My outline of the available options, YMMV

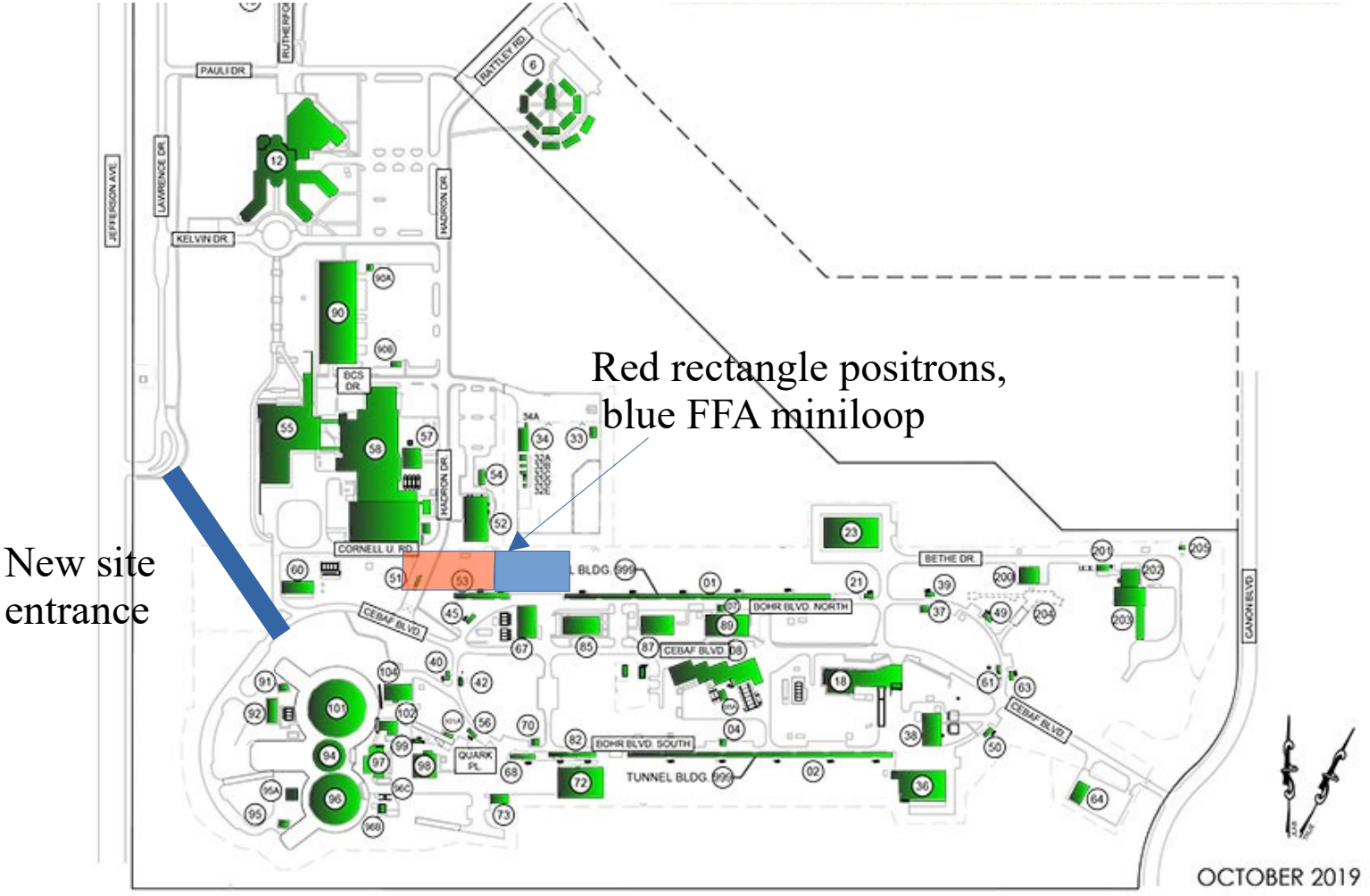
Jay Benesch

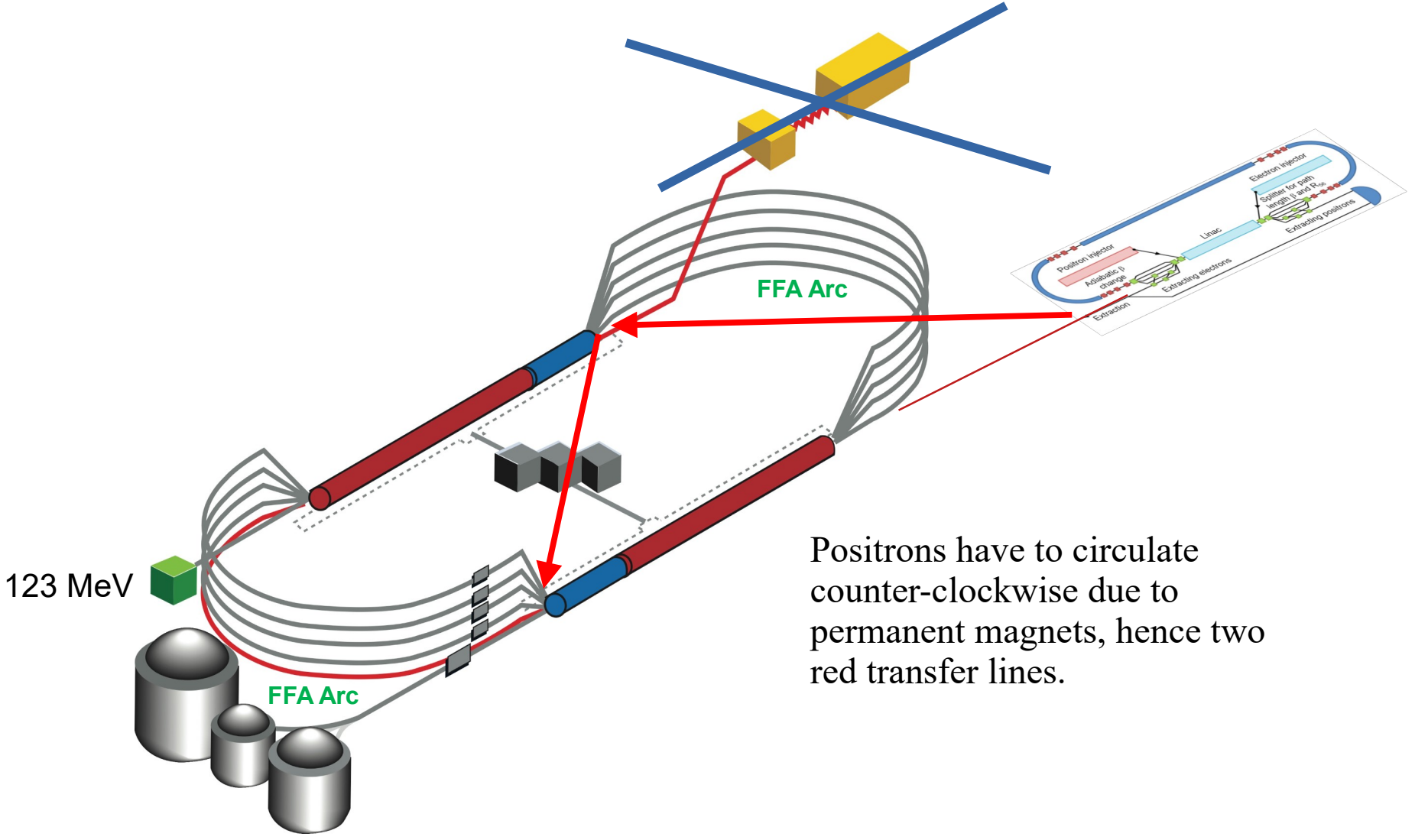
7 March 2022

Injector options

A Large vault for positrons and 650 MeV racetrack, new road entrance to site (slide 3). CEBAF cannot operate during construction.

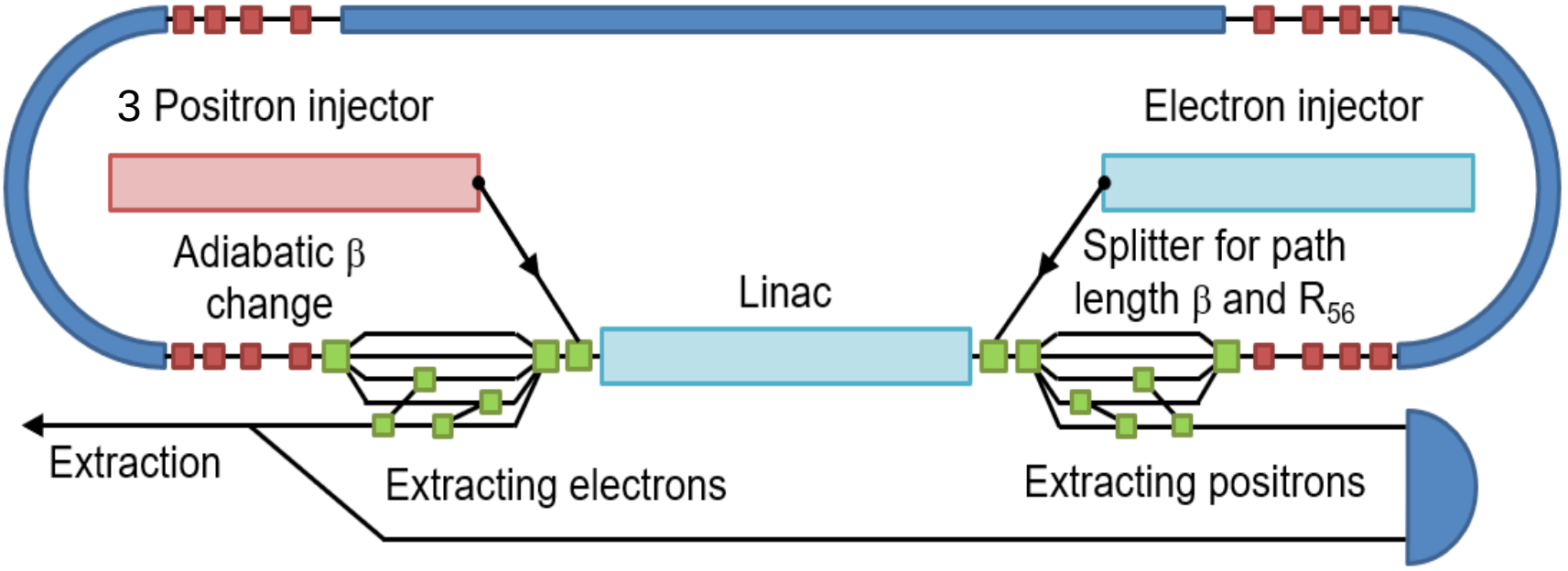
B Three large-emittance positron/electron injectors, one chopped low-emittance electron injector inside 1.2 GeV racetrack on Canon Blvd side of site. CEBAF likely could operate during construction, perhaps via sand-filled moat to damp vibrations (C100 vulnerability). Two long transfer lines needed. Slides 4,5


Red rectangle positrons,
blue FFA miniloop
New site
entrance
PAULI DR.
KELVIN DR.
JEFFERSON AVE.
LAWRENCE DR.
HADRON DR.
RUTHERFORD
RATTLEY RD.
CORNELL U. RD.
ECS DR.
GEBAF BLVD.
BOHR BLVD. NORTH
BOHR BLVD. SOUTH
BETHE DR.
CANON BLVD.
QUARK PL.
TUNNEL BLDG.
OCTOBER 2019



Positrons have to circulate counter-clockwise due to permanent magnets, hence two red transfer lines.

1.2 GeV FFA booster injector



CEBAF options

1. Three EM passes at 1100 MeV/linac, two FFAs, final energy 22 GeV.
2. Four EM passes at 1200 MeV/linac, one FFA to ~17 GeV. Recall tunnel arcs designed for 16 GeV max.
3. Four EM passes at 1200 MeV/linac, two FFAs with the higher energy FFA having beam center 20 cm off the tunnel floor. Final energy 22 GeV.

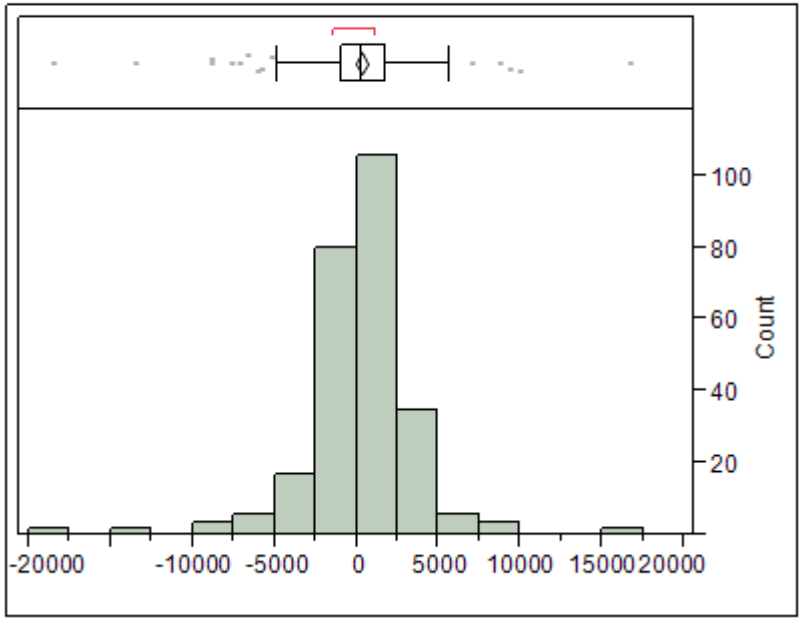
Implications of CEBAF options

- Existing first pass magnets can't accept momentum from any of these options. Passes 2-4 (2-5 in options 2,3) need to be shifted up one notch. New stands needed everywhere.
- All linac girders need to be replaced with new ones containing triplets. Linacs will be at 300K for this work. Replacement of CHL2 with a duplicate of CHL1R should be part of the plan if it hasn't already happened due to cold compressor failure.
- If a particulate removal process has been developed for the original cryomodule design it should be applied. If 300K plasma processing doesn't work on C100s, apply the process there too.

Arc correctors 1/30/22 scaled to 1100 MeV/linac

Distributions

BdL G-cm



Quantiles		
100.0%	maximum	16723.8
99.5%		14898.6
97.5%		5594.16
90.0%		3389.07
75.0%	quartile	1725.2
50.0%	median	364.536
25.0%	quartile	-968.32
10.0%		-2614.1
2.5%		-6992
0.5%		-17156
0.0%	minimum	-18520

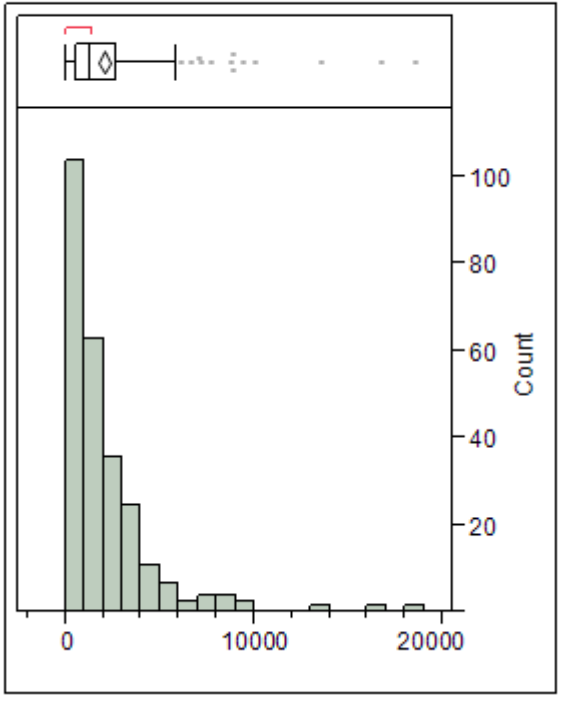
Moments	
Mean	303.66626
Std Dev	3143.3296
Std Err Mean	197.61944
Upper 95% Mean	692.8624
Lower 95% Mean	-85.52988
N	253

Dejan's comment about putting correctors outside the permanent magnets made me wonder. I scaled the arc correctors from a machine snapshot at 980/linac to 1100/linac. Values [-1,1] excluded from plot. Can these fields really be provided from outside?

Absolute value of arc correctors

Distributions

abs(BdL)



Quantiles

100.0%	maximum	18519.6
99.5%		18034.7
97.5%		8864.63
90.0%		4305.31
75.0%	quartile	2699.68
50.0%	median	1334.53
25.0%	quartile	576.149
10.0%		267.689
2.5%		58.8195
0.5%		5.36451
0.0%	minimum	4.14095

Moments

Mean	2037.581
Std Dev	2409.3336
Std Err Mean	151.47351
Upper 95% Mean	2335.8963
Lower 95% Mean	1739.2656
N	253