

ESR 17 - Elisa Mariani^{a,b,c} : Presentation

HiggsTools MidTerm Review

^a *Université Catholique de Louvain (CP3)*, ^b *Università degli Studi di Milano*
^c *Nikhef*,



ESR 17 - Elisa Mariani: Introduction

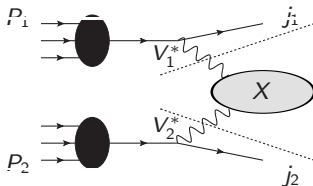
- Bachelor Degree in Physics at University of Milan: 2006-2009
 - Master Degree in Theoretical Physics at University of Milan: 2009-2011
 - Joint PhD at Université de Louvain (BE) and University of Milan: October 2011 up to now
 - HiggsTools member : November 2014 up to now at Nikhef, Amsterdam
Supervisors: Eric Laenen (Nikhef, NL), Fabio Maltoni (UCL, BE)
Collaborators: Claude Duhr (UCL, CERN)
- 1 October 2011 to April 2013 : UCL, Belgium
 - 2 April 2013 to October 2014: University of Milan, Italy
 - 3 November 2014 to now: Nikhef, Netherlands



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WP2: Predictions and Simulations of Signal and Background



$$X = h, H, H^+ H^-, hh, HH, \dots$$

■ Task 2.2: Improved predictions for non-standard electroweak symmetry breaking scenarios

1 Improving codes for 2HDMs through

- a) NNLO-QCD corrections to VBF production of 2HDMs final state
- b) Soft Resummation and small p_T treatments for NLO plus parton shower codes

2 NLO calculation for charged Higgs plus jets and loop-induced processes involving charged Higgs

■ Results M2.2.2: Precision calculations of non-standard Higgs boson scenarios 24.45

Main results obtained so far

■ Scientific Training:

- 1 First HiggsTools Summer School (Palleusieux, July 2015)

■ Conferences/Meeting

- 1 FOM Conference on General Physics (Veldhoven, January 2015)
- 2 First HiggsTools Annual Meeting (Freiburg, April 2015) → Talk 25' *Precision Physics for 2HDM's*
- 3 Amplitudes (Zurich, July 2015) → Poster
- 4 HPP Meeting (Nikhef) → Talk 30' *'Single Top@NNLO'*

■ Other training (soft skills):

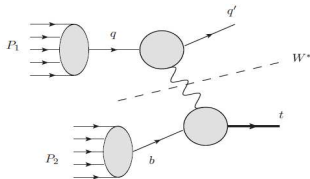
- 1 HiggsTools First Young Researchers Meeting (Durham, February 2015)
- 2 Dutch course (Amsterdam Spring 2015): level A1 (european classification)

■ PhD defense (19 October 2015), positive result

- 1 PhD project : Analytical computation of NNLO-QCD corrections to Single Top in t -channel

Outlook on Future Research Work - Vol.1

- **PhD** project *Single Top in t-channel at NNLO-QCD: an analytic approach*



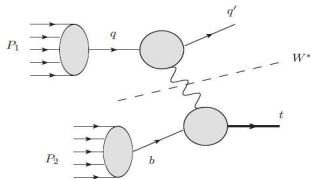
Set of Master Integrals needed to describe $q + b \rightarrow t + q' + X$

up to $\mathcal{O}(\alpha_s^2)$ computed analytically.

In collaboration with Dr. Claude Duhr (UCL, Be)

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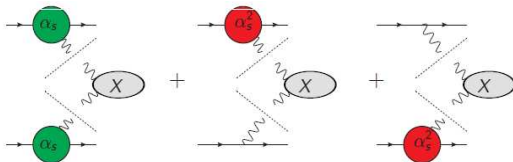
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Finalization of project (~ 2 months):

- 1 Renormalization of bare results \rightarrow Physical inclusive cross-section
- 2 Construction of precision benchmark of Single Top in t -channel: NNLO-QCD + Soft Resummation NNLL + NLO-EW corrections + m_b correction

Outlook on Future Research Work - Vol.2

- **HiggsTools** project: *Improvement of theoretical predictions for 2HDM models*

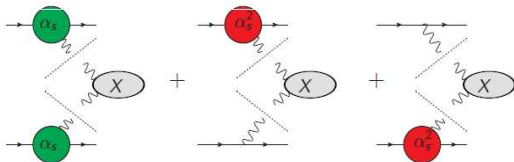


Step 1: Implement NNLO-QCD corrections to VBF production of scalar singlet state in 2HDM's in a Structure Function approach.

In collaboration with F. Maltoni (UCL, Be) and Theory Group at ULB (Université Libre de Bruxelles)

Outlook on Future Research Work - Vol.2

- **HiggsTools** project: *Improvement of theoretical predictions for 2HDM models*



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In collaboration with F. Maltoni (UCL, Be) and Theory Group at ULB (Université Libre de Bruxelles)

- PhD project n.2 : *Drell-Yan rapidity distribution resummed at small- x*
 - 1 Numerical computation
 - 2 Analytical computation: exploration of Master Integrals technique applied to small- x resummation

In collaboration with F. Caola (CERN), S. Marzani (U.Buffalo), S.Forte (UNIMI)

Secondments

- **Université Catholique de Louvain-la-Neuve** ~ once per month
 - 1 HiggsTools knowledge requires great amount of hard coding work (FORTRAN-PYTHON)
↓
 - 2 Collaboration with ULB and UCL Theory Group to aquire necessary knowledge in coding

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- **CERN February-March 2016**

- 1 Speed-up work in present projects (Single Top@NNLO, DY@small-x)

- 2 Beneficiate of CERN Theory Group environment to increase my knowledge and maybe entame new collaboration

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All secondments meant to build **complementary skill**
BG in Analytical computation (Mathematica) → Numerical computation

Outreach and Outlook on future career

Outreach:

Nikhef Open Dag for general public (10-2015): representative of Theory Group



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Future career

Both Academia and Private Sector are still open possibilities..

...very interested in the private sector

- 1 Theory in Practice Workshops: March-April 2015, NL
- 2 Physics with Industry 2015: 23-27 November 2015, NL
- 3 Shell: Spring 2016, NL

... thank you for your attention.