformational order.

The add-on IR spectroscopy unit allows for the *in-situ* investigations of Si-supported interfaces in ATR (attenuated total reflection) geometry. A Bruker Vertex 70 infrared spectrometer is installed at the sample position for the very reason. The IR beam enters the Si substrate through the inclined top surface (45°) under 90° incidence, is then totally reflected internally several times at the sample surface (front side) and the backside of the Si-substrate before leaving the substrate through its inclined bottom face and deflected into an external IR-detector. The setup enables combined *in-situ* (kinetic) NR and IR studies with z-resolved depth profiles from about 5 – 420 nm total thickness and conformational information on the embedded molecules acquired at the same time.

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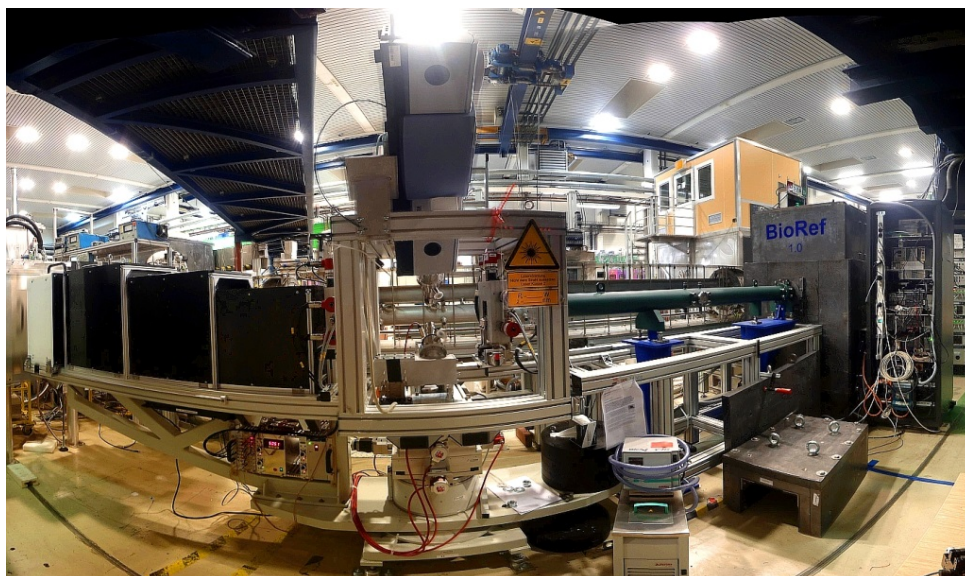


Figure 1: View of V18.

2 Instrument application

Typical applications are:

- Solid-liquid interfaces
- Combined NR and ATR-FTIR measurements
- Time resolved NR

3 Instrument layout

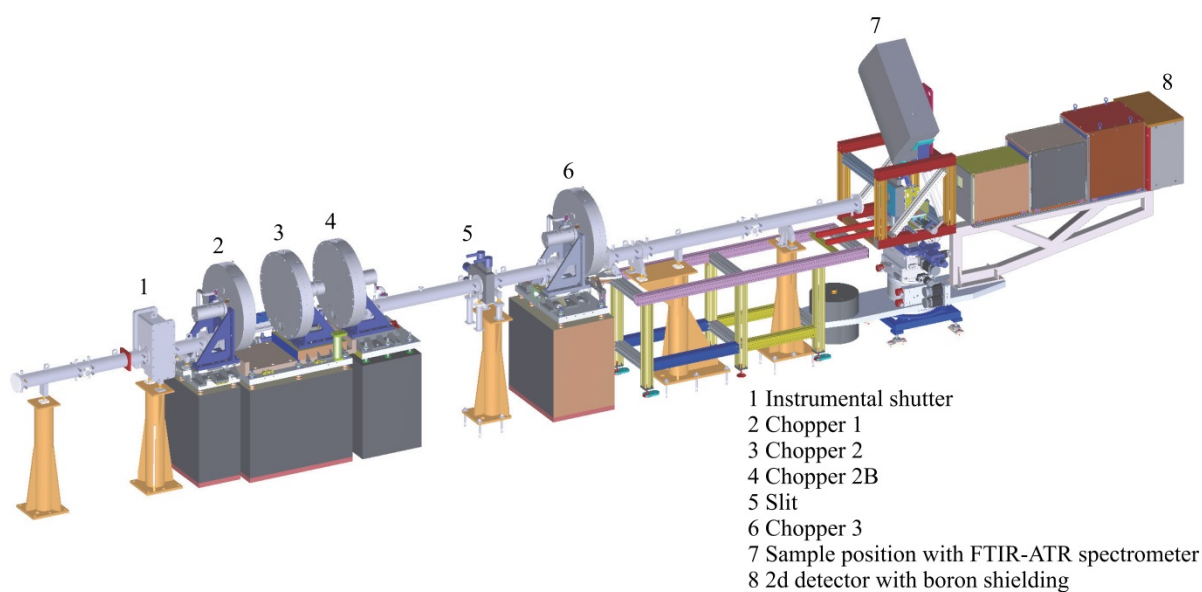


Figure 2: Schematic view of V18.

4 Technical Data

Neutron guide	NL 3b
Wavelength	90 Hz: 2.0 - 6.0 Å 45 Hz: 2.0 - 10.0 Å 25 Hz: 2.0 - 16.4 Å
Wave length resolution	Constant $\Delta\lambda/\lambda = 1 - 5\%, 7\% - 11\%$
Scattering plane	Horizontal
Range of reflectivities	1×10^{-7} with a 50x80 mm ² sample
Q resolution	$\Delta Q/Q = 1.4 - 7\%$ and $10 - 15\%$
Detector	300 x 300 mm ² Multiwire PSD detector
Polarized neutrons	No
Instrument options	Possibility of combined NR and ATR-IR measurements
Sample environment	• Rectangular flow cells (50x80 mm²) • Round flow cells ($\varnothing$ 60 mm) • Hydration chamber

Table 1: Technical data of V18.

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