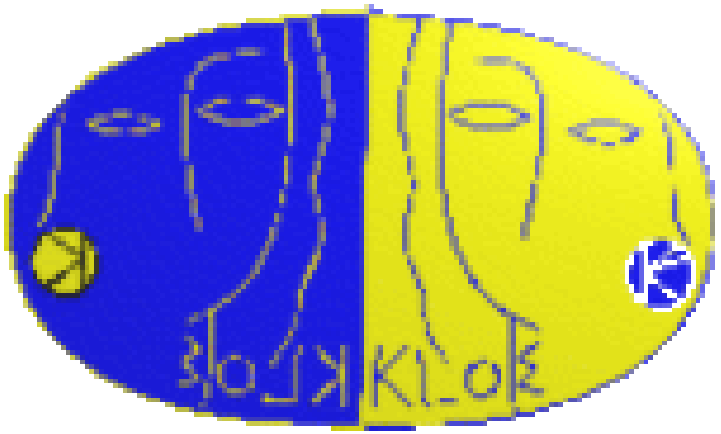
KLOE and the LNF



Fabio Bossi

KLOE LNF

Frascati May 30, 2013

We are here to honour our colleagues and friends Juliet and Paolo and celebrate their 80 birthday

There are many ways to do that, and express gratitude and respect for them, and I think that the presence of those who have come here just for the purpose is the best way to do it

On my side, I have choosen the way of briefly summarizing what has for sure been one of their scientific “masterpieces”, KLOE, trying to underline the importance that it has had in the life of this laboratory in the last 20 years, and the lesson that we have learnt from this wounderful experience (and that we should try not to forget!)

Frascati has been one of the leading laboratories for the birth of particle physics, but I think no-one can disagree if I say that in the late 80s, despite some heroic effort by a handful of people (Rinaldo in primis), it was basically in a dead end

With the push and the endorsement of people such as Nicola Cabibbo, Luciano Maiani, Enzo Iarocci, and others, J&P joined LNF with the goal of re-launching the laboratory in the “Premier League” of particle physics with a distinctive and very ambitious program

This “re-foundation” of the laboratory has passed through three major steps, which I will describe in the following

First step:
Building the detector

Building KLOE has been a HUGE effort but also a BIG fun

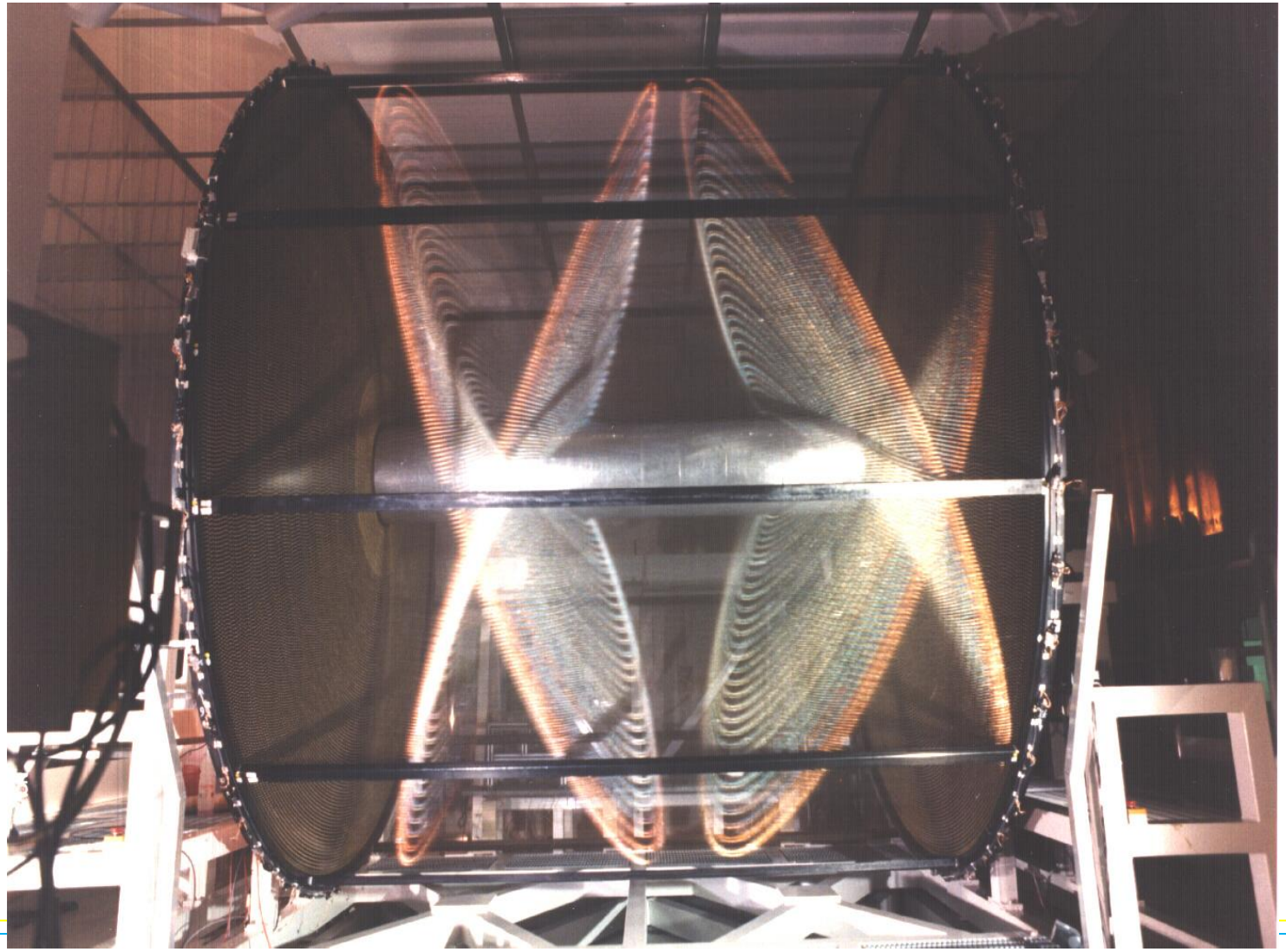
The ability to build state-of-the-art detectors was already present in the laboratory. LNF was in the forefront in the construction of big detectors to be installed in many other laboratories in the world, such as ALEPH, CDF, MACRO…

The construction of KLOE required combinig together these experiences, as well as those of other INFN and foreign laboratories: Bari, Karlsruhe, Lecce, Napoli, Pisa, Roma 1, Roma 2, ISS, Trieste

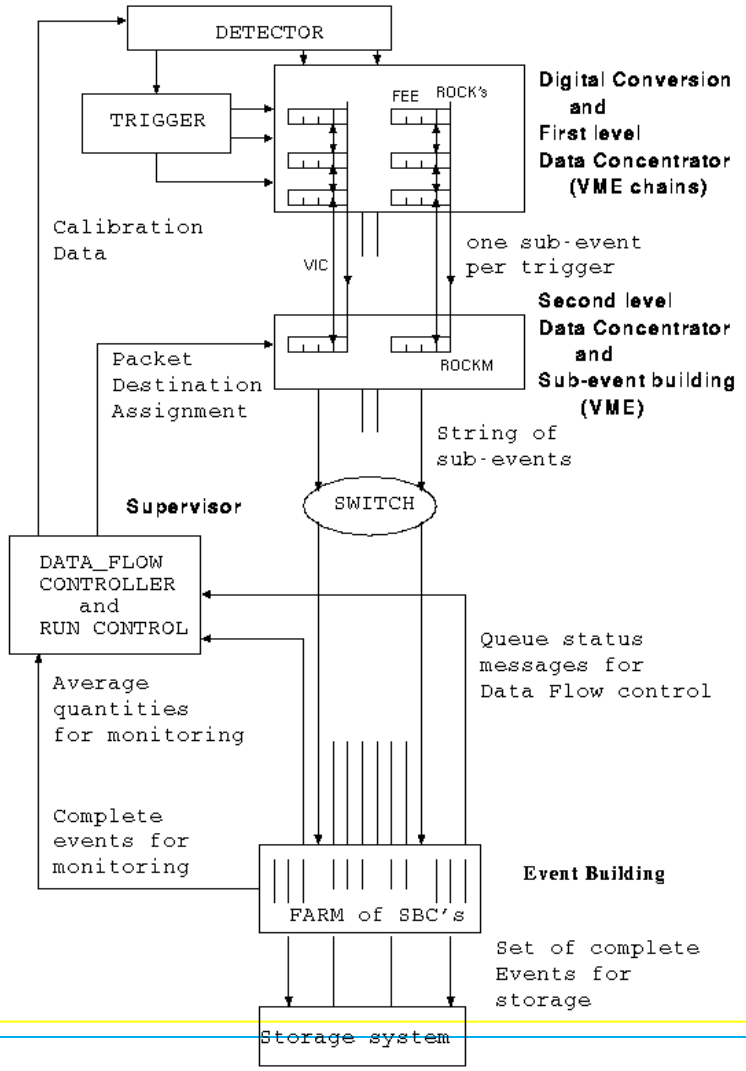
This has allowed us to:

Build an exceptionally performing e.m. calorimeter, that has been “copied” by several other experiments in the world

Build the largest drift chamber in the world, the first one using carbon fibers as material for the end-plates



Set-up a sophisticated FEE-trigger-DAQ-data handling system, capable of managing for several years Mbytes/s of data with basically no errors



But the real challange/achievement was the ability of putting everything together as a consequence of a well defined project

This has required the common and well organized effort of the most part of the laboratory, of its infrastructures, its personnel: physicists, engineers, technicians, administrative staff…

And also from time to time the support of the community around us, maybe not always particularly enthusiastic…


Oxford Instruments (UK) Ltd
KLOE

Second Step:
Physics Achievements

The first KLOE physics paper:

PLB 535 (2002) 37

ELSEVIER

Physics Letters B 535 (2002) 37–42

PHYSICS LETTERS B

www.elsevier.com/locate/npe

Measurement of the branching fraction for the decay $K_S \to \pi e \nu$ ☆

KLOE Collaboration

A. Aloisio [f], F. Ambrosino [f], A. Andryakov [c,o], A. Antonelli [c], M. Antonelli [c], C. Bacci [j], G. Bencivenni [c], S. Bertolucci [c], C. Bini [h], C. Bloise [c], V. Bocci [h], F. Bossi [c], P. Branchini [j], S.A. Bulychjov [o], G. Cabibbo [h], R. Caloi [h], P. Campana [c], G. Capon [c], G. Carboni [i], M. Casarsa [m], V. Casavola [e], G. Cataldi [e], F. Ceradini [j], F. Cervelli [k], F. Cevenini [f], G. Chiefari [f], P. Ciambrone [c], S. Conetti [b], E. De Lucia [h], G. De Robertis [a], R. De Sangro [c], P. De Simone [c], G. De Zorzi [h], S. Dell'Agnello [c], A. Denig [c], A. Di Domenico [h], C. Di Donato [f], S. Di Falco [k], A. Doria [f], M. Dreucci [c], O. Erriquez [a], A. Farilla [j], G. Felici [c], A. Ferrari [j], M.L. Ferrer [c], G. Finocchiaro [c], C. Forti [c], A. Franceschi [c], P. Franzini [h], C. Gatti [k], P. Gauzzi [h], S. Giovannella [c], E. Gorini [e], F. Grancagnolo [e], E. Graziani [j], S.W. Han [c,n], M. Incagli [k], L. Ingrosso [c], W. Kluge [d], C. Kuo [d], V. Kulikov [o], F. Lacava [h], G. Lanfranchi [c], J. Lee-Franzini [c,l], D. Leone [h], F. Lu [c,n], M. Martemianov [d], M. Matsyuk [c,o], W. Mei [c], A. Menicucci [i], L. Merola [f], R. Messi [i], S. Miscetti [c], M. Moulson [c], S. Müller [d], F. Murtas [c], M. Napolitano [f], A. Nedosekin [c,o], F. Nguyen [j], M. Palutan [j], L. Paoluzi [i], E. Pasqualucci [h], L. Passalacqua [c], A. Passeri [j], V. Patera [c,g], E. Petrolo [h], D. Picca [h], G. Pirozzi [f], L. Pontecorvo [h], M. Primavera [e], F. Ruggieri [a], N. Russakovic [k], P. Santangelo [c], E. Santovetti [i], G. Saracino [f], R.D. Schamberger [l], B. Sciascia [h], A. Sciubba [c,g], F. Scuri [m], I. Sfiligoi [c], T. Spadaro [h,*], E. Spiriti [j], G.L. Tong [c,n], L. Tortora [j], E. Valente [h], P. Valente [c], B. Valeriani [d], G. Venanzoni [k], S. Veneziano [h], A. Ventura [c], Y. Xu [c,n], Y. Yu [c,n], P.F. Zema [k]

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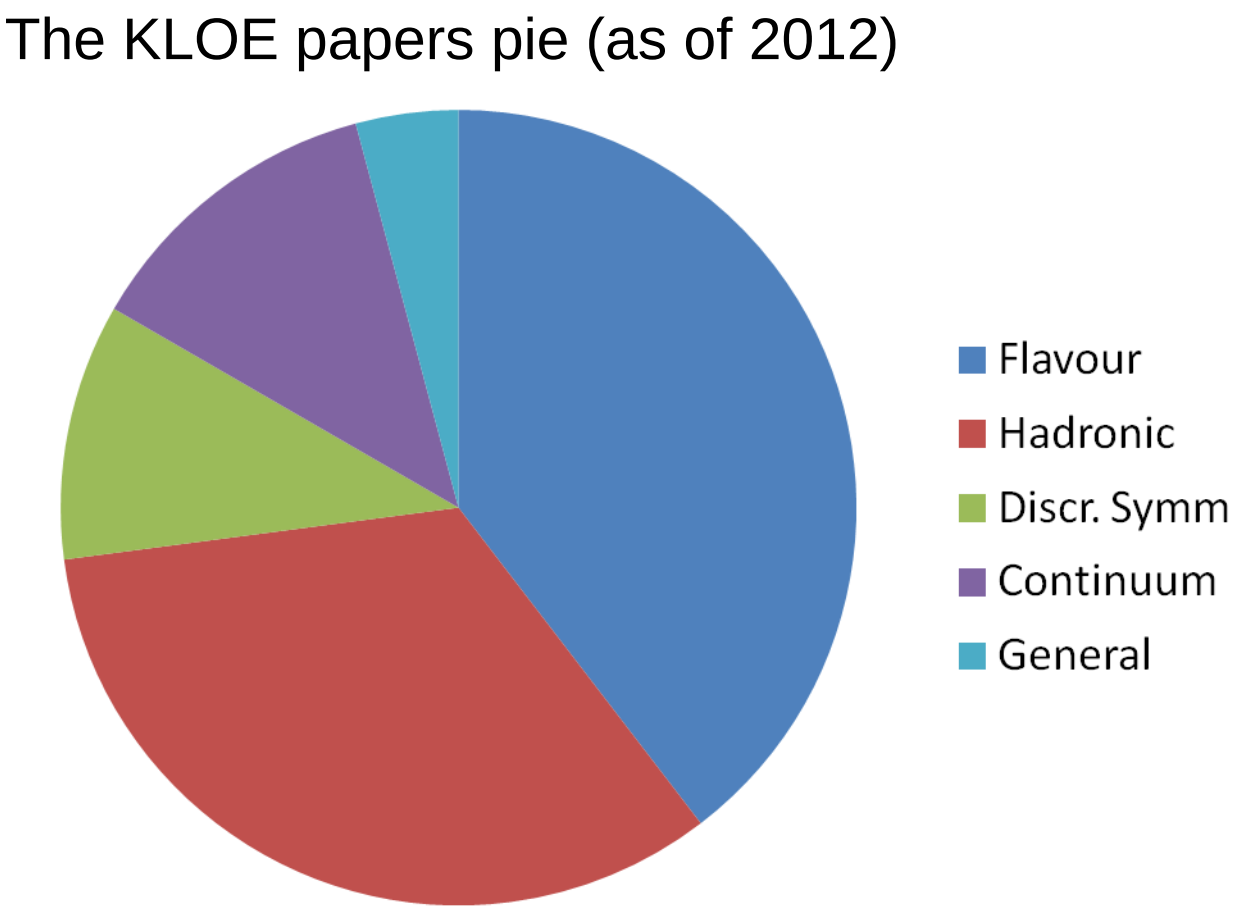
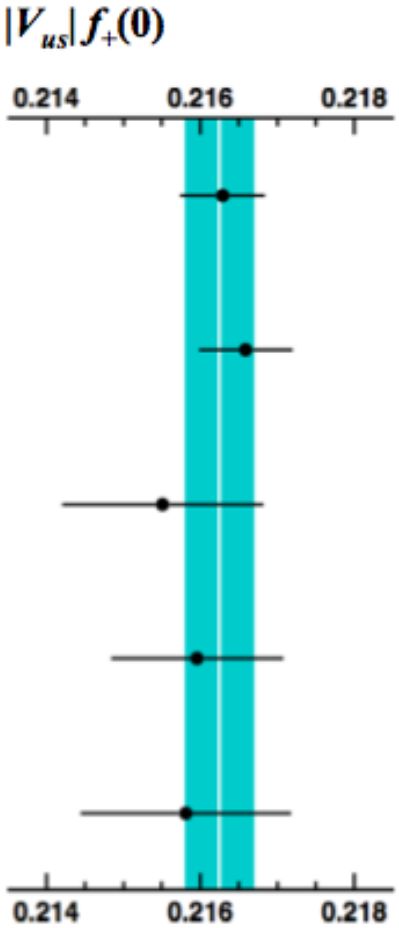
Since then, KLOE has been publishing on international journals at a rate of ~ 5 papers/year, out of which 1 200+, 3 100+, 13 50+ , in several different fields of particle physics



Among the most relevant achivements of KLOE we can enumerate:

- The complete set of measurement of neutral and charged kaon decay parameters to allow the precision measurement of V_{us} setting the best unitarity limit on the CKM matrix
- A precise determination of the hadronic contribution to the g-2 of the muon
- The most detailed studies on the nature of scalar mesons
- The measurement of some of the rarest branching ratios of the K_s and η mesons
- Several precision tests of fundamental discrete symmetries conservation (C, CP, CPT), as well as precision tests of QM
- Competitive limits on the existence of light hidden gauge bosons ("dark photons")

$|V_{us}| f_+(0)$ from world data: Update

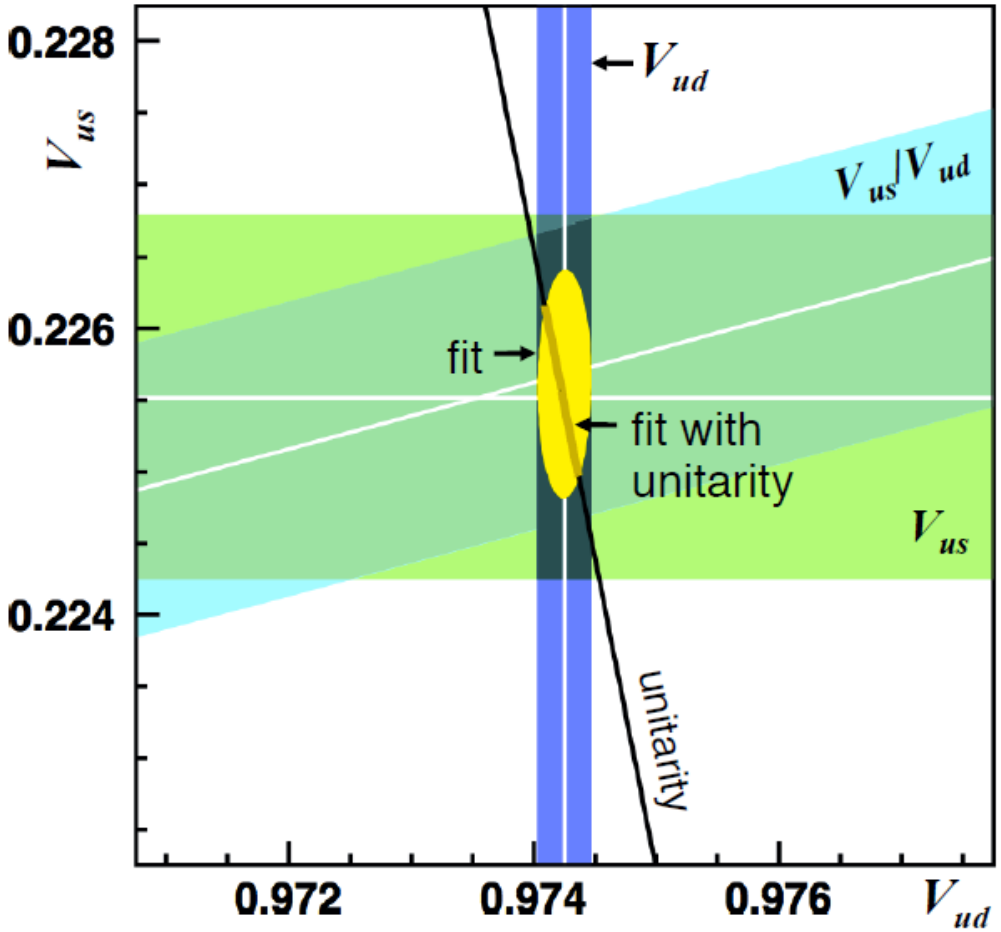


		% err	Approx. contrib. to % err from: BR	τ	Δ	Int
$K_L e3$	0.2163(5)	0.26	0.09	0.20	0.11	0.05
$K_L \mu 3$	0.2166(6)	0.28	0.15	0.18	0.11	0.06
$K_S e3$	0.2155(13)	0.61	0.60	0.02	0.11	0.05
$K^{\pm} e3$	0.2160(11)	0.52	0.31	0.09	0.41	0.04
$K^{\pm} \mu 3$	0.2158(13)	0.63	0.47	0.08	0.41	0.06

Average: $|V_{us}| f_+(0) = 0.2163(5)$ $\chi^2/\text{ndf} = 0.84/4$ (93%)

Stolen to B. Sciascia

Use $f_+(0) = 0.959(5)$ and $f_K/f_\pi = 1.193(5)$
Fit to results for $|V_{ud}|$, $|V_{us}|$, $|V_{us}|/|V_{ud}|$



$|V_{ud}| = 0.97425(22)$
$|V_{us}| = 0.2255(13)$
$|V_{us}|/|V_{ud}| = 0.2317(11)$

Fit results, no constraint

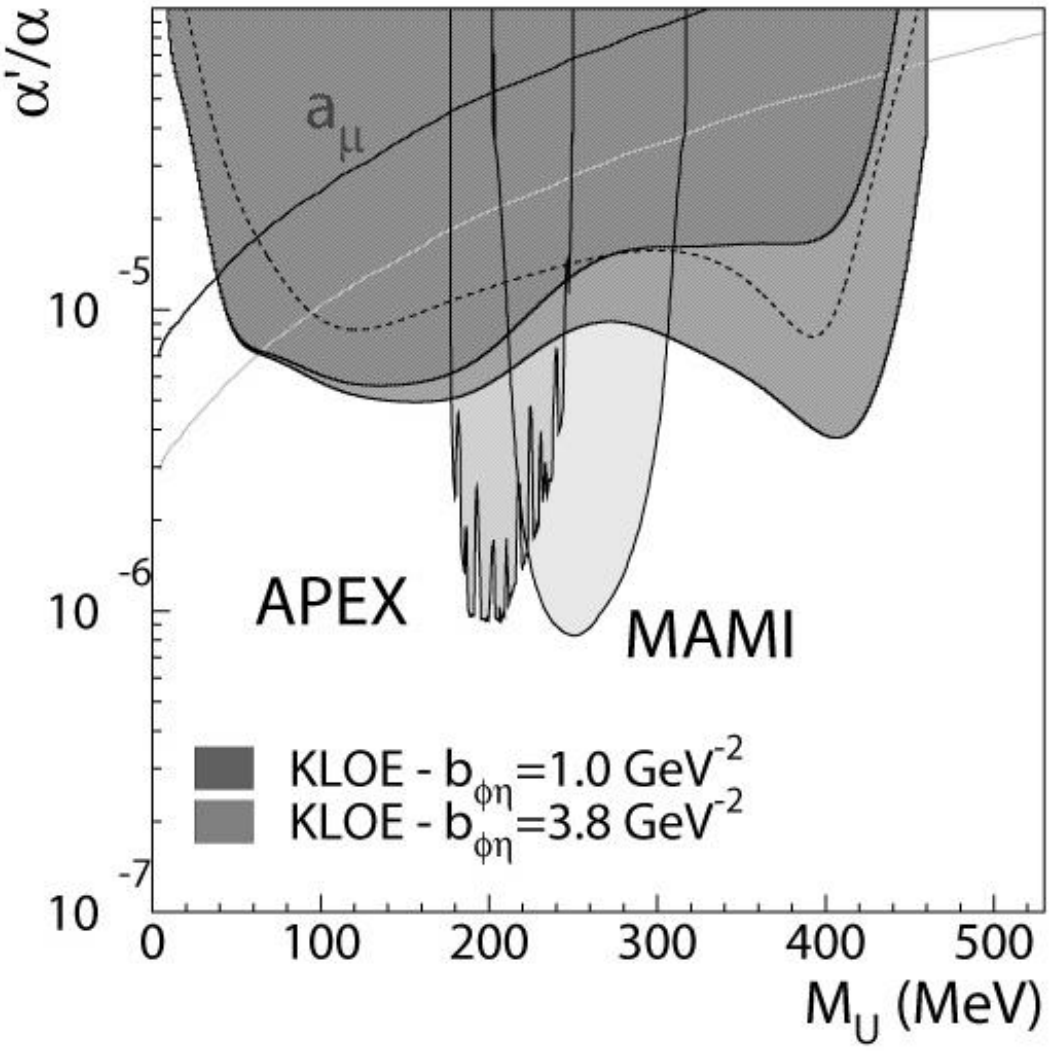
$V_{ud} = 0.97425(22)$
$V_{us} = 0.2256(8)$
χ^2/ndf = 0.03/1 (86%)
$\Delta_{CKM} = +0.0001(6)$

Fit results, unitarity constraint

$V_{ud} = 0.97423(14)$
$V_{us} = 0.2255(6)$
χ^2/ndf = 0.05/2 (97%)

Stolen to B. Sciascia

KLOE limit on dark photon as a function of its mass and of its couling to the ordinary matter, compared to other existing experiments



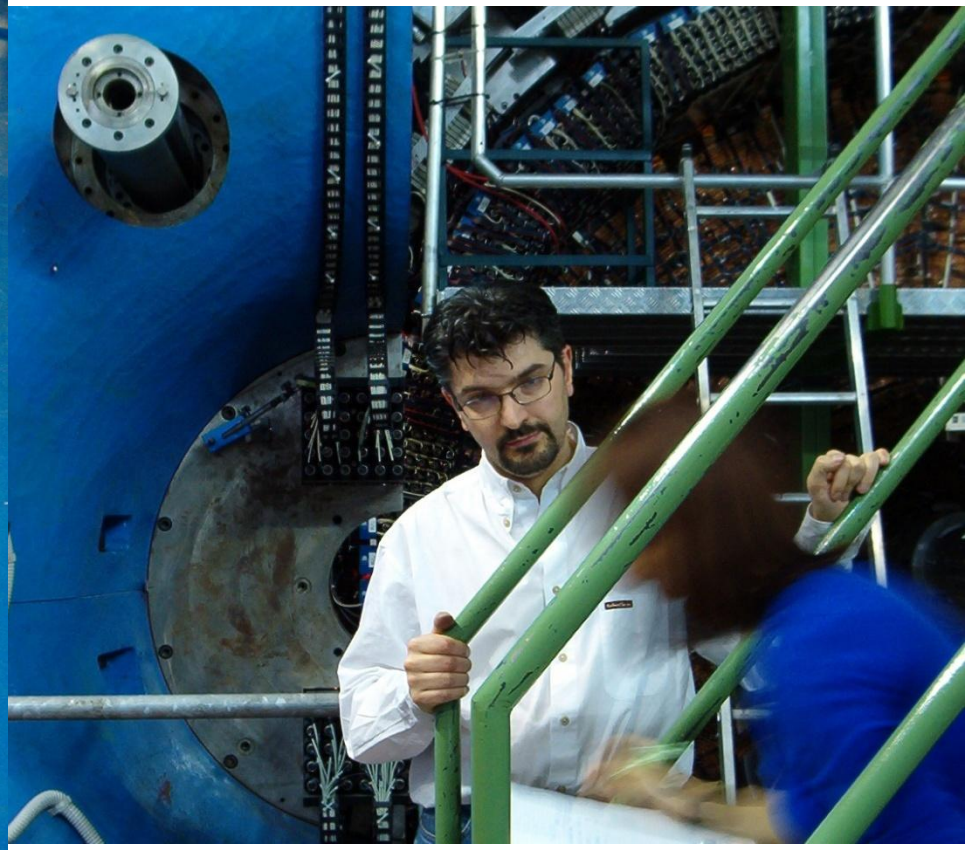
Third Step:
Recruiting the Troops

However, the most important achievement obtained by KLOE has been the recruitment and the training of a large number of (once) young physicists, engineers, technicians

The experience that we had on KLOE has been unique and is now being exported in many other experiments all over the world with great success

It has been a wonderful experience under several points of view. Along the years of KLOE, we had the opportunity to…

….work hard



…visit beautiful and interesting places

….have fun together

with some unexpected consequences….

We have learnt a lot. Not only in terms of physics, but also in terms of how to work in a group and, last but not least, of how to present the results of our work

Actually, a distinctive feature of a KLOE member is that, differently from many other non-english-speaking colleagues, he/she

DETERMINES something and does not DETERM*AI*NS it

finds something PROMISING and not PROM*AI*SING

makes a fit with a GAUSSIAN and not with a G*OSC*IAN

I must also acknowledge the fundamental contribution of many other non-KLOE colleagues:

- The AD staff that has operated DAΦNE with increasingly good performance
- The members of many international physics networks (Eurodafne/Euridice, Flavianet, CKM, HadronPhysics) who have followed with interest our progress and supported us under many respects
- The colleagues of the other DAΦNE experiments for their continuous interactions with us and often their very appreciated collaboration
- Many theoreticians who have provided us with physics insights and *sometimes have also been members of our team*


LEGEA
K's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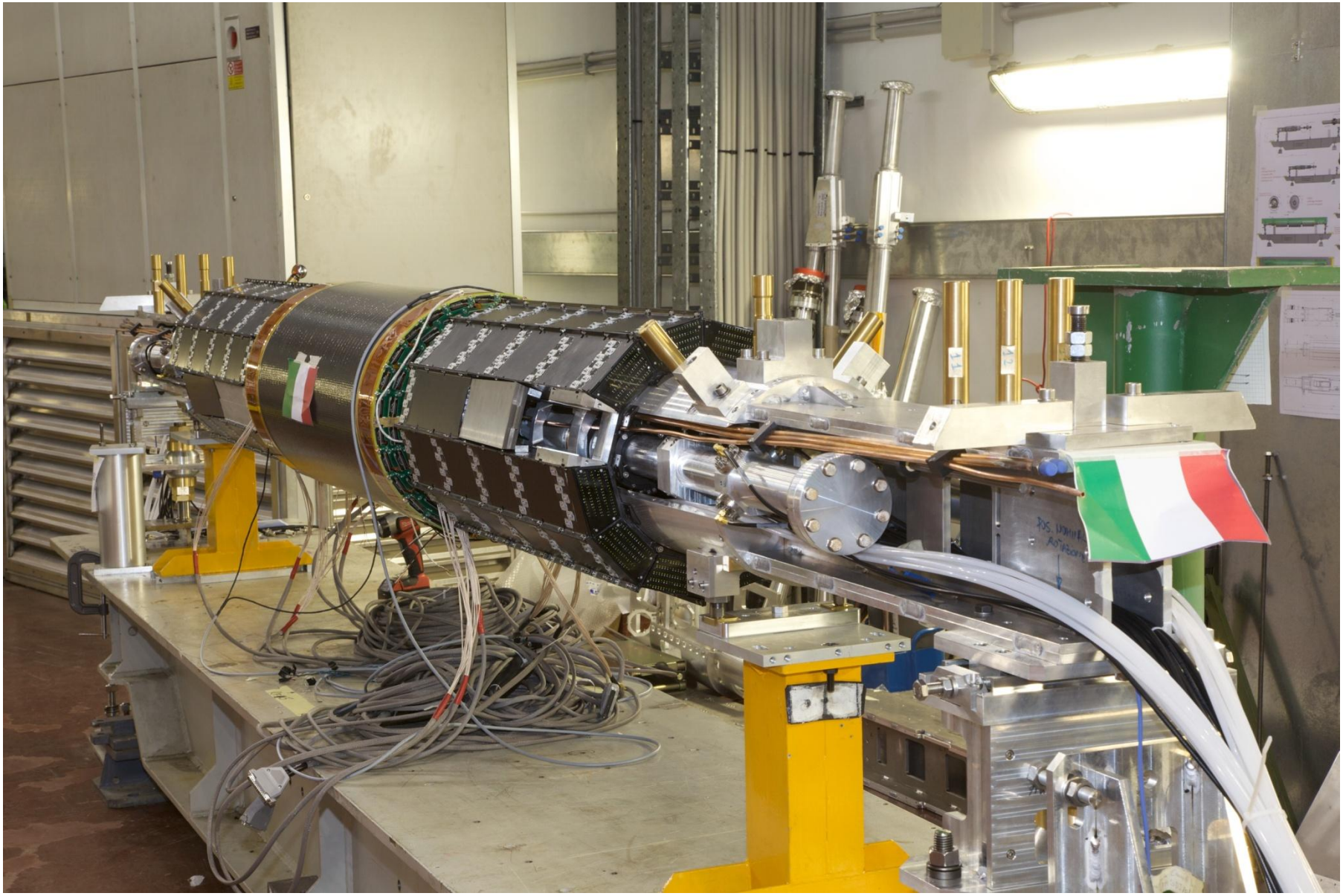
Φ

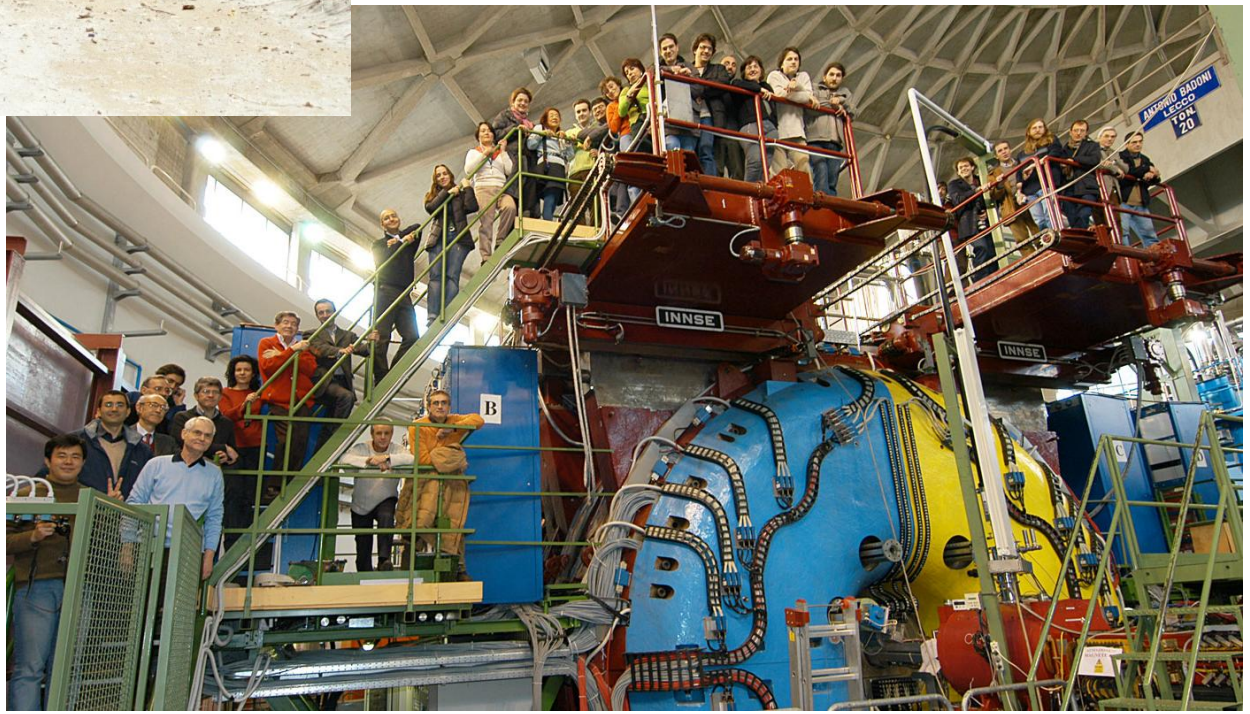
In conclusion I think that the KLOE experience has taught us that this laboratory can do first class physics, provided there is a well defined and properly supported project

This lesson is particularly relevant in these days, in which we are debating about the future of LNF and about its role in the physics developments of the next decade

My opinion is that we can still do excellent things, as shown by the recent construction achievements for KLOE-2



JULIET AND PAOLO



THANK YOU !