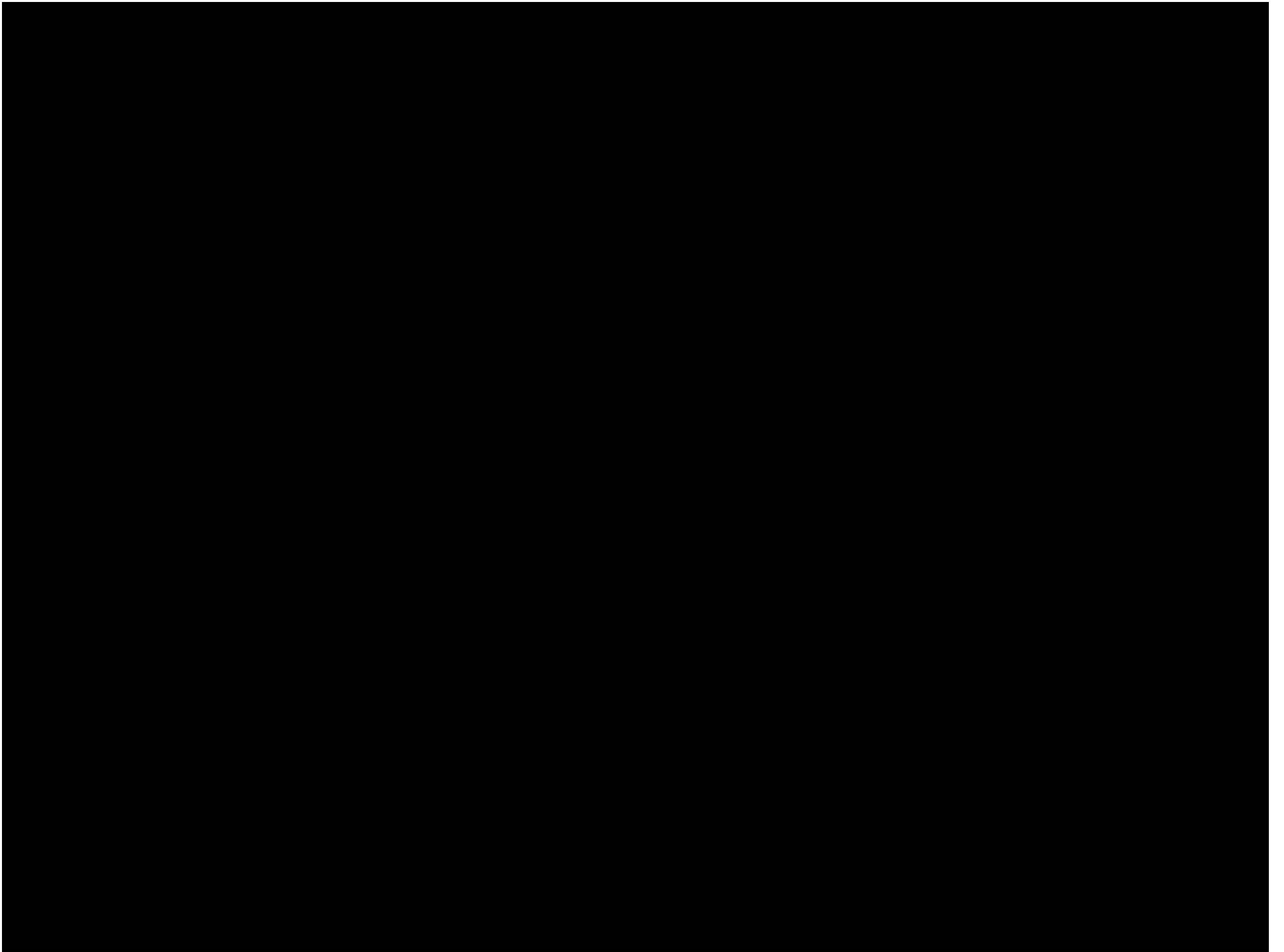




# Der Large Hadron Collider (LHC)

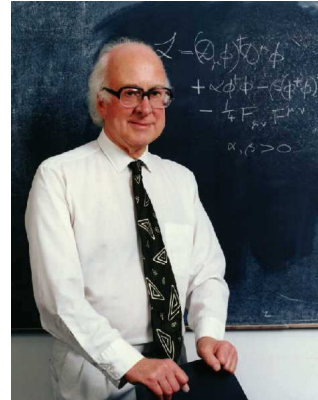
...ein Rundgang durch das größte Experiment  
der Welt



# Offene Fragen



- Higgs-Teilchen



- Dunkle Materie

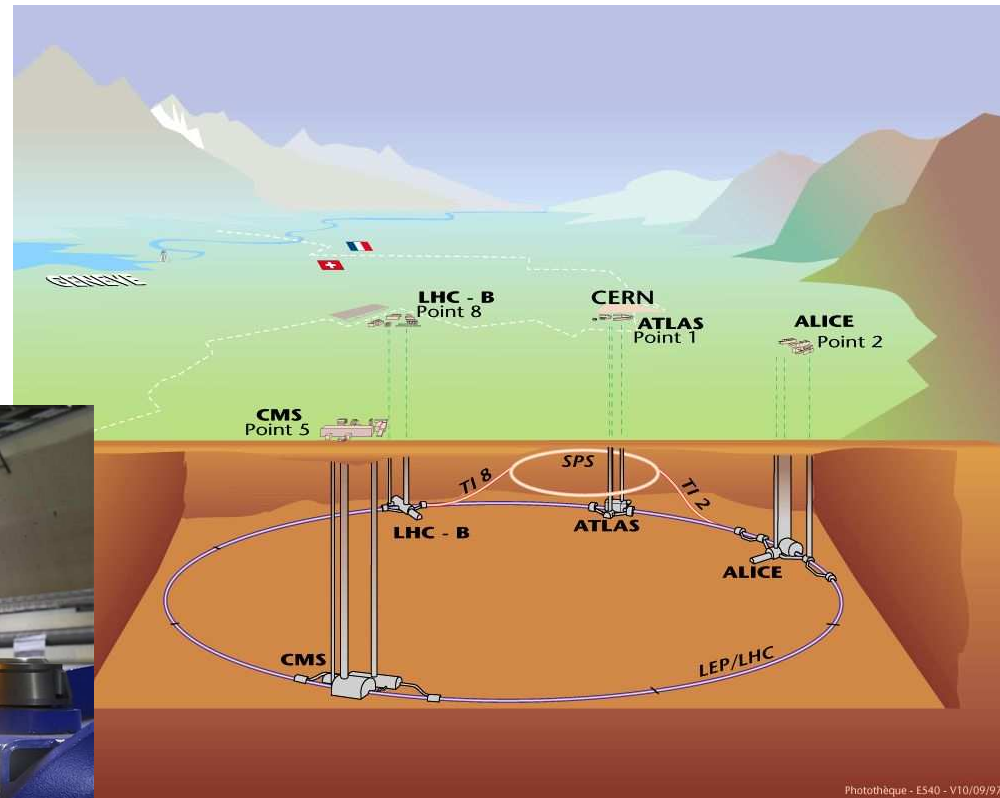


- ...

# Der Large Hadron Collider am CERN



- Länge: 27 km
- 100 m unter der Erde
- 4 Teilchendetektoren



# Teilchenbeschleuniger



# Teilchenbeschleuniger in der Schule

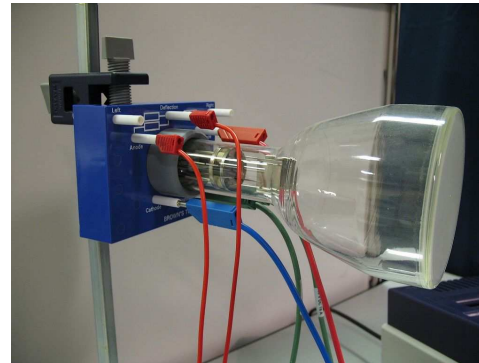




# Teilchenbeschleuniger in der Schule



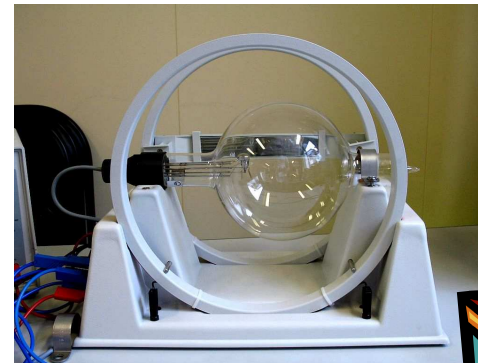
- Braun'sche Röhre



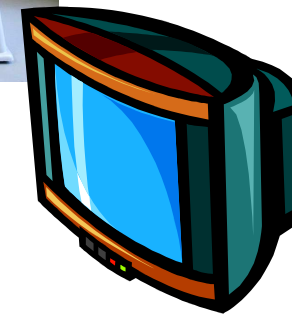
- Oszilloskop



- Fadenstrahlröhre



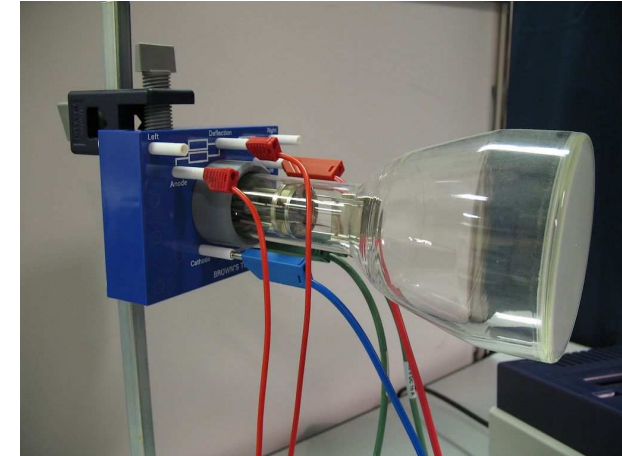
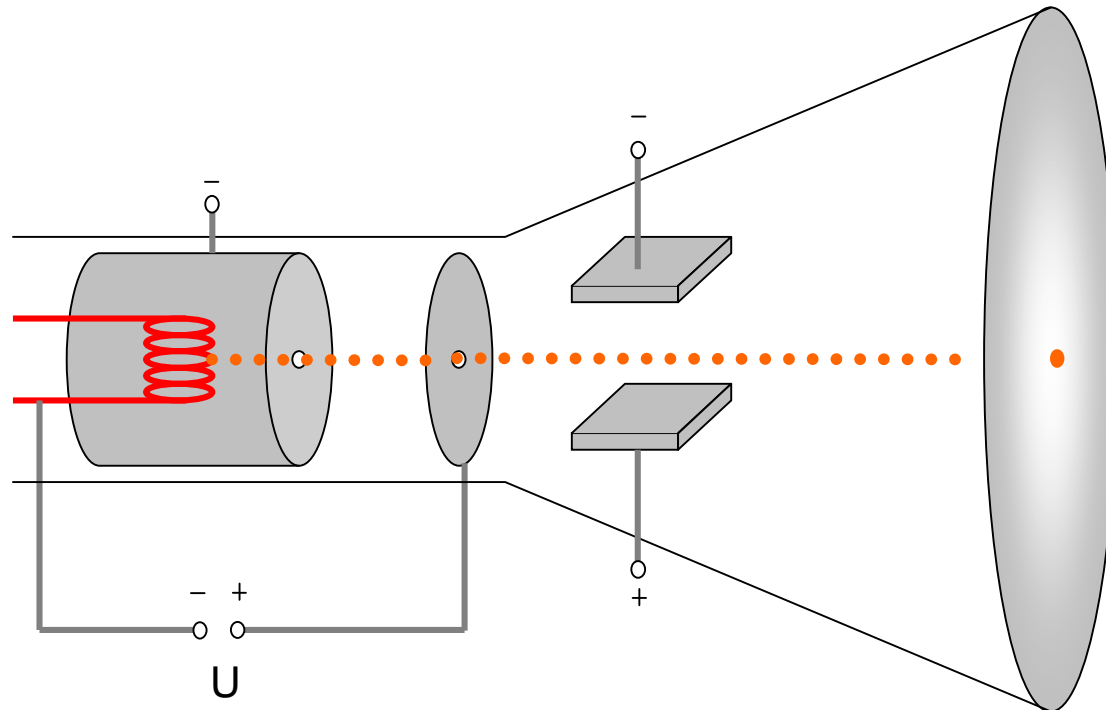
- TV-Gerät



# Braun'sche Röhre / TV-Gerät



- Erzeugung, Beschleunigung und Ablenkung von Teilchen

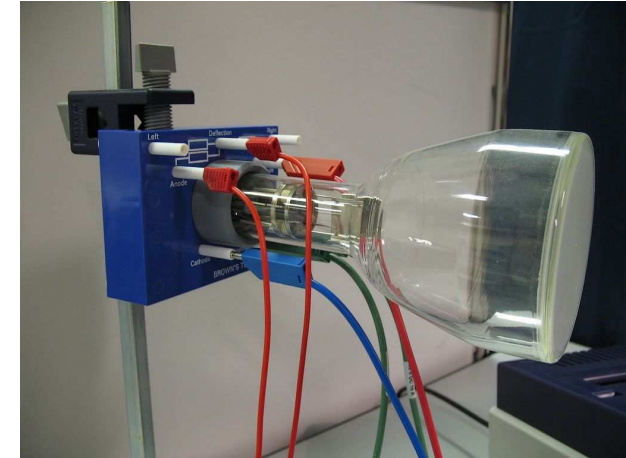
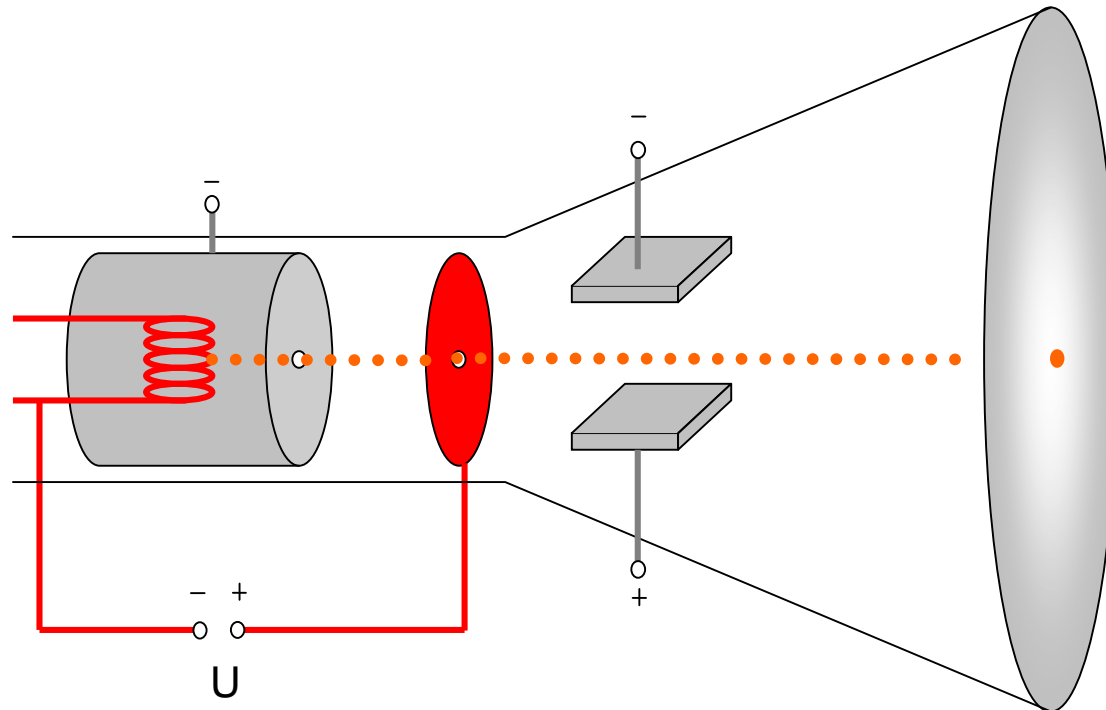




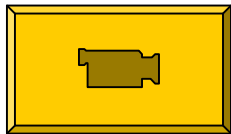
# Braun'sche Röhre / TV-Gerät



- Erzeugung, Beschleunigung und Ablenkung von Teilchen



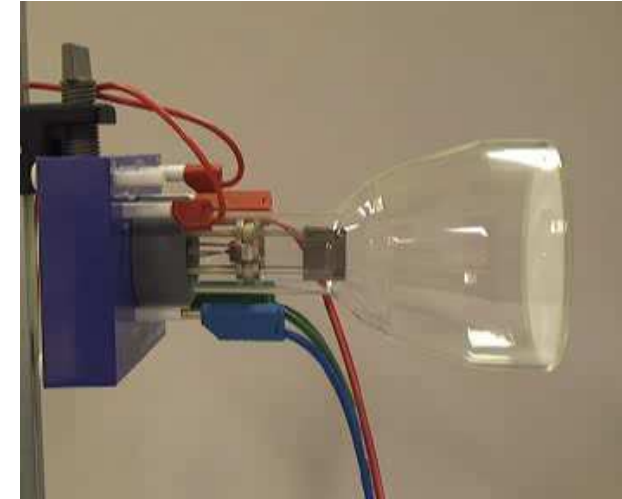
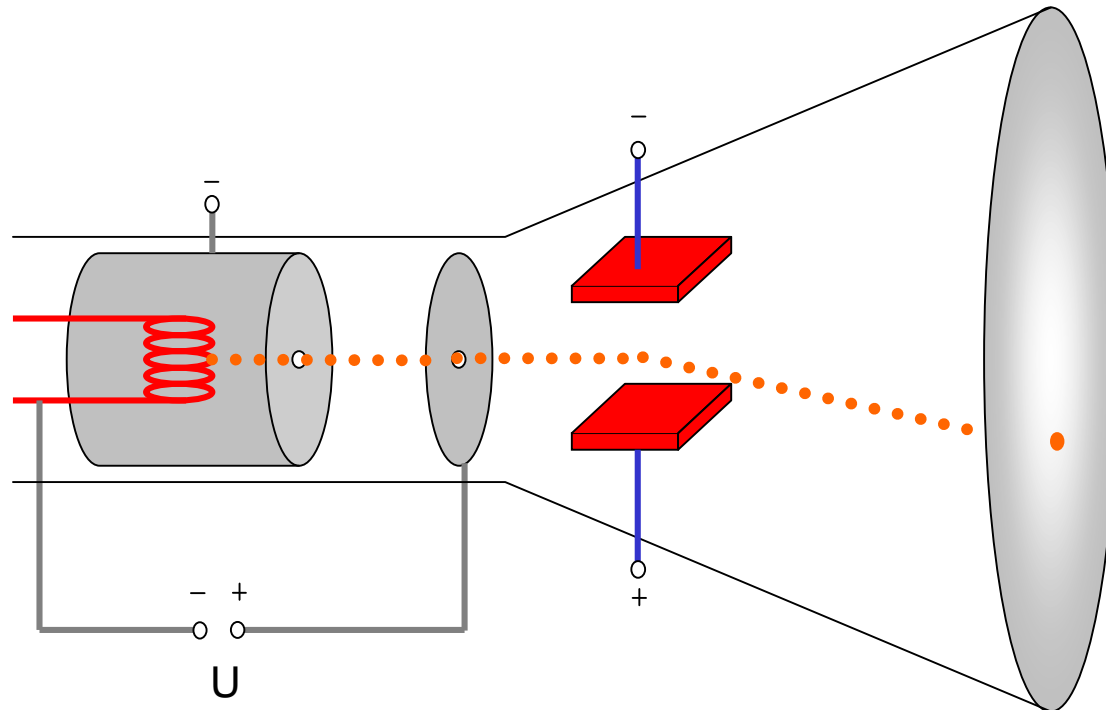
# Teilchenbeschleuniger



# Braun'sche Röhre / TV-Gerät



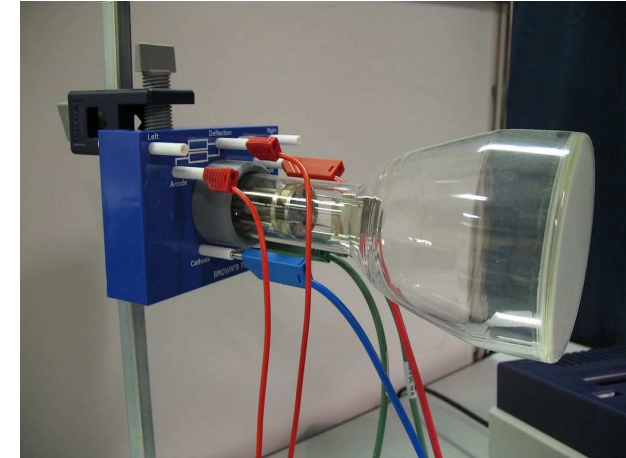
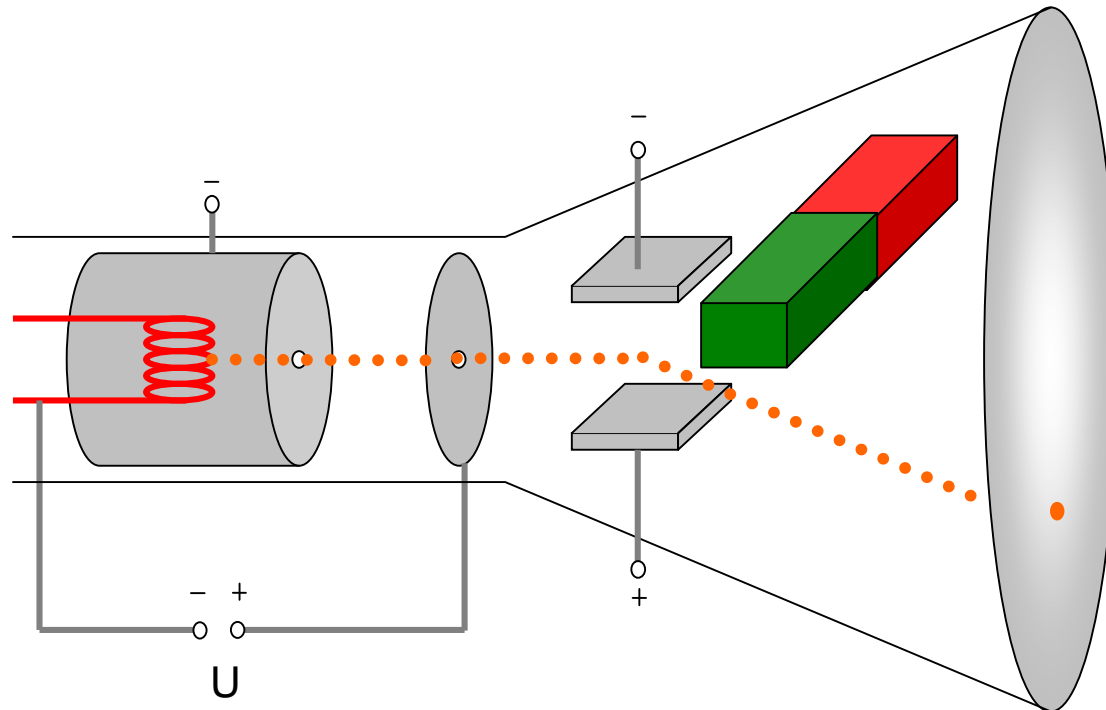
- Erzeugung, Beschleunigung und Ablenkung von Teilchen



# Braun'sche Röhre / TV-Gerät

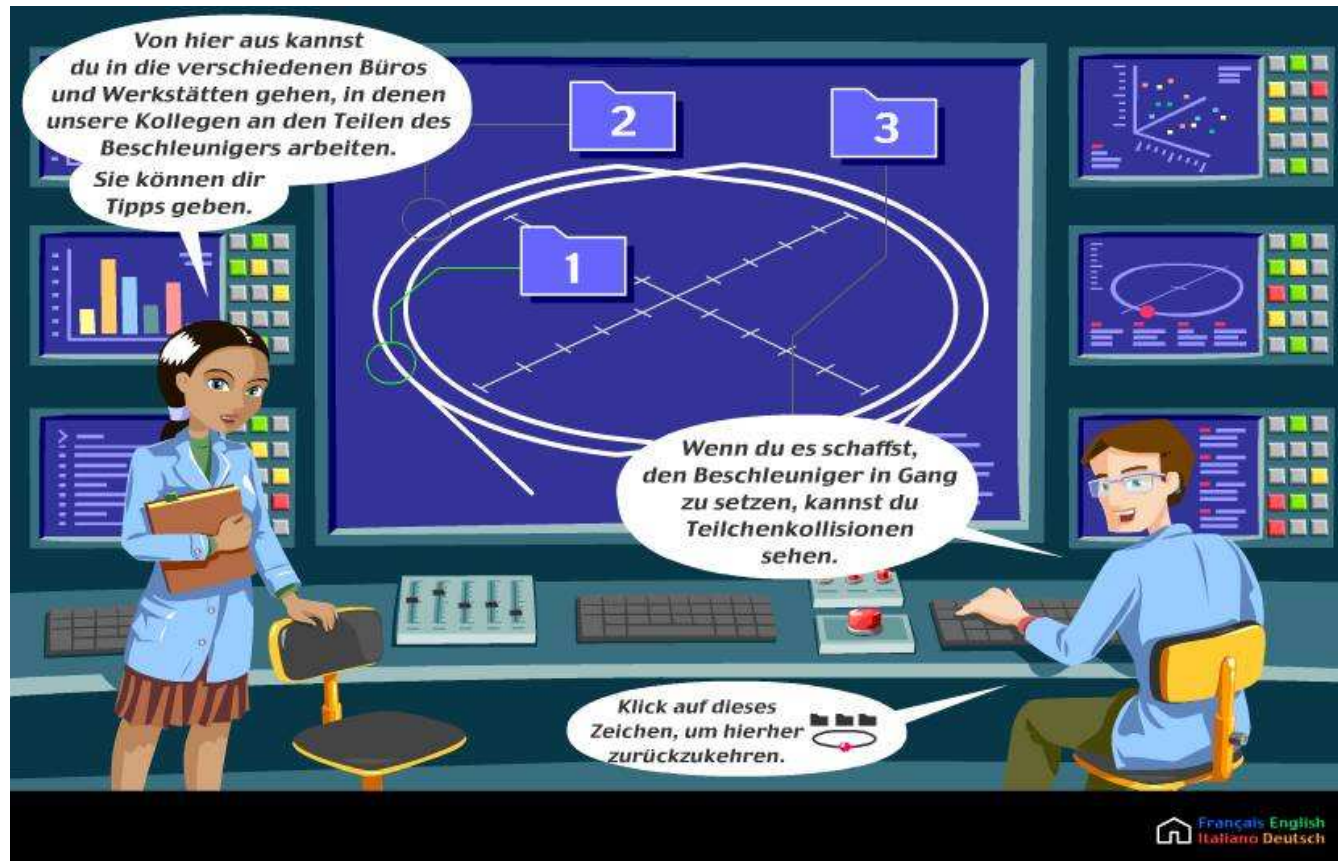


- Erzeugung, Beschleunigung und Ablenkung von Teilchen





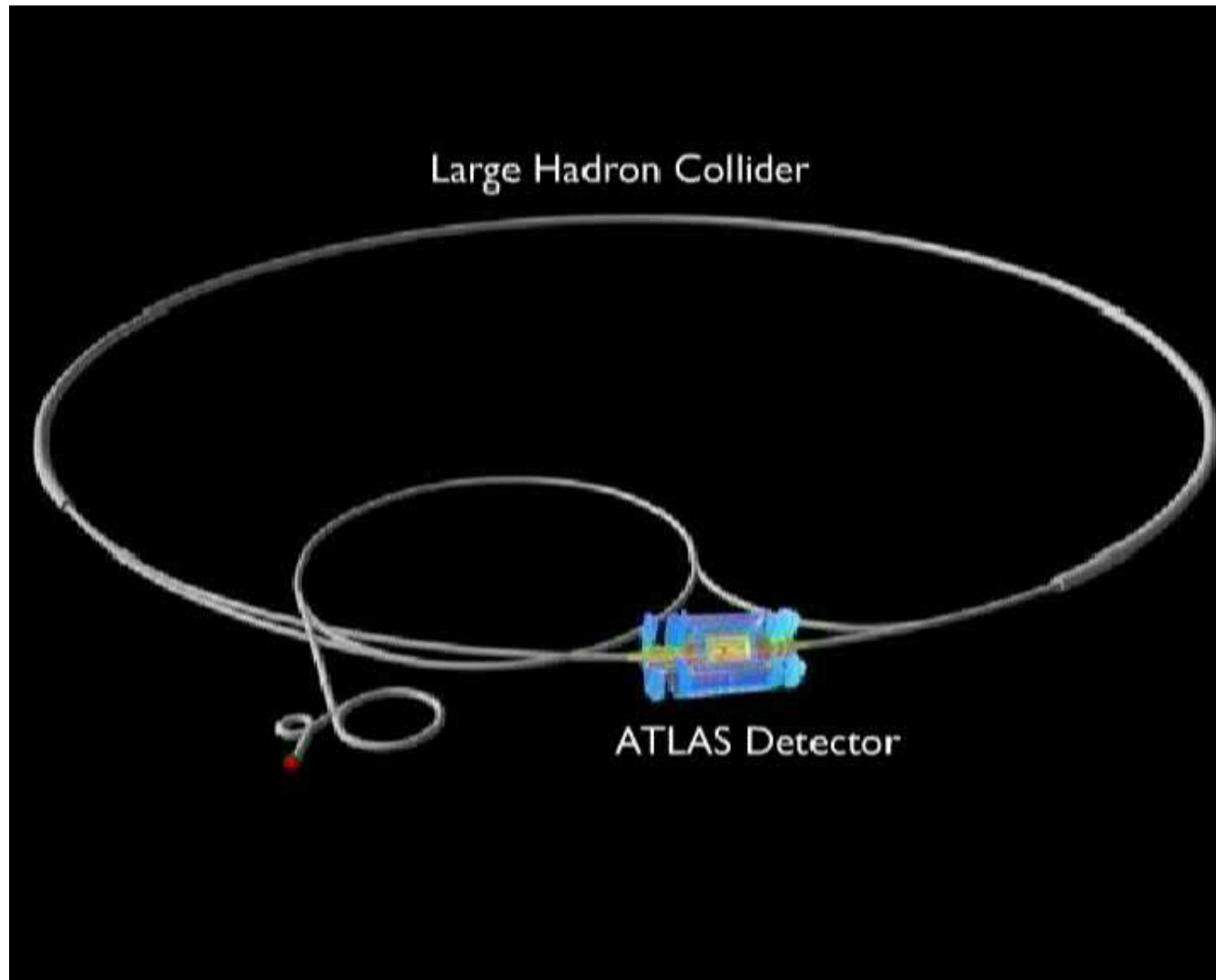
# LHC-Spiel



Start

(Internetverbindung erforderlich)

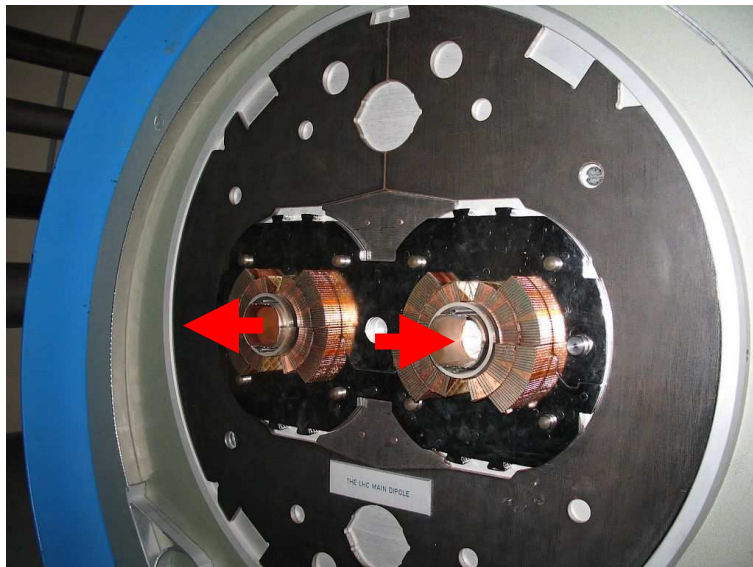
# LHC und Vorbeschleuniger



# Large Hadron Collider



- Maximalenergie: 7 Tera-Elektronenvolt
- Geschwindigkeit:  $v=0,9999999991 c$
- 2808 Teilchenpakete mit je  $1,15 \cdot 10^{11}$  Protonen
  - Abstand: 25 ns
  - → 40 Millionen Kollisionen pro Sekunde





# Large Hadron Collider



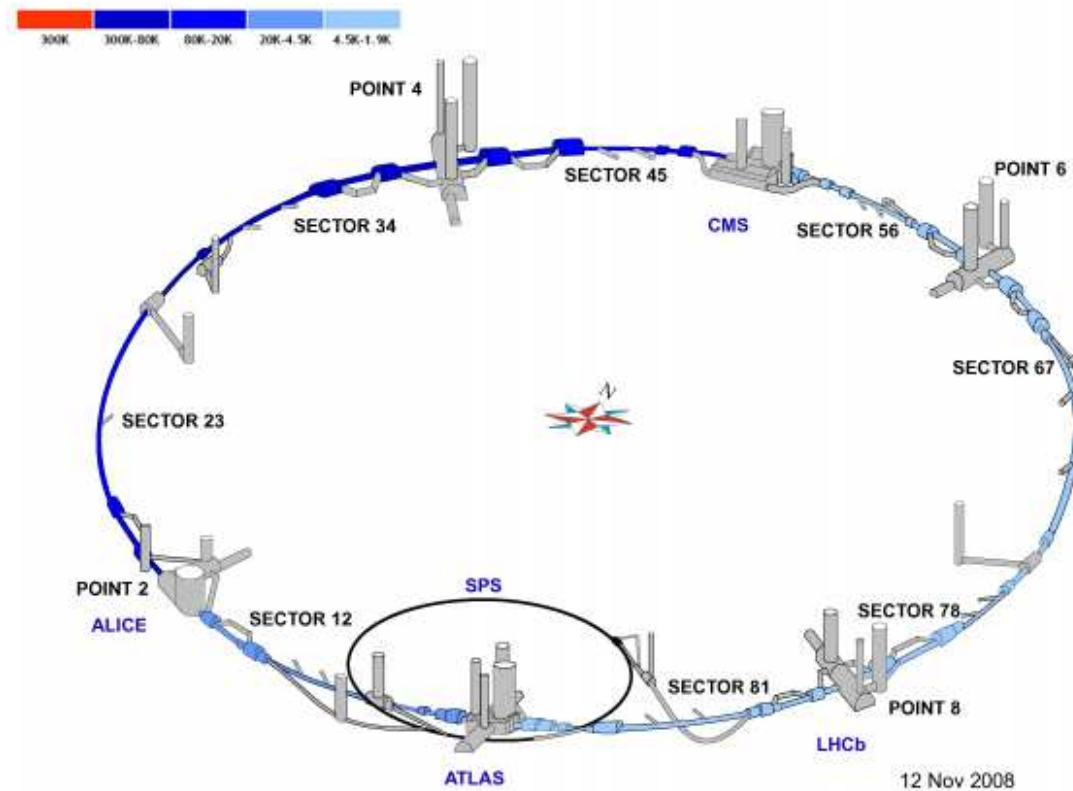
- 1232 supraleitende Magnete
  - Magnetfeld: 8,3 T bei 11.850 Ampère
  - Betriebstemperatur: -271 °C
  - Länge: 15 m
  - Gewicht: 35 t
  - Preis: 500.000 CHF
- Transport bei 3 km/h!
  - ...bis zu 15 km weit



# Large Hadron Collider



- LHC-Temperatur
  - Kälter als das Weltall!



# Large Hadron Collider



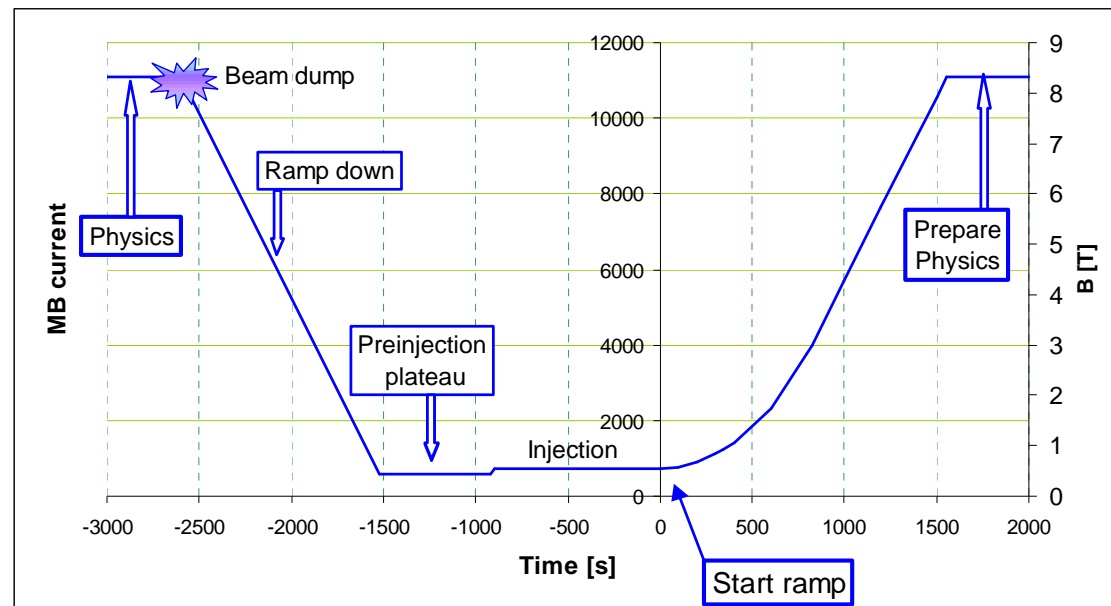
# Large Hadron Collider



- Weitere Daten:

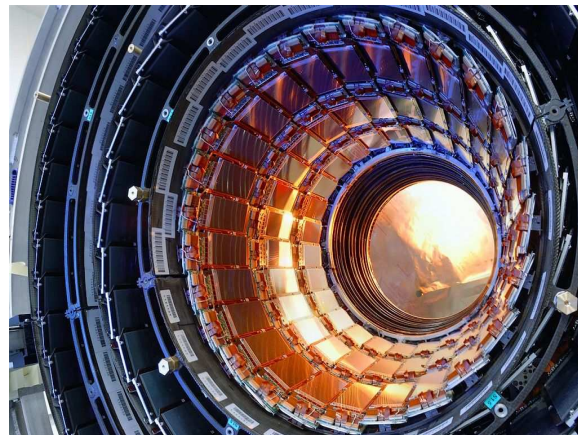
- Energieverbrauch: 180 MW (= Kanton Genf)
- 360 MJ Energie gespeichert im Strahl (=ICE bei 200 km/h, schmilzt 500 kg Kupfer)
- Ultrahochvakuum größer als auf dem Mond

Ramp down	≈ 18 Mins
Pre-Injection Plateau	15 Mins
Injection	≈ 15 Mins
Ramp	≈ 28 Mins
Squeeze	≈ 20 Mins
Prepare Physics	≈ 10 Mins
Physics	0 - 20 Hrs





# Teilchendetektoren





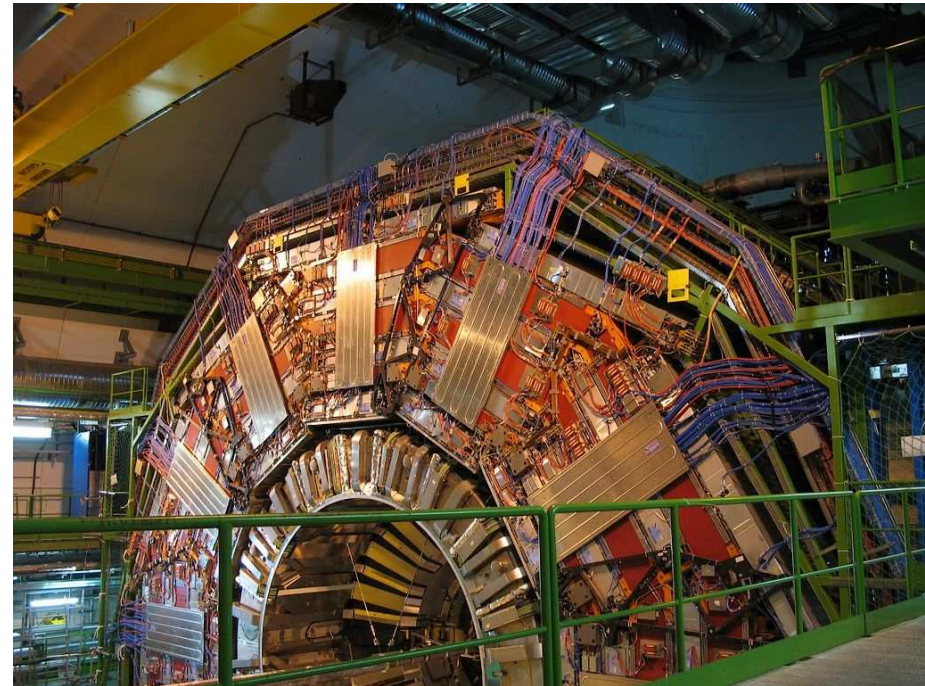
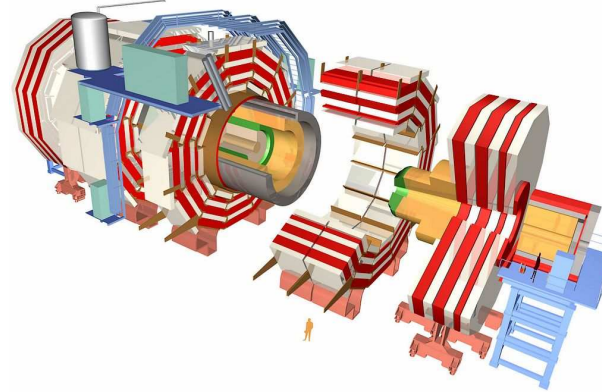


# CMS-Detektor



- Länge: 25 m
- Höhe: 16 m
- Gewicht: 12.500 t
  
- Mitarbeiter:
  - 2310 Wissenschaftler
  - 38 Staaten
  - 175 Institute

55 aus  
Karlsruhe



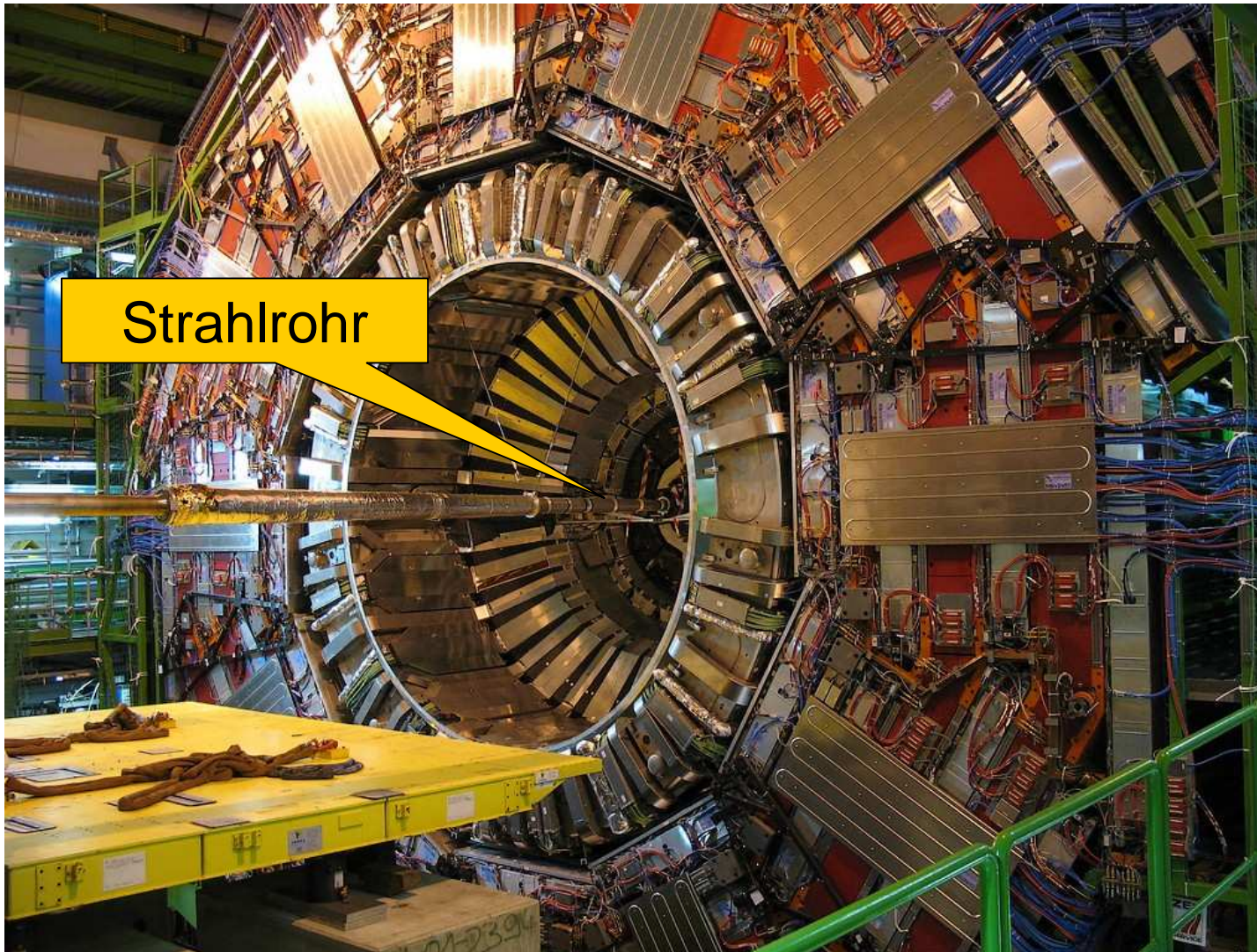


# CMS-Detektor



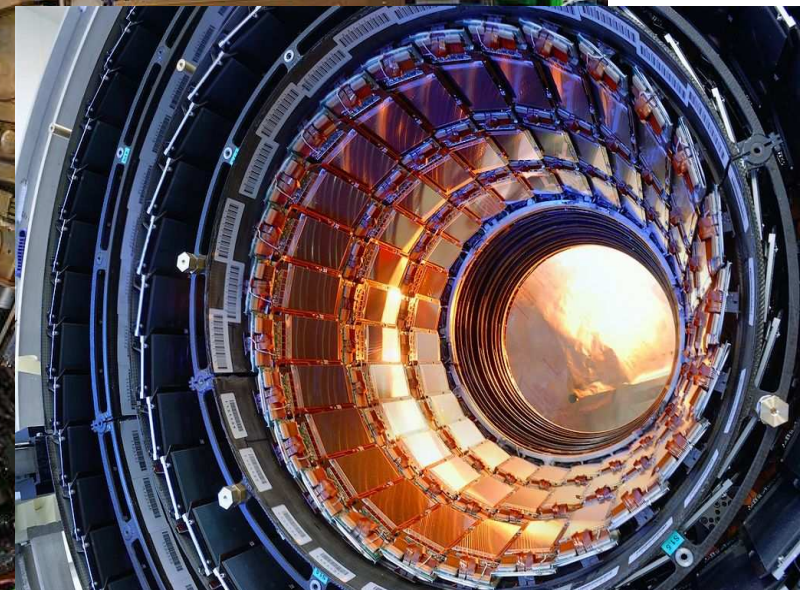


# CMS-Detektor



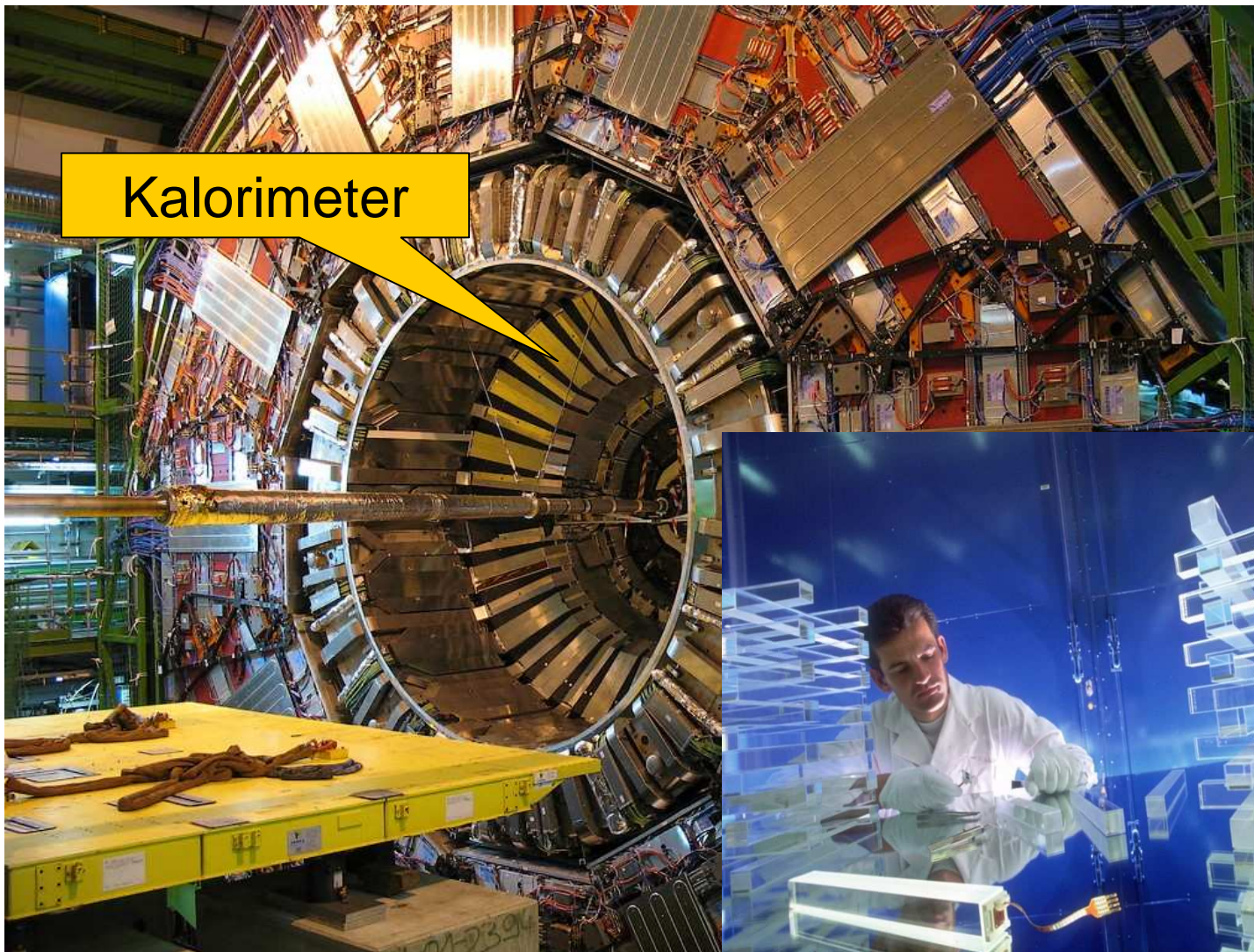


# CMS-Detektor



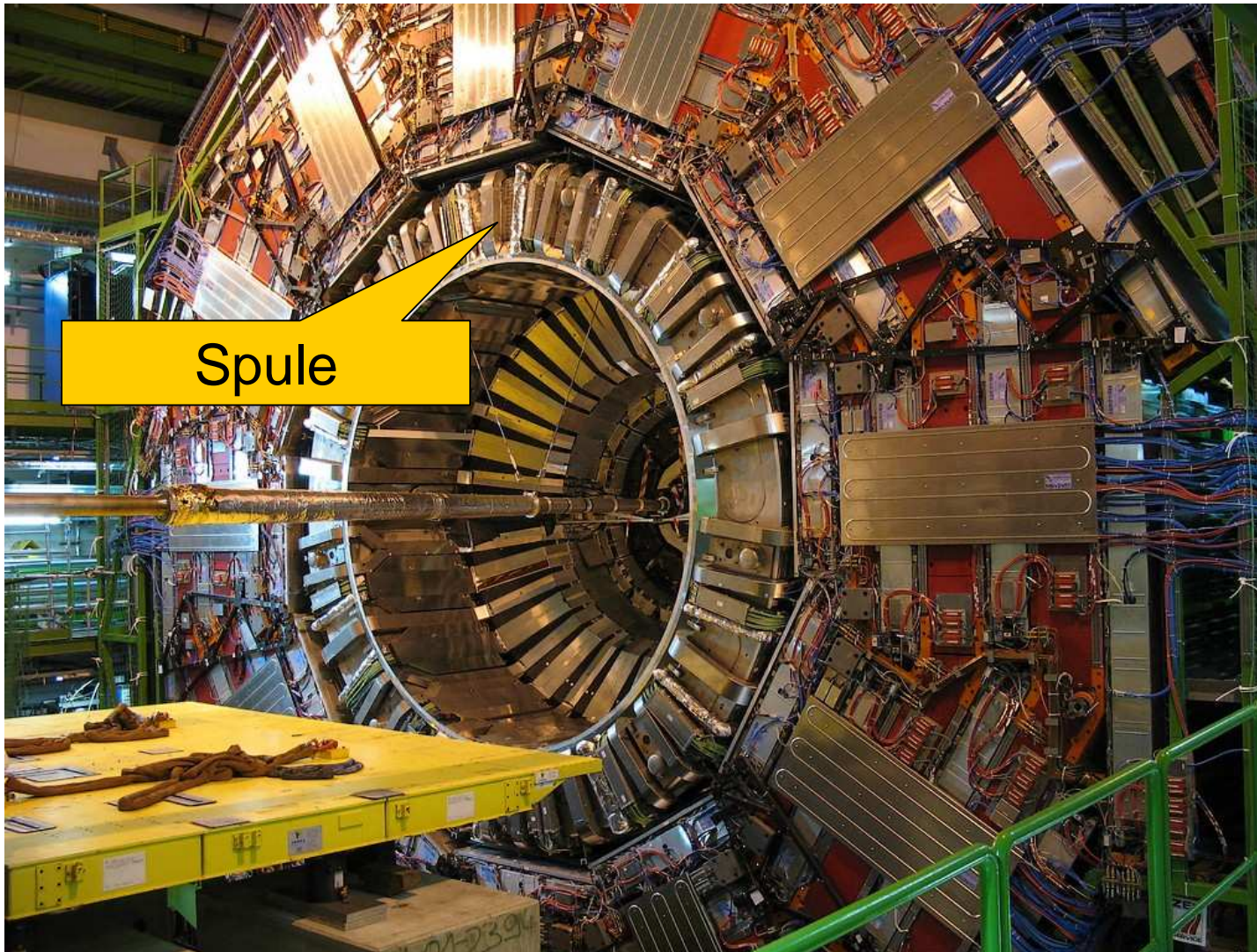


# CMS-Detektor



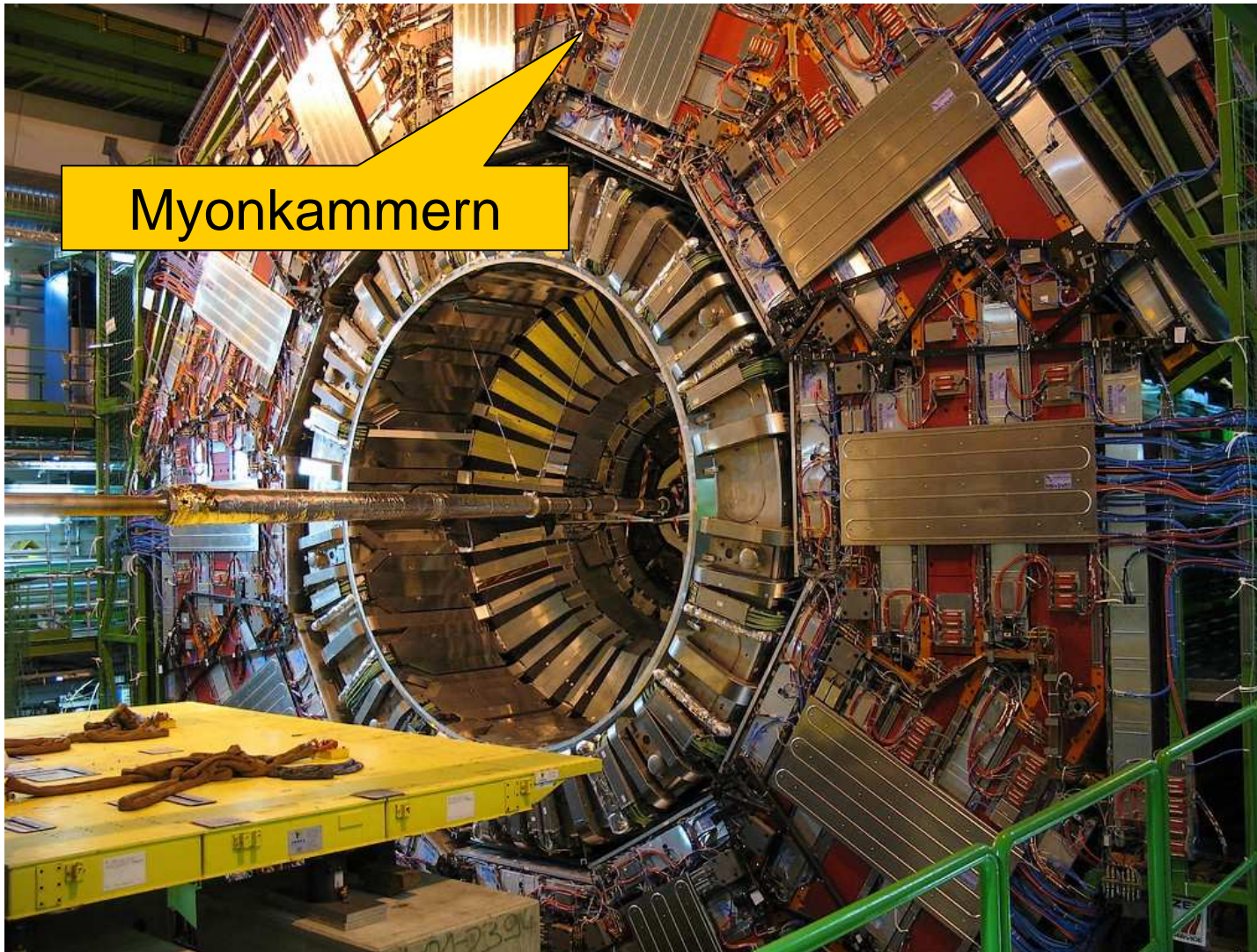


# CMS-Detektor



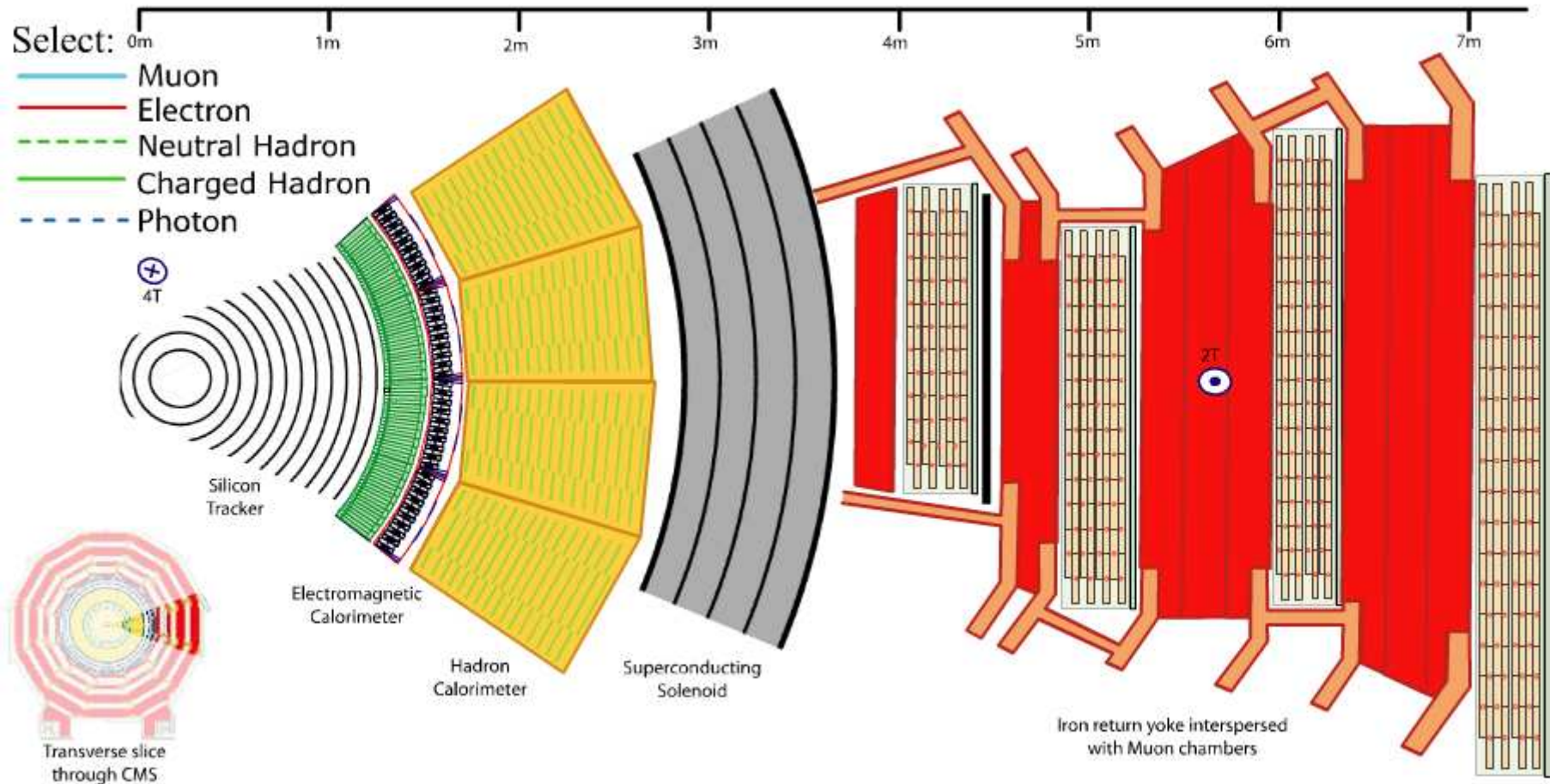


# CMS-Detektor





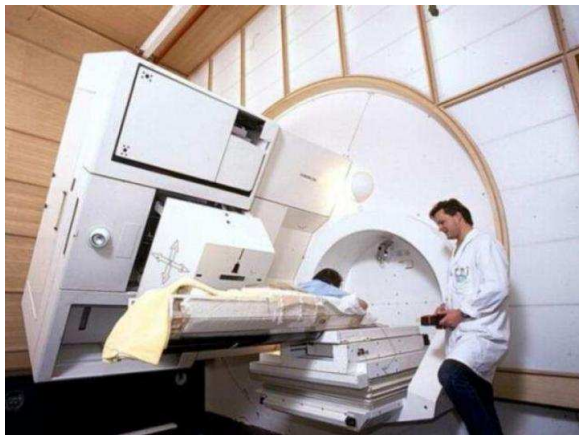
# CMS-Detektor



© Bernabè-CERN, 2004



# Technologietransfer



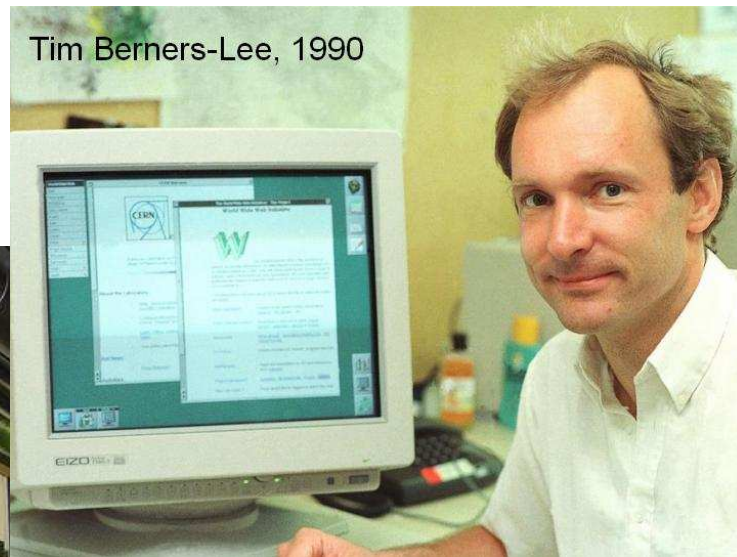
# Technologietransfer



# Technologietransfer



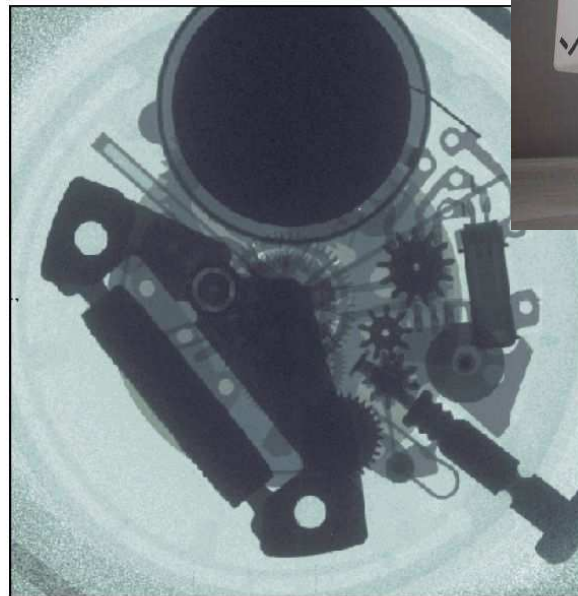
- World Wide Web



# Technologietransfer



- Medipix-Kamera

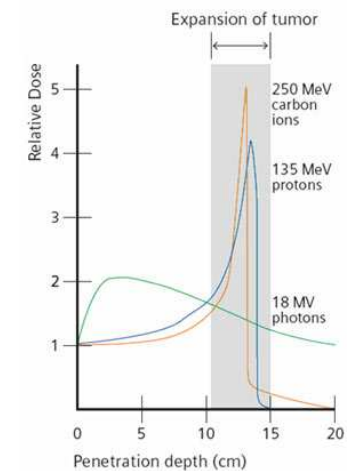




# Technologietransfer



- Teilchenbeschleuniger in der Medizin



# Technologietransfer



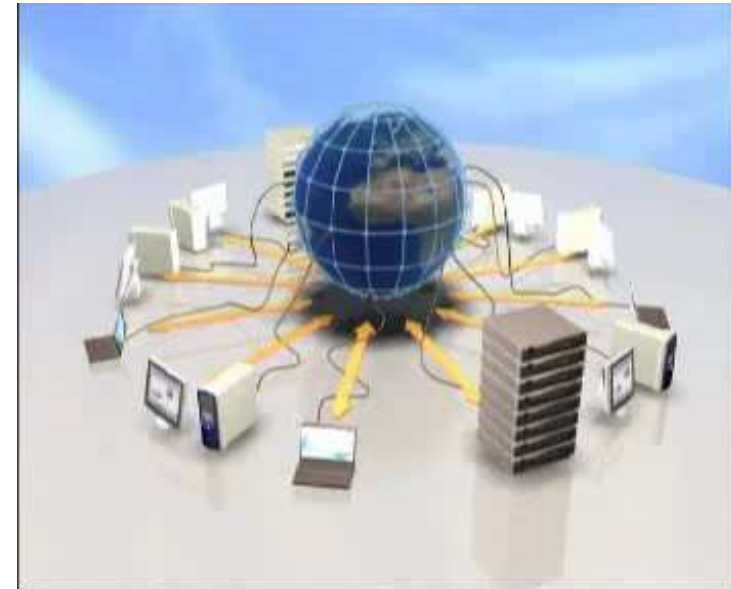
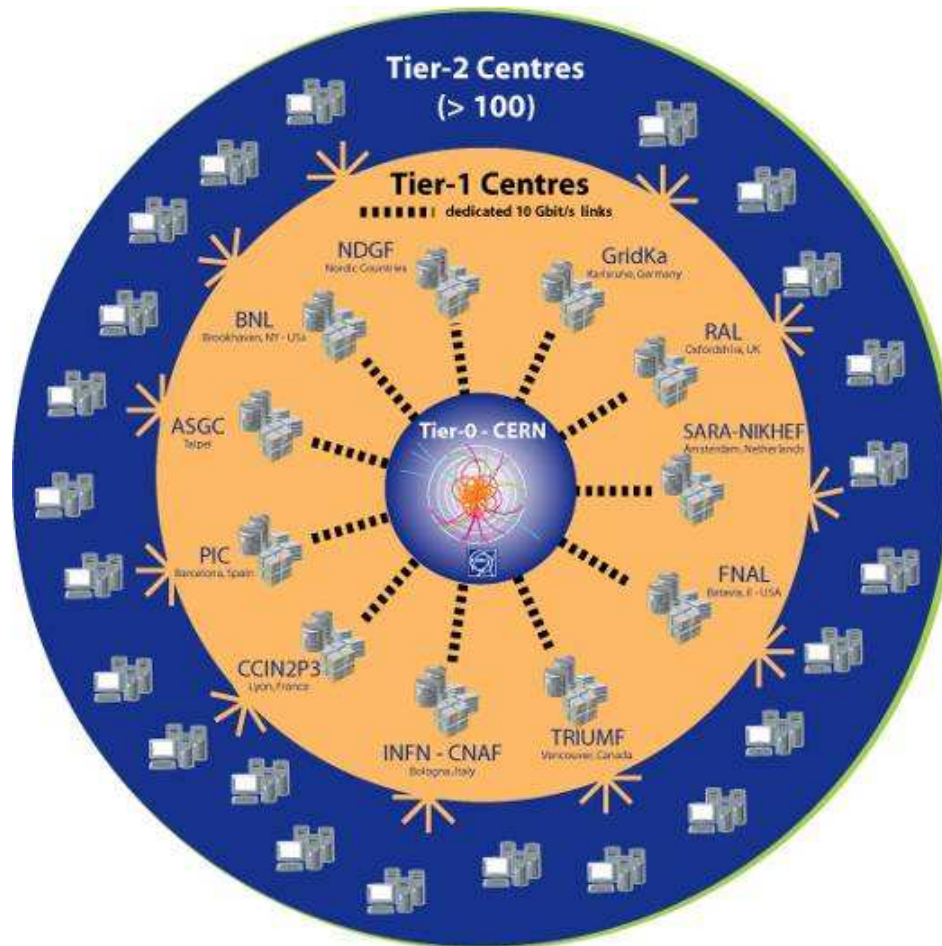
- Teilchenbeschleuniger in der Industrie
  - Polymerisation von Kunststoffen
  - Sterilisierung von Lebensmitteln und medizinischen Geräten
  - Dotieren von Halbleitern
  - Werkstoffüberprüfung



# Technologietransfer



- Das Grid





# Large Hadron Rap

