BLM Noise mitigation (William Vigano’)

- In the SWY area, many BLMs suffered from high noise coupling into the signal cables. Inspections have shown that many of these cables were running close to power cables and in some cases through flooded areas.
- Existing earthing strategy at CERN is concerned primarily with safety, not signal quality
- Based on these findings, the following noise mitigation measures were taken
  - Cable screening
    - Rerouting of all BLM channels in SWY
    - Use flexible metallic ducts for additional shielding, grounded every 5 m
    - These ducts carry BLM power and signals, they are spaced approx 50 cm from other power cables
    - Shielding of related cables from surface to tunnel
  - Nanocrystalline cores on two very noisy channels
    - F16.BLMIB.248, F16.BLMIB.255
- Limitations of the adopted mitigations
  - The grounding points at SWY are not stable due to pulsing power equipment
  - There is a high risk of introducing ground loops in the SWY
  - Nanocrystalline cores are effective and easy to install, but they only treat the noise symptomatically, they do not solve the underlying issues
- Results
  - Tests with pulsing DFAs show noise peaks equivalent to $< 15$ Gy
  - Compared to 2021 this is an improvement by three orders of magnitude
  - For channels with nanocrysts. cores the noise reduction depends on the selected cores but is also up to two orders of magnitude
  - Cedric has made global studies across all BLMs comparing the 2021 and 2022 situation (see slides)
- Conclusion
  - All upgraded channels show great noise level improvements
– Need a new vision for grounding to also consider electromagnetic interference and not
safety alone
– Some TT2 devices remain noisy (not part of this campaign)
– Pending operational experience, future actions can be evaluated

- Alex H.: Have already observed much better noise levels last week, big thanks from OP!
- Fernando: What is the most effective step of those taken in the campaign? - William:
Prefer cable rerouting and shielding, but more studies are needed for a definitive answer.
- Ron: Does this 5m interval grounding not create antennas and ground loops? - William:
Yes, star point grounding would absolutely be preferable, but is nearly impossible in SWY
with the existing infrastructure. Having the cables run close to ground is the next best
option.
- Bettina: We should have a discussion with BI-BL, a large scale solution is probably needed.
  - Yes discussion is welcome, the short interval grounding is expensive and labor intensive,
    there is little space for new separated cable trays, but there is more need for noise reduction
- Bettina: We should make it clear that BLMs are often used for beam steering due to lack
  of dedicated instrumentation in the transfer lines.
- William: A rethinking of grounding philosophy at CERN may be needed to consider
  explicitly signal quality.
- William: There are some more measurements in progress (e.g. ferrite core in TT10). The
  results should inform future strategy.
- Thomas Kramer: We found common mode noise on BLM cables that could be suppressed
  by the ferrite cores, but the noise source is not clearly identified
- William: OP should make a priority list of the worst BLMs so that actions can be planned.
  Ferrite cores have already been ordered “just in case” because of often long lead times.

Plans for EAST beam commissioning (Gil Imesh)

- Presentation of the tasks for the EAST area commissioning, for details see slides
- Key dates
  – EAST Setup w/o extraction: 07/03/2022
  – Beam permit: 11/03/2022
  – Start setting up extraction 14/03/2022 (maybe start 11th)
  – Start of physics 28/03/2022
- Additional remarks
  – Check the pulse shape generated by the power converters, some overshoots were
    observed last year and little time was available to reduce these perturbations.
  – Some IRRAD BPMs have to be bridged with UCAP to be accessible to YASP, this
    should really get a proper fix with FESA
- Alex L.: You compute $dp$ from the spill dynamics? - Matthew: Yes this is a chromatic
  extraction process.
- Alex L.: Did you use tomography also to measure $dp$? - Matthew: No, but a comparison
  would be very interesting, indeed.
- Matthew: Elliot will look the optics in the transfer lines (some have already been uploaded).
  Will also try to infer the beam position in Q74 by performing a quad scan and measuring
  the induced beam deflection.
- Matthew: Would love to use YASP, but this means extra work for Jörg (integration of
  IRRAD BMps)
- Federico: CSS is working on a new BPM publishing system. Update possibly next week.
This new system won’t be available right away, big new territory. Eventually data should arrive in NXCALS
- Alex H.: NXCALS is not online, do we need UCAP anyway? - Federico: The BPM data should be available online before being sent to NXCALS
- Federico: A bit worried CSS are not implementing exactly what is needed, so a close discussion would be good to be safe. → Alex will join, Federico invites further parties
- Federico: We expect to sign permit on Friday, foreseen to open area on 15/03 and 16/03. Date set by (external) technician availability.
- Federico asks to delay BCT test to 17/03 to ease time conflicts - Gil agrees
- Pablo: Is there going to be parasitic TOF by default? - Alex H. Generally yes - Pablo: There is a remaining RF structure in the spill. Smearing out this structure can clash with parasitic TOF.
- Matthew: Radial loop behavior is different when intense TOF bunch is present (needs settings for with and without) - Alex L.: Agrees there are some question marks, also curious about RF structure smearing, should discuss offline

PS Report (Denis Cotte)
- Activity summary (details see slides)
  - Phasing of C200 MHz, C40 MHz, and C80 Mhz
  - Energy matching with PSB (INDIV)
  - Fixed TT2 SEMFil fits
  - DFA extrema tested successfully
  - Broken digitizer in WCM03
  - logical.BTP.DHZ10 linked to FGC after successful kick response test
  - Polarity inversion noted in F16BVT
  - KFA71: m11 and m12 synchronized
  - Tested CPS SPS synchronization
  - Check effect of KFA on MTE
  - Emittance measured for nTOF (200 · 10^{10} ppp, \epsilon_h \approx 9 \mu m, \epsilon_v \approx 6 \mu m)
  - First energy matching with SPS
- Beam status
  - [SFTPRO (core only / 5 turn extraction)] OPERATIONAL
  - [TOF] Basic setup
  - [AD, EAST] not started
  - [LHCPROBE, LHCINDIV] OPERATIONAL
  - [LHC25 (72b)] setup in progress
  - [LHC25 (12b / 24b), LHC25 BCMS (48b), AWAKE] not started
- Follow ups (unaddressed, see remaining in slides)
  - Ensure that energy matching has correctly propagated to all beams currently in use
  - JMAD file for optics in EAST AREA
  - TT2 BPM offsets need to be updated in FESA class
- Federico: The PFW tripped today while Oliver was working on the PFW regulation
- Alex L. / Heiko: The new Makerule for the stable phase of C10 MHz could cause problems if beam intensity effects are significant, suggest to wait with linking until more data has been gathered