FUTURE CIRCULAR COLLIDER

Summary and follow-ups from review of CE and TI requirements for FCC experimental sites

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Presentations

09:00 **Introduction**
Speakers: Andy Parker (University of Cambridge (GB)), Michael Benedikt (CERN)
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09:10 **FCC-hh detector concepts and requirements**
Speaker: Werner Riegler (CERN)
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09:40 **FCC-ee detector concepts and requirements**
Speaker: Mogens Dam (University of Copenhagen (DK))
20221003_CE_TI_re... 20221003_CE_TI_re...

10:10 **CE and TI requirements from the FCC-hh and FCC-ee detectors**
Speaker: Werner Riegler (CERN)
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10:30 Break

11:00 **Civil engineering aspects and constraints**
Speaker: Timothy Paul Watson (CERN)
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11:30 **Technical infrastructure aspects and constraints**
Speaker: Klaus Hanke (CERN)
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Review committee

- **Composition**
  - Austin Ball (STFC),
  - Alain Chabert (SFTRF),
  - Peter Krizan (Jozef Stefan Institute),
  - Rolf Lindner (CERN),
  - Andrew Parker (University of Cambridge – Chairperson),
  - Roberto Tenchini (INFN Sezione di Pisa),
  - Frank Zimmermann (CERN – Secretary).

Preliminary conclusions (i)

- **GENERAL**
  - The committee endorses the baseline concept for the FCC experiment site underground structures of an experimental cavern with a single experimental shaft for the main detector installation, linked via a transfer tunnel to the service cavern, with a second shaft, and connected via bypass tunnels to the machine tunnel on either side of the experimental area. This is an effective and efficient solution, taking into account also experience from LEP and LHC.

Shaft diameter: 17m

- **CAVERN SIZE**
  - The committee recommends that the cost change which would be produced by a change in the main cavern size be evaluated, in the event that it is possible to consider a smaller width than the default 35 m, perhaps as low as 30 m.

Length: 66m

  - The decision to operate the cavern with a single shaft has implications for the logistics of the detector installation and operation which need to be studied.
  - Secondary experimental caverns could be of CMS size and costed for this.

Height/Width: 25m; Length: 55m

  - We recommend that the construction of the service caverns, even though not strictly required for FCC-ee, be not staged, subject to proper cost estimates being checked for initial and staged construction.

Also essential for FCC-ee, to keep machine cryogenic equipment vibrations far from the beam.

Preliminary conclusions (ii)

- **STRAY FIELDS OF FCC-hh DETECTORS**

Study of FCC-ee detector stray field on the booster to be continued

  - The committee is not yet convinced that all the implications of the large stray field from a detector magnet without a return yoke, as proposed for the two FCC-hh general-purpose experiments, are fully understood.
  - Therefore, we recommend that the option to build a return yoke is retained, and this option should be costed.
  - This recommendation may have implications for the default cavern size.
  - Working solutions for the effects of the stray field on all active components and passive structures nearby, including cranes, lifts, access and safety systems, as well as experiment-related infrastructures such as coolant pumps need to be considered, together with the cost of novel solutions, and the implications for operations.
  - The option to build a return yoke should only be discarded when convincing solutions to the above issues are in place.
- **NUMBER OF DETECTORS**
  - Plan for 4 FCC-hh experiments, two large general-purpose detectors and two specialized ones.
  - The plan for four ee detectors needs to be clearly justified on the basis of better science value for the investment in the infrastructure, for example the total delivered luminosity per run and the possibility of housing detectors optimised for different types of physics searches, in addition to physics arguments relating to systematics.

Preliminary conclusions (iii)

- **SURFACE SITES AND INFRASTRUCTURE**
  - Power needs (e.g. for experimental IT farms) are uncertain, and so a modular expandable approach to powering is recommended.
  - The available surface site size is quite limited due to surrounding land use and public infrastructure.
  - The final configuration of the surface site will require additional features, but at the moment the general-purpose detector site layout is dominated by the magnet production hall for FCC-hh general-purpose detectors, which is temporary; the magnet has to be built well before the detector assemblies and data centres; the big hall site can be repurposed.
    Check that the big CLD magnet can be transported to CERN from outside (or that its size can be reduced).
  - Parking and office spaces are needed, also food, recreation areas, rapid fire brigade and emergency responses. The most remote site must be an efficient, safe and attractive work place.
- **ACCESS AND OPERATIONS**
  - A lift in the experimental cavern shaft is foreseen as single direct access to the experimental cavern. The lift system will have to integrate with a pit-head radiation cover at the surface that must be closed during operation.
  - The integrated shaft, service cavern and bypass designs (i.e. staging areas, route to transfer tunnel, machine and experiment technical areas etc.) should allow factorised and, as much as possible simultaneous, activity by machine and experiment teams.
  - The large-diameter transfer tunnel linking experimental and service caverns will need appropriate separation for radiation aspects that will need to respond to various access procedures and safety conditions.

Thank you for your attention.