Mandate for an EP Experimental Magnet Working Group

CERN, December 2020

1 Introduction

A key role of the EP Department at CERN is to provide technical, administrative and logistics support for experimental teams performing experiments at CERN's accelerator facilities.

Magnet systems of experiments and facilities at the LHC, the PS and SPS are an important part of CERN's infrastructure and future particle physics experiments will continue to use them. Unique expertise to design, maintain and operate them exists within the EP department. With the setting up of an Experimental Magnet Working Group, the EP Department fosters the support of the magnets for the current experiments and ensures that continuous expertise is maintained at CERN for future experimental magnet systems for the particle physics community worldwide.

2 Goals of the Working Group

The goal of the EP Working Group on experimental magnets is to build up and to maintain an expertise group capable to operate the present experimental magnet systems at CERN. The expertise should include magnet design, measurements and controls, safety-, cryo- and vacuum systems, with particular focus on magnet systems required for experiments (e.g. spectrometers). As there is no other laboratory, institute or university with comparable experience or similar size, the EP Working Group should be available for the worldwide particle physics community for advice and support.

In the EP Experimental Magnet Working Group, experts from various groups within the EP Department collaborate, in particular from EP-ADO, EP-CMX and EP-DT. Colleagues from other Departments, e.g. the BE-EA (Experimental Area) group or the TE-MSC (Magnet, Superconductor, Cryogenics) group should be invited as the need arises.

The main activities of the Working Group are the following:

- maintenance and operation of the ATLAS and CMS superconducting magnet systems;
- maintenance of the warm magnets of ALICE and LHCb;
- provide expertise for other magnets of EP, in particular the superconducting systems, as well as for detector magnets that are currently not in use and stored;
- participate in R&D and the study, design, test, prototyping and construction of magnets for future experiments;
- maintain and expand magnet design knowledge and techniques as well as magnetic field, forces and stress calculations;
- foster the collaboration with other laboratories and institutes.

Highest priority for the working group members of ATLAS and CMS is the maintenance and operation of the ATLAS and CMS superconducting magnet systems, as well as the leading role in any upgrade of the systems. The working group shall identify commonalities between ATLAS and CMS and develop them further. In case of problems with one of the systems, the working group is expected to be a place to discuss and find solutions to the problems, to collect expertise, advice and – if possible – organise additional and common support from all working group members.

The maintenance of the warm magnets of ALICE and LHCb is carried out by the technical teams of the respective experiment in collaboration with EP-DT. Also here it is expected that in case of problems of one of the magnets, the working group is a place to discuss and find solutions to the problems and – if possible – to organise additional and common support from all working group members.

The EP Department is responsible for a significant number of other experimental magnets. The working group shall provide expertise and take defined responsibilities for these magnets, in particular the superconducting systems, as well as for detector magnets that are currently not in use and stored. A list of the experimental magnets is given in Table *1*, together with the contact persons and the groups in charge for the various subsystems. For those magnets, where contributions and responsibilities are defined for the EP Magnet Working Group, it is expected that the working group ensures that contributions and responsibilities are fulfilled, and that a risk assessment for each magnet is carried out and updated regularly, so that an efficient, safe and reliable functioning of the magnet is ensured. For CERN-wide projects, as the North Area Consolidation project, the EP Magnet Working Group should be involved for the relevant magnets to ensure that decisions and plans are supported also by the working group.

Magnet Name	Location	Contact	Magnet Experts	Power Supplies	Controls & Protection	Magnetic Measurements	Electrical Infrastructure	Activities Planning	Cooling	Comments
Morpurgo	EHN1 / H8	M. Mentink	EP-ADO	TE-EPC	EP-DT & TE-MPE	EP-DT	EN-EL	EN-EA	TE-CRG	
Goliath	EHN1 / H4	SPS Coordinator	/	TE-EPC	EP-DT	EP-DT	EN-EL	EN-EA	EN-CV	
M1	EHN1 / H2	D. Lazic & B. Cure	EP-CMX	TE-EPC	EP-DT	EP-DT	EN-EL	EN-EA	TE-CRG & EN-CV	
VTX1 & 2	EHN1 / H2	S. Kowalski (NA61)	EP-ADO	TE-EPC	EP-DT & TE-MPE	EP-DT	EN-EL	EN-EA	TE-CRG & EN-CV	
SM1 & 2	EHN2 / M2	S. Levoratto (COMPASS)	EP-SME	TE-EPC	EP-DT	EP-DT	EN-EL	EN-EA	EN-CV	TE-MC also involved
COMPASS Polarised Target Magnet	EHN2 / M2	S. Levoratto (COMPASS)	EP-SME	TE-EPC	EP-DT	EP-DT	EN-EL	EN-EA	EN-CV	TE-MC also involved
MNP-33	ECN3 / K12	H. Danielsson	EP-SME	TE-EPC	EP-DT	EP-DT	EN-EL	EN-EA	EN-CV	TE-MC also involved
MNP-22	EHN1 hall	SPS Coordinator & EN-EA	EP-ADO	EPC	EP-DT & TE-MPE	EP-DT	EN-EL	EN-EA	EN-CV	Test facility
AD Magnets (PUMA, GBAR, ALPHA, ASACUSA…)	AD Hall	Technical Coordinators of the Collaborations	Directly managed by the experimental collaborations + external companies						In some cases EN-CV	

Table 1: Experimental magnets, contact persons and stakeholders, currently in use at the SPS North Area and at the AD

The working group shall also actively participate in R&D programmes and study, design, test, prototype and build magnets for future experiments. Examples for such future detector magnet systems are the upgrades of the LHC detectors such as the ALICE Phase 2 upgrade, the fix target experiments at the CERN PS and SPS such as the proposed NA60+ experiment, and magnet studies at future collider detectors. In the framework of the EP R&D programme, the working group is carrying out studies on advanced magnet powering, magnet control safety and instrumentation and the design of a new 4 T General Purpose Magnet Facility at the SPS North Area, see https://ep-rnd.web.cern.ch/topic/experimental-detector-magnets.

As the expertise of the working group is world-wide unique, technical advice, participation in R&D and – if agreed within EP – also in the design and construction of magnet systems of

other particle physics experiments outside CERN as IAXO or AMS is part of the working group's programme.

To keep the worldwide unique expertise, the working group shall maintain and expand magnet design knowledge and techniques as well as magnetic field, forces and stress calculations. It shall also maintain and expand sensor and actuator developments as well as measurement robots. The Working Group should enable the EP Department and CERN to keep knowledge and documentation of the experimental magnets and their systems in a single place.

The worldwide unique expertise should be used to identify and to foster the collaboration with other laboratories, institutes and universities as the Brookhaven National Laboratory (BNL), the Fermi National Accelerator Laboratory (FNAL) or the High Energy Accelerator Research Organization (KEK), for sharing end expanding expertise for the benefit of particle physics community.

3 Composition and organisation of the Working Group

The EP Working Group on Experimental Magnets comprises the following staff members of the EP department, arranged by group, as of 1 December 2020:

- EP-ADO: Philippe Benoit, Matthias Mentink and Alexey Dudarev;
- EP-CMX: Benoit Cure;
- EP-DT: Hans Danielsson, Laurent Deront, Raphael Dumps, Francois Garnier, Nicola Pacifico, Maciej Ostrega, Xavier Pons, Sylvain Ravat.

The working group shall be run by two coordinators, nominated by the EP Department management. The initial designees are: Matthias Mentink and Hans Danielsson.

The working group will meet regularly (monthly or bi-monthly) to discuss projects, plans and topics of common interest.

Once per year or more often if needed, the working group will organise an EP Magnet Forum, in which achieved progress and plans for the coming year are presented. The following stakeholders will be invited:

Technical Coordinators of the experiments using EP magnets, i.e. the Technical Coordinators of the LHC experiments ALICE, ATLAS, CMS and LHCb, the SPS experiments NA58 (COMPASS), NA61 (SHINE) and NA62, the EP management, the EP PS and SPS Physics Coordinator and the EP-DT group leader.

The working group is free to invite other colleagues from their respective groups and from other Departments, both to regular meetings as well as to Fora, e.g. the BE-EA group, the EN-MME (Mechanical and Materials Engineering) group and the TE-MSC group. Collaboration with these groups and sharing of test facilities (e.g. Cryolab, FRESCA, SM18) and knowledge would be very beneficial.

The main points of a Magnet Forum (status of projects, results, plans) will be summarised by the coordinators in a concise report which should be provided to the group hierarchies as well as to the EP department management.

The members of the working group remain embedded in their CERN EP hierarchical structure. Activities of the working group need to be communicated to the hierarchical

structure and to the EP department management. The activities as well as a plan for resources need to follow a mutual understanding and agreement among all parties involved.

4 Resources

The tasks on the experimental magnets of the LHC experiments are covered with financial resources from each of the experiment collaborations, or by an agreement on resources between the experiments and the EP-DT group. Support provided for e.g. magnet measurements for experiments outside CERN, the expenses have to be covered by the respective collaborations, as up to now. The activities on the EP R&D programme are covered by the EP R&D funds. Future projects at CERN, such as studies for the ALICE Phase 2 upgrade or the FCC, will require additional resources that go beyond the available ones and which have to be found. Contributions to studies for experiments outside CERN such as IAXO/BabyIAXO have to be provided by these experiments.

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