UPDATE ON RF GEOMETRY
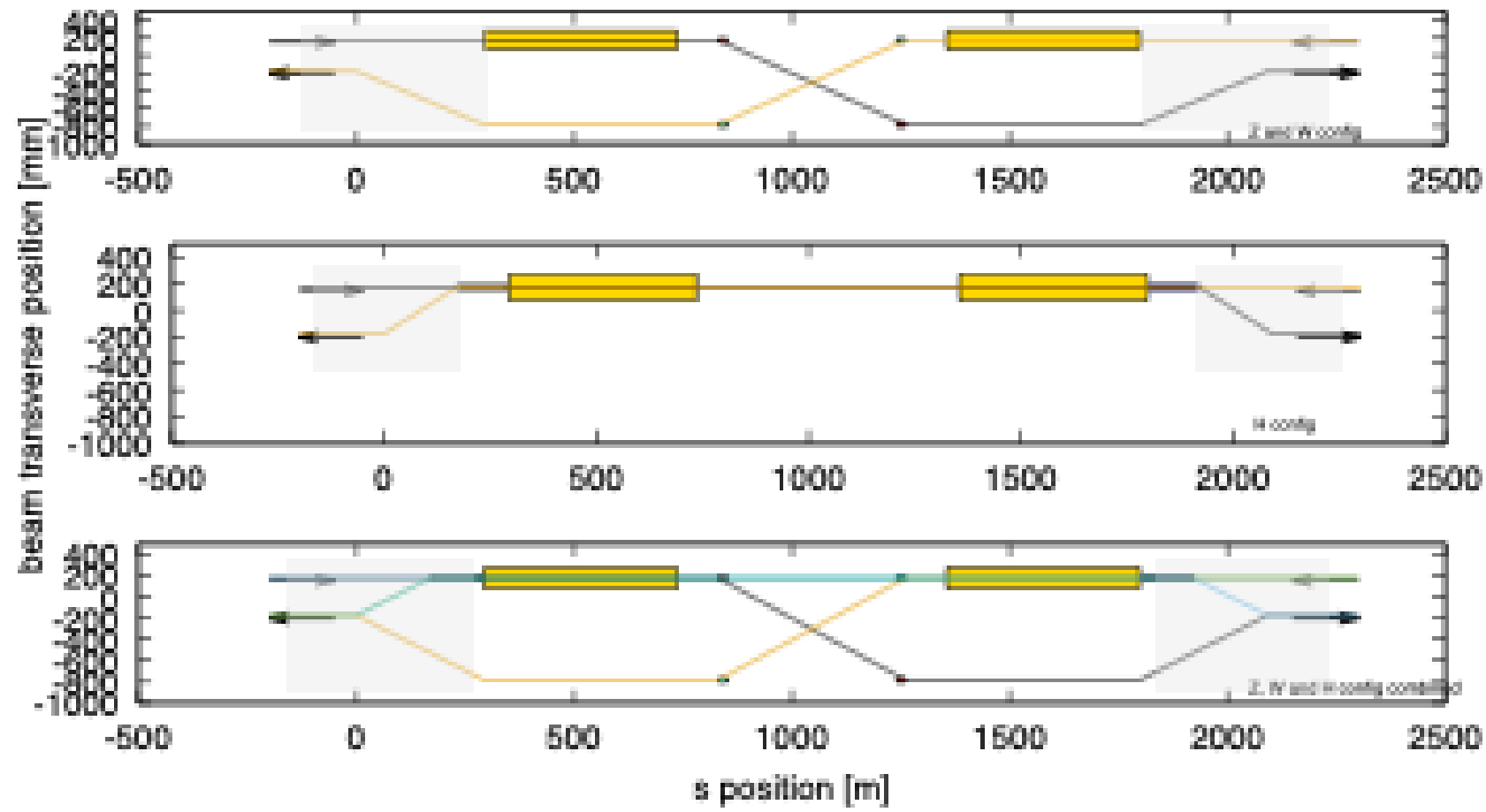
gratefully acknowledging discussions with Christian Carli and Kevin André

RF geometry schematics

V24.3_GHC at Z, W

S (m)	Location	Length (m)	
0	End Arc		End of regular arc cells – entering dispersion suppressor
171.574	Start Sep	171.574	Match arc to RF incl. to zero dispersion; move beam to transverse pos.
289.060	End Sep	117.486	Electro-Magneto switch (No net force on incoming beam)
293.900	Start e+RF	4.840	
737.144	End e+RF	443.244	33 cryomodules 400 MHz - 2cell
831.205	Start Switch	94.061	
1260.531	End Switch	429.326	960 mm change : 2.238 mrad (10% stronger than arc bends)
1355.125	Start e-RF	94.594	Positron beam goes around the cryostats of electron RF
1798.365	End e-RF	443.240	33 cryomodules 400 MHz - 2cell
1803.205	Start Sep	4.840	
1920.691	End Sep	117.486	Electro-Magneto switch (Full net force on outgoing beam)
2091.435	Start Arc	170.744	Match RF to arc incl. dispersion (helped by start of arc curvature)

positron beam

V24.3_GHC at H

S (m)	Location	Length (m)	
0	End Arc		End of regular arc cells – entering dispersion suppressor
171.574	Start Sep	171.574	Match arc to RF incl. to zero dispersion; move beam to transverse pos.
289.060	End Sep	117.486	Electro-Magneto switch (No net force on incoming beam)
293.900	Start RF	4.840	
737.144	End RF	443.244	33 cryomodules 400 MHz - 2cell
831.205	Start Switch	94.061	
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1803.205	Start Sep	4.840	
1920.691	End Sep	117.486	Electro-Magneto switch (Full net force on outgoing beam)
2091.435	Start Arc	170.744	Match RF to arc incl. dispersion (helped by start of arc curvature)

positron beam

800MHz RF at ttbar

Challenges

- Is there enough space to have both Z, W and H configs at the same time ?
- Match to arc optics including dispersion in both modes
  - Provided the arcs have the same layout (not optics) for both configs
  - not the case currently with GHC optics
- Path lengths are different in both configs
  - Can we reshape the insertion to have same path lengths in the two configs ?
  - Keep same machine length and synchro with Booster
  - Keep IP to IP path lengths for beam-beam ?

- Beam crossing and long range beam-beam interactions ?
  - At 25 ns bunch spacing, beam encounters spaced by 12.5 ns or 3.75m !

- All 400 MHz modules to be installed upfront
- Impedance ? Intensity limitations at Z ?

Advantages (to be completed)

Integrated Physics Program
- Single configuration does not require shutdown between physics phases; Z to W and W to H

- Possibility to start the Physics Program with H (for example), which could be easier from a machine tuning perspective, and more appealing for a Higgs Factory

Modulation of the physics program from fill to fill.
- Z fills for energy calibration between H fills to improve the energy model