Physics Beyond Collider Technology Working Group

4th mini-workshop: Cryogenics

Introduction and scope

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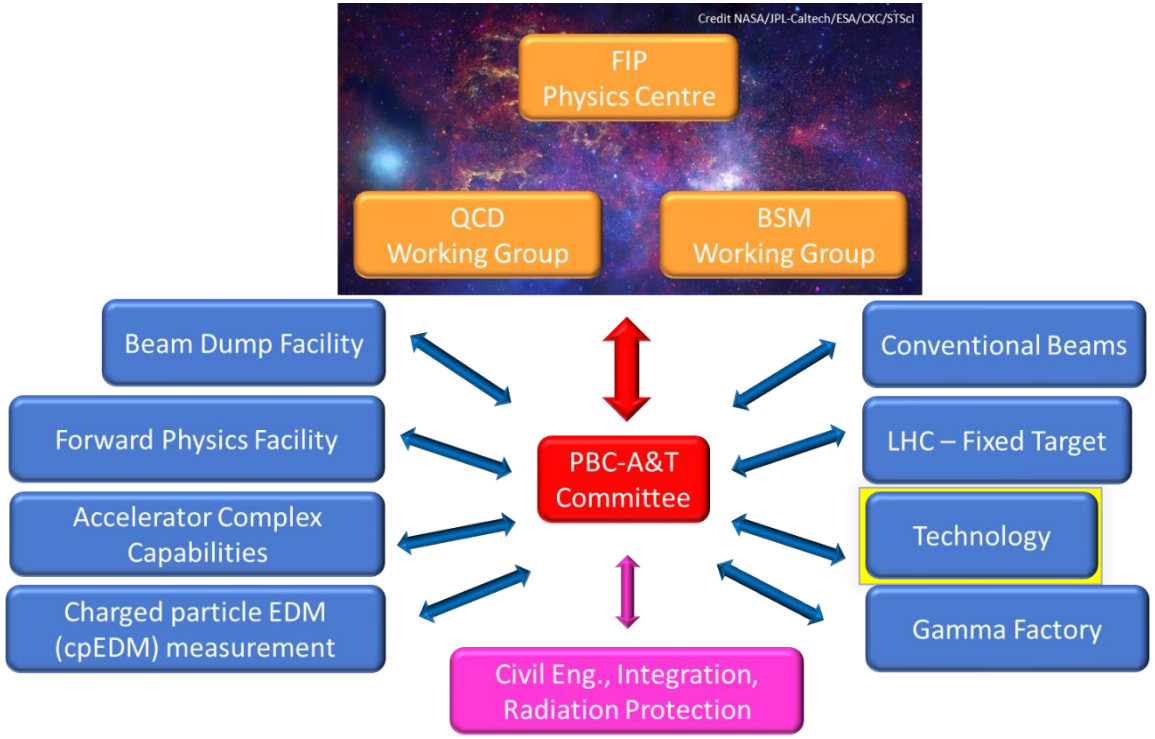
https://indico.cern.ch/event/1180067/

The Physics Beyond Colliders Study Group

Overview

Physics Beyond Colliders (PBC) is an exploratory study aimed at exploiting the full scientific potential of CERN's accelerator complex and technical infrastructure, as well as its know-how in accelerator and detector science and technology. PBC projects complement the goals of the main experiments of the Laboratory's collider programme. They target fundamental physics questions that are similar in spirit to those addressed by high-energy colliders, but require different types of beams and experiments. The PBC mandate is available here.



The PBC Technology Working Group

Mandate

The Technology WG will explore and evaluate possible technological contributions of CERN primarily to non-accelerator-related experimental physics initiatives and projects that may also be hosted elsewhere, and will survey technologies that could become relevant to CERN accelerator and non-accelerator projects. The working group will favour the exchange of experience and expertise in technological domains such as superconducting and normal conducting magnet and RF technology, cryogenics, optics, vacuum and surface technology to support the development of new physics experiments and detection methods like quantum sensing and new (accelerator and non-accelerator) experiment proposals aiming at fundamental Standard Model physics measurements and/or addressing physics Beyond the Standard Model questions.

4 mini-workshops organized

- Sep 2021: Superconducting RF https://indico.cern.ch/event/1057715/
- Dec 2021: Lasers & Optics https://indico.cern.ch/event/1092283/
- Apr 2022: Vacuum, coating and surface technologies https://indico.cern.ch/event/1134154/
- **Sep 2022: Cryogenics https://indico.cern.ch/event/1180067/**

Possible future PBC technology workshops: superconductivity, quantum sensing

Cryogenic technologies – low temperatures

Very wide and diverse use for

Cooling superconductors

Liquefied gas (e.g. liquid Ar)

High vacuum

Low thermal noise

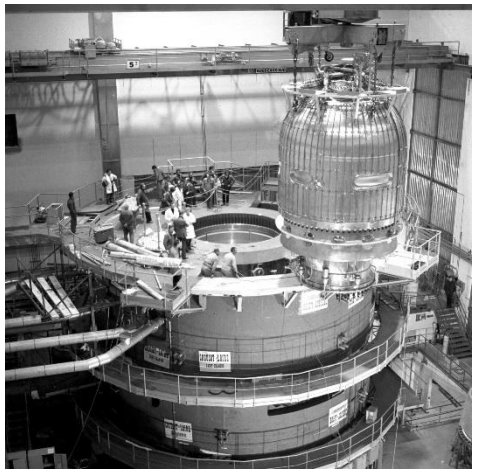
Cooling of detection devices

etc.

Characteristic temperatures of cryogenic fluids [K]

Cryogen	Triple point	Normal boiling point	Critical point
Methane	90.7	111.6	190.5
Oxygen	54.4	90.2	154.6
Argon	83.8	87.3	150.9
Nitrogen	63.1	77.3	126.2
Neon	24.6	27.1	44.4
Hydrogen	13.8	20.4	33.2
Helium	2.2*	4.2	5.2

* lambda point



A long history… (BEBC 1970)

Agenda & practical information

- 09:00 → 09:10 Introduction and scope of the workshop
- 09:10 → 09:45 CERN Cryolab range of technologies, Torsten Koettig (CERN)
- 09:45 → 10:10 Cryogenic technologies for the AMS 100 SC magnet, Prof. Stefan Schael (Rhein. Westf. Tech. Hoch.)
- 10:10 → 10:35 Ultralight cryogenic structures, Maria Soledad Molina Gonzalez (CERN)
- 10:35 → 11:05 Coffee break
- 11:05 → 11:30 Liquid Argon cryogenics for the Neutrino platform, Caroline Fabre (CERN)
- 11:30 → 11:55 Remote ultralow vibration cooling for the Einstein telescope, Stefan Hild (University of Maastricht)
- 11:55 → 13:45 Lunch
- 13:45 → 14:10 An overview of sub-Kelvin cooling technologies, Gerard Vermeulen (Institut Neel (CNRS))
- 14:10 → 14:35 Effective passive thermal heat pipes for cryocooling, Bertrand Baudouy (CEA - SACLAY)
- 14:35 → 15:00 Overview of cryocooler technologies enabling accelerator science, Dr Srinivas Vanapalli (Uni. of Twente)
- 15:00 → 15:25 Cryogenic instruments for microscopy and nano-precise sample positioning, Dr Philipp Leubner (Attocube)
- 15:25 → 15:55 Final discussion and close up

Practical information

The presentations are on the Indico website of the workshop

Participation on-site and remote

Coffee will be served during the morning break just outside the meeting room

For specific Questions and Answers it is possible to use the Google Docs link found on the meeting Indico page:
https://docs.google.com/document/d/1wWs4H083h7Xv6m09Tpsy699whQQgjryflW9NLu_6Mxw/edit