LHCb VELO problem on 26/11/2018
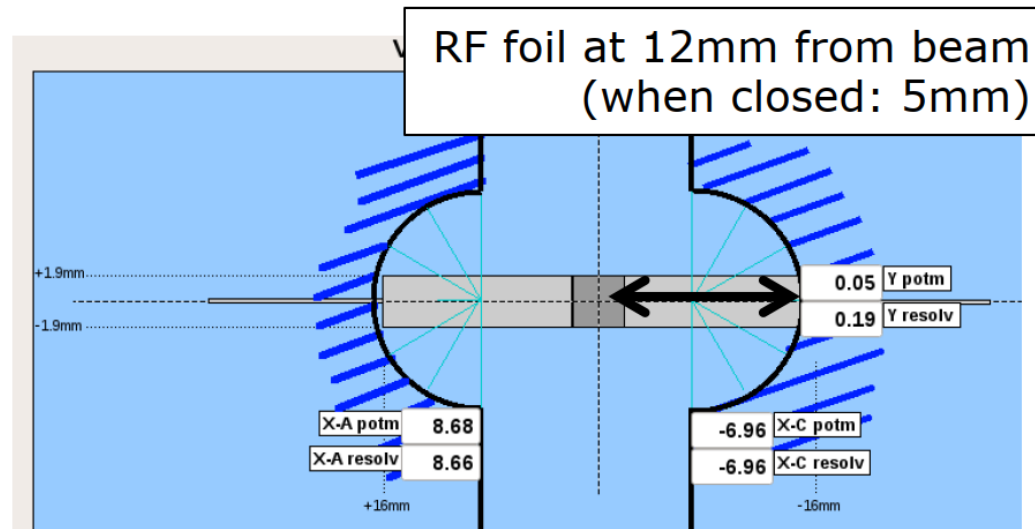
Fill 7474, 26 Nov 2018, ~2.30am:
- VELO got stuck when closing after Stable Beams declared
- Expert called, came in and concluded it was a hardware problem

→ Intervention was needed
  ✓ decided to wait until the morning to profit from *non-on-call* expertise
→ Also intervention would have cause a request of beam dump, so decided to leave the fill in until it was dumped in the morning (~8am)
  ✓ But VELO can't be opened for injection purposes → ask LHC to wait.

RF foil at 12mm from beam
(when closed: 5mm)

+1.9mm

-1.9mm

0.05 Y potm
0.19 Y resolv

X-A potm 8.68
X-A resolv 8.66

-6.96 X-C potm
-6.96 X-C resolv

+16mm

-16mm

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26 Nov 2018, ~8am:
- Experts in point 8
  - ✓ A power-supply card broke → No power to stepper motor

Actions:

1. Replaced with spare power supply: unsuccessful, still no power (~2hr)
2. Replaced bridge rectifier: unsuccessful, still no power (~1hr)
3. Suspected incompatibility between spare parts and original parts
   - ✓ Spare brought back to Meyrin to perform soldering of older components (~2hr)
4. Replaced again: unsuccessful, still no power (~1hr)
5. Checked the fuse on the 220-VAC: it's burnt.
   - → replace fuse → power again. (~1hr)
6. Recabled, motion system secured.
   - → intervention completed @ 2.30pm

VELO closed again at 6:12pm: no issues

✓ During the intervention VELO did not make any wrong moves.

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Notes & lessons:

- First failure in ~10 years of operation for VELO motion system.
- Intervention was timely (spare available) but could have been hindered by absence of experts.
  - ✓ We were lucky the very expert was at CERN (by chance...)
- Experts however were mislead by the broken bridge rectifier
  - ✓ In fact the problem was also burnt fuse behind the bridge rectifier
- The intervention posed NO risks in terms of machine protection.
- VELO could have been moved by hand, but it was decided not to do so cause it may have created serious damage to the cable connections on the side of the VELO
- It was investigated if injection with VELO half closed could be done to allow LHC to continue, but it was dismissed as this would have taken too much time to prepare

System is going to be completely replaced in LS2 due to upgrade of VELO.