

SM physics at 100 TeV, the Workshop

- Most talks scheduled for 30' : 15-20' for presentation, rest for discussion
- Focus on results of calculations at 100 TeV \Rightarrow
 - no general introductions on state of the art etc,
 - no technical details or reviews of how calculations were made,
 - no discussion of current LHC results except where relevant to tuning or benchmarking of calculations before extrapolation to 100 TeV
- Apologies for the long Wednesday morning session and later afternoon start (due to TH seminar at 2pm)
- Apologies for some inconsistency in the placing of some sessions (due to people's availability, time zones, etc)
- Reception for registered participants:
 - tonight, 6:30pm or after end of the session, in the Glass-Box (back rooms of Restaurant I)

SM physics at 100 TeV, the Report

- Chapter of the Report on Physics at 100 TeV, part of the study for a Future Circular Collider, which will include:
 - SM (conveners: Giulia Zanderighi and MLM + sections' editors)
 - Higgs and EWSB (conveners: Roberto Contino and Heather Gray + sections' ed's)
 - BSM (conveners: Filip Moortgat and MLM + sections' editors)
 - Hvy Ions (conv's: N.Armesto, A.Dainese, S.Masciocchi, C.Salgado, U.Wiedemann)
 - Experiments with the FCC injector complex (conv's: B.Goddard, G.Isidori, F.Teubert)
- SM Chapter, subsections' editors:

several volunteers already recruited, room for more editors, and plenty of room for contributors
- Timeline of the report:
 - first draft of contributions by end 2015
 - final document, printed, by early April 2016
 - \Rightarrow distributed at the 2016 FCC week (Rome, April 2016)

SM physics at 100 TeV, the Report

- Report, document style:
 - typical CERN Yellow Report, edited sections incorporating all relevant material in a uniform way
 - No cut and paste of individual mini-articles by individual authors
 - ➡ discuss your contribution with the editors before preparing/submitting it
 - mostly focus on theory/phenomenology results. Results of analyses with detector simulations welcome, but unlikely to take place in this time frame \Rightarrow software tools and reference detectors' design/performance still under discussion)
 - general author list, with all those who contributed

Goals of the SM chapter

- document final state properties of collisions at 100 TeV, production rates and distributions of SM objects
- establish benchmarks for the performance of FCC-hh detectors
- assess reliability of theoretical tools
- explore unprecedented kinematical domains
 - high p_T , high mass
 - huge production rates for EW bosons
- explore opportunities and challenges for precision physics
 - exploit large rates
 - exploit large momentum to reduce bg's and improve efficiencies
 - exploit event properties (e.g. boosted regimes, jet substructure)
- explore opportunities to probe BSM phenomena via
 - kinematical anomalies:
 - in precision measurements
 - enhanced by access to large Q^2
 - study of rare/forbidden decays
 - associated production of multiple SM objects (EW bosons, Higgs, top quarks)

Current table of contents (for discussion)

1	Introduction: the goals of this Chapter of the FCC-hh physics report ¹	4
2	Technical preliminaries ²	5
2.1	Calculational setup	5
2.2	Codes and calculations used	5
2.3	Monte Carlo issues, tools	5
3	Parton distribution functions ³	6
3.1	Introduction	6
3.2	Heavy Quark Partons	6
3.3	EW bosons as partons	6
4	Global event properties ⁴	8
5	Inclusive vector boson production ⁵	9
5.1	High mass Z and W production	9
5.2	Diboson production (with discussion of anomalous couplings)	9
5.3	Diphoton production	9
6	Jets ⁶	10
6.1	Inclusive jet and dijet production	10
6.2	Multi-jet cross sections	11
6.3	Matching at multi-TeV energies	11
7	Vector bosons and jets ⁷	12
7.1	Inclusive rates	12
7.2	Scaling behaviour of V plus multi-jet production	12
7.3	Photons and multi-jet production	12
7.4	Diboson plus jet production	12
7.5	Production of gauge bosons at the highest energies	12

J.Rojo →

P.Skands,
D.D'Enterria →

Current table of contents (for discussion)

8	Heavy flavour production ⁸	16
8.1	Inclusive bottom production	16
8.2	Inclusive top pair production	17
8.3	Bottom and top production at large Q^2	18
8.4	Single top production	18
9	Physics with top quarks ⁹	19
9.1	$t\bar{t}Z$ production	19
9.2	$t\bar{t}W$ production	19
9.3	$t\bar{t}\gamma$ production	19
9.4	Top properties ¹⁰	19
10	Vector boson and heavy flavours ¹¹	20
11	Production of multiple heavy objects ¹²	21
11.1	Production of multiple gauge bosons	21
11.2	Multi top-quark production	21
11.3	Multi Higgs boson production by gluon fusion and VBF	21
11.4	Multi Higgs boson production in association with top pairs or gauge bosons	21
11.5	Other rare processes	21
12	Loop-induced processes	22

JA
Aguilar-S →

Current table of contents (for discussion)

13	* Higgs	23
13.1	Higgs production rates	23
13.2	Inclusive ggF Higgs production	24
13.3	Higgs transverse momentum	24
13.4	Higgs plus jet production	24
13.5	Higgs plus multi-jets	24
13.6	Associated Higgs production	24
13.7	VBF Higgs production	24
13.8	VBF Higgs plus jet production	24
13.9	ttH production	25
13.10	Higgs constraints from Vector Boson fusion and scattering	25
13.11	Double Higgs production	25
14	Vector Boson fusion gauge boson production ¹³	26
14.1	Z and W production	26
14.2	ZZ and WW production	26
14.3	Same sign WW production	26
14.4	Anomalous couplings	26
15	Sources of missing transverse energy ¹⁴	27
16	SM physics of boosted objects ¹⁵	28

A.Larkowski →

* Theory part of the Higgs section under SM responsibility, but will ultimately be included in the Higgs chapter

To follow FCC-hh activities

- Register with the FCC-hh mailing list for announcements:
 - <http://simba3.web.cern.ch/simba3/SelfSubscription.aspx?groupName=fcc-experiments-hadron>
- Check agendas and contents of previous events at the following indico categories:
 - Informal physics meetings of all subgroups:
 - <https://indico.cern.ch/category/6067/>
 - Workshops
 - <https://indico.cern.ch/category/6071/>
 - Physics with injectors:
 - <https://indico.cern.ch/category/6070/>
 - Heavy ion physics:
 - <https://indico.cern.ch/category/6068/>
 - Detector subgroup:
 - <https://indico.cern.ch/category/6069/>
 - Detector magnets subgroup:
 - <https://indico.cern.ch/category/6244/>