Optics optimization and chromaticity correction in PS2 NMC rings

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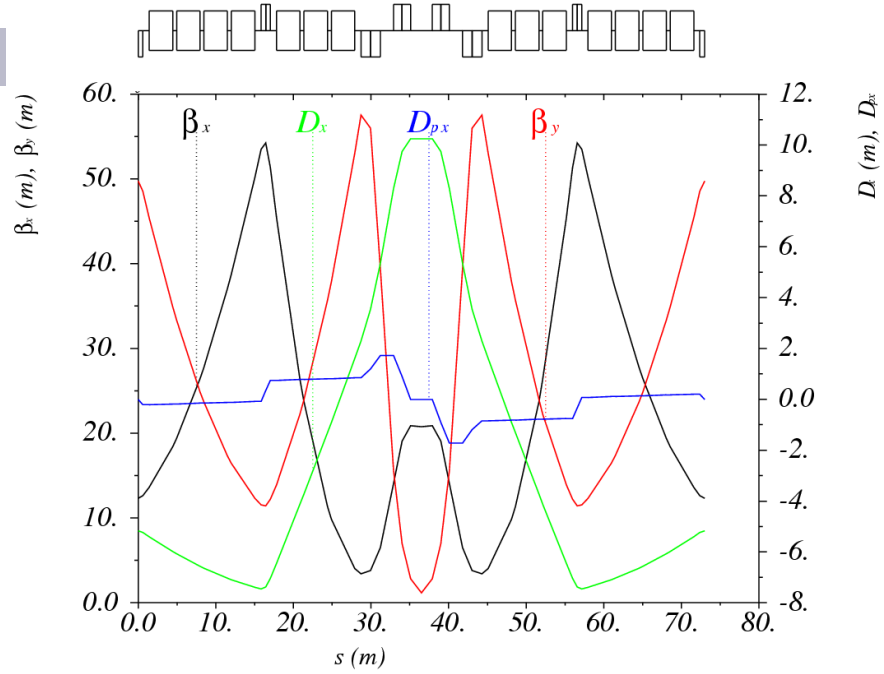
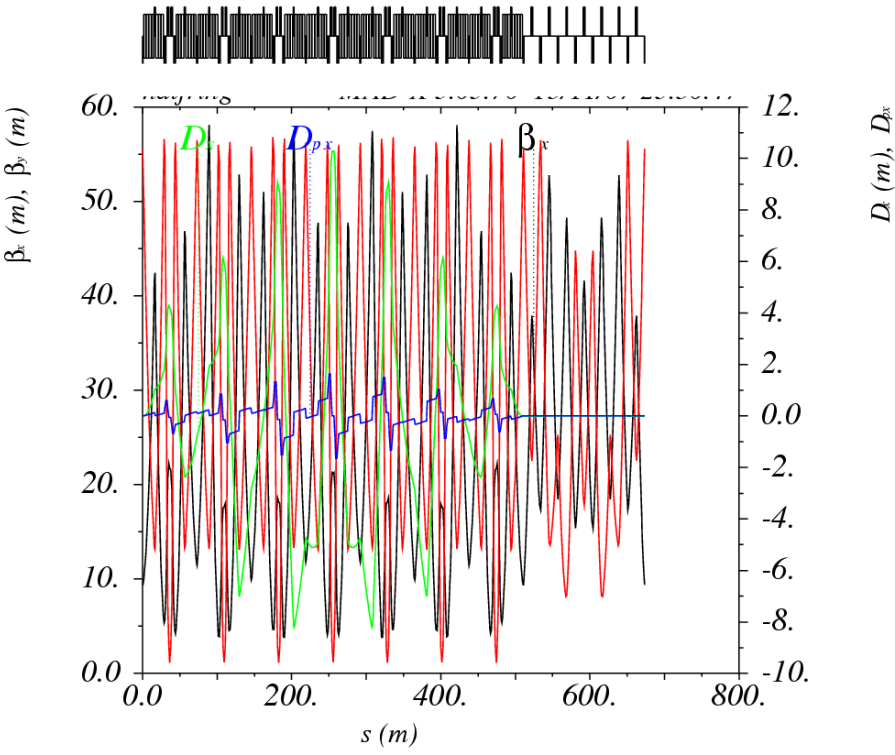
Outline

- Optimised NMC ring with dispersion supressor
  - Refining the straight section matching
- Chromaticity correction
  - First order
  - Second order and chromatic beta beating

The NMC ring II

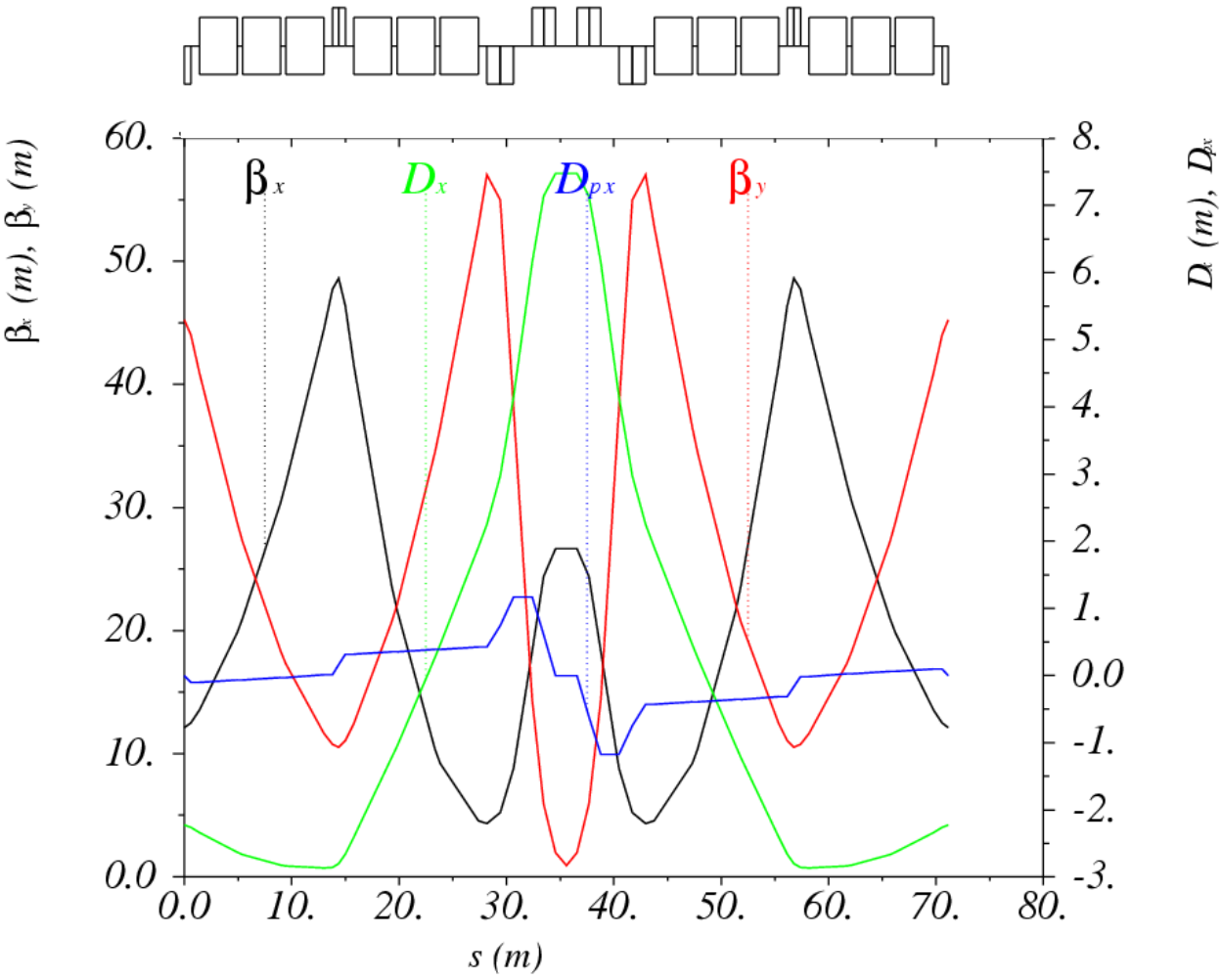
- Arc module with 1 asymmetric FODO cell with 4 + 3 bends and a low-beta doublet with **4** families of quads, with max. strength of 0.1m^{-2} and total length of **73m**
- Suppressing arc dispersion with phase advance close to multiple of **2π** and **2** extra quad families
- Straight section with 7 FODO cells drift of **9.5m**) using **2** matching quadrupoles
- Ring of **1346m**, with **10** quad families (max strength of 0.1m^{-2})
  - Tunes of (13.8,13.4), γ_t of **10.9i**, chromaticities of -18.7, -29.5
  - Max beta of **58m** and **56m** and min. and max. dispersion of **-8.2m** and **10.2m**
- Matching not perfect for horizontal phase advance of 90^o in the straights





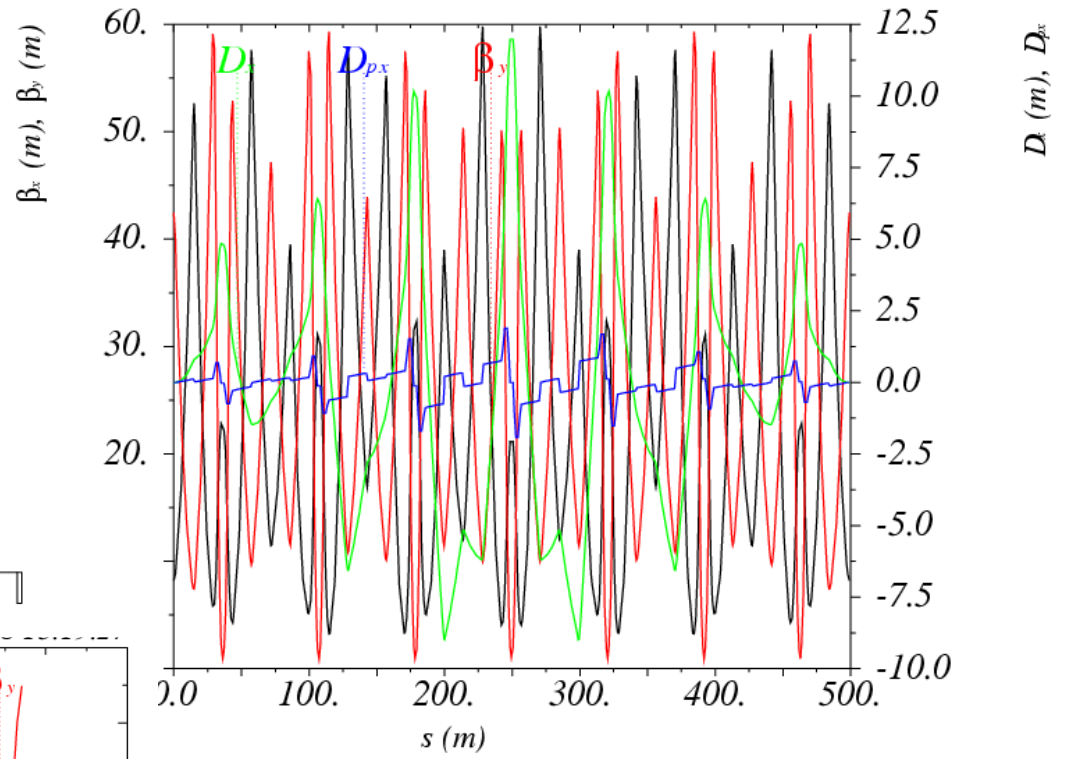
Optimizing the arc module

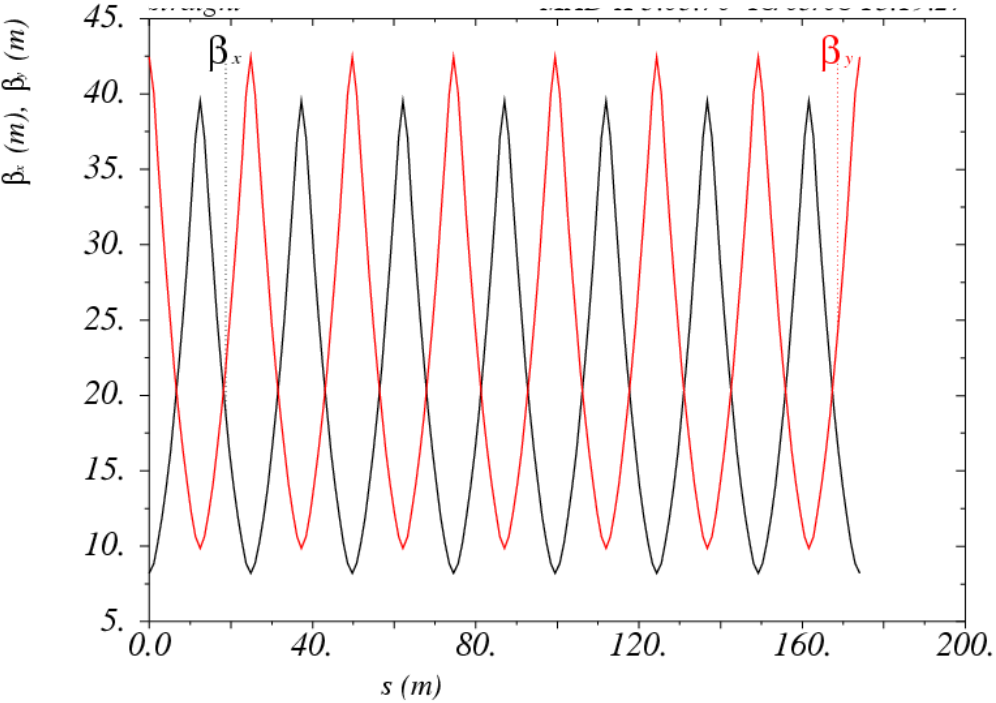
- 1 symmetric FODO cell with 3 + 3 bends and a low-beta doublet
  - Phase advances of 294°,310° per module
  - γ_t of **10.2i**
  - **4** families of quads, with max. strength of $0.1m^{-2}$
  - Max. beta of **49m** and **57m**
  - Min. dispersion of -2.9m and maximum of **7.5m**



Arc and straight section

- Dispersion suppression with 2 extra quad families in the last arc modules
- Last arc quad. shared between arc and straight

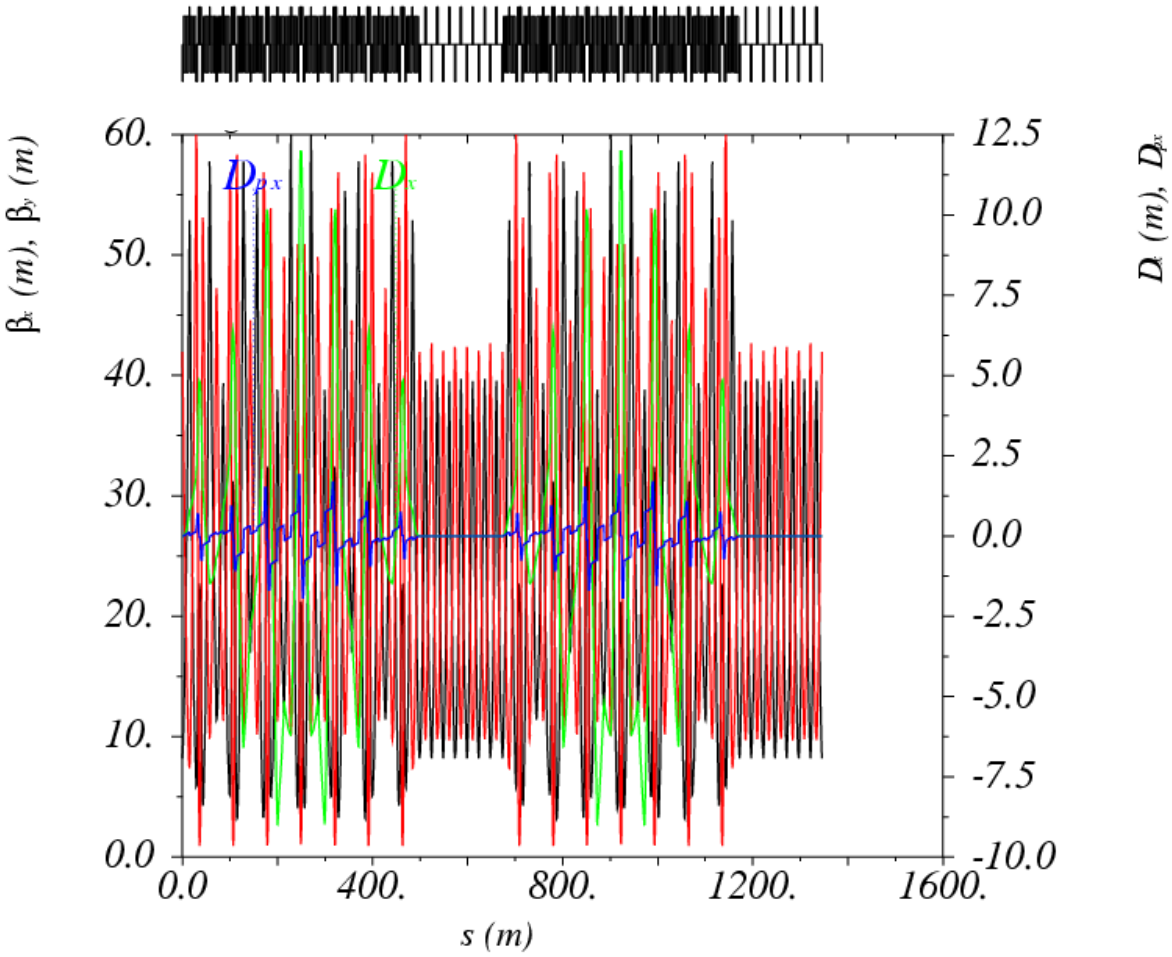




- Straight section with horizontal phase advance of **87.5°**
- Straight section drift of **10.2m**
- Only two families of quadrupoles are used
- Extra two families can be added for extra internal phase adjustments
- Perfectly matched to the arc

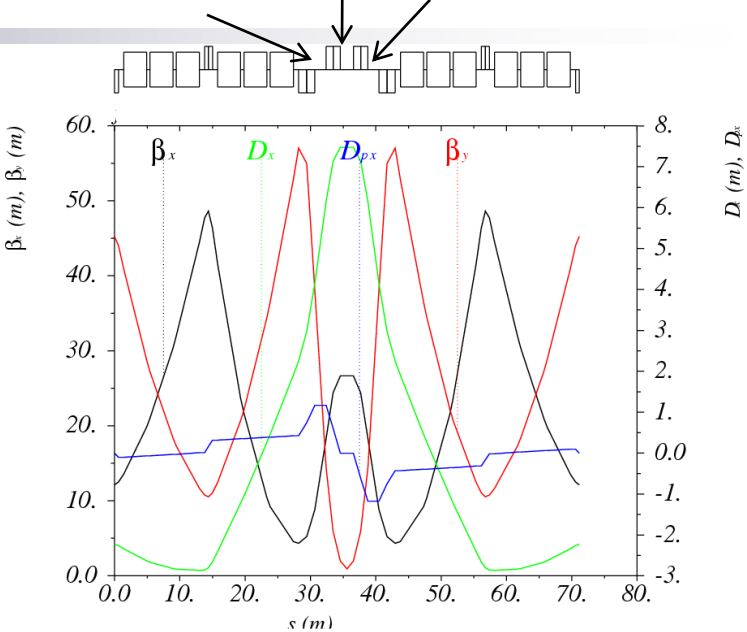
The NMC ring II

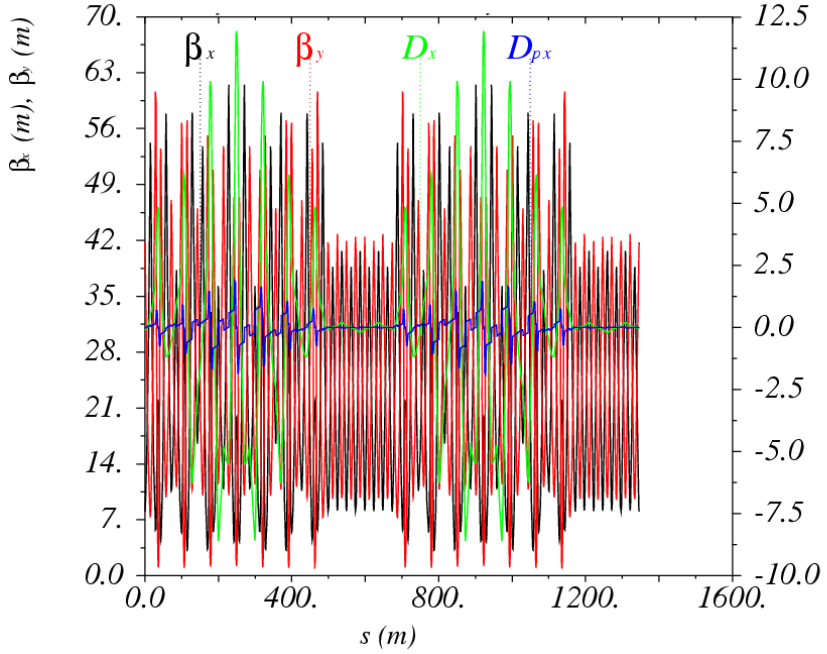
- Three types of 8 (+2) quadrupole families (max. strength of $0.1m^{-2}$) for a length of **1346.4m**
- γ_t of **11i**
- Tunes matched to **(14.8,15.2)**
- Max. β's of around **60m** both planes
- Dispersion of -2.3m and maximum of **4.6m**
- Tunability between **14** and **16** in both planes but penalty on the beta function maxima
- Chromaticities of -21.5, -32.2



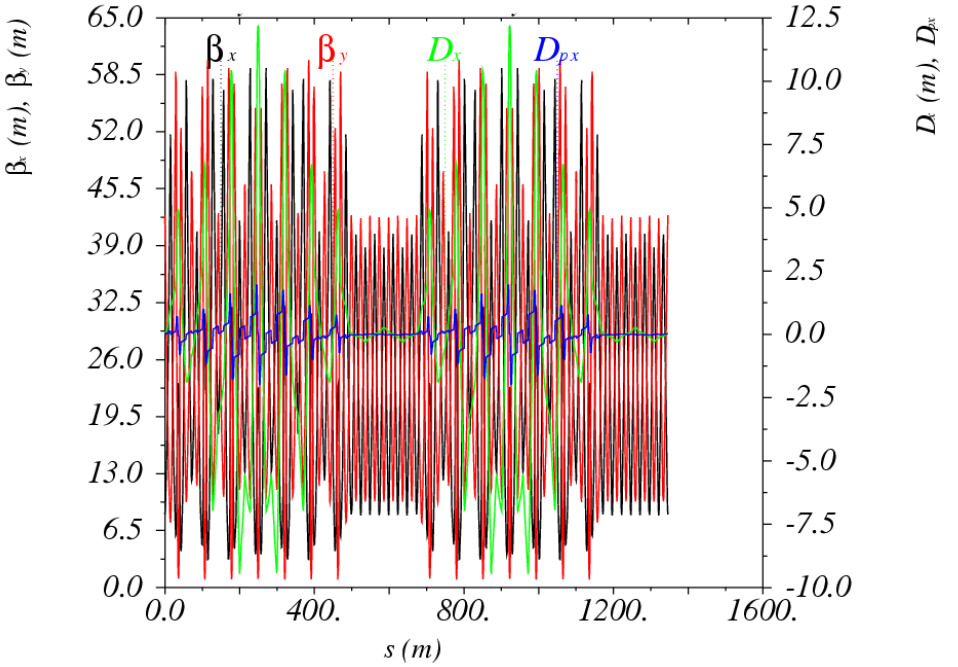
Chromaticity correction

- Sextupoles of 0.4m long placed in the low beta doublet
- In principle 2 families needed for chromaticity correction
- Second-order chromaticity and off-momentum β-beating not corrected





δp/p=-0.5%



δp/p=0.5%

Next steps

- Optimise and correct chromaticity in NMC ring I (module with dispersion suppressor)
- Optimise sextupole strength and working point for good dynamic aperture
- Introduce non-linear correction schemes