

# FLUCO

## FLUids incl. gases, vapors and COmplex fluids

- H. Schneider –

FLUCO presentation at STAP 02<sup>nd</sup> April , 2019

### FLUCO provides Sample Environment Systems (SES)\* and devices\* for :

Biology

Soft  
condensed  
matter

.....  
Fill in

Material  
Science  
engineering

Electrochemistry

FLUCO SES



- Main usage at large scale instruments
  - SANS { LOKI , SKADI }
  - Reflectometer { ESTIA , FREIA }
  - Spectrometer { CSPEC , MIRACLES , VESPA }
  - But , if needed also at other instruments

FLUCO devices



- Usefull for all instruments

\* SES = Humdity chamber , devices = humidity cell, humidity generator, temperature controller, gas supply

\* SES = Orange cryostat , devices = cryostat mech. , temperature controller, pumping unit, level meter, Lhe/LN<sub>2</sub>

### Planned suite of sample environment systems & devices, ESS/construction

- Humidity Chamber(s)
- Rheometer (RheoSANS), Shear cells, Cuette cells
- Stopped Flow devices
- Syringe Pumps , Peristaltic Pumps
- Gas Process Handling, Manifolds
- Water (Oil) bath circulating devices.
- Magazines (multiple samples) , Rotating cells, peltier driven devices
- Thermalizing gas blower
- Liquid-Solid-Cells

### Provided as part of instrument budgets :

- |   |                  |                   |
|---|------------------|-------------------|
| • Sample changer , multiple samples, 8 pos. | CSPEC/MIRACLES   | TUM, Ger, Esp.    |
| • Troughs, Langmuir troughs                 | FREIA            | STFC, GB          |
| • SANSMAG                                   | LOKI/SKADI/ESS   | STFC/FZJ ; GB/Ger |
| • Sample changer                            | VESPA            | STFC , GB         |
| • HPLC Pump                                 | LOKI/FREIA/ESTIA | STFC/PSI ; GB/CH  |
| • Liquid-Solid-Cells                        | FREIA/ESTIA      | STFC/PSI ; GB/CH  |
| • Cryostream                                | NMX              | ESS , DK, FR      |
| • Humidifier                                | NMX              | ESS , DK, FR      |

**By that the FLUCO strategy for user oriented Sample Environment looks as follows :**

**Sample Environment Systems  
In Kind - Cash**





... And more

Sample Environment Systems  
In Kind - Cash



In Kind contributions



.....And much more

Sample Environment Systems  
In Kind - Cash



In Kind contributions



Collaboration



...And much , much more

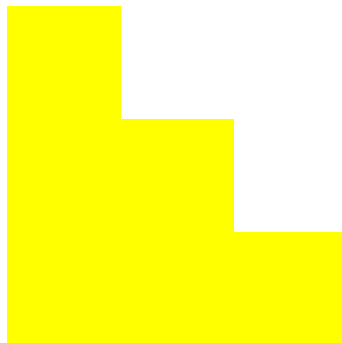
Sample Environment Systems  
In Kind - Cash



In Kind contributions



Internal R&D



Collaboration



... and finally , the FLUCO-toolbox for user service.

Sample Environment Systems  
In Kind - Cash

In Kind contributions

Tool box with  
Permanent growing no.s and  
Kind of devices

Internal R&D

Collaboration

### Gas process handling system

$P < 200$  bar

Flushing, pressurising, filling  
Simple adsorption measurement

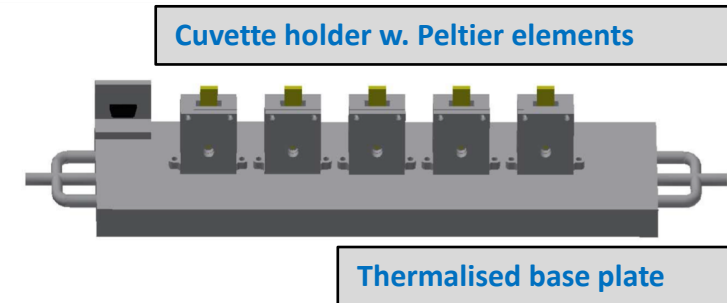
$T \leq 773$  K

$N_2, O_2, H_2, D_2, He, Ne, Ar, CO, CO_2$   
expandable

InKindPartner, Univ Tartu, Est

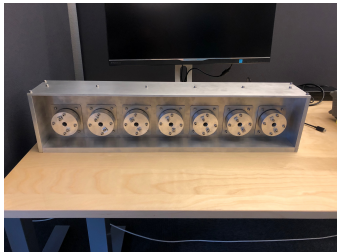


### Principle sketch of the device



*IK Partner: B Jakobson, C Niss, RUC*

### Tumbler, Basque interns/ESS

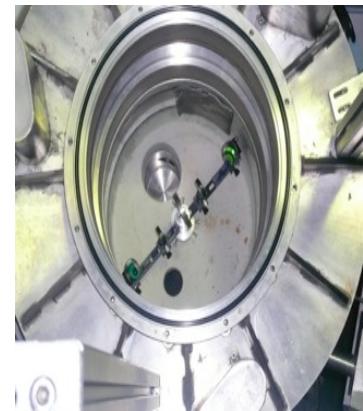


### Laser pump probe

Optical trigger  
for photosynthesis

### Laser pump probe II

Thermal stimuli of sample

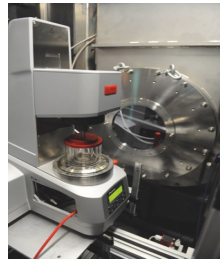


InKindPartner, Prof. J. PieperUniv Tartu, Est

### Both , moved to OPS

#### Rheometer

Various setups  
e.,g shear cell  
Taylor-Cuette cell  
Quench technique



JCNS , Outstation at FRM2 , MLZ

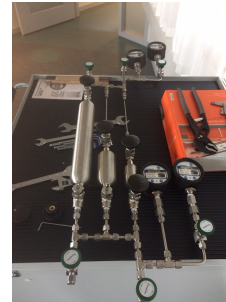
### Gas stream thermalizer



In Test thermal solutions

Potential InKindPartner, FZJ ,Ge

#### First H2 gas manifold



#### Stopped flow cell 6 channels. 278 K – 368 K



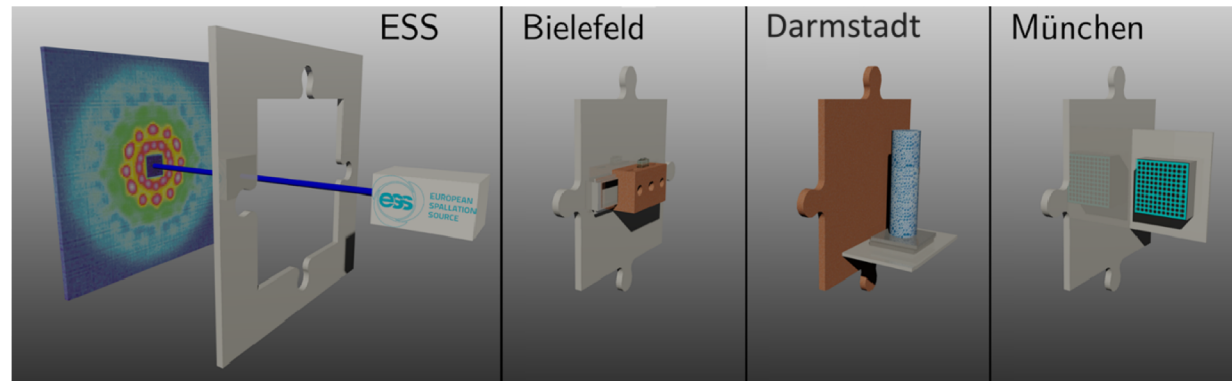
In Kind with Univ. Tartu

### Ultrasonic Levitator



Testoperation at MV Lab,  
Collaboration with SULF

### FlexiProb , A german BMBF funded project



- **Additional equipment and methods available by FlexiProb project**
  - **BMBF funded project by University of Bielefeld, TU-Darmstadt, TU-Muenchen**
  - **FZ-Juelich incl. the SKADI team.**
  - **Development of experimental setup's for ESS experiments at SANS instr.**
  - **Some topics**
    - **Foams : Structure, dynamics/kinetics**
    - **Humidity cells + GISANS techniques, In Situ UV VIS, WL-Spectroscopy**
    - **In situ light scattering setup , DLS, SLS**

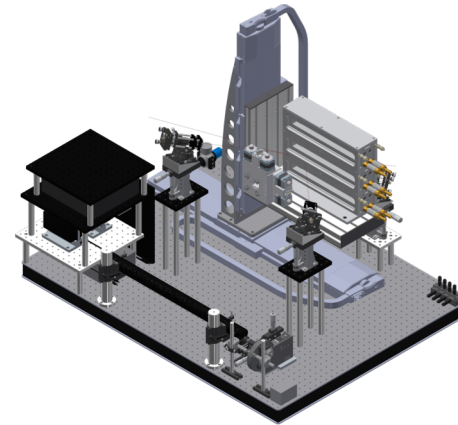
**Partner : Prof. R. von Klitzing, Prof. Th. Hellweg, Prof. P. Mueller-Buschbaum**

- H. Schneider -

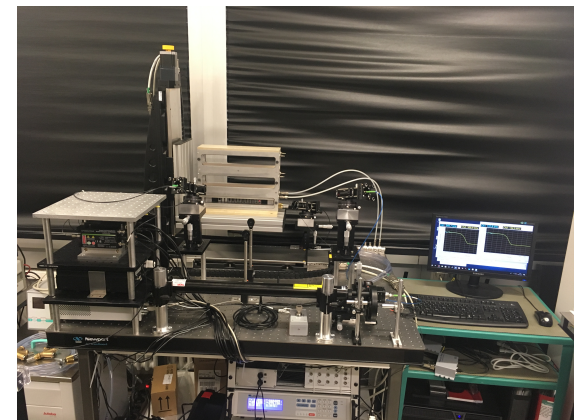
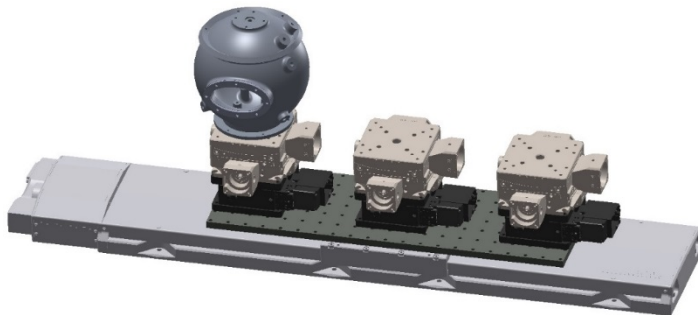
Foam cell , TUD, first hot test at V20 in May



SANS magazine with In Situ DLS , Uni. Bielefeld  
Tested at KWS1, MLZ

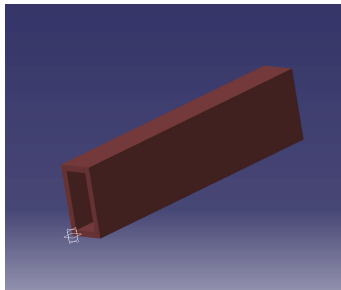


3 humidity chambers , TUM, tested at MLZ

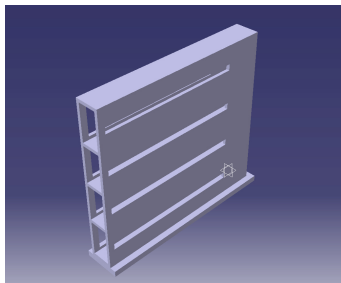




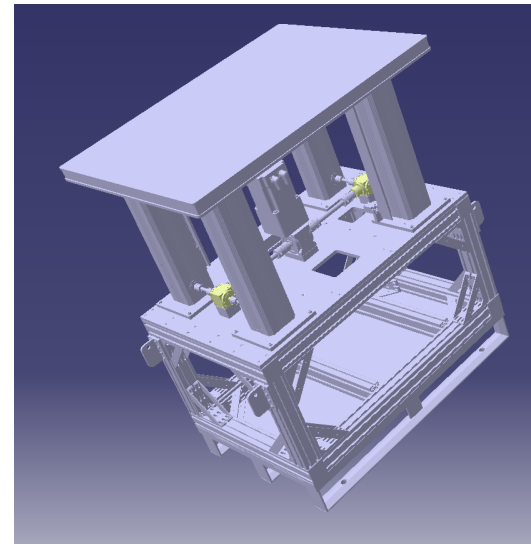
- SANSMAG : On going base design, parameters changed, LOKI needs 45° Outgoing scattering angle-challenging
- 4 Modules are planned initially, more to be developed later :
  - 8 pos. peltier element driven thermalizing (individual) module, 8x temp. controller device based on Beckhoff PLC development by MESI just startet. 1st prototype end of (this) year
  - 10/20 pos same temperature module , driven by JULABO device, standard and 2x standard cuvettes
  - 5 pos. high temperature module, up to 500°C each, individual temp. per position.
  - Tumbler with 7 positions, “Bonsai version of existing one (Sonja G. S.)
- Development of hood like system to have dry gas around SANSMAG to run also  $T \leq 5^\circ\text{C}$



ESS-intern



FZ-Juelich, part of FlexiProb



# FLUCO

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WP	Partner	16	17	18	19	20	21	22	23	24	25
Gas-processing-system	U.Tartu(Est)		[Green bar]			MESI/ICS, Integr. Delay					
Laser Pump Probe	U.Tartu(Est)	Successfully finished			MESI/ICS, Integr.						
Laser Pump Probe 2	U.Tartu(Est)		[Green bar]								
Stopped-flow-Cell	U.Tartu(Est)		[Green bar]			MESI/ICS, Integr.					
Humidity Chamber	U.Tartu(Est)		[Green bar]			MESI/ICS, Integr.					
Rheometer	FZJ (G)	Cost reduction exercise → Moved									[Red bar]
Light scattering	FlexiProb		[Black bar]			Follow up project					
5x SANS-Peltier	RUC	Successfully finished			MESI:Multi-chan-devel.						
Rotating cells	ESS	Successfully finished			MCA-Integr.						
Thermalizing Bl.	FZJ (G)	Cost reduction exercise → Moved									[Red bar]
Chem. Cell	ESS								[Blue bar]		
Cells/solid-liquid	ESS								[Blue bar]		
Lab Eq./Devices	ESS	[Green bar]									
SANSMAG	ESS/STFC/FZJ				[Green bar]						

Pool Equipment available  
 -> Tested and integrated  
 Ready to run  
 at instruments

Pool Equipment

R&D , Sample changer

- Planned
- Started, on going
- In discussion

Lab building, D04, available

Beam on target , BOT

Hot commissioning first instruments



Users > =2023 - SOUP

**Staffing development up to 2025 as envisaged start of steady state operation ,  
First technician is on the way , application is open, start at least 09/2019.**

personnel	15	16	17	18	19	20	21	22	23	24	25
Scientific engineer	5/12	1	1	1	1	1	1	1	2	2	2
Technician 1	-	-	-	-	0.5	1	1	1	2	3	3

Lab building available

Hot commissioning first instruments

Users >= 2023

FTE : 5 , ( Full Time Equivalent )

Management

0.3 FTE = 6%

R & D

1.0 FTE = 20%, or minimum 1 person

FLUCO Infrastructure

0.2 FTE = 4%

User operation / support

2.5 FTE = 50%

Platform service

1.0 FTE = 20%

Leading , fixed No's are 20 % R & D and service providing 50 %.

### So ....

- The most needed pool equipment is defined and with In-Kind projects and "Cash" on the way, signed or in discussion.
- The Gas-Process-Handling-System is on the way (Estonia)
- Some other projects for Stopped flow and Humidity chamber are on going(Estonia)
- Also FLUCO's own developments are started and first low value devices are procured, thermalizers/syringe pumps/HPLC pump/  
H<sub>2</sub> gas manifold (build), peristaltic pump, levitator (ultrasonic)
- Actually testing the possibilities of ultrasonic levitation as sample holder, in collaboration with SULF.
- Also a approach to find Field Flow Fractionation using with Neutron scattering @ SANS/GISANS has started.

### Conclusions about the FLUCO platform

- For the hot commissioning and the first users for the first 8 instruments, the mandatory pool equipment will be available. For the first 3 instruments ; LOKI/DREAM/ODIN the envisaged SES and devices are on the way.
- With the BMBF Flexiprob project a very promising complementary partner for the ESS arises. The first project was finished successful and an application for a follow up project was sent.
- As well as by the staffing plan and by increasing resources there is enough space left for future new needs and developments.

**Thank you for your attention**

**Questions ?**

**Notes , Remarks, . . . . .**