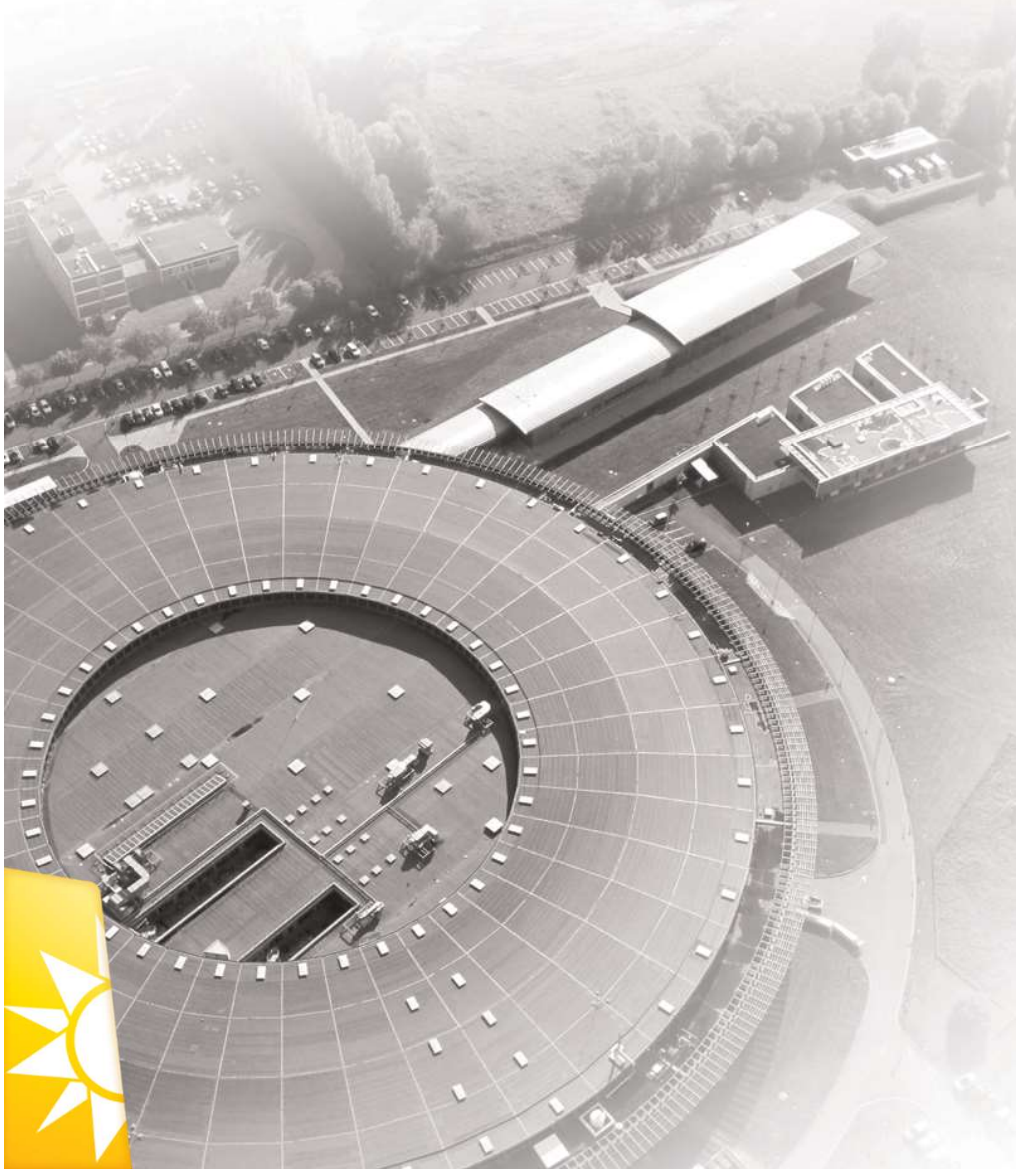
Update on PSD and pumping properties measurements at SOLEIL



Nicolas Béchu, Christian Herbeaux,
Vincent Le Roux

On behalf of Vacuum Group, PSD and
Transmission Bench Task Force

12th Mai 2022, ZOOM
IFAST Task 10.5 - 3rd Meeting

Contents

- Reminders on NEG coating capabilities at SOLEIL :
  - Deposition lab for occasional coatings only,
  - Sticking factor and sorption capacity characterisation with transmission measurement benches,
  - PSD beamline fully operational.
- Last results for PSD measurement :
  - downscaling to small VC diameters,
  - preliminary results on partial pressures.
- Possible evolution of the PSD beamline :
  - Calibration of instruments,
  - 3-gages method adaptation,
  - hiring a dedicated student 2022-2023.
- Conclusions and foresights

NEG coating characterization by transmission method

SOLEIL SYNCHROTRON
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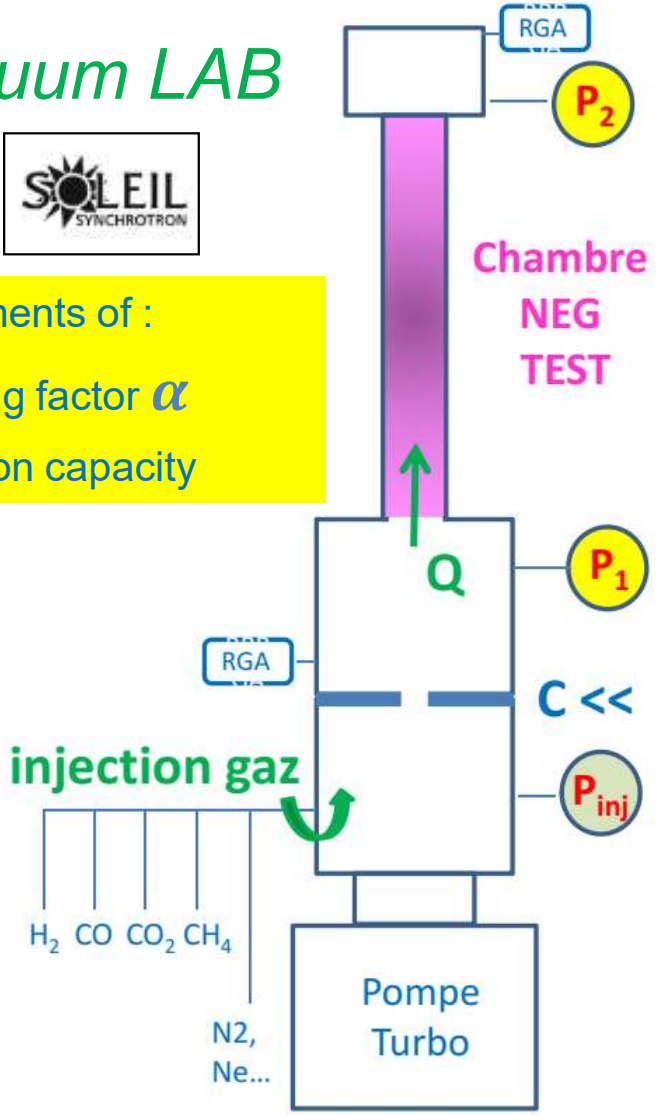
@ Vacuum LAB

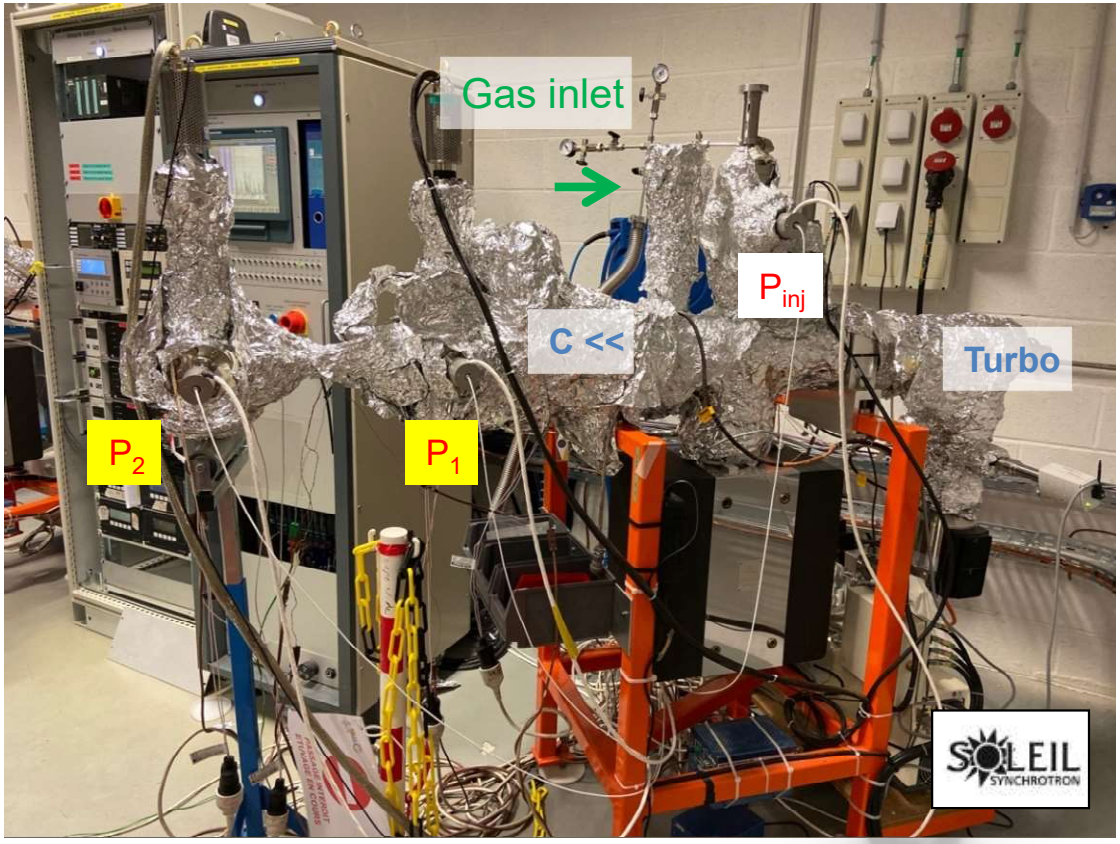
SOLEIL SYNCHROTRON

Measurements of :

- Sticking factor α
- Sorption capacity



2 Transmission Method Test Benches for NEG coating characterization



Transmission Method

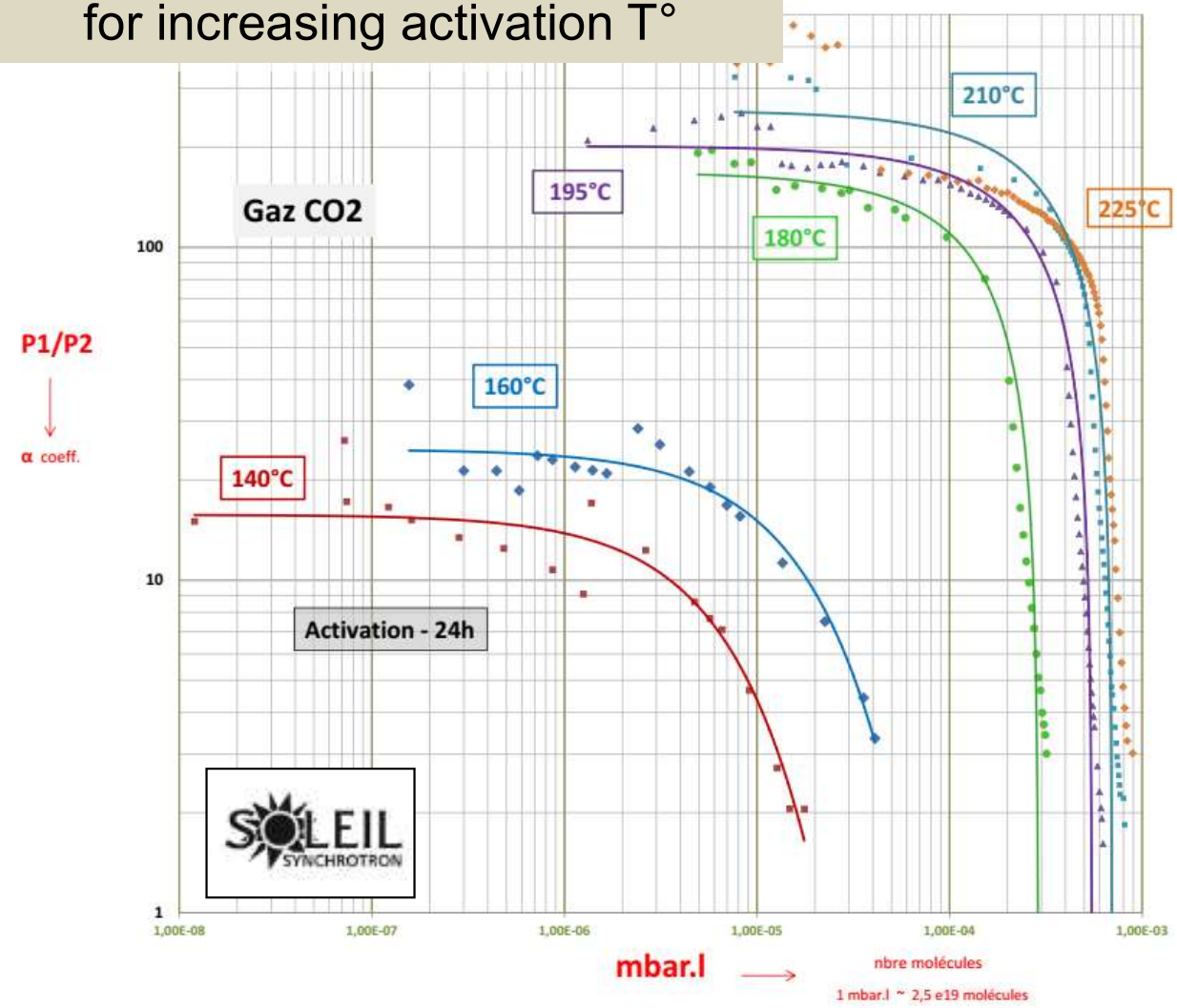
P. Costa Pinto, P. Chiggiato, A. Sapountzis, T. Sinkovits, M. Taborelli, ***CERN***
80th IUVSTA Workshop, NSRRC, Hsinchu, Taiwan (2016)

P_1/P_2 is calibrated with **MOLFLOW+** to find α

Quite easy fist NEG coating characterization

@ *Vacuum LAB*

Typical sorption capacity curves
of NEG coating
for increasing activation T°



Evolution of the ratio P_1/P_2
(→ 'pumping speed ')
is a function of the number of injected molecules

When the NEG starts to saturate the ratio start to decrease

Possible to make multiple measurements in different conditions

Example here:

Vs. activation temperature :
when the activation T° is higher the NEG can pump more molecules

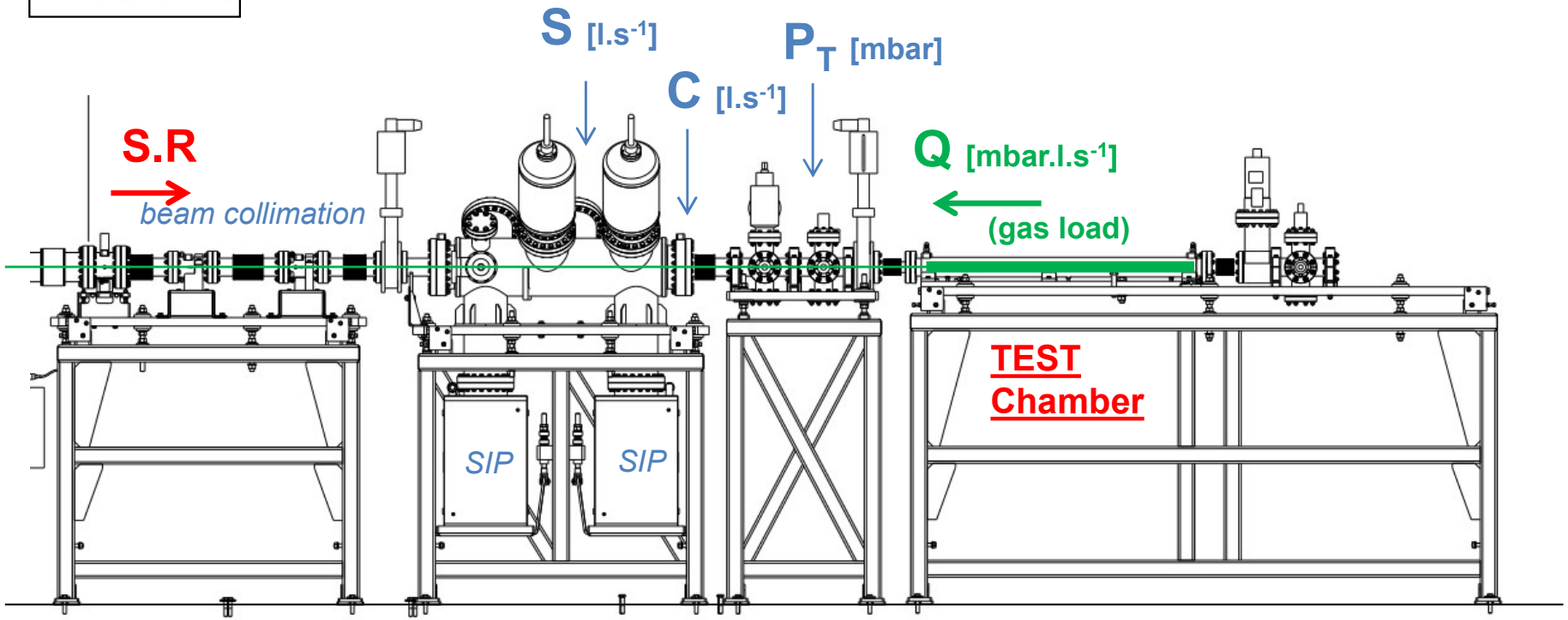
Threshold ~ 180°C
Optimum ~ 230°C
for a standard TiZrV 1µm NEG

NEG coating Characterization on PSD BL

Fully operational
(started October 2020)

Internal beam line → photon exit D08-1 inside the Storage Ring

- Evolution of the PSD yield with the photon dose
- In situ activation of the NEG

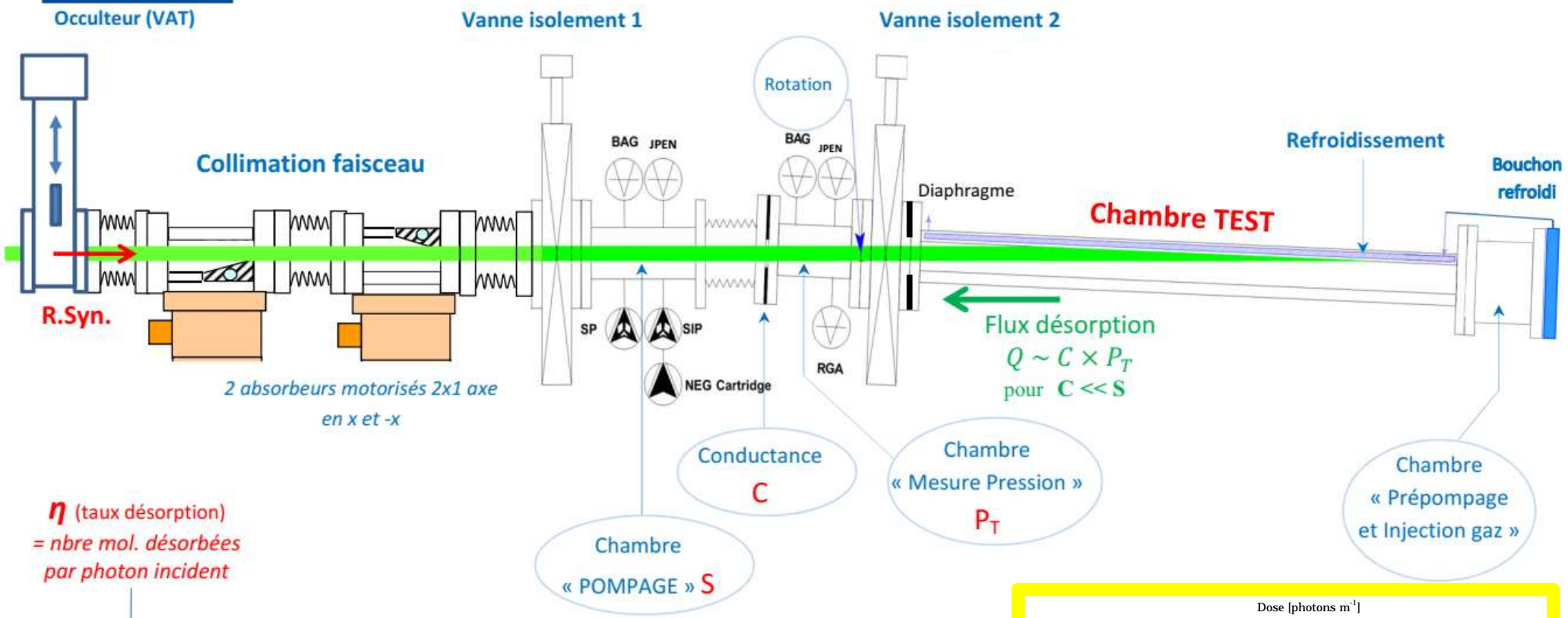


Photon to molecule yield η

$$\eta \propto \frac{Q}{8{,}17.10^{20}.E[GeV].I[A]}$$

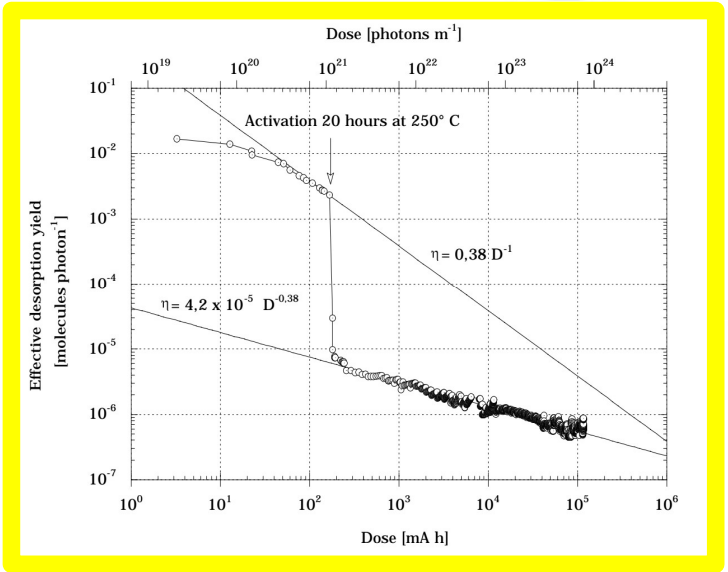
Q ~ C x P_T
C << S

PSD measurements with NEG activation



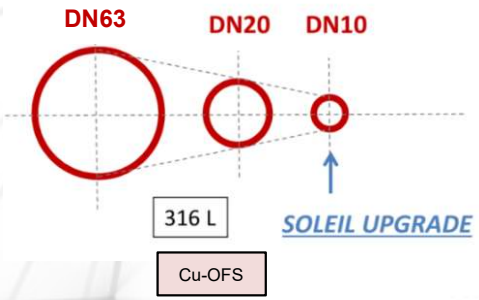
η (taux désorption) = nbre mol. désorbées par photon incident

$$\eta \propto \frac{\text{Flux de désorption}}{\text{Nbre Photons/s}} \longrightarrow \eta \propto \frac{C \times P_T}{8,17.10^{20}.E[GeV].I[A]}$$



[P. Chiggiato, R.Kersevan ***Vacuum*** *2001]*

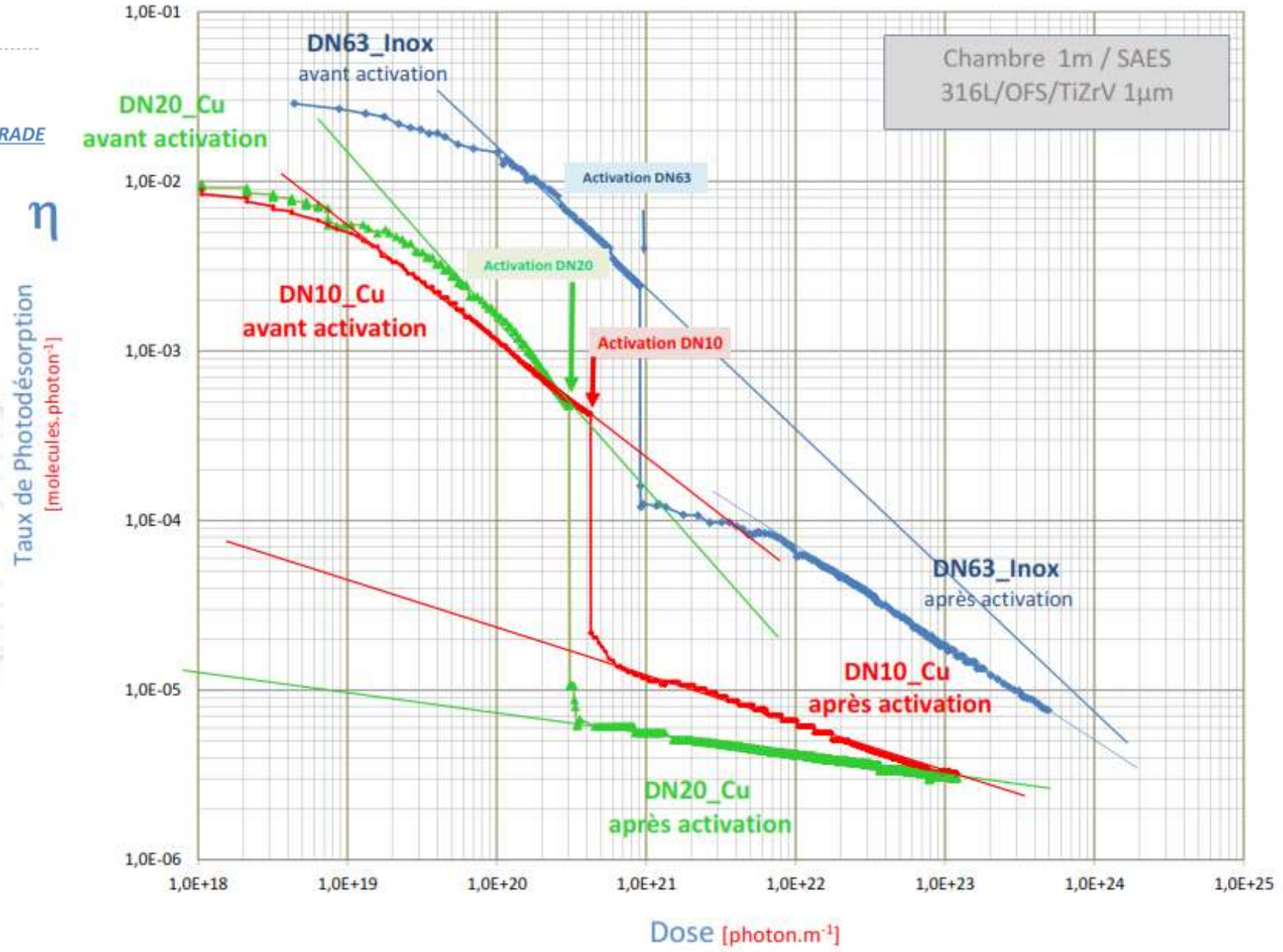
Last PSD Measurements downscaling VCs



Red curve : latest results DN10 Cu OFS

Green curve : DN20 Cu OFS / Blue curve : DN63 SS

No issues with small diameters



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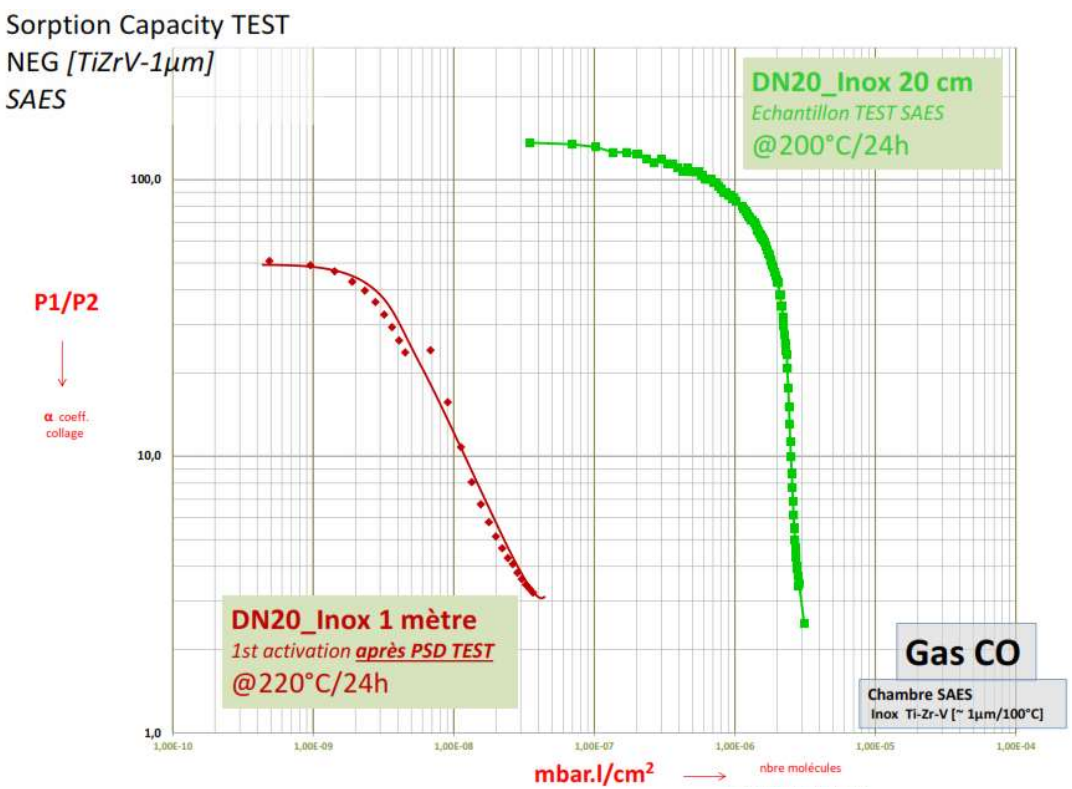
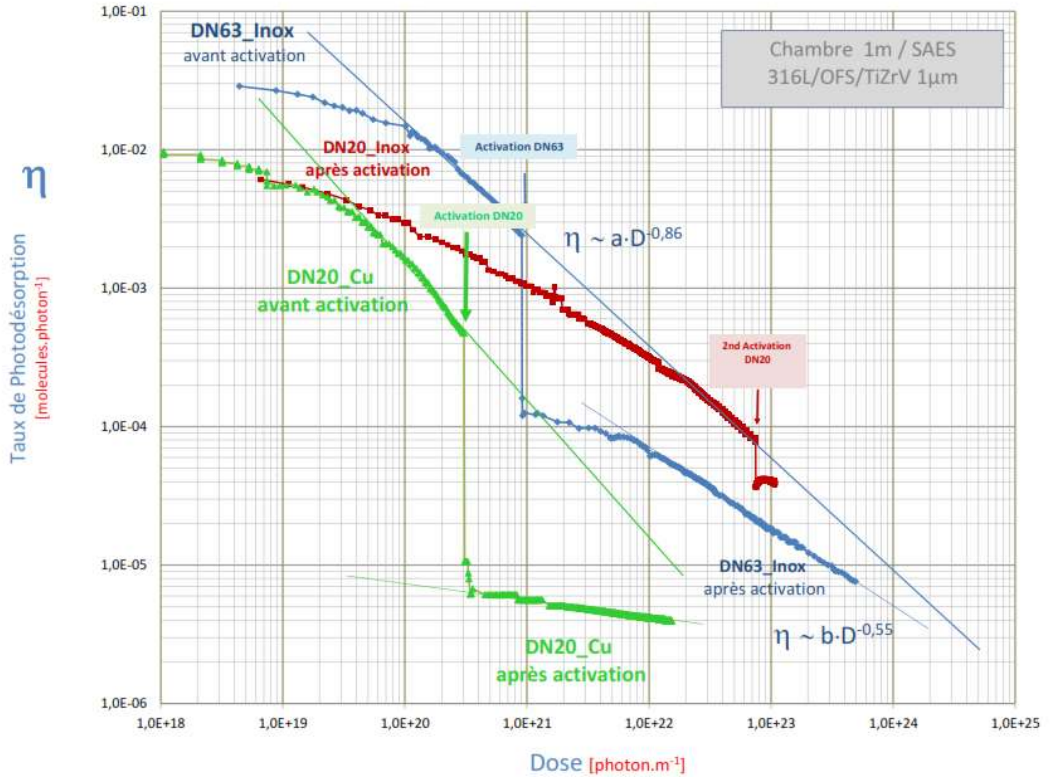
Correlation between transmission and PSD measurements

Good or **bad** NEG by transmission
(sticking coef. & capacity)

=

Good or **bad** NEG with PSD
(photodesoption yield)





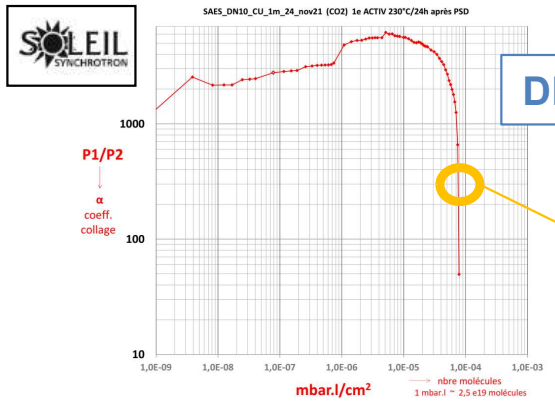
Pumping in small DN10 diameter chambers

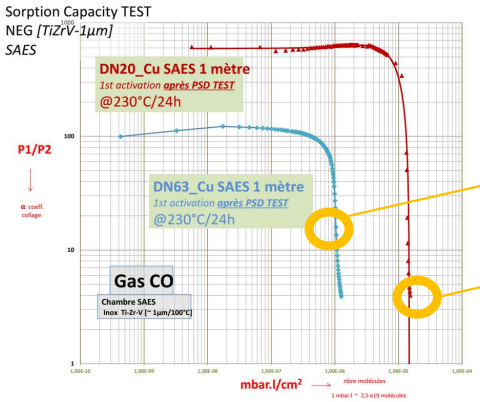
*If we compare the **sorption capacity** of the chambers to their **PSD yield** evolution after NEG activation*

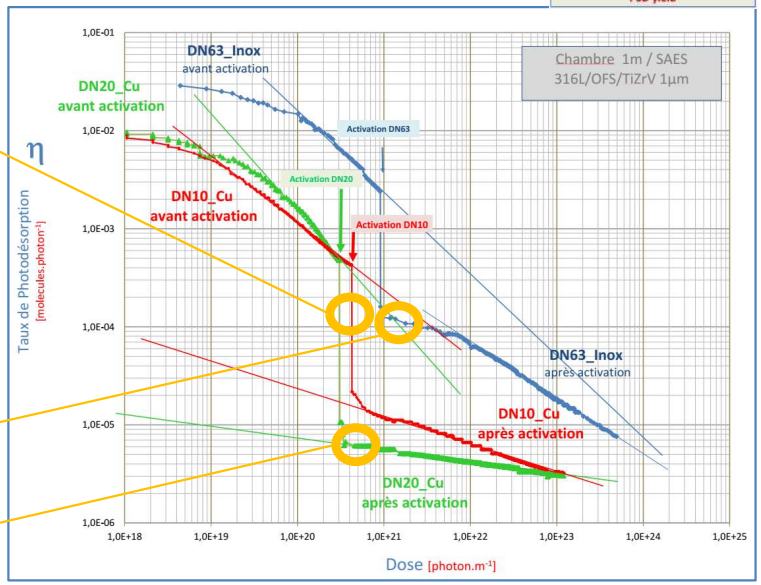
Sorption capacity in the vacuum LAB

PSD yields on the D08-1 beamline

DN63 / DN20 / DN10





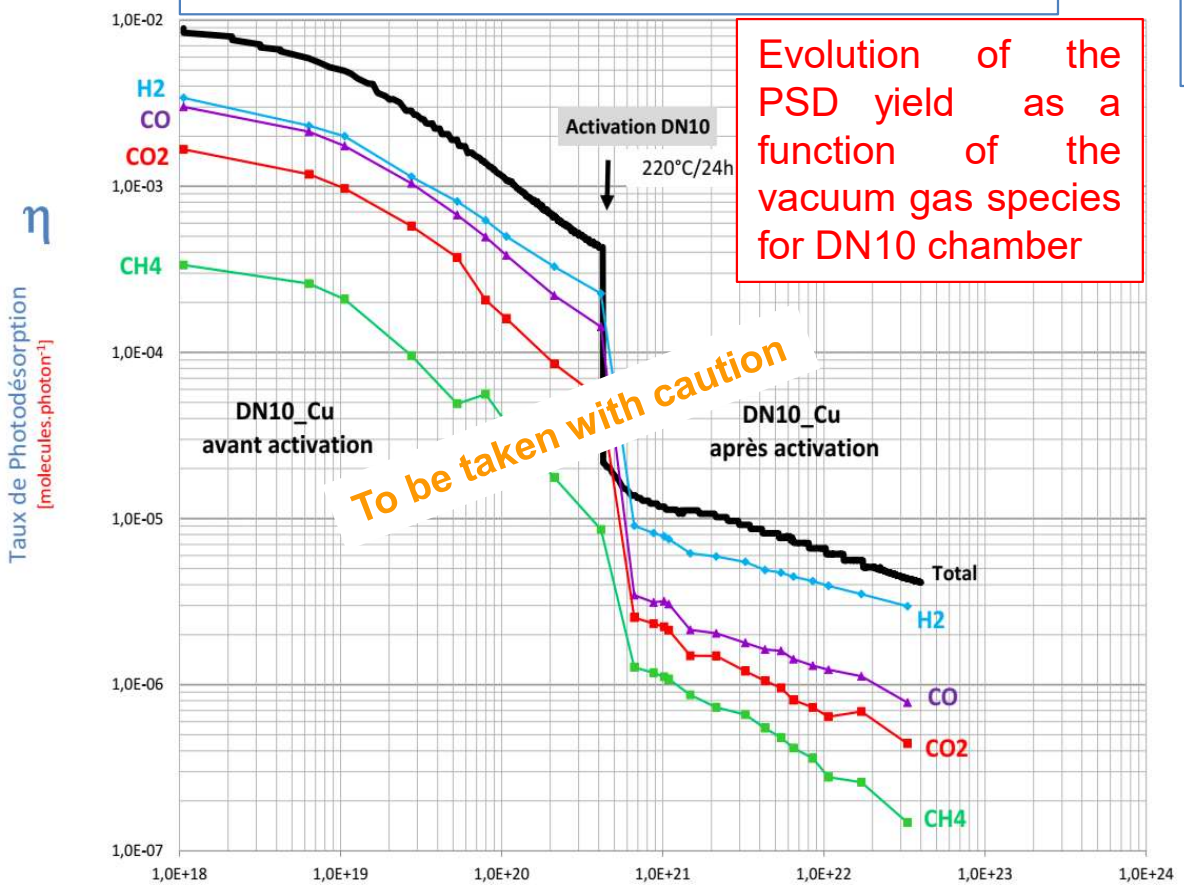


There is a closed correlation between the two results
[the better is the sorption capacity the lower is the PSD yield, and we can have some big difference between chambers!]

*This is a very interesting feature in view of the forthcoming **validation campaign** of all the vacuum chambers to be installed on the upgrade ring*

Preliminary results with RGA

H2 / CO / CO2/ CH4 evolution with the Dose



Evolution of the PSD yield as a function of the vacuum gas species for DN10 chamber

*We tried to investigate the result of **R**esidual **G**as **A**nalysis for vacuum lifetime contribution*

Difficulties of RGA calibration with non linear artefact at low vacuum pressure with the actual RGA

MKS INSTRUMENTS

Working now with calibrated gages from a collaboration with GANIL

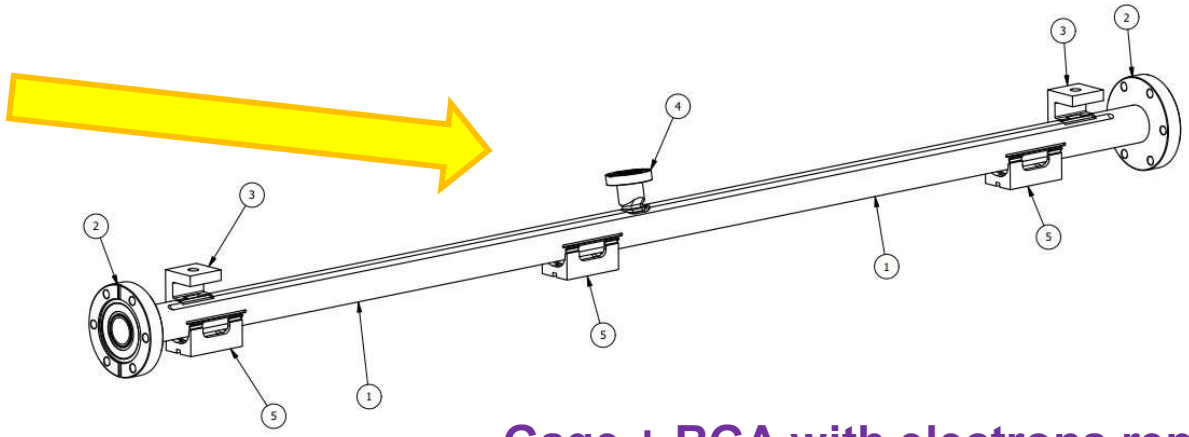
A calibration campaign is in progress with a much more linear equipment…

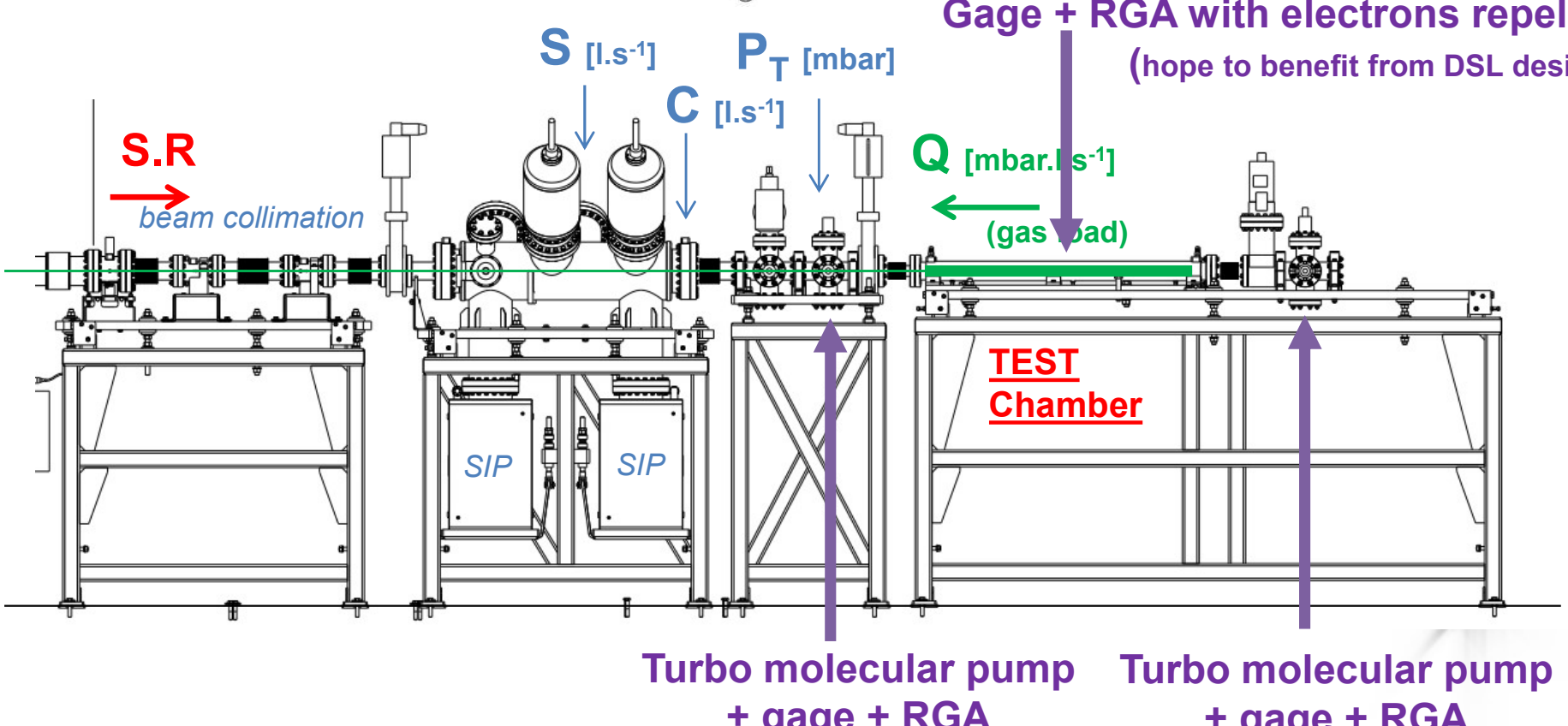
HIDEN ANALYTICAL

Evolution of PSD Beamline toward 3-gages method

Adaptation of the PSD beamline for 3-gages method

Waiting for PSD sample vacuum chambers in manufacturing at RIAL with central port





Conclusions and foresights

- Characterizations of NEG coating are on-going :
  - with sorption and PSD measurement :
  - all experiences indicate that sorption characterization are in correlation with PSD measurement,
  - simplest enough to validate the coating quality.

- Evolution of the PSD beamline for 3-gages method measurement :
  - in summer 2022,
  - with apprenticeship student in September (TechViMat 2022-2023).

- Going toward measurements with calibrated instruments :
  - already calibrated gages from collaboration with GANIL,
  - HIDEN RGA was bought recently,
  - working toward RGA calibration too.

- Waiting for PSD samples manufacturing from RIAL :
  - schedule not very optimistic for now… (July → June 2022),
  - alternative solution : one non-coated PSD sample for summer to engage 3-gages measurements ?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