

SMARTHEP

REAL-TIME ANALYSIS FOR
SCIENCE AND INDUSTRY

ESR9: Real-time analysis for Dark Photons search in LHCb and smart vehicles

Mid-term check,
10/01/2023

Carlos Cocha



SMARTHEP is funded by the European Union's Horizon 2020 research and innovation programme, call H2020-MSCA-ITN-2020, under Grant Agreement n. 956086



Outline

- ❑ **Background information**
- ❑ **ESR9 Project**
- ❑ **Training activities**
- ❑ **Career expectations**



Background information

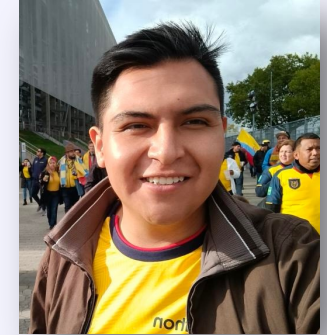


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Background information

- ❑ **Full Name:** Carlos Eduardo Cocha Toapaxi
- ❑ **Date of birth:** 31/12/1994
- ❑ **Place of birth:** Ambato, Ecuador.
- ❑ **Recruiting beneficiary:** Heidelberg University
- ❑ **Start of the contract:** 1st October, 2022
- ❑ **Education:**
 - Bachelor in Physics at Yachay Tech University (Ecuador) in 2020
 - Master in Physics at the University of Padova (Italy) in 2022



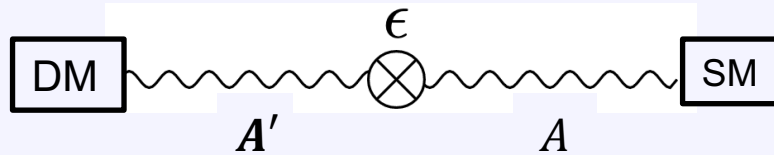
ESR9 Project



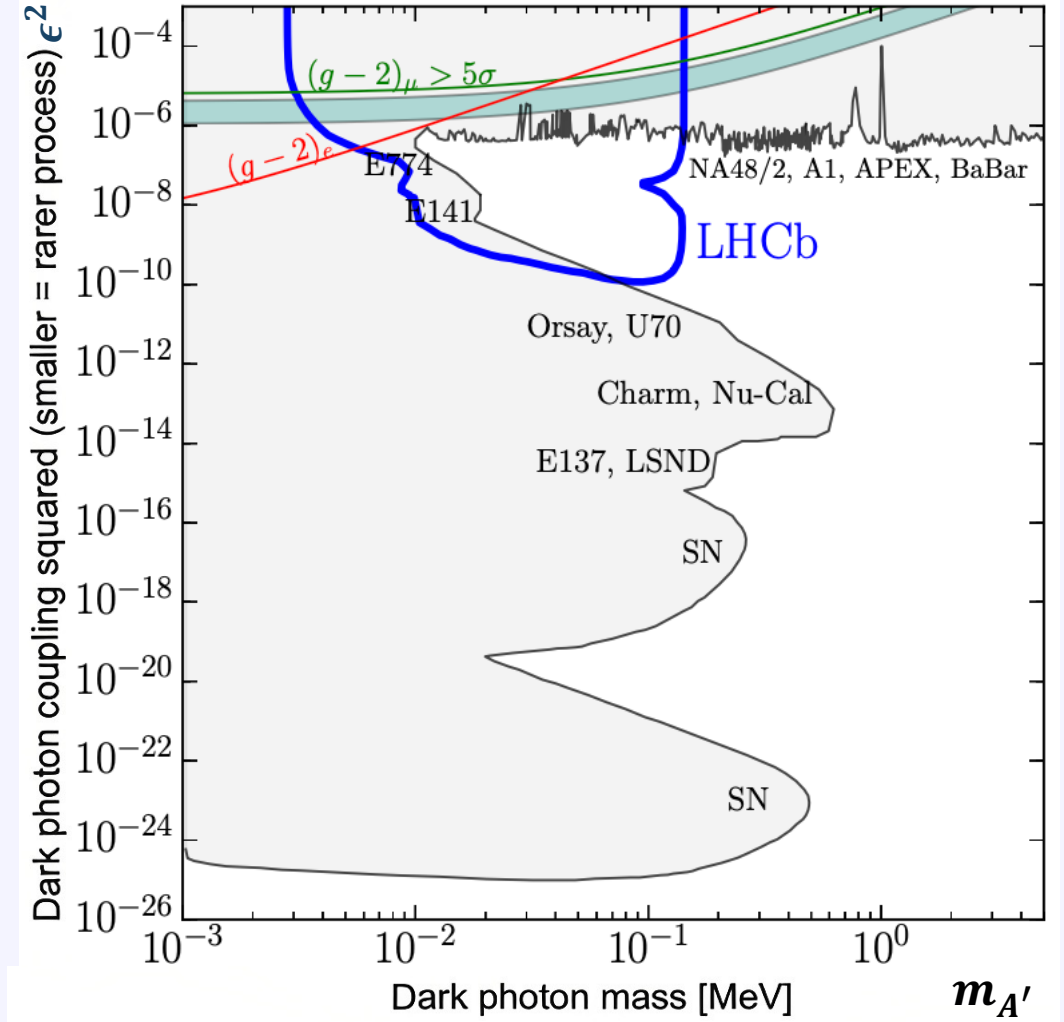
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ESR9 Project

- ❑ The nature of dark matter (DM) is still unknown.
- ❑ Dark sector interacting through dark photon A'
 \Rightarrow **portal** to SM



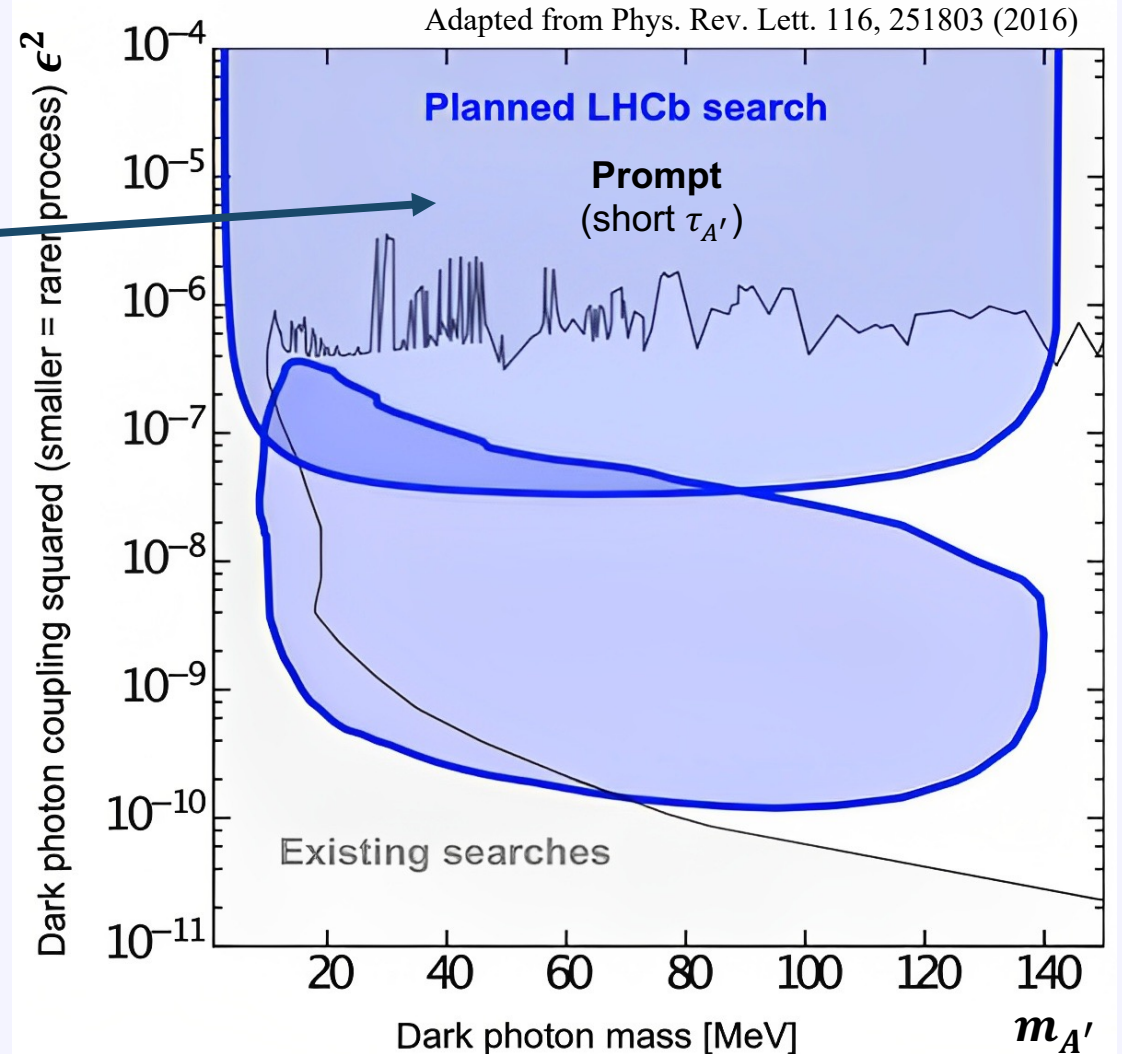
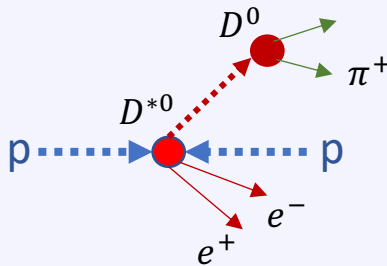
- ❑ A large fraction of the A' parameter space remains unexplored.
- ❑ The new LHCb upgrades allow to trigger low-energy objects in real time.
- ❑ **LHCb experiment potentially will be the first to explore extremely difficult regions.**



Methodology

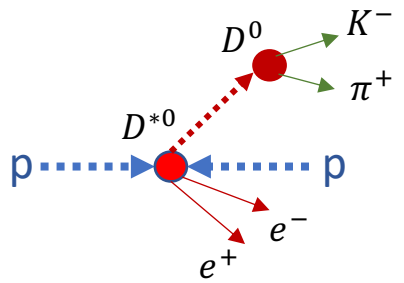
Methodology

- | | | |
|---|---|---|
| 1 | Use a decay channel to collect a clean source of γ
$D^{*0} \rightarrow D^0 e^+ e^-$ | ✓ |
| 2 | Generate simulated data of these collision events | ✓ |
| 2 | Write the trigger HLT2 line | ✓ |
| 3 | Optimize the trigger selection efficiency and rates | ✗ |
| 4 | Deploy the trigger line before the run restarts. | |
| 5 | Assess trigger performance with early data | |

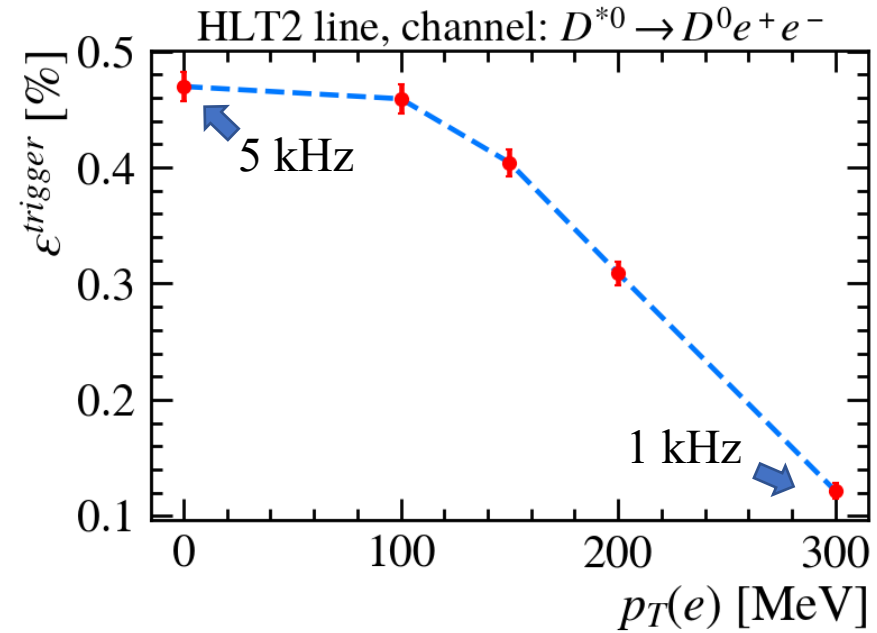


Results

- An HLT *line* is a sequence of steps that check whether an **event** contains an **object**(candidate) of interest
- Trigger line: **Hlt2CharmDst0ToDOEE**



Stage	Parameter
K, π, e	p p_T χ_{IP}^2
e^+e^-	m
D^0	m
D^{*0}	m



Training activities



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Training activities

October 2022

- Oct 6 - Oct 7 [Annual meeting of the German LHCb groups at Physikalisches Institut Heidelberg](#)
- Oct 10 - Oct 13 [49th Heidelberg Physics Graduate Days at Physikalisches Institut Heidelberg](#)

November 2022

- Nov 21 - Nov 25 [SMARTHEP kick-off at the University of Manchester](#)
- Nov 28 - Dec 2 [LHCb Starterkit 2022 at CERN](#)

January 2023

- Jan 09 - Jan 10 [Mid-term check meeting with the Project Officer](#)
- Jan 10 - Jan 13 [SMARTHEP School on Collider Physics and Machine Learning at UniGe](#)



Career expectations



Career expectations

Academia:

- Postdoc, Professorship or scientific institutions (CERN).
- Expertise in RTA, ML and parallel architectures
- Expertise in data analysis for High Energy Physics
- Collaboration within an LHC experiment: LHCb

Industry:

- Focus on AI or data analysis.
- Software development.

THANKS

