

SESAME a child of CERN

- similarities and differences-

Herwig Schopper

University Hamburg and CERN

Babies inherit
many properties of their parents
but eventually they have their
proper life

History, People are important
How decisions are taken in real life

What is CERN?

CERN is a unique European success that one could learn from 60 years of experience
Anniversary in 2014

In this talk the less known aspects of CERN will be considered
(not science or technology):

How CERN was founded and helped to bring nations together

Explain how SESAME was born

Foundation of CERN

Looking back in history it seems easy- it was not!

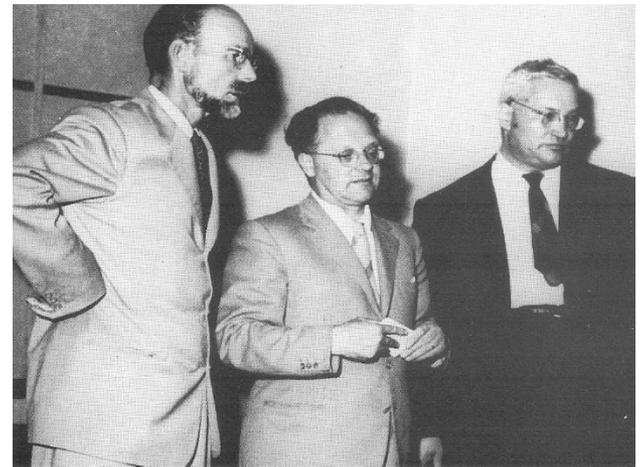
Two initiatives in parallel:

1. Physicists:

join European forces to be competitive with US, in particular for large facilities

P.Auger, L.Kovarski, E.Amaldi, F.Perrin

Discussions followed - difficult, chaotic, tense, sometimes at the point of breaking down



Auger, Amaldi, Kowarski

2. Political initiative:

European Movement

European Cultural Conference,

Lausanne 8-12 December 1949

Ministers, senators, member of parliaments,
others from 22 countries
first time Germans could attend (C. Schmid)

Objectives:

bring former enemies of Europeans together
improve ‘the material and moral conditions of
cultural life in Europe’
freedom of movement
“produce tangible manifestations of European unity”

Organisers: *D.de Rougemont* (Swiss writer),
R.Dautry (F Minister), *G.Colonnetti* (I),
J.Willems (NL)



Denis de Rougemont,
Robert Schumann

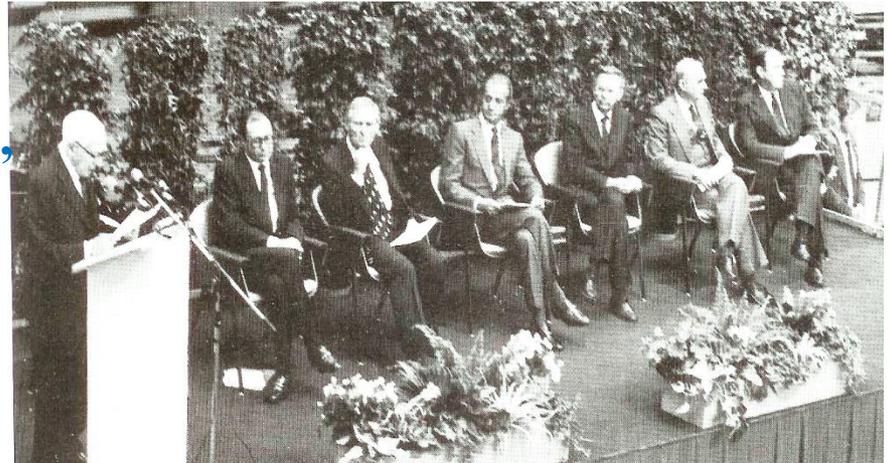
The two initiatives united at 5. General Conference of UNESCO in Florence June 1950

Rabi's Resolution 7 June 1950 addressed to DG UNESCO
could be considered as 'conception' of CERN (or real birth??)

At CERN 30. Anniversary

Rabi's speech: CERN peaceful compensation for building bomb

...So at this point I appeal to the personalities present to remember that CERN is not just an instrument for technical progress in high energy physics, but it is **the realization of an ideal which had been part of a civilization for a long time**..... I appeal to [scientists of CERN] them not to consider themselves as technicians ...but .. **as guardians of this flame of European unity so that Europe can help preserve the peace of the world.**"



Agreement to constitute “Council”

signed on 15 February 1952 by 11 countries

celebrating:

“official birth of [Rabi] project fathered in Florence”

Telegram to Rabi “mother and child doing well”

Finally

**Approval of Convention 1 July 1953,
signed until December 1953 by 12 States**

who knows what CERN stands for?

Conseil Européen pour la Recherche Nucléaire

**Convention comes into force if ratified by at least
7 States: on 29 September 1954 (Birth!!?)**

Still Some Problems had to be solved

1. Choice of site :

Proposals: Geneva (CH), Copenhagen (DK), Arnhem (NL), Longjumeau (Paris)

,...delegates had clearly been officially briefed to make **stiff fight**,...

scientific prestige ...was clearly rated very high,...

expectation of ..appreciable .. **financial gain**'

Final decision at 3. Council meeting at Amsterdam October 1952

Geneva: small country, neutrality, nice



2. National Financial contributions

Proportional to income and wealth, but how to assess it?

GNP or GNP per capita?

*Sweden and CH against GNP/capita
(since their GNP 50% higher than UK and F !)*

Italy and Yugoslavia in favour

‘...endless and confused discussion..’

Ben Lockspeiser (Council President) exploded, fed up with

‘shameful horsedealing’

‘Offended, a Swedish Delegate broke down and wept openly’

Final solution:

GNP with limit of 25 % maximum contribution

Already the Foundation
of CERN has brought Europeans
together

by discussions, considerations,
conflicts, compromises and
finally decisions

Not only scientists but also
administrators and politicians
involved

**Pragmatism and definite will to bring
Europe together prevailed**

CERN has task splendidly achieved in Europe

**CERN became model for other
organisations**

JINR, ESO, EMBL, SESAME

**Now CERN is a model for
international cooperation
on world scale**

SESAME

Most recent off-spring of CERN

following closely the CERN Model

Imitating - also difficulties



SESAME

An International Center for Research and Advanced Technology

Synchrotronlight for
Experimental
Science and
Application in the
Middle
East

Meaning of acronym will be forgotten!

Has meaning in several cultures

“Door opener”

SESAME

to open many doors

for Science and Technology

(capacity building)

Training

(scientists, technicians, administrators)

Bringing nations together

(different traditions, religions, races, political systems)

**International Centre Created
under Auspices of UNESCO**

Is SESAME really needed in the region?

Abdus Salam Pakistani Physicist and Nobel Laureate dreamed of several centres in the Middle East, including a synchrotron radiation laboratory.



Excellent tool to promote science and technology

Revive the 'golden times' of Arabic science (900 to 1200 AD)

A. Salam proposed SR Lab for Jeddah, Bahrain,
H.Schopper proposed SR Lab for Ryad, Saudi Arabia,

Nothing happened

SESAME corrects the situation?



Ibn-Rushd (Averroes,
1126 to 1198)

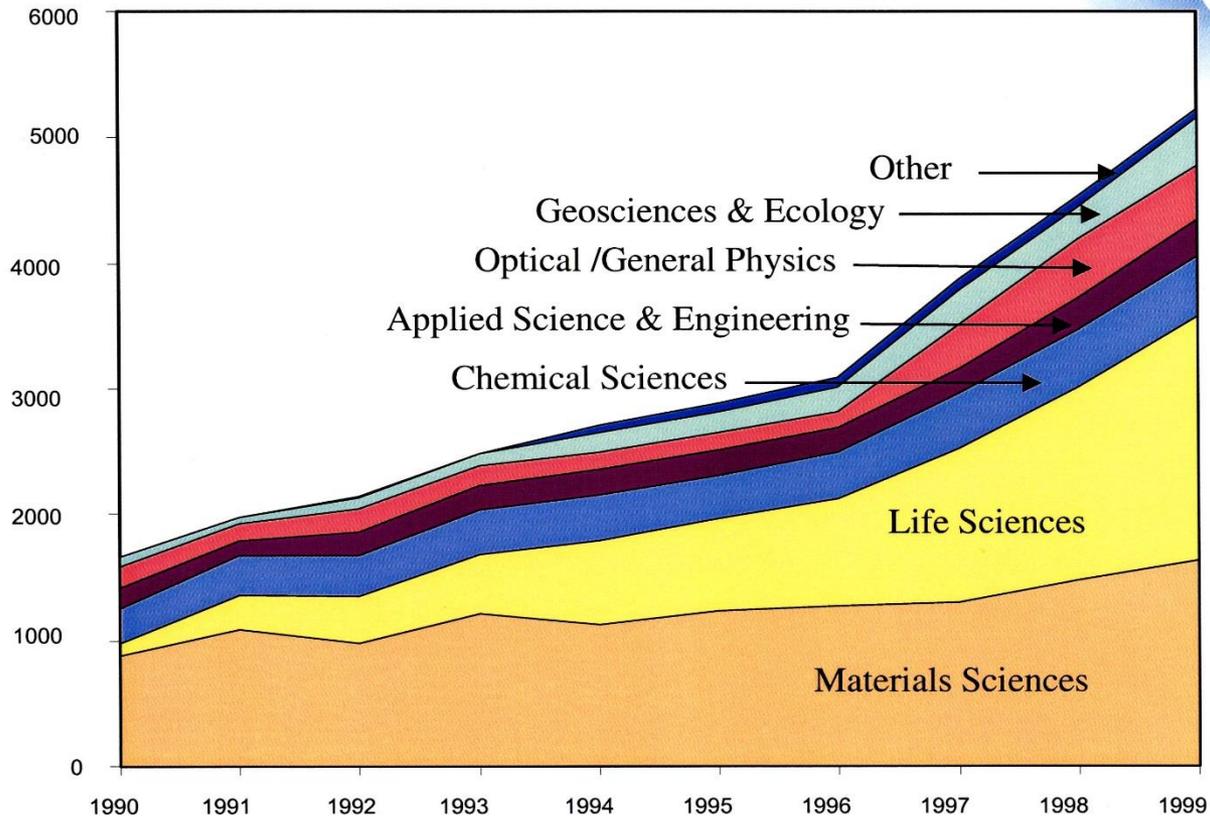
Al Biruni (973 -1048),

Brain drain

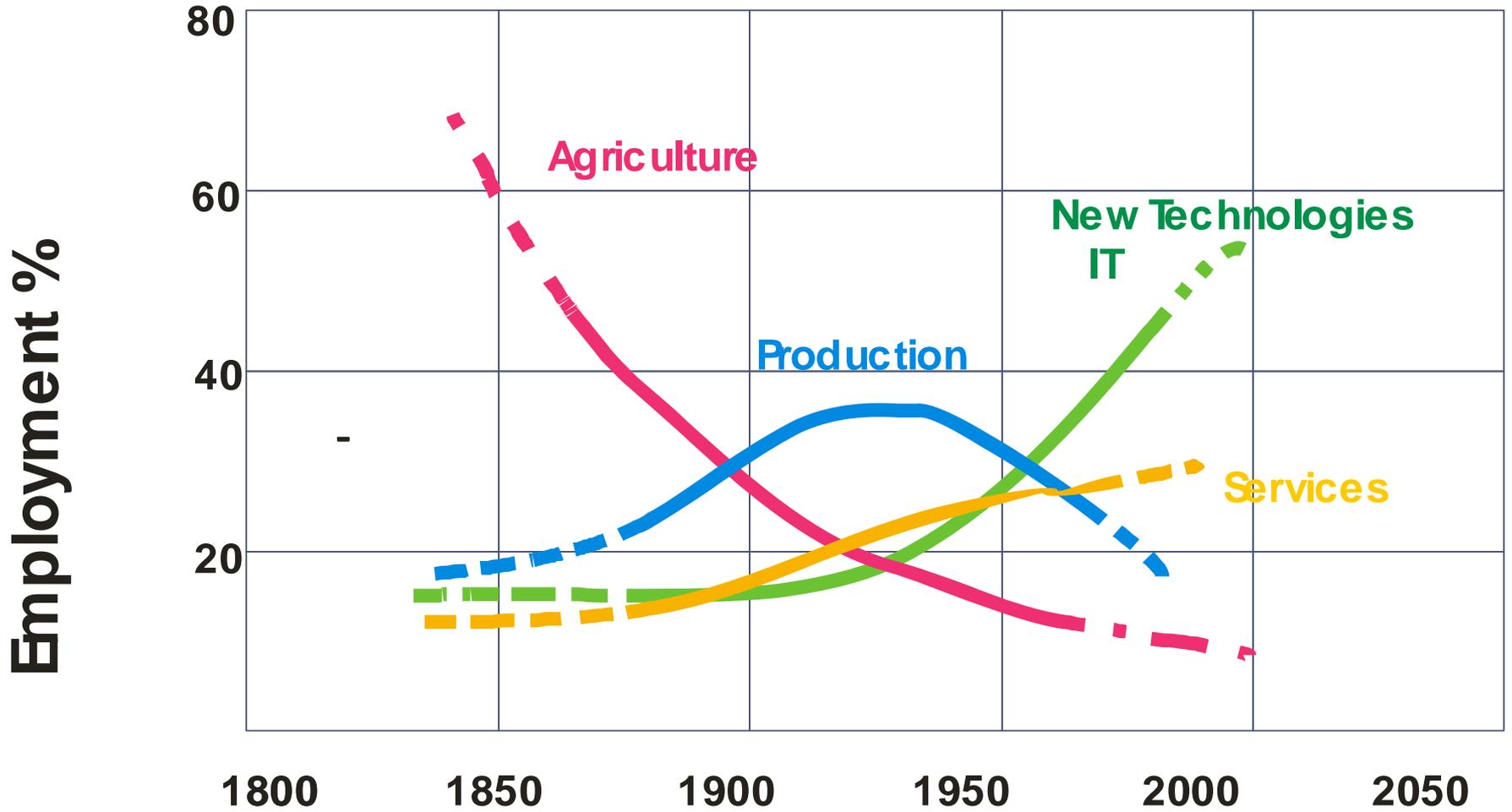
In some developing countries the education systems for scientists and engineers are very good but after studies no attractive jobs.

- *emigration* to industrialised countries
to avoid it, a minimum of infrastructure and some interesting projects must exist in the home country or region.
- *internal brain drain*
To study natural sciences or engineering requires a great effort. Remuneration for jobs in economy (banks, brokers, ...) are much higher than for scientists.
Many excellent young scientists choose such more profitable careers.

Numbers of Light Source Users (ALS, APS, NSLS and SSRL) by Discipline



Employment in Germany

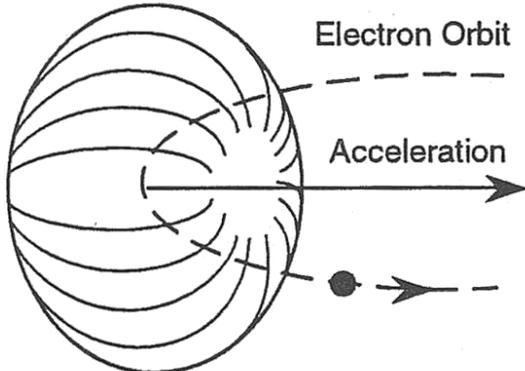


What is Synchrotron Radiation?

Accelerated electrons radiate

a. in **Antenna**

b. in **synchrotron**

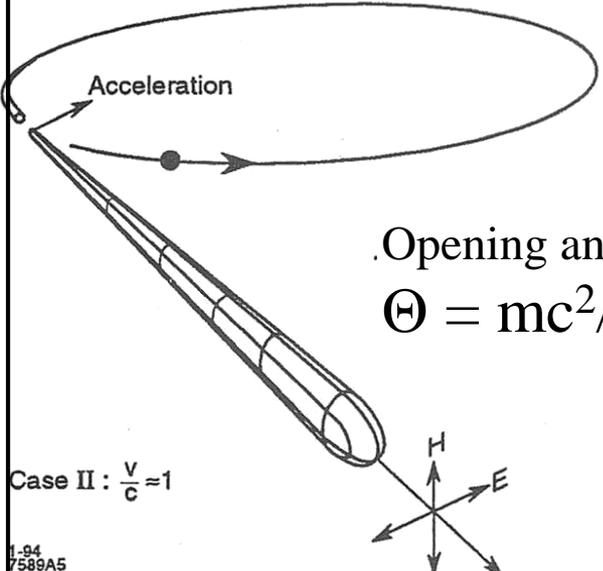


The diagram shows a central point representing an electron. A dashed line labeled "Electron Orbit" forms a circle around it. A horizontal arrow labeled "Acceleration" points to the right. Concentric, roughly spherical wavefronts radiate outwards from the electron, representing a non-directional radiation pattern. A small black dot with a dashed arrow points to the right, representing the electron's path.

Case I : $\frac{v}{c} \ll 1$

1-94
7589A4

At low electron velocity (non-relativistic case) the radiation is emitted in a **non-directional pattern**



The diagram shows an electron moving in a circular path, labeled "Acceleration". A long, narrow cone of radiation is shown extending from the electron's position, representing a highly directional emission pattern. The opening angle of the cone is labeled as $\Theta = mc^2/E$. A small black dot with a dashed arrow points to the right, representing the electron's path. At the tip of the cone, a coordinate system is shown with axes labeled H (vertical), E (horizontal), and a diagonal axis.

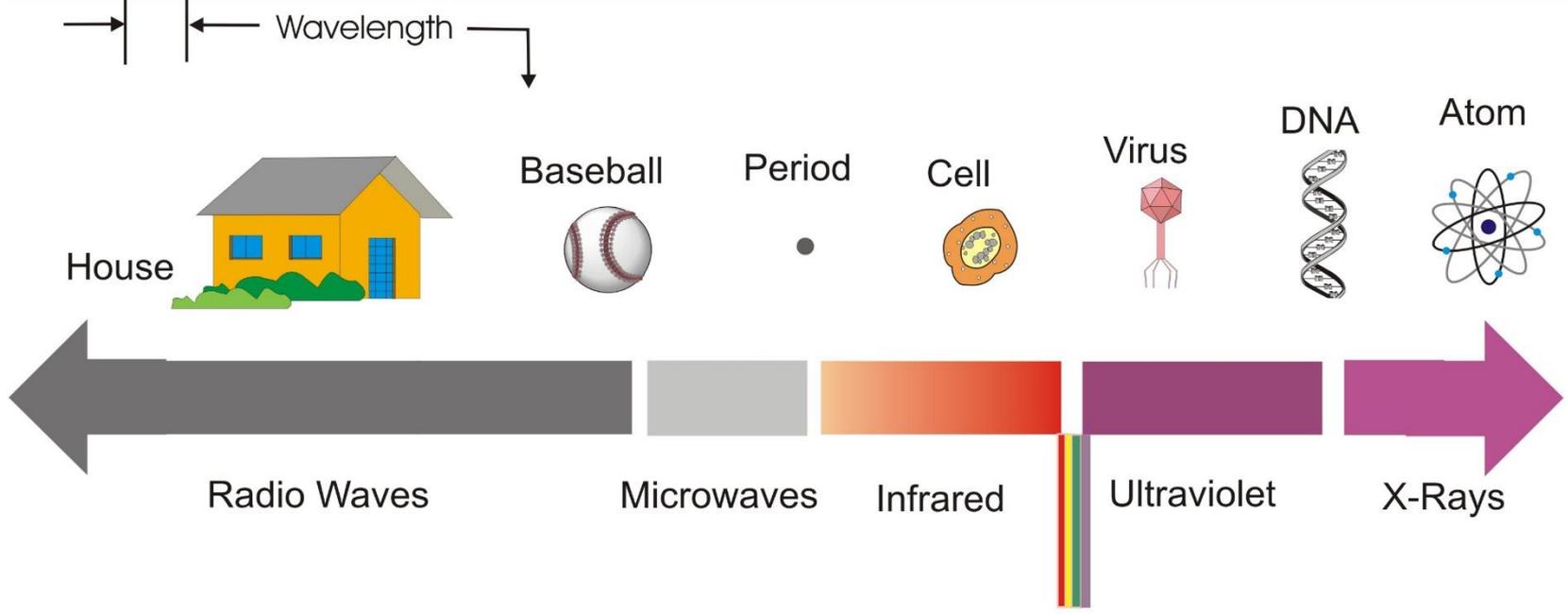
Opening angle
 $\Theta = mc^2/E$

Case II : $\frac{v}{c} \approx 1$

1-94
7589A5

When the electron velocity approaches the velocity of light, the emission pattern is folded **sharply forward**.

Electromagnetic Radiation - How It Relates to the World We Know



Synchrotron radiation is used for experiments typically over this region

What Properties Make Synchrotron Radiation (SR) so Useful?

High brightness:

SR is extremely intense (hundreds of thousands of times higher than conventional X-ray tubes)

Wide energy spectrum:

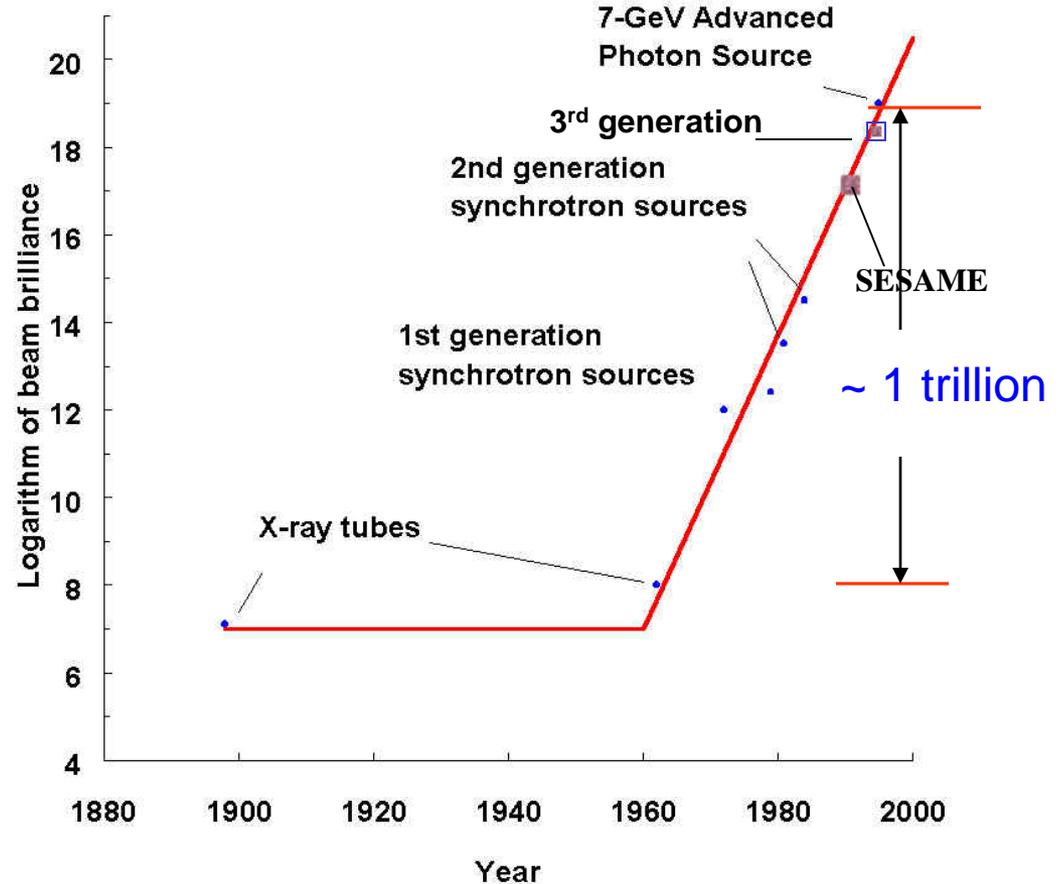
SR is emitted with a wide range of energies

Highly polarized and short pulses:

SR is emitted in very short pulses, typically less than a nano-second (a billionth of a second)

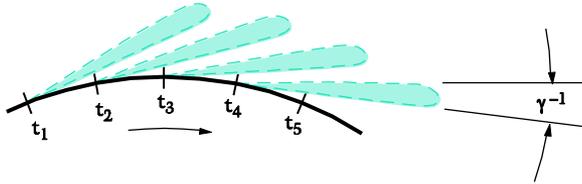
Multidisciplinary

At beginning parasitically at e⁺e⁻ colliders



SR offers many characteristics of visible lasers but into the x-ray regime!

Bending Magnets and Insertion Devices on Storage Rings



bending magnet - a “sweeping searchlight”

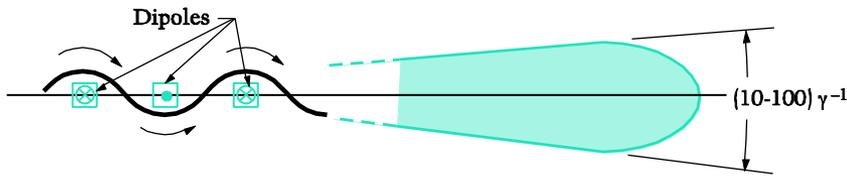
Continuous spectrum

characterized by ε_c = critical energy

$$\varepsilon_c(\text{keV}) = 0.665 B(\text{T}) E^2(\text{GeV})$$

e.g: for $B = 2\text{T}$ $E = 3\text{GeV}$ $\varepsilon_c = 12\text{keV}$

(bending magnet fields are usually lower $\sim 1 - 1.5\text{T}$)



wiggler - incoherent superposition

Quasi-monochromatic spectrum

with peaks at lower energy than a wiggler

$$\lambda_1 = \frac{\lambda_u}{2\gamma^2} \left(1 + \frac{K^2}{2}\right) \sim \frac{\lambda_u}{\gamma^2} \text{ (fundamental)}$$

+ harmonics at higher energy

$$\varepsilon_1(\text{keV}) = \frac{0.95 E^2(\text{GeV})}{\lambda_u(\text{cm}) \left(1 + \frac{K^2}{2}\right)}$$

$K = \gamma\theta$ where θ is the angle in each pole



undulator - coherent interference

Material Science/Physics/Chemistry

**Glasses
Polymers**

**Ceramics
Thin Films**

**Magnetic Materials
Superconductors**

Biological & Medical Sciences

Pathogen structure

Genetic diversity; plants and microorganisms

Metalloenzymes and Metalloproteinases

Biosensors

Industrial Applications

Polymer characterisation

Synthesis and characterisation of novel materials

Chemical analysis

Screening for drug design

Environmental Science

Clay minerals

Mineral analysis of rocks

Soil contaminants

Applications in agriculture and bioremediation

Archaeology

History of SESAME

1997: Proposal to use components of BESSY I at Berlin
by H.Winick and G.-A.Voss during workshop of Middle East Scientific Cooperation (**S.Fubini, CERN**)

First proposal: upgrade from 0.8 GeV of BESSY I to 1 GeV

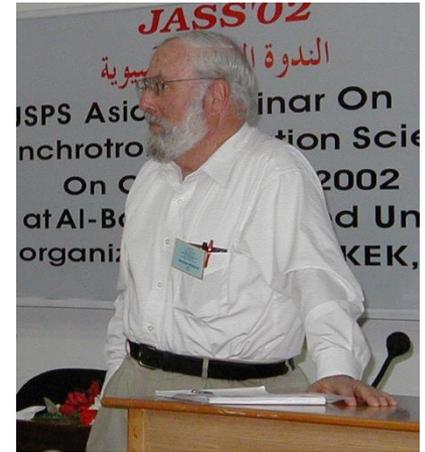
H.Schopper ask DG UNESCO to take initiative

June 1999:

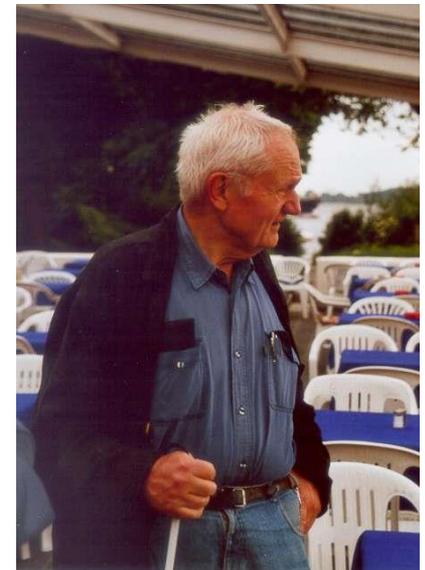
F.Mayor, DG UNESCO invites governments of MENA region to meeting:

create international laboratory following to CERN Model

Interim Council established with 12 Members,
6 Observers
(chair H.Schopper)



H. Winnick



G.A. Voss

IT Council Members:

Greece

Turkey

Iran

Palestinian

Authority

Israel

Jordan

Egypt

Pakistan

Bahrain

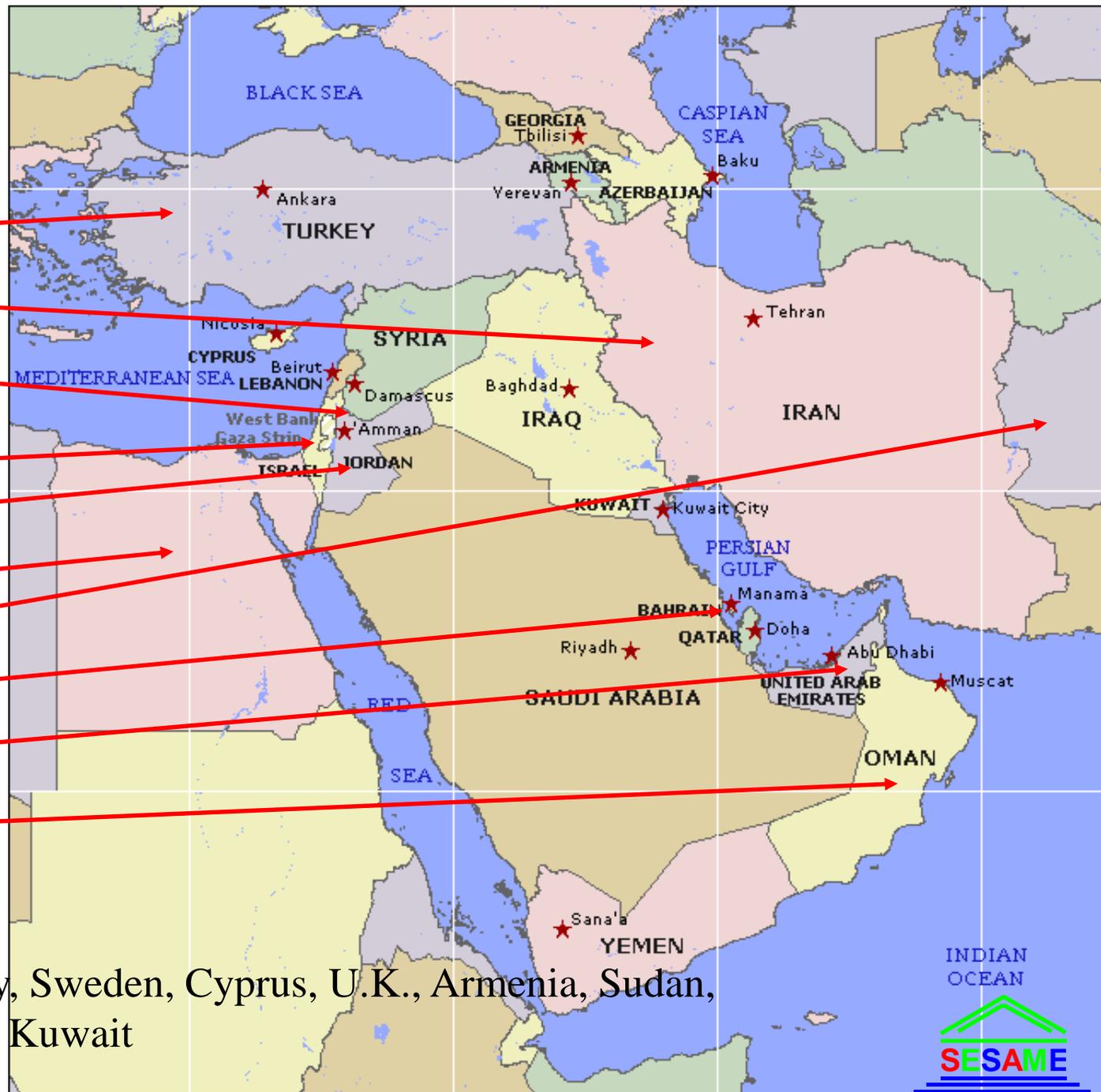
UAE

Oman

Morocco

Observers:

U.S.A., Germany, Italy, Sweden, Cyprus, U.K., Armenia, Sudan,
Russia, France, Japan, Kuwait



INDIAN OCEAN



2000: German Government agrees to make gift BESSY I

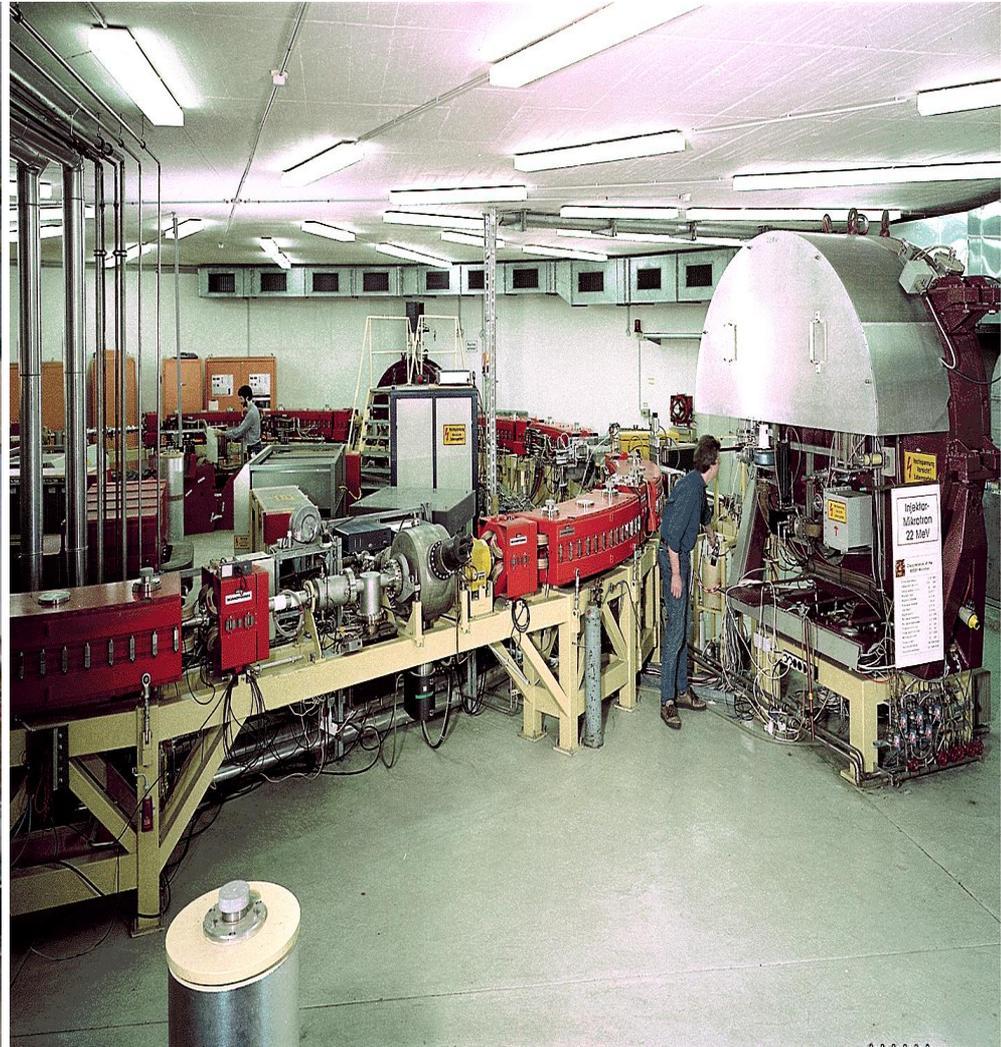
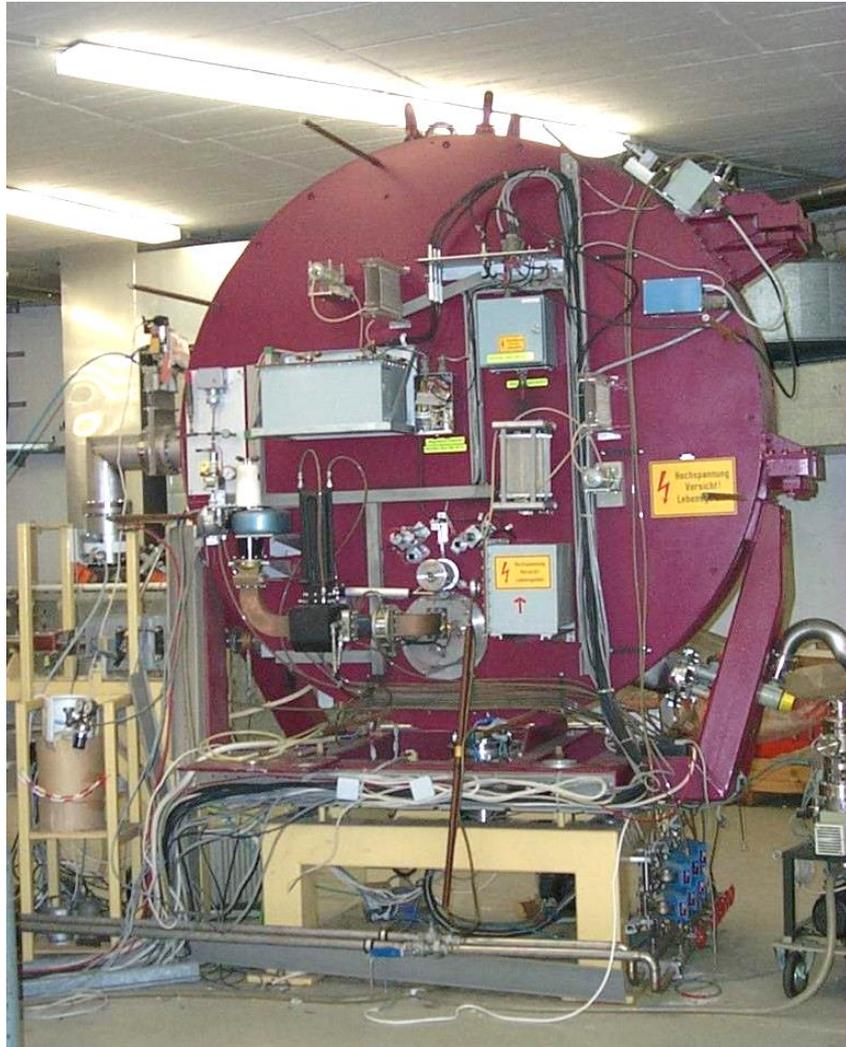
Dismantling of BESSY I (very urgent)
\$ 600.000 to be found within 3 months !!

Obtained from SESAME countries \$200.000
and UNESCO \$400.000 (thanks to DG Matsuura)

➤ June 2002, Bessy I shipped to Jordan.



BESSY I microtron and booster synchrotron will be used as preinjector and injector for SESAME



Programme became more ambitious
not a machine for training
But fully competitive light source
BESSY only preaccelerator
New main ring

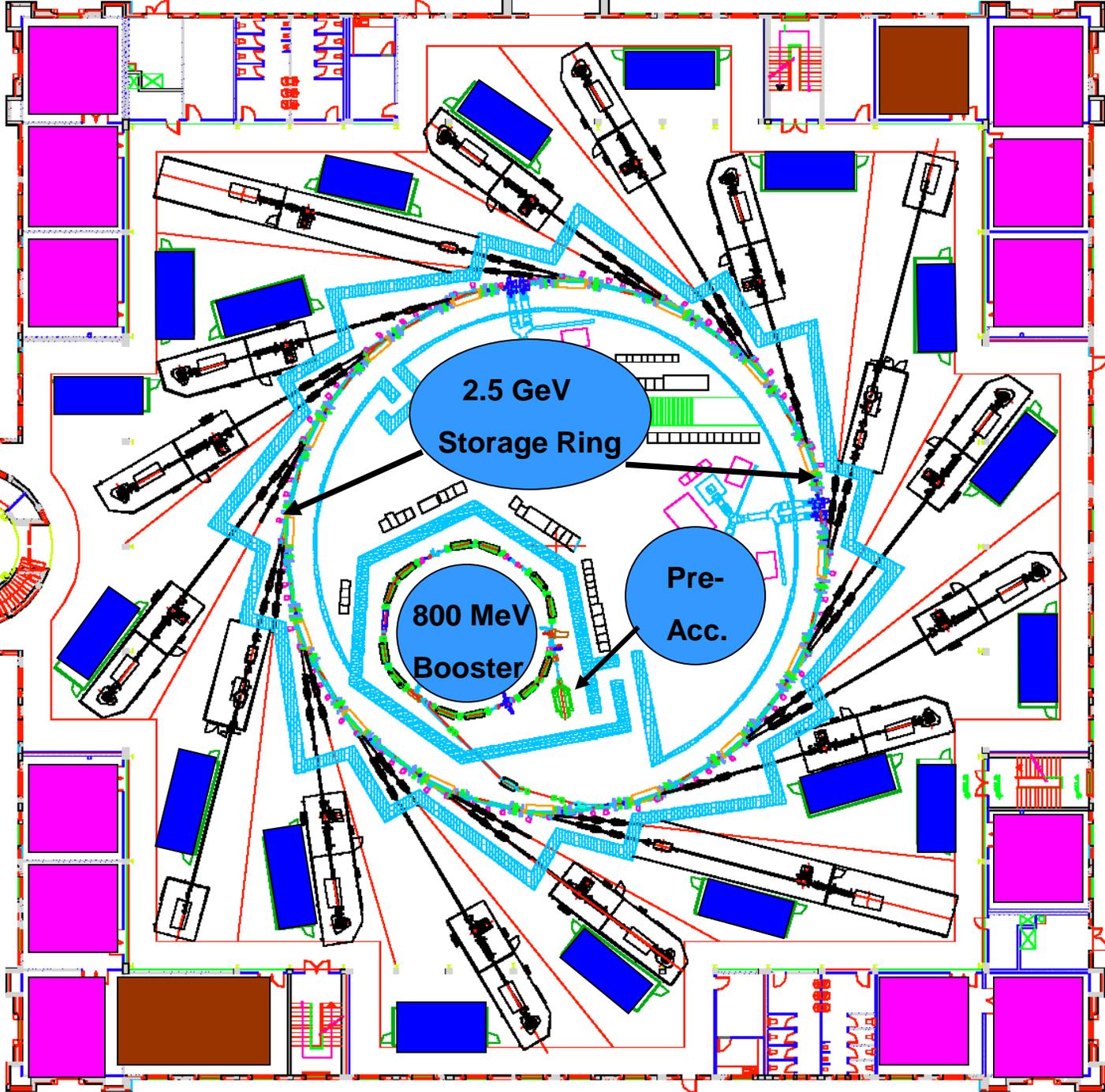
June 2001:

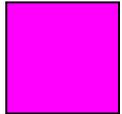
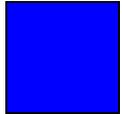
**Upgrading of SESAME to 2 GeV, circumference 116 m
square building (copy of ANKA at Karlsruhe)**

**2003: Upgrading to 2.5 GeV after evaluation by
EU Panel, circumference 124 m**



Layout of SESAME



-  Laboratories
-  Workshops
-  Hutches

Approval by UNESCO as autonomous international laboratory

(following CERN procedure)

November 2001 approval in principle by

UNESCO General Assembly (more than 150 Countries)

Authorised Executive Board for final decision including Statutes

Mai 2002 Unanimous approval by Executive Board (more than 50 countries)

(Procedure takes usually more than 2 years)

”...model project for other regions....

Quintessential UNESCO project combining capacity building with vital peace-building through science.”

Suggests seed money for similar projects (South Africa ?)

6. January 2003:

- **SESAME formally established** (at least 6 Members)
during groundbreaking ceremony
announced by UNESCO DG K.Matsuura
(some legal formalities of ratification to be settled)

Interim Council => Council

Has approved documents essential for operation of SESAME:

Statutes (*copied and adjusted from CERN Convention*)

Rules of procedure of Council

Financial Rules

Staff Rules

25 April 2004:

Ratification by Foreign Ministers (official birth!)

Host agreement with Jordan

Providing international privileges like CERN



Opening of IC meeting with H.M. King Abdullah II and DG Matsuura

Site Selection

Very difficult decisions

7 Members proposed 12 sites

Criteria:

- a. Accessible to all scientists from world
- b. Central geographical location
- c. Political commitment by authorities
- d. Special contribution by host country(**building**)
- e. Technical infrastructure (water, electricity, soil, airport)

Visit to various countries
with ADG Iaccarino of
UNESCO
Armenia, Egypt, Israel,
Palestine, Jordan



Visit to President Arafat



Financial contribution to SESAME ?

Finally visit to Amman in Jordan

Official meeting --- no result

Call **Isa Khubeis**, my former student,
Vice-rector University of Jordan

Invitatione to dinner with **Khaled Toukan**



Prof. Dr. Isa Khubeis



H.R.H. Prince Ghazi

**Next morning audience with
H.M. King Abdullah II**

Explain Conditions:

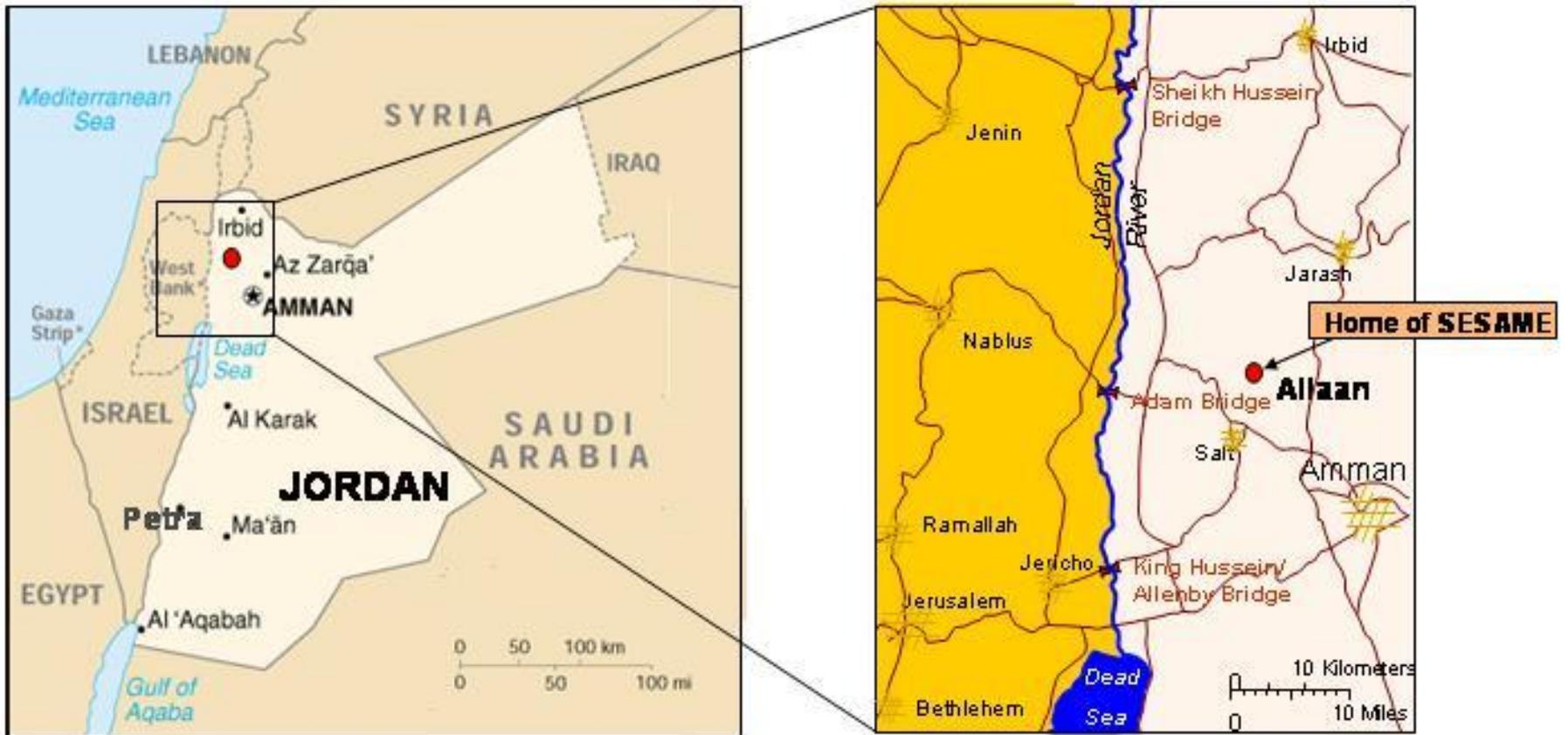
- *all scientists from the world get access*
- *Site and building financed by host state*
- *Strong support by authorities*

**Host country has special obligations
(Host State agreement, privileges like CERN)**

Agreed by King, letter signed



**Allan site (Salt) of Al-Balqa Applied University, Jordan
(20 km from Amman, centrally located)**



SESAME location in Allaan, Jordan



**Groundbreaking
Ceremony at Allan Site
and Establishment of
SESAME**

in presence of

**H.M.King Abdullah II and
UNESCO DG K.Mastuura**

6 January 2003



**H.M.King Abdullah II and UNESCO DG Matsuura unveiling marble plate,
Groundbreaking January 2003**



SESAME Council at Groundbreaking, January Amman 2003

SESAME JSPS Workshop - First USERS meeting 27 October 2002, Amman





SESAME 2. Users meeting, Isfahan, October 2003



R.Sarraf 28-2-2004



SESAME Building 30 May 2004



First important personalities



Khubeis, Hasnain, HS, Toukan, Kurokawa



M.Nalecz,
UNESCO Dir.

Governance

in CERN spirit

Programme of SESAME is **not dictated
by Member States (Council)**

Initiatives from users

**Filtered and approved by Advisory
Committees**

SESAME Advisory Committees

Technical Committee: give advice on the machine

Chairperson: A. Wrulich (Switzerland)

Beam-Lines Committee: proposed first generation of beam-lines,
form collaborations for beam-lines, in future evaluating of individual proposals

Chairperson: Zaid Hussain (LBL)

Scientific Committee: advice on the overall long-term scientific programme

Chairperson: Zehra Sayers (Turkey)

Training Committee: to coordinate workshops, seminars, fellowships

Chairperson: Reza Mansouri (Iran)

Finance Committee: prepare financial decisions of Council

Chairperson: A. Moleskis (Cyprus)

Have been very efficient

in establishing programme and users' community

Training Programme

One of the essential objectives of SESAME

- Several workshops have been organized
- Young people from region (about 30, 'Trainees') spend up to 2 years at European and US SR labs. **Will come to Amman next year to be hired by SESAME to form nucleus of staff**
- Similar programme for scientists for beam lines to start
- Fellowships

Funds from IAEA, UNESCO, USA, Brazil,...)

International cooperation

Science for peace

**Sceptics: collaboration between scientists easy,
but no influence on politics –
wrong**

- 1. Cooperation for large projects requires scientific, administrative and political efforts on “lower level” which irradiate into different and even highest government levels.**

Promotion of human values like rationality, honesty and tolerance

more efficient than production and exchanges of documents! (UN)

2. Confidence building

➤ **CERN – IHEP (Sovjetunion) agreement in 1968**

(Mirabelle staff, 1. Strike on SU territory)

became model for IHEP-USA agreement

and later for model for USA- Sowjetunion agreement *(Breshnev-Ford)*

➤ **Disarmament meeting at Geneva in 1980ies**

when in deadlock private meeting at CERN unblocked it

(Trivelpiece asked for lunch)

➤ **Meeting with Ambassadors of
Disarmament Conference**

‘CERN does better’

3. Bringing people together for better understanding

❖ **CERN-Dubna: only link East-West Germany**

❖ **L3 chinese from Mainland and Taiwan**

❖ **SESAME: Israel -Palestine – Iran
Cyprus – Turkey**

*Where are government representatives of
these countries sitting around table to discuss
peacefully problems?*

4. Help individuals

who have of political, racial or religious problems

➤ **Orlov**

(from Sowjetunion to CERN, talk to Petrosyansk)

➤ **Okun**

(in SPC, not allowed to come, talk to Chuvilov)

➤ **Hadizadeh**

(arrested in Iran, letter to Minister and Chatami, could come to SESAME meetings, now in USA)

Conclusions

**CERN and SESAME help
beyond promoting science**

- ❖ **To establish better contacts (data transport WWW)**
- ❖ **training of scientists, technicians, teachers, administrators**
- ❖ **Give them feeling to belong to world society**
- ❖ **Help them to survive (fellowships)**

Similarities CERN -SESAME

- **International organisations under roof of UNESCO**
- **Only organisations with two objectives:
promote science and international collaboration
'science for peace'**
- **Every scientist is admitted (if competent)**
- **Financing essentially by Member States according
to their financial strength**
- **Programms selected according to scientific quality**
- **User determined (if resources allow it)**
- **No quota for staff or contracts**

Differences CERN - SESAME

CERN

- **Unique World lab**
- **Particle- and nuclear - and astrophysics**
- **Independent of UNESCO**
- **about 10000 users**
- **Technology competence**
- **Well established**

SESAME

- **Regional Lab**
- **Wide range of sciences**
- **Needs still UNESCO**
- **A few 100 users**
- **no technology yet**
- **In development**

In time where relations between some nations are characterised by

hatred and violence

it is gratifying that CERN and SESAME bring together politicians and scientists to work peacefully together

Small light in dark times

Hope that SESAME will be as successful in MENA region as CERN in Europe