

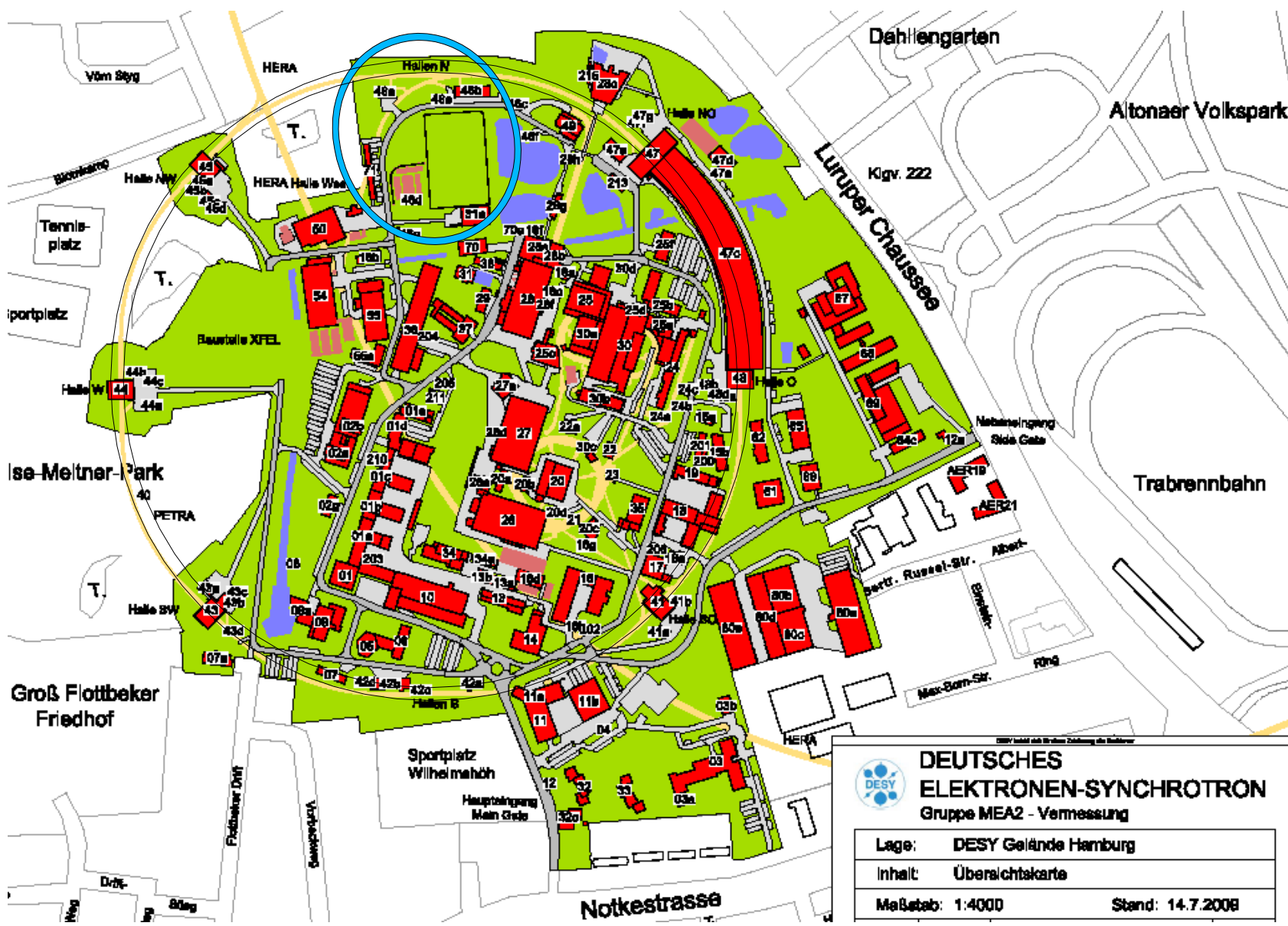
a 12 GeV e⁺ pre-accelerator



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Z-group 24.9.2010

- a name:
 - ▶ Zwiblj?
- what?
- why?
- how?
- where?



Introduction

- what?
 - ▶ an intermediate accelerator and damping ring between DESY II and HERA-e.
 - why?
 - ▶ DESY II top: 6 GeV, $\epsilon_x = 320$ nm rad.
 - ▶ HERA-e min: 12 GeV, $\epsilon_x = 1$ nm rad.
 - how?
 - ▶ 12 GeV e^+ ring.
 - ▶ as short as possible.
 - ▶ normal conducting (large heat load from synchrotron radiation).
- ⇒

Magnet considerations

- Peak B field in iron magnets: stay below 1.5 T to avoid saturation.

- Dipole:

$$\triangleright \frac{e}{p} B = \frac{1}{\rho}$$

$$\Rightarrow \rho > 27 \text{ m.}$$

- Quadrupole:

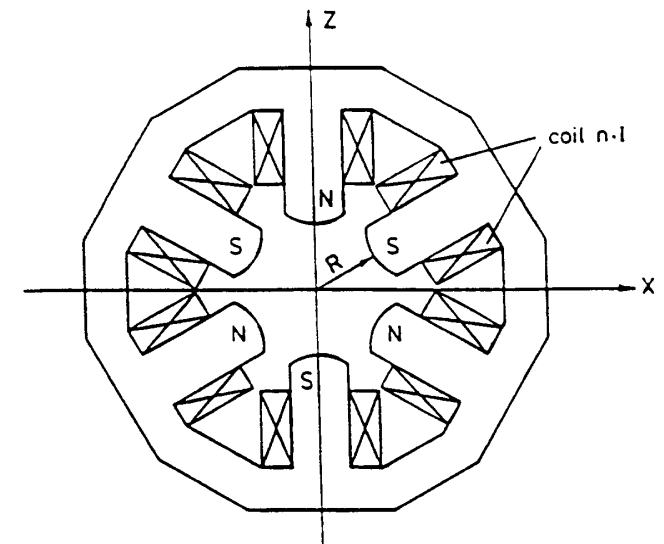
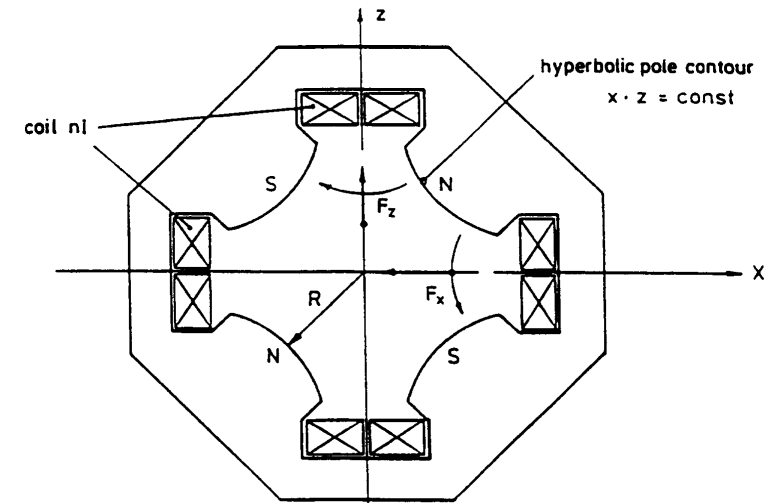
$$\triangleright \frac{e}{p} B_y = k_1 x$$

$$\Rightarrow k_1 < 1.25 \text{ m}^{-1} \text{ for a pole radius } R = 3 \text{ cm.}$$

- Sextupole:

$$\triangleright \frac{e}{p} B_y = k_2 x^2 / 2$$

$$\Rightarrow k_2 < 80 \text{ m}^{-2} \text{ for a pole radius } R = 3 \text{ cm.}$$



damping ring arc cell

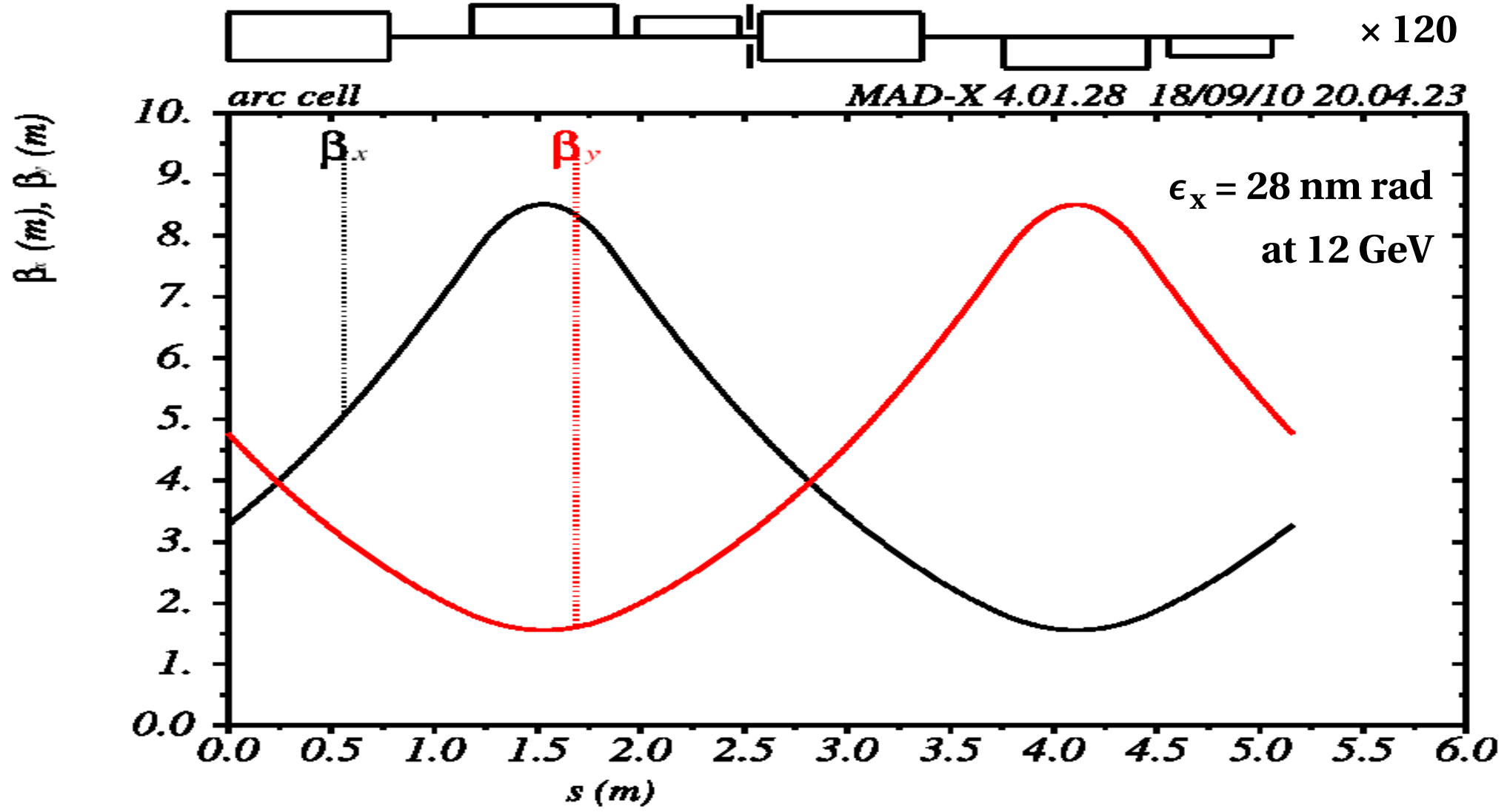
dipole
fraction
30%

dipole
R=31m
 $\theta=1.5^\circ$

h-quad
 $k_1=0.9\text{m}^{-1}$

sext
 $k_2=25\text{m}^{-2}$

v-quad
 $k_1=-0.9\text{m}^{-1}$



Straight RF section

SynRad:
60 MeV
energy loss
per turn

last 2
arc cells

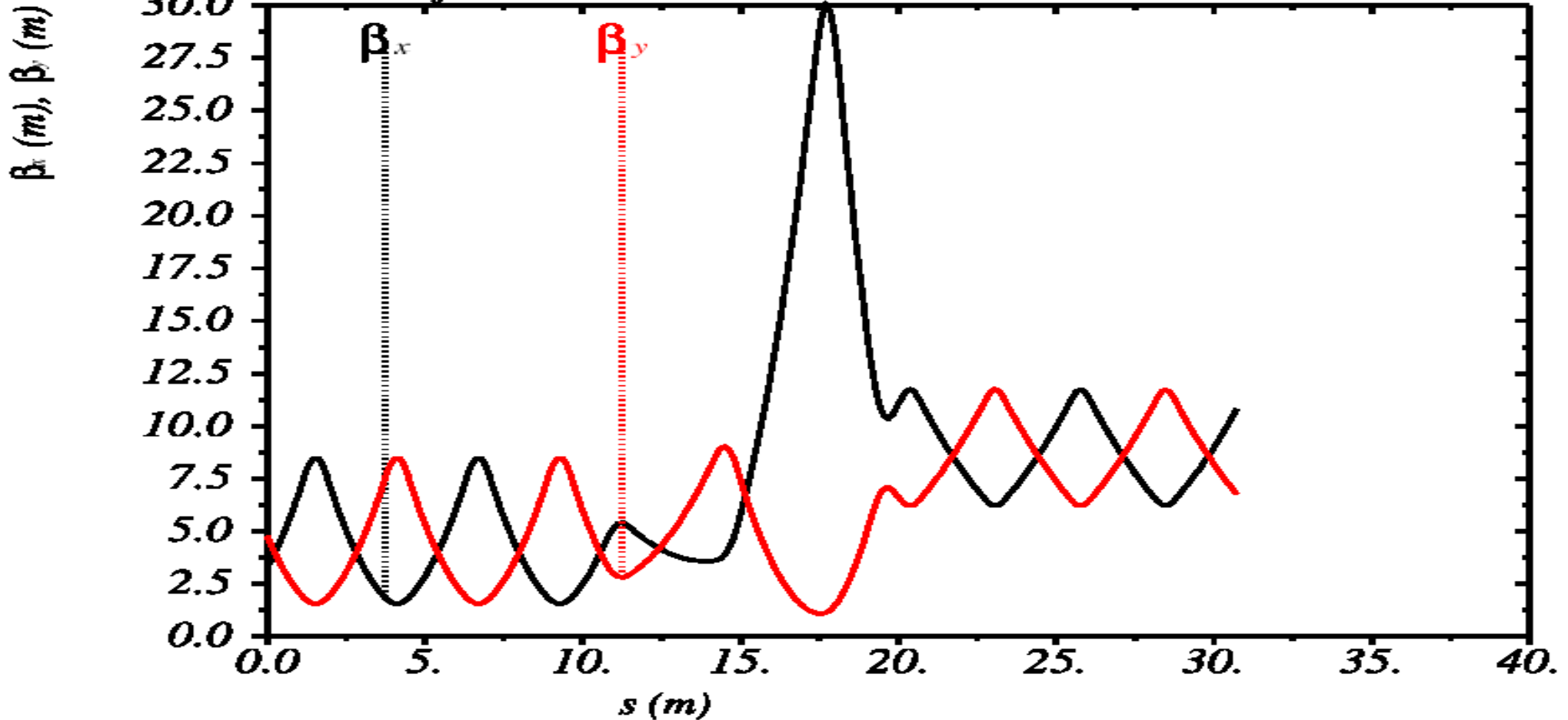
matching
section

500 MHz RF
1.5 MV/m

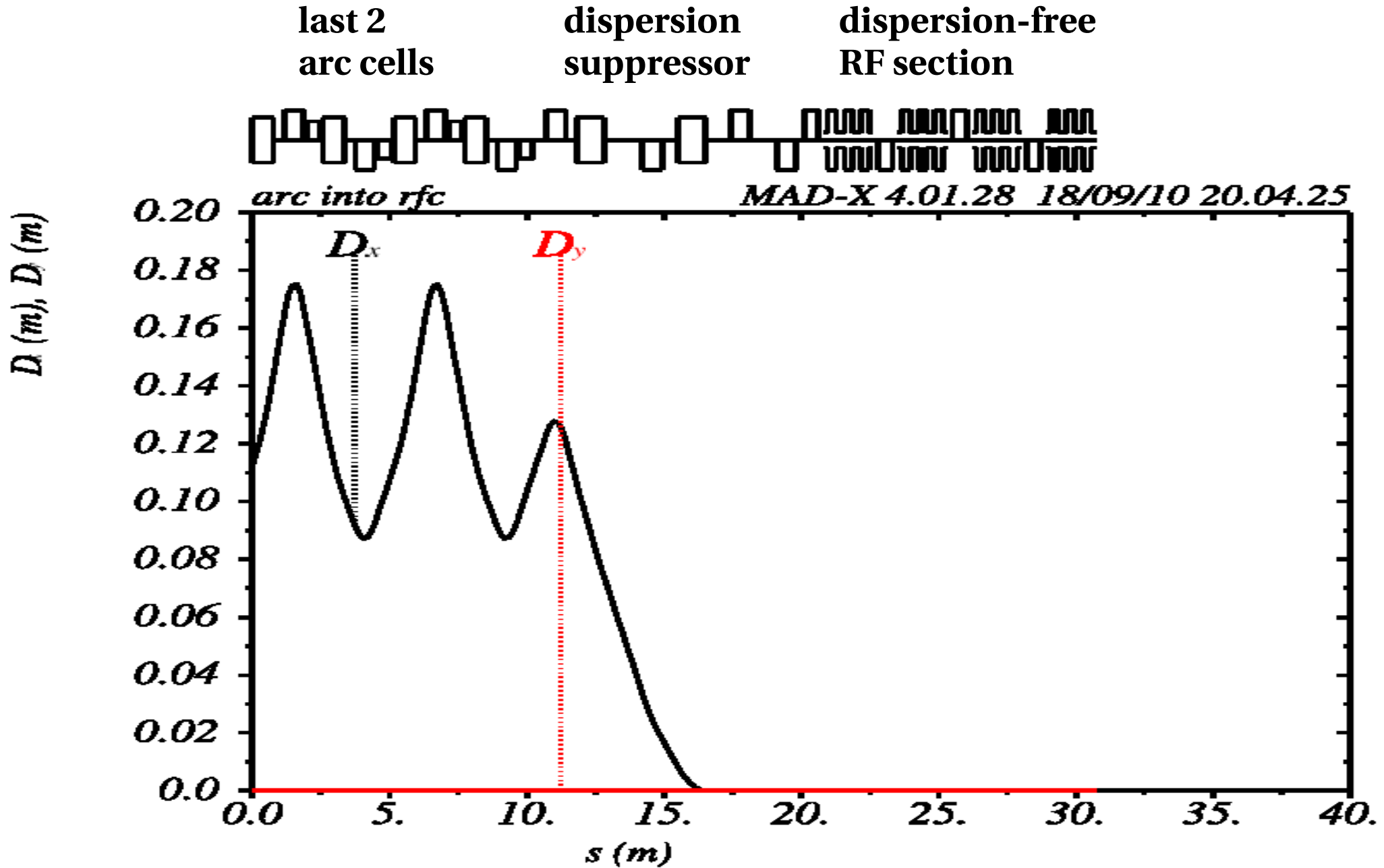


arc into rfc

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dispersion suppressor



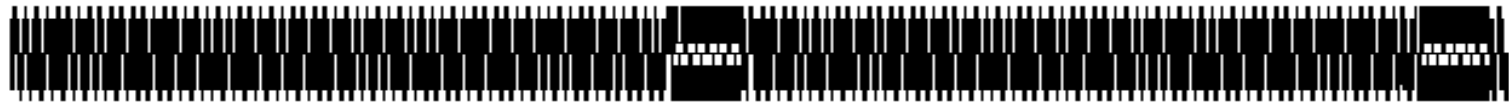
entire damping ring

half-ring

RF

half-ring

RF

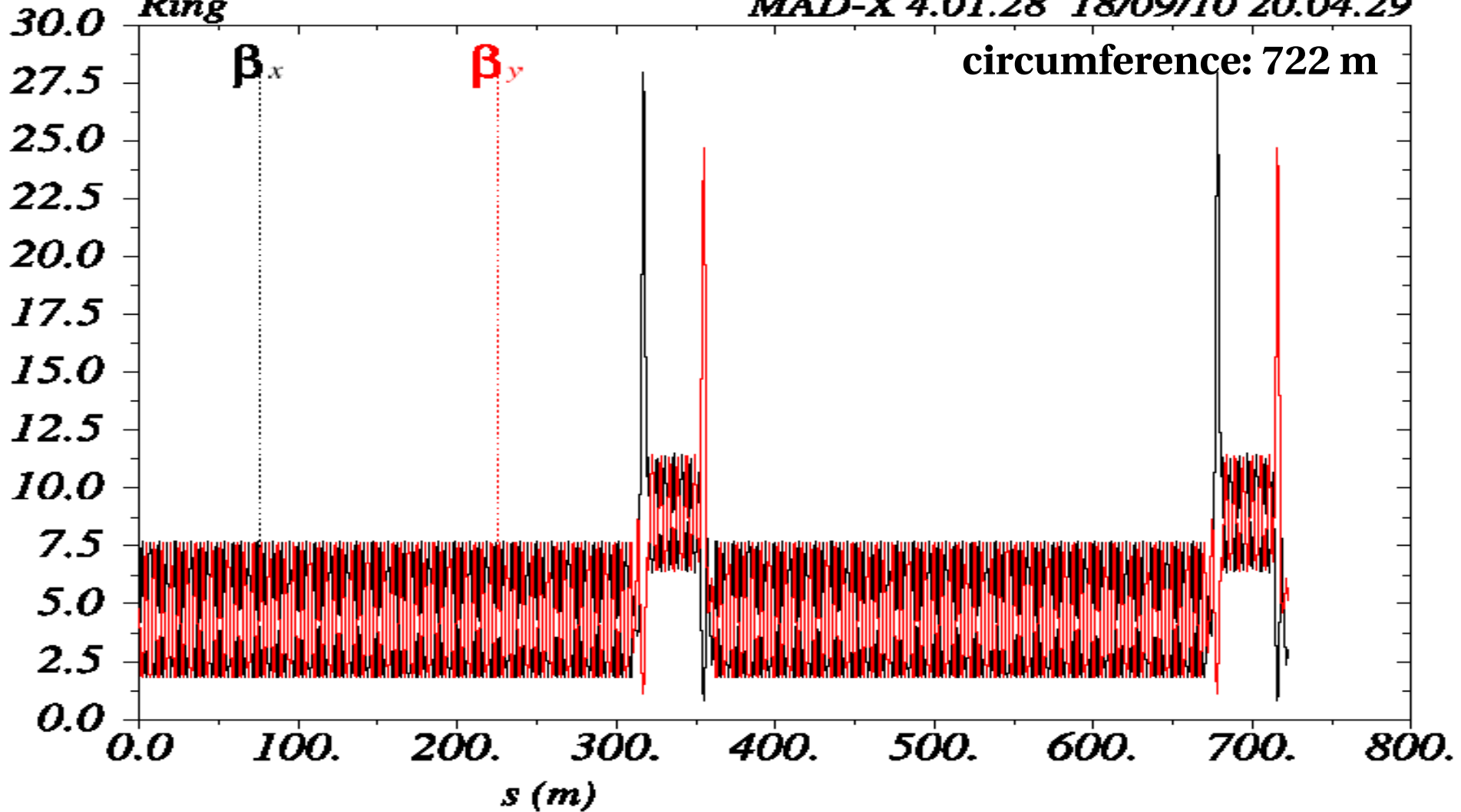


Ring

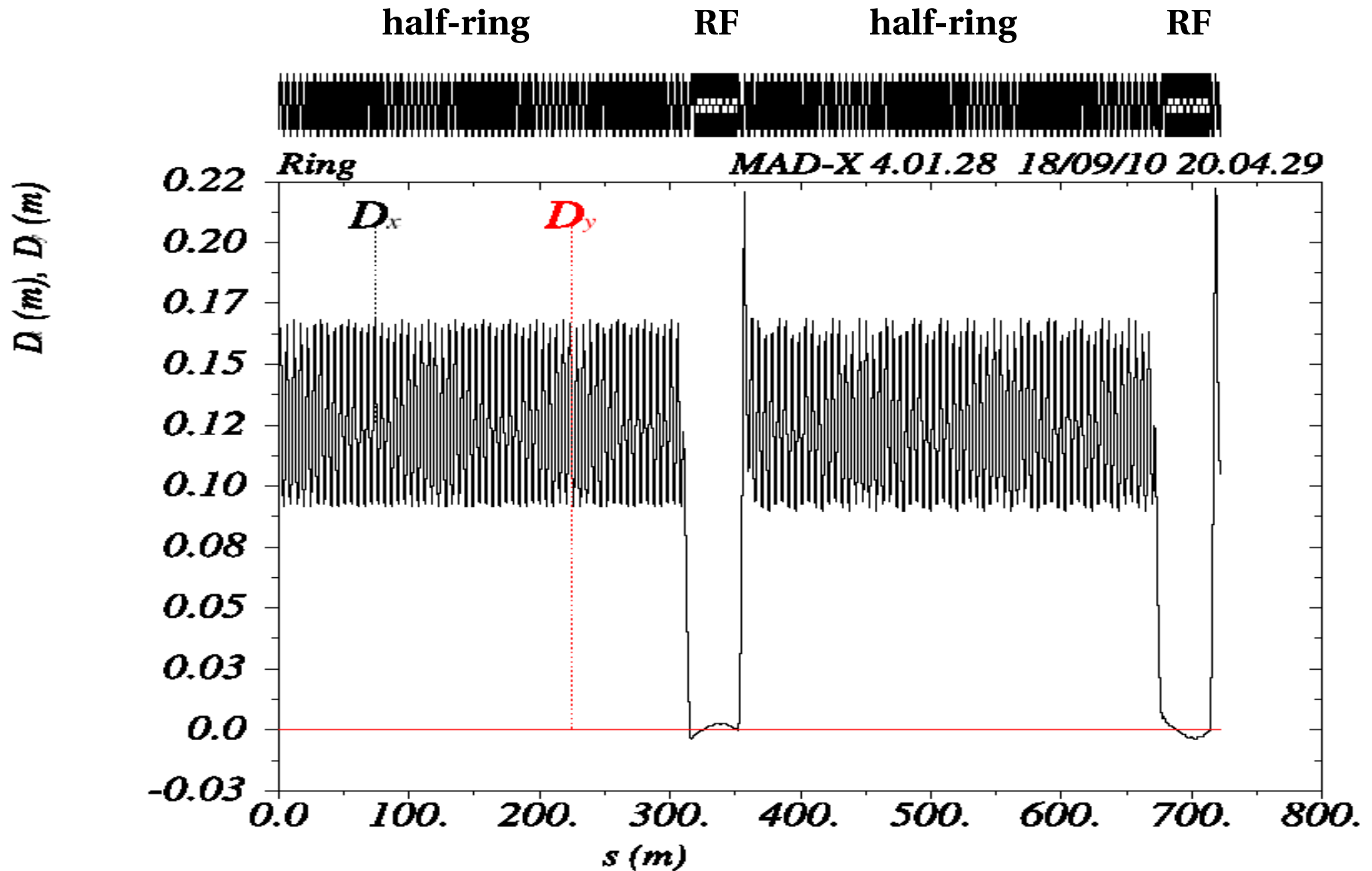
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circumference: 722 m

$\beta_x(m), \beta_y(m)$



entire damping ring: dispersion



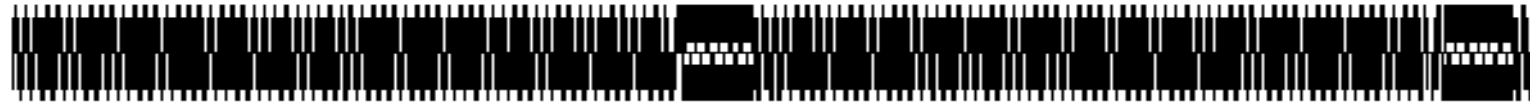
entire damping ring: chromaticity

half-ring

RF

half-ring

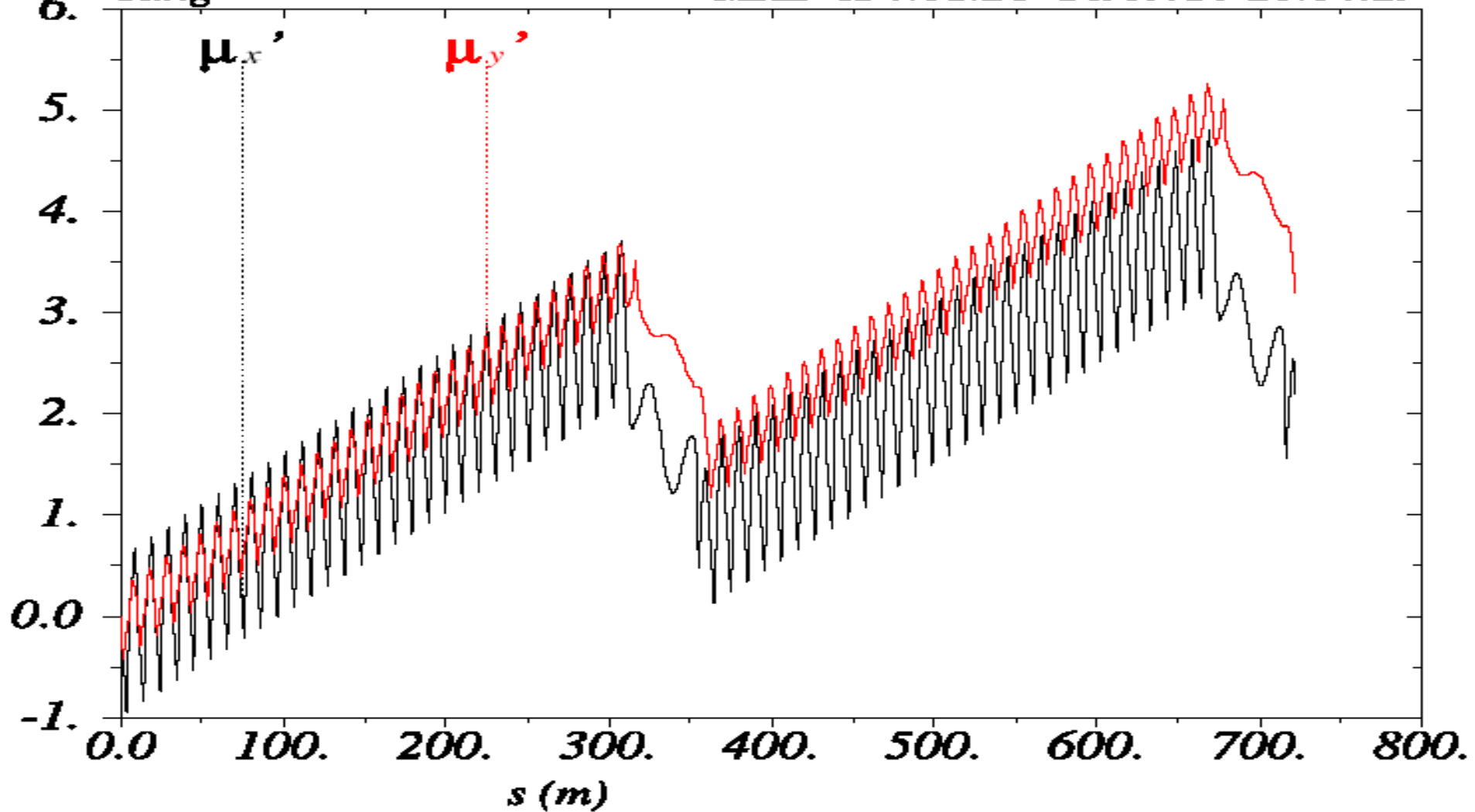
RF



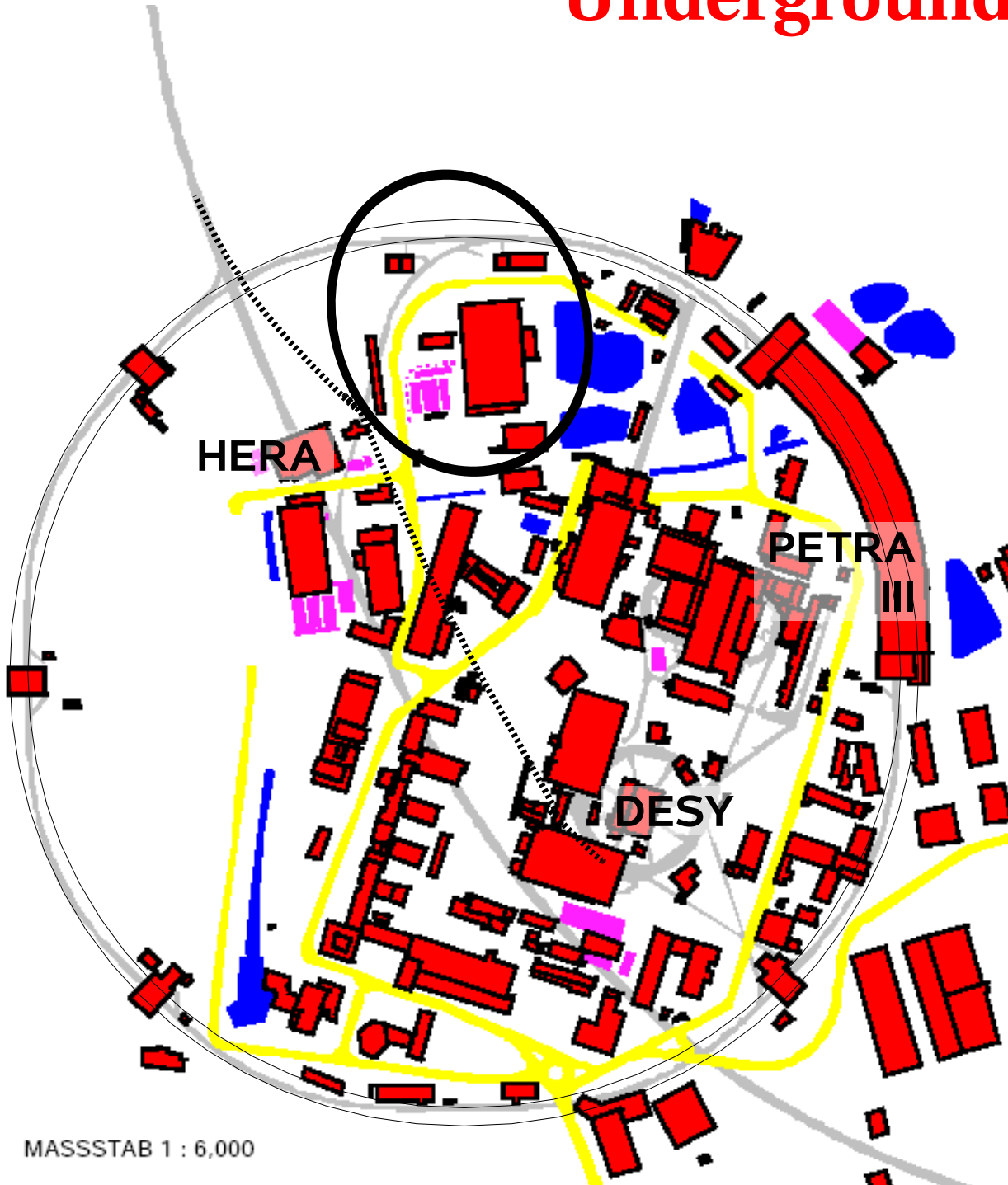
Ring

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$d\mu/ds, d\mu/d\delta$



Underground site



- 12 GeV damping ring:
 - ▶ length 720 m.
- Underground on DESY site.
- Long transfer line from DESY II.

MASSTAB 1 : 6,000

Summary

- A compact 12 GeV ring has been developed with MAD-X:
 - ▶ $L = 720$ m, $\rho_{\text{dipole}} = 31$ m, $f_{\text{dipole}} = 30\%$
 - ▶ 2 arcs (120 F0D0 cells) and 2 straight sections (RF, transfer),
 - ▶ $\epsilon_x = 28$ nm rad at 12 GeV.
- Open issues:
 - ▶ Transfer lines from DESY II and into HERA-e.
 - ▶ Transfer efficiency ?
 - ▶ Underground installation ?
 - ▶ Cost ?