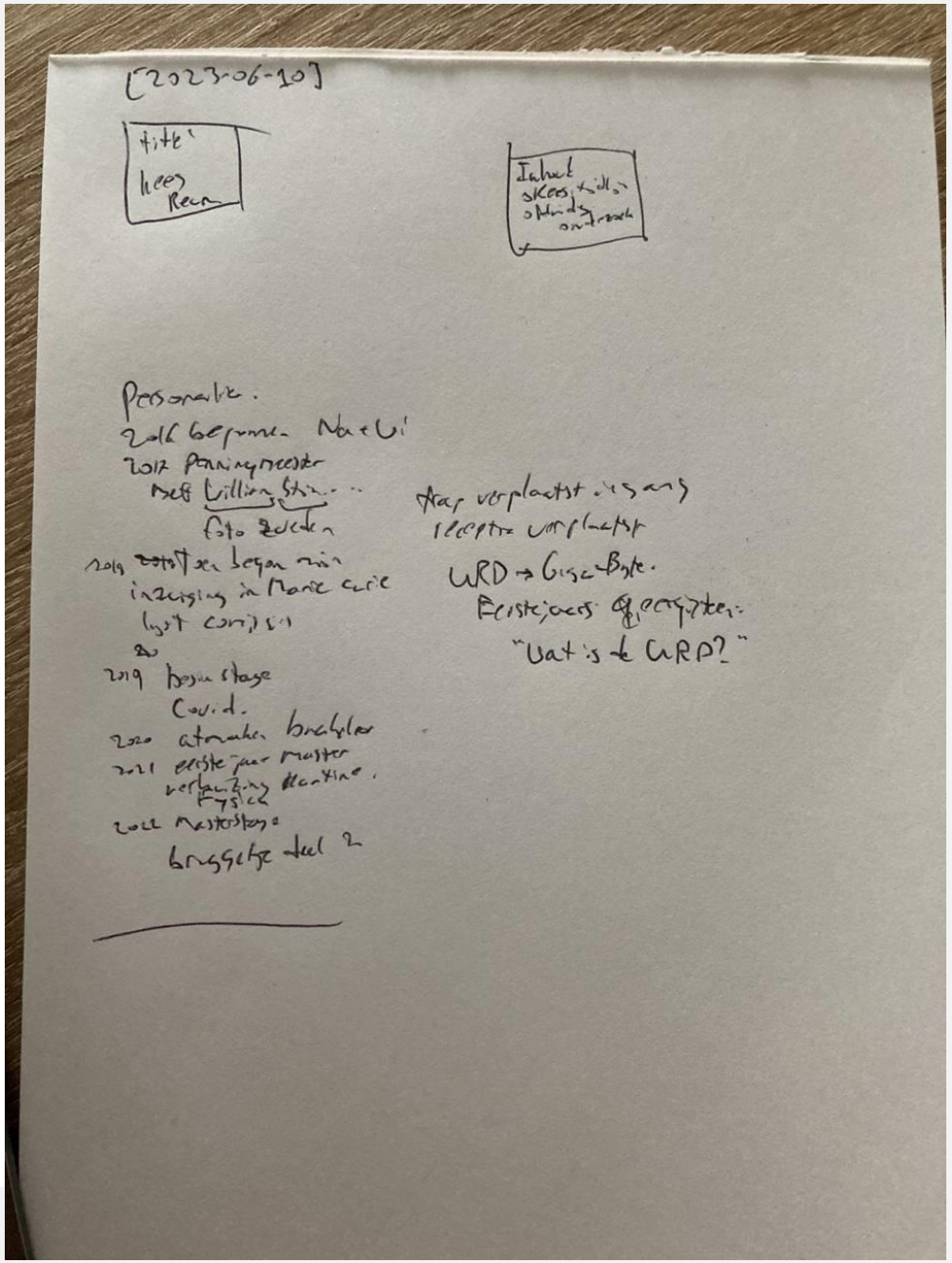
Reünistendag 2023

10-06-2023 voor S.V. Marie Curie
Kees van Kempen <ru@keesvankempen.nl>
Life Science Trace Detection Laboratory

INHOUD

- Tijdlijn 2016 – 2023
- Huidig onderzoek:
  - Absorptiespectroscopie met supercontinuumbronnen voor sporengassenonderzoek



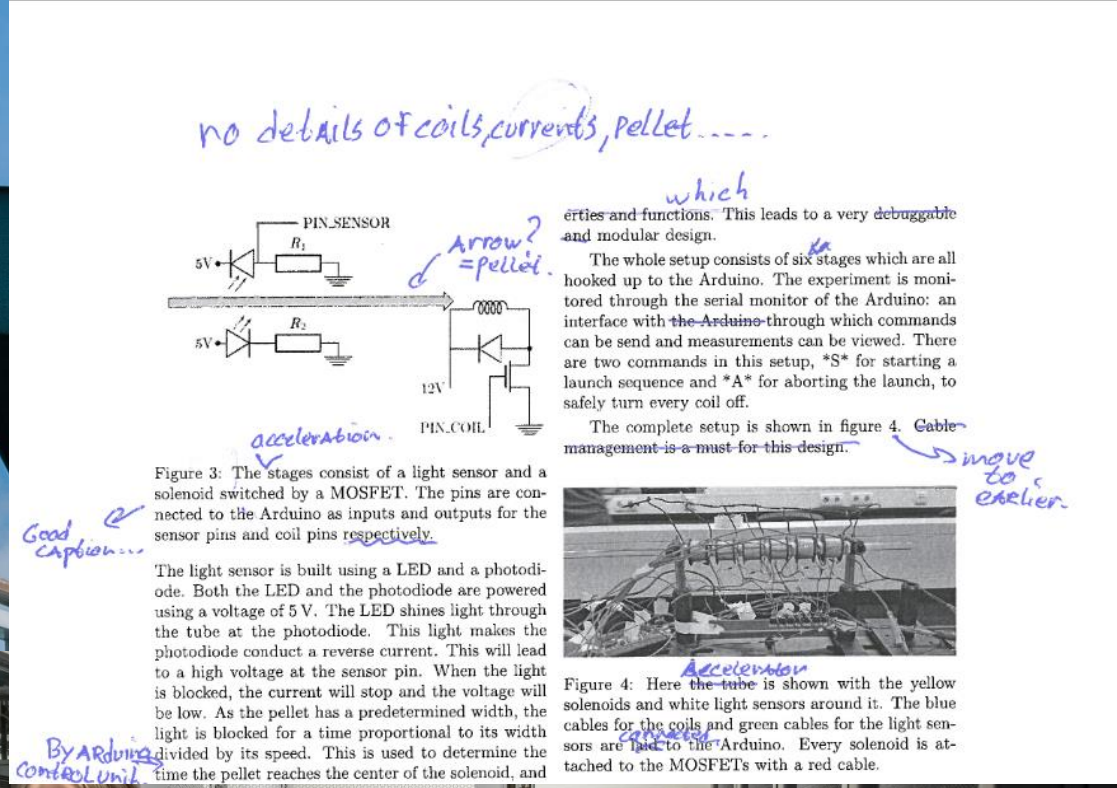
TIJDLIJN
2016 – 2017

- Eerstejaars student NaSt + Wi
- Aanraking Marie Curie: Diescie met Beate en Thoma
- Tijdens een college groepentheorie door Bartje gestrikt worden te besturen

versity

TIJDLIJN
2017 – 2018 (1/2)

- Besturen
  - AVG
  - Digitalisering
- Lustrum!
- Mentorouder
- Commissies:
  - Batacie
  - www-cie
  - Excurcie
- Practicum 2b
- Wiskunde is moeilijk



no details of coils, currents, pellet.....

Figure 3: The stages consist of a light sensor and a solenoid switched by a MOSFET. The pins are connected to the Arduino as inputs and outputs for the sensor pins and coil pins respectively.

The light sensor is built using a LED and a photodiode. Both the LED and the photodiode are powered using a voltage of 5 V. The LED shines light through the tube at the photodiode. This light makes the photodiode conduct a reverse current. This will lead to a high voltage at the sensor pin. When the light is blocked, the current will stop and the voltage will be low. As the pellet has a predetermined width, the light is blocked for a time proportional to its width divided by its speed. This is used to determine the time the pellet reaches the center of the solenoid, and

erties and functions. This leads to a very debuggable and modular design.

The whole setup consists of six stages which are all hooked up to the Arduino. The experiment is monitored through the serial monitor of the Arduino: an interface with the Arduino through which commands can be send and measurements can be viewed. There are two commands in this setup, *S* for starting a launch sequence and *A* for aborting the launch, to safely turn every coil off.

The complete setup is shown in figure 4. Cable management is a must for this design.

Figure 4: Here the tube is shown with the yellow solenoids and white light sensors around it. The blue cables for the coils and green cables for the light sensors are laid to the Arduino. Every solenoid is attached to the MOSFETs with a red cable.

TIJDLIJN

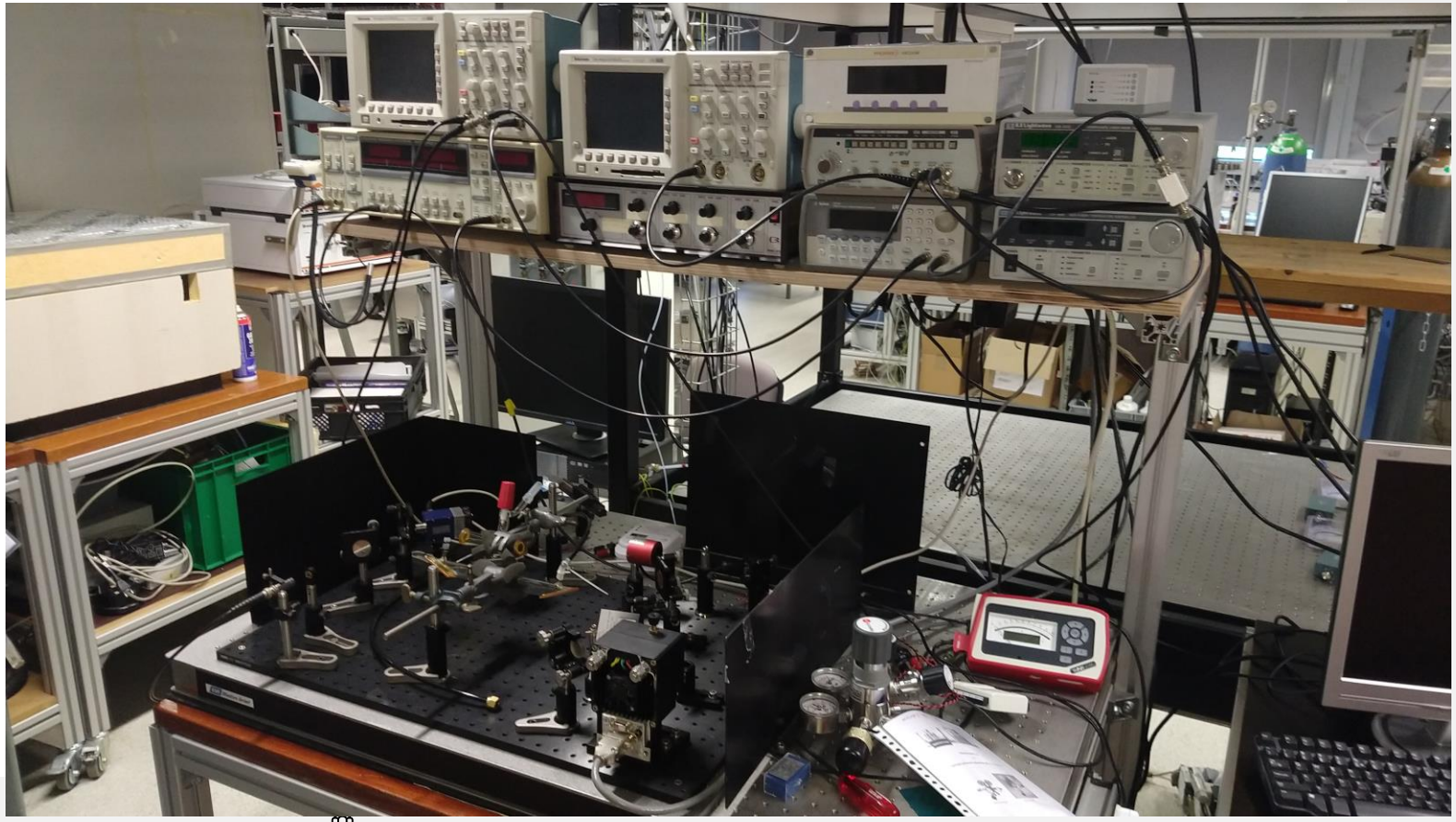
2017 – 2018 (2/2)

TIJDLIJN
2018 – 2019

- Studiereis Japan
- Lijst commissies werd lang
  Batacie, www-cie, Educacie, Interferencie, Kascontrolecommissie, Observacie, …
- Belangenverstrengeling

TIJDLIJN
2019 – 2020

- Bachelorstage
- Covid-19



TIJDLIJN
2020 – 2021

- Afmaken bachelorstage
- Lekker veel lock-downs
- Weer mentorouder

TIJDLIJN
2021 – 2022

- Master Physics of Molecules and Materials
- Was dit het jaar van de statutenwijziging of heb ik dat even tactisch overgeslagen?
- Nieuw Zuid

TIJDLIJN
2022 – 2023

- Masterstage bij Life Science Trace Detection Laboratory (TDLab)
- Persoonlijk Batarecord

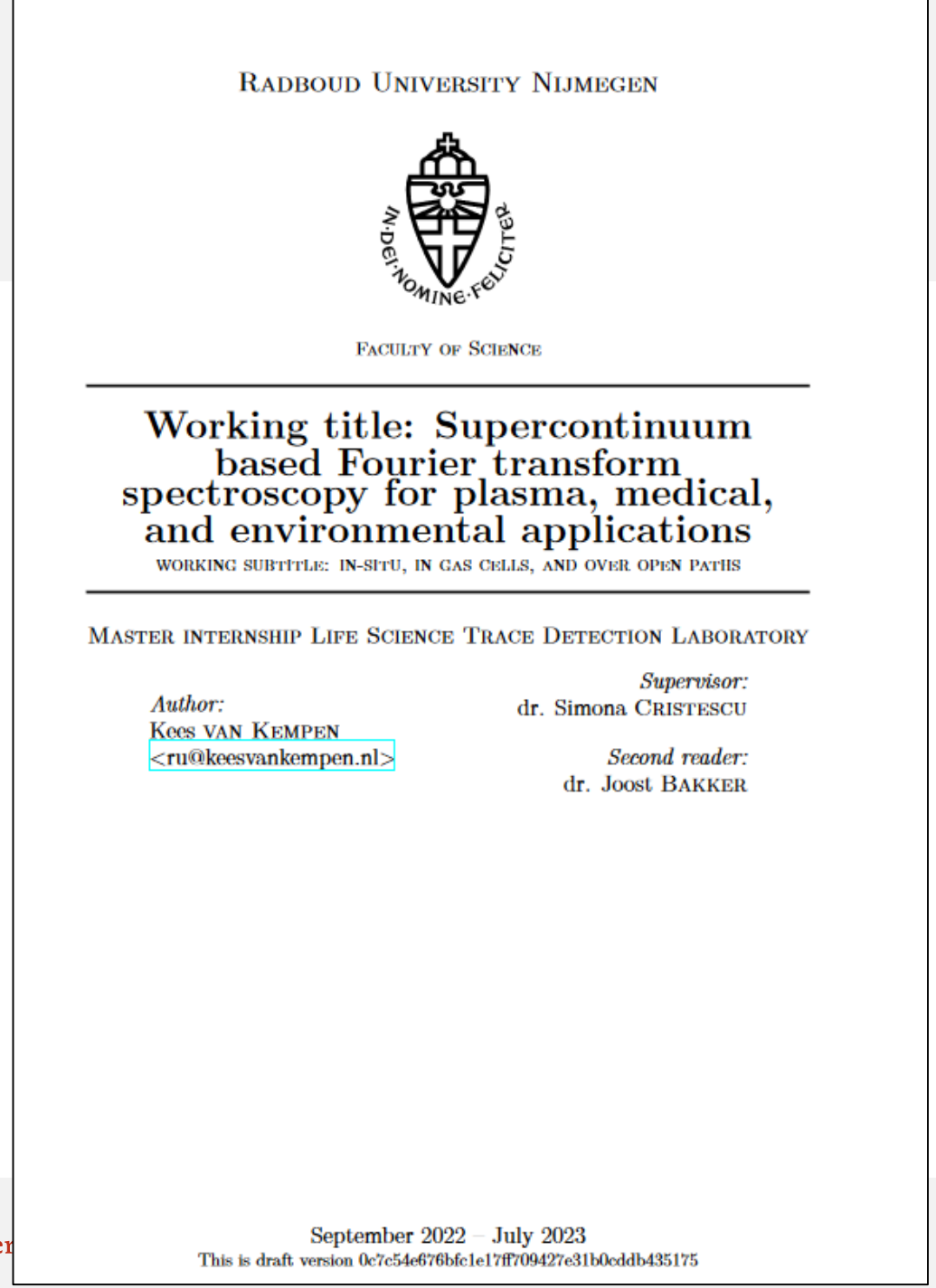
Officieuze ploeg-uitslag van Marie Curie

10

#	Naam	Tijd	Snelheid	Straftijd	Fc	Klass. tijd	#	Cum. tijd	Cum. #
01	Kees van Kempen	00:24:06	14.80	00:00:00		00:24:06	61	00:24:06	60

TIJDLIJN
2023 – ∞

- Ik ga afstuderen ☺.



RADBOUD UNIVERSITY NIJMEGEN

FACULTY OF SCIENCE

Working title: Supercontinuum based Fourier transform spectroscopy for plasma, medical, and environmental applications

WORKING SUBTITLE: IN-SITU, IN GAS CELLS, AND OVER OPEN PATHS

MASTER INTERNSHIP LIFE SCIENCE TRACE DETECTION LABORATORY

Author:
Kees VAN KEMPEN
<ru@keesvankempen.nl>

Supervisor:
dr. Simona CRISTESCU

Second reader:
dr. Joost BAKKER

September 2022 – July 2023
This is draft version 0c7c54e676bfc1e17ff709427e31b0cddb435175

OVERGANG

EEN GOED MOMENT VOOR EEN KORTE PAUZE

- https://hetiswarm.nl/

ONDERZOEK

LIFE SCIENCE TRACE DETECTION LABORATORY

ONDERZOEK
IN EEN NOTENDOP

- We kijken naar lage concentraties gas/vloeistof(/vaste stof).
- Ik kijk naar mid-infraroodspectra van moleculen.
- Ik gebruik daarvoor
  - Een supercontinuumbron
  - Een Fourier transform spectrometer
  - LabVIEW
  - MATLAB
  - Veel koffie

- Waarom dan?

ONDERZOEK

MOTIVATIE

- Plasmakatalytische omzetting van CO_2 naar ethanol et al.
- Medische en algemenere gezondheidstoepassing
- Uitstoot natuur, industrie, rioolwaterzuivering

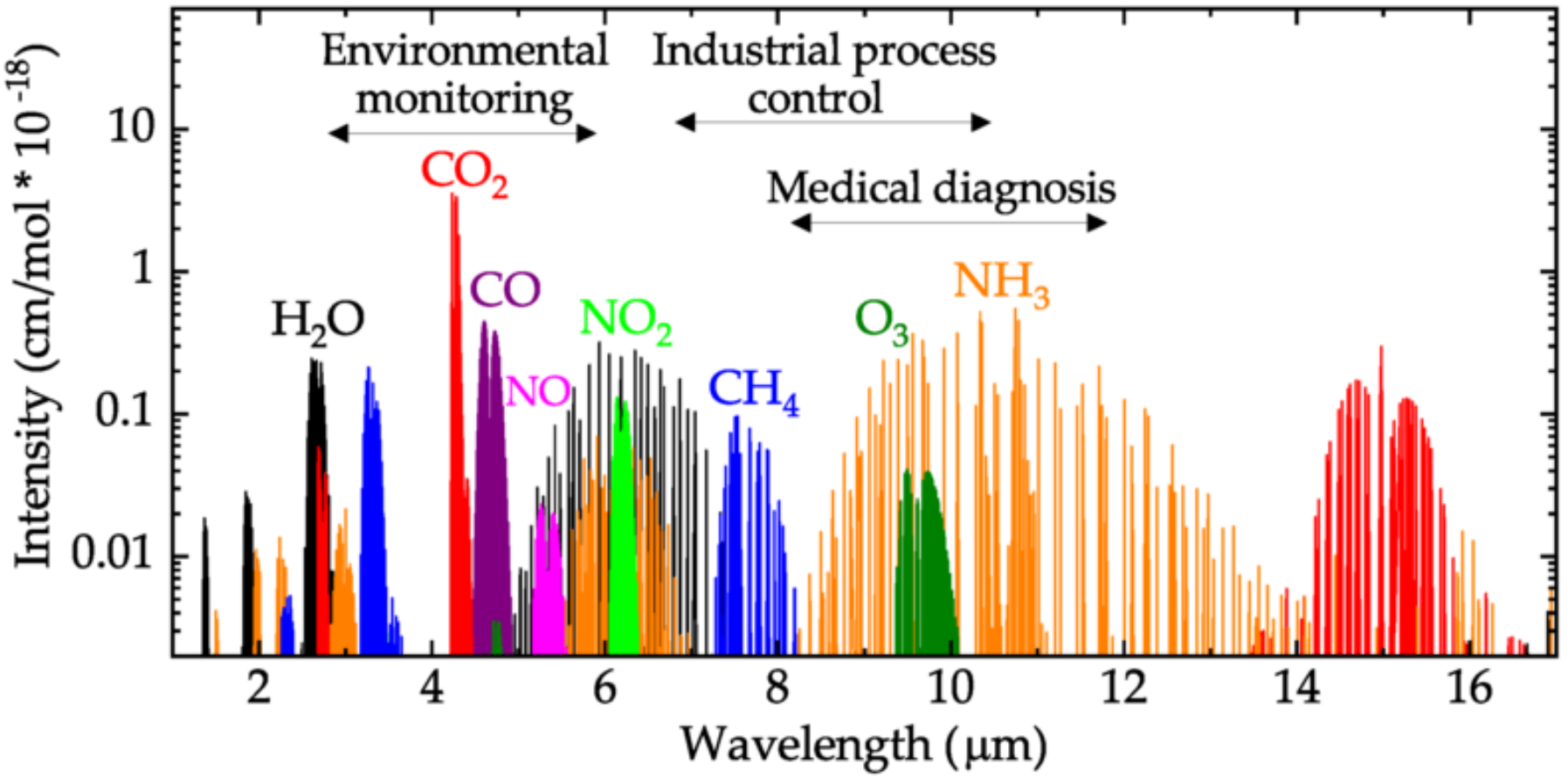
ONDERZOEK
ABSORPTIESPECTRA

Greek letter, epsilon

$$\log_{10}\frac{I_o}{I} = \varepsilon\, l\, c$$

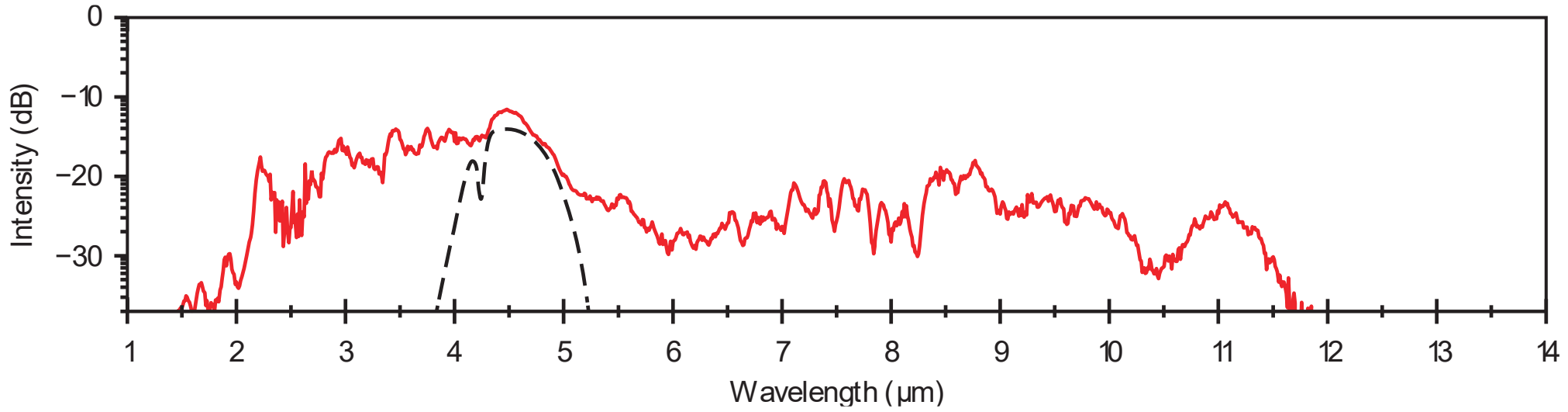
concentration of solution (mol dm^{-3})

length of solution the light passes through (cm)



ONDERZOEK

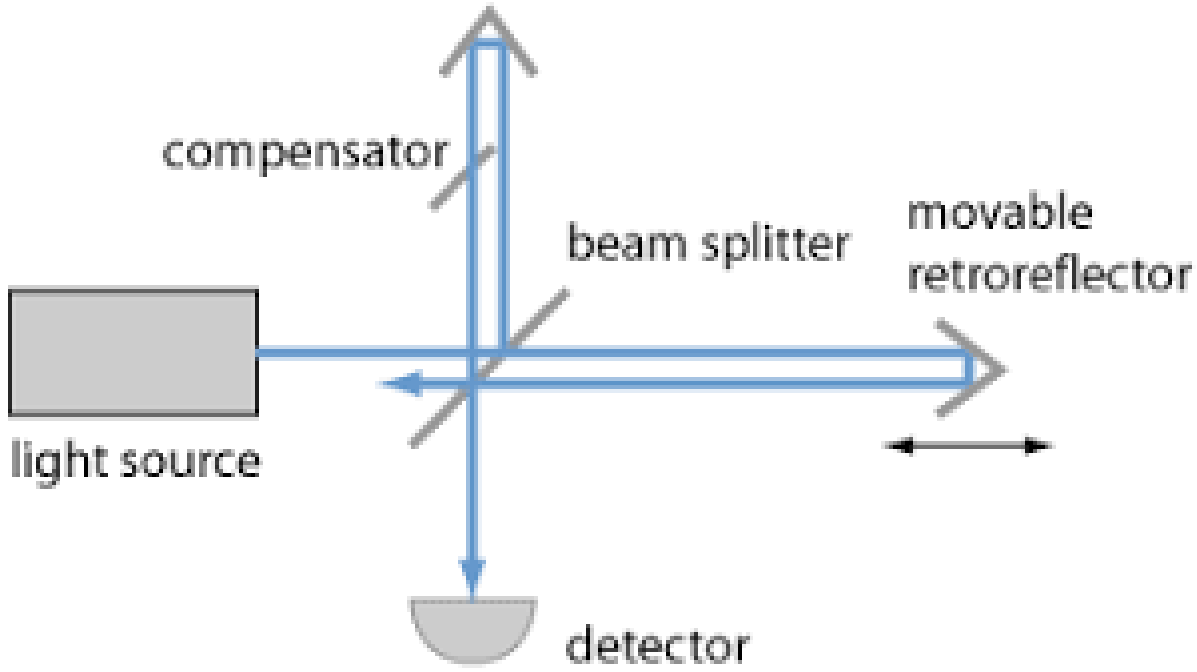
SUPERCONTINUUM



Petersen, Christian Rosenberg, e.a. 'Mid-Infrared Supercontinuum Covering the 1.4–13.3 Mm Molecular Fingerprint Region Using Ultra-High NA Chalcogenide Step-Index Fibre'. *Nature Photonics*, vol. 8, nr. 11, November 2014, pp. 830–34. *DOI.org (Crossref)*, https://doi.org/10.1038/nphoton.2014.213.

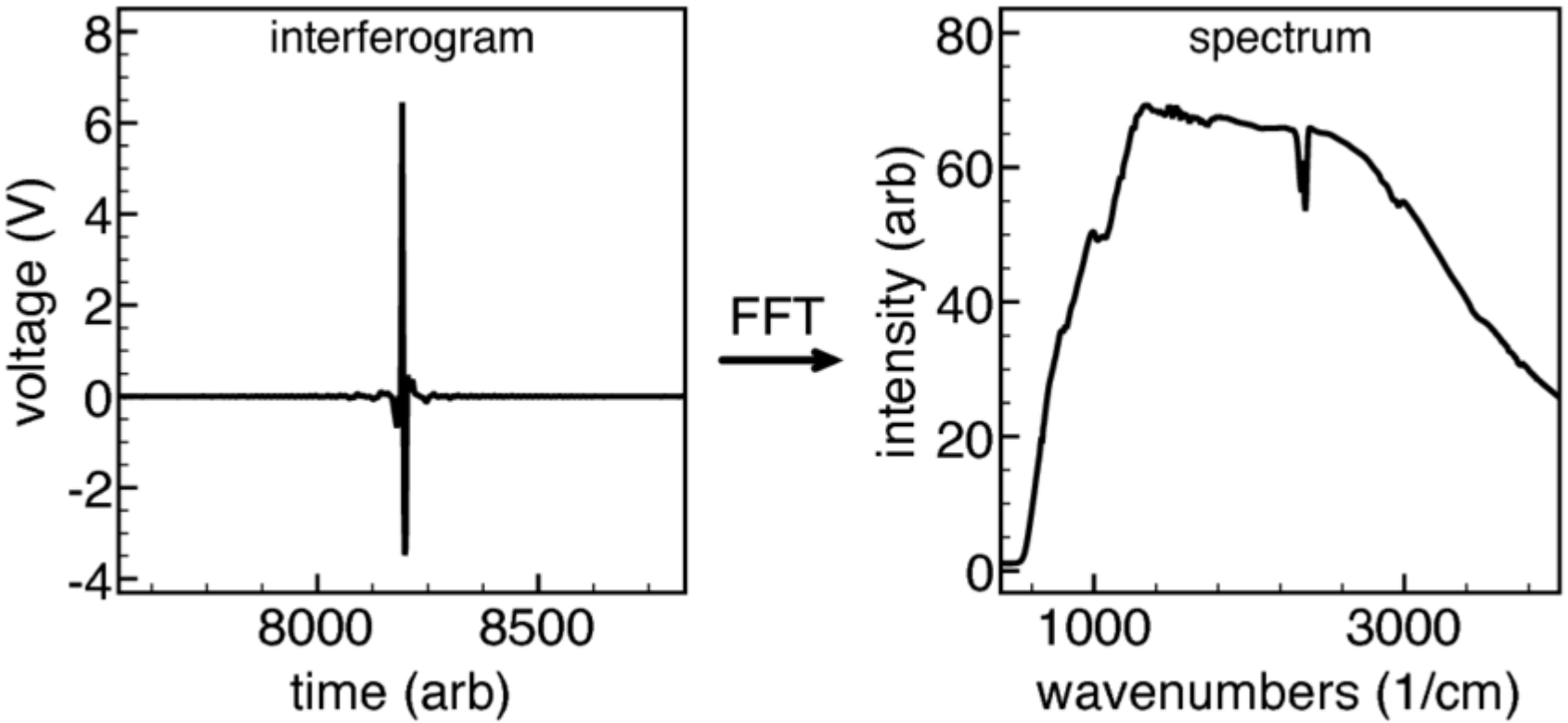
ONDERZOEK

FOURIER TRANSFORM SPECTROMETER



ONDERZOEK

INTERFEROGRAM



ONDERZOEK
OPSTELLING

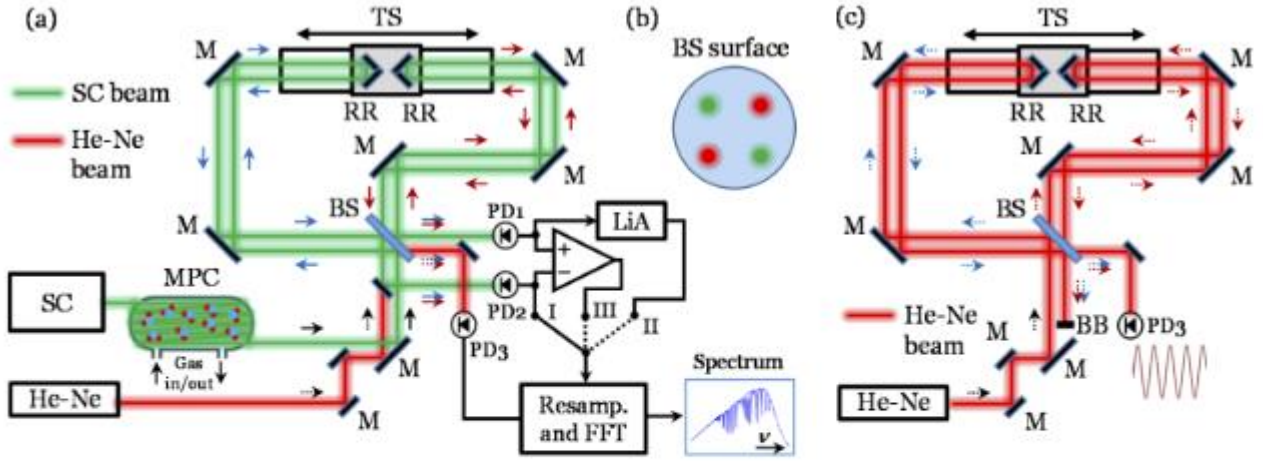
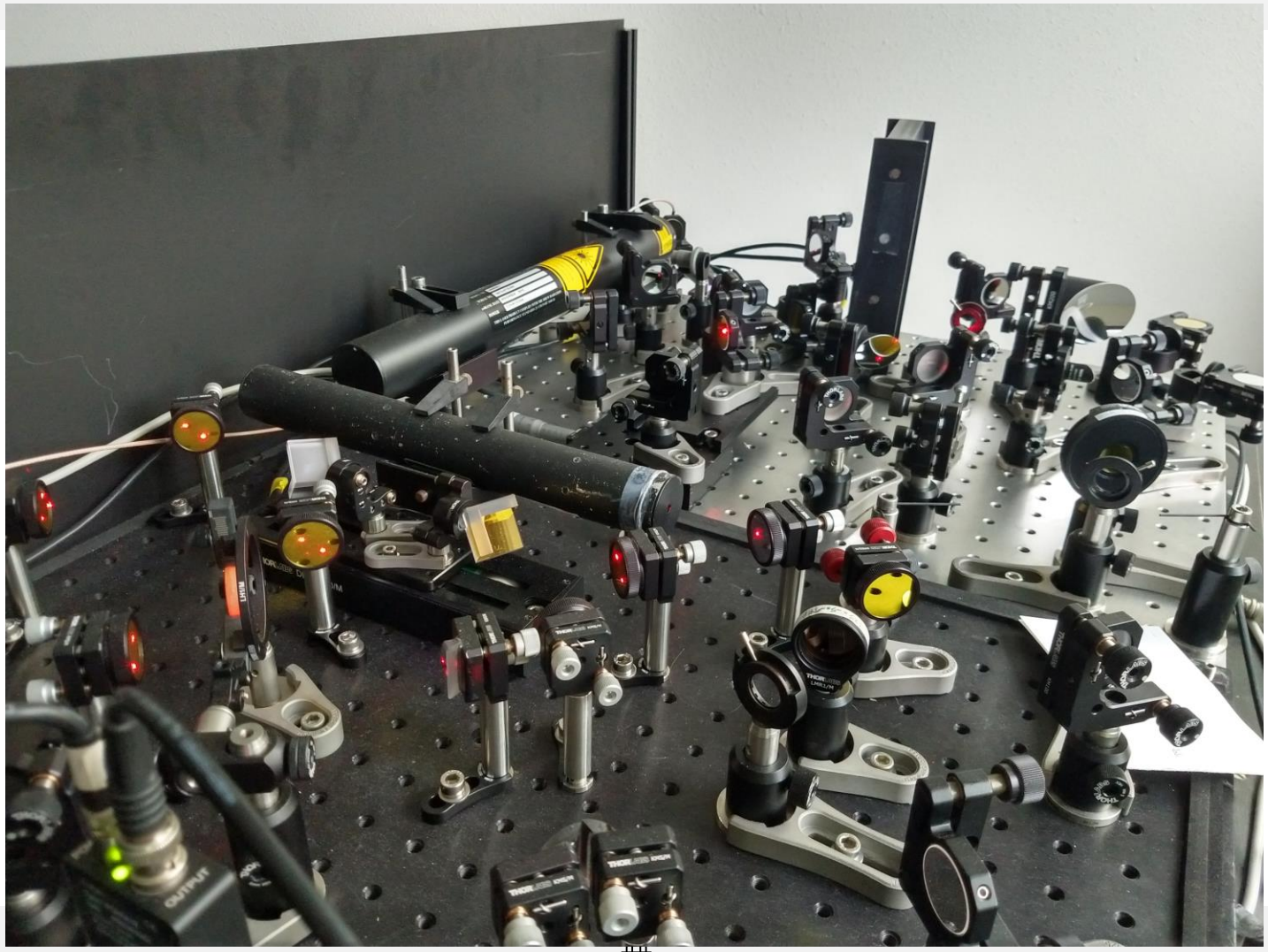


Fig. 1. (a) The experimental setup (top view of the FTS). SC: supercontinuum source, He-Ne: Helium-Neon laser, MPC: multipass cell, M: mirror, BS: beamsplitter, RR: retroreflector, TS: translation stage, LiA: lock-in amplifier. (b) The beam pattern on the surface of the beamsplitter. The two bottom beams are the insertion beams and the two top beams are the reflected beams from the retroreflectors. (c) The propagation pattern of the He-Ne laser beam in the FTS. BB: beam blocker.

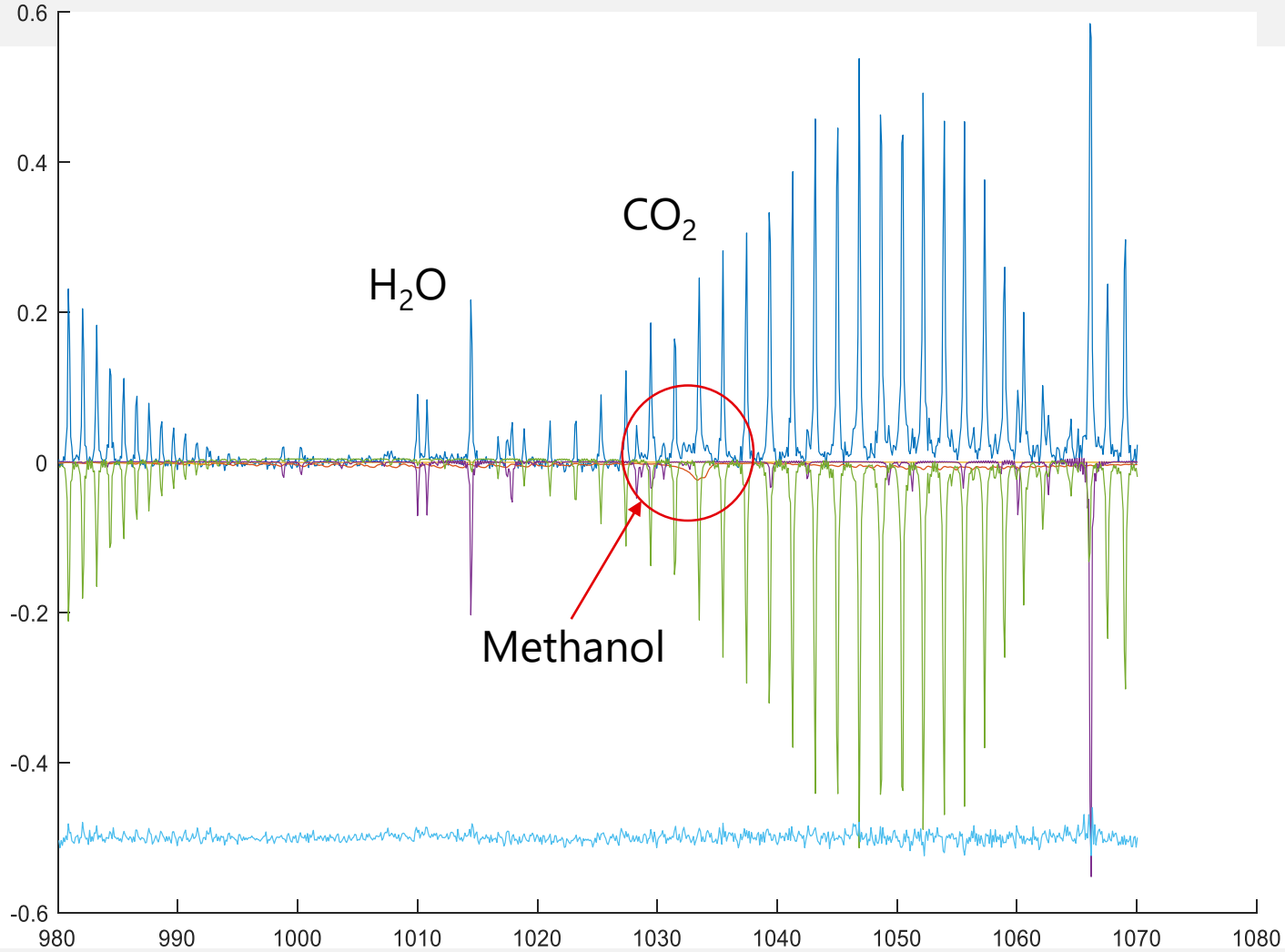
ONDERZOEK

FOURIER TRANSFORM SPECTROMETER



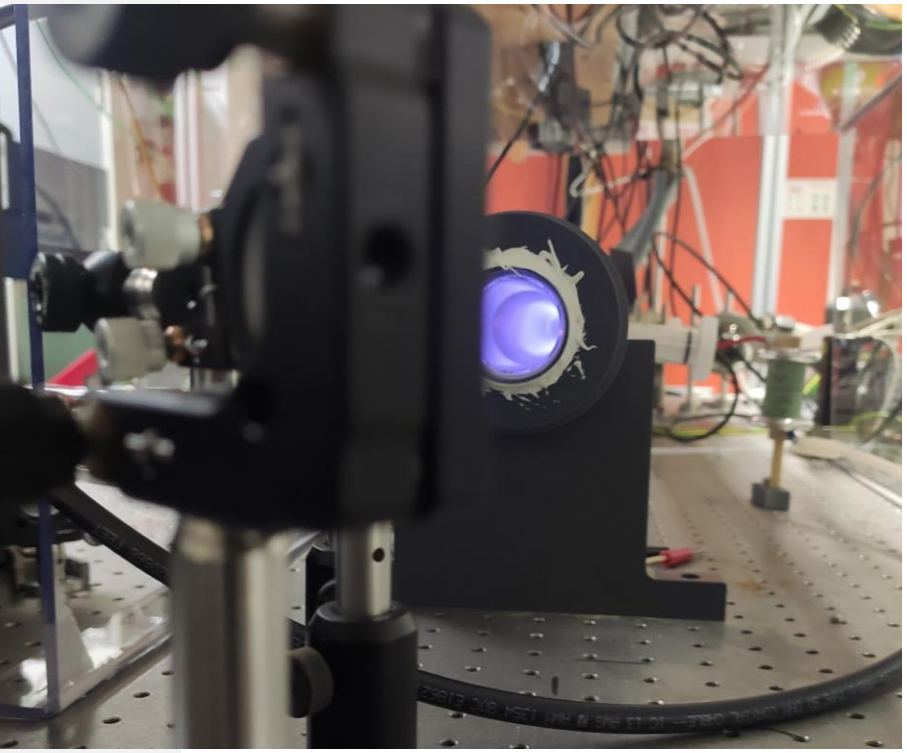
ONDERZOEK

ABSORPTIESPECTRA



ONDERZOEK

PLASMA (1/2)



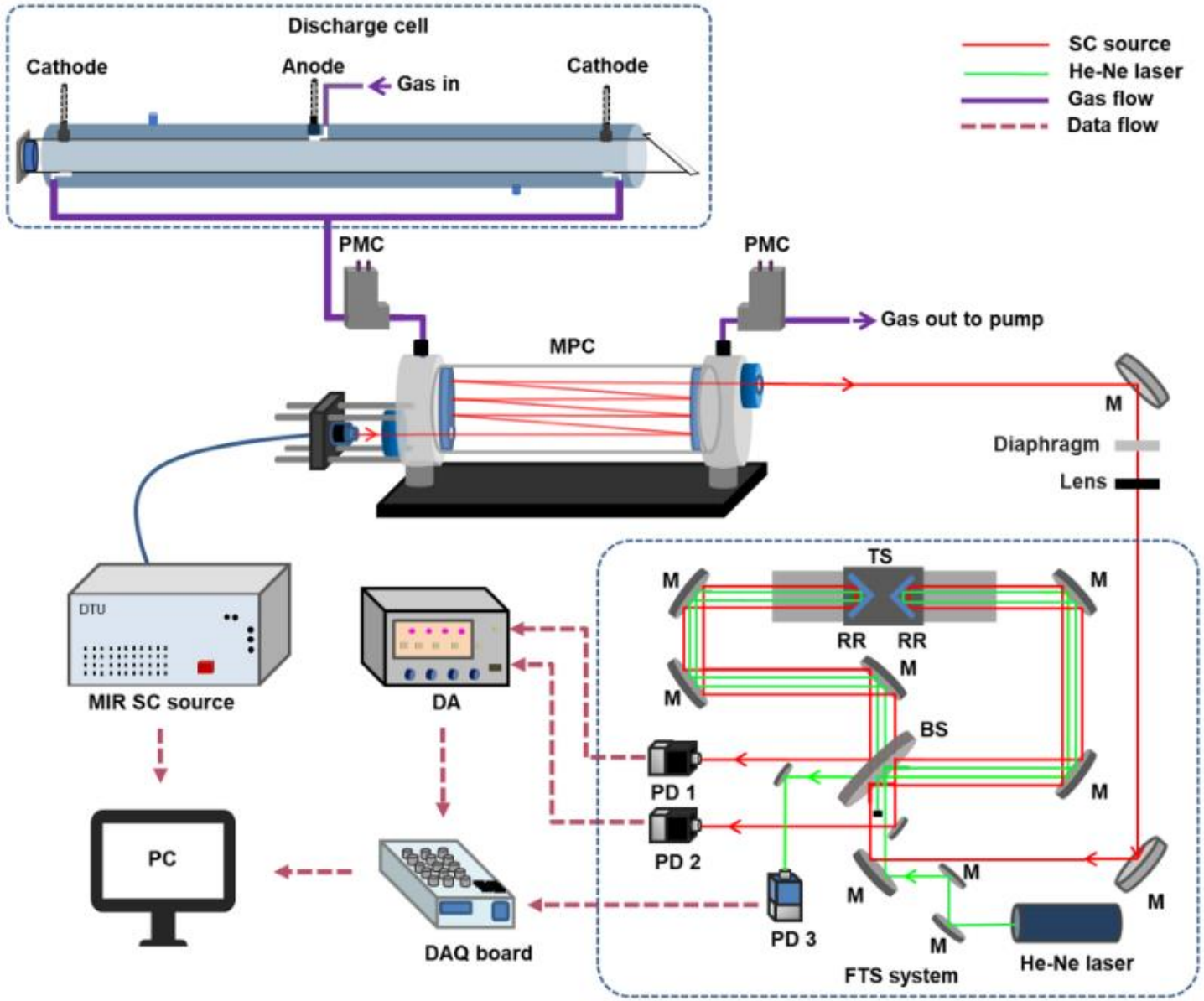


Figure 1. Experimental setup of the SC source and FTS-based multi-species detection system. *MPC* multipass cell, *PMC* pressure meter & controller, *M* mirror, *TS* translation stage, *RR* retroreflector mirror, *BS* beamsplitter, *He–Ne laser* helium–neon laser, *PD* photodetector, *DA* differential amplifier, *DAQ board* data acquisition board, *PC* computer.

ONDERZOEK

PLASMA (2/2)

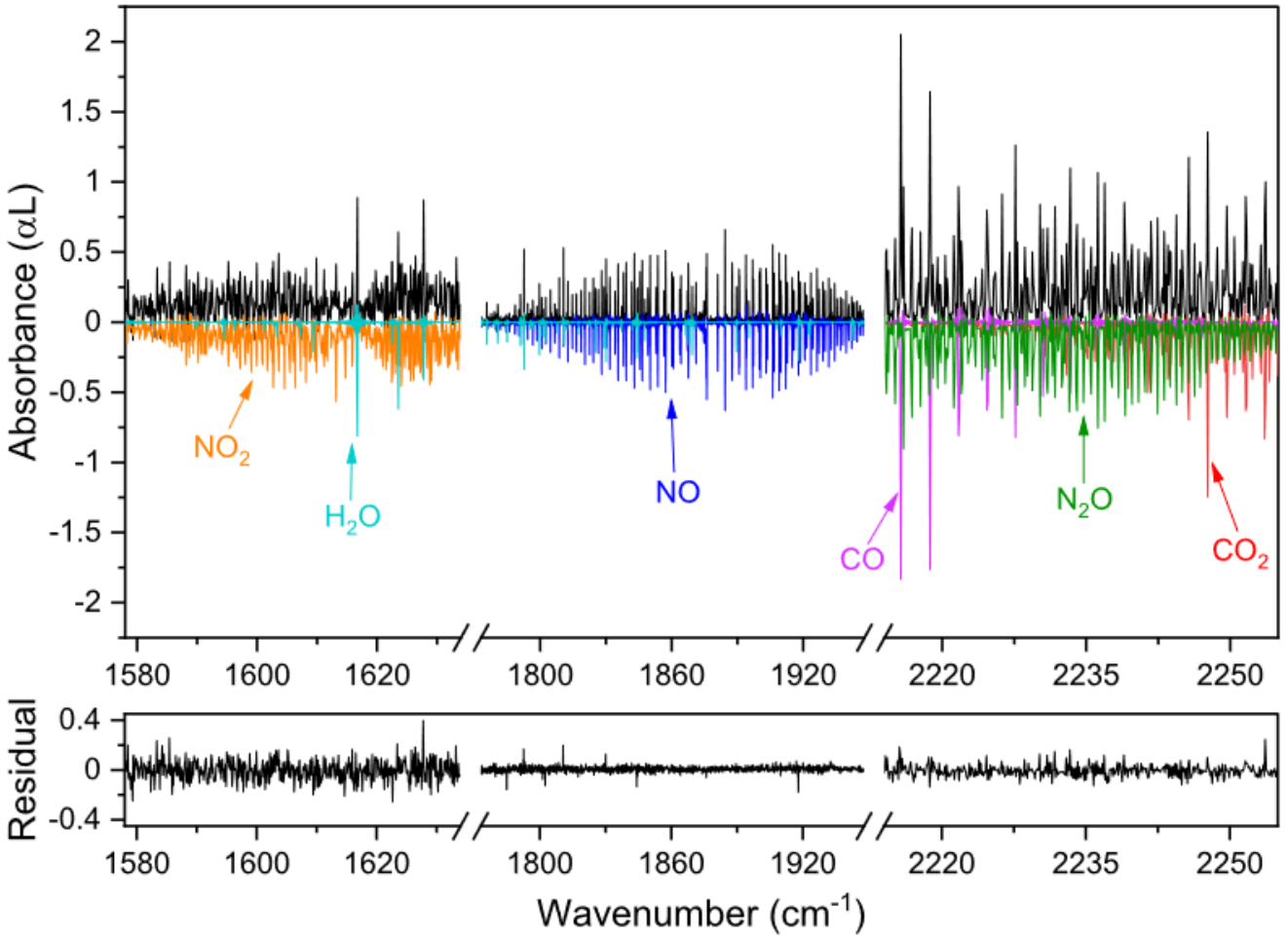
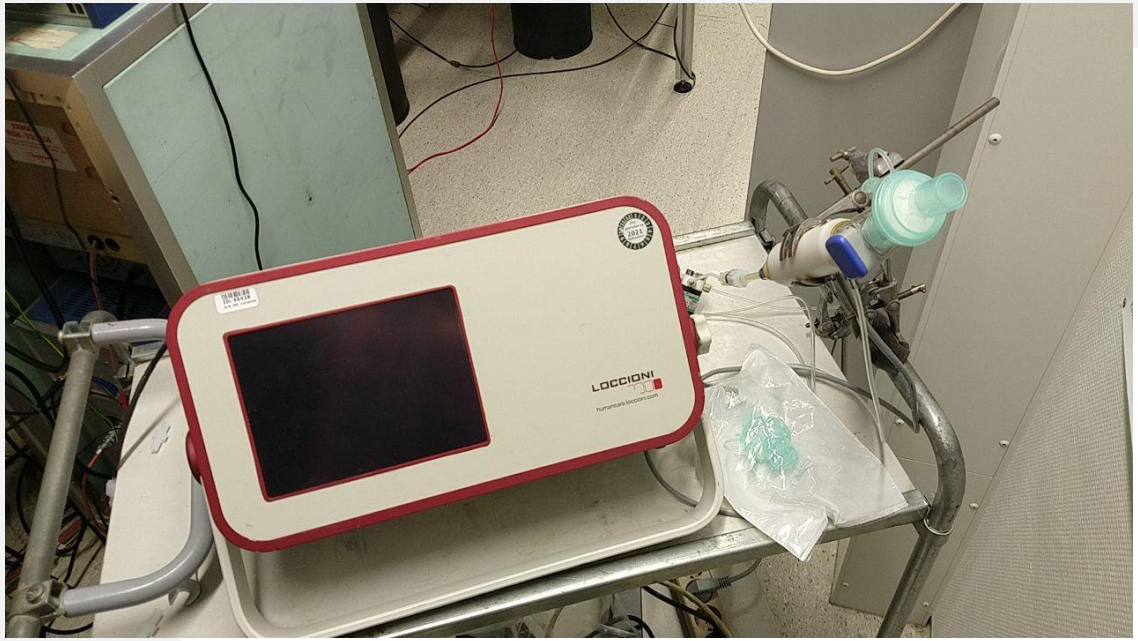
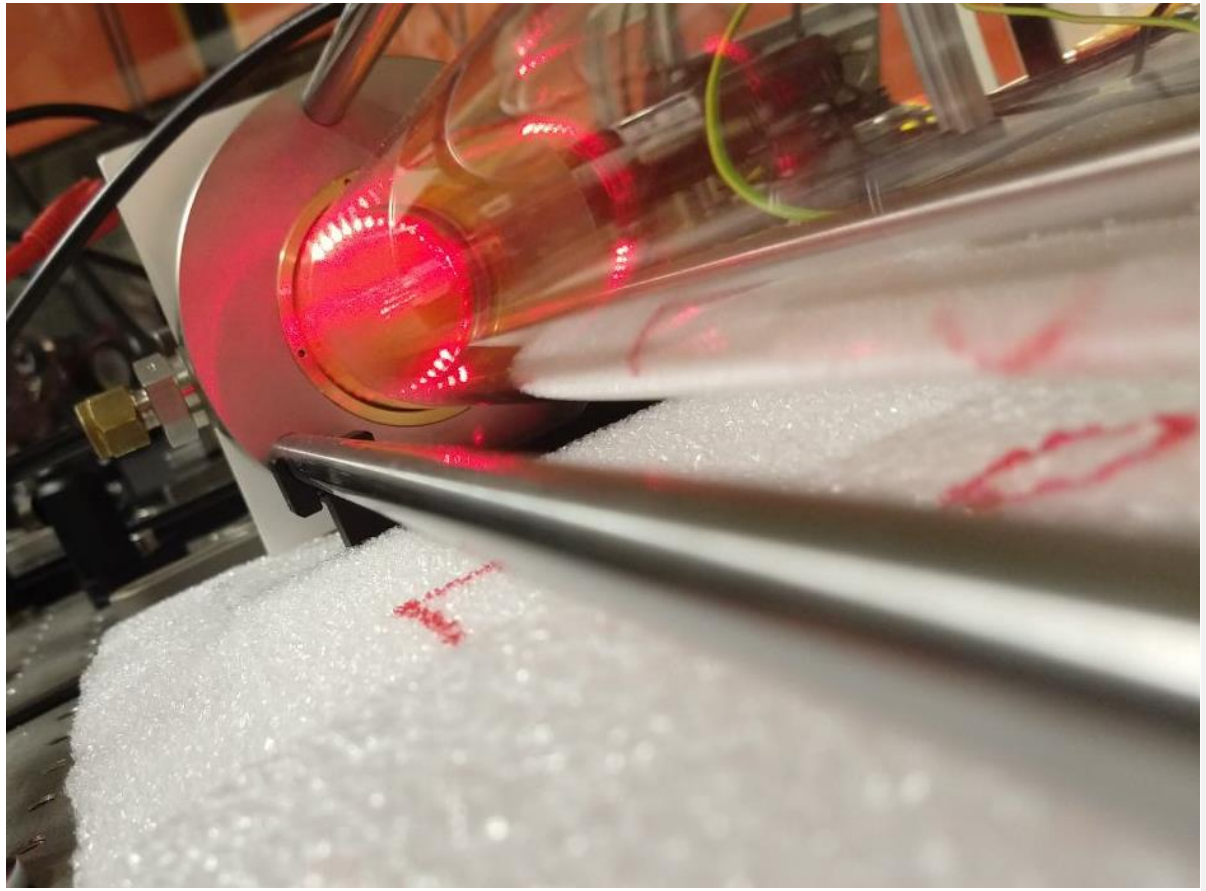


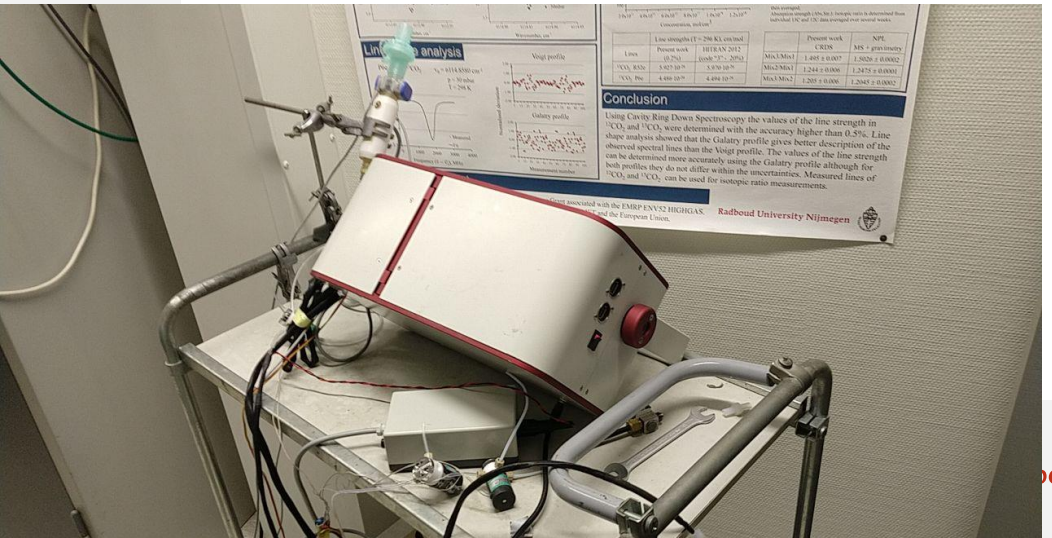
Figure 5. Measured spectrum (in black, 0.1 cm^{-1} spectral resolution, 16.5 mbar pressure, ~ 16 min) of reaction products of a 50% CO_2/50% N_2 discharge and the fitted modelled spectra (in colors, inverted) based on the HITRAN database parameters and Voigt profiles convolved with a sinc function. The residual of the fit is shown in the lower panel.

ONDERZOEK

ADEM

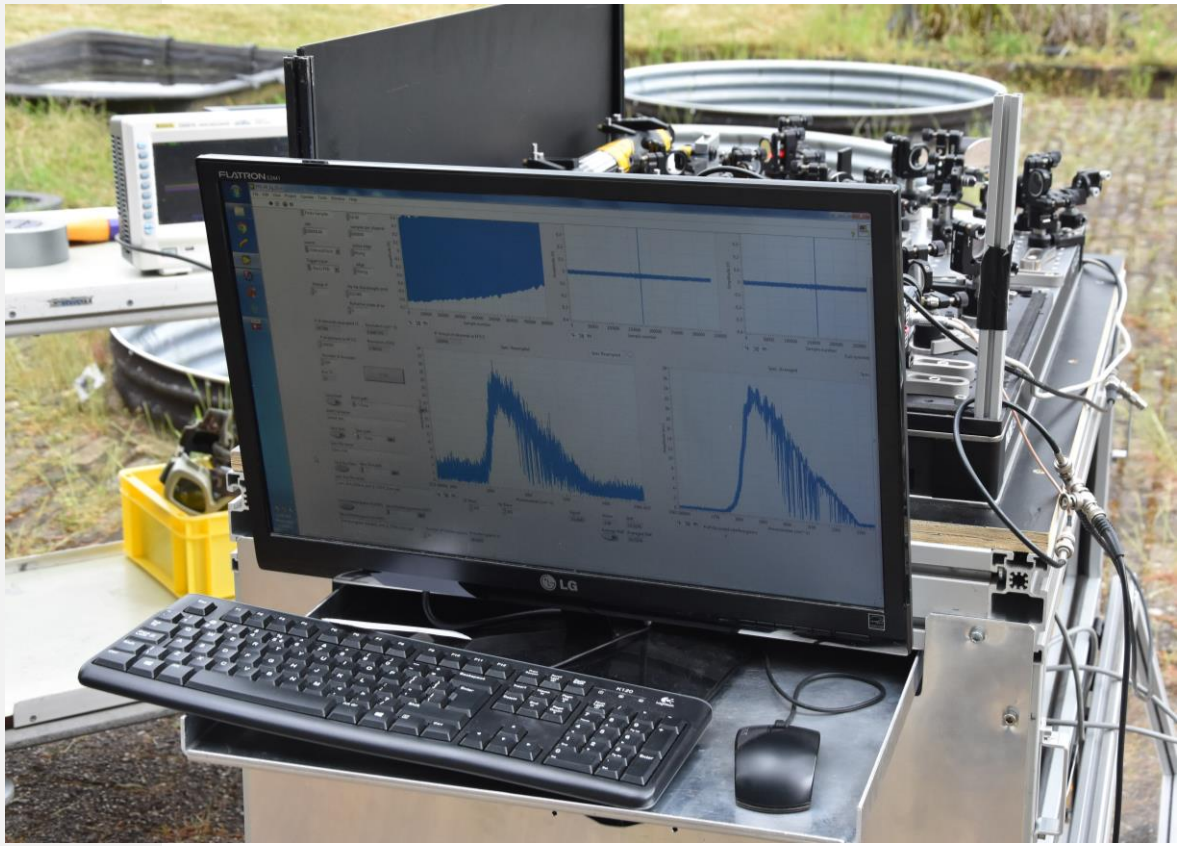






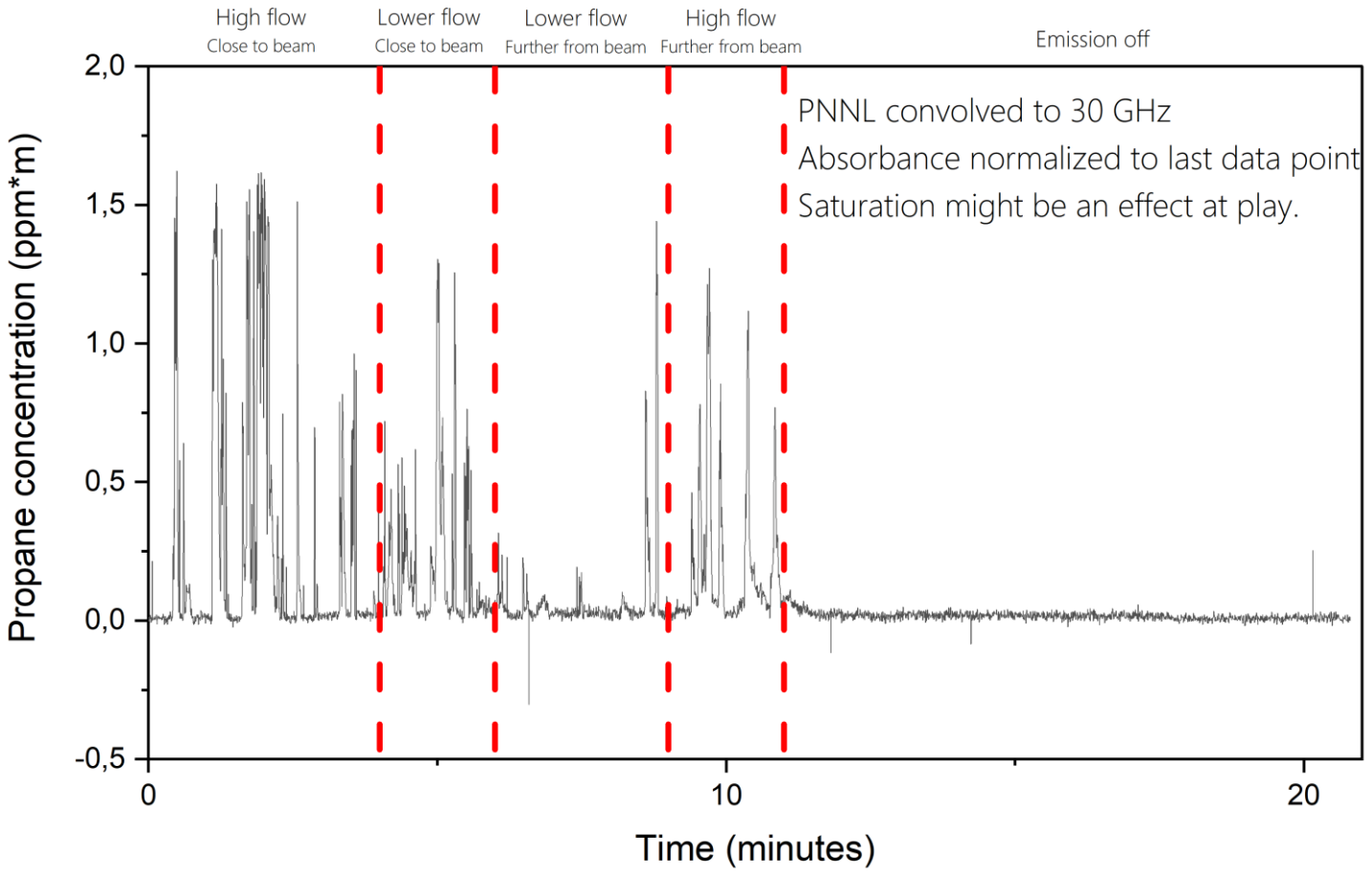
ONDERZOEK

OPEN PAD (1/2)



ONDERZOEK

OPEN PAD (2/2)



TIJDLIJN
2023 – ∞

- Tijdlijn 2016 – 2023
- Huidig onderzoek:
  - Absorptiespectroscopie met supercontinuumbronnen voor sporengassenonderzoek

- Ik ga afstuderen. Wat nu?