FCC-hh physics analysis

Introduction & News

Heather Gray, Filip Moortgat
Goal of today’s meeting: preview the material that will be shown in the various presentations at the FCC week in Amsterdam.

Today’s not meant to be an actual rehearsal – just going through the content of the talks.
FCC-hh Physics Benchmark Studies

1.1 Introduction
Heather Gray, Filip Moortgat
Discussion on physics motivation of the benchmark channels.

1.2 Higgs and Electroweak Symmetry Breaking
1.2.1 Higgs Properties
Responsible: Michele Selvaggi
1.2.1.1 $H \rightarrow ZZ$
1.2.1.2 $H \rightarrow \gamma\gamma$
1.2.1.3 $H \rightarrow Z\gamma$
1.2.1.4 $H \rightarrow \mu\mu$

1.2.2 $tH$ Production
Responsible: Michele Selvaggi, Valentin Volkl, Clement Helsens
1.2.2.1 $tH, H \rightarrow \gamma\gamma$
1.2.2.2 $tH, H \rightarrow \text{multileptons}$
1.2.2.3 $tH, H \rightarrow bb (boosted)$?

1.2.3 Measurement of di-Higgs production
Responsible: Michele Selvaggi, Sylvie Bralbant, Giacomo Ortona, Biagio Di Micco, Nicola De Filippis, et al.
1.2.3.1 $HH \rightarrow bb\gamma\gamma$
1.2.3.2 $HH \rightarrow bbWW/WWZZ$

1.2.4 Measurement of Vector Boson Scattering
Responsible: Andre Sznajder, et al.

1.3 Searches for new physics
1.3.1 Resonances: $cc, \mu\mu, jj$
Responsible: Clement Helsens, Michele Selvaggi
1.3.2 Resonances: $WW, t\bar{t}$
Responsible: Clement Helsens, Michele Selvaggi
1.3.3 Supersymmetry: stop search
Responsible: Loukas Gouskos
1.3.4 Dark Matter: monojet + DM, $t\bar{t} + DM$, VBF + DM
Responsible: Phil Harris
1.3.5 Dark Matter: disappearing tracks
Responsible: Ryu Sawada, Koji Terashi, Masahiko Saito

Aim to have a first rough draft by FCC week!

Repository in www.overleaf.com → “FCC-hh Physics Analyses”

~20 pages of material at this point 😊
Introduction will contain some plots motivating some of the detector requirements, plus some motivation behind the choice of the physics benchmark channels.

E.g. muon acceptance:

Jet acceptance:
1.2 Higgs and Electroweak Symmetry Breaking

1.2.1 Higgs Properties
Responsible: Michele Selvaggi

1.2.1.1 $H \rightarrow ZZ$
1.2.1.2 $H \rightarrow \gamma\gamma$
1.2.1.3 $H \rightarrow Z\gamma$
1.2.1.4 $H \rightarrow \mu\mu$

1.2.2 tH Production
Responsible: Michele Selvaggi, Valentin Volkl, Clement Helsens

1.2.2.1 $t\bar{t}H, H \rightarrow \gamma\gamma$
1.2.2.2 $t\bar{t}H, H \rightarrow multileptons$
1.2.2.3 $t\bar{t}H, H \rightarrow bb$ (boosted)?

1.2.3 Measurement of di-Higgs production
Responsible: Michele Selvaggi, Sylvie Braibant, Giacomo Ortona, Biagio Di Micco, Nicola De Filippis, et al.

1.2.3.1 $HH \rightarrow bb\gamma\gamma$
1.2.3.2 $HH \rightarrow WW/ZZ$
1.2.3.4 $HH \rightarrow bb\tau\tau$
1.2.3.5 $HH \rightarrow bhhh$ (boosted)

1.2.4 Measurement of Vector Boson Scattering
Responsible: Andre Sznajder, et al.

Talk by Michele Selvaggi

Talk by Giacomo Ortona

Also covered in Michele’s talk

FCC-hh physics analysis meeting
1.3 Searches for new physics
1.3.1 Resonances: ee, \(\mu\mu\), jj
    Responsible: Clement Hensens, Michele Selvaggi
1.3.2 Resonances: WW, \(t\bar{t}\)
    Responsible: Clement Hensens, Michele Selvaggi
1.3.3 Supersymmetry: stop search
    Responsible: Loukas Gouskos
1.3.4 Dark Matter: monojet + DM, \(t\bar{t} + DM\), VBF + DM
    Responsible: Phil Harris
1.3.5 Dark Matter: disappearing tracks
    Responsible: Ryu Sawada, Koji Terashi, Masahiko Saito

BSM searches

Talk by Clement Hensens

Talk by Loukas Gouskos

Talk by Ryu Sawada

FCC-hh physics analysis meeting
For all speakers next week:

Remember that most people in the audience are non-experts.

There is no need to introduce the FCC collider or detector in general. But please do add some introduction about the physics channel that you are studying (what is it? why is it interesting? what is the challenge?) and possibly about detector subsystems that are critical to your analysis.
Today’s agenda

14:00 → 14:10  Introduction  
Speakers: Filip Moortgat (CERN), Heather Gray (LBNL)

14:10 → 14:40  Higgs & EW Symmetry Breaking  
Speaker: Michele Selvaggi (CERN)

14:40 → 15:10  Heavy resonance searches at the FCC-hh  
Speaker: Clement Helsens (CERN)

15:10 → 15:30  Top squark searches at 100 TeV  
Speaker: Loukas Gouskos (Univ. of California Santa Barbara (US))

15:30 → 15:45  Single Production of Charged Higgs Boson at Future Circular Hadron Collider  
Speakers: ILKAY TURK CAKIR (TURKISH ATOMIC ENERGY AUTHORITY), Ilkay Turk Cakir (Istanbul Aydin University),

15:45 → 16:10  Measurement of the Higgs Self-Coupling in the HH → VVbb Channel at the FCC-hh Collider  
Speakers: Dr Giacomo Ortona (Centre National de la Recherche Scientifique (FR)), Michele Selvaggi (CERN)

Next appointment is during FCC week in Amsterdam: our 2 sessions are on Wednesday afternoon
• Required for end 2018, as input for European Strategy Update
• Common physics summary volume
• Three detailed volumes FCChh, FCCee, HE-LHC
• Three summary volumes FCChh, FCCee, HE-LHC

FCC-hh physics analysis meeting
Reminder

There is a monthly informal meeting to discuss FCC-hh physics analysis studies aimed towards the CDR in 2018. Please don’t hesitate to contact us if you have anything you’d like to discuss.

How to get started on 100 TeV Physics studies?

- Pick a topic from the list of 100 TeV Physics Benchmarks: https://docs.google.com/document/d/1l7SbsqleXnuyPvhqMjPeiy8qsFdz8LoxQLEQYxbrNIU/edit

- Follow the FCC Pythia + Delphes + Heppy tutorial: http://fccsw.web.cern.ch/fccsw/tutorials/fcc-tutorials/FccFullAnalysis.html


- Keep us (Heather Gray & Filip Moortgat) informed about your plans & progress