

MICE

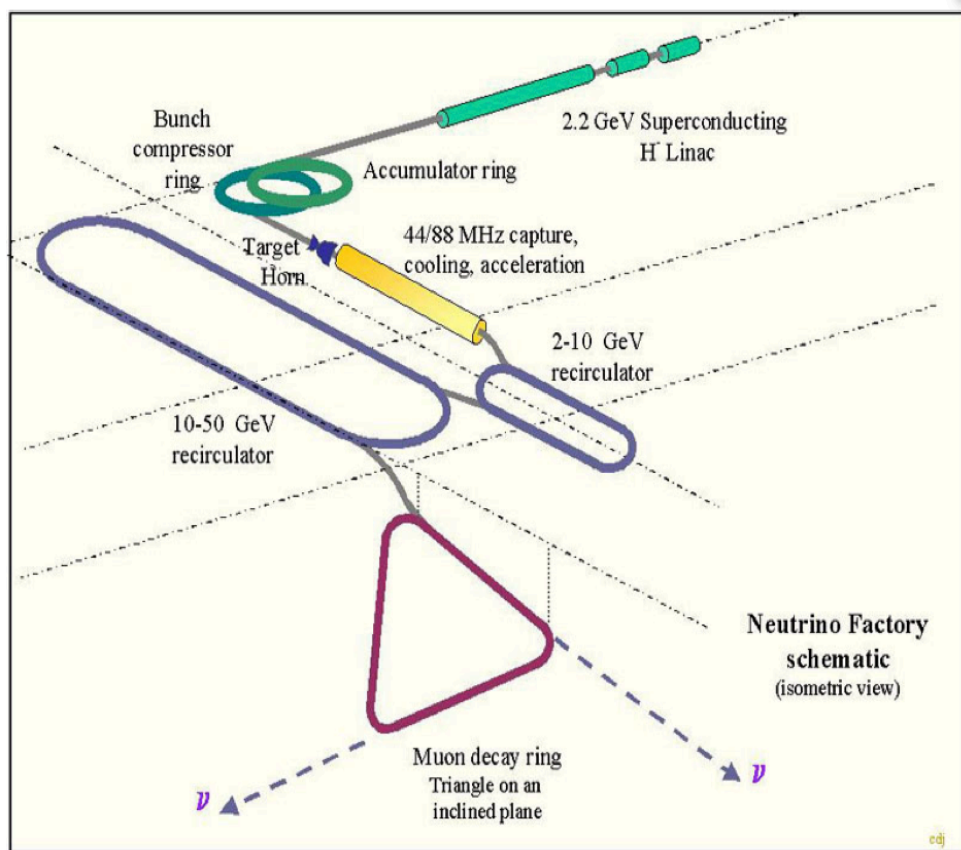
Muon Ionization cooling Experiment

Javier Bilbao

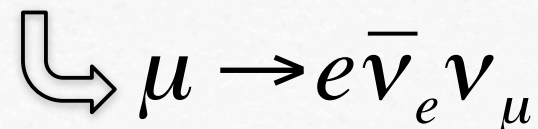


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Why MICE



Neutrino factories



~~Classical cooling techniques~~

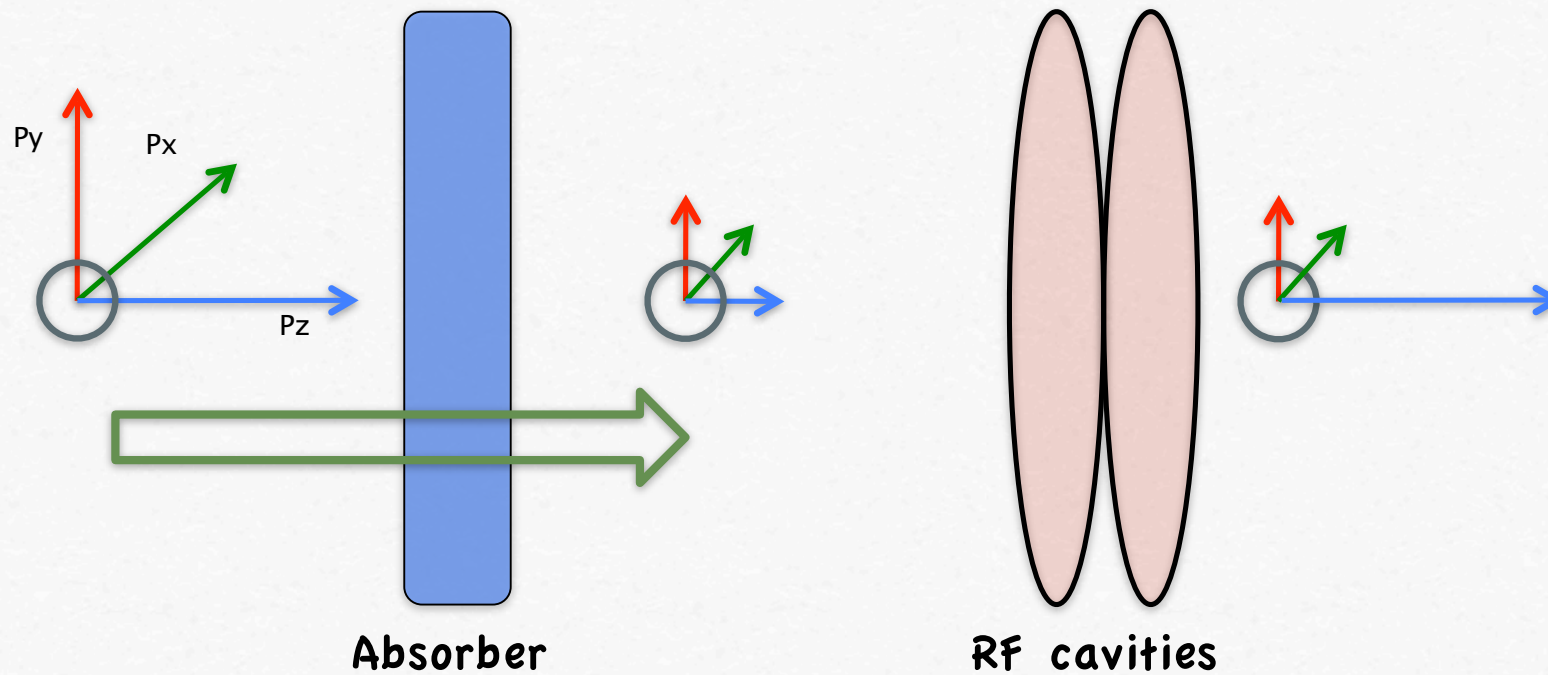
First step to $\mu\mu^+$ colider



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Cooling Principle

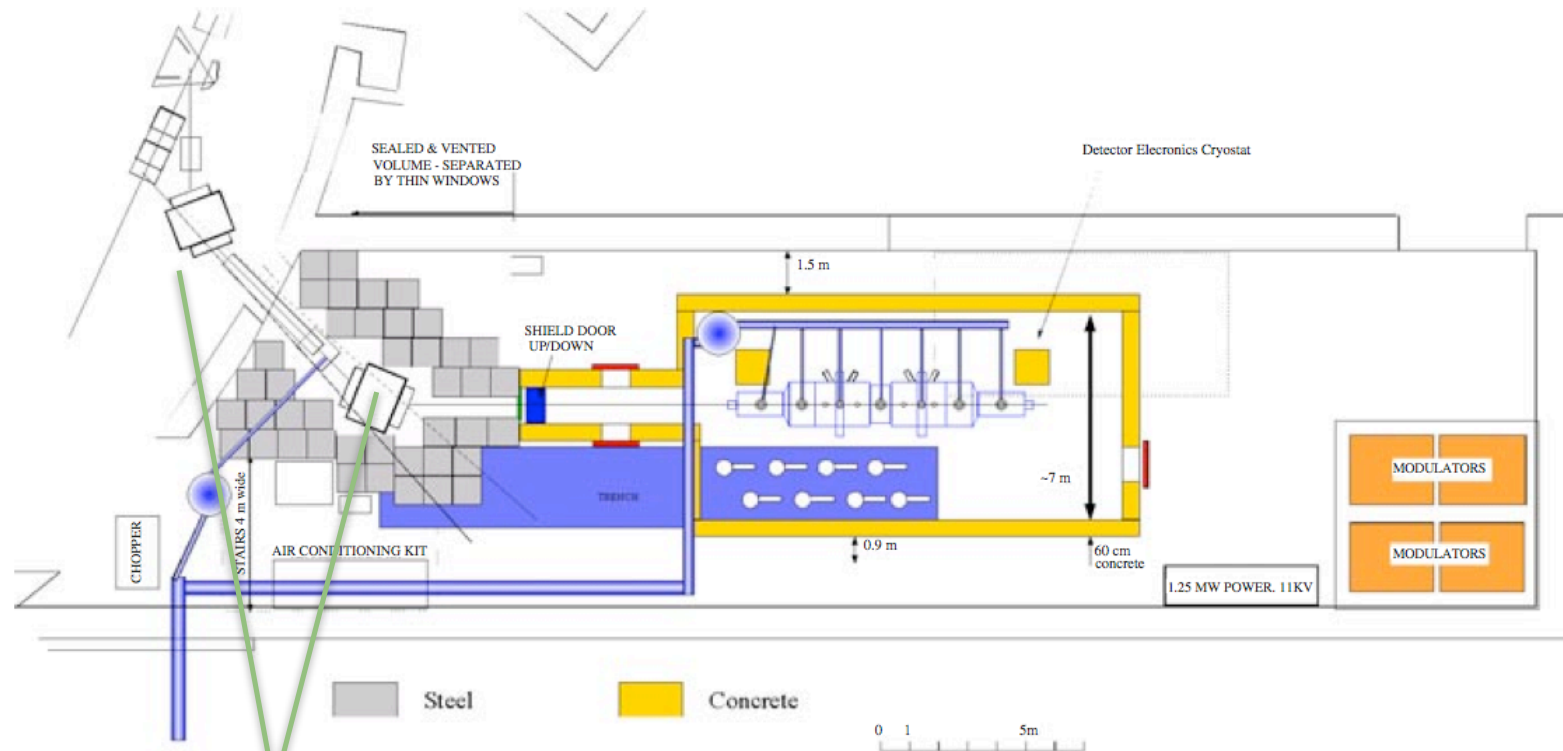


Reduction of transverse momentum



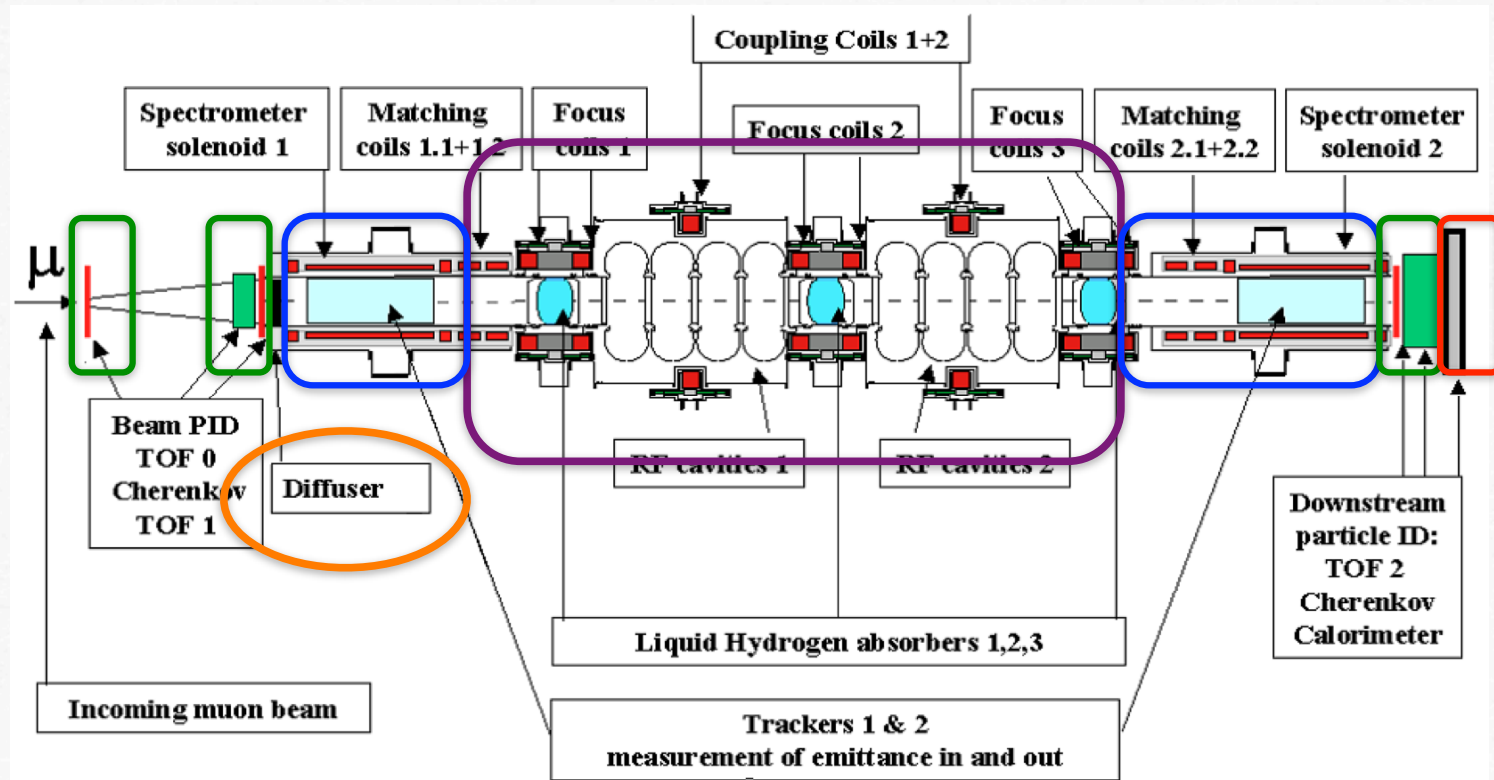
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MICE Setup



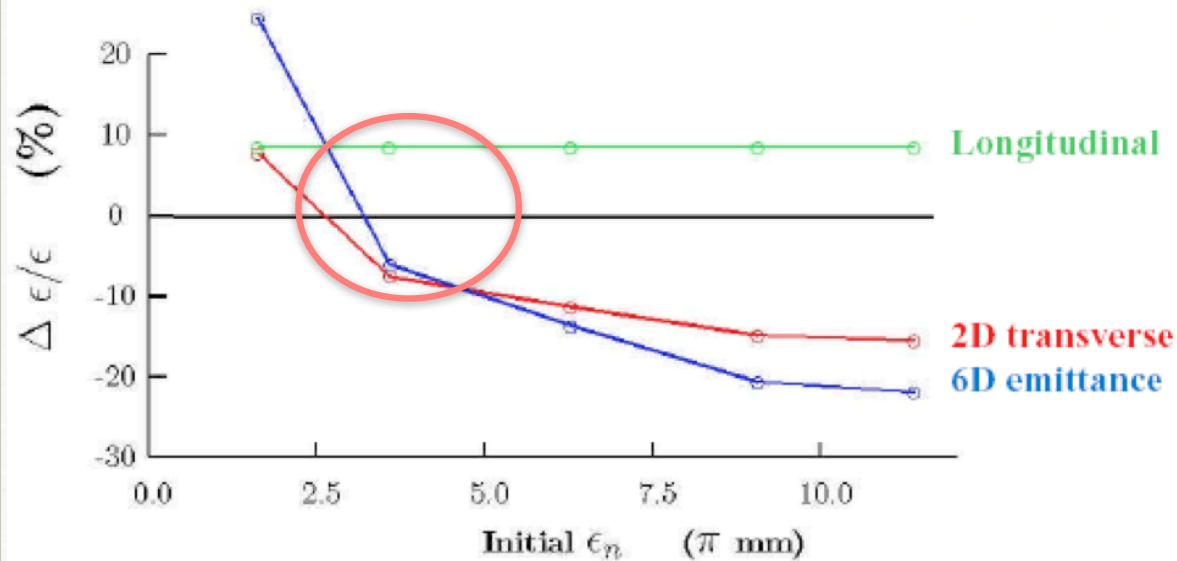
Momentum analyzer

MICE Setup

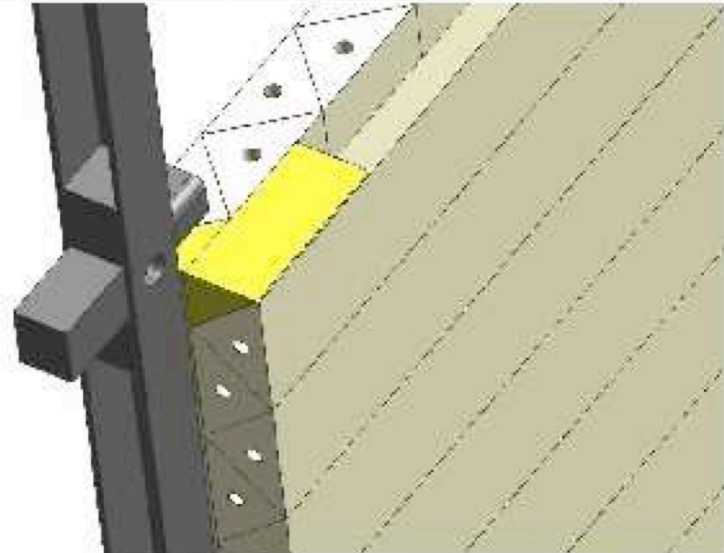
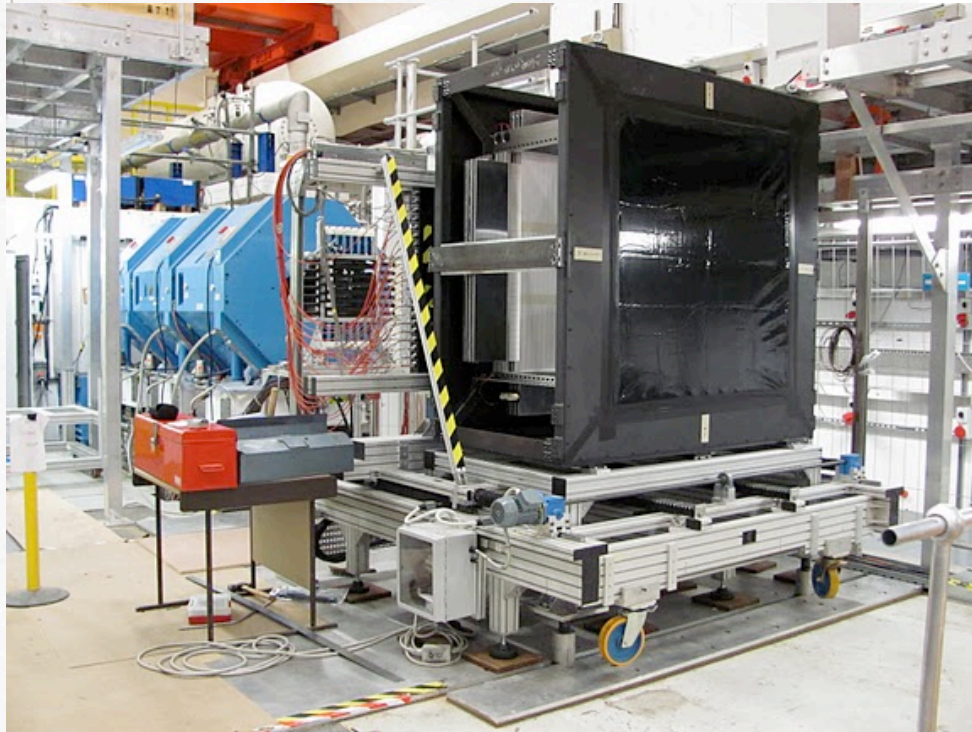
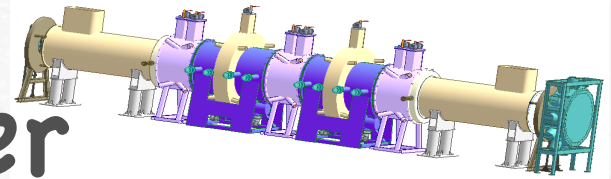


Limits

$$\frac{d\epsilon_n}{ds} = -\frac{1}{\beta^2} \left\langle \frac{dE_\mu}{ds} \right\rangle \frac{\epsilon_n}{E_\mu} + \frac{1}{\beta^3} \frac{\beta_\perp (0.014)^2}{2E_\mu m_\mu X_0},$$



Calorimeter



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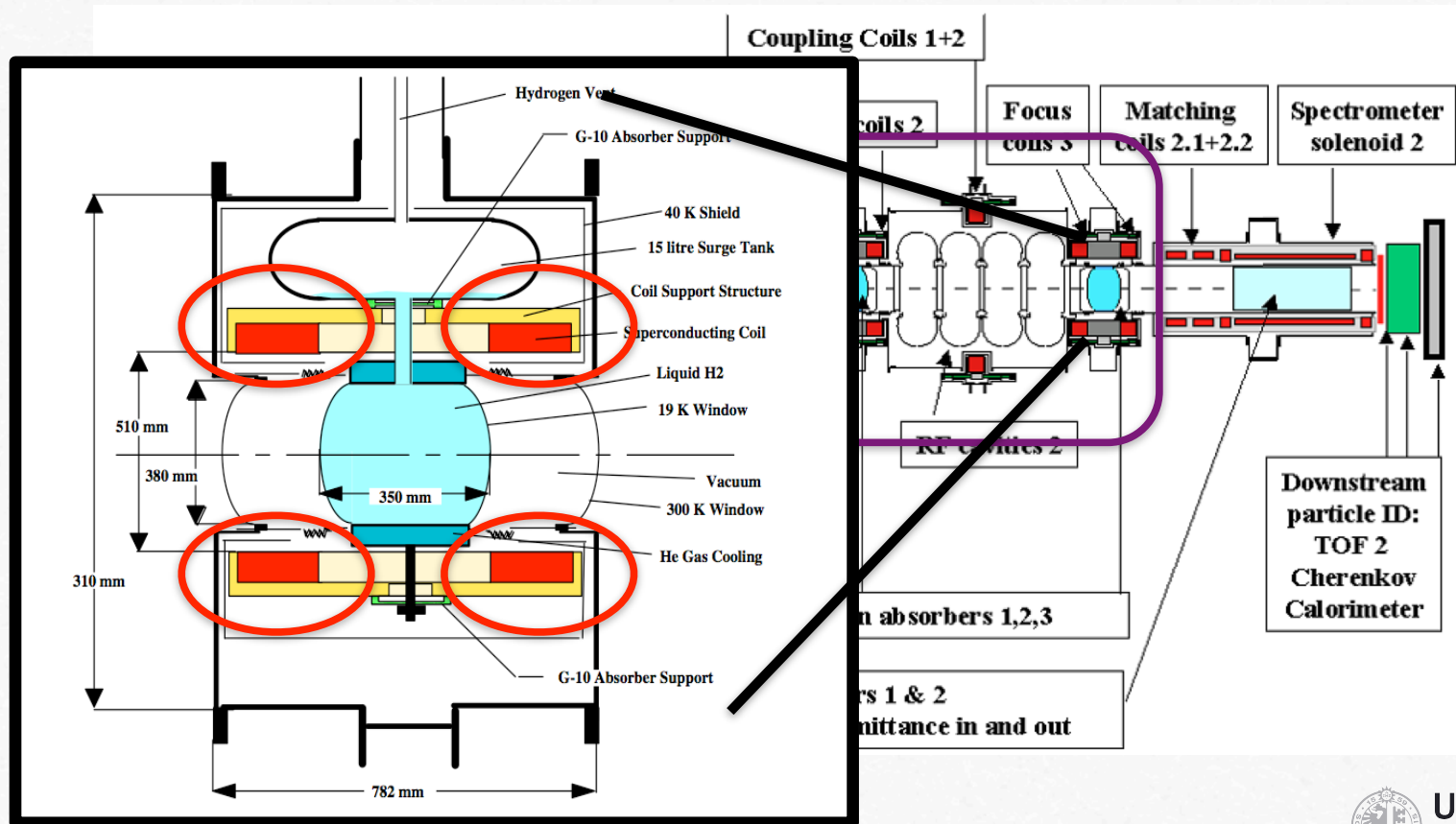
Javier Bilbao

Thank you

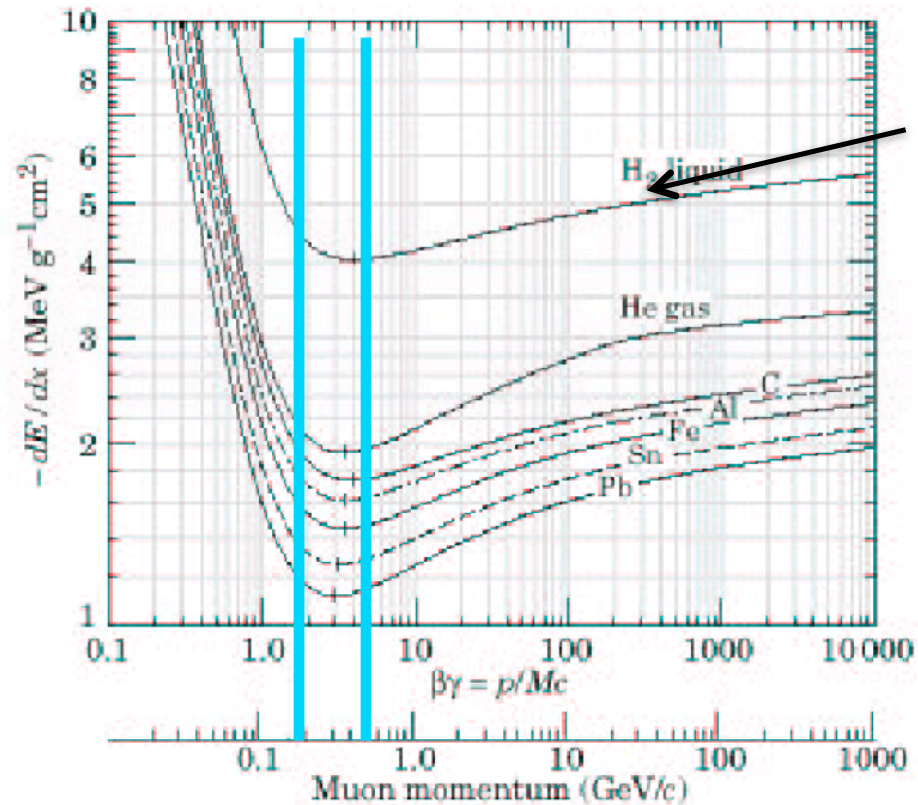


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Absorbers



Absorbers

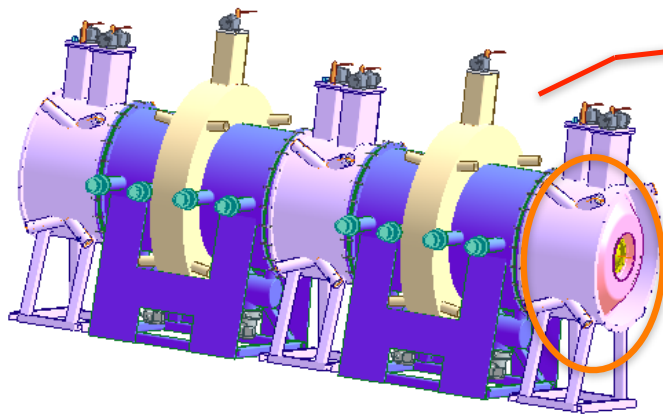


Liquid Hydrogen
absorbers



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RF cavities



large background generated

200 MeV + 10% cooling

$$\downarrow \frac{\Delta E}{E} = \frac{\Delta \varepsilon}{\varepsilon}$$

20 MeV

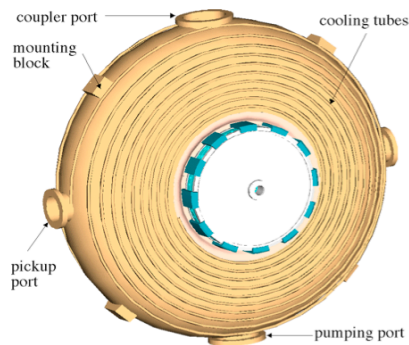


Figure 5.5: Cavity model showing external cooling tubes.

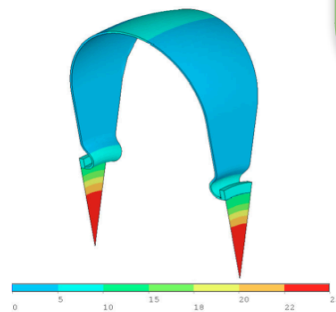


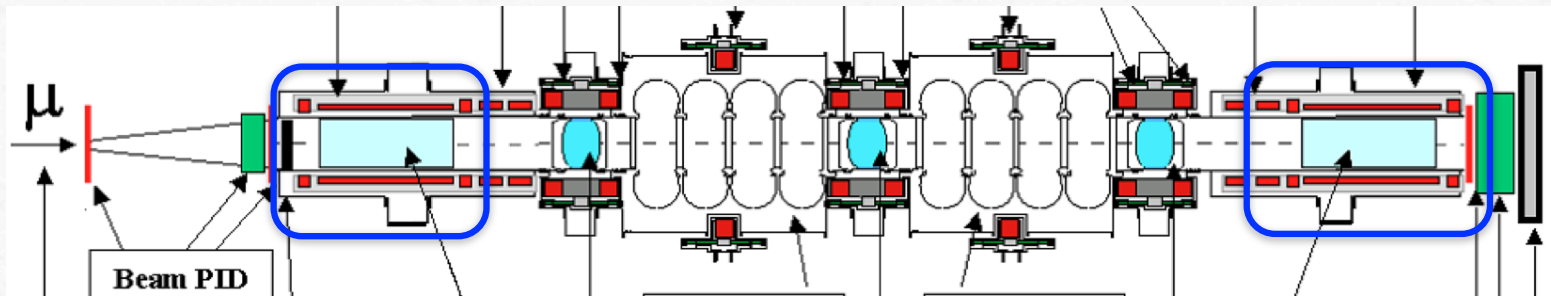
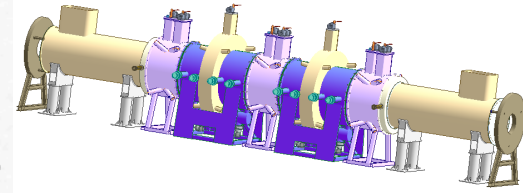
Figure 5.6: ANSYS temperature calculation with 10 kW average power.



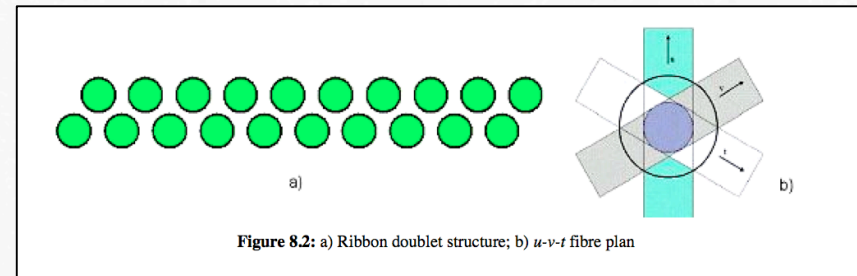
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Spectrometers

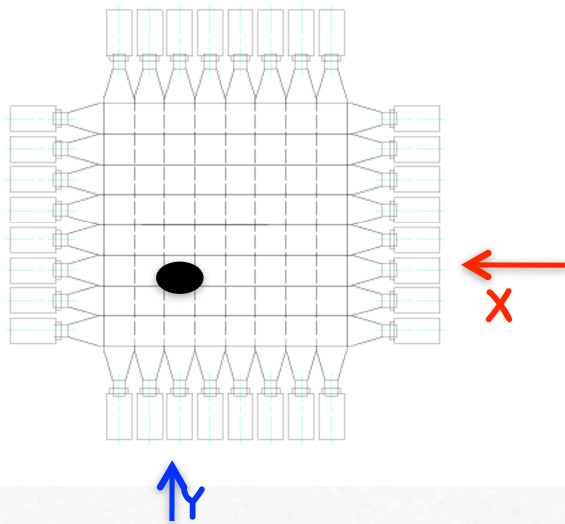
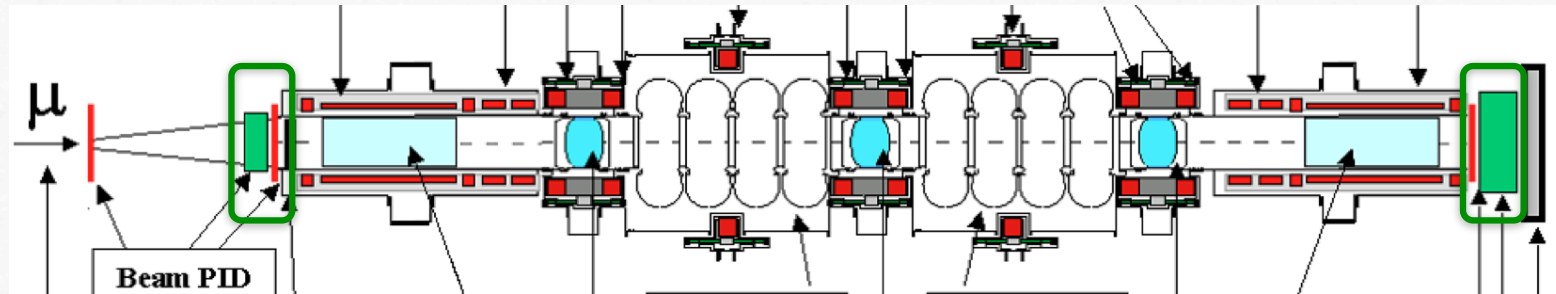
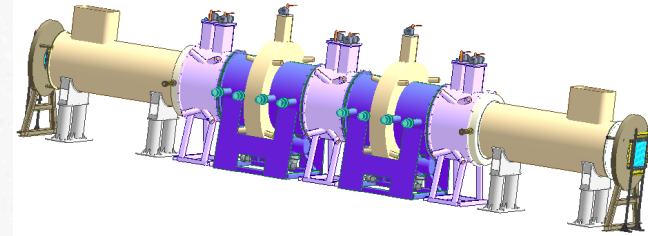


Spectrometer $\begin{cases} x, y, z \\ p_x, p_y, p_z \end{cases}$



➔ redundant information

TOF



200 MHz RF system, 5° degrees

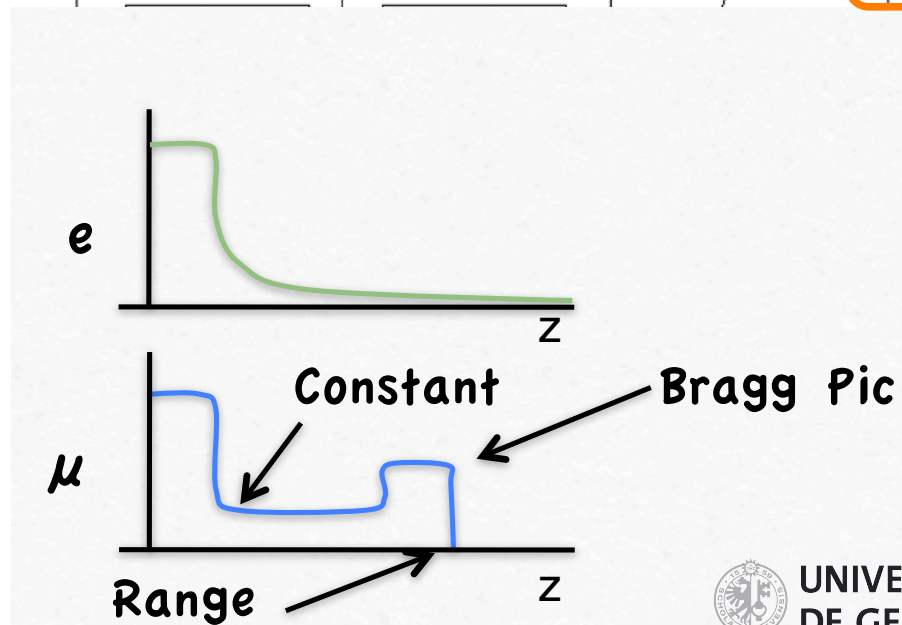
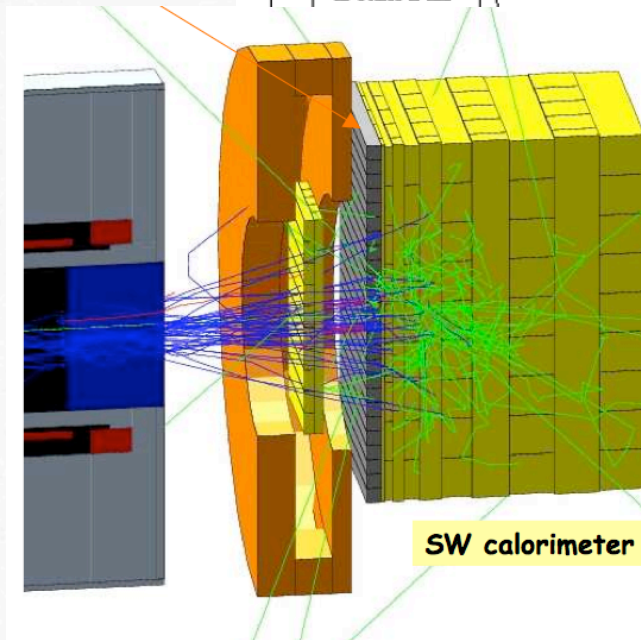
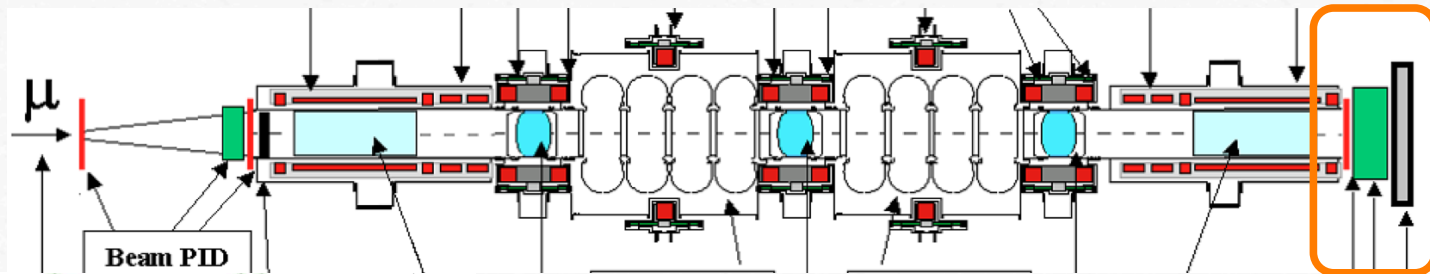
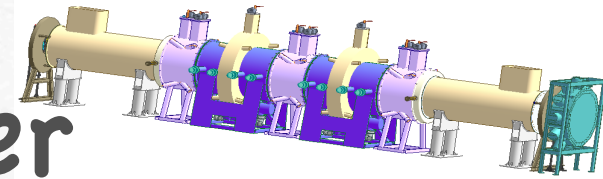


51 and 62 ps

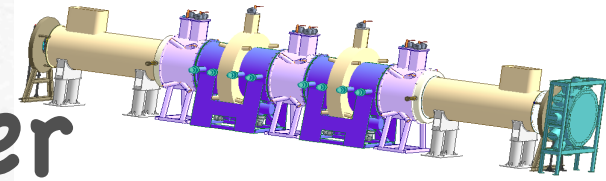


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Calorimeter



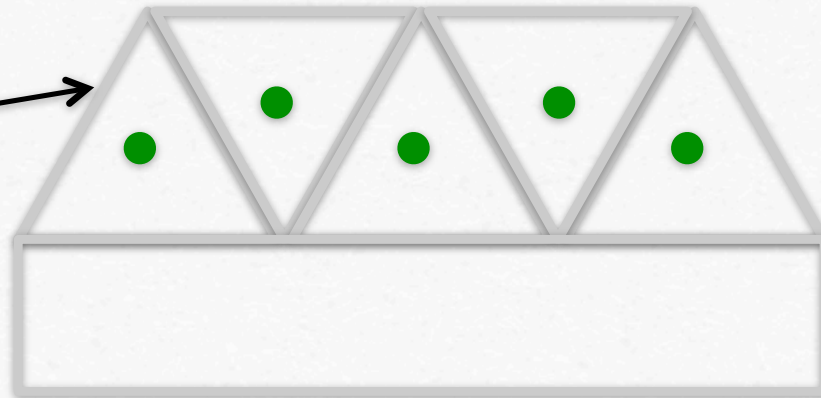
Calorimeter



- Good segmentation (Range)
- X and Y mesurment
- Large calorimeter 1m x 1m
- No dead regions

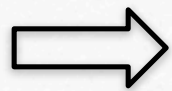
\$/ channel

Low
sensitivity



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Conclusion



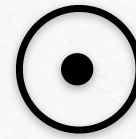
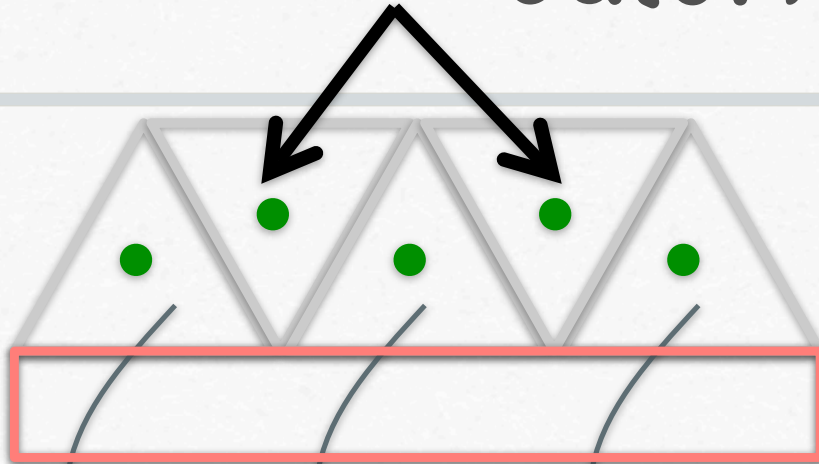
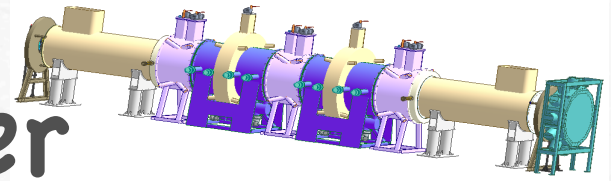
- **First Muon Cooling**
- **Good Emittance measurement**
- **Needed for Neutrino Factory**

And lot more coming soon!!

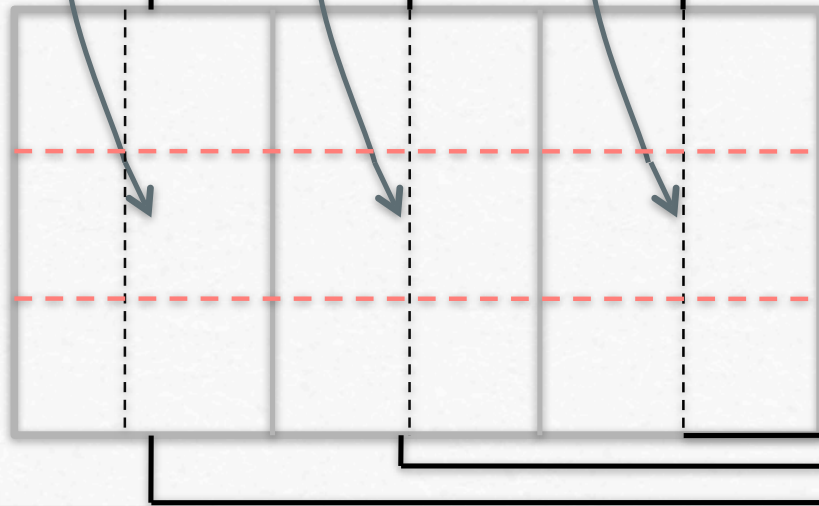


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Calorimeter



Global plane E

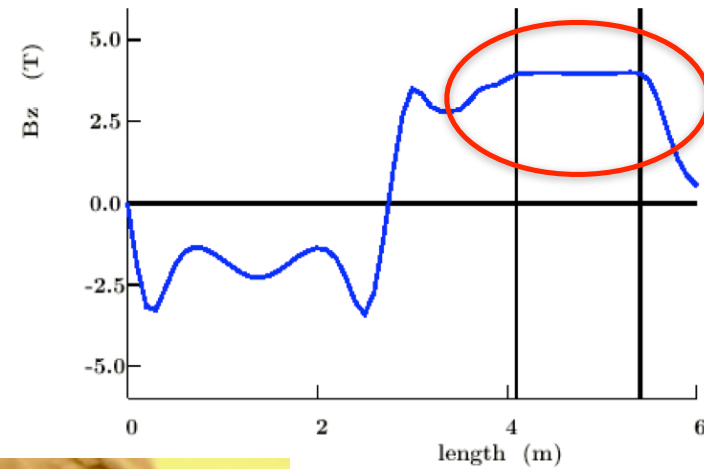
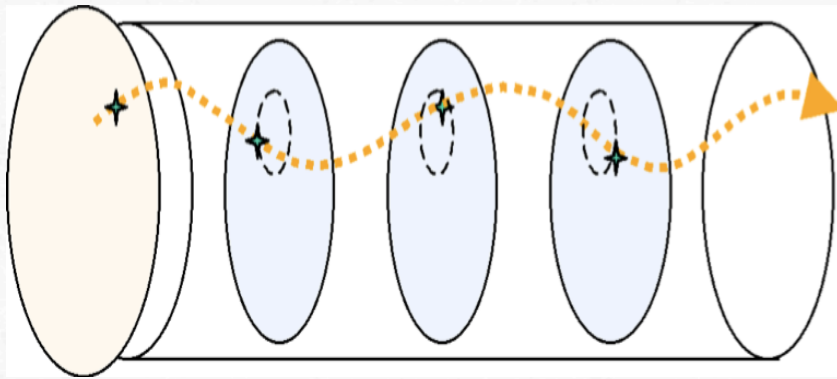


Digital reading



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Emittance measurement



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