Project Progress Review (PPR) 3-2025

WP-04

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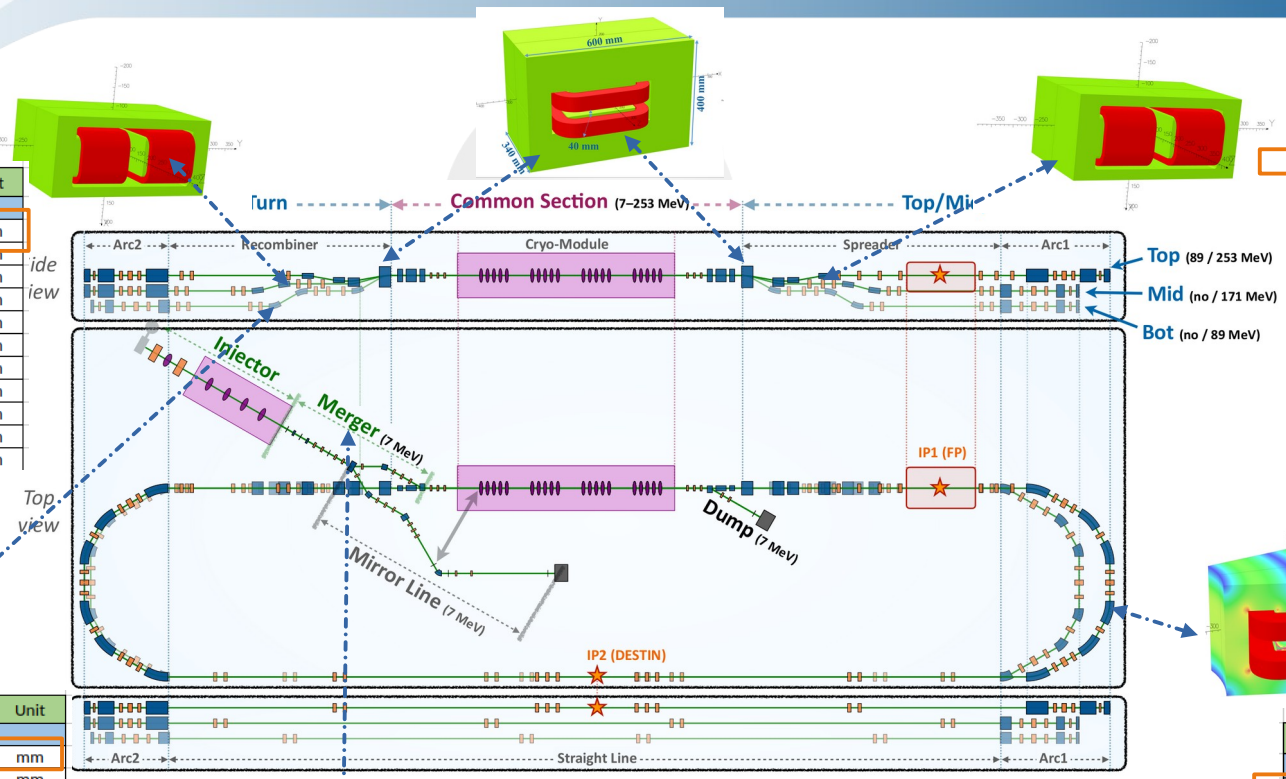
22 May 2025

Outline

- Magnetic design
  - Status and upcoming actions
  - Interaction with other workpackeges
- Purchasement and donation
  - Reuse on-shelf magnets (Thom-X, PSI, CTF3, CERN)
  - Purchasement (SEF Technologies, Elytte Technology)
- Preparation of the SSW bench
- Human resources

Magnetic design status



Parameters	Value	Unit
Yoke		
Aperture heigth	51	mm
Pole width	89	mm
Pole chamfer heigth	0	mm
Pole chamfer width	0	mm
Pole shim heigth	0	mm
Pole shim width	0	mm
Yoke back leg width	22.5	mm
External chamfers side	0	mm
Coil window width	24	mm
Coil window height (from X axis)	154.5	mm
Yoke overall width	182	mm

Parameters	Value	Unit
Yoke		
Aperture heigth	51	mm
Pole width	89	mm
Pole chamfer heigth	0	mm
Pole chamfer width	0	mm
Pole shim heigth	0	mm
Pole shim width	0	mm
Yoke back leg width	23.5	mm
External chamfers side	0	mm
Coil window width	24	mm
Coil window height (from X axis)	154.5	mm
Yoke overall width	188	mm

Parameters	Value	Unit
Yoke		
Aperture heigth	49	mm
Pole width	80	mm
Pole chamfer heigth	0	mm
Pole chamfer width	0	mm
Pole shim heigth	0	mm
Pole shim width	0	mm
Yoke back leg width	22	mm
External chamfers side	0	mm
Coil window width	24	mm
Coil window height (from X axis)	153.5	mm
Yoke overall width	172	mm

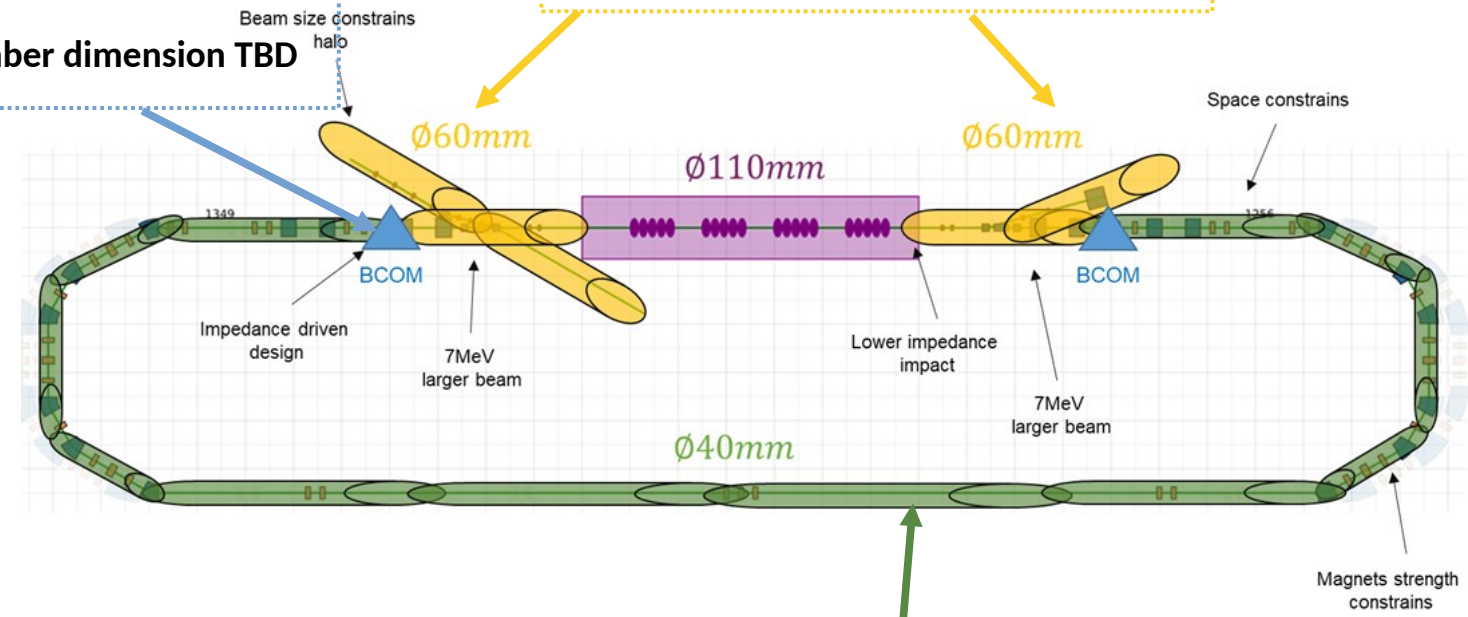
Parameters	Value
Height	100 mm
Yoke thickness	15 mm
Length	50 mm
Aperture	40 mm
Pole width	17 mm
NI per coil	318.31 A.turn
Gradient	3 T/m

Parameters	Value	Unit
Yoke		
Aperture heigth	49	mm
Pole width	162.5	mm
Pole chamfer heigth	0	mm
Pole chamfer width	0	mm
Pole shim heigth	0	mm
Pole shim width	0	mm
Yoke back leg width	77	mm
External chamfers side	0	mm
Coil window width	91	mm
Coil window height (from X axis)	88.5	mm
Yoke overall width	360.5	mm

New vacuum chamber diameter

New magnet aperture=76 mm

New vacuum chamber dimension TBD



New magnet aperture=56 mm

Magnet aperture=vaccum chamber internal diameter+16 mm

- Thickness:3 mm
- Etuvage: 10 mm
- Tolerances: 3 mm

Courtesy to J. Michaud

Recent decision on the vacuum chamber diameter

- Important impact on the magnetic field of all already-designed magnets
- Effect evaluation by analytical calculation (OPTIMISTIC)
- Study case: B com magnet

Parameter	Current design	Updated design	Relative change%
Aperture (mm)	40	72	+80%
Excitation current (A.turn)	15212	15212	0
Magnetic field (T)	0.47	0.26	-45%

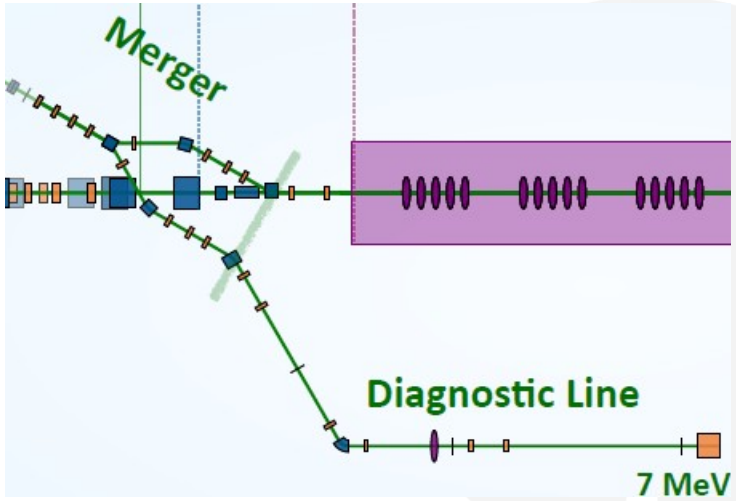
Two possibilities to adapt the new vacuum chamber

Parameter	Current design	New vacuum chamber consideration	Relative change %
Aperture	40 mm	72 mm	+80%
Magnetic field	0.47 T	0.47 T	0
Excitation current (A.turn)	15212	27382	+80%
Current density (A/mm^2)	6.04	10.86	+80%
Power (kW)	1.1	3.4	+200%

Updated magnetic design should be foreseen to maintain the same magnetic field and minimize the power consumption

Magnetic design status: upcoming actions

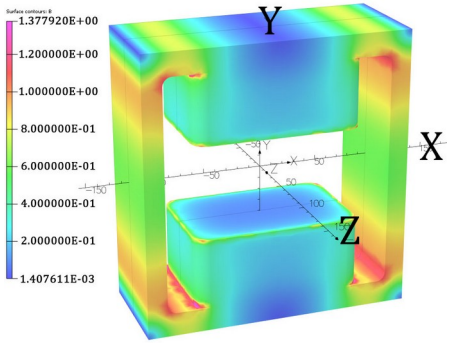
- Design of the magnets of the temporary line considering the new vacuum chamber diameter
- Work already started remotely by a Palestinian student
- Intern will arrive jun 18th

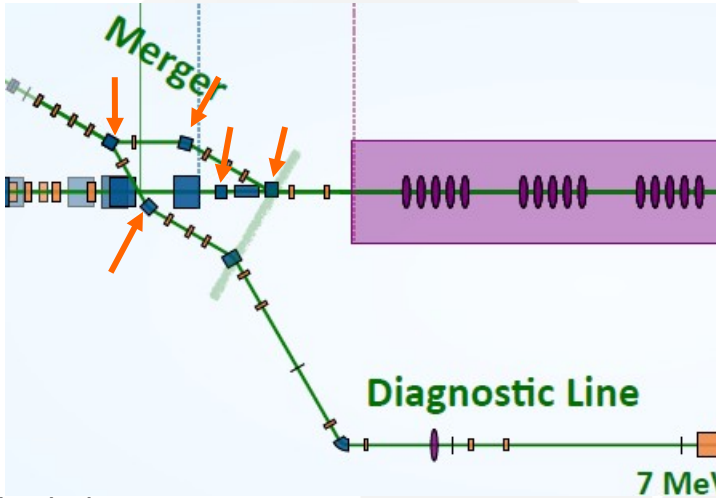


Magnet type	Number
Dipole	1
Quad	4
Kicker	2
Dipole spectrometer	1

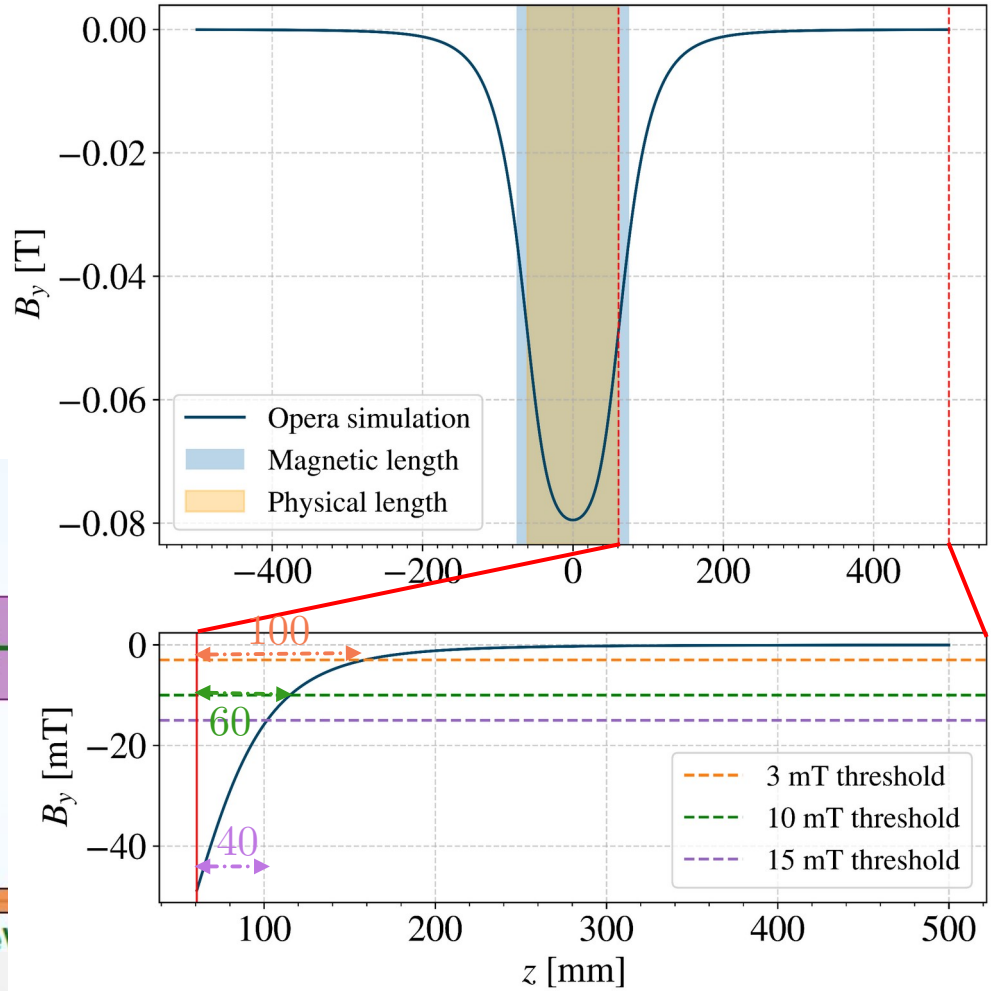
Current measurement and sensitivity to magnetic filed

- ACCT for current measurement
- Sensitivity to the vertical magnetic field of the dipoles along the beam direction in the merger
- ACCT location TBC=> further investigation





Courtesy to R. Abukeshek



Reusing on shelf magnets

- **1. Magnets from the PSI**

➢ We are potentially interested in 25 quadrupoles for the straight section

➢ 4 can be used for the temporary line

- **2. Magnets of Thom-X**

➢ Technical specification and magnetic measurement reports are provided by SOLEIL

➢ **Conclusion: the magnets of ThomX can not be used for PERLE**

Parameter	ThomX	PERLE
Physical aperture	41 mm	~56 mm (min. value)
Gradient “for Qpoles”	5 T/m	4-23 T/m

Reusing on shelf magnets

- **3. Donation from CERN**

Magnet code	Accepted/Not accepted	Potential location in PERLE	Available number	comments
1. PXMCCLAWAP	Not accepted	N.A	N.A	not convenient as a dipole too large if used as a steerer
2. PXMCXADWAP	Not accepted	N.A	N.A	max. field=0.043 T Vs 0.08 T needed
3. PXMCXAEWAP	Not accepted	N.A	N.A	max. field=0.043 T Vs 0.08 T needed
4. PXMCXAFWAC	Not accepted	N.A	N.A	max. field=0.043 T Vs 0.08 T needed
5. PXMCXAHWWP	Not accepted	N.A	N.A	Type 8a water Too big (transversely)
6. PXMBHBDCWP	Not accepted	N.A	2	Only 2 are available
7. PXMQNAGNAP	Not accepted	N.A	N.A	Inner diameter=58 mm vacuum chamber of PERLE is 60 mm
8. PXMQNAHNAP	Not accepted	N.A	N.A	Inner diameter=58 mm vacuum chamber of PERLE is 60 mm
9. PXMM_AAIAP	Not accepted	N.A	N.A	Exotic shape (does not fit anywhere)
10. PXMQNALNAP (D80/L104)	Accepted	TBC	1	Only one is available
11. PXMQNLINWP	Accepted	Straight section	2	Only 2 are available
12. PXMCCABWAP	Accepted	ERL	1	Only one is available
13. PXMCCAZWWC	Accepted	merger	2	Only 2 are available
14. PXMCXCAHWC	Accepted!	Arc single turn	35	Too big for PERLE 3 Turns but should work for Single Turn

Reusing on shelf magnets

- **3. Donation from CERN**

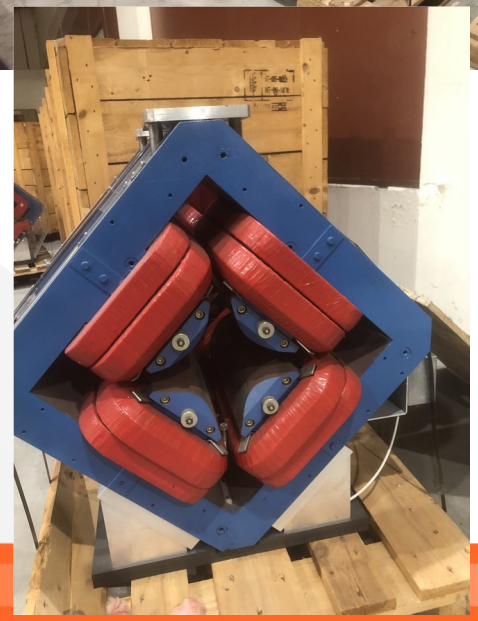
Magnet code	Accepted/Not accepted	Type	Potential location in PERLE	Needed number for PERLE	Available number at CERN	comments
10. PXMQNALNAP (D80/L104)	Accepted	Quadrupole	TBC	N.A	1	Only one is available
11. PXMQNLINWP	Accepted	Quadrupole	Straight section	11	2	Only 2 are available
12. PXMCCABWAP	Accepted	Dipole	ERL	6	1	Only one is available
13. PXMCCAZWWC	Accepted	Quadrupole	Merger	8	2	Only 2 are available
14. PXMCXCAHWC	Accepted	Dipole	Arc single turn	22	35	Too big for PERLE 3 Turns but should work for Single Turn

Reusing on shelf magnets

- **4. Magnets of the CTF3**
  - Available at the IJCLab (Super ACO)
  - Parameters are available on the data sheet of the magnets of CERN!

Parameter	CTF3	PERLE	Conclusion
Geometrical length (cm)	~ 50	5, 10, 15	Can only fit in the straight section and the Diag. Line
Integrated field gradient (T)	3.65	0.5	Reducing the current might help to reach 0.5 T
Current (A)	475	TBD	High current to field gradient ratio

- For missing information the ideal is to measure the magnets
- Power supplies are not found till now ⚠

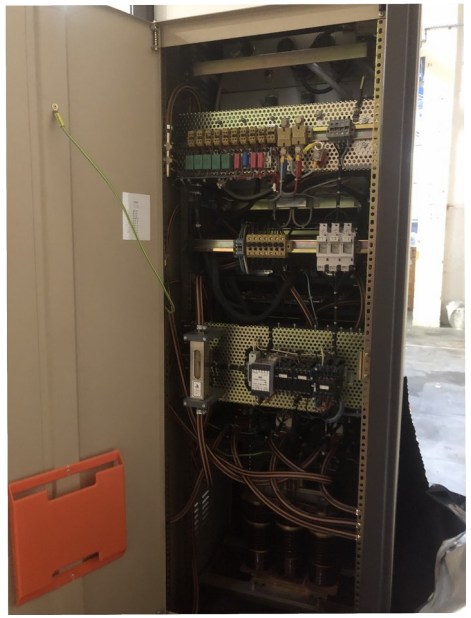


Reusing on shelf magnets: summary

Location in PERLE	Type	Needed number	Available number	Source	Comments
Merger	Quadrupoles	8	2	CERN	Only 2 out of 8
spreader/ recombiner	Dipoles	8	0	None	Limited space
	Quadrupoles	13			
Arcs	Dipoles	12	35	CERN	compatible with single turn
Straight section	Quadrupoles	11	2	CERN	Flexibility due to available space
			25	PSI	
			32	CTF3	Conditioned by finding adequate power supplies!

Power supplies

- Packed power supplies (Bruker) from Trieste are available in the Super ACO
- Data sheet is unavailable
- E. Froidefond (LPSC)is joining the work on the power supplies
- Possibility to check their functionality?



Purchasement

- SEF technologies
  - We provide the magnetic design
  - SEF provides mechanical design
  - Define delivery date by priority :
    - Merger and diag line: rectangular dipoles (17 quadrupoles, and 2 kickers), delivery in mid-2027 for on-site installation by the end of 2027.
    - The magnets for the first the single turn phase: (24 dipoles, 71 quadrupoles, 7 chicanes and 9 kickers) delivery by mid-2028 for installation by the end of 2028
    - The remaining magnets for the three turns phase (34 dipoles, 94 quadrupoles and certain number of kickers TBD) delivery by mid-2029 for installation by the end of 2029.
- Elytt Energy
  - Slow reactivity
  - They can not secure the tender currently due to other heavy engagement
  - High cost estimation, to be followed…

Cost estimation from Elytt:

31 bending magnets, 6 types of dipoles = about 1.315.000 €

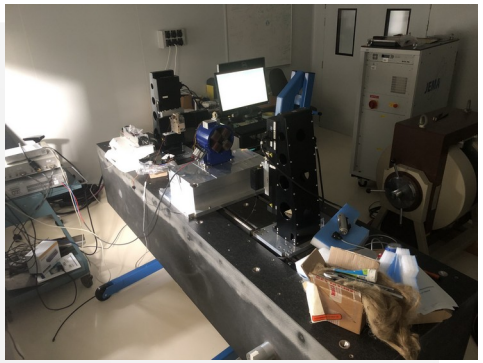
82 Quadrupoles magnets of 4 types is about 2.020.000 €.

22 steering magnets of 3 types is about 150.000 €

Preparation of the SSW bench

- Measurement automation will start on June 18th by a Palestinian intern.
- Discussion with Gael Le Bec (ESRF) during GDR/SciPac:
  - Changing the computer and update the software (ongoing)
  - Possibility of visiting the magnetic workshop at the ESRF (measurement automation is already done)
  - We will collaborate with ESRF on the project of migration towards Python

- Organization and arrangement of the room is mandatory
- Access to 209 and powering



Human resources

WP leaders

- H. Abualrob
- L. Perrot

Rasha

- Phd defense is planned for October 2025
- Post do fund is secured

Power supplies

- E. Froidefone (LPSC)

June-August 2025 at the IJCLab (E+ fund)

- J. Souyani (L3 physics): Magnetic design of the magnets of the temporary line
- M. Salah (M1 mechatronics engineering): SSW bench

July- September 2025 remotely (other sources of fund)

- M. Rafiq (L3 physics): Magnetic design of the magnets of the merger
- T. Onalah (L3 physics): Magnetic design of the magnets of the merger

October-December 2025 (E+ fund)

- One intern will resume the design
- One intern will resume the SSW automation