

# WG4: FLAVOUR

JURE ZUPAN  
U. OF CINCINNATI

## **Conveners:**

Jorge Martin Camalich - TH

Jure Zupan - TH

Alex Cerri - ATLAS

Sandra Malvezzi - CMS

Vladimir Gligorov - LHCb

HL/HE-LHC workshop, Fermilab, Apr 4th, 2018

# WG4: THE CHARGE

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- charge for WG4 is to assess the potential for flavor physics at HL/HE LHC
  - B/K/D/tau rare processes, mixings, etc.
- the end result: Yellow report (~150pp)
  - "HL/HE-LHC Physics Workshop Report  
WG4: Opportunities in Flavour Physics "

# STATUS OF THE WRITE-UP

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- the general structure is in place
- majority of core contributors have been solicited
- if you have not been contacted but would like to contribute please get in touch
- theory speakers at this meeting are either already contributors or will be asked shortly

# THE OUTLINE

*only TH contributors shown*

## **1 Vision**

**Author(s): G. Isidori (5pages)**

## **2 CKM Metrology and HL/HE questions for B physics**

**Author(s): Luca Silvestrini, Jerome Charles, Marco Ciuchini, Vincenzo Vagnoni, Sebastian Descotes-Genon, Olivier Deschamps**

(25 pages, TH:EXP= 50%:50%)

## **3 HL/HE questions for charm**

**Author(s): J. Brod, A. Lenz, S. Fajfer (15 pages, TH:EXP= 50%:50%)**

## **4 HL/HE questions for strangeness**

**Author(s): G. D'Ambrosio, Teppei Kitahara (5 pages, TH:EXP= 50%:50%)**

## **5 HL/HE questions for taus**

**Author(s): M. Gonzalez-Alonso, Vincenzo Cirigliano, Adam Falkowski (5 pages, TH:EXP= 50%:50%)**

# THE OUTLINE

*only TH contributors shown*

## **6 Spectroscopy**

**Author(s): A. Polosa, J. Nieves, Feng-Kun Guo, Sasa Prelovsek** (10 pages, TH:EXP= 50%:50%)

## **7 Implications of flavor anomalies and future sensitivities**

**Author(s): J. Virto, D. Straub, D. Robinson, S. Schacht, Martin Jung** (10 pp, TH:EXP= 50%:50%)

## **8 Flavor aspects of top physics**

**Author(s): Frederic Deliot, Gauthier Durieux, Mariel Estevez, Darius Faroughy, Jernej F. Kamenik, Fabio Maltoni, Eleni Vryonidou, Cen Zhang** (10 pages, TH:EXP= 50%:50%)

## **9 Flavor aspects of Higgs**

**Author(s): F. Bishara, Y. Soreq, M. Schlafer, R. Harnik** (anticipated length 10 pages)

## **10 High $p_T$ searches in the context of the flavor anomalies**

**Author(s): Alejandro Celis, Tevong You, Marco Nardecchia, Admir Greljo** (anticipated length 10 pages)

## **11 Summary of theory + experimental outlook**

# MECHANICS OF WRITING

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- the main repository for the project is [Overleaf](#)
- to use it register for free at [www.overleaf.com](http://www.overleaf.com)
  - allows people to work simultaneously on the report
- two main ways to use [Overleaf](#)
  - work directly through the web interface
    - instantaneous compilation of Latex
  - can use [git](#), with the usual git commands
- more detailed instructions available in .pdf file from conveners (or contributors)

HL/HE LHC Meeting (04-April 6, 2018)

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HL/HE-LHC WG4 Yellow Report - Overleaf

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\main if needed

\documentclass[../report.tex]{subfiles}

\providecommand{\main}{..}

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\begin{document}

\section{CKM Metrology and HL/HE questions for B physics}

{\bf Author(s): Luca Silvestrini, Jerome Charles, Marco Ciuchini, Vincenzo Vagnoni, Sebastian Descotes-Genon, Olivier Deschamps}\\

(25 pages, TH:EXP= 50\%:50\%)

\subsection{Tree-level determinations of CKM elements}

\subsubsection{\$V\_{ub}\$}

\subsubsection{\$V\_{cb}\$}

\subsubsection{Angle Beta}

\subsubsection{Angle Gamma}

\subsubsection{...}

\subsection{\$\Delta F=2\$ processes and unitarity triangle}

\subsection{Future of inputs from charm and \$K-\bar K\$ mixing}

\subsection{Experimental prospects (including interplay with Belle II)}

\subsubsection{\$V\_{ub}\$ and \$V\_{cb}\$ from semileptonic}

\subsubsection{Time-integrated tree-level measurements of \$\gamma\$ (including prospects with neutral and high-multiplicity modes)}

2 CKM Metrology and HL/HE questions for B physics

Author(s): Luca Silvestrini, Jerome Charles, Marco Ciuchini, Vincenzo Vagnoni, Sebastian Descotes-Genon, Olivier Deschamps

(25 pages, TH:EXP= 50%:50%)

2.1 Tree-level determinations of CKM elements

2.1.1  $V_{ub}$

2.1.2  $V_{cb}$

2.1.3 Angle Beta

2.1.4 Angle Gamma

2.1.5 ...

2.2  $\Delta F = 2$  processes and unitarity triangle

2.3 Future of inputs from charm and  $K - \bar K$  mixing

2.4 Experimental prospects (including interplay with Belle II)

2.4.1  $V_{ub}$  and  $V_{cb}$  from semileptonic

2.4.2 Time-integrated tree-level measurements of  $\gamma$  (including prospects with neutral and high-multiplicity modes)

2.4.3 Time-integrated loop-level measurements of  $\gamma$

2.4.4 Time-dependent measurements of  $\gamma$

2.4.5 Gamma combination and impact of external inputs

2.4.6 Loop level measurements of  $\gamma$  and comparison with tree-level

2.4.7 Determinations of  $\Delta m_s$ ,  $\Delta m_d$ , and interplay with b-hadron lifetimes

2.4.8 Semileptonic asymmetries and prospects for  $\Delta \Gamma_d$

2.4.9 Measurements of  $\phi_d$  and  $\phi_s$ , including prospects for LHC-only  $\phi_s$  combination, and prospects for  $B_s \rightarrow \phi \phi$  for CMS/ATLAS at HL-LHC

2.4.10 Measurements of  $\alpha$

2.5 Combined th/exp perspective on future of global CKM fits

J. Zupan WG4: Flavour

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HL/HE-LHC, Fermilab, Apr 4 2018

# STRUCTURE OF WG4

## PARALLEL SESSIONS

### Wed afternoon 3.30-4.00pm

15:30 - 16:00

**Perspectives on flavor at HE/HL LHC** Zoltan LIGETI

IARC 1WA/B First Floor, Fermilab 16:00 - 16:25

**B physics measurements at HE/HL LHC** Dr. Daniel CRAIK

IARC 1WA/B First Floor, Fermilab 16:30 - 16:55

**Belle 2 physics overview** Dr. Alan SCHWARTZ

IARC 1WA/B First Floor, Fermilab 17:00 - 17:25

### Thu morning 9.00-10.30am

**b- $\rightarrow$  c tau nu and high pT** Dr. Marat FREYTSIS

IARC First Floor Lecture Hall, Fermilab 09:00 - 09:18

**b- $\rightarrow$  s mumu and high pT** Wolfgang ALTMANNSHOFER

**Flavor observables at HE/HL LHC in view of anomalies** Brian HAMILTON

**Experimental searches at high pT in view of flavor anomalies** Dr. Kerstin HOEPFNER

### Thu afternoon 2.00-3.30pm

**HL/HE Detector challenges for LHCb** Matthew RUDOLPH

IARC 1WA/B First Floor, Fermilab 14:00 - 14:25

**ATLAS+CMS detector challenges for flavor** Yangyang CHENG

IARC 1WA/B First Floor, Fermilab 14:30 - 14:55

**HL/HE LHC perspectives on taus** Emilie PASSEMAR

### Thu afternoon 3.30-5.00pm

**HL/HE LHC perspectives on charm** Alexander KAGAN

IARC First Floor Lecture Hall, Fermilab 16:00 - 16:23

**Future of charm, strangeness, tau at LHCb** Miguel RAMOS PERNAS

IARC First Floor Lecture Hall, Fermilab 16:28 - 16:51

**tau- $\rightarrow$ 3 mu at ATLAS**

IARC First Floor Lecture Hall, Fermilab

**tau- $\rightarrow$ 3 mu at CMS** Prof. Kajari MAZUMDAR

IARC First Floor Lecture Hall, Fermilab 17:13 - 17:27

# STRUCTURE OF WG4

## PARALLEL SESSIONS

Wed afternoon 3<sup>rd</sup>

Fri morning 9.00-10.30am

Afternoon 2.00-3.30pm

<p><b>Perspectives on flavor at HE/HL LHC</b></p> <p>IARC 1WA/B First Floor, Fermilab</p>	<p><b>TH perspective on Higgs and Flavour</b> Emmanuel STAMOU</p> <p><b>TH perspective on CP violation in Higgs Couplings (tau, ttH)</b> Adam MARTIN</p> <p>IARC First Floor Lecture Hall, Fermilab</p>	<p><b>Challenges for</b> Matthew RUDOLPH</p> <p>Floor, Fermilab 14:00 - 14:25</p>
<p><b>B physics measurements at HE/HL LHC</b></p> <p>IARC 1WA/B First Floor, Fermilab</p>	<p><b>EXP prospects for charm tagging and the Higgs</b> Dr. Daniel CRAIK</p> <p><b>EXP prospects for Higgs and CPV</b> Ms. Isobel OJALVO</p> <p>IARC First Floor Lecture Hall, Fermilab 10:08 - 10:30</p>	<p><b>Factor challenges</b> Yangyang CHENG</p> <p>Floor, Fermilab 14:30 - 14:55</p>
<p><b>Belle 2 physics overview</b></p> <p>IARC 1WA/B First Floor, Fermilab</p>	<p><b>Anomalous tWb couplings and HL/HE LHC</b> Wouter DEKENS</p> <p><b>Flavor aspects of ATLAS+CMS top program</b> Alexander KHANOV</p> <p>IARC 1WA/B First Floor, Fermilab</p>	<p><b>pectives on taus</b> Emilie PASSEMAR</p> <p><b>pectives on</b> Alexander KAGAN</p> <p>re Hall, Fermilab 16:00 - 16:23</p>
<p><b>b<math>\rightarrow</math>c tau nu and high pT</b></p> <p>IARC First Floor Lecture Hall, Fermilab</p>	<p><b>Lepton flavor violation at the LHC</b> Prof. Alexey PETROV</p> <p><b>Spectroscopy questions for HL/HE LHC</b> Tomasz SKWARNICKI</p>	<p><b>LHCb</b> Miguel RAMOS PERNAS</p> <p>re Hall, Fermilab 16:28 - 16:51</p>
<p><b>Flavor observables at HE/HL LHC in view of anomalies</b></p> <p><b>Experimental searches at high pT in view of flavor anomalies</b></p>		<p><b>S</b></p> <p>re Hall, Fermilab</p> <p><b>Prof. Kajari MAZUMDAR</b></p> <p>re Hall, Fermilab 17:13 - 17:27</p>

Fri morning 11.00am-12.30pm

Afternoon 3.30-5.00pm

Thu morning 9.00am

# FUTURE

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- in May will have a few short online vidyo meetings for each of the chapters
- 18-20 June 2018 a workshop at CERN

# CONCLUSIONS

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- the work on WG4 Yellow report has only started
- you are welcome to join the effort

# BACKUP SLIDES