Women physicists : their presence in the scientific institutions and their future

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Sono molto felice di essere qui

Ringrazio moltissimo per l‘invito!

Women physicists : their presence in the scientific institutions and their future

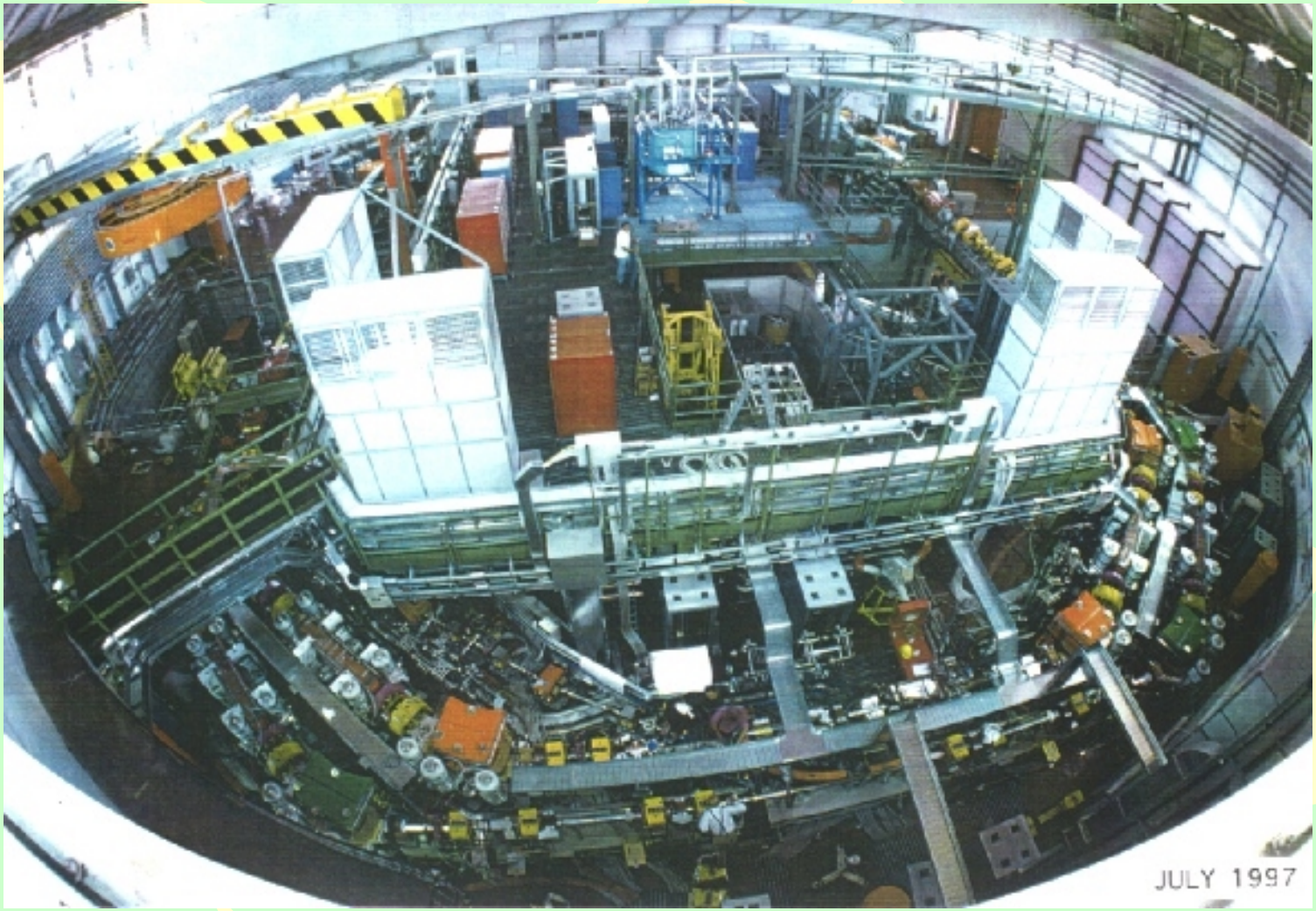
- Introduction
- Human resources in RTD in Science and Technology in Europe
- Barriers and perspectives for women in physics research
- Conclusions and recommendations

Introduction

- I am a theoretical particle physicist : models of electron and positrons interactions and what the quantum vacuum produces when particle-antiparticles collide
- Chair of equal Opportunity Committee in Italian Institute for Nuclear Physics (INFN)
- Member of EU working group Benchmarking Human Resources in RTD in Science and Technology

Electron-positron accelerator
and colliding ring machine
in INFN Frascati
National Laboratories near Rome

DAΦNE



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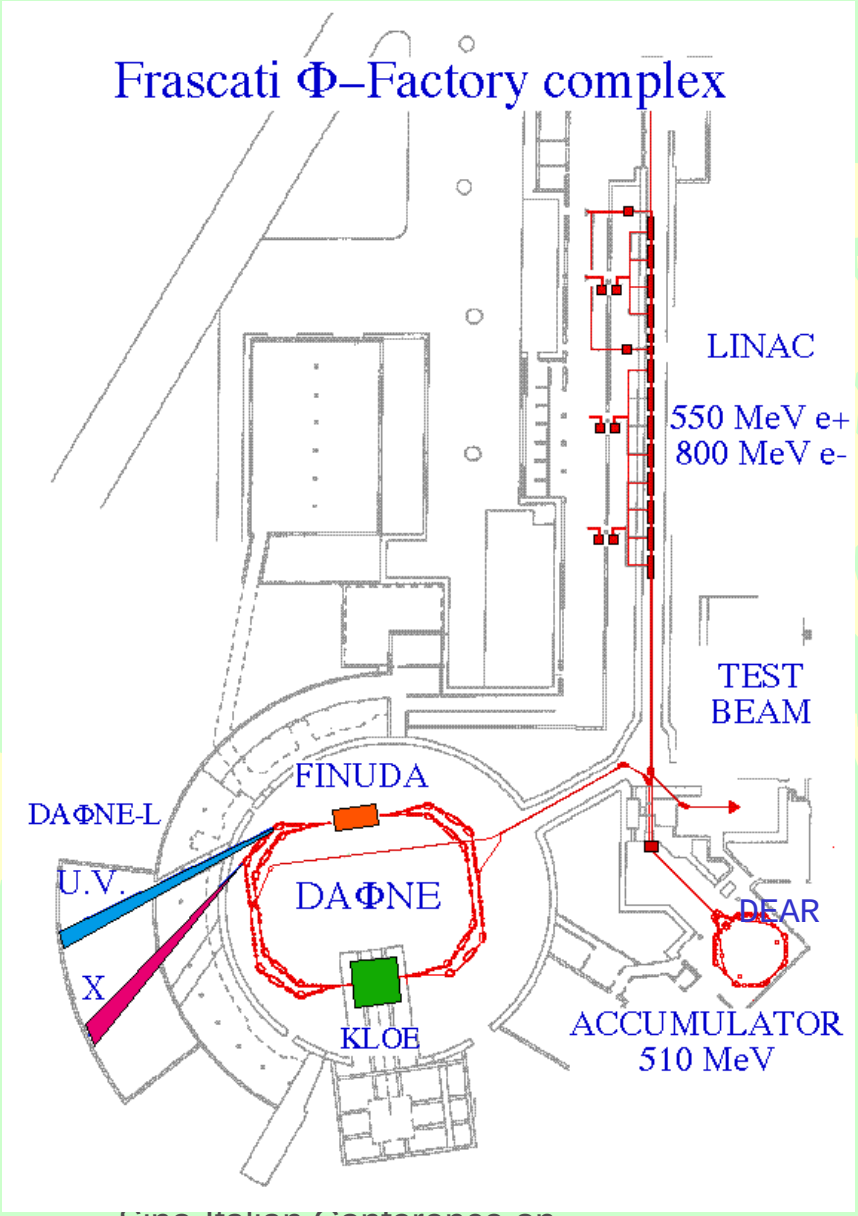
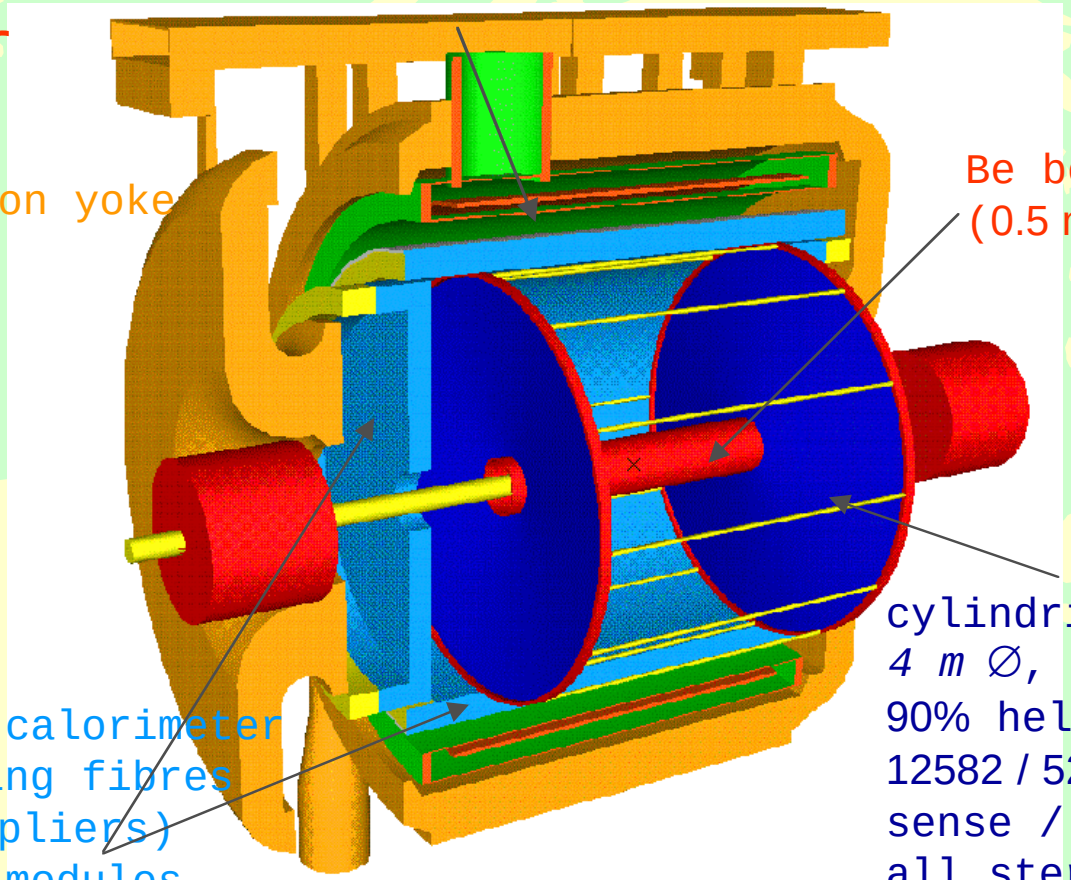

Frascati Φ–Factory complex
LINAC
550 MeV e+
800 MeV e-
TEST
BEAM
FINUDA
DAΦNE-L
U.V.
DAΦNE
X
KLOE
DEAR
ACCUMULATOR
510 MeV

The KLOE Detector

superconducting coil
B=0.6 T



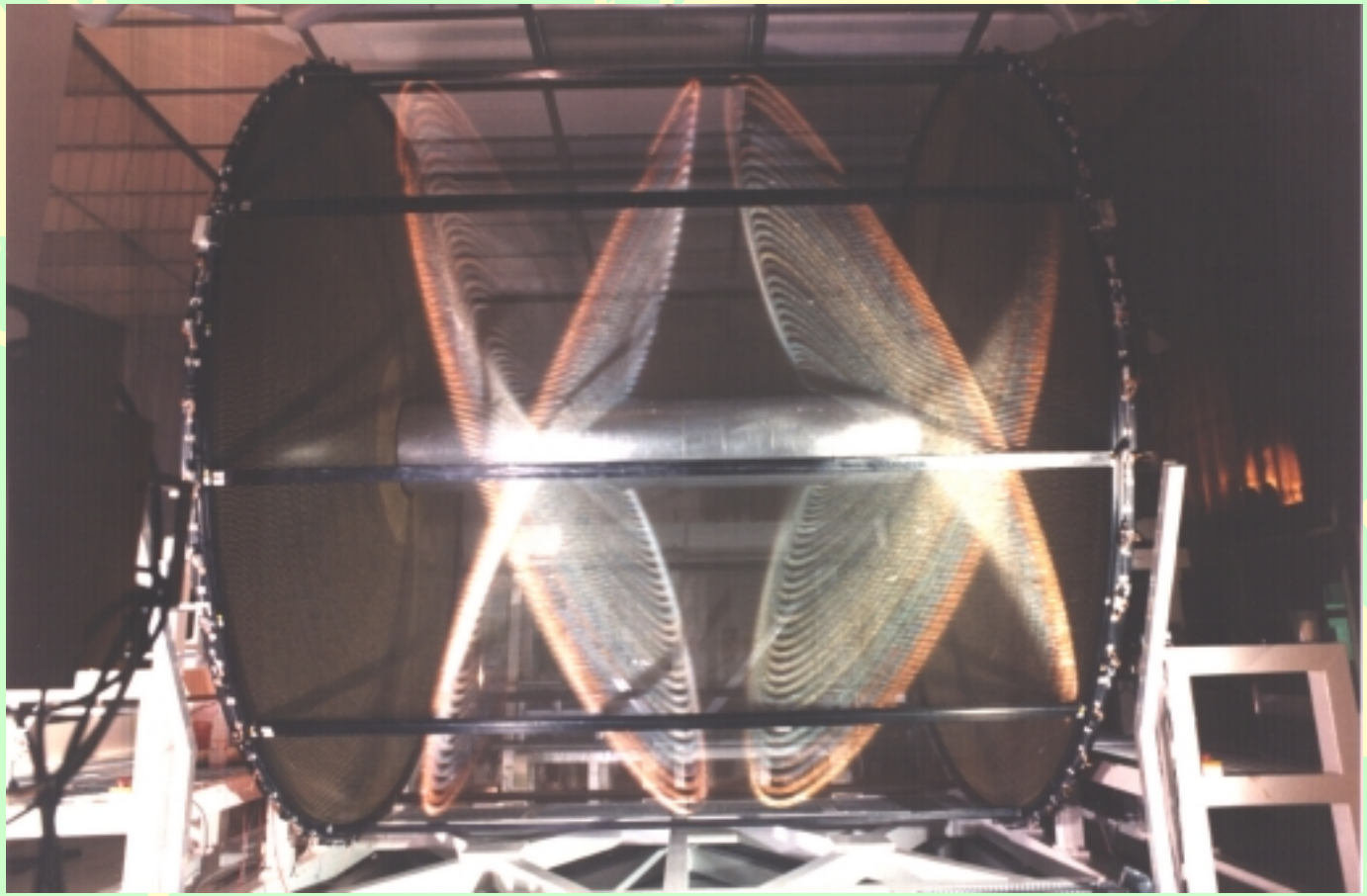
iron yoke

Be beam pipe
(0.5 mm thickness)

cylindrical drift cham
4 m ∅, *3.3 m* length
90% helium, 10% isobut
12582 / 52140
sense / total wires
all stereo wires

electromagnetic calorimeter
Pb / scintillating fibres
(4880 Photomultipliers)
endcap, barrel modules

The drift chamber



KLOE Physics Program

NON - KAON PHYSICS

Radiative ϕ - decays
- ➔ into $f_0(980)$
- ➔ into $a_0(980)$
- ➔ into η, η'

$\phi \rightarrow \pi^+ \pi^- \pi^o$

Measurement of the hadronic cross section $e^+ e^- \rightarrow \pi^+ \pi^-$

KAON PHYSICS

CP violation studies
- ➔ Double Ratio
- ➔ Interference

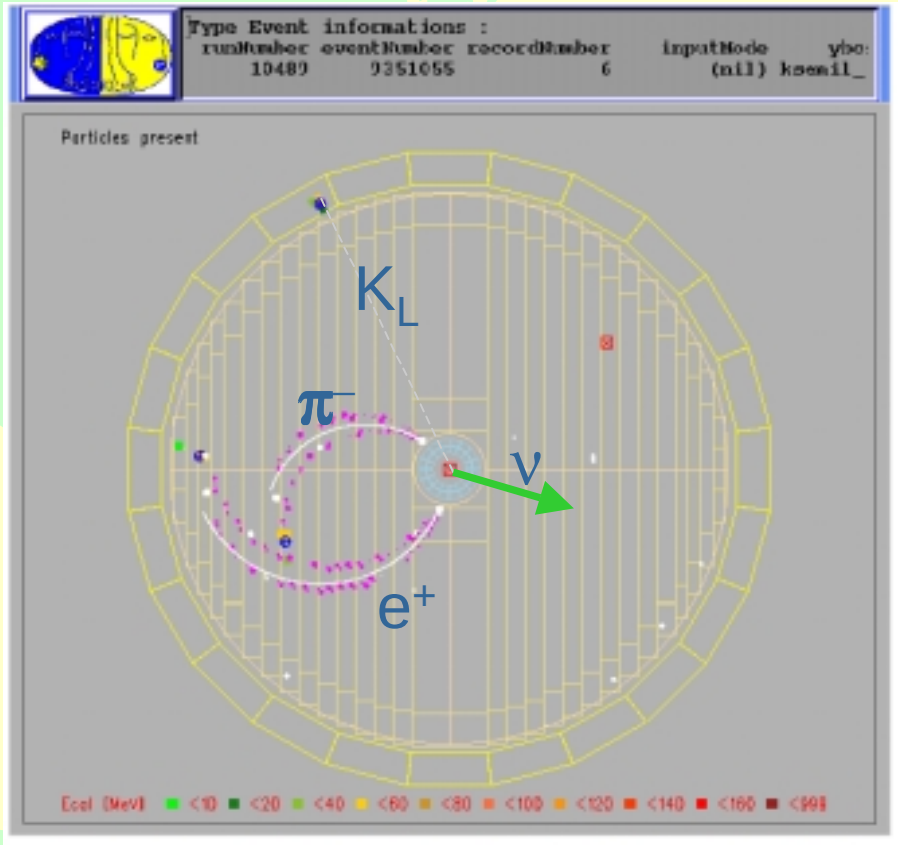
CPT violation studies
- ➔ Semileptonic asymmet
- ➔ Interference

Kaon formfactors

$K_L \rightarrow \pi l \nu$, $K^+ \rightarrow \pi^o l$

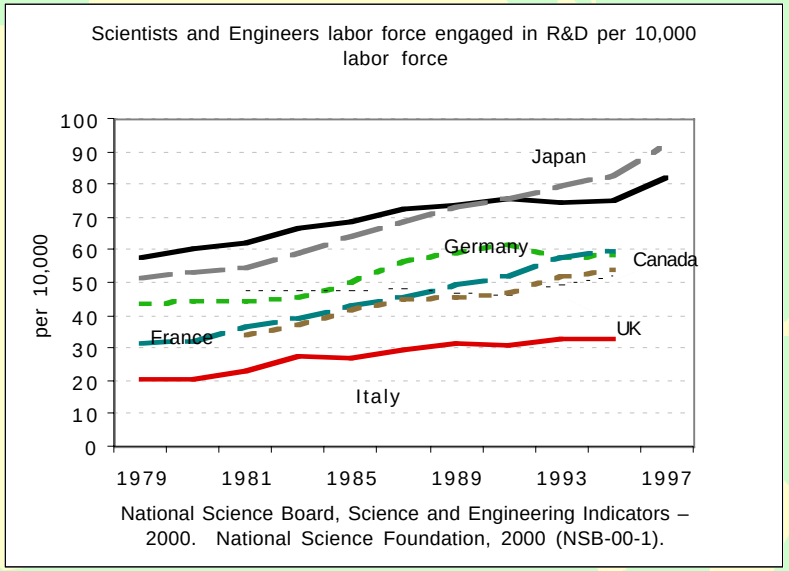
Kaon regeneration at low energies

K_S semileptonic decays

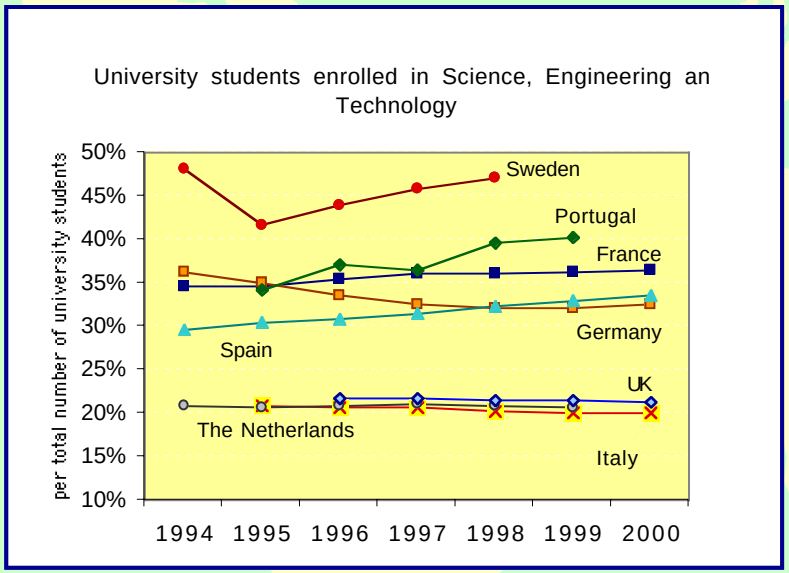


Human resources in RTD in Science and Technology in Europe

- Scientists and Engineers constitute the basic human resources for a knowledge based economy
- Europe is lagging behind Average annual growth of number of researchers is
  - For USA 6.21%
  - For EU 2.89%
  - For Japan 2.57%
  - For Italy 0.34%



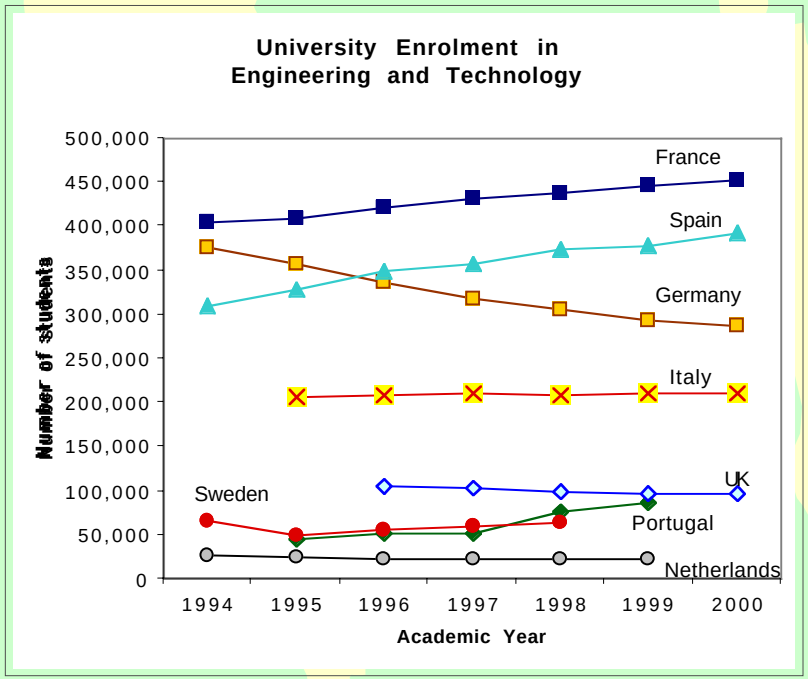
Human resources in RTD in Science and Technology in Europe

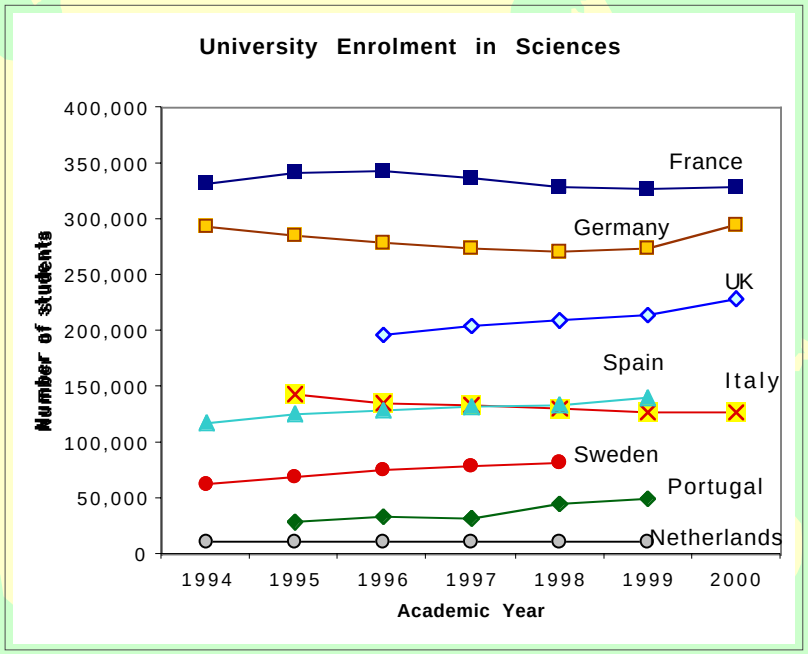


9 million
university students
for a selection of Member States
totaling 330
million people

- The main recruitment pool for scientists and engineers is from the higher education sector
- The percentage of of the population in tertiary education in the corresponding age group
  - EU-15 is less than 25%
  - USA is close to 40%
- It is perceived that in some EU states the recruitment base for S&T is fragile
- Enrolment trend: very static in large countries

Undergraduate enrolment in Science, Engineering and Technology in Europe



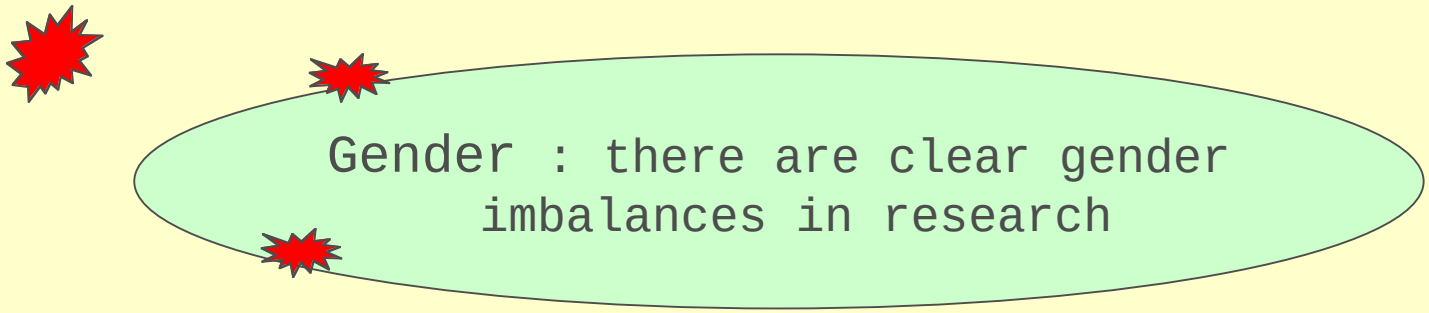


Barriers and perspectives for women in physics research

- The lost tribe : women in science
- Italian women in particle physics :
  - the scissor diagram for INFN and university women
  - women in high energy physics : the ATLAS experiment
- Women in physics : why still so few?
- Life begins at forty
- Quotas and the Affirmative Action Plans of Italian public institutions
- Women in the decision room

Barriers to training and efficient development of human resources in RTD

- Financial considerations
  - Research training requires considerable public and private investment
  - Teachers and Researchers salaries are often non-competitive with other jobs
- Mobility across disciplines and between countries and institutions is relatively low
- Last, but not the least :

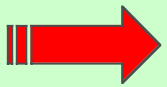


The lost tribe : women in science

Two different problems

- Women's contribution to the development of modern science, and physics in particular, is scarce and mostly ignored, with few notable exceptions like Marie Curie

the main reason, albeit not the only one,
for the scarce participation of women to the formulation of modern science, is ascribable to the fact that women were not admitted as students in those universities where modern science was formulated and taught.

- Women constitute less than 1/3 of the Science and Engineering work force in EU  later

Higher education, women and science

The lack of participation of
women to the development of science which still persists up to these days,
has been the esclusion of women from Institutions of High Learning in the
most prestigious North Europe Universities

- During the Middle Ages, convents and monasteries were the places where poor and rich girls received their education
- The destruction by Henry VIII of convent schools where the female population, rich and poor, found their only teachers was the absolute extinction of any systematic education of women for a long period [in England] H. Mozans,Woman in Science, 1913, New York
- In Catholic Universities, in Italy in particular, it was different and in the 18th century there were famous women teachers at University of Bologna, like
  - Laura Bassi holding the Chair of Experimental Physics in 1776 and
  - Maria Gaetana Agnesi holding the Chair of Analytical Geometry in 1750
- By this time, however, the hub of scientific thought had moved from the South to the Middle and North of Europe

A few examples of University access policies in Northern Europe and the United States

- In the USA
  - The first public school were founded in Boston in 1642, but girls were not admitted until 1789 and only to read and write (no math)
  - Harvard College was founded in 1636 for " ye indian and english youth" but women were not admitted
  - The first women college was Vassar college, founded in 1865
  - At Harvard, Radcliffe College was officially incorporated in 1894, but women were not allowed to attend classes with Harvard students until 1943 (full merger only in 1999)
- In the United Kingdom
  - At Cambridge the first women's Colleges were founded in 1869 (Girton) and 1872 (Newnham)
  - At Oxford the first women's College was founded in 1878
  - At Durham the first woman enrollment in the University was in 1896
- In Sweden
  - 1870: women acquire the right to take "student exam", the official finishing exam of the "high school" (gymnasium) level of studies, that defined the standard of learning required to be admitted to universities in the first place
  - 1873: women acquire the right to study and take exams at the universities, with the exception of theology and law, which followed much later
  - 1880: the first woman is admitted to Lund University (she acquired a medical degree in 1892, as the second female doctor in the country)

What is happening now?

- There no barriers to education
- women enrolment is around 50% of university students

but

- women researchers in public institutions are less than 30% of all researchers
- And much less in physics

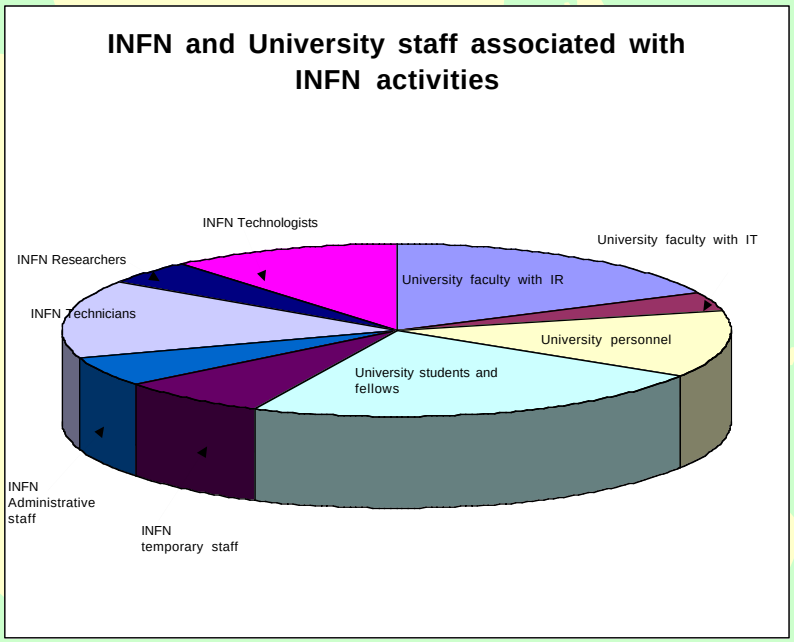
In Italy

- 29% of researchers in public institutions are women
- 28 % of university researchers are women
- 31% of researchers in natural sciences are women (EU average 23%)
  - Mathematics
  - Physics
  - Chemistry
  - Computer sciences
  - Biology and earth sciences

The Istituto Nazionale di Fisica Nucleare (INFN): National Institute for Nuclear Physics

- Government funded Public Research Institution
- Annual budget 300 MEURO
- Funds fundamental research in nuclear, subnuclear and astroparticle physics

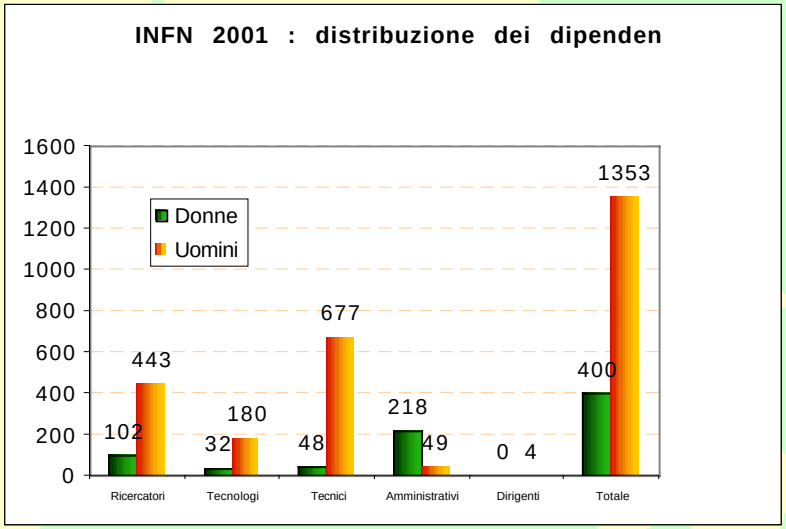
Particle physics



- Employs researchers and administrative personnel
- Funds university faculty for research in particle physics

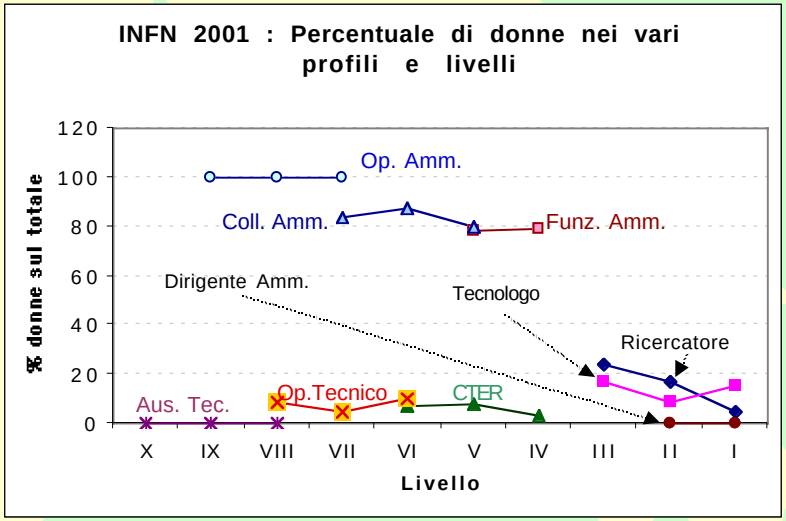
The Istituto Nazionale di Fisica Nucleare (INFN) Personnel and gender distribution

- Women are 23% of all personnel
- Personnel include
  - researchers
  - technologists (accelerator physicists, computer experts, etc.)
  - technicians (electronics, cryogenics, etc.)
  - Administrative staff
- Women are
  - 18% of researchers
  - 15% of technologists
  - 7% of technicians



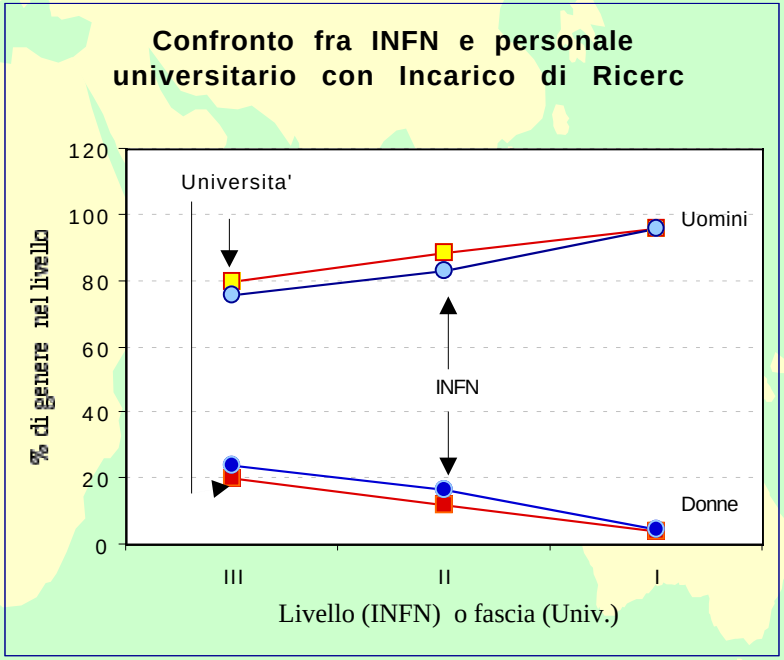
The Istituto Nazionale di Fisica Nucleare (INFN) : career levels and gender distribution

- In the technical and scientific positions women are always less than 20%
- Administrative positions below level III are mostly occupied by women
- Administrative positions at levels I,II and III are only occupied by men
- There are fewer and fewer women in the high research positions (level I)



The scissor diagram for INFN and university women in particle physics

- INFN women physicists have poor career prospects
- About as poor as their university counterparts in particle physics funded by INFN
  - Percentage slightly better for women in INFN at the beginning and at mid career
  - Just as bad at the end



Are italian women physicists in better position than others?

- There is a diffuse idea that Italian women physicists are better off
- Science magazine in 1994 talks about

  Warm climate for women in the Mediterranean

Comparing Italy and UK physics faculty

University Physics faculty in Italy in 1999				Women in UK physics academia in 1996/97 from ETAN Report	
Position	Women	Total	% Women	Position	% Women
Researcher	187	757	25	Lecturer	9
Associate Prof.	142	963	15	senior lecturer	4
Full Professor	29	645	4	professors	1
Total	358	2365	15	Tot. reg. staff	5

Is this true?

Women in high energy physics : the ATLAS experiment

- ATLAS is a high energy physics experiment with world wide collaborations
- ATLAS was started 10 years ago and will study proton proton collisions at the Large Hadron Collider, being built at CERN, Geneva, to be ready in 2008
- ATLAS is high technological and scientific frontier activity
- There are about 2000 physicists in ATLAS
- Italian and Spanish groups have highest proportion of women

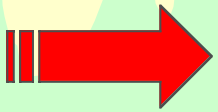
Women in physics : why still so few?

What is happening now?

- Education is now equally provided to young men and women and
- enrollment in S&T is not lacking
- Natural qualities for a scientist :
  - intelligence
  - intuition
  - ability to sustain concentrated intellectual efforts

  are all equally present in men and women
- Why so few women in the HARD SCIENCES?

- Elements playing a fundamental role in the training and retaining of a scientist :
- Role of mentors and teachers
- Emotional satisfaction and stability
- Institutional support



Women's specific life pattern requires specific actions

Life begins at forty

Drawbacks
specific to women

For women wishing to follow the pattern of having both a family and a scientific career, there are drawbacks such as:

- In daily life women are hardly able to dedicate all their time to think and study, as they are unwilling to ignore the emotional needs of children and elderly parents
- Because of childbearing during the career forming years, women do not have the necessary professional mobility, often because of the dual career problem, as most of them are married to fellow scientists
- Myths that all great discoveries are done by scientists before they turn 40, whereas women's biological clock urges then to have children before and during these years

In the arts one can invoke and obtain

A Room of One's Own

but in the Sciences ? One needs

- A Laboratory of one's own
- some fellow scientists
- Institutional support

Ways out?

Quotas and the Affirmative Action Plans of Italian public institutions : institutional support

- Both cultural and organizational actions are needed if the number of women researchers has to increase
- Italian law requires Positive Action Plans to be approved and deployed
- INFN has approved its own three year plan on December 2001

INFN Positive Action Plan

- To contribute to the image of a woman scientist
  - Insert women's contributions to science in Scientific Week programs and other cultural events
  - Prepare and distribute material on women scientists during high school student visits
  - Dedicate library sections to women's studies in National Laboratories
- To ease harmonization between personal and professional life introduce
  - Special economic support for child care
  - Flexible working hours
  - Home based office work via computer links
  - Code against mobbing and sexual harassment

Women in the decision room ?

- INFN Board of Directors is constitued by 41 members
  - President
  - Executive Board
  - Directors of 4 National Laboratories
  - Directors of University Units
  - Reps from Ministry of Research, Industry, Treasure

Not a single woman!

The Plan of Positive Actions and the quotas for women in promotion and recruitment Committees

- All recruitments and promotion for researchers in INFN (CNR as well) take place through a national competion with 3-7 Committee members designated by the INFN Director's Board
- Prodi-Finocchiaro norm requires that such Committees be composed by 30% of women :
- Satisfaction of this norm is one of the objectives of the Plan
- Such objective is not easy to reach as there are too few women for highest level committees (4% in INFN), but it is crucial to strive for it

Conclusions and recommendations

- Society must fully exploit its human resource capital
- Women are the largest untapped resource in science and technology

- More women are needed in the *Control Rooms* to ease other women's entry
- Age barriers to women's entry and remaining in science must be removed at national and EU levels:
  - higher limits for fellowships for young researchers
  - Higher age limits for staff positions
  - Lift retirement age restrictions