The Undulator Vacuum System

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Undulator Vacuum System

- Length: ~ 30 m
- Gap height: 12 mm
- Inner diameter of the beampipe: 9.5 mm
- Chamber material: Al or Cu coated stainless steel
- Expected average pressure: <10^{-7} mbar → spez. outgassing rate <10^{-11} mbar·l/sec·cm²
- Assembly environment: cleanroom better class 100

Structure of the vacuum system:
- Six undulator vacuum chambers (length: 4.5 m) combined with seven intermediate pieces
- Pumping: 20 l/sec ionpumps at both ends of the undulator vacuum chambers

Beam position monitoring and steering

**Intermediate pieces:**
- Beam position measurement with:
  - Horizontal - vertical wire scanners and horizontal - vertical pickup monitors
- Beam steering with:
  - Remote controlled alignment of the quadrupoles (and correction coils in the quadrupoles)

**Undulator vacuum chambers:**
- Beam position measurement with:
  - Horizontal - vertical pickup monitors integrated at two positions in the vacuum chamber
- Beam steering with:
  - Correction coils integrated in the vacuum chamber only for diagnostic purposes
pick up BPM
steerer
chamber support
beam
pick up BPM
wirescanner
quadrupole
beam
Ion pump
quadrupole alignment system
stretched wire position control system
granite baseplate
Pressure distribution of a 5m long vacuum pipe with pumping at both ends

Effective pumpingspeed (S): 0.5 l/sec
Desorption rate (a): $1 \cdot 10^{-12}$ mbar l/(sec cm$^2$)
Pipe inner diameter: 9.5 mm
Conductance (C): 0.04 l/sec

Average Pressure

$$P_{av} = \frac{a \cdot u \cdot L}{C} \cdot \left( \frac{2 \cdot C}{S} + \frac{1}{3} \right) = 9 \cdot 10^{-9} \cdot \text{mbar}$$

For $S >> C$:

$$P_{av \min} = \frac{a \cdot u \cdot L}{C} \cdot \left( \frac{1}{3} \right) \rightarrow 6 \cdot 10^{-9} \cdot \text{mbar}$$