

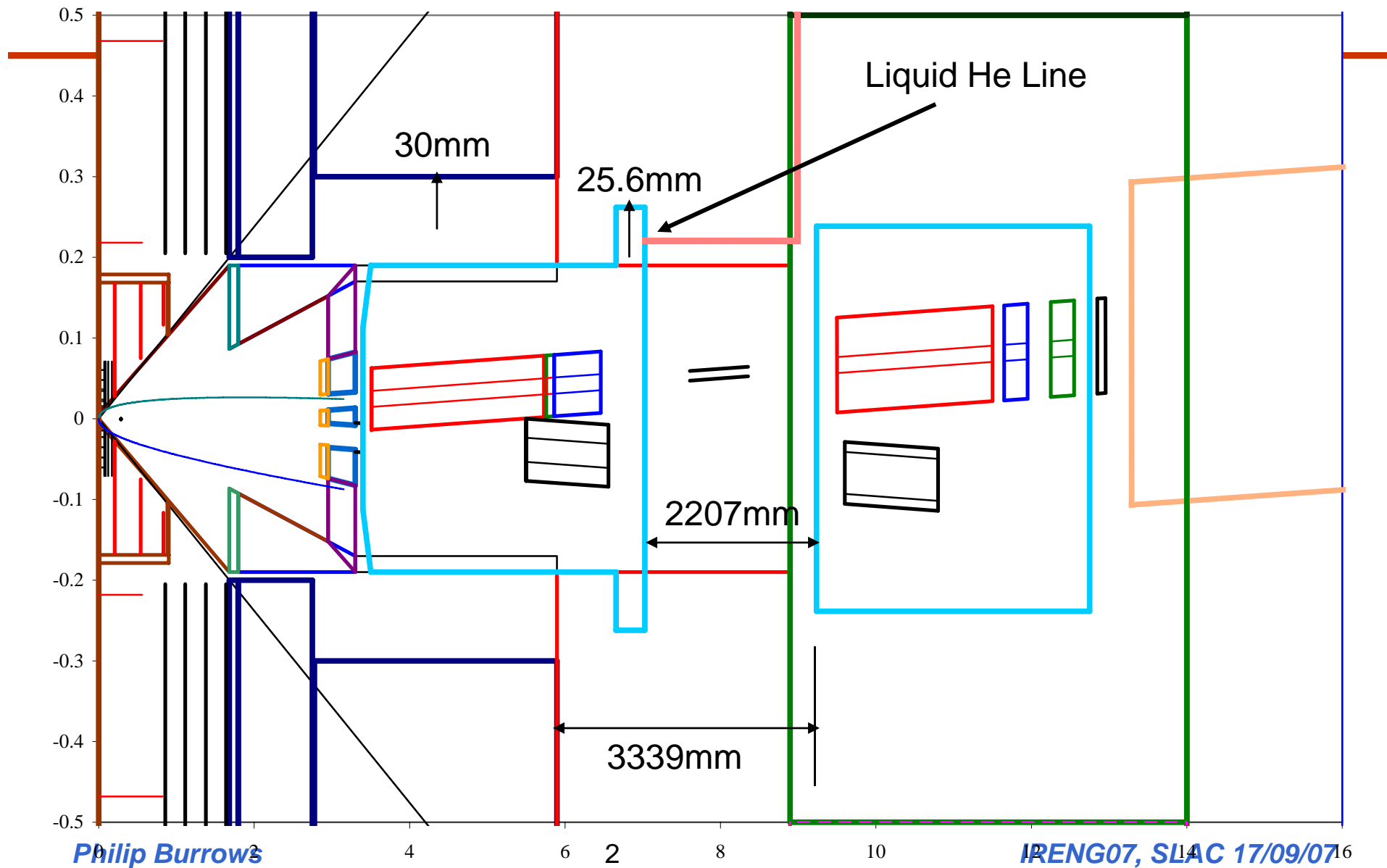
Engineering issues for IP intra-train feedback

Philip Burrows

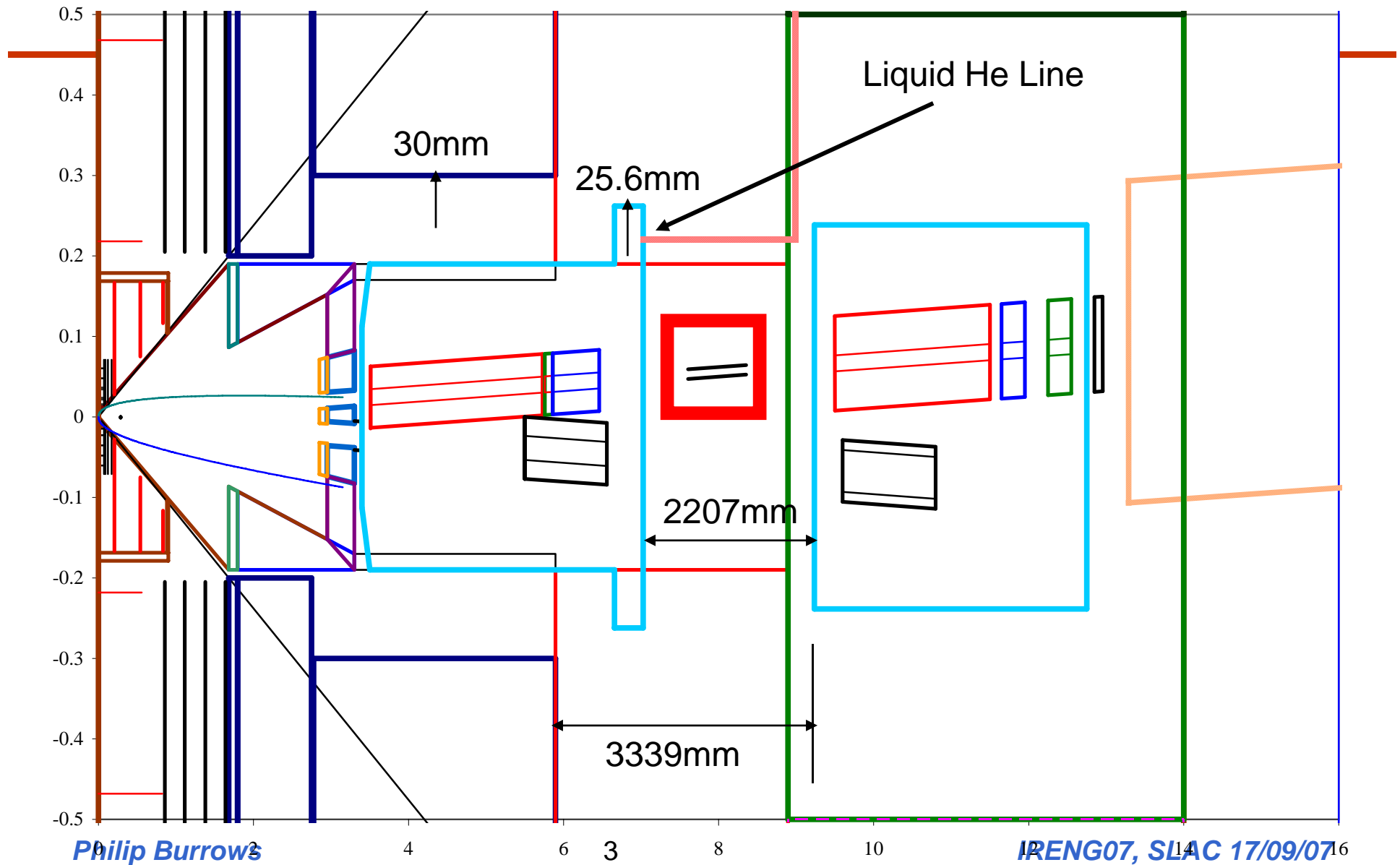
John Adams Institute

Oxford University

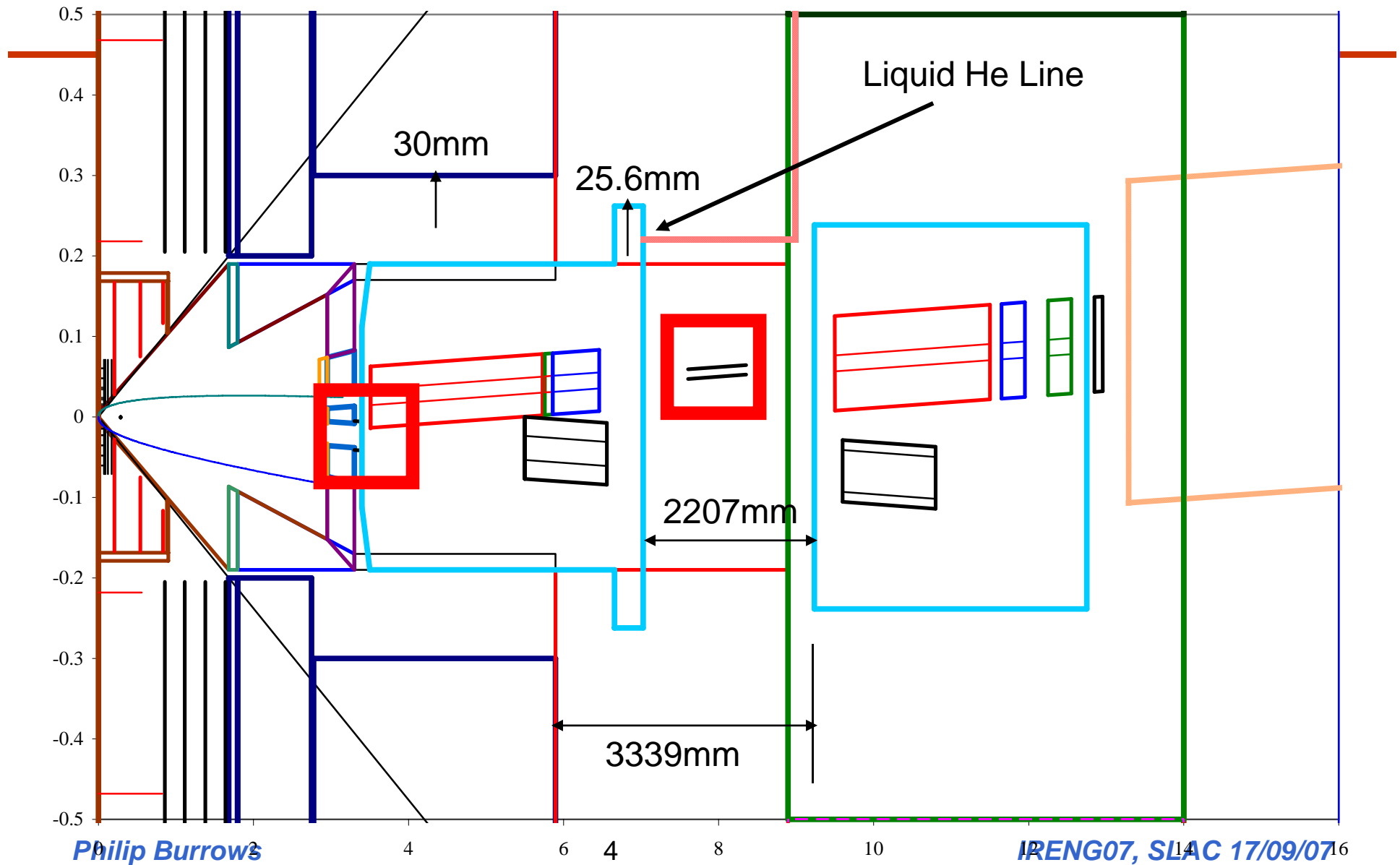
Location of FB hardware (SiD, $L^*=3.7\text{m}$)



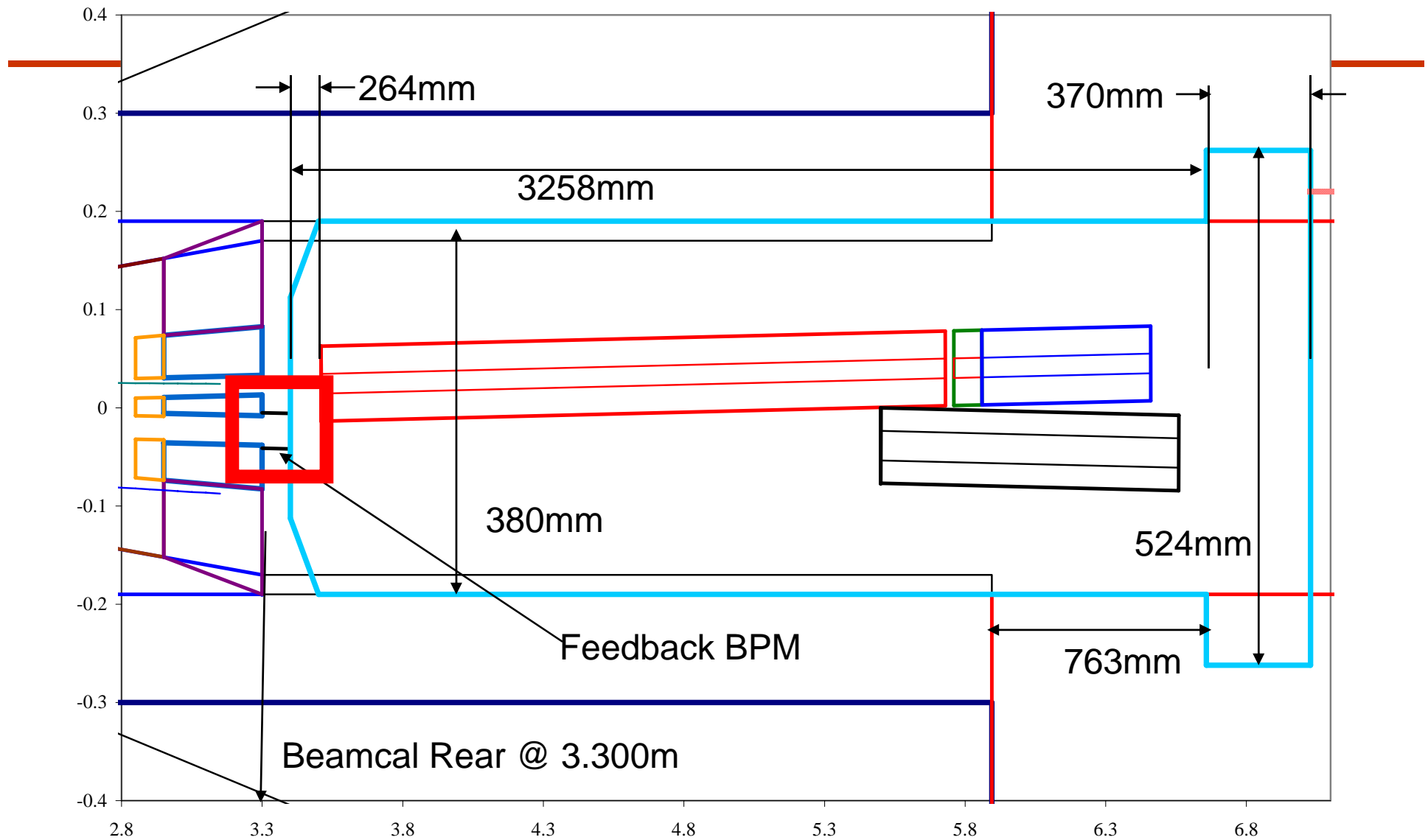
Location of FB hardware (SiD, $L^*=3.7\text{m}$)



Location of FB hardware (SiD, $L^*=3.7\text{m}$)



Zoom-in showing BPM location



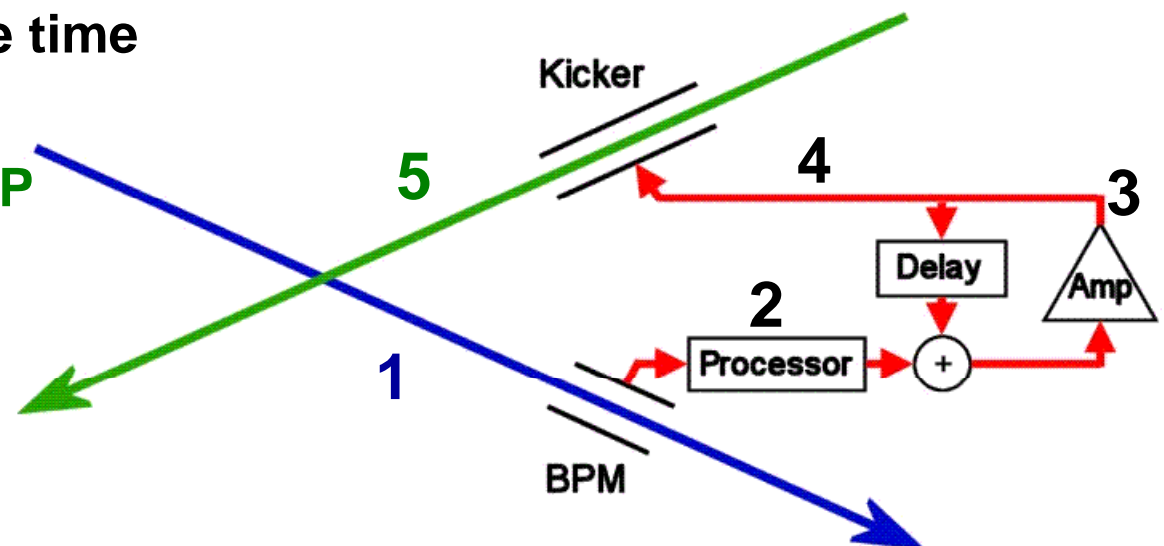
IP position feedback

Designed for bunch-by-bunch position correction of beams at IP

→ Latency of order bunch spacing: 150ns – 300ns

Latency:

1. Beam flight time IP → BPM
2. Signal processing, FB calculation
3. Amplifier + kicker response time
4. Cable delays
5. Beam flight time kicker → IP

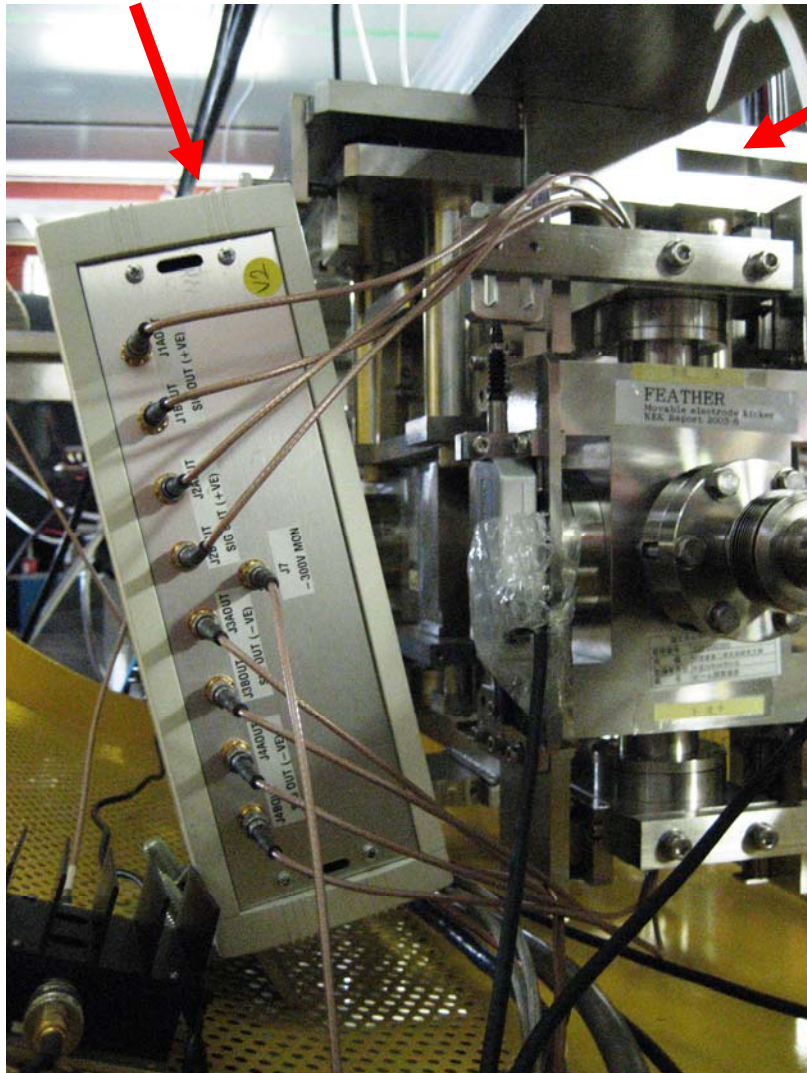


Latency issues

- **BPM or kicker further from IP**
 - longer beam flight distance
 - **increase latency (3ns per metre)**
- **Electronics further from beamline**
 - longer cable runs
 - **increase latency (4-5ns per metre)**
- **FB system electronics latency: constant**

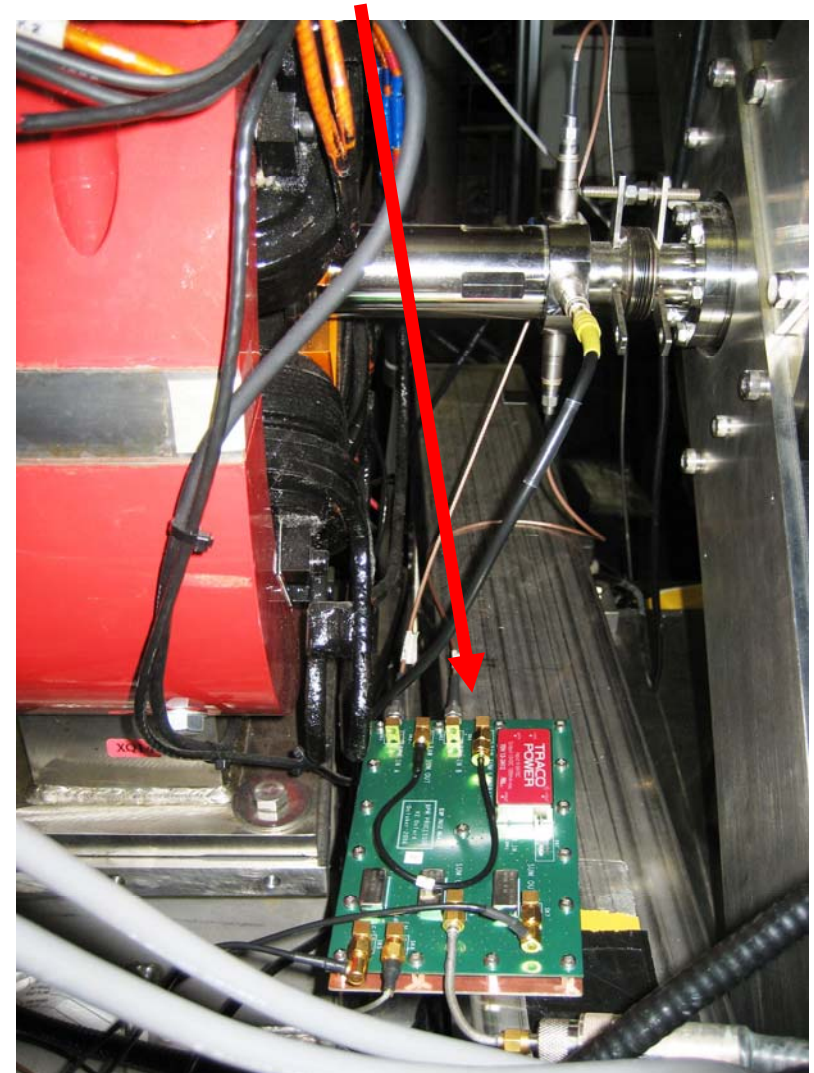
FONT4: beamline at KEK ATF (May 07)

Amplifier



FEATHER Kicker

BPM processor board



ILC IP feedback engineering

System component locations + specs listed in RDR

**No detailed engineering work done in terms of:
actual designs of BPM and kicker
integration into beamline design**

However, components are envisaged to be 'standard':

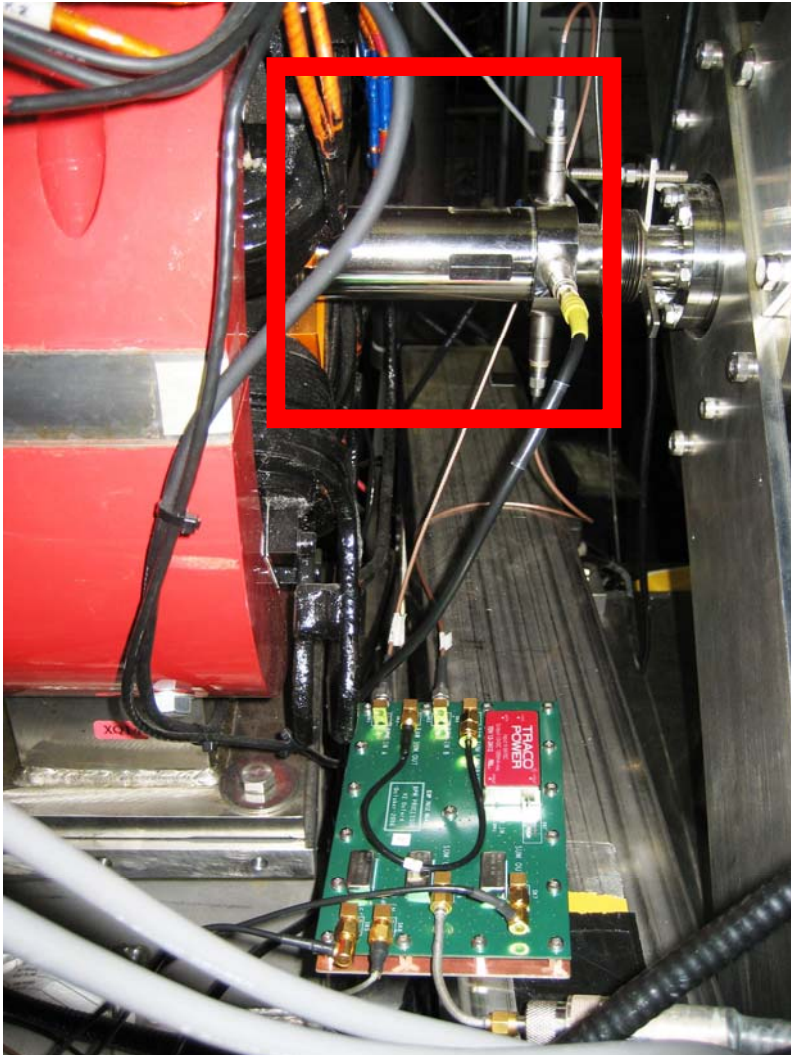
Stripline BPM c. 10-20cm long (ATF: 12.5cm)

Stripline kicker c. 30-60cm long (ATF ~ 40cm)

Stripline radius c. 1-2cm (ATF ~ 1cm)

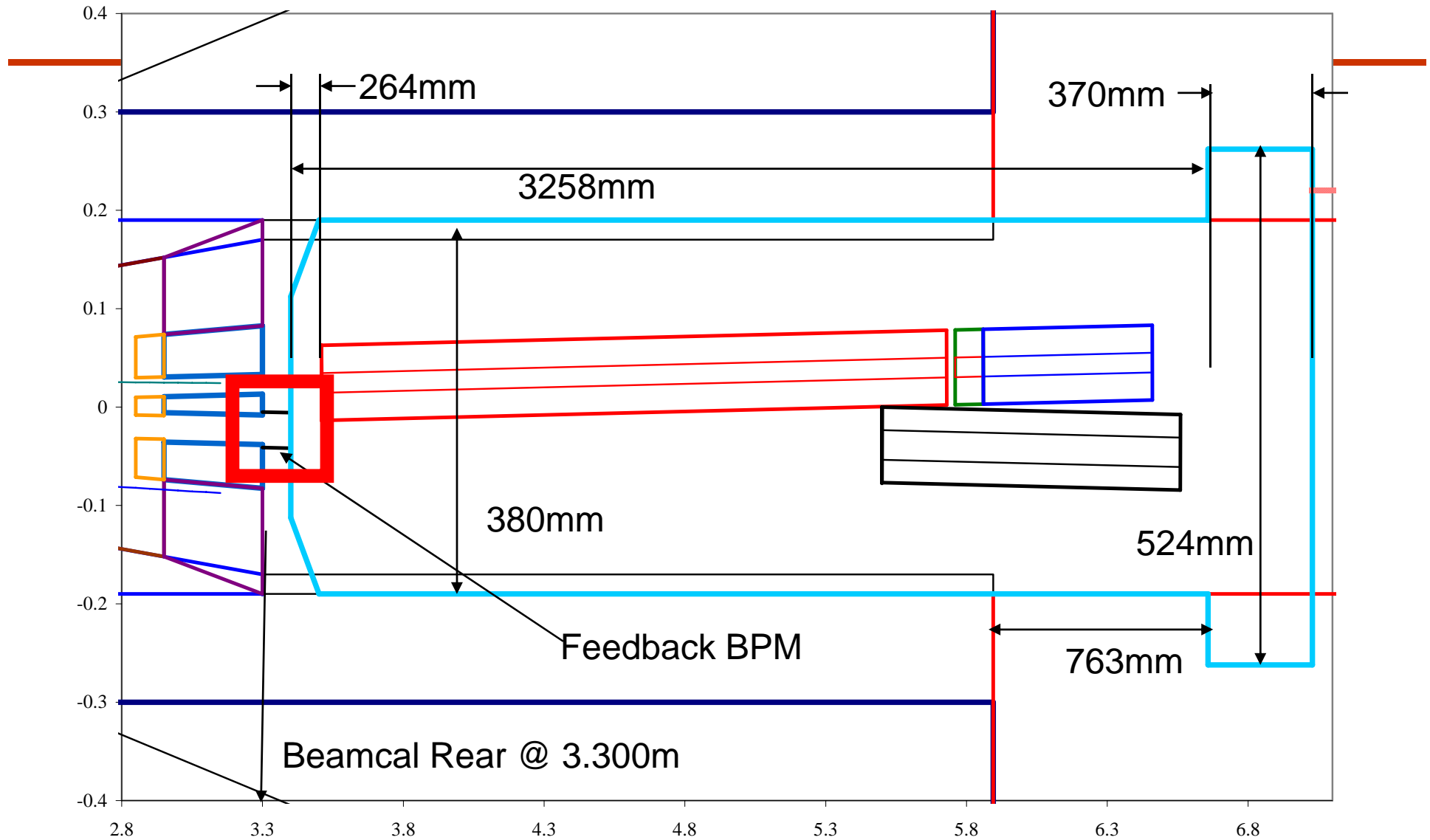
Possible want to customise design to fit into tight beamline environment

BPM engineering issues

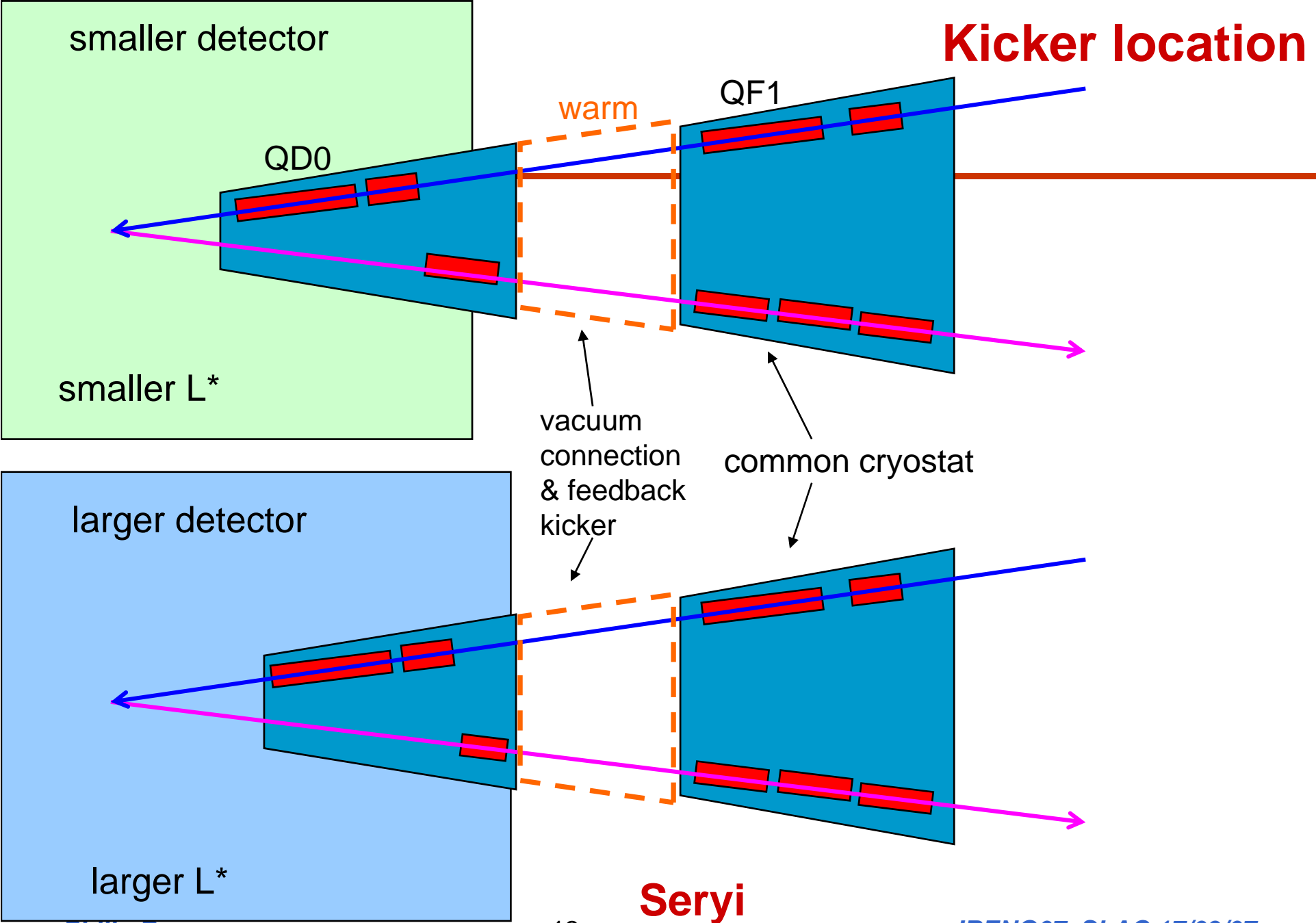


- Connections to BEAMCAL, QD0 cryostat?
- Bellows, at both ends?
- Shorten pickoffs?
- Electronics off to side and shielded?
- Define cable runs: door opening, push-pull?

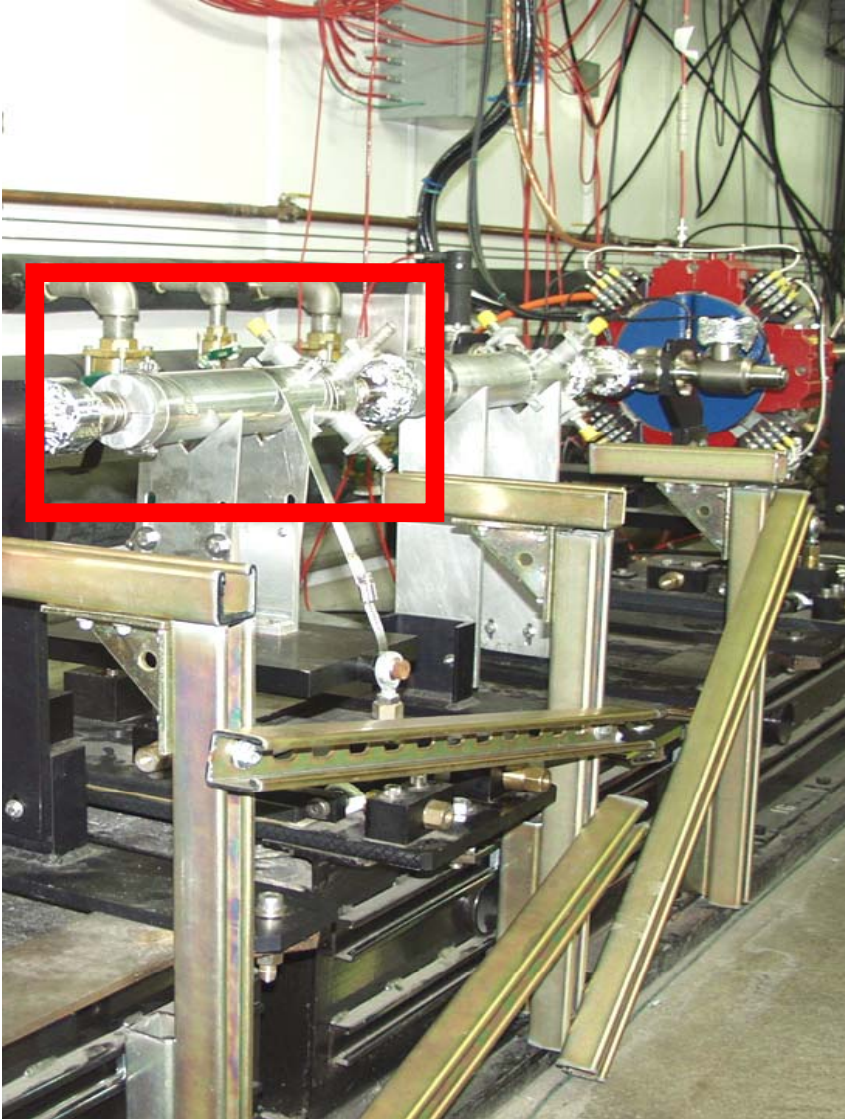
Zoom-in showing BPM location



Kicker location



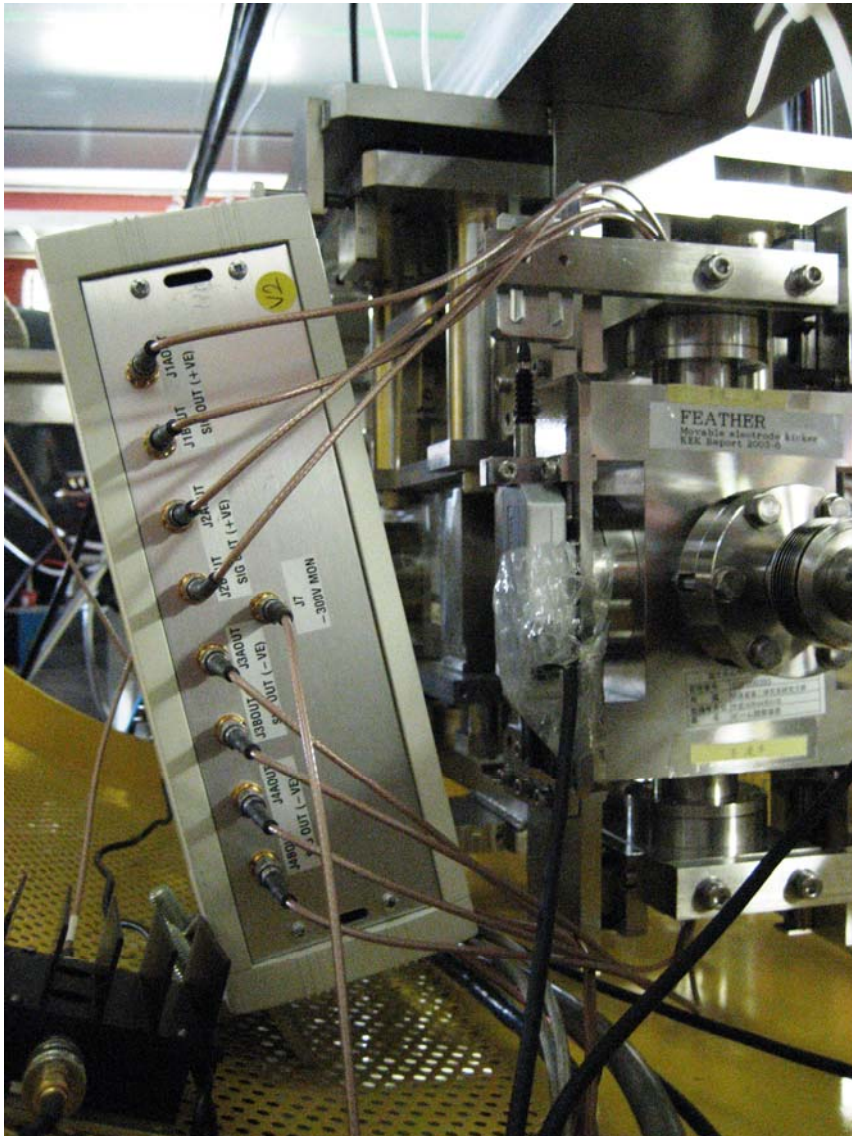
Kicker engineering issues



Real-estate more generous

- **Does warm section move with detector in push-pull?**
- **Amplifier detector-side or machine-side of break?**
- **Flanges, bellows, at both ends?**
- **Shorten pickoffs?**

Amplifier engineering issues



FONT4 amplifier performance:

Kicker 30cm long, 1cm aperture, 1kW drive

**50 nrad deflection
(500 GeV beam)**

lever arm 8m

**+ - 400 nm at IP
(c. 50 σ_y)**

Kick $\sim I, 1/r, \text{sqrt}(P), 1/p \dots$

Summary / issues

Detailed mechanical/integration engineering needs to be done for EDR

Radiation environment for BPM electronics, feedback electronics, kicker amplifier:

radiation tolerance, locations, shielding ...

EM interference:

Pickup on BPM or kicker

Broadcast RF (to detector)

Ground loops

Interface to BEAMCAL?

UK group ready to do this