

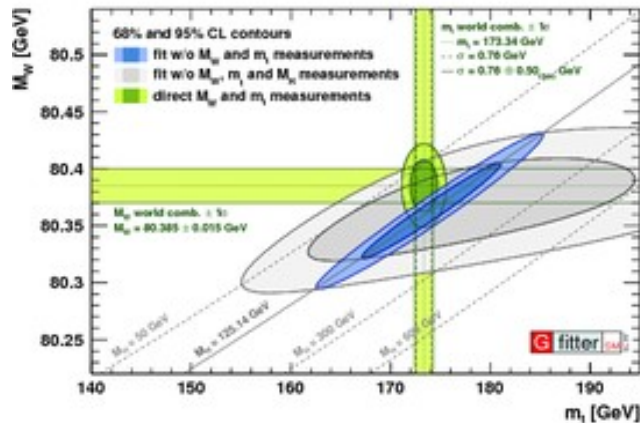
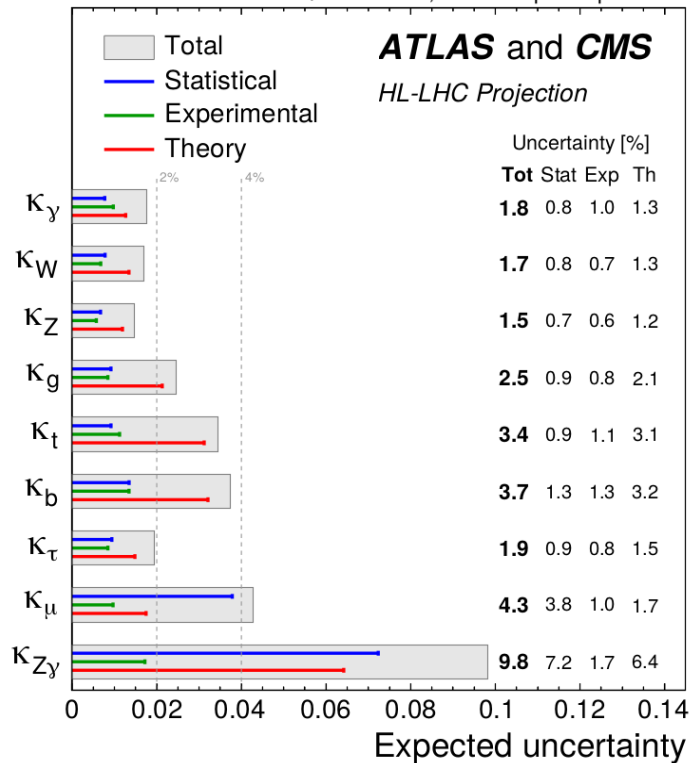
Institut Pascal Program

Towards Ultimate Precision  
at Hadron Colliders

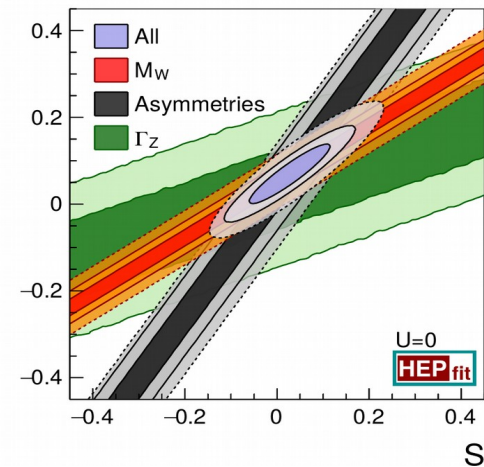
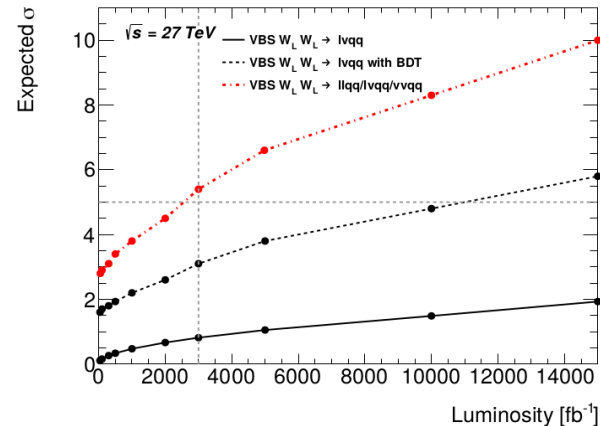
Introduction

# Where will we be by 2035?

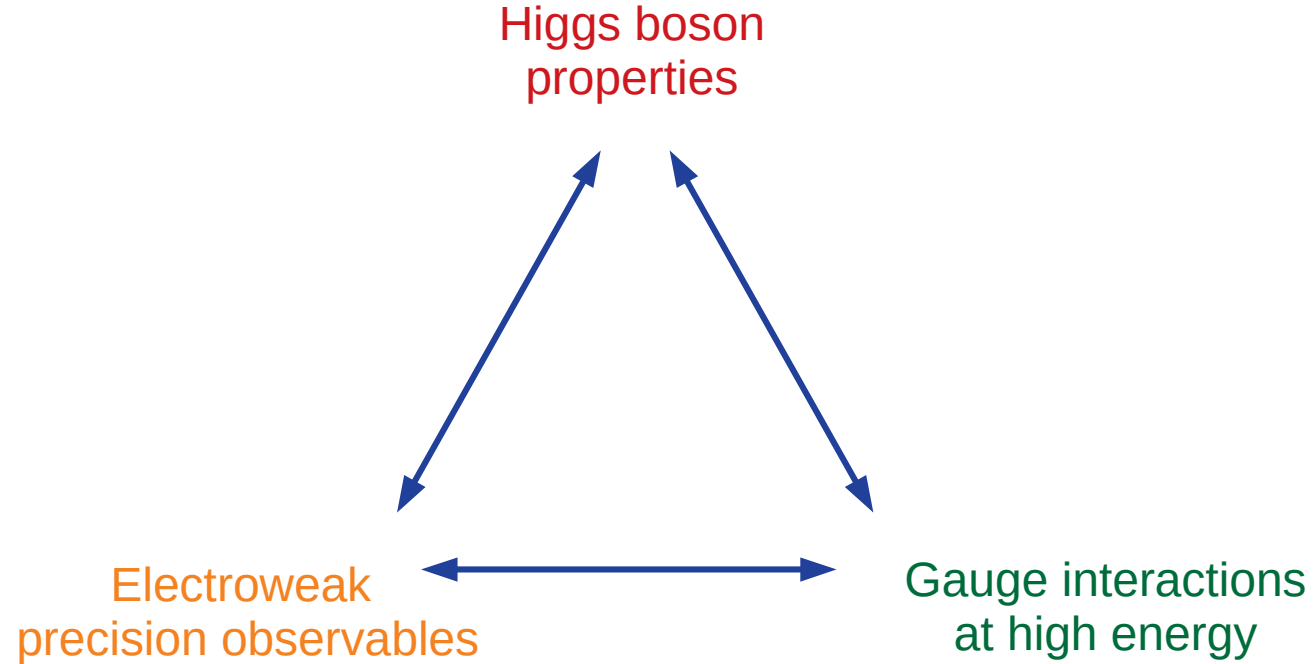
$\sqrt{s} = 14 \text{ TeV}$ ,  $3000 \text{ fb}^{-1}$  per experiment



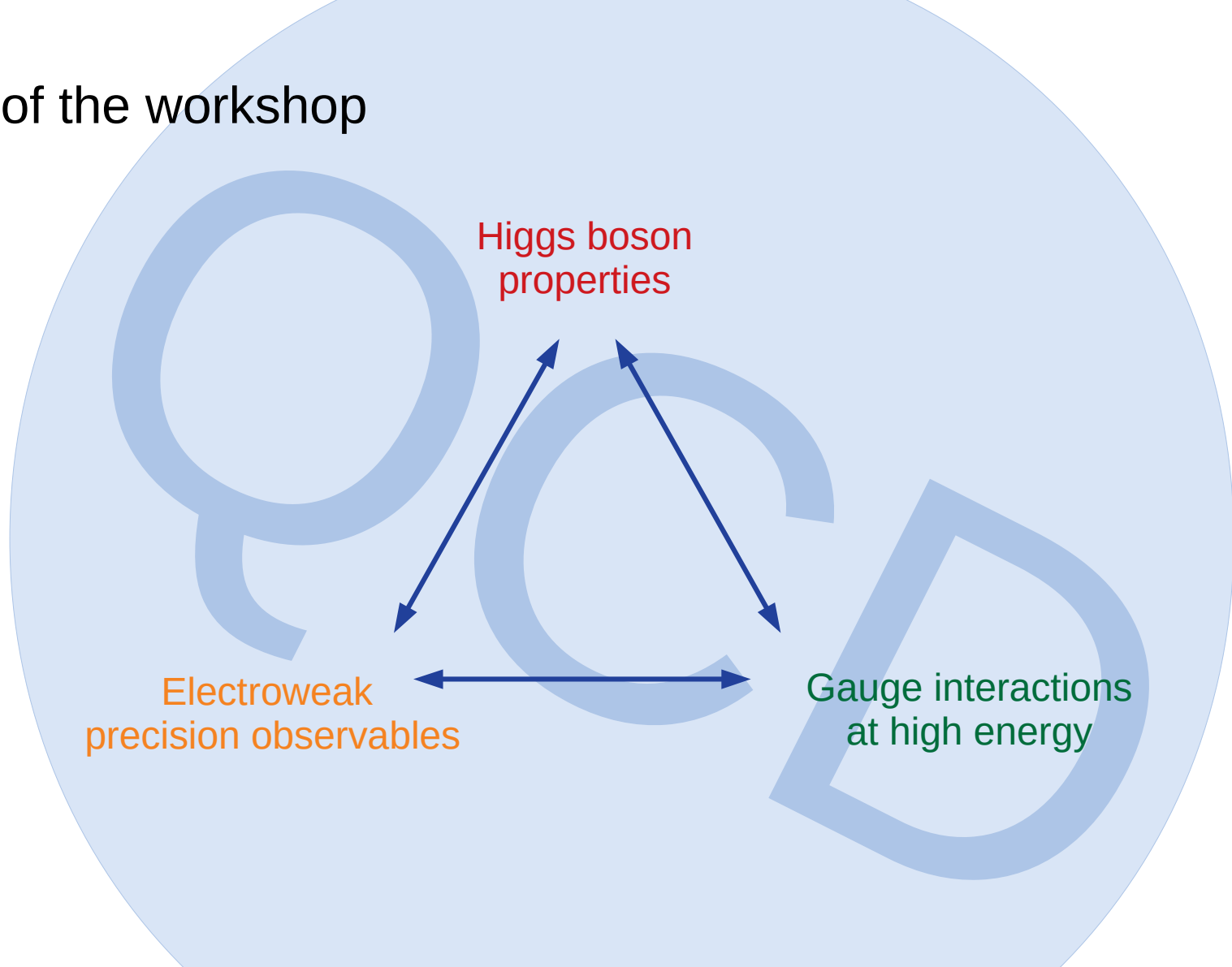
Channel	Prior	Lower limits on $\Lambda$ [TeV]							
		Left-Left		Left-Right		Right-Left		Right-Right	
		Const	Dest	Const	Dest	Const	Dest	Const	Dest
Obs: $ee$	$1/\Lambda^2$	36.9	24.0	33.0	26.1	32.8	26.3	32.6	26.3
Exp: $ee$		28.0	21.5	25.8	22.6	25.7	22.7	25.4	22.5
Obs: $ee$	$1/\Lambda^4$	31.7	22.3	28.9	24.0	28.6	24.1	28.7	24.1
Exp: $ee$		25.7	19.9	23.9	21.2	23.8	21.2	23.6	21.0
Obs: $\mu\mu$	$1/\Lambda^2$	29.8	20.3	27.8	22.0	27.5	22.4	27.5	20.4
Exp: $\mu\mu$		26.1	19.6	24.4	21.2	24.3	21.0	24.2	19.7
Obs: $\mu\mu$	$1/\Lambda^4$	26.7	18.9	25.1	20.7	25.0	20.9	24.9	19.0
Exp: $\mu\mu$		23.8	18.4	22.5	19.7	22.4	19.8	22.2	18.4
Obs: $\ell\ell$	$1/\Lambda^2$	40.1	25.4	35.7	27.5	35.1	27.5	35.2	27.7
Exp: $\ell\ell$		30.9	22.7	28.2	23.8	28.0	24.0	28.3	23.5
Obs: $\ell\ell$	$1/\Lambda^4$	35.2	23.5	31.8	25.1	31.5	25.3	31.4	25.2
Exp: $\ell\ell$		28.4	21.1	26.3	22.4	26.2	22.5	26.0	22.0



# Scope of the workshop



# Scope of the workshop



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Higgs boson  
properties

Optimize the scientific output of the LHC in the field of Electroweak Symmetry Breaking

Minimize theoretical and phenomenological uncertainties, especially related to QCD,  
with help of present and potential future projects on that timescale

And including inputs from present or accepted low-energy programs


precision observables

at high energy

# Context

- Many strong and longstanding efforts & working groups in this area :
  - PDF4LHC
  - LPCC : the Electroweak and Higgs cross-section working groups
  - Dedicated workshops on low-energy observables (g-2, etc)
  - Supporting/complementary experimental programs (low-energy experiments, deep inelastic scattering for better PDFs, theoretical calculations)
  - The recent HL-LHC Yellow Reports
- Our idea here is to rediscuss salient points, spot/fill gaps if any, and generally put this work into perspective over the timescale of the HL-LHC.

# Sessions

- 
- PDFs
    - J.Kretzschmar, K.Lipka, M.Ubiali
  - Electroweak precision observables
    - A.Vicini, M.Vesterinen, U.Blumenschein
  - Low-energy probes of electroweak symmetry breaking
    - C.Lehner, D.d'Enterria
  - Higgs properties and high-energy probes
    - G.Petruccinani, L.di Ciaccio, M.Grazzini
  - Global interpretation
    - N.Berger, A.Falkowski

# Talks & discussions

- General idea of the workshop : alternate long talks with in-depth discussions and more standard, workshop-like topical presentations. On average one day each, for each session
- Ample time for more topical meetings, brainstorming sessions, or any form of collaboration – you decide!
  - Coffee area on 1<sup>st</sup> floor (please wash your cups!)
  - Office space on 2<sup>nd</sup> floor – look for “electroweak”



# Outcome

- It is quite late, but our program is obviously of relevance for the ongoing update of the European strategy in high-energy physics. We ambition to contribute our conclusions and recommendations to this discussion.
- In this perspective, and in general to ensure that the discussions at the workshop are not lost, we propose to write a concise document formulating the questions and discussions that form a roadmap towards the ultimate precision at at the LHC and all conclusions reached during the workshop.

# Outcome

- Proposed (ambitious!) course of action:
  - For each session, the chairs prepare a 2-3 page document summarizing:
    - the main messages from their talks and discussions
    - Questions to address by the second iteration of this workshop (>summer 2020, TBD).
  - within one week after the end of the workshop, i.e. by December 13
- we would merge these contributions into an overall summary document, in consultation with the participants, during the following week. The overall size should stay within 15 pages. The result could hopefully be submitted to the arXiv before the end of year.
- Stub :
  - <https://fr.overleaf.com/2946667331tnchhfbmwjcx>

# Social events

- Tuesday 26/11 : dinner at restaurant Le Gramophone, Orsay
  - Please subscribe on the excel paper sheet in the main hall
- Thursday 28/11 : Happy hour at IPa – drinks and snacks
  
- Tuesday 3/12 : dinner at restaurant "Le Mangata", Bures-sur-Yvette
- Thursday 5/12 : Happy hour at IPa
  
- No organized excursions, but we are happy to give suggestions!
- Strike from Dec.5 – please let us know if you might be affected!!

# Thank you!!

- To the organizing committee & Advisory board for precious feedback and advice on the general structure of this workshop
- To the session chairs for defining a highly interesting program for all sessions, identifying and inviting speakers, and (in anticipation) for help with the write-up
- To Institut Pascal for hosting us, and to the staff who did an enormous effort helping us organize this program
- To all of you for joining us here and contributing your presentations and ideas. We wish you interesting discussions and a fruitful stay!