

Small Form Factor Readout Platform for PICs, design, accuracy and validation.

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11 & 12 DECEMBER

INTERNATIONAL

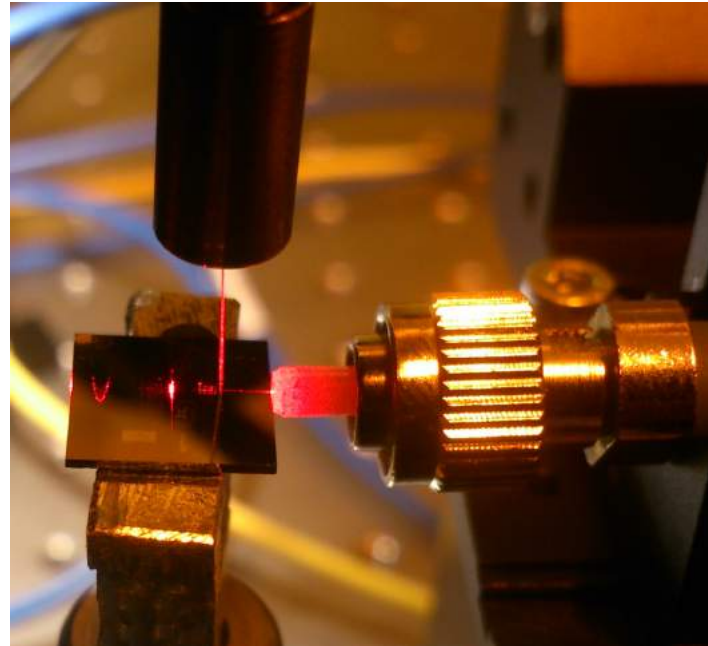
MICRO
NANO

CONFERENCE AMSTERDAM
2018

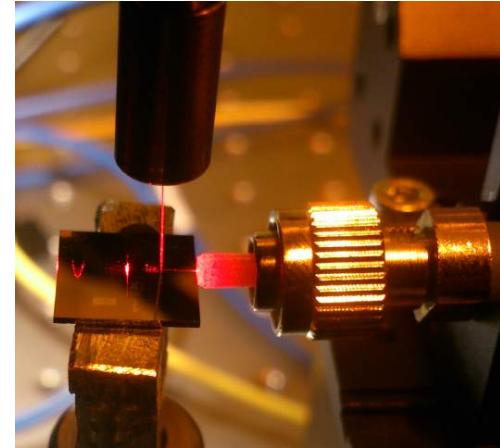
- Introduction
- Platform
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- Results
- Outlook

Introduction

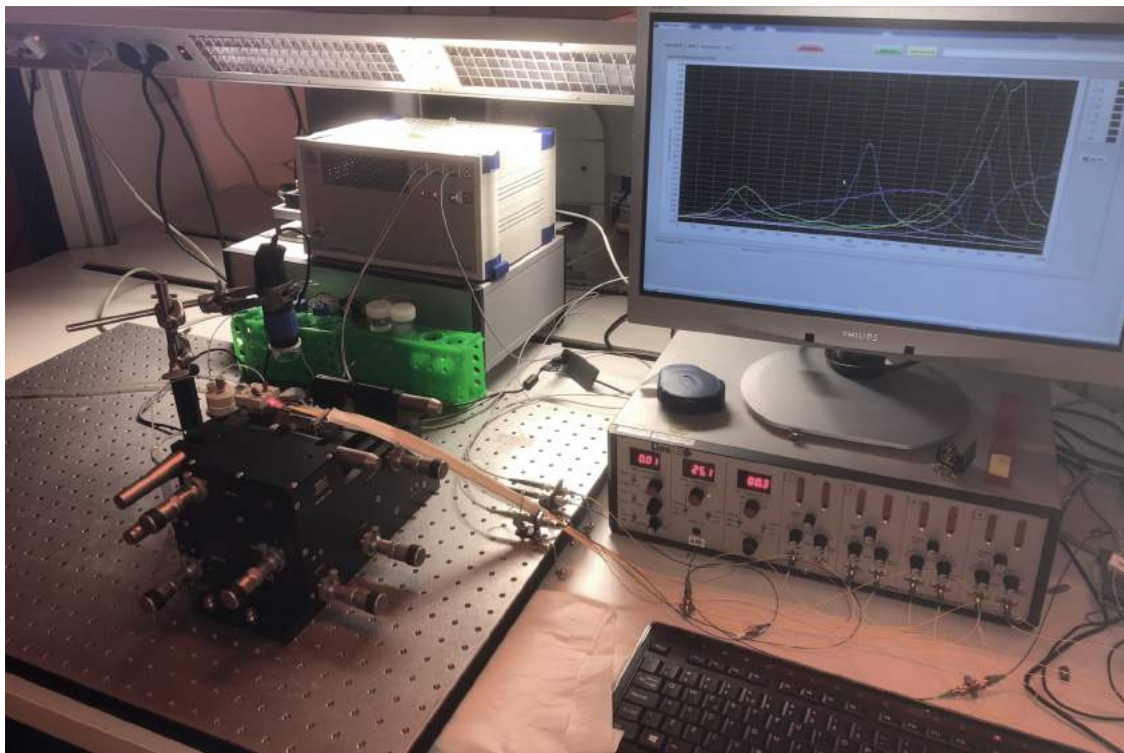
- Research group within Saxion
- Chip based sensors.
 - photonics
 - fluidics
 - MEMS
 - electronics
 - packaging



- Several Projects in Photonics and BioSensing
 - EU
 - Tech For Future
 - SiA
 - Private companies



Chip in a lab, not lab on a chip.



Chip in a lab, not lab on a chip.

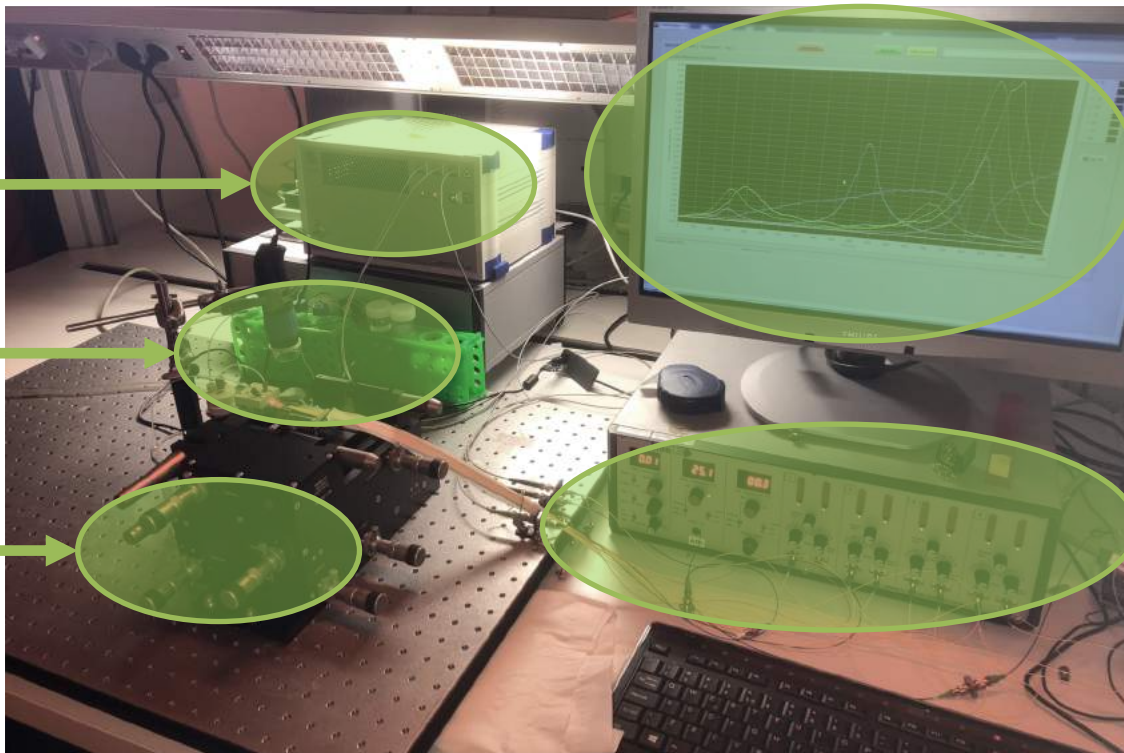
Auxiliary
Lasers

Fluidics

Alignment

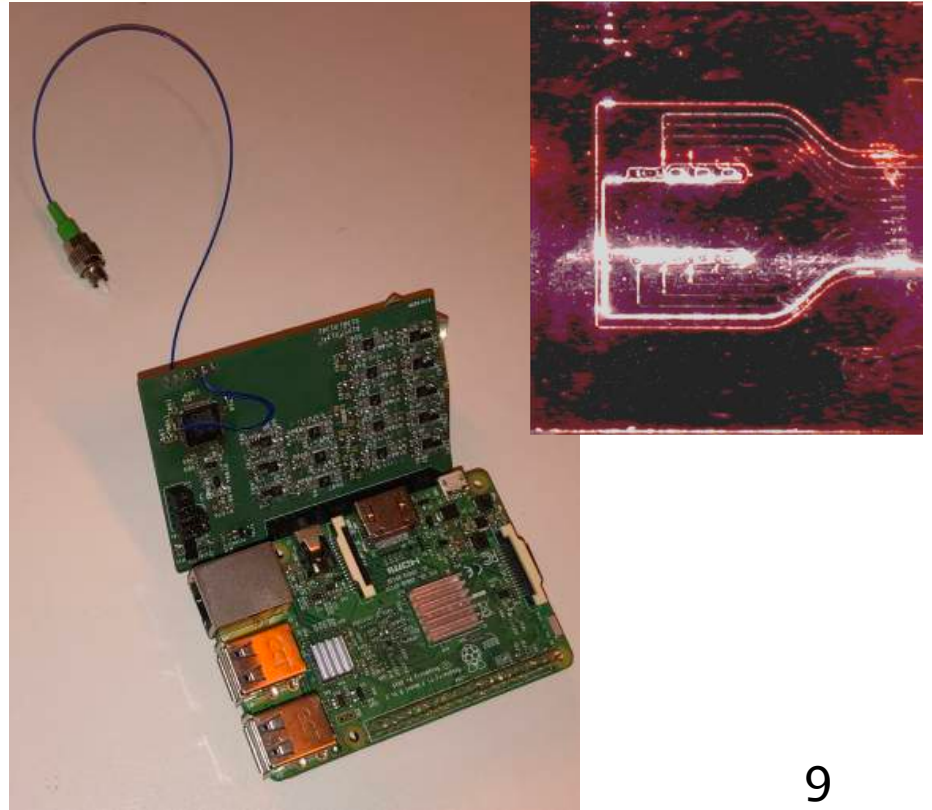
PC

Readout



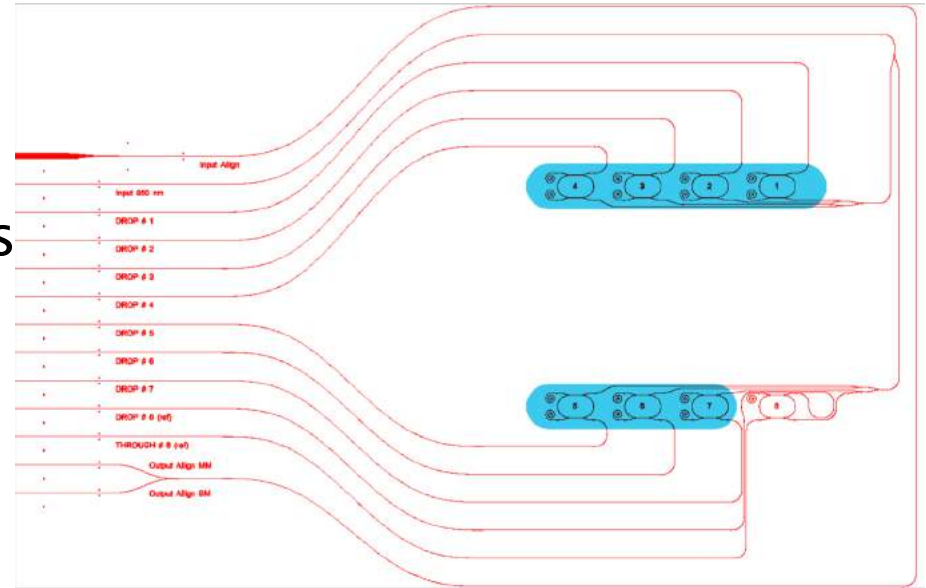
The platform

- Photonic Integrated Chip
- Portable Electronics
- specialised software



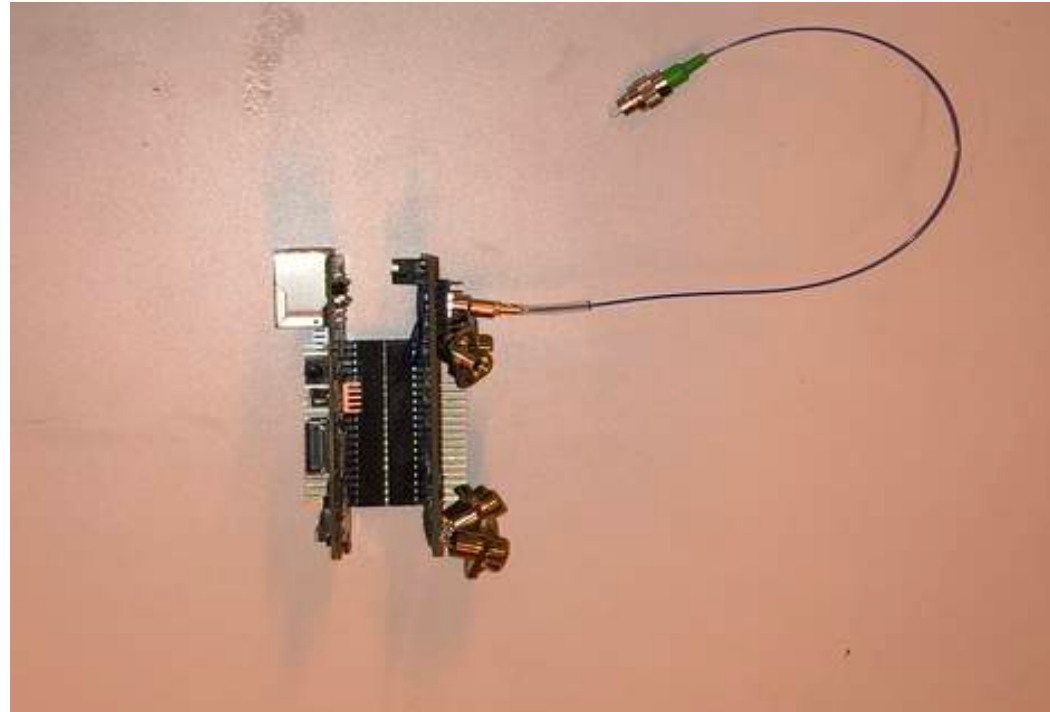
- Photonic Integrated Chip
- Multiple users
- Generic chip
- Conflicting specifications

- Photonic Integrated Chip
- 10 x 10 mm
- 7+1 microring resonators
- 1 alignment structure

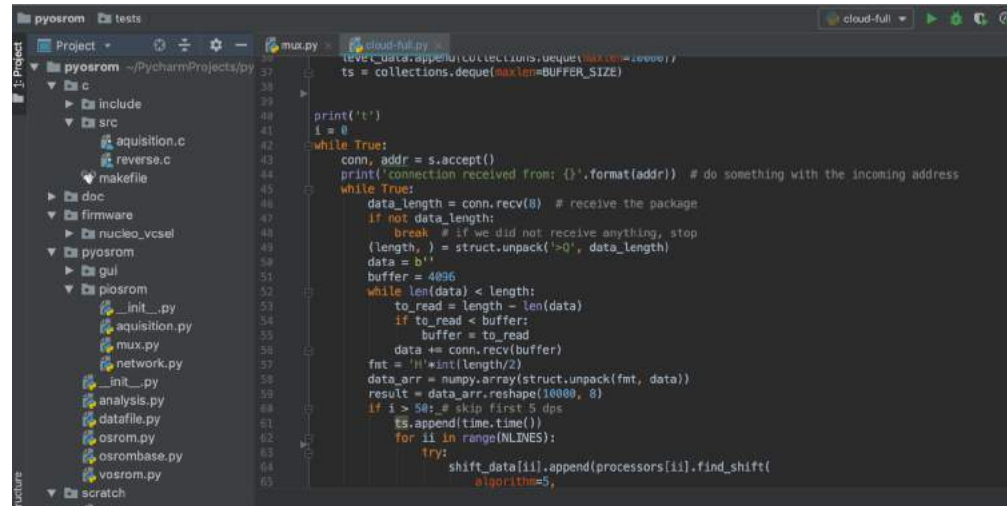


- Portable Electronics
- Noise challenges
- Portable and lower cost
- High amplification 500k – 5M

- Portable Electronics
- 1 laser output
- 8 Photodiodes
- Wireless communication



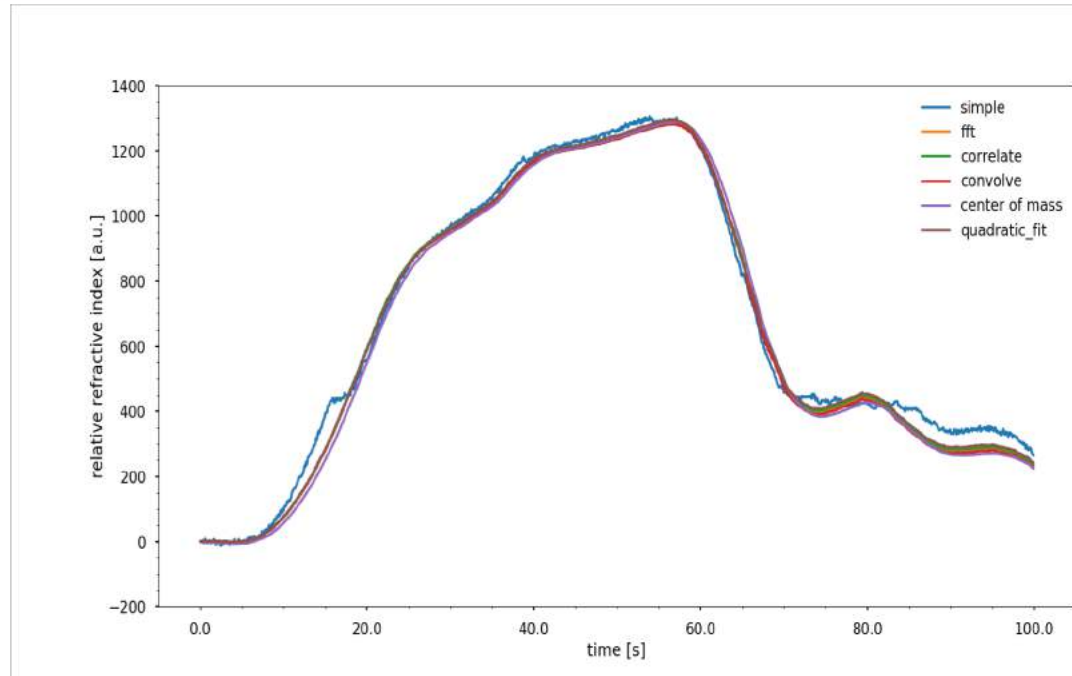
- Specialized software
- Onboard shift calculations
- Bluetooth to smart device or WiFi to cloud.



```
pyosrom tests
Project
  pyosrom ~/PycharmProjects/py
    c
      include
      src
        aquisition.c
        reverse.c
      makefile
    doc
    firmware
    nucleo_vcsel
    pyosrom
      gui
      piosrom
        __init__.py
        aquisition.py
        mux.py
        network.py
        __init__.py
        analysis.py
        datafile.py
        osrom.py
        osrombase.py
        vosrom.py
    scratch
```

```
cloud-full.py
36 ts = collections.deque(maxlen=10000)
37
38
39
40
41 print('\n')
42 i = 0
43 while True:
44     conn, addr = s.accept()
45     print('connection received from: {}'.format(addr)) # do something with the incoming address
46     while True:
47         data_length = conn.recv(8) # receive the package
48         if not data_length:
49             break # if we did not receive anything, stop
50         (length, ) = struct.unpack('>0', data_length)
51         data = b''
52         buffer = 4096
53         while len(data) < length:
54             to_read = length - len(data)
55             if to_read < buffer:
56                 buffer = to_read
57             data += conn.recv(buffer)
58         fmt = 'H'*int(length/2)
59         data_arr = numpy.array(struct.unpack(fmt, data))
60         result = data_arr.reshape(10000, 8)
61         if i > 50: # skip first 5 dps
62             ts.append(time.time())
63             for ii in range(NLINES):
64                 try:
65                     shift_data[ii].append(processors[ii].find_shift(
66                         algorithm=5,
```

- Specialized software
- New shift algorithm
 - Faster
 - Same accuracy



Demonstrators

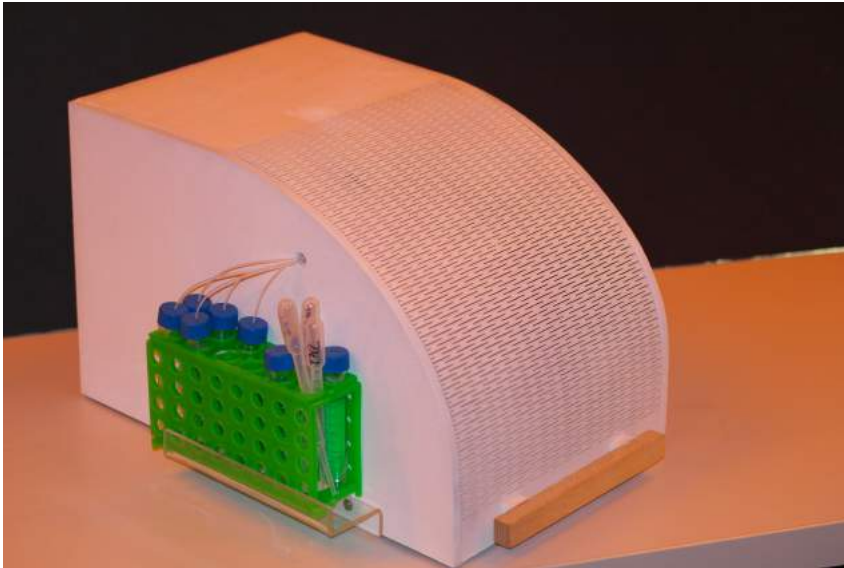
Desktop Demonstrator

- Measures in liquids (serum)
- Pumps and valves
- CrP measurement
- Antibodies

Wearable Demonstrator

- Measures gasses
- Equilibrium
- Skin emanating VOC detection
- Polymer coating

Desktop Demonstrator



2018-12-11

Wearable Demonstrator



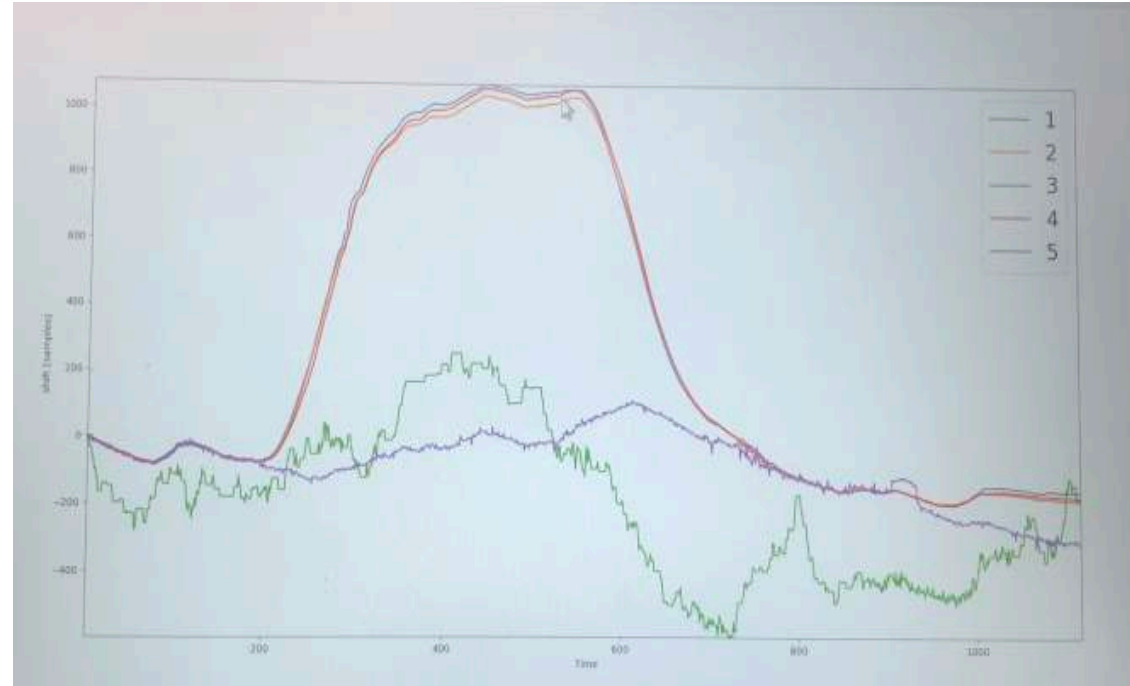
18

Results

First measurements:

Quantization $< 10^{-6}$ RIU

Comparable to current
systems



100 ppm sucrose/DI

Outlook

- New software optimized for aMZI sensors
- Measurement speed increase
- Smaller form factor
- Delivery of demonstrators to other projects
 - Label Free sensing of insulin
 - Several proposals have been made
 - Further development through SMEs

Thanks

Thanks to the people of our group!

- Group leader
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More thanks: our partners!!!



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TWENTE.



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Centre of Expertise HTSM Oost



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