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Task 10.5 leader

I.FAST Period 1 Review, 09.02.2023

Task 10.5 structure

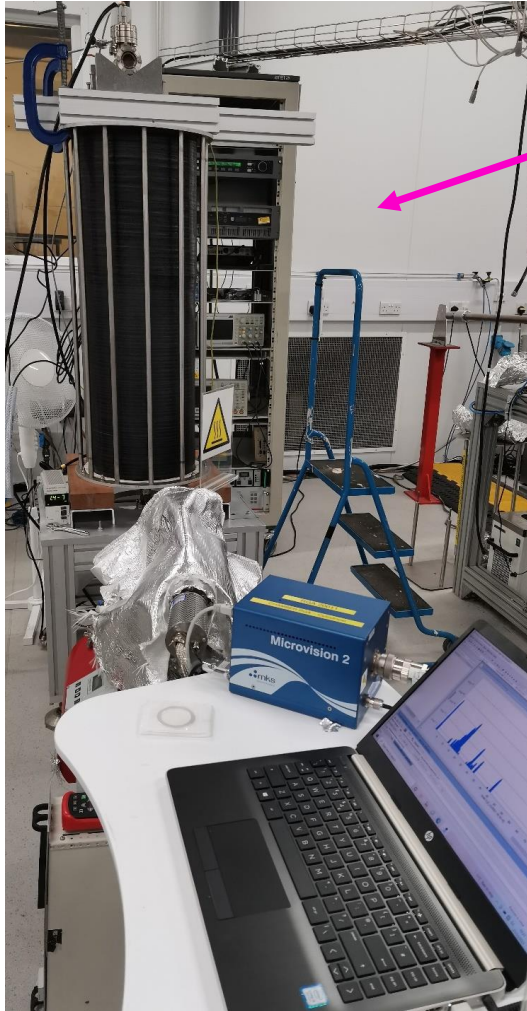
Partner	Main capability relevant to the project	Future machine
UKRI/STFC/ASTeC <i>beneficiary</i>	<ul style="list-style-type: none"> • NEG deposition and characterisation • Pumping property and ESD evaluation • Gas dynamics modelling, data analysis, large vacuum system design 	UK-XFEL
Diamond LS <i>beneficiary</i>	<ul style="list-style-type: none"> • PSD facility at a SR beamline on Diamond • Pumping property and ESD evaluation • Large vacuum system design and operation 	Diamond-2
Soleil <i>beneficiary</i>	<ul style="list-style-type: none"> • PSD facility at a SR beamline on Soleil • Pumping property and ESD evaluation • Large vacuum system design and operation 	Soleil-2
DESY <i>in-kind contribution</i>	<ul style="list-style-type: none"> • NEG deposition and characterisation • Pumping property and ESD evaluation • Large vacuum system design and operation 	PETRA-IV

WP9 objectives

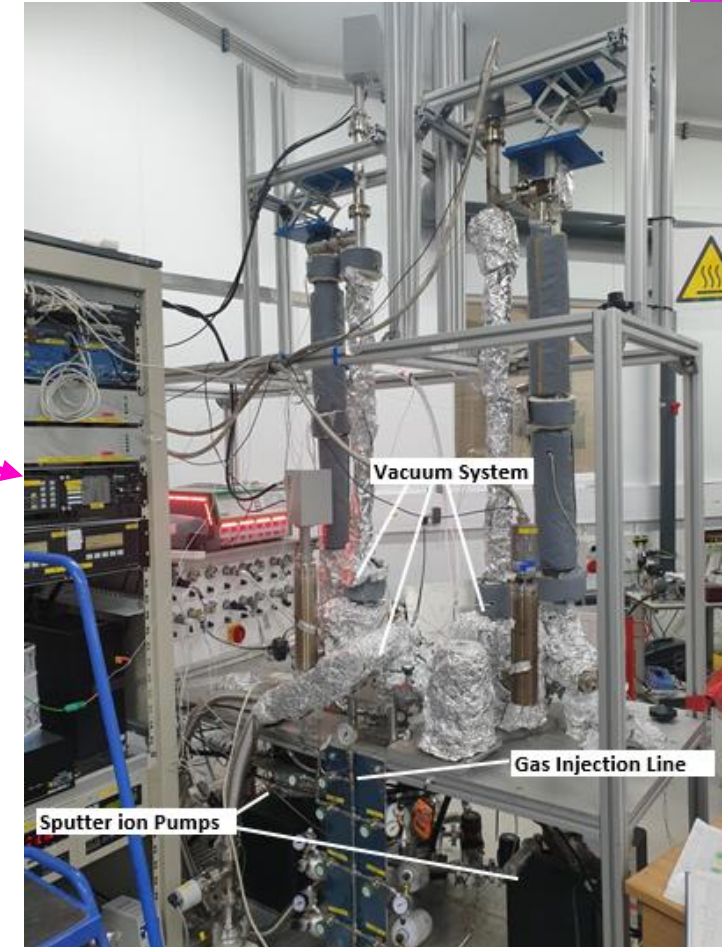
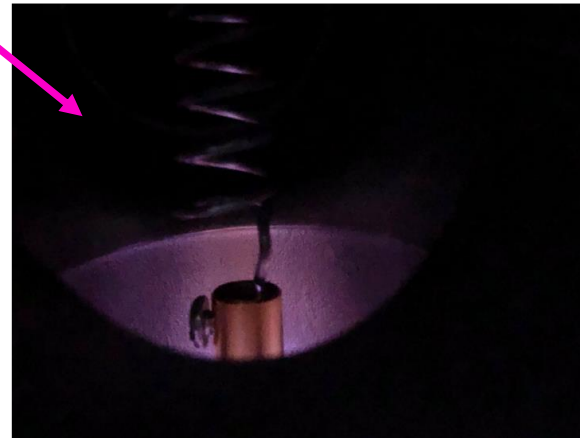
- Building facilities for photon stimulated desorption (PSD) yield measurement on beamlines.
- Obtaining and analysing the photon stimulated gas desorption (PSD) experimental data from Non-Evaporable Getter (NEG) coated prototypes under conditions similar to future light sources.

	Milestone/Deliverable name	Delivery date (in months)	Content
Milestone	First NEG coated sample are installed on SR beamline at DLS and Soleil	12	Report - Completed
Deliverable	First PSD data from NEG coating	36	Report

Summary of activities in P1: UKRI



- *Upgrading the NEG deposition facility*
 - a new coil to deposit thin films on tubes with
 - length of 1 m
 - Inner diameter 5-100 mm
 - CF16-CF150 flanges.
- *Upgrading NEG coating evaluation facility*
 - for 1-m long samples.
- *Coating 1st PSD sample with NEG*



Summary of activities in P1: DESY

- It was agreed that a project *standard sample* for pumping properties evaluation is
 - made of OFHC or OFS copper
 - ID = 20 mm, L = 500 mm,
 - equipped with two CF40 flanges
- **Progress for P1:**
 - DESY has provided 11 OFS samples for NEG coating (delivered to UKRI in March 2022)
 - 3 samples has been used for comparison of cleaning/ etching procedures by thermal outgassing measurements
 - samples found to have
 - Thermal outgassing was a factor 2-3 higher than a reference sample cleaned at UKRU
 - some black coverage identified as silver oxide
 - 8 samples have been send back to DESY
 - the DESY cleaning procedure has been changed to address this issue



- **Future:**
 - New 8 samples (expected from DESY) to be coated at UKRI (DL):
 - 4 samples will be coated with Zr
 - 4 samples will be coated with Ti-Zr-V
 - so *identical samples* will be tested in 4 labs for comparing (cross-verifying) the results obtained on different facilities
 - More samples can be produced in a future.

Summary of activities in P1: DLS and Soleil

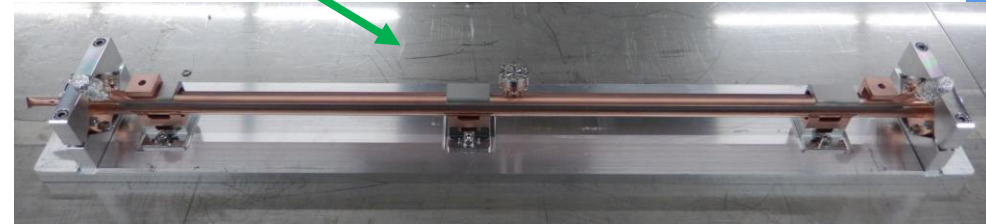
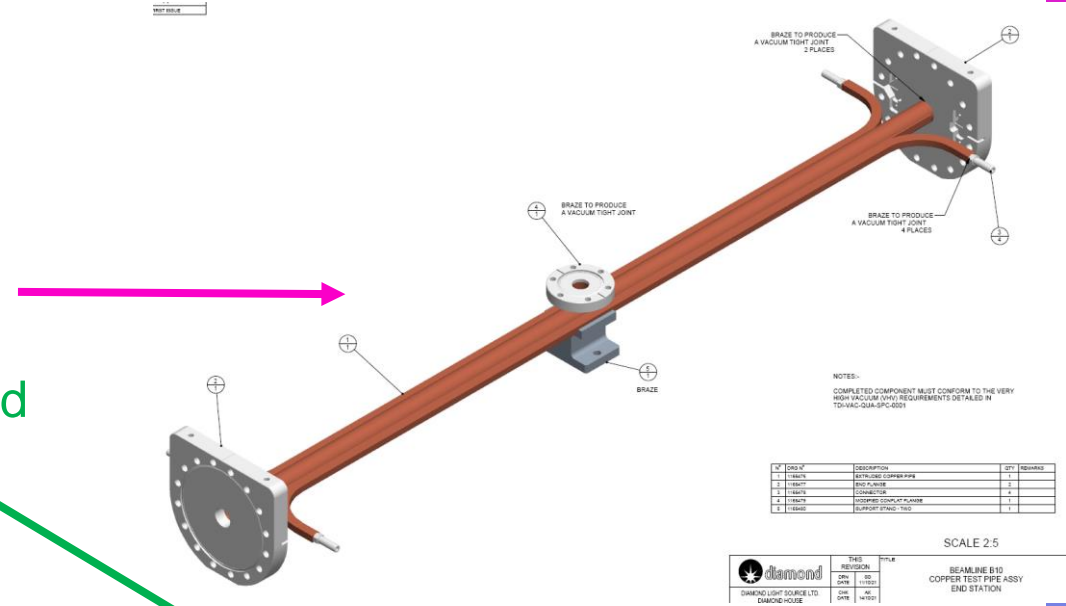
Measurements of PSD yields will be performed on Synchrotron Radiation (SR) beamlines at DLS and Soleil.

Progress for P1:

- Sample for PSD measurements was jointly designed by Soleil and DLS
- 9 samples have been produced from C10700 copper and delivered in October 2022 for coating (6 to UKRI and 3 to DESY).
 - delivery delayed by industrial manufacturer SAES REAL
 - these samples have been cleaned by a manufacturer
 - one sample has been inspected visually and tested on thermal outgassing - *satisfactory*

Future:

- First two samples will be coated with Zr at UKRI (DL),
 - so *identical samples will be initially tested in DLS and Soleil for comparing* (cross-verifying) the results obtained on different facilities
- More samples will be produced in a future
 - Later, samples will be cleaned at DESY following a procedure being developed in an ongoing research



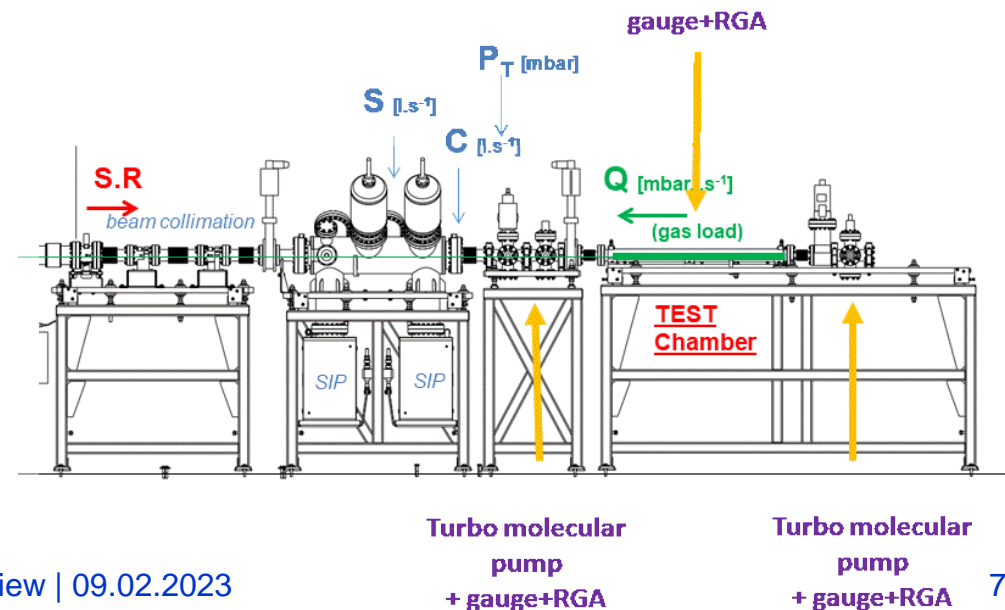
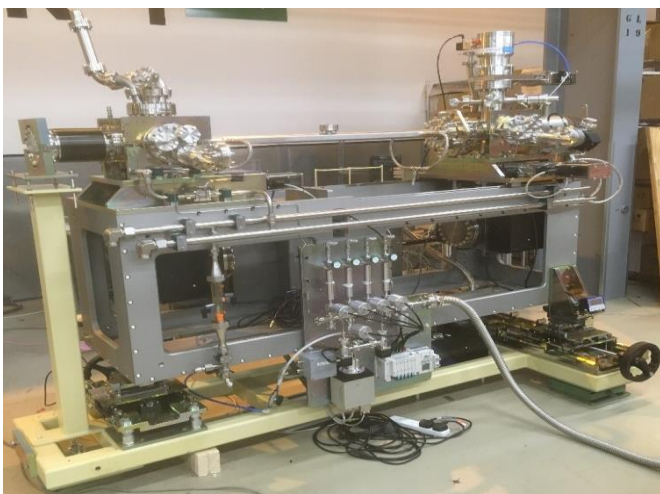
Summary of activities in P1: DLS and Soleil

DLS: dipole front-end (FE10B):

- Front-end section: installed November 2020
- Experimental end-station:
 - post-installation conditioning with an uncoated stainless steel DN40 sample vessel till Feb 2022
 - Stainless steel DN40 DLS type sample NEG coated at UKRI (DL) was installed during a DLS shutdown in March 2022 and remain under SR till present
- Future:
 - Copper sample coated with NEG will be installed during a following DLS shutdowns starting on the 24th March or on the 26th May 2023.

Soleil: dipole front-end

- Front-end section: reconditioned during 2020
- Experimental end-station:
 - currently under operation with samples coated with NEG at SAES getters
- Future:
 - Copper samples will be NEG coated at UKRI (DL) and installed during a Soleil shutdown in in Feb-March 2023



Deliverables and Milestones P1

**One Milestones has been completed,
No Deliverable scheduled for P1**

	Milestone/Deliverable name	Delivery date (in months)	Content
Milestone	First NEG coated sample are installed on SR beamline at DLS and Soleil	12	Report - Completed
Deliverable	First PSD data from NEG coating	36	Report

Relevance of objectives and impact

- 1st Objective:
 - *Building facilities for photon stimulated desorption (PSD) yield measurement on beamlines.*
 - *Completed: two facilities for PSD yield measurement are in operation at DLS and Soleil*
- 2nd Objective:
 - *Obtaining and analysing the PSD experimental data from NEG coated prototypes under conditions similar to future light sources.*
 - *Work in progress*
- Relevance: *very important data for designing future machines with SR:*
 - *DLS-2, Soleil-2, PETRA-IV, UK-XFEL, etc...*
- Impact:
 - *NEG coated vacuum chamber can be activated at low temperature of 150-160°C*
 - *Meeting challenging vacuum specification at UHV or XHV*
 - *Lower cost of vacuum system*
 - *Less number of pumps, thus less controllers and cables*
 - *Smaller size of the pumps, thus lower cost per unit*
 - *The only solution for narrow vacuum chambers*

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Thank you for your attention!



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