# The Strange Quark as a probe for new Physics in the Higgs Sector

*Matt Basso* (U. of Toronto)

*Valentina Maria Martina Cairo* (CERN)

# On the Arxiv!

https://arxiv.org/abs/2203.07535

*[Submitted on 14 Mar 2022]*

## Strange quark as a probe for new physics in the Higgs sector

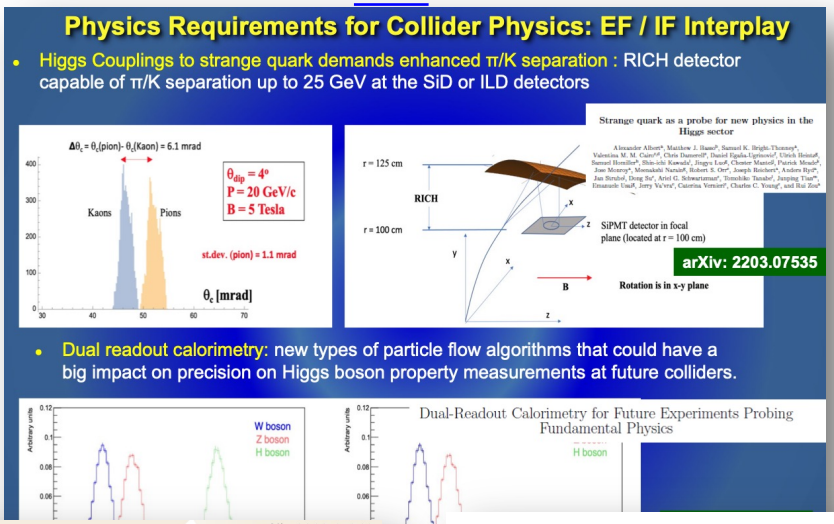
Alexander Albert, Matthew J. Basso, Samuel K. Bright-Thonney, Valentina M. M. Cairo, Chris Damerell, Daniel Egana-Ugrinovic, Ulrich Heintz, Samuel Homiller, Shin-ichi Kawada, Jingyu Luo, Chester Mantel, Patrick Meade, Jose Monroy, Meenakshi Narain, Robert S. Orr, Joseph Reichert, Anders Ryd, Jan Strube, Dong Su, Ariel G. Schwartzman, Tomohiko Tanabe, Junping Tian, Emanuele Usai, Jerry Va'vra, Caterina Vernieri, Charles C. Young, Rui Zou

Also ILD-PHYS-PROC-2022-001

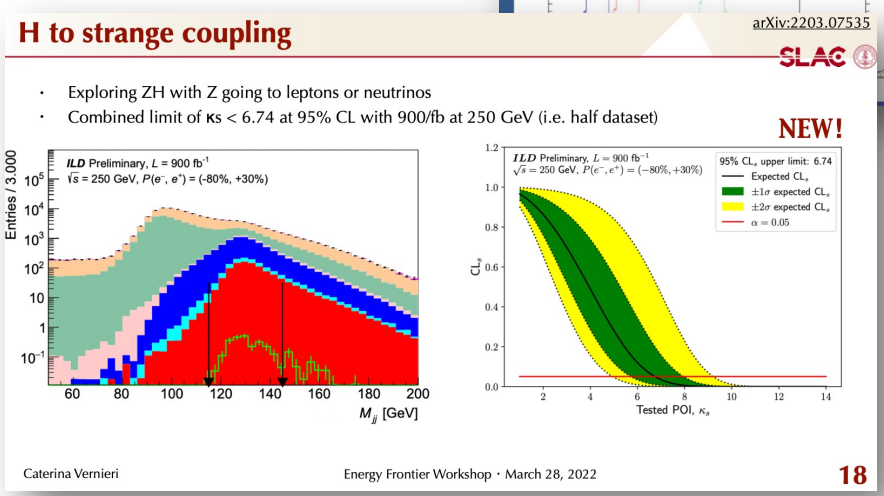
# In the past month…

- Our work very well highlighted in the Snowmass Energy Frontier Workshop…
  - March 28- April 1 https://indico.fnal.gov/event/52465/

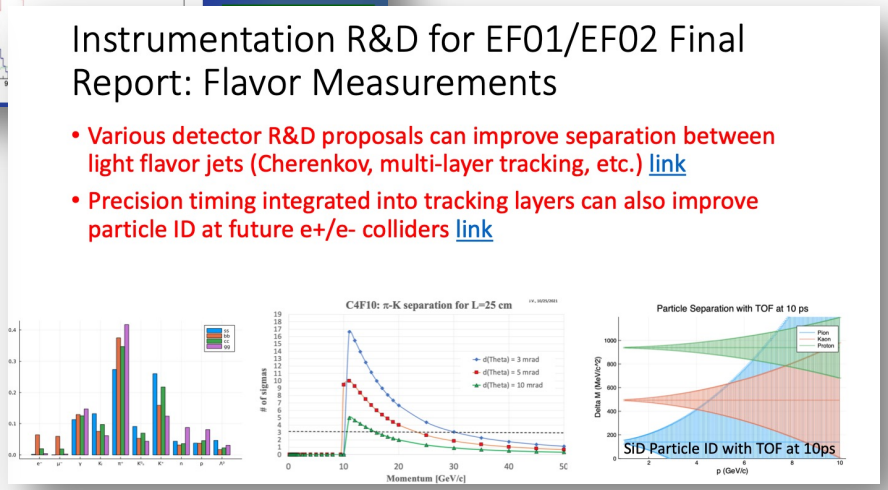
Talk




Talk




Talk



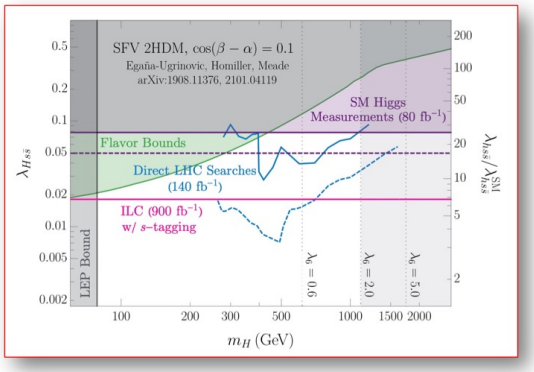
# In the past month…

- …and beyond Snowmass!

ECFA Seminar

## Summary and Outlook (1)

- The ordinary matter is composed by electron and light quarks – **none of the Higgs boson couplings to such particles has been verified yet!**
- Testing Yukawa universality is a **key benchmark** for future Higgs factories
- The most stringent constraints on the **strange Yukawa** have been derived via a direct SM $h \to ss$ search: phase space for new physics reduced down to $k_s \sim 6x\ SM$




- Higgs *& friends* Factories: **Z, W, top, flavor physics in general…**
- Many unexplored physics benchmarks rely on **strange tagging**, in turn enabled by $\pi$ **high momenta**

April 8th 2022 V. M. M. Cairo

DIS 2022

## Strange Quark as a probe for new physics in the Higgs sector

XXIX International Workshop on Deep-Inelastic Scattering and Related Subjects – May 5, 2022

**Matthew Basso** (University of Toronto),
On behalf of the authors of the associated Snowmass 2021 paper and the ILD Concept Group

UNIVERSITY OF TORONTO

SnowMass2021


Plus FCC workshop, C3, etc…

# A side note

## Feb. 15th

Dear colleague

As you know a broad international discussion is ongoing on the best way to realize a Higgs factory as the future project in particle physics. A number of projects are being discussed, ILC of course, CLIC, FCC-ee, CEPC, others. In Europe ECFA has launched a study on the science capabilities of such a facility, similar efforts are underway in other regions of the world.

At the same time the Japanese government starting last year had organized a review of the ILC project as a project hosted in Japan. Preliminary conclusions indicate that Japan will not come forward with a bid to host ILC in the near future, and will currently not support the formation of a pre-lab as proposed about a year ago.

This new situation clearly poses questions to ILD as a collaboration which up to now had a strong focus on the ILC project.

**After a discussion in the ILD management, and a presentation and discussion with the general ILD group we like to propose that ILD starts a strategy process to define its future in this changed world.** There was a broad agreement by the people present in the recent ILD meeting, **that ILD as a group has a significant offer to make to the global effort towards an Higgs factory and that it is worth to re-direct the know-how and accumulated experience in ILD towards a broader community of people supporting electron positron colliders**. Being able to study the science capabilities of these facilities, to compare different options, and to do this in the context of a well-developed integrated detector concept is seen as a significant advantage and added value which ILD can deliver.

We therefore like to start a process in ILD to more clearly understand our position, to understand how we can move forward to become engaged in other collider projects not just ILC, and in general develop a view on the future development of ILD.

**We will start this with a series of (virtual) ILD meetings, where we will look at ILD, its state, the different projects which are under discussion,** and try to understand how ILD could be integrated into these concepts. The first of these meetings will be on Tuesday, March 1, at the slot of our regular ILD group meetings.

**The results from these open meetings will then be combined by a strategy group consisting of the ET and the working group conveners into a strategy document for ILD, which will describe the future direction of ILD, including a work plan on how to proceed. We anticipate that the process will be finished early in summer 2022.**

At the end of the process shall then be a plan, broadly discussed in ILD, which will then be formally endorsed by the institute assembly.

Please get in touch with us (ild-et@desy.de) if you want to make your opinion known, have a question, or have suggestions on how to shape the process.

Best regards, Ties

Dr. Ties Behnke
DESY-FH
HTel +49 40 89984918
e-mail Ties.Behnke<at>desy.de

March 1st: ILD Strategy discussion Part I: https://agenda.linearcollider.org/event/9623/
March 22nd: ILD Strategy discussion Part II: https://agenda.linearcollider.org/event/9624/

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**Very important for us to keep these studies as general as possible!**

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# Next steps

- **Update the arxiv paper with some fixes, additional plots etc**
  - Discussed more in the next talk(s)

- **ILD supports us moving forward to a paper publication**

- A few outstanding points that would need to be added:

  **1. The additional polarization scenarios to be able to perform the analysis on the full 2000 fb-1 dataset.**
  This is the most urgent item, and the sample production is ongoing.
  Since we have to produce miniDST again for this, it might also be a chance to actually include the proper dE/dx info now and study how it compares to our truth PID results. Uli is actually helping us with this.

  On the wish list we also have:

  2. Alternative network for Flavour Tagging (studies are ongoing)
  3. H->cs analysis (studies have started on generating the events)

Agreed with ILD to wait until at least 1. is in place before initiating a paper review process