1\textsuperscript{st} impedance working group meeting
Christine Vollinger, Benoit Salvant

• Mandate

• Draft proposal for:
  • Structure
  • Procedures
  • List of members

• Opening discussion on guidelines
Impedance Working Group mandate

Impedance has caused and can continue to cause performance limitations in CERN machines

→ Compute, simulate, measure impedances of all existing and future CERN near-beam equipment

→ Maintain and benchmark impedance models

→ Work together with beam dynamics experts to provide intensity limitations

→ Validate new designs

→ Identify non-conformities

→ Propose solutions

Continuing combined effort of BE-ABP and BE-RF

→ with the help of equipment groups and experiments,

→ to help equipment groups and experiments

Mandate of the Accelerator and Technical Sector Working group on simulation and measurements of impedance and its effects.

The performance of the CERN accelerators is critically depending on beam coupling impedance. Impedance can lead to beam induced heating and longitudinal and transverse instabilities disrupting operation and affecting performance. A working group is mandated to follow-up the above aspects in the CERN accelerators.

The working group is mandated to:

- Estimate the longitudinal and transverse impedance of existing and new pieces of equipment seen by the beam.
- Conduct bench measurements of the longitudinal and transverse impedance of components prior to the installation in the machines.
- Contribute, maintain and update the longitudinal and transverse impedance models of all the CERN circular accelerators, create them for new ones.
- Benchmark the impedance models with beam based measurements.
- In collaboration with the relevant experts, follow up of the corresponding longitudinal and transverse beam stability thresholds as well as intensity limitations resulting from beam induced heating.
- Validate the design of new components or propose modifications compatible with structural and mechanical integrity, vacuum requirements and system performance in preparation of Engineering Change Requests for the installation of equipment seen by the beam.
- Follow up machine performance limitations related to impedance and its effects, identify possible non-conformities and propose solutions.
- Gather guidelines for equipment design in an EDMS document and keep it updated with new findings. This document is meant to evolve with increasing experience and include input from equipment owners.

The Impedance Working Group should present its recommendations to the LMC for the LHC machine, to the IEFC for the other accelerators.

The Impedance working group will be chaired by B. Salvant (BE/ABP) and C. Vollinger (BE/FP) will act as Deputy.
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Draft structure (to be discussed)

• 3 contribution lists:
  → Coordination members: chairs, scientific secretaries.
    → including representatives for BE, EN and TE (EP?)

  → Core members: experienced colleagues with little or no impedance work, but with advisory and review duties.
    → including representatives for the main impedance friends
      - in BE: RF, ABP, BI
      - in EN: STI and MME
      - in TE: ABT and VSC
      - in EP: ALICE, ATLAS, CMS, LHCb, TOTEM

  → Contributing members: colleagues who actually do the work calculations/simulations/measurements.
    → including mainly members of BE-ABP-HSC and BE-RF-BR, but not exclusively.
Draft structure (under discussion)

→ One identified responsible for the impedance model (longitudinal and transverse) per circular machine and its upgrade (could be a beam dynamic expert, that would then provide the relevant impact on beam dynamics):
  - PSB (+LIU-PSB)
  - PS (+LIU-PS)
  - SPS (+LIU-SPS)
  - LHC (+HL-LHC)
  - LEIR (+LIU-ions)
  - FCC (+HL-FCC)
  - AD and ELENA

→ One identified responsible for (1) measurement effort and (2) computational effort.

→ Linear machines could also be in the scope of the WG if deemed useful in the future.
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Workflow (1/2)

1) Inform IWG coordination members
2) Recorded on the IWG SharePoint website

1) Chairs assign priority, estimated manpower, budget and timeframe
2) Report request at the IWG

Compatible with group requirements → Work starts
Not compatible with group requirements → Needs arbitration of conflicting requests by
- Group leader if within group
- IEFC or LMC if across groups → Work starts
Work starts

**Answer simple**
- Circulation of proposed answer by email to the committee members and relevant contributing members

**Answer not trivial**
- Presentation by equipment group at IWG meeting
- Presentation by impedance experts of preliminary assessment

After discussion, simulation and measurement work is defined
- Presentation at IWG by impedance expert(s) of the impact on impedance and beam dynamics

Recommendation by IWG
- Presentation at IEFC or LMC if needed with these recommendations

**Answer on ECR by IWG member for the IWG**

**Answer to equipment group**

**After comments**
In principle, all new or modified near-beam equipment should be measured to detect issues and non-conformities before installation.
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Coordination members

• Christine Vollinger and Benoit Salvant

• 3 ATS department representatives:
  • Inigo Llamas Garcia (scientific secretary, representative for EN)
  • Vasileios Vlachodimitropoulos (deputy scientific secretary, representative for TE)
  • Thomas Kaltenbacher (representative for BE)
  • Need for representative from EP?

→ Will meet quite often (weekly)
Proposal for core members

• Mike Barnes, TE-ABT
• Sergio Calatroni, TE-VSC
• Federico Carra, EN-MME (to be confirmed by Alessandro Bertarelli)
• Alexej Grudiev, BE-RF
• Elias Métral, BE-ABP
• Simone Gilardoni, EN-STI (and more from EN-STI if deemed useful)
• Federico Roncarolo, BE-BI (to be confirmed)
• Giovanni Rumolo, BE-ABP
• Elena Shaposhnikova, BE-RF
• Manfred Wendt, BE-BI
• Mauro Migliorati, Sapienza and CERN
• Massimiliano Ferro-Luzzi (LHCb)
• Mario Deile (TOTEM)
• Sune Jakobssen (ATLAS)
• Bernd Dehning, BE-BI (to be confirmed)

→ Request for meetings will be on the monthly basis, depending on needs
Proposal for contributing members

- Christine Vollinger, BE-RF
- Thomas Kaltenbacher, BE-RF
- Alejandro Castilla Loeza, BE-RF
- Inigo Llamas Garcia, EN-STI
- Vasilis Vlachodimitropoulos, TE-ABT
- Mario Beck, BE-ABP
- Olav Berrig, BE-ABP
- Alistair Arnold, BE-ABP
- Nicolo Biancacci, BE-ABP
- Kyrre Ness Sjobaek, BE-ABP
- Tatiana Rijoff, BE-ABP
- Edoardo Bonanno, BE-ABP, soon replaced by Giacomo Mazzacano
- Eleonora Belli, BE-ABP
- David Amorim, BE-ABP
- Benoit Salvant, BE-ABP
Proposal for responsible for the impedance models

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<tr>
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<th>Longitudinal impedance model</th>
<th>Transverse impedance model</th>
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<tbody>
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<td>PSB (+LIU-PSB)</td>
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- Need to define and agree on these key responsibilities
- Will give a proposal at the next meeting
- Anyone can ask to be added on the for-info list to know what is going on.
Next steps

• Set up sharepoint website to gather all requests and follow up actions
• Finalize lists and procedures
• Review the simulation and measurement tools
• Gather from the equipment groups the lists for EYETS and LS2.
• Address the urgent requests and continue the work
Ongoing and pending requests

**EN-STI:**
- TIDVG#4 (SPS)
- TIDVG#5 @LSS5 (SPS)
- PS Internal Dump (PS)
- PS Booster Absorber Scraper (PSB)
- TCDI (SPS-LHC)
- TDI+TDIS (LHC and HL-LHC)
- Removal of SPS scraper (ECR)

**EN-MME and collimation**
- Collimators in cryostats (e.g. 11T dipole for HL-LHC)
- New collimators with lower resistivity (HL-LHC)
- Electron lens (HL-LHC)

**BE-BI**
- New Fast BCT for SPS LSS5 (ECR)
- Wire scanner for PSB, PS and SPS
- New PS BGI
- Heating issues with LHC BGI?

**TE-VSC**
- Impedance reduction of SPS flanges (with BE-RF)
- New sector valves (see dedicated talk at this meeting)
- New LSS5 and LSS6 vacuum layout (with new dump and crab cavities)
Ongoing and pending requests

• **TE-ABT:**
  • Shielding of ZS interconnection
  • MKP shielding

• **LHCb**
  • VELO upgrade for HL-LHC

• **CMS**
  • Beam pipe modifications for HL-LHC

→ Others?

→ This list should be shown at every IWG meeting and kept up to date on the sharepoint website