Feasibility of a double pulse experiment using ATA equipment

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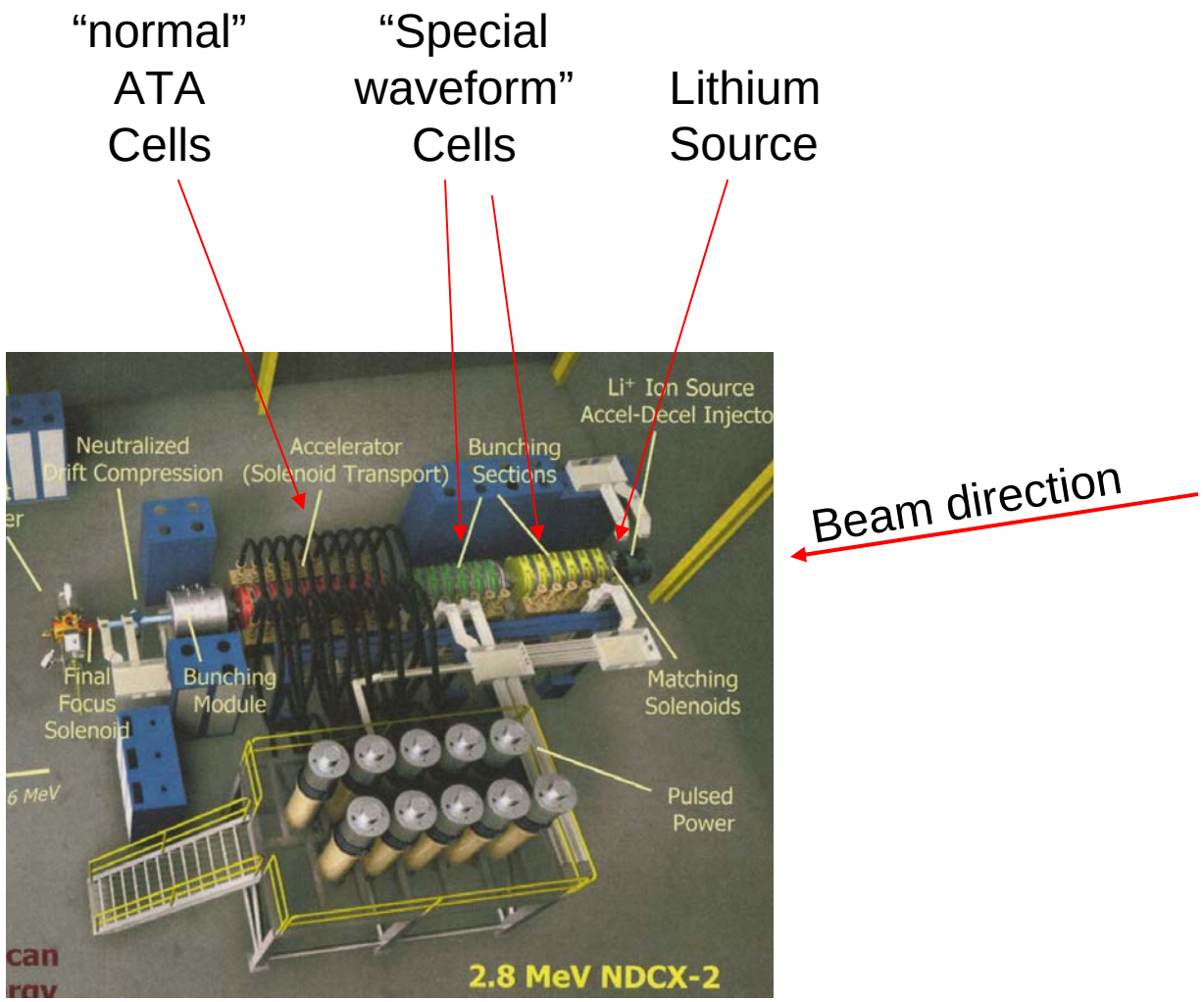
The following presentation is only a suggestion of how a double pulse could be achieved on NDCX-II.

Additional work is needed on:

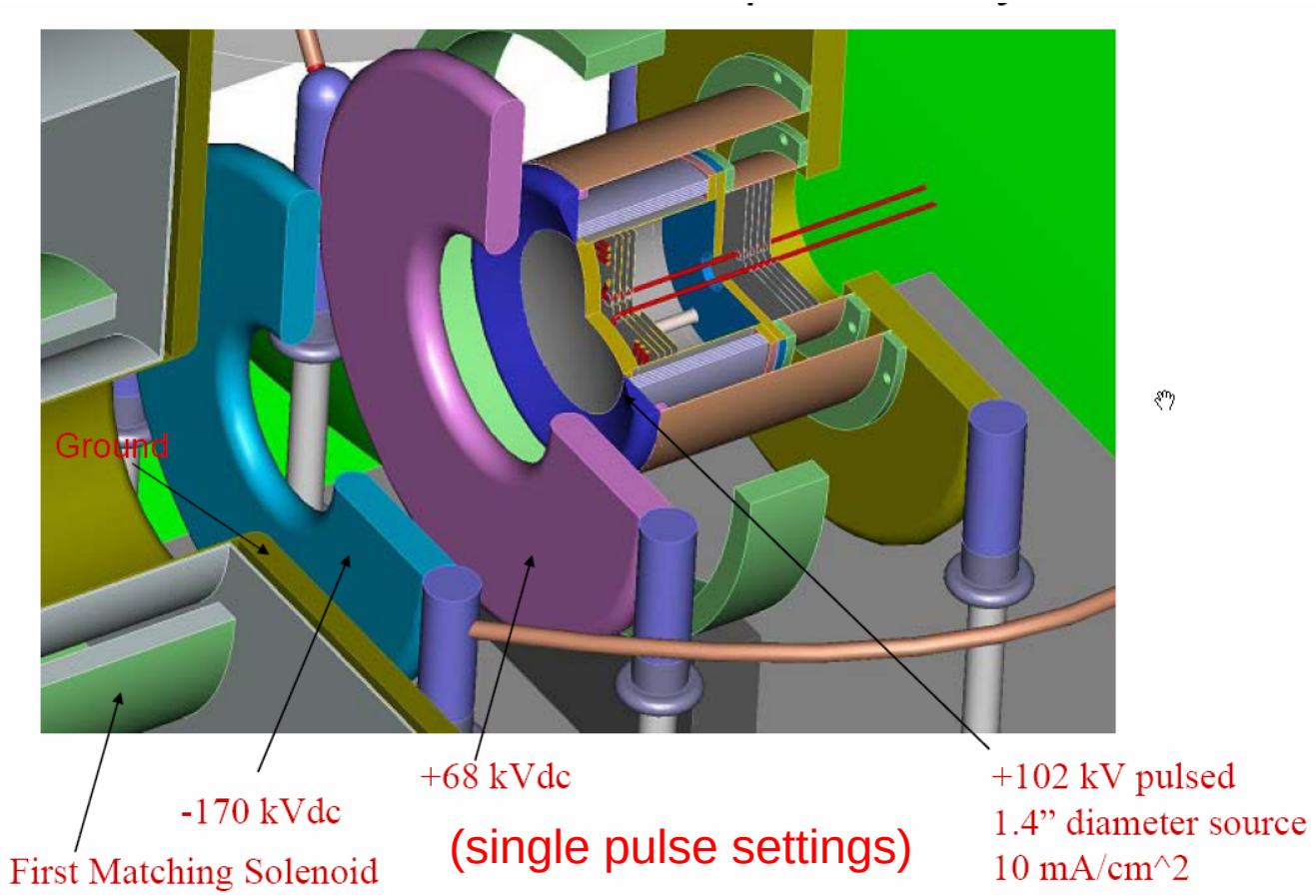
- Longitude and transverse beam dynamics.
- Solenoid focusing fields.
- Tolerance on voltage levels and timing jitter.
  (e.g. A 1% injector voltage jitter yields 5 ns timing jitter at the target in the following example.)
- Design of fast focus element.
- Realistic cell voltage waveforms.
- Lithium source design.
- Final bunching module.

Planned layout for NDCX-2



A double pulsed voltage source is attached to the cathode.

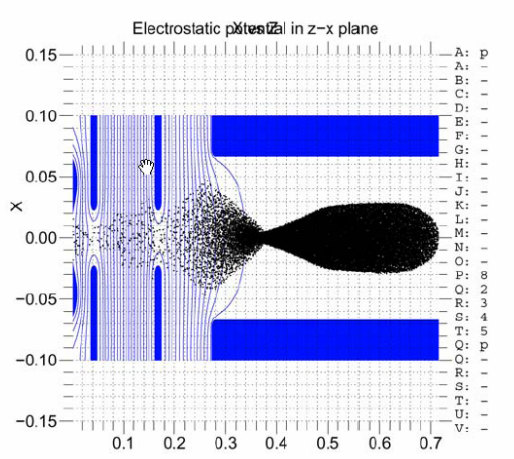
- First pulse at 43 kV (250 ns pulse in the matching solenoid)
- 250 ns delay between the pulses
- Second pulse at 80 kV (250 ns pulse in the matching solenoid)

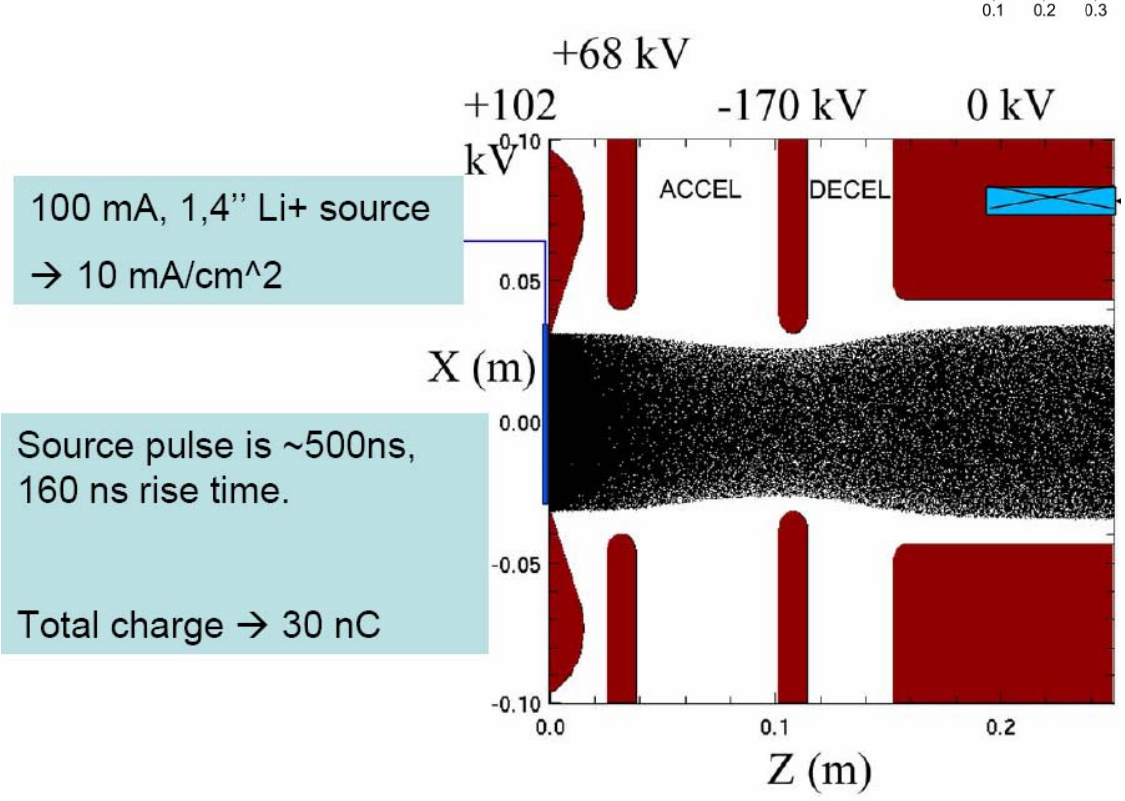


Accel-Decel Lithium Source

(figures are for the “standard” case)

(may need to reduce charge by ~ ½ for the double pulse case to reduce space charge forces)





The “special waveform” accelerator cells will be used to:

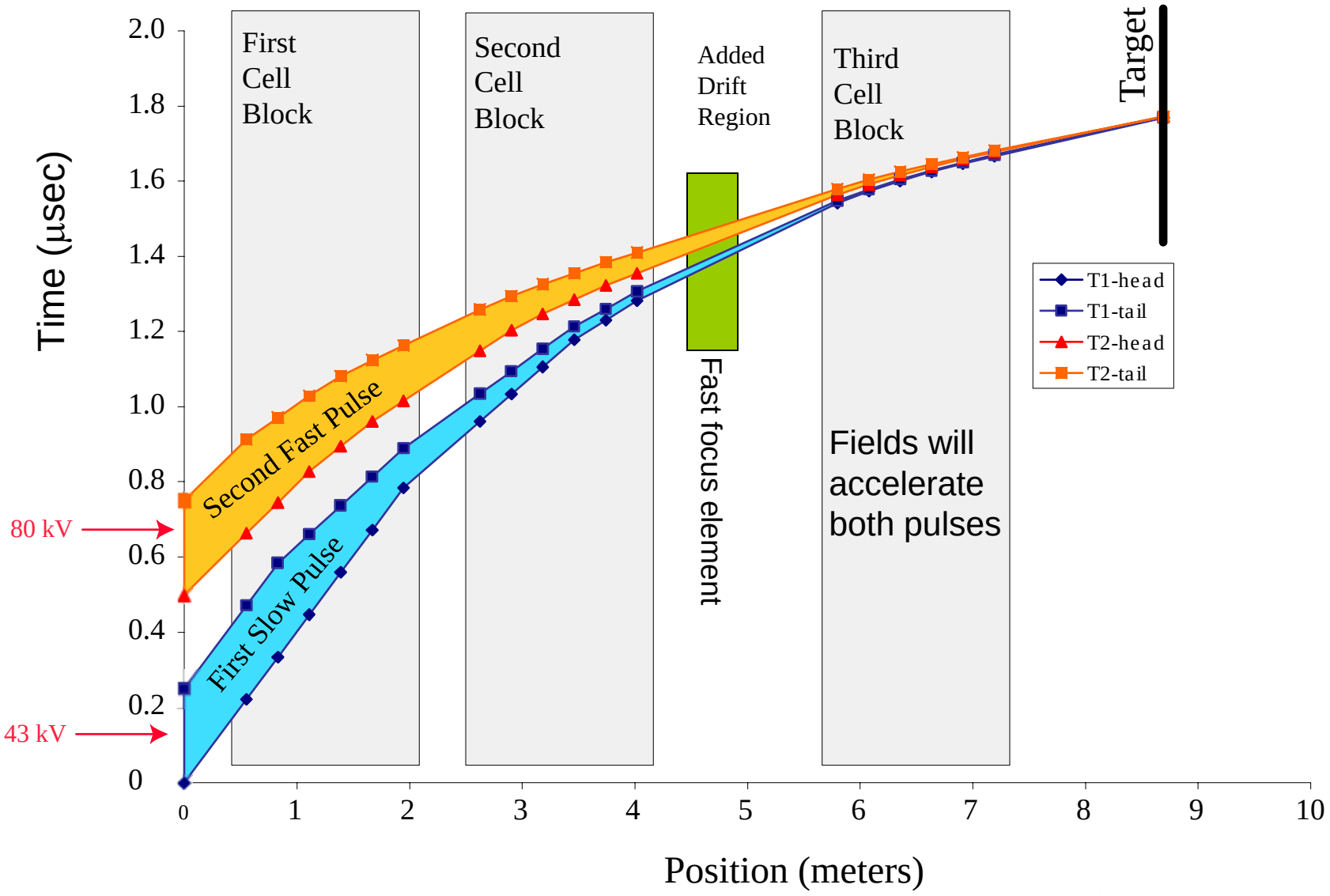
- Compress the first pulse so that it’s duration at target is ~ 1 ns.

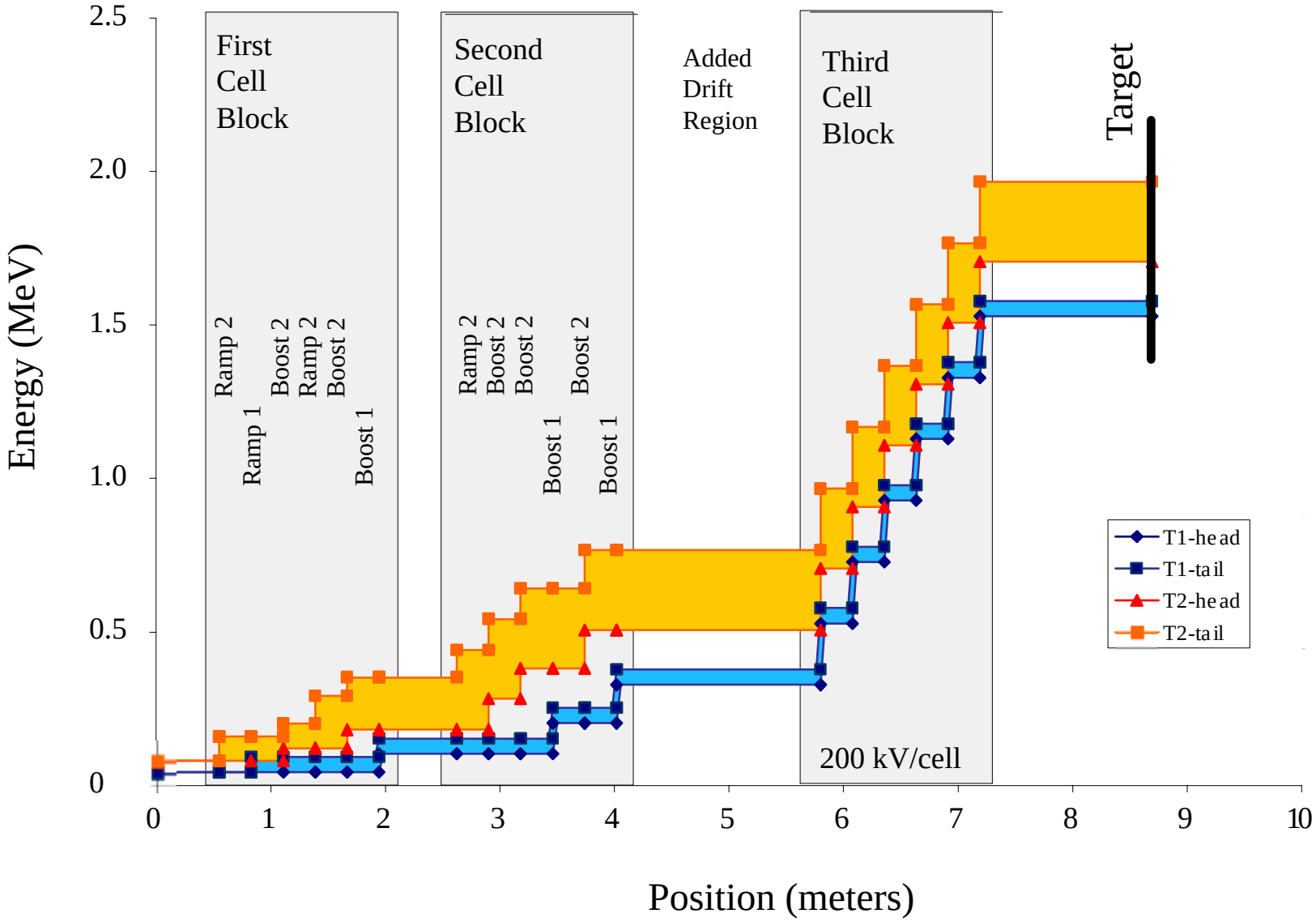
  (will need head/tail correction when include space charge forces)
- Compress the second pulse so that it’s duration at target is ~ 1 ns.
- Have the second pulse almost overtake the first pulse at the target.

The two pulses will have different mean energies.

There is a head-to-tail energy variation within both pulses.

Simple “v t = d” simulation




Energy (MeV)
Position (meters)
First Cell Block
Second Cell Block
Added Drift Region
Third Cell Block
Target
Ramp 2
Ramp 1
Boost 2
Ramp 2
Boost 2
Boost 1
Ramp 2
Boost 2
Boost 2
Boost 1
Boost 2
Boost 1
200 kV/cell
T1-head
T1-tail
T2-head
T2-tail
0
0.5
1.0
1.5
2.0
2.5
0
1
2
3
4
5
6
7
8
9
10

Summary

- We can use the NDCX-II hardware to produce two pulses on the target without major hardware modifications.
- Additional study is needed to determine the feasibility of the concept (e.g. quality of the beam).
- Need to iterate on the design with the proposed HEDP experiment to reach suitable parameters.