



# PETRA III at DESY Hamburg/Germany



16 October 2003

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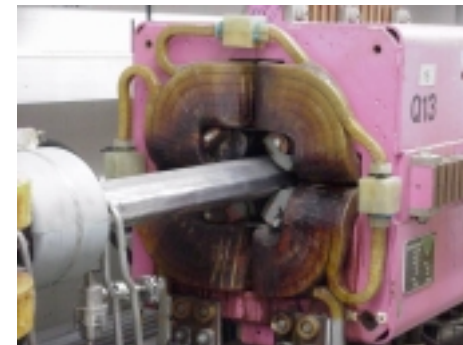
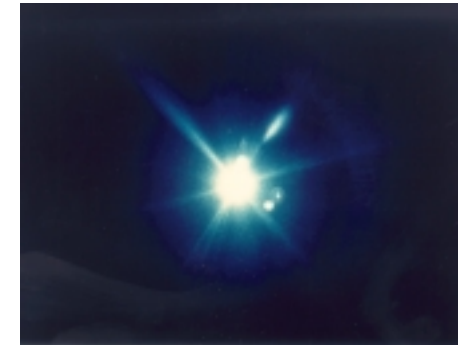
# PETRA III at DESY Hamburg/Germany

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# PETRA as a New High Brilliance Synchrotron Radiation Source

- DESY plans to convert the PETRA II storage ring, which is now used as a proton/lepton preaccelerator to HERA and as a synchrotron radiation source for HASYLAB, into a new high brilliance third generation synchrotron radiation source.
- Make use of existing hardware whenever possible
- **To ensure reliable machine operation**
  - New vacuum system (decoupling of chamber and quads)
  - Installation of more correctors and beam position monitors
  - Replace radiation damaged coils of magnets
  - New coupled bunch feedback system
  - Etc.
- ➔ **Modernize rf system**

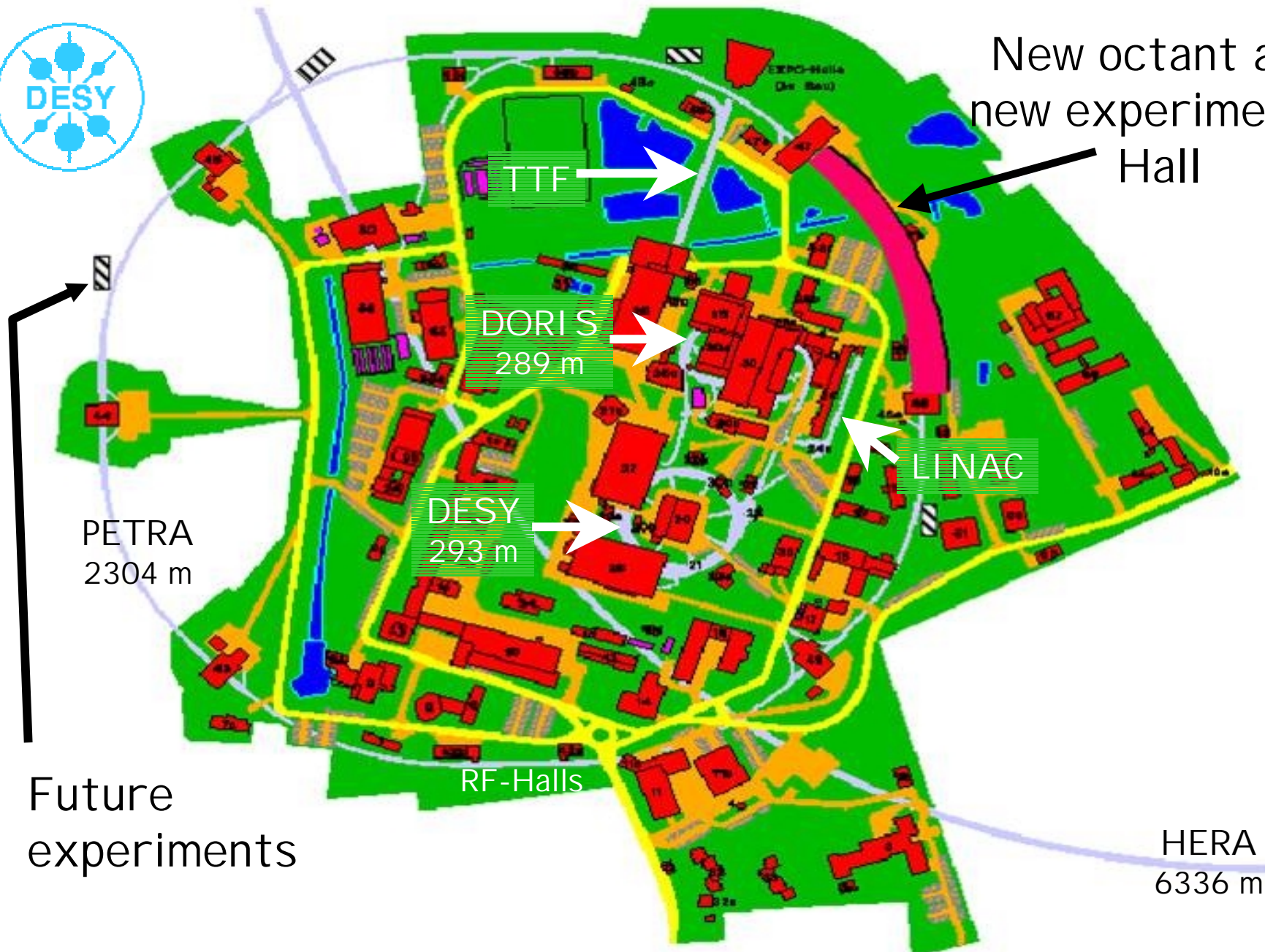




# Schedule

An aerial photograph of the DESY facility, showing various buildings, green spaces, and a large pond. A yellow dashed line traces a path that starts at the top left, curves around the central buildings, and ends at the bottom right. A yellow shaded area highlights a specific section of the facility, likely the PETRA storage ring.

**preliminary design study May 2001**  
**completion of CDR beginning 2004**  
**approval of project in 2004**  
**final design of components and**  
**ordering of hardware in 2005/2006**  
**rebuilding of PETRA in 2007**  
**start of operation in 2008**

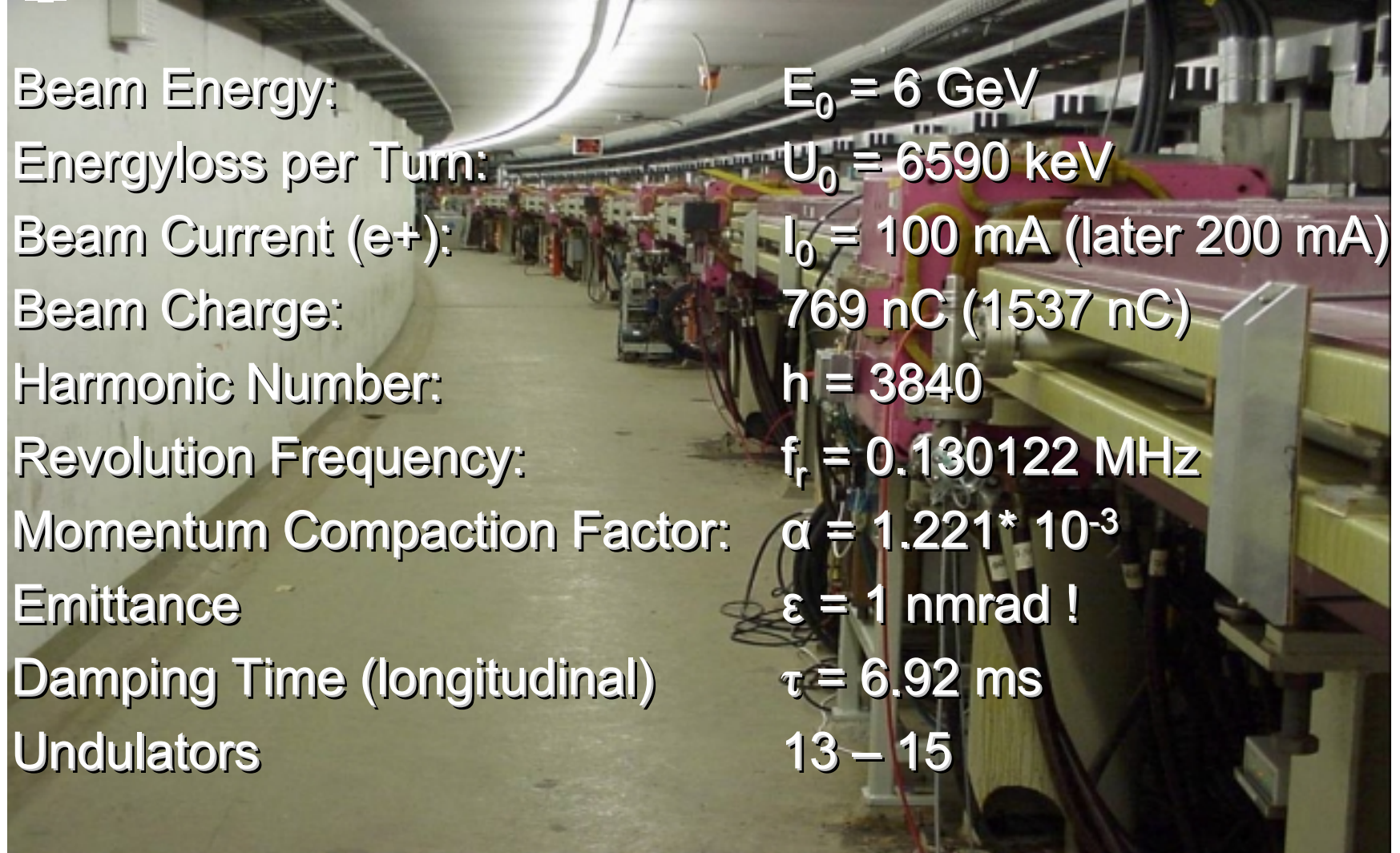


New octant and  
new experimental  
Hall

Future  
experiments




# Machine Parameter of PETRA III

A photograph showing the interior of the PETRA III synchrotron tunnel. The tunnel is long and narrow, with a curved ceiling and walls. The floor is concrete. On the right side, there are various pieces of equipment, including what appears to be a large yellow and pink structure, possibly a beamline component. The lighting is bright, coming from overhead fixtures.

Beam Energy:	$E_0 = 6 \text{ GeV}$
Energyloss per Turn:	$U_0 = 6590 \text{ keV}$
Beam Current (e <sup>+</sup> ):	$I_0 = 100 \text{ mA}$ (later 200 mA)
Beam Charge:	769 nC (1537 nC)
Harmonic Number:	$h = 3840$
Revolution Frequency:	$f_r = 0.130122 \text{ MHz}$
Momentum Compaction Factor:	$\alpha = 1.221 \cdot 10^{-3}$
Emittance	$\epsilon = 1 \text{ nmrad !}$
Damping Time (longitudinal)	$\tau = 6.92 \text{ ms}$
Undulators	13 – 15



# RF - System of PETRA III

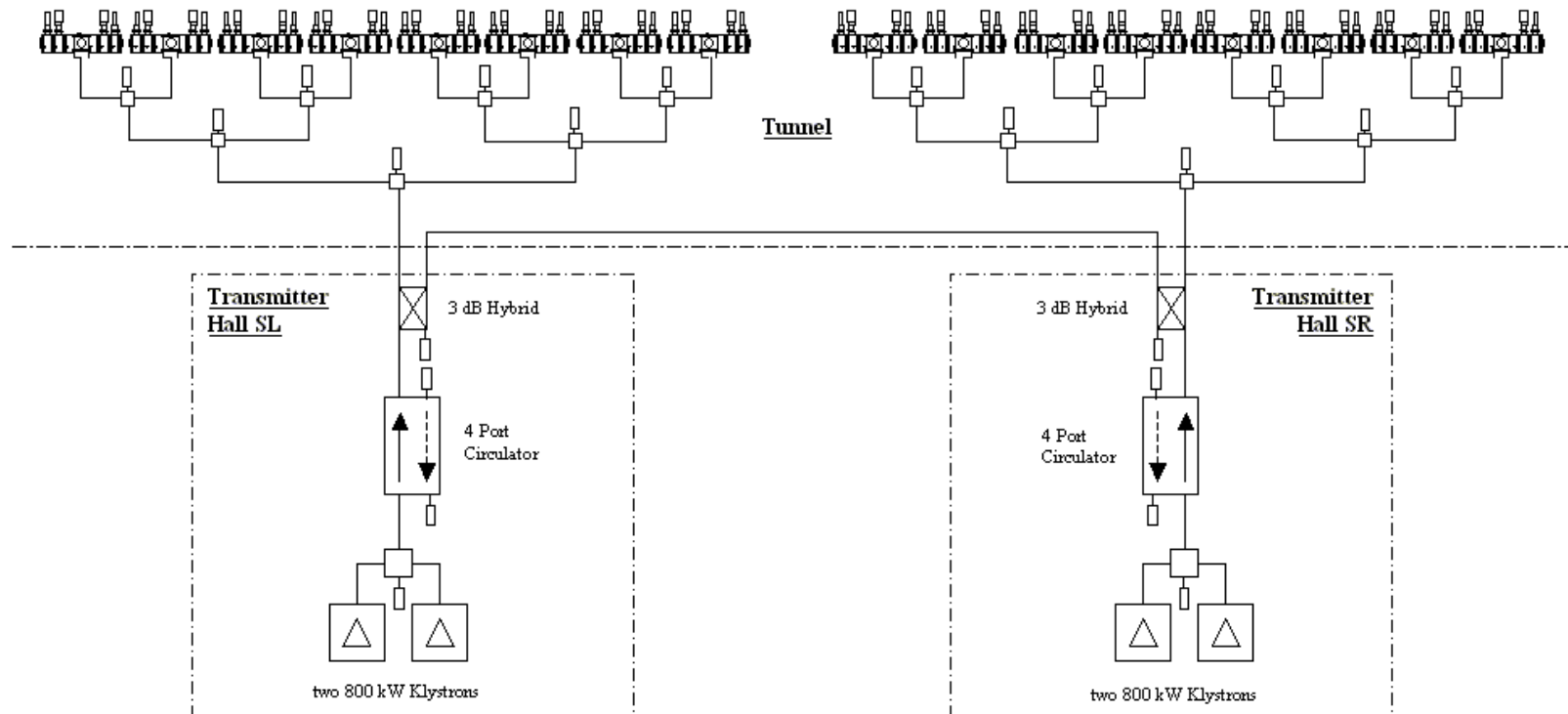
A photograph of the PETRA III tunnel, showing the complex infrastructure of the synchrotron. The tunnel is filled with various pieces of equipment, including cables, pipes, and structural supports. The lighting is dim, with some overhead lights illuminating the scene.

Frequency:  $f_{\text{RF}} = 499.66 \text{ MHz}$   
Synchrotron Frequency:  $f_s = 6.31 \text{ kHz}$   
Circumferencial Voltage:  $U_c = 20 \text{ MV}$   
Shunt-Impedance of  
one 7-cell cavity:  $R_s = 23 \text{ M}\Omega$   
Beam Power:  $P_{\text{beam}} = 659 \text{ kW (1318 kW)}$   
+ HOM-losses



# Existing RF-System of PETRA

2 \* 8 7-cell cavities, normalconductive







# scenarios

max. 150 kW per coupler

Number of installed 7-Cell Cavities	Coupling Factor for Matching @100mA	Power Transmission per Coupler [kW]	Required Transmitter Power @ 20MV, 100mA [kW]	Max. Beam Current with one Transmitter @1440 kW [mA]
2 x 8	2.4	81	2 x 690	107
2 x 7	2.2	99	2 x 731	97
<b>2 x 6</b>	<b>2.0</b>	<b>124</b>	<b>2 x 786</b>	<b>83</b>
<b>2 x 5</b>	<b>1.9</b>	<b>163</b>	<b>2 x 863</b>	<b>63</b>
2 x 4	1.7	230	2 x 978	31

Some more ideas:

- superconductive cavities
- single-cell cavities
- IOTs



## Conclusion

- Many decision are not yet made
- New LLRF (phase loops, ...) in I/Q-technique (DSP)
- Redesign of control system
- Slow archiving and trip-diagnostic is needed

### **But:**

Final design is limited by costs, time and manpower



Thank You!  
Any ideas?  
Questions?

