

Piero & Paola in Bologna

(Well begun is half done)

Fest for Gianni and  
Dalpiaz<sup>2</sup> Ferrara, October  
8, 2018)

In the days of “auld lang syne”  
(1962/63) two former-highlanders (Piero  
and me) and a well-born young lady  
(Paola) graduated in Physics at the  
Bologna University, and soon enough the  
P&P duo got married.

The following is a personal report of the  
beginnings in research which under  
different respects involved the three of us  
in the following few years.

Birth and growth of the *Muon capture in gaseous hydrogen* experiment:

(a) About one year after our laurea degree...

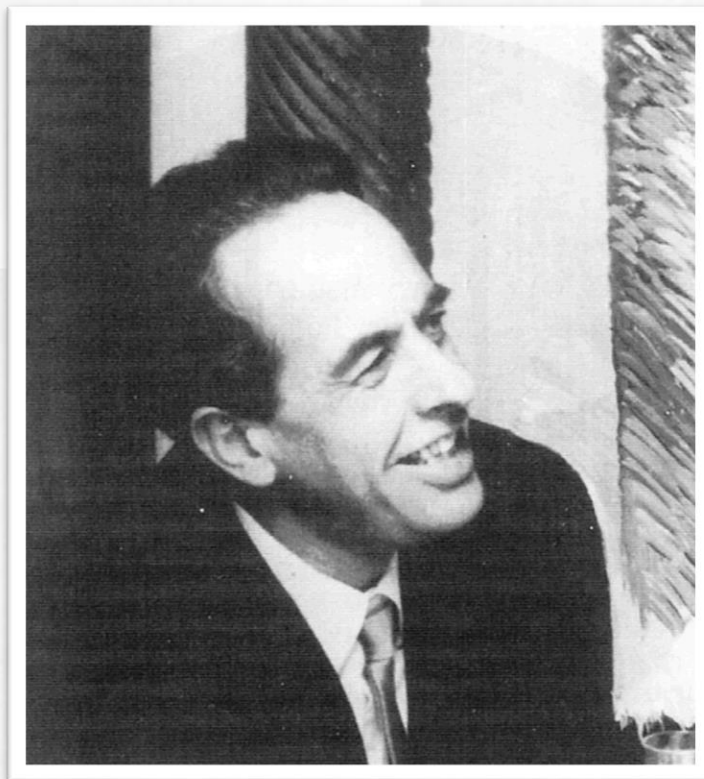
(b) Piero Bassi, at the moment Director of the Bologna INFN Section, supported the newly born Collaboration...

(c) Among the many difficulties we had to face on the occasion, especially one...

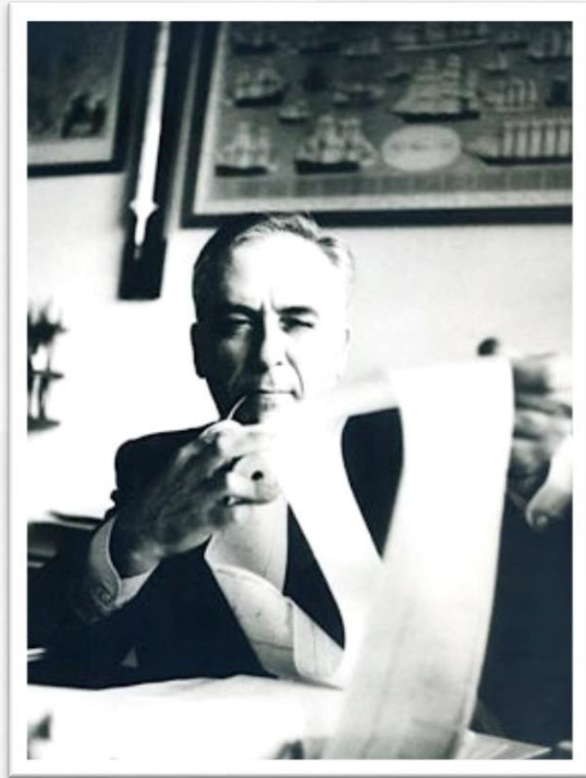
(d) When we had just begun to handle the muon beam...

## Piero Bassi (1970)

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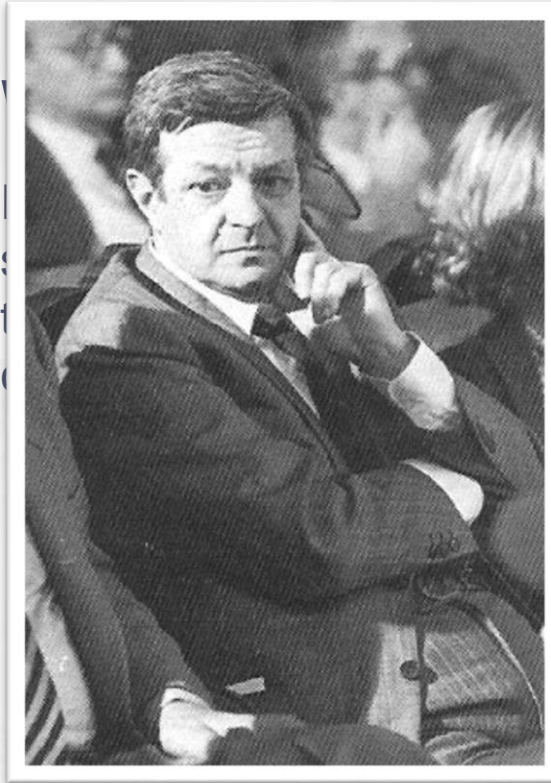


## A. Alberigi Quaranta (1976)





## Emilio (*Mimmo*) Zavattini (1984)



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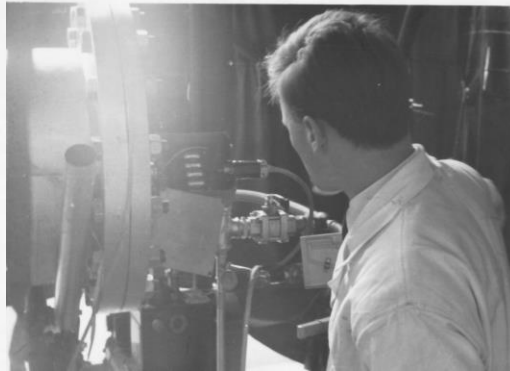
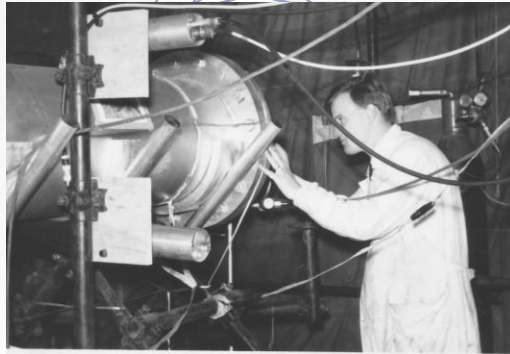
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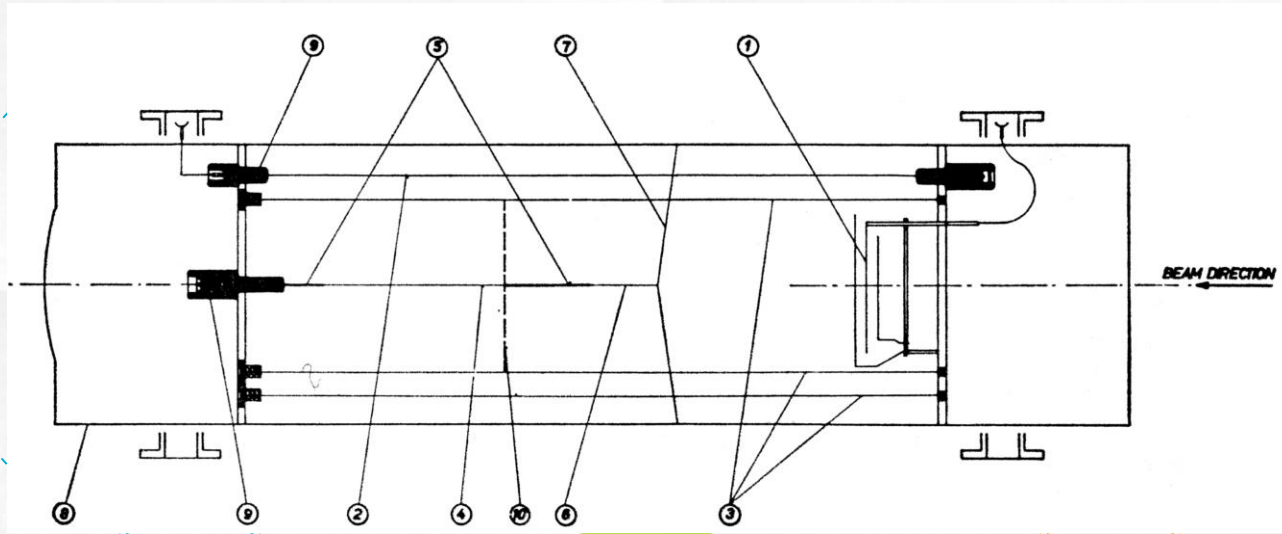
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# Will that work?



# The lidless pressure-cooker



## **Weak interactions**

Perhaps the most difficult experiment ever to be attempted at the SC is being carried out by a CERN/Bologna University collaboration led by E Zavattini. Their aim is to re-examine the weak interaction  $\mu^- + p \rightarrow n + \nu_\mu$  where the  $\mu^-$  is bound in a  $\mu p$  atom of total spin zero. The experiment uses a target of very pure gaseous hydrogen at eight atmospheres pressure and a very clean muon beam from the SC.

(CERN Courier vol. 6, August 1966)

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Printed in U. S. A.

(per ore)  
muon e il più bello!  
deuterio  
18 14 65

## Muon Capture in Gaseous Hydrogen

A. ALBERIGI QUARANTA,\* A. BERTIN, G. MATONE,† AND F. PALMONARI  
*Istituto di Fisica dell' Università di Bologna, and Istituto Nazionale di  
Fisica Nucleare, Sezione di Bologna, Italy*

AND

G. TORELLI

*Istituto di Fisica dell' Università di Pisa, and Istituto Nazionale di Fisica Nucleare, Sezione di Pisa, Italy*

AND

P. DALPIAZ, A. PLACCI, AND E. ZAVATTINI

*CERN, Geneva, Switzerland*

(Received 22 August 1968)

An experiment to measure the muon nuclear capture rate in ultrapure gaseous hydrogen (8 atm, 293°K) has been performed using a special target in which a system of gas proportional counters, working with the pure hydrogen of the target itself, were operating. Neutrons from the capture reactions were detected using a scintillation-counter technique, and the  $\gamma$ -ray background was eliminated by pulse-shape discrimination. The working conditions ensured that the captures were taking place in  $\mu p$  atomic systems in a singlet total-spin state. The experimental result is  $\Lambda_{\text{expt}} = 651 \pm 57 \text{ sec}^{-1}$ , which has to be compared with the theoretical rate  $\Lambda_{\text{theor}} = 626 \pm 26 \text{ sec}^{-1}$ . From the experimental capture rate, and within the framework of the currently accepted theory, we have obtained for the induced pseudoscalar coupling constant  $g_p = (-7.3 \pm 3.7)g_V$ . The results of the present experiment are analyzed, together with results obtained from stopping negative muons in liquid hydrogen.



# *Well begun, half done*

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NUCLEAR INSTRUMENTS AND METHODS 55 (1967) 273–287; © NORTH-HOLLAND PUBLISHING CO.

## **A SPECIAL SYSTEM OF PROPORTIONAL COUNTERS TO BE USED AS A HIGH PRESSURE GAS TARGET WITHOUT WALLS**

A. ALBERIGI QUARANTA \*, A. BERTIN, G. MATONE<sup>†</sup>, F. PALMONARI and A. PLACCI<sup>†</sup>  
*Istituto di Fisica dell'Università di Bologna and Istituto Nazionale di Fisica Nucleare, Sez. di Bologna, Italy*  
and  
P. DALPIAZ <sup>†</sup> and E. ZAVATTINI,  
*CERN, Geneva, Switzerland*

Received 9 May 1967

A special assembly of high pressure wire proportional counters is described. Their operation defines a volume in a gaseous target, the effective limits of which are set mainly by the electric fields of the counters and not by a continuous material wall. The apparatus, used in a recent experiment – at the CERN

600 MeV synchrocyclotron – while filled with extremely purified hydrogen, is fitted to work with any gas, or mixture of gases, proper to fill gas proportional counters. The device seems suitable to be used in different fields of high-energy physics.

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VOLUME 8, NUMBER 11

1 DECEMBER 1973

## Muon Capture in Gaseous Deuterium

A. Bertin\* and A. Vitale

*Istituto di Fisica dell'Università di Bologna and Istituto Nazionale di Fisica Nucleare, Sezione di Bologna, Bologna, Italy†*

A. Placci and E. Zavattini

*CERN, Geneva, Switzerland*

(Received 3 July 1973)

We report the results of an experiment performed to measure the muon nuclear capture rate by free deuterons. The muons were slowed down in ultrapure gaseous hydrogen at 7.6 atm and 293 °K, containing 5% of deuterium. A special target was used, in which a system of gas proportional counters, working with the ( $H_2 + D_2$ ) gaseous mixture itself, was operating. Neutrons from the capture reactions were detected using liquid scintillation counters, and the  $\gamma$ -ray background was eliminated by pulse-shape discrimination. The experimental result is  $\Lambda_{\text{exp}} = (445 \pm 60) \text{ sec}^{-1}$ , which is consistent with muon-electron universality and with the assumption that the nuclear capture proceeds from the doublet spin state of the  $\mu d$  muonic atoms. Combining the present experimental value with a previous result obtained with a liquid-hydrogen deuterated target, one obtains a ratio between the axial-vector and vector coupling constants given by  $g_{A,\mu}/g_{V,\mu} = -1.35 \pm 0.1$ .

# To say nothing of the crew (1964)

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Sample  
text



Diagram featured by <http://slidemodel.com>

...from field theory to  
tentacular wires





*...and final remarks.*

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Final positions of the team members of the  
*Muon Capture in gaseous hydrogen* experiment.

Name	Role
A.Alberigi Quaranta	<i>Emeritus professor (Univ. of Modena Reggio Emilia)</i>
E. Zavattini	<i>Lincei Academician</i>
G. Torelli	<i>Emeritus professor (Univ. Pisa)</i>
P. Dalpiaz	<i>Emeritus professor (Univ. Ferrara)</i>
A. Bertin	<i>Emeritus professor (Univ. Bologna)</i>
F. Palmonari	<i>INFN emeritus scientist</i>
G. Matone	<i>INFN team spokesman</i>
A. Placchi	<i>CERN team spokesman</i>



***That's all, Folks!***