



This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under GA No 101004730.

Report on Task 7.3: VArriable Dipole for the Elettra Ring

I.FAST P1 Review - 09/02/23

Y. Papaphillipou

iFAST



VARIABLE Dipole for the Elettra Ring - VADER

- **Task 7.3** within I.FAST **WP7**: High Brightness Accelerators for Light Sources
- Partners and collaborators:



Y. Papaphilippou
A. Poyet



F. Toral
M. Dominguez



E. Karantzoulis

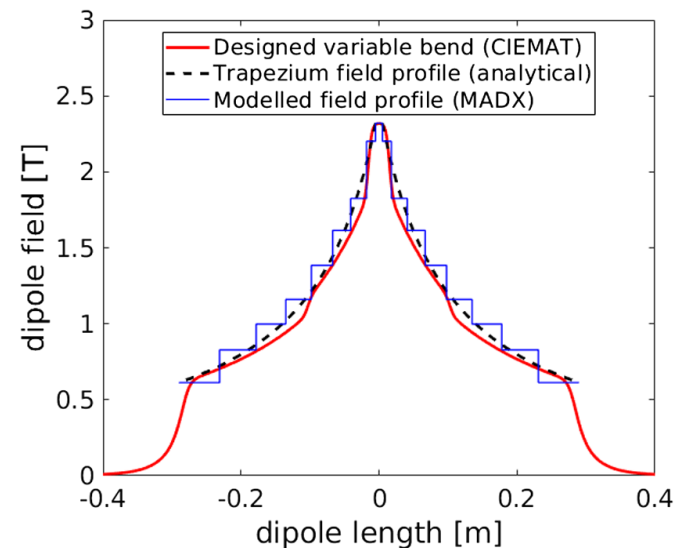
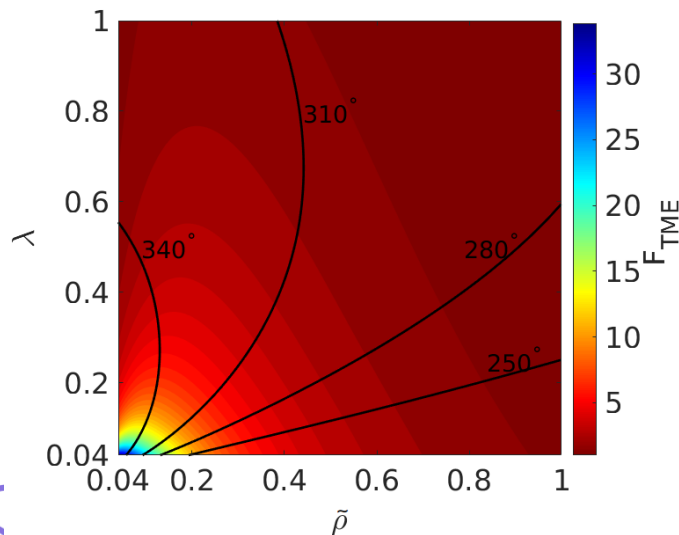


R. Geometrante



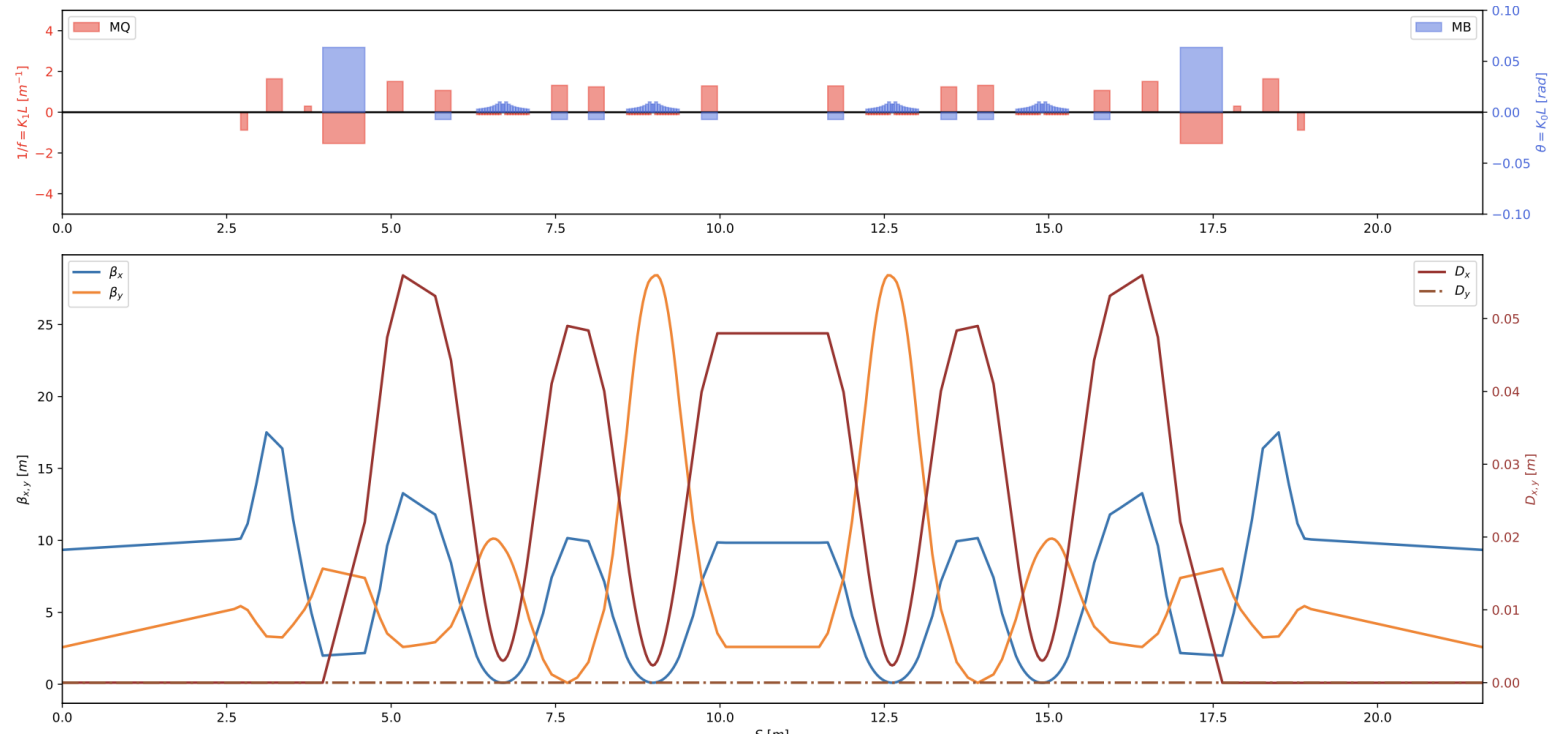
VADER objectives

- **Fabricate** an innovative dipole magnet prototype with longitudinal varying dipole field, including a transverse gradient for the ELETTRA upgrade
- Permanent magnet **concept** with trapezoidal bending radius, **2.3 T** peak field and **~10 T/m** gradient, already established (CERN/CIEMAT)
- Proved the **horizontal emittance reduction** to ultra-low levels of i.e. **~60 pm @ 2.86 GeV**, for the CLIC DR (M. A. Domínguez Martínez et al., [IEEE Trans. Appl. Supercond. 28, 1, 2018](#); S. Papadopoulou et al, [PRAB 22, 091601, 2019](#))
- First **demonstrator constructed/qualified** by CIEMAT



Lattice and optics design

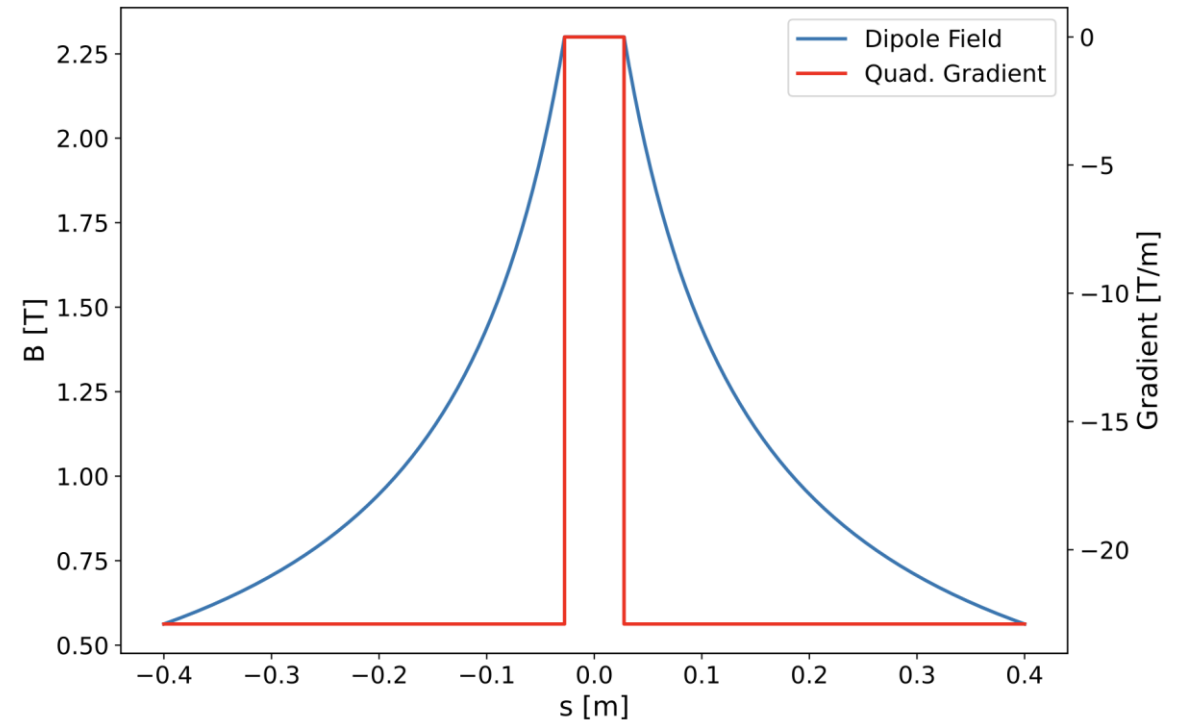
A. Poyet



- Optics constraints at the ID are **matched**
- **Tunes: 34.706 / 22.852**
- **Horizontal emittance reduction from 212 to 100 pm (more than factor of 2!)**
- **Chromaticities: -157/-125**
- ✓ Non-linear optimization on-going: **already good on-momentum DA of about 6 mm**

Profile Design and Magnet Specifications

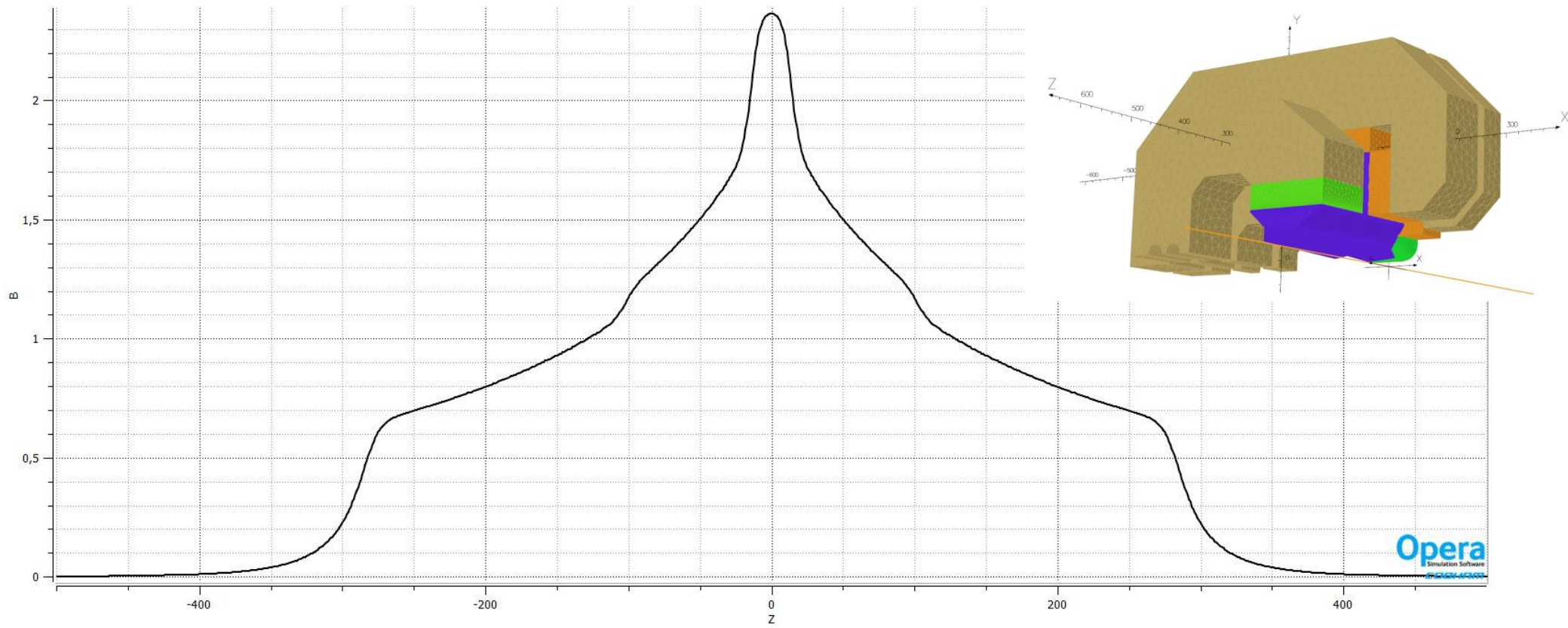
- **Good field region: +/- 6-8 mm**
- **Gap: 17 mm**
- **Quadrupolar gradient: 23 T/m**
- Profile optimized according to the calculation of the **emittance reduction factor**
- Magnetic design on-going at CIEMAT



A. Poyet

VADER: Magnetic design progress

- Feasibility study with adaptation of the **CLIC demonstrator** model
- Increasing **permanent magnet (NdFeB) volume** around **30%** (@ high field region), peak of **2.3T** with gap of **17mm** can be reached



VADER timeline

	Deliverable description	Month
1	Magnet Specifications based on optics calculations for ELETTRA	12
2	Magnetic and mechanical design (including fabrication drawings)	24
3	Fabrication of the prototype	42
4	Acceptance tests	48

Milestone **MS 26**

Deliverable **D7.3**

Milestone **MS 27**

- **Optics work completed** (CERN/Elettra), non-linear dynamics optimization on-going
- **Magnet specification document in final review stage**
- [Internal meeting](#) between **CIEMAT/KYMA** to discuss fabrication process in **fall 2022**
- **Magnetic and mechanical design** from CIEMAT **on-going** with input from KYMA for fabrication, to be **ready by summer 2023**
- Fabrication of the prototype by KYMA to start on **summer 2023**, ready for acceptance tests by **beginning of 2025**



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Thank you for your attention!



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