

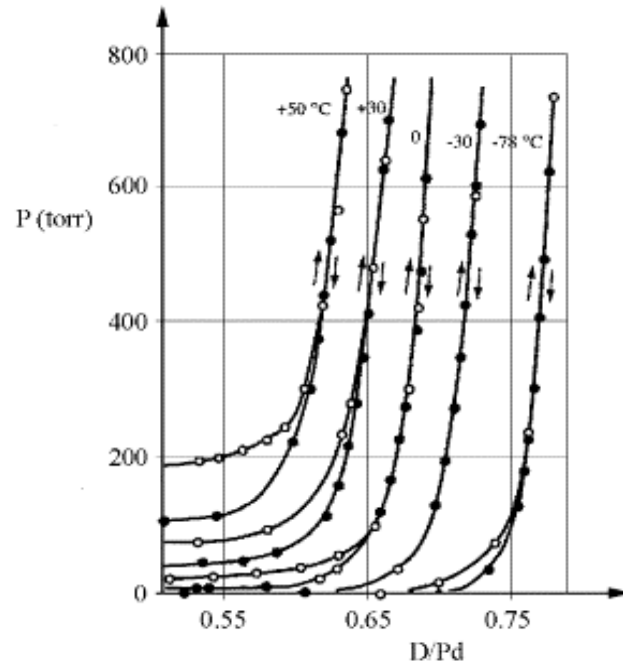
LOW TEMPERATURE GAS LOADING OF DEUTERIUM IN PALLADIUM

F. Scaramuzzi

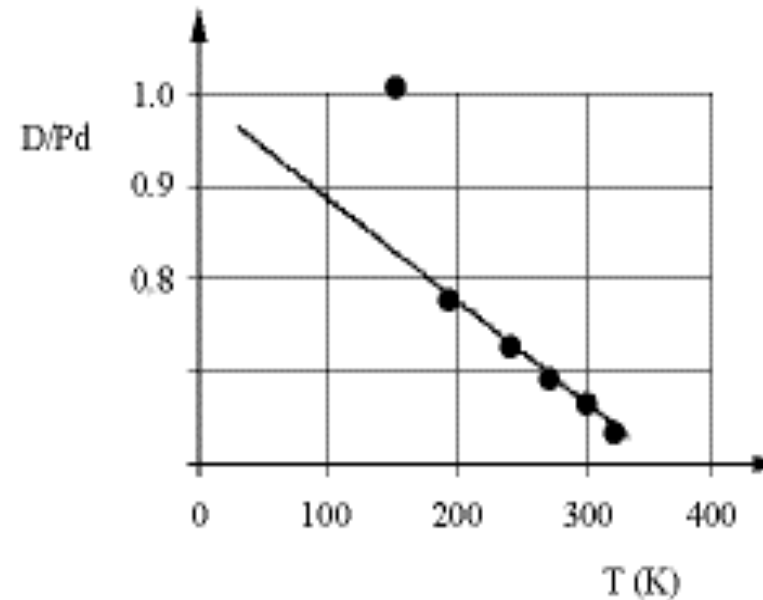
LNF/INFN, Frascati, Italy

frascara@lnf.infn.it

Why low temperature?



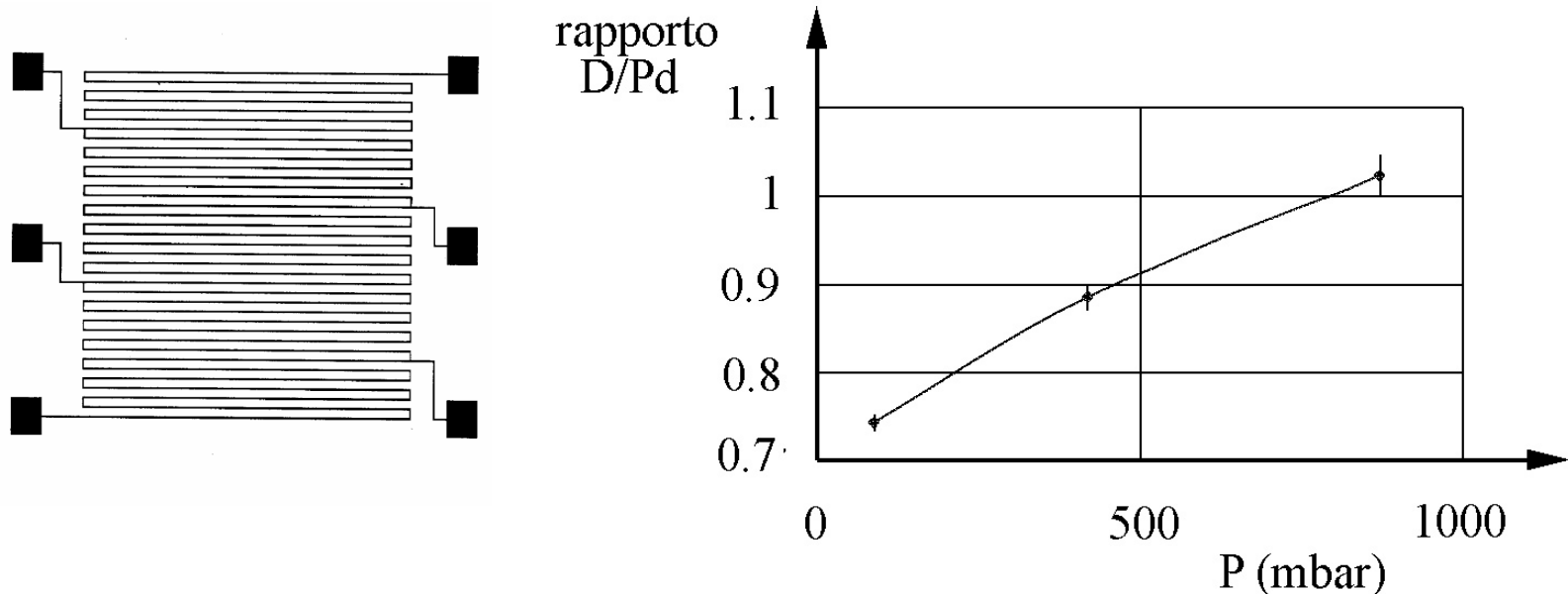
(a)



Everything started from these data

[Von E. Wicke, G.H. Nernst, Ber. Bunsenges. phys. Chem., 68, 224 (1964)]

First Measurement (ENEA Frascati 2002)



Measuring the D/Pd ratio at 150 K as a function of pressure. The sample is roughly 10 mg of Pd, in a film 3 μm thick. It took almost a month to perform the measurement.

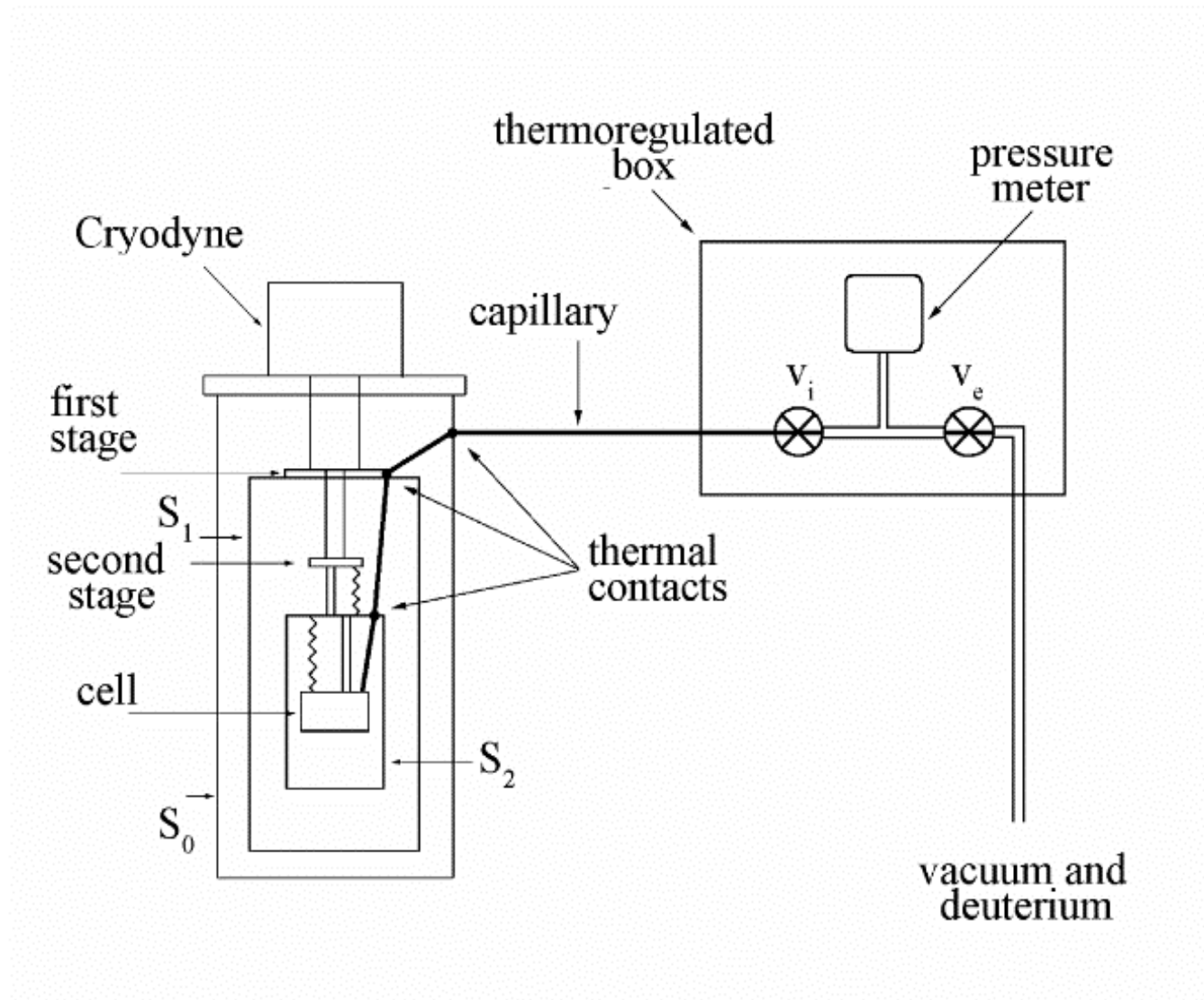
F. Scaramuzzi, **Gas loading of deuterium in palladium at low temperature**, *Journal of Alloys and Compounds*, 385, 19 (2004).

Objectives of the experiment

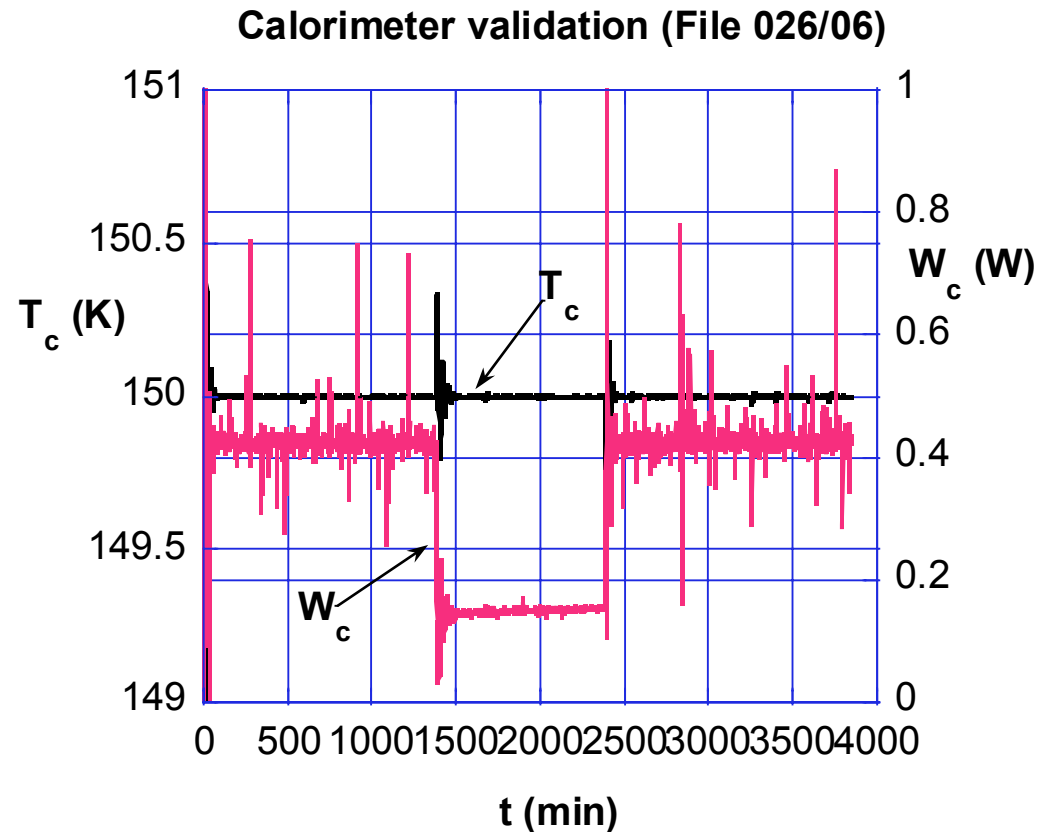
The idea is to realize a conceptually simple experiment, reproducible, and with a straightforward answer:

- To start with, measuring the D/Pd ratio, aiming to high values.
- Possibly detecting excess heat.
- Analyze the gas, looking for ^4He .
- Studying the loading dynamics.

The apparatus



Calorimetry



Shield S_2 and cell are thermoregulated. $T_c > T_s$. The power used to keep ΔT is monitored: it is the calorimeter.

The samples

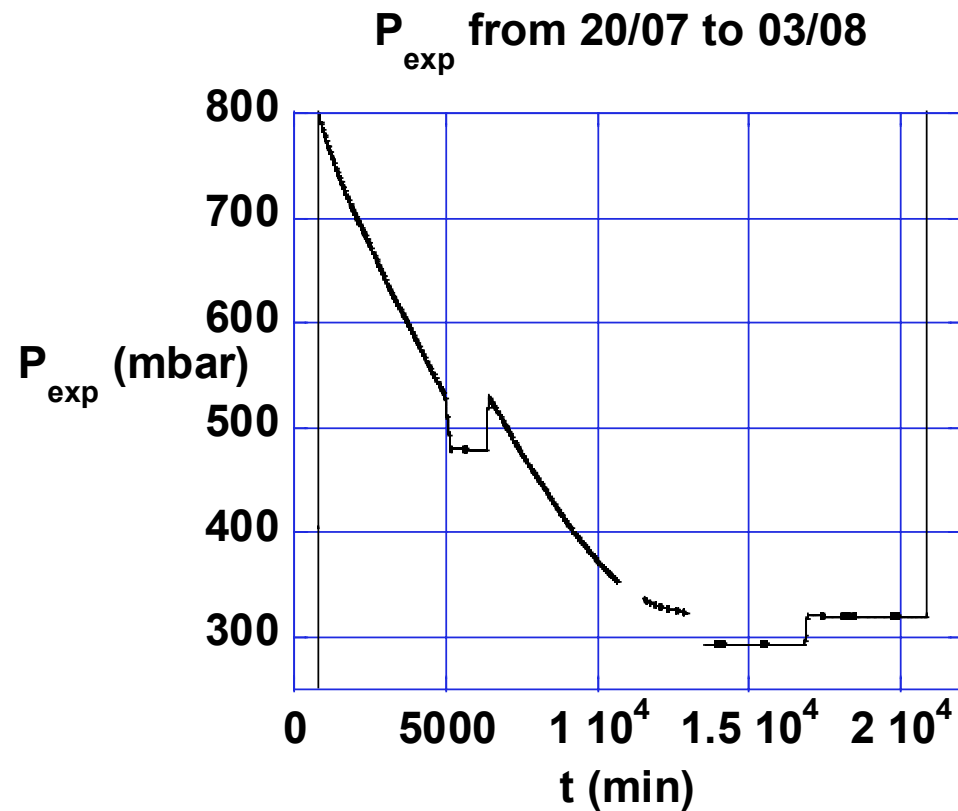
Three types of sample have been used:

- the film shown before (3 μm thick);
- sample from Vittorio Violante (50 μm thick):
- sample obtained by synthesizing Pd powder ($< 1 \mu\text{m}$).

The most promising is the first: there is a chance that more samples will be realized in a cooperation with NRL (Dr. David Knies).

The synthesized sample looks unsatisfactory: the use of nanoparticles is a very interesting perspective: a possible cooperation is being considered.

A recent result from a 50- μm thick sample of Vittorio Violante: the pressure as a function of time is reported ($T = 250\text{ K}$)

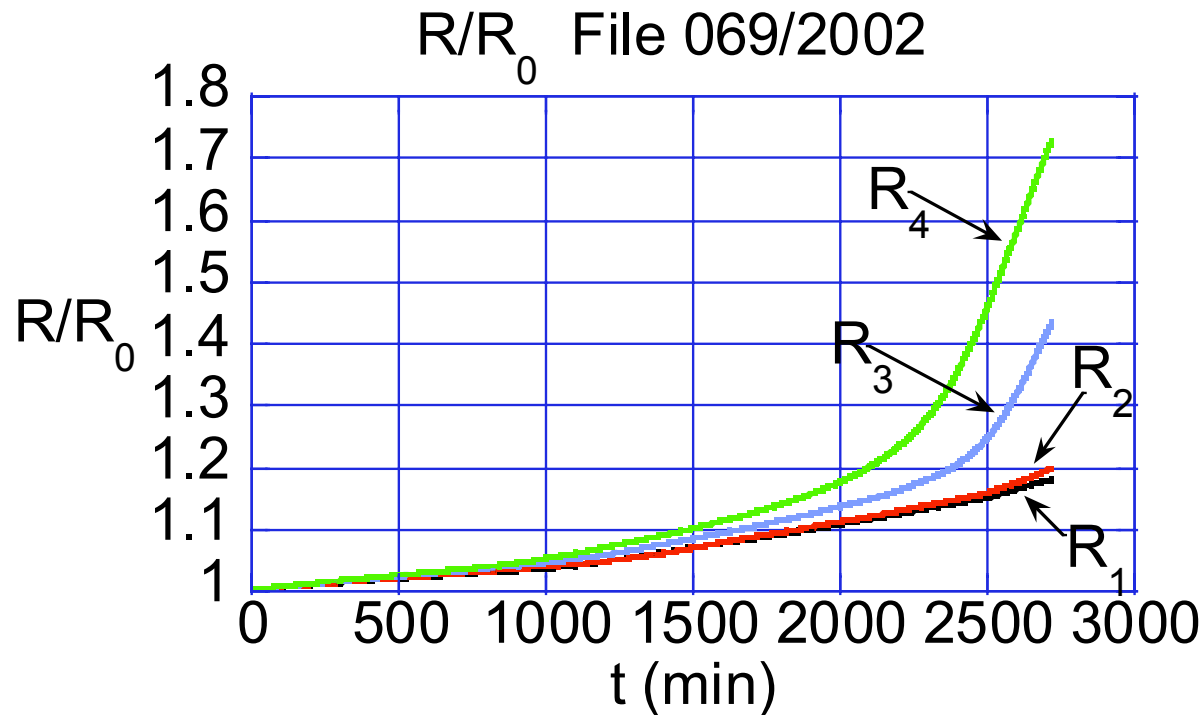


The loading ratio evaluated at the end is $D/Pd = 0.70$. It is possible that close to the surface it is higher. No heat excess detected.

Loading Dynamics - 1

- The geometry of the first sample allows measuring the electric resistance of each section independently, as a function of time, loading ratio, temperature.
- This has been done, keeping also in mind the “Preparata Effect”.
- The results are quite interesting, but presently rather poor. New samples and new tests are needed.

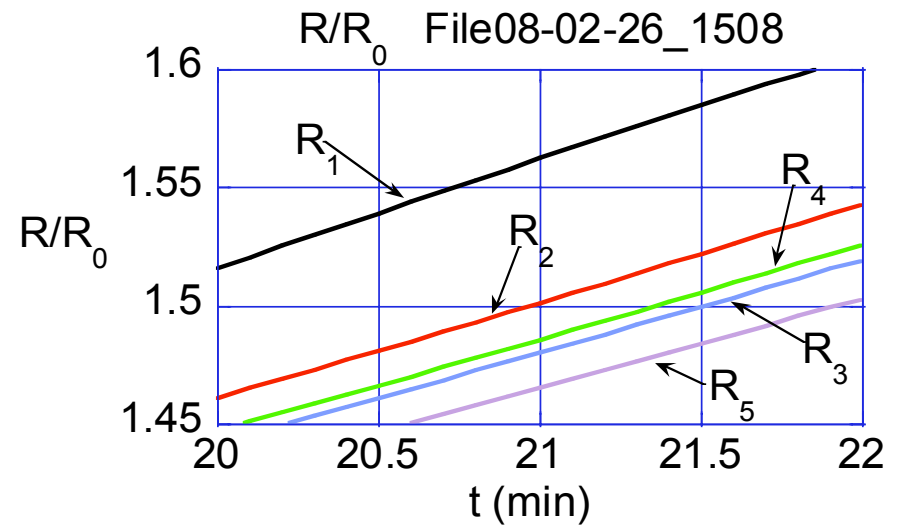
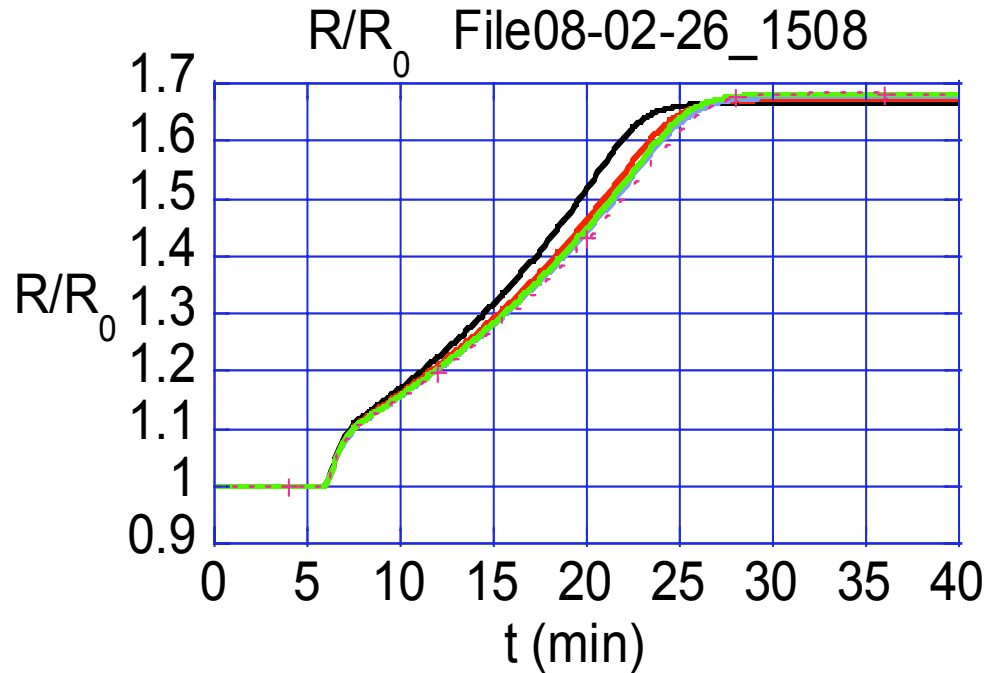
Loading Dynamics - 2



	R/R ₀	D/Pd
R ₁	1.18	0.13
R ₂	1.20	0.14
R ₃	1.42	0.29
R ₄	1.75	0.52

The 2002 experiment. $T = 150$ K. R_5 was broken after 1 day. R_1 is the most positive, R_4 the most negative. The time interval is 2 days. In the table the loading ratio.

Loading Dynamics - 3

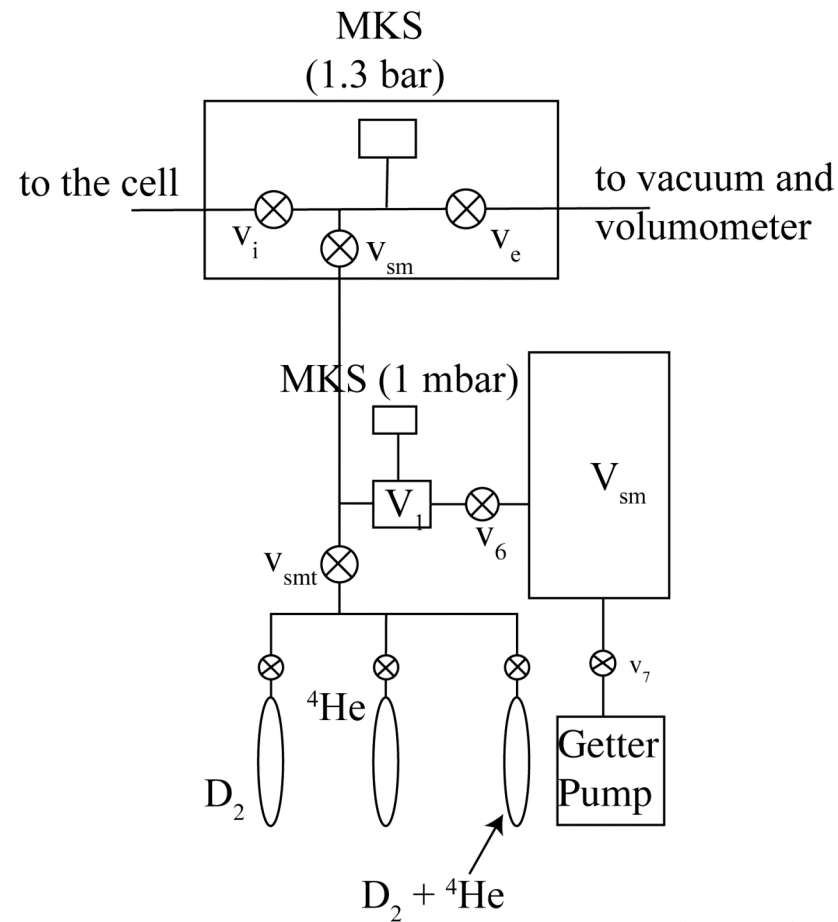


An “old” (5 years) sample at room temperature. R_5 is the most positive, R_1 the most negative. In the long term differences are smaller.

Acknowledgements

- Since 2005 this experiment was hosted at the LNF of INFN: thanks are due to the Direction of the Laboratory and to Commission 5 of INFN for its support.
- The Author is grateful to his colleague and friend Ivo Modena for continuous scientific support in the conduction of the experiment.
- He thanks warmly Arturo Moleti, Alessio Rocchi and Filippo Sanjust, who took care of the LabView data acquisition system.
- Thanks are due to ENEA and to Alberto Clozza and Angelo Viticchié for procuring valuable instrumentation.
- The experiment would not have been possible without the skillful help of Franco Campolungo, Mauro Iannarelli and Lorenzo Martinis: also to them goes the Author's gratitude.

The system for the detection of ^4He



Not completed

The apparatus

