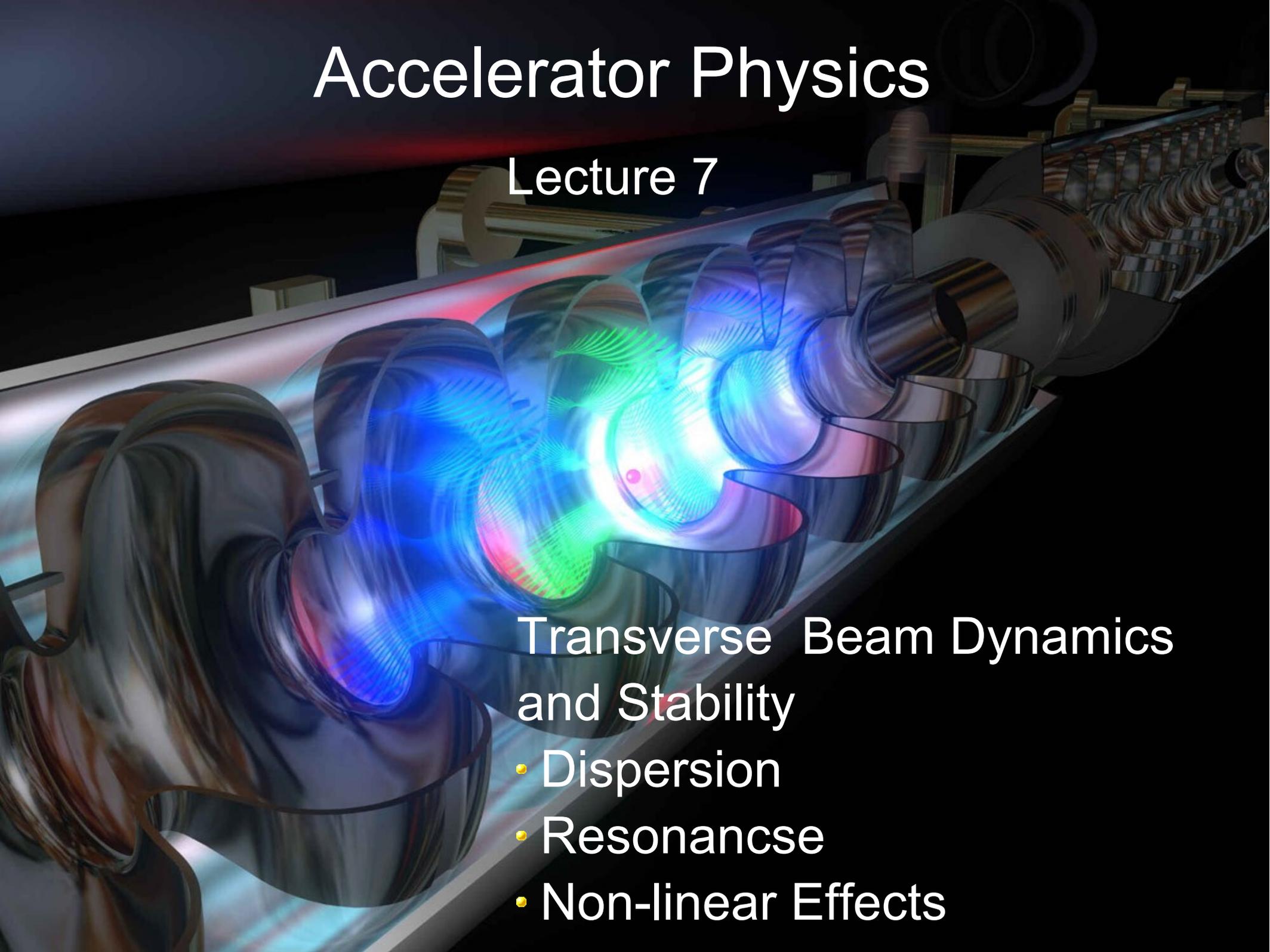


Accelerator Physics

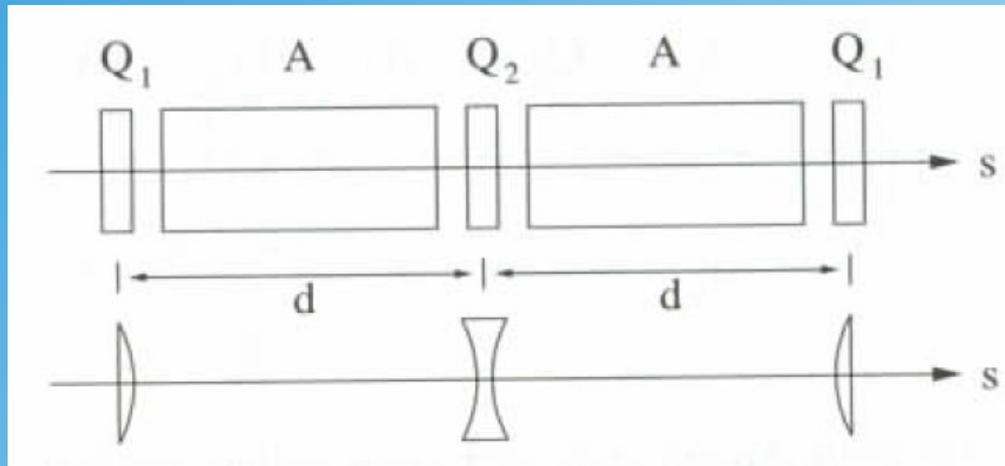
Lecture 7

Transverse Beam Dynamics and Stability

- Dispersion
- Resonance
- Non-linear Effects



FODO element



SPS (CERN) FODO structure

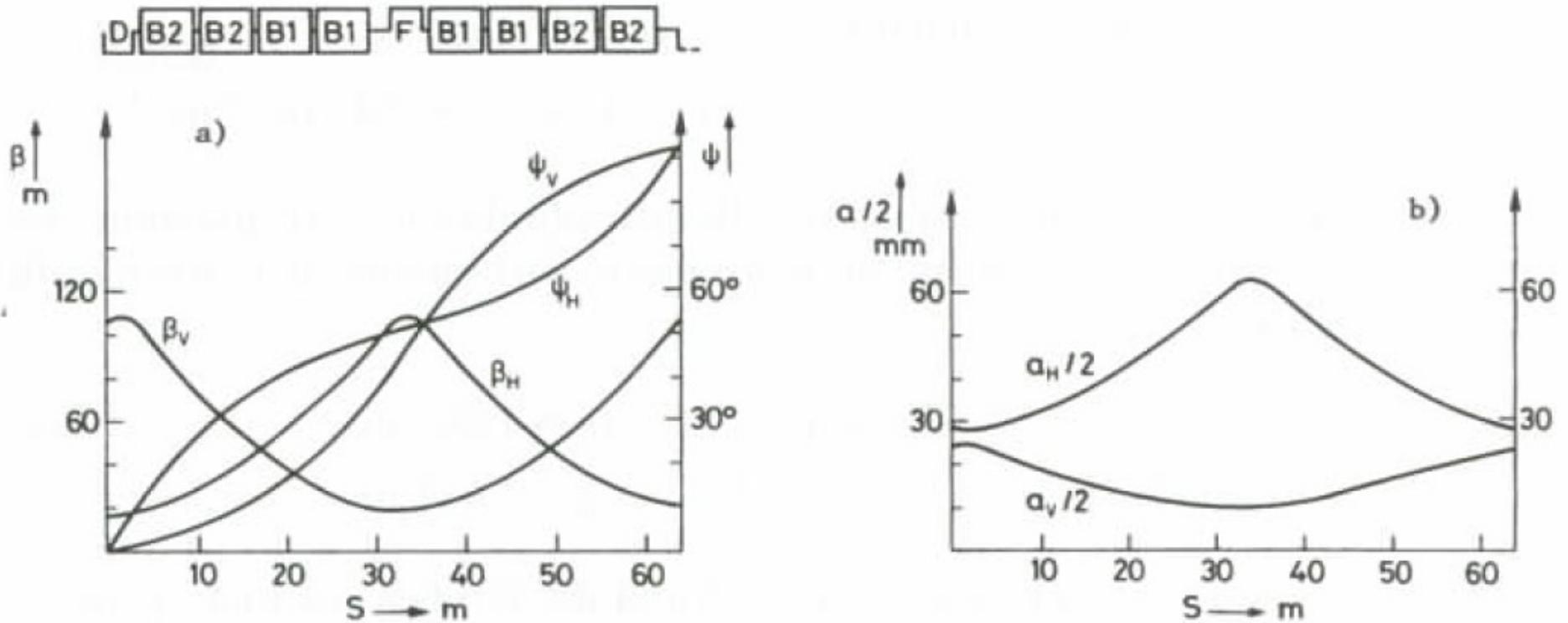


Abb. 6.11. SPS-Einheit zelle: Horizontale und vertikale Betatronfunktion $\beta_x = \beta_H$ und $\beta_y = \beta_V$, Betatronphasen $\psi_x = \phi_H$ und $\psi_y = \phi_V$ und Enveloppen $a_H/2 = \sqrt{\beta_x \epsilon_x}$, $a_V/2 = \sqrt{\beta_y \epsilon_y}$. Aus [Wi85] entnommen

SPS: 108 unit cells; $d=32\text{m}$; $\mu=91.8620^\circ$

focus: $\beta_F=112.7\text{ m}$

maximum: $\beta_D=17.6\text{ m}$

SPS (CERN) FODO structure

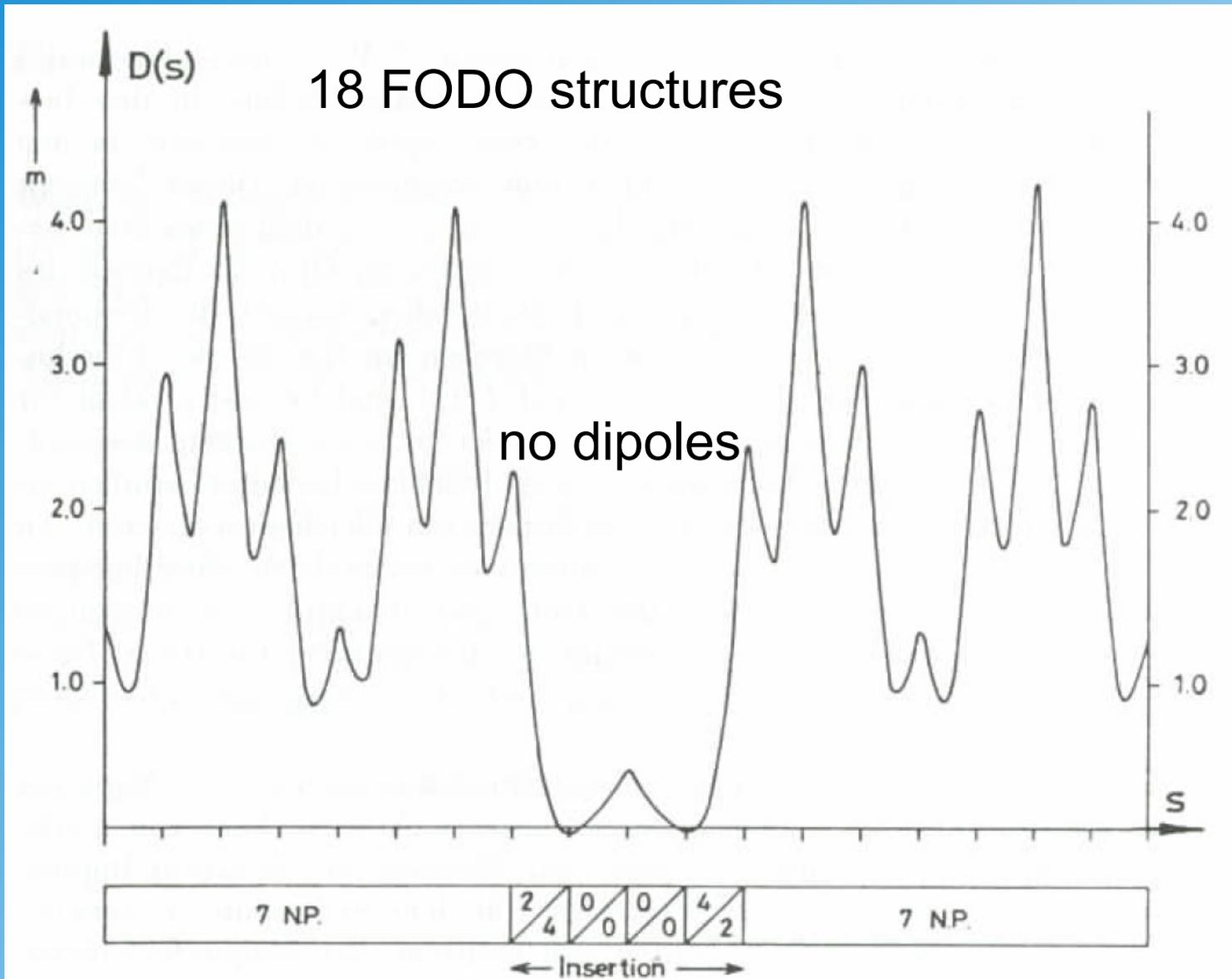
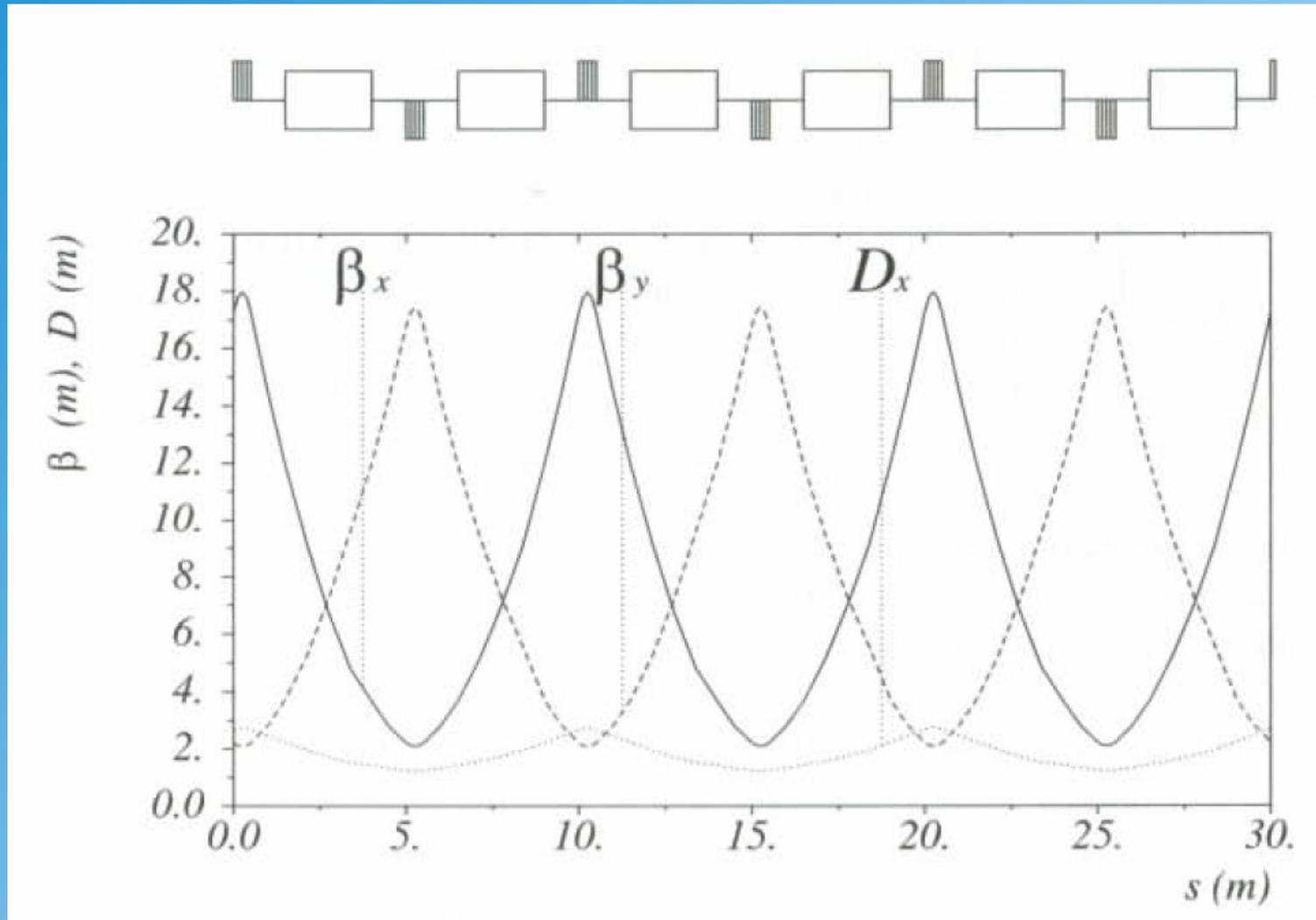


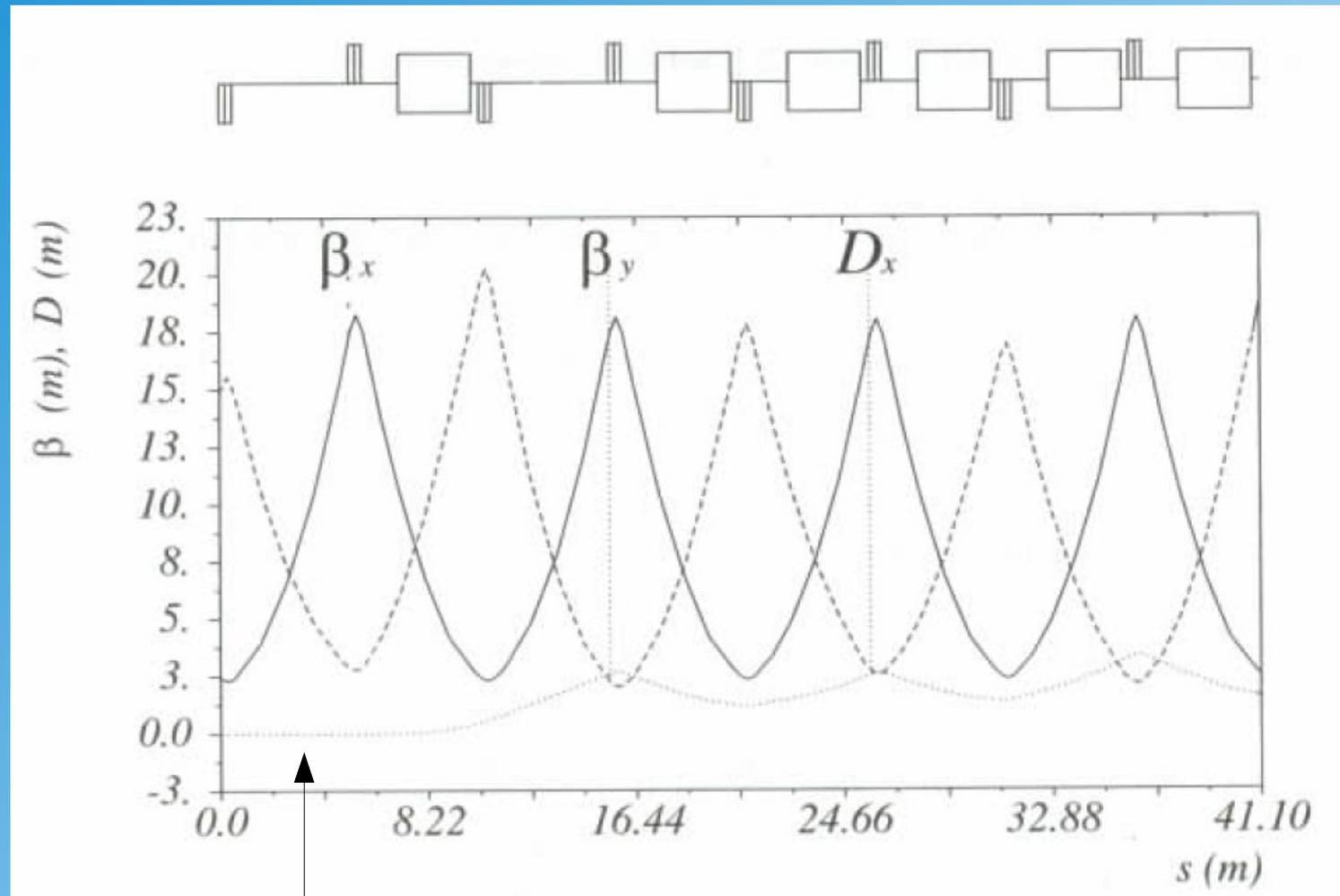
Abb. 6.12. SPS-Superperiode: Periodische Dispersion $D(s)$. Aus [Wi85] entnommen

Model Ring



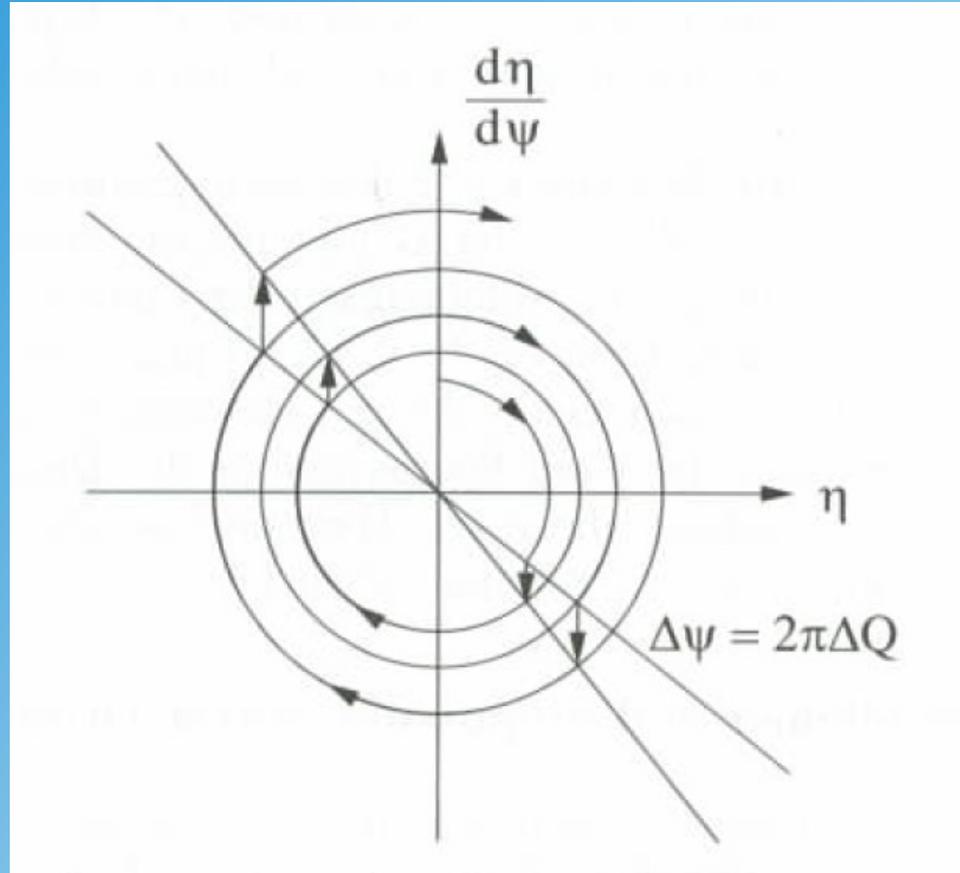
ELSA (Electron Stretcher Anlage)

Bonn



dispersion = 0

Distortions and Stop-Band 2nd Order



Resonance Diagram SPS

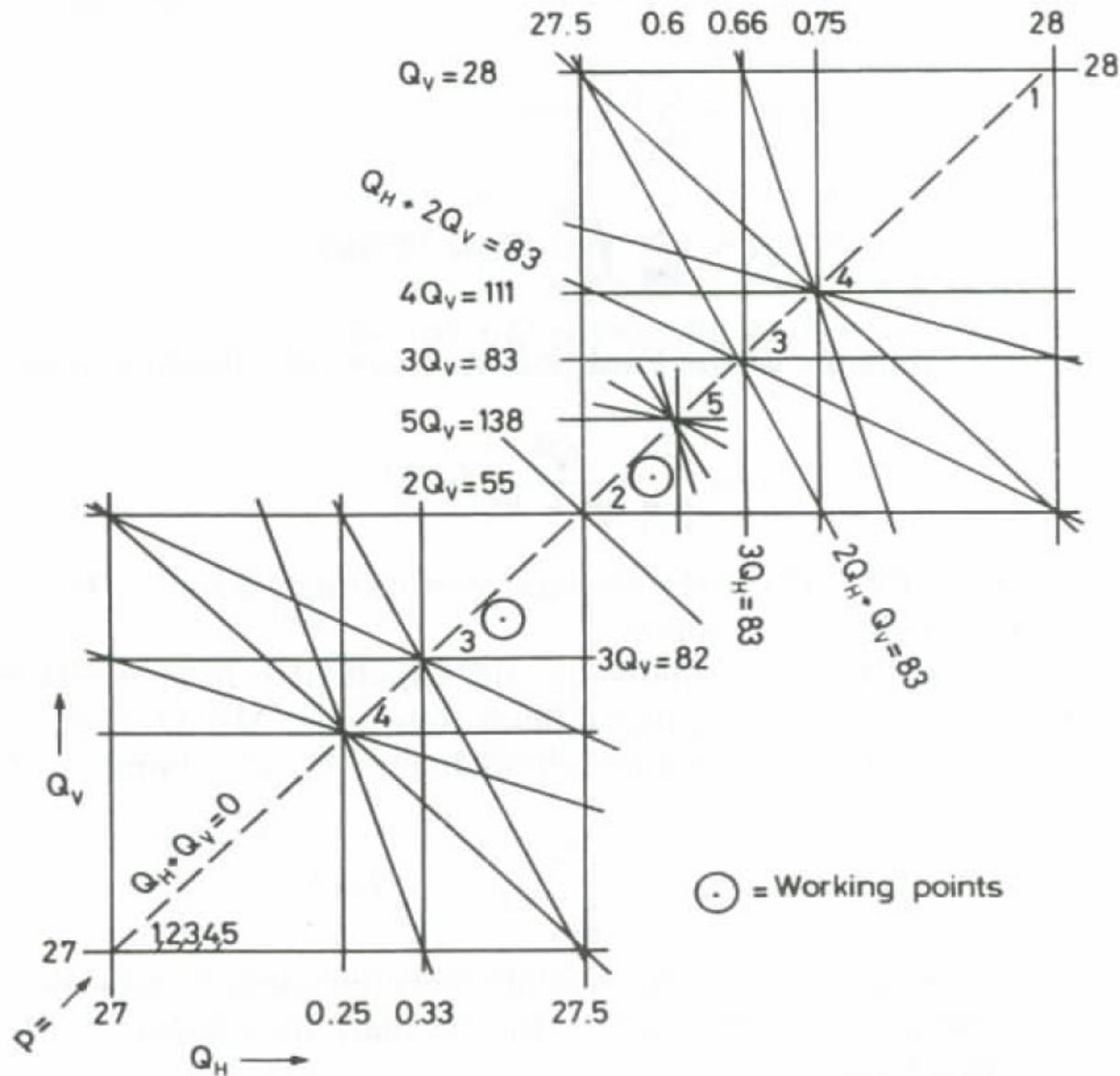
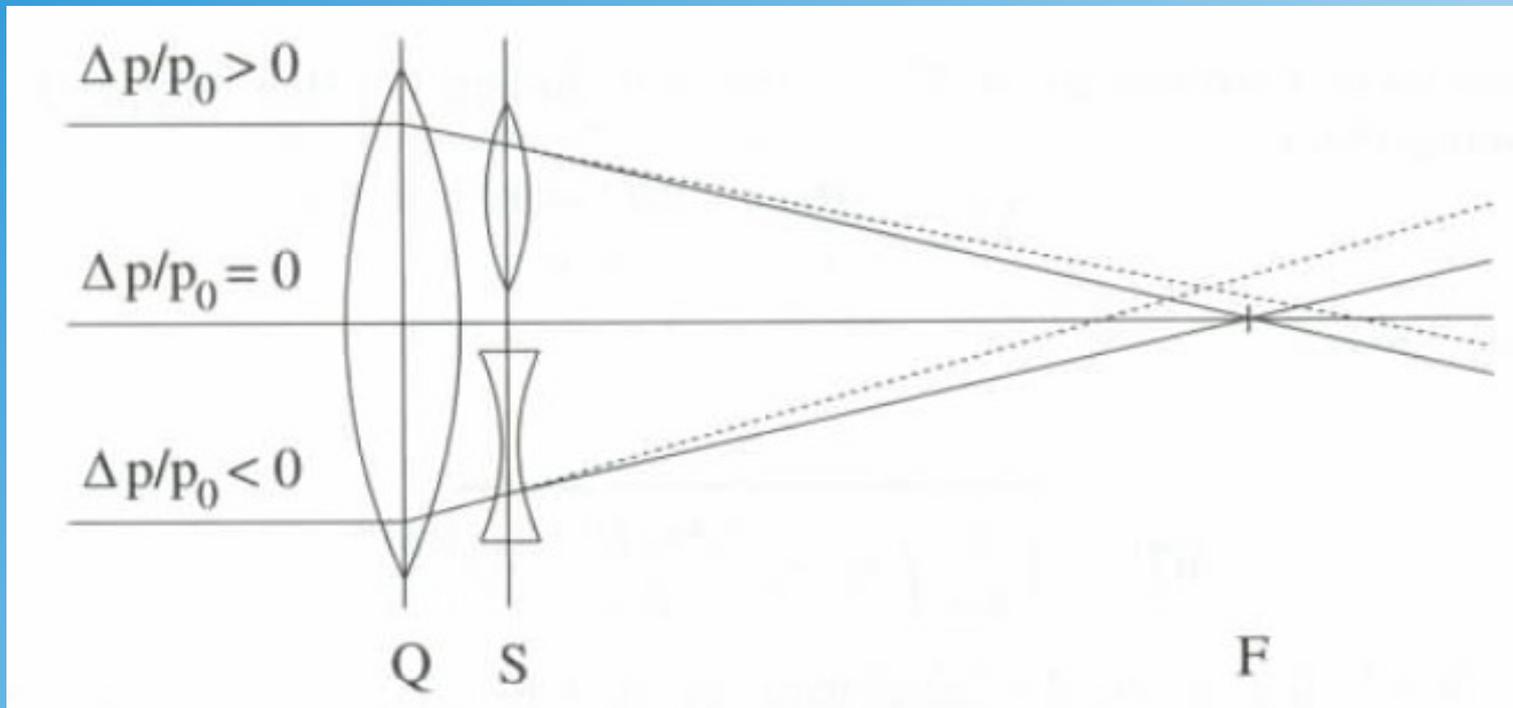


Abb. 7.4. Resonanzdiagramm am Beispiel des CERN SPS-Synchrotrons. Die $Q_H = Q_x$ bzw. $Q_V = Q_y$ ist die Zahl der horizontalen bzw. vertikalen Transversenschwingungen pro Umlauf. Das Diagramm zeigt Resonanzlinien der Ordnung

Correction of Chromaticity using Sextupoles



Chromaticity from Quadrupole

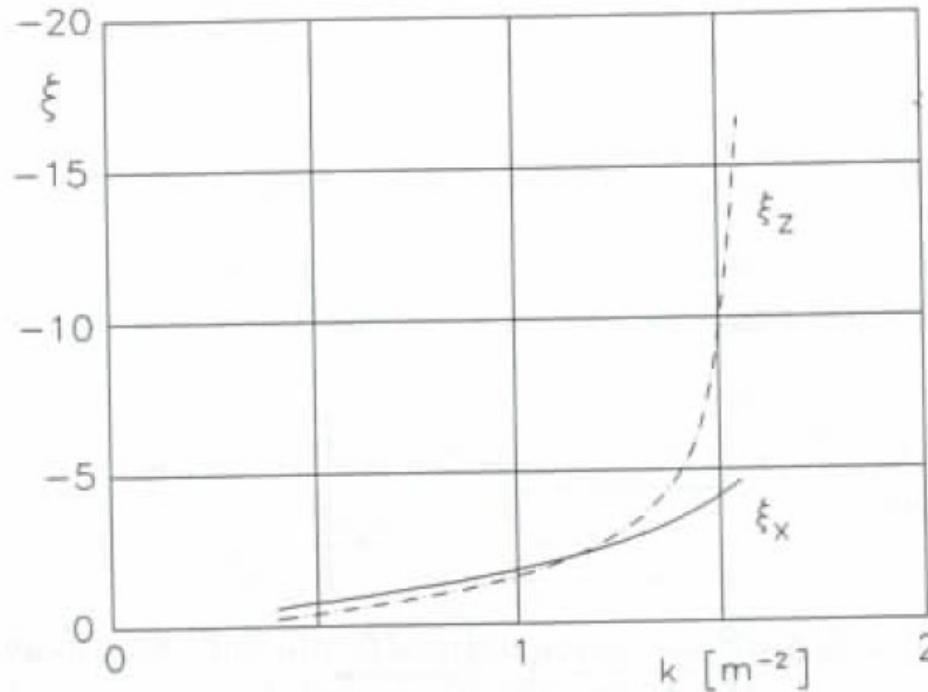


Fig. 6.6 Verlauf der horizontalen Chromatizitäten $\xi_{x,z}$ des FODO-Modellrings als Funktion der Quadrupolstärke k .

Dynamic Aperture from Sextupoles

