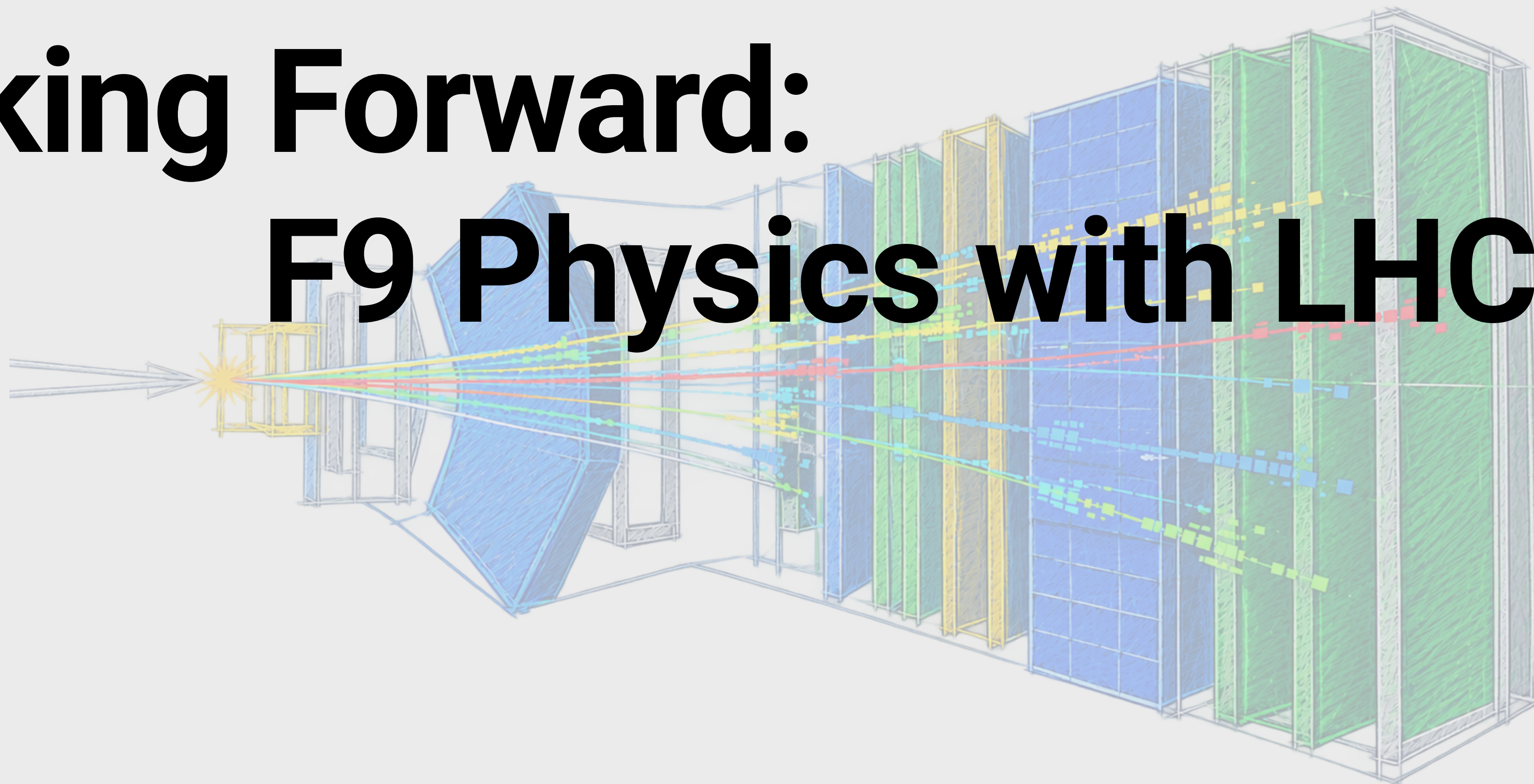


Looking Forward: F9 Physics with LHCb



Contents

- LHCb experiment
- LHCb collaboration
- History of F9 involvement
- Short-term physics and computing plans
- Long-term plans



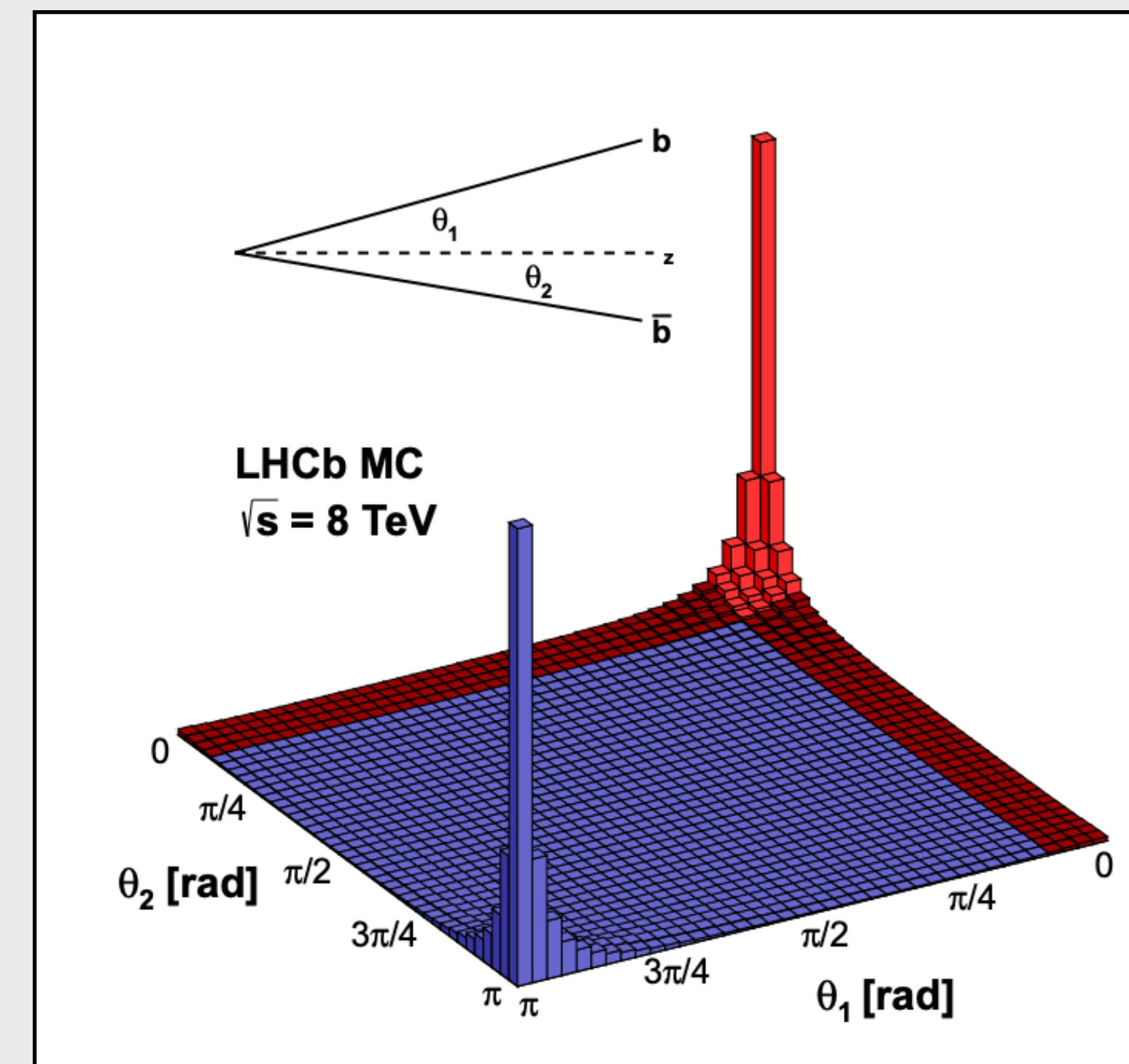
LHCb Experiment

LHCb experiment basics

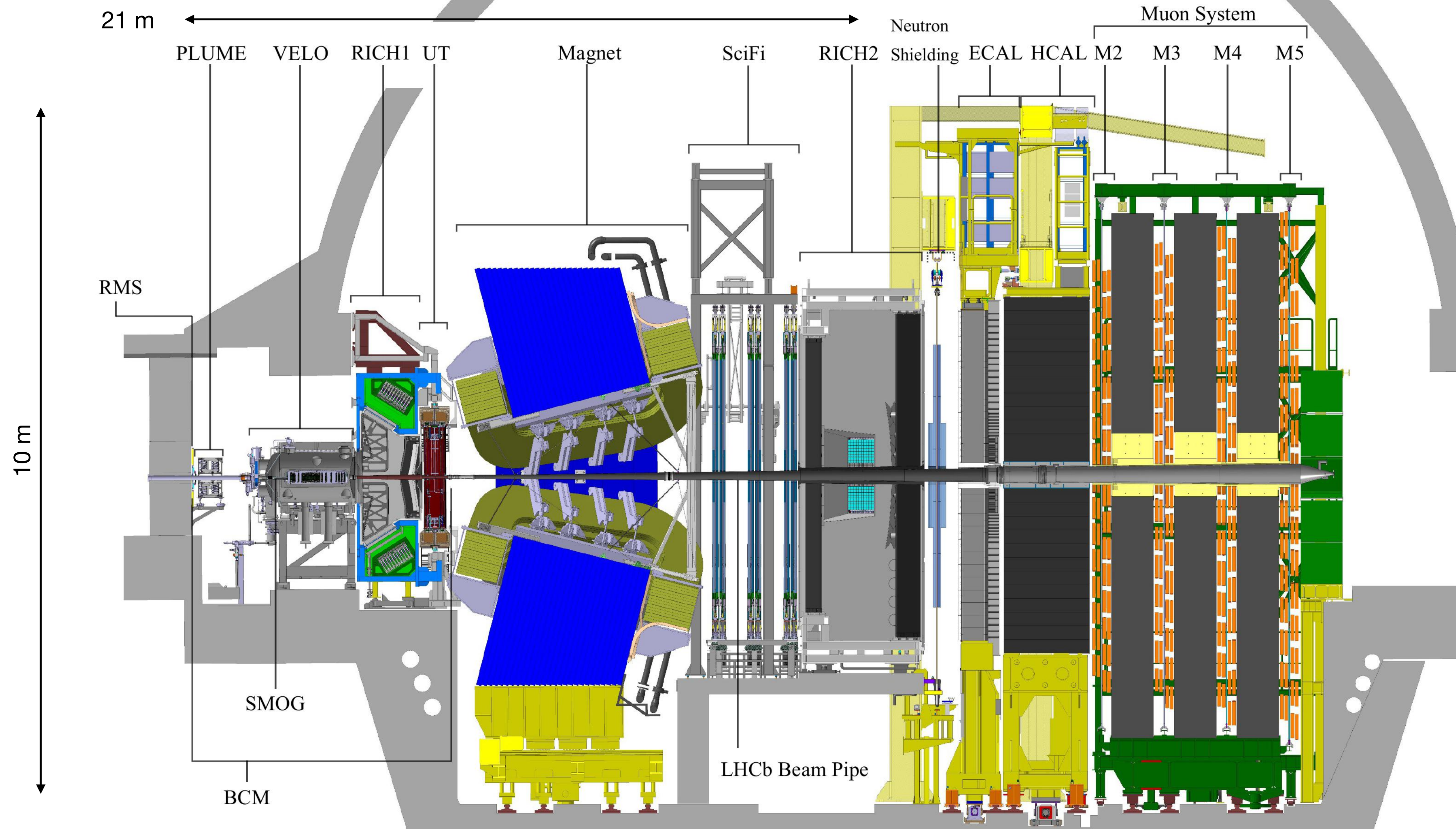


- LHCb is a **single-arm forward region spectrometer** located at the interaction point 8 of the LHC, covering the pseudorapidity range $2 < \eta < 5$, ie. $\theta \in [0.8^\circ, 15.4^\circ]$.
- The choice of detector geometry is justified by the fact that both b and $\bar{b}$ **hadrons are predominantly produced** in the same **forward or backward cone**.
 - “If our collaboration had the budget of the ministry of defence we would probably have built two LHCb detectors, to catch both the forward and backward pairs.” [[arXiv:2005.11226](https://arxiv.org/abs/2005.11226)]
- **Excellent performance** of the detector allowed the **physics program to be extended** very rapidly to explore also charm, electroweak, and even heavy ion physics.

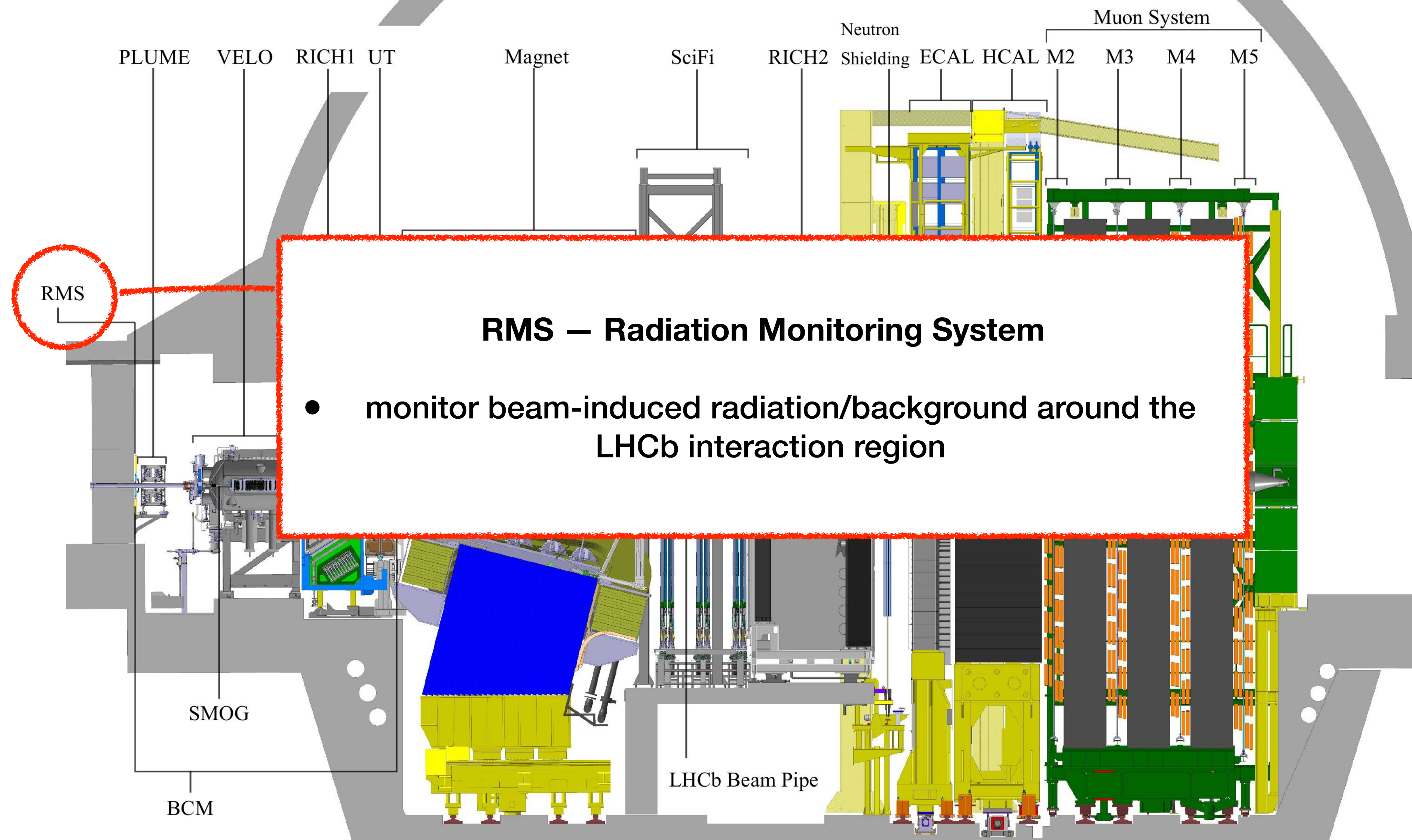
 - LHCb acceptance



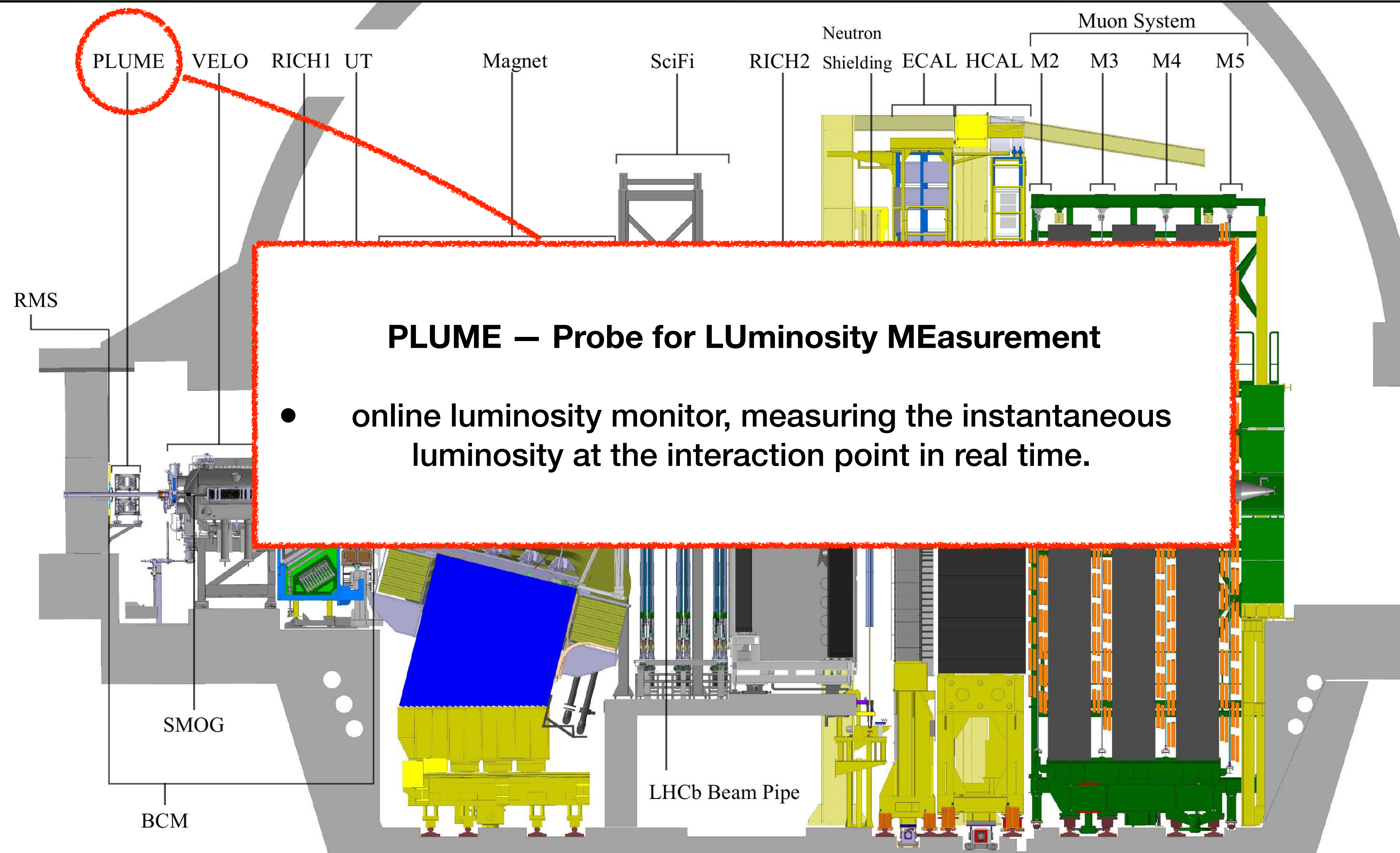
LHCb experiment layout



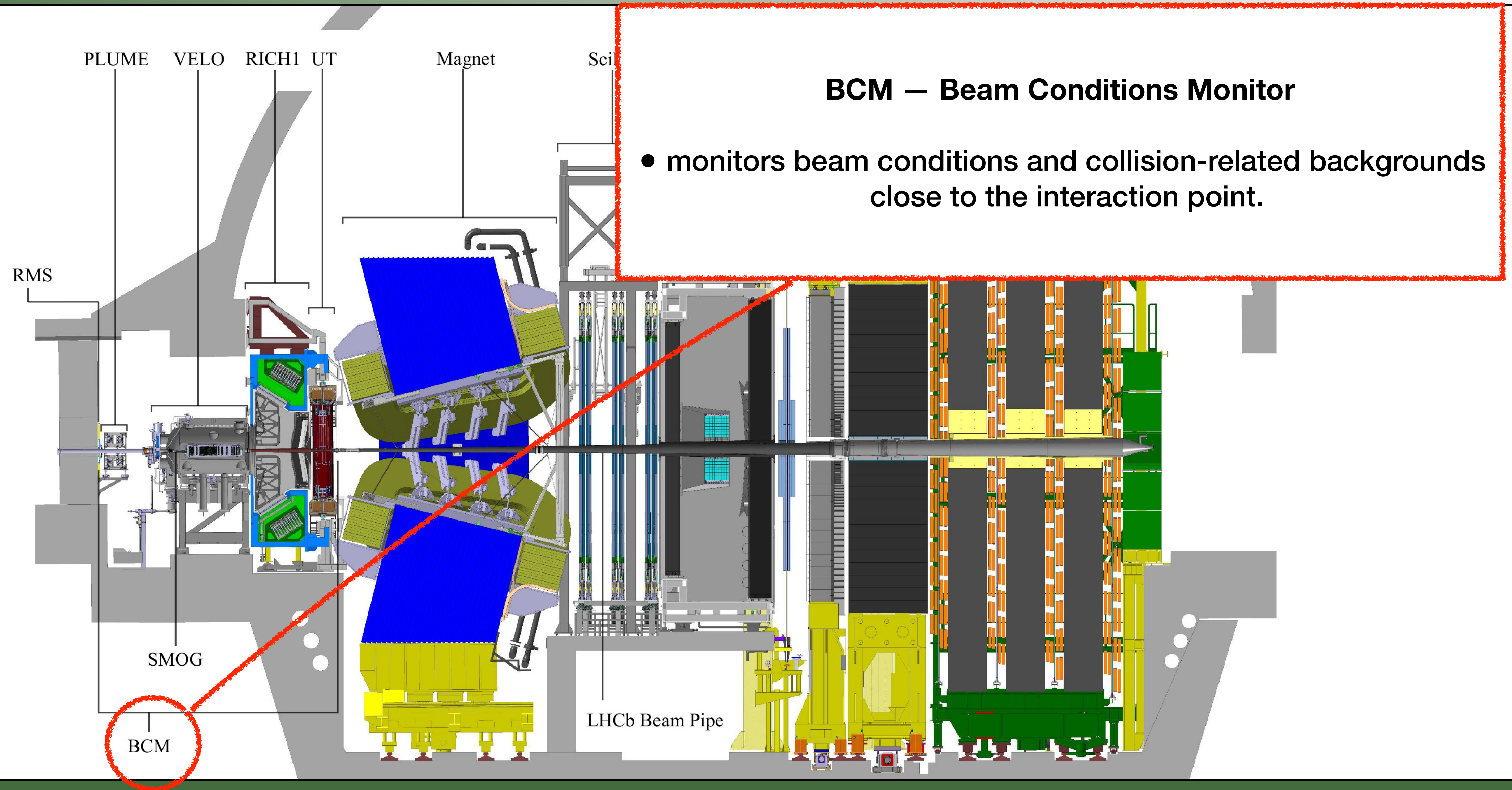
LHCb experiment layout



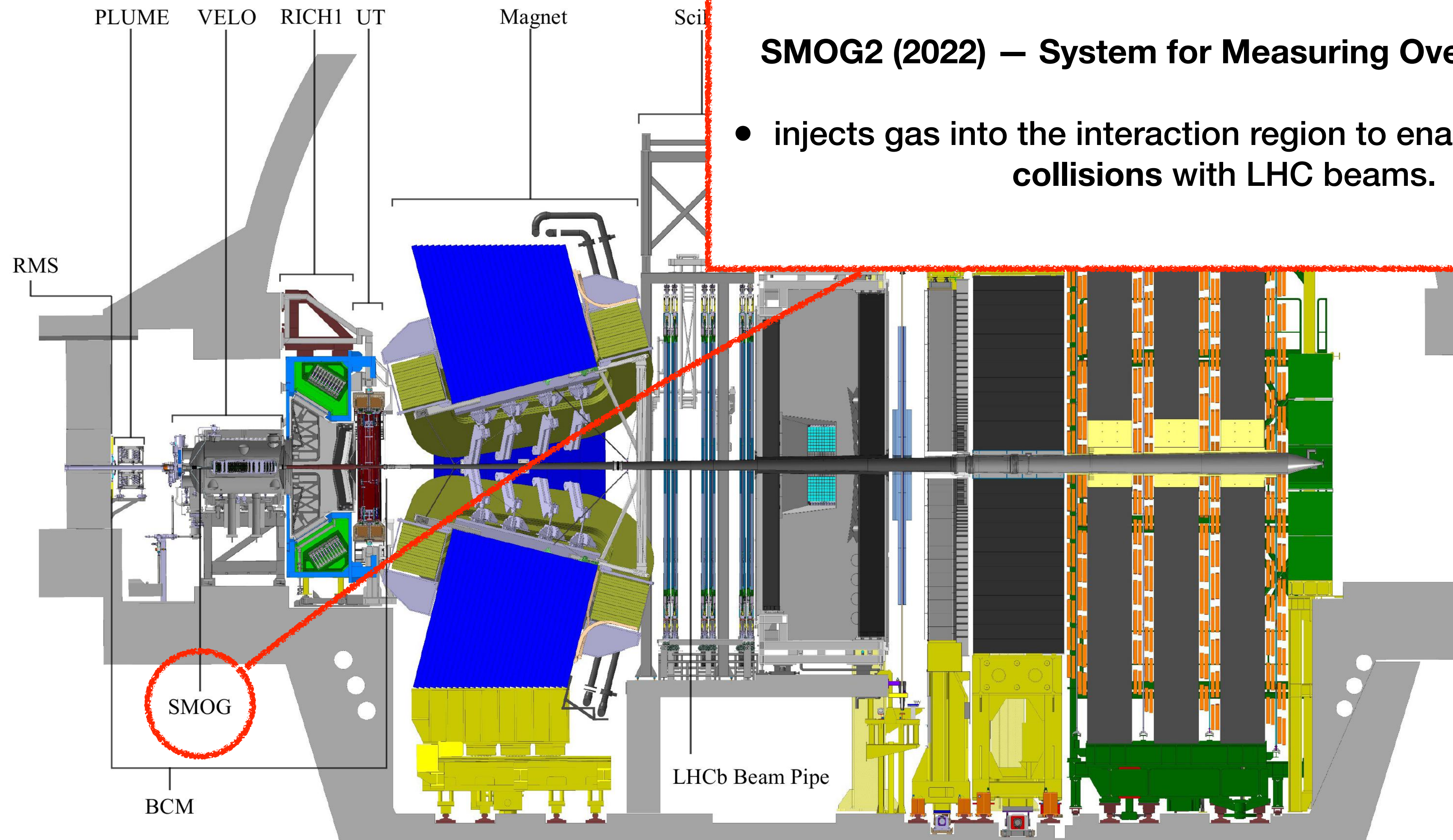
LHCb experiment layout



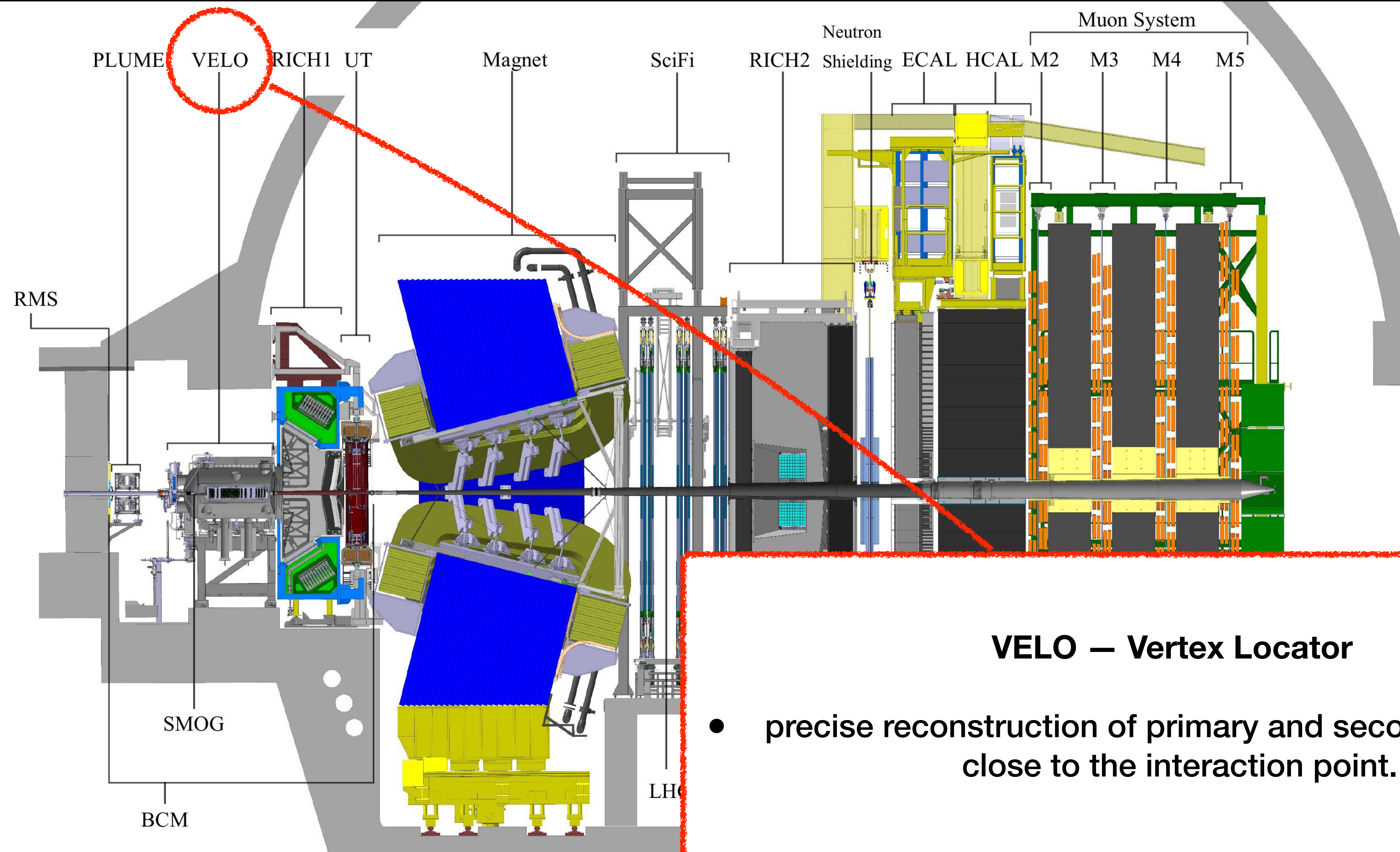
LHCb experiment layout



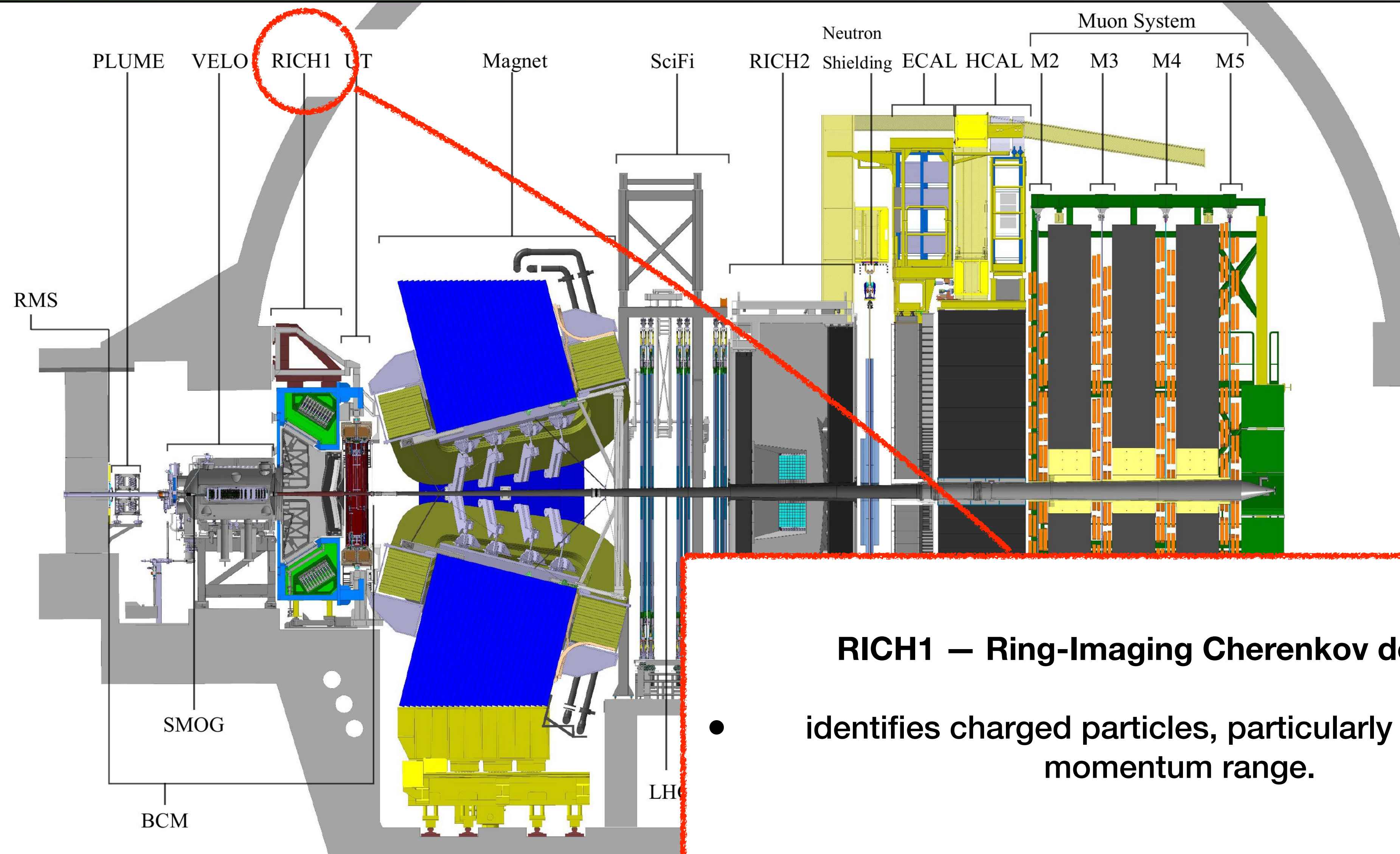
LHCb experiment layout



LHCb experiment layout



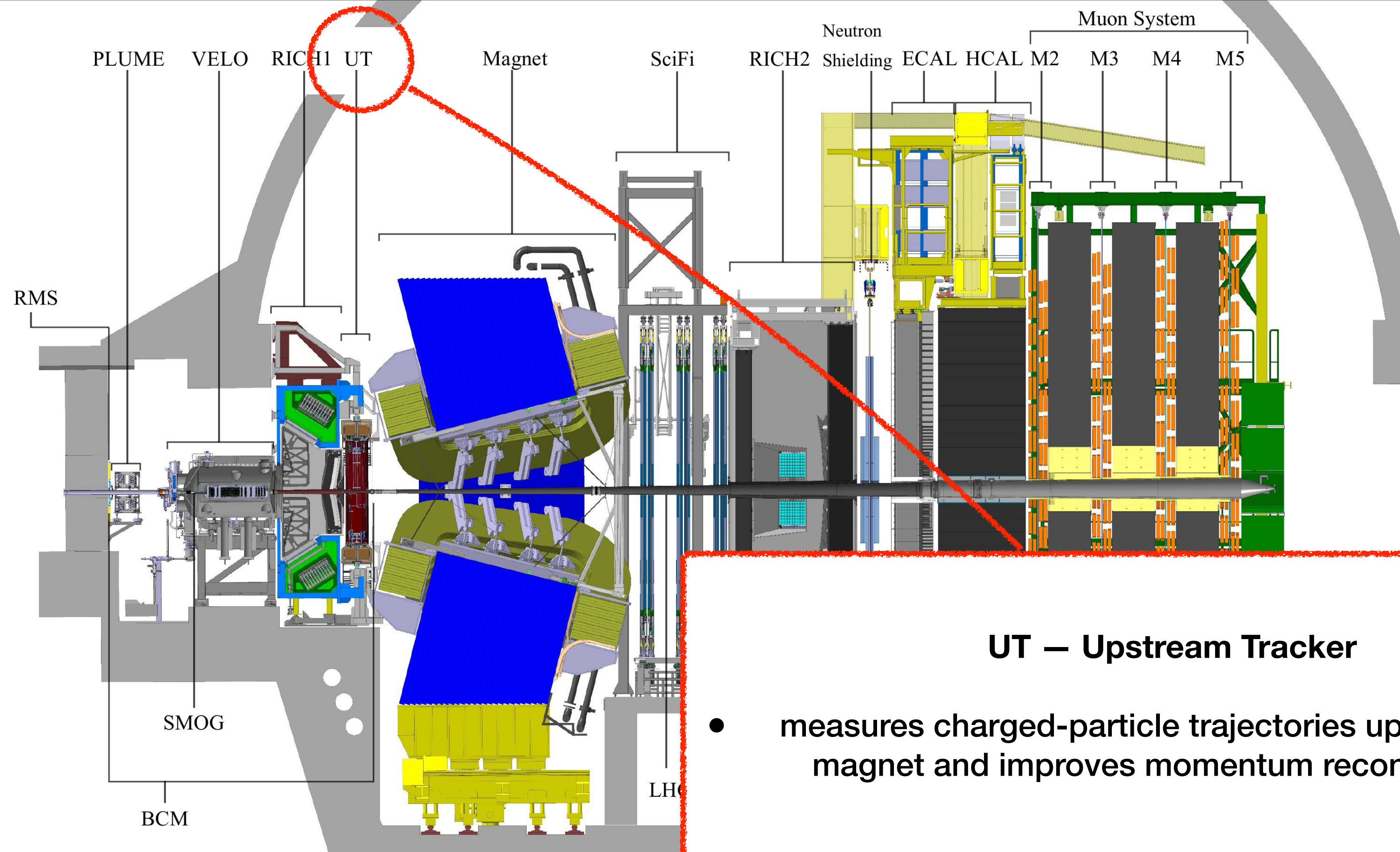
LHCb experiment layout



RICH1 — Ring-Imaging Cherenkov detector

- identifies charged particles, particularly in the lower momentum range.

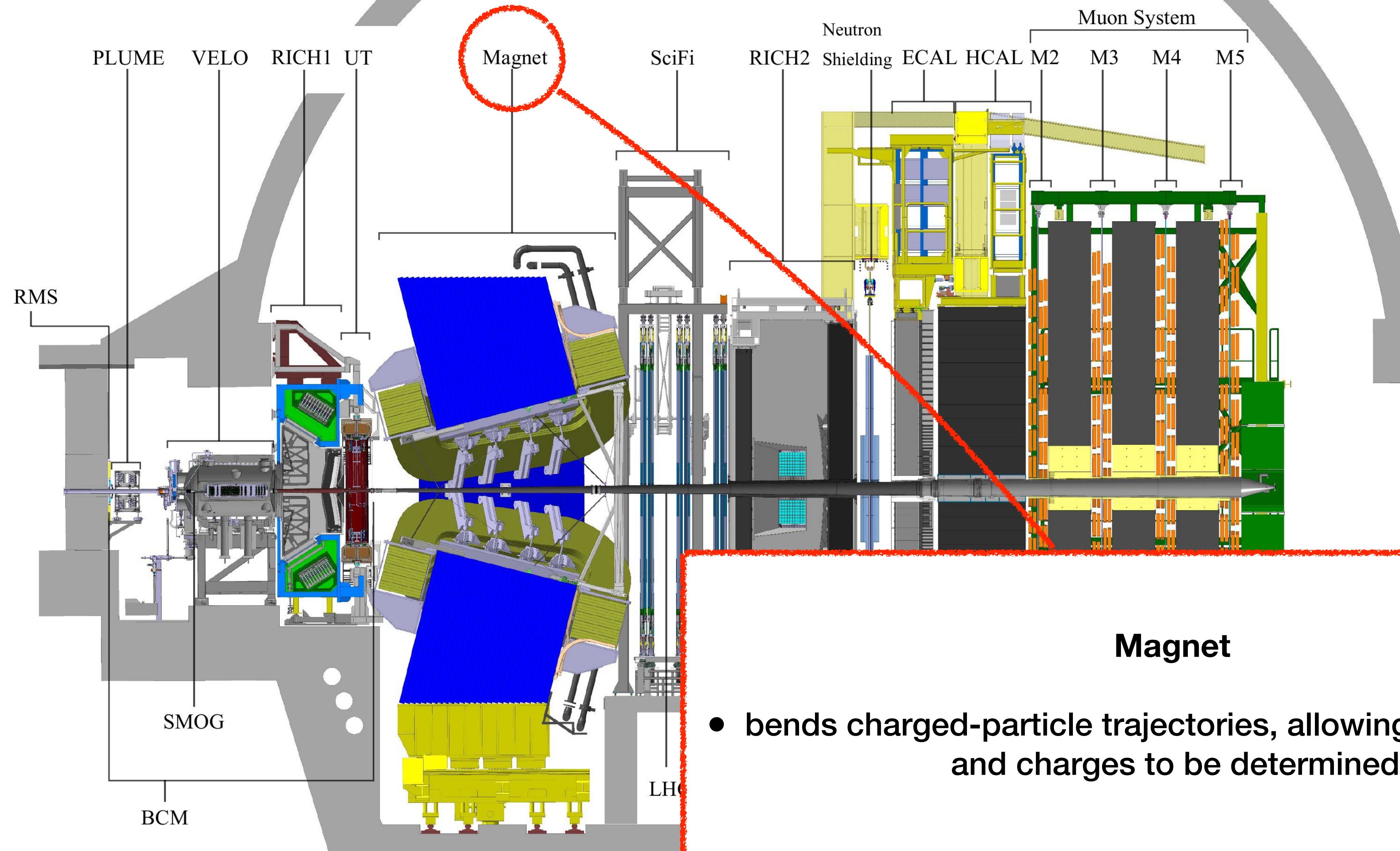
LHCb experiment layout



UT – Upstream Tracker

- measures charged-particle trajectories upstream of the magnet and improves momentum reconstruction.

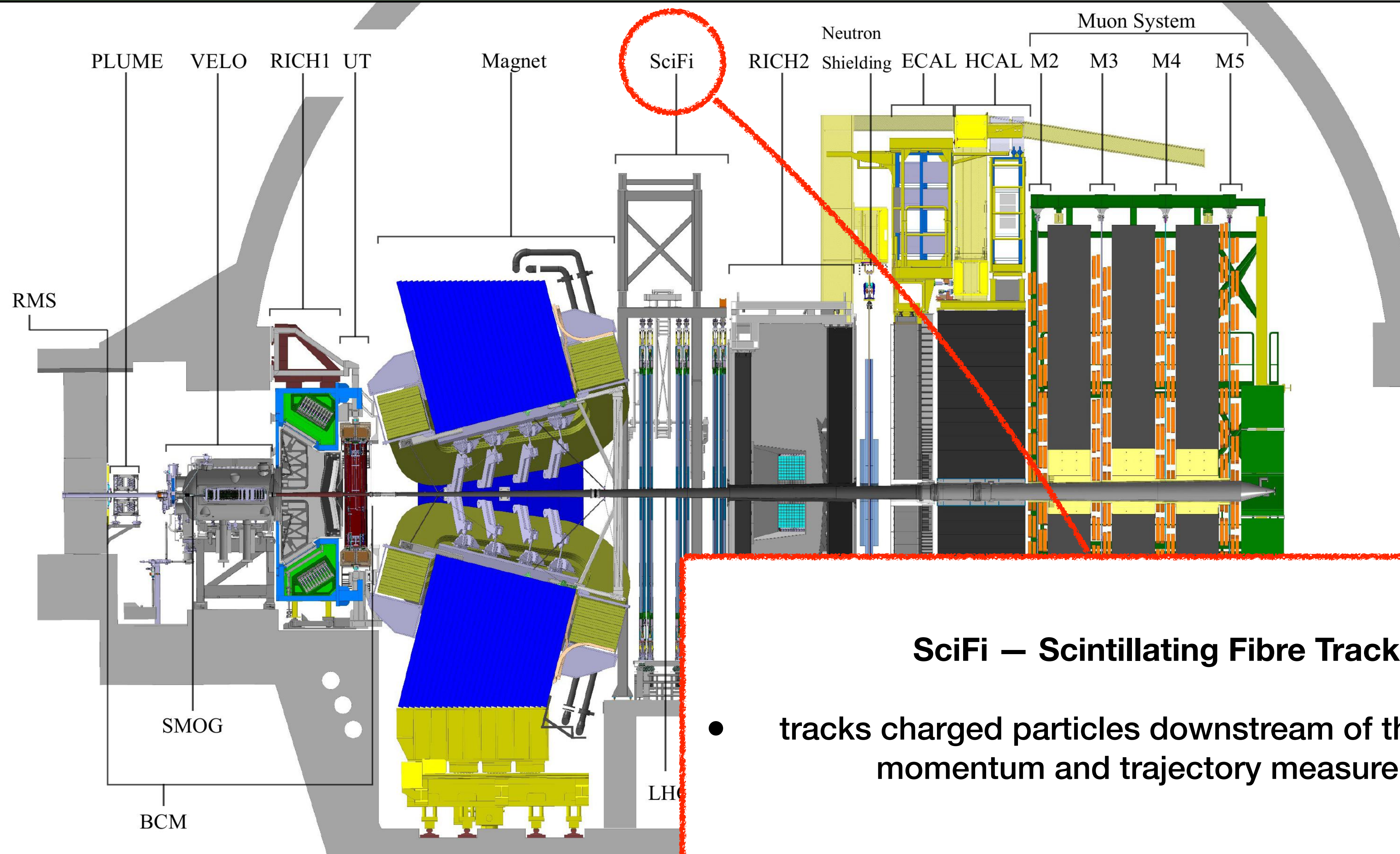
LHCb experiment layout



Magnet

- bends charged-particle trajectories, allowing their momenta and charges to be determined.

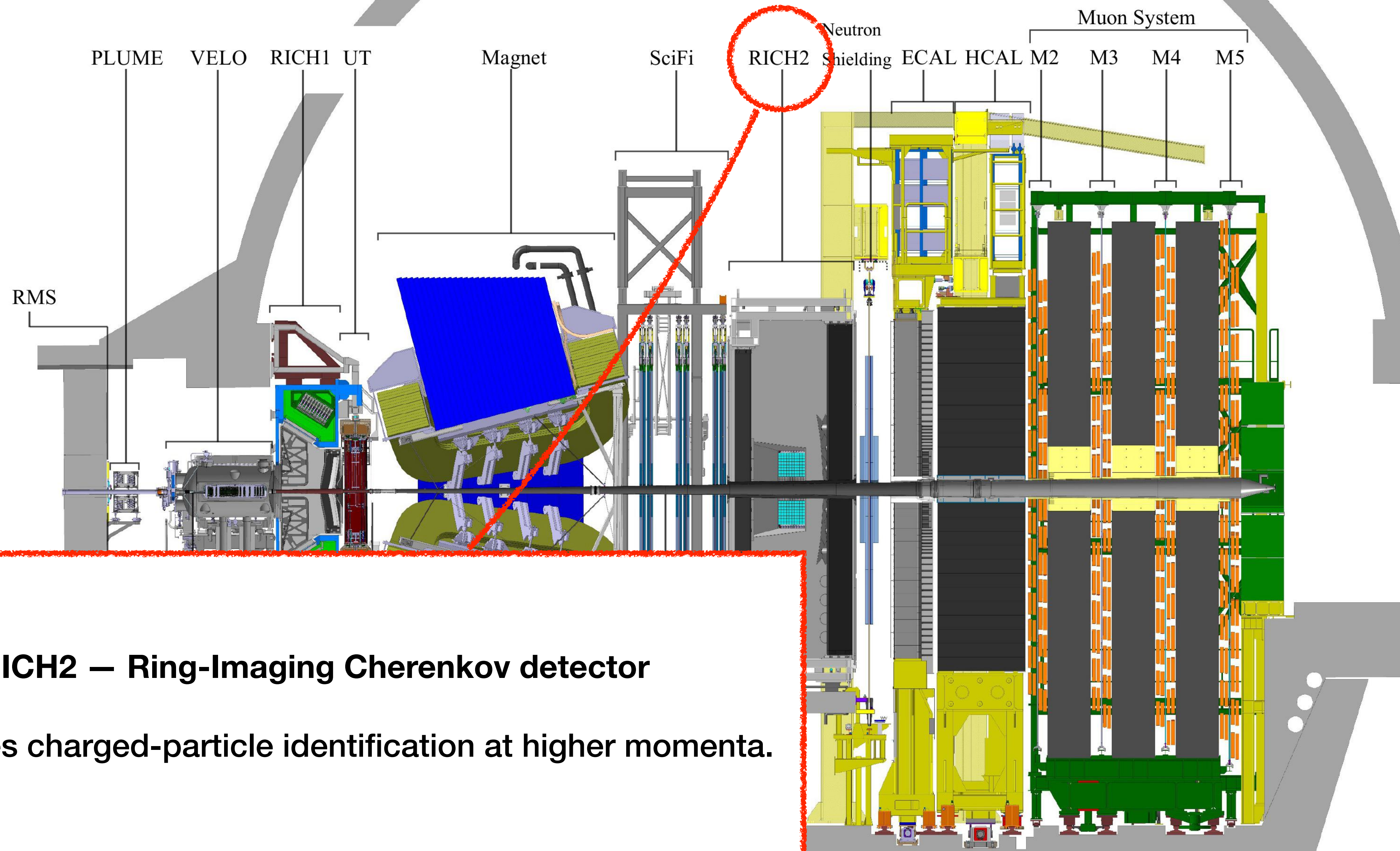
LHCb experiment layout



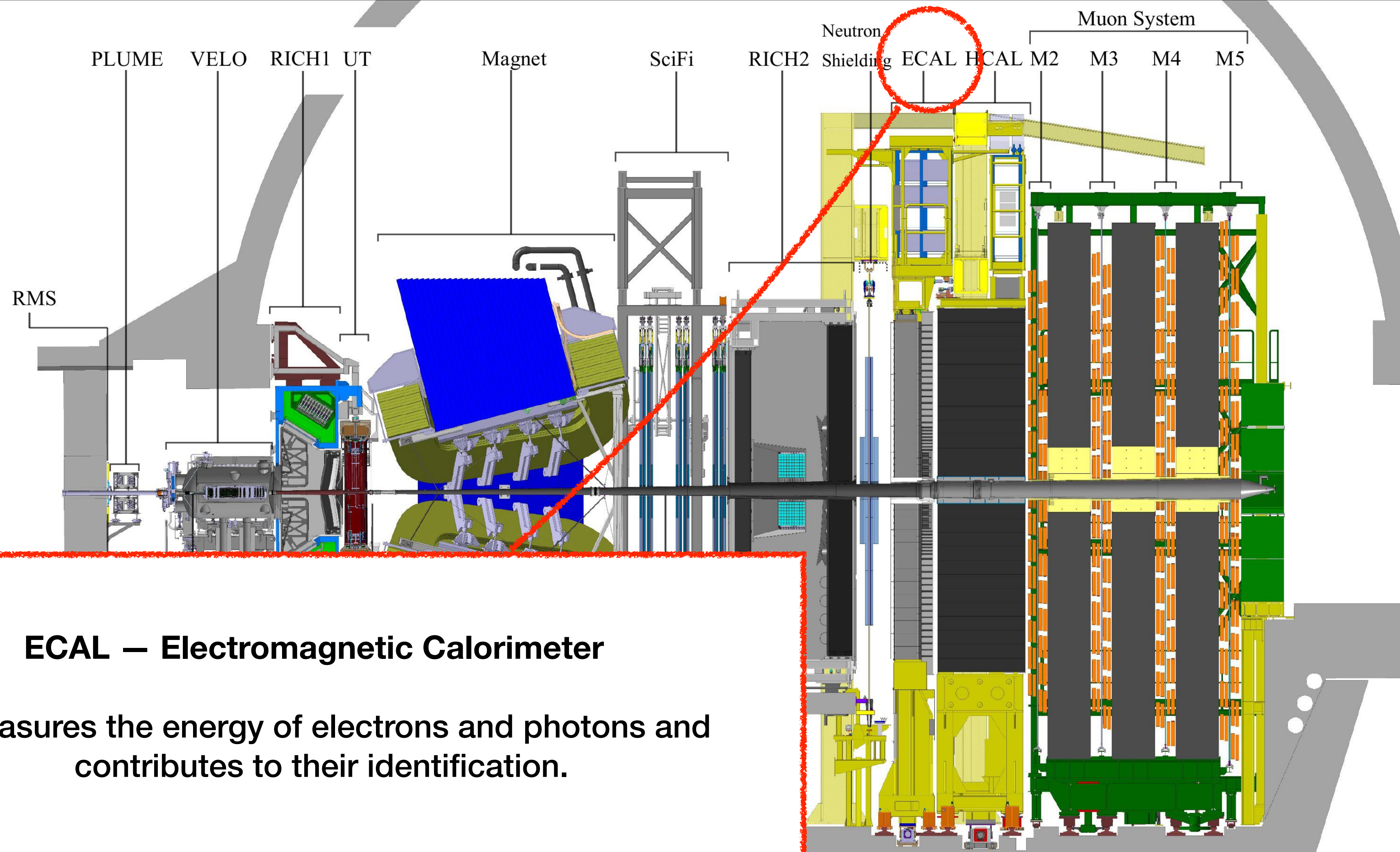
SciFi — Scintillating Fibre Tracker

- tracks charged particles downstream of the magnet for momentum and trajectory measurement.

LHCb experiment layout



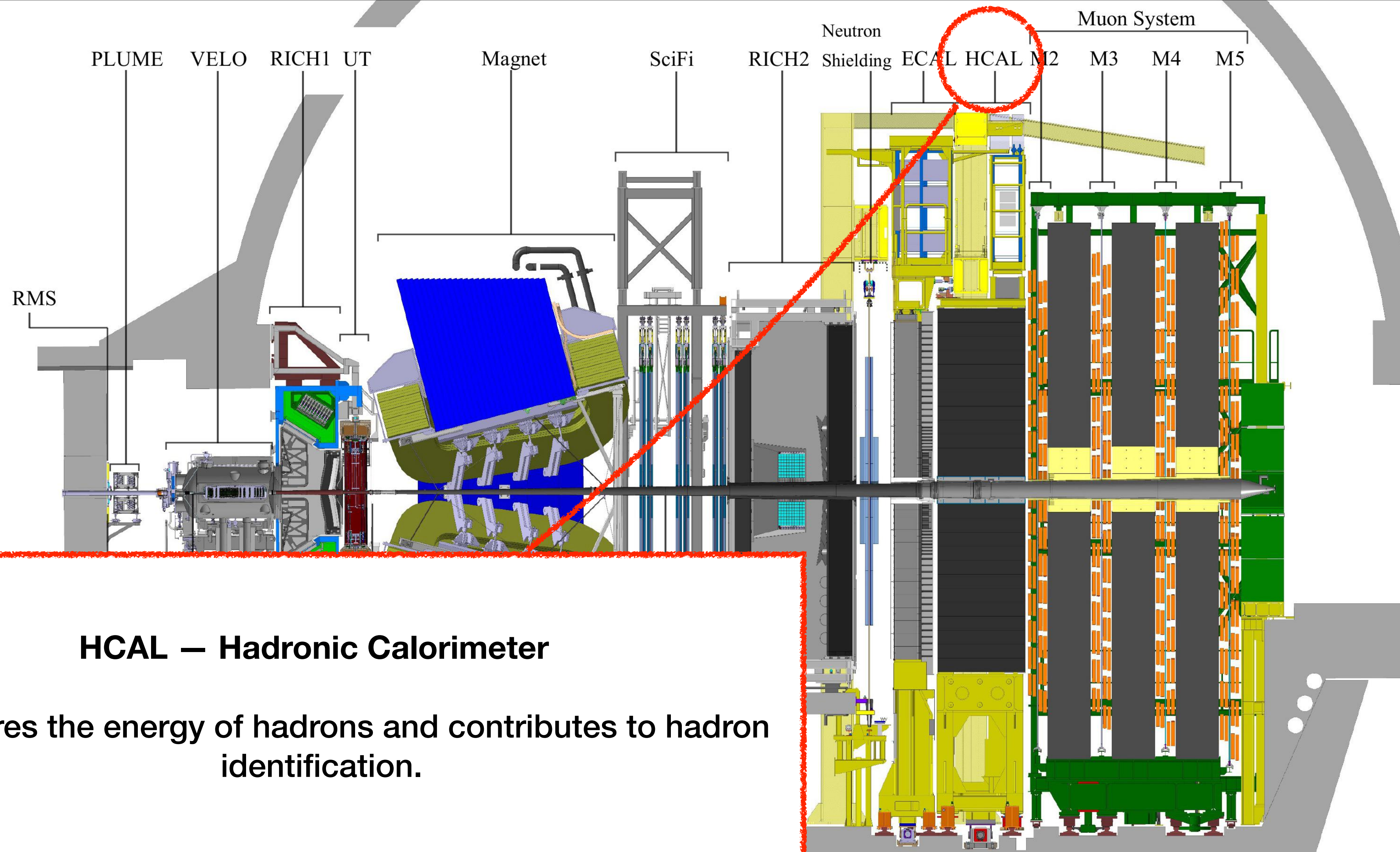
LHCb experiment layout



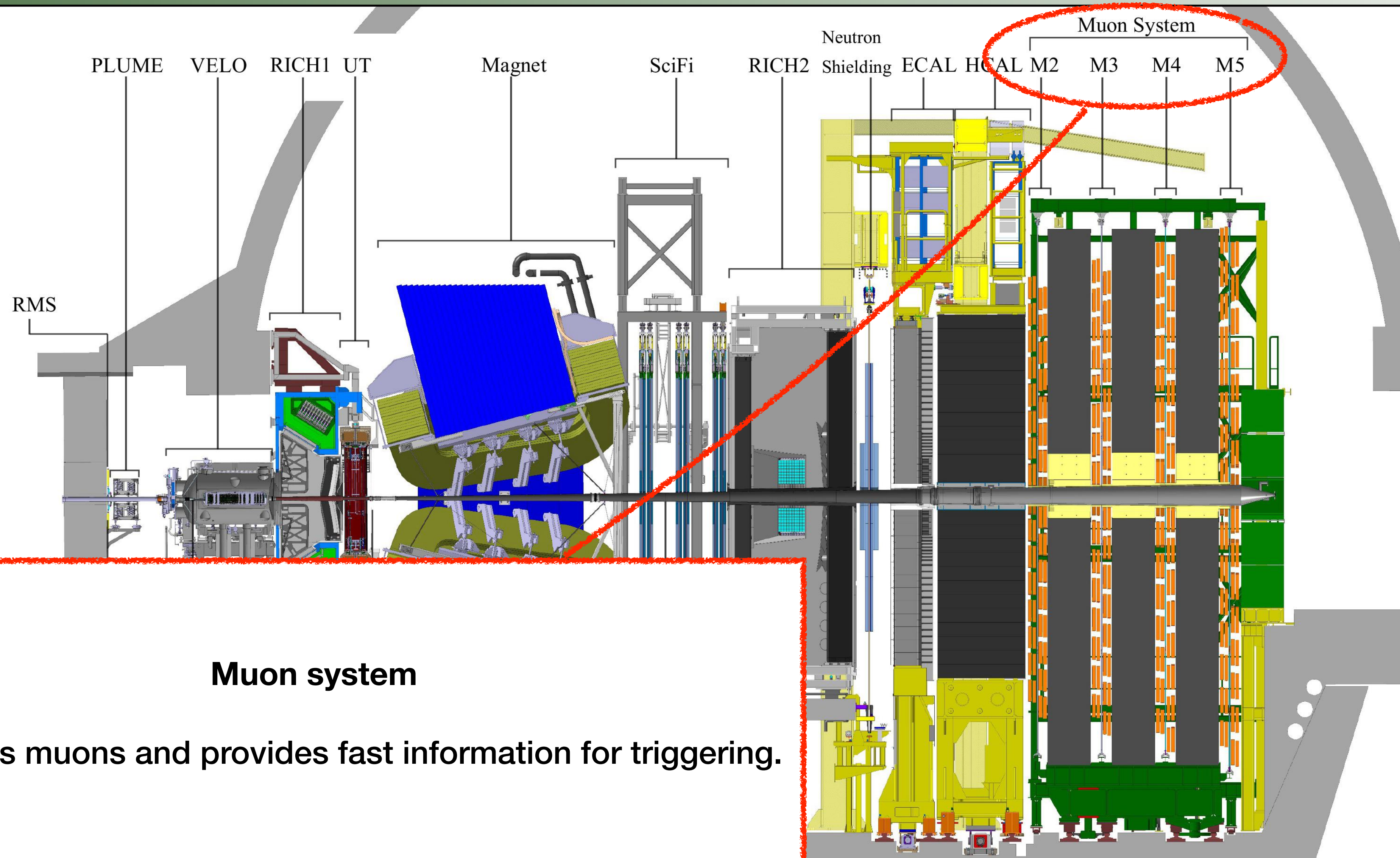
ECAL — Electromagnetic Calorimeter

- measures the energy of electrons and photons and contributes to their identification.

LHCb experiment layout



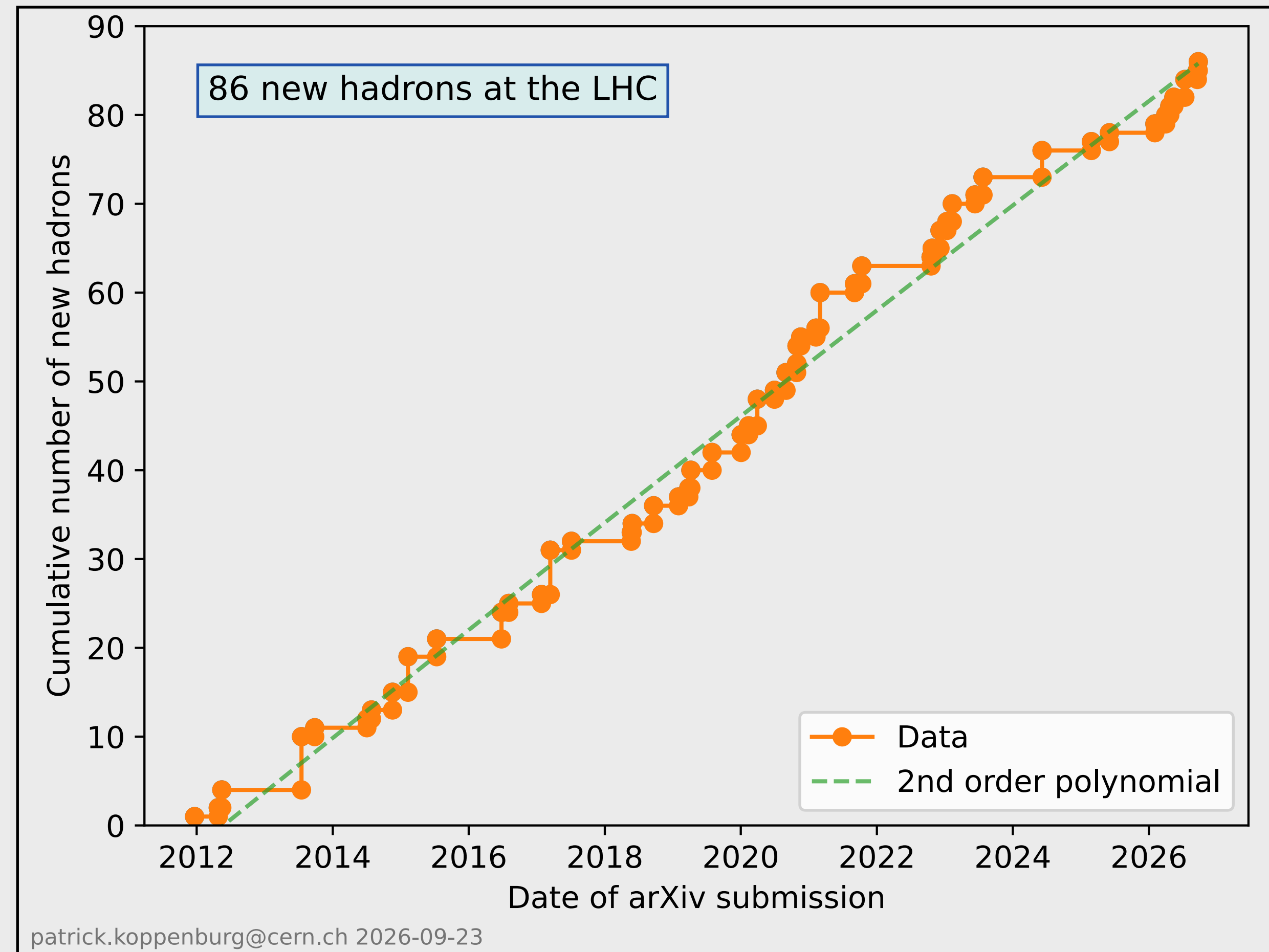
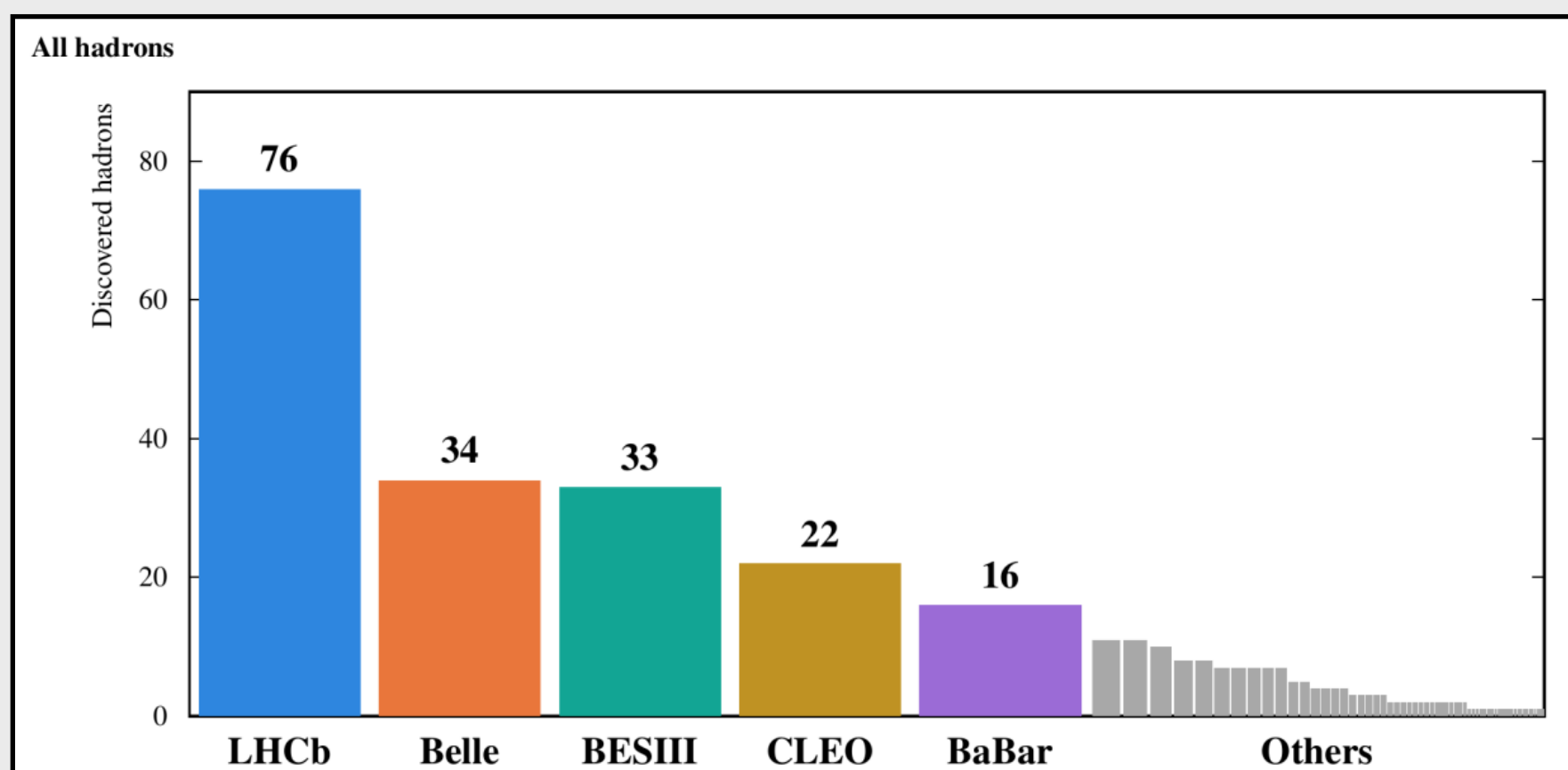
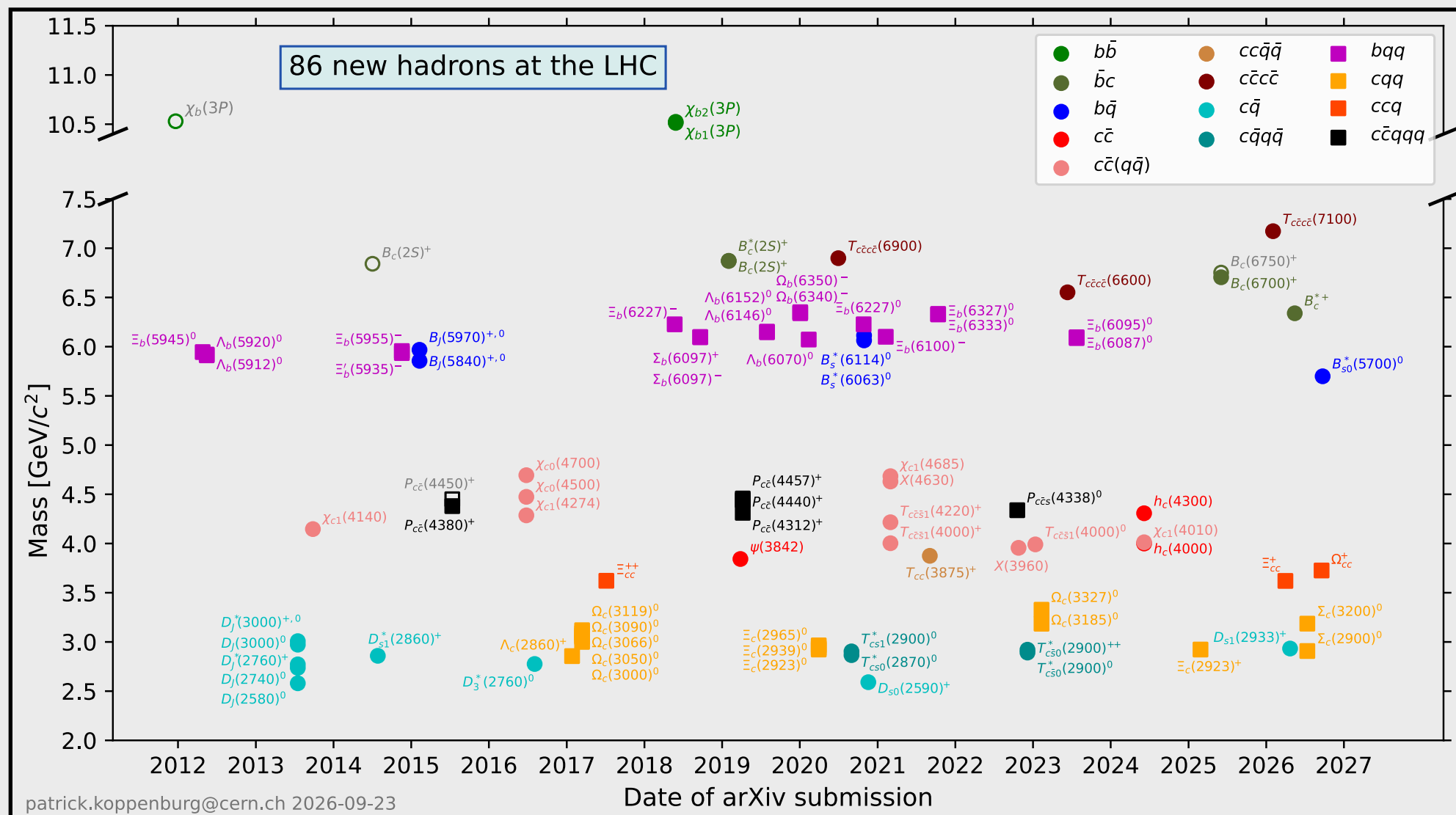
LHCb experiment layout



LHCb experiment success



- So far **86 hadrons** have been discovered at the LHC, of which **76 by LHCb**.





LHCb Collaboration

- **1995:** Letter of Intent
- **1998:** Experiment approved
- **2008:** First data
- **2019–22 (LS2):** Upgrade I - over 90% of its active electronics, detector channels, and the data acquisition system replaced.
- **LS3:** Upgrade II for Run 5 and Run 6 era
- **1912 members** from 112 institutes in 28 countries
- **1201 authors** from 121 institutes

⁴⁸ Jozef Stefan Institute, Ljubljana, Slovenia

Team Leader: Rok Pestotnik

Members: Andrej Lozar, Andrej Seljak, Blaž Leban, Boris Gardinovacki, Frank Bernard Grijalva Iii, Kristof Spenko, Rok Dolenec, Rok Pestotnik

 JSI

Jozef Stefan Institute

Official institute in LHCb

 Country
Slovenia

 Code
003996

 Team leader
Rok Pestotnik

 Deputy team leaders
-

Members status

8 active members

Participations

Active participation

Status
Official

Start date
2026-02-19

End date
-

Comments
-

Closed participation

Status
Technical Associate

Start date
2018-06-13

End date
2026-02-18

Comments
-

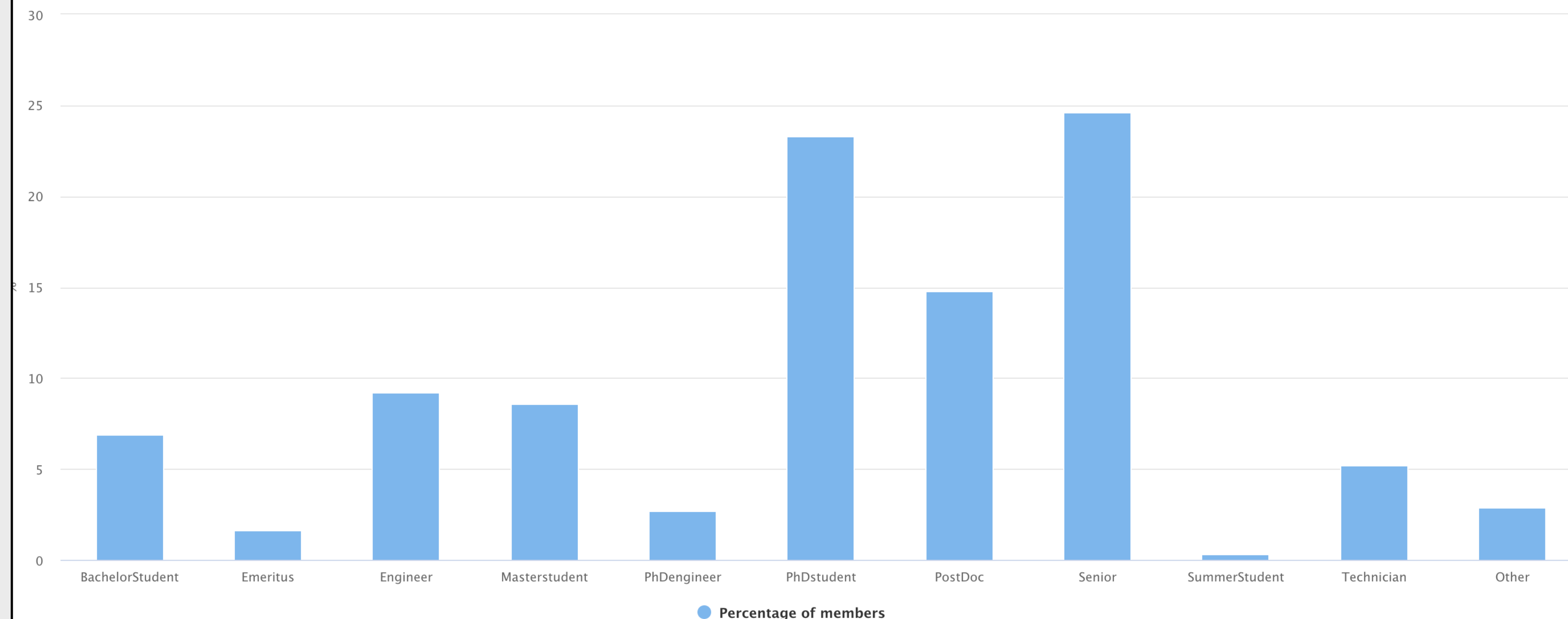
Associated to
Particle Physics, Department of Physics

LHCb Collaboration

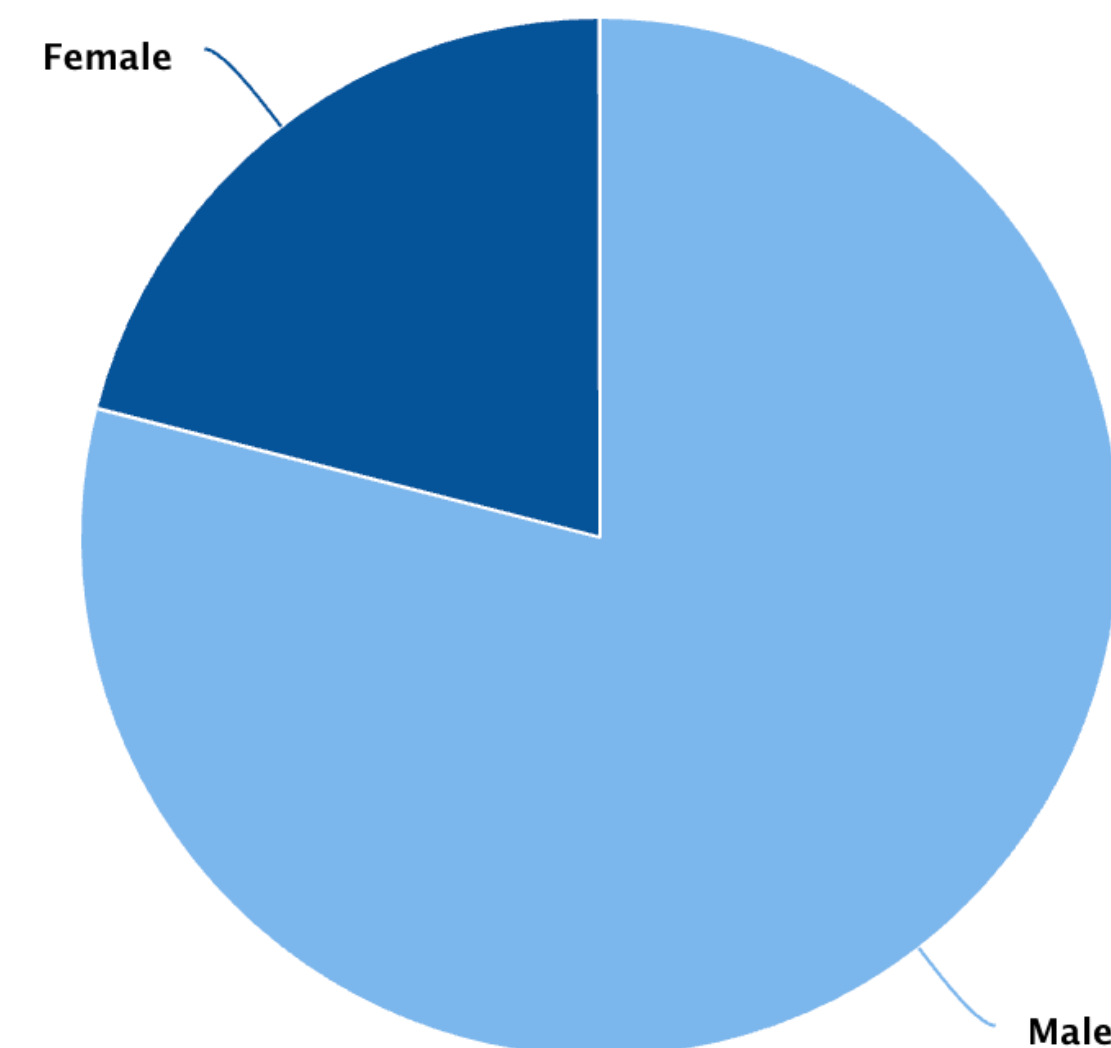


- **PhD students:** 23,3%
- **PostDocs:** 14,8%
- **Seniors:** 24,5%

Member distribution by profession



Gender distribution in LHCb





Past, present, future...

- 13. 6. 2018 - 18. 2. 2026: **Technical Associate** through the University of Oxford.
- Contributed to detector R&D:
 - RICH,
 - TORCH (withdrawn from Upgrade II).
- Since 2021 involvement in Beam tests.
- LS3 Enhancement:
 - Responsible for the design and production of the electronics backboard, quality assurance, and radiation hardness of the electronics.
- Upgrade II:
 - Evaluation of the photo sensor and mitigation strategies for the detectors.

JSI becoming a Full Member



European Organization for Nuclear Research
Organisation européenne pour la recherche nucléaire

CERN
CH 1211 - GENEVA

Secretariat: + 41 22 767 92 78
Email: menzemer@physi.uni-heidelberg.de

Professor Rok Pestotnik
Josef Stefan Institute
Experimental Particle Physics
Department
Jamova 39
PO Box 3000
1001 Ljubljana
Slovenia

Geneva, 03rd of March 2026

Dear Professor Pestotnik,

It is our pleasure to inform you that the LHCb Collaboration Board decided to accept the application of your group at Josef Stefan Institute, in Ljubljana, Slovenia as a Full Member of the LHCb experiment in its meeting on 19th of February 2026.

The CB highly appreciates your significant involvement in RICH and TORCH efforts in the past and is looking forward to your future contributions to the RICH project and to the general operation of the experiment. The CB welcomes your huge expertise in flavor physics. It is excited about upcoming analysis efforts of your group but likes to remind you to carefully separate those from the Belle II involvement of parts of your institute.

These contributions must be formalised in the form of an addendum to the existing Memorandum of Understanding for operating the LHCb experiment, to be signed by your University or Funding Agency.

We are looking forward to a fruitful collaboration.

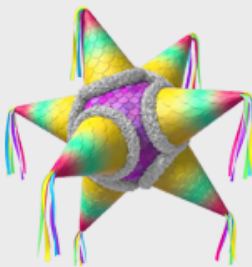
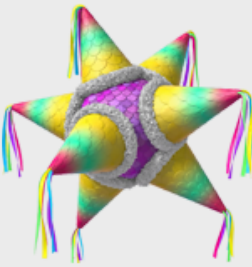
Yours Sincerely,


Vincenzo Vagnoni
Spokesperson of the LHCb Collaboration

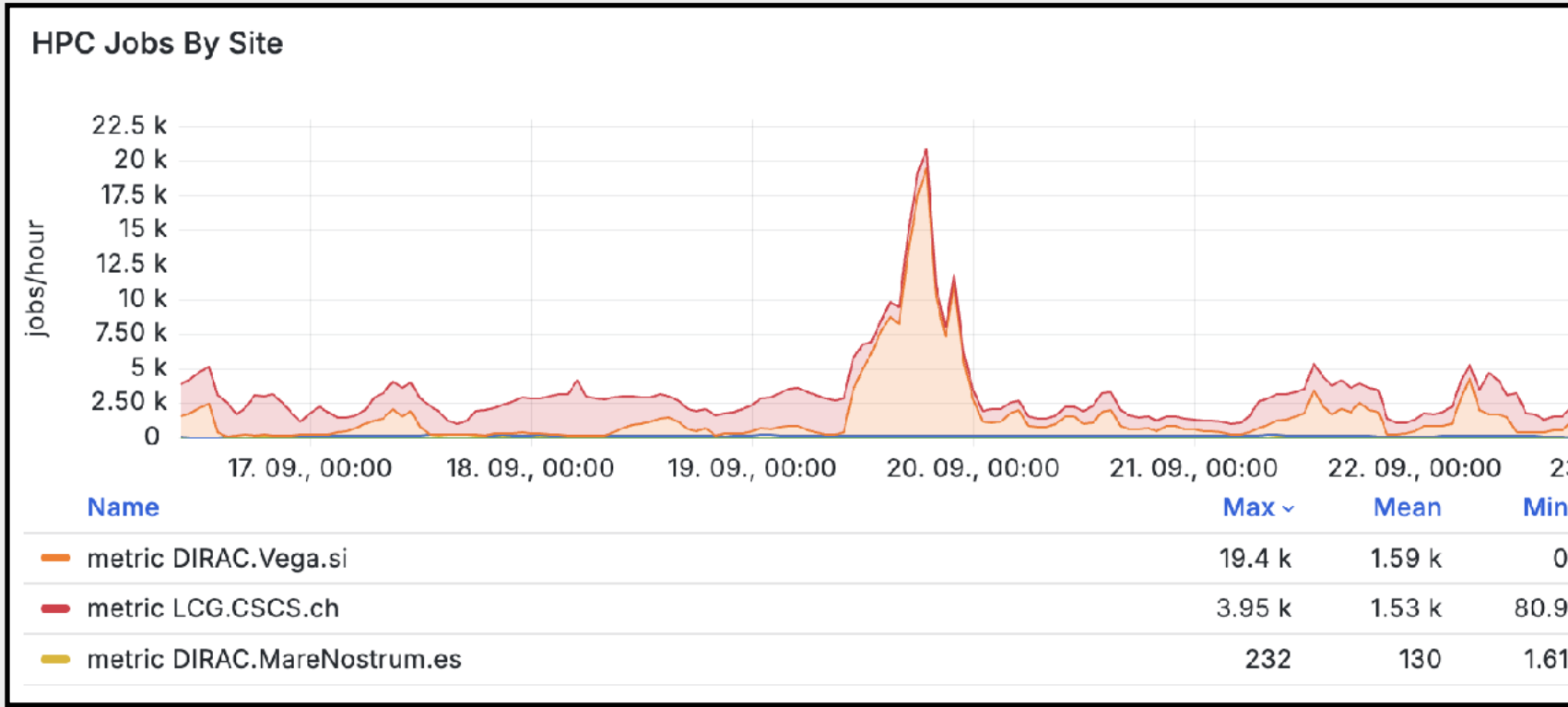

Stephanie Hansmann-Menzemer
Chair of the LHCb Collaboration Board

cc :
Gautier Hamel de Monchenault, CERN, Director for research and computing

home.cern



- Building visibility within the Collaboration:
 - Taking **shifts**, which helps getting to know LHCb software.
 - Improving **tutorials and documentation**.
 - Participating at **collaboration events**.
- We are currently offering **opportunistic use of Vega HPC**. If no issues a few thousand jobs are running.



Assignments						
August 2026						
Mon	Tue	Wed	Thu	Fri	Sat	
27	28	29	30	31	1	
DQCS Shift	DQCS Shift	DQCS Shift	DQCS Shift	DQCS Shift	DQCS Shift	DQCS Shift
3	4	5	6	7	8	
DQCS Shift	DQCS Shift	DQCS Shift	DQCS Shift	DQCS Shift	DQCS Shift	DQCS Shift
10	11	12	13	14	15	
MC production chi	MC production chi	MC production chi	MC production chi	MC production chi		
17	18	19	20	21	22	
MC production chi	MC production chi	MC production chi	MC production chi	MC production chi		
24	25	26	27	28	29	
MC production chi	MC production chi	MC production chi	MC production chi	MC production chi		
31	1	2	3	4	5	
MC production chi	MC production chi	MC production chi	MC production chi	MC production chi		

LHCb Run 3 Starterkit

HOME

First Analysis Steps

Second Analysis Steps

The Run 3 Data Set

Contributing

Interesting Links

Welcome to the Run 3 LHCb Starterkit

If you have any problems or questions, you can [send an email to jls](#).

Prerequisites

Before starting you should be familiar with using a shell, like `bash`, and with `progs`. The `analysis essentials` course has an introduction to these topics, as does the `set` included many other useful computing tools.

Credits

The Run 3 LHCb Starterkit was originally authored in 2015 by:

Miguel Fernandez Gomez

Janine Gooding

Luke Guzzetta

George Hillier

Andy Morris

Enrik Muhammad

Nicola Sciamanna

Mark Smith

Aldin Wierchold

With additional contributions by:

Ahmed Abdelmotaleb

Chris Burr

Ross Hunter

Patrick Koepf

Blaž Leban

Lorenzo Piccolo

Sascha Stahl

Wed Sep 23rd, 2026

LHCb

LHCb

Large Hadron Collider beauty experiment

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LHCb NEWS

PHYSICS

DETECTOR

FILTERING DATA

COLLABORATION

INSTALLATION

ACTIVITIES

The LHCb activity book

Enjoy the activity book by the LHCb Collaboration, written for kids (and adults) of all ages!

The LHCb Experiment colouring book introduces kids to the field of High-Energy Physics with special focus to the physics research at LHCb Experiment: the search of new particles.

Free download

The LHCb Experiment activity book – English

Le livre d'activités de l'expérience LHCb – Français (French)

Il libro d'attività dell'esperimento LHCb – Italiano (Italian)

Das Aktivitätsbuch zum LHCb-Experiment – Deutsch (German)

Livro de atividades da Experiência LHCb – Português (Portuguese)

Kritička aktivnost za eksperiment LHCb – Srpskohrvatski (Serbo-Croatian)

LHCb实验活动书 – 中文 (Chinese)

Download: zvezek eksperimenta LHCb – Slovenski (Slovenian)

El libro de actividades del experimento LHCb – Español (Spanish)

LHCb Experimenten jarduera-liburua – Euskara (Basque)

LHCb гуримтын даалгавартай ном (Mongolian)

LHCb كتاب أنشطة الفيزياء (Arabic)

Het LHCb-experiment: een werkboek (Dutch)

Leabhar oibre an Turgnaimh LHCb – Gaeilge (Irish)

Terms of Use and Credits

The LHCb Experiment Activity book is free to download for personal and educational use.

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Credits:

Illustrations by Yasmine Amis

Text and Activities by Violaine Boile and Silvia Borghi

With many thanks to those who helped to translate into other languages and proof reading: Rolf Lindner, Carla Göbel, Vava Gilepov, Aleksandra Felković, Yingrui Hou, **Blaž Leban**, Alejandro Perez Casas, Mary- Richardson-Sipper, Eleasour Calani, Janina Nicolini, Carina Trippel, Nathan Heatley.

LHCb

LHCb

Powered by WordPress | Theme: Vuesup by Themaware modified by LHCb-JC

August 15

Jan Peter Wagner

15:09

Hi,

thanks for all the valuable work in the simulation right now, last week and now

Let me know if I can support you with anything 😊

Analysis identifier	Paper identifier ↓	Assignment accomplished	Status	Contacts
QEE-XsectionV0Ratios-2024	LHCb-PAPER-2026-045	No	Waiting for second draft	Lukas Calefice; Noah Albin Behling
BandQ-Bspi0-Runs12	LHCb-PAPER-2026-021	Yes	Submitted	Liupan An; Marco Pappagallo; Yuhao Wang; Zifan Li

- Based on our experience in BSM Exotic physics, we are **joining the QCD, Electroweak and Exotica (QEE) working group**.
- Due to the **restricted access** to physics content up until mid-summer, it was **challenging to identify** the most suitable **entry point**.
- Following discussions with the QEE WG coordinators (some of whom share similar past involvement in ATLAS), the recommendation was to begin with a relatively straightforward SM **measurement using Run 3 data**, e.g. measurement of diboson (WW, ZZ), or W/Z +jets cross-section. We are in contact with:
 - *Davide Zuliani (Padova)* about contributing to Run 3 +jets analysis and potentially start a Z + HF jets analysis (which includes common ML flavour tagging studies).
 - *Hengne Li (SCNU)* about contributing to ZZ analyses, with $H \rightarrow ZZ^*$ and electron channel feasibility study.
- This approach allows our group to **quickly integrate** into the WG operations and **build familiarity** with current software tools before progressing to more advanced and exotic BSM topics that better match our core expertise, while still providing **valuable contributions to the community**.

Long-term physics plans



- Depending on **person power** and **interests**, a progression towards flavour physics would open a larger field of physics opportunities:
 - Possible collaboration with flavour-physics theory colleagues from F1 department, who expressed interest in us joining the LHCb experiment before.
 - Will need to be careful to stay orthogonal to Belle II physics at F9, to avoid potential overlap or conflict of interests (we are currently even working in the same offices 🤔).
 - We will need a good strategy to bring more people (back) to be able to be broad.
- Personally, I definitely want to stay within the Simulation Project.
- If LHCb gets pledged allocation at Vega somebody (me) will need to take care of the maintenance.

Future?

- Likelihood to stay with LHCb: 9/10
- Likelihood to stay in charm: 7/10
 - Would pursue CPV in multibody D decays
- Preference between detector and software: software
 - Would stay in RTA

T. Nanut Petrič, Strateško srečanje sodelavcev Odseka za eksperimentalno fiziko osnovnih delcev, 21.-23. 9. 2022

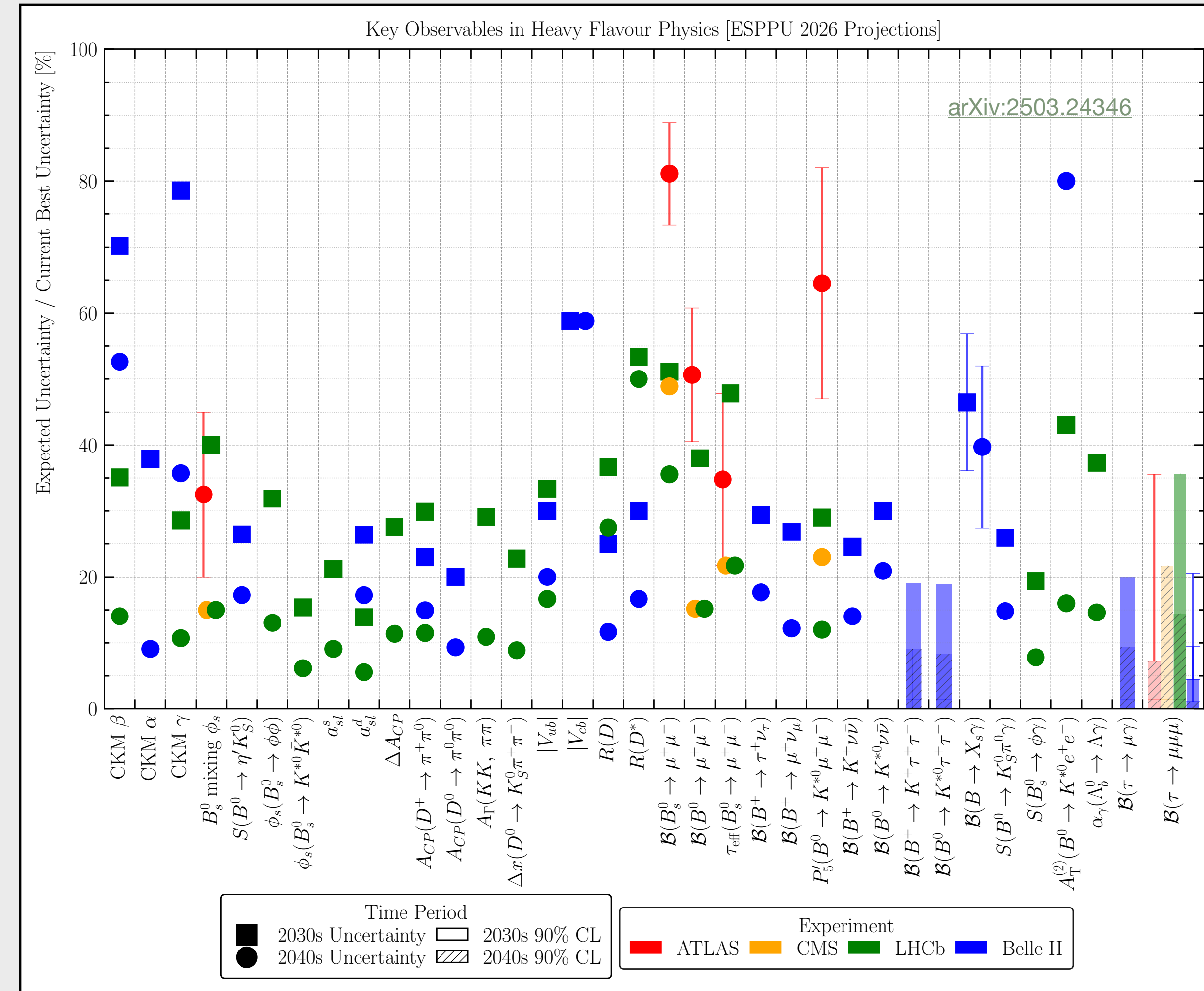
11

Projections in HF physics



- LHCb Upgrade II ● will give the best precision to the broadest range of key observables.
- Belle II ● has unique capability for modes with multiple neutrals or missing particles.
- ATLAS ● and CMS ● will be competitive for modes with multiple muons.

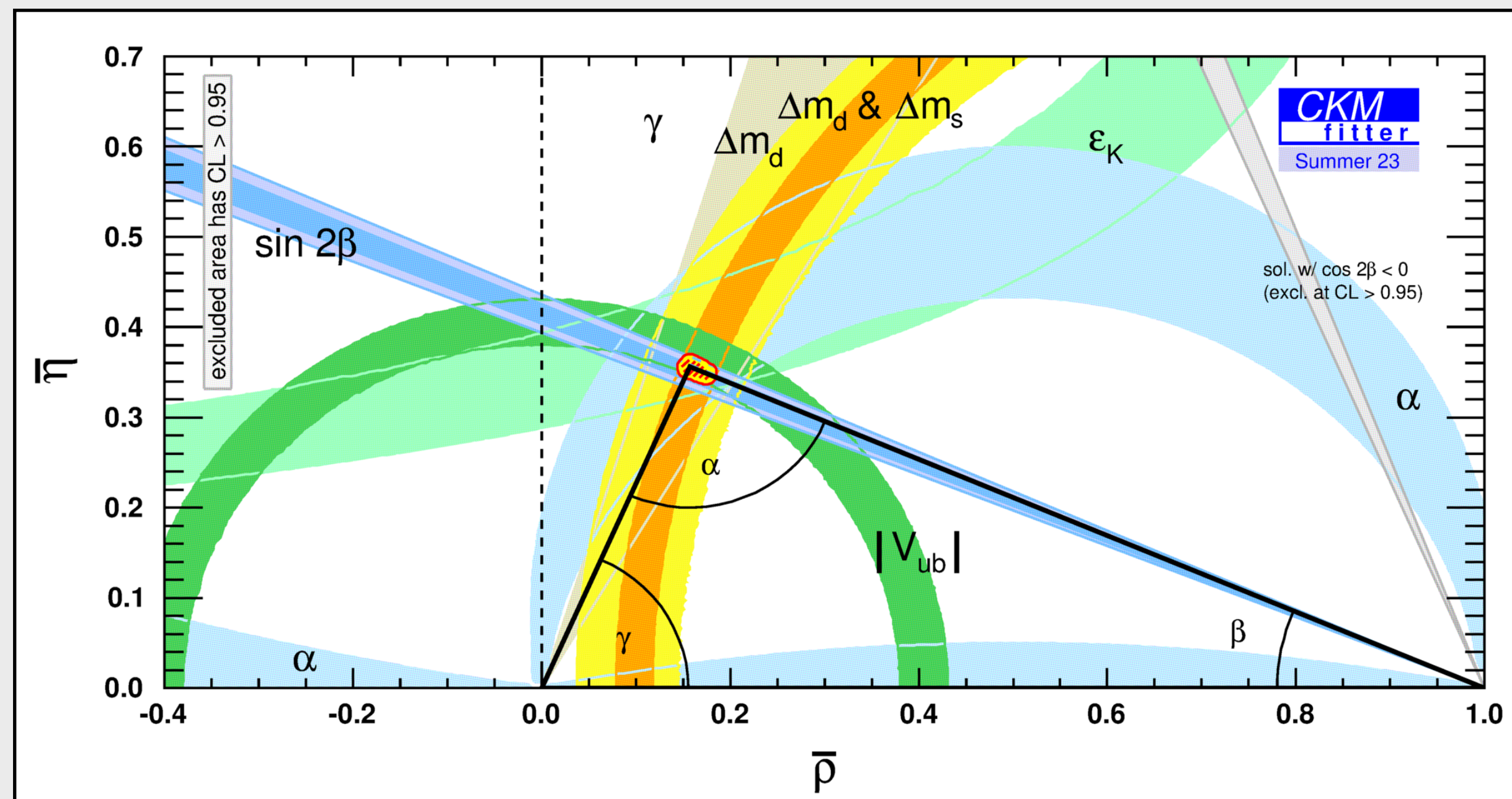
NOTE: LHCb Upgrade II physics programme also includes spectroscopy, heavy ion physics, EW precision measurements, dark sector searches ...



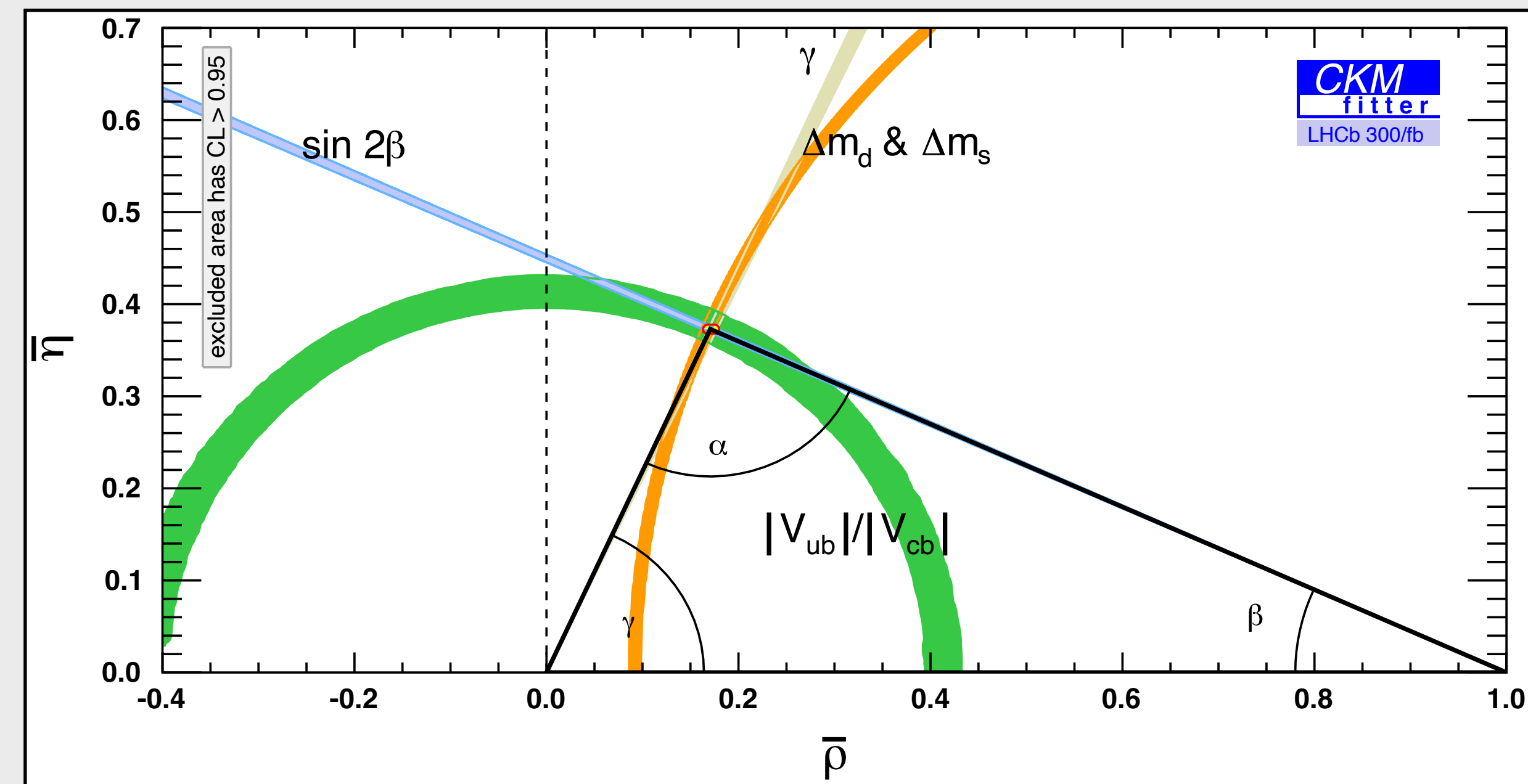
Evolution in unitary triangle

- The latest data from LHCb give a measurement of γ with a precision better than 3° .
- With LHCb Upgrade II the precision of the “direct” determination will be improved down to $\sim 0.35^\circ$.

LHCb-TDR-026



Global inputs as of 2023.



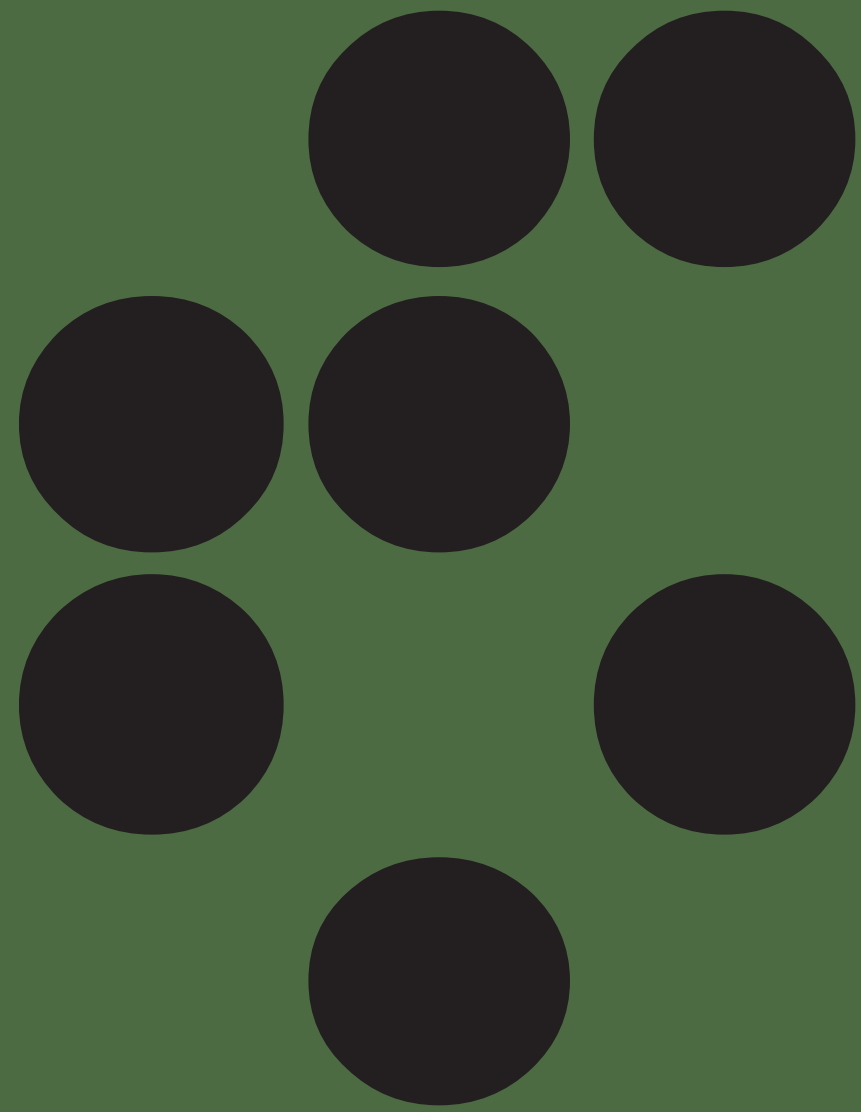
LHCb Upgrade II measurements with 300 fb^{-1} and improved lattice QCD calculations.

Conclusions



- F9 has recently become a Full Member of another major (LHC) collaboration.
- Valuable work has been done before by our colleagues, making the transition to Full Member smooth and straightforward.
- We are keen to expand our visibility and contributions:
 - Need new Master and PhD students, PostDocs.
 - Need experience in flavour physics analyses.





IJS