



# *Willkommen bei CERN*

Dr. Sascha Schmeling



European Organization for Particle Physics  
*Organisation européenne pour la physique des particules*



# CERN wurde 1954 von 12 europäischen Staaten gegründet

## “Science for Peace”

Heute hat CERN 22 Mitgliedsstaaten

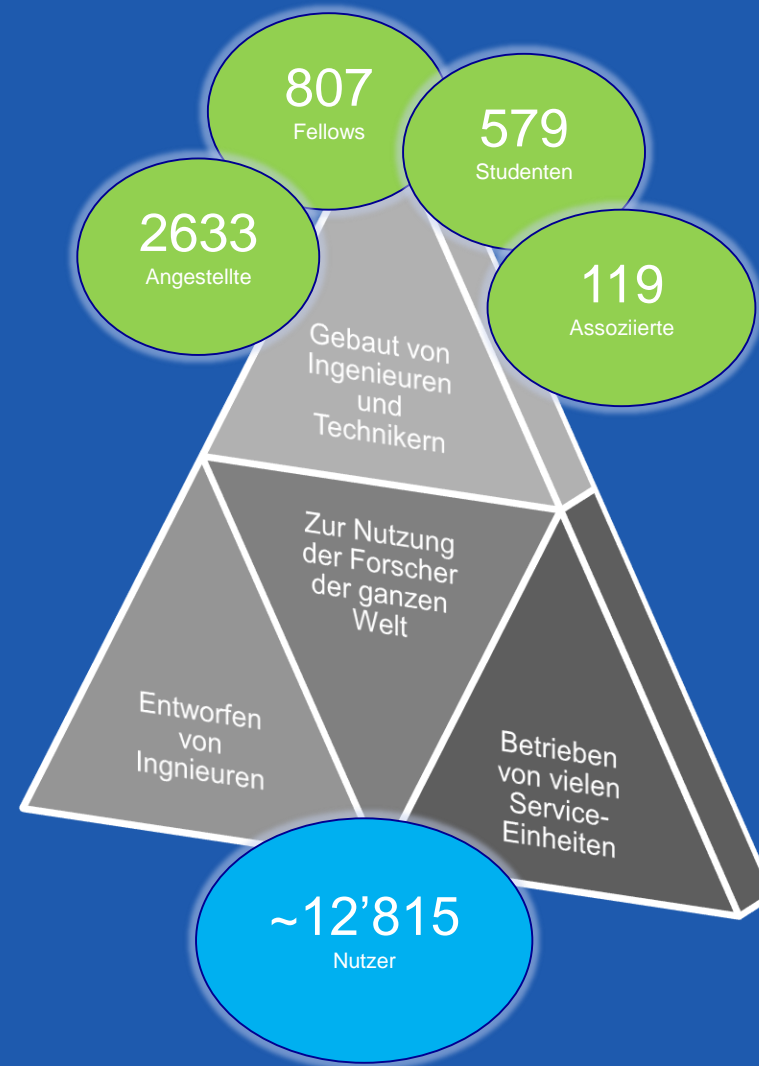
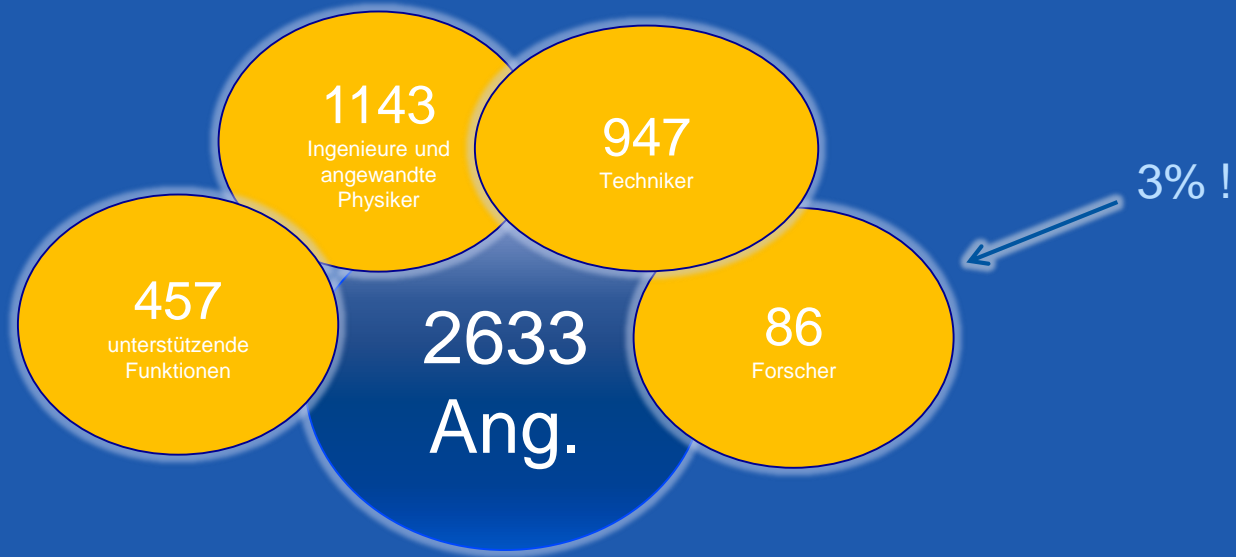
~ 2.560 internationale Beamte  
~ 2.490 weitere Angestellte  
~12.000 Nutzer  
Budget (2018) ~1.240 MCHF

**Mitgliedsstaaten:** Belgien, Bulgarien, Dänemark, Deutschland, Finnland, Frankreich, Griechenland, Großbritannien, Israel, Italien, Niederlande, Norwegen, Österreich, Polen, Portugal, Rumänien, Schweden, Schweiz, Slowakische Republik, Spanien, Tschechische Republik, Ungarn

**Assoziierte Mitgliedsstaaten:** Indien, Litauen, Pakistan, Türkei, Ukraine; ... **im Beitrittsverfahren:** Serbien, Slowenien, Zypern

**Beitrittskandidaten:** Australien, Brasilien, Estland, Irland, Kanada, Kroatien, Lettland, Südkorea

**Beobachter im Rat:** Japan, Russland, USA; Europäische Kommission, UNESCO, JINR



 Wer arbeitet bei CERN?



# Jedes Jahr ...

30  
admin.  
Studenten

eine große  
Anzahl von  
Assoziierten

TTEs

80  
Doktorierende

über 600  
CERN  
Studenten



über 250  
Fellows

angewandte  
Physik

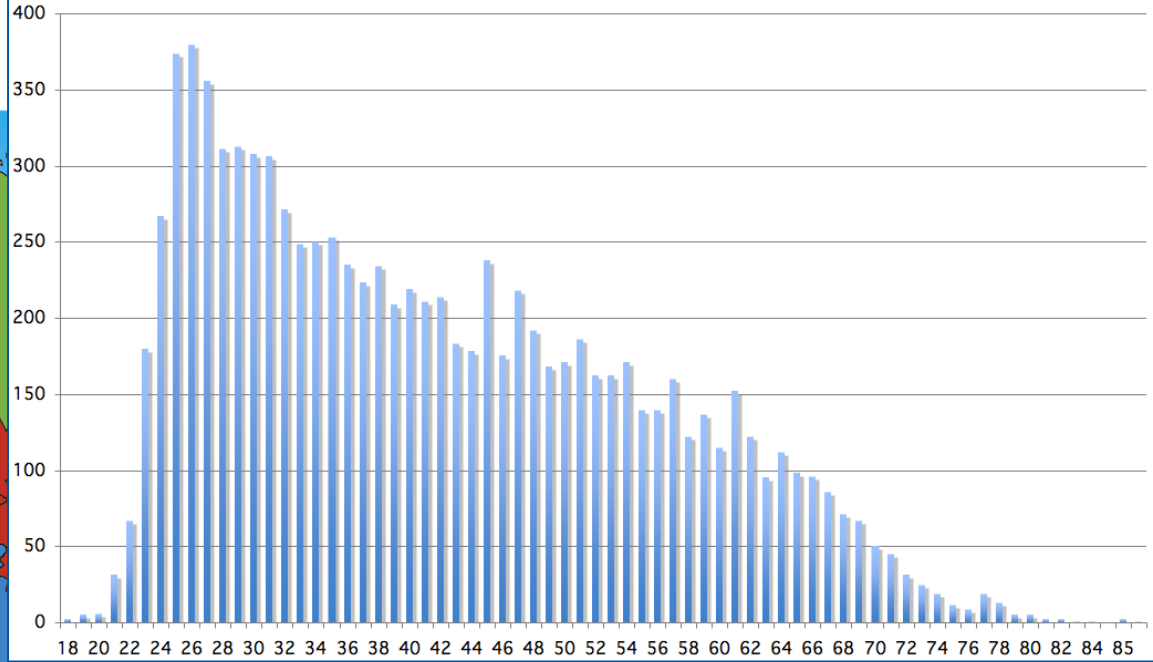
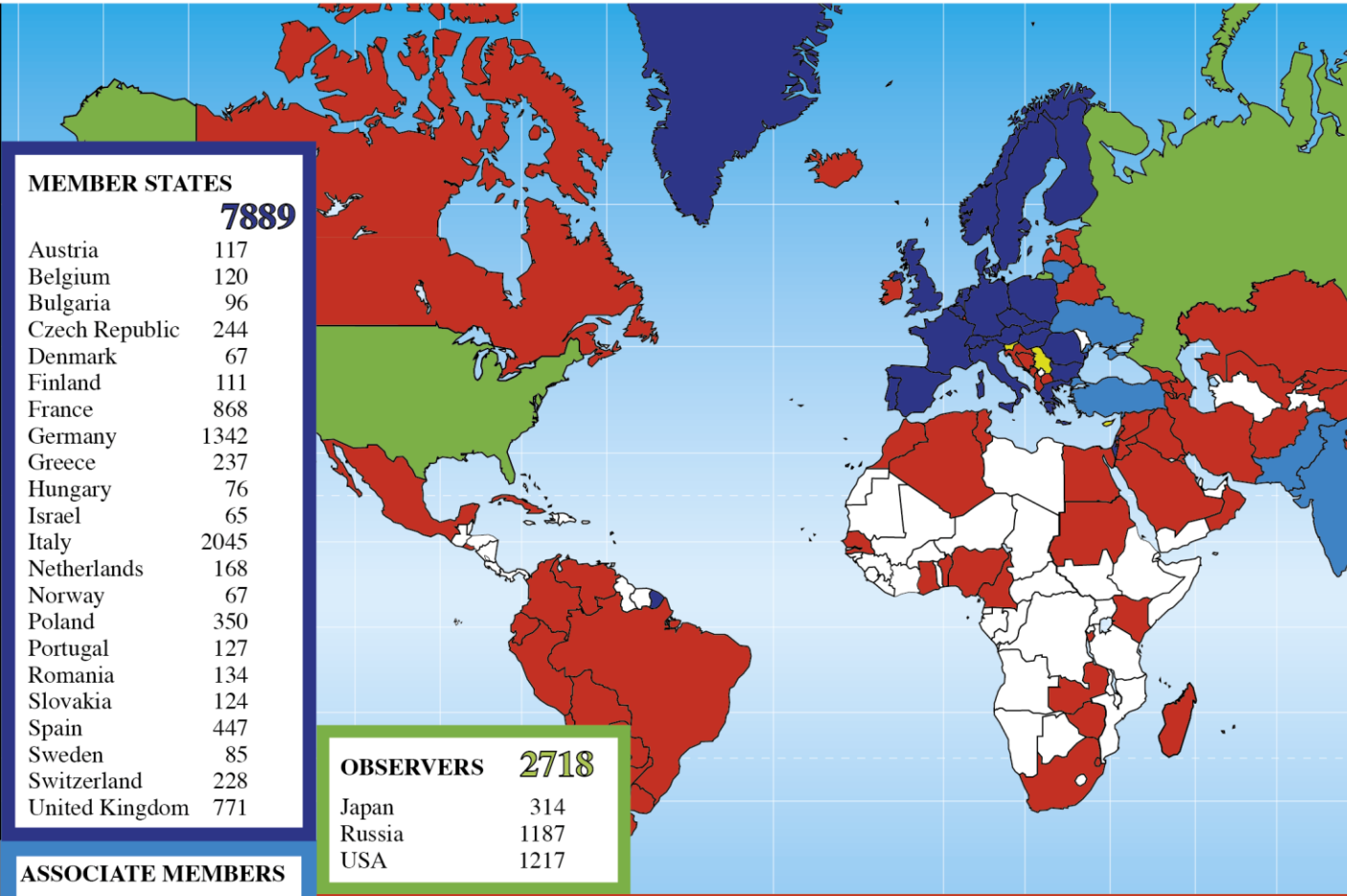
240  
technische  
Studenten

300  
Sommer-  
Studenten

über 150  
Angestellte

Forscher

# Distribution of All CERN Users by Nationality



## MEMBER STATES

**7889**

Austria	117
Belgium	120
Bulgaria	96
Czech Republic	244
Denmark	67
Finland	111
France	868
Germany	1342
Greece	237
Hungary	76
Israel	65
Italy	2045
Netherlands	168
Norway	67
Poland	350
Portugal	127
Romania	134
Slovakia	124
Spain	447
Sweden	85
Switzerland	228
United Kingdom	771

## OBSERVERS

**2718**

Japan	314
Russia	1187
USA	1217

## ASSOCIATE MEMBERS

**745**

India	357
Lithuania	35
Pakistan	65
Turkey	173
Ukraine	115

## ASSOCIATE MEMBERS IN THE PRE-STAGE TO MEMBERSHIP

**118**

Cyprus	26
Serbia	57
Slovenia	35

<b>OTHERS</b>	<b>1872</b>	Bolivia	4	Egypt	31	Kazakhstan	5	Mongolia	2	Philippines	3	Thailand	22
		Bosnia & Herzegovina	2	El Salvador	1	Kenya	3	Montenegro	11	Saint Kitts and Nevis	1	T.F.Y.R.O.M.	2
Afghanistan	1	Brazil	135	Estonia	15	Korea Rep.	185	Morocco	20	Saudi Arabia	2	Tunisia	5
Albania	3	Burundi	1	Georgia	46	Kyrgyzstan	1	Myanmar	1	Senegal	1	Uruguay	1
Algeria	14	Cameroon	1	Ghana	1	Latvia	2	Nepal	10	Singapore	4	Uzbekistan	4
Argentina	27	Canada	161	Hong Kong	1	Lebanon	23	New Zealand	5	Singapore	4	Venezuela	10
Armenia	19	Chile	20	Iceland	3	Luxembourg	2	Nigeria	3	South Africa	56	Viet Nam	13
Australia	31	China	510	Indonesia	11	Madagascar	4	North Korea	1	Sri Lanka	6	Zambia	1
Azerbaijan	10	Colombia	45	Iran	51	Malaysia	15	Oman	3	Sudan	1	Zimbabwe	2
Bangladesh	11	Croatia	41	Iraq	1	Malta	9	Palestine (O.T.)	7	Swaziland	1		
Belarus	48	Cuba	12	Ireland	16	Mauritius	1	Paraguay	2	Syria	1		
Benin	1	Ecuador	6	Jordan	1	Mexico	82	Peru	7	Taiwan	51		

## CERN Council

President: S. de Jong  
Secretary: CERN DG



- (Associate) Member States: 2 delegates each
- ex-officio members
  - FC Chairperson
  - SPC Chairperson
- different observers on invitation, incl. ECFA Chairperson

## Finance Committee

Chairperson: O. Malmberg



- (Associate) Member States: 1-3 delegates each
- ex-officio members
  - Council President
  - SPC Chairperson

## Scientific Policy Committee

Chairperson: K. Ellis



- 14 individual members
- ex-officio members
  - ECFA Chairperson
  - Chairpersons of CERN Committees (LHCC, MAC, SPSC, INTC)
- standing invitations
  - CERN DG, Council President, FC Chairperson

## Audit Committee

Chairperson: FC Chair

## Tripartite Employment Forum

Chairperson: B. Åsman



## Pension Fund Governing Board

Chairperson: T. Roth








Council Secretariat  
Legal Service

Director General  
**Fabiola Gianotti** 

Internal Audit  
Health, Safety, and Environment Unit

Finance and Human  
Resources  
**Martin Steinacher** 


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Technology  
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Technology  
Jose Miguel Jimenez 

Protocol

Industry, Procurement, and  
Technology Transfer  
Thierry Lagrange 

Information Technologies  
Frédéric Hemmer 

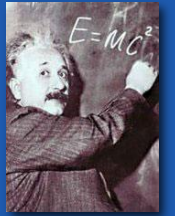
Engineering  
Roberto Losito 

Stakeholder Relations

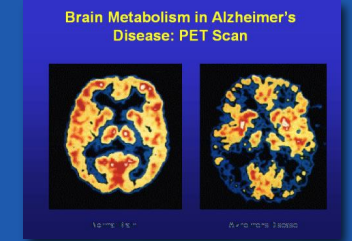
Space Management  
and Buildings  
Lluís Miralles Verge 



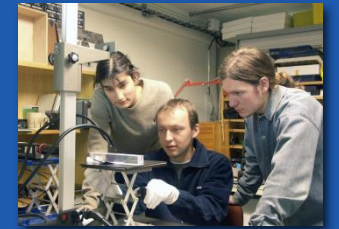
# Forschung an den Grenzen menschlichen Wissens



## Innovative Technologien für die Forschung



## Ausbildung: Wissenschaftler



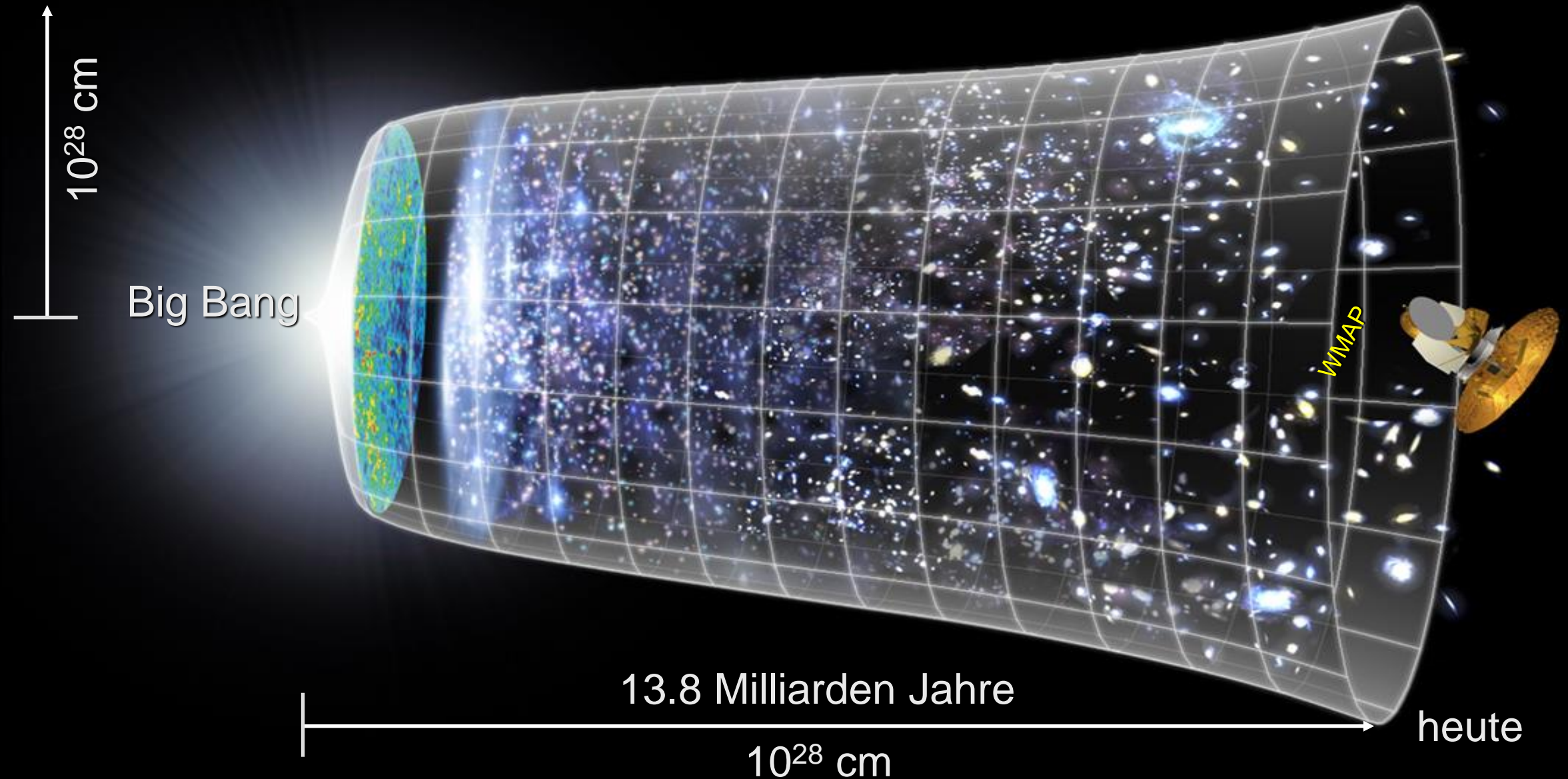
## Zusammenarbeit und Verständigung



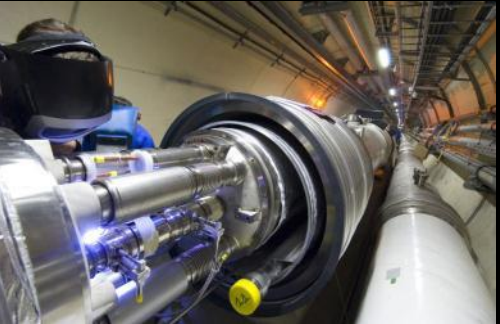
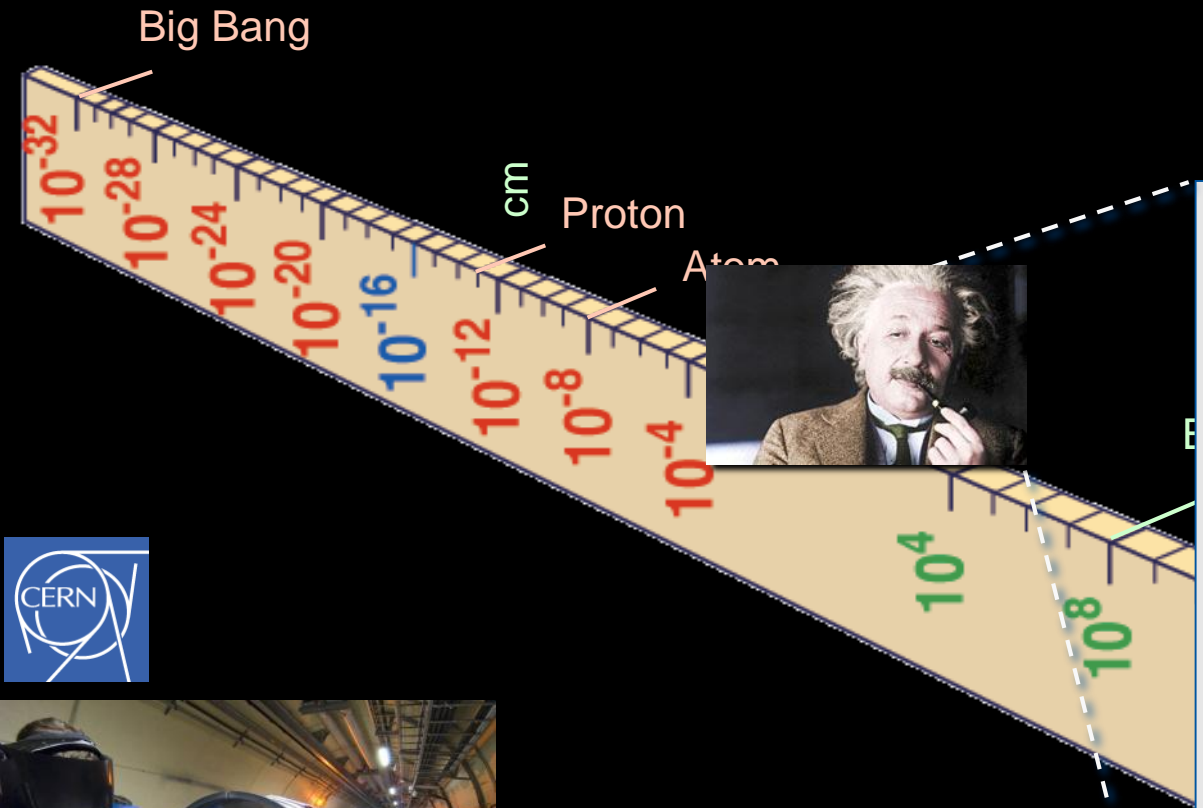
# The Mission



# Die wissenschaftliche Herausforderung: Erforschung der Entwicklung des frühen Universums

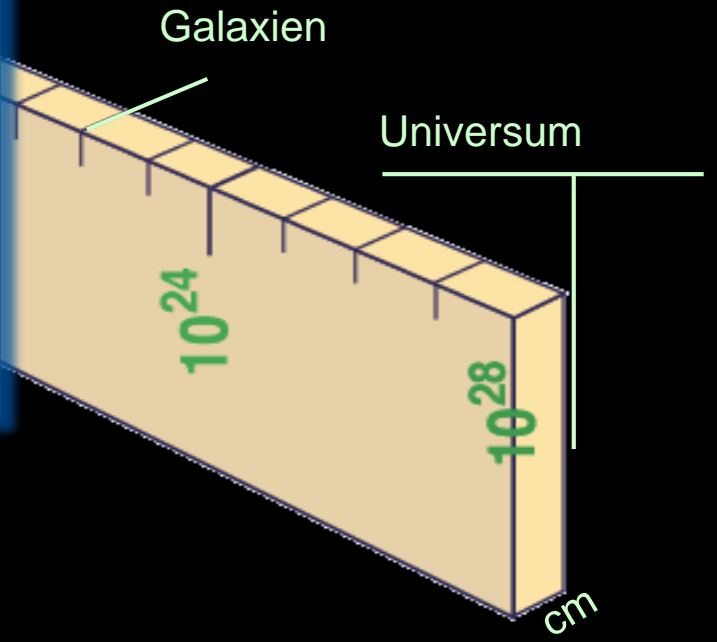
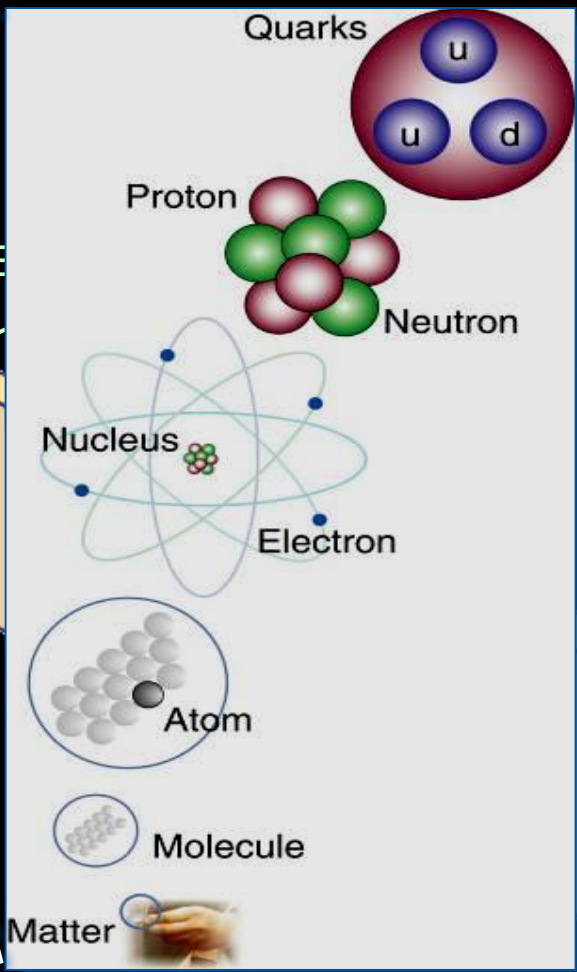






LHC

Supermikroskop



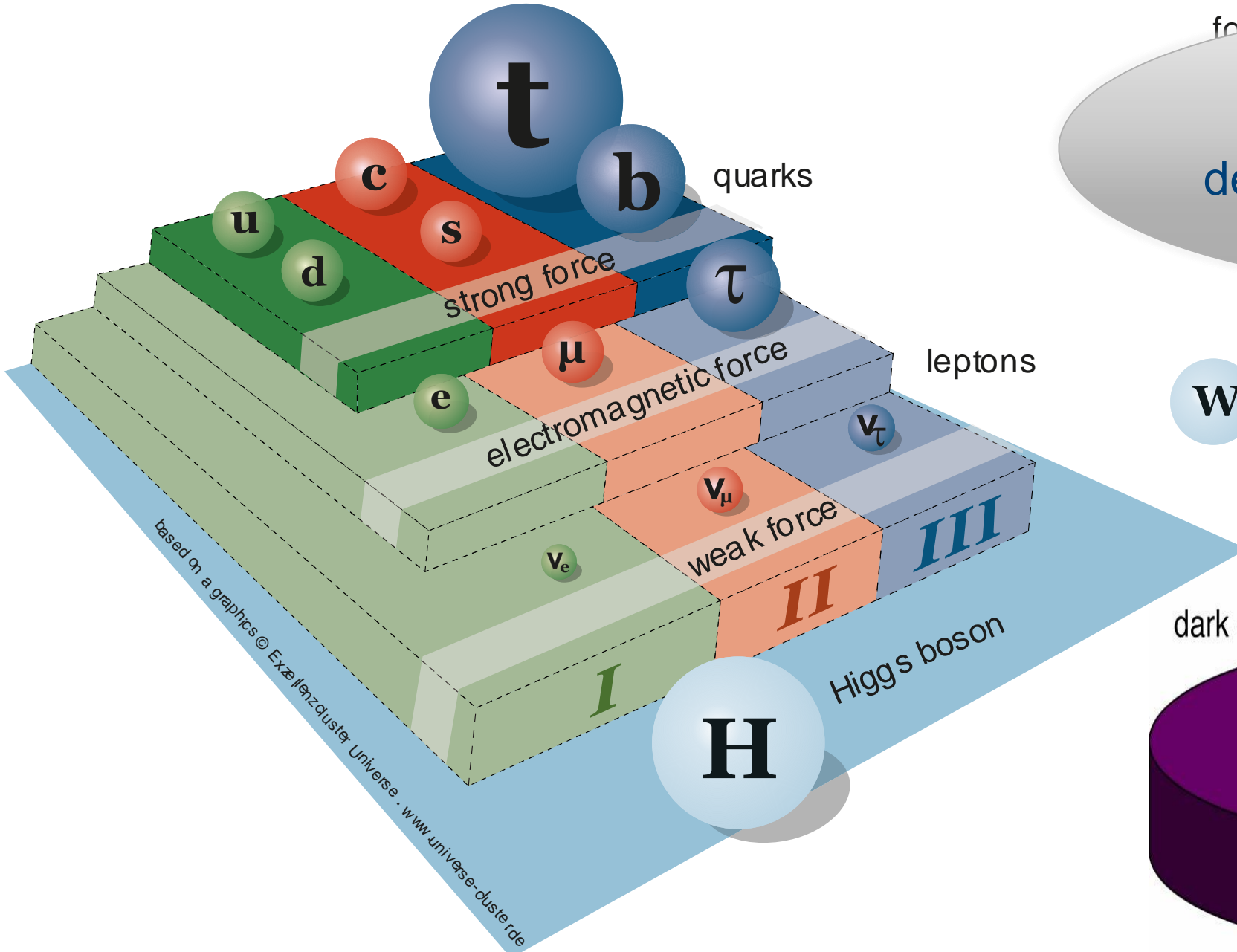


The Nobel Prize in Physics 2013 was awarded jointly to François Englert and Peter W. Higgs "for the theoretical discovery of a mechanism that contributes to our understanding of the origin of mass of subatomic particles, and which recently was confirmed through the discovery of the predicted fundamental particle, by the ATLAS and CMS experiments at CERN's Large Hadron Collider".



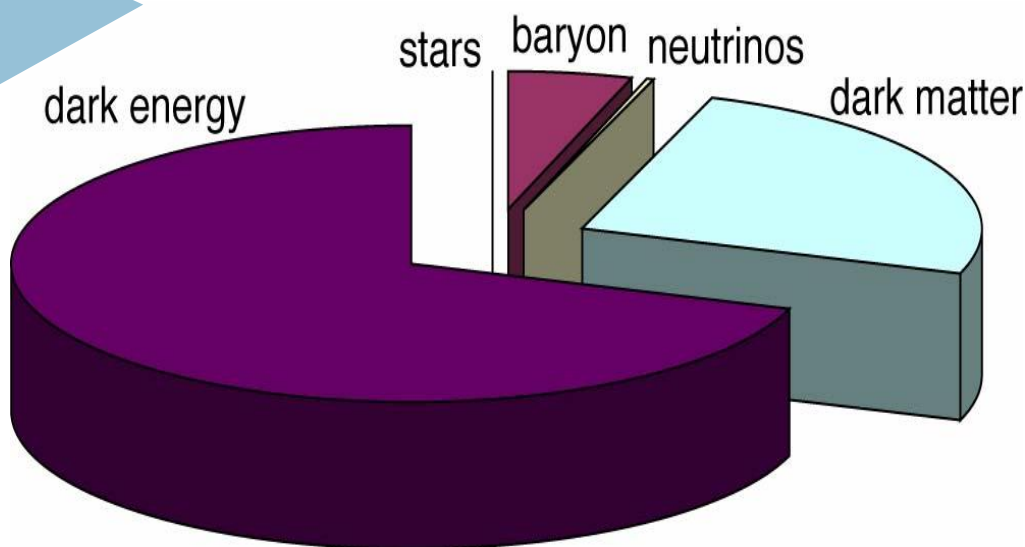
# Physics Nobel Prize 2013





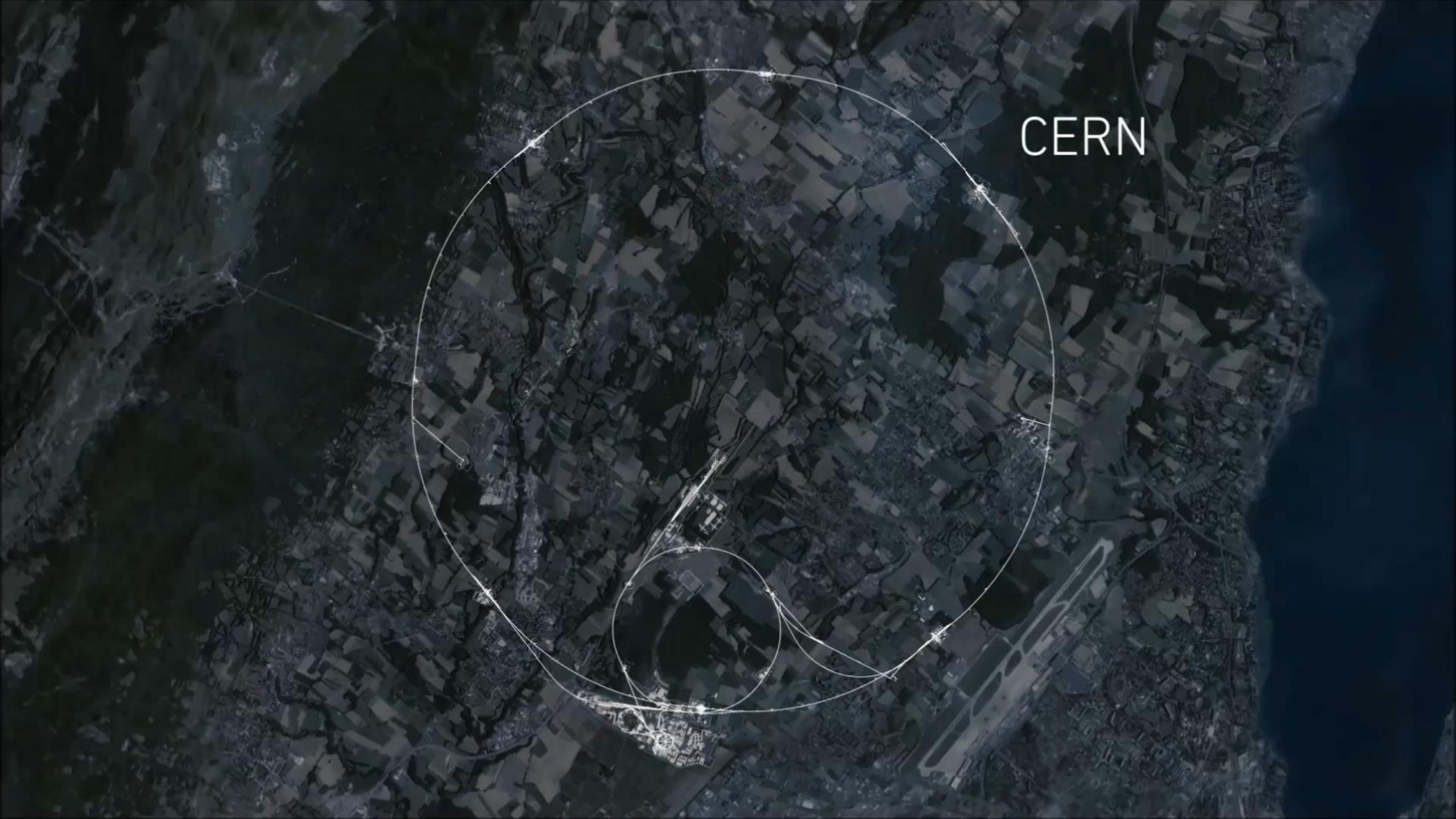
„Es gibt Licht am Ende des dunklen Universums!“

$W^+$   $Z^0$   $W^-$

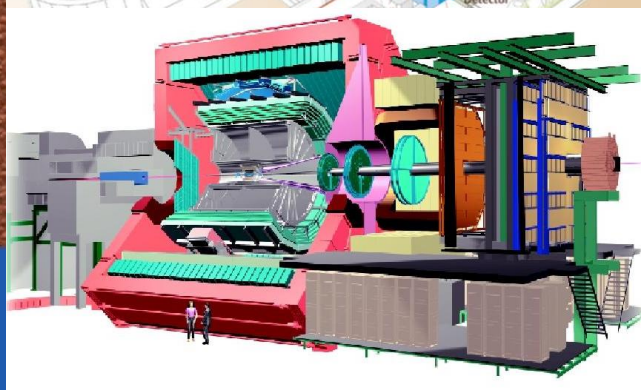
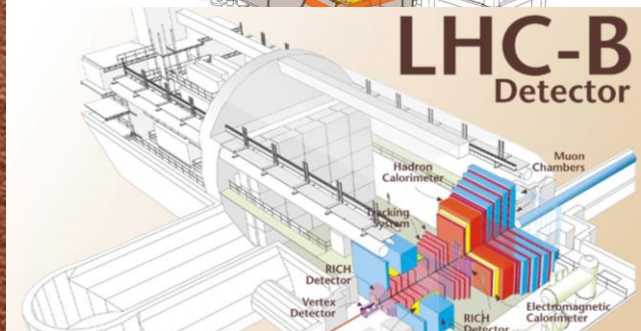
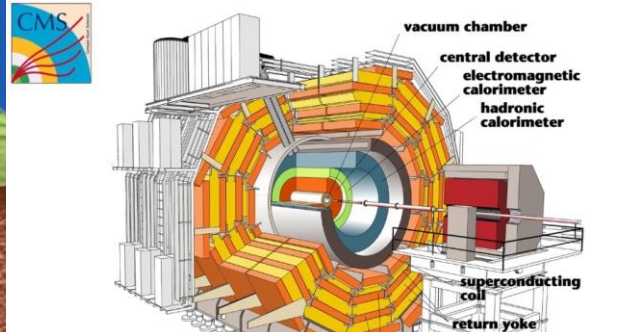
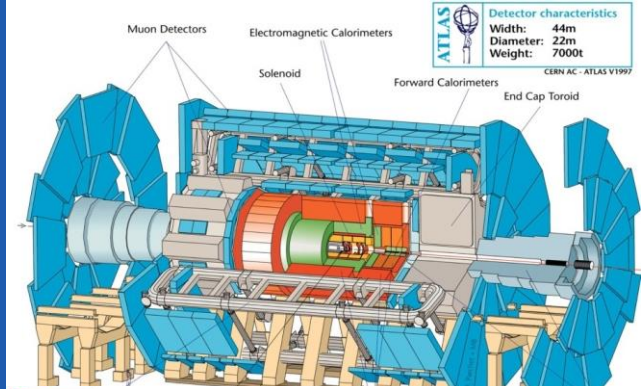
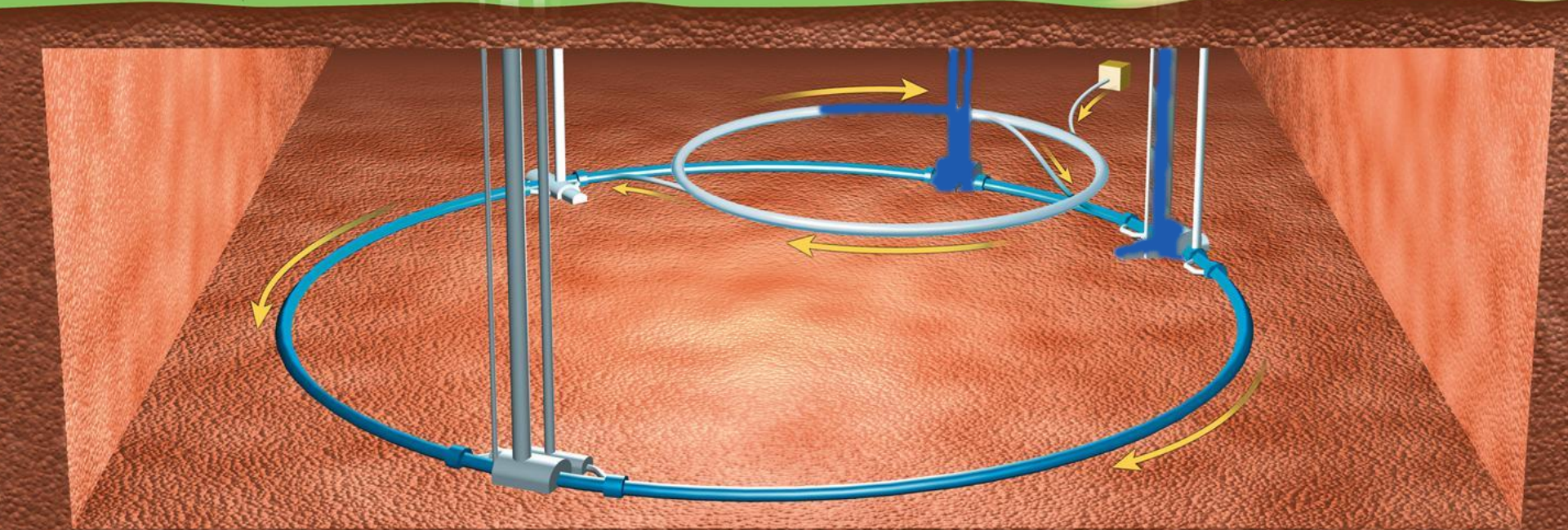
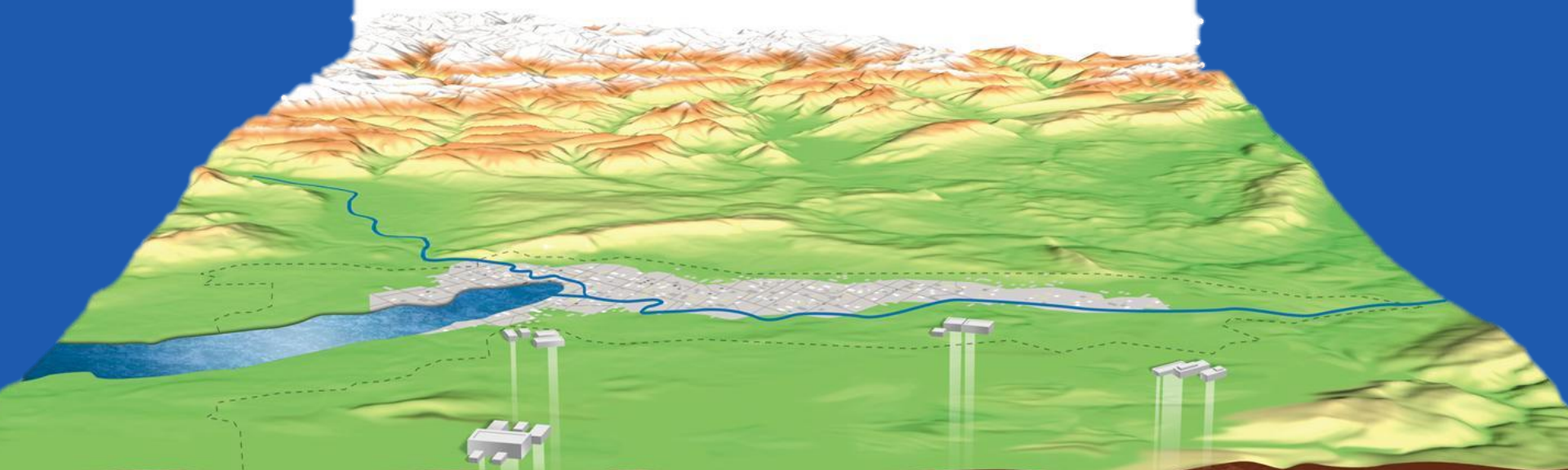




CERN







# Große LHC Experimente



# Weitere Aktivitäten





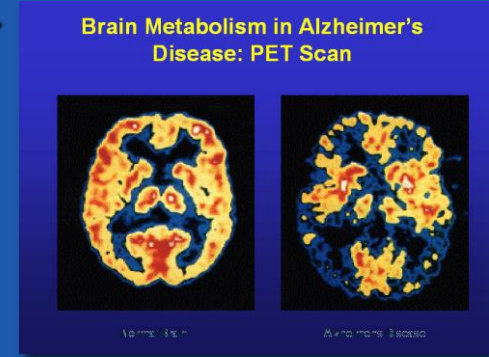
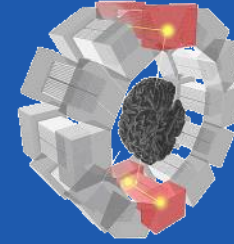
Teilchendetektion

## Bildgebung

klinischer Test für ein neues Mammografie-System (ClearPEM)



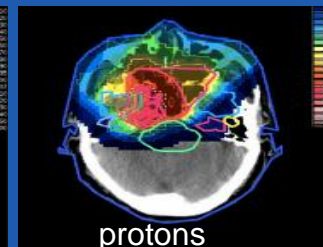
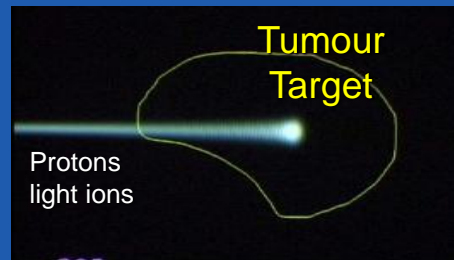
## PET Scanner



## beschleunigte Teilchenstrahlen

~30'000 Beschleuniger weltweit  
~17'000 für medizinische Nutzung

## Hadronentherapie



>70'000 Patienten weltweit (30 Einrichtungen)  
>21'000 Patienten in Europa (9 Einrichtungen)

Kompetenzen in der Ionen-Therapie sind nun in Japan und Europa konzentriert



# Medizinische Anwendungen



# World Wide Web

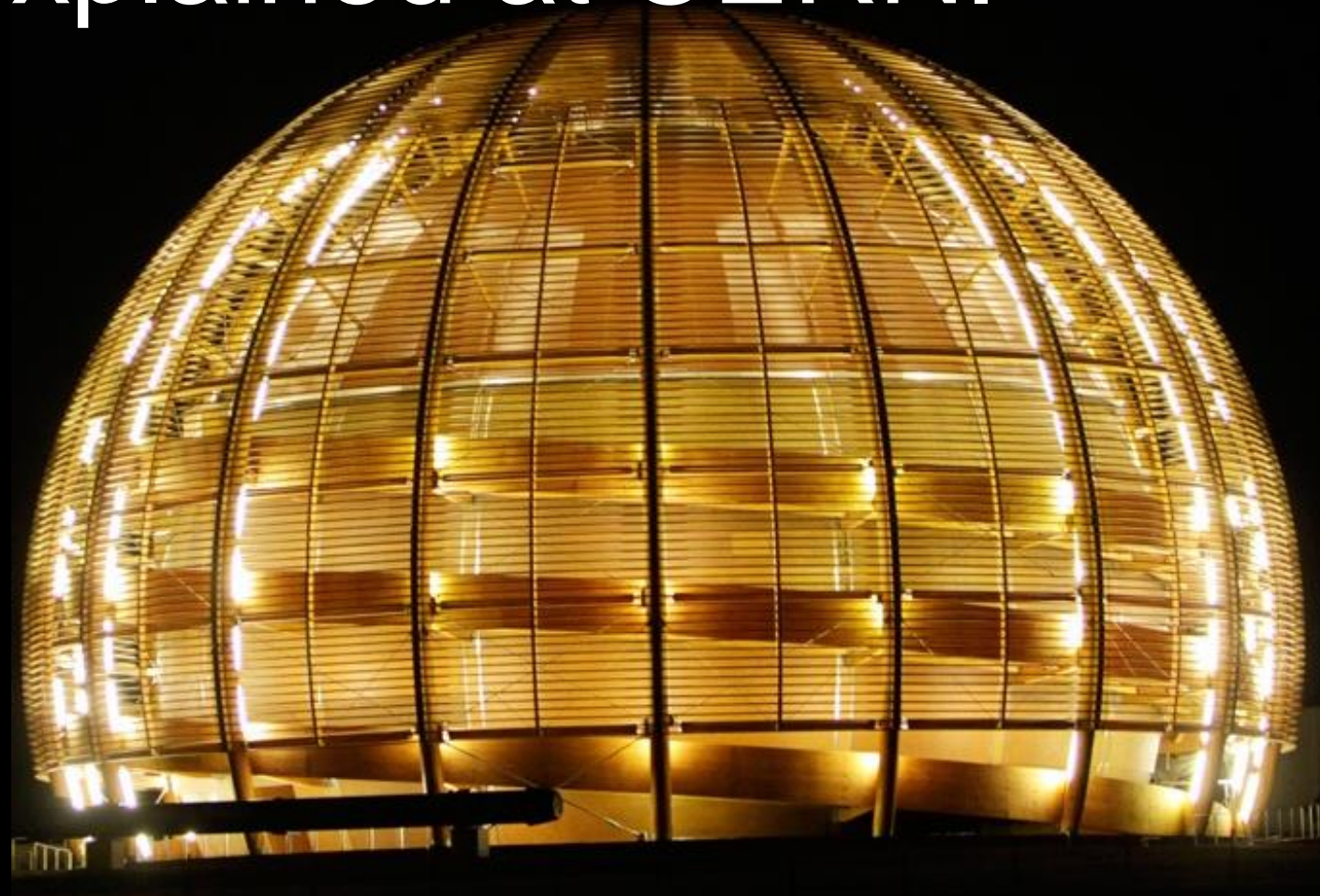
# WWW





“Magic is not happening at CERN,  
magic is being explained at CERN.”

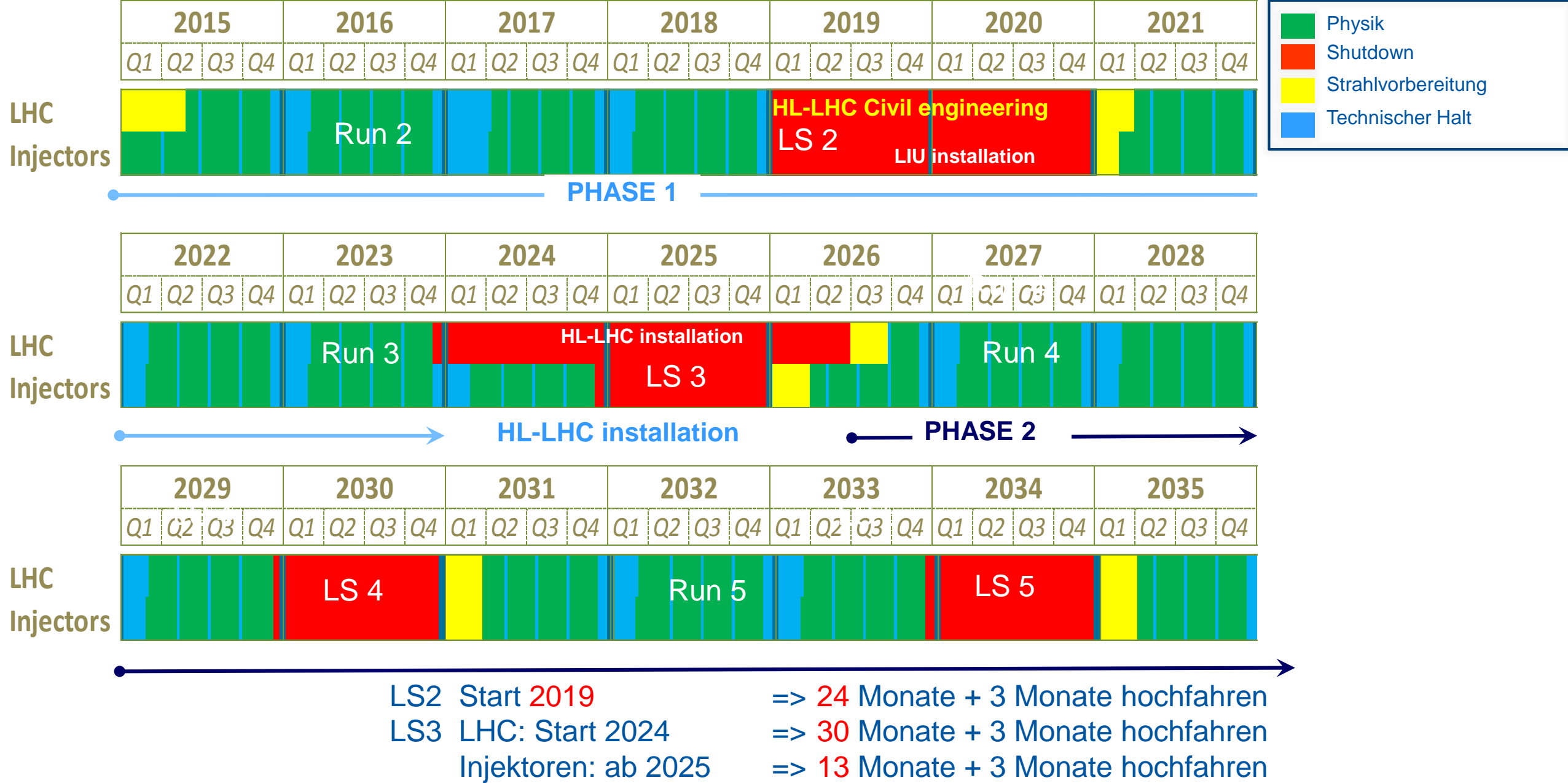
*Tom Hanks*



European Organization for Particle Physics  
*Organisation européenne pour la physique des particules*



# Was passiert zur Zeit?





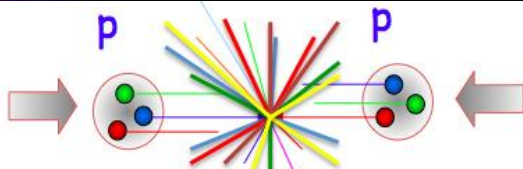
# Und dann?



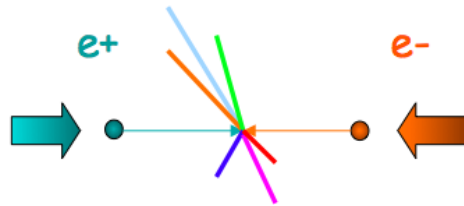
Proton

Elektron  
Positron

LHC



CLIC



### p-p Kollisionen

**Ein Proton ist ein zusammengesetztes Objekt**

- Der Initialzustand ist nicht pro Ereignis bekannt
- schränkt die Präzision ein

**Hohe Raten von QCD-Untergrund**

- komplexe Trigger notwendig
- hohe Strahlungsraten

High cross-sections for **colored-states**

### e<sup>+</sup>e<sup>-</sup> Kollisionen

**e<sup>+</sup>/e<sup>-</sup> sind punktförmig**

- Initialzustand ist gut bekannt ( $\sqrt{s}$  / Polarisation)
- hochpräzise Messungen möglich

**Sehr klare Experimente**

- Auslese sogar ohne Trigger möglich
- sehr niedrige Strahlungsraten

Superior sensitivity for **electro-weak states**



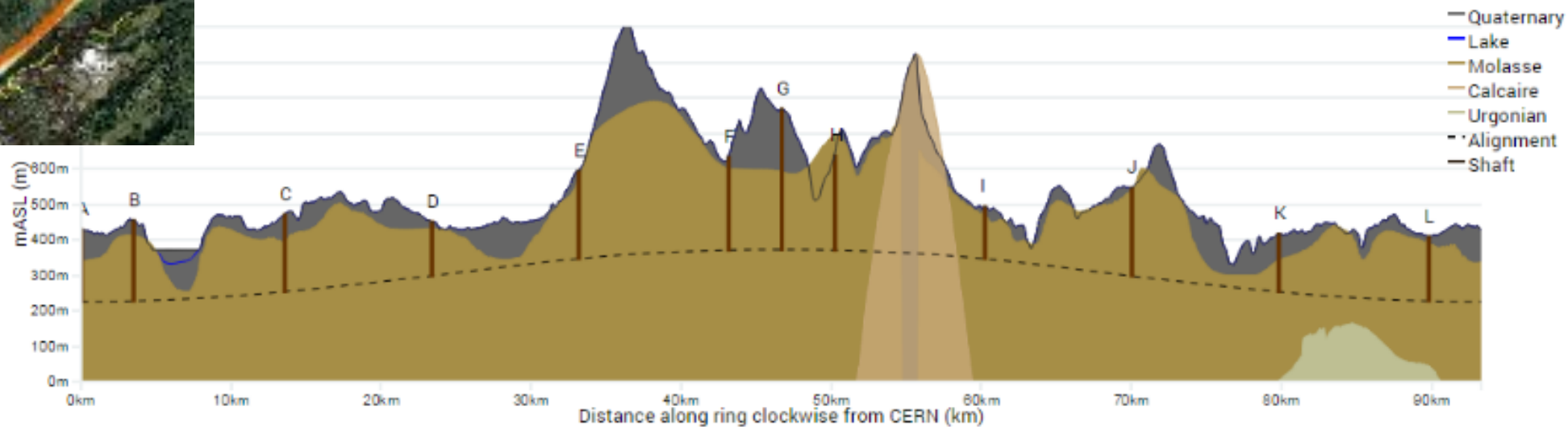


## Eine internationale Studie

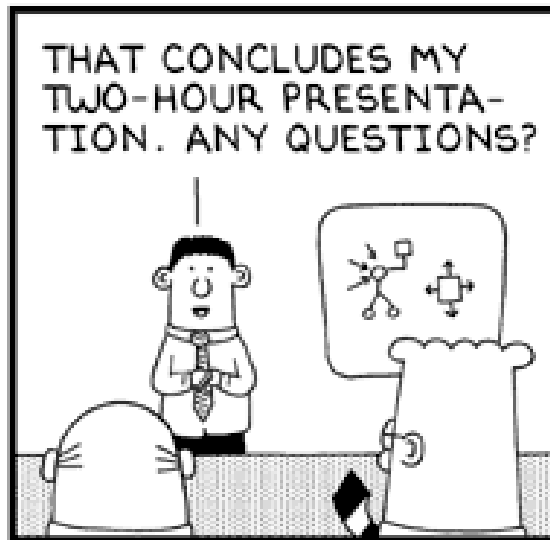
- $pp$ -Kollider ( $FCC-hh$ )
- $e^+e^-$ -Kollider ( $FCC-ee$ )
- $p-e$  ( $FCC-he$ ) Option
- 80-100 km Tunnel



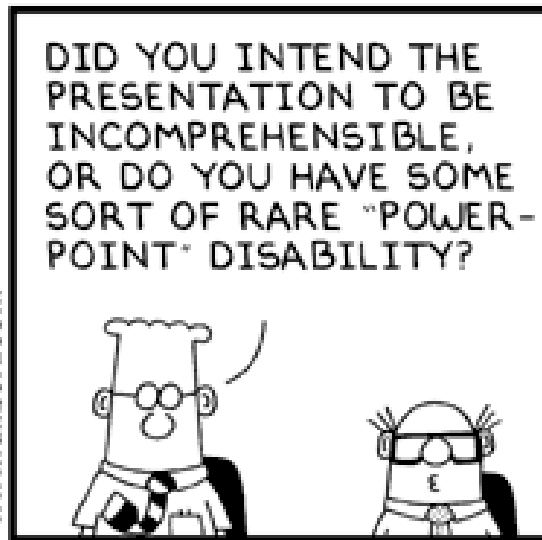
**$\sim 16 T \Rightarrow 100 \text{ TeV } pp \text{ in } 100 \text{ km}$**   
 **$\sim 20 T \Rightarrow 100 \text{ TeV } pp \text{ in } 80 \text{ km}$**



# Ihre Fragen!



www.dilbert.com scottadams@aol.com



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