LHCb and η Physics

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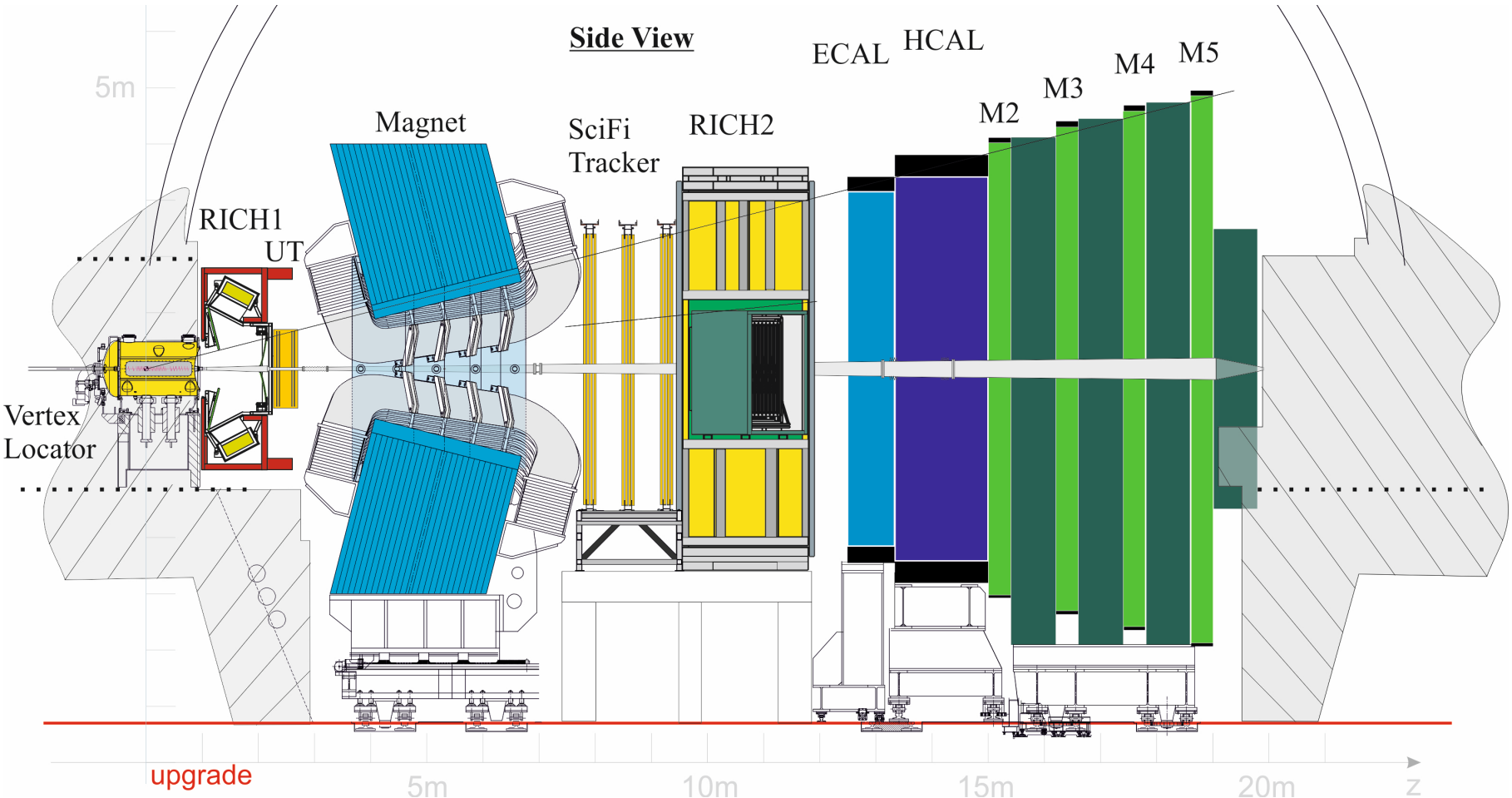
University of CINCINNATI

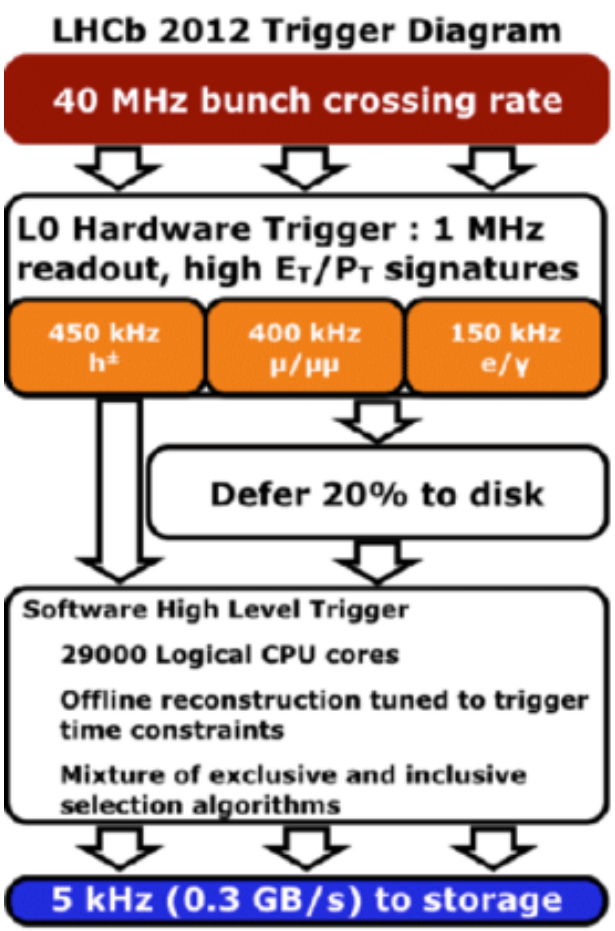
May 18, 2022

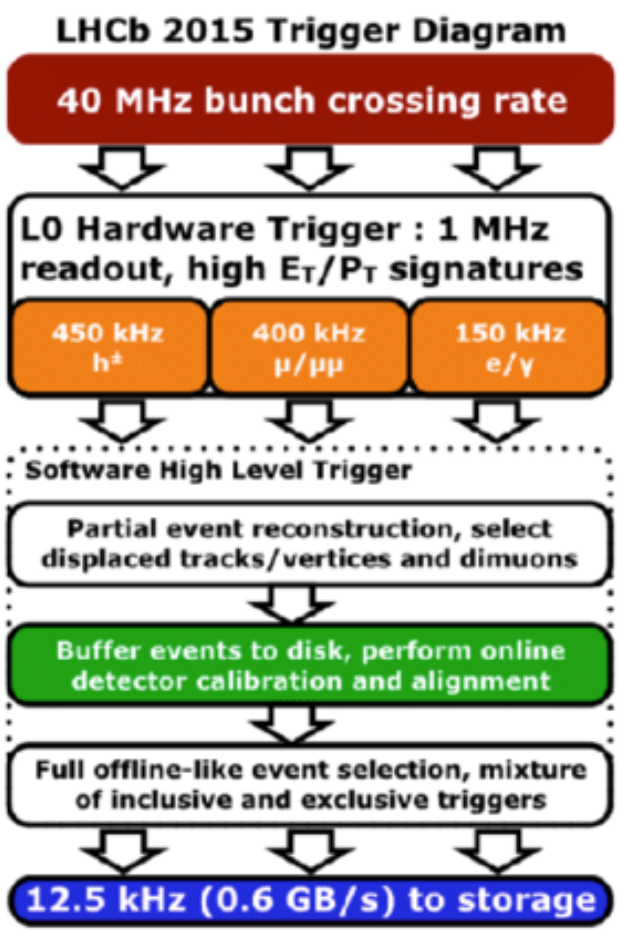
RF Snowmass 2022 Spring Meeting

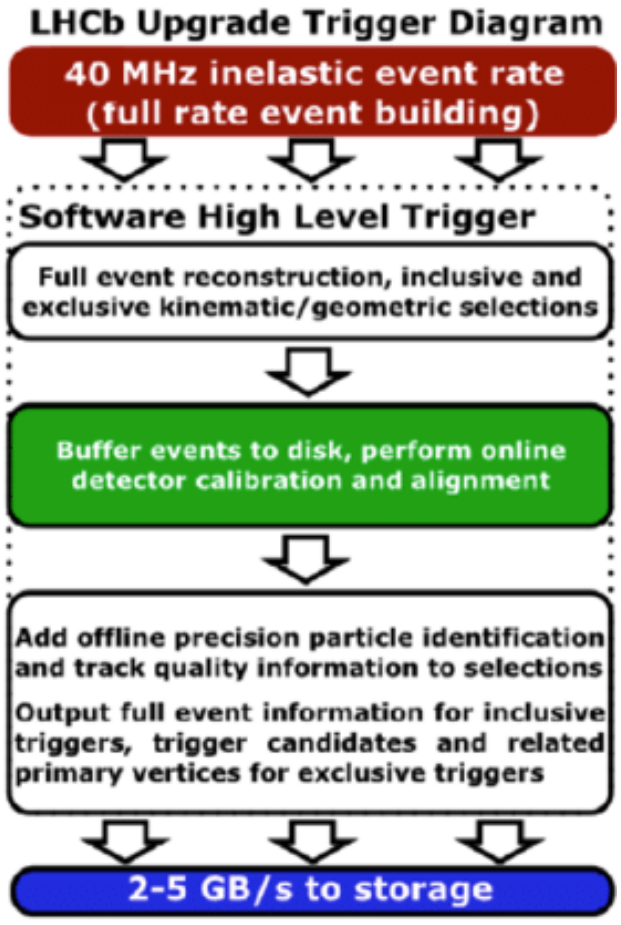
LHCb Upgrade I



LHCb Trigger

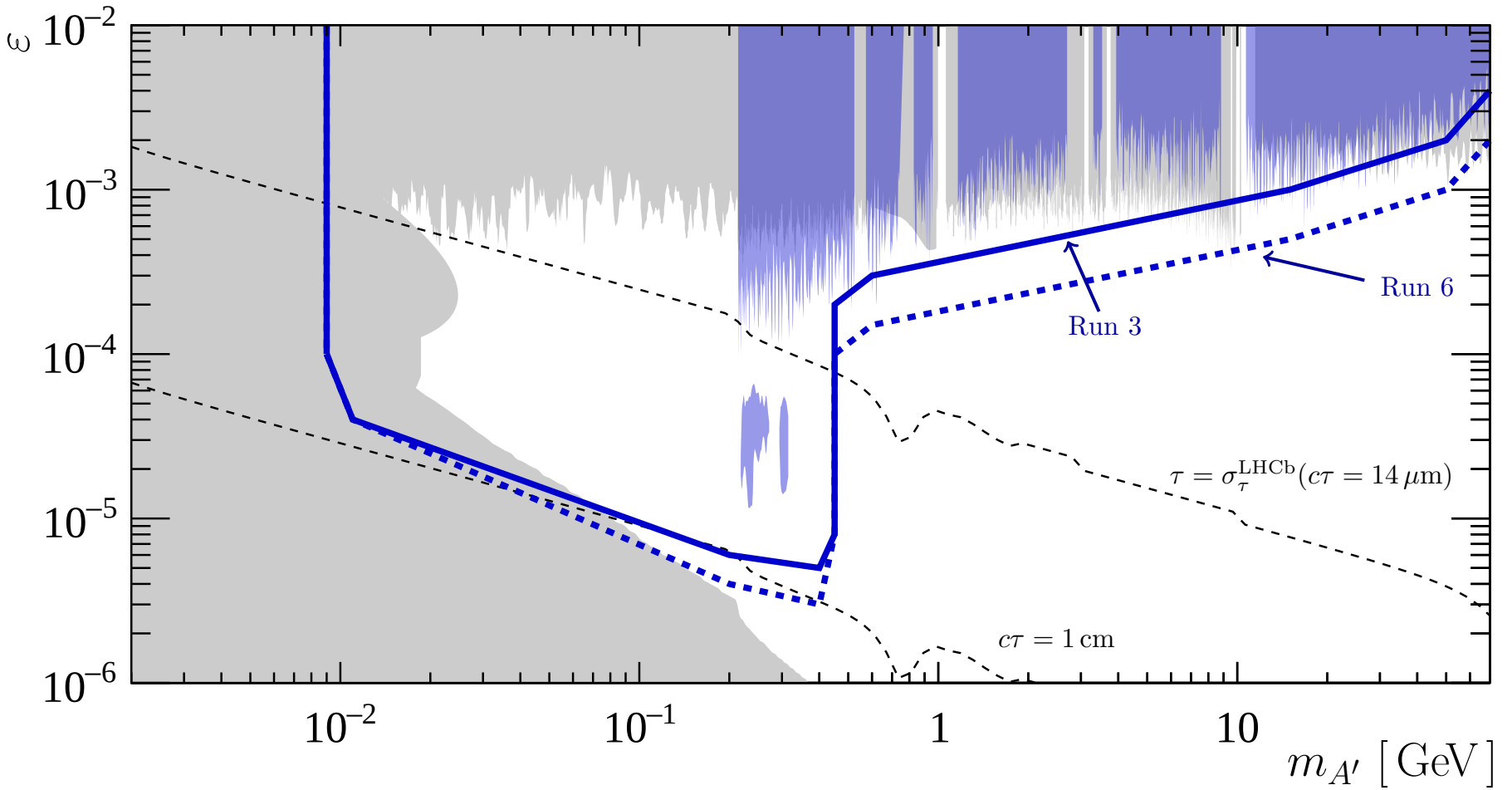


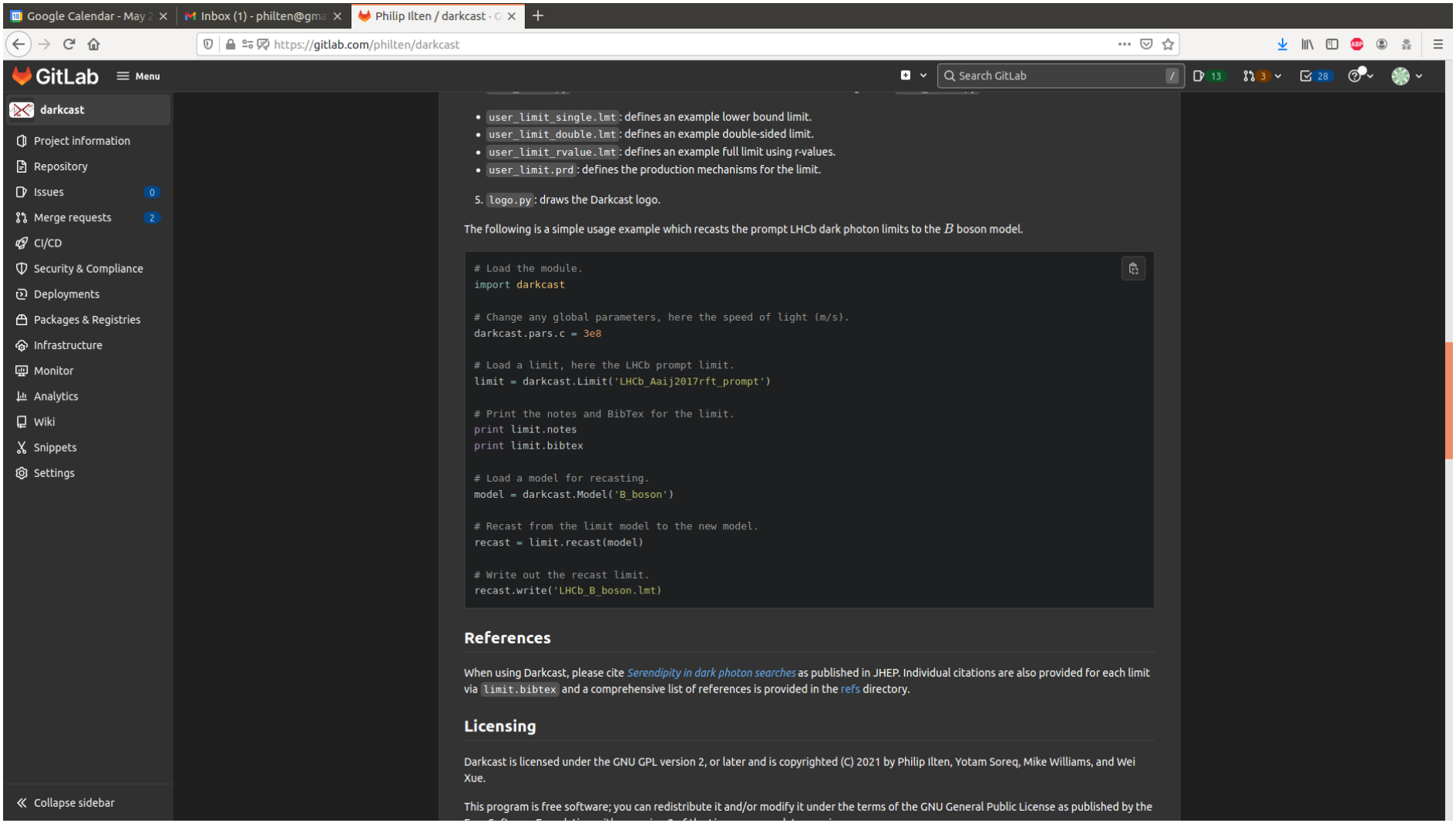


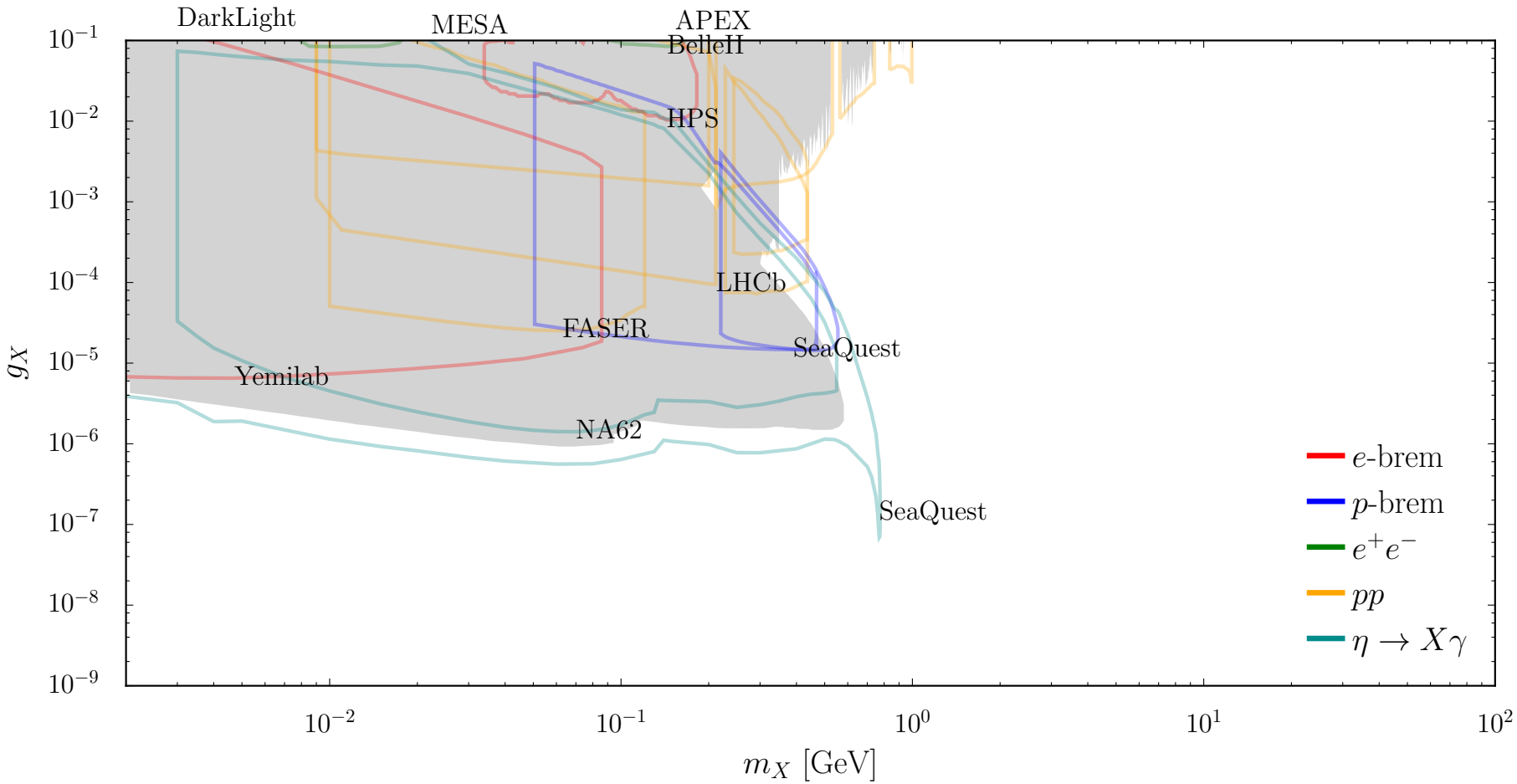


Dark Photon (Projection)

arXiv:2203.07048

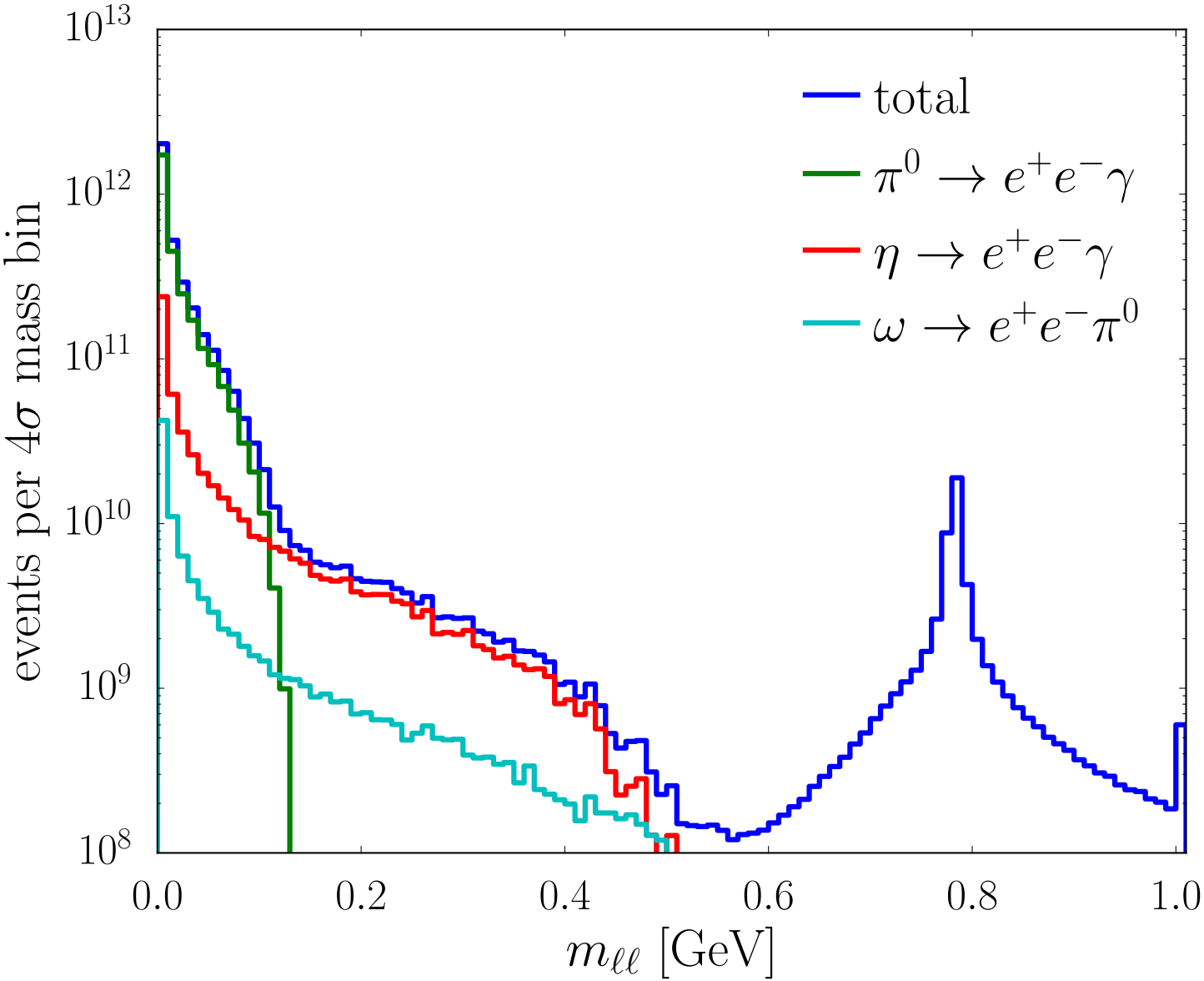



Google Calendar - May 2
Inbox (1) - philten@gma
Philip Ilten / darkcast · G
https://gitlab.com/philten/darkcast
GitLab
Menu
Search GitLab
darkcast
Project information
Repository
Issues 0
Merge requests 2
CI/CD
Security & Compliance
Deployments
Packages & Registries
Infrastructure
Monitor
Analytics
Wiki
Snippets
Settings
Collapse sidebar
user_limit_single.lmt : defines an example lower bound limit.
user_limit_double.lmt : defines an example double-sided limit.
user_limit_rvalue.lmt : defines an example full limit using r-values.
user_limit.prd : defines the production mechanisms for the limit.
5. logo.py : draws the Darkcast logo.
The following is a simple usage example which recasts the prompt LHCb dark photon limits to the B boson model.
# Load the module.
import darkcast
# Change any global parameters, here the speed of light (m/s).
darkcast.pars.c = 3e8
# Load a limit, here the LHCb prompt limit.
limit = darkcast.Limit('LHCb_Aaij2017rft_prompt')
# Print the notes and BibTex for the limit.
print limit.notes
print limit.bibtex
# Load a model for recasting.
model = darkcast.Model('B_boson')
# Recast from the limit model to the new model.
recast = limit.recast(model)
# Write out the recast limit.
recast.write('LHCb_B_boson.lmt)
References
When using Darkcast, please cite Serendipity in dark photon searches as published in JHEP. Individual citations are also provided for each limit via limit.bibtex and a comprehensive list of references is provided in the refs directory.
Licensing
Darkcast is licensed under the GNU GPL version 2, or later and is copyrighted (C) 2021 by Philip Ilten, Yotam Soreq, Mike Williams, and Wei Xue.
This program is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the


DarkLight
MESA
APEX
BelleII
HPS
LHCb
FASER
SeaQuest
Yemilab
NA62
SeaQuest
e-brem
p-brem
e^+e^-
pp
$\eta \to X\gamma$
g_X
m_X [GeV]
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
10^{-9}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}

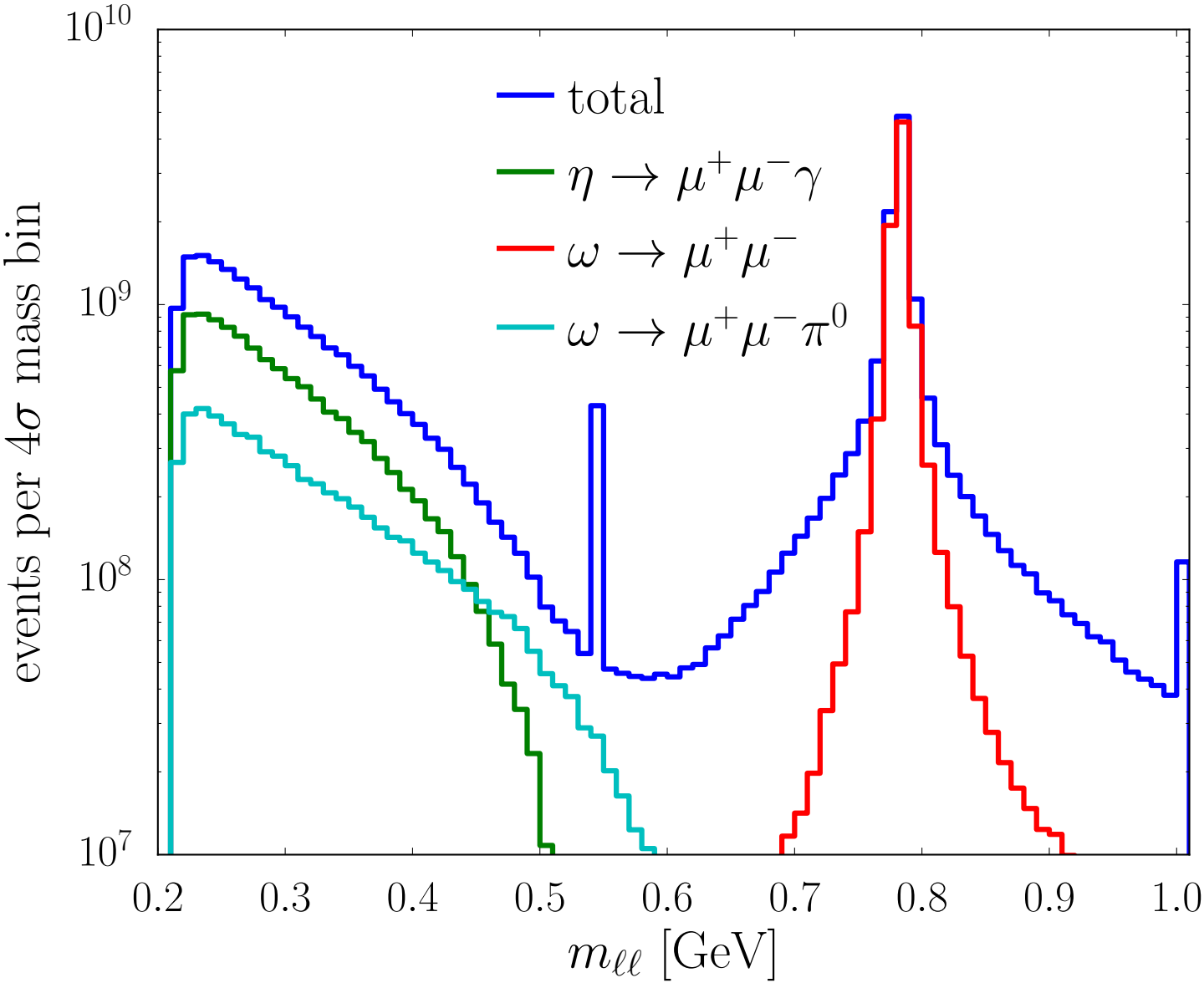
Run 3 Projection - ee

CPC 258, 107622 (2021)



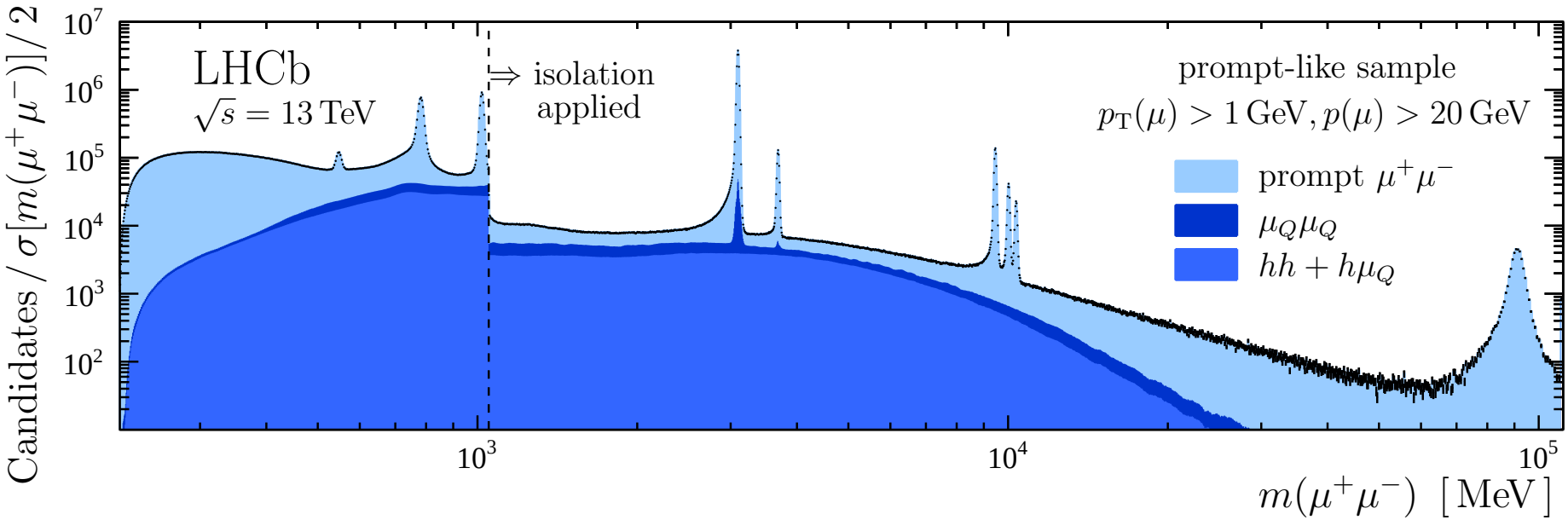
Run 3 Projection - $\mu\mu$

CPC 258 (2021) 107622



Real Data

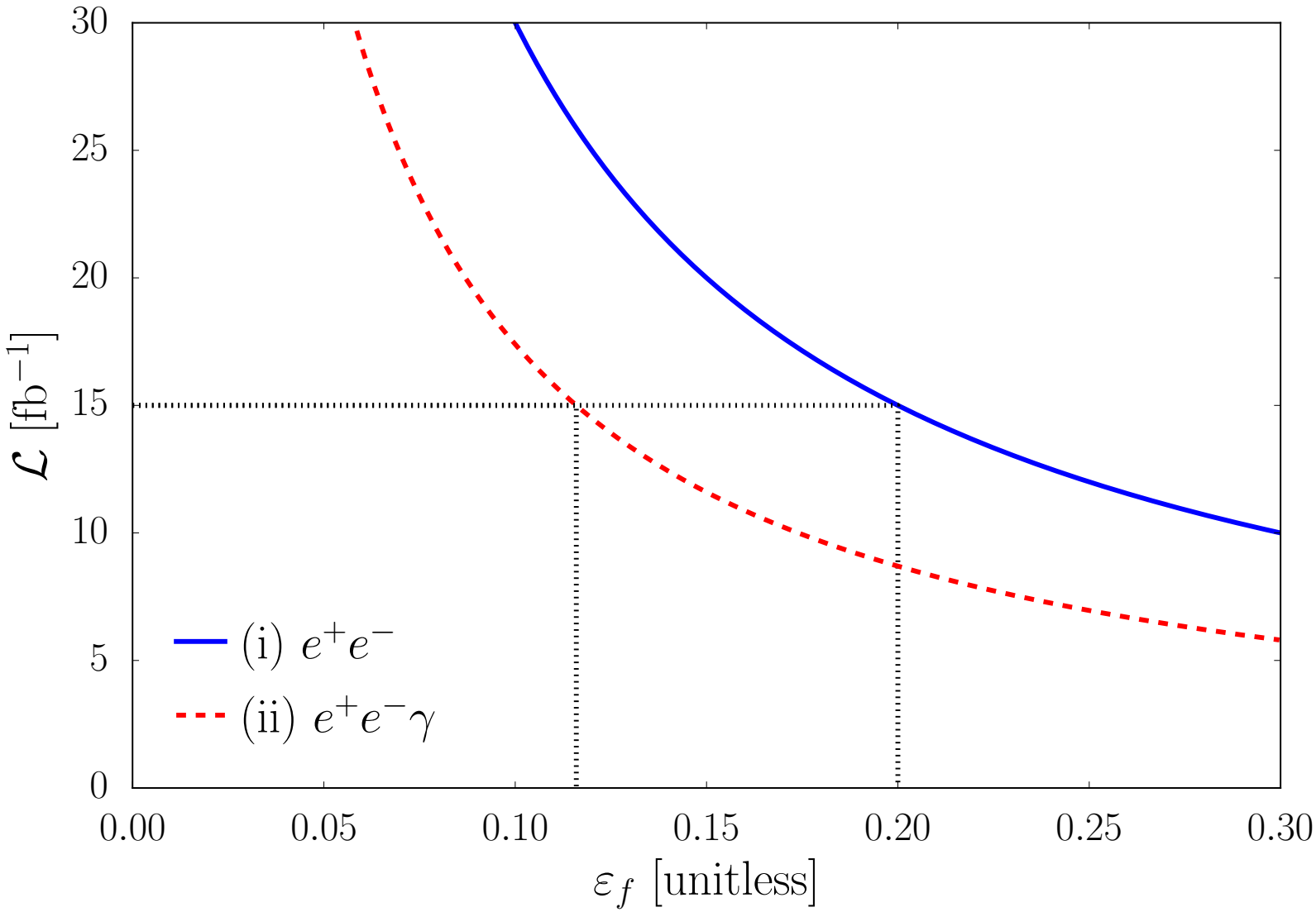
PRL 120 (2018) 061801



Run 3 Projection - Rough Numbers

- these are very rough numbers, but include all detector efficiencies
- roughly 4 η per event and 0.5 η' per event

decay	number of candidates
$\eta \to \gamma\mu^+\mu^-$	3×10^8
$\eta \to \mu^+\mu^-$	6×10^6
$\eta \to \mu^+\mu^-\pi^+\pi^-$	1×10^4
$\eta' \to \mu^+\mu^-$	2×10^4
$\eta' \to \mu^+\mu^-\pi^+\pi^-$	1×10^4
$\eta \to \gamma\ {}^3S_1[\mathrm{TM}](\to e^+e^-)$	6×10^2


30
25
20
15
10
5
0
$\mathcal{L}$ [fb^{-1}]
0.00
0.05
0.10
0.15
0.20
0.25
0.30
ε_f [unitless]
(i) e^+e^-
(ii) $e^+e^-\gamma$