# PETRA III at DESY
# Hamburg/Germany

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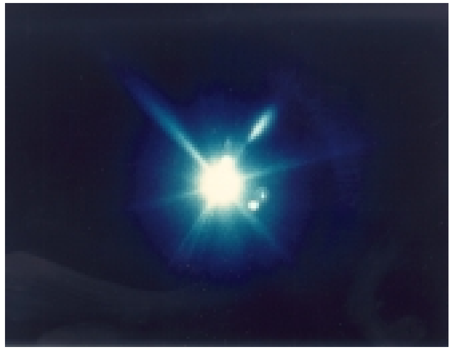
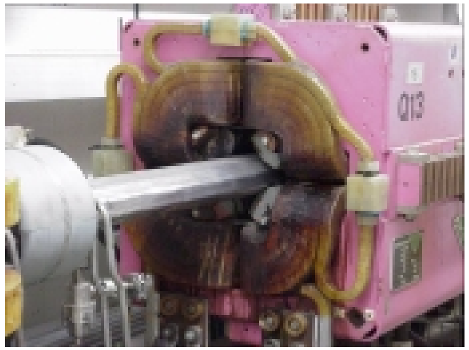
- Introduction
- Schedule
- Overview
- Parameter
  - Machine
  - RF-System
- Scenarios
- Conclusion

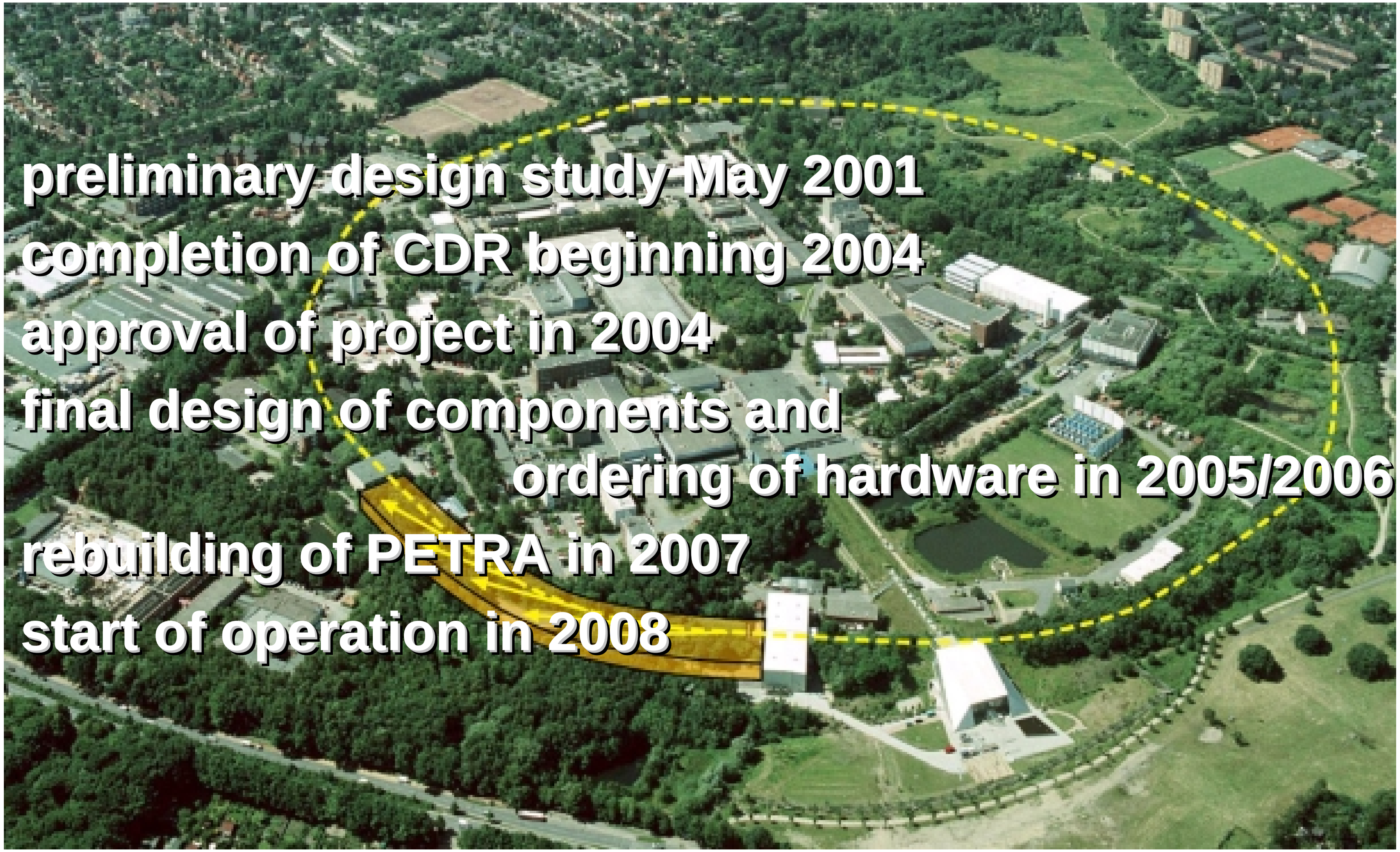
# PETRA as a New High Brilliance Synchrotron Radiation Source



- 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**

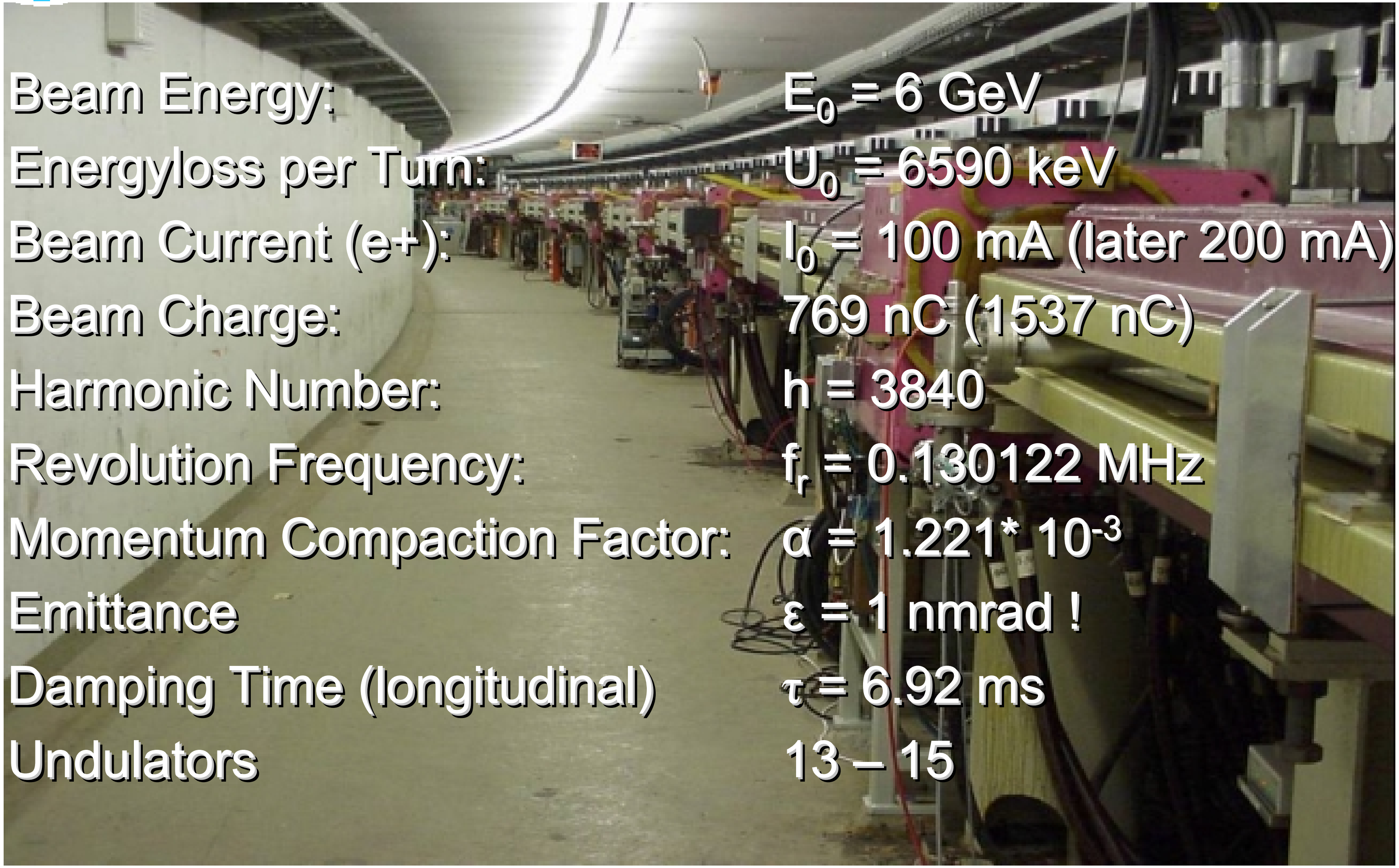


# Schedule


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

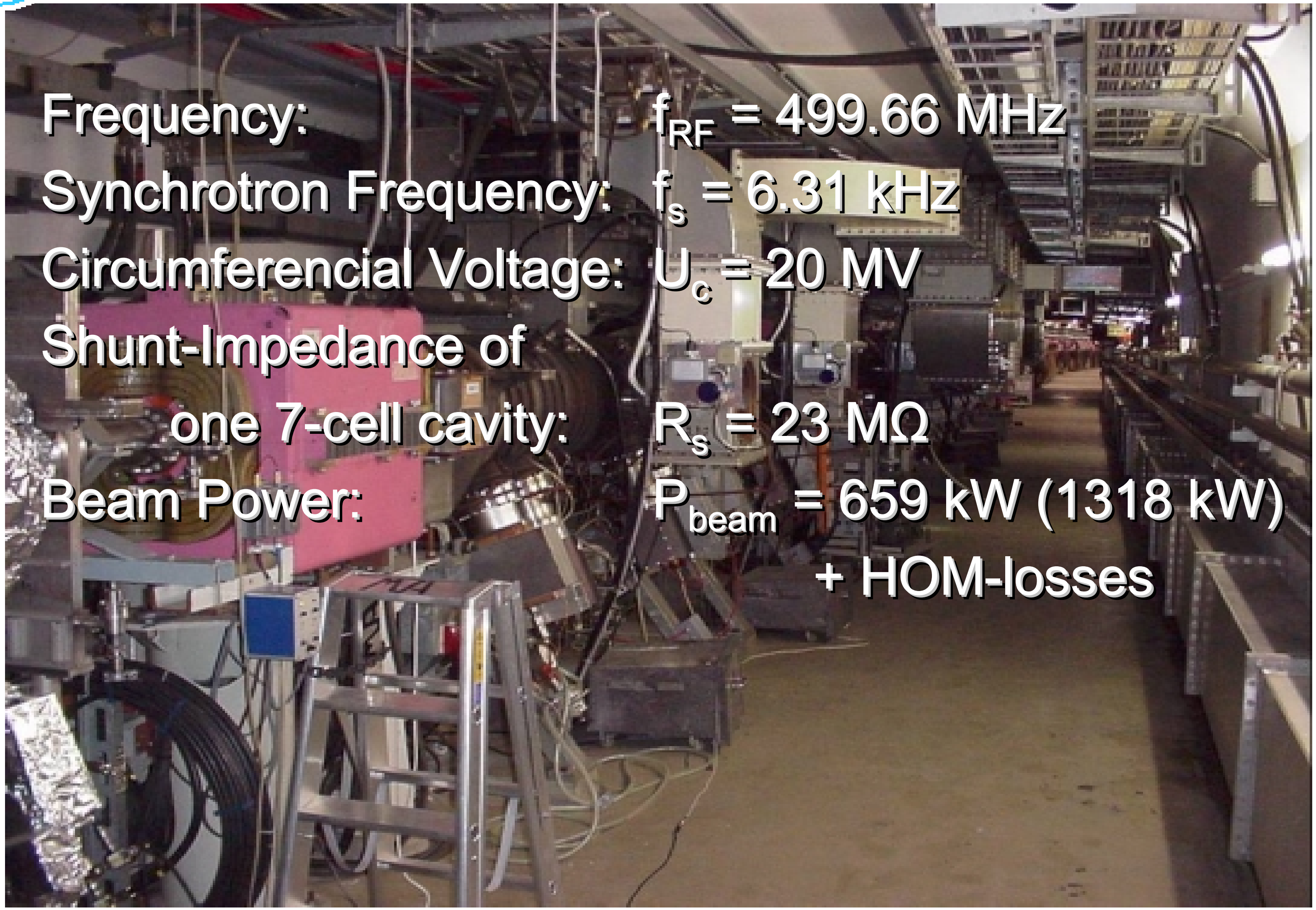

New octant and new experimental Hall
TTF
DORIS
289 m
LINAC
DESY
293 m
PETRA
2304 m
RF-Halls
HERA
6336 m
Future experiments

# Machine Parameter of PETRA III



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

# RF – System of PETRA III



Frequency: $f_{RF}$ = 499.66 MHz

Synchrotron Frequency: $f_s$ = 6.31 kHz

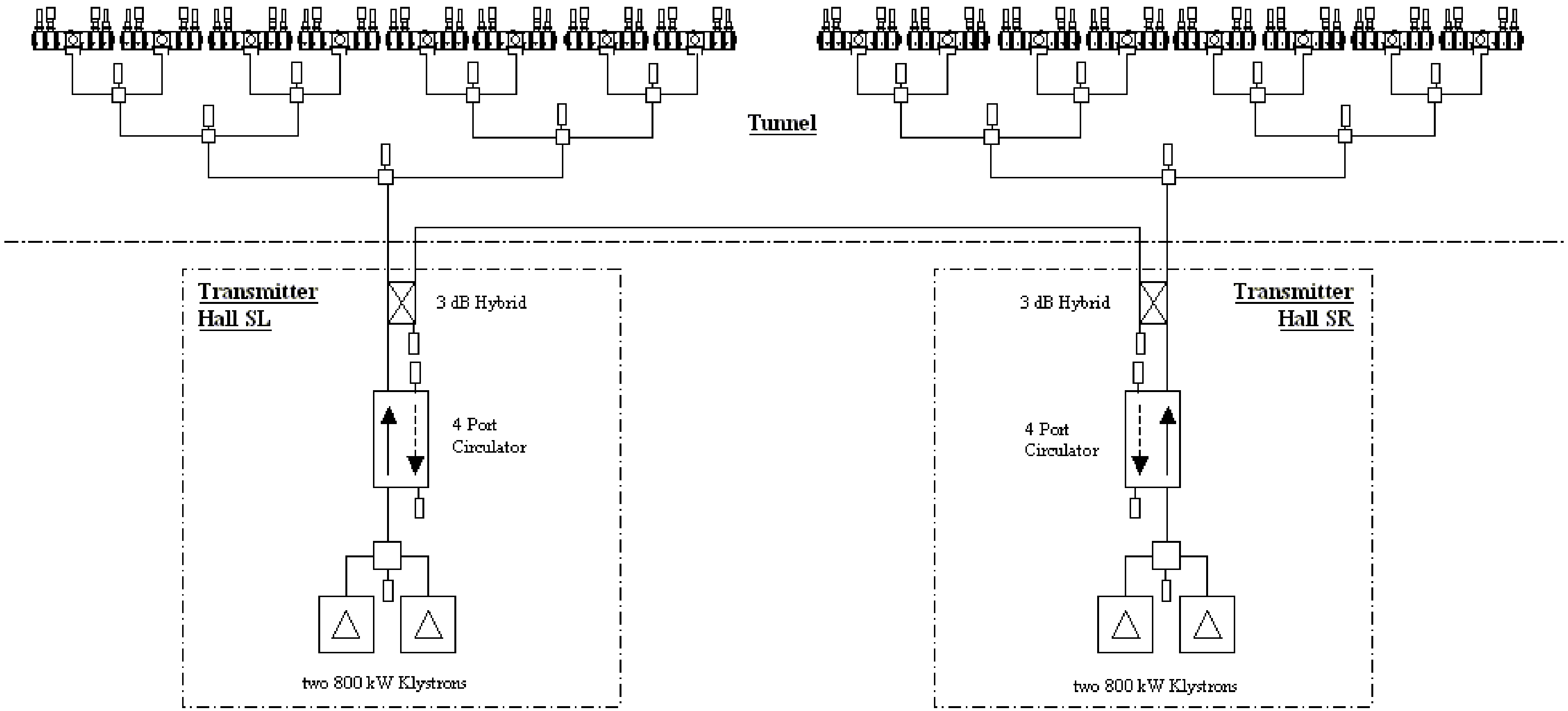
Circumferencial Voltage: $U_c$ = 20 MV

Shunt-Impedance of one 7-cell cavity: $R_s$ = 23 MΩ

Beam Power: $P_{beam}$ = 659 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 |
| **2 x 6** | **2.0** | **124** | **2 x 786** | **83** |
| **2 x 5** | **1.9** | **163** | **2 x 863** | **63** |
| 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?