Timeline and Experiment Management Discussion

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Introduction

- Experimental facility + till now five candidate experiments (FASER2, FASERnu2, AdvSND, FORMOSA, FLArE)
  - Not all of these necessarily fully dependend on the FPF
- The goal is to moderate a discussion about how to proceed with the project planning and coordination between CERN, other institutions, and funding agencies.
- Aim to agree on possible timelines and next steps in particular in the next 2-3 years. Addressing issues
- Start thinking about a more formal organization for the detector part of FPF.

Which committee @CERN?

- Informal contacts with LHCC started, suggested by CERN management

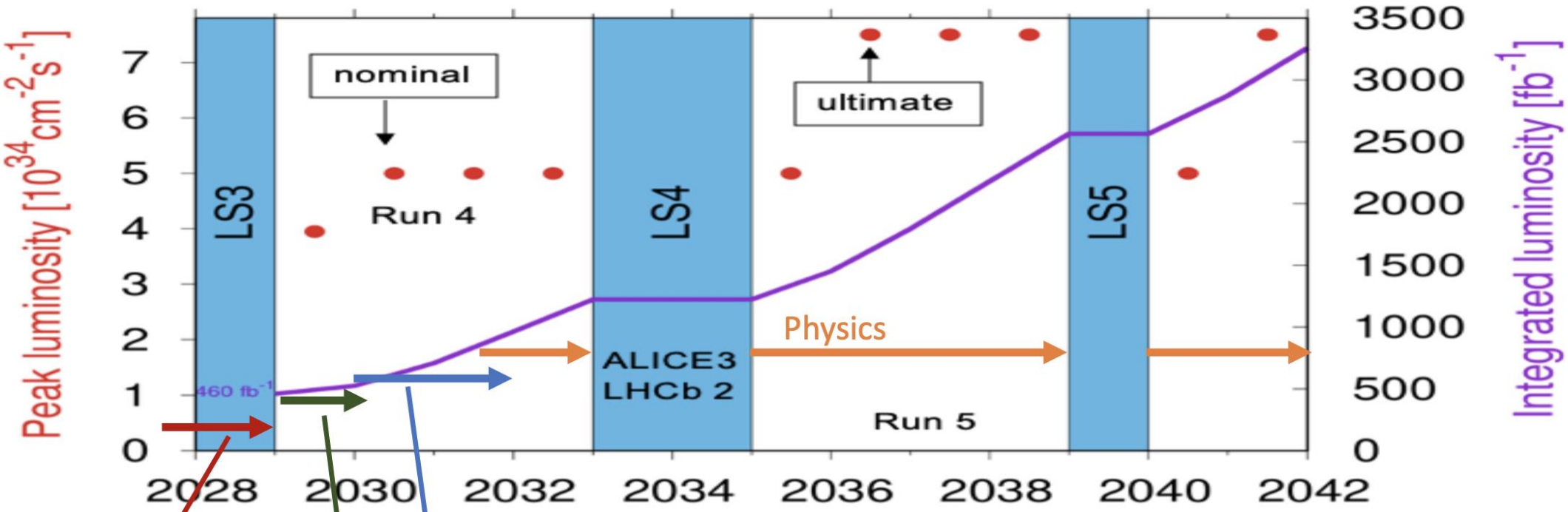
A proposal on the Forward Physics Facility (FPF), a large underground experimental facility, well shielded in the line of sight of the ATLAS interaction point, is being put forward. First informal discussions about the next steps with this proposal have taken place between the proponents and the LHCC chair.

- Given the scope of the proposed facility and the scientific overlap with projects that fall into the responsibility of other committees, **the LHCC proposes** to discuss the FPF together with other proposals, in an appropriate forum such as the Physics Beyond Colliders study group, prior to moving towards reviews by the scientific committees to ensure a comprehensive and aligned view of the strategy for CERN moving forward. Considering the implications for the long-term scientific strategy and the future development of the CERN infrastructure, a discussion in the SPC may be appropriate to help define priorities prior to further steps.

- First step is the PBC study group
- Meeting last week with FPF presentations, see further
- Overall timeline under discussion ->

Possible FPF schedule

https://indico.cern.ch/event/1137276/contributions/4950688/attachments/2542150/4378787/FPF_PBCworkshop_Nov22.pdf



Pure CE works

Installation and commissioning of the experiments

Installation of services (CERN technical teams, busy during LS3)

Such a schedule would:

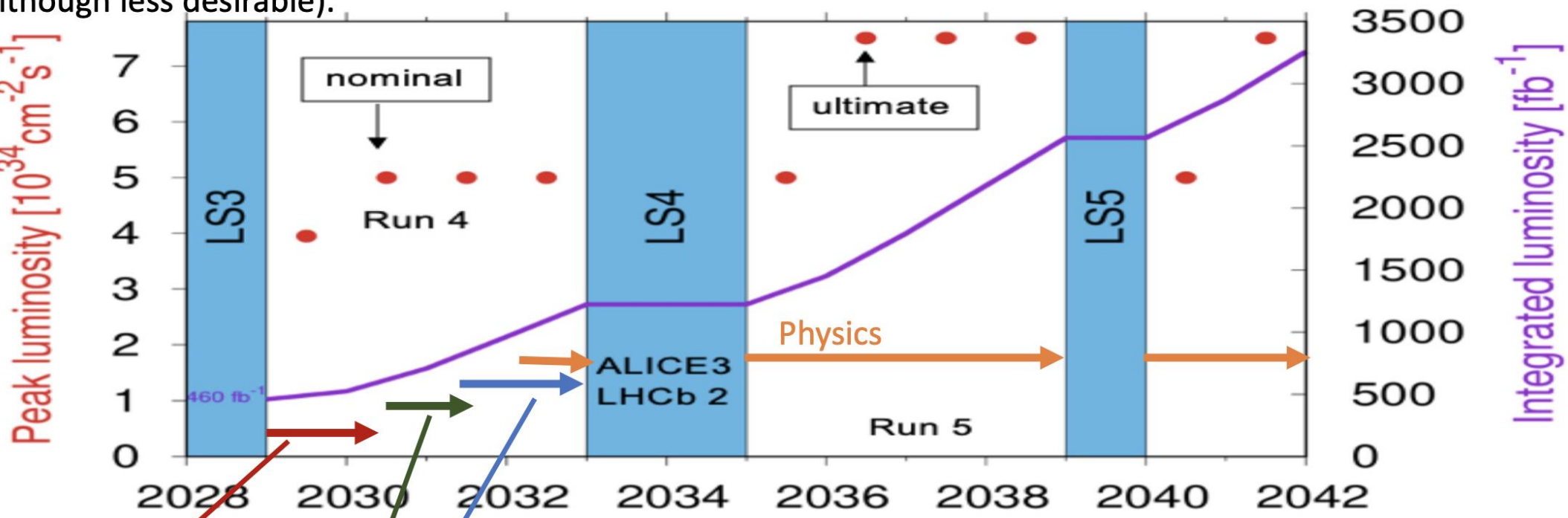
- Allow physics data taking for most of the luminosity of the HL-LHC
- Not overload CERN technical teams during LS3
- Design of facility would allow different experiments to come online at different times

Time is tight: Need to move fast towards CDR/TDR for funding and approval

Do we all agree on this basic timeline as realistic?

Possible FPF schedule

Based on RP study, and preliminary study on CE works during operations, a later schedule would also likley be possible (although less desirable).



In such a scenario some experiments could start taking physics data during Run 4, while others are being installed/commissioned.

Pure CE works

Installation and commissioning of the experiments

Installation of services

Plan B?

From the PBC:

FORWARD PHYSICS FACILITY

Good progress in the conceptual design of the infrastructure and decoupling from LHC operation constraints

Strong support from Snowmass HE group to HL-LHC auxiliary detectors

LHCC statement in September recommending to further study the FPF in the global PBC context

Next steps:

- **CDR expected in 2023 with more details on detector technical aspects, physics complementarity and Collaboration structure**
- **Relevant information on physics reach (sensitivity curves, etc…) to be provided to FPC, BSM and QCD WGs to address comparison with other projects**

Points for Discussion

- First step is the PBC: what is needed?
  - Take part in the PBC studies, providing sensitivity curves on plots for BSM and QCD/neutrino group. This process has been actually ongoing since ~2 years so we integrated already. Curves should be 'experiment' validated to be included in the summary plots. Take the time to complete some of the studies in sync with the physics working groups.
  - Present an excellent physics case, show complementary to the other projects discussed in the PBC. Explore the added value of FPF as a coherent facility (the sum is more than the parts) & synergy. Stress the unique capabilities of the FPF, such as the high energy neutrino program, compared to other planned or approved projects.
  - Demonstrate that there is a large interested community. Here we do have the communities of at least 4 of the 5 proposed experiments already, but it is certainly important to try to further enlarge the intersted community for the experiments.
- PBC is not a review committee but LHCC is "waiting" to get signal back.
  A review by LHCC could be initiated once the PBC and the FPF proponents agree that the project is mature enough for its initial examination.
- A document (or several) in 2023 will be useful for the PBC, for recruiting new institutes, budget proposals, special processes (eg P5) and move to the next stage. ….Not clear one and the same document can do full the job…

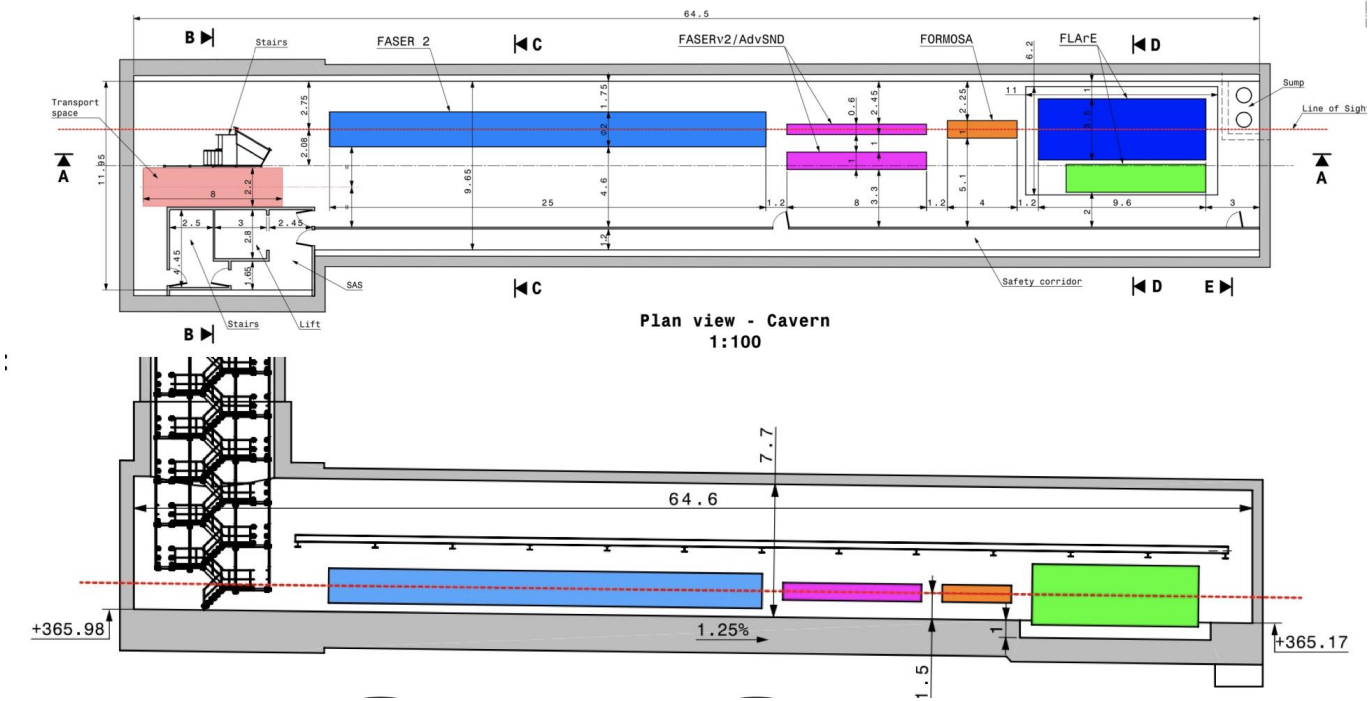
Points for Discussion

- Next step is the LHCC: what is needed?
- To the LHCC we wil need to submit a document which logically would be a Letter of Intent (LOI) as a first step. We should prepare this in 2023. The proposal here can be to have one LOI including the facility and the proposed experiments to date. Does that cover also our other needs?
- CDRs will need more time. Almost all of the experiments are busy with Run-3 commisioning and data analysis, which has priority and which will form a basis for solid CDR information. But what format?
  - The CDR for the facility will be needed first. Can we aim for a CDR by 2024?
  - Experiments.: we could plan for one CDR per experiment a year later, and roughly all aiming the same deadline. This allows for flexibility where needed.
  - Include (formally) a CDR on physics as well? E.g. based on last detailed FPF paper with updates, and discussing the FPF as a coherent facility.
- TDRs for the facility and experiments ~1-2 years after the CDRs? Time-critical for the Facility TDR.
- Have to take into account timelines when eg federal funding agencies have to commit to funding some part of this; the starting P5 process, etc..

Proposal for Discussion

- Submit in 2023 a common LOI to the PBC (& LHCC in agreement with the PBC?)
- Mostly based on current and evolving work to be completed on that timeline
- Start exploring possibility of combined measurements: the sum of the experiments is greater than its parts. Highlight the strenghts. Examples:
  - Muons from FLArE in FASER2 spectrometer
  - Measure millicharged candidate in the FASER2 and/or AdvSND mag. Field
- Use this LOI to attract new interested institutes, where desired/needed
- Plan for CDR later next, following the timeline and for a (LHC) review committee
- Timeschedule (tentative)
  - 2023 - LOI
    2024 - Facility CDR
    2025 - Experiment(s) CDR / Physics CDR
    2025-2026 - Facility TDR
    2026-2027 - Experiment TDRs
- This allows to benefit from the run-3 experience and have more in depth simulations studies, background estimations and common physics studies..

Experiments Lay-out



- Presently 5 potential experiments, still each being optimised. The present order and arrangement in the cavern is as given above
- Is this the final word on the layout? Likely not yet.
- Any interference in the operation of these experiments ?
- Is the “call for experiments” closed or do we need a procedure if more proposals come up? Presently no real place is foreseen for other expts. Explore timing..
- Are the experimental requirements on the cavern hall all worked out?
- Possible installation sequence &interference and access during operation needs to be understood

Discussion

- This meeting has shown that we are not just a collection of single experiments but there is a lot of “cross talk” and communication needed as of now. We need to install a formal communication procedure to make progress on the experimental hall organization
- An example could be to install a board with representatives of all stakeholders, with regular meetings (2-weekly or monthly?) to discuss the projects evolution and in particular issues/ideas that need to be worked out with the FPF community (eg via working groups on given common issues)
- Funding organization discusion and illustration-> See comments by Millind
- However, CERN matters to keep in mind ☹ 15/11/2022
  - “Management is reviewing all projects and activities with the goal of pottentially staging, descoping or cancelling some of them, and the priority of implementation…”

Note: ECN3 Beam Dump Discussion at CERN

ECN3 FUTURE

March 2023: decision for physics agnostic high-intensity facility (inclusion in next MTP):

- ***Most critical document due by NA-CONS/ECN3 accelerator TF, BDF and CB WG, based on exp'ts requirements***
- **Experiments LoI's successfully submitted,** ***to be scrutinized by SPSC and PBC conveners/coordination***

End 2023: decision for experimental programme *(assuming positive outcome of previous step)*

- ***HIKE, SHADOWS and SHiP LoIs to be consolidated into proposals or with addenda:***
  - Coherent simulation tools/methods for background simulations
  - Details on detectors developments, schedules and costings
  - Updated collaboration support
- **TauFV consideration will depend on updated information provided by proponents**
- ***BSM physics reach of all projects to be compiled by FPC (FIPs) and BSM WG (Flavor) in worldwide context (incl. FPF)***
- ***Neutrino physics reach (SHADOWS/SHiP) to be addressed by QCD WG in worldwide context (incl. FPF)***

Important we make the point on the complementarity and significant added value to the ECN3 program!!

CERN-PBC Report-2022-xxxx

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Post-LS3 Experimental Options in ECN3

C. Ahdida, G. Arduini, K. Balazs, H. Bartosik, J. Bernhard, A. Boyarsky, J. Brod, M. Brugger, M. Calviani, A. Ceccucci, A. Crivellin, G. d'Ambrosio, B. Döbrich, M. Fraser, A. Golutvin, M. Gonzalez Alonso, E. Goudzovski, J. Jaeckel, R. Jacobsson, Y. Kadi, F. Kahlhöfer, M. Koval, G. Lanfranchi, C. Lazzeroni, K. Massri, M. Moulson, J. Osborne, M. Pospelov, Ch. Rembser, A. Rozanov, G. Ruggiero, G. Rumolo, Y. Soreq, T. Spadaro, C. Vallée (to be finalized).

Backup: Example for FLArE

Nov 2, 2022												
2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Run3	Run3	Run3	Run3	LS3	LS3	LS3	Run4	Run4	Run4	Run4	LS4	LS4
	Pre-CDR and physics proposal	R&D and detetor prototypes	CDR	Start of civil construction. Technical Design report for detector.	Detector construction start	Long lead items for detector	End of civil constr. Install services	Detector install	Detector Commissioning and physics start	Physics running with full complement of detectors		
	Agreement on process	LHCC review	LHCC review CDR	Approve program directors and resource board organization	LHCC review of TDR	Approve entire scope of FPF and the exceution plan						
Snowmass process	P5 process for prioritization	DOE Research program portfolio discussion	DOE/NL review institutional review process for 413.3b determination or equivalent of CD0	Assume US works under the small project umbrella. PD-1 Approve Conceptual Design and Cost Range	PD-2 Approve Project Performance Baseline	PD-3 Approve Project Execution				PD4 review/completion of project.		
		European Strategy process										
		Funding proposals to agencies	Funding proposals to agencies									
	R&D proposals	Funding proposals to agencies	Funding proposals to agencies									
	R&D proposals											
pre funding. pretty approval. community discussion		protocollaborations	After scientific approval. protocollaboration	collaborations formation and project management formation	project and collaborations							