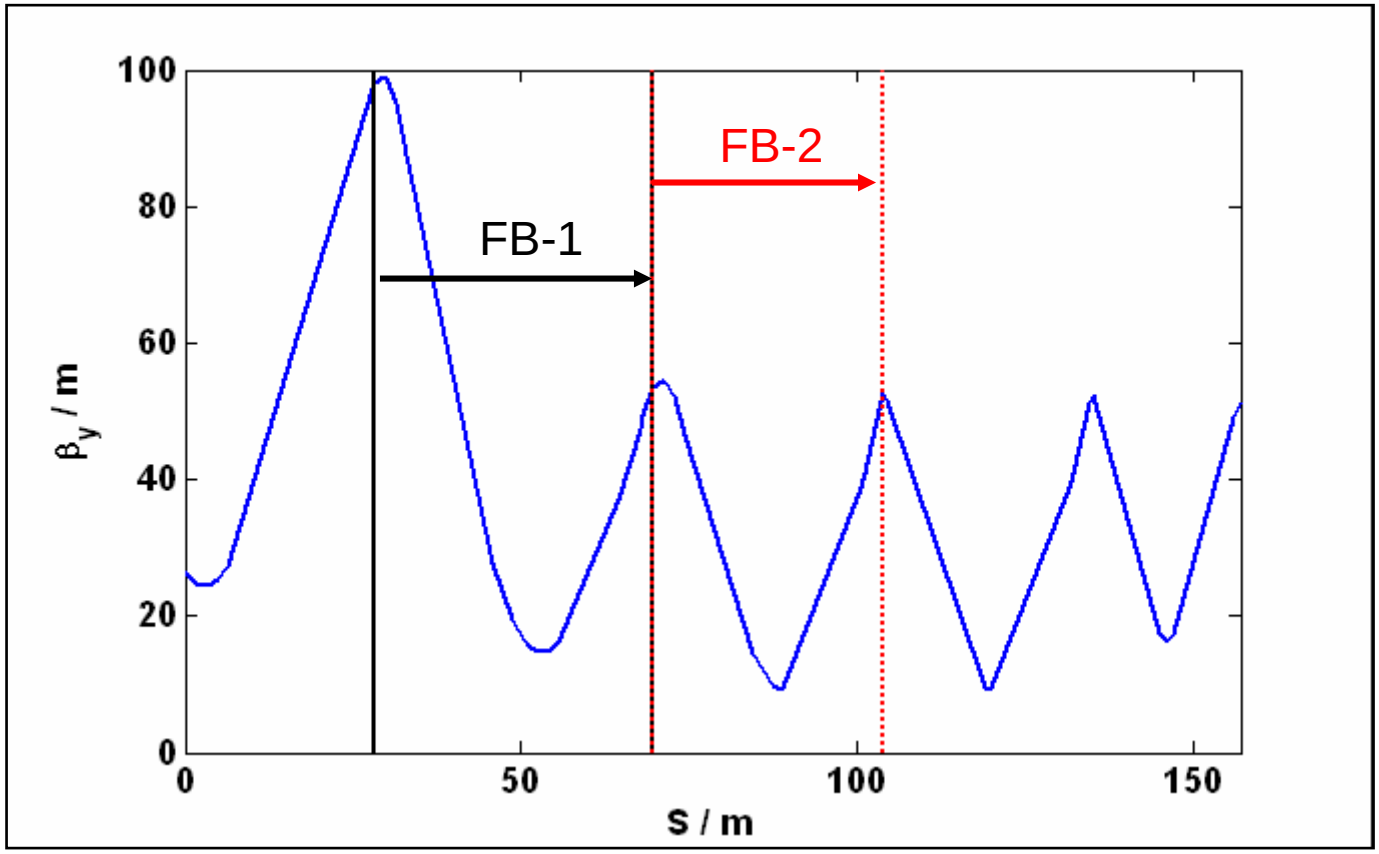
BDS Front-End FFB System

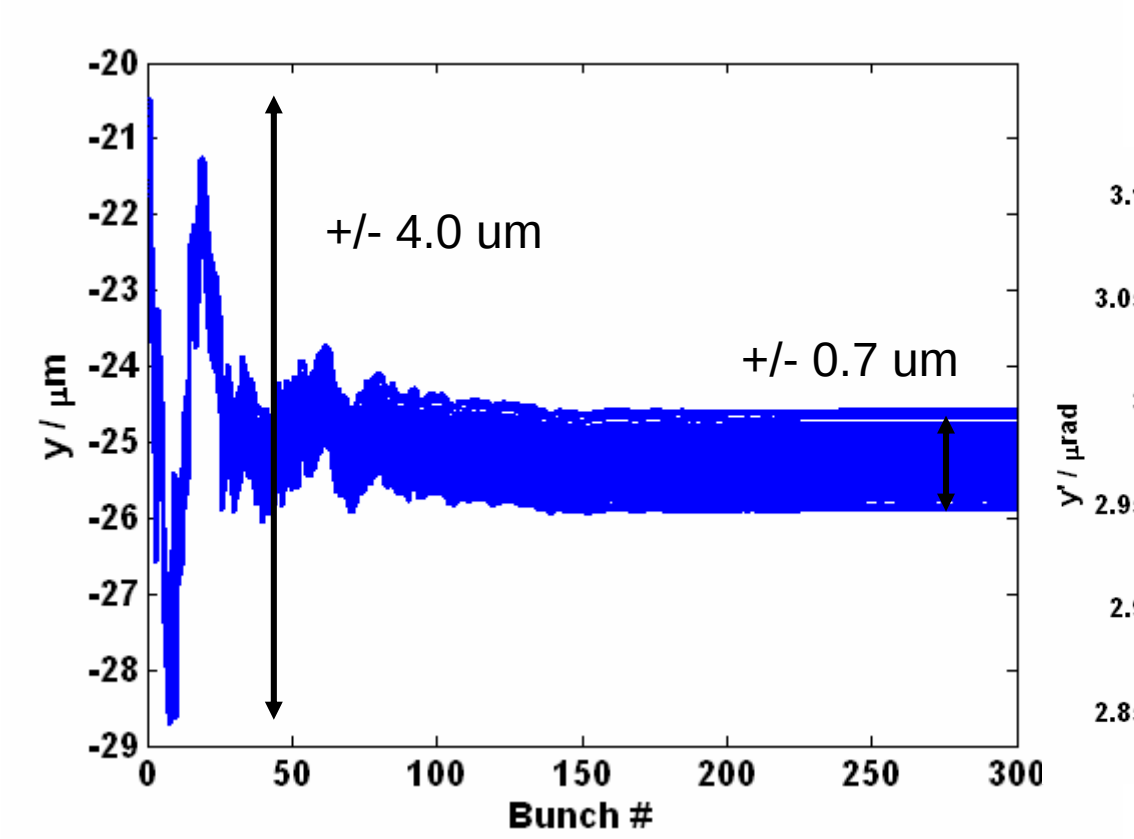
Glen White

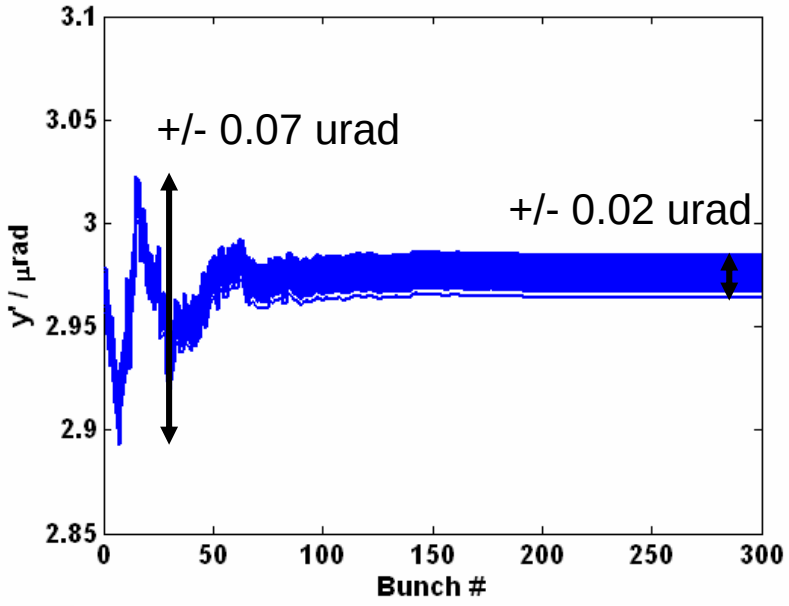
BDS FFB Location



- 2 Kicker / BPM pairs to straighten train and remove jitter at entrance to BDS.
- FB-1:
  - Kicker: upstream QMBSY2
  - BPM: upstream QD90C
- FB-2:
  - Kicker: upstream QD90C
  - BPM: upstream QD90

Incoming Jitter from LINAC





- Vertical positions/angles of bunch train exiting LINAC (subtract mean values to get real offsets- 2 bits of beamline modeled separately in simulation).
- 200 Seeds of 0.2s model ‘K’ GM + 100nm Quad jitter.
- (1 sigma y = 2.6 um at BDS entrance)

Kicker Requirements

- Need to zero BPM readings to remove train shape and train-train jitter ~(3.6 um BPM1; 8.3 um BPM2).
- Assume 1m length TESLA FFB stripline kicker design (max 0.15urad kick @ 250 GeV).
- With calculated R34's between BDS entrance and BPMs and between kickers and BPMs:
  - Can correct up to 9.9um (BPM1) and 7.5um (BPM2) per meter of kicker.
  - Need 0.36m of kicker for FB-1, 1.1m of kicker for FB-2.
  - Would need more kick in reality to take care of additional errors that build up over longer-timescales due to GM etc.
  - Specs to come from LINAC 5-Hz feedback studies.
- From calculated R34's between Kickers and IP:
  - 0.1 sigma y^* equates to ~ 3nrad kick (Kicker 1); 116nrad kick (Kicker 2)
  - 0.1 sigma y'^* equates to ~ 14nrad kick (Kicker 1); 5nrad kick (Kicker 2)
  - Max required resolution: <2%

BPM Requirements

- To keep jitter introduced by kickers affecting vertical IP position and angle greater than the 0.1-sigma level, BPM's require better than the following resolution:
- BPM 1: 200 nm
- BPM 2: 265 nm

FB Latency

- Kicker-BPM distances:
  - FB-1: 41.4m
  - FB-2: 34.3m
- ToF time + cable time (at 0.9c) + 100ns digital processing time gives latencies:
  - FB-1: 390ns
  - FB-2: 340ns
- Feedback possible every-other bunch.
- Interleaving with ANG+IP FFB systems minimizes jitter-growth impact.