Short term Upgrades
2nd Beam Line

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S. Doebert - S. Curt – A. Chauchet (RF experts)

K. Sjobaek (remotely from Oslo)

Motivations

CLEAR SCIENTIFIC BOARD REPORT 8/3/24

- **Near-term through 2025**
- Near-term improvements to the CLEAR facility include the introduction of a second beamline. This addition enables the creation of more areas for in-air and in-vacuum testing, reducing the need for frequent mounting and dismounting of experiments and diagnostics equipment. Consequently, it increases the available beam time and operational flexibility, allowing for the parallel execution of 'non-compatible' experiments within the same week or day, with a quick turnaround. This modification also broadens the beam parameter space, for example allowing for larger beam sizes and stronger focusing. Commissioning is scheduled for late 2024 or early 2025.
- Finding 8: The second beamline and laser-system improvements will enhance reliability and flexibility for operations in 2024/25, and can be executed within the existing planned resource envelope.
- **Beyond 2025**
- Completion of the construction and commissioning of the new beamline will be crucial to support an extended programme beyond 2025. This will provide more flexibility to cope with the increasing beamtime demands and will enlarge the technical portfolio of the CLEAR facility. Moreover, as preparations progress towards a future Higgs factory at CERN, there is growing consensus on the need for relevant electron-beam test facilities including, for example, prototypes of key system elements of the FCCee injector complex. If such future electron facilities are designed for versatile use, they could continue and expand the CLEAR programme, attracting a broad user community, in addition to serving as a foundational step towards a Higgs factory.

Constraints for the second beam line

- To fulfil **new experiments requirement** (large beam size, bunch compression, larger experimental areas)
- **Time**: no operations interruption apart of the usual shutdowns (summer: 3 weeks, winter: 2 months)
- **Resources**: Only the annual material budget (+ some Eurolabs founding)
- Limited support availability.

Solutions:

Optimize the design (accurate beam dynamic study, large chamber size, magnetic chicane, use of sextupoles)

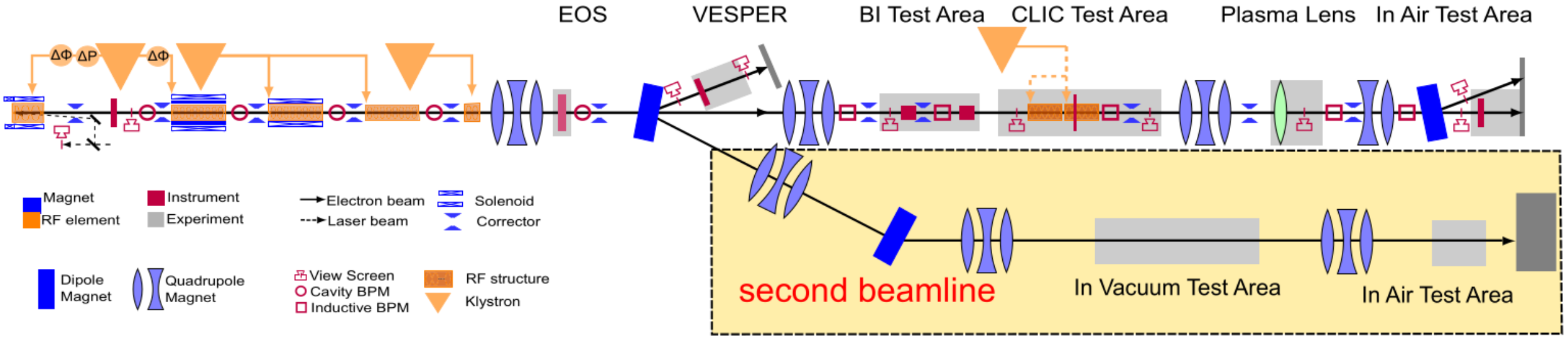
Reuse of the existing equipment (taken from Drive Beam or DL/CR)

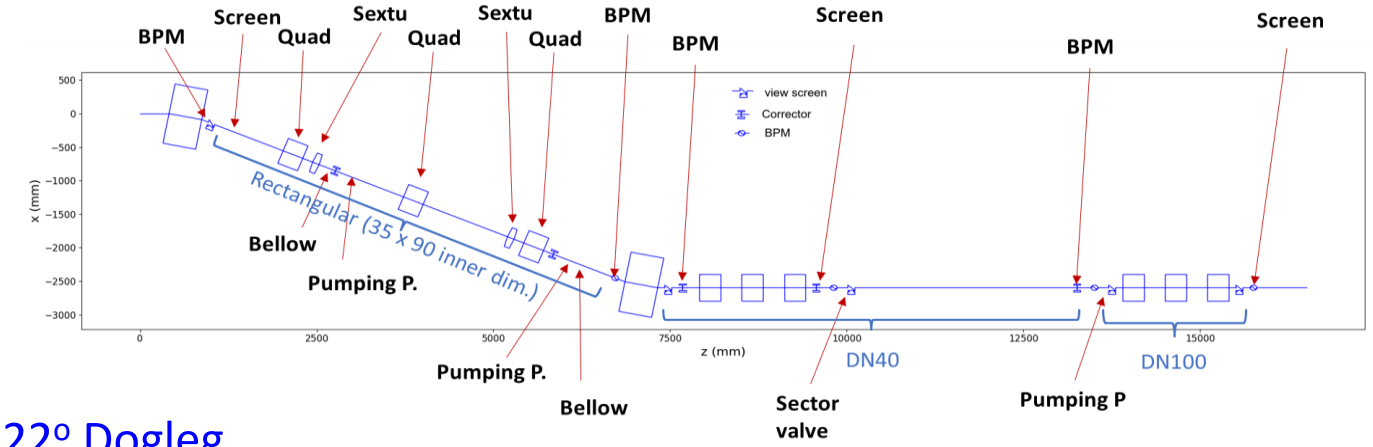
Reuse of the installed cables whenever possible, no general de-cabling

Tasks driven or even executed by the CLEAR team during shutdown, with the support of various groups experts.

Flexibility in the commissioning date.

Proposition of Beamline Layout





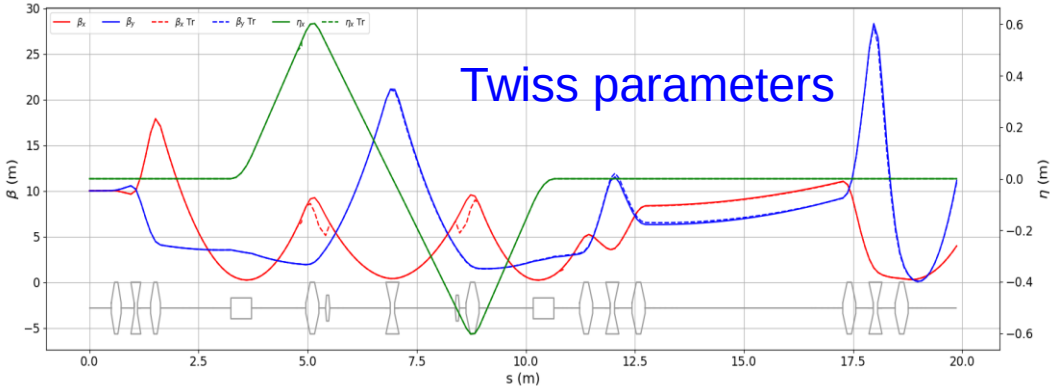
22º Dogleg

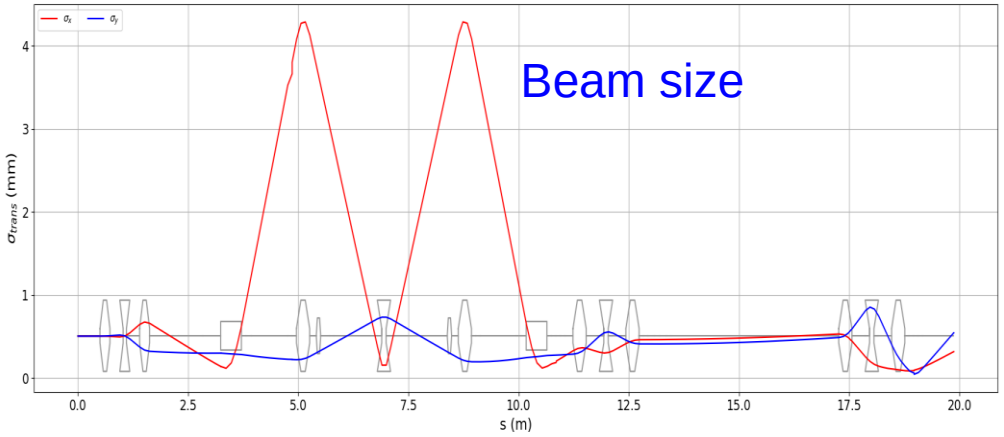
Beam dynamic studies and optimization

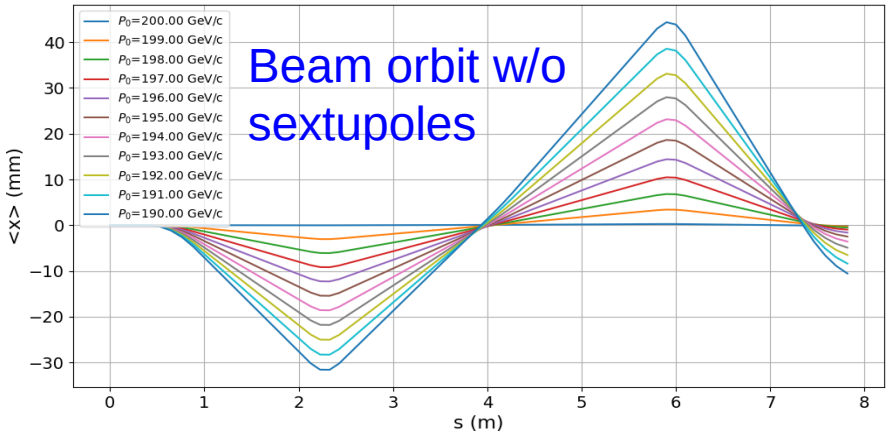
- The dispersion is closed by side quadrupoles of a standard dogleg.
- Flexible beam size adjustment with triplets on straight line

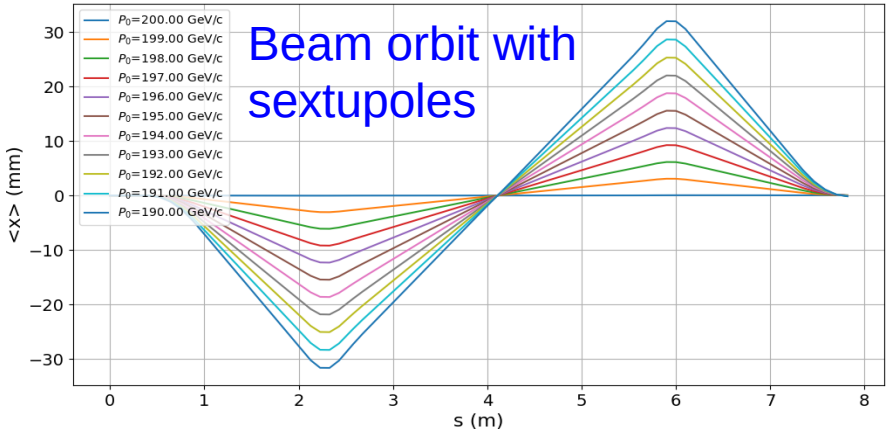
Credit: A. Aksoy

- Sextupoles are adapted to close second order dispersion when energy spread is large



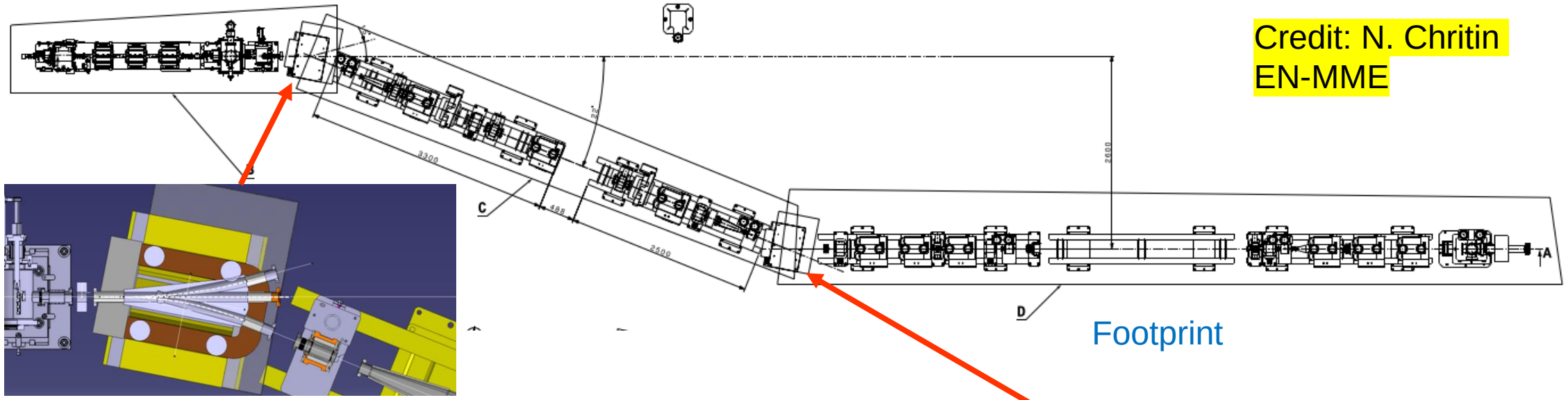




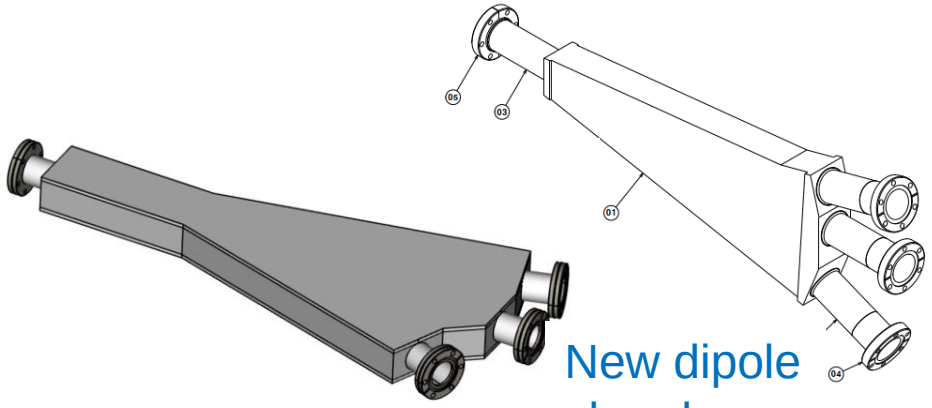


Implementation and manufacturing drawings

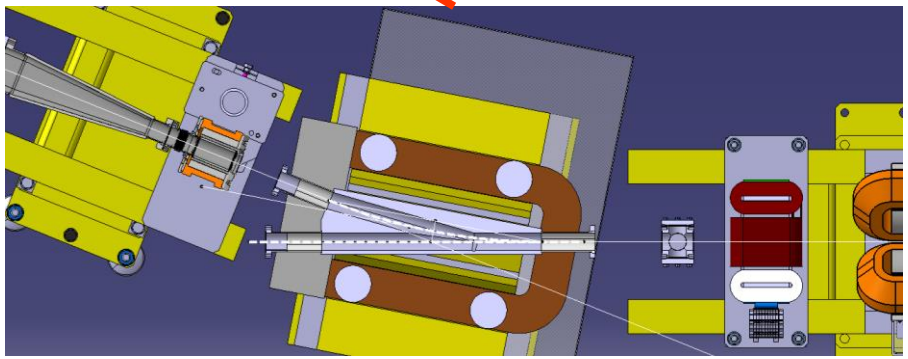
Credit: N. Chritin
EN-MME



Footprint



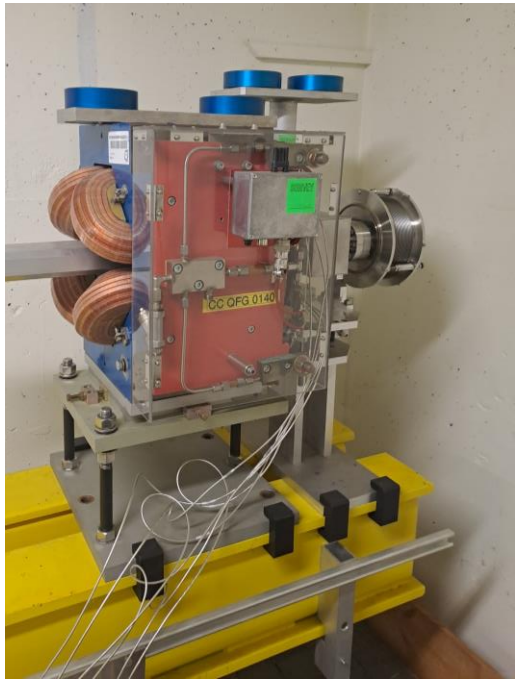
New dipole chamber

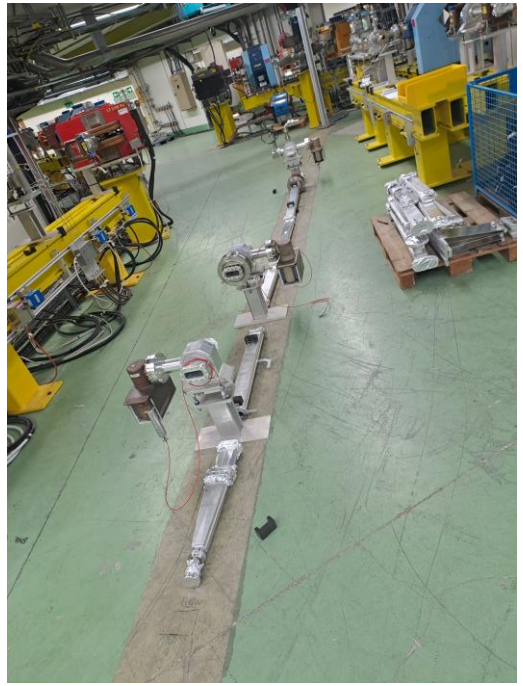


Work Progress

- Theoretical analysis performed (Luke, Alex, Avni), equipment location validated
- Area cleared last summer (Transport group), cables sorting done (by ourself with the support of EN-EL)
- 10 Quad and 3 Sextupoles taken from the CR renewed by the Magnet group TE-MSC-NCM. 2 new dipoles being prepared.
- Available Power supplies identified in the gallery by SY/EPC (former CTF3 equipment)
- First part of survey work achieved (positions of the existing equipment and footprint tracing)
- Vacuum chambers identified and result transmitted to EN-MME-EDS
- Implementation and manufacturing drawings nearly achieved
- Vacuum layout validated by TE-VSC
- Beam dump simulated and validated by the RP and STI
- New RP sensors installed by HSE-RP
- Some components already received (YAG screens, cameras, BCM, optical breadboard). Others developed: New samples handling robot

Some recent pictures





Renewed quads and sextupoles with large aperture

Blank mounting and obtained solution for the dogleg.

Stay in touch on our website: https://clear.cern/

Thank you for your attention