The SAGA of the « french » apeNEXT's

To fight for decent computing power it sometimes needs Don Quixote's stubbornness and Sancho Panza's patience

Don Quixote and Sancho Panza
by Honoré Daumier.

Dulcinea del Toboso

We discovered a collaboration full of Don Quixote's

- These poeple were simply conceiving and developing from scratch (well, let's say, from APEmille), at dawn of the 21st century, on the european continent, practically void of computer industry,

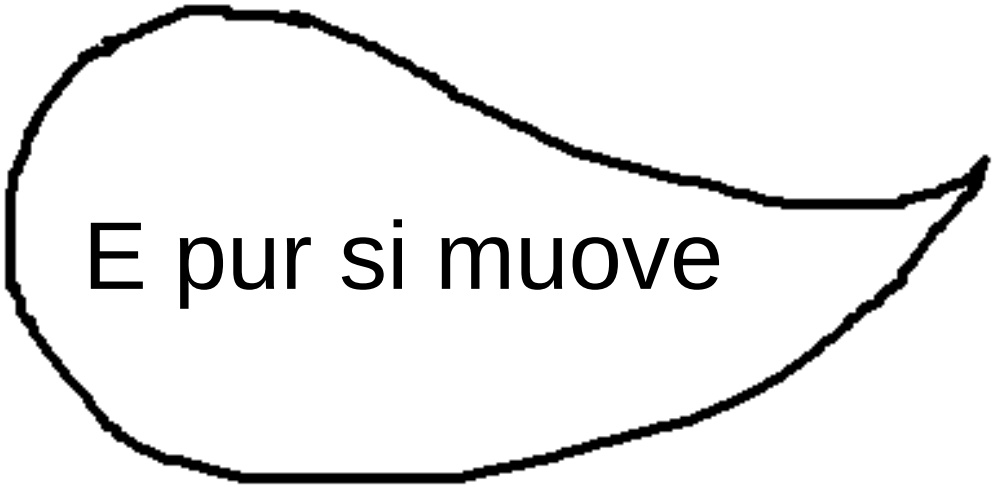
a Teraflop computer !!!

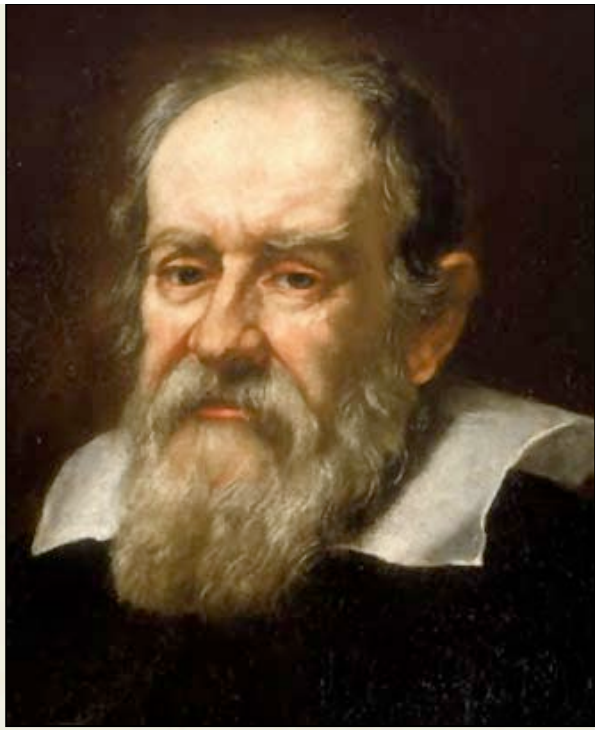
We did not hesitate one second, we asked to join

The apeNEXT collaboration

- These people were not beginners, they had already developed three generations of APE
- The tribes were located in Pisa/Ferrara, Roma, Zeuthen/Berlin, later joined by the teutonic knights from Bielefeld.
- There was a huge amount of wind mills to defeat

DON QUIJOTE DE LA MANCHA. - La aventura de los molinos





And yet apeNEXT runs !

Provided they don’t
deliver bad chips

We have brought our modest contribution to apeNEXT R&D:

- Unexpert contribution from LPT (Orsay) to the tests.
- CAPS group of IRISA/INRIA (Rennes):

creates « SOFAN », code optimizer for the ApeNext system, *developed in*

In collaboration with Zeuthen and Pisa/Ferrara

- SOFAN (Software Optimizer for ApeNEXT) — is designed as a flexible middle-end optimizer for apeNEXT. Operating on the level of assembly code it performs various analyses coupled with a set of standard and target-dependent optimizing transformations, that address specific features of the J&T chip architecture. SOFAN attempts to remove low-level code slackness left over by the code generation process of the front-end compilers (nlcc, rtc). The optimizer is based on SALTO framework.

We then needed funding to buy apeNEXT

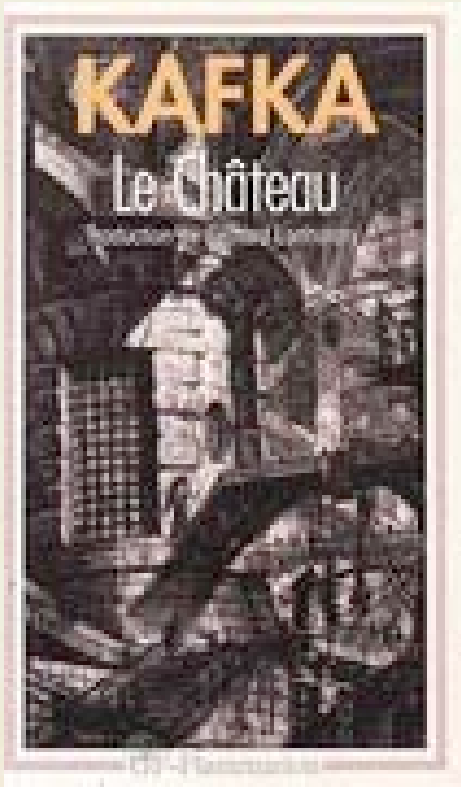
We went to the funding institutions:

Département scientifique
Mathématiques, physique, planète et univers

IN2P3/CNRS

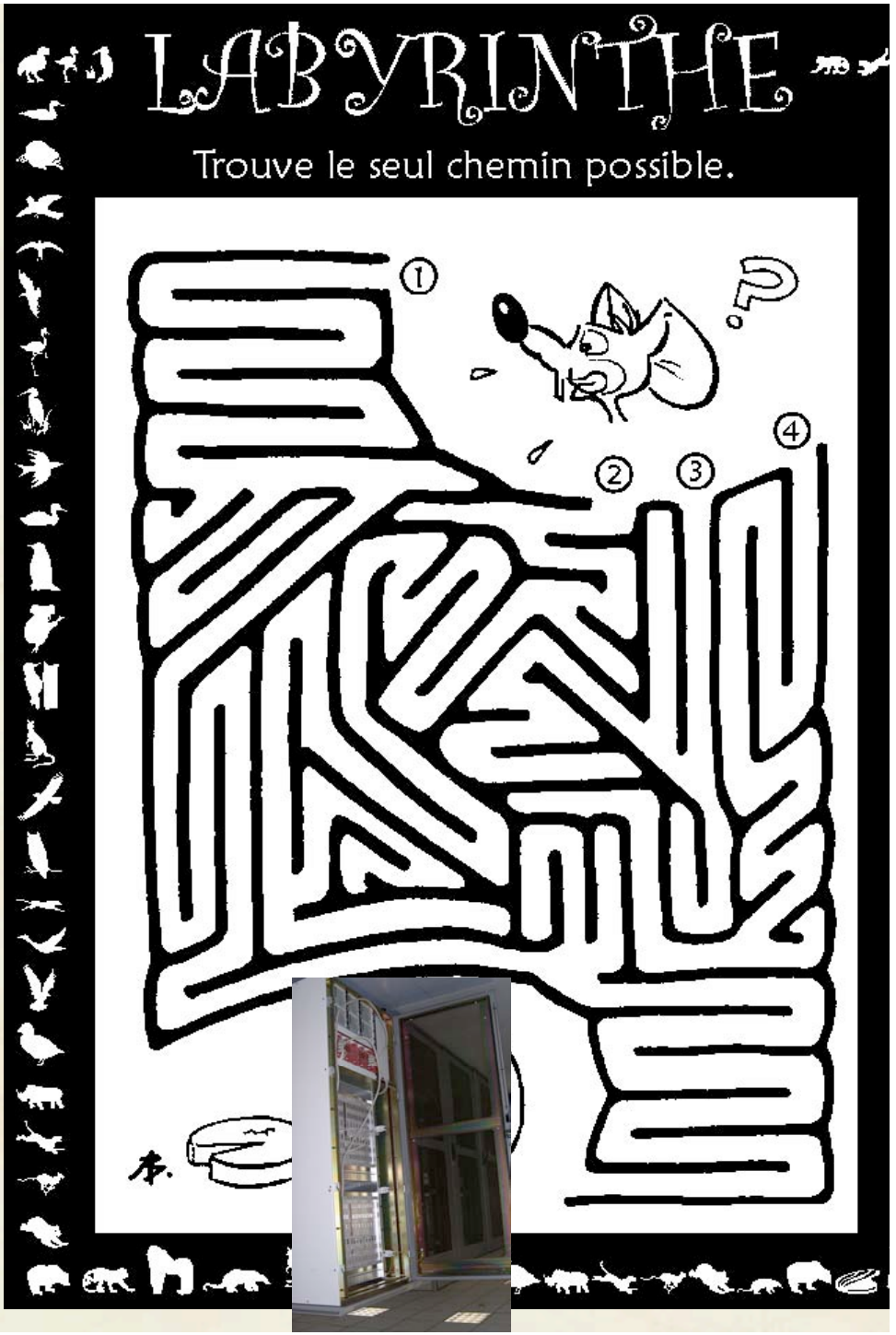
ANR

Dapnia



- Notwithstanding the support of several high rank scientific directors
- It took four years in a kafkaesque labyrinth
- To get one rack funded by ANR and another by CNRS (MPPU/IN2P3)

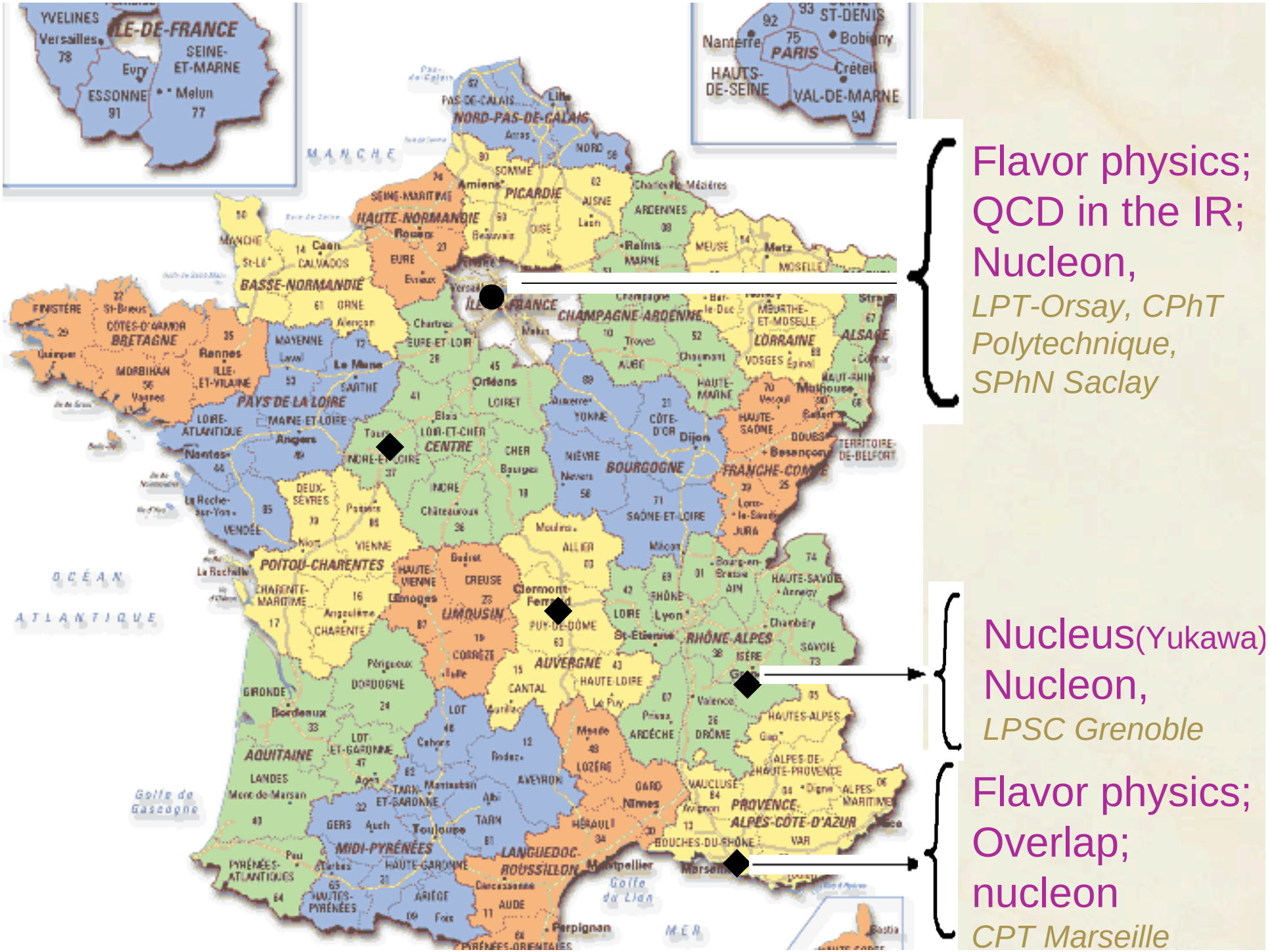
Not yet delivered



They will be located in the university Roma La Sapienza (thanks to Roma-I and INFN)

What to be done with these two racks ?

- *One preliminary remark: two racks are not enough for an unquenched calculation according to modern standards; collaborations are necessary and welcome*


Flavor physics;
QCD in the IR;
Nucleon,
LPT-Orsay, CPhT Polytechnique, SPhN Saclay
Nucleus(Yukawa)
Nucleon,
LPSC Grenoble
Flavor physics;
Overlap;
nucleon
CPT Marseille

- *The scientific projects concerning flavor physics and nucleon physics do need dynamical quarks.*
- Lattice flavor physics, beauty, charm, strangeness has been studied since long. Several retirements are closing up, but a younger generation is present in Orsay and Marseille.
- Newcomers from nuclear and hadronic physics are joining (Grenoble and Saclay)

Program on charm physics

Orsay

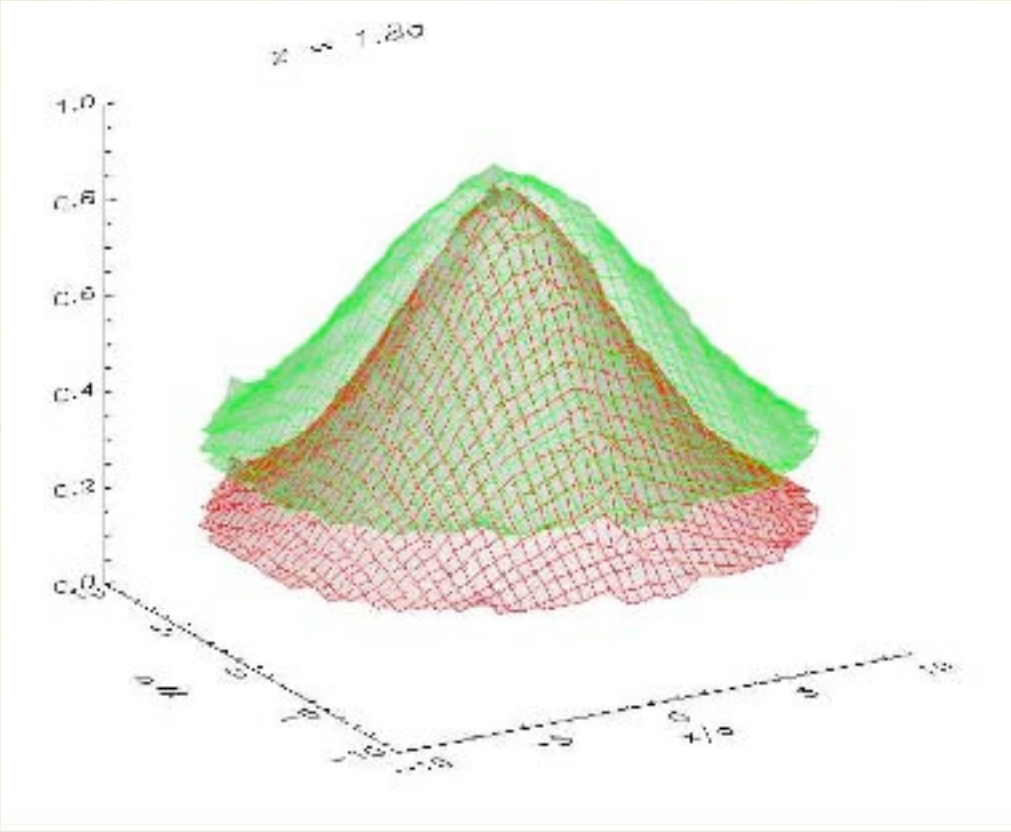
- New strategies for a precision calculculation of weak matrix elements on the lattice with Wilson quarks: $K \to \pi\mu\nu$, $D \to \pi\mu\nu$ transition form factors

- Towards a handle on weak annihilation matrix elements in B-decays, and computation of $\Delta F=2$ and $\Delta B=2$ operators

- Combining theory and experiments: from D's to B's
- Electromagnetic properties of hadron interactions on the lattice (light→light and heavy→heavy meson transitions)

- Regular discussions about charm form factors with experimentalists of the BABAR group who perform high statistics measurements

- Marseille's group will pursue its program on flavor physics using overlap quarks. TAO language is an obstacle to using apeNEXT. A C-compiler is requested there.



u and d quark wave function in a Λ-like state s-quark being at z=1.8a

Twisted quarks and ETMC collaboration

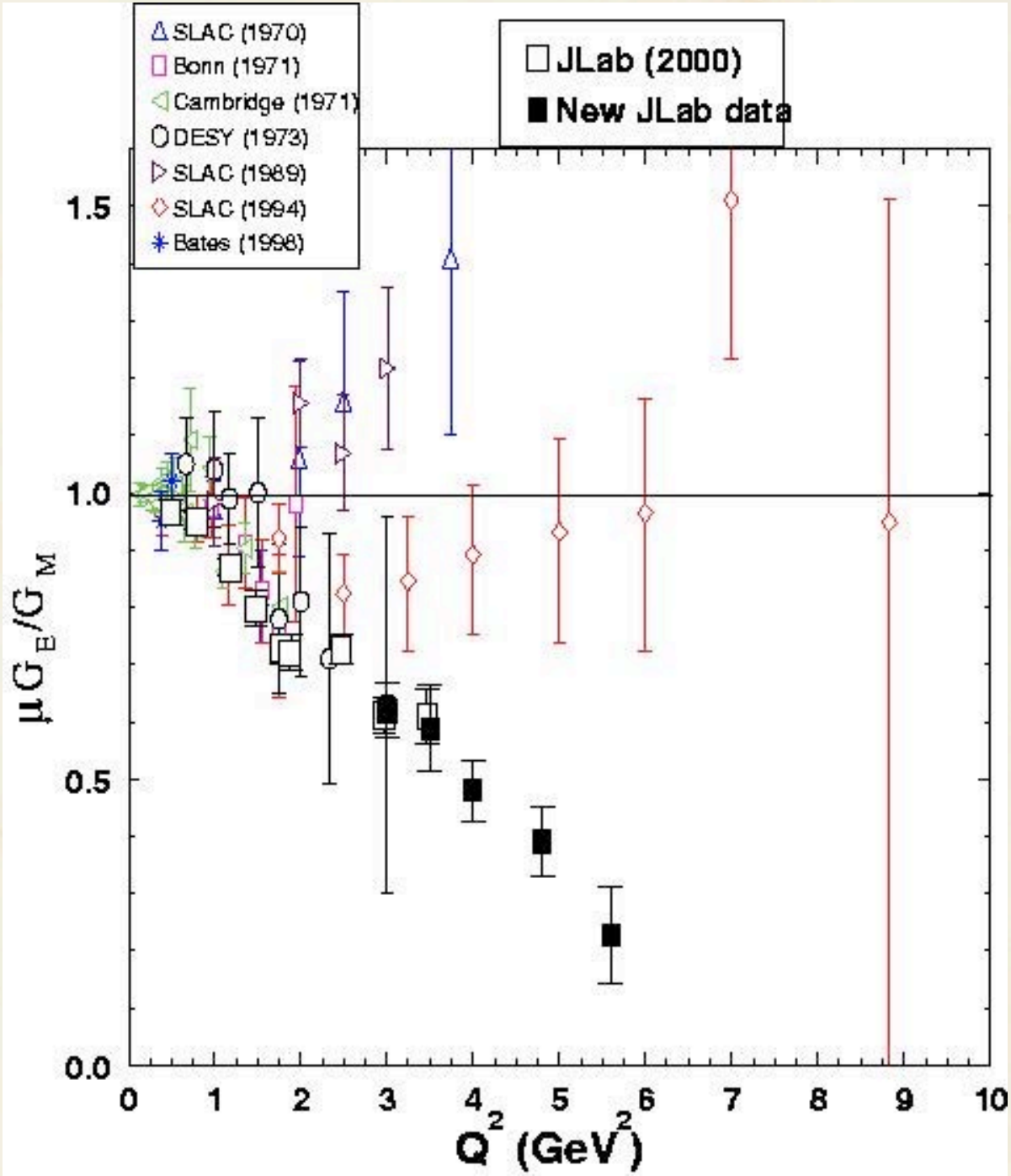
- Collaboration of lattice groups in Italy, Germany, Spain, UK, France
- Has produced more than 25000 $N_f=2$ trajectories down to masses lower than 300 MeV for the pion.
- Wide program of physics
  - To be described by Karl Jansen

Nucleon physics

- The nucleon constitute the majority of the visible matter of the universe.
- Yet it is not so well known as one would expect
- There is an intensive experimental activity: Jefferson-lab, GSI (Darmstadt), CERN (COMPASS) etc.

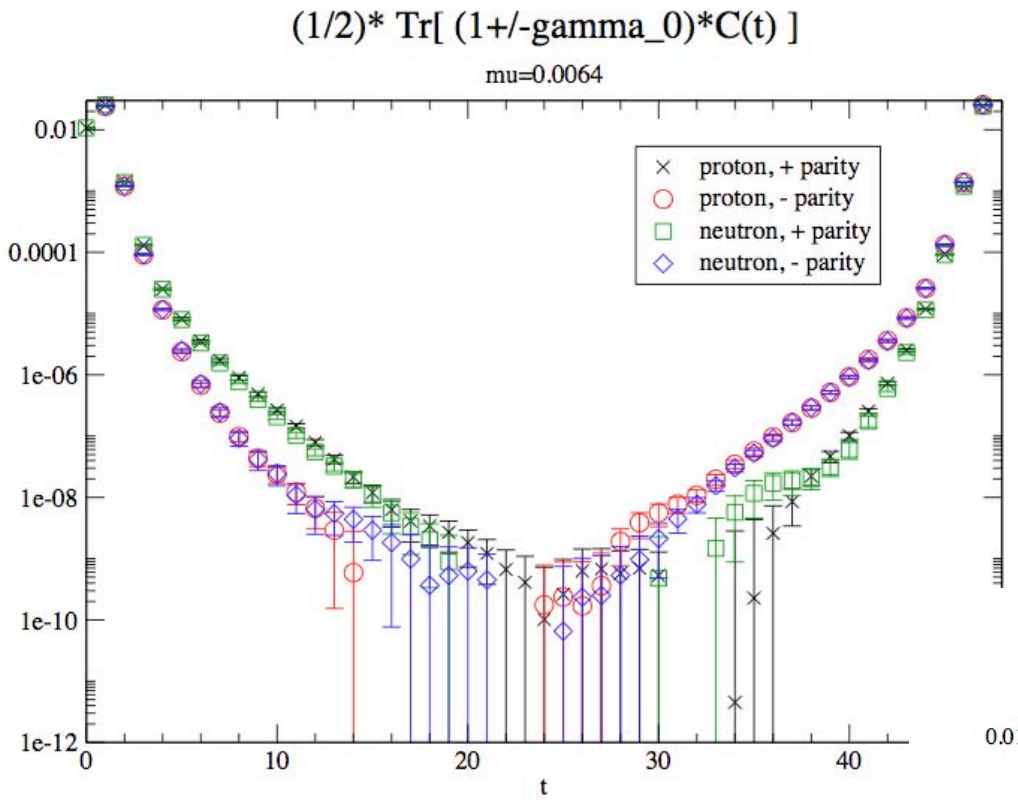
- One example:
- *Electric and magnetic form factors of the proton*

Is this due to two photons exchange, To radiative corrections ?

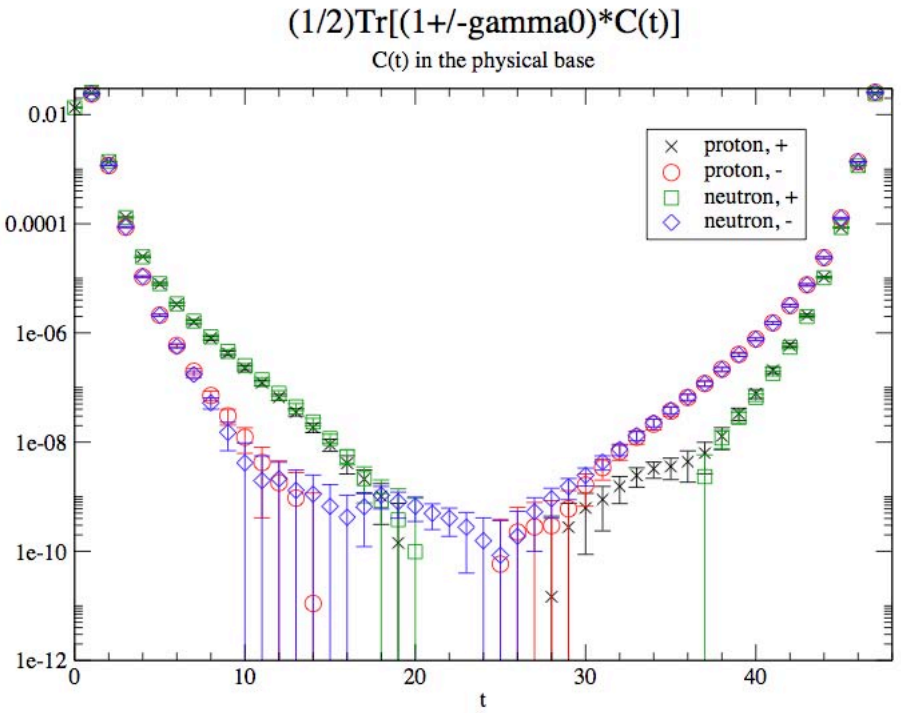


Many additional mysteries

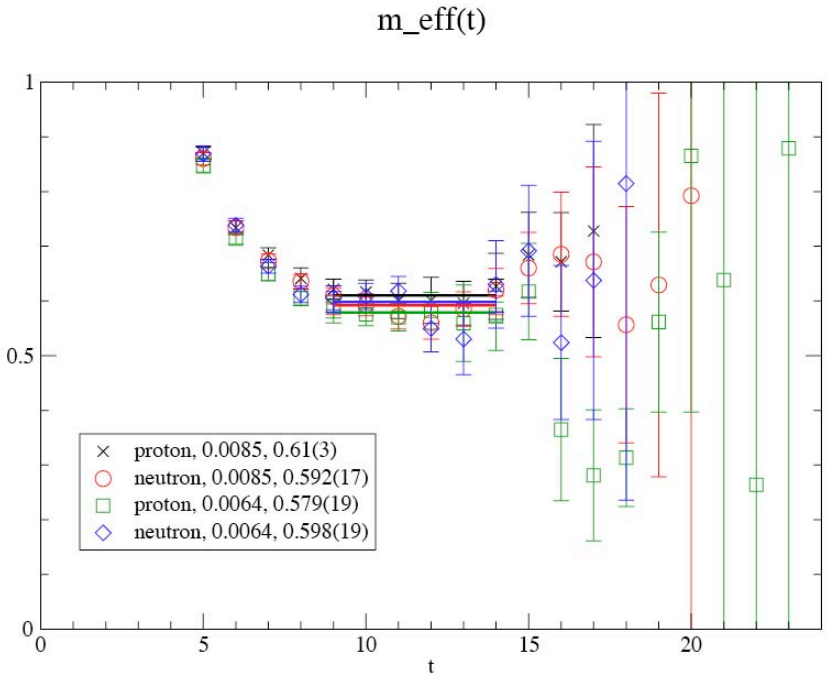
- What is the strange content of the nucleon ?the strange magnetic moment ?
- What fraction of the nucleon spin is borne by the quarks, what is the orbital momentum of the quarks ?
- Why is the positive parity Roper resonance (1440 MeV) lighter than the negative parity (1535 MeV) ?
- Can one explain from first principles the nucleon interaction in nuclei ?
- And many other questions which you don't even dare to ask !!!
- And many more you cannot answer with lattice

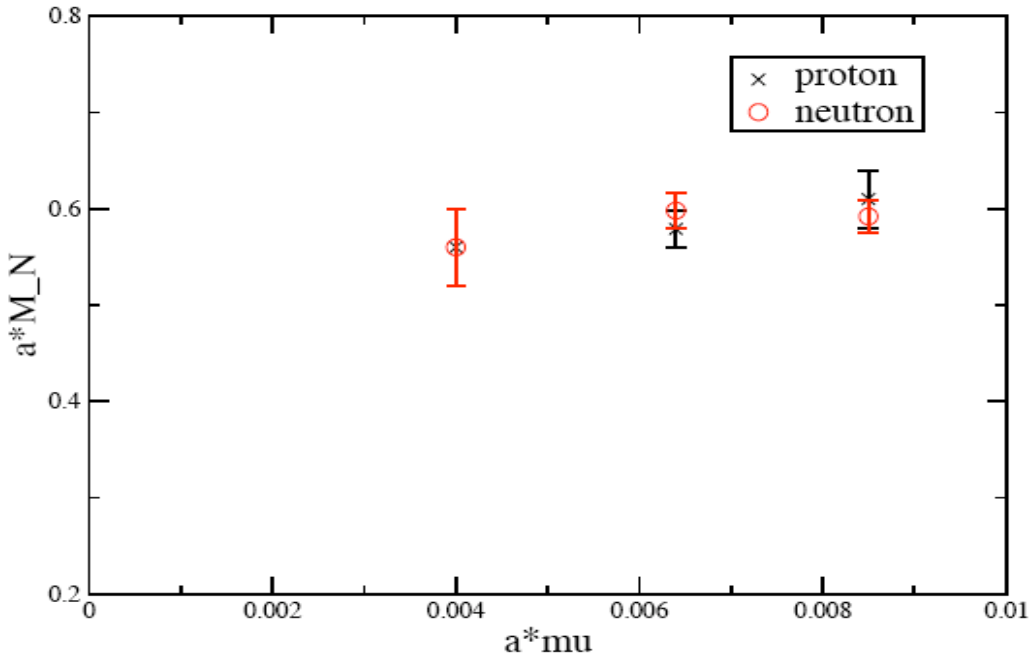


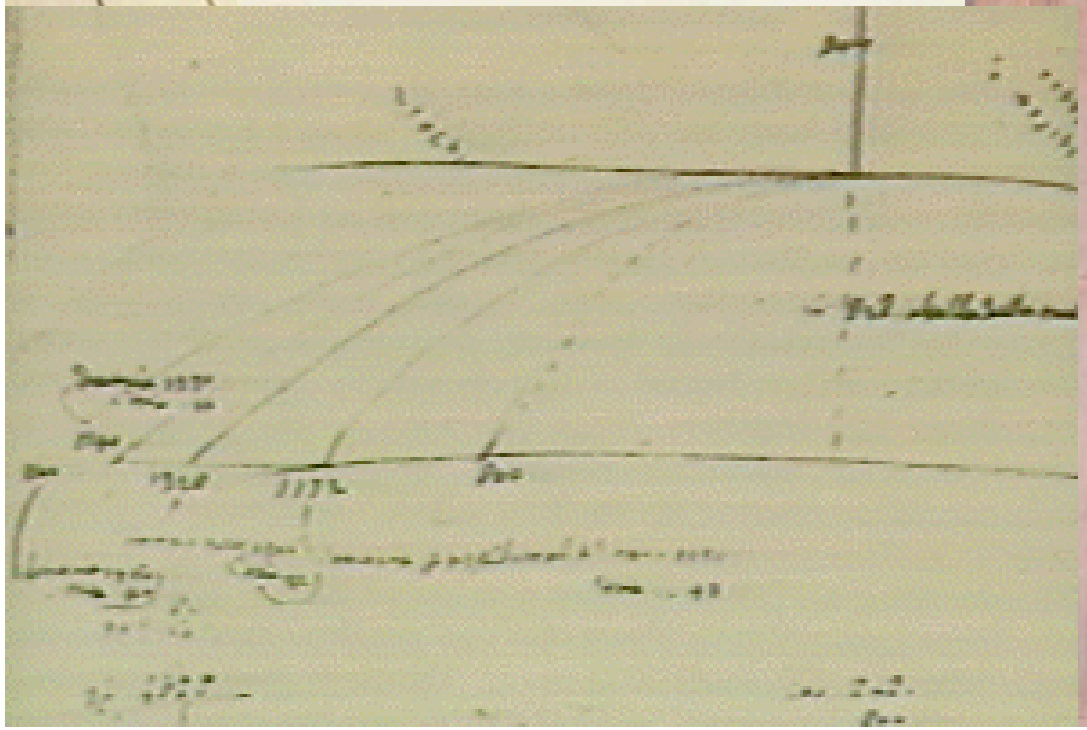
β=3.9,
μ=0.0085



β=3.9,
μ=0.0064


m_eff(t)
1
0.5
0
0
5
10
15
20
t
proton, 0.0085, 0.61(3)
neutron, 0.0085, 0.592(17)
proton, 0.0064, 0.579(19)
neutron, 0.0064, 0.598(19)


0.8
0.6
0.4
0.2
a*M_N
0
0.002
0.004
0.006
0.008
0.01
a*mu
proton
neutron




GALILEO GALILEI