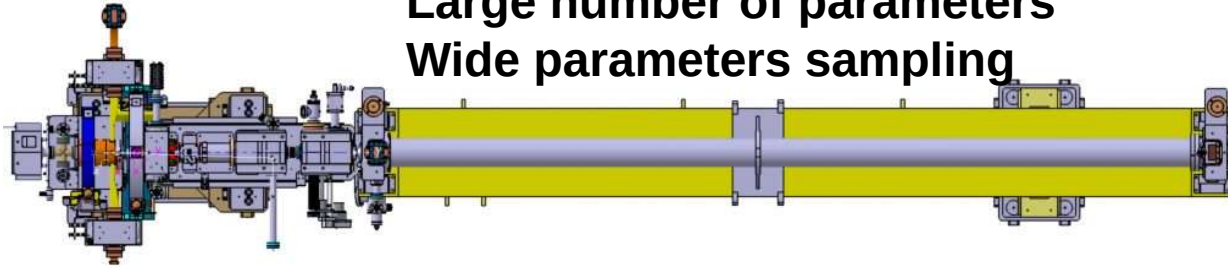


Surrogate Model for ThomX Linac

Large number of parameters
Wide parameters sampling



\mathcal{A} : Controllable Parameters

- 15 controllable parameters
 - ▶ Laser position and size
 - ▶ Gun and Cavity phase and field
 - ▶ Solenoid Fields
 - ▶ Steerer Fields
 - ▶ Quadrupoles Fields

\mathcal{B} : Hidden Parameters

- Mechanical Misalignment
- Unknown initial particle distribution
- Slow drift of electromagnetic elements

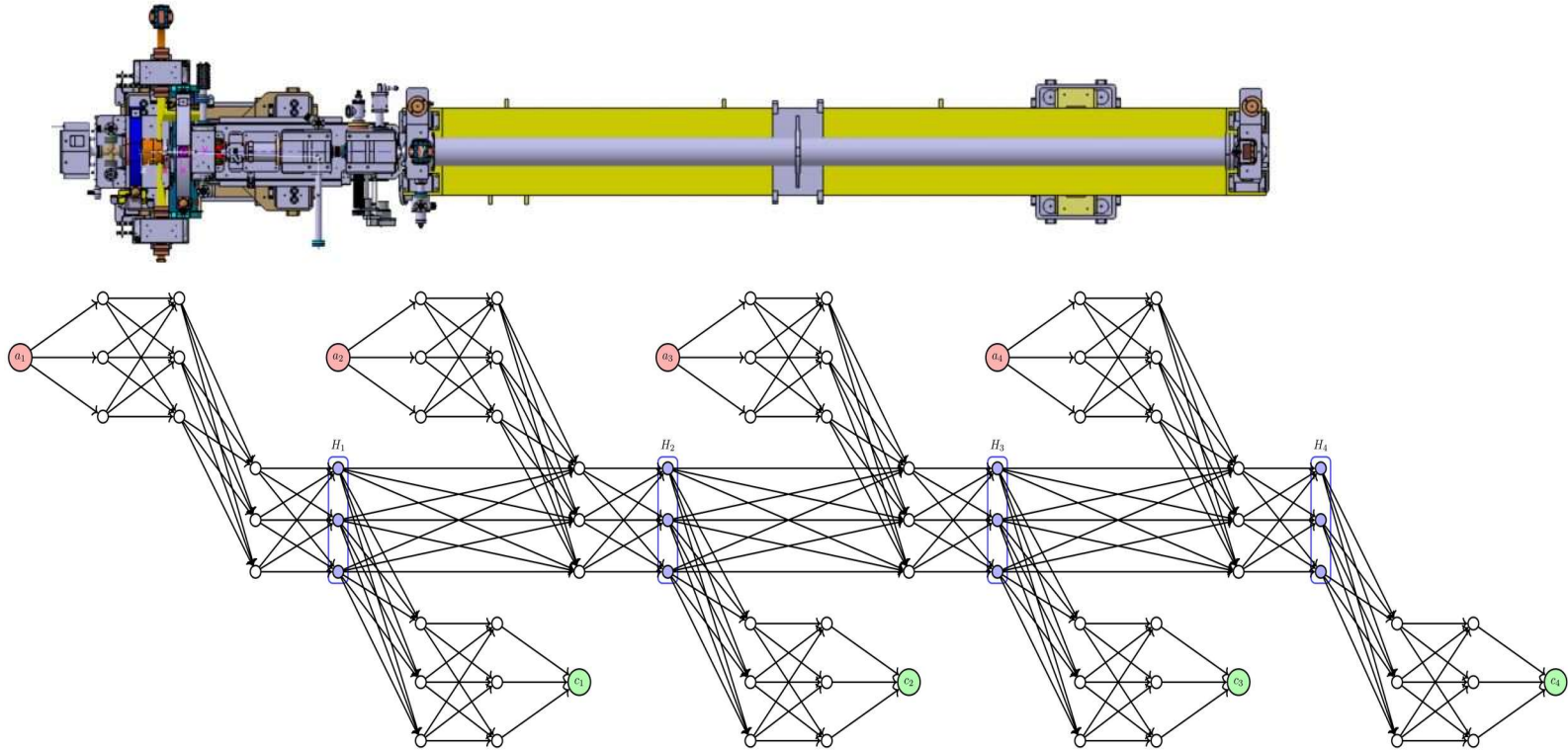
\mathcal{O} : Observables

- 17 Observables
 - ▶ Position and Charge at BPMs
 - ▶ Charge at ICTs
 - ▶ Position and Size at Screen
 - ▶ Charge at Faraday Cup

F : Objective function

- Quality of the beam
- Function of (A, B)

Surrogate Model for ThomX Linac

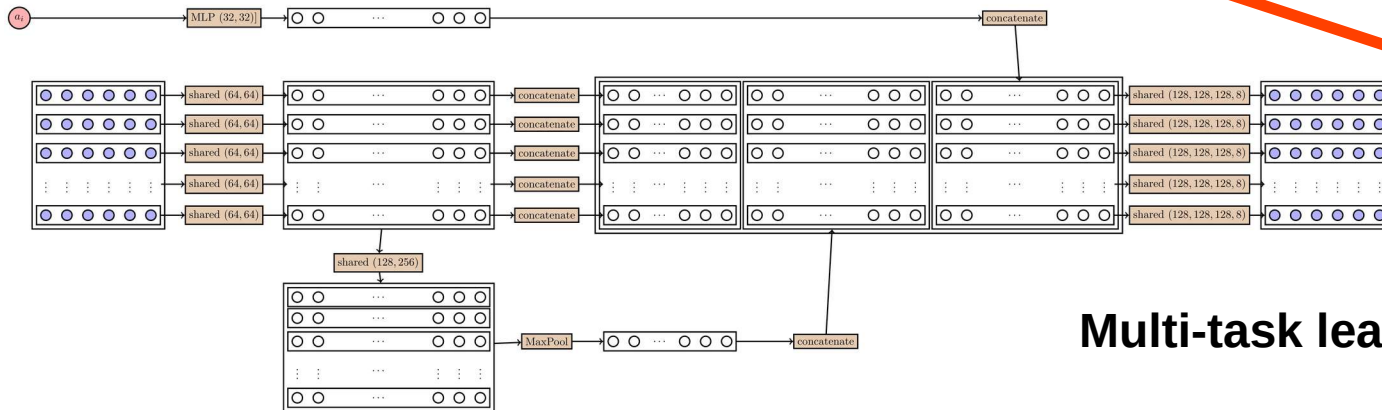
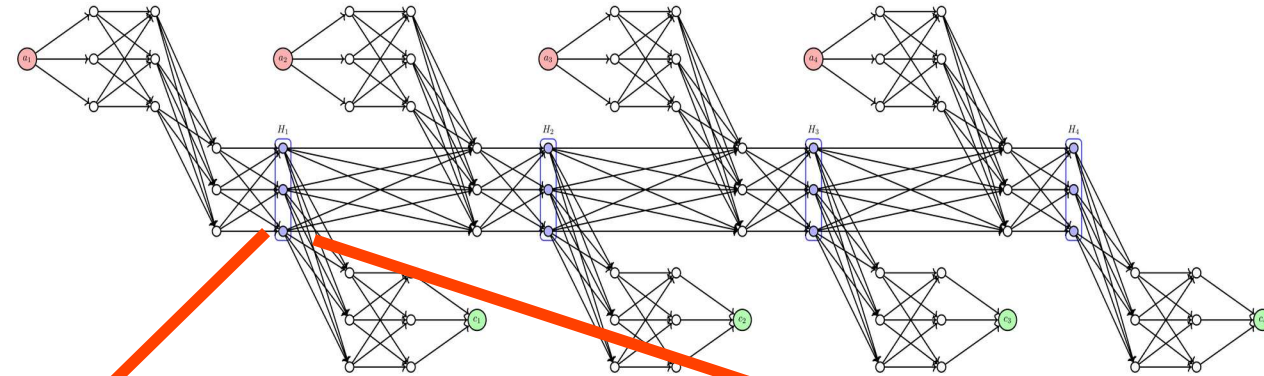


Split input and output according to their position in the Linac **follow causality**
Neural Network Architecture reflecting a Linac architecture
Each Module models one Diagnostic (real or virtual)

Surrogate Model for ThomX Linac

Track full distribution of particles

Qi et al., "PointNet: Deep Learning on Point Sets for 3D Classification and Segmentation" (CVPR 2017)



Multi-task learning