# Project Progress Review (PPR) 1-2024

## WP4- Magnets and Power Supplies

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20 March 2025

# WP4: Goals and objectives

- Design magnets that reply to the requirements of the beam dynamics
- Write specifications and technical details report
- Contact providers and/or explore other possibilities (donation)
- Magnetic measurements
- installation

# Which constrains should our magnets respect?

1. Imposed tolerances

- On the magnetic field, magnet aperture, geometry, etc.
- On the accepted machine performance : orbit distortion, dynamic aperture, tune value, etc.
- This requires direct coordination with beam dynamics

2. Reliability

- Reduce as much as possible the failure time
- Easy access and minimal repairing time in case of failure
- Unknown for a new design!
- Requires careful design analysis and review

3. Safety conditions

- More constrains on the design
- But nominal operation
- Direct coordination with project leader and adequate department

4. Financial constrains

- Short term: raw material and fabrication cost
- Long term: Power consumption and cooling cost
- Can be reduced if we get some donation

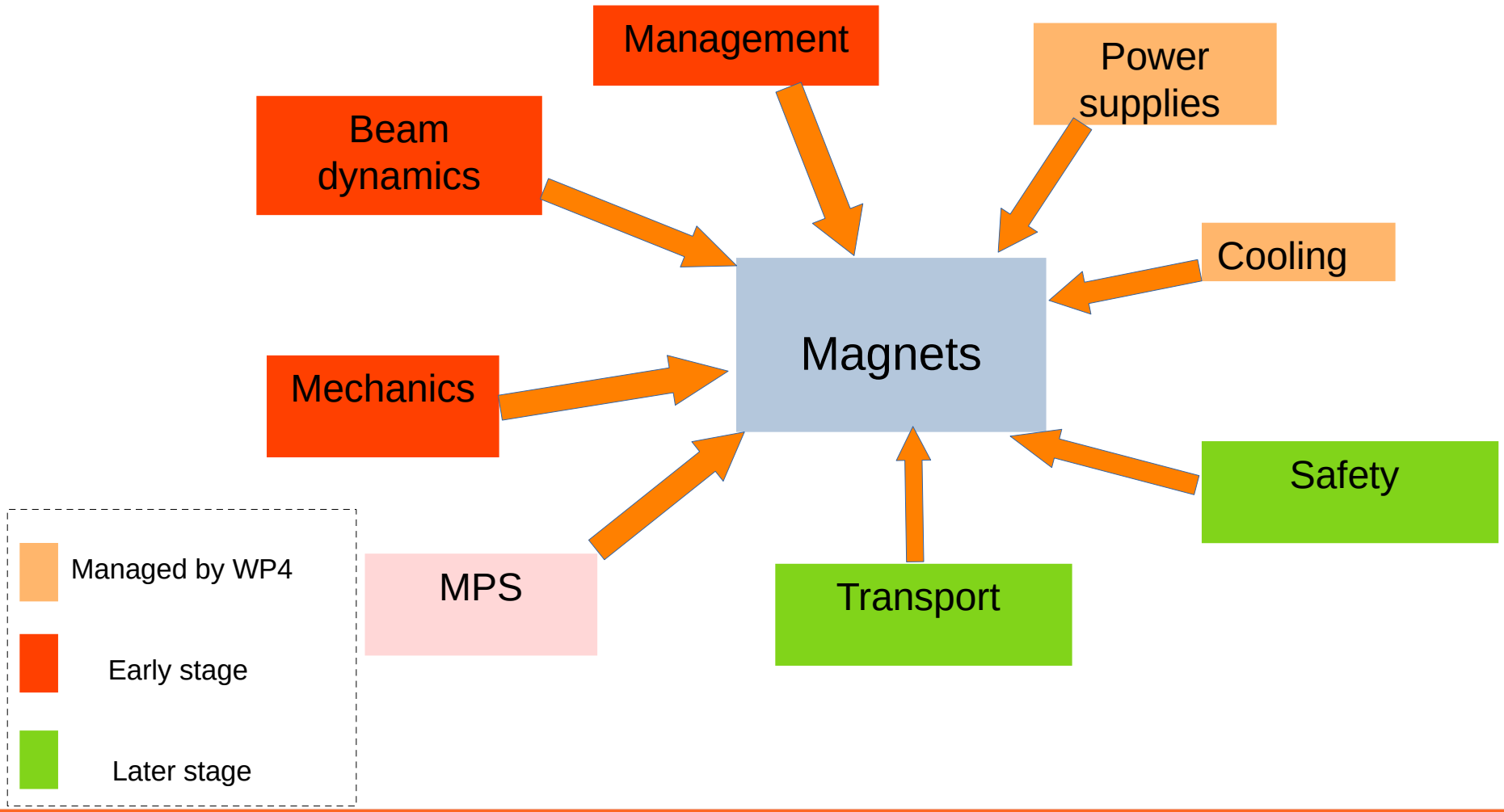
5. Project timeline

- Defined in coordination with the management

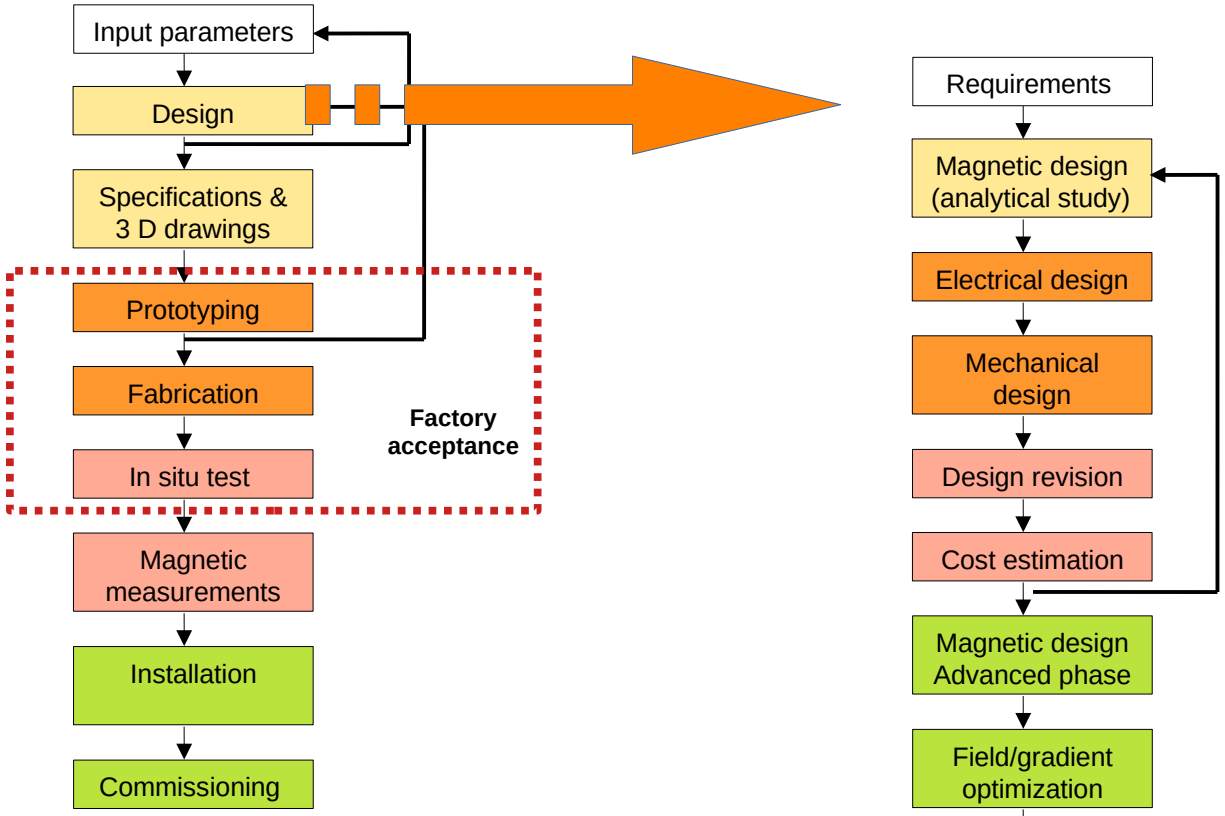
6. Upgradable

Fit for both single turn and 250 MeV machine

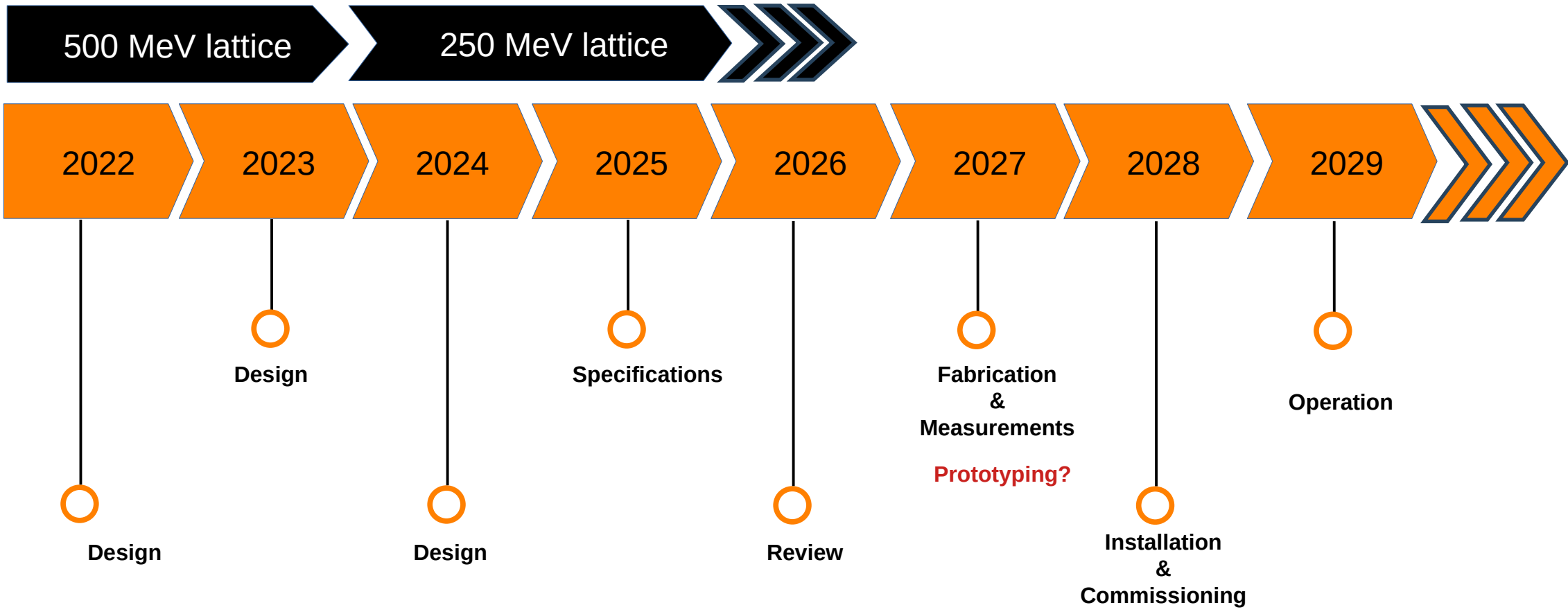
# WP4: Interaction with other WPs



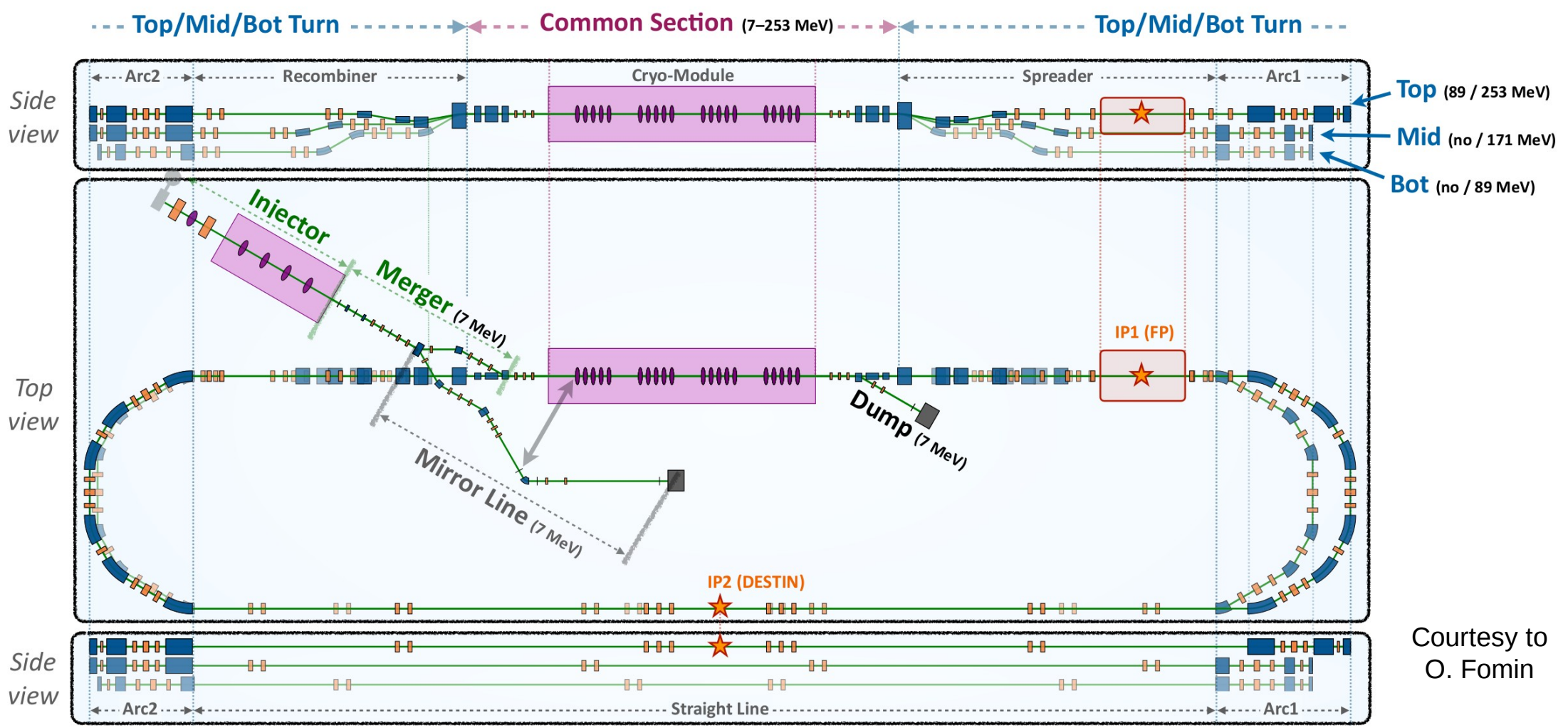
# WP4: Work flow



# Timeline (Macroscopic scale)



# PERLE single turn



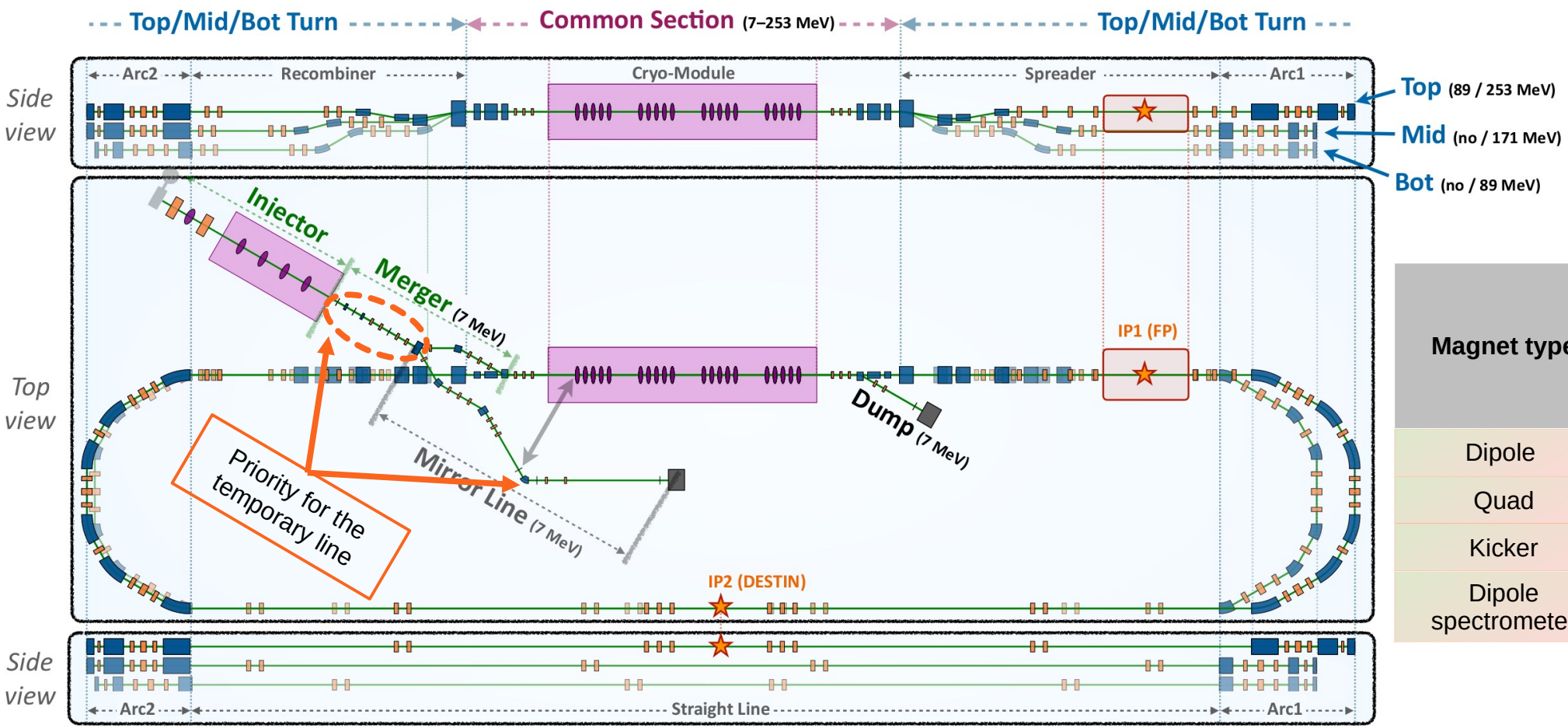

Courtesy to O. Fomin

# Magnets for PERLE single turn: overall view

| Location/ Magnet type | B com | S Bend | R Bend | | Quadrupoles | | Chicane | Kickers |
|---|---|---|---|---|---|---|---|---|
| | 2 types | | L= 10 cm | L=30 cm | ⌀ 80 mm | ⌀ 50 mm | 2 types | |
| **Merger** | | | 2 | | 8 | | | 2 |
| **Mirror** | | | 2 | | 9 | | 1 | |
| **Common** | | | | | 6 | | 6 | |
| **Spreader** | 2 | | | 2 | | 9 | | 1 |
| **Arc 1** | | 6 | | | | 11 | | 2 |
| **Straight line** | | | | | | 11 | | 2 |
| **Arc 2** | | 6 | | | | 11 | | 1 |
| **Recombiner** | 2 | | | 2 | | 4 | | 1 |
| **Dump** | | | | | 2 | | | |
| **Total** | **4** | **12** | **4** | 4 | **25** | 46 | **7** | **9** |

Total of 111 magnets of all types according to the latest lattice version

# Magnets needed for the temporary line




| Magnet type | Number |
|---|---|
| Dipole | 1 |
| Quad | 4 |
| Kicker | 2 |
| Dipole spectrometer | 1 |

# Technical Specification
# Dipoles and Quadrupoles of PERLE

This technical specification concerns the supply of ?? dipoles and ?? quadrupole electromagnets including prototypes for PERLE. The yokes are laminated 1010 steel and the coils are water cooled, wound from hollow copper conductor, and epoxy impregnated. Delivery shall be completed within 24 months after placement of the contract.

https://www.overleaf.com/project/67c1da76258dfffbe7c23685

March 19, 2025

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# Potential providers

sef Technologies

+33(0)5 61 39 89 64

320 rue du Chêne vert
31670 LABÈGE (Toulouse, FRANCE)

Contact established
First meeting: March 21st at 11:00 AM

Other possibilities

ELYTT ENERGY

Calle Orense 11, 2°B, 28020 Madrid, Spain
Phone: +34 914 110 963 Fax: +34 914 110 964
Email: angel.garcia@elytt.com

Already contacted
No answer till now

rtc Engineering

Revol TT Consulting s.r.o.
VAT: SK2022832185
Vlarska 28, 917 01 Trnava
Slovakia

tesla

MAGNET DIVISION
Tesla Engineering Ltd
Water Lane
Storrington
West Sussex
RH20 3EA
UK

# Other possible tracks

- **Purchasement from PSI**
  - A lower price than the market
  - Meeting On February 10th with Kallestrup Jonas
  - Internal meeting: L. Perrot, R. Abukeshek, O. Fomin, H. Abualrob:
    - We are potentially interested in 25 quadrupole for the straight section **(Not urgent priority)**
    - 4 can be used for the temporary line, then can be moved to the straight sections later
    - https://atrium.in2p3.fr/12a5be0c-5a75-4375-a7ff-cca0e9ee5dd0

- **Donation from CERN**
  - We pay the shipment cost
  - Meeting on February 4th with Jeremie Bauche
  - Internal meeting: L. Perrot, R. Abukeshek, O. Fomin, H. Abualrob:
    - A short list of potentially interesting magnets is extracted out of a giant list
    - More specification about this short list is needed to confirm our need
    - Specification list will be sent to us

# Available magnets at CERN

| Type needed / CERN options | PERLE needs / Avaliable | Spare / Installed | Dipole Integrated Field at Peak Current [Tm] | Quad. Gradient Integrated Field at Peak Current [T] | Total Length [mm] | Total Width [mm] | Total Height [mm] | Aperture width [mm] | Aperture height [mm] | Aperture height [mm] | Function | Cooling System | Iron Length [mm] | Weight [Kg] | Design Code |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **7 MeV, 30 deg** | **8** | | **> 0.012** | | **M 150** | | | **> 80** | **> 80** | **> 80** | | | | | |
| Corrector magnet, H+V, type 11 | | 3 / 19 | 0.018 | | 270 | 257 | 270 | 153 | 153 | 153 | Horizontal and Vertical | Air | 229.2 | 64 | PXMCCLAWAP |
| Corrector magnet, H or V, type 8af | 1 | 8 / 7 | 0.016 | | 385 | 340 | 310 | 105 | 120 | 120 | Horizontal or Vertical | Air | 250 | 74 | PXMCXADWAP |
| Corrector magnet, H or V, type 4af | | 3 / 13 | 0.019 | | 370 | 312 | 230 | 160 | 150 | 150 | Horizontal or Vertical | Air | 300 | 40 | PXMCXAEWAP |
| Corrector magnet, H or V, type 4AD | 2 | 2 / 0 | 0.02 | | 362 | 344 | 190 | 200 | 145 | 145 | Horizontal or Vertical | Air | 300 | 60 | PXMCXAFWAC |
| Corrector magnet, H or V, type 8a water | 6 | 6 / 0 | 0.04 | | 385 | 490 | 290 | 105 | 120 | 120 | Horizontal or Vertical | Water | 250 | 95 | PXMCXAHWWP |
| **Spr/Rec dipoles** | **14+4** | | **> 0.3** | | **M 330** | | **?** | **> 50** | **> 50** | **> 50** | | | | | |
| **Arc dipoles 33** | **18** | | **> 0.442** | | **M 330** | | **?** | **> 50** | **> 50** | **> 50** | | | | | |
| **Arc dipoles 66** | **12(?)** | | **> 0.884** | | **M 660** | | **?** | **> 50** | **> 50** | **> 50** | | | | | |
| Corrector magnet, H or V, type MDX | | 35 / 50 | 0.756 | | 655 | 730 | 680 | 140 | 52 | 120 | Horizontal or Vertical | Water | 400 | 1100 | PXMCXCAHWC |
| **(Arc dipoles 33)** | **(18)** | | **> 0.442** | | **M 330** | | **?** | **> 50** | **> 50** | **> 50** | | | | | |
| Bending magnet, type FO56 | | 2 / 2 | 0.6115 | | 575 | 400 | 390 | 72 | 72 | 72 | Horizontal | Water | 450 | 256 | PXMBHBDCWP |
| **Q5** | **24** | | | **> 0.2** | **M 50** | | | **> 80** | **> 80** | **> 80** | | | | | |
| Quadrupole magnet, type Q#B or QL1 | 14 | 14 / 0 | | 0.5582 | 270 | 274 | 274 | 58 | 58 | 58 | Normal | Air | 200 | 94 | PXMQNAGNAP |
| Quadrupole magnet, type Q#A or QS | 19 | 19 / 0 | | 0.3134 | 175 | 274 | 274 | 58 | 58 | 58 | Normal | Air | 104 | 51 | PXMQNAHNAP |
| Quadrupole magnet, type Q#G | 1 | 1 / 0 | | 0.2198 | 175 | 274 | 274 | 80 | 80 | 80 | Normal | Air | 140 | 49 | PXMQNALNAP |
| **Q10 (& Q15)** | **110 (& 18)** | | | **> 2.4** | **M 150** | | **?** | **> 50** | **> 50** | **> 50** | | | | | |
| Quadrupole magnet, HIE Isolde TL | | 2 / 28 | | 5 | 339 | 485 | 535 | 50 | 50 | 50 | Normal | Water | 185 | 200 | PXMQNLINWP |
| **H / V correctors ERL** | **60** | | **0.005** | | **M 0** | | **?** | **> 80 (50)** | **> 80 (50)** | **> 80 (50)** | | | | | |
| Corrector magnet, H+V, type 9af | 1 | 1 / 0 | 0.00531 | | 200 | 100 | 100 | 70 | 70 | 70 | Horizontal and Vertical | Air | 200 | 15 | PXMCCABWAP |
| Corrector magnet, H+V, HIE Isolde | | 2 / 15 | 0.0091 | | 92 | 469 | 604 | 92 | 92 | 92 | Horizontal and Vertical | Water | 34 | 50 | PXMCCAZWWC |
| Multipole magnet, type 403 | | 18 / 26 | 0.00833 | 0.013 | 155 | 276 | 145 | 156 | 89 | 89 | *Not applicable* | Air | 155 | 15 | PXMM_AAIAP |

# Magnetic measurements

- Received magnets (either donation or purchasemnt should be measured)
- SSW bench available in building 209
  - Access and powering issues?
  - Already discussed with Walid
- Work on the bench already started in 2022 in collaboration with SOLEIL
- Measurement automation is necessary at this stage

**Functionality and Performance Analysis of the Stretch Wire Magnetic Measurement Bench**

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AN-Najah National University
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24 December, 2022

https://atrium.in2p3.fr/554abe00-bc13-459c-a611-b41ee8460b80

# Priorities and quick actions

- 
- Design of the temporary line magnets
  - Internship of Palestinian student (Jana Souyani, L3 physics, Juin 18-August 17 2025)
- Automation of measurements of the single stretched wire bench
  - Internship of Palestinian student (Mohammedkhaled Salah, M1 Mechatronics engineering, Juin 18-August 18 2025)
- Technical specification report for all magnets and global cost estimation
- Contact providers and compare estimated cost