Laying out the Cooling Demonstrator

Science & Technology Facilities Council
ISIS Neutron and Muon Source

C. T. Rogers
ISIS
Rutherford Appleton Laboratory

Overview

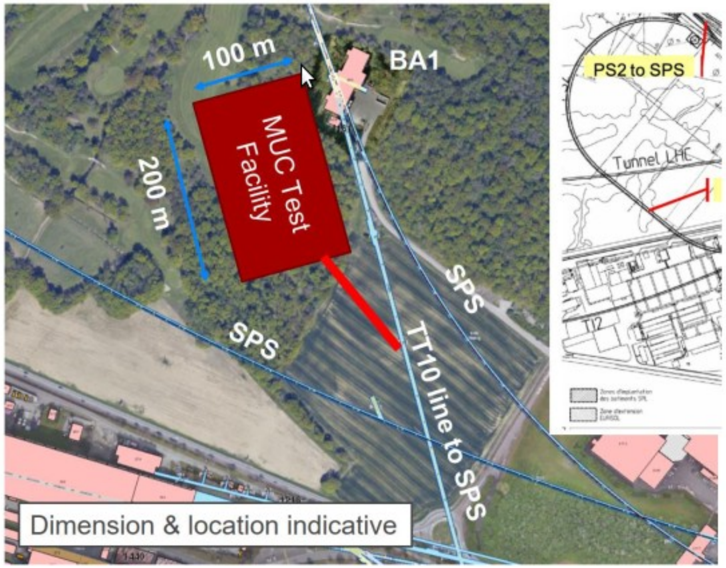
- Starting to work on conceptual layout for the cooling demonstrator
  - Finding an area at CERN
  - Establish basic lattice
  - Establish feasibility of collimation system
  - Establish compatibility with nuSTORM/enubet

Site option - Rui Ximenes (CERN)

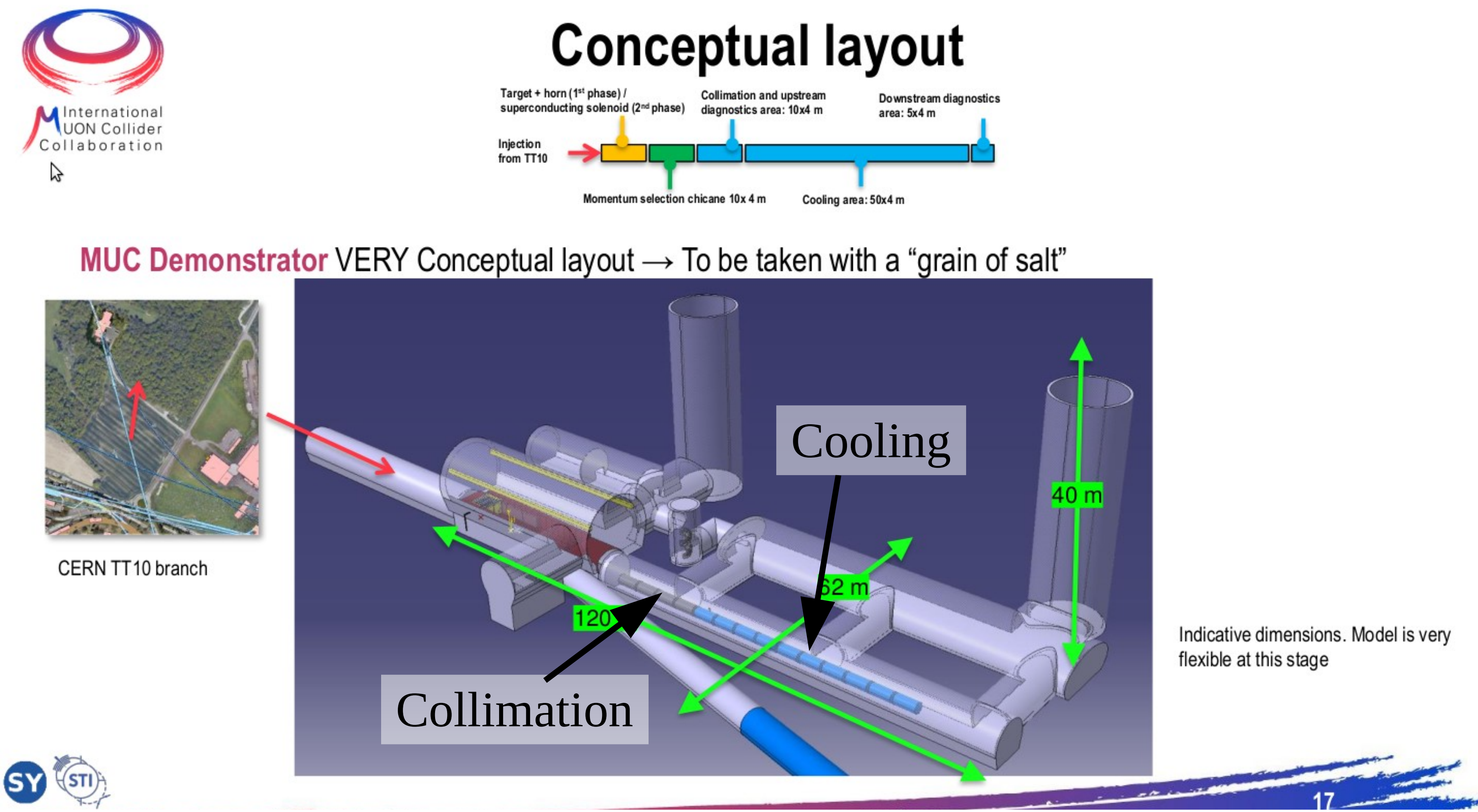
International MUON Collider Collaboration

TT10 line option (recap)

- First ideas proposed by Marco C. in the 1st Community meeting. **TT10 line option seen as most attractive** (Roberto L. presentation).
  - O(80kW) should be easily feasible by going sufficiently underground.
  - 4 MW does not appear to be a showstopper in this layout, but detailed studies will have to be performed.
  - Future upgrades towards a collider and HP-SPL should be compatible with this layout.
  - **Experience** with other facilities available
  - Important to collect all **requirements** at this stage in order to be able to provide a first cost estimate by end of 2021 as requested by the study



Overall layout - Rui Ximenes (CERN)



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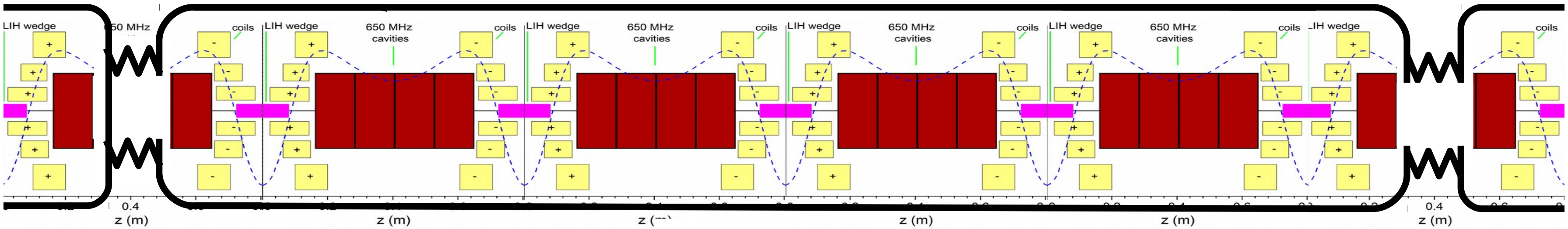
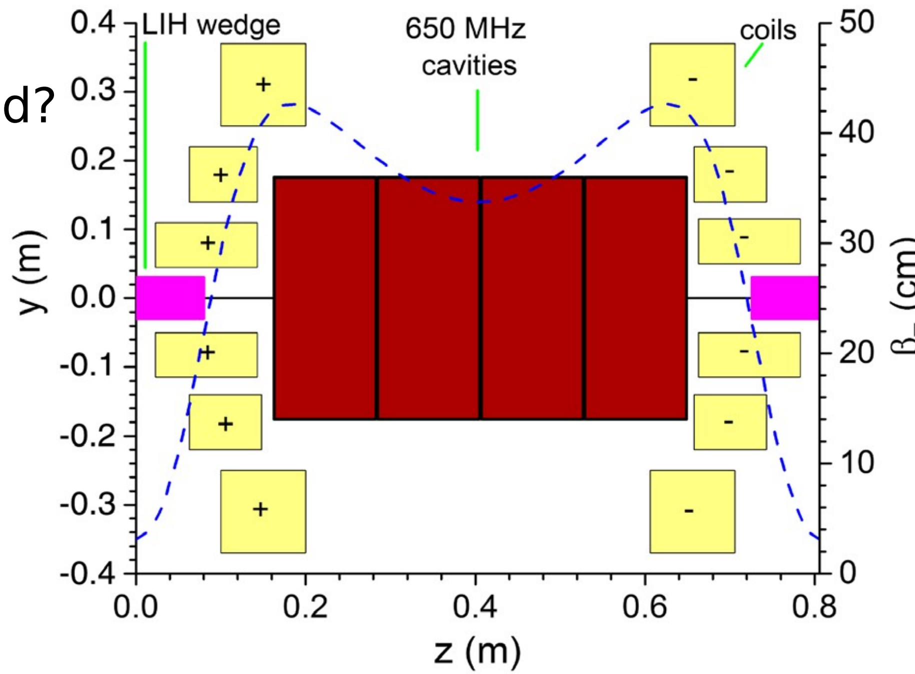
Cooling channel concept



- Ongoing discussion:
  - What should be the peak field?
  - Lowest emittance @ 13 T
  - ~9 T may be cheaper
    - It is an MRI field
  - Needs consideration
- Plan for ~ 10 cryostats
  - Each containing ~ 5 cells
- Lattice well-established
  - Needs optimisation
  - Needs modification/engineering



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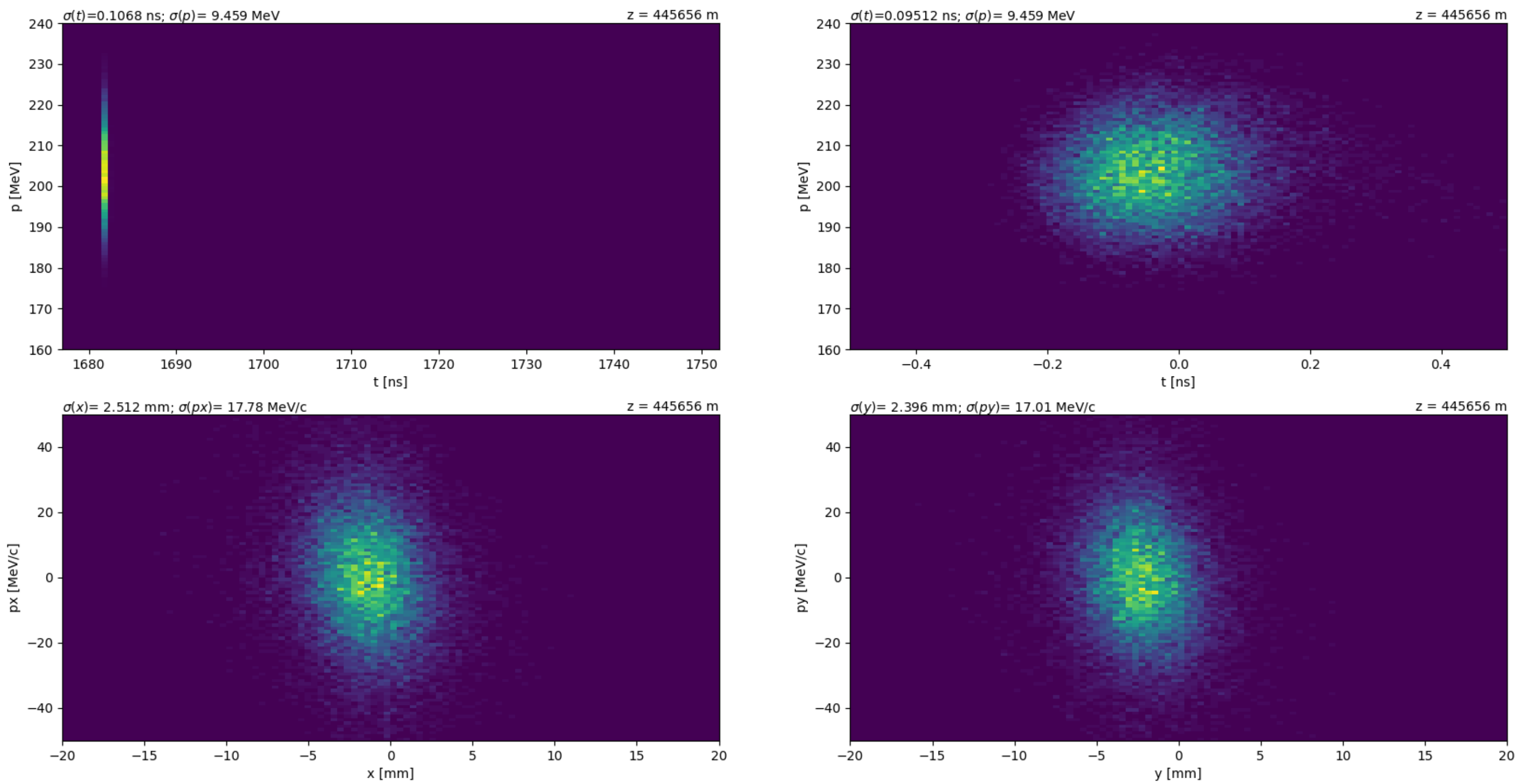
Input beam for cooling channel



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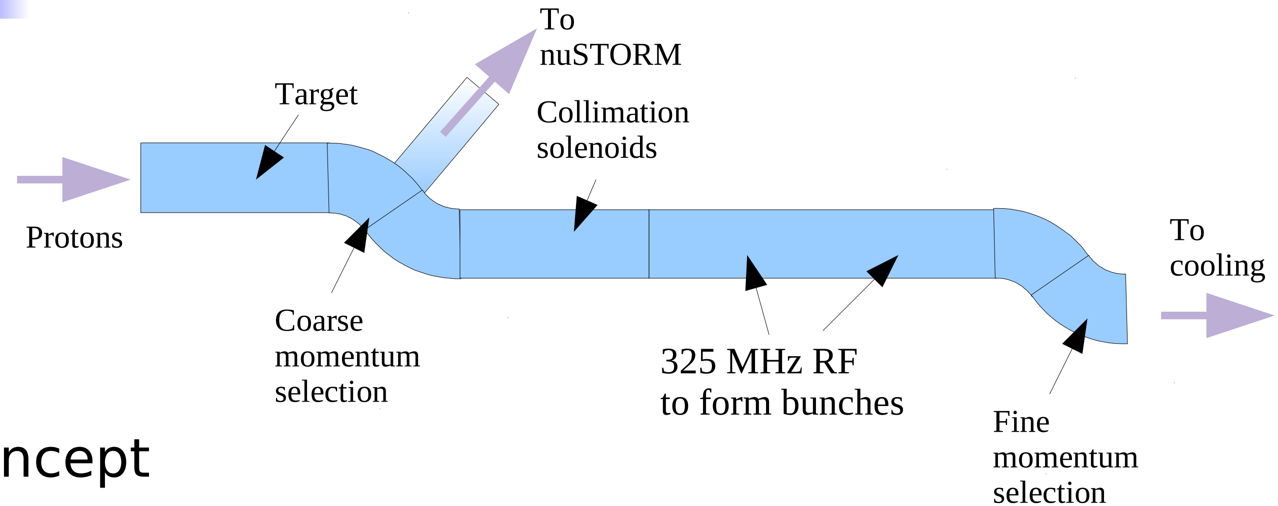
Collimation System



- Concept
  - Chicane to do a first momentum selection
  - Collimation lattice
  - Section of RF to do time selection
    - Need about 20-30 MeV → guess about 50 MV here
  - Pions are decaying as we go – how much of a mess does this make?
    - (Nb: pion lifetime is about 8 metres at 200-300 MeV)
  - What about electron impurities?
- How clean do we need the beam to be?

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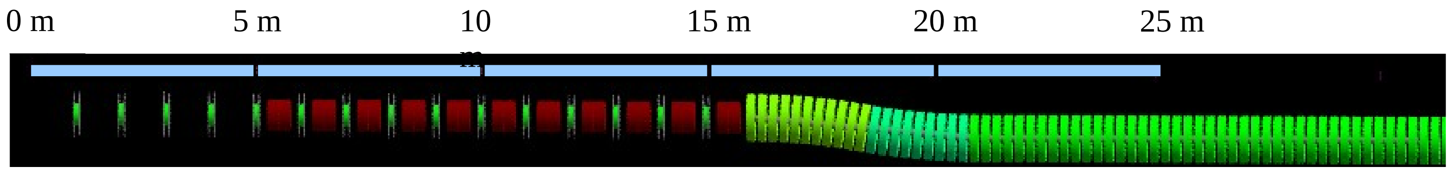
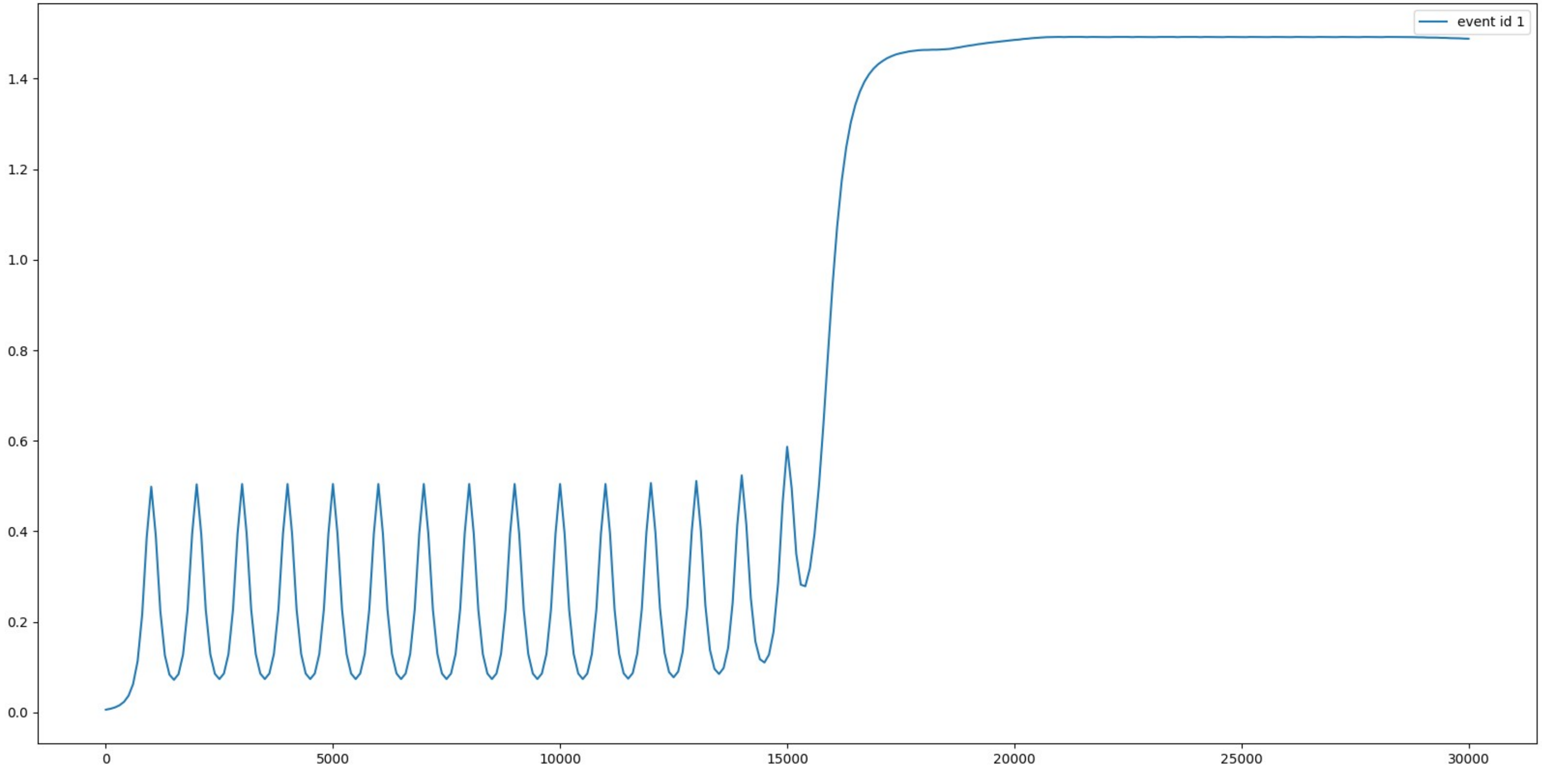
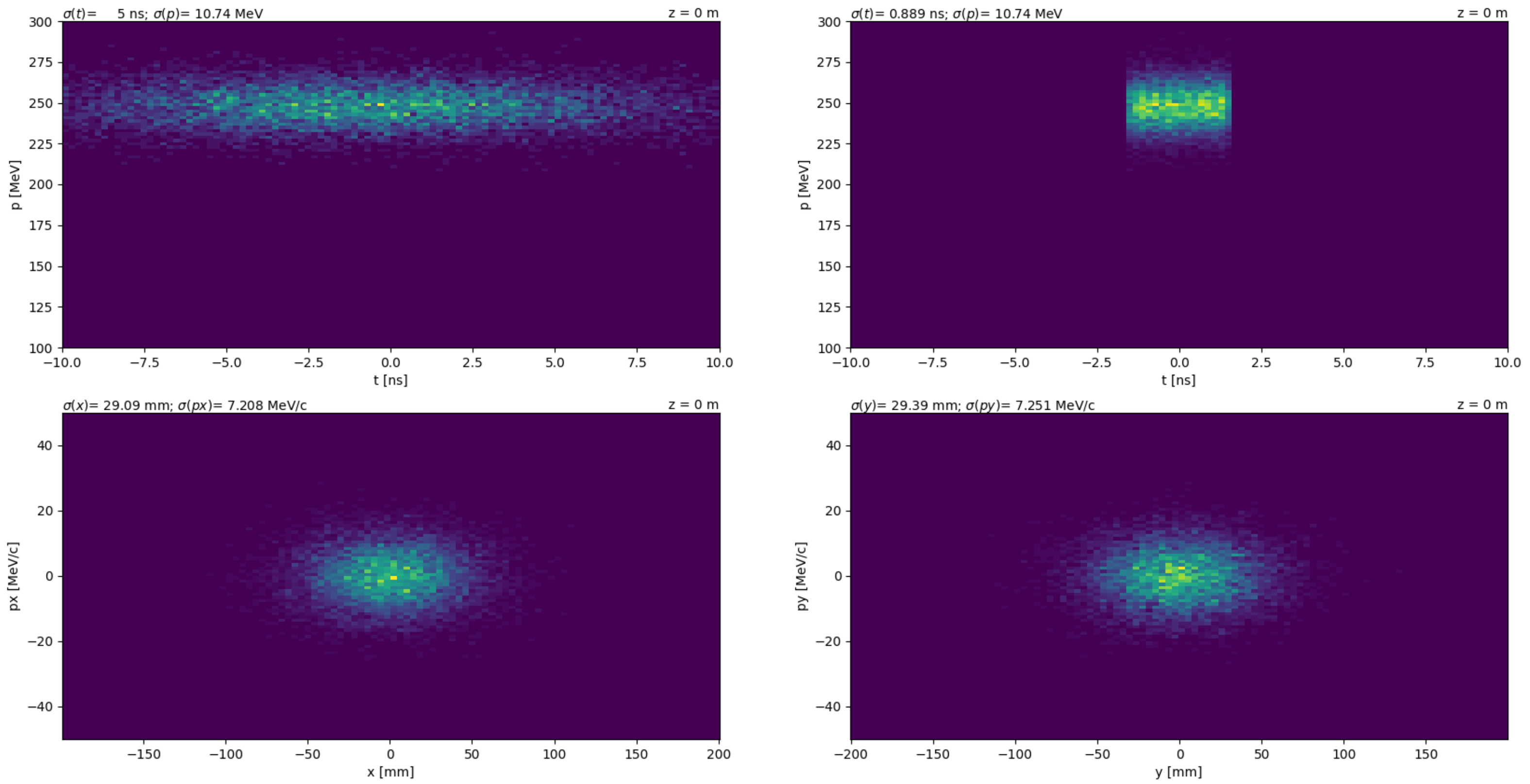
Collimation System

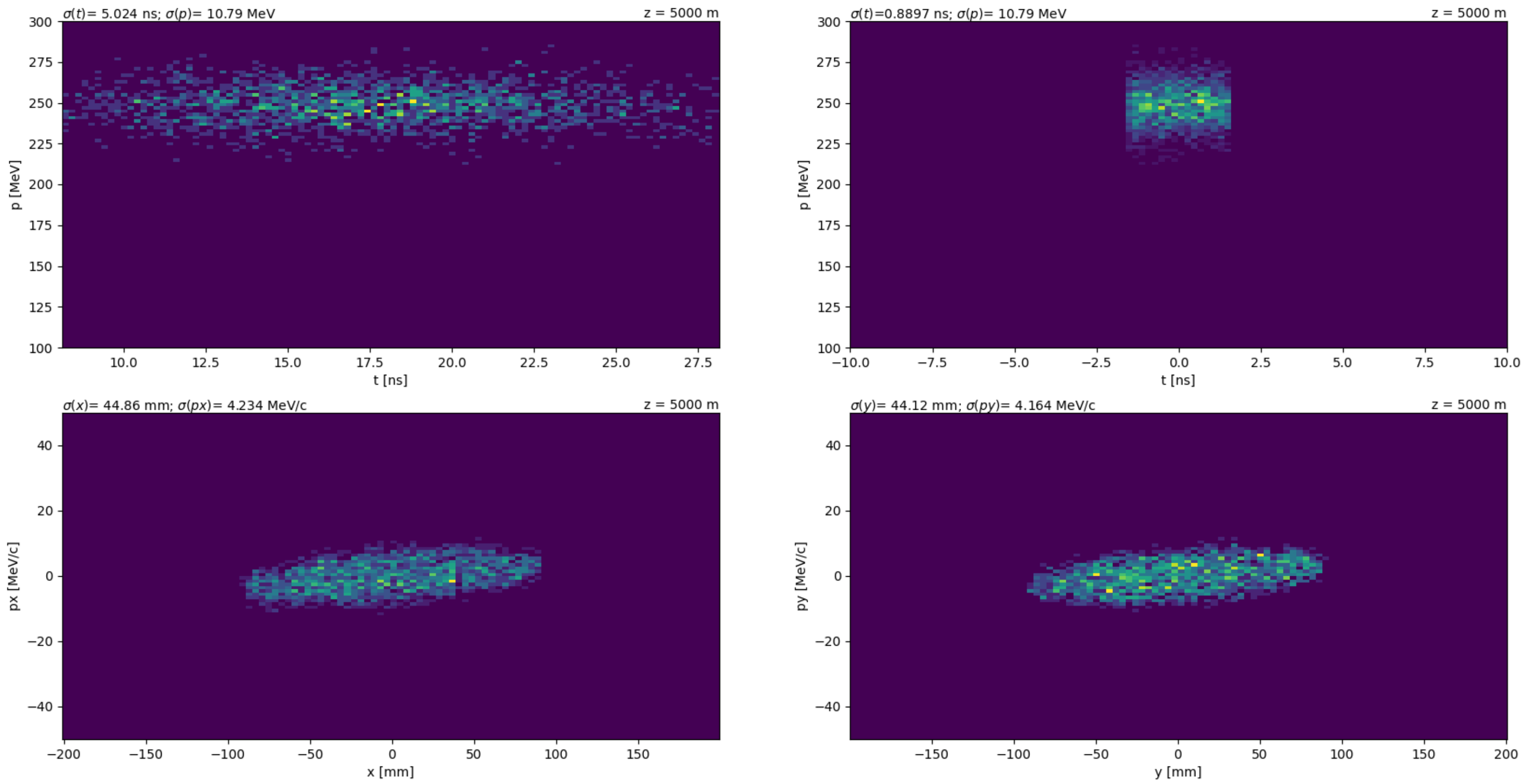




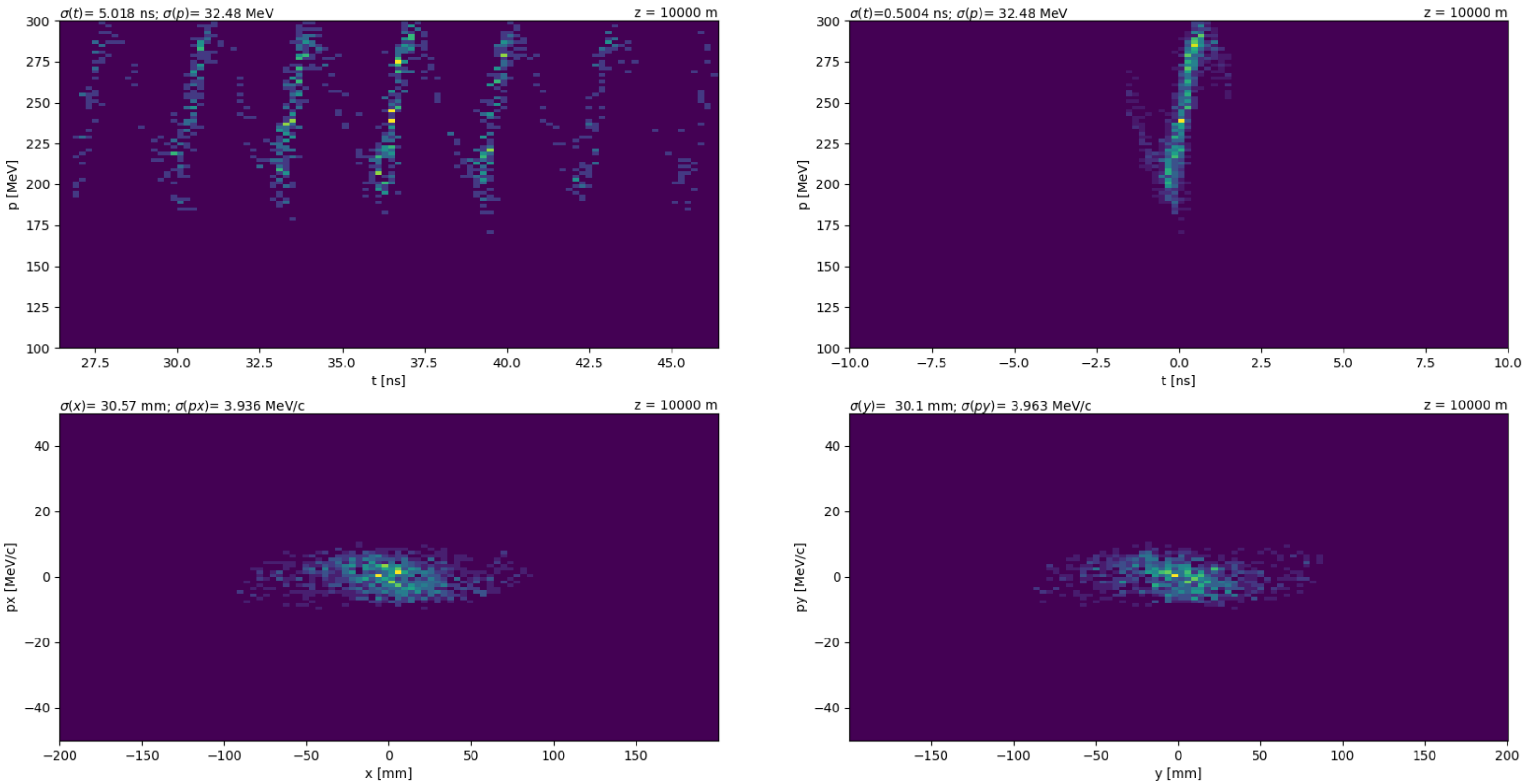
Initial beam distribution



Beam distribution before RF



Beam distribution half way along RF



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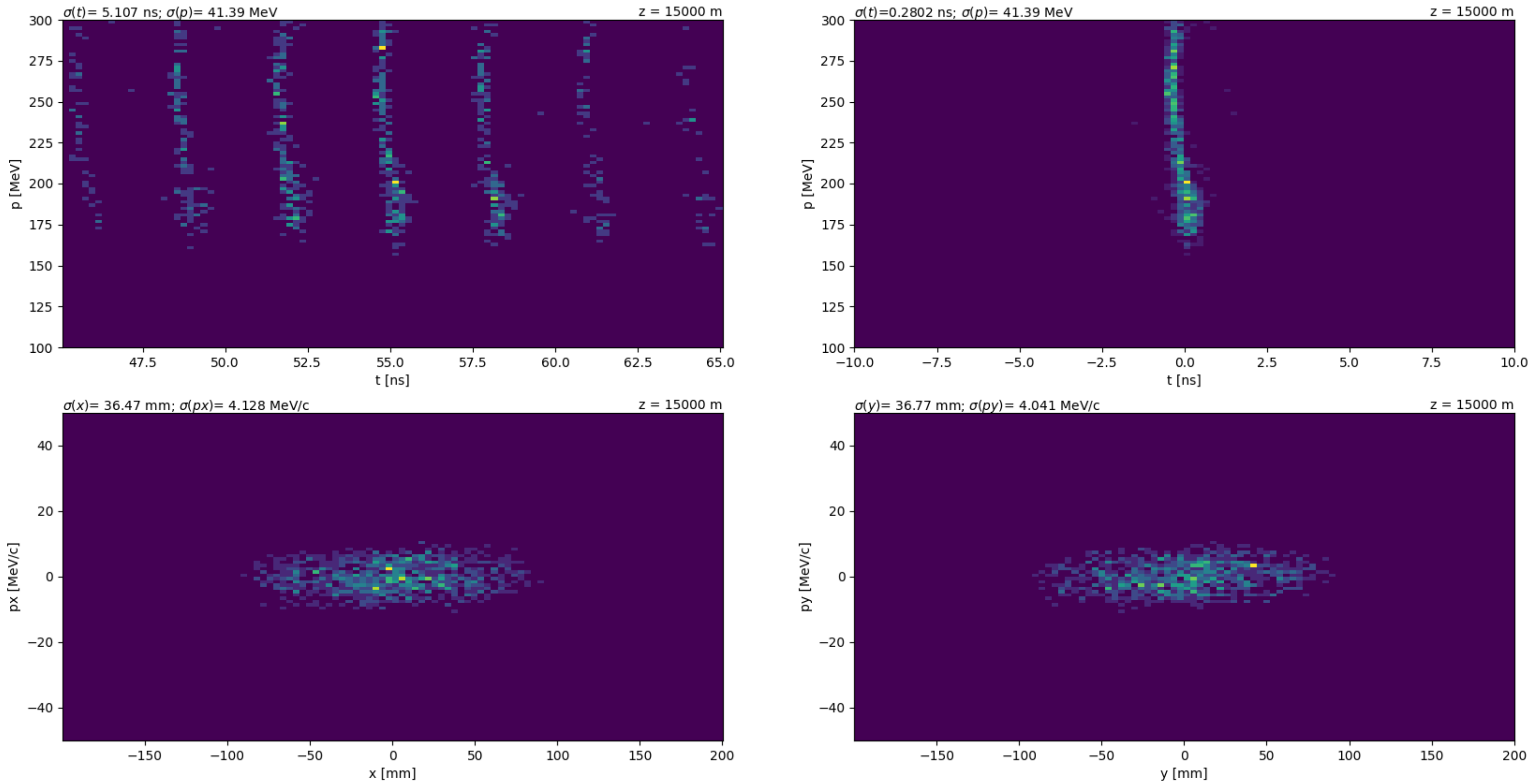
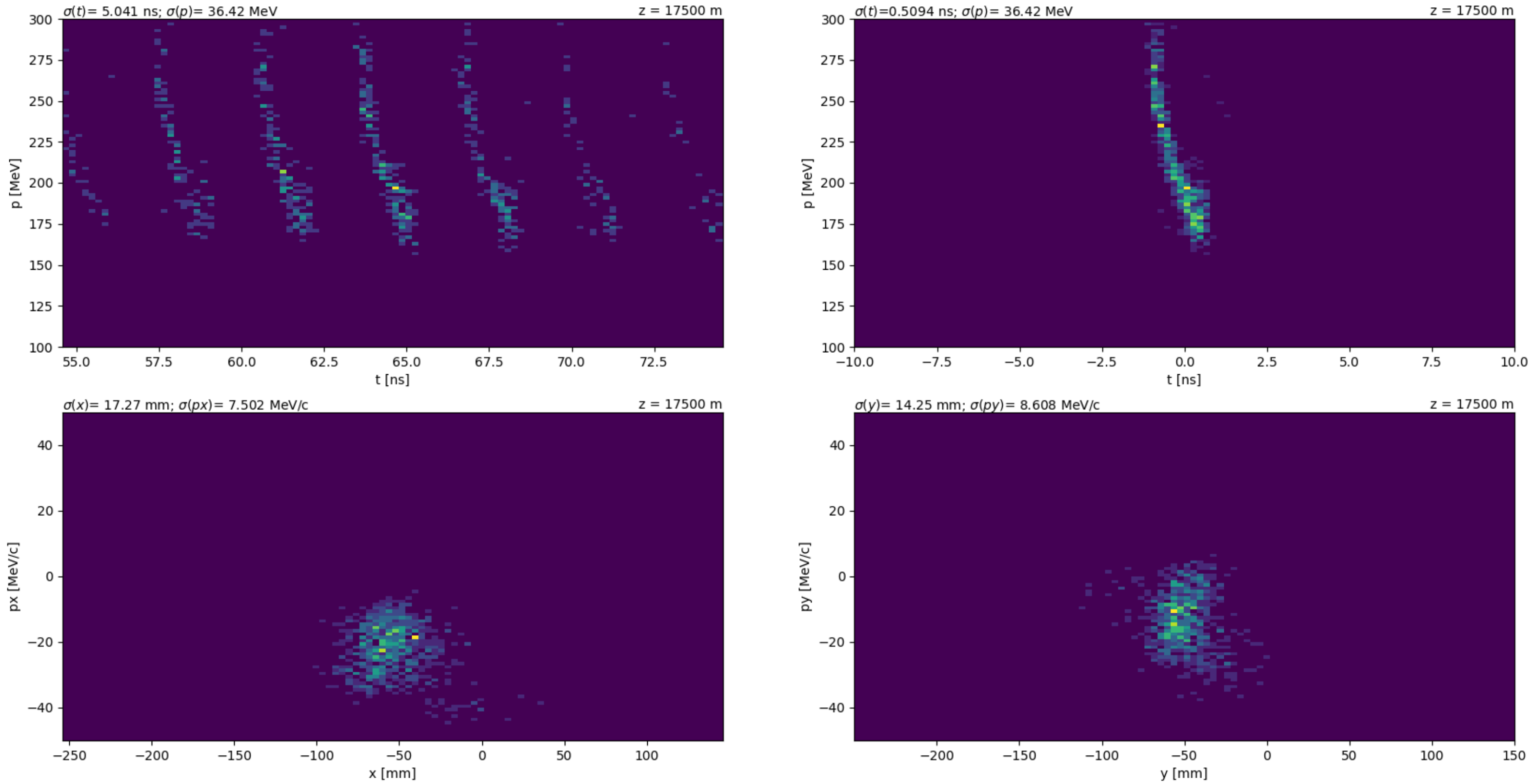
Beam distribution end of RF



Beam distribution middle of chicane



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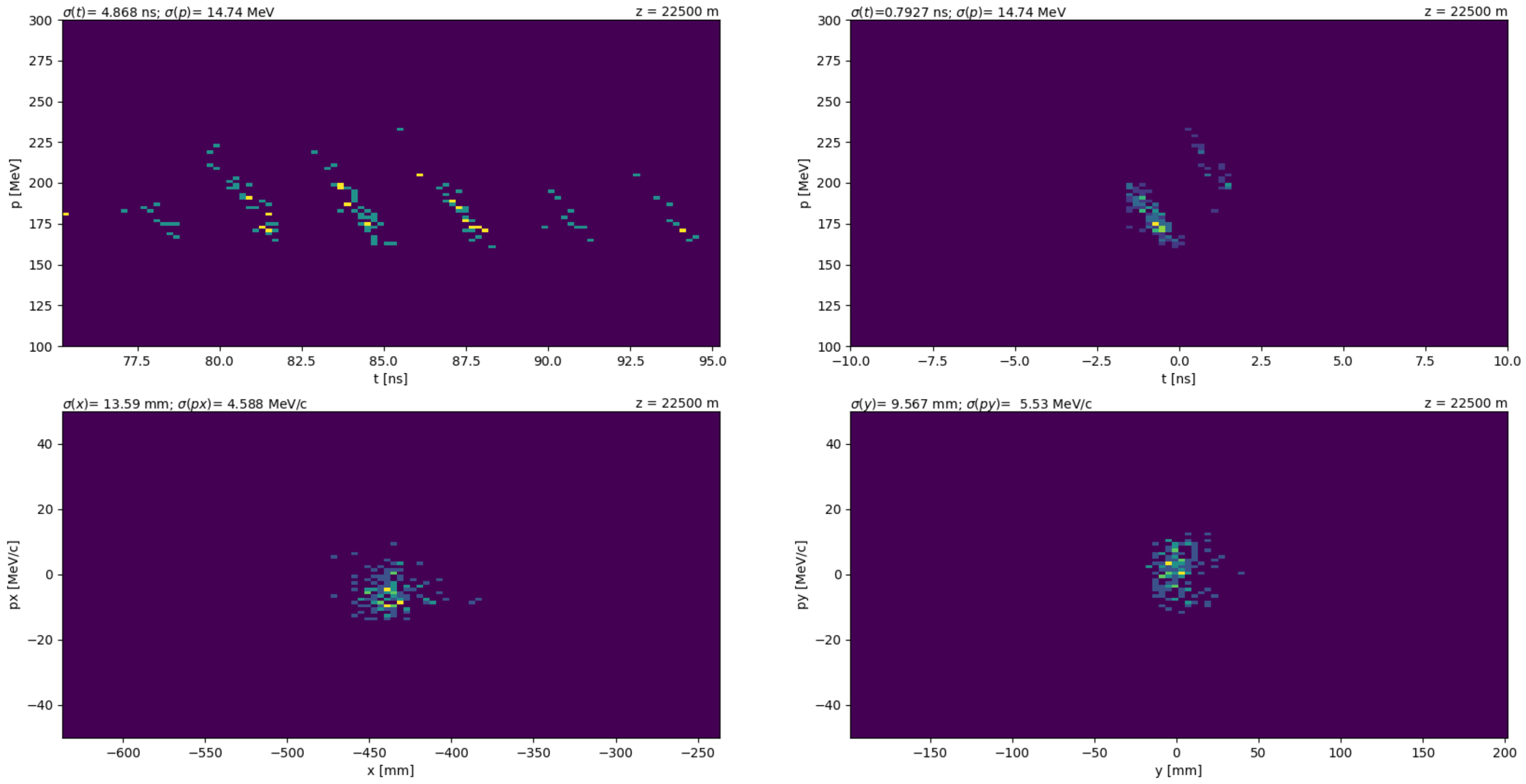
Beam distribution end of chicane



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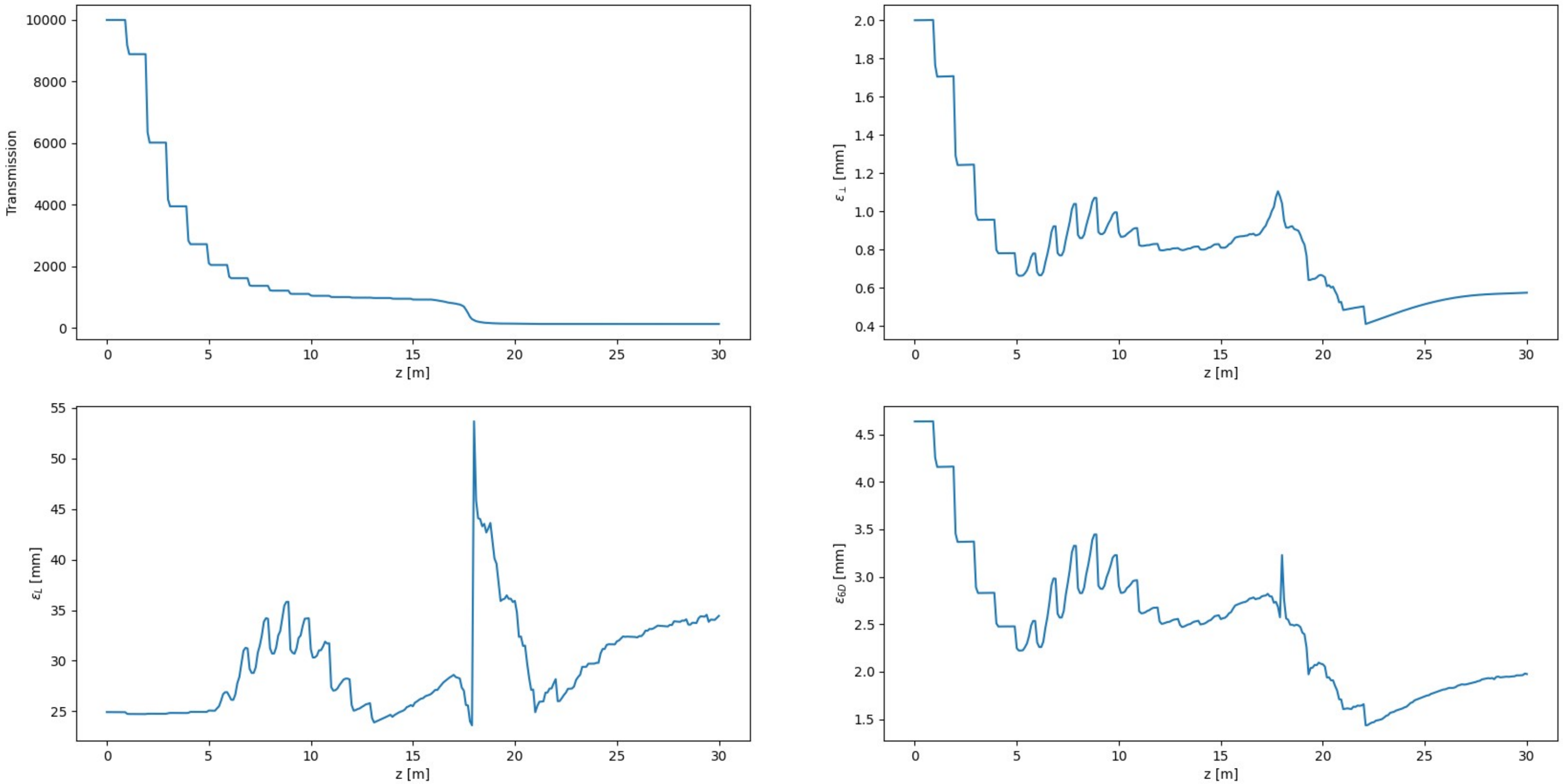
Beam distribution end of chicane



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Comment

- Conclusions:
  - Transverse emittance is about right
  - Longitudinal emittance is still too high
  - Need some more RF
  - Is a solenoid chicane really useful here?
    - Good for large transverse emittance
    - Maybe transverse emittance is manageable