Outcomes of Evian 2021 and Chamonix 2022 workshops

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introduction: two workshops

• Chamonix: “LHC Performance”, since 2001
  • long standing tradition: “LEP performance” since 1991
  • technical, strategic, and managerial workshop, targeting plans, expectations, and challenges
  • latest one: 24th LHC Performance Workshop, “Chamonix” (24-27 January 2022, on zoom)
    • with the CMAC, and charge questions and recommendations

• Evian: “LHC Operation”, since 2010
  • younger contributions and participation, focusing on previous and next year, more detailed, feed into the next Chamonix
  • latest one: 10th LHC Operations Workshop, “Evian” (22-25 November 2021, at CERN/hybrid)
topics covered by the workshops (outline)

• commissioning plans, operational scenarios, parameter ranges
• beam and hardware related limitations
• overview of system changes, equipment readiness, system issues
• Run 3 topics
• some HL-LHC topics
  • not treated here: part of HL-LHC subjects and future physics options

• ...19+83 follow up items...
commissioning and operational scenarios

- **commissioning plans**
  - Evian tackled 2022 (MP, OMC, collimation), further optimisations for 2023

- **beam parameters**
  - $1.4 \times 10^{11}$ ppb in 2022 and $1.8 \times 10^{11}$ ppb onwards

- **machine configuration**
  - optics choices: start easier in 2022, add complexity in 2023

- **feedback from experiments and expectations**
  - more details on wishes for 2023 in Chamonix 2023

- **minimisation of cryo consumption by change of configuration** (LMC 436, Chamonix 2023)

- **scrubbing in short blocks** implemented in the 2022 schedule after Evian

- **follow up of LHCb VeLo delays** (LMC 436, 437, 446, 450)
  - aperture at the LHCb VeLo (LMC 451)

- **covid/isolation/quarantine + new EiCs**
  - one close call for shift coverage
  - now well trained EiCs, occasional loss of efficiency from single person on shift

- **retrospective performance to investigate future improvements**
  - dedicated or parallel filling: some steps forward in 2022

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limitations

- **UFO showers, but no UFO storm** (LMC 453)
  - BLM thresholds well managed

- **ecloud shaped operation**, e.g. sector 78, 2400 bunches, 36b trains, hybrid scheme
  - beam screen surface studies (Chamonix 2023)

- **beam dump**: UHV window replaced, spare ready by mid-2023, max number of dumps per unit time
  - Dump Autopsy Review (LMC 430, LMC 435, LMC 448)

- **MKI heating not limiting yet**, thresholds increased
  - one MKI Cool installation (LMC 454)

- Injection losses, tails

- **10Hz noise for ions** (LMC 434)
system issues

- MKBV dilution kicker voltage reduction
- RF klystron exchange, tuner control cards, beam 2 beam phase module
  - RF burst disks task force (LMC 437, 445, 449, 454)
- UPS batteries (LMC 430, 437)
- TDIS misalignment (LMC 442)
- TCLIA settings issues (LMC 442)
Run 3 topics

- much rework of Run 3 schedule done and ongoing
  - shift and extension of LS3 (endorsed in early 2022)
  - impact of energy crisis (LMC 450, Chamonix 2023)
  - scheduling of ion runs taking into account risks and (E)YETS cool-down requirements (Chamonix 2023)

- baseline predictions update with Run 3 modifications (Chamonix 2023)

- choice of ion run energy

- ATLAS polarity changes to preserve triplet lifetime (LMC 434)
selected HL-LHC topics

• required beam-based validations (Chamonix 2023)
  • quench test, analysis ongoing (LMC 453)
  • crystals in the ramp + verification of channelling (LMC 453)
  • RF power limitations for half detuning at injection
  • long range beam beam compensation
• 7 TeV or not 7 TeV for Run 4, to be decided in 2025
  • 2022 training quench analysis (Chamonix 2023)
• triplet task force (Chamonix 2023)
  • triplet tilt procedure
conclusions

• 24\textsuperscript{th} Chamonix and 10\textsuperscript{th} Evian: focal points of LHC operation and performance
  • prep work is key
  • discussion during workshop and during breaks is added value (impaired by covid)
  • CMAC recommendations duly addressed

• 2022 operation concluded successfully
  • a recommissioning year, with luminosity goals exceeded
  • even some ions despite the shorter run
  • Run 3 optics and bunch intensity already validated in MD

• JAP workshop and Chamonix 2023 wrap the foundations for a successful 2023 and for the rest of Run 3
  • luminosity production, for both protons and ions, and HL-LHC preparation

enjoy the workshop!
spares
references


• LHC Performance Workshop (24 to 27 January 2022): https://indico.cern.ch/event/1097716/

• LMCs in 2022: https://indico.cern.ch/category/14665/
  • LMC actions: https://lmc-public.web.cern.ch/actions
Evian 2021

1. Setting the scene
2. System overview
3. Run 3
4. Commissioning and operation 2022

Chamonix 2022

1. Run 3 operations
2. Run 3 machine
3. Run 3 limitations
4. Programmed stops
5. Future physics options
6. Run 3 MDs and beam
7. Key HL-LHC
8. Schedule logistics and XXX

JAP 2022

1. Accelerator and client view by beam
2. Accelerator performance LHC and LIU injectors
3. Accelerator performance LHC
4. Equipment availability and efficiency performance
5. Beam related issues throughout the complex
6. Efficiency reliability and tools across the complex
7. Outlook and roadmap for Run 3 and Run 4