Physics Beyond Colliders General Working Group Meeting
CERN, June 13-14, 2018

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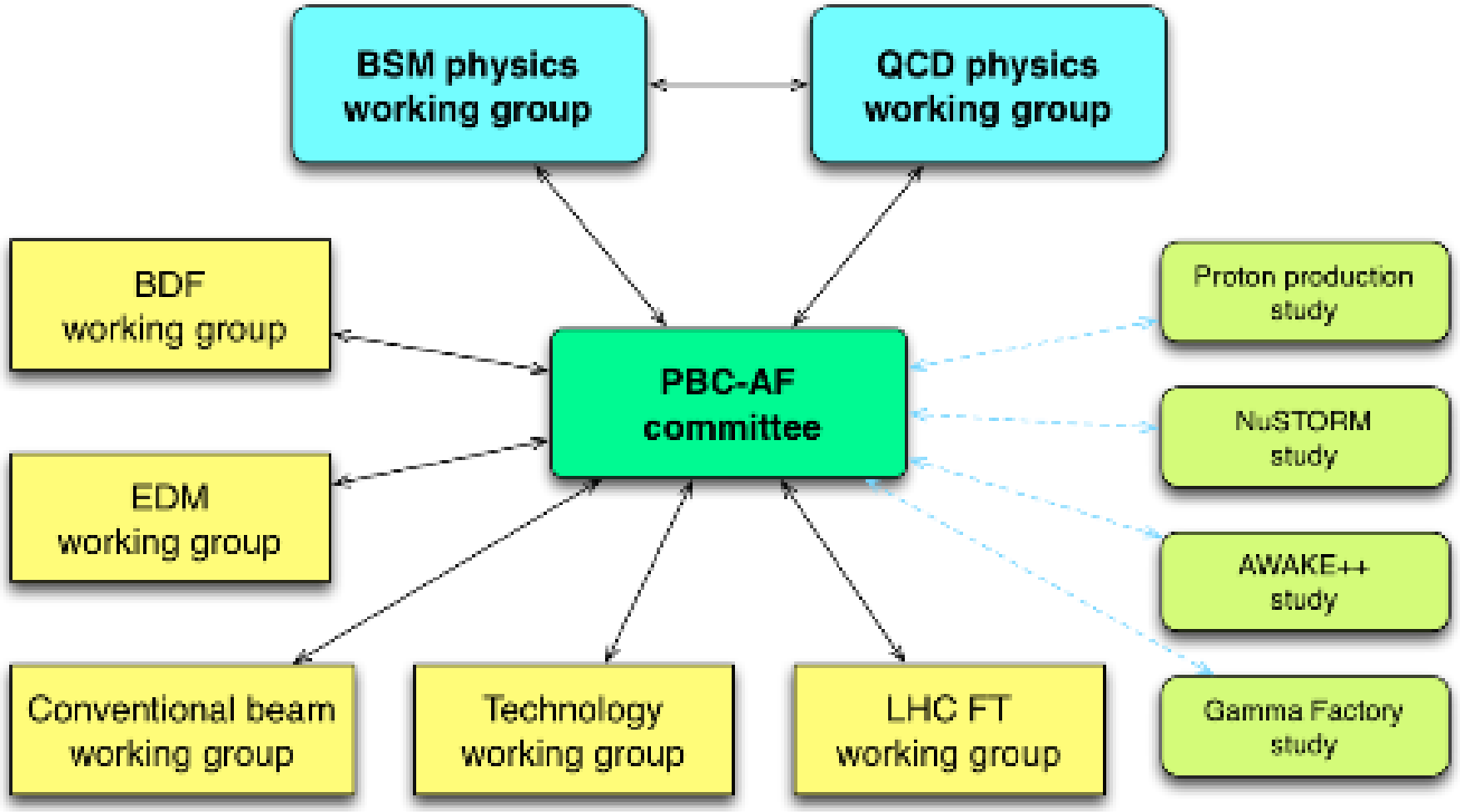
PBC DELIVERABLES

Overall structure
Working group documents
Main document

PBC WORKING GROUP STRUCTURE



Organisation and follow-up of activities documented on http://pbc.web.cern.ch/

PBC DELIVERABLES

Due end 2018 as input to the next European Particle Physics strategy update

Guidelines for structure and content distributed to all participants end 2017

STRUCTURE OF PBC DELIVERABLES

The following table describes the overall spirit, content and relationship of the documents expected at the term of the PBC study. The PBC working groups are in charge of defining the detailed structure and content of their own deliverables along these lines.

DOCUMENT	EDITORS	AUTHORS	CONTENT
Main (30-50 pages)	PBC coordinators	PBC WGs	Highlights of the physics case of the proposed PBC experiments at CERN, and how they can address it: *physics orientations in the worldwide landscape, uniqueness of CERN context, compatibility of projects, technical feasibility, timelines and financial implications.* The content of this document will be supported by the detailed information provided in the ancillary documents listed hereafter.
BSM context	BSM WG conveners	BSM WG *+ possible externals as appropriate*	Worldwide BSM physics landscape with a focus on how the proposed PBC projects fit in term of theoretical motivation and experimental sensitivity: *overview of experimental physics processes (direct production modes, decay signatures, indirect searches…) reach in term of new particle types, masses and couplings; comparison and complementarity of their sensitivities via common simplified BSM models (e.g. accelerator WIMP searches vs recoil experiments via effective operator and simple mediator test models, helioscope and LSW searches vs EDM limits via axion-like particle models, p/d vs n EDM,…); indication of mass and coupling ranges favored by current observations (DM amount, experimental&astrophysical hints, …); general suggestions for possible extension of the PBC projects discovery reach.*
QCD context	QCD WG conveners	QCD WG *+ possible externals as appropriate*	Worldwide QCD physics landscape with a focus on how the proposed PBC projects fit in term of theoretical motivation and experimental sensitivity: *QCD fundamental open questions and measurements of interest for other domains.*
Experiments contributions	Proponents	Proponents	Experiments contribute to the BSM and QCD context documents by providing their sensitivity curves within the commonly agreed models and assumptions for comparison with past, present and future experiments. --- Documents are also expected from the Collaborations with a level of details matched to the maturity of their project: *physics motivation; expected sensitivity; detector layout; estimated timeline and cost; Collaboration structure.* NB: these documents stay under responsibility of the Collaborations and can be the basis for possible future consideration of the projects by the SPSC and LHCC.

Complex Performance	Complex study group	Complex study group	Injector complex performance after LIU: *proton delivery through the CERN accelerator complex in view of the potential provided by LIU; intensity limitations and possible mitigation; considerations on the optimization of the delivery rates.*
BDF Comprehensive Design Study	BDF WG	BDF WG	Conceptual design of the Beam Dump Facility: *complete technical feasibility studies, layout and performance from SPS extraction to experimental hall; siting and civil engineering; interconnection to the SHiP detector and to possible additional detectors; possible longer term use as a general high-intensity facility; construction schedule and costing.*
EDM	EDM WG	EDM Collab.	Fully developed feasibility study of the proton/deuteron EDM storage ring: *ring layout options; experimental aspects of the EDM measurement (e.g. systematics); initial civil engineering studies for a possible siting at CERN; timeline and cost estimate; collaboration structure.*
Conventional Beams upgrades	CB WG	CB WG	Description of the conventional beam upgrades associated to the proposed projects: *technical feasibility; schedule and cost; identification of potential areas of conflict between projects siting in available experimental halls.* Level of details to be matched to the available manpower for the studies, with a priority to implementations possible after LS2: *NA62++ beam dump, NA64++ and MUE muon beams, NA61++ higher intensity ion beam. Reliable estimates of the orders of magnitude of the costs of the COMPASS RF-separated beam and of the KLEVER K^0 beam are also needed.*
LHC Fixed Target	LHC-FT WG	LHC-FT WG	Study of the implementation of LHC internal fixed targets in the LHCb and ALICE areas: *technical description of the discussed options (gas targets with and without polarisation, crystals, etc…); estimation of the maximal luminosities achievable for each option, compatible with the experiments and LHC constraints.*
Technology support	Technology WG	Technology WG	Exploration and evaluation of possible technological contributions of CERN to non-accelerator projects possibly hosted elsewhere: *survey of suitable experimental initiatives and their connection to and potential benefit to and from CERN; description of identified initiatives and how their relation to the unique CERN expertise is facilitated.*
AWAKE	AWAKE study group	AWAKE study group	Exploratory study of possible applications of the AWAKE concept: *development of physics cases and experimental design; accelerator systems and realistic range of parameters; possible infrastructure and siting.*
nuSTORM	nuSTORM study group	nuSTORM study group	Updated broad outline of a possible nuSTORM implementation at CERN.
γ Factory	γ Factory study group	γ Factory study group	Exploratory study of the concept feasibility: *results of initial tests and extrapolated performance; elaboration on the corresponding physics reach.*

PBC DELIVERABLES in short

Accelerator technical documents

Working group	10 pager for ESPP for 18th December - WG dependent	Possible proponents/clients submitting 10 pager to ESPP	PBC deliverable for 18th December * (referenced by 10 pager)	Foreseen no pages
AWAKE++	Y tbc		Exploratory study	100
BDF	Y	SHiP	Comprehensive Design Study	300 - 400
Conventional beams	Y	NA61, NA62++, KLEVER etc.	Description of the conventional beam upgrades associated to the proposed projects	100
EDM	Y		3 appendices: COSY; prototype; full ring (feasibility study).	50,50,200
eSPS	Y tbc	LDMX	Technical report on possible implementation at CERN	100
FASER acc.	N	FASER	Technical report on possible implementation in LHC	50
Gamma factory	Y		Exploratory study	~300
LHC FT	N	AFTER@LHC, LHCspin, MDM/EDM	Technical study of feasibility	20-30
nuSTORM	Y		Broad outline of a possible nuSTORM implementation at CERN	300
Perf post-LIU	N		Injector complex performance after LIU	50
Technology	Y	IAXO et al	Exploration and evaluation of possible technological contributions of CERN to non-accelerator projects possibly hosted elsewhere	100
			* PBC deliverable foreseen as either CERN or Yellow report	

BSM and QCD physics context documents

(see previous presentations)

One main overview document

(details in next slides)

Reminder: no arbitration between projects to be done by PBC !

PBC MAIN DOCUMENT

Self-readable document
based on the main pieces of information from the ancillary documents
(accelerator technical documents, BSM and QCD context documents, project documents)

NB: not just an executive summary catalog of the proposed projects:
structured argumentation relating the projects to each other and to the competition
+ outline of relevant key issues for their realization within the worldwide context.

1) <u>Setting the landscape</u> (~5 pages)

2) <u>Proposed projects</u> (~0.5 - 1 page/project)

3) <u>Global argumentation</u> (~10 pages)

PBC MAIN DOCUMENT: *Setting the landscape*

Presentation and summary of the open questions that we aim to address.
Short reminder of the usual general argumentation on the theory landscape, embedding the PBC questions into a wider context

Physics landscape

SM&BSM status → growing interest in precision/rare physics processes
Observational&theoretical motivations for a hidden sector

CERN landscape and worldwide competition

Quick overview and unique features of the CERN complex in the HL-LHC era
Experimental evolutions in the past decade and ongoing R&D of interest for the future
Brief summary of potential and future options for precision/rare/DM/QCD
Future worldwide QCD (JLAB, JPARC, FAIR…) and precision/rare (BELLE2, neutrino, …) facilities
Smaller scale experimental efforts with physics reach in the same regions as PBC

PBC MAIN DOCUMENT: *Proposed projects*

Summary of the main *intrinsic* characteristics of the proposed projects
For each project: reach in terms of the underlying physics questions;
Experimental feasibility/maturity; Collaboration strength; Estimated cost and time scale.

Among some key points to emphasize (excerpt of main projects):

BDF: multi-user possibility as a facility (SHiP, TauFV, future upgrades), cost&schedule.
SHiP: physics reach and extent, BG reliability.
NA62++: motivation of extension beyond approved program
KLEVER: physics motivation, BG reliability, feasibility&cost of K^0 beam.
NA64++: ultimate sensitivity of proposed experimental method with e, μ and hadron beams.
EDM ring: control of systematics, motivation for oscillating EDMs.
IAXO and other non-accelerator projects: physics reach/uniqueness and CERN inputs.
COMPASS++: fundamental QCD physics reach, prioritization of program, cost&schedule RF beam.
LHC-FT: achievable lumi compatible with HL-LHC, specific physics questions at this kinematics.
MUonE: control of systematics and precision of theoretical prediction.
NA61++: fundamental motivation of open charm and feasibility of beam intensity increase.

PBC MAIN DOCUMENT: *Global argumentation*

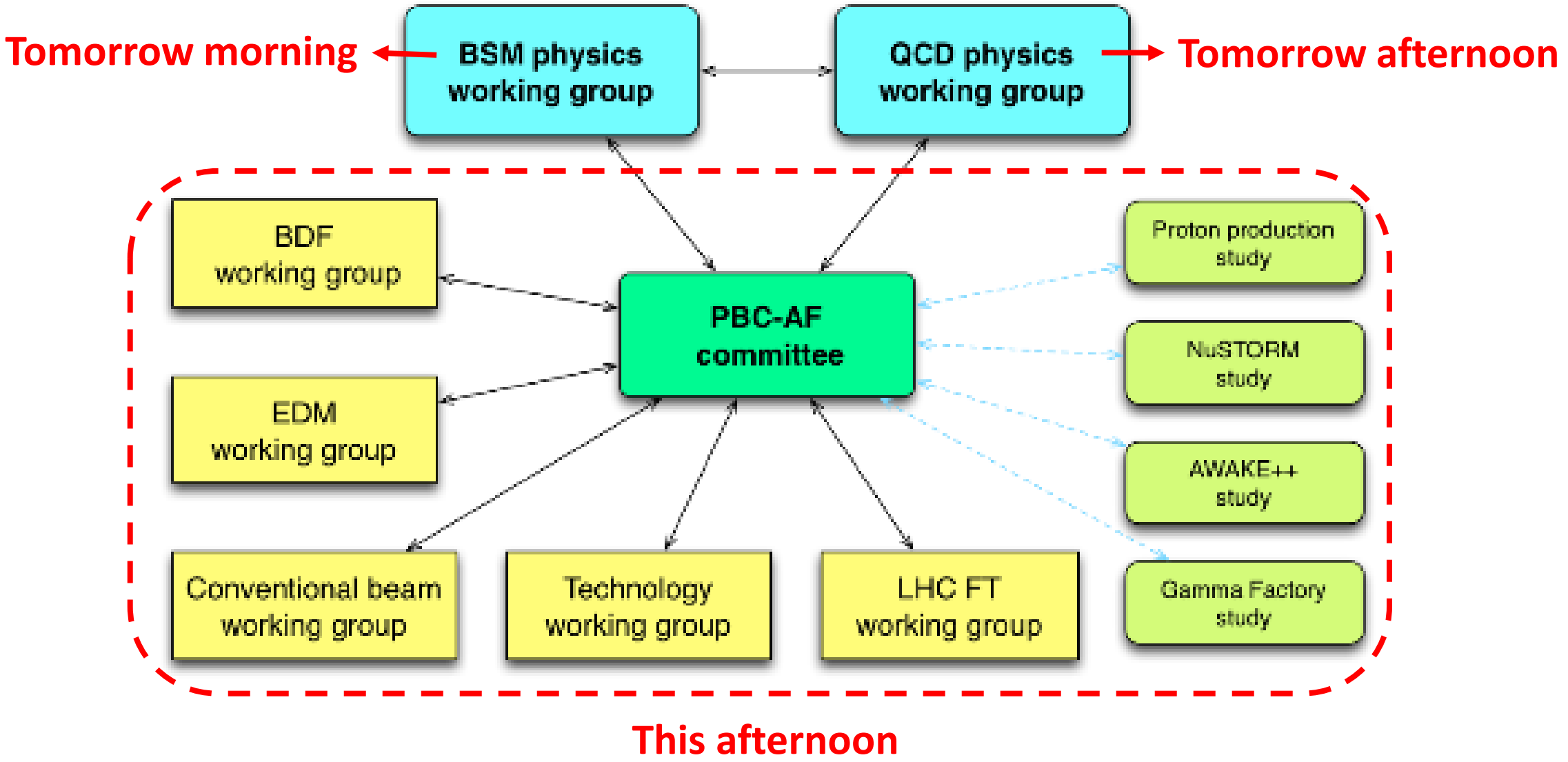
Positioning of the projects versus each other and their competition
in the worldwide landscape, putting together all considerations of relevance.

Comparison in the physics landscape using the BSM&QCD benchmark sensitivity plots

Argumentation on the global situation of the projects in relation to other efforts. e.g.

SHiP, NA62++, NA64++ versus each other and versus LHC-LLP and other future beam dumps worldwide
KLEVER vs B-anomalies, BELLE-2 and KOTO competition at JPARC.
EDM ring versus neutron-EDM facilities, COSY as a possible demonstrator facility.
COMPASS++ versus other QCD factories in the world (JLAB, JPARC, FNAL, EIC, FAIR…).
MUonE versus expected improvements from e^+e^- method and lattice QCD computations.
QCD@SPS-FT versus QCD@LHC-FT (for both structures and deconfinement).
Hall usage constraints: EHN2 for COMPASS++/MUonE/NA64++, ECN3 for NA62++/DIRAC++/NA60++
Opportunities elsewhere in Europe

WORKING GROUP MEETING SCHEDULE



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