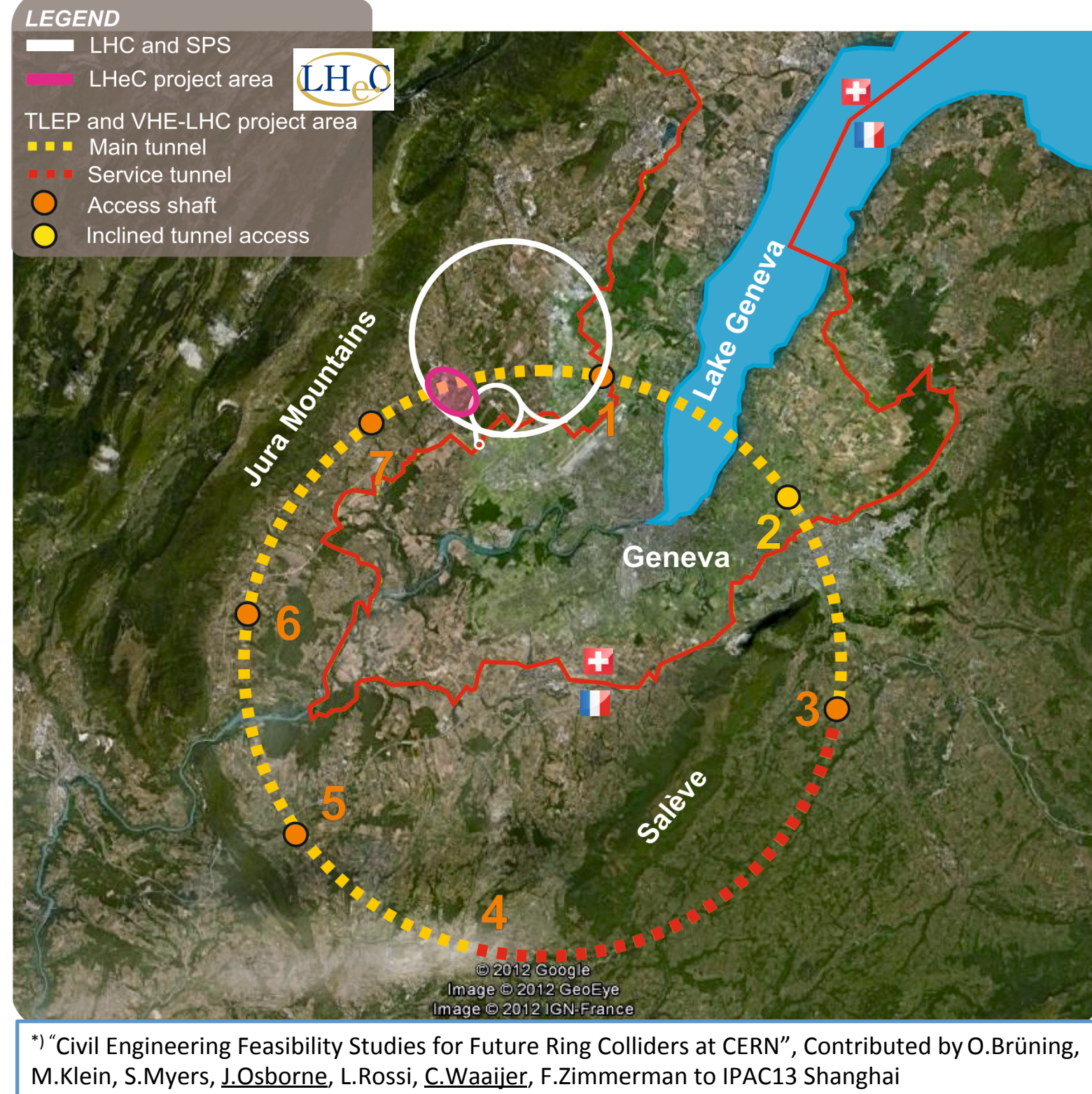
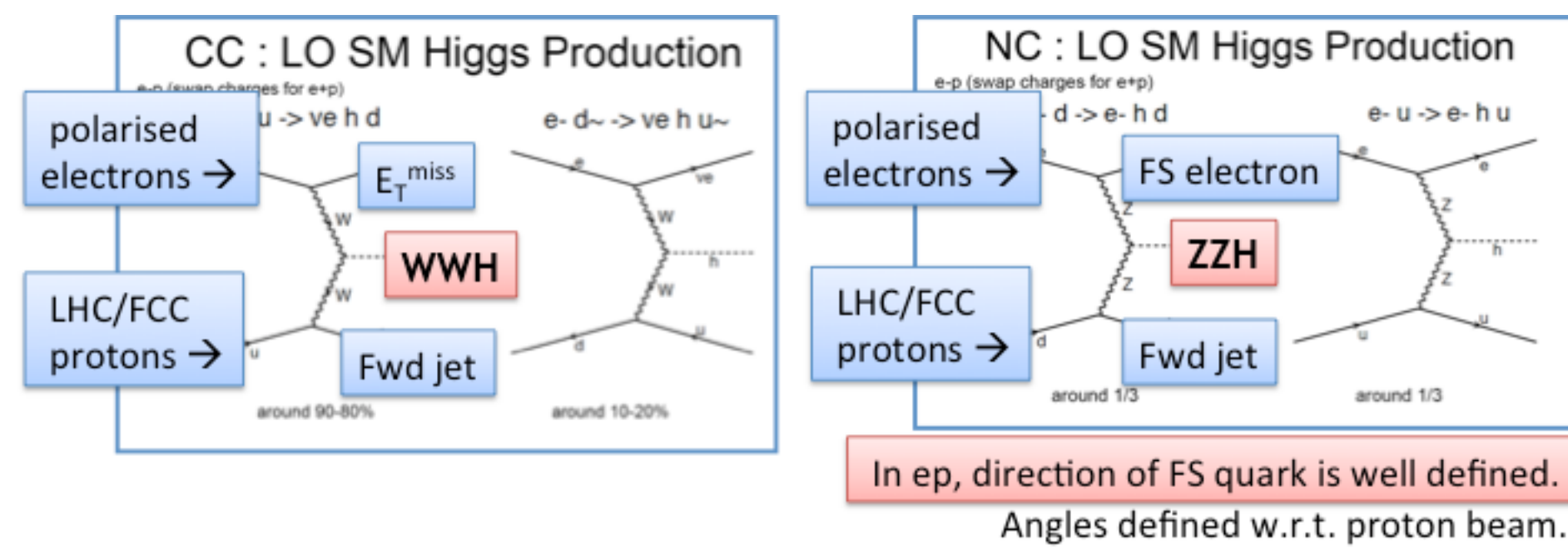


- LHeC and FCC-he, in ep(A) collisions **synchronous** with pp (AA) running, could deliver fundamentally new insights on the **structure of the proton** (and nucleus) and the **strong coupling α_s** with **high precision** → thus strengthen enormously the HL/HE-LHC physics case for searches [e.g. "On the Relation of the LHeC and the LHC", arXiv:1211.5102]
- LHeC sensitivity to $H \rightarrow b\bar{b}$ is estimated by an initial simulation study : LHeC has the potential to measure $H \rightarrow b\bar{b}$ coupling with an $S/N > \sim 1$ and to 1% accuracy with 60 GeV electron beam based on a luminosity of $10^{34} \text{ cm}^{-2} \text{ s}^{-1}$.
- At LHeC, various Higgs boson decays and Higgs CP eigenstates could be accessed via WW and ZZ fusion at c.m.s. energies of **1.3 TeV** and with **1000 fb⁻¹** - complementary to LHC experiments.
- There are exiting prospects to measure **double Higgs boson** production at **FCC-he** that deserve further detailed studies.
- New high luminosity and high energy prospects in ep have just started to be explored and open exciting new potential for complementary, precision Higgs physics at the LHC and FCC facilities.**

An Accelerator Complex

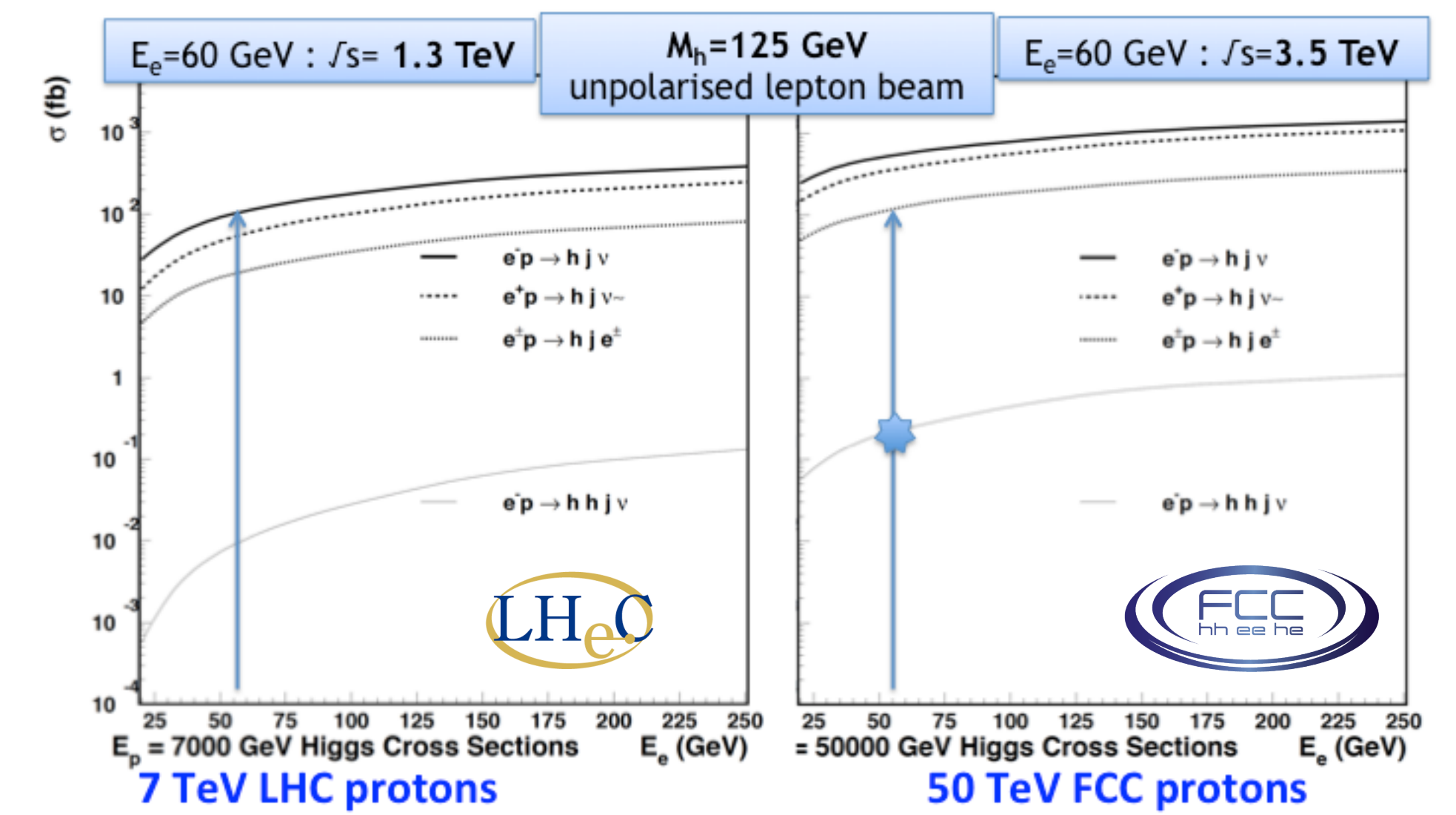


SM Higgs production in ep



- WWH and ZZH vertices can be probed **uniquely and simultaneously**
- ERL : high electron polarisation of 80-90% → **doubling of CC rates!**
- Scale dependencies of the LO $\sigma(\text{Higgs})$ calculations are in the range of 5-10%.
- NLO QCD corrections in DIS are small in comparison to pp
- For Higgs : shape distortions of kinematic distributions up to 20% due to NLO QCD. QED corrections up to -5%. [J. Blumlein, G.J. van Oldenborgh, R. Ruckl, Nucl.Phys.B395:35-59,1993] [B.Jager, arXiv:1001.3789]

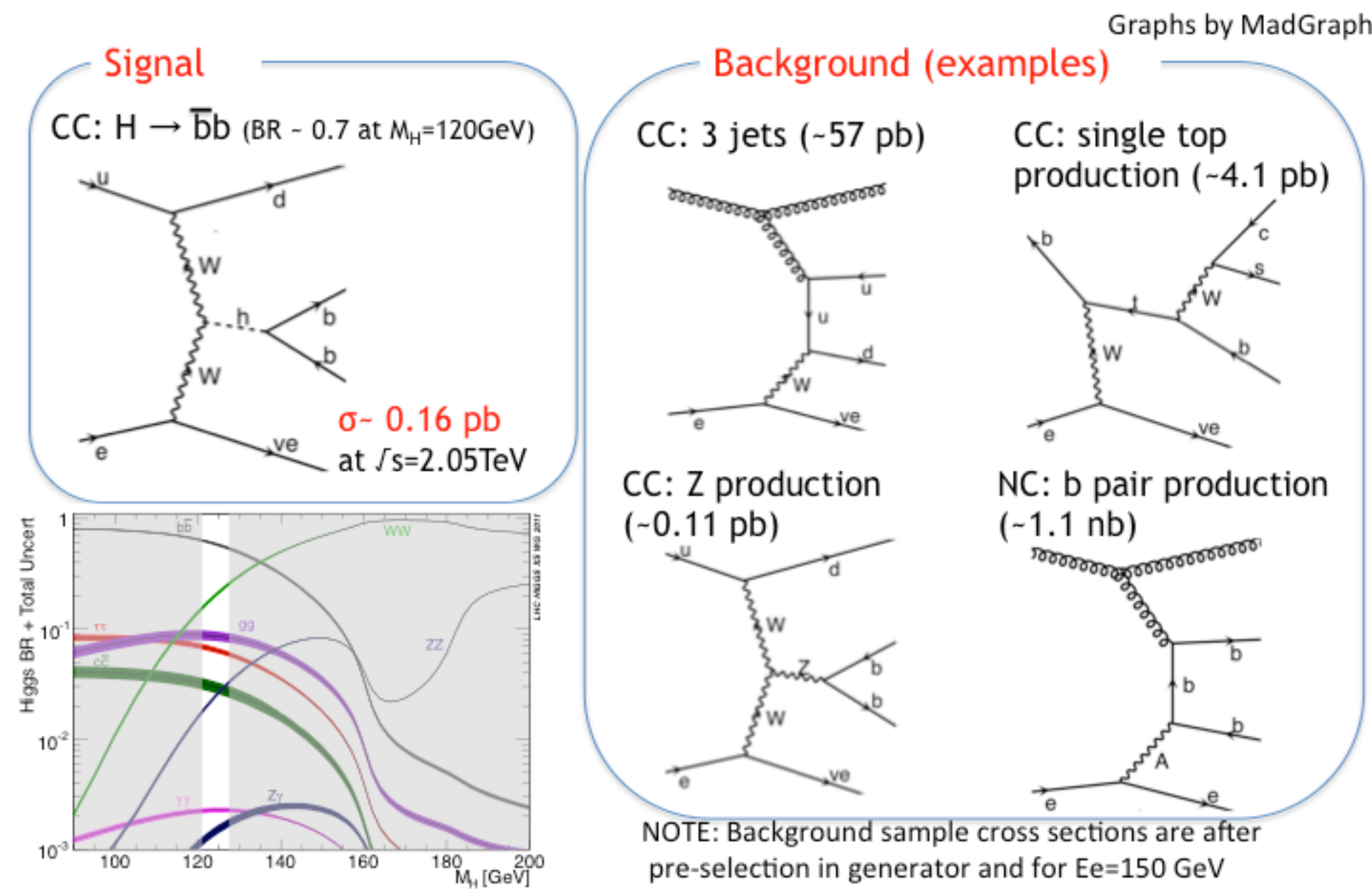
Total SM Higgs Cross Sections



and electrons from a 60 GeV energy recovery LINAC

	CC e'p	CC e'p	NC ep	CC hh	CC e'p	CC e'p	NC ep	CC hh
cross section [fb]	109	58	20	0.01	566	380	127	0.24
polarised cross section [fb] P=-80%	196	N.A.	25	0.02	1019	N.A.	229	0.43

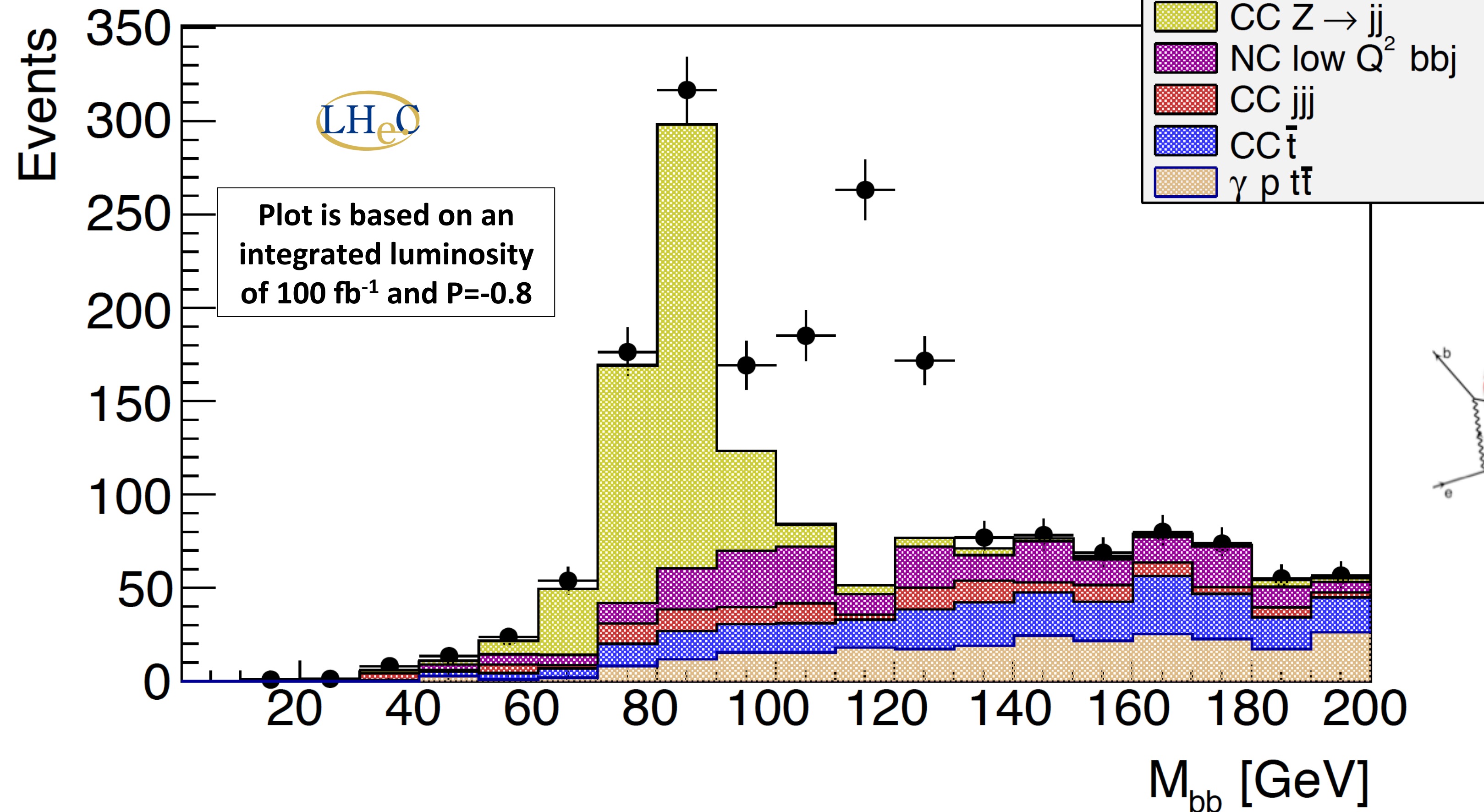
Higgs Signal vs Backgrounds



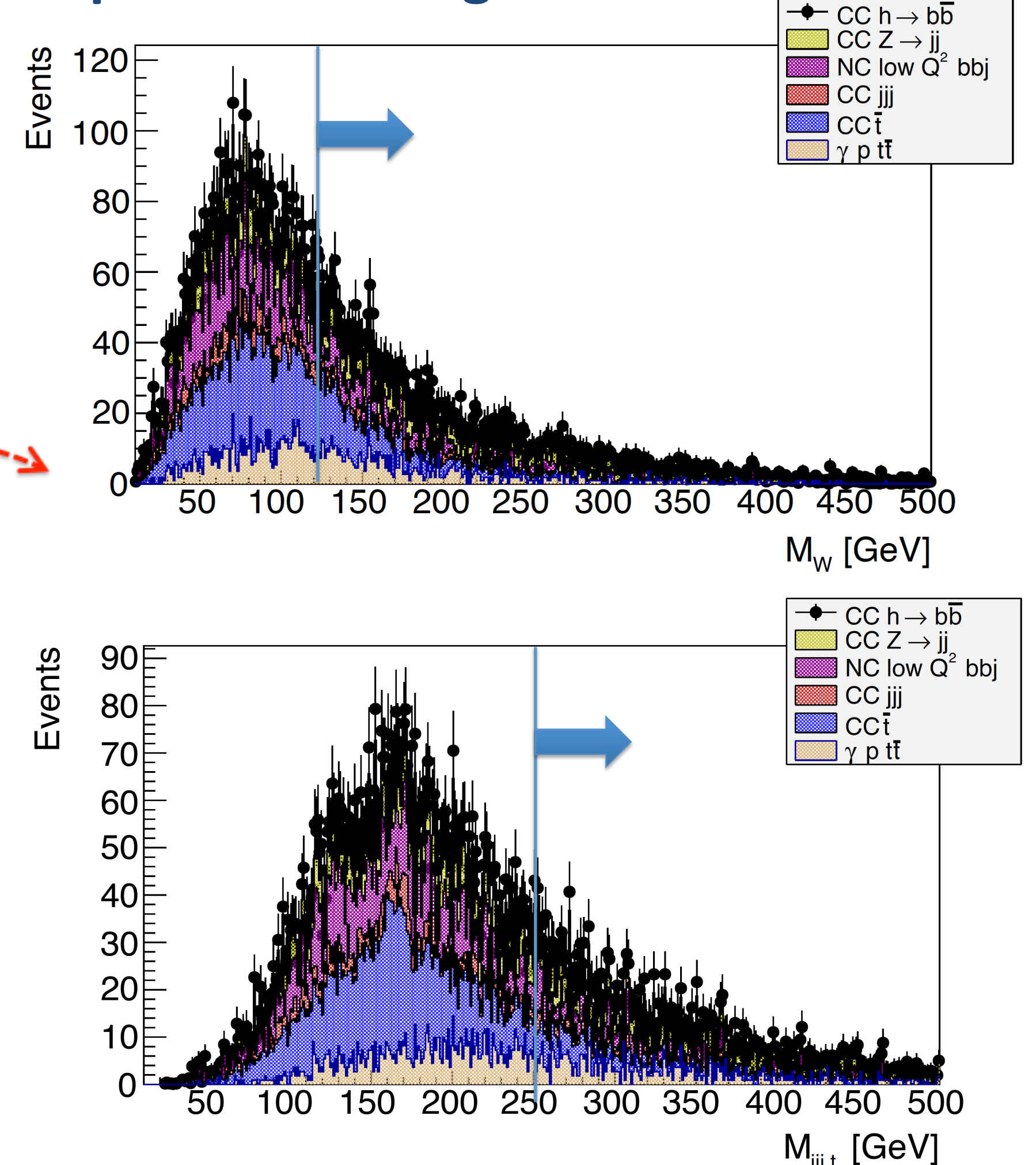
Expected Event Rates

	vs= 1.3 TeV		vs= 3.5 TeV	
Higgs in e'p	CC - LHeC	NC - LHeC	CC - FCC	
Polarisation	-0.8	-0.8	-0.8	
Luminosity [ab ⁻¹]	1	1	5	
Cross Section [fb]	196	25	850	
Decay	BrFraction	N _{CC} ^H	N _{NC} ^H	N _{CC} ^H
H → b $\bar{b}$	0.577	113 100	13 900	2 450 000
H → c $\bar{c}$	0.029	5 700	700	123 000
H → $\tau^+ \tau^-$	0.063	12 350	1 600	270 000
H → $\mu\mu$	0.00022	50	5	1 000
H → 4l	0.00013	30	3	550
H → 2l2 ν	0.0106	2 080	250	45 000
H → gg	0.086	16 850	2 050	365 000
H → WW	0.215	42 100	5 150	915 000
H → ZZ	0.0264	5 200	600	110 000
H → $\gamma\gamma$	0.00228	450	60	10 000
H → Z γ	0.00154	300	40	6 500

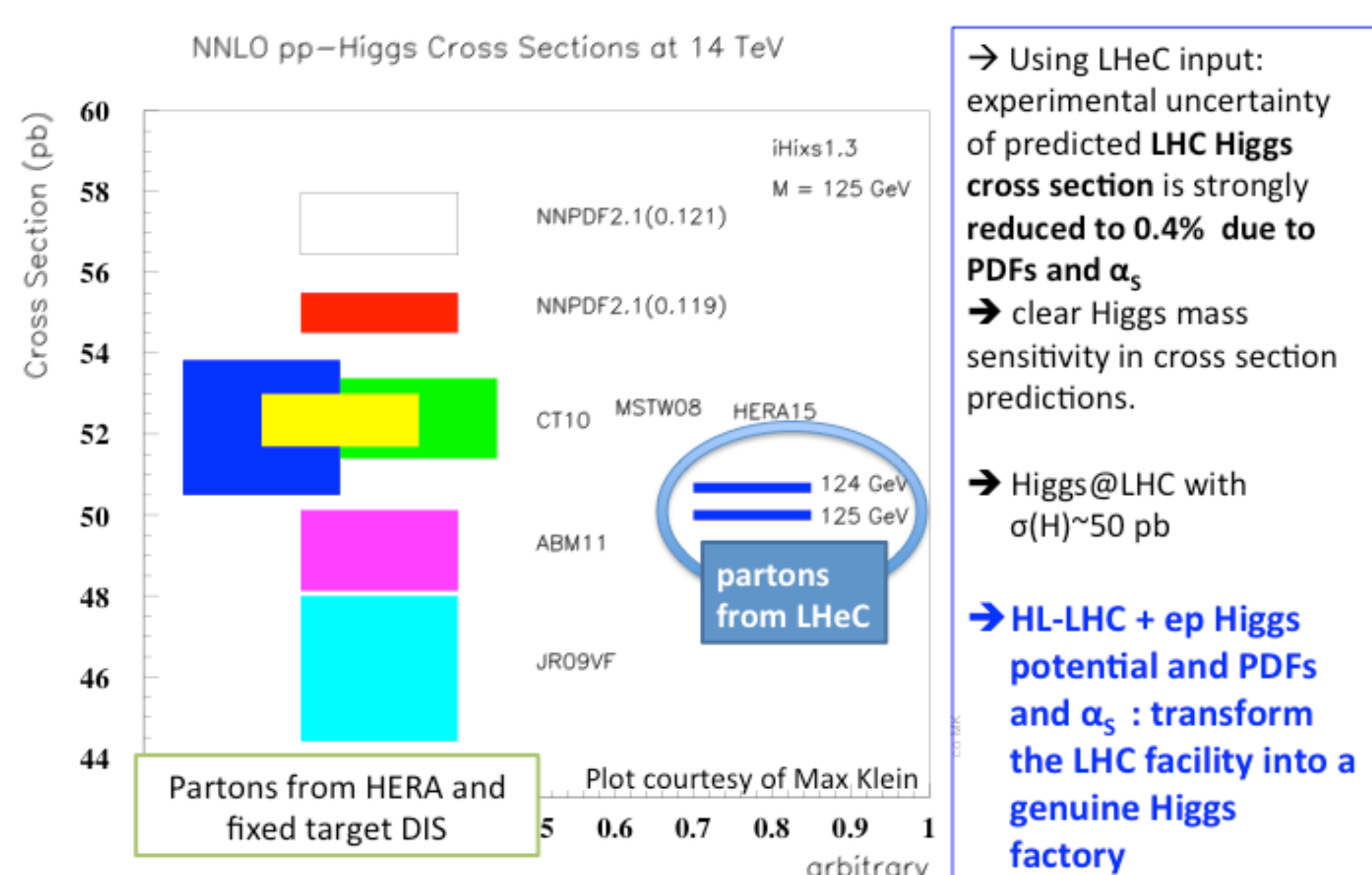
Higgs Signal and Backgrounds



Top related Backgrounds



Precision Partons for LHC and FCC-hh



Weak Mixing Angle Measurements at LHeC and FCC-he

