Incontri di Fisica delle Alte Energie

La stato della Fisica delle Particelle Elementari in Italia

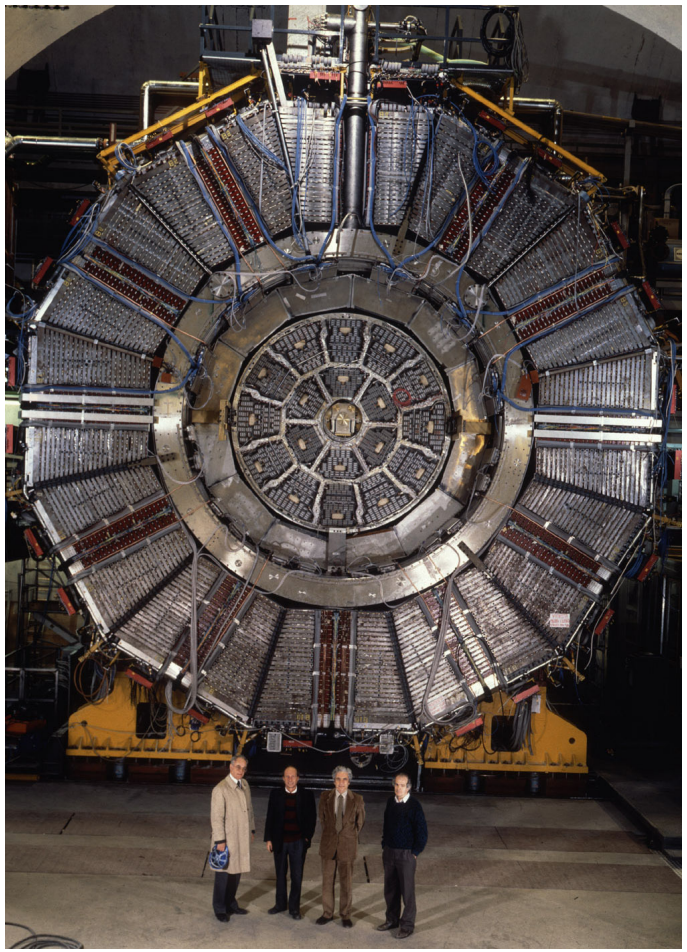
Umberto Dosselli

Sviluppo ai LNF: la sala di ADONE (che ora ospita DAPHNE)

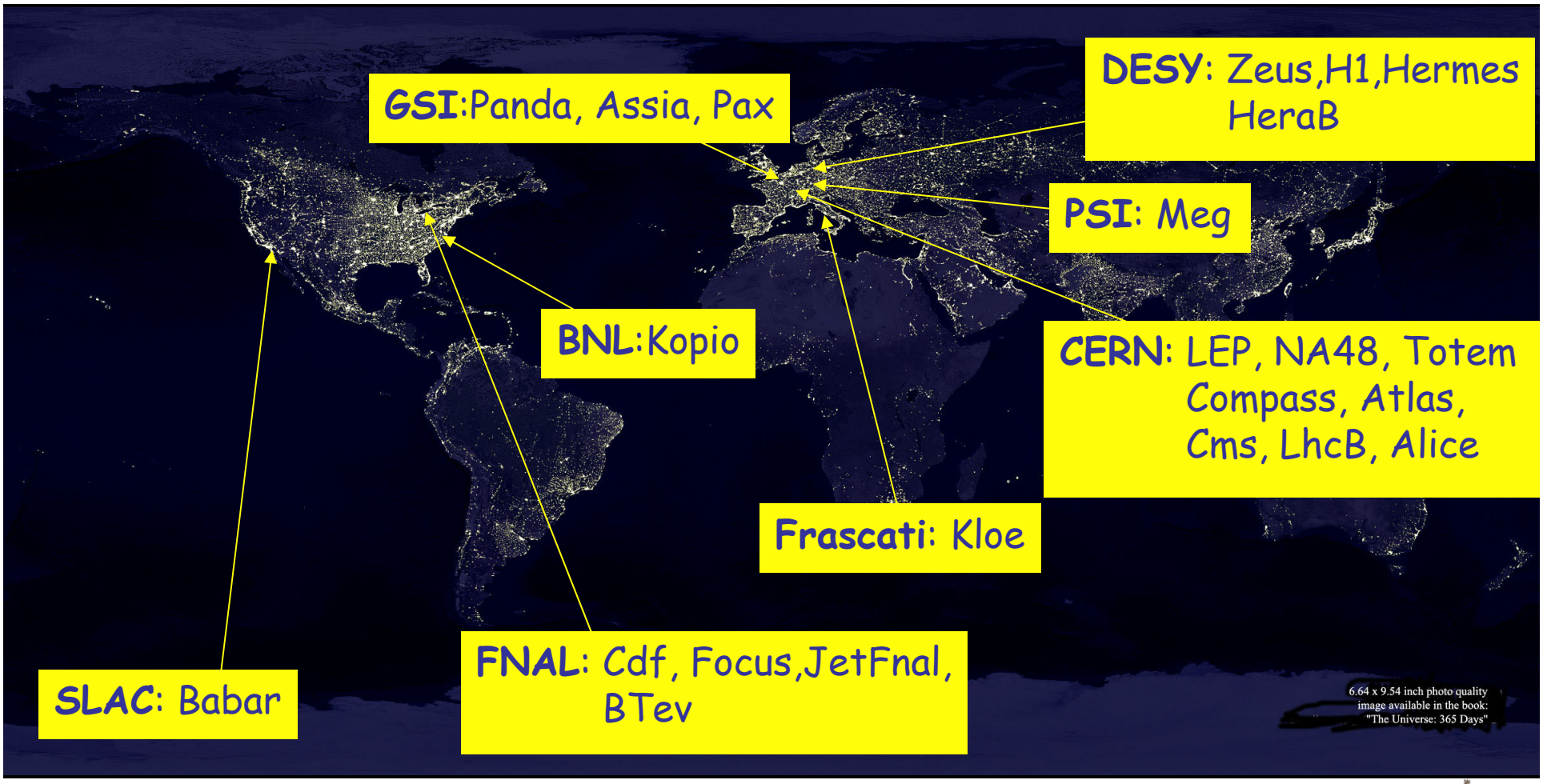
nel tempo la scala e' cambiata ma non l'impegno italiano:

inizio anni '60

inizio anni '90



Esperimenti HEP INFN nel mondo



Esperimenti per area tematica:

- **Violazione di CP e decadimenti rari**: KLOE, BABAR, NA48, MEG, LHCB, KOPIO, BTEV
- **Interazioni adroniche**: ATLAS, CMS, TOTEM, CDF, ALICE
- **Deep Inelastic Scattering**: COMPASS, HERMES, ZEUS, H1

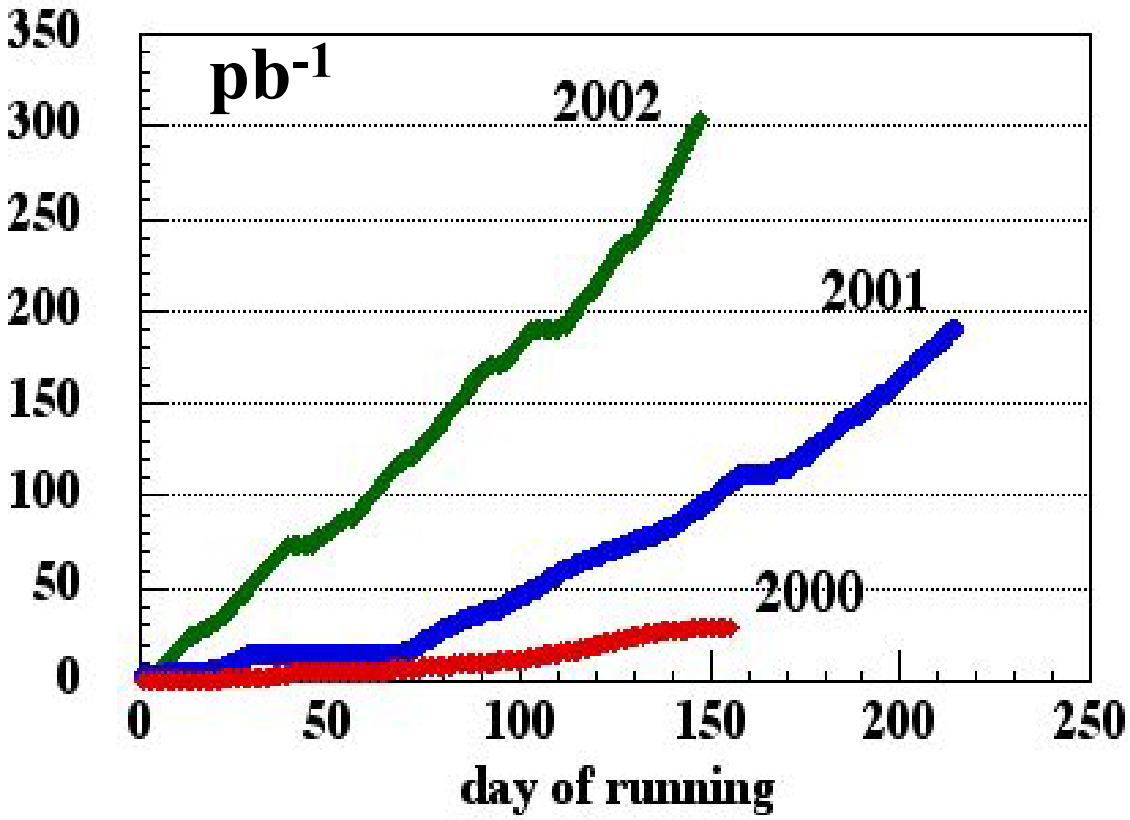
+ futuri esperimenti al GSI (LOI di PANDA, ASSIA, PAX)

+ NLC, SLHC, S - B factory

*+ altre buone idee…… **DA VOI !!***

Kloe central drift chamber

KLOE integrated luminosity



1999 run : **2.5 pb^{-1}**
machine and detector studies

2000 run : **25 pb^{-1}**
7.5 x 10^{7} ϕ
published results

2001 run: **190 pb^{-1}**
5.7 x 10^{8} ϕ
published results

2002 : ~ **300 pb^{-1}** delivered

KLOE physics program

S. Bertolucci, INFN/LNF
ICFA Seminar
CERN, October 8 – 11, 2002

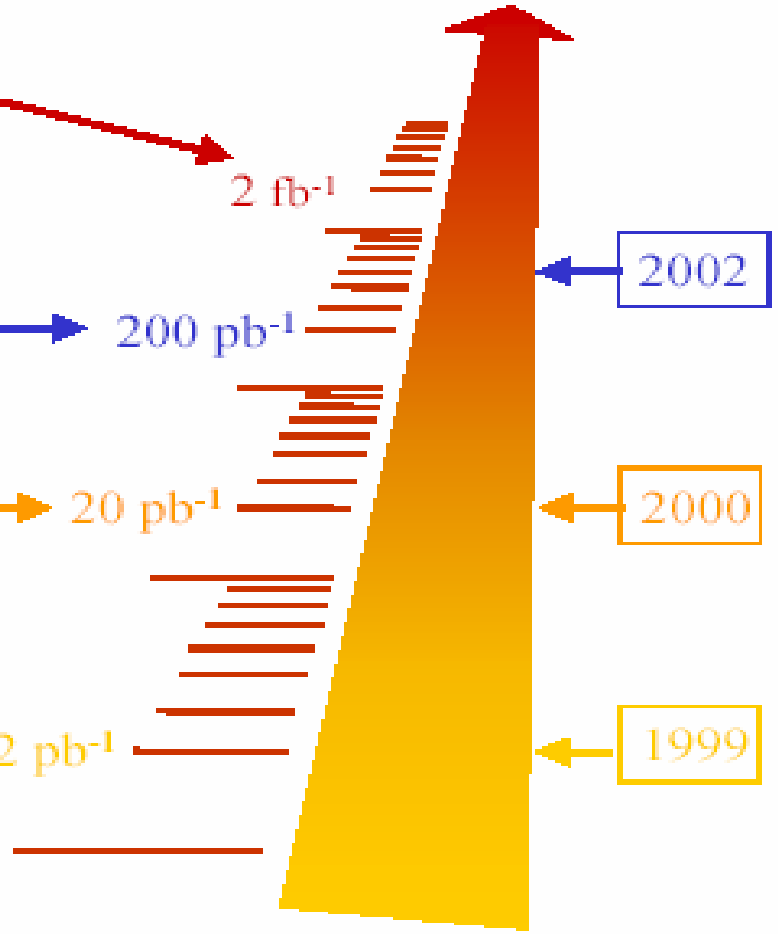
ε'/ε to via double ratio
Semileptonic asymmetry (CPT test)
$K_L K_S$ Interferometry

K_L form factors, rare K_S decays,
$K_L \to 2\pi$,
$K_L \to \gamma\gamma$, $K^{\pm}$ decays
$\sigma(e^+e^- \to \pi^+\pi^-)$ to < 1 % (stat)

Being analyzed

K_S physics
$BR(K_S \pi^+\pi^-)/BR(K_S \to \pi^0\pi^0)$
$BR(K_S \to \pi e \nu)$
φ radiative decays
$\phi \to f_0\gamma$, $a_0\gamma$
$\phi \to \eta'\gamma$, $\eta\gamma$

First result published



L'avventura del LEP:the Z line shape

$2 \cdot 10^{-5}$ accuracy for one of the most fundamental constants !

mz = 91.1874 ± **0.0021 GeV**

The total Z width: $\Gamma Z = 2.4952 \pm 0.0023$ GeV

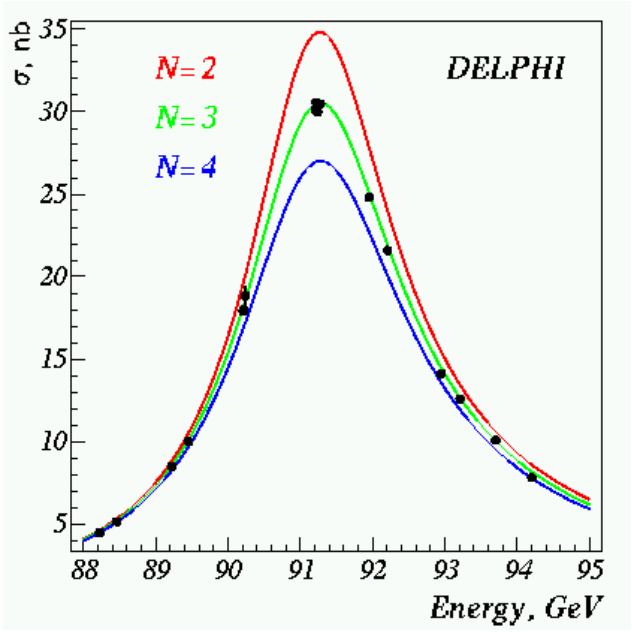
From the measured $\Gamma inv/\Gamma ll$

divinding by $\Gamma \nu\nu/\Gamma ll$ from SM

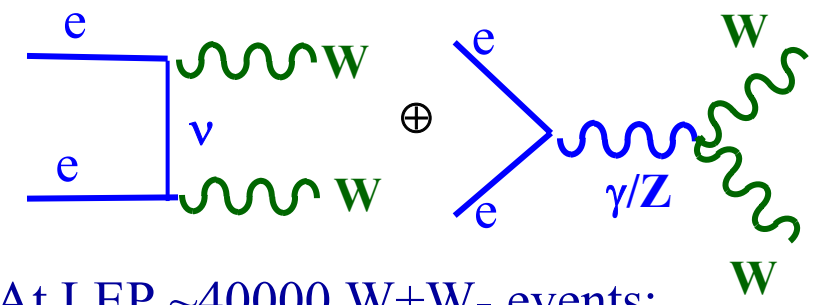
where $\Gamma inv = \Gamma Z - \Gamma had - \Gamma ll$

$$N(\nu) = 2.9841 \pm 0.0083$$

2σ below 3



The measurement of the W mass



At LEP ~40000 W+W- events:

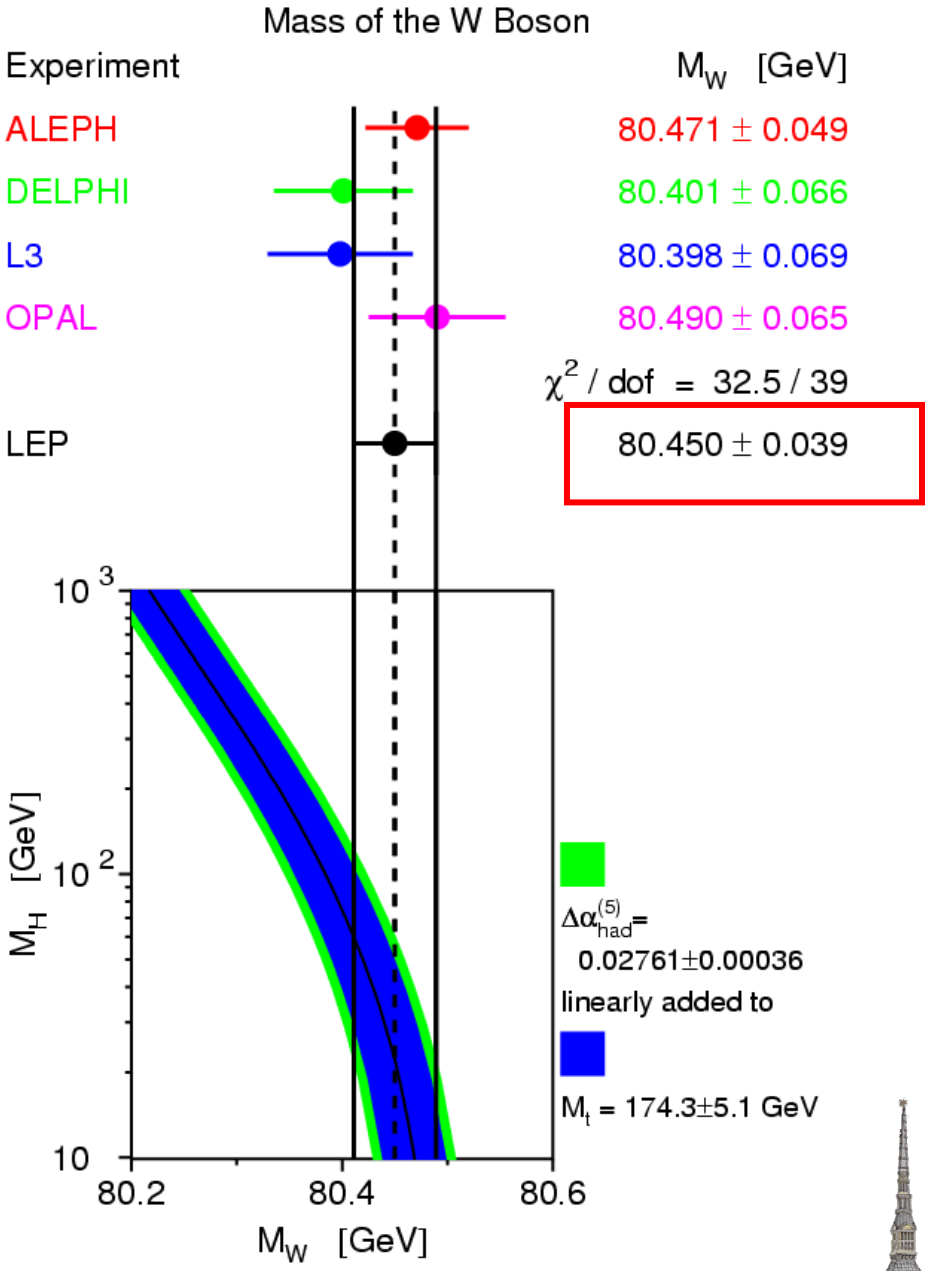
45.6% WW–> hadrons

43.8% WW–> leptons+hadrons

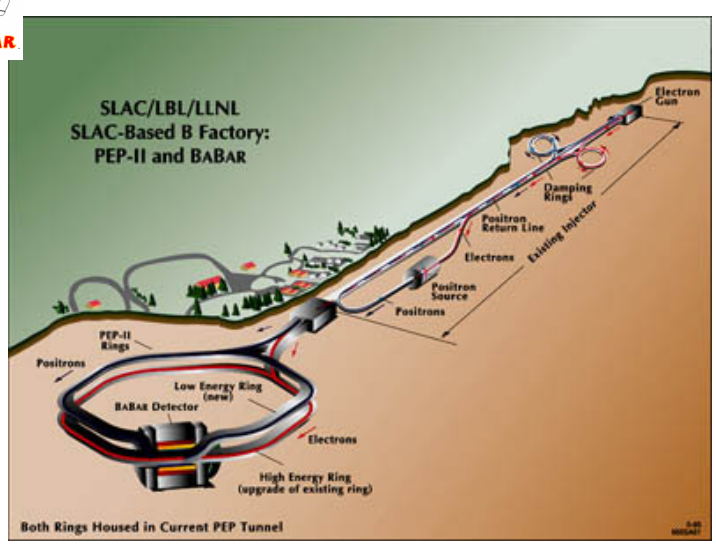
10.6% WW–> leptons

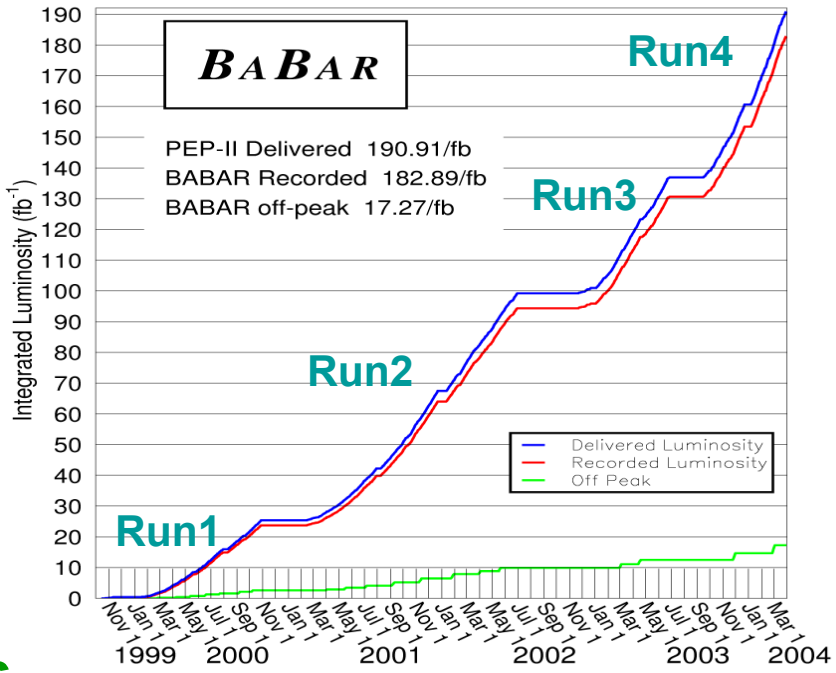
the width

Γ_W= 2.150 ±0.091 GeV



BaBar and PEP-II

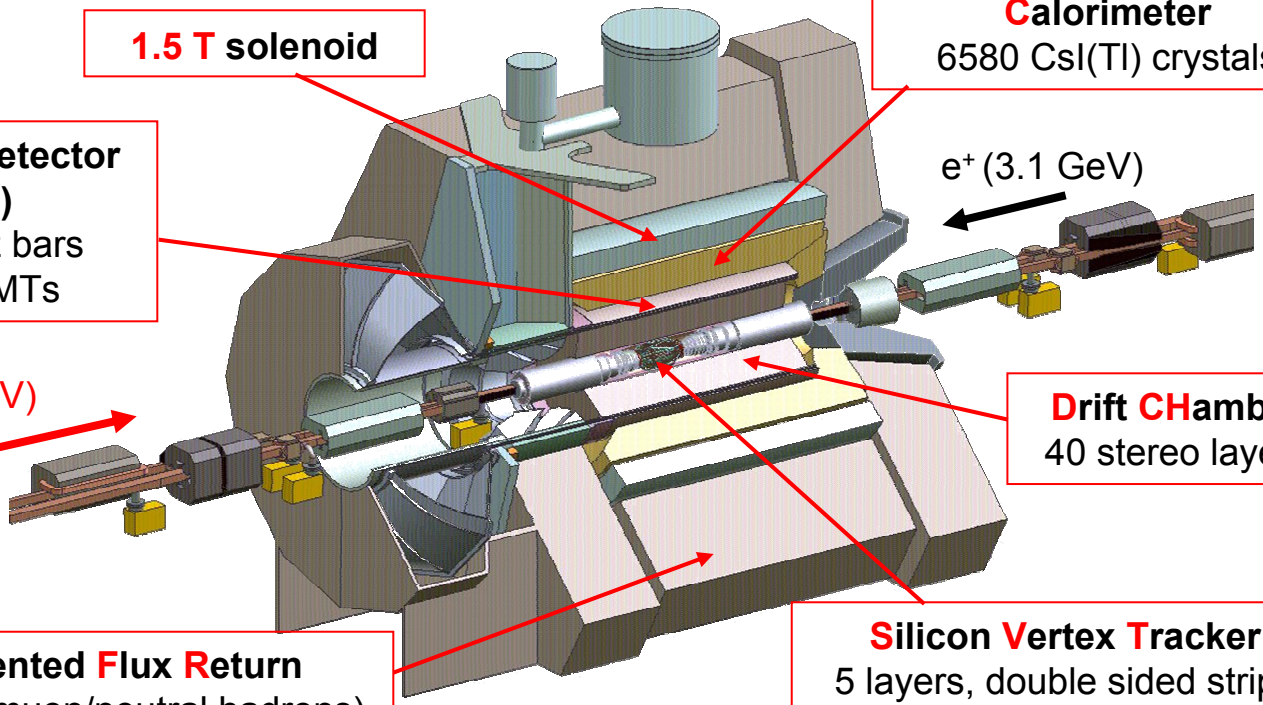




Future expectations

	L_{peak} (10^{33})	L_{int} fb^{-1}	I_{her} (mA)	I_{ler} (mA)
2004	12.5	260	1600	2700
2005	18.2	395	1800	3600
2006	23	580	2000	3600
2007	30	880	2200	4500

Il rivelatore BaBar



SVT: 97% efficiency, 15 μm z hit resolution (inner layers, ⊥ tracks)

SVT+DCH: $\sigma(p_T)/p_T = 0.13\ \% \times p_T + 0.45\ \%$

DIRC: K-π separation 4.2σ @ 3.0 GeV/c → >3.0σ @ 4.0 GeV/c

EMC: $\sigma_E/E = 2.3\ \% \times E^{-1/4} \oplus 1.9\ \%$

The *BABAR* Collaboration

9 Countries
74 Institutions
527 Physicists

50% Outside US

USA [37/261]
California Institute of Technology
UC, Irvine
UC, Los Angeles
UC, San Diego
UC, Santa Barbara
UC, Santa Cruz
U of Cincinnati
U of Colorado
Colorado State
Florida A&M
Harvard
U of Iowa
Iowa State U
LBNL
LLNL
U of Louisville
U of Maryland
U of Massachusetts, Amherst
MIT
U of Mississippi
Mount Holyoke College
Northern Kentucky U
U of Notre Dame
ORNL/Y-12
U of Oregon
U of Pennsylvania
Prairie View A&M
Princeton
SLAC
SUNY Albany
U of South Carolina
Stanford U
U of Tennessee
U of Texas at Austin
U of Texas at Dallas
Vanderbilt
U of Wisconsin
Yale

Canada [4/15]
U of British Columbia
McGill U
U de Montréal
U of Victoria

China [1/5]
Inst. of High Energy Physics, Beijing

France [5/52]
LAPP, Annecy
LAL Orsay
LPNHE des Universités Paris 6/7
Ecole Polytechnique
CEA, DAPNIA, CE-Saclay

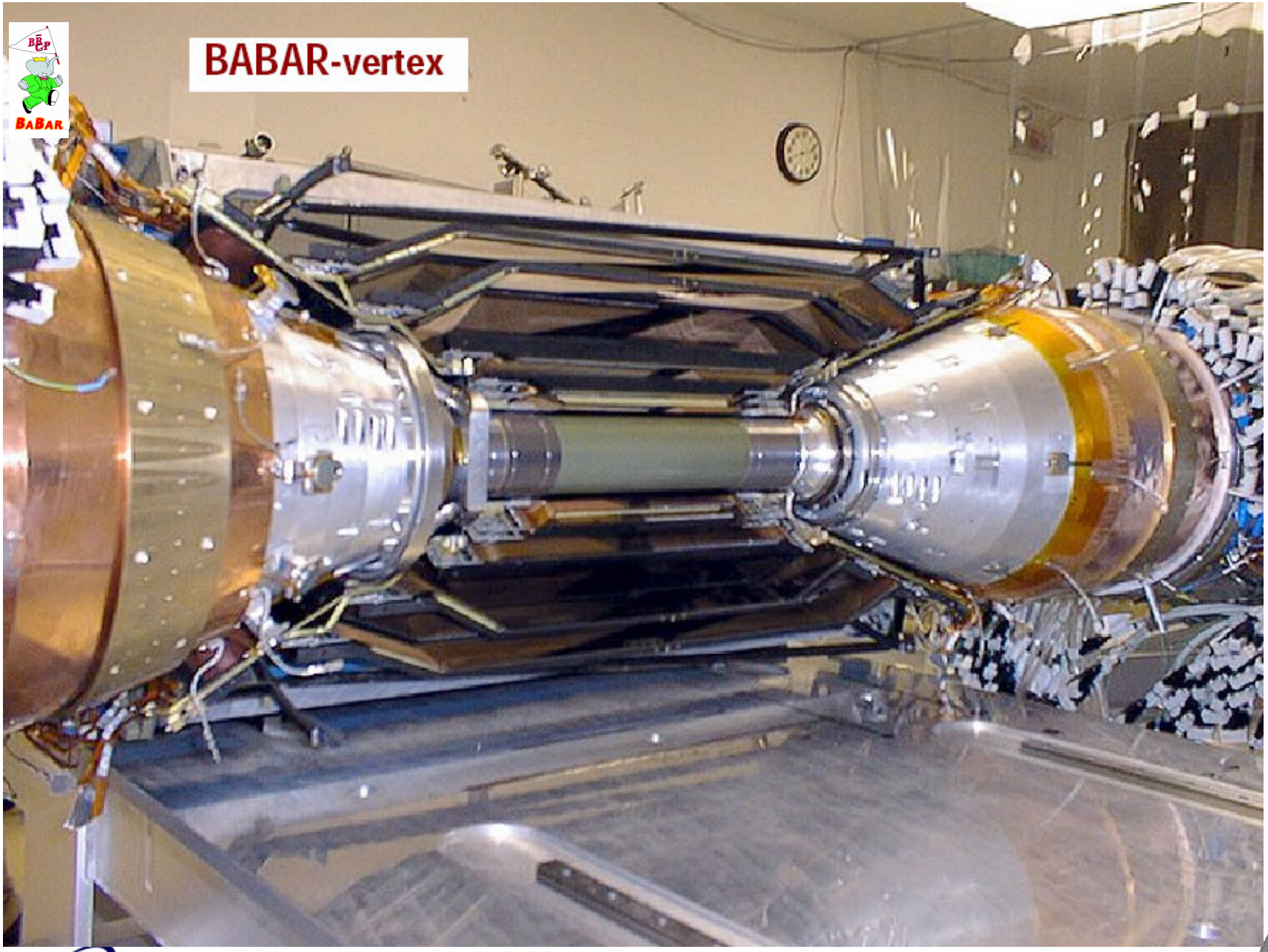
Germany [3/24]
U Rostock
Ruhr U Bochum
Technische U Dresden

Italy [12/94]
INFN and U Bari
INFN and U Ferrara
Lab. Nazionali di Frascati dell' INFN
INFN and U Genova
INFN and U Milano
INFN and U Napoli
INFN and U Padova
INFN and U Pavia
INFN, SNS and U Pisa
INFN, Roma and U "La Sapienza"
INFN and U Torino
INFN and U Trieste

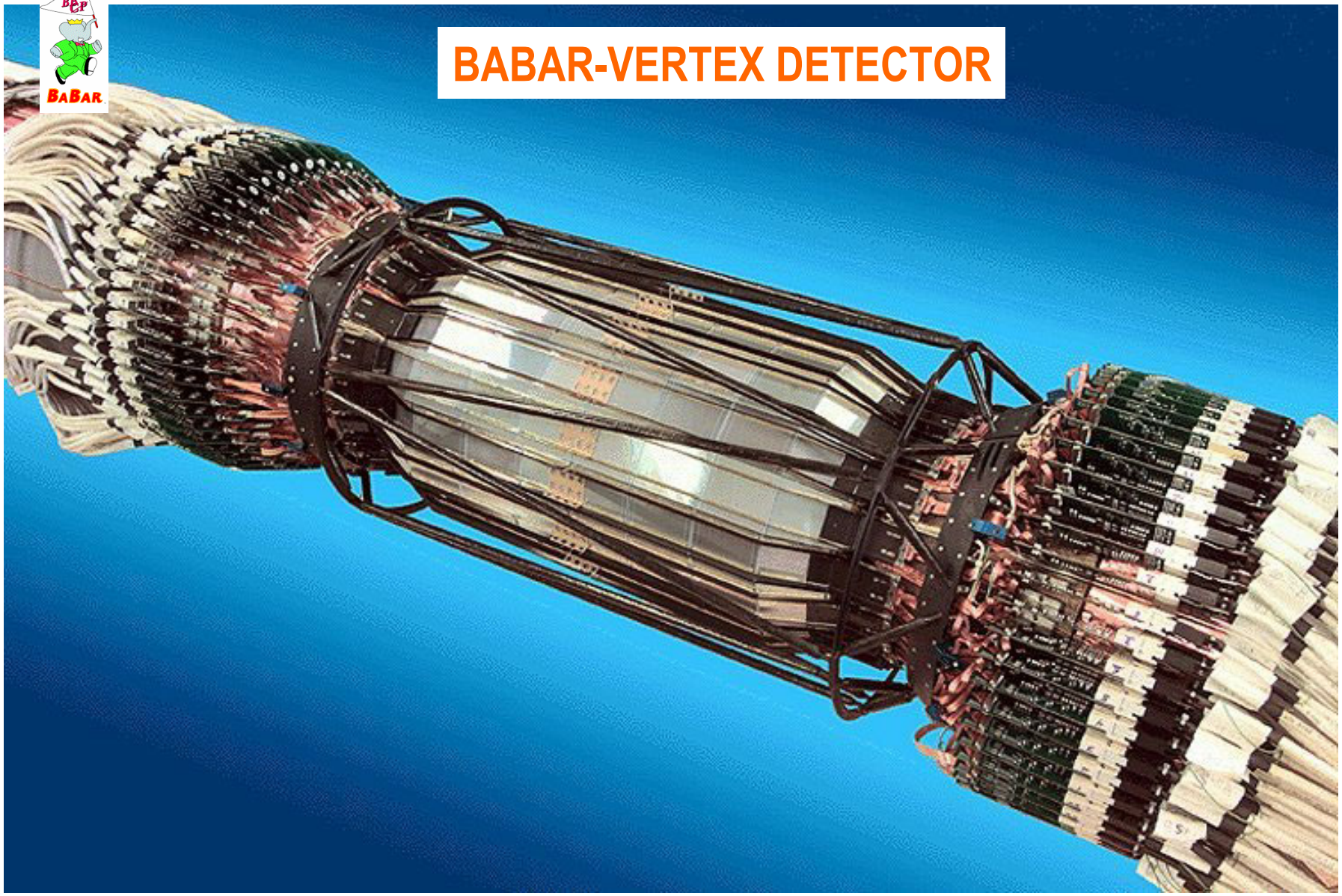
Norway [1/3]
U of Bergen

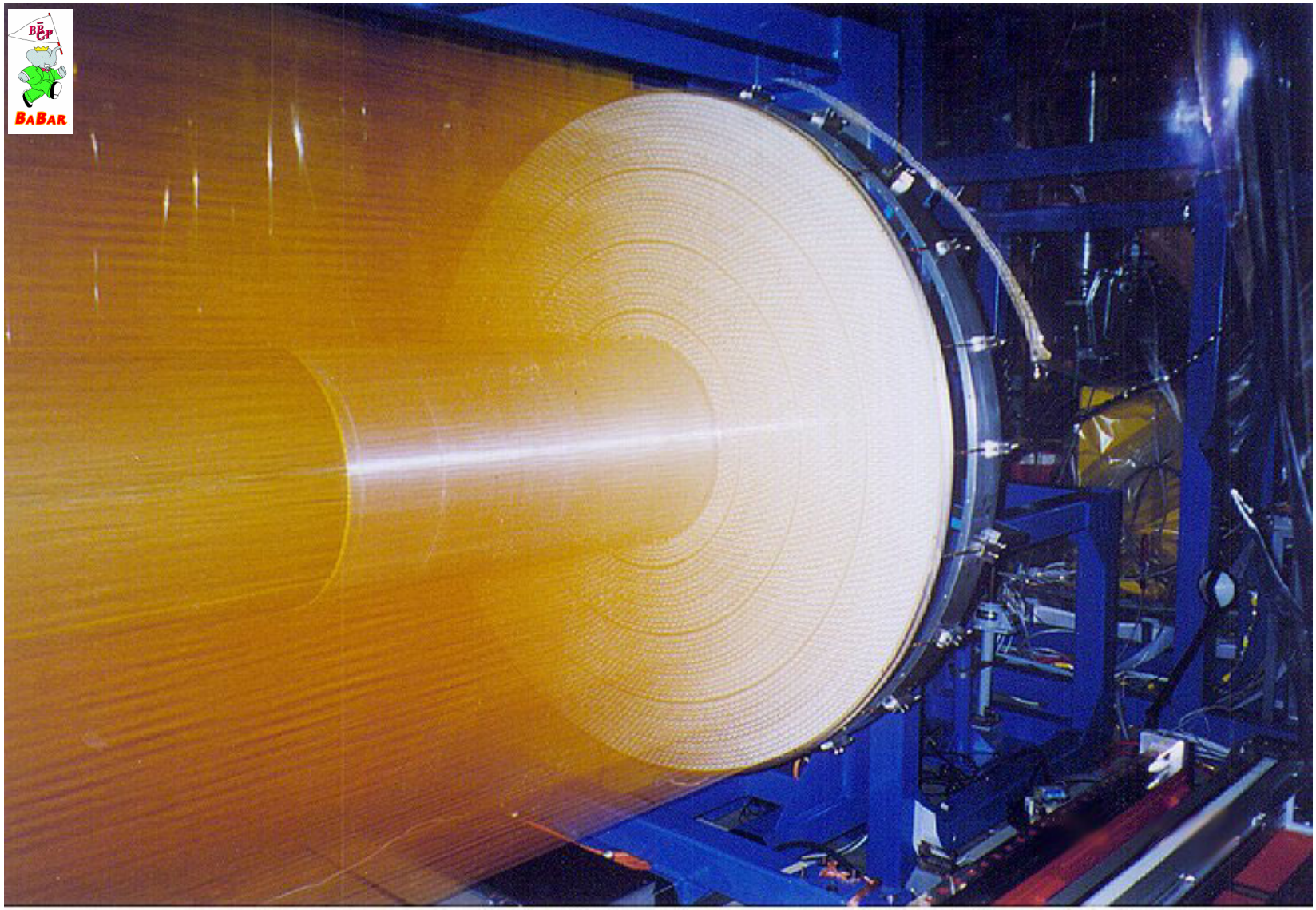
Russia [1/8]
Budker Institute, Novosibirsk

United Kingdom [10/65]
U of Birmingham
U of Bristol
Brunel University
U of Edinburgh
U of Liverpool
Imperial College
Queen Mary & Westfield College
Royal Holloway, University of London
U of Manchester
Rutherford Appleton Laboratory


BABAR-vertex

BABAR-VERTEX DETECTOR



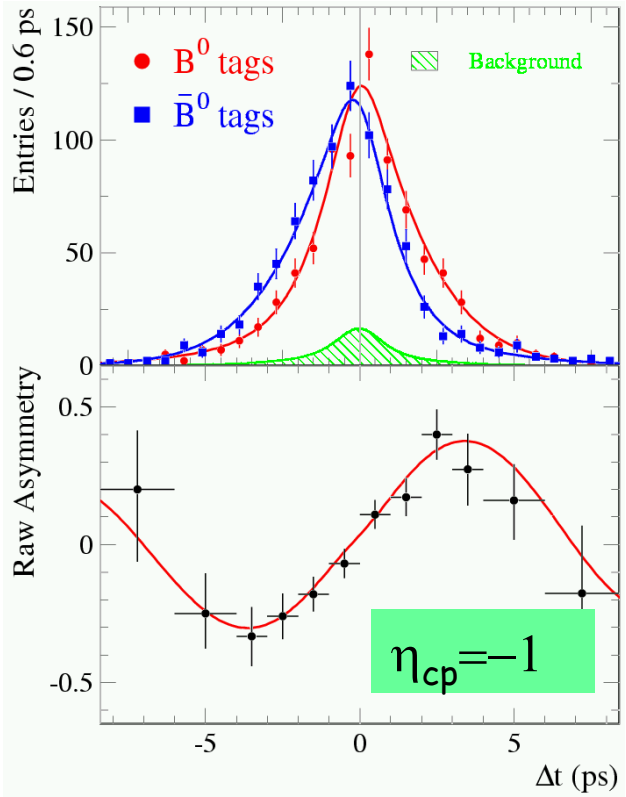


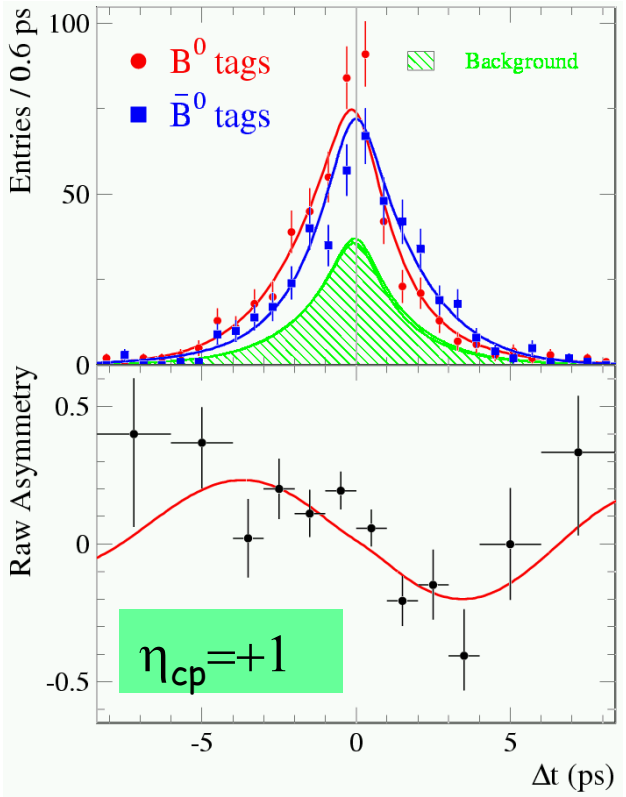
SS_012

Preparation of the Babar Central Drift Chamber

Arrival in S. Francisco of the superconducting solenoid for Babar, designed by INFN and built in Ansaldo (Italy)

CP violation: sin2β





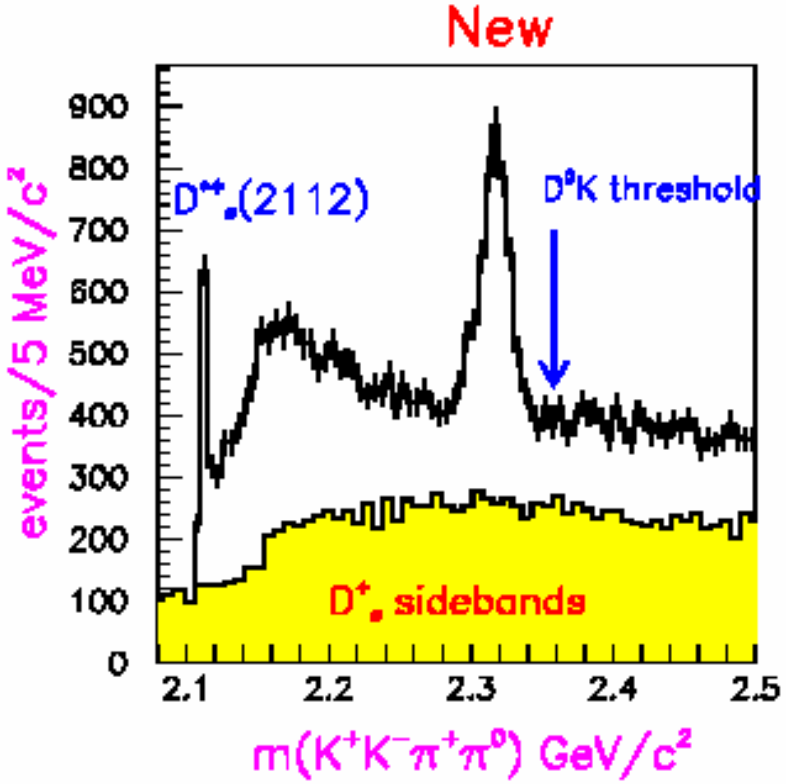
sin2β = 0.755 ± 0.074 **sin2β = 0.723 ± 0.158**

sin2β = 0.741 ± 0.067 (stat) ± 0.034 (syst)

PRL 89 (2002) 201802

$D_s^+\pi^0$ mass spectrum.

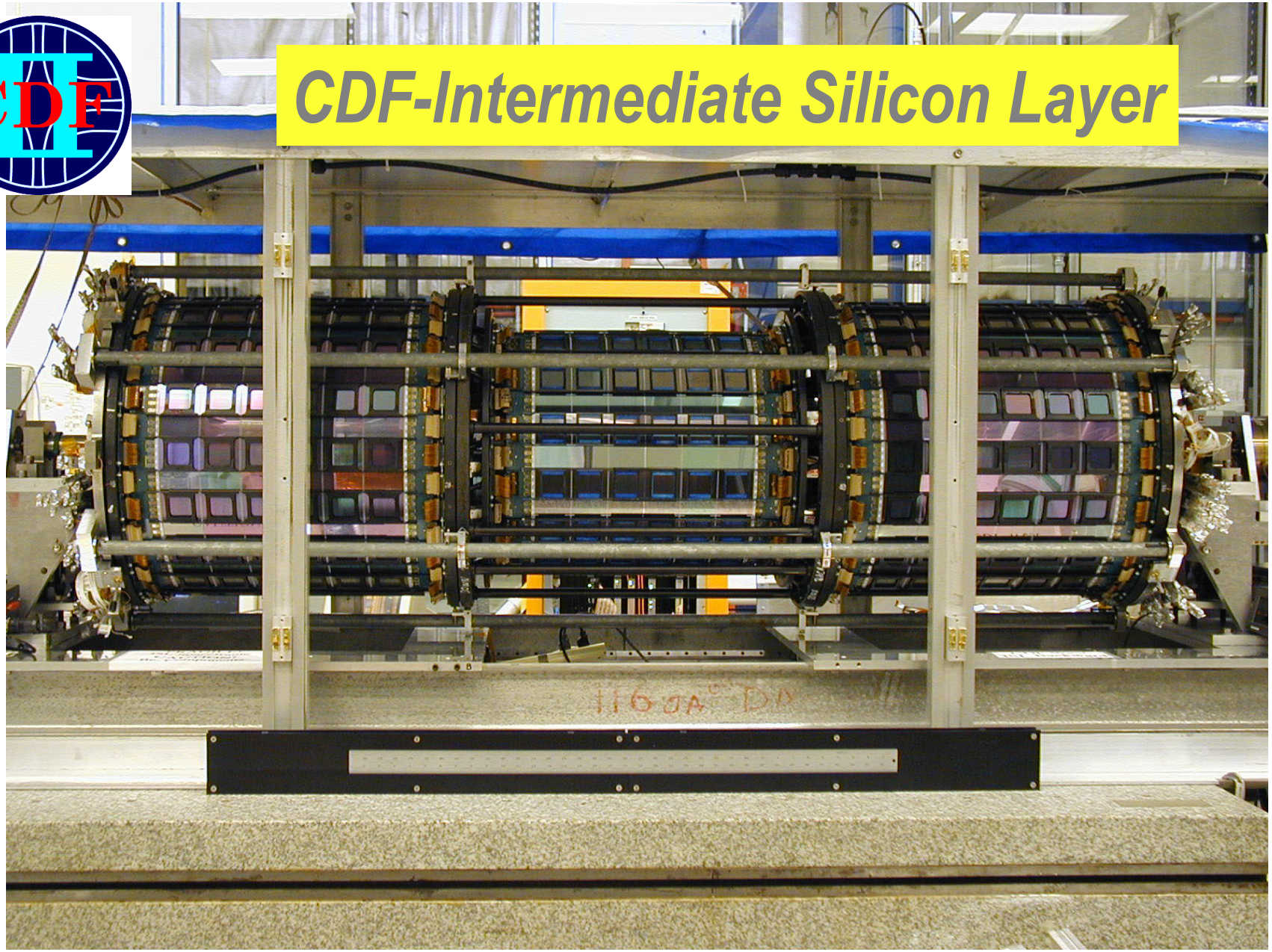
- Compare $(K^+K^-\pi^+)\pi^0$ mass spectra for the D_s^+ signal region and sidebands.
- We observe the known decay: $D_s^{*+}(2112) \to D_s^+\pi^0$.
- Totally unexpected large signal ($\approx$ 2200 events) at 2.32 GeV.



Original analysis completely italian (A. Palano, INFN Bari)

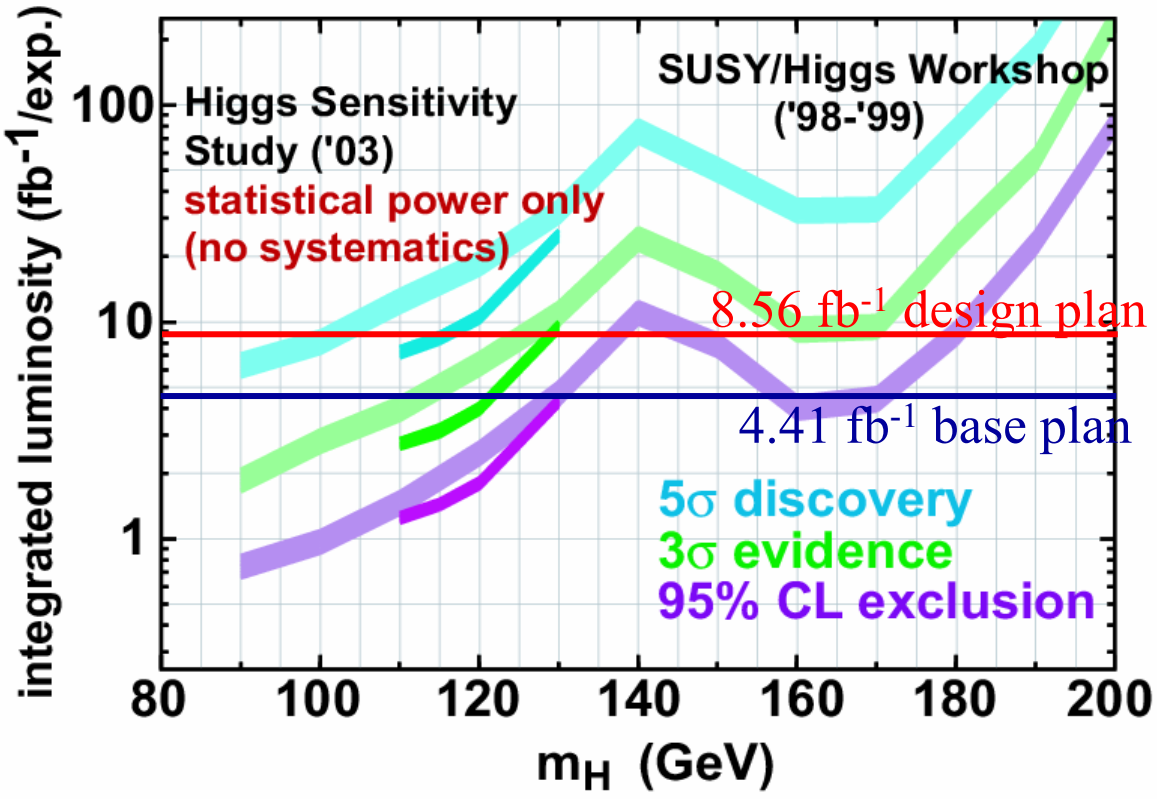
- No signals for the D_s^+ sidebands.

CDF-Intermediate Silicon Layer



Higgs reach

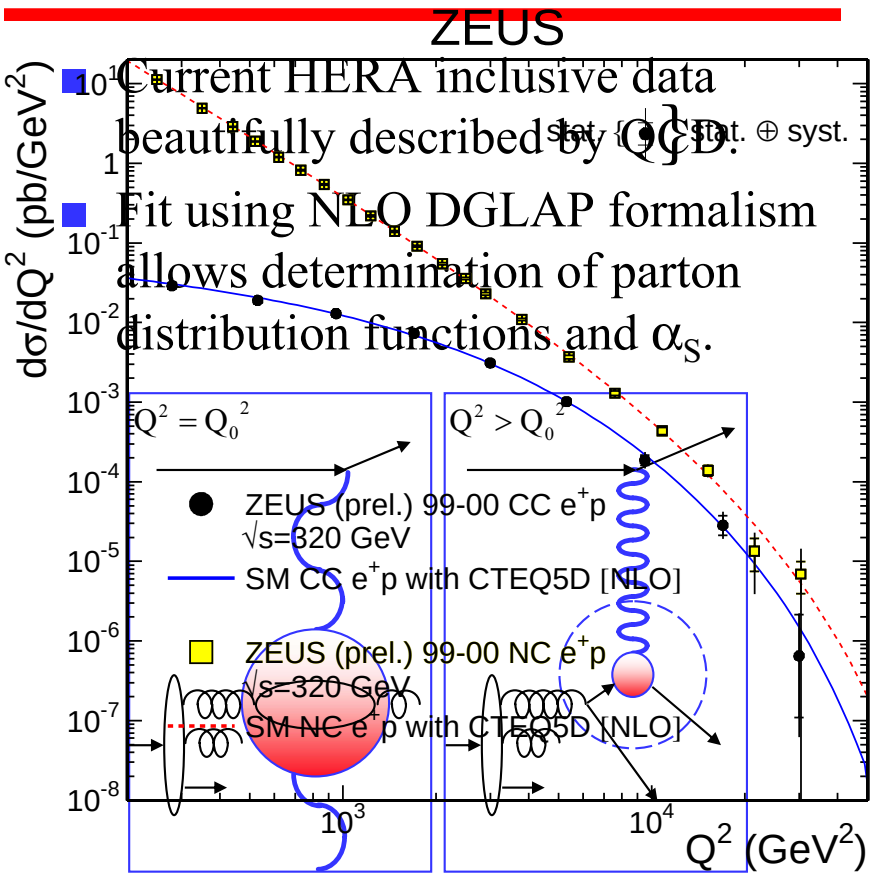
- Reach for SM Higgs and other "new" physics searches affected by factor 2-3 reduction in expected total integrated luminosity (relative to 15 fb^{-1})

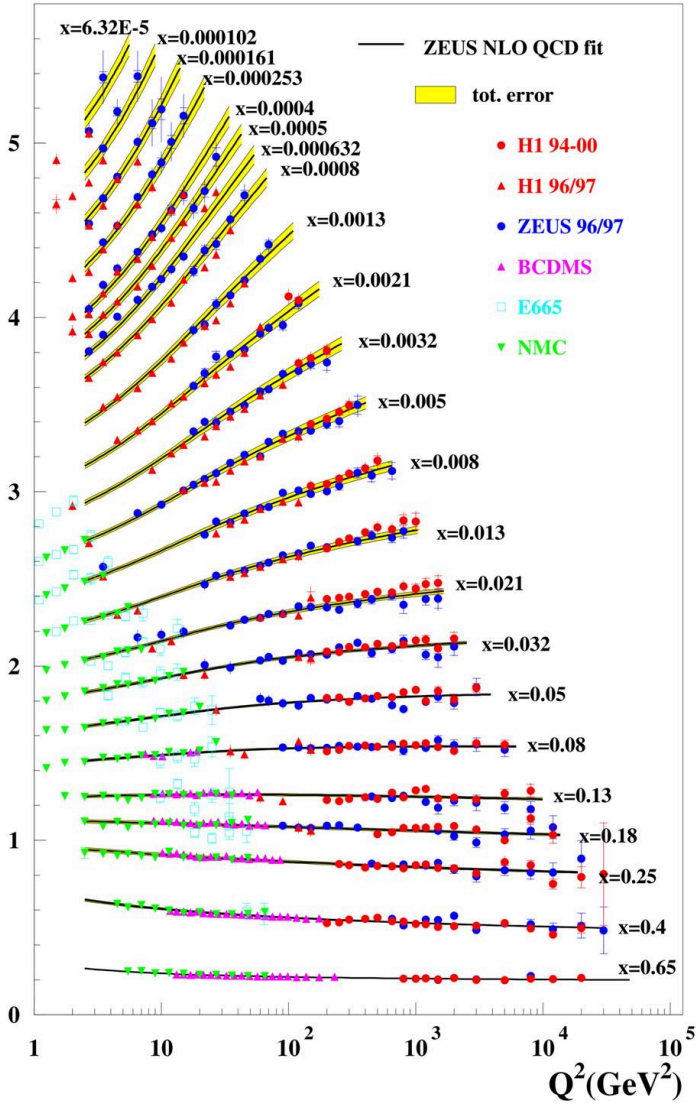


Structure Functions at HERA

Measuring hadron structure

- Current HERA inclusive data beautifully described by QCD.
- Fit using NLO DGLAP formalism allows determination of parton distribution functions and α_S.





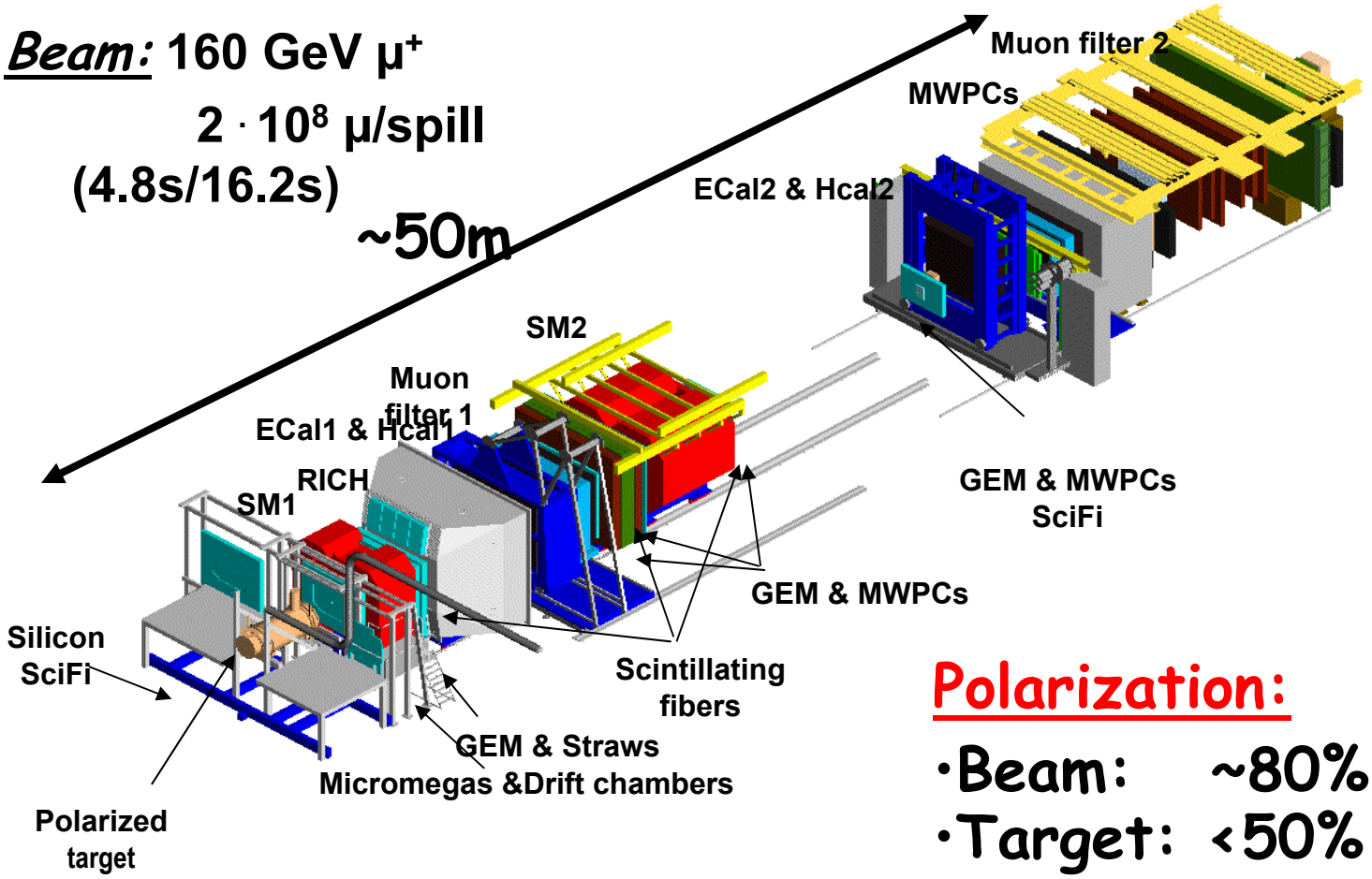
COMPASS SPECTROMETER

Beam: 160 GeV μ^+

$2 \cdot 10^8$ μ/spill

(4.8s/16.2s)

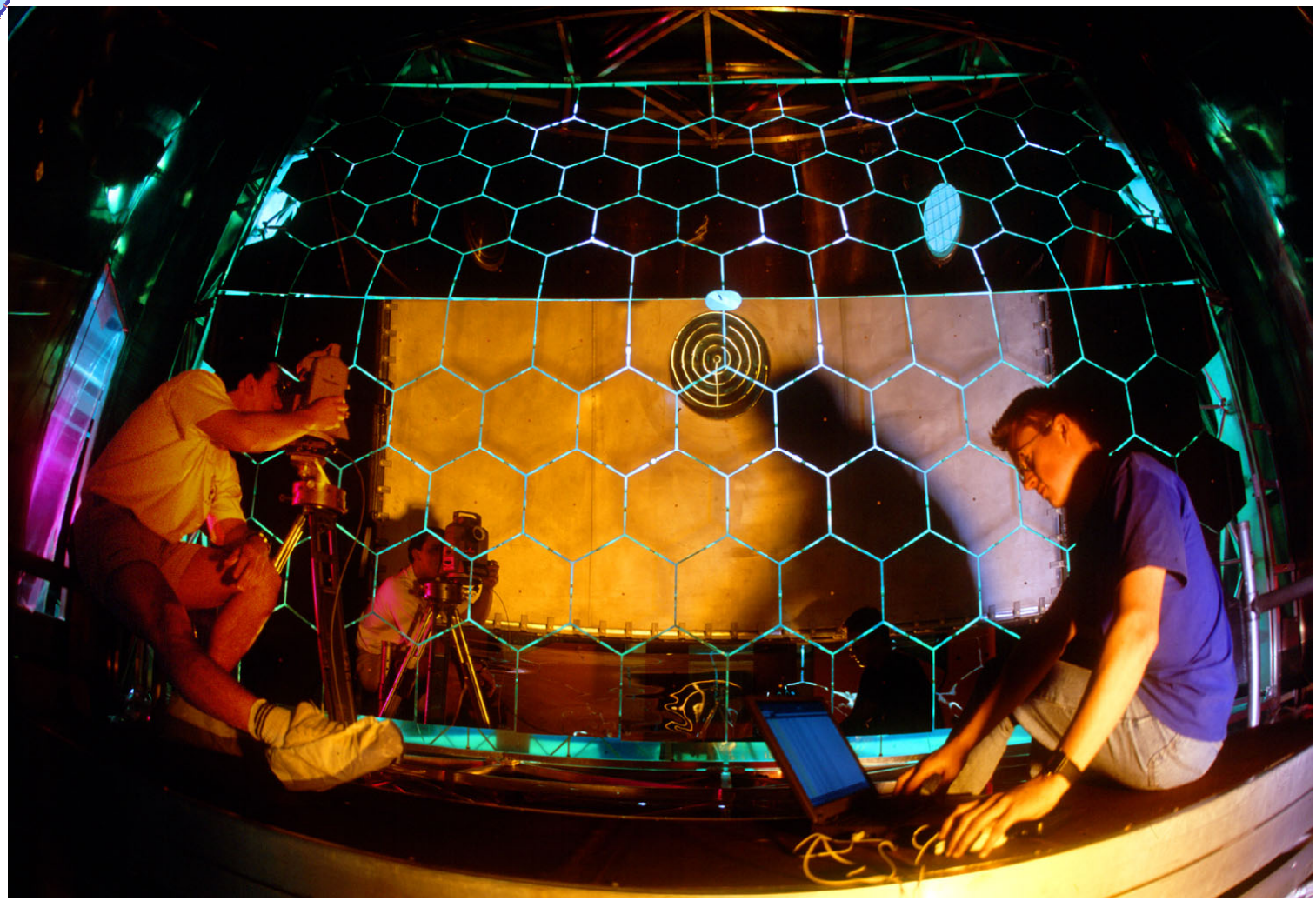
~50m



Polarization:

- Beam: ~80%
- Target: <50%>

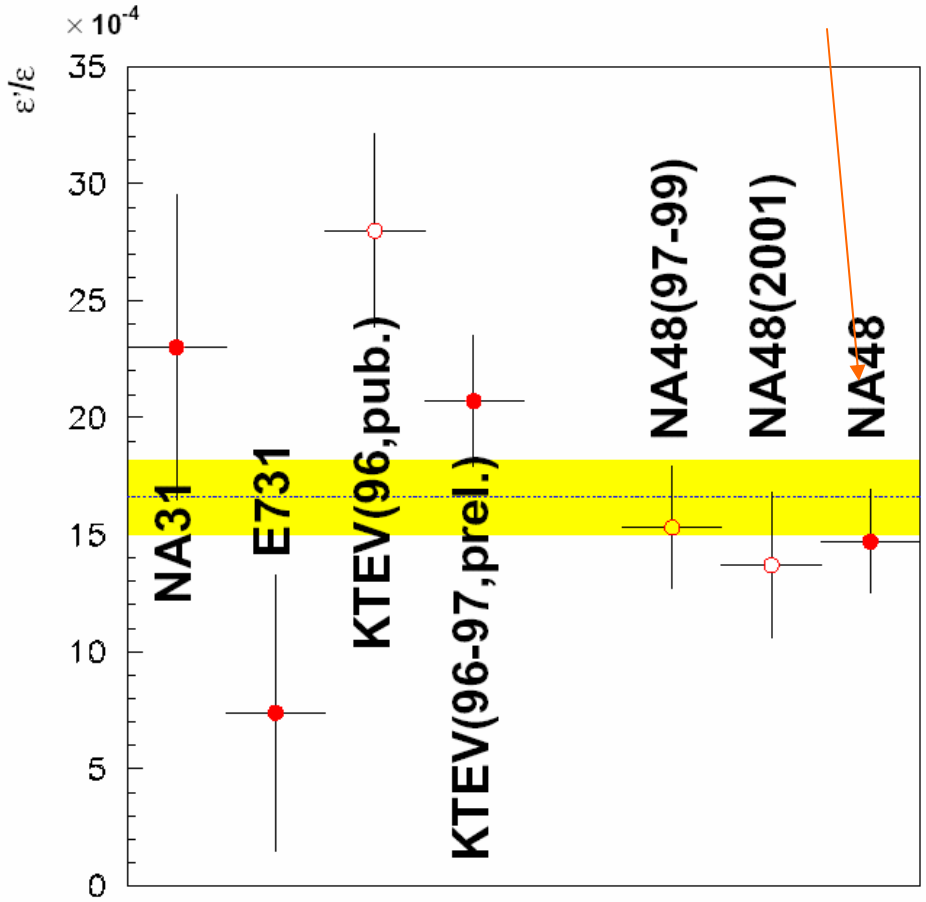
Compass experiment: Deep Inelastic Muon Scattering



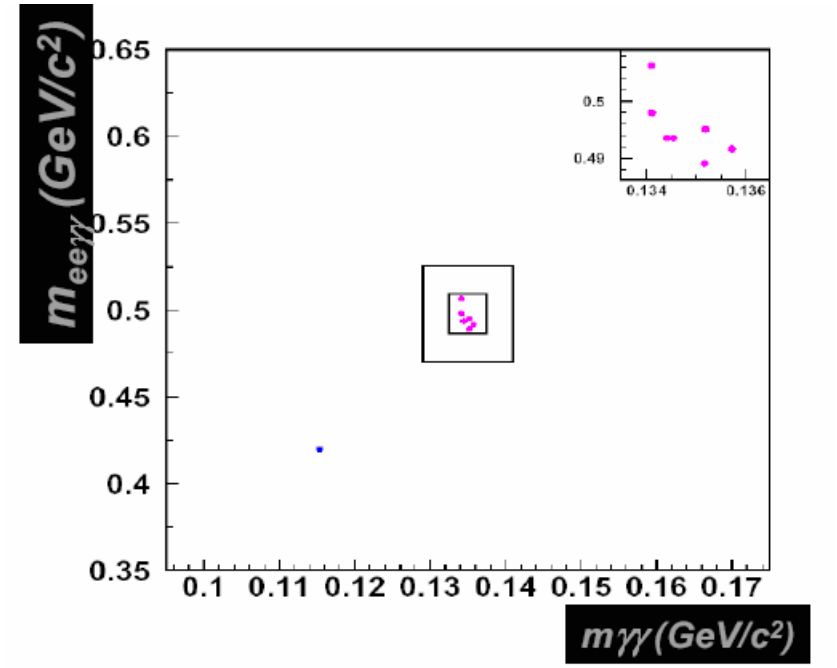
UV mirror of the RICH detector

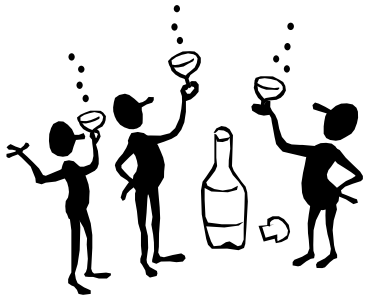
CP violation in the K system (NA 48 experiment):

$$\mathrm{Re}(\varepsilon'/\varepsilon) = (14.7 \pm 2.2) \times 10^{-4}$$



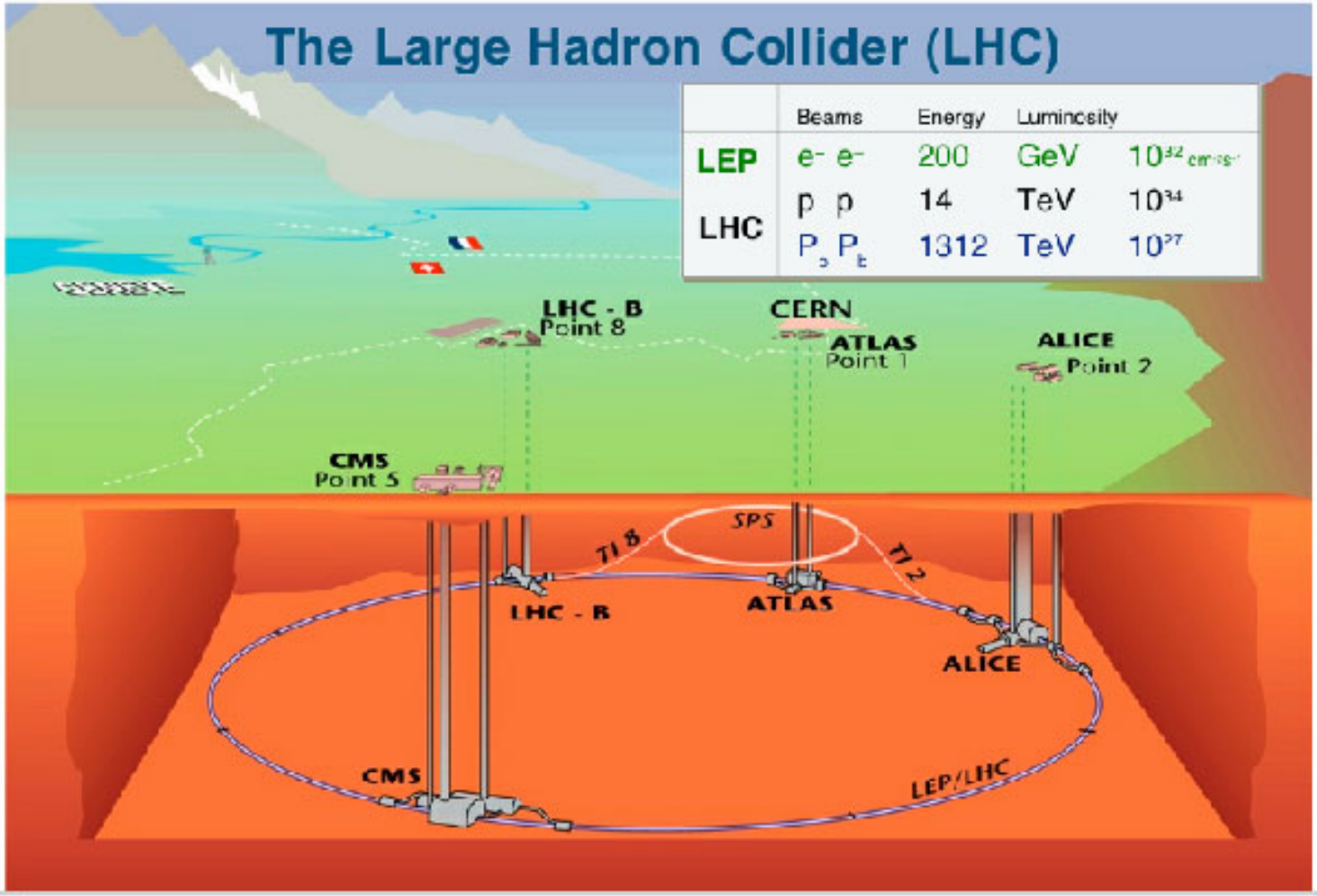
Rivelazione del decadimento raro $K_S \to \pi^0 e^+ e^-$ (esp. NA48)



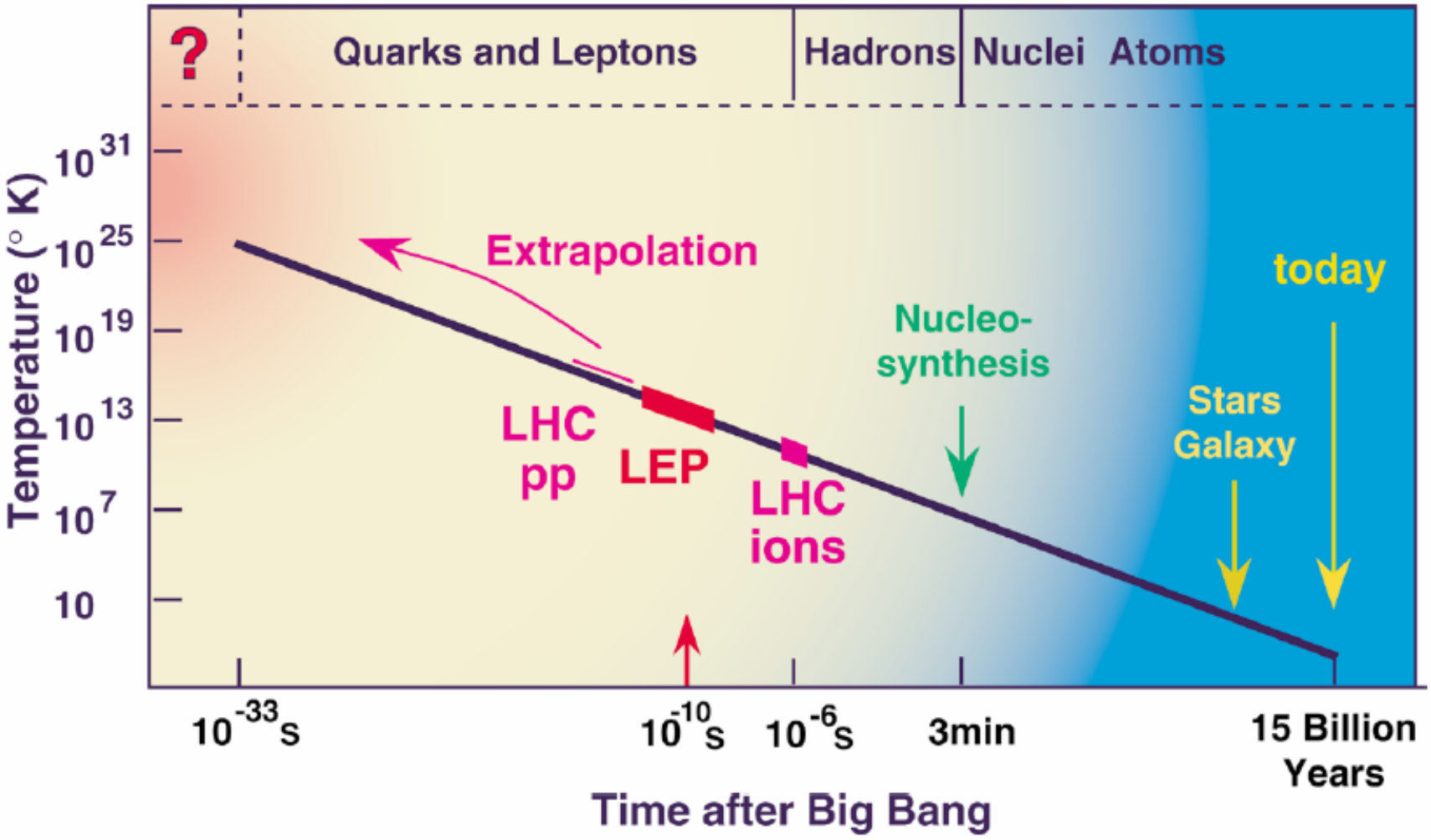


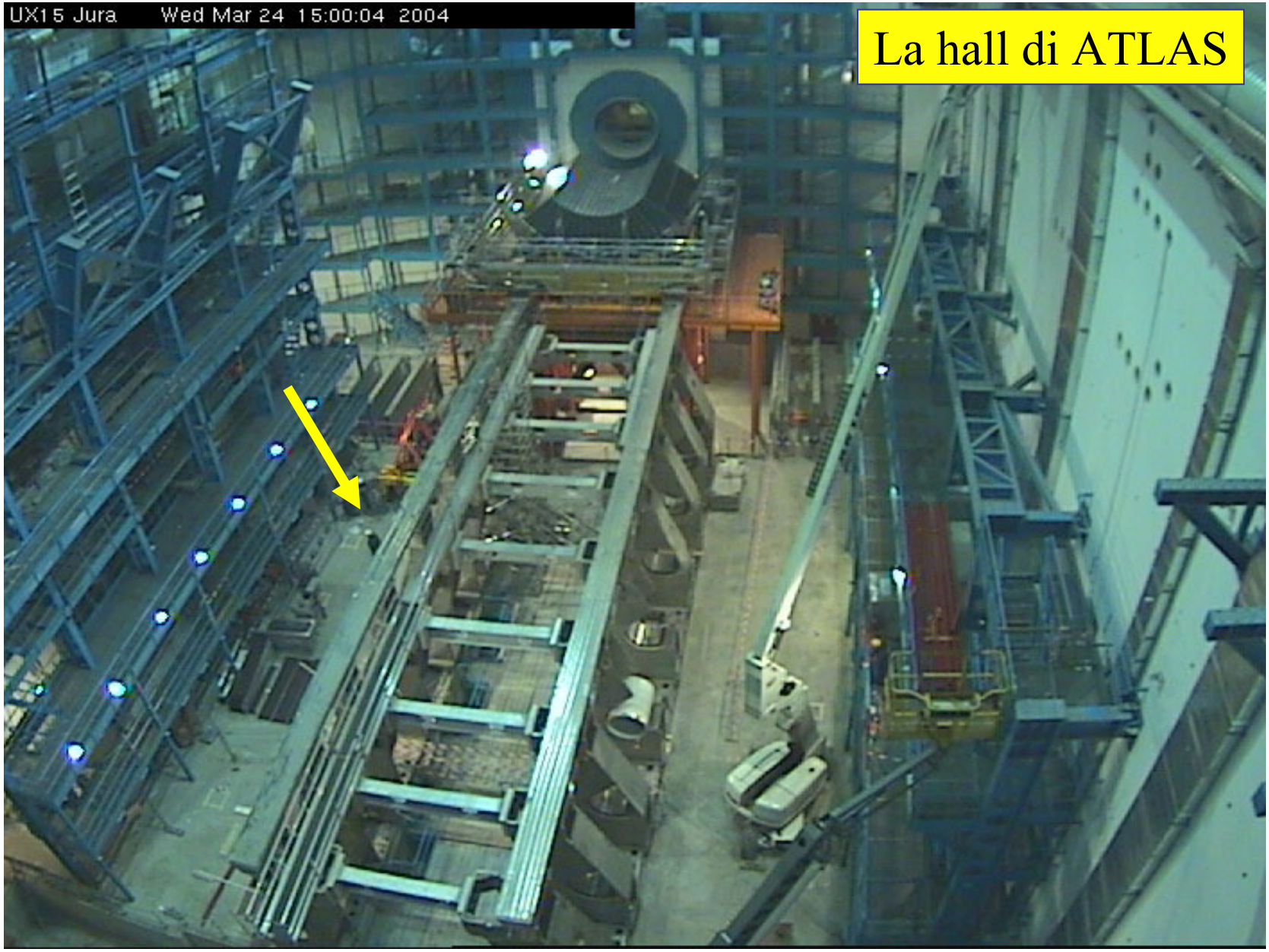
BR piu' raro mai misurato al CERN !!

$$BR(K_S \to \pi^0 e^+ e^-)_{mee>165MeV} = (3.0^{+1.5}_{-1.2} +/- 0.2_{syst}) \times 10^{-9}$$


The Large Hadron Collider (LHC)
Beams
Energy
Luminosity
LEP
e- e-
200
GeV
LHC
p p
14
TeV
LHC - B
Point 8
CERN
ATLAS
Point 1
ALICE
Point 2
CMS
Point 5
SPS
TI 8
TI 2
LHC - R
ATLAS
ALICE
CMS
LEP/LHC

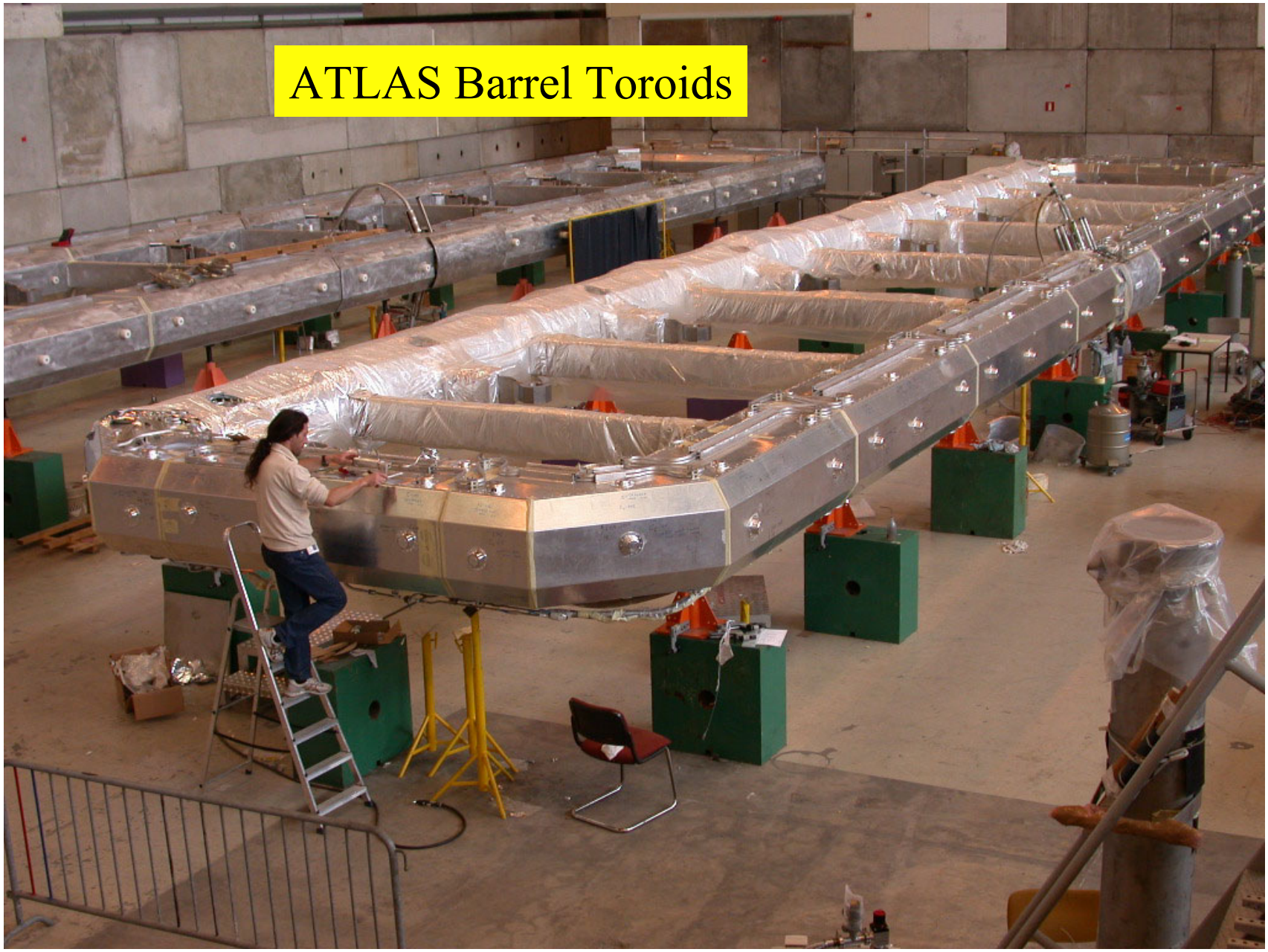
Towards the origin





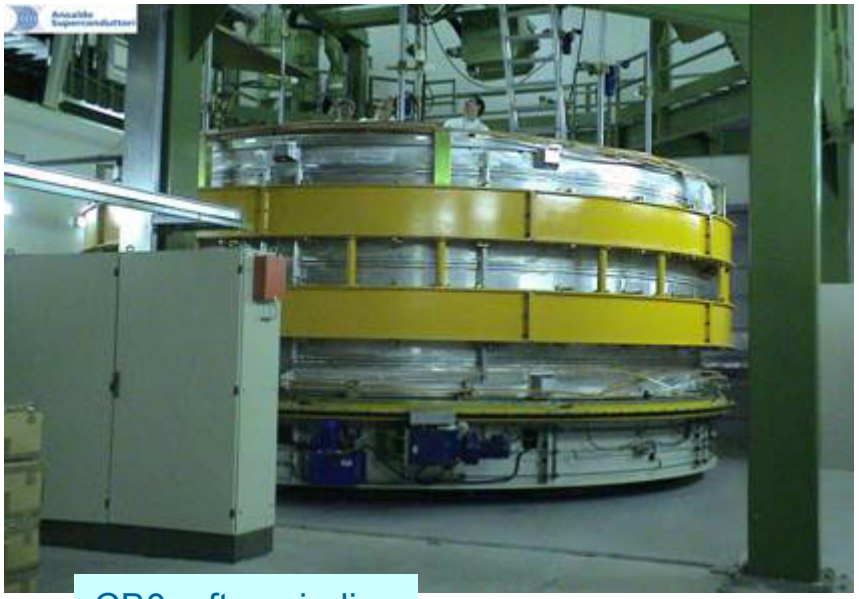
La hall di ATLAS

ATLAS Barrel Toroids



CMS - Produzione delle bobine del solenoide

Modulo CB-2 (100%); CB-1 (98%);
CB0 82%; CB+1 (49%); CB+2 (26%)

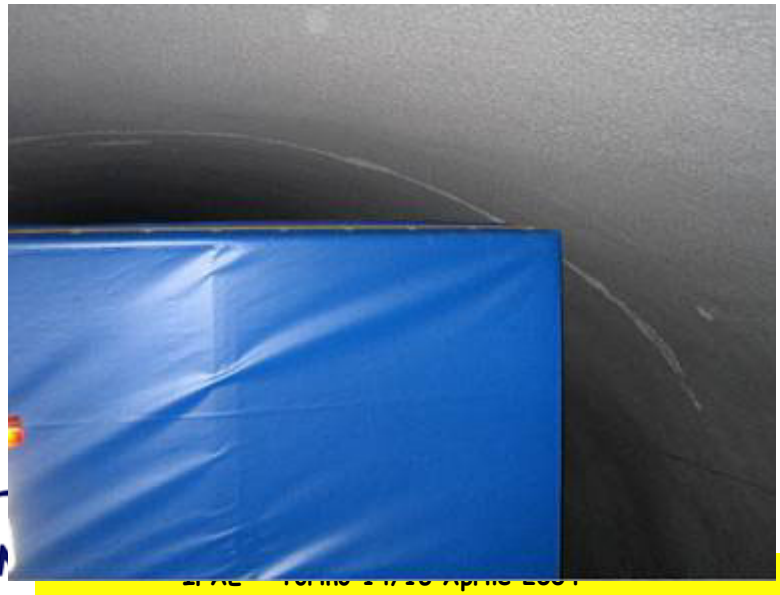


CB0: after winding

CB+1: 1 month to completion

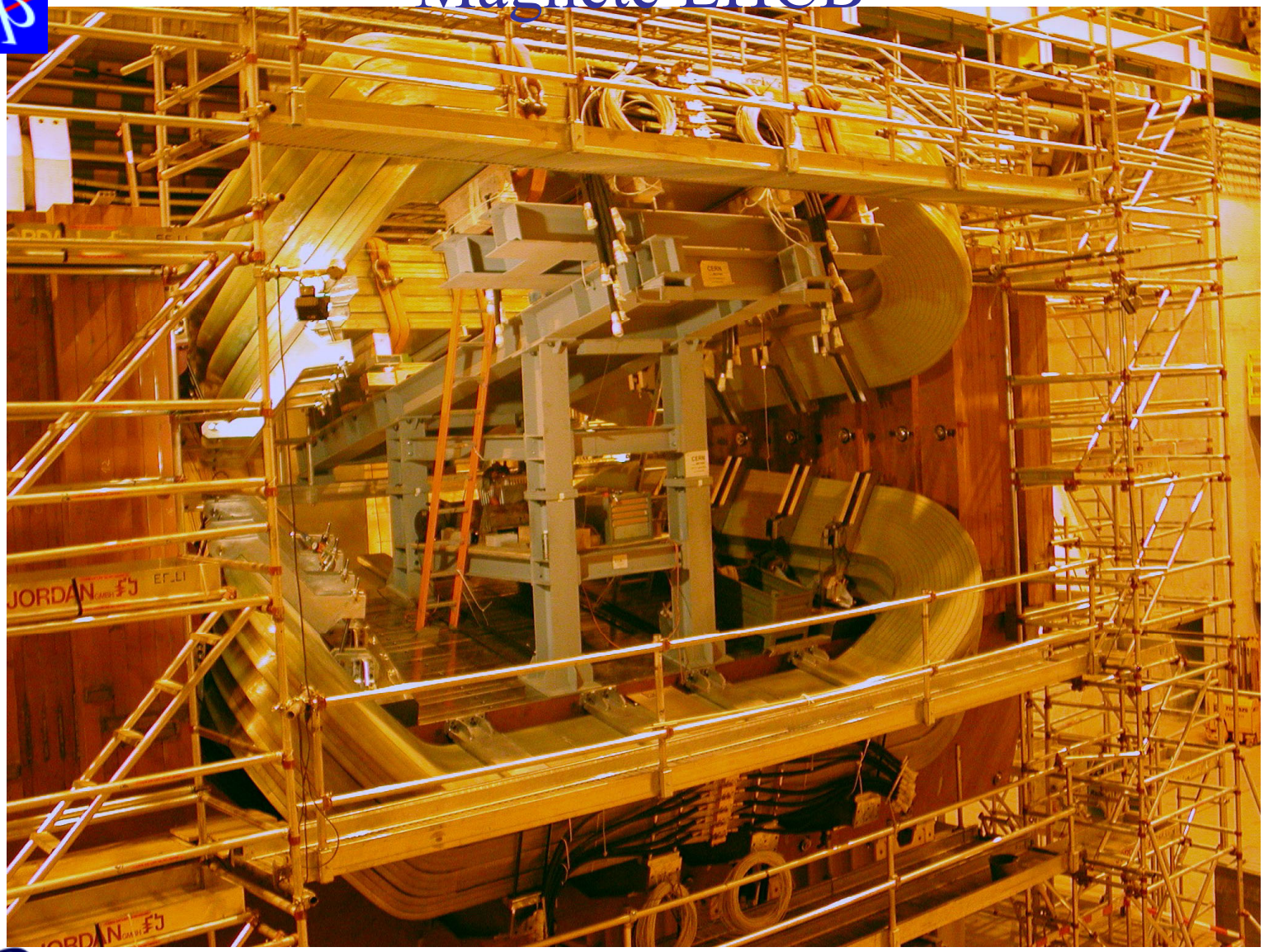
CB+2

Trasporto di CB-2



Esercizi di installazione al CERN

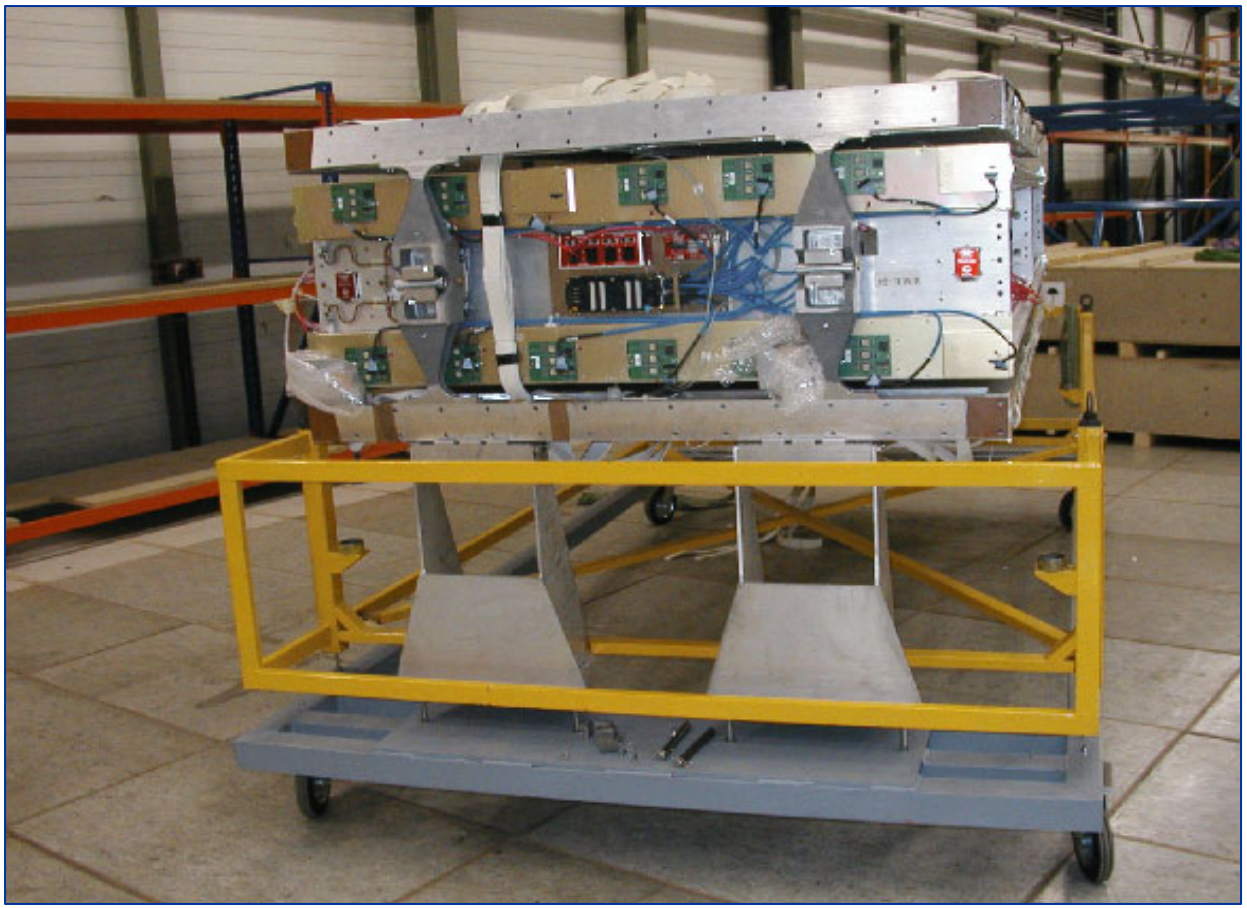
Magnete LHCB



Supermodules Production ECAL

INFN regional center

Stazione MDT-RPC



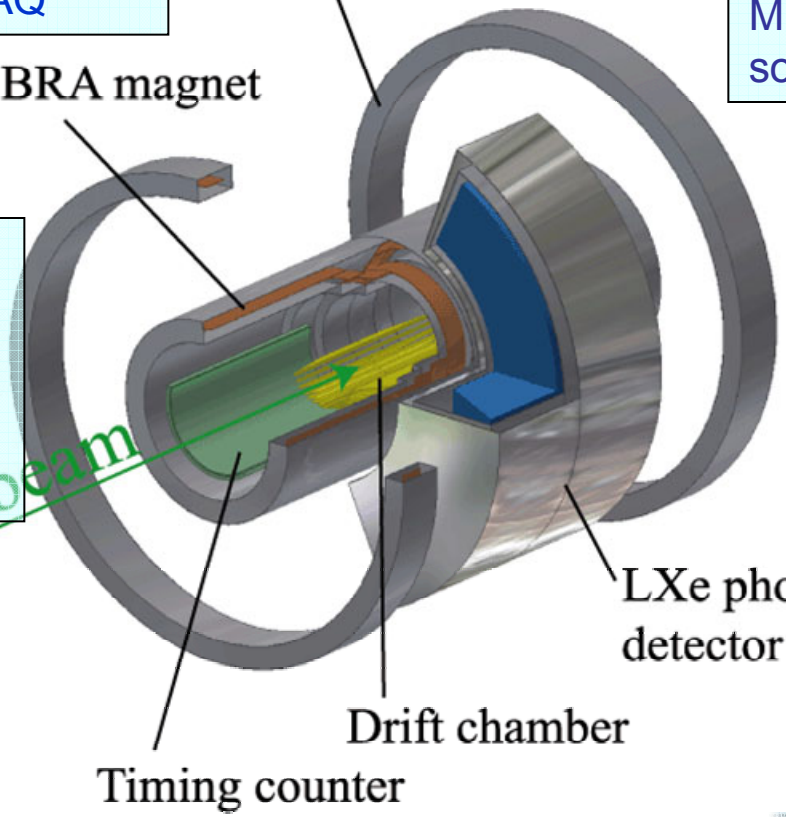
assembled MB3 in LNL/Padova and view of two assembly tables

approvato in aprile '03 dalla CSN1
GOAL: limite BR $\mu \rightarrow e\gamma < 10^{-13}$

MEG

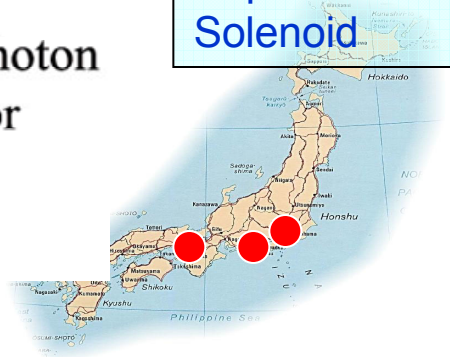
Switzerland
Drift Chambers,
Readout & DAQ

Russia
Manpower
Muons transport solenoid



Italy
e+ counter
Trigger
Splitter
LXe Calorimeter

Japan
LXe Calorimeter,
Superconducting Solenoid



The MEG collaboration

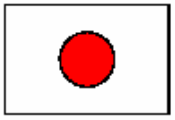
INFN & Genova University S. Dussoni, F. Gatti, D. Pergolesi, R. Valle

INFN & Lecce University G. Cataldi, S. Spagnolo, C. Chiri, P. Creti, F. Grancagnolo, M. Panareo

INFN & Pavia University A.de Bari, P. Cattaneo, G. Cecchet, G. Nardoí, M. Rossella

INFN & Pisa University A. Baldini, C. Bemporad, F.Cei, M.Grassi, F. Morsani, D. Nicoloí, R. Pazzi, F. Raffaelli, F. Sergiampietri, G. Signorelli

INFN Roma I D. Zanello



ICEPP, University of Tokyo T. Mashimo, S. Mihara, T. Mitsuhashi, T. Mori, H. Nishiguchi, W. Ootani, K. Ozone, T. Saeki, R. Sawada, S. Yamashita

KEK, Tsukuba T. Haruyama, A. Maki, Y. Makida, A. Yamamoto, K. Yoshimura

Osaka University Y. Kuno

Waseda University T. Doke, J. Kikuchi, H. Okada, S. Suzuki, K. Terasawa, M. Yamashita, T. Yoshimura

PSI, Villigen J. Egger, P. Kettle, H. Molte, S. Ritt

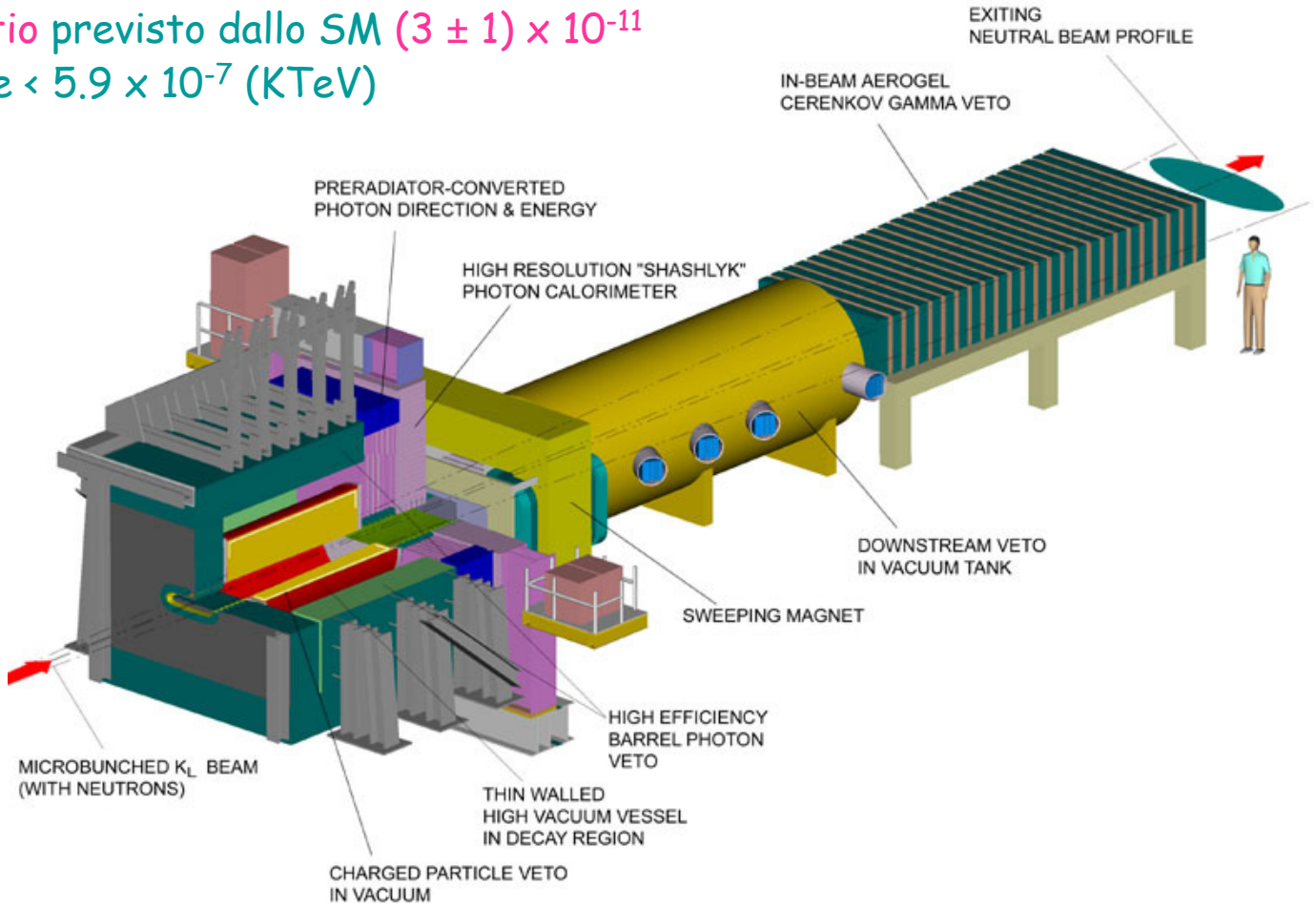
Budker Institute, Novosibirsk L.M. Barkov, A.A. Grebenuk, D.G. Grigoriev, B, Khazin, N.M. Ryskulov

Esperimento KOPIO

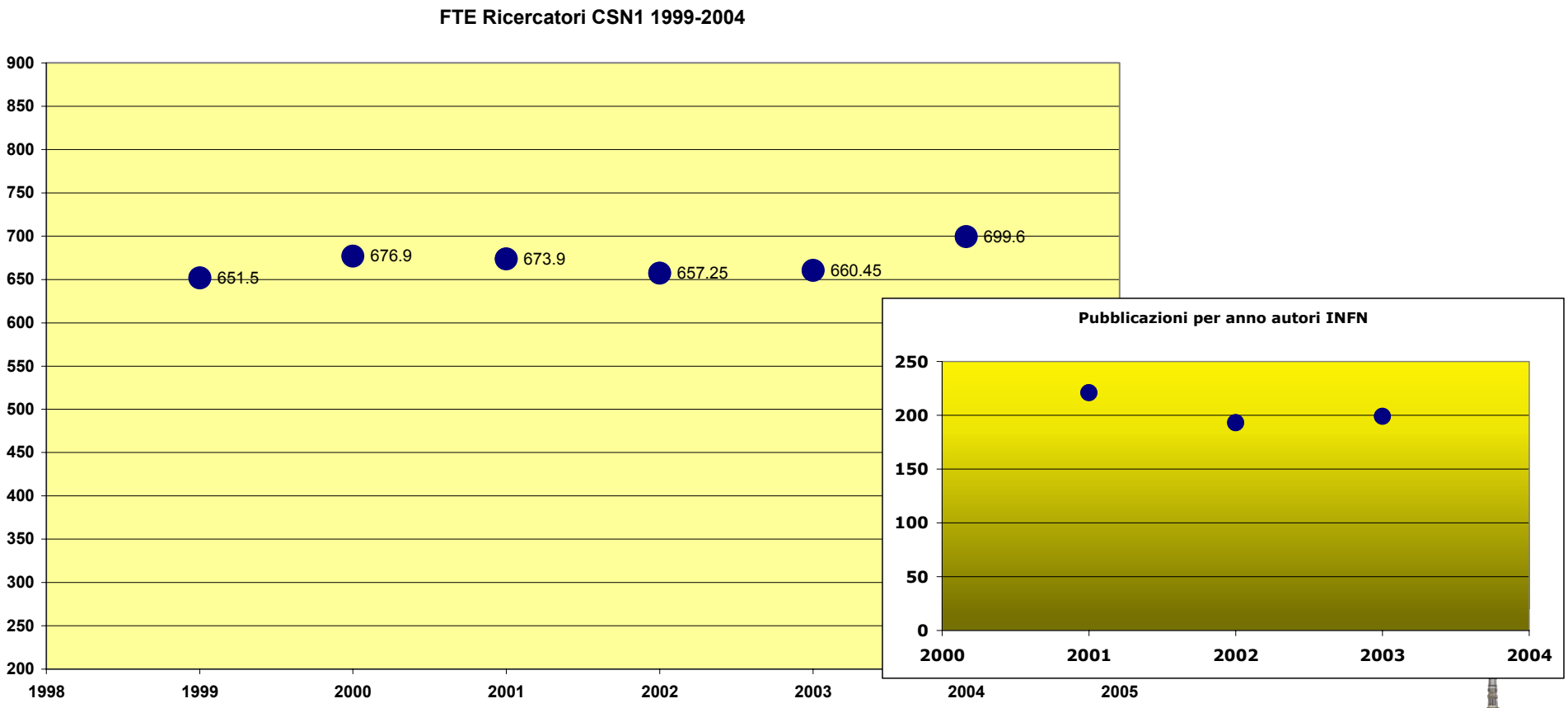
(misura $K_L \to \pi^0 \nu \bar{\nu}$)

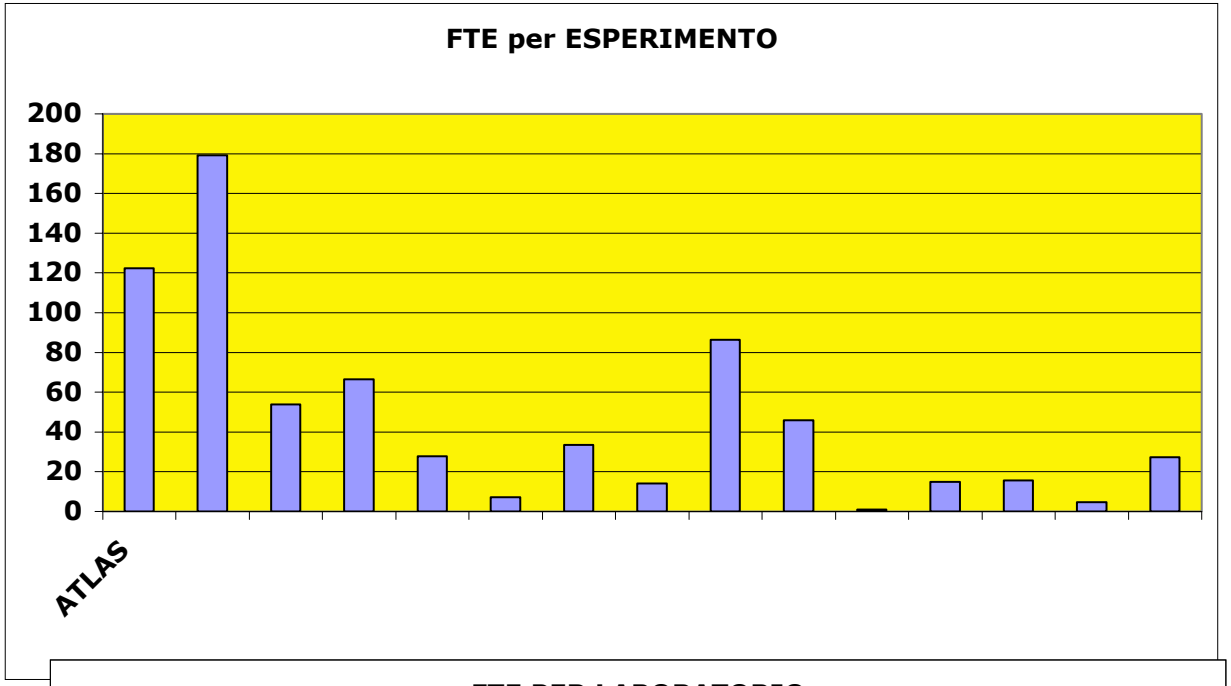
Branching ratio previsto dallo SM $(3 \pm 1) \times 10^{-11}$

Limite attuale $< 5.9 \times 10^{-7}$ (KTeV)



- la comunita' INFN che partecipa ad esperimenti di HEP e' rimasta costante in questi anni, segno di un programma ricco ed interessante

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160
140
120
100
80
60
40
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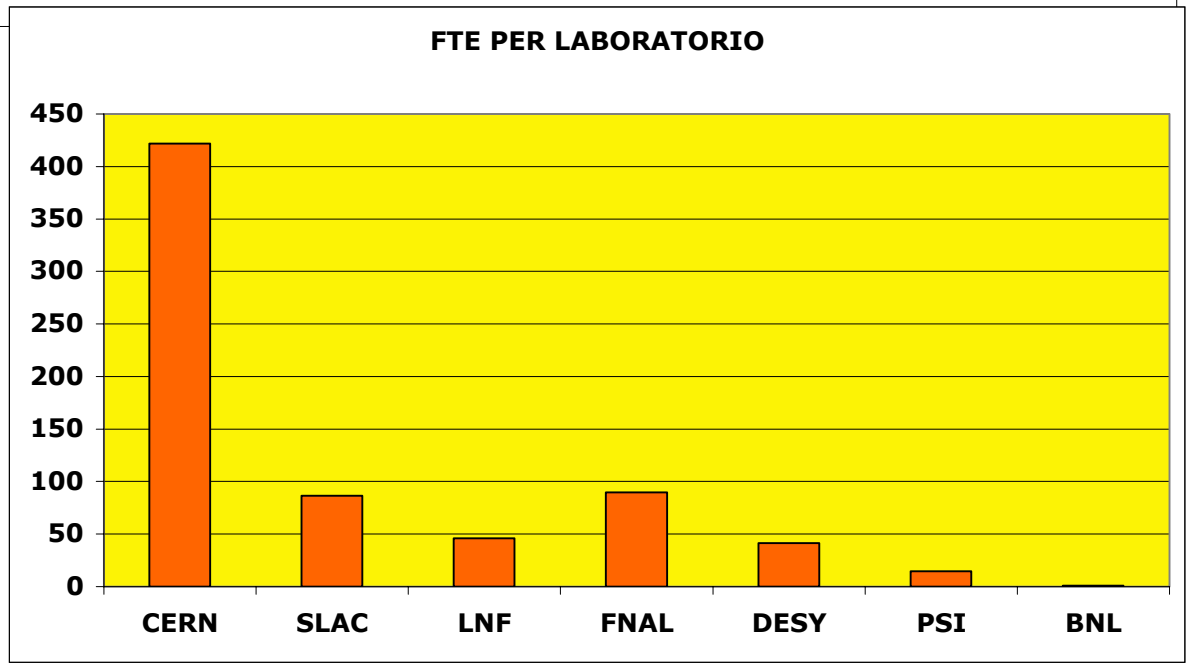
ATLAS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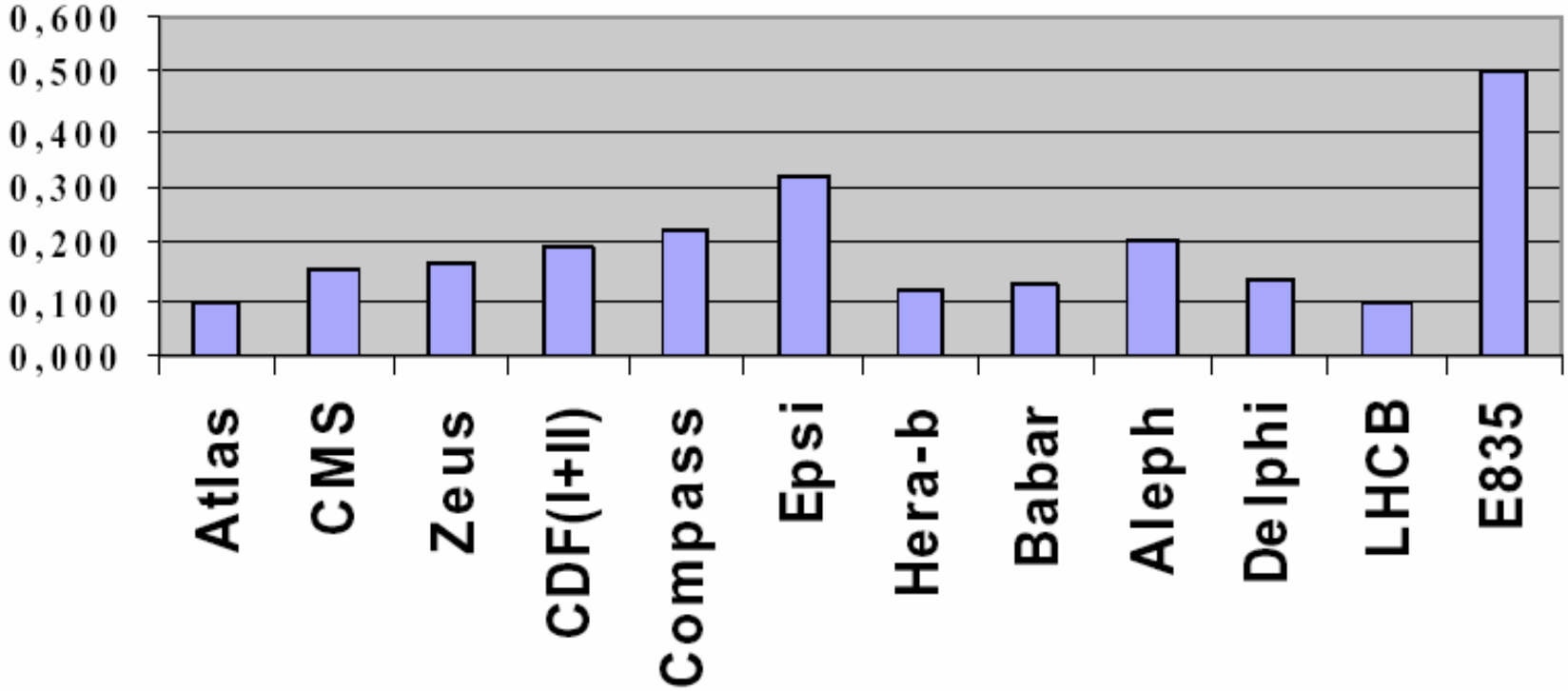
50
0
CERN
SLAC
LNF
FNAL
DESY
PSI
BNL

INFN FTE / ALL FTE per Esperimento



- Sicuramente non mancano le opportunita' in HEP per fare avanzare scienza. **Italia ben presente sulla Frontiera della Ricerca.**

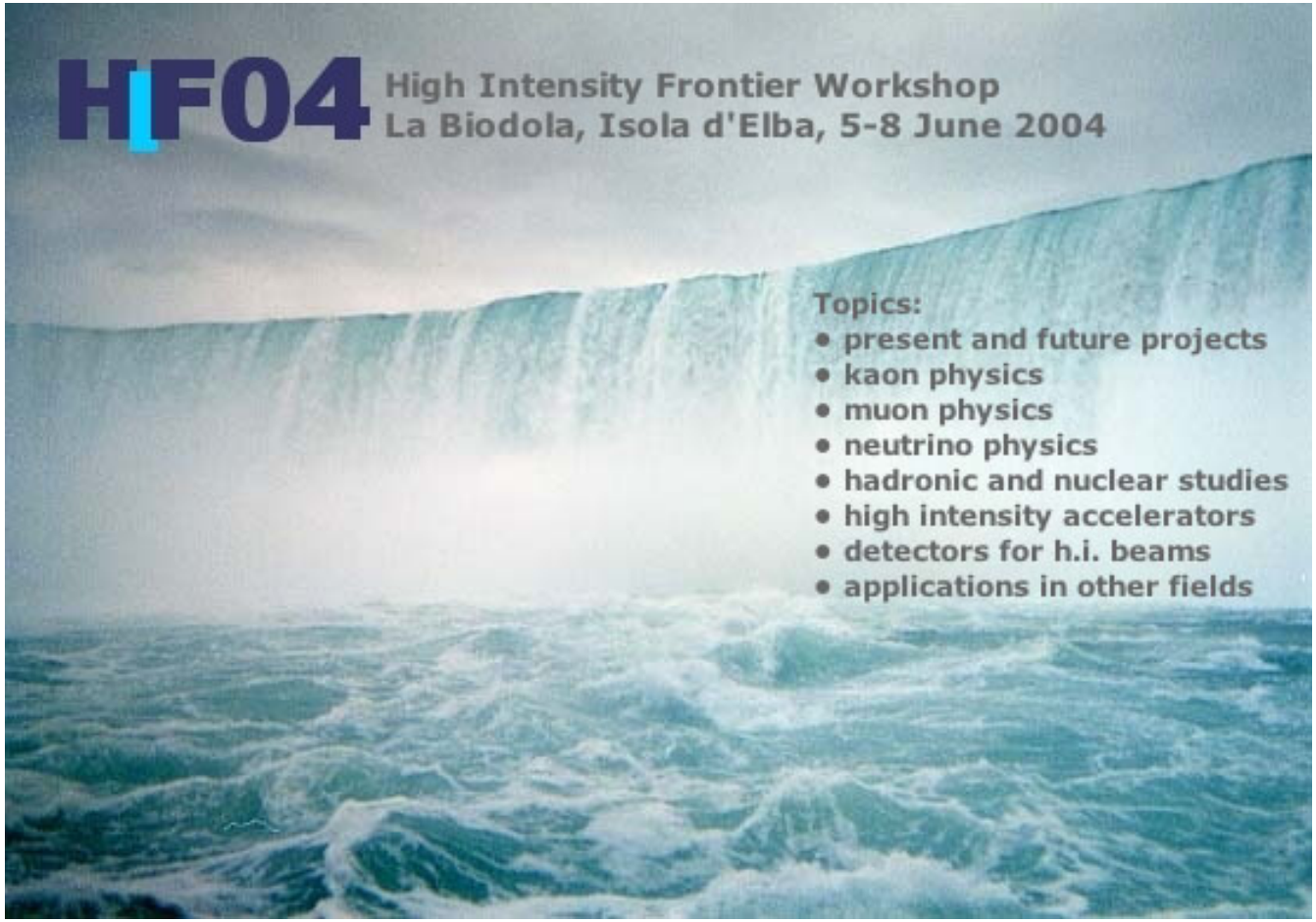
  Preoccupazioni principali:

  - ricambio generazionale: possibilita'?
  - i giovani ricercatori saranno abituati ad essere propositivi?
  - il programma attuale (LHC et al.) lascia spazi per misure, a medio termine, interessanti? Con quali facilities? HIF vs HEF

Nuova iniziativa in corso, workshop a giugno, partecipazione "Cogne meeting" dell'SPSC di settembre

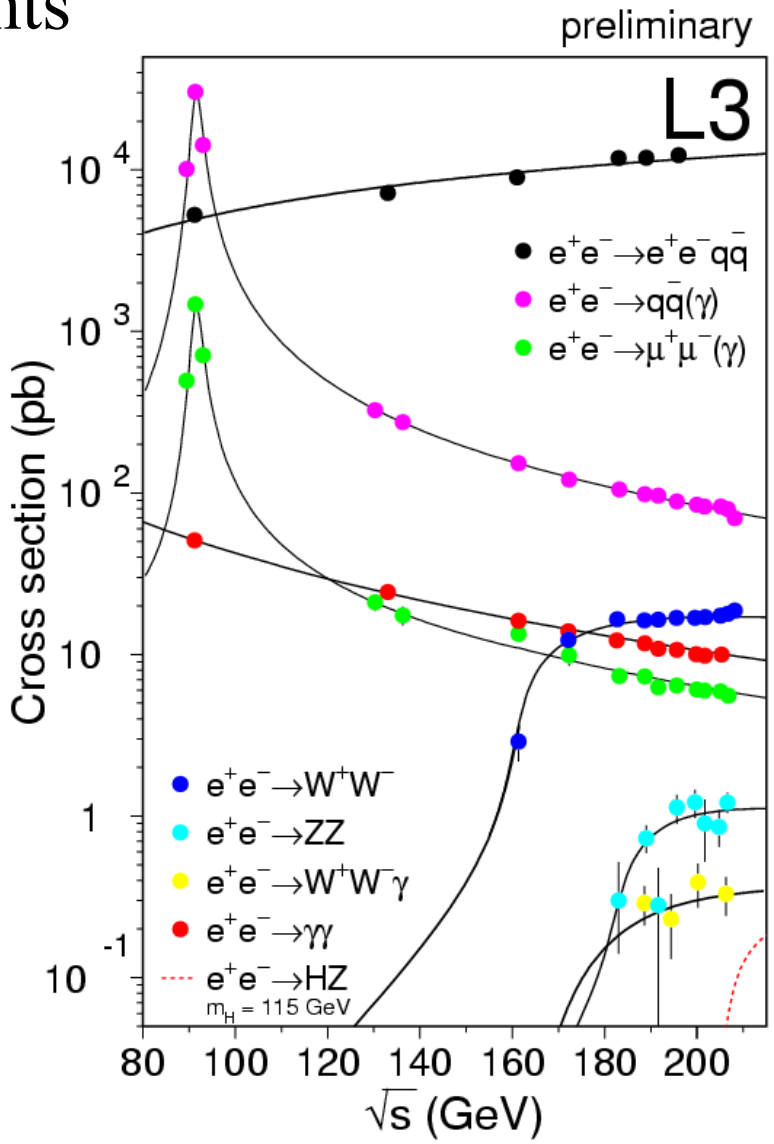
presentazione finale in CSN1 di novembre

PARTECIPATE !!

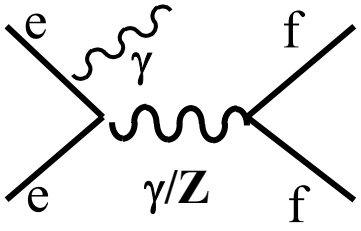

HIF04
High Intensity Frontier Workshop
La Biodola, Isola d'Elba, 5-8 June 2004
Topics:
• present and future projects
• kaon physics
• muon physics
• neutrino physics
• hadronic and nuclear studies
• high intensity accelerators
• detectors for h.i. beams
• applications in other fields

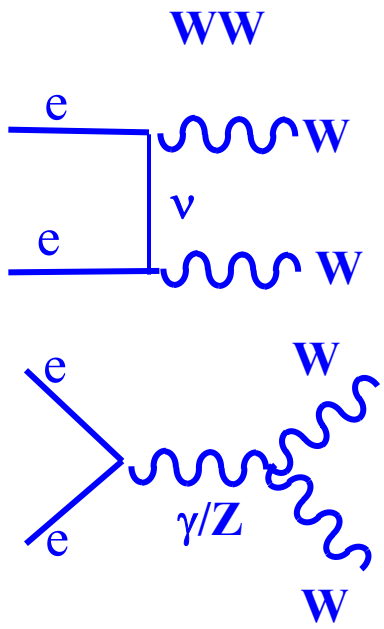
Backup slides

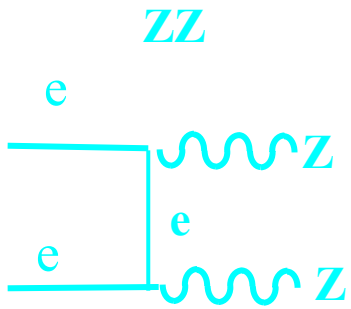
The measurements at LEP2



2-fermions

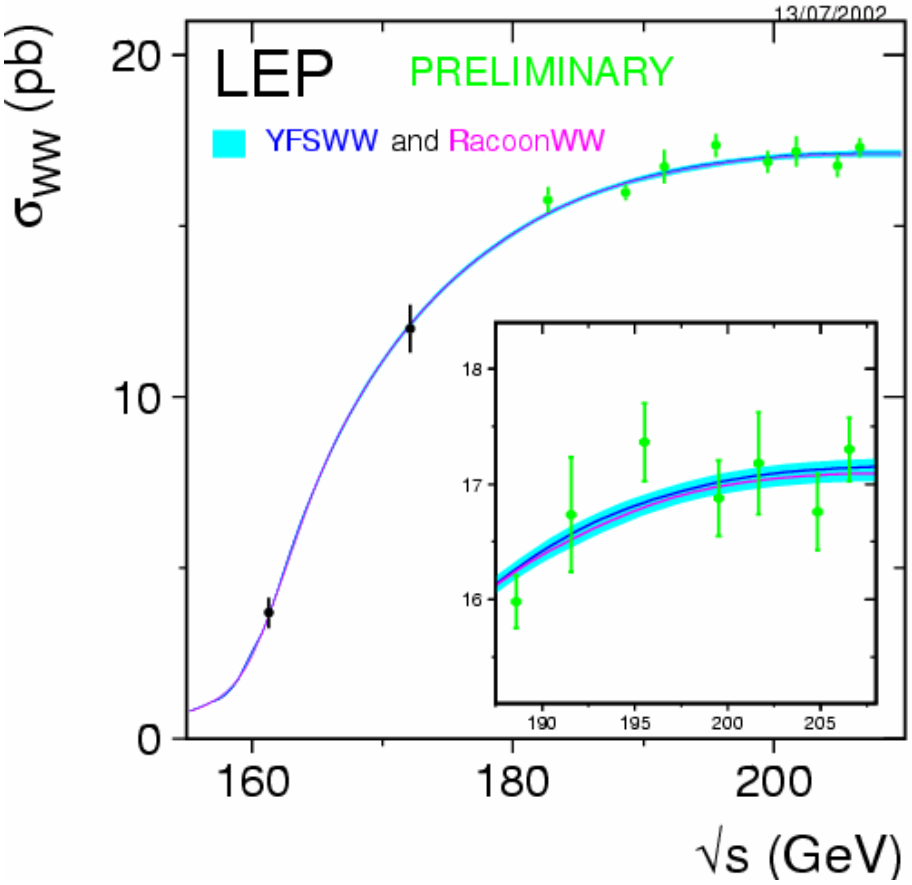


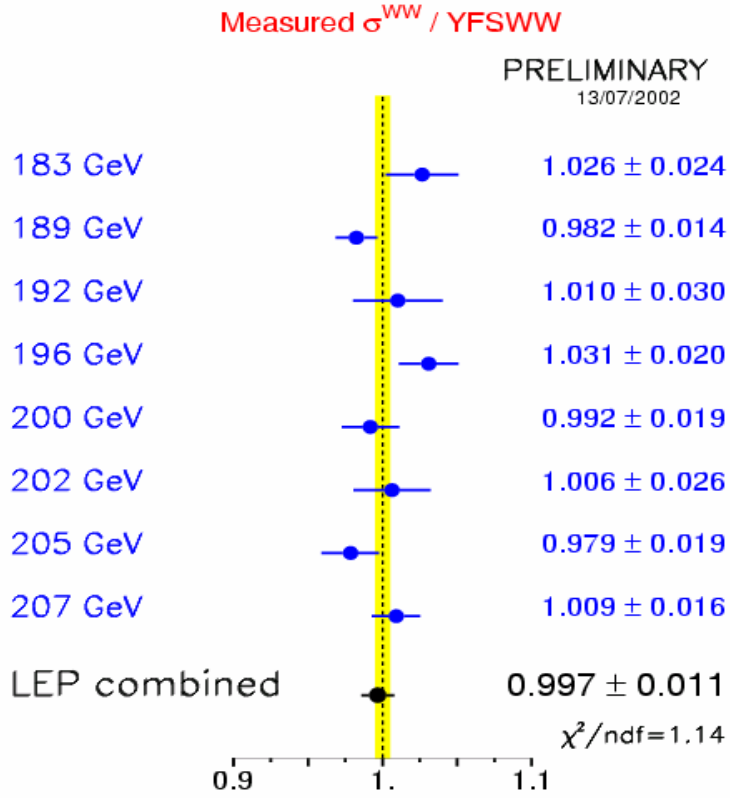




L'avventura del LEP: WW

Misure elettrodeboli: σ_{WW}

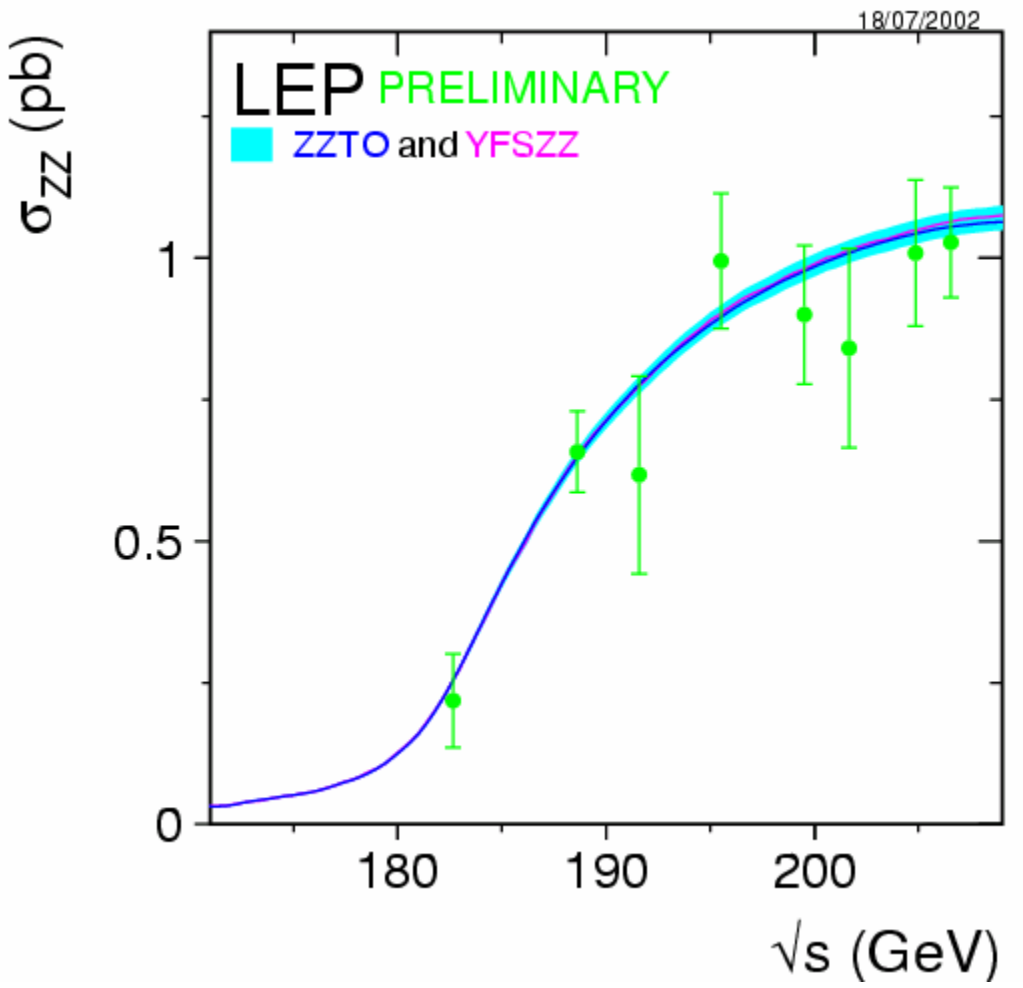


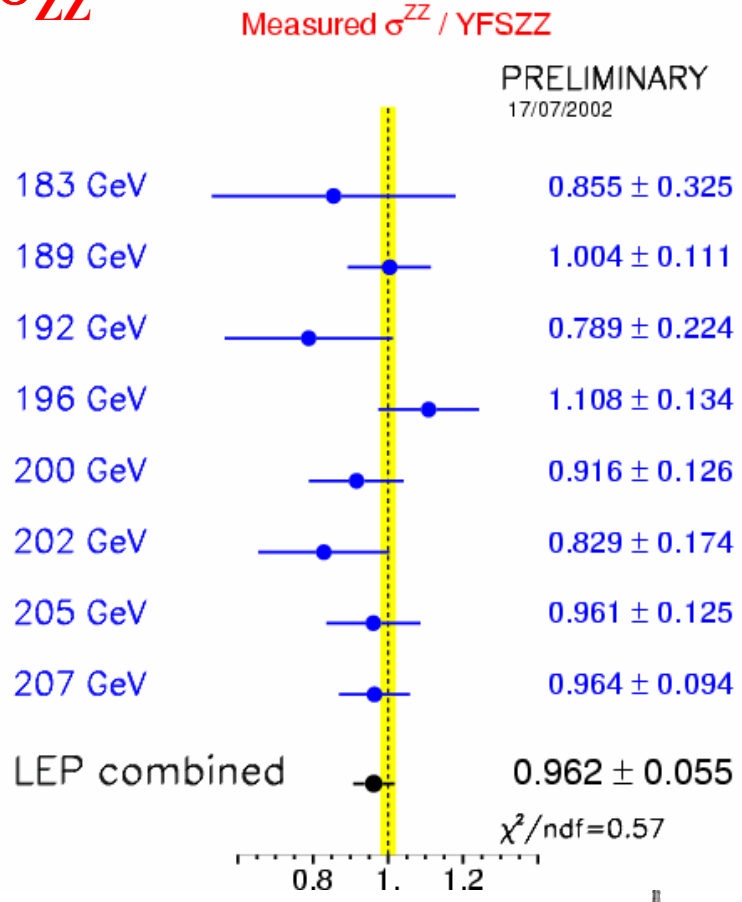


Test a livello dell' 1%

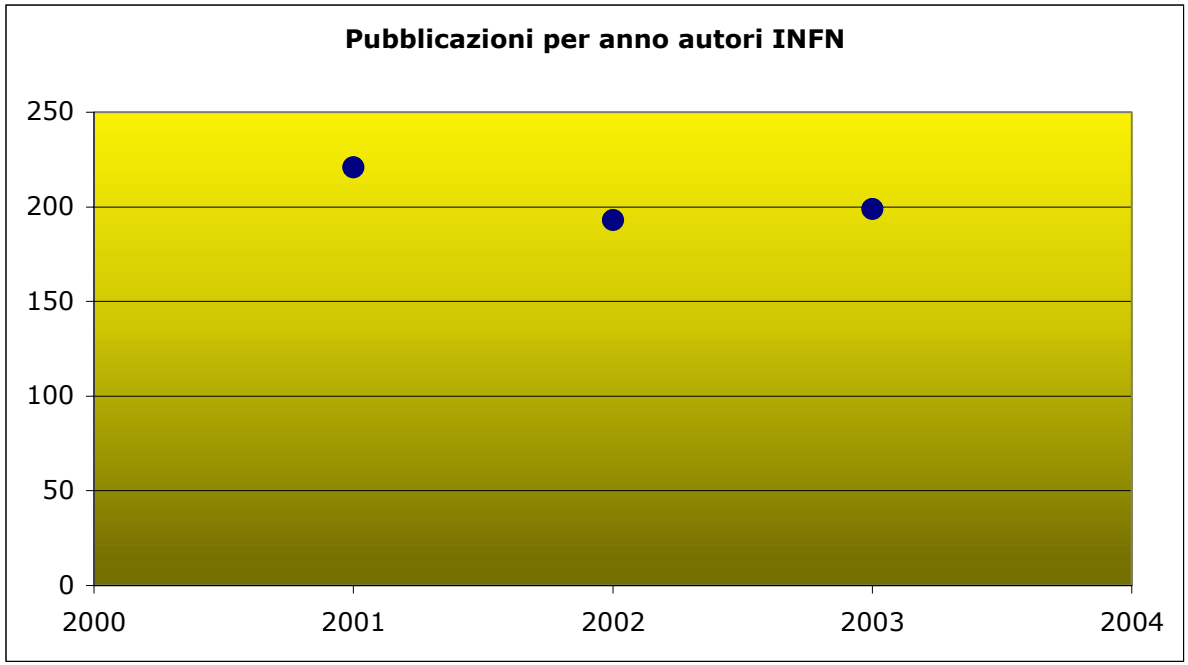
L'avventura del LEP: ZZ

Misure elettrodeboli: σ_{ZZ}





Test a livello del 5%


Pubblicazioni per anno autori INFN
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