PERLE INJECTOR DIAGNOSTICS

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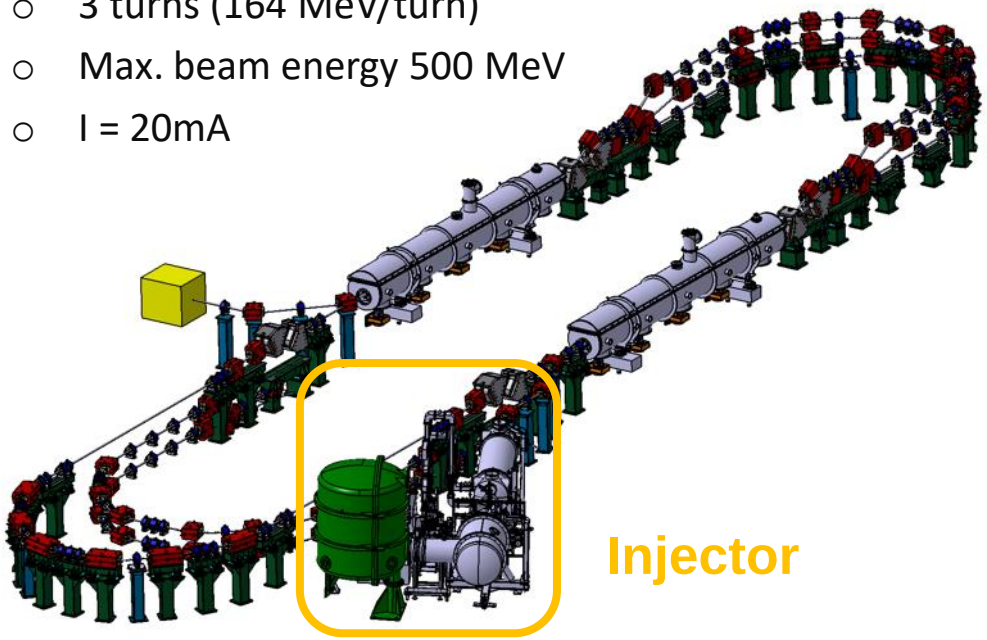
PERLE Genesis

PERLE: A testbed to explore and validate a broad range of accelerator phenomena & technical choices on the pathway to the LHeC and other new frontier machines realisation.

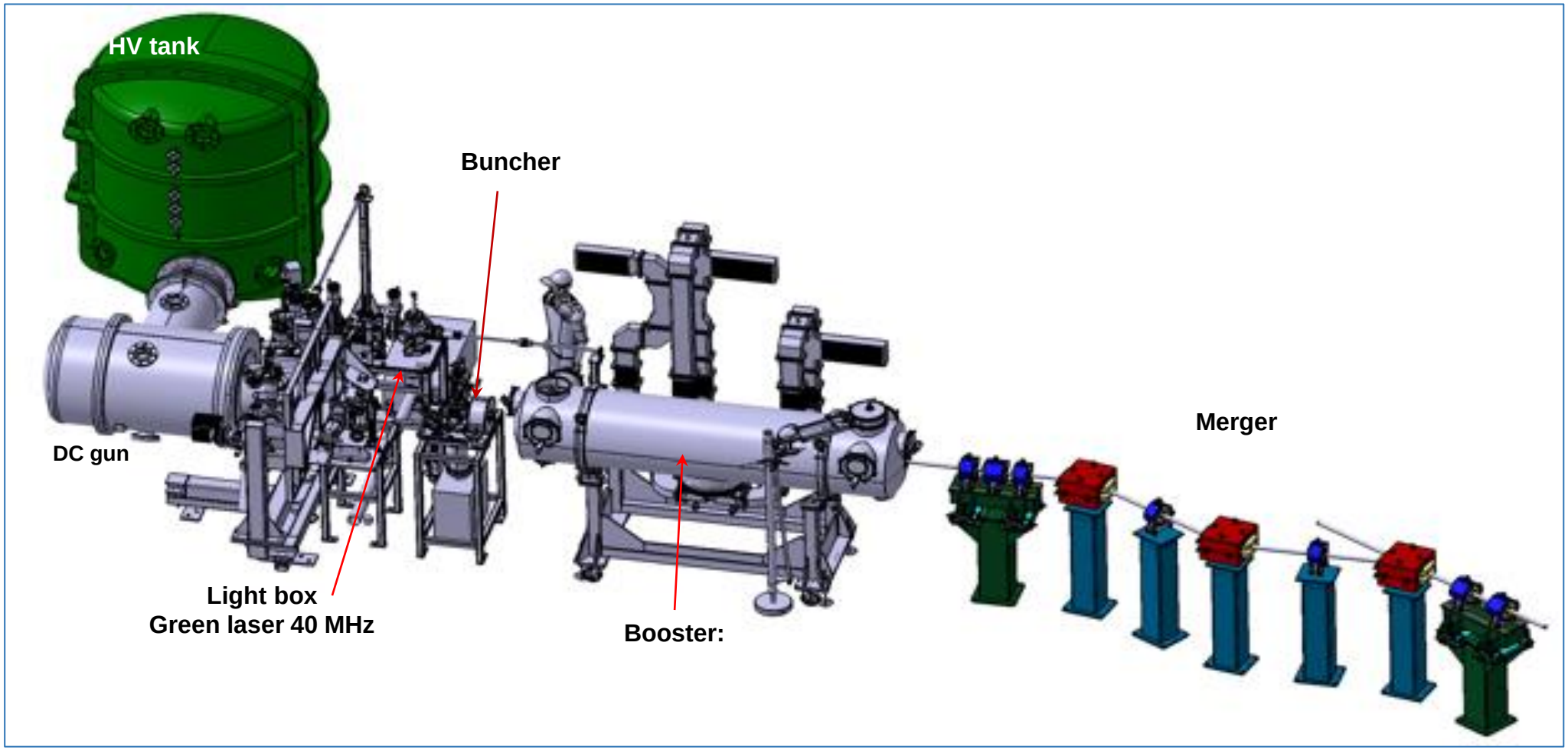
Main challenges: Multi-turn, high bunch charge, high power energy recovery, …

- 2 Linacs (Four 5-Cell 801.58 MHz SC cavities)
- 3 turns (164 MeV/turn)
- Max. beam energy 500 MeV
- I = 20mA



Injector Parameters	Unit	Value
Injection energy	MeV	7
Normalised Emittance $\gamma\varepsilon_{x,y}$	mm mrad	6
Average beam current	mA	20
Bunch charge	pC	500
Bunch length	mm	3
Bunch spacing	ns	25
Duty factor		CW

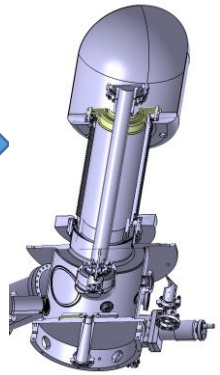
PERLE Injector scheme



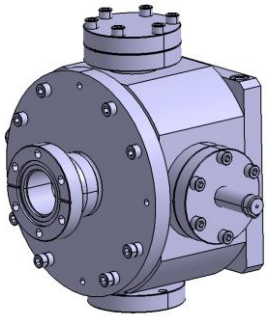
PERLE injector: what should be monitored?

Laser

Cathode

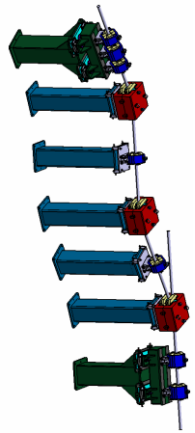


Buncher

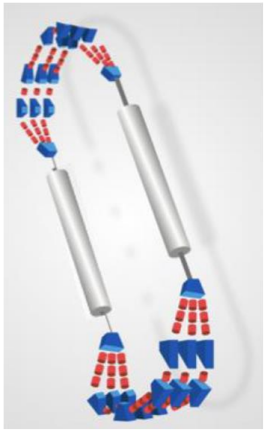


Booster

Merger



ERL



$$\begin{pmatrix} X \\ Y \\ \sigma_X \\ \sigma_Y \\ E \end{pmatrix}$$

LASER

$$\begin{pmatrix} X \\ Y \\ \sigma_X \\ \sigma_Y \\ Q \\ E \end{pmatrix}$$

$$\begin{pmatrix} X \\ Y \\ \sigma_X \\ \sigma_Y \\ Q \\ E \end{pmatrix}$$

$$\begin{pmatrix} X \\ Y \\ \sigma_X \\ \sigma_Y \\ Q \\ E \end{pmatrix}$$

$$\begin{pmatrix} X \\ Y \\ \sigma_X, \sigma_Y \\ E, \Delta E \\ \sigma_Z \\ Halo \end{pmatrix}$$

BEAM LOSS

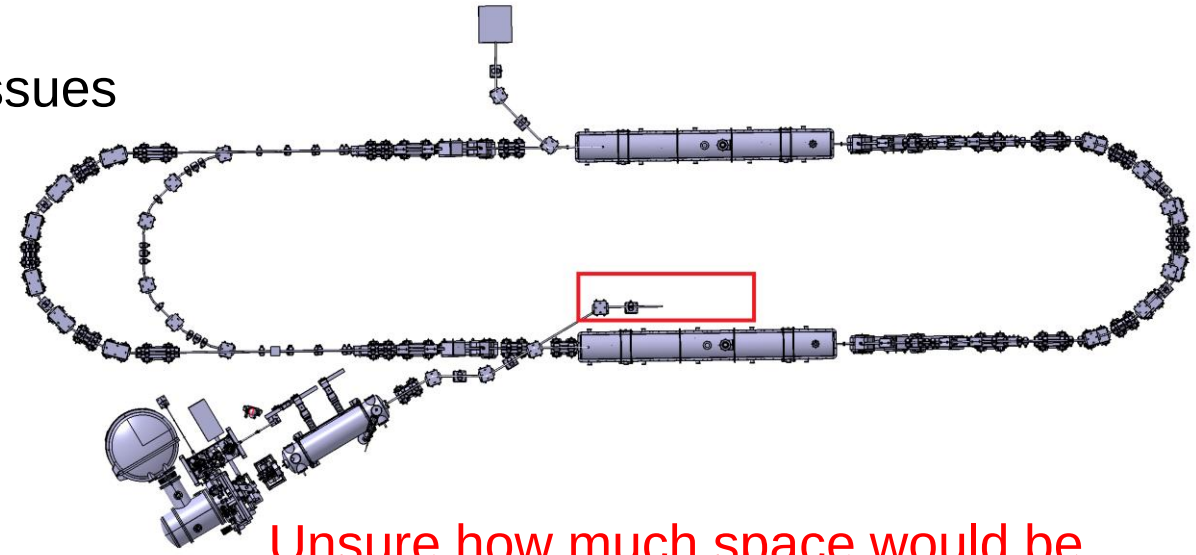
PERLE injector: where should it be monitored?

Diagnostics along the injector: Beam manipulation constraints available space for diagnostics

- Position, charge
- Transverse profile
- Loss
- Laser parameters (might be optional)

Diagnostics beyond the Merger: Footprint issues

- Energy and Energy dispersion
- Transverse profile
- Halo
- Longitudinal profile



Unsure how much space would be dedicated to post merger diagnostics

PERLE injector: monitors to be used

BEAM

ORBIT
- BPM
- View screens

PROFILE
- View screens (transverse)
- + deflecting cavity (longitudinal)

ENERGY
- Dipole + View screen

CHARGE
- BCM (BPM)
- ICT
- Faraday cup

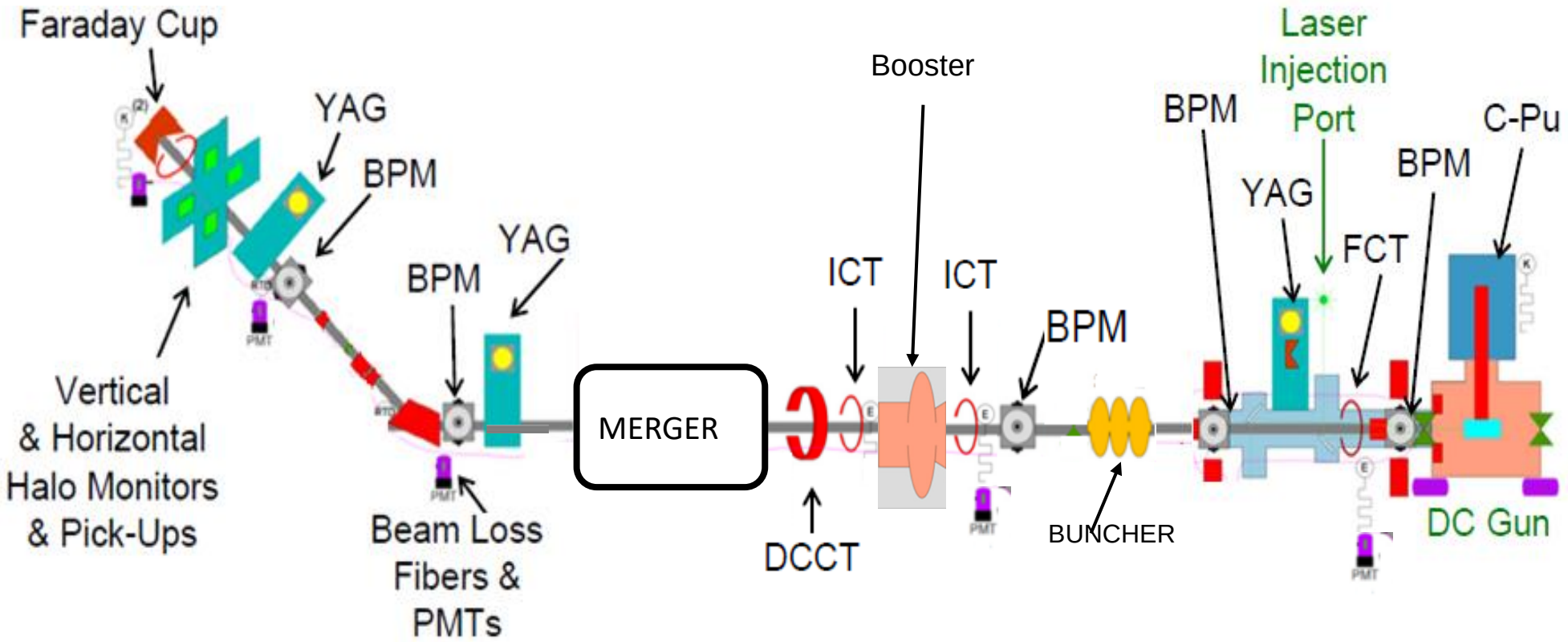
LOSSES
- PMT
- Fiber

LASER
- Power meters
- CCD Cameras
- Virtual cathode

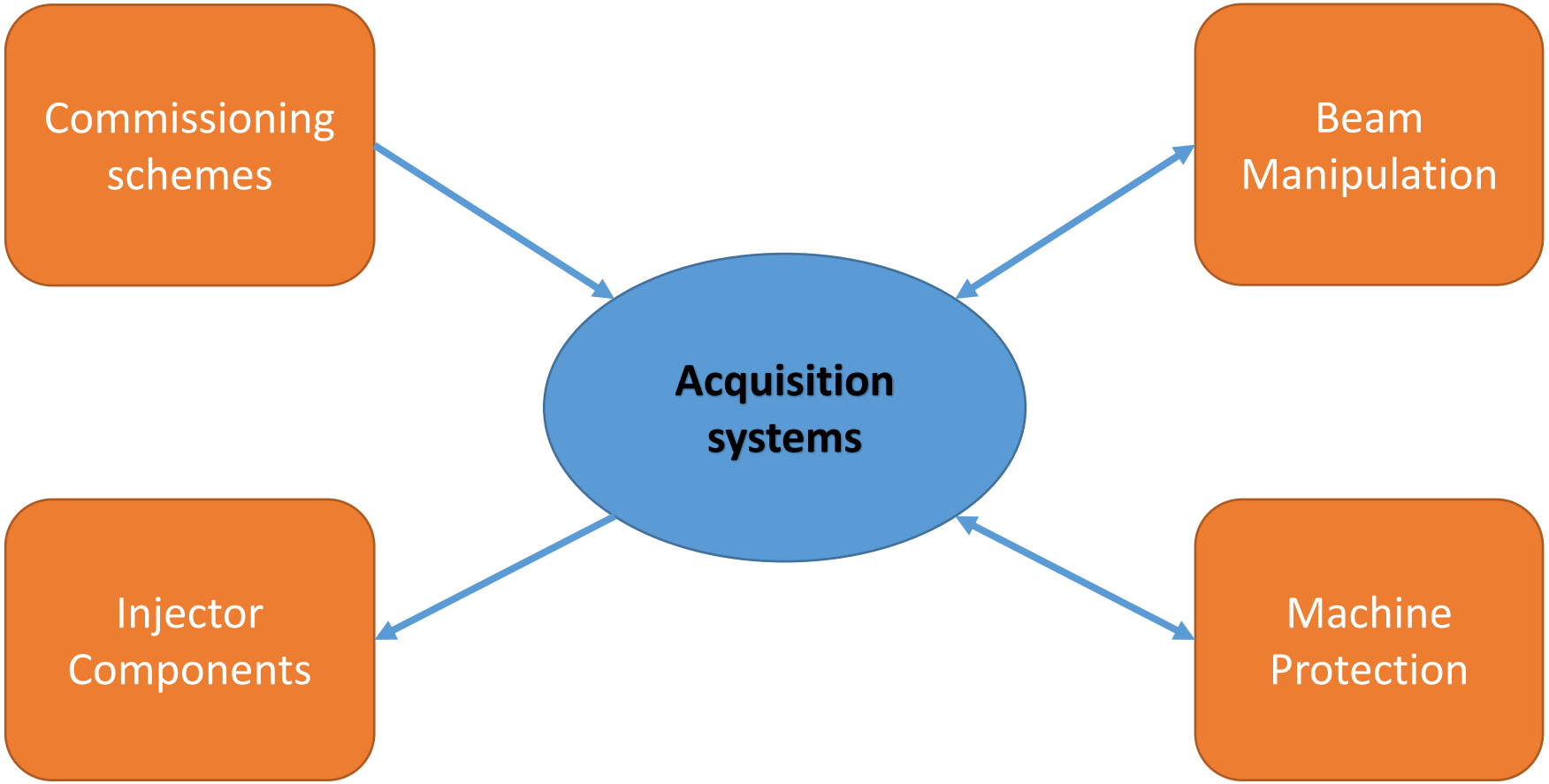
GUN (optional)
- High voltage Ripple monitor

GOAL: injector with necessary diags and not a diag station

PERLE Injector : example with diag positions



Readout hardware and interface issues



Task force and partners

IJCLab Irène Joliot-Curie Laboratoire de Physique des 2 Infinis

ESS bilbao

LPSC GRENOBLE | MODANE

Needs: Task force for many diagnostics yet to be studied

Conclusions

- **PERLE@Orsay is a key ERL project for HEP and Nuclear Physics communities**
- **Diagnostics** are crucial devices for PERLE success.
- **PERLE injector diagnostics quite challenging**: commission schemes, CW operation, large dynamic ranges, broad range diagnostics, beam dynamics...
- **Collaborations on diagnostics under construction** and still opened to new comers.

Thank you for your attention!