Existing Sample Environment Equipment for use in Soft Matter and Biomaterials Research

GP-SANS (CG-2)

1. 15 position banjo cell sample-changer
    a. Banjo style Hellma cells, water bath temperature control (10-80 ^{o}C)
2. 12 position Peltier sample changer
    a. Hellma or NIST demountable style cells, Peltier temperature control (-15-150 ^{o}C) with four independently controlled regions
3. 4 position tumbler-changer
    a. Titanium style cells, water bath temperature control (15-45 ^{o}C).
4. Humidity chamber
    a. This equipment is shared with the WAND^2. It holds samples on a rotational stage, 0-95% relative humidity control using an RH generator, no temperature control.
5. Electrochemical cell
6. Hellma flow-through cell
    a. Syringe pump
7. Anton-Paar rheometer (model 501)
8. 4 position dome-type pressure cells:
    a. 1 kbar for CO_2, CH_4, He, N_2 and Ar; heating rod temperature control (room temp-200 ^{o}C); qmax = 1.3 Å^{-1}; gas manifold for mixing gases up to 200 ^{o}C and 1 kbar.
9. 4 position extended angle pressure cells (EAP)
    a. 1 kbar for CO_2, CH_4, He, H_2, N_2 and Ar; heating rods and water bath temperature control (10-200 ^{o}C); q_{max} = 0.6 Å^{-1}.
10. 4 position Yuri pressure cells
    a. 1 kbar for CO_2, CH_4, He, H_2, N_2 and Ar; heating rods and water bath temperature control (10-200 ^{o}C); q_{max} = 0.6 Å^{-1}.
11. Hellma flow-through cell with syringe pump
12. Vacuum furnace (ILL)
    a. It can go up to 1200 ^{o}C.
13. Orange cryostat
    a. Temperature control (1.5-300 K), sapphire windows on OVC and IVC, compatible with 300 bar pressure cell.
14. Cryo-magnet (Mag-H)
    a. A 5.0 T horizontal field, dry superconducting magnet with an open bore, cryogenic temperatures can be obtained with a closed-cycle refrigerator insert upon request.
15. Electro-magnet
    a. 2T field, 4 position sample holder for Hellma cells. The pressure cells are designed to seal and use resistive heating up to about 200 C.
16. Cryo-magnet (Mag-G)

a. 11 T horizontal field, cryomagnet with temperature control (1.8 to ~300 K) that could be used for soft matter if higher fields are needed.

Bio-SANS (CG-3)

1. 8 position Peltier Neutron iQ
    a. The temperature range is -10-80 °C ± 0.01°C on individually controlled samples. It needs 50% ethylene glycol/50% water to get as low as -10C, otherwise it bottoms out near 0C. With water it can control at 4C.
2. 18 position rectangular Hellma cell sample changer
    a. Rectangular style Hellma cells, water bath temperature control (10-60 ^{o}C)
3. 15 position Banjo-style Hellma cell sample changer
    a. Banjo style Hellma cells, water bath temperature control (10-60 ^{o}C)
4. 4 position Extended Angle Pressure Cell (EAP)
    a. Pressure rating of 1 kbar is to hold pressure as it builds during reactions; heating rods and water bath temperature control (10-300 ^{o}C); q_{max} = 0.6 Å^{-1}; vertical translation stage for vertical alignment in addition to horizontal translation stage; tantalum alloyed parts for acid corrosive resistant solvents.
5. 4 position sample-tumbler
    a. Titanium style cells, water bath temperature control (10-80 ^{o}C)
6. Humidity chamber
    a. Holder for silicon wafers on a rotational stage, 0-95% relative humidity control using an RH generator, no temperature control.
7. 6 position stretcher
    a. This equipment is for the study of fibrous samples. The stretching action is manual and symmetric about the center of sample. No control on the surrounding environment of the samples and so not suitable for humid samples.
    a. 1 kbar for CO_2, CH_4, He, N_2 and Ar; heating rods and water bath temperature control (10-200 ^{o}C); vertical translation stage; tantalum plated parts for chemically aggressive solutions
8. Size-Exclusion Chromatography-SANS
    a. HPLC pump integrated with columns and 4 stop-flow cells that can measure dynamic protein complexes and aggregation prone proteins, with integrated autosampler. Automated flushing of cells and change of concentrations. Size exclusion chromatography can accurately determine peak fraction for neutron beam.
9. Rigol controller
    a. integrate equipment, used to set a voltage to various User equipment, light sources, and communication to ancillary devices.
10. Banjo Meca 6-axis Robot
    a. This is the workhorse equipment 48 position 6 axis robot arm for Hellma banjo cells. Storage positions are temperature controlled by Polyscience

water chiller within the range of 14C-65C. Single cell sample position is temperature controlled by Peltier stage with range of 4C-80C and airflow to prevent condensation. Optional light cover for future upgrade of photo-spectrometer integration.

11. Titanium Meca 6-axis Robot
    a. 58 position 6 axis robot arm for Titanium cells. Storage positions are temperature controlled by Polyscience water chillers within the range of 1C-55C. Single cell sample position is temperature controlled by Peltier stage with range of 4C-80C and airflow to prevent condensation.

EQ-SANS (BL-6)

1. 12 position sample-changer
   a. Hellma or NIST style cells, Peltier temperature control (10-130 ^{o}C) with two independently controlled regions
2. HOT-017 6-position sample translation furnace (ambient to 330 ^{o}C)
3. Humidity cell
4. Rotating tumbler, 6-position (ambient to 120 ^{o}C)
5. Biologic stopped flow-cell
6. Biologic potentiostat
7. Psylotech tensile stage
8. Sliding plate shear cell
9. Anton Paar Rheometer

LIQREF (BL-4B)

1. **Solid/liquid interface cells:** x12 cells. Temperature control using resistive heating from ambient to 70C integrated with DAS. One cell modified for temperatures to 130C. All cells compatible with electrochemical measurement using a BioLogic potentiostat partially integrated with DAS. Cells have limited capabilities for efficient fluid exchange.
2. **Vapor can:** x8 cans. Simple chamber for exposure of samples to saturated vapors or dry conditions. No external connection or temperature control. No humidity control. No DAS integration.
3. **Langmuir trough**: x1 trough. For liquid/air interface measurements with control of surface pressure. Monolayer surface pressure and circulating water temperature control integrated into DAS.
4. **Adsorption troughs**: x2 troughs. For liquid/air interface measurements, no surface pressure control or monitoring. Circulating water temperature control integrated into DAS.
5. **Rheometer:** x1 Anton Paar 501. Shared with GP-SANS, EQ-SANS and USANS.

6. **Multi-environment chamber**: x1 chamber. UHV and gas handling from 1 mTorr to 1000 Torr. Temperature to 600C integrated into DAS.
7. **High E-Field chamber**: x1 chamber. High vacuum chamber with +/- 10kV and temperature control to 200C integrated with DAS.
8. **High pressure cell**: x1 cell. Solid/liquid interface cell for pressures up to 50 MPa and temperatures to 450K. Fluid charging system needs to be supplied by user. No integration with DAS.
9. **High temperature solid/liquid cell**: x1 cell. Solid/liquid interface for temperatures up to 850C. Used for study of molten salts. Temperature control with Eurotherm, integrated into DAS.
10. **Full solar spectrum light source**: x1 light. To be commissioned and integrated into DAS.
11. **Fluid handling cart**: x1 system. Fluid handling cart including HPLC pump, automated switching valves, and syringe pumps. Shared with beamline 4A. Integrated with DAS.
12. **Peristaltic pump**: x1 pump. For fluid flow compatible with Langmuir trough and solid/liquid interface cells. Partially integrated into DAS.
13. **Eurotherm temperature controller**: x1 controller compatible with multiple sample environments. Integrated with DAS.
14. **Lakeshore temperature controller**: x1 controller compatible with multiple sample environments. Integrated with DAS.

BASIS (BL-2)

1. **Top-loading CCR-015** is BASIS's workhorse equipment for most soft material research (~70-80%). This CCR allows going from 10 K – 700 K in the presence of helium as an exchange gas.
2. **Top-loading CCR-018** is also heavily used for soft matter research. This allows from 4 K to 370 K in the presence of helium exchange gas.
3. We also have a **bottom-loading CCR** that allows going up to 325 K.
4. **Paris-Edinburgh cell** has been used at BASIS for high-pressure research.
5. **Orange cryostats** with a temperature control capacity of 1.5-300 K.
6. **Gas pressure cell** (~4.8 kbar) for gas loading experiment.
7. **Some specialty cells** are available for low- and high-applied voltage measurements.
8. **MICAS FURNACE** with a higher temperature limit of 1673 K
9. **Humidity generator**
10. **Electrochemical cell**

NSE (BL-15)

1. **SP Scientific Temperature Forcing System (TFS).** This is the primary device **(~90%** of soft matter studies on the SNS-NSE) used for temperature control experiments; The temperature range is 0-100 °C. It cools and dries air down to -80C and then heats it and blows it via attached hose into a sample container that can hold up to two samples in quartz, aluminum, or niobium cells. It is now controlled via EPICS IOC.
2. **Janis Cryo-furnace.** Used for those studies that require cryogenic or high temperatures. The temperature range is 4K-700K. It is controller via LakeShore 336 and EPICS IOC.
3. **Sample Tumbler.**