

# Hall C line history and status

Jay Benesch  
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# Outline

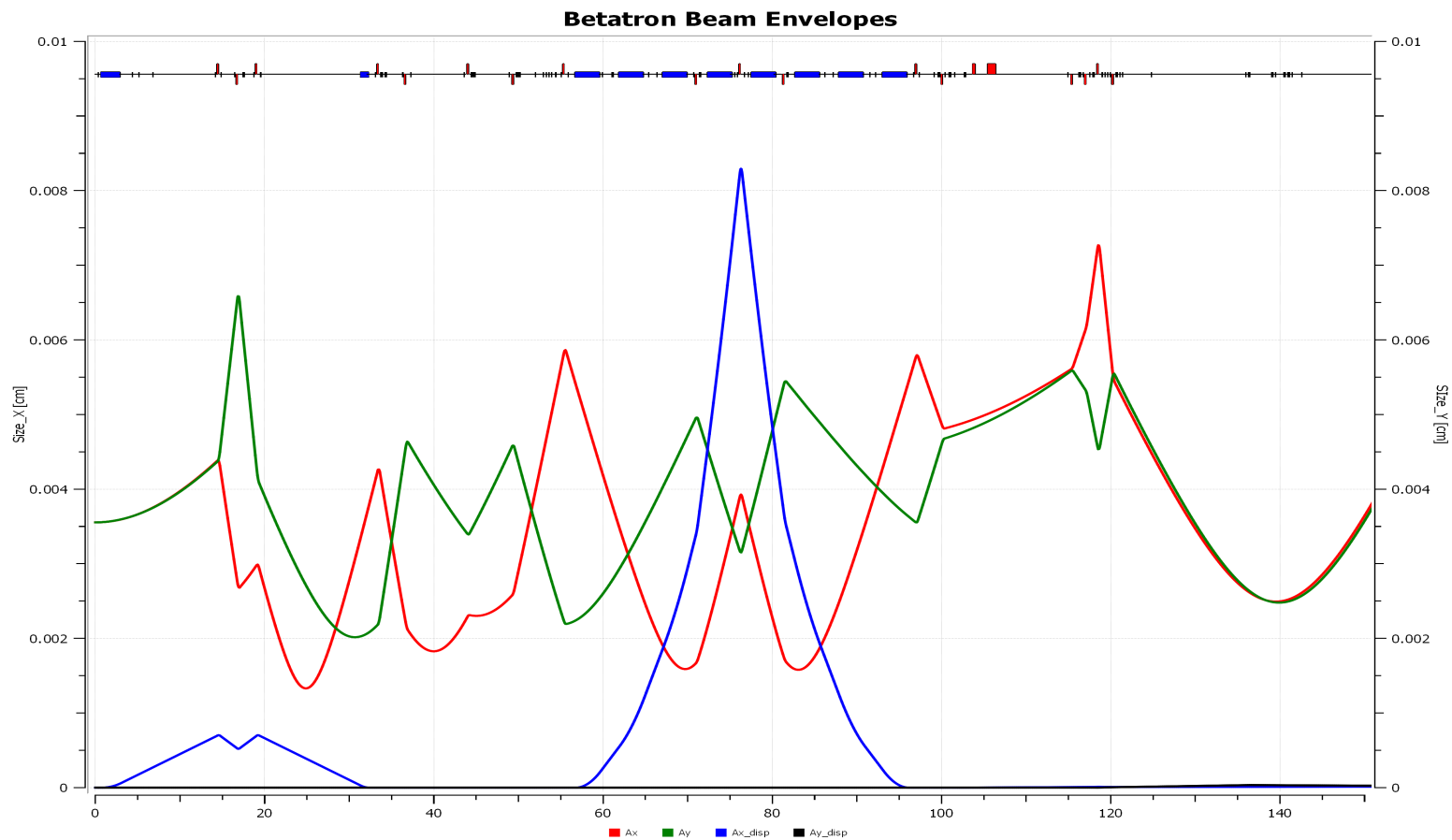
- Construction
- Before Qweak
- Qweak and initial 12 GeV
- Arc quad addition and lower emittance optics
- Making space for CPS or similar

# Construction

- Hall C pivot and HMS were placed at same height as linacs
- Hall C beam comes out of Lambertson 2.2 cm below linac height
- A vertical corrector was placed just after the hall arc to put the beam path on a  $-0.263^\circ$  slope downward to meet pivot. This was flattened by another corrector just upstream of the diagnostic girder. All elements between those correctors were on that slope.
- There was/is a horizontal corrector providing  $-0.716^\circ$  angle to point beam at pivot.
- Within the arc, only the central three quad locations were populated
- Raster after last quad

# 2007 Beam Envelope

100 micron  
Full scale

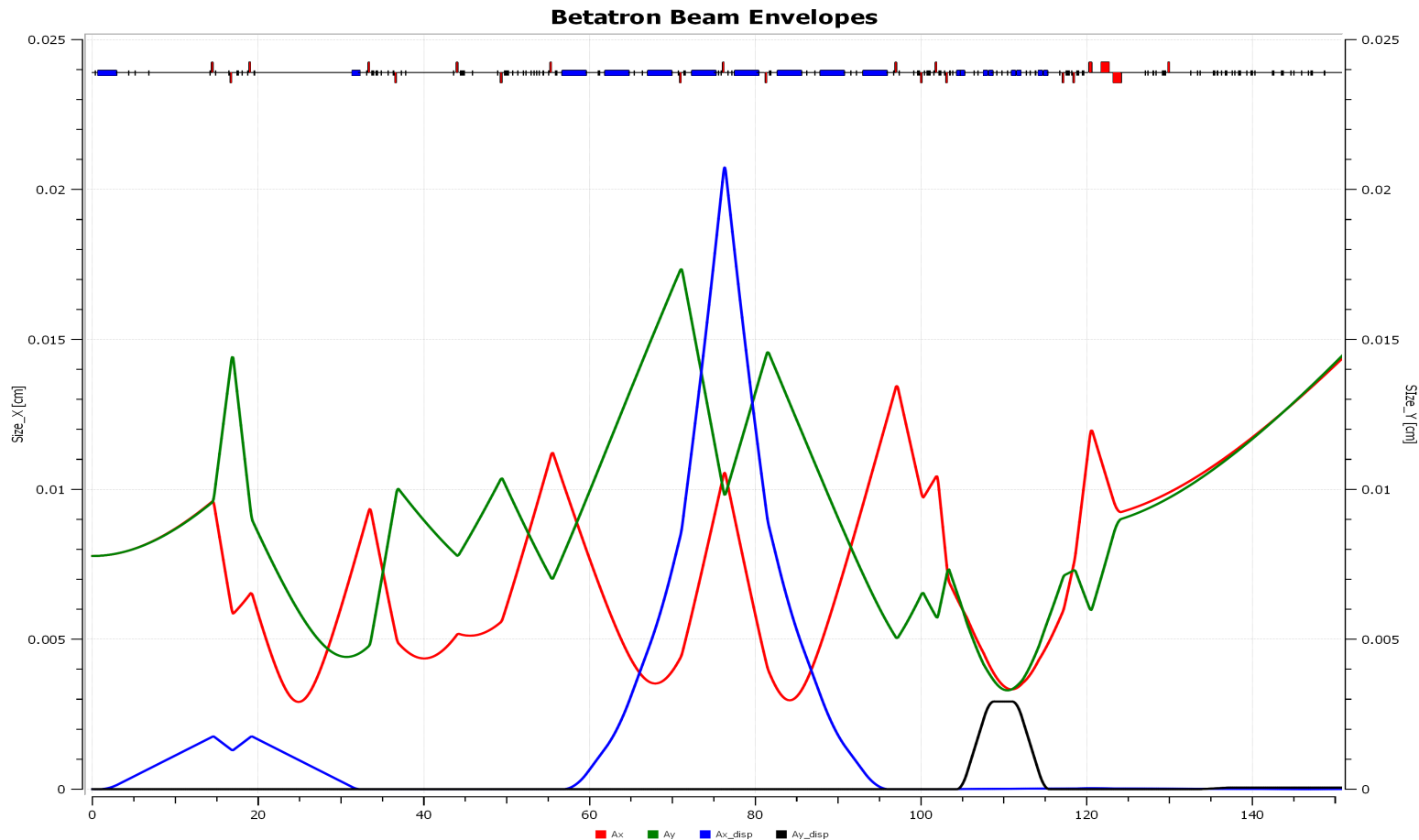


# Qweak

- Addition of the Compton chicane for Qweak and 11 GeV upgrade of Hall C were undertaken as one design effort.
- Hall C input from Dave Gaskell
- Quadruplet placed before Compton to allow tight focus within moderate range of input parameters
- Triplet including the large Moller polarimeter quad to focus at target
- Raster tucked between arms of Moller
- Short vertical chicane after raster so alcove elements easier to place/survey

# Qweak layout optics, five pass

250 micron  
Full scale  
Theoretical  
emittances



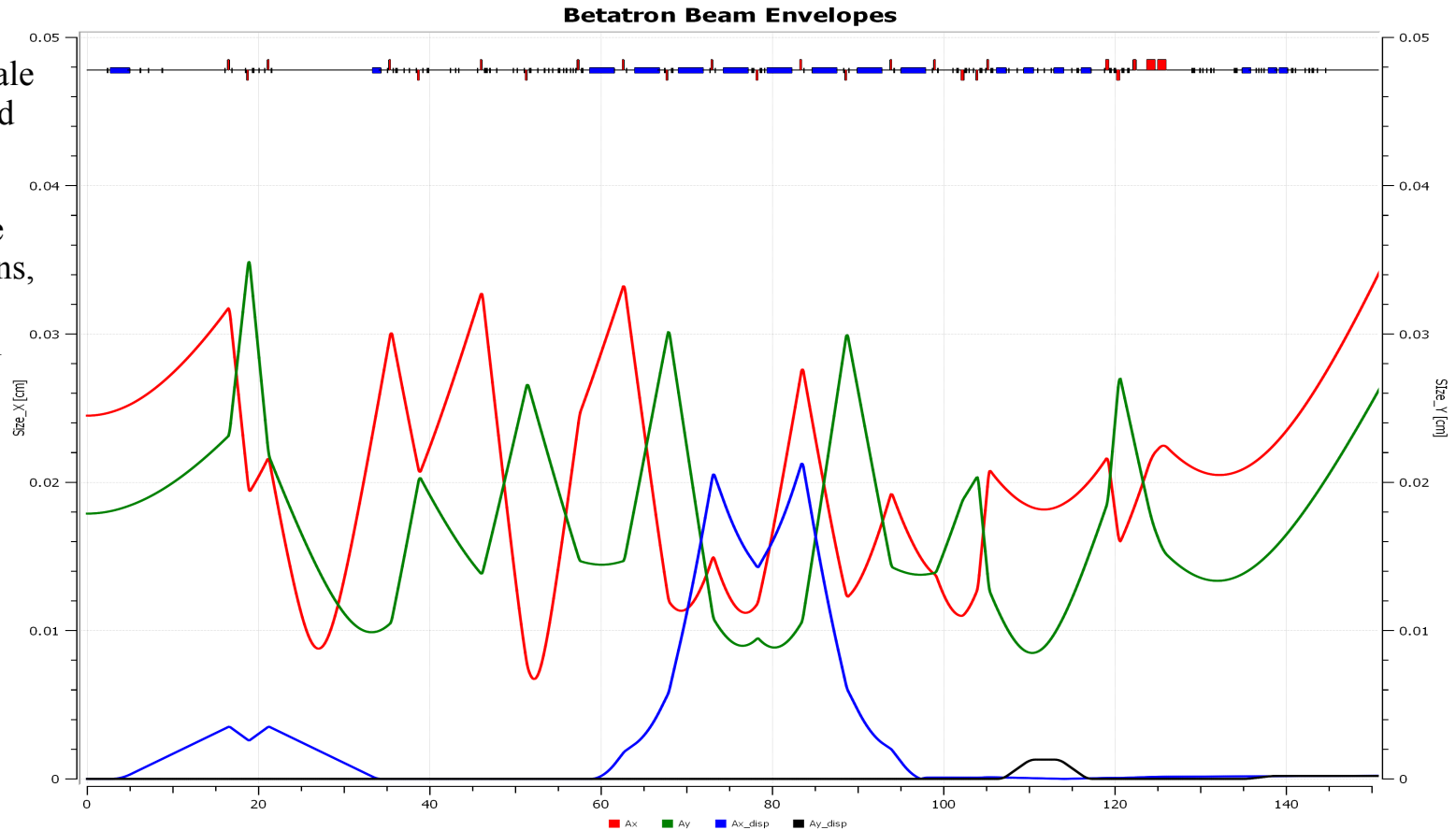
# 11 GeV and 2018 changes to line

- Corrector vertical chicane used for 1.1 GeV Qweak replaced with one meter dipoles with BCM/Unser/BCM between dipoles
- One meter horizontal dipole just before diagnostic girder in case SHMS beam deflection required pre-bending in opposite direction (not yet used)
- Two raster coils per plane
- Four quads added to arc so Yves' lower emittance optics could be used 2018
- Settings for non-dispersive quads 4-7 assumed equal horizontal and vertical emittance based on measurements through mid-2018. Should be 3:1. Recent measurements 2:1.

# In machine now

500 microns Full scale  
Emittances measured  
1/24/2020

TN-18-022 spot size  
spec 235-500 microns,  
set via fractional  
factorial exploration  
of input conditions.





# Making space at end of line

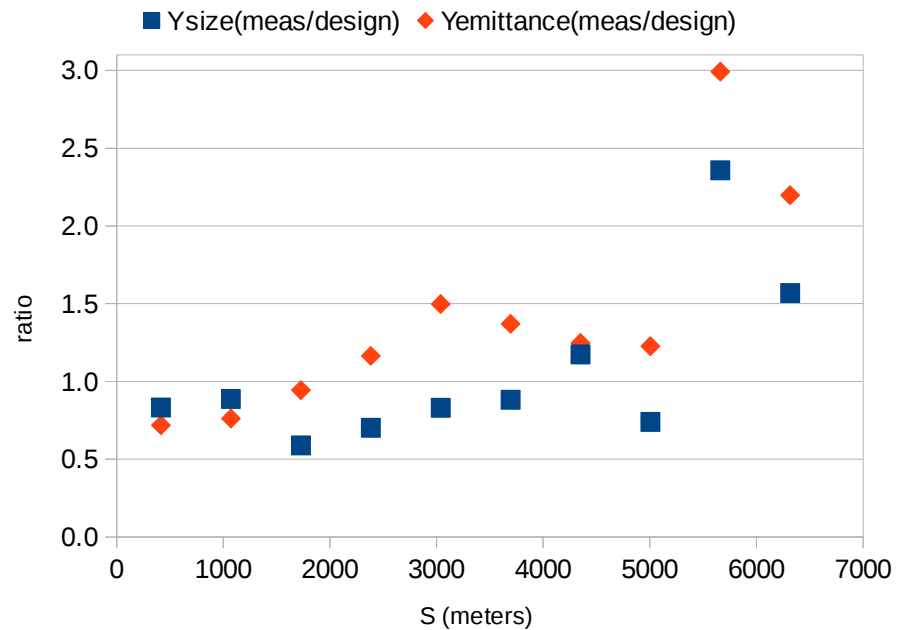
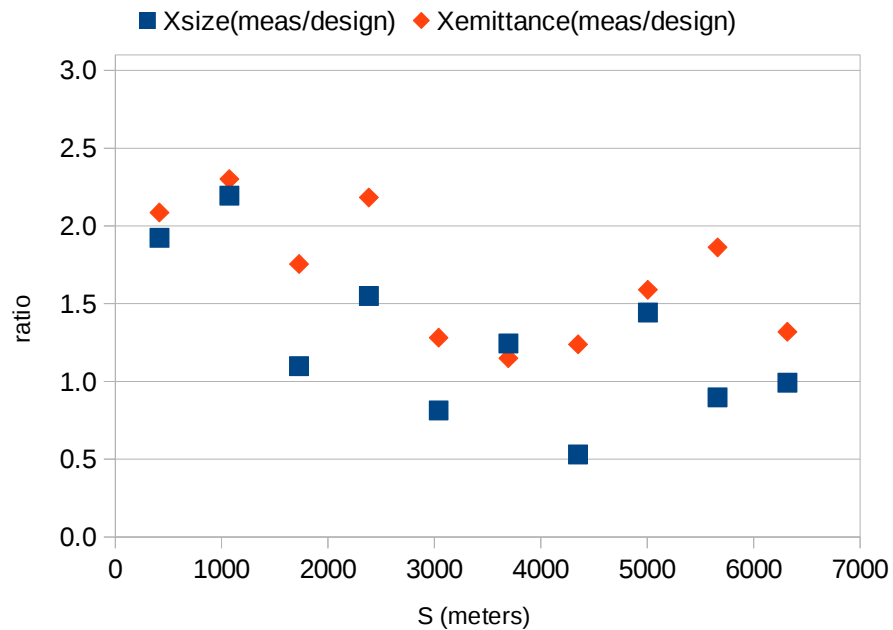
- Remove the one meter horizontal dipole  $\sim 125$  cm with spool pieces
- Remove excess drift in vertical chicane  $\sim 75$  cm with power supply upgrade so fields can be increased to get 2.2 cm vertical offset
- Eliminate slot for BCM triplet or slow raster at end of platform  $\sim 100$  cm, requires moving some downstream material onto platform
- Shorten diagnostic girder
- Ferrite return raster with new power supplies, shifting all downstream items upstream  $\sim 80$  cm (expensive)

# Summary

- Hall C line has evolved to meet Physics needs within constraint of original construction
- Arc optics has more flexibility (single/double dispersion peak) since all quad slots were populated. Per PREX/CREX, single peak works better for energy fast feedback. Position FFB: irrelevant. Can install new BPMs to make energy FFB work better with double peak.
- Changes to allow Compact Photon Source are possible with capability compromises (shorten diagnostic girder) or \$\$ (ferrite raster)

# Extras

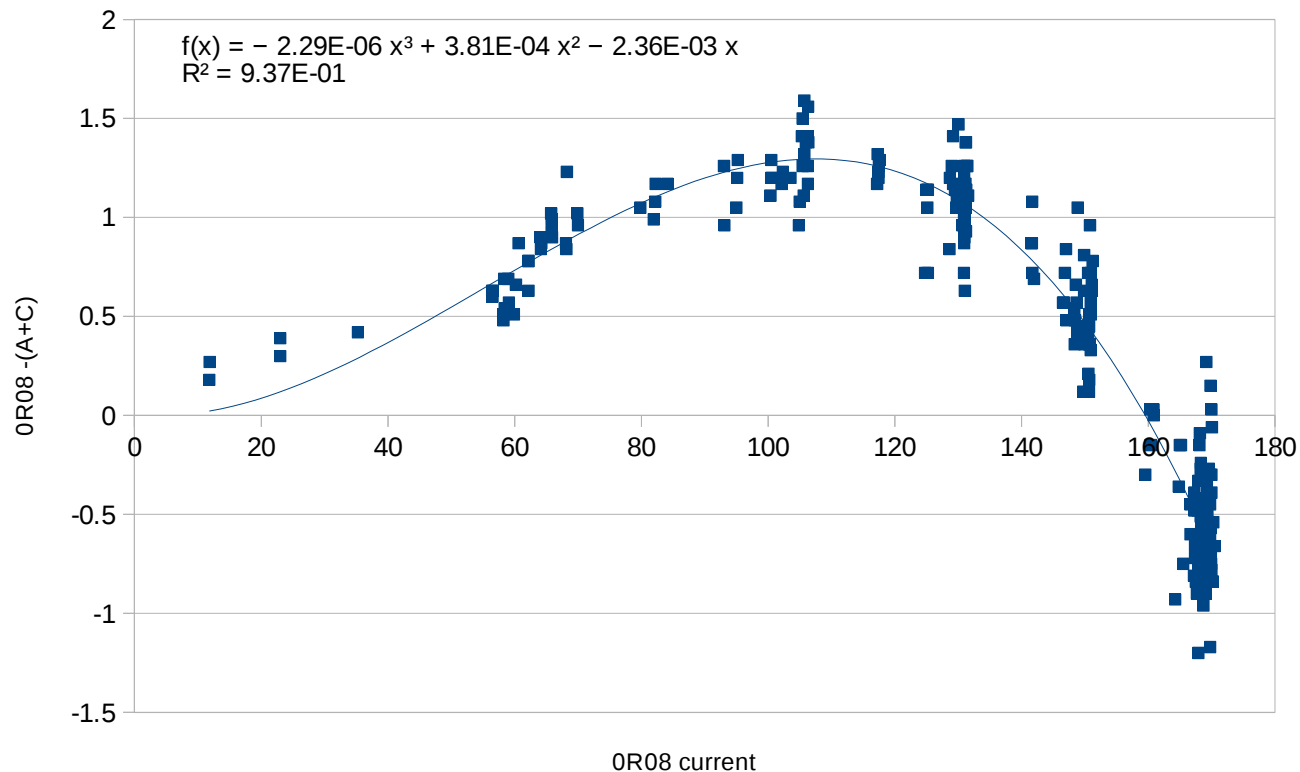
# November 2019 setup



# 2020 Injector work

- Most components in 0-500 keV KE region are being moved. Source is being replaced with 200 kV capable unit, will run at 130 kV.
- Solenoids, Wien filter coils and 15° bend are being replaced with my designs. See TNs 15-032, 19-023, 19-041. Maybe 19-025.
- Pre-buncher will be after Wien filters, not between them.

# BCM non-linearities



Currents from  
injector (0R08),  
halls A and C MPS  
BCMs ramping up  
after a trip.  
Equivalent to beam  
loss accounting  
Instantaneous Loss

Why a cubic?