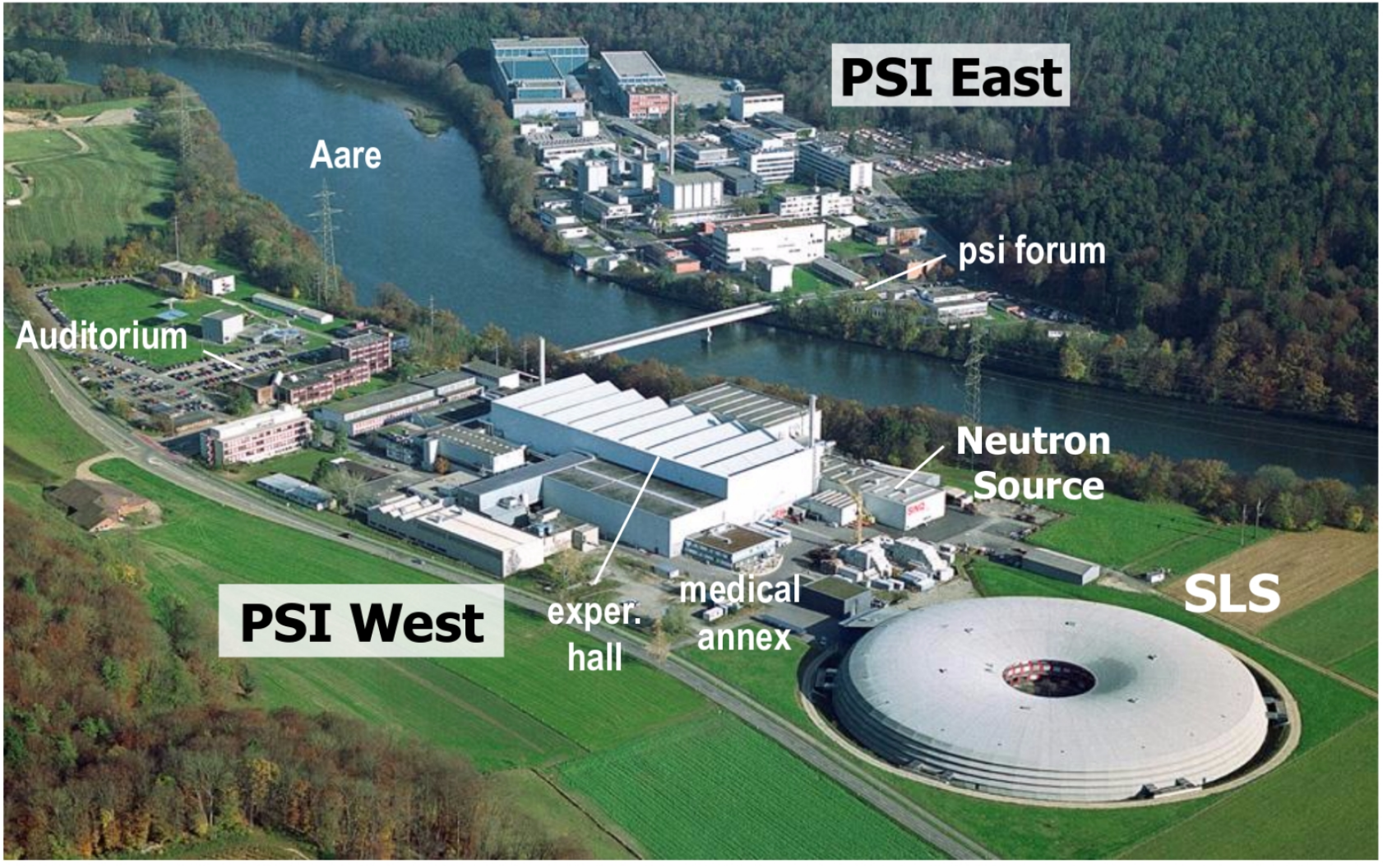
The Swiss Light Source (SLS)

Aerial View



SLS Strategy

Quality

- high brightness , small emittance,
  ➡ large circumference with many magnets

Flexibility

- large spectral range (VUV to hard x-rays)
- straights of 4 m, 7 m and 11 m => choice for undulators

Stability

- separation of building structure from floor
- stable temperature in tunnel and experimental hall
- positioning of the magnets on rigid girders
- fast orbit feedback (up to 100Hz)
  with high accuracy (< 0.5 µm)
- constant beam current with **top-up injection** (every 2 min)
  ➡ constant heatload on optical components

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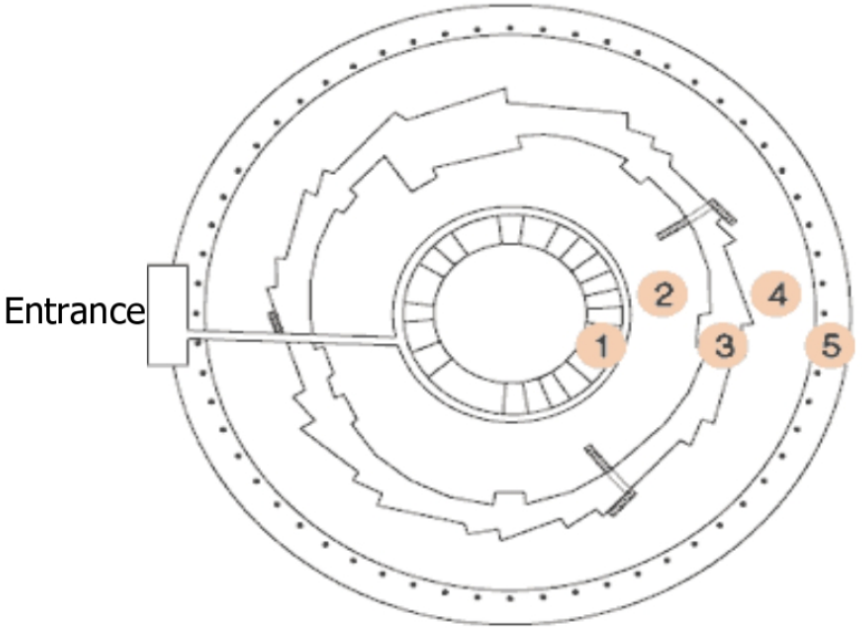
SLS-Components

Accelerators

- Electron gun 90 keV
- LINAC 100 MeV
- Booster, 3 Hz 0.1-2.4 GeV
- Storage Ring, 288m 2.4 GeV

Beamlines

- Protein Cristallography
- Material Sciences
- Surface Microscopy
- Surface Spectroscopy
- environment sciences



Building Concept

- separate annular Ring (40 cm) for Floor of Tunnel und Beam Lines (Zones 3, 4)

  => decouples Tunnel and Exp. Floor from Rest of Building

- very stable Temperatures in Tunnel und Hall

=> stable Conditions for Electron Beam and Beam Lines

Zones:

1. Office Building (3 Floors)
2. Technical Galery
3. Tunnel (Storage Ring, Linac and Booster)
4. Area for Beam Lines
5. Outer Ring (60 Columns, Air Inlet System)

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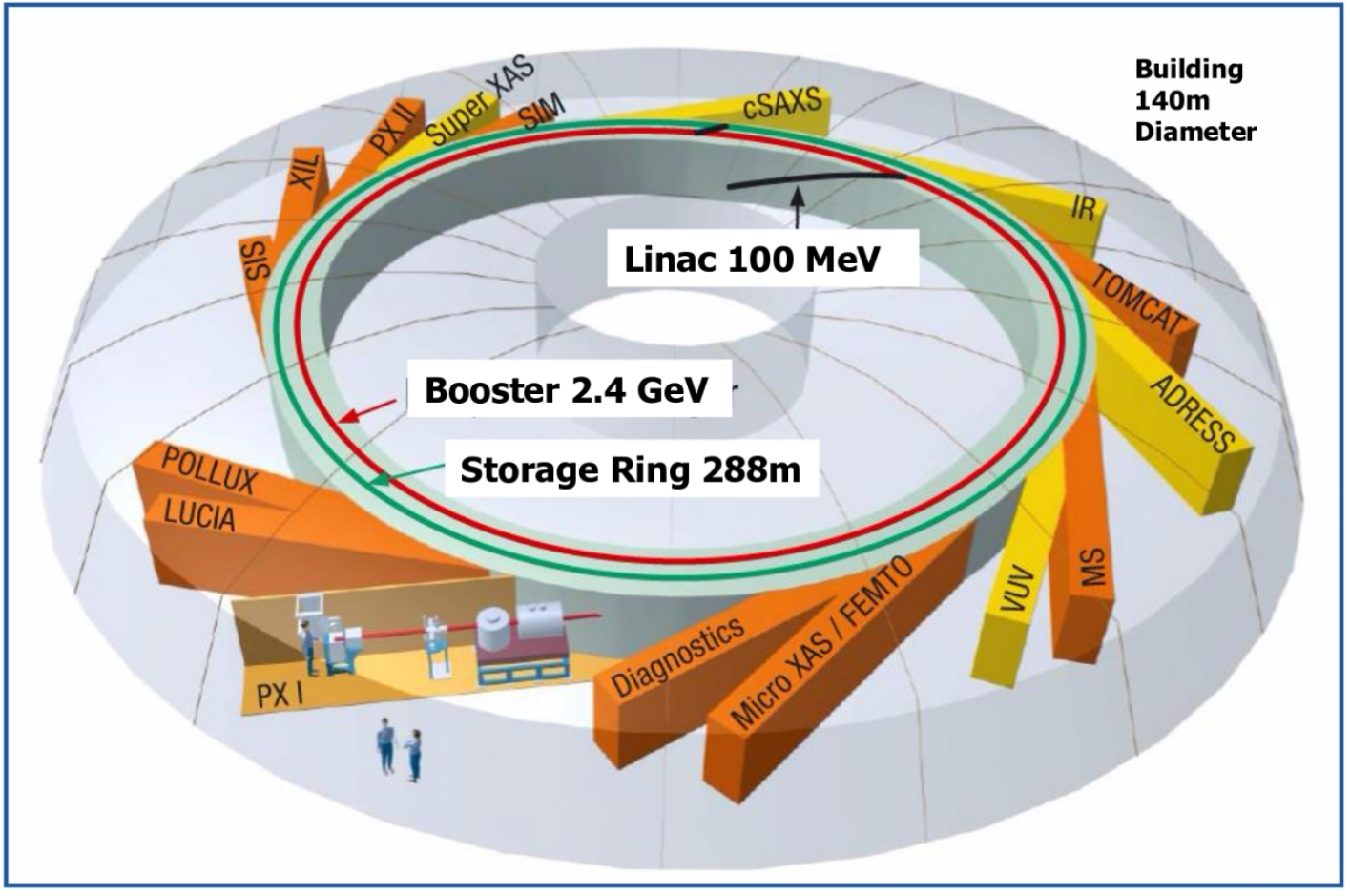
SLS Layout



Accelerator Components

- 600 Magnets
- 300 Vacuum Pumps
- 150 Beam Monitors
- 5 RF Cavities
- 600 m Vacuum Tubes
- 50 km Power Cables
- 500 km Signal Cables
- 3 MW Power Consumption

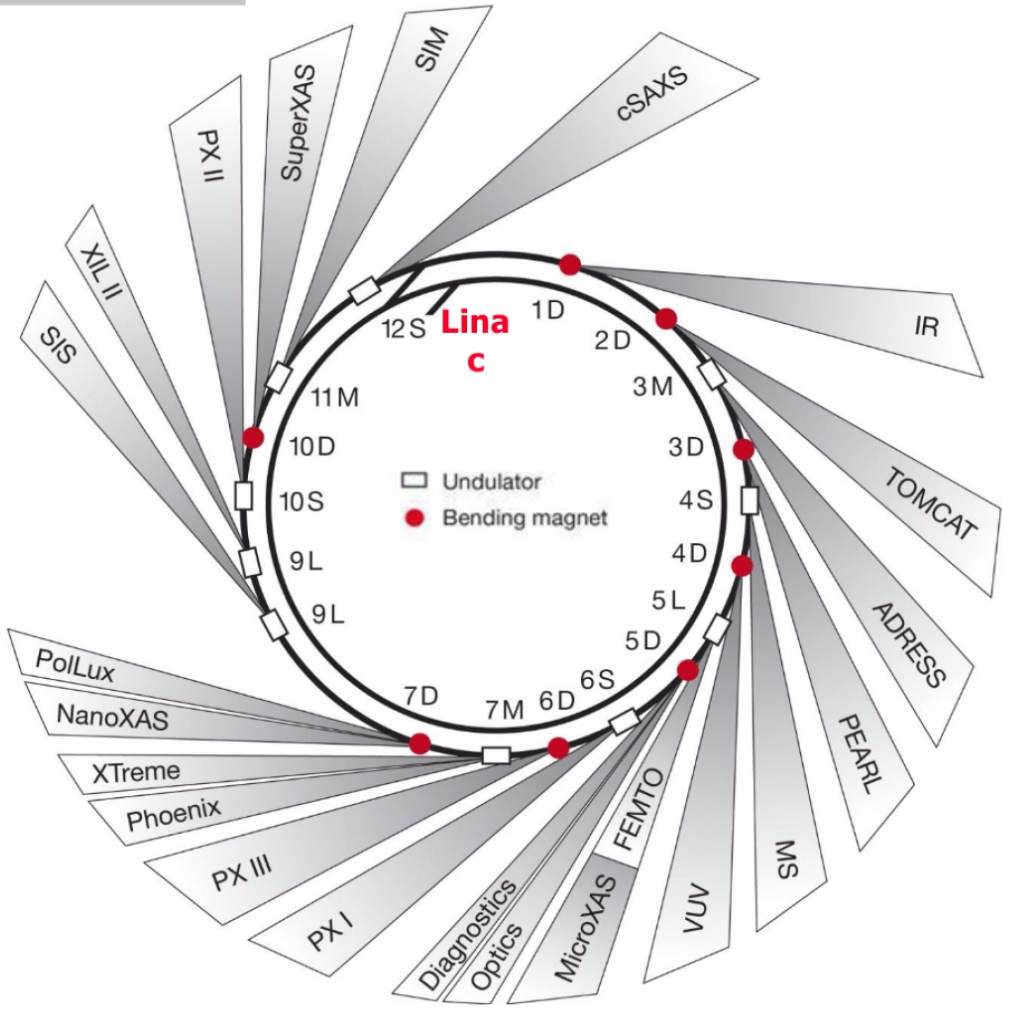
SLS Beamlines

21 Beamlines in Operation:

10 with Undulators

3 from Superbends

8 from Dipoles



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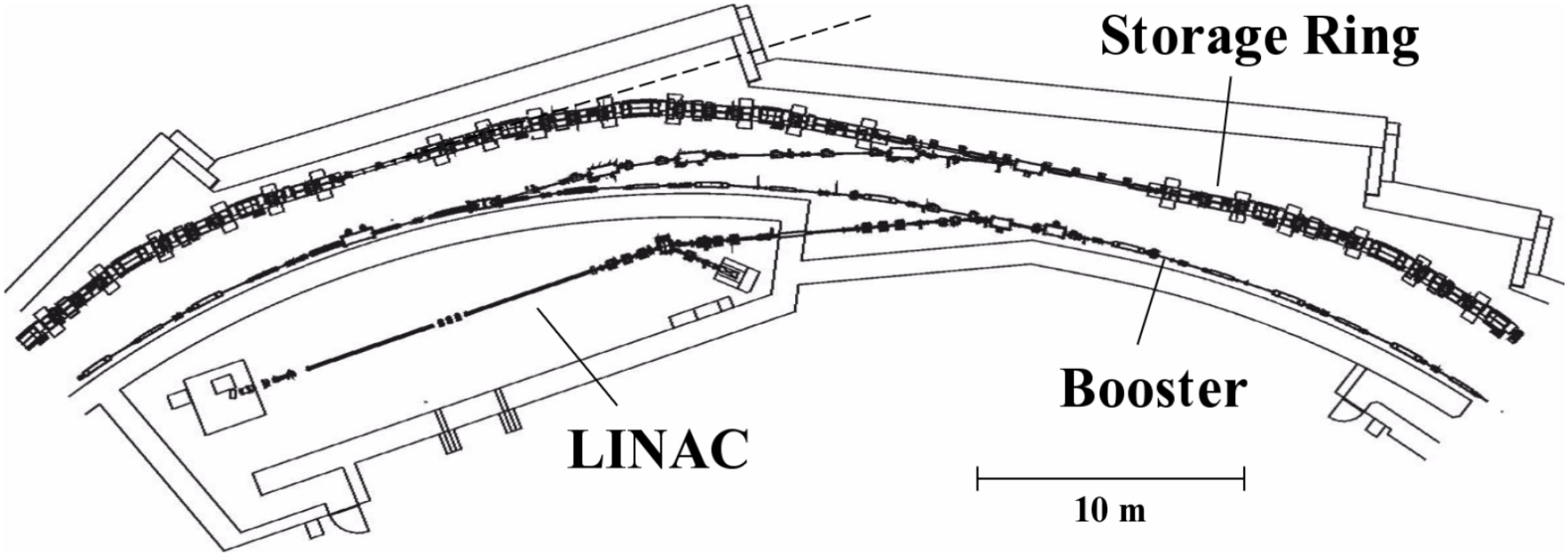
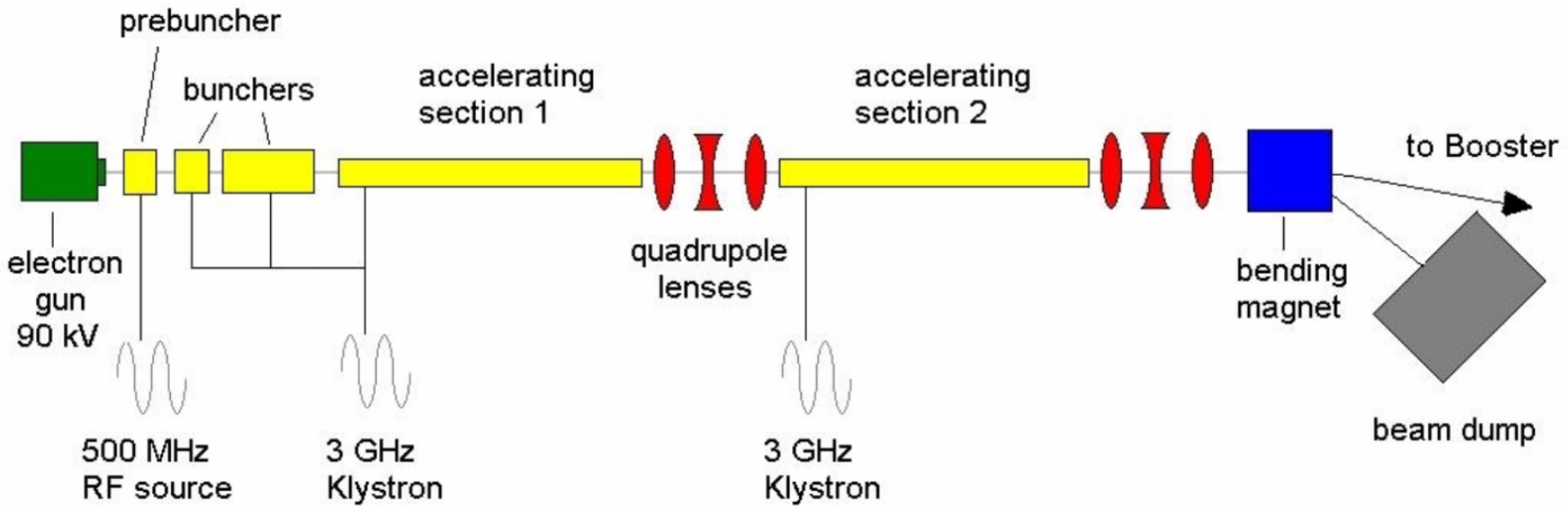
Injection Region



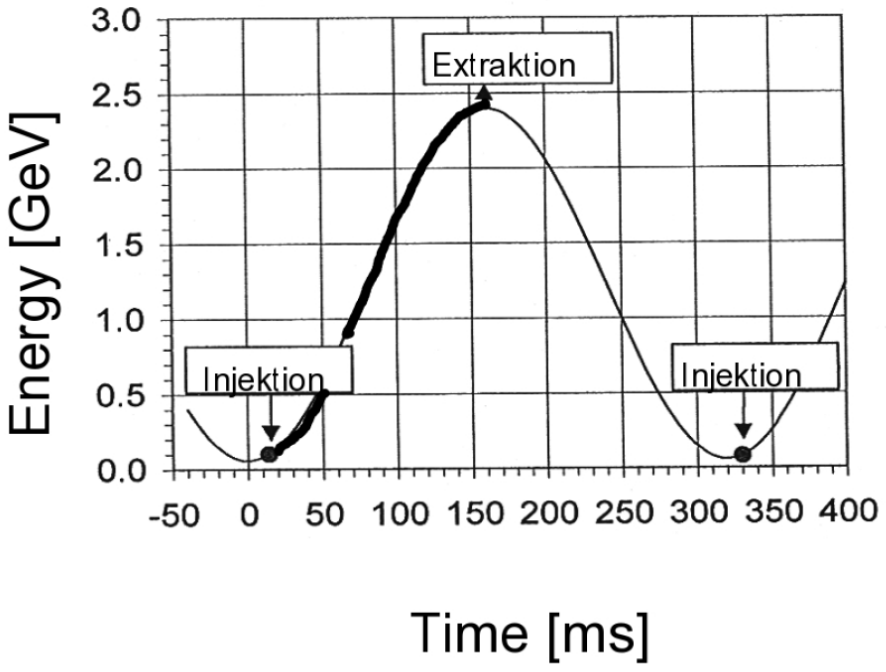
Layout 100 MeV Linac

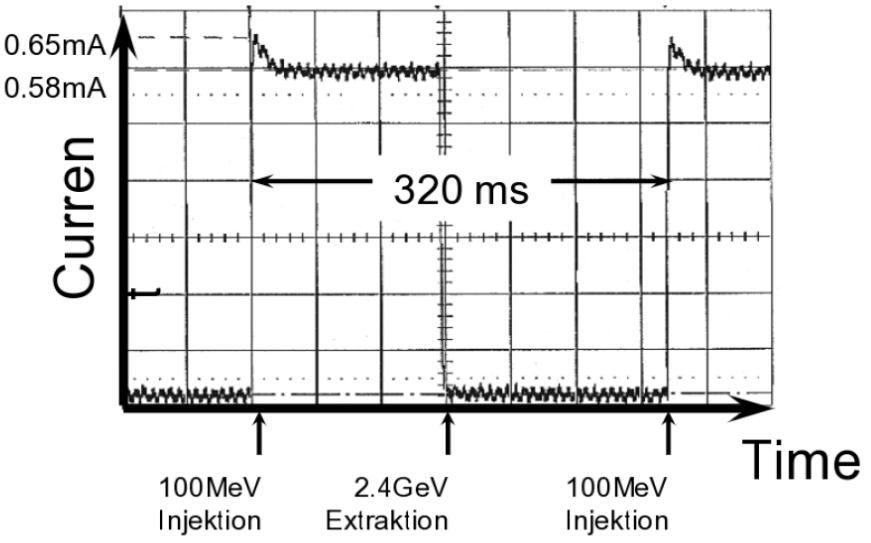


Booster Specialty

- Booster in same Tunnel as Storage Ring
- => large Circumference => small Emittance
- efficient Injection into Storage Ring, filling in 6 min.
- compact, economic Magnets
- simple Vacuum Chamber (30 x 20 mm)
- Top-up Injection
- short refill every 2-3 min. => constant Beam Current
- => stable Temperatures on optical Components
- Energy Consumption < 20 kW

Acceleration in Booster

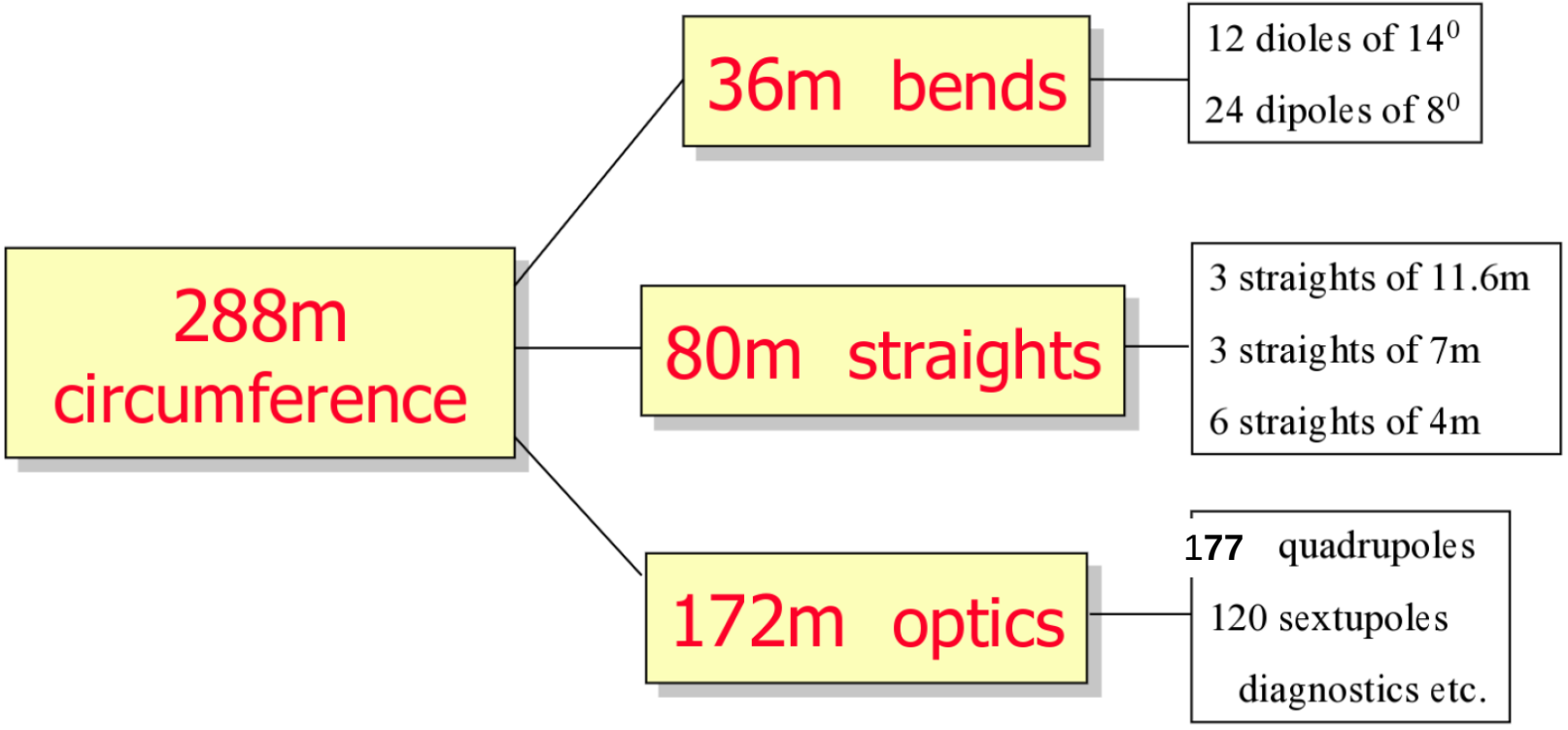




Parameter of 2.4 GeV Storage Ring

circumference	288 m
12 straights	3x11.7m, 3x7m, 6x4m
current	400 mA
emittance	5 nm
lattice	Triple Bend Achromat
tunes Q_x , Q_y	20.44 , 8.74
momentum compaction	$0.6 \cdot 10^{-3}$
RF frequency	500 MHz
peak RF voltage	2.6 MV
radiation loss / turn	500 keV
energy spread (rms)	$9 \cdot 10^{-4}$
damping times (x, y, E)	9 , 9 , 4.5 ms

Allocation of space for Storage Ring



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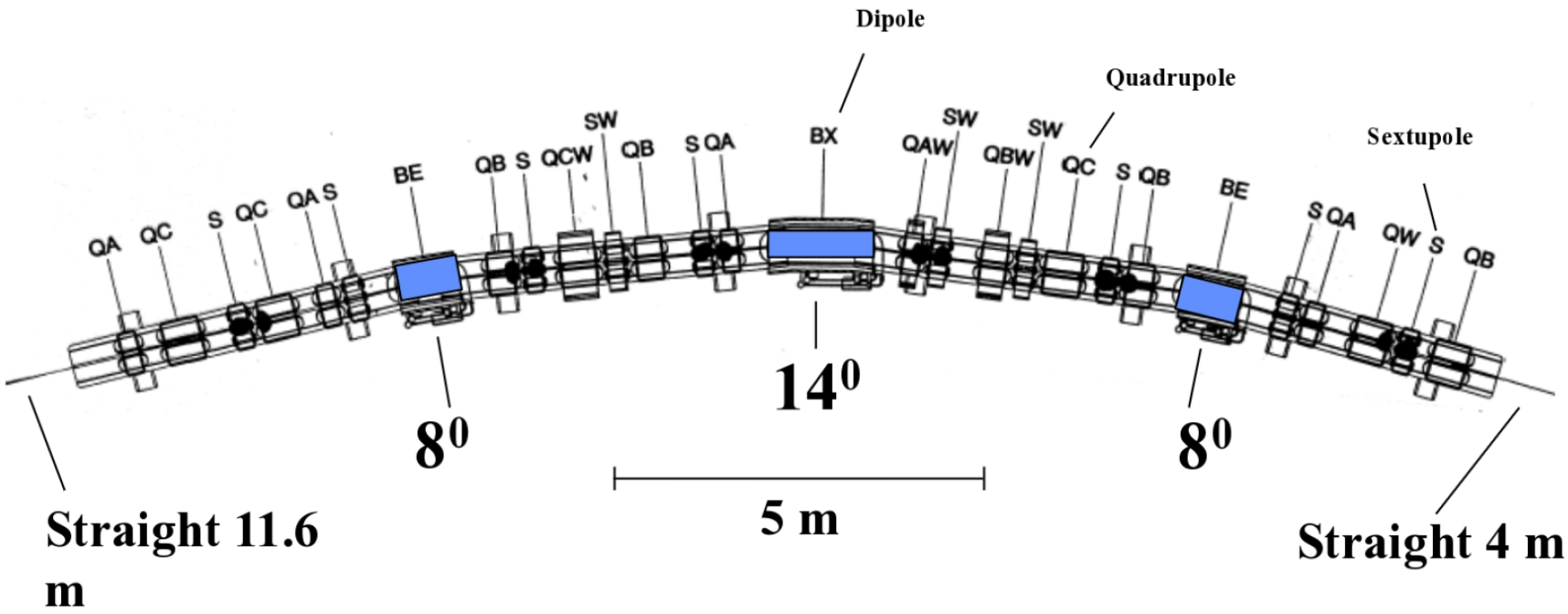
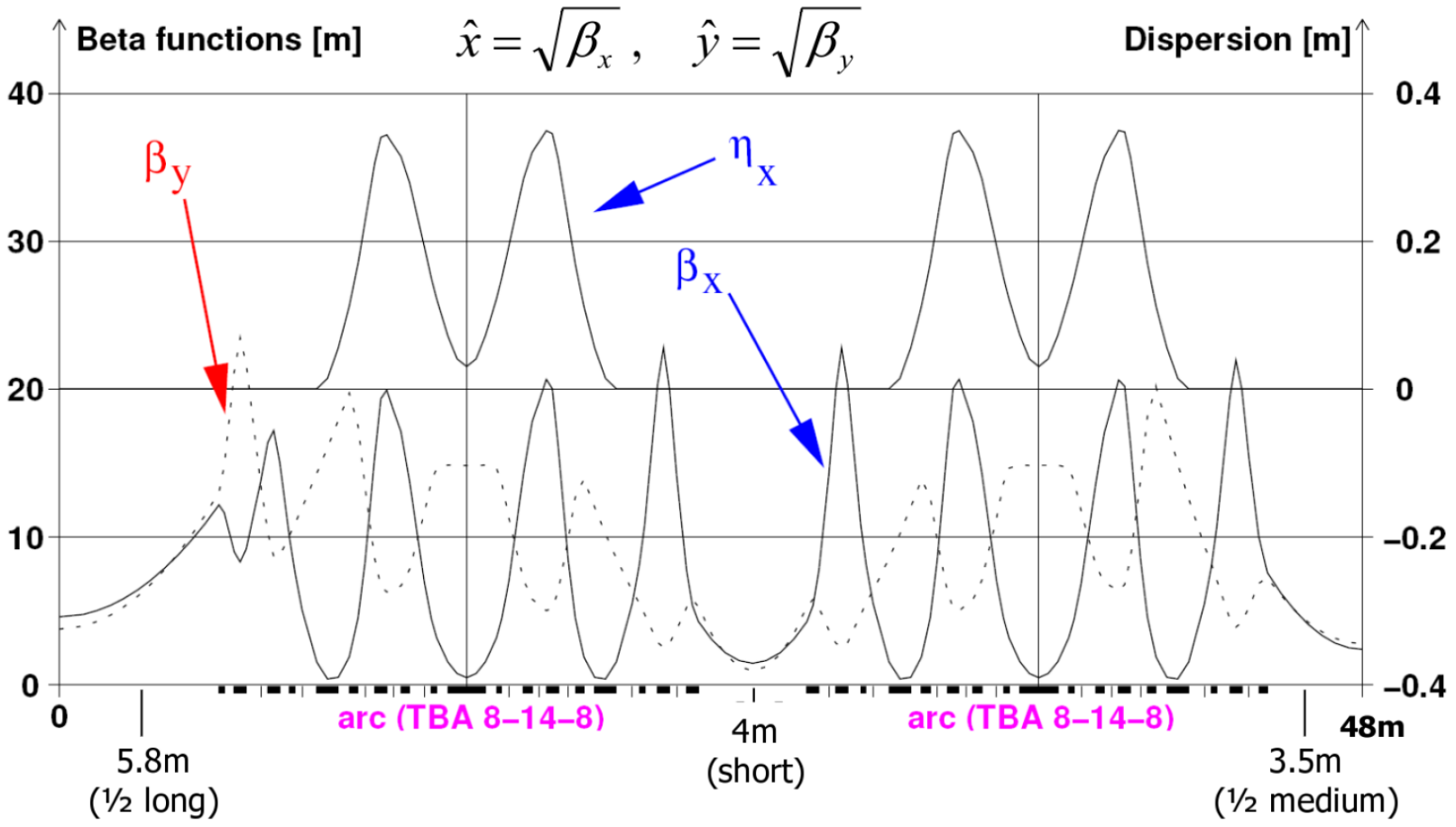
SLS 30^0 Arc



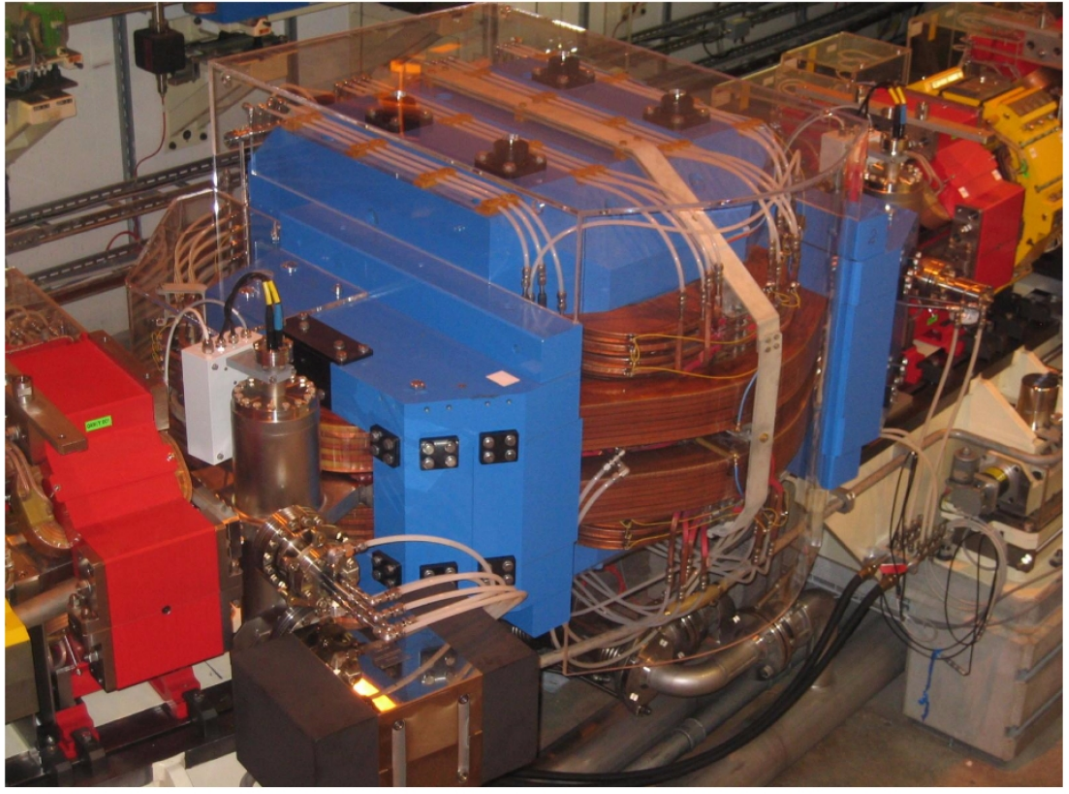
TBA-lattice

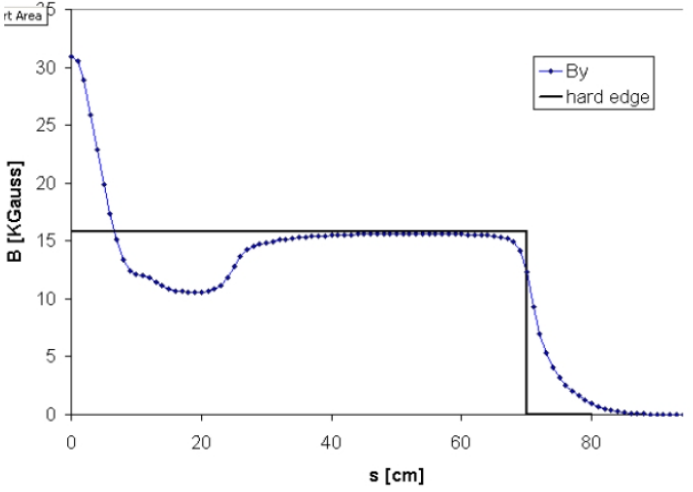
(**T**riple **B**end **A**chromat)

Lattice functions over 2 arcs à 30^0



Superbend



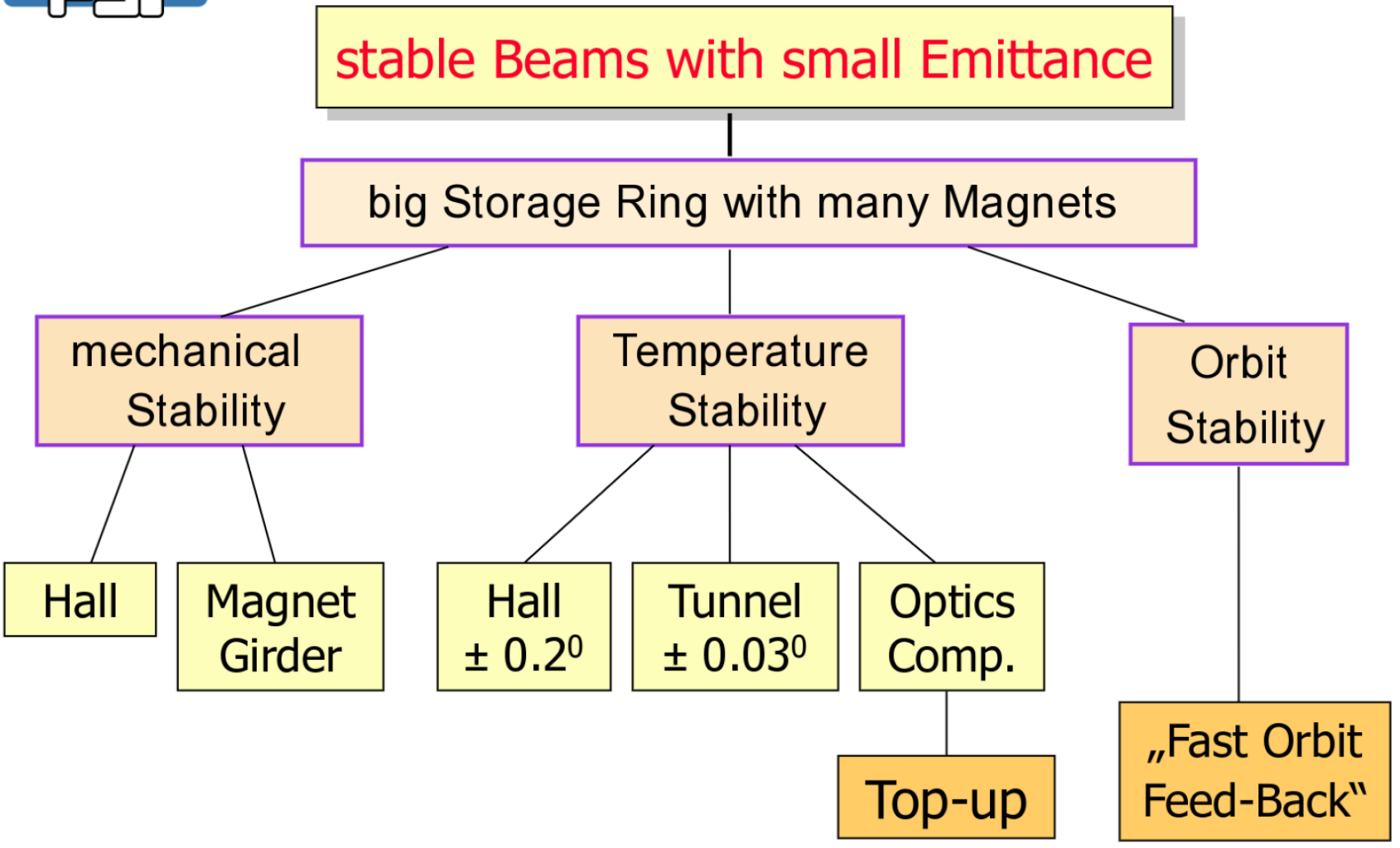


bending angle 14^0

center cone with 3 T

critical energy = 11.5 keV

end regions with 1.5 T


stable Beams with small Emittance
big Storage Ring with many Magnets
mechanical Stability
Temperature Stability
Orbit Stability
Hall
Magnet Girder
Hall ± 0.2⁰
Tunnel ± 0.03⁰
Optics Comp.
Top-up
„Fast Orbit Feed-Back"

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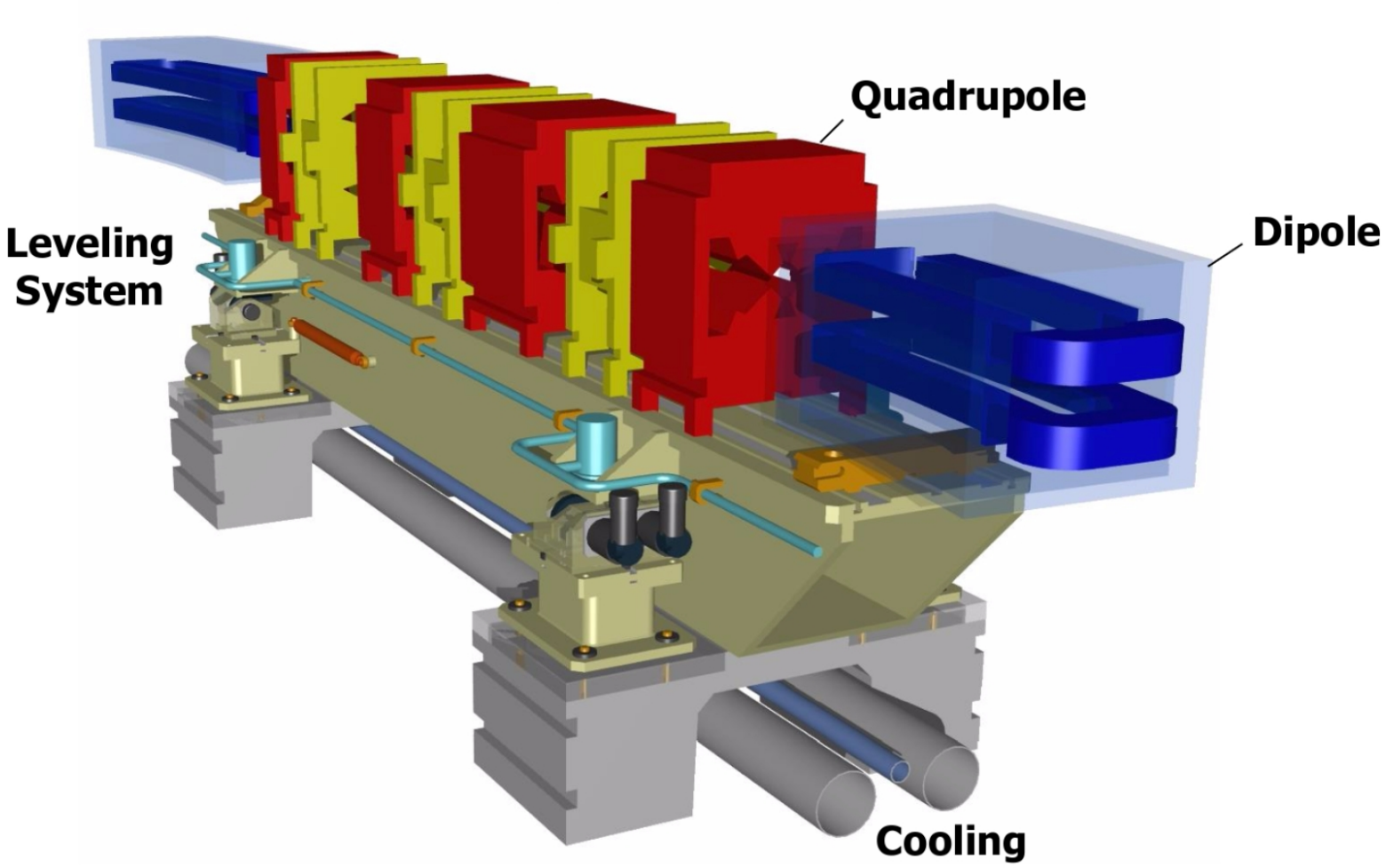
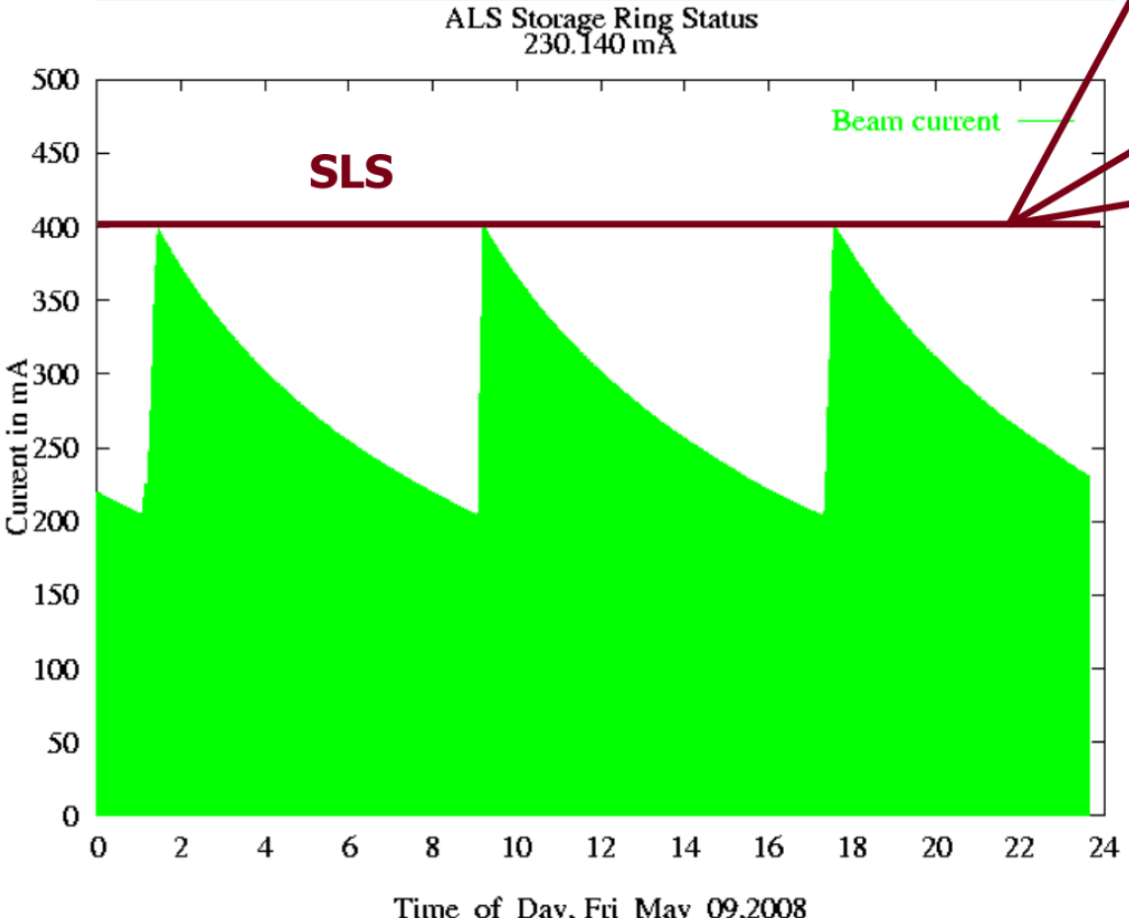
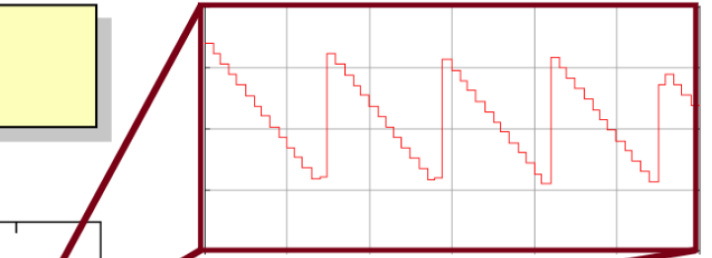
SLS Girder



Lifetime vs. Top-up Injection





ALS (Berkeley , California):

Lifetime ~ 10 h ,

Refilling every 8 h

Current: **400 => 200 mA**

SLS (in 2008):

Lifetime ~8 h ,

not relevant !

top-up every 2.5 min.

Current: **402 => 400 mA**

SLS Summary (A.Streun)