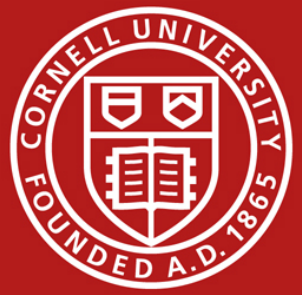
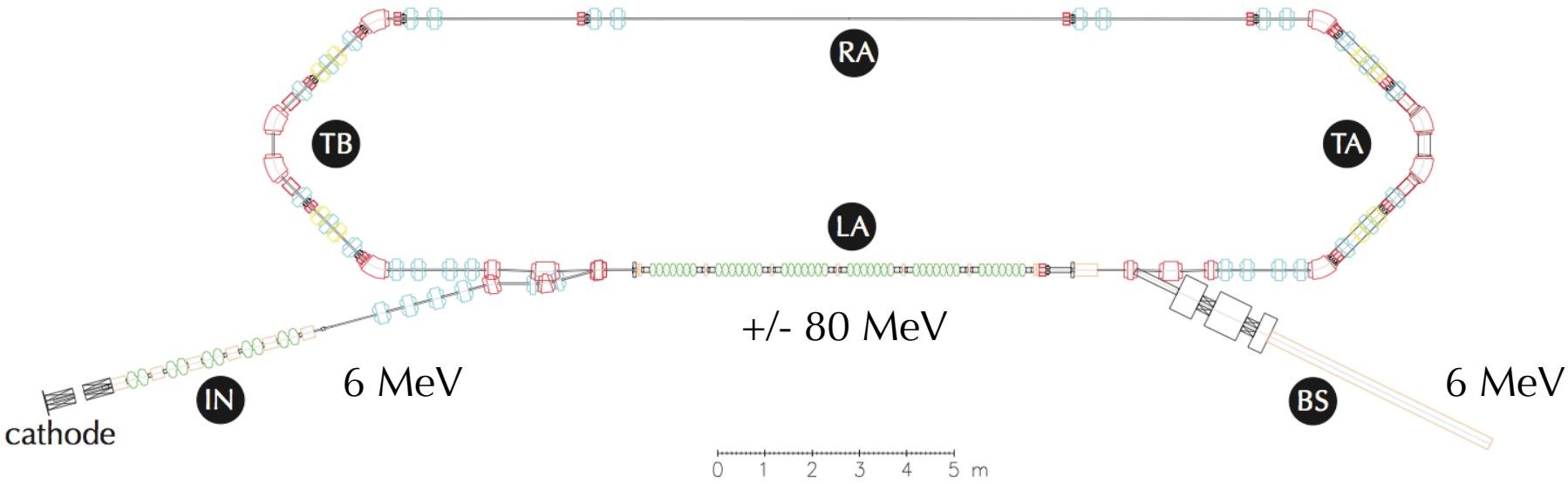


Cornell-BNL ERL-FFAG Lattice considerations

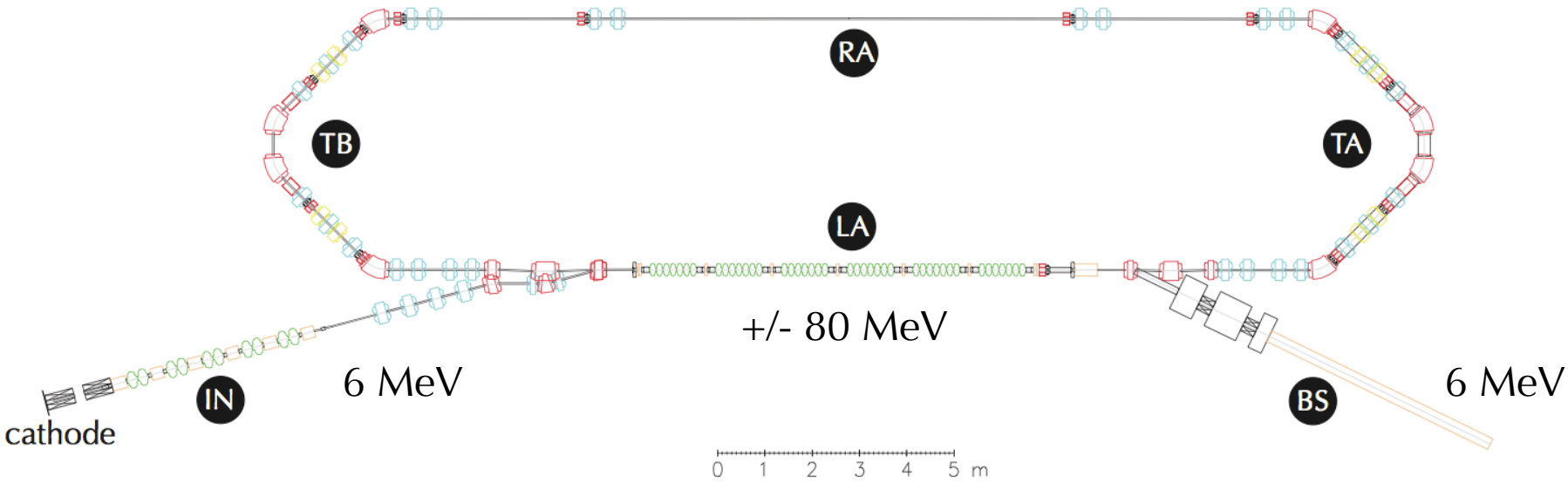
Christopher Mayes – September 25, 2014

Single pass ERL



Energy	86	MeV
Current	100	mA
Emittance x, y	0.3	mm-mrad
Frequency	1.3	GHz
Bunch charge	77	pC

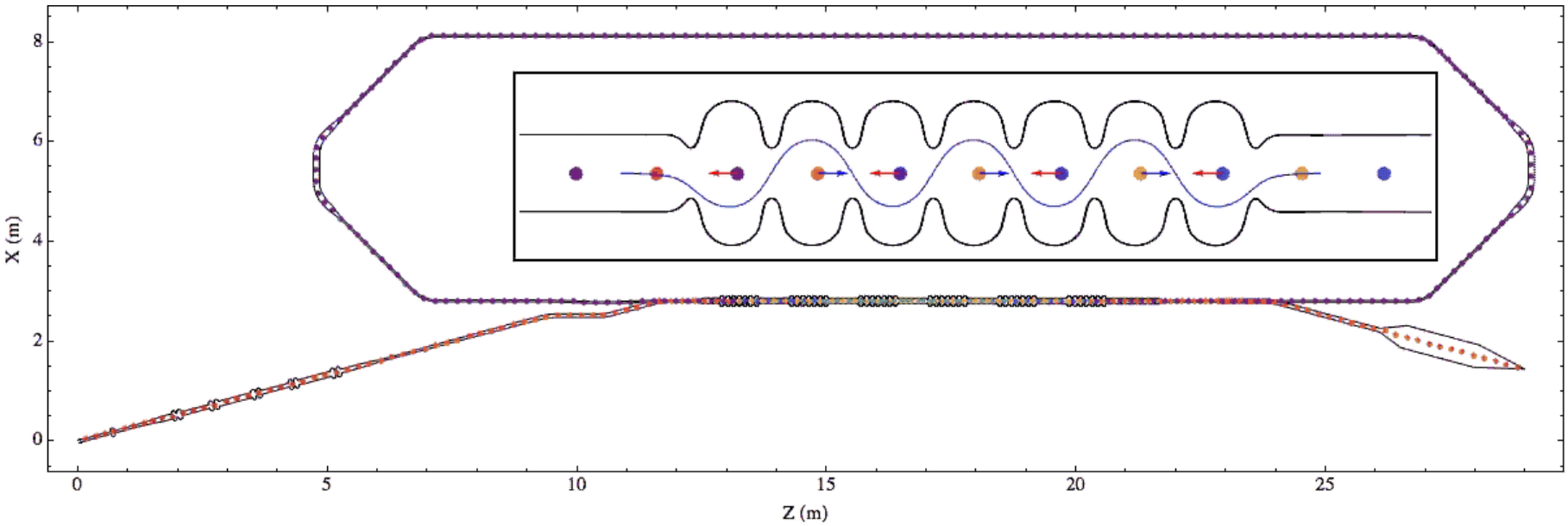
Single pass ERL

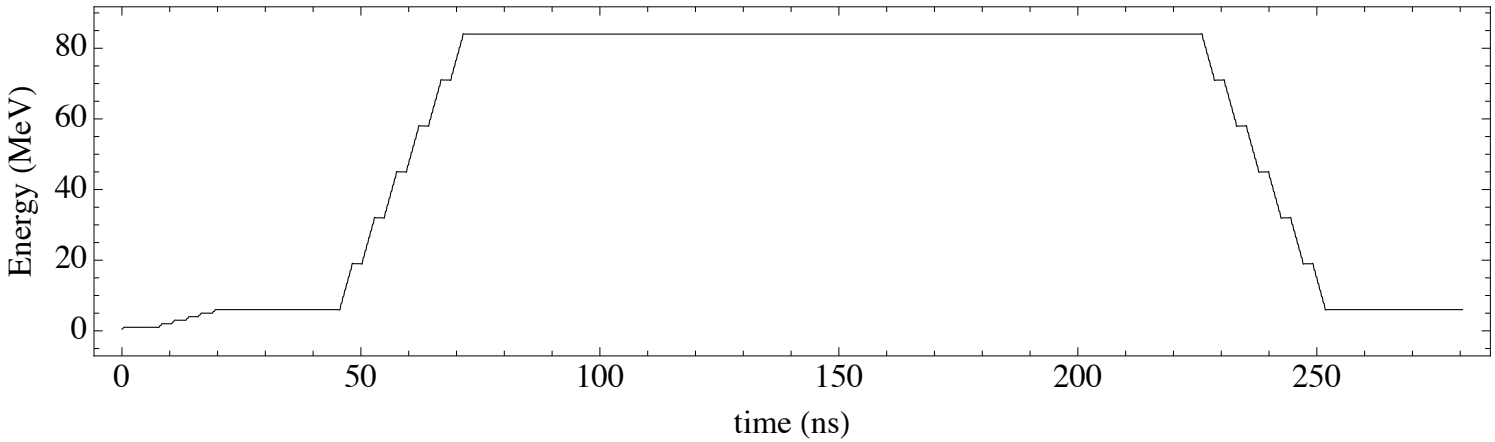


Basic loop requirements:

- Accept space-charge influenced beam from linac
- total loop path length $L_{\mathrm{tot}} = (n + 1/2)\lambda_{\mathrm{rf}}$
- total loop time-of-flight (r_{56}) small
- match second pass linac optics and dump

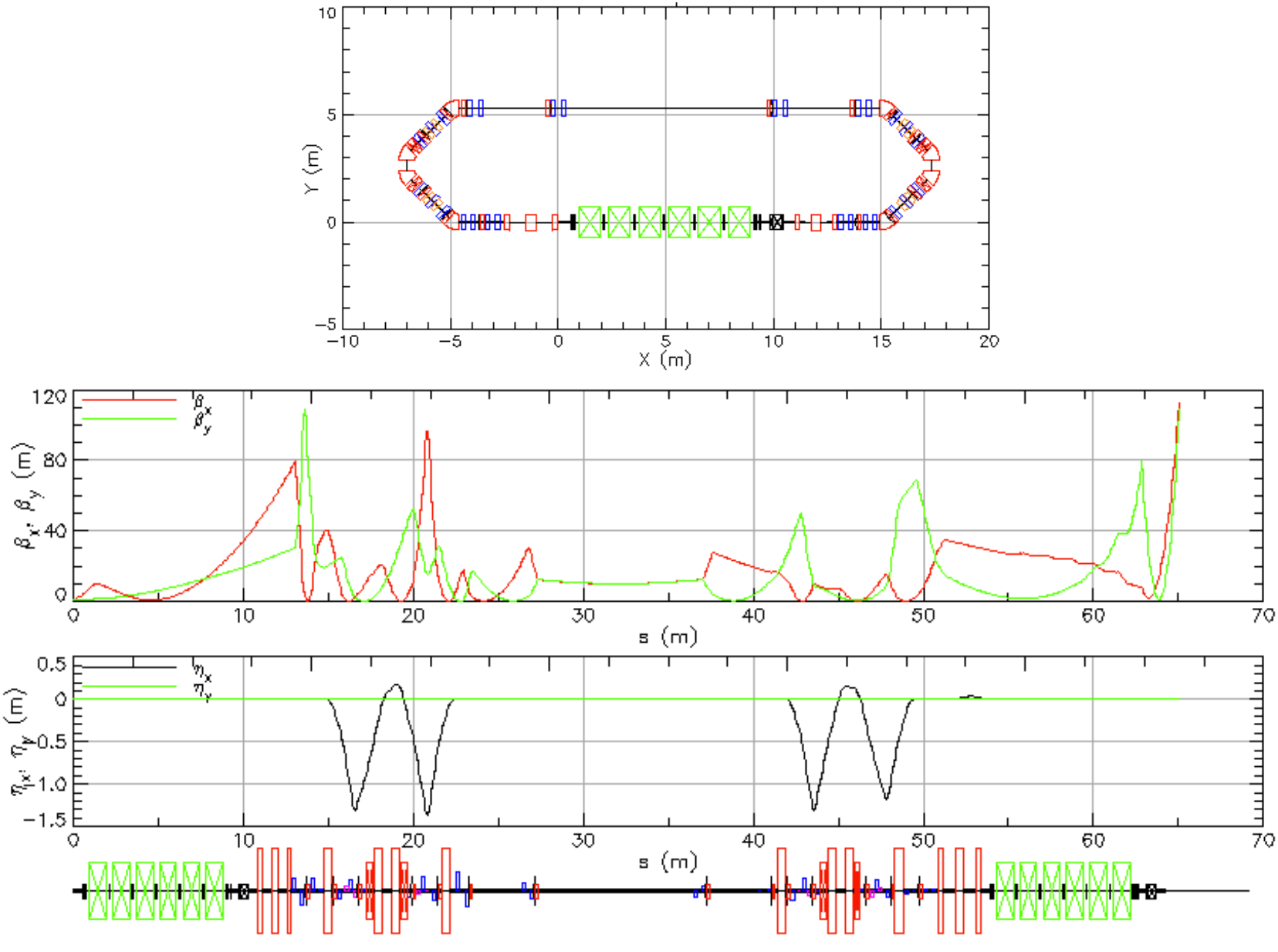
Single pass ERL



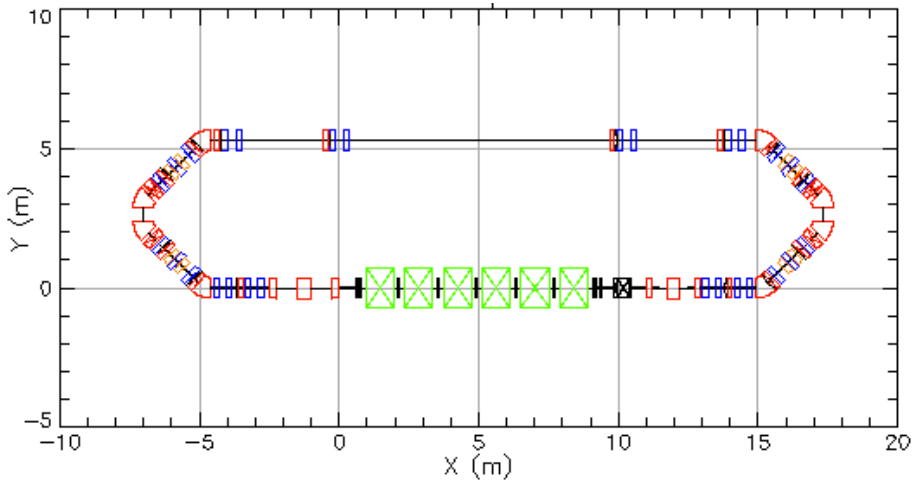


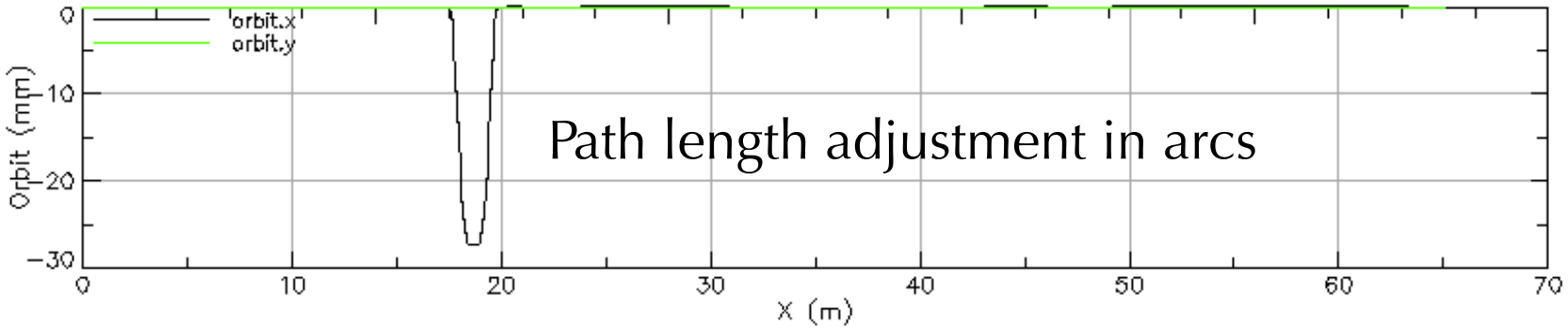
http://www.lepp.cornell.edu/~cem52/Movies/ERL_animation.mov

Single pass ERL optics

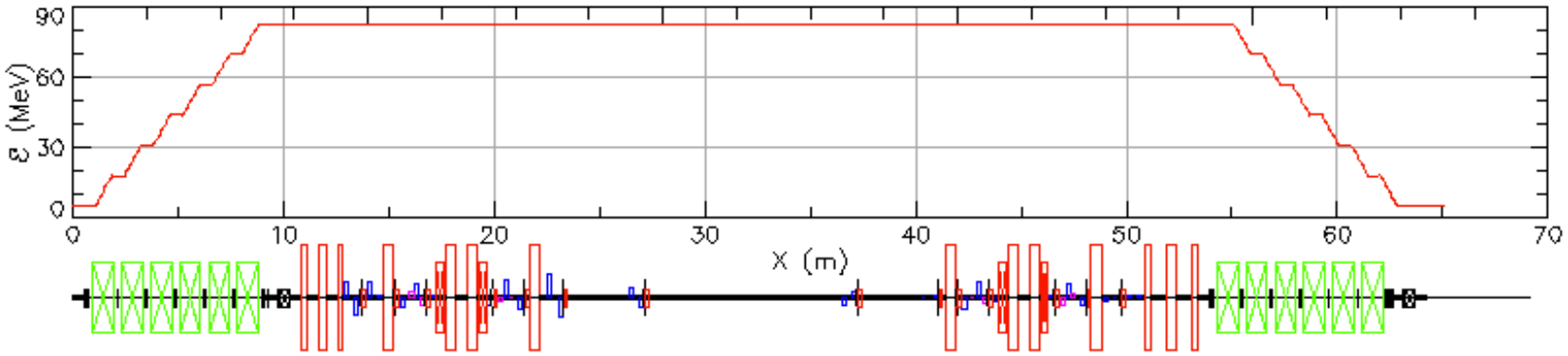


Single pass ERL optics

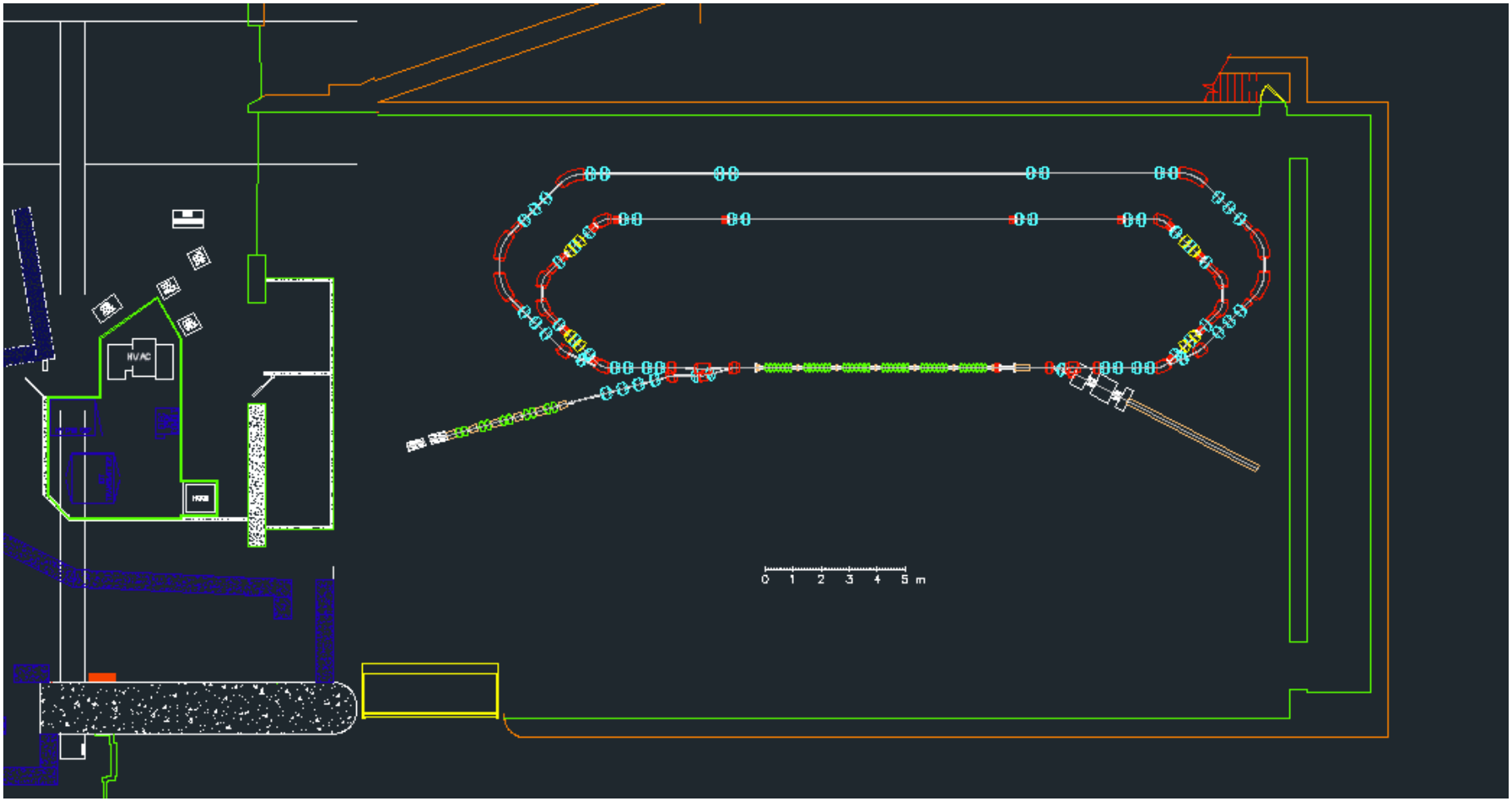




Path length adjustment in arcs



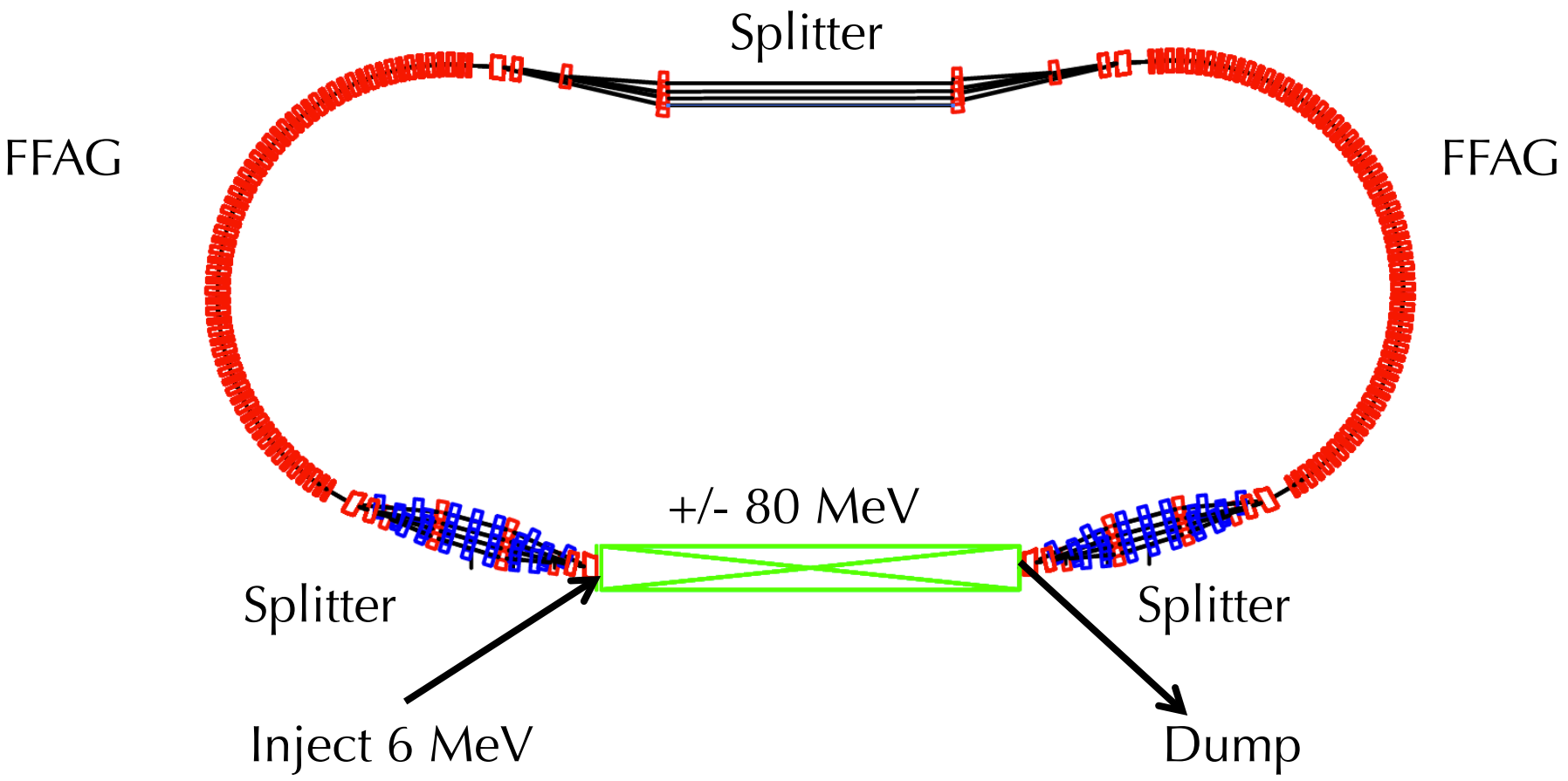
Two pass ERL



Inner (low energy) loop adjusted for $L_{\mathrm{tot}} = m\lambda_{\mathrm{rf}}$

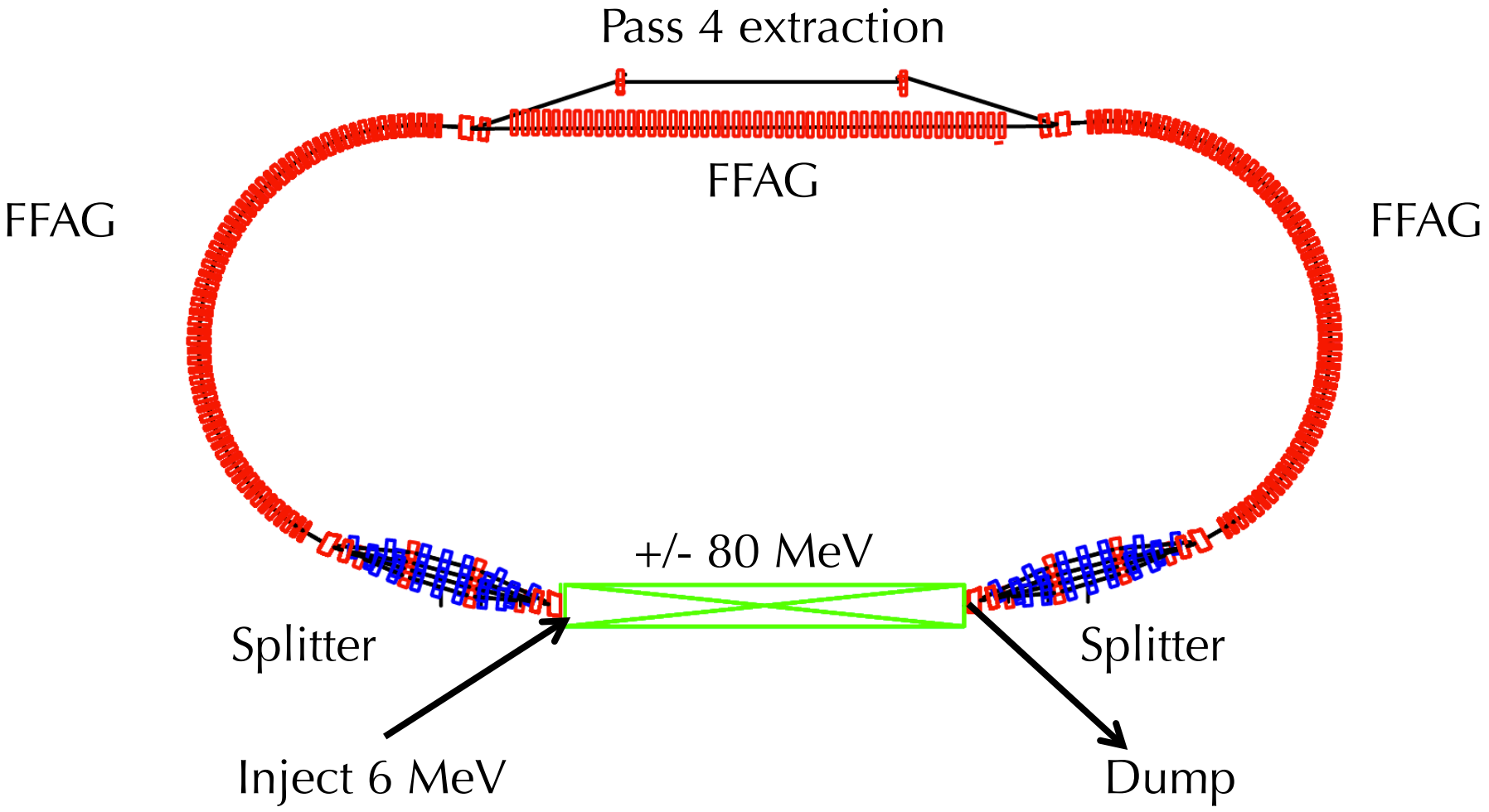
Outer (high energy) loop adjusted for $L_{\mathrm{tot}} = (n + 1/2)\lambda_{\mathrm{rf}}$

Four pass ERL-FFAG cartoon 1



$$\frac{326\ \text{MeV}}{86} \approx 3.8$$

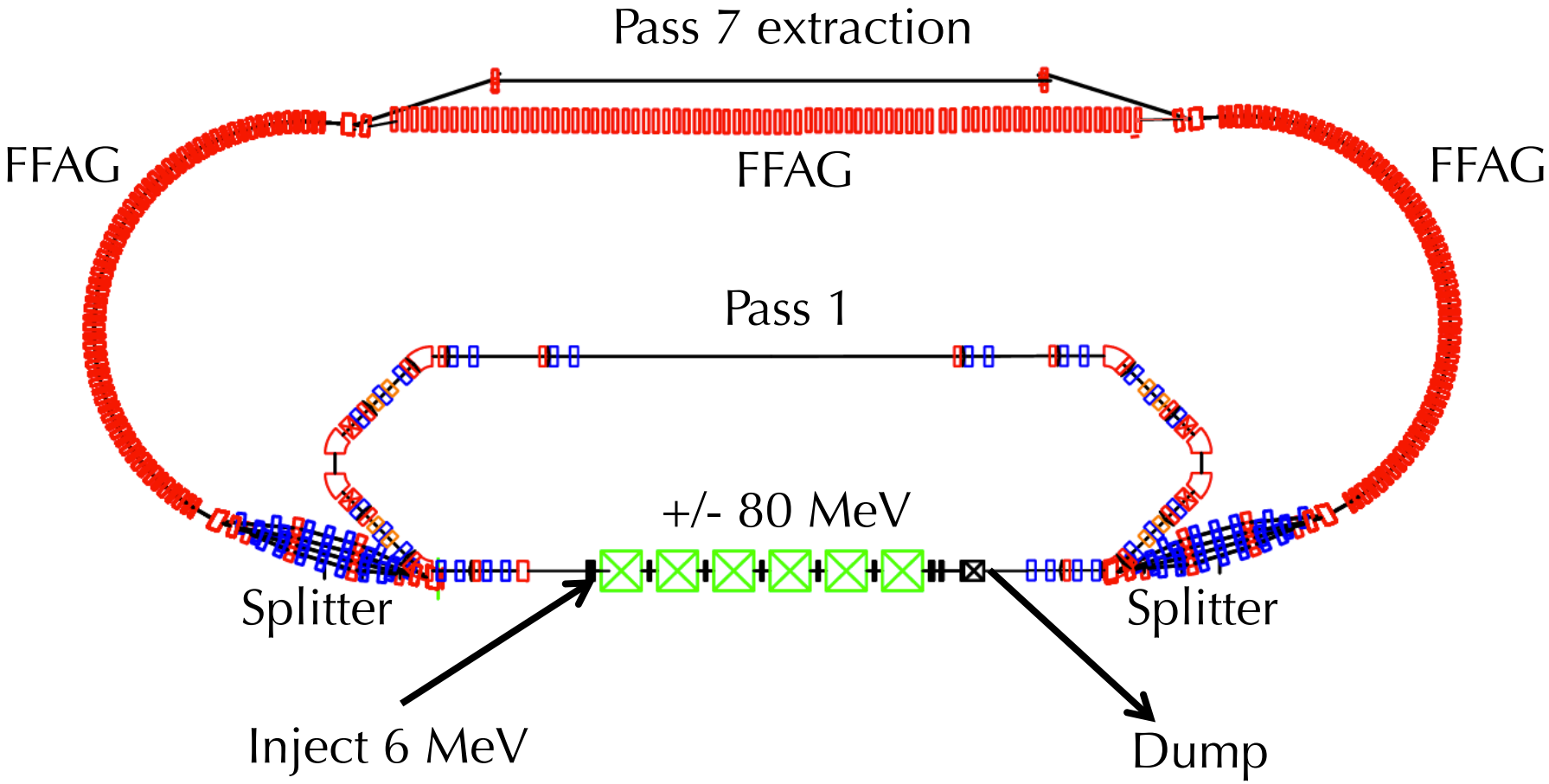
Four pass ERL-FFAG cartoon 2



$$\frac{326\ \text{MeV}}{86} \approx 3.8$$

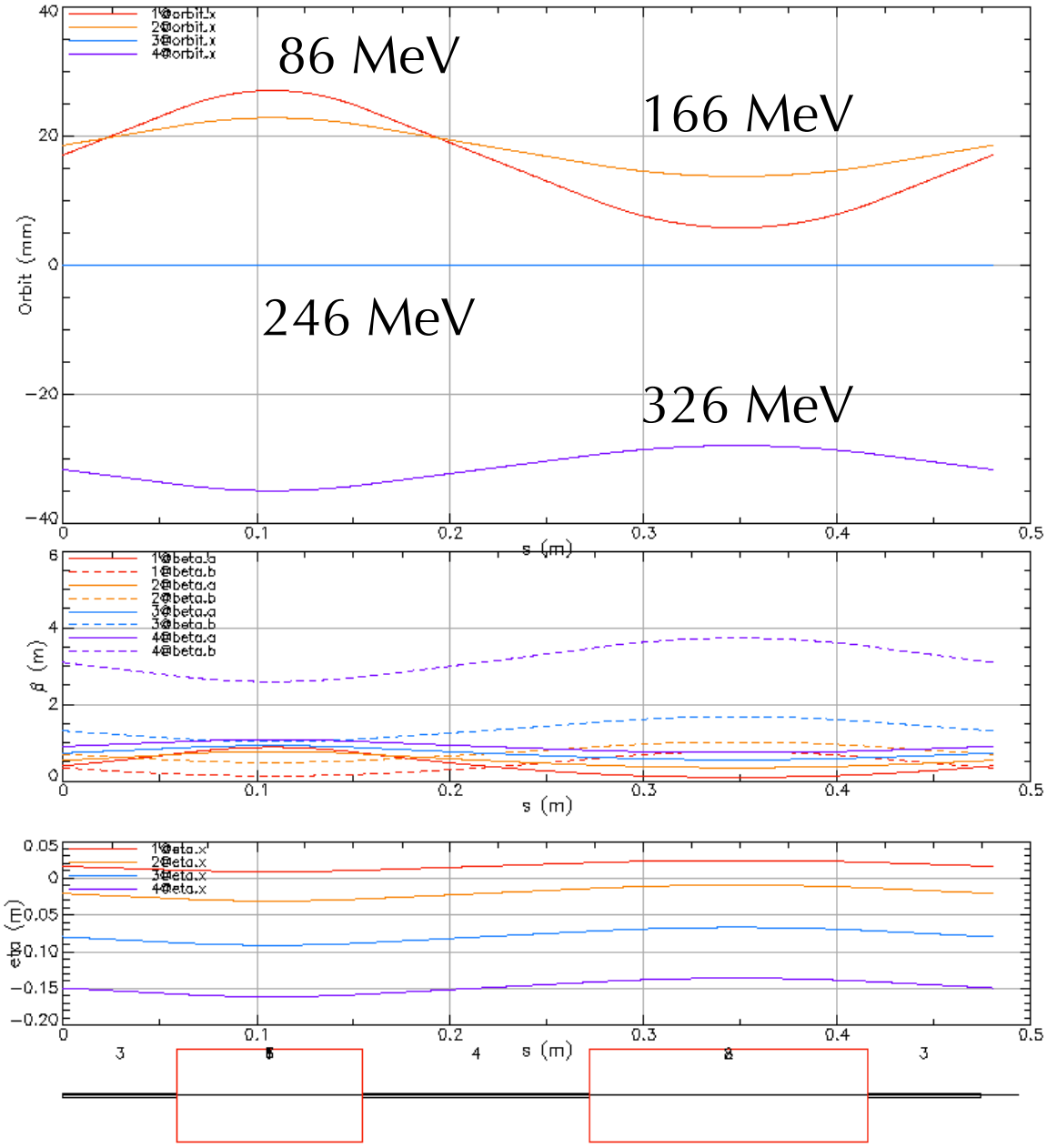
Seven pass ERL-FFAG cartoon 3

86, **166, 246, 326, 406, 486, 566** MeV



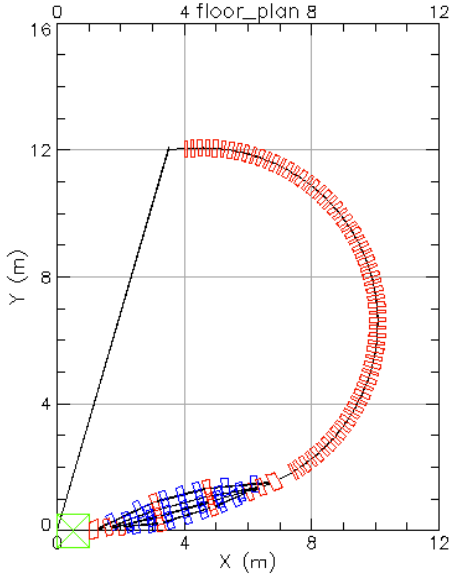
$$\frac{566\ \text{MeV}}{166} \approx 3.4$$

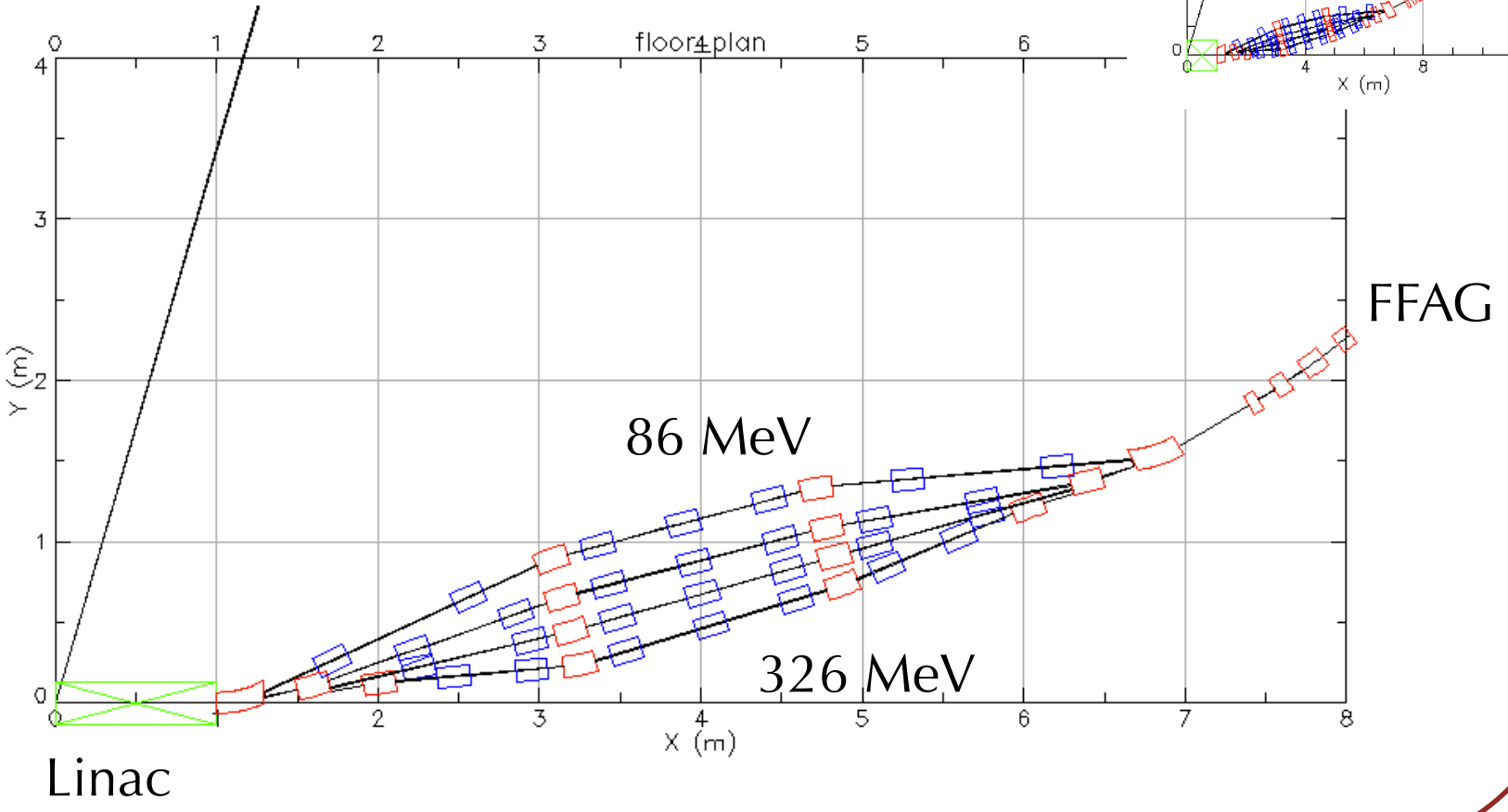
FFAG cell orbits and optics



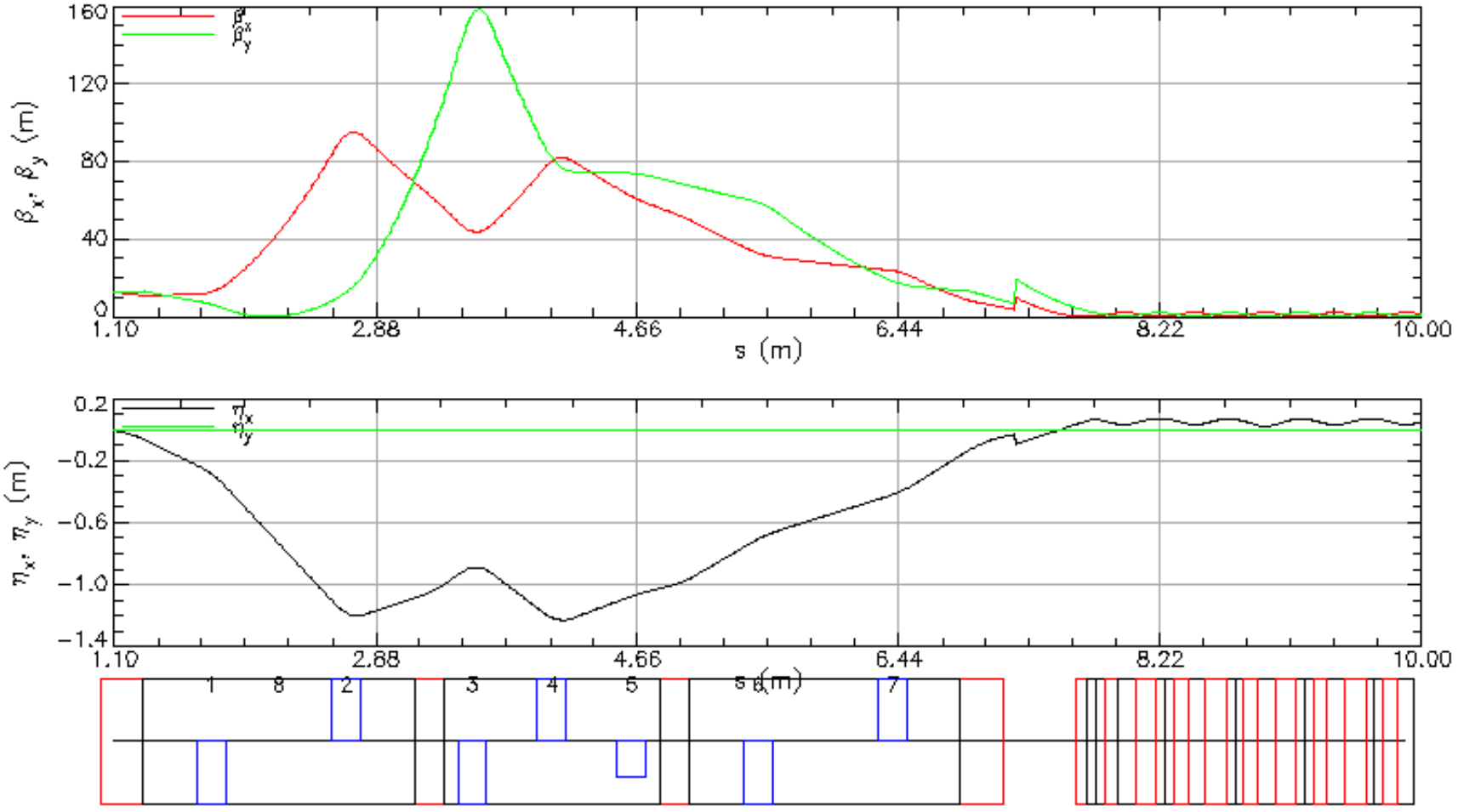
Four pass splitter

- Accept large beams from Linac
- Steer onto FFAG closed orbits
- Match to FFAG optics
- Possible path length adjustment



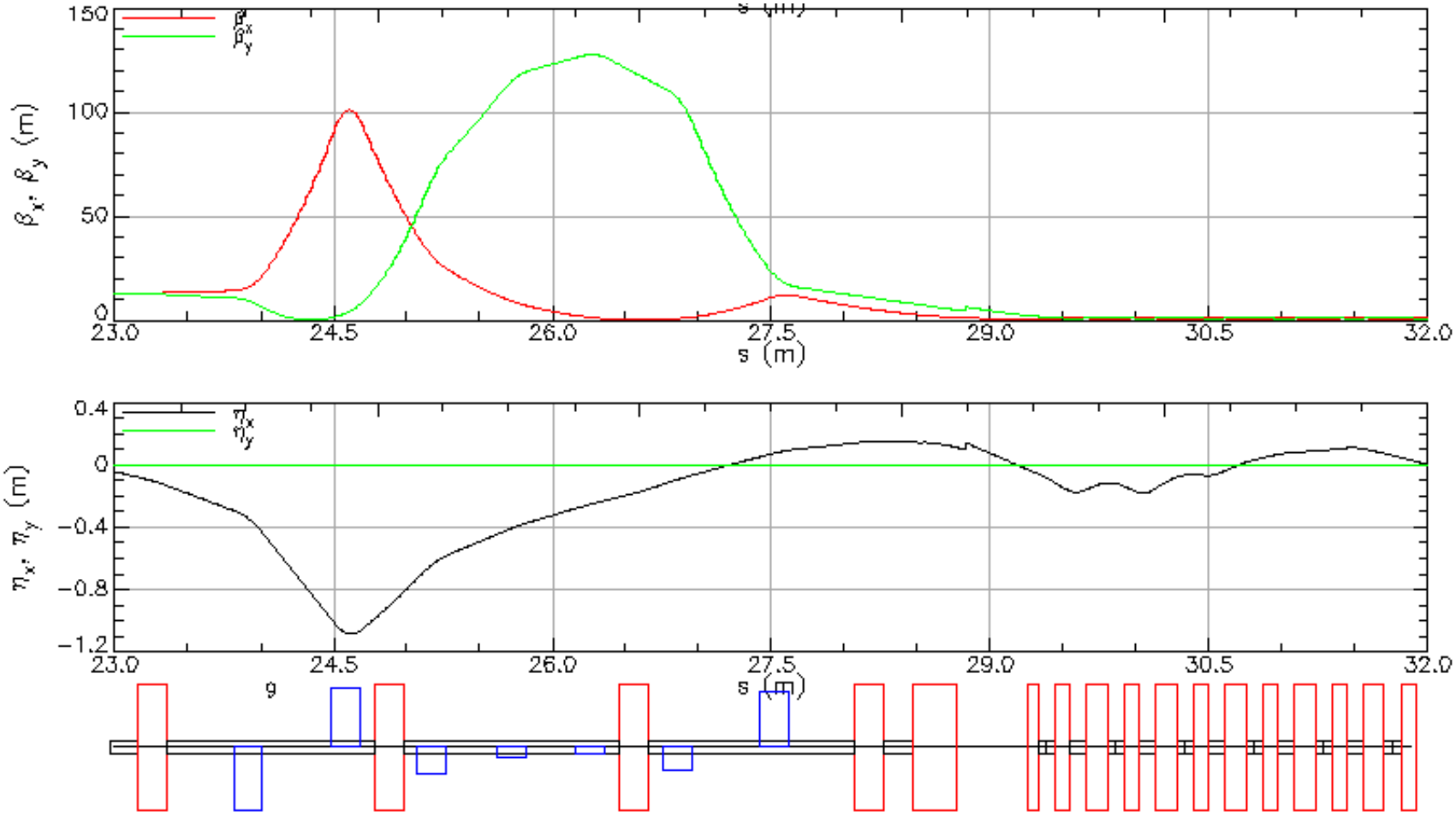


Splitter pass 1: 86 MeV



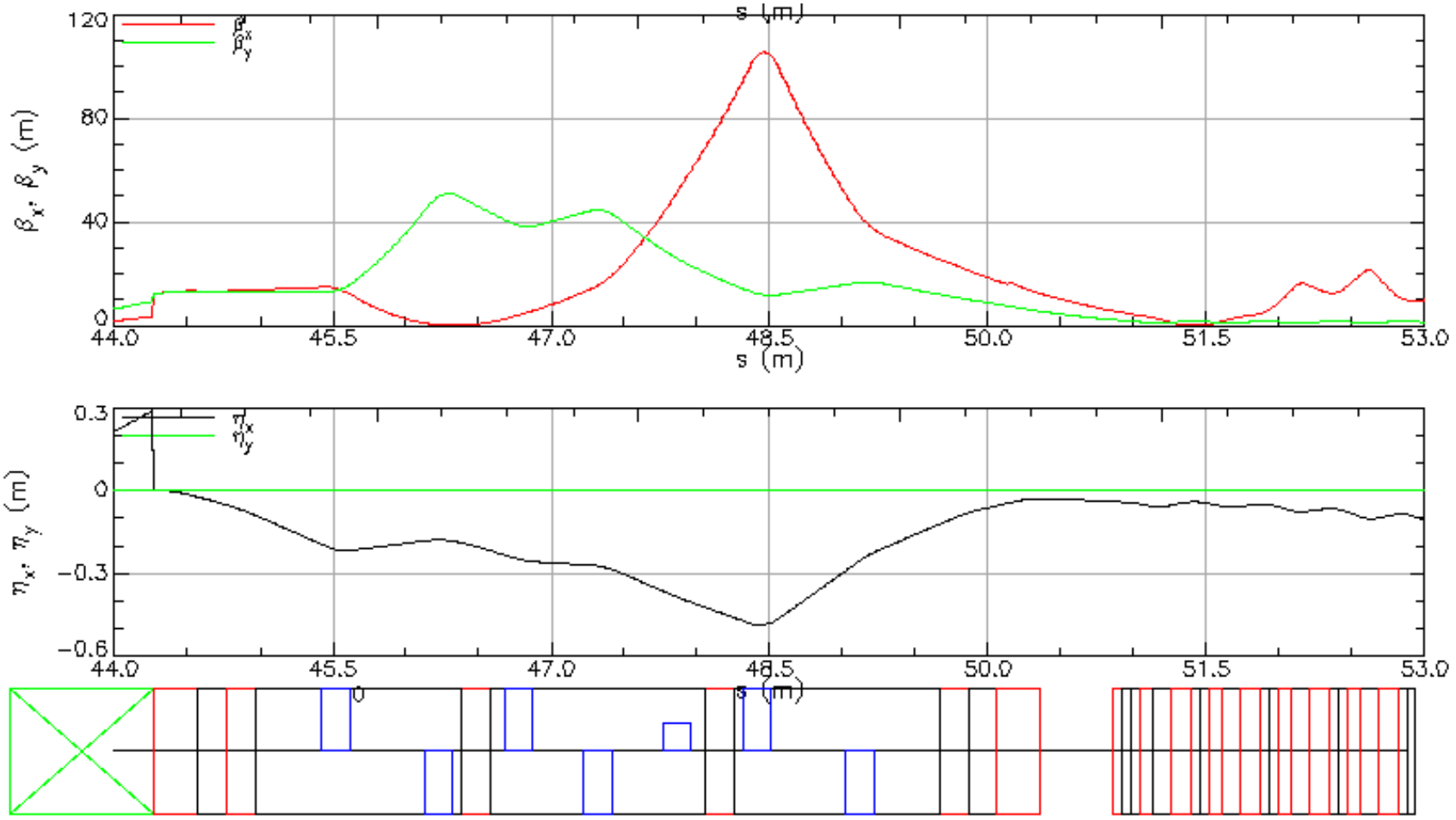
FFAG

Splitter pass 2: 166 MeV



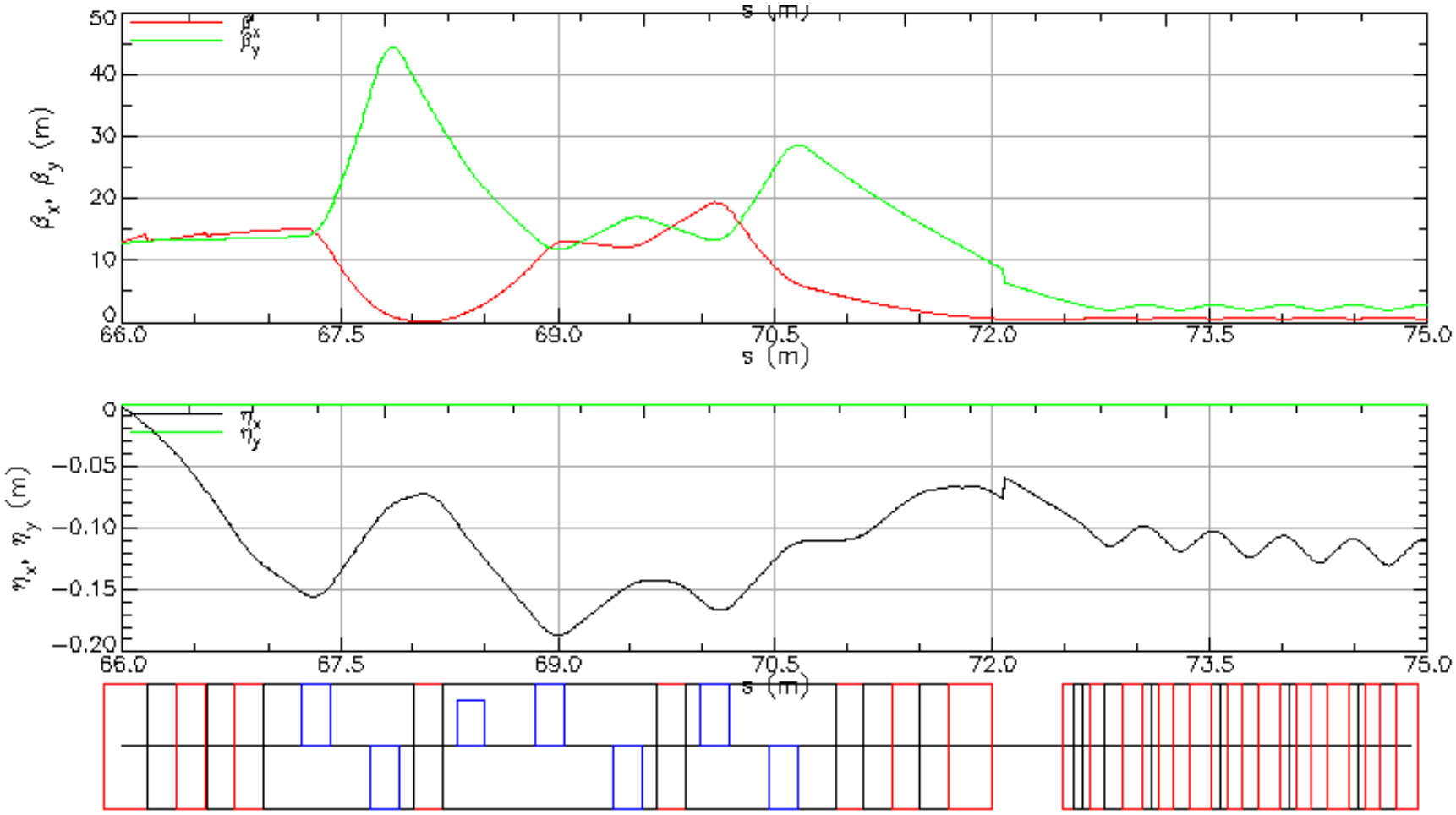
FFAG

Splitter pass 3: 246 MeV



FFAG

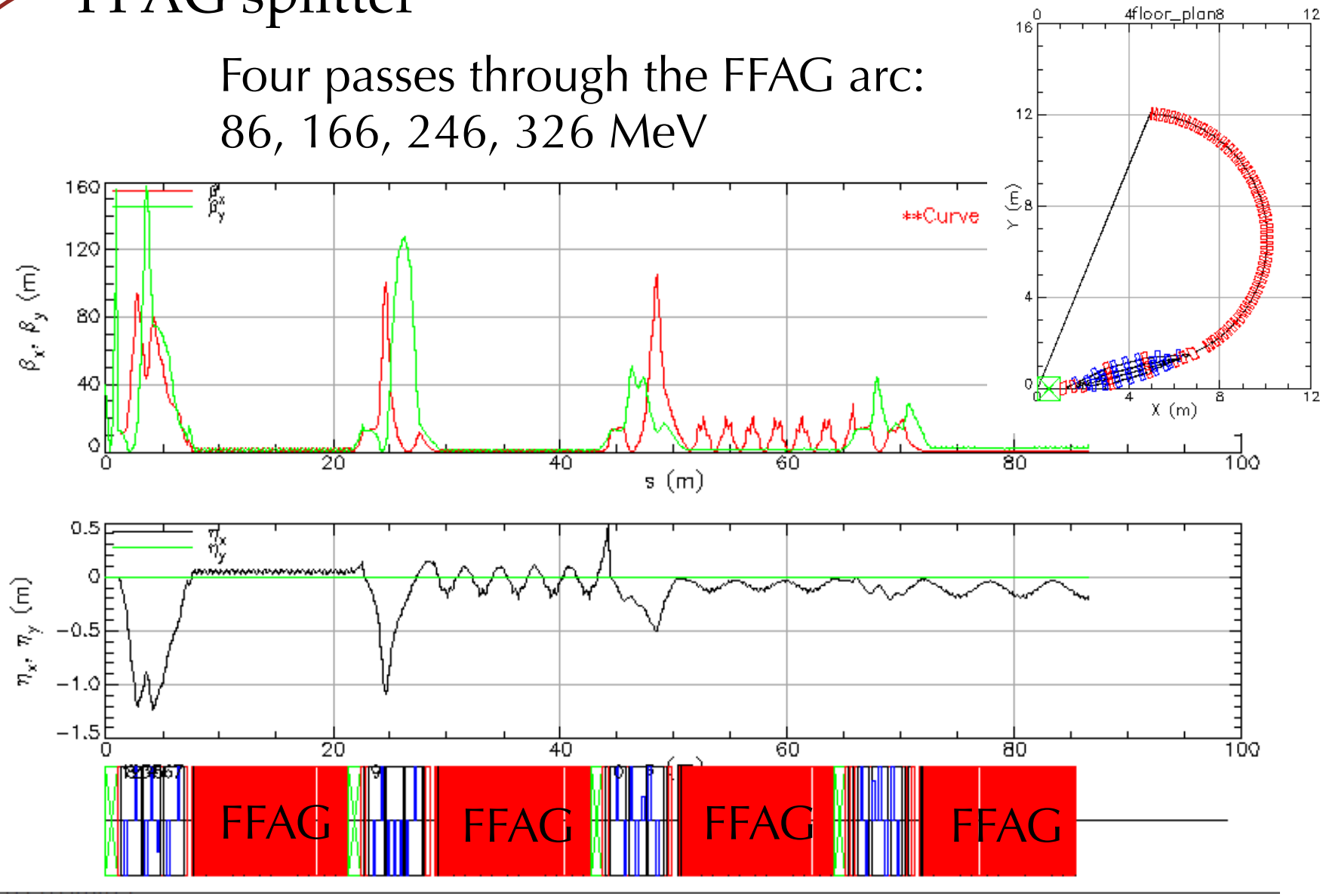
Splitter pass 4: 326 MeV



FFAG

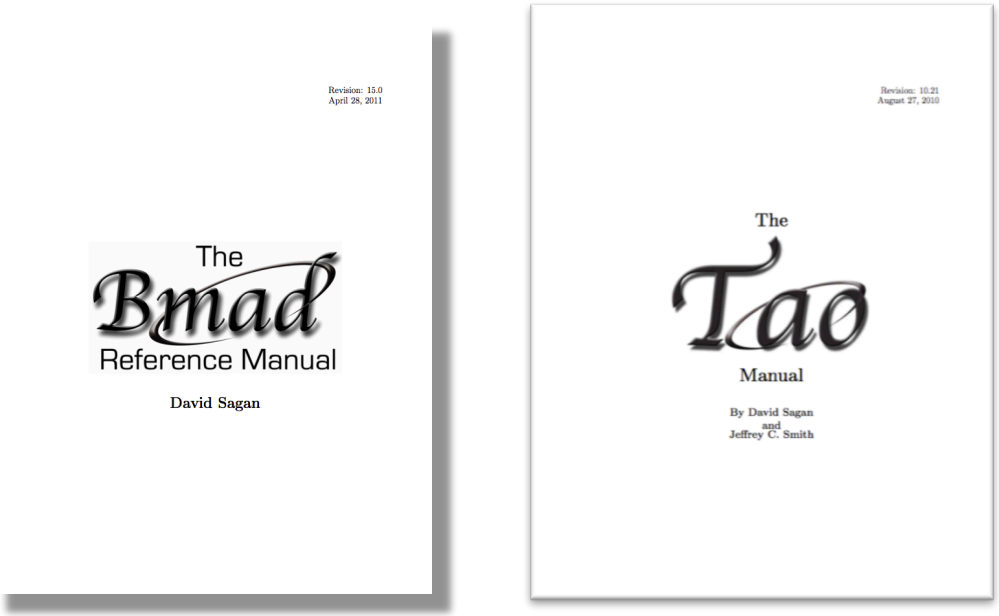
FFAG splitter

Four passes through the FFAG arc:
86, 166, 246, 326 MeV

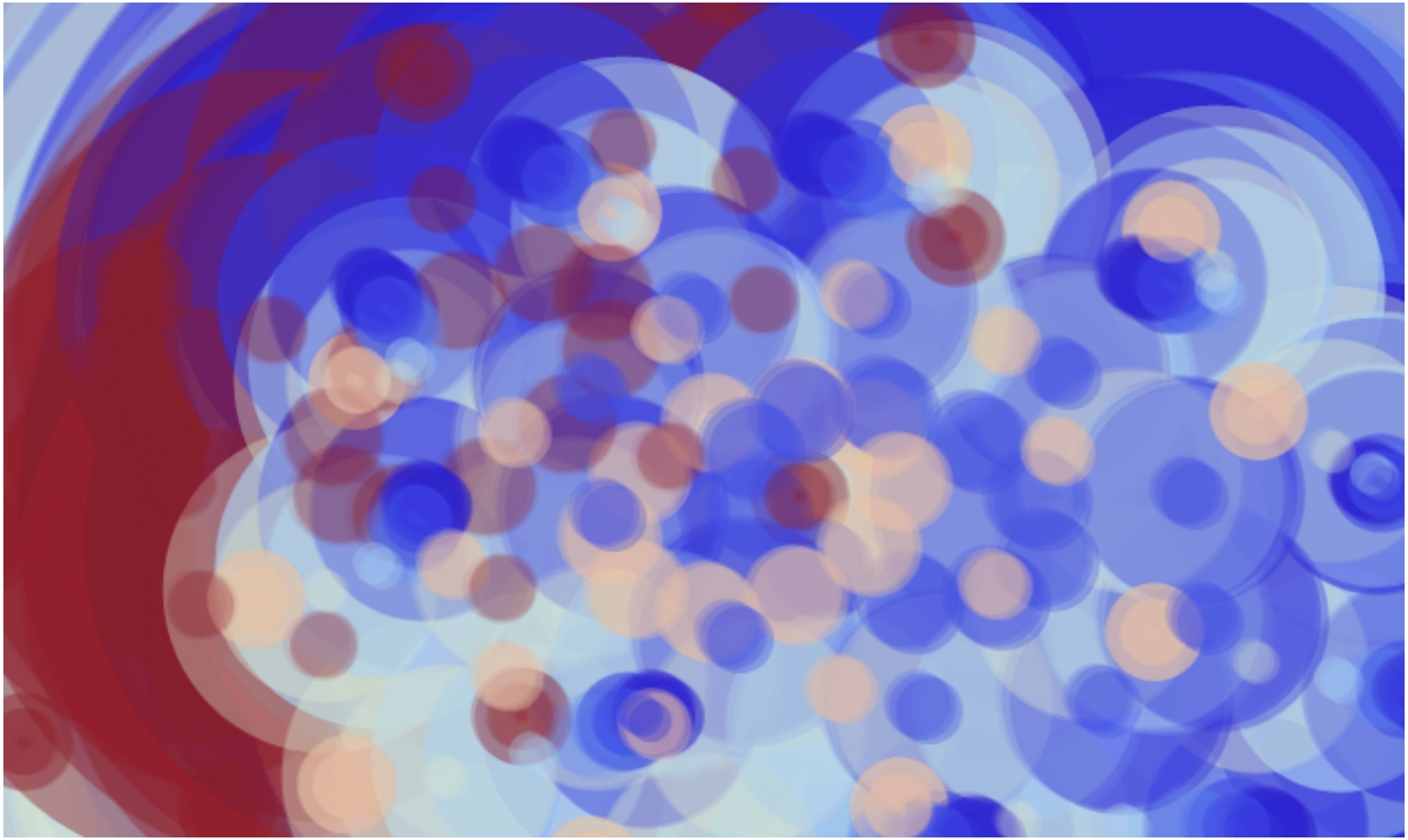


Simulation Software

Bmad & Tao (Cornell)



www.lns.cornell.edu/~dcs/bmad



End