Future perspectives at the ESRF

Outline

- Increase of current
- Topping-up
- Canted undulators
- Reduction of emittance

Long-term strategy plans to be discussed and approved by the ESRF Council

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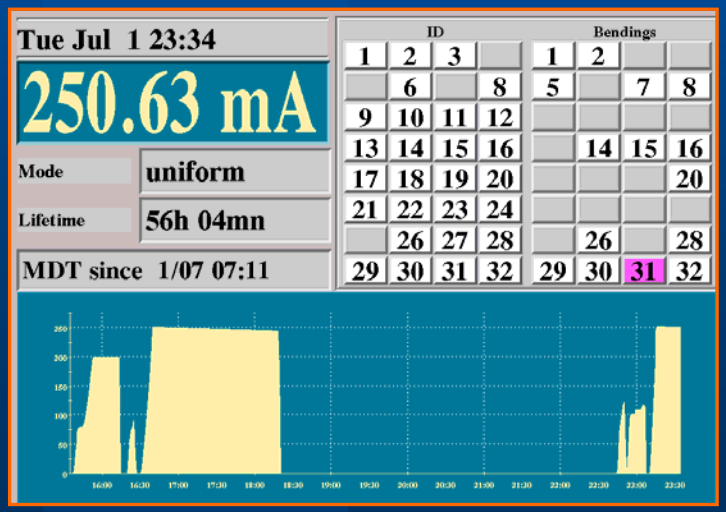
History of the increase of current

- 1992: 100 mA in 1/3 filling mode (design goal)
- 1996: delivery of 200 mA in uniform filling
- 2003: 250 mA in uniform filling achieved during machine studies



BUT

Difficulties in mastering HOM driven coupled bunch instabilities

No stable operation in USM

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Plans for the increase of current

- **2008: 300 mA in USM**
  - **New crotch absorbers OK**
    Replacement time ~ 2 years
  - **Stable operation feasible with the bunch by bunch feedback under development**
- **?: 500 mA**
  - **Design of new crotches**
  - **Feedback capabilities tested at lower energy**
  - **Development of new RF cavities with heavy damping of HOMs**

Topping-up

- No need in multibunch mode: τ = 80 h at 200 mA
- Attractive in time-structured modes (16 bunches, hybrid, 4x10 mA)
  - ✓Beam position stability
  - ✓Higher average current

Bunch purity in the 10^{-9} range

⬇

Cleaning in the booster

- ✓Reproducibility problems at low energy
- ✓Tested at 6 GeV with using the bumpers to scrap the parasitic bunches

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Canted undulators (1)

Increase the number of independent instruments in a beamline by splitting the 5 m long ID into 2 shorter IDs generating the radiation at different angles

~ ± 3 mrad possible
To be confirmed by a detailed study

Implementation of the canting upgrade on the first beamline within the next 4 years

10 straight sections in the long-term

Canted undulators (2)

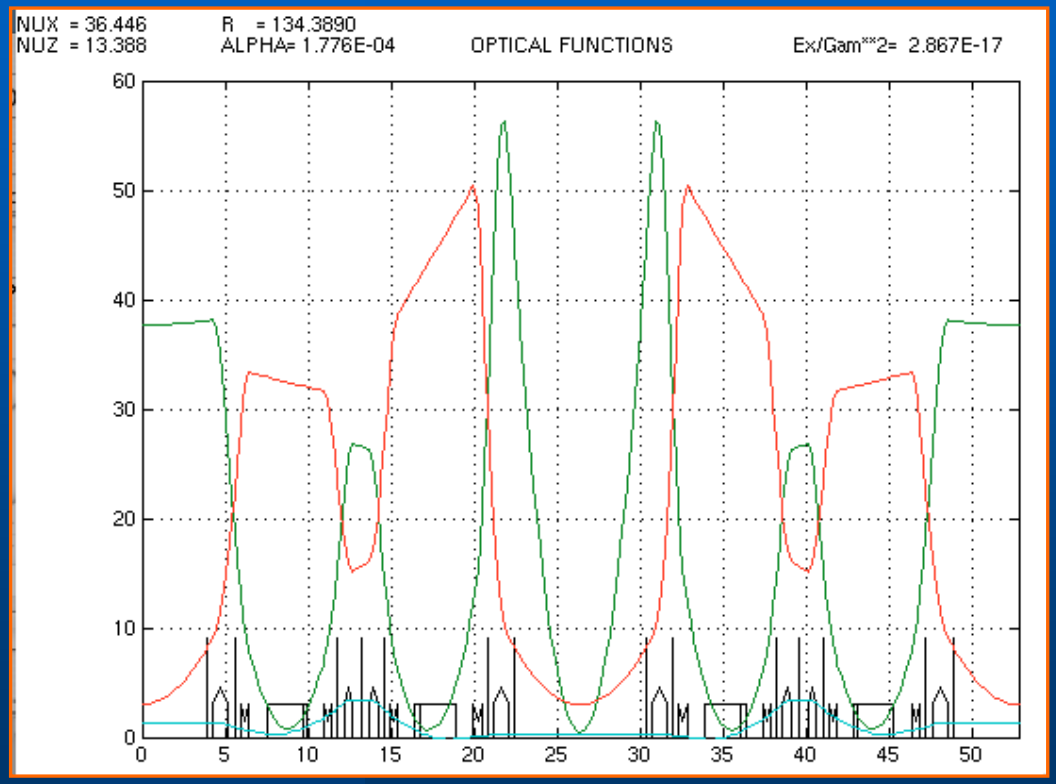
New design for

the front-end
the dipole vessel
the crotch absorber

The increase in current is essential to compensate the reduction in brilliance induced by the shorter undulators

Modified lattice with doublet quadrupoles in the straight section instead of triplets to provide maximum length for the undulators

Canted undulators (3)



- ✓Same emittance
- ✓Same source sizes
- ✓Vertical tune decreased by one integer

Tests under way
Operation expected in 2007

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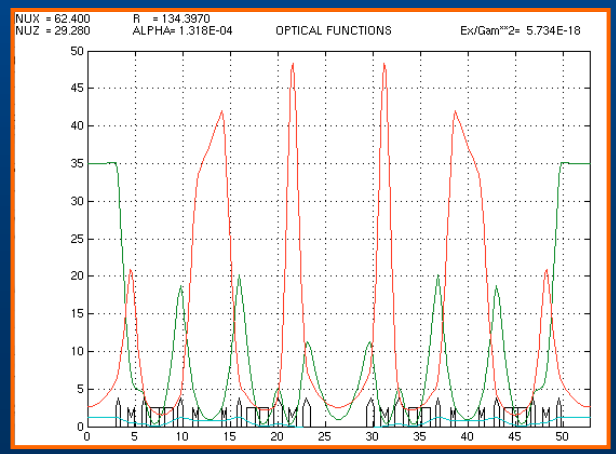
Lattice upgrade (1)

Constraint: keep the tunnel, shielding and beamlines untouched
Replacing all magnets, associated power supplies and vacuum chambers

2 scenarios for reducing the effective emittance from 4 nm down to 1 nm

TBA

DVB: DBA with dipoles providing a variable magnetic field along the beam path



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Lattice upgrade (2)

Numerous challenging issues raised by these new designs

- **Design of combined-functions magnets of unprecedented small apertures**
- **Non-linear beam dynamics**

Smaller dispersion
Higher focusing

→

Much stronger sextupoles
Small dynamic aperture
Questionable feasibility

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Lattice upgrade (3)

- Revisiting the ultimate storage ring design with installing damping wigglers to achieve 0.3 nm