

U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Science

# TRACK TRIGGERS FOR UNCONVENTIONAL SIGNATURES



TOVA HOLMES, UNIVERSITY OF TENNESSEE

KATE PACHAL, KARRI DI PETRILLO, JESSE FARR, JESS NELSON, CHRIS GUO

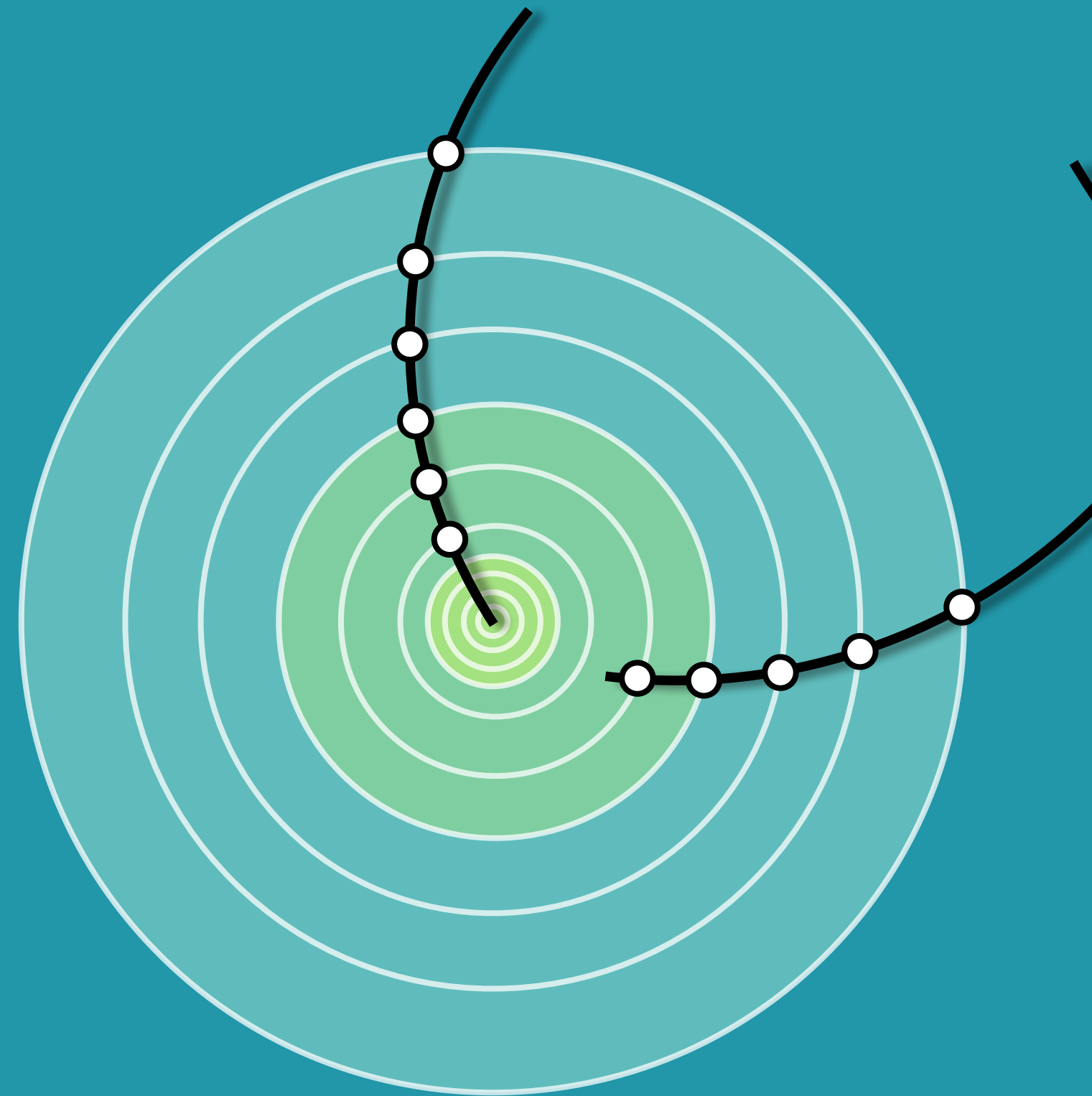
SNOWMASS 2021, 19 JULY 2022





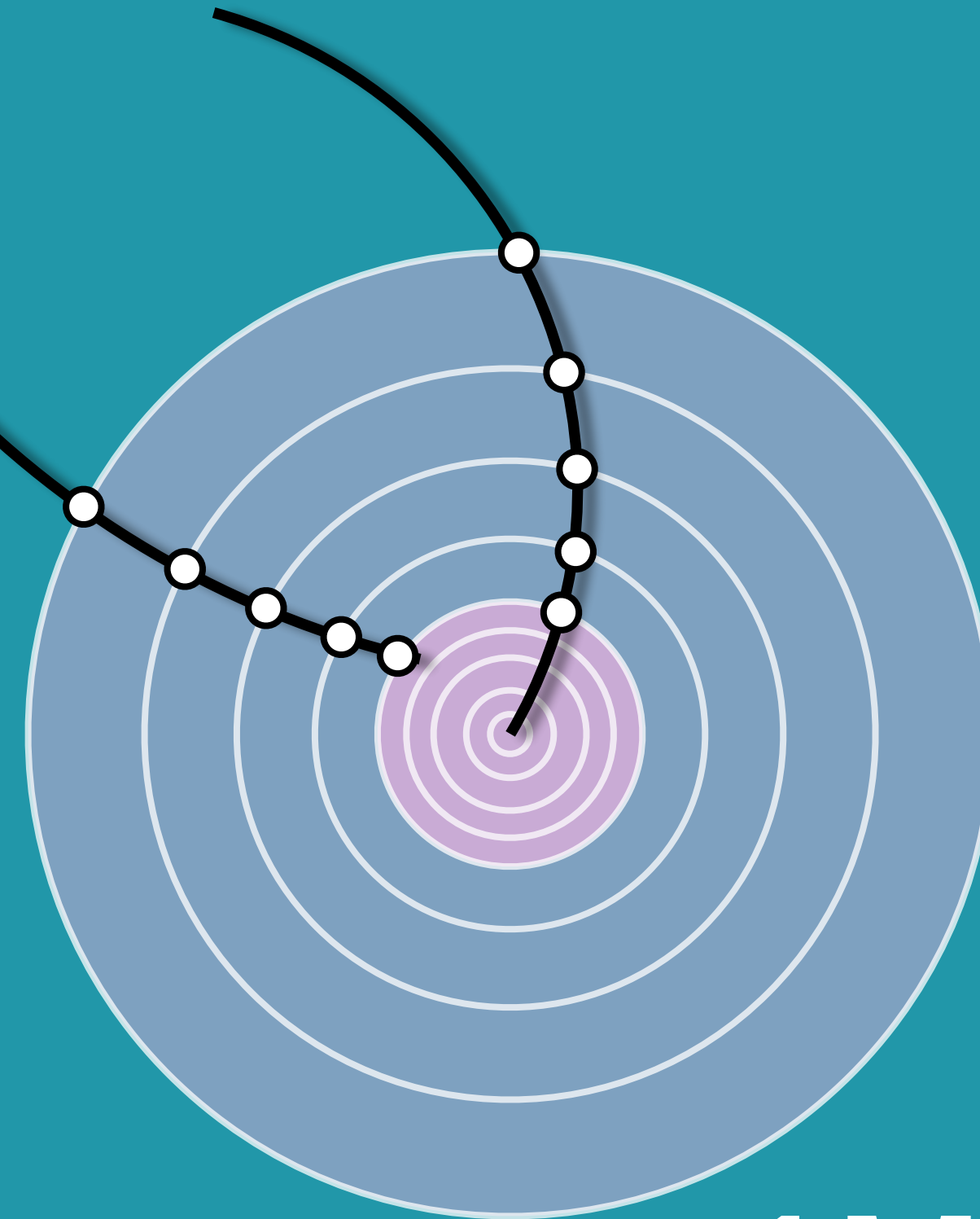
# EXPANSION OF TRACK-BASED TRIGGERS FOR HL-LHC

CMS



**L1 TRACKS** potential to add displaced tracks

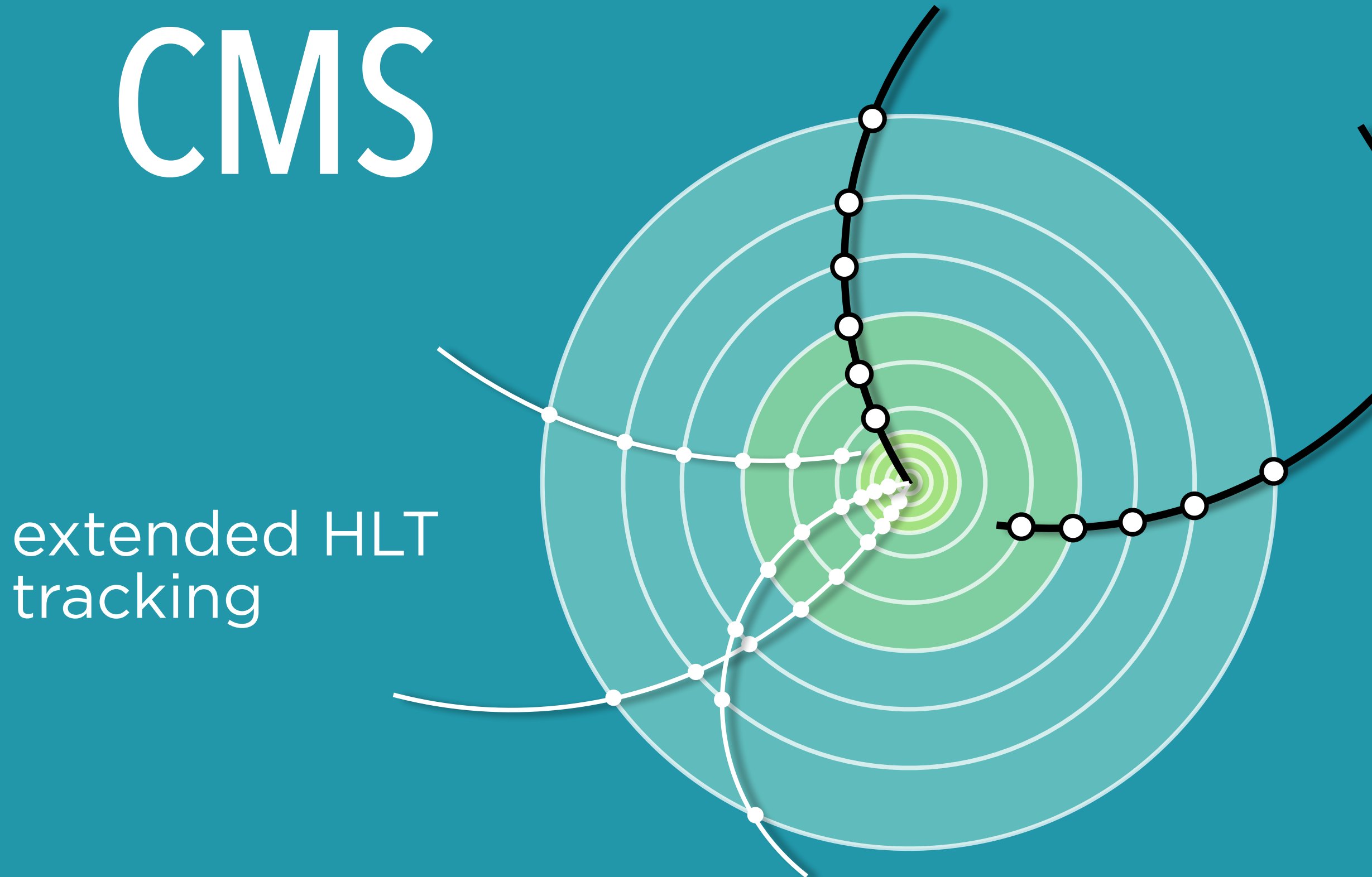
ATLAS



**1MHZ TRACKS**  
with displaced tracks  
included in the baseline

# EXPANSION OF TRACK-BASED TRIGGERS FOR HL-LHC

CMS

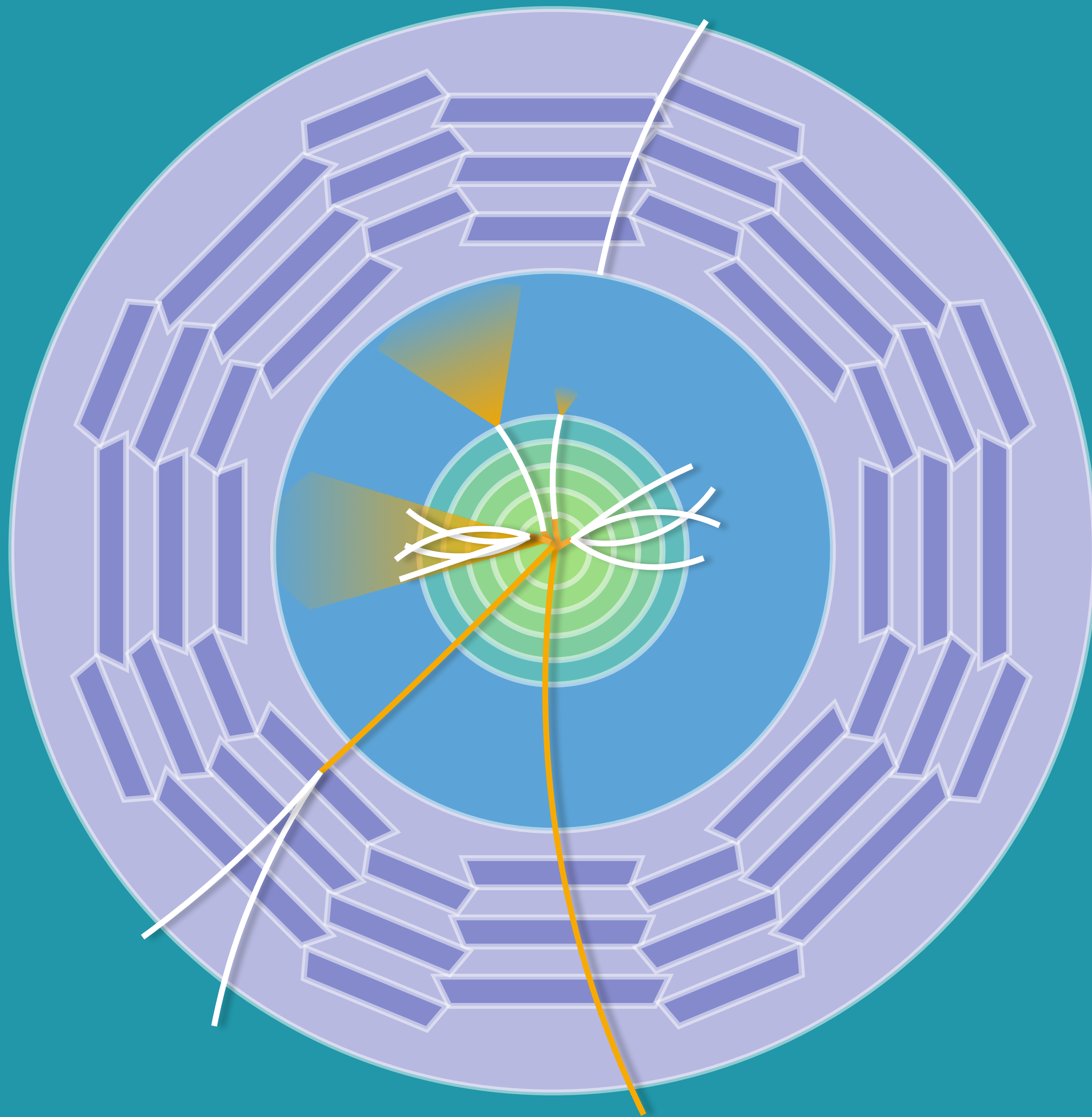


**L1 TRACKS** potential to add displaced tracks

ATLAS

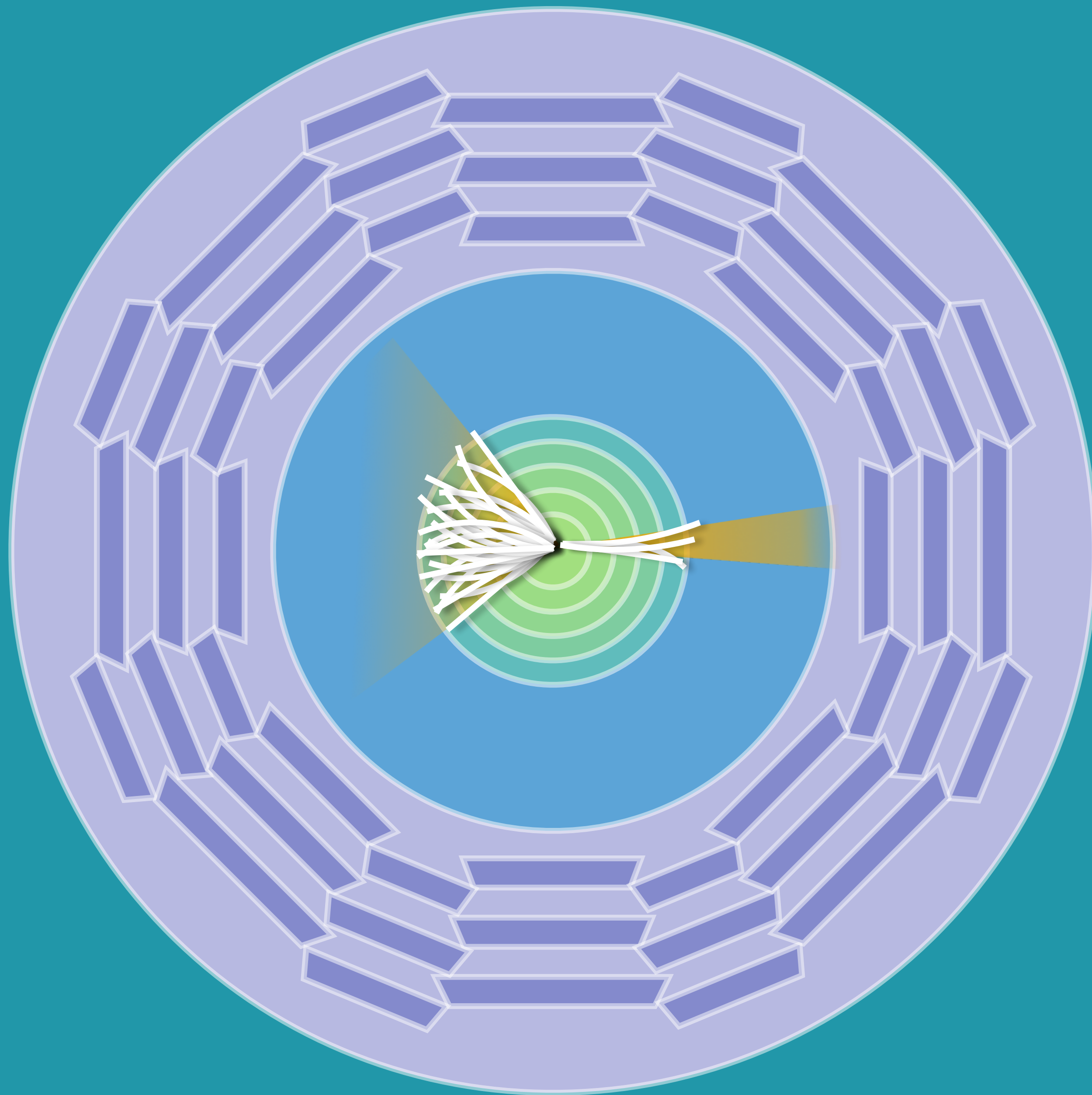


**1MHZ TRACKS**  
with displaced tracks included in the baseline



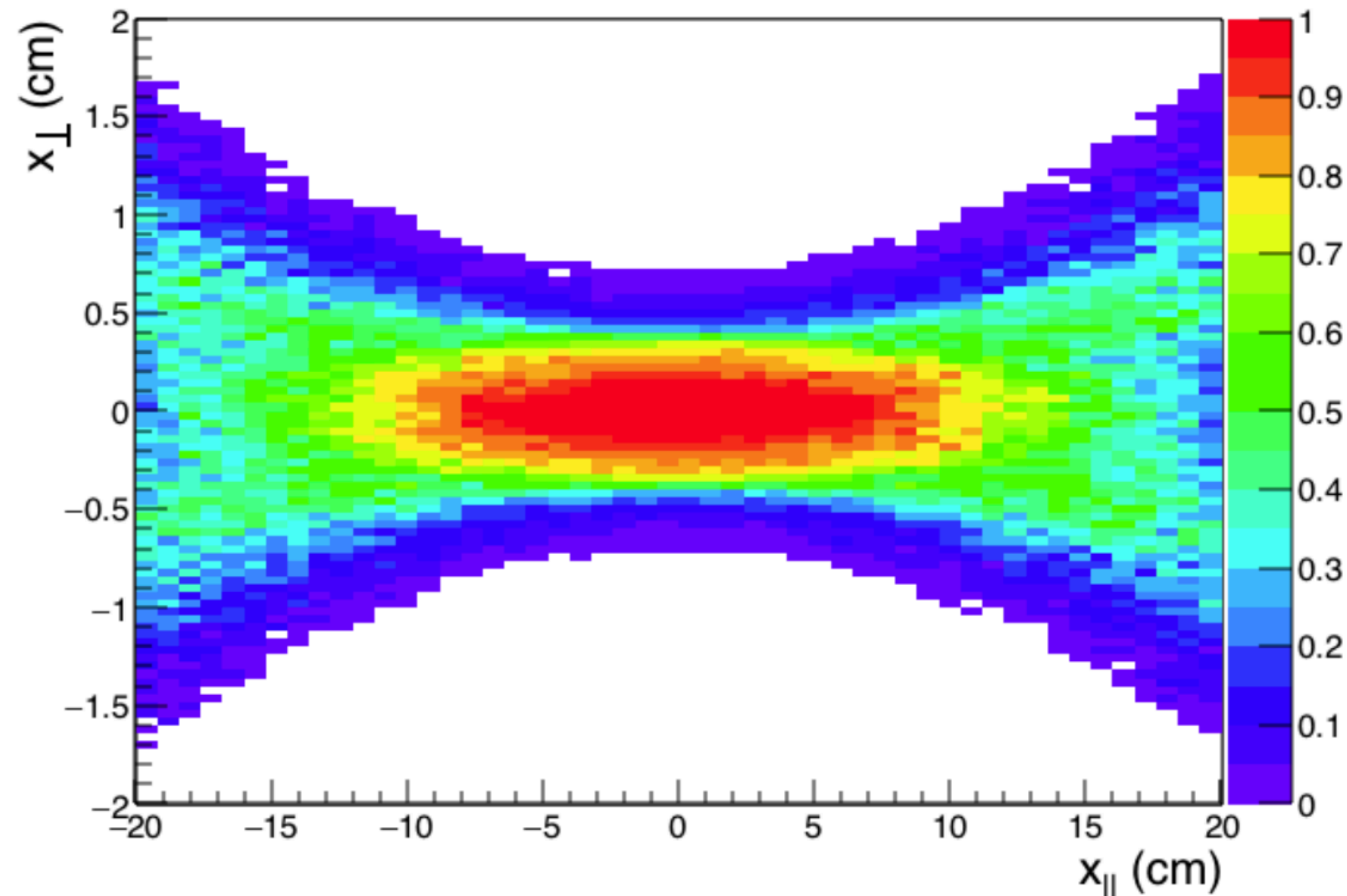
EVERY UNCONVENTIONAL  
SIGNATURE IS DIFFERENT



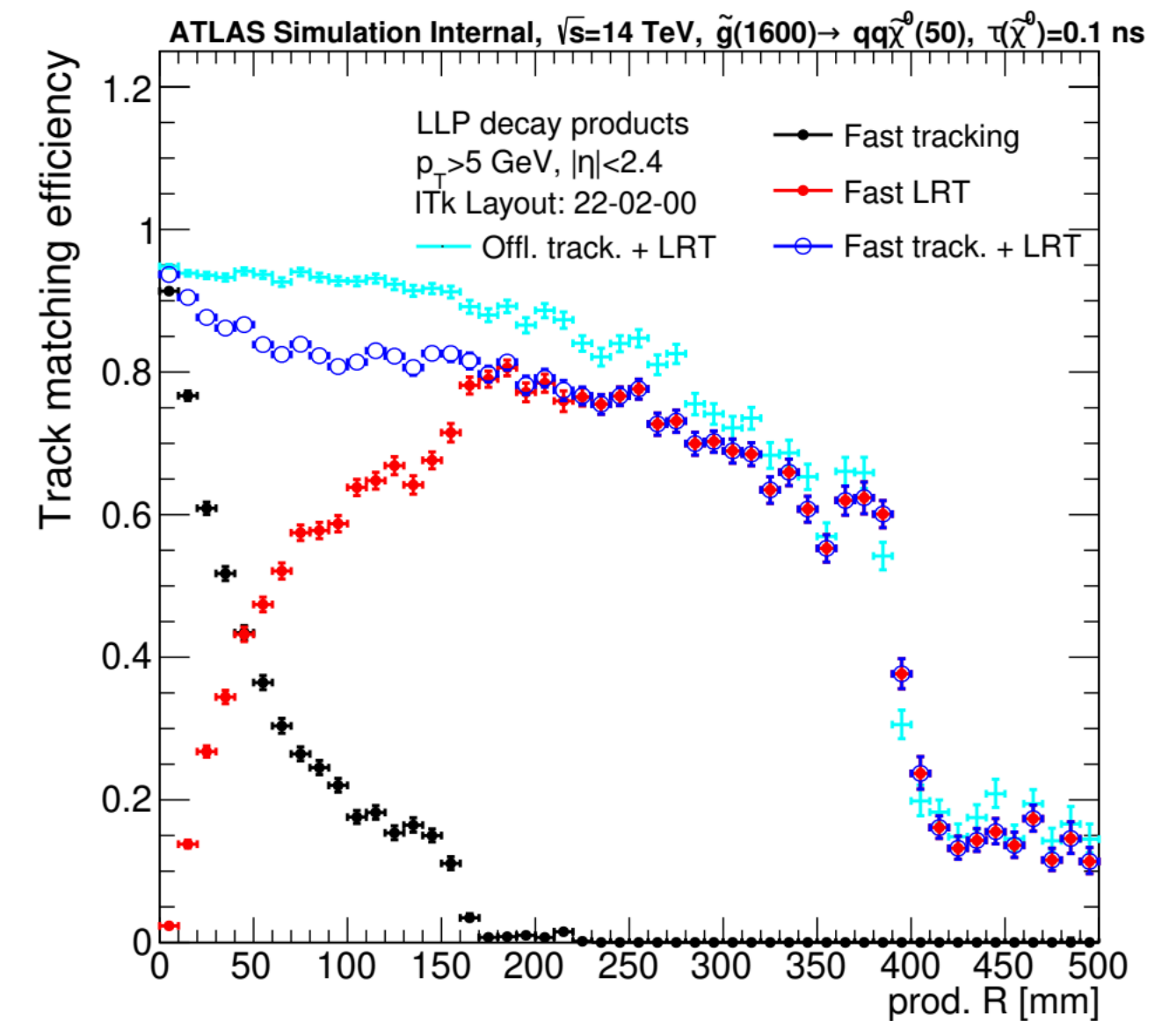
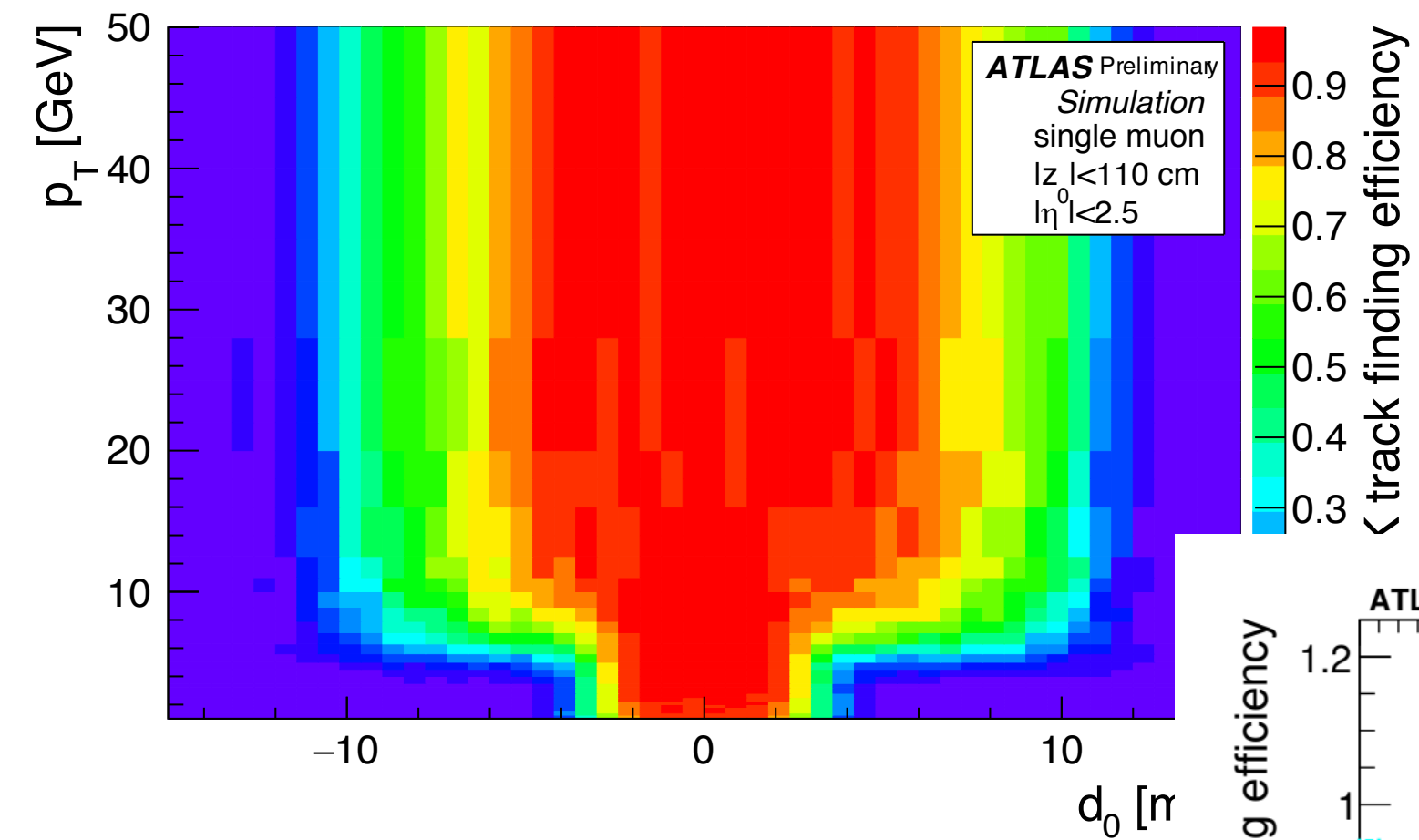


EVERY UNCONVENTIONAL  
SIGNATURE IS DIFFERENT

# IDENTIFICATION IN THE TRIGGER



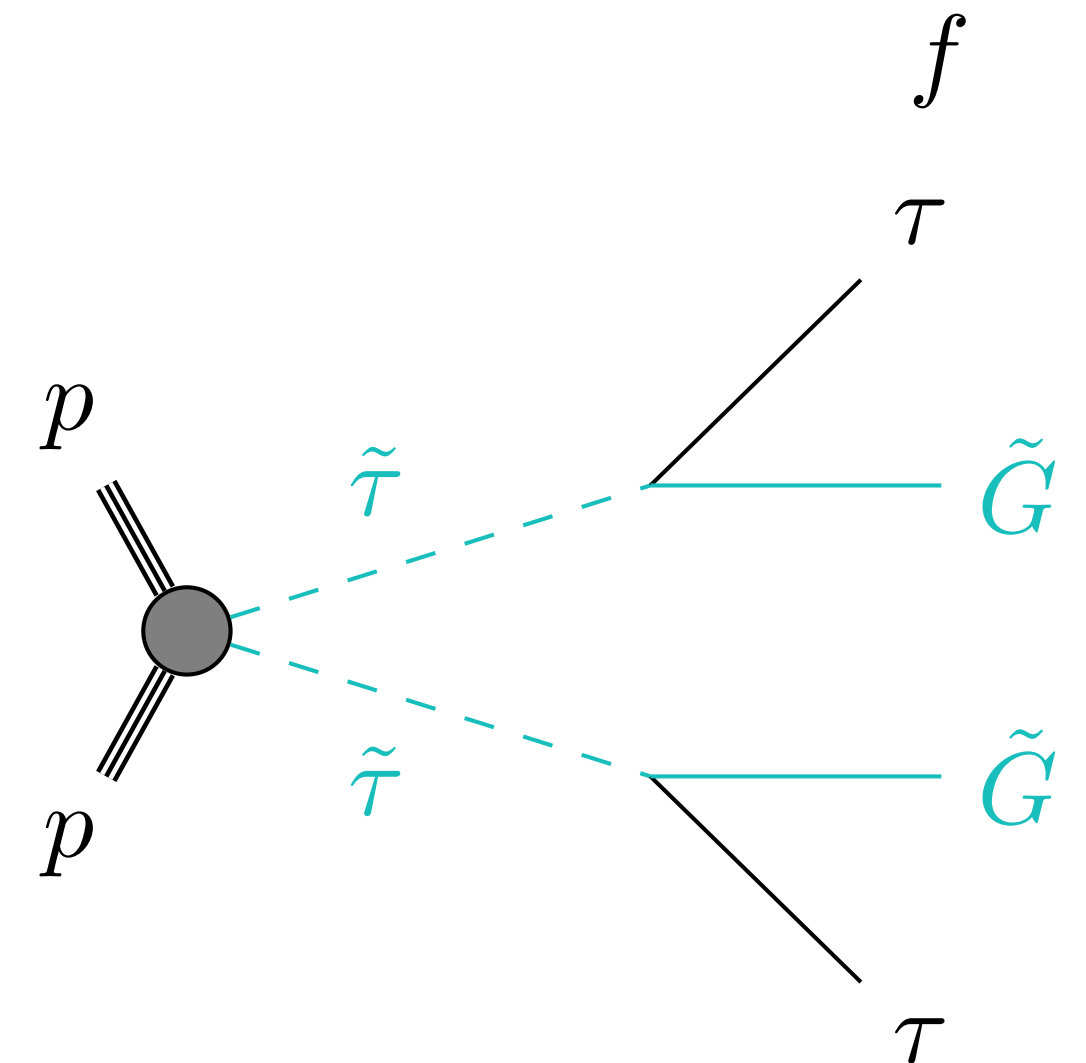
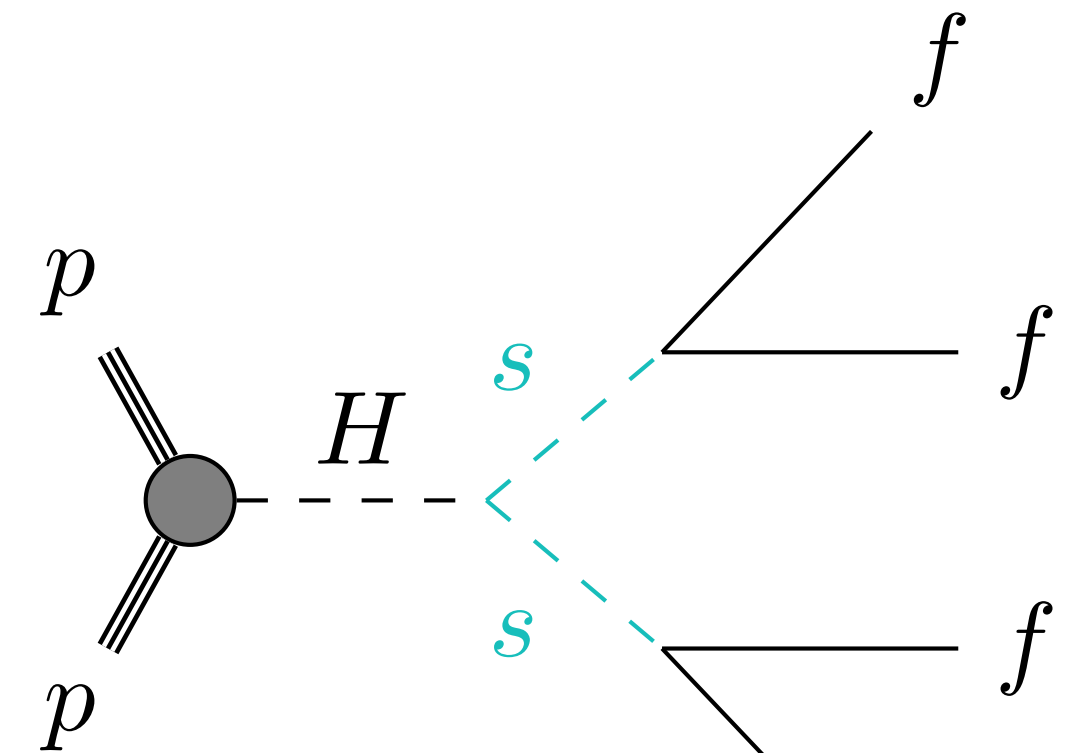
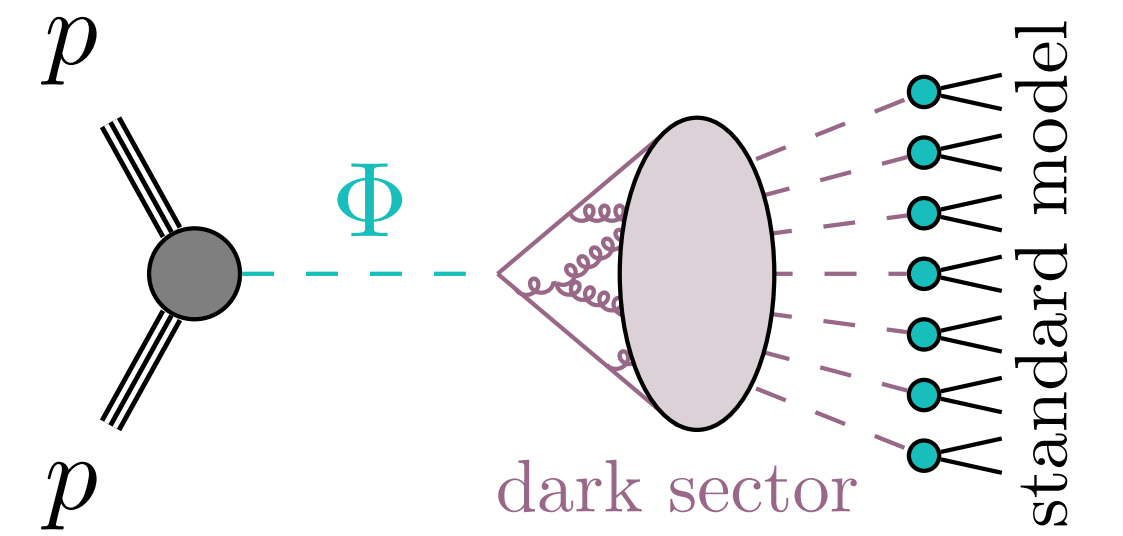
Y. Gershtein



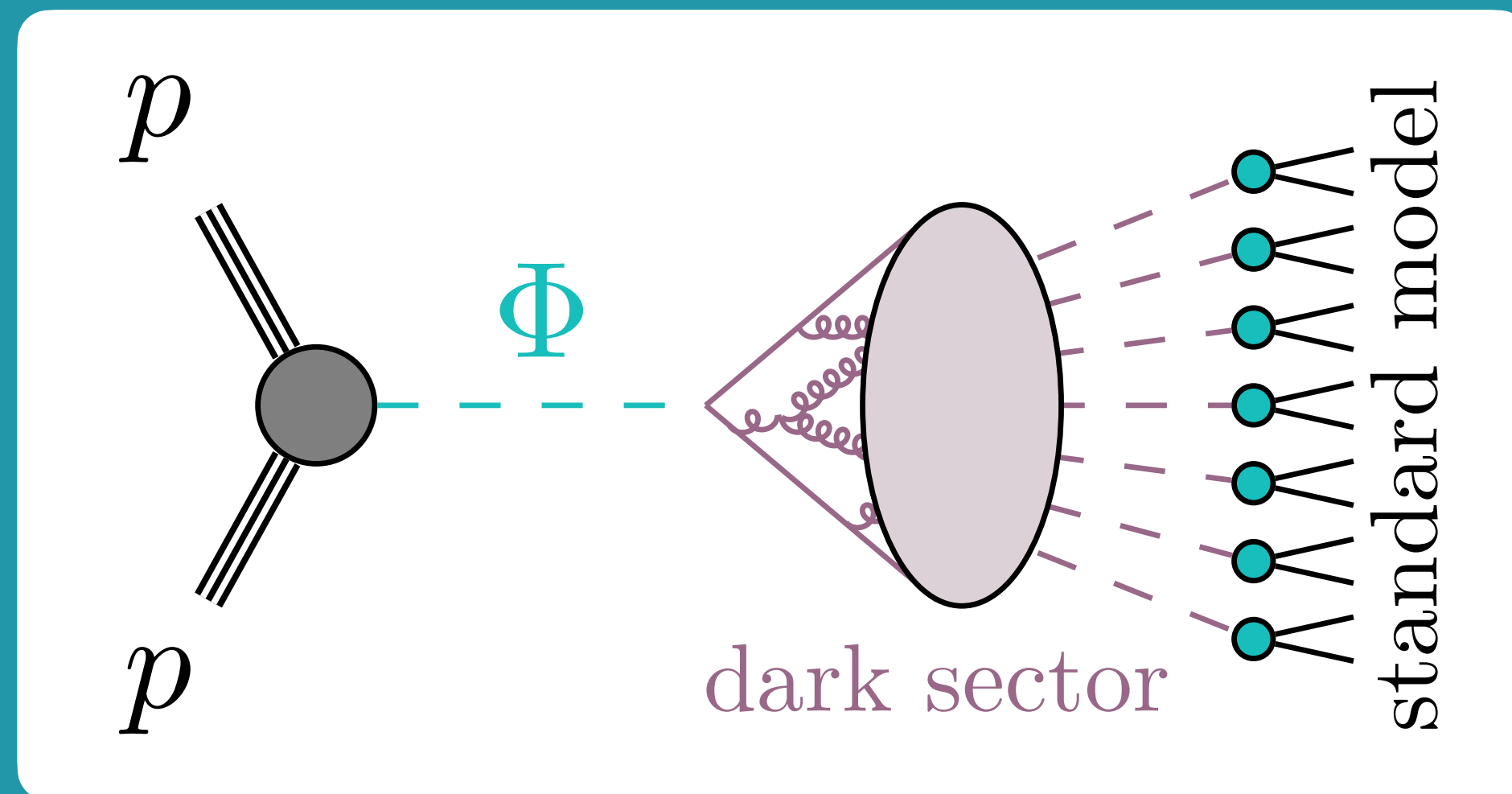
ATLAS Collaboration



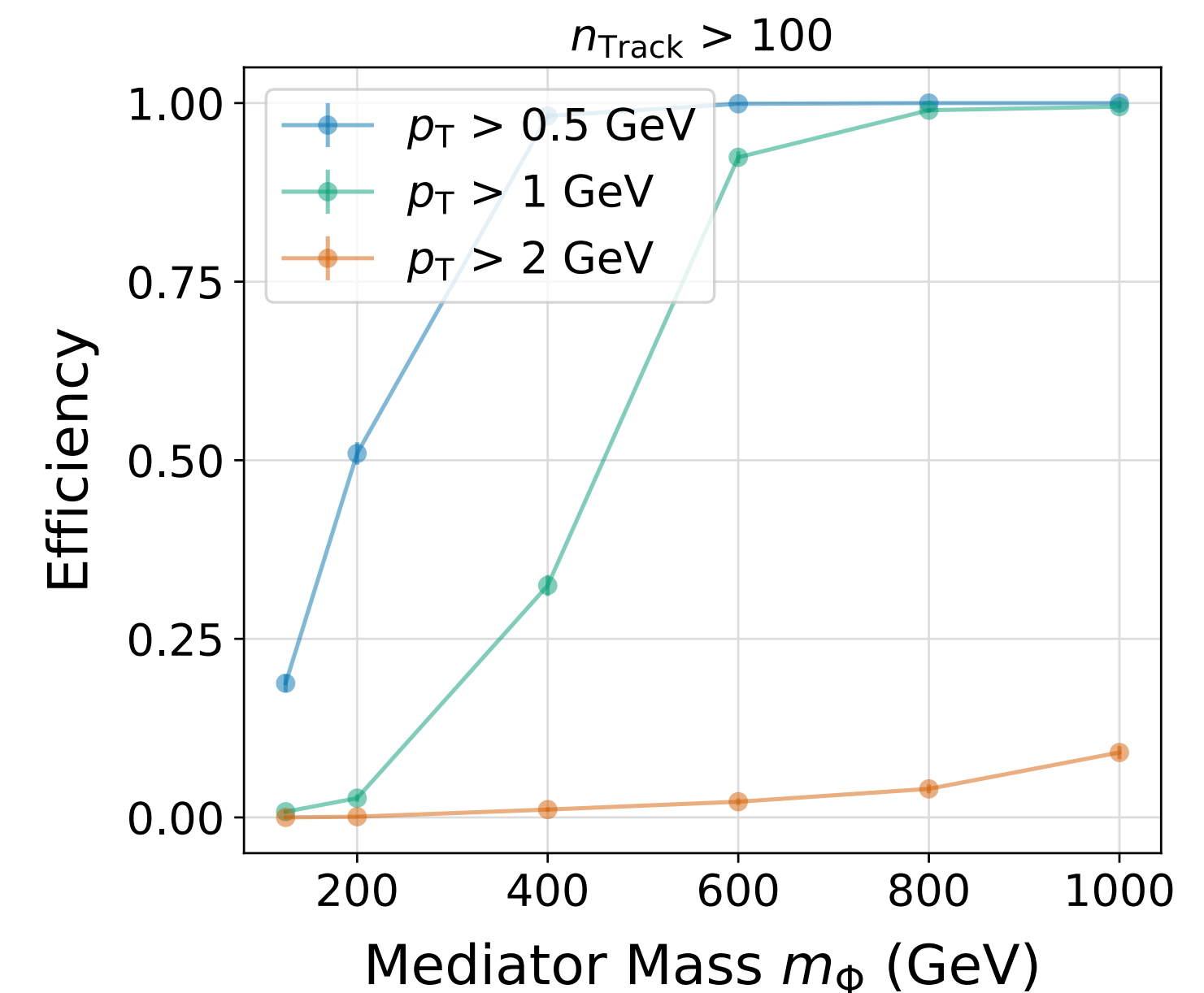
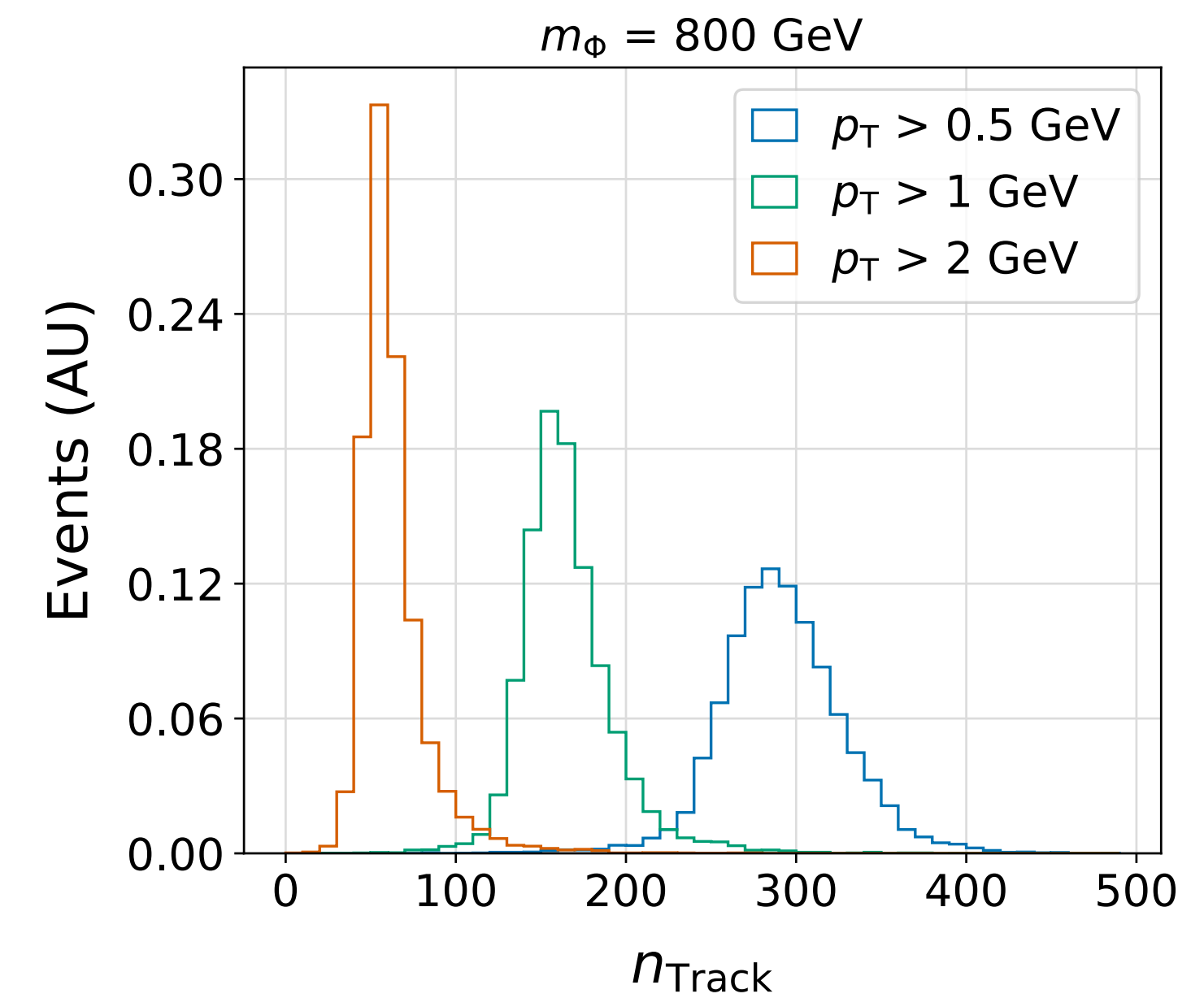
# HOW TO MAXIMIZE FLEXIBILITY?



# SUEPS

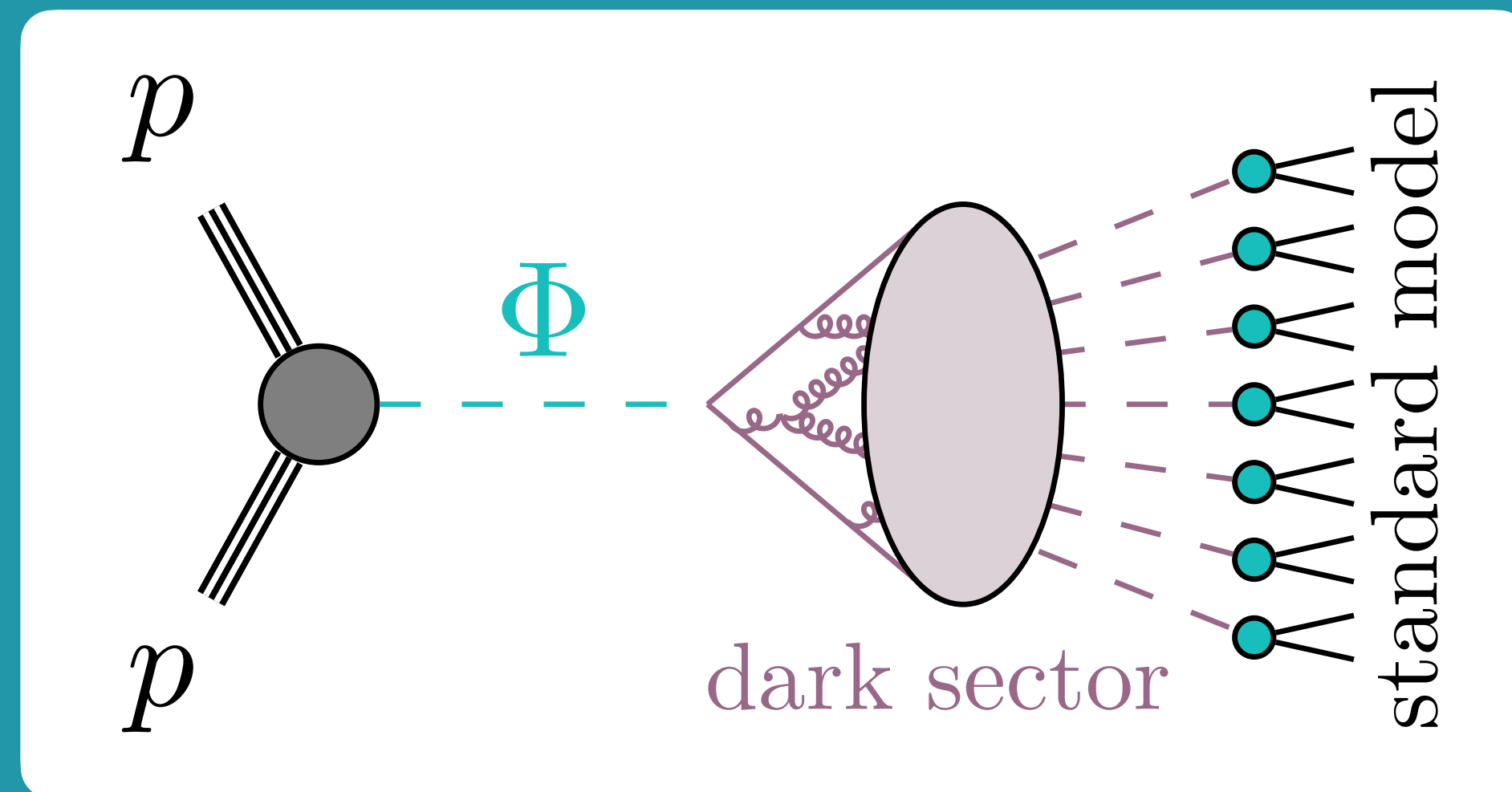


**DISTINCTIVE SIGNATURE: HIGH TRACK MULTIPLICITY**

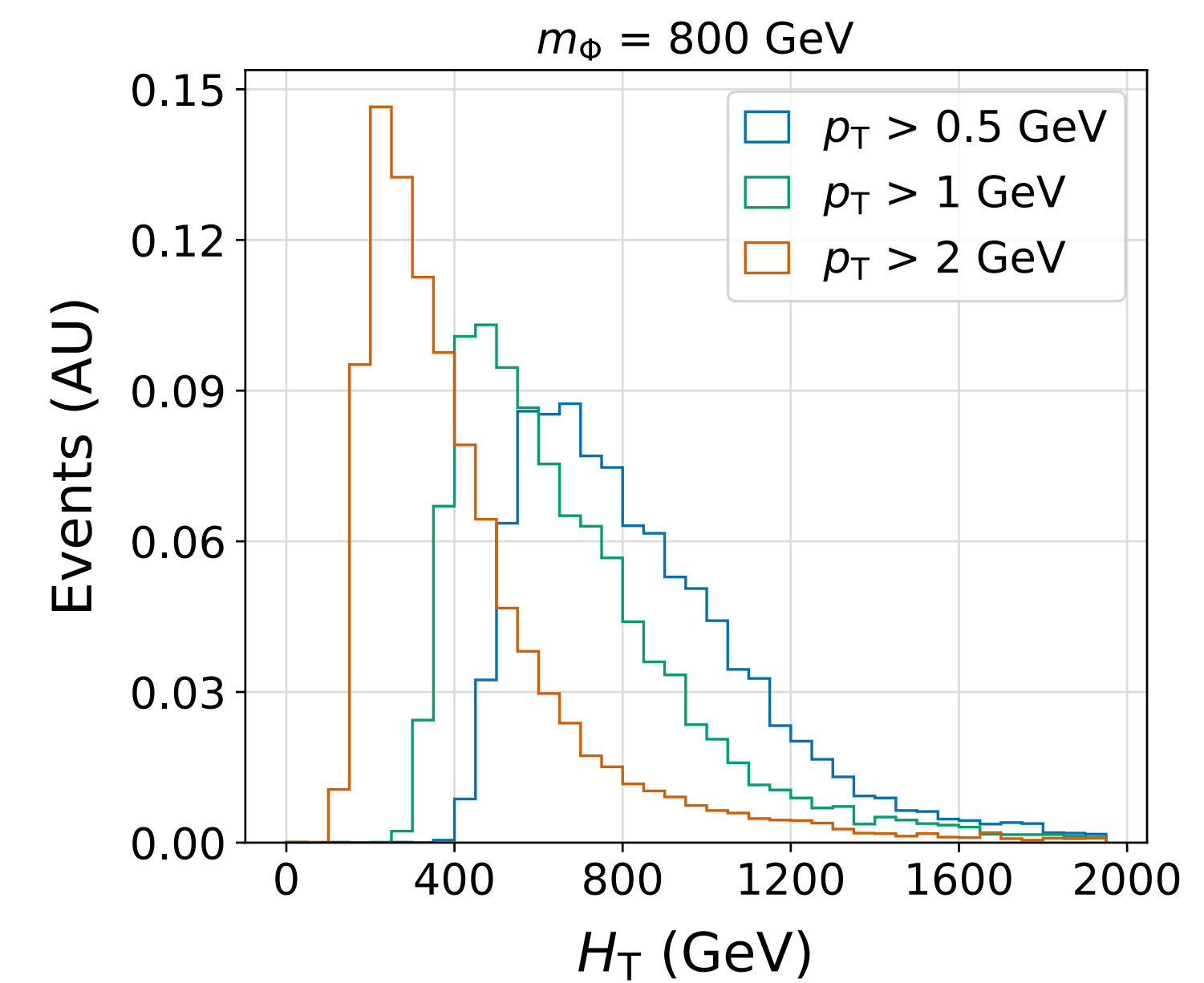
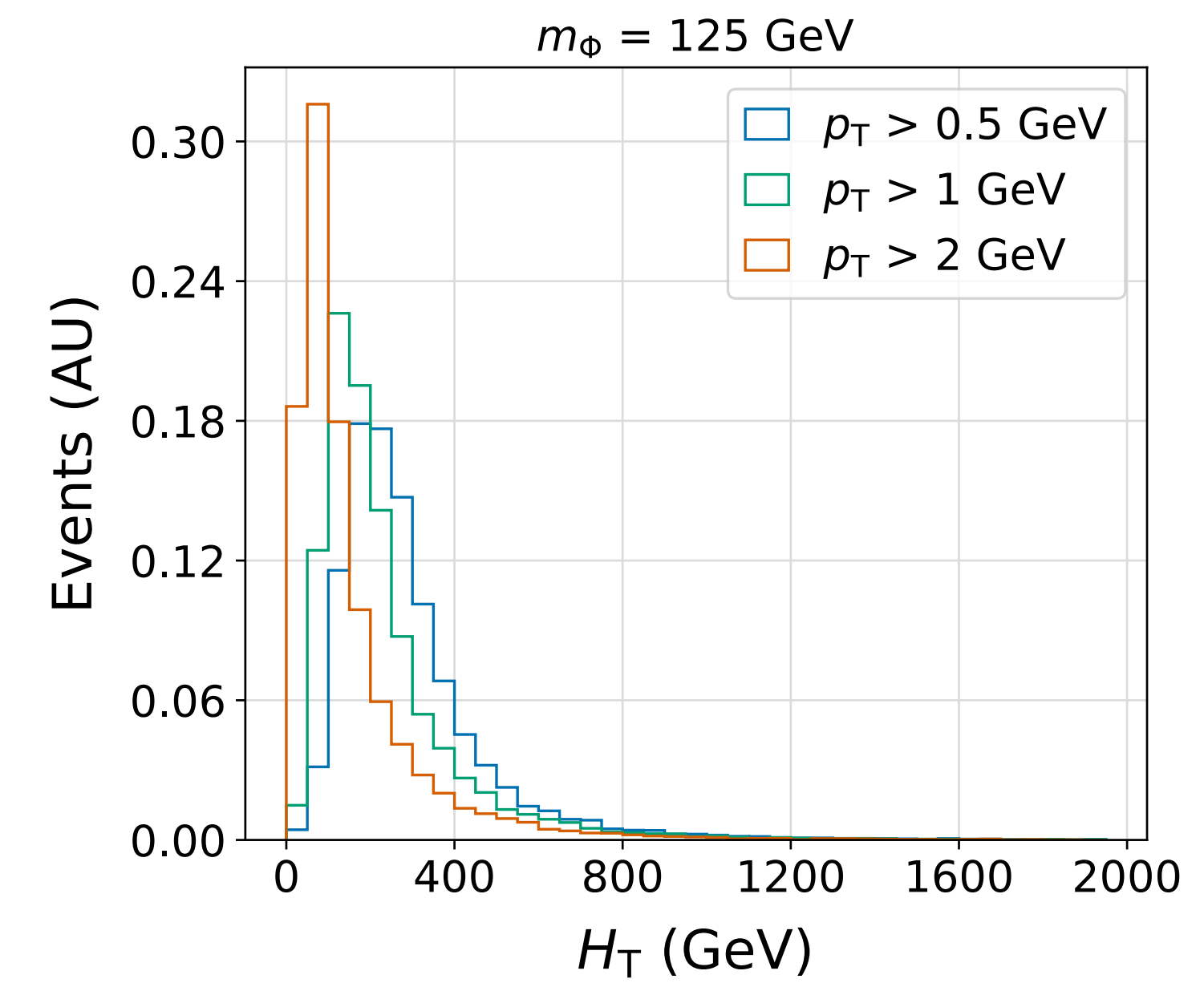




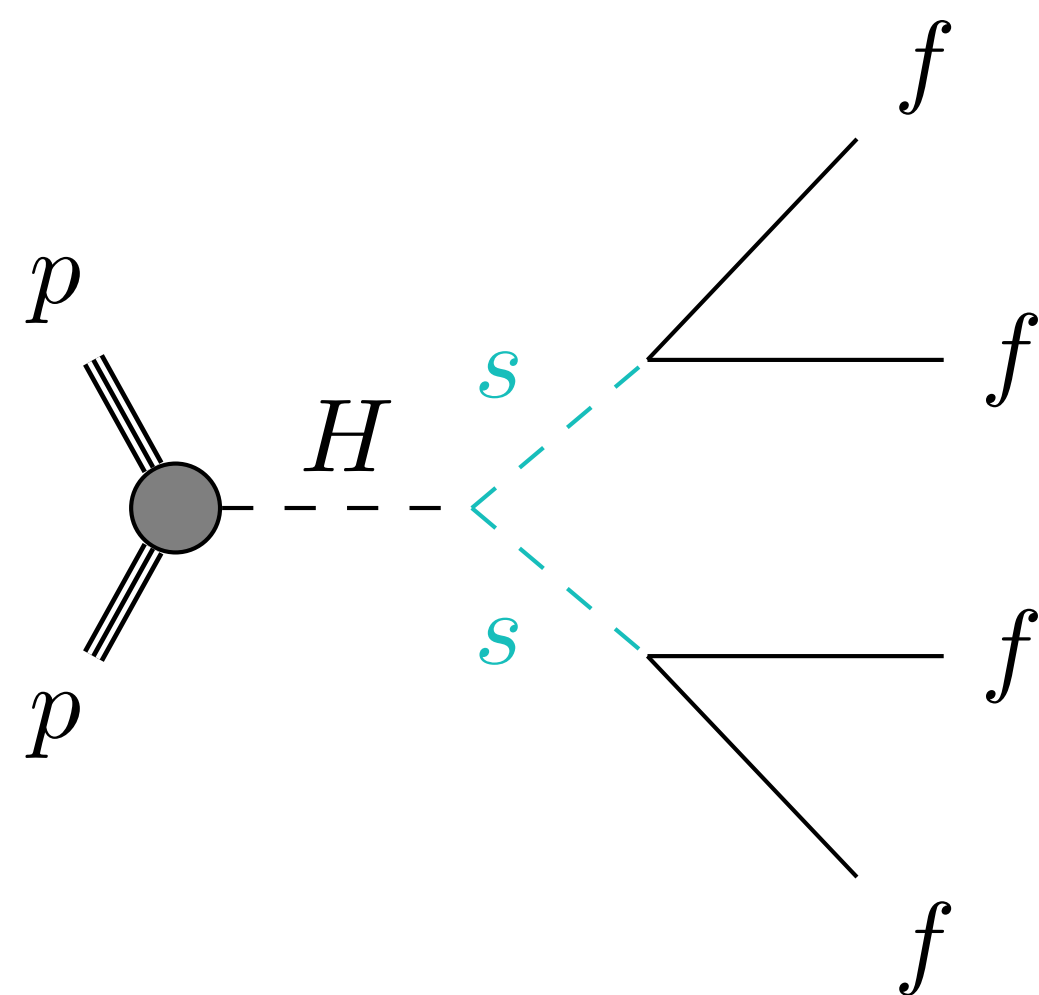
# SUEPS



**MOST IMPORTANT: AS LOW A PT THRESHOLD AS POSSIBLE**

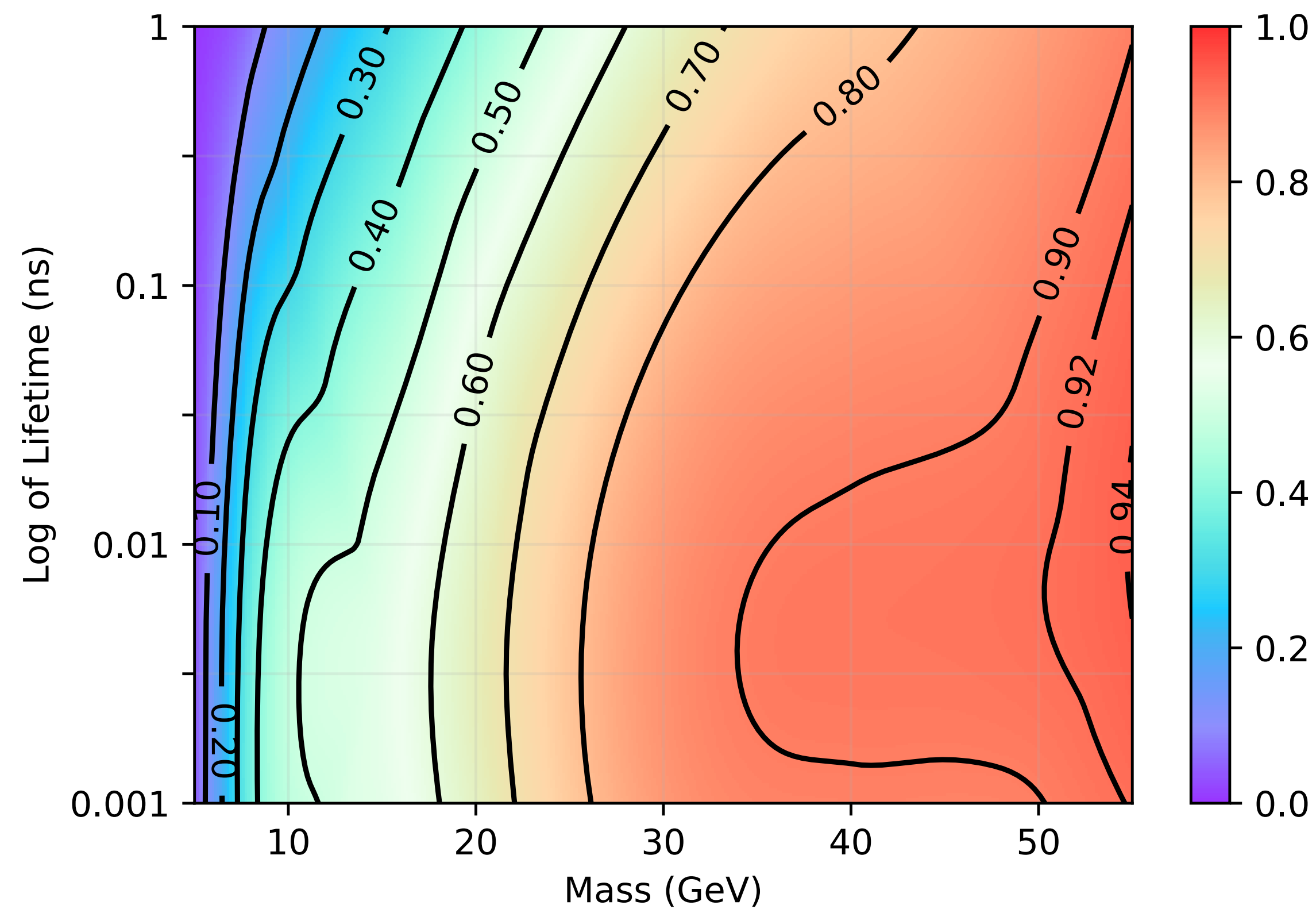


# HIGGS PORTAL



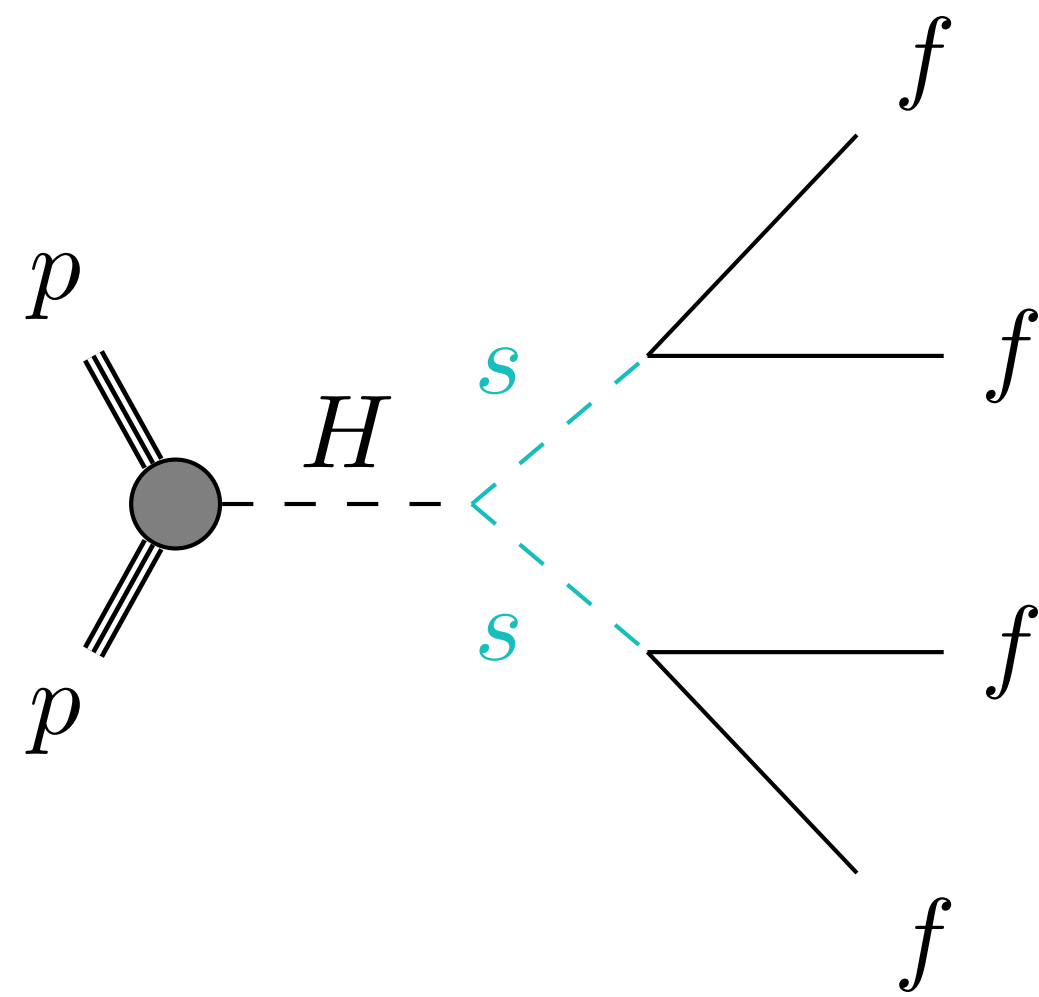
**DISTINCTIVE SIGNATURE: DISPLACED VERTICES**

**ACCEPTANCE: 5 DISPLACED TRACKS**

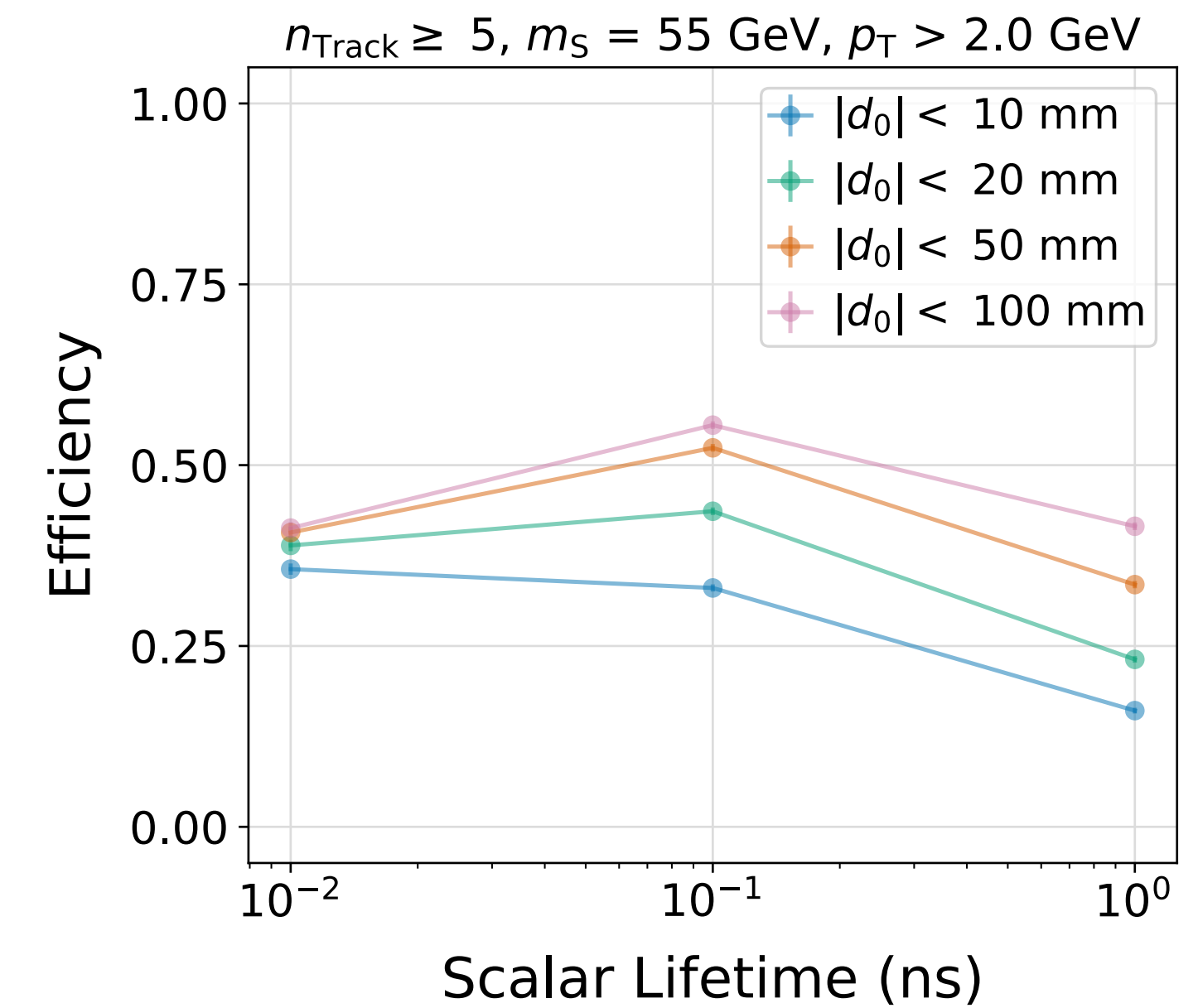
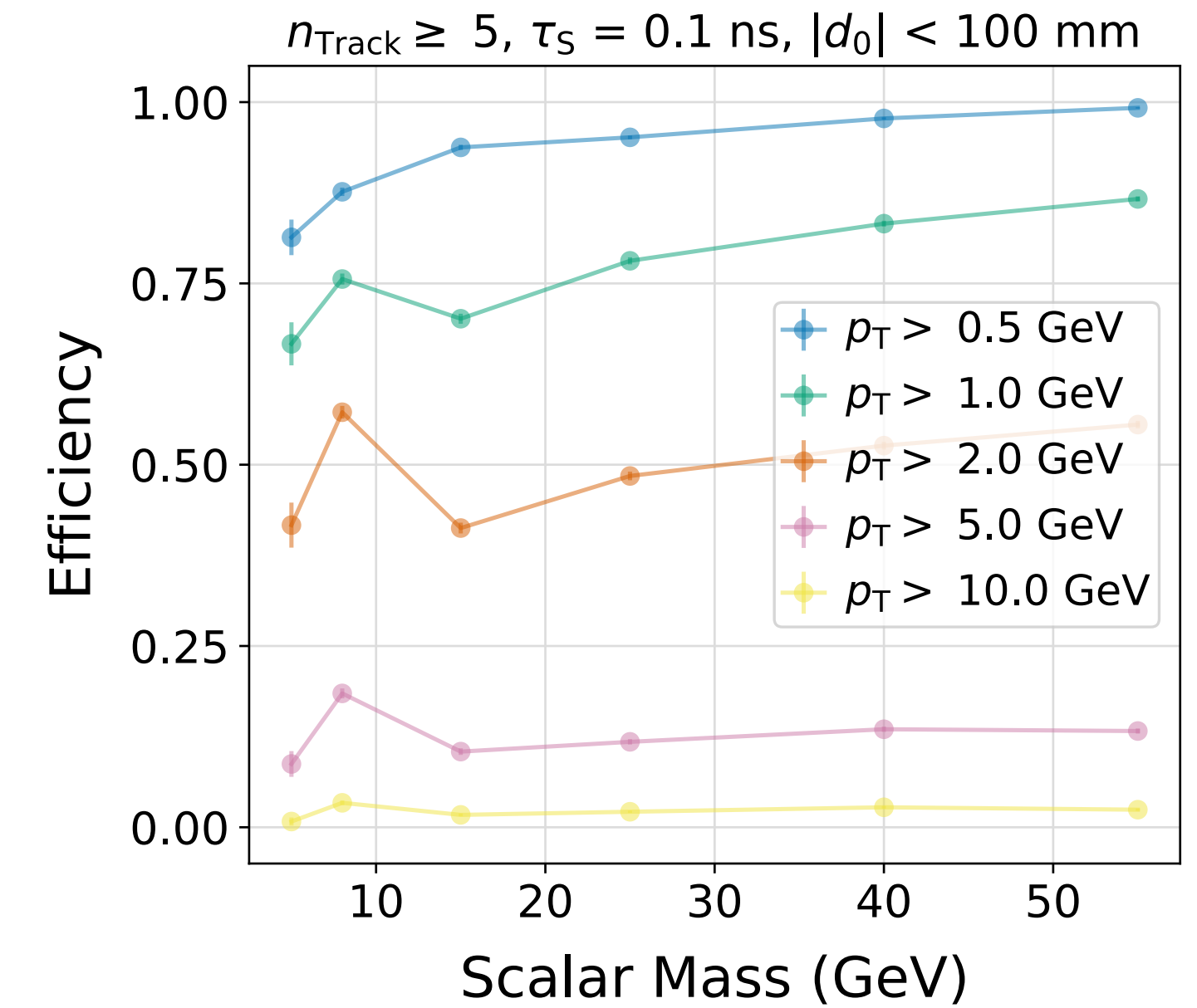




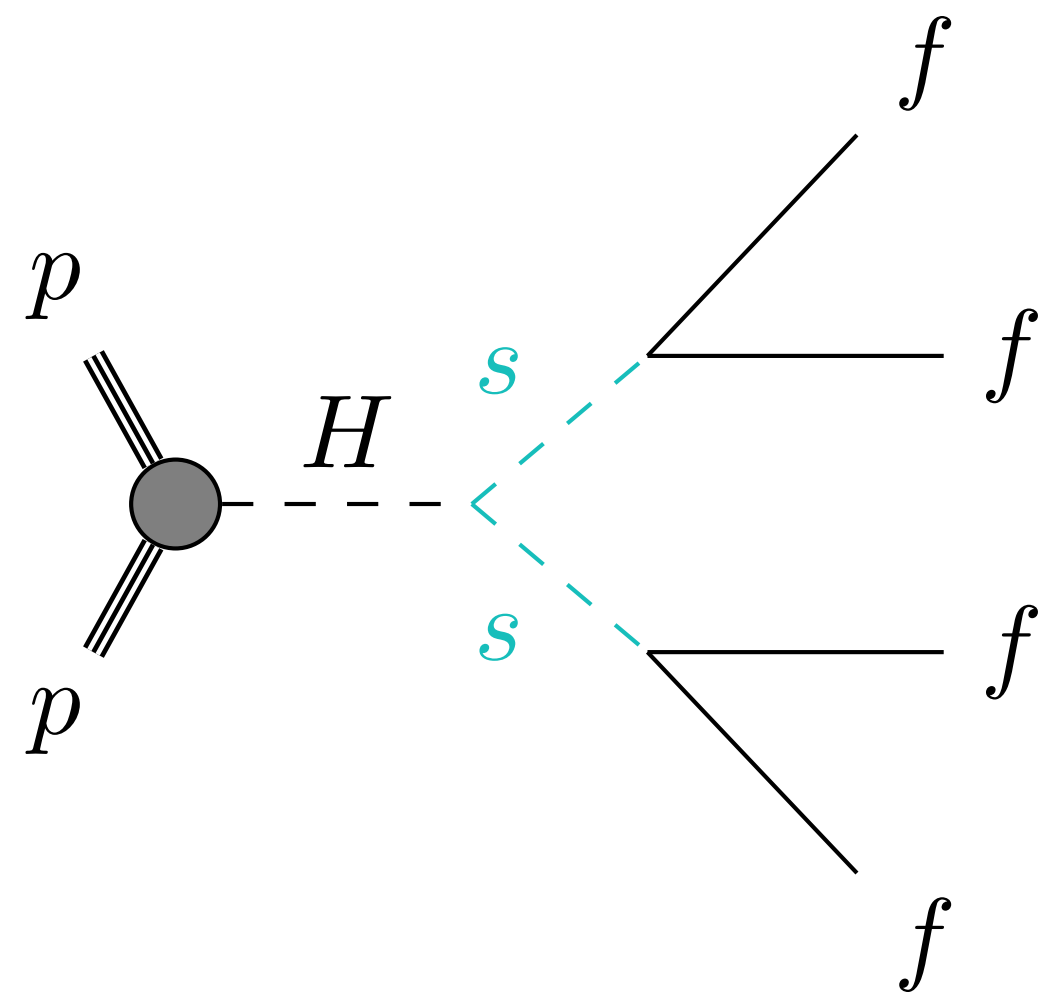
# HIGGS PORTAL



**MOST IMPORTANT: LOW PT THRESHOLD  
WITH NON-ZERO DISPLACEMENT RANGE**

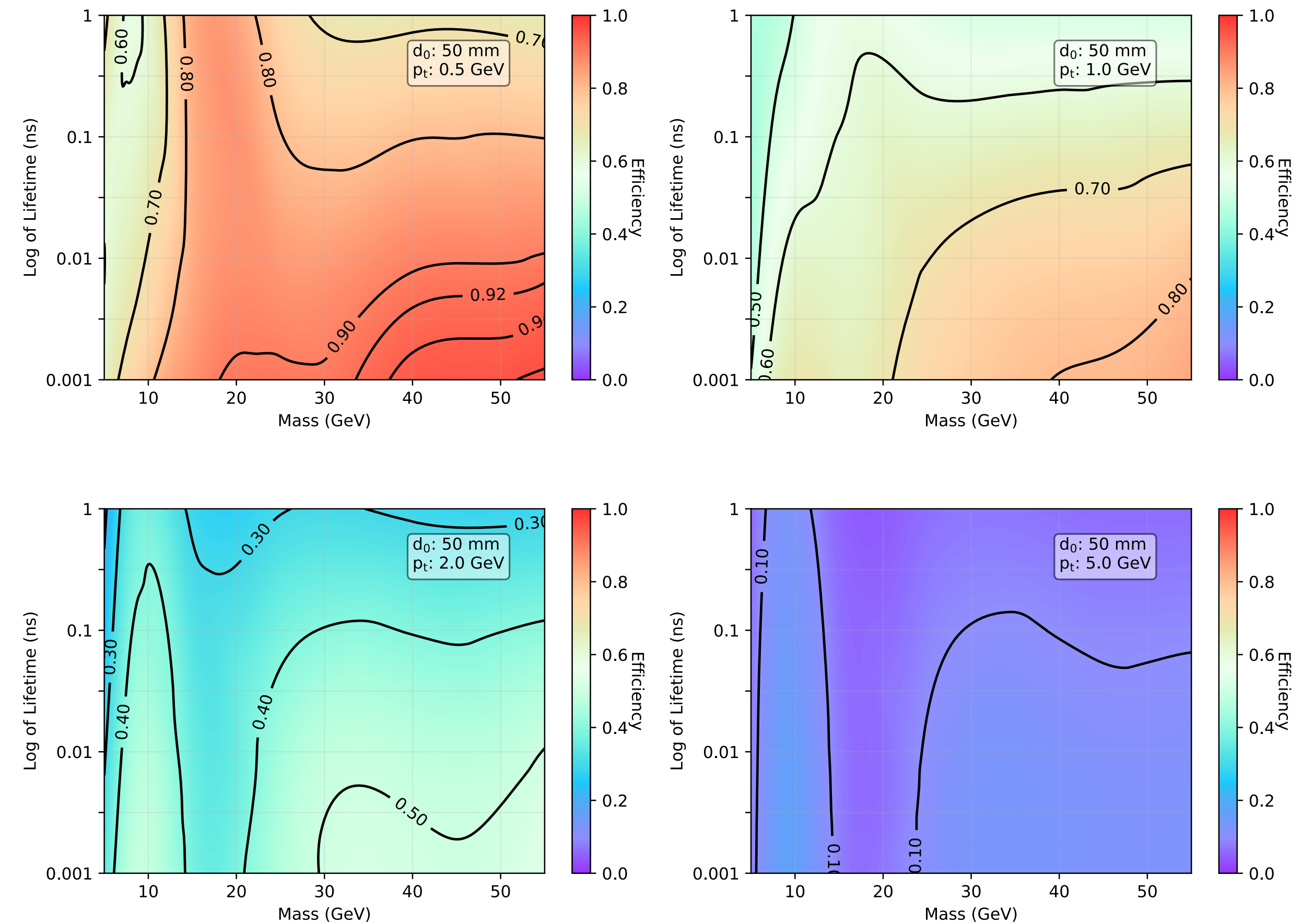


# HIGGS PORTAL



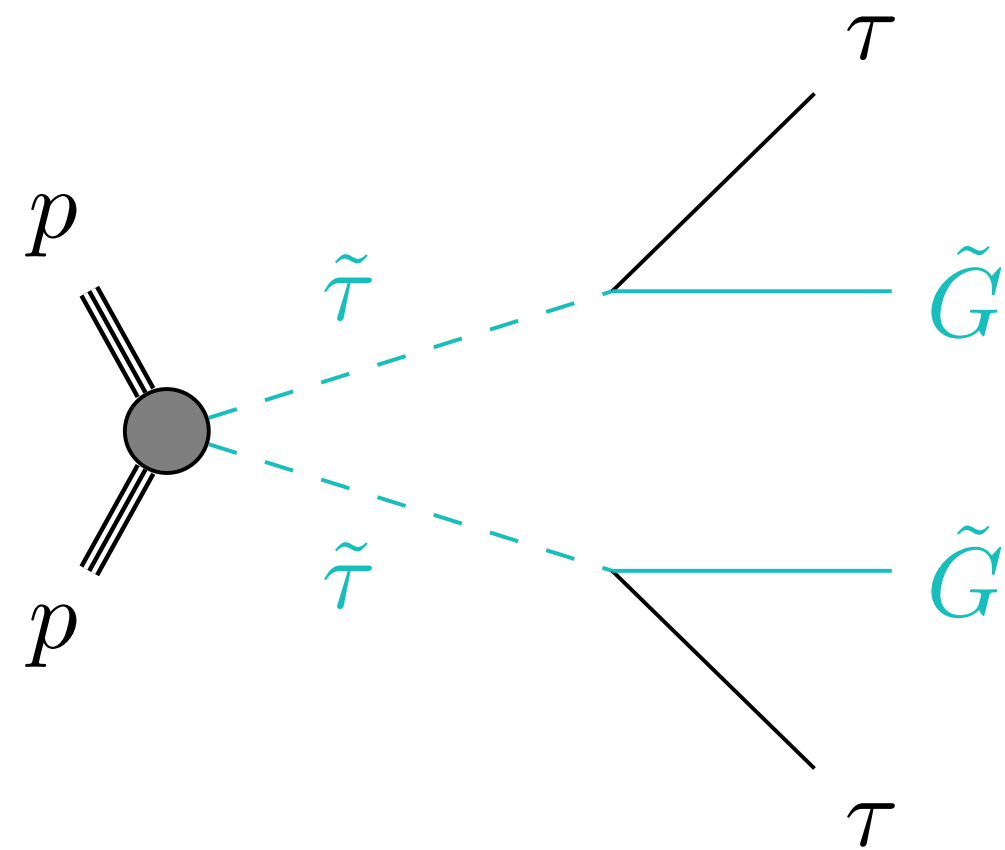
**MOST IMPORTANT: LOW PT THRESHOLD  
WITH NON-ZERO DISPLACEMENT RANGE**

## EFFICIENCY DUE TO INCREASING PT THRESHOLDS

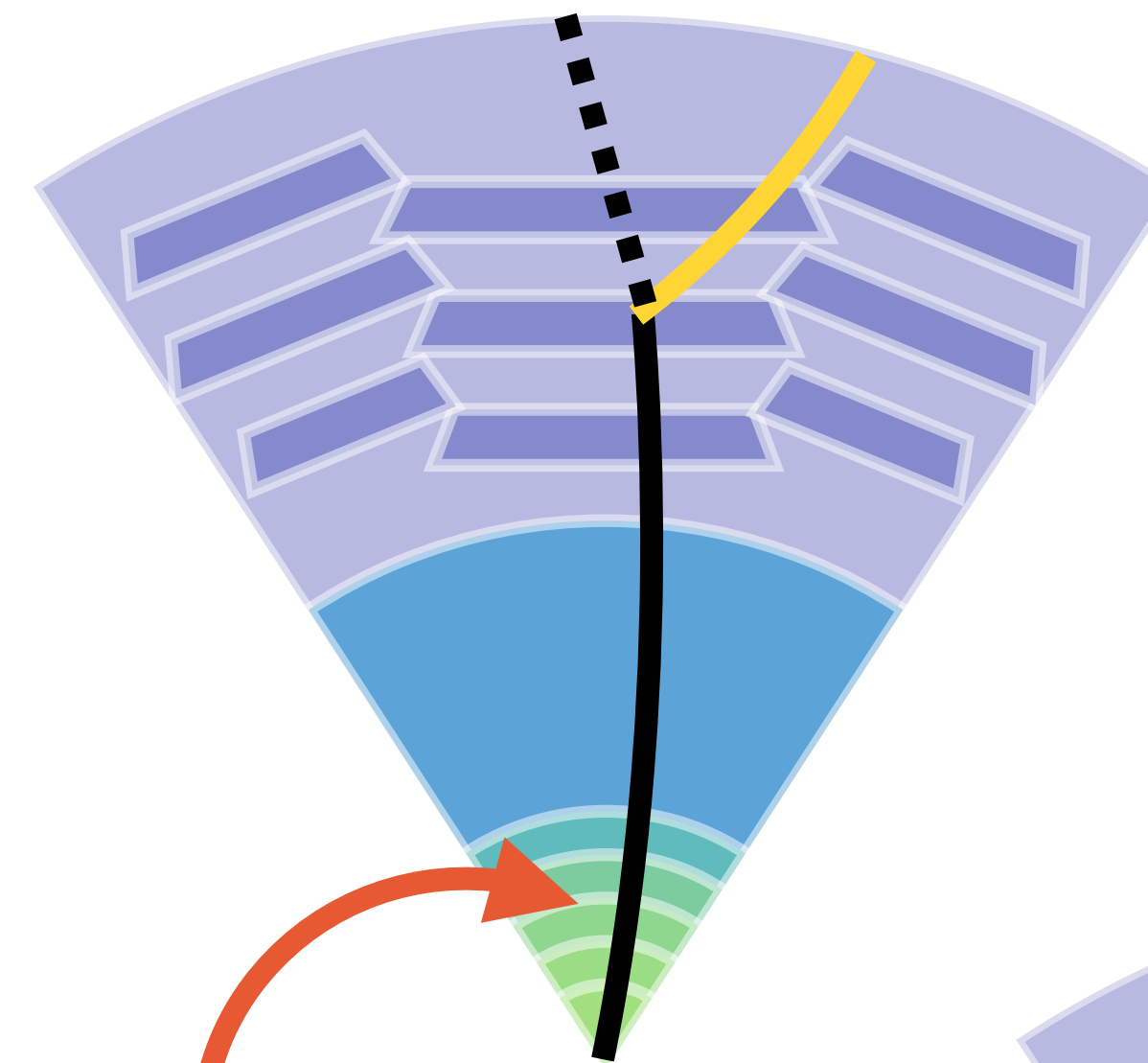




# LONG-LIVED STAU



## DISTINCTIVE SIGNATURES

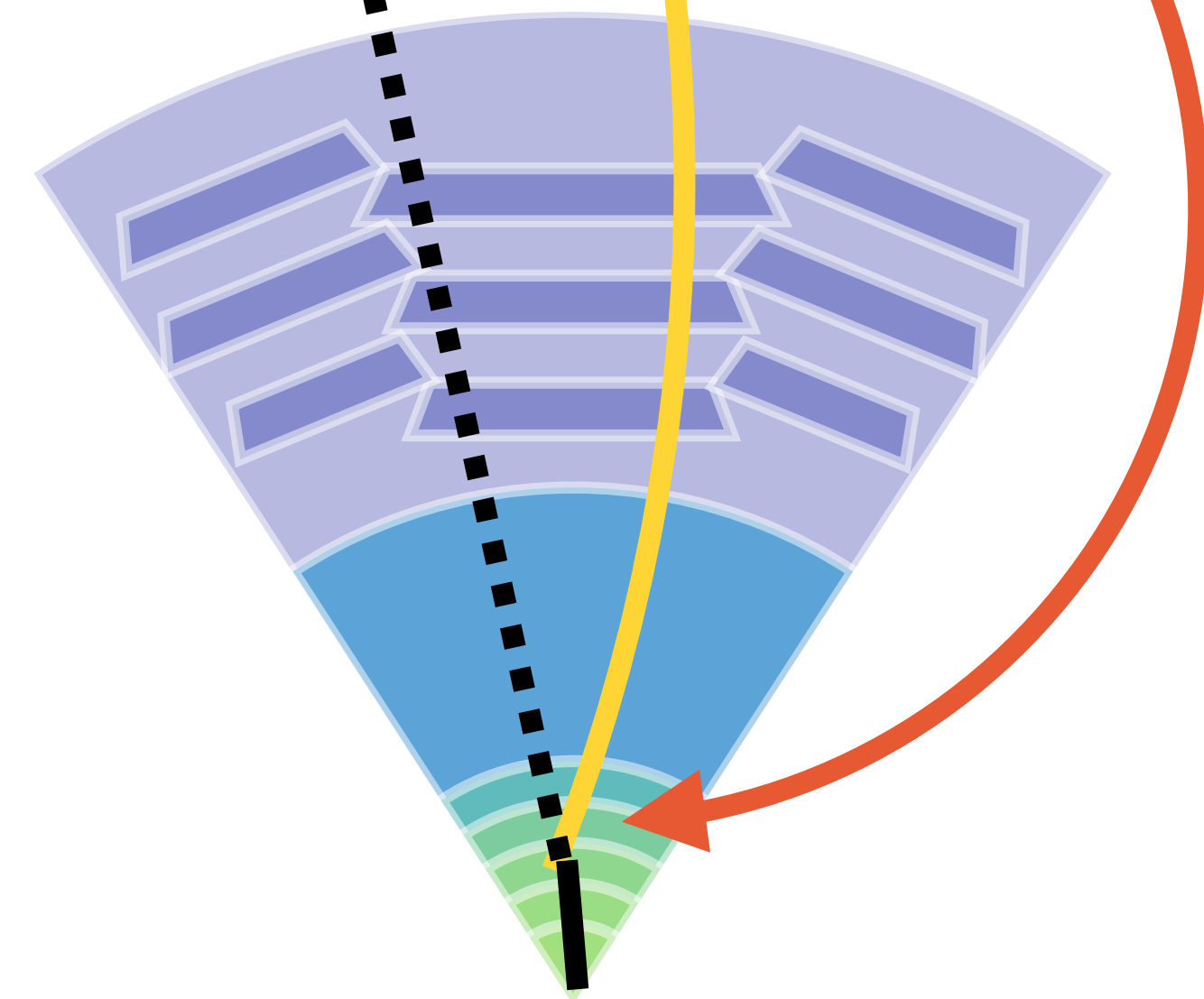


NON-SM TRACK

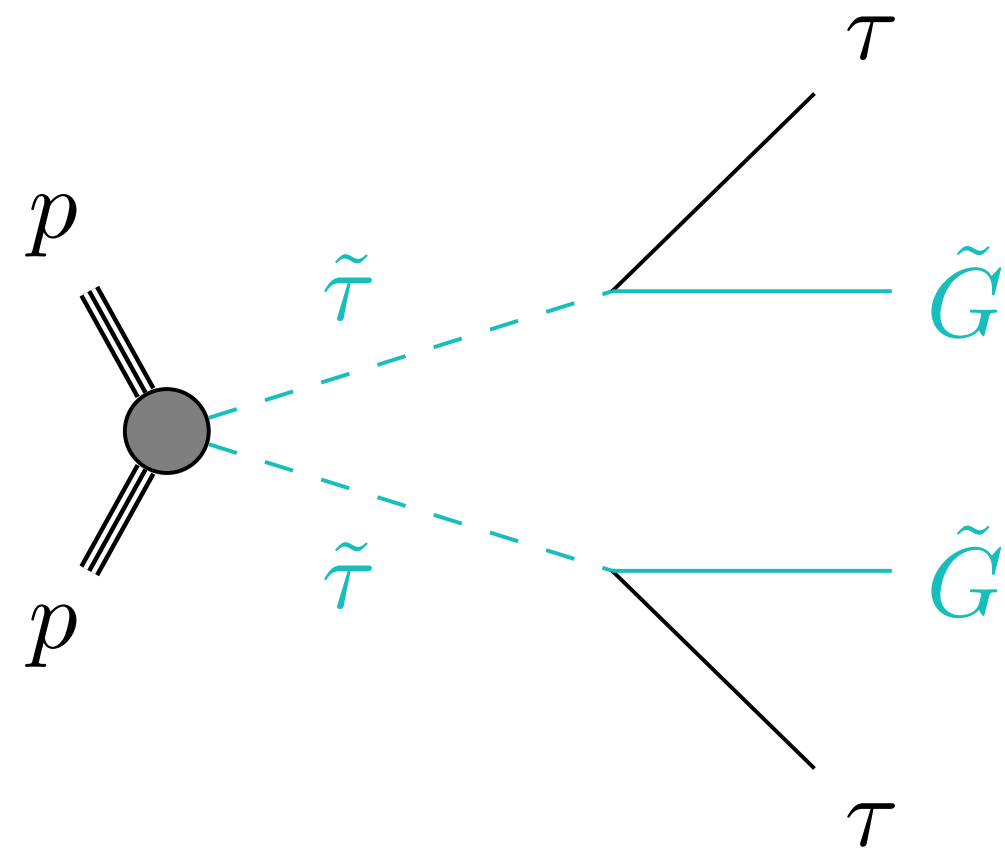
lifetimes  $> 1$  ns

## DISPLACED LEPTON

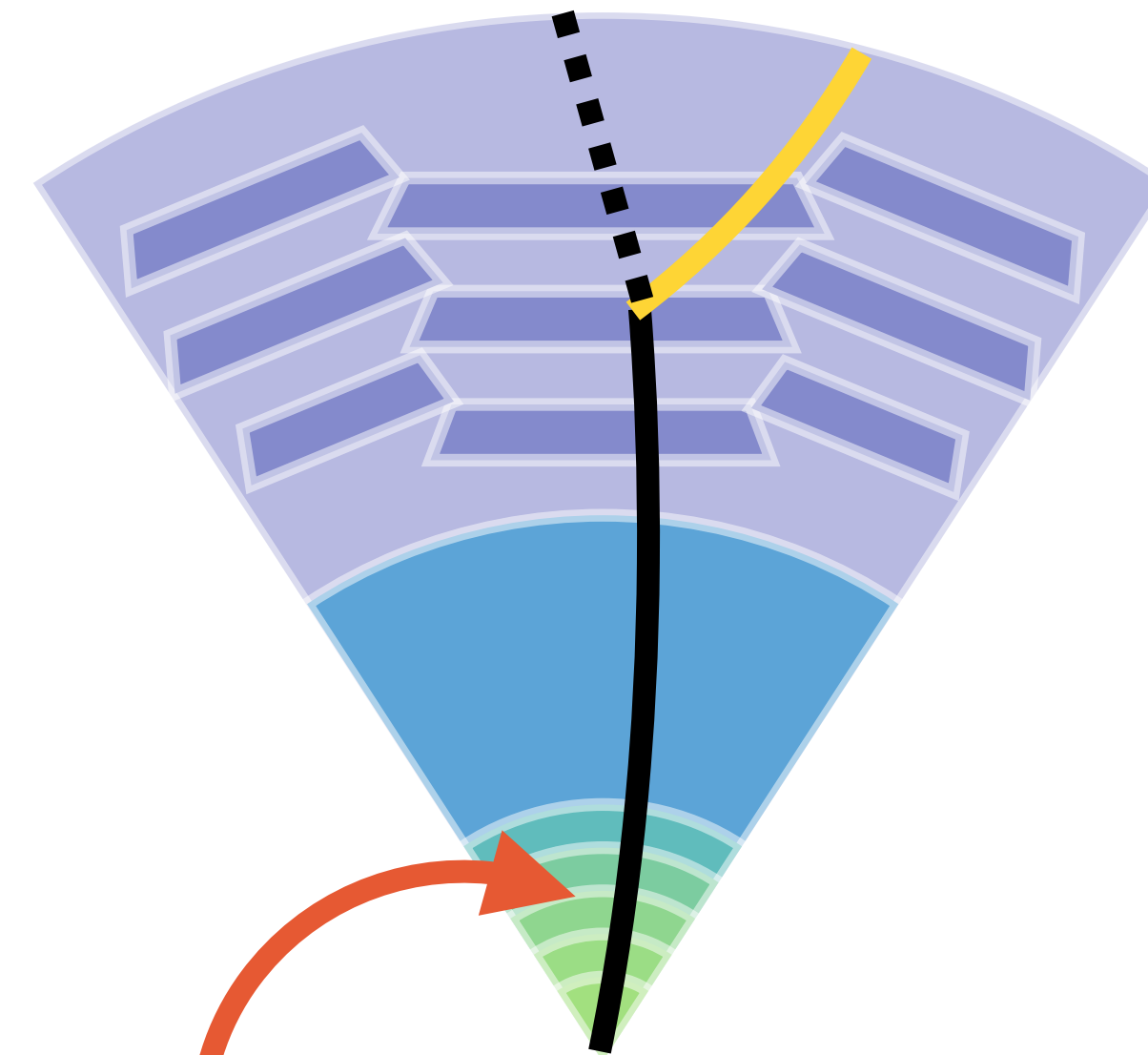
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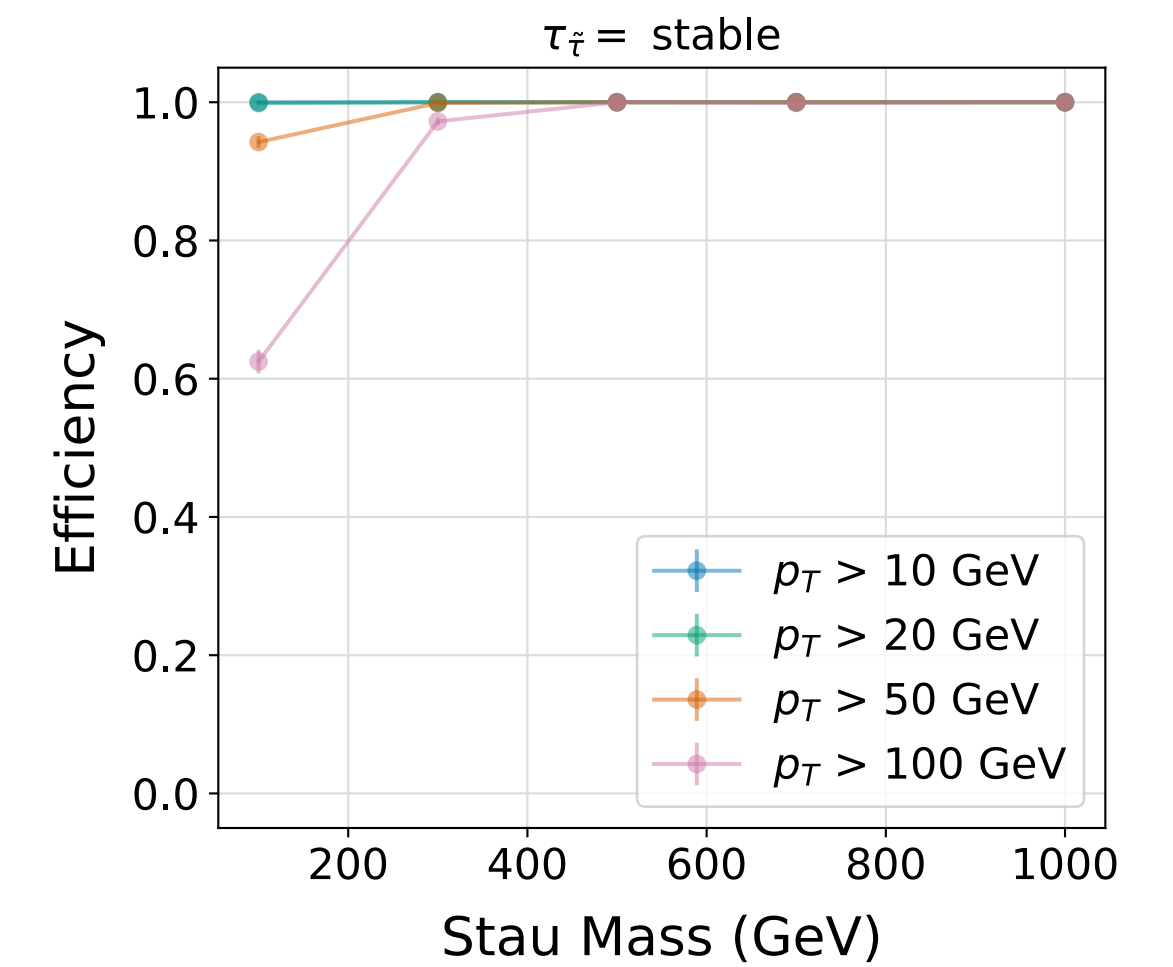
# LONG-LIVED STAU



**DISTINCTIVE SIGNATURES**



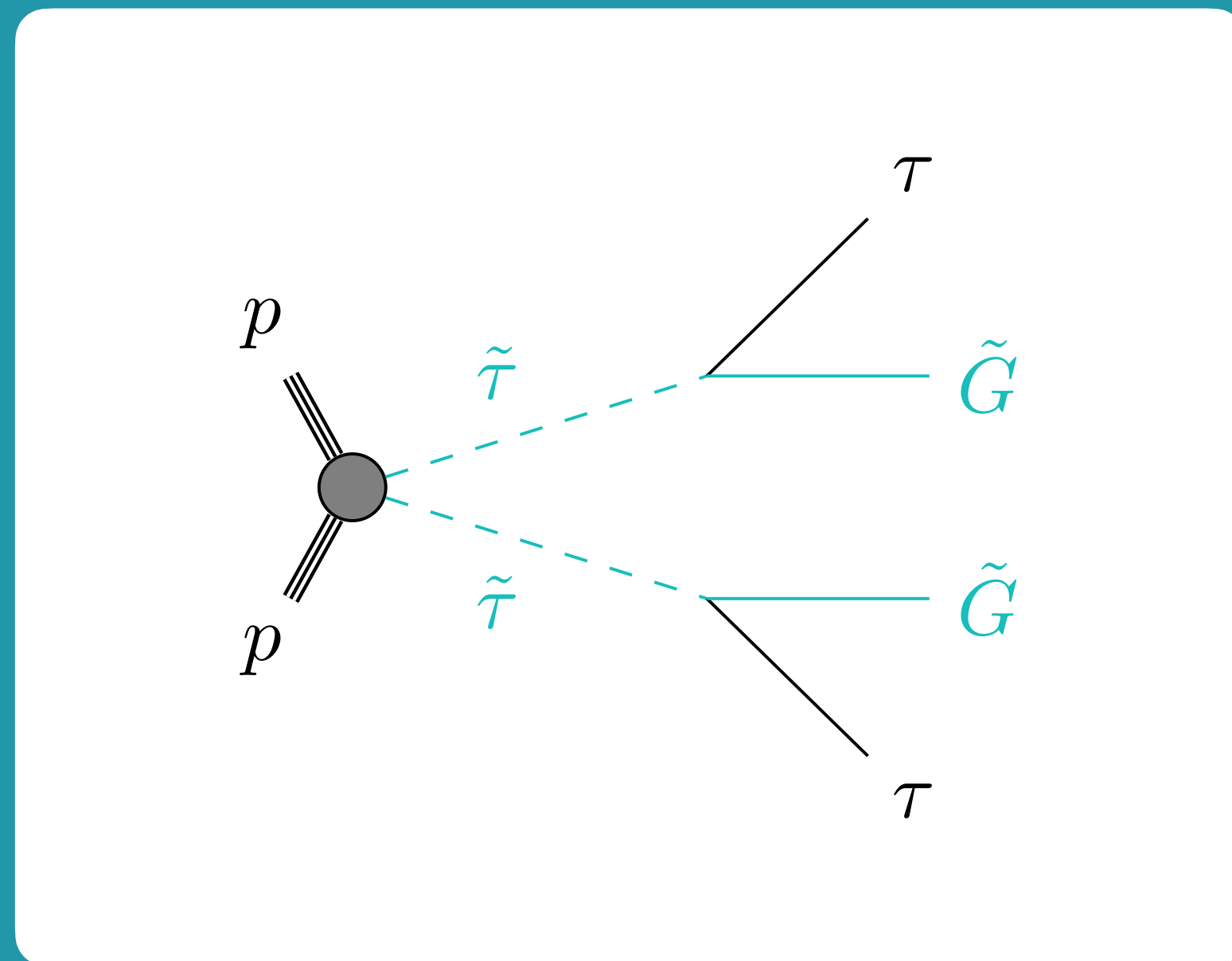
**NON-SM TRACK**



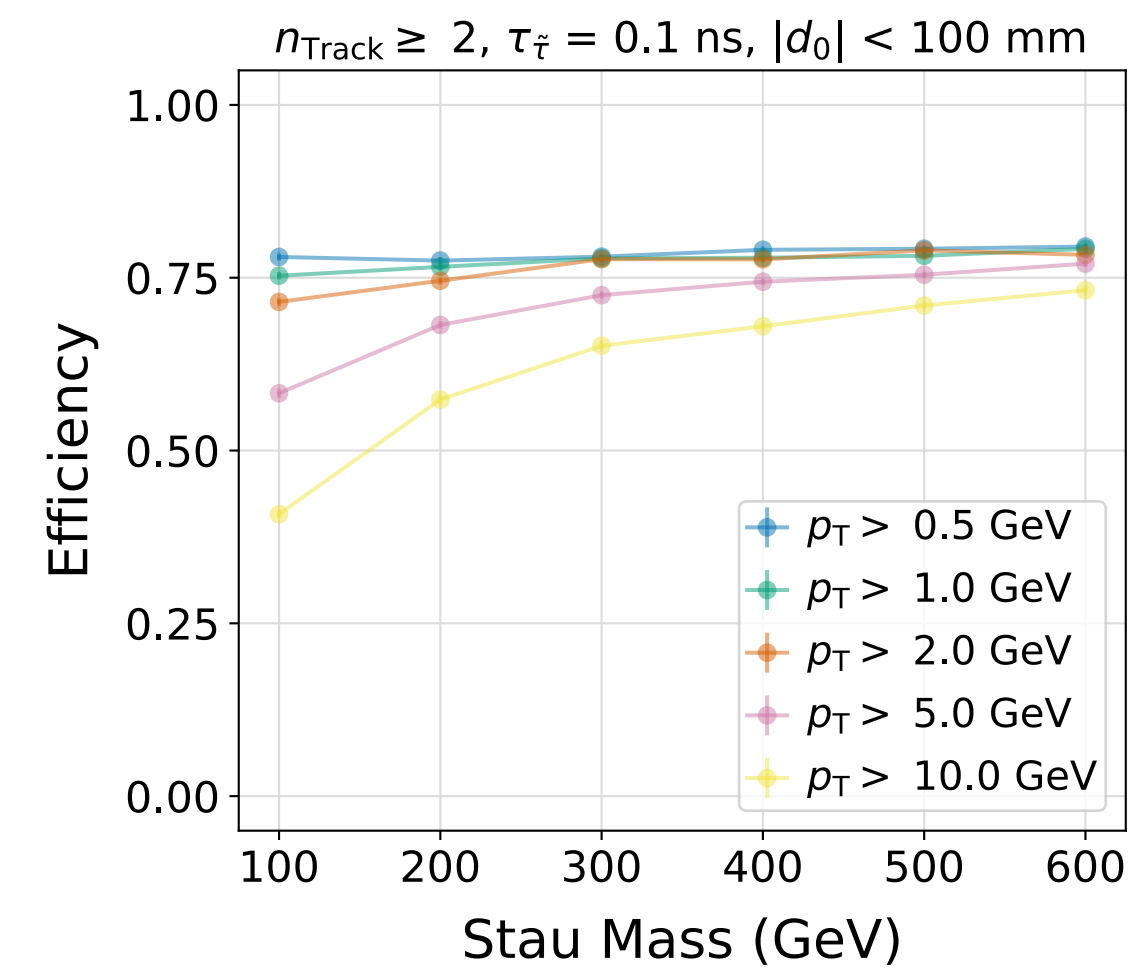
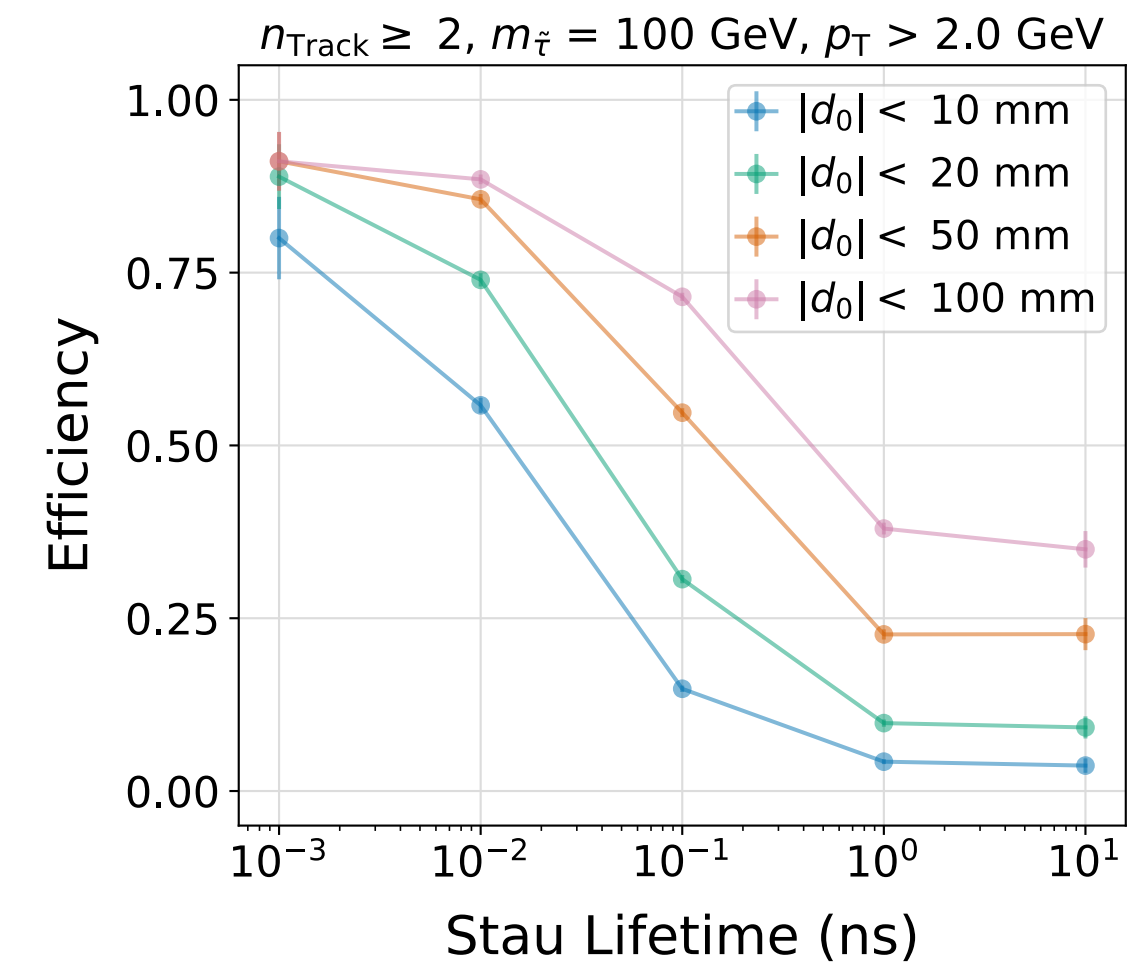
**much more in our [paper!](#)**



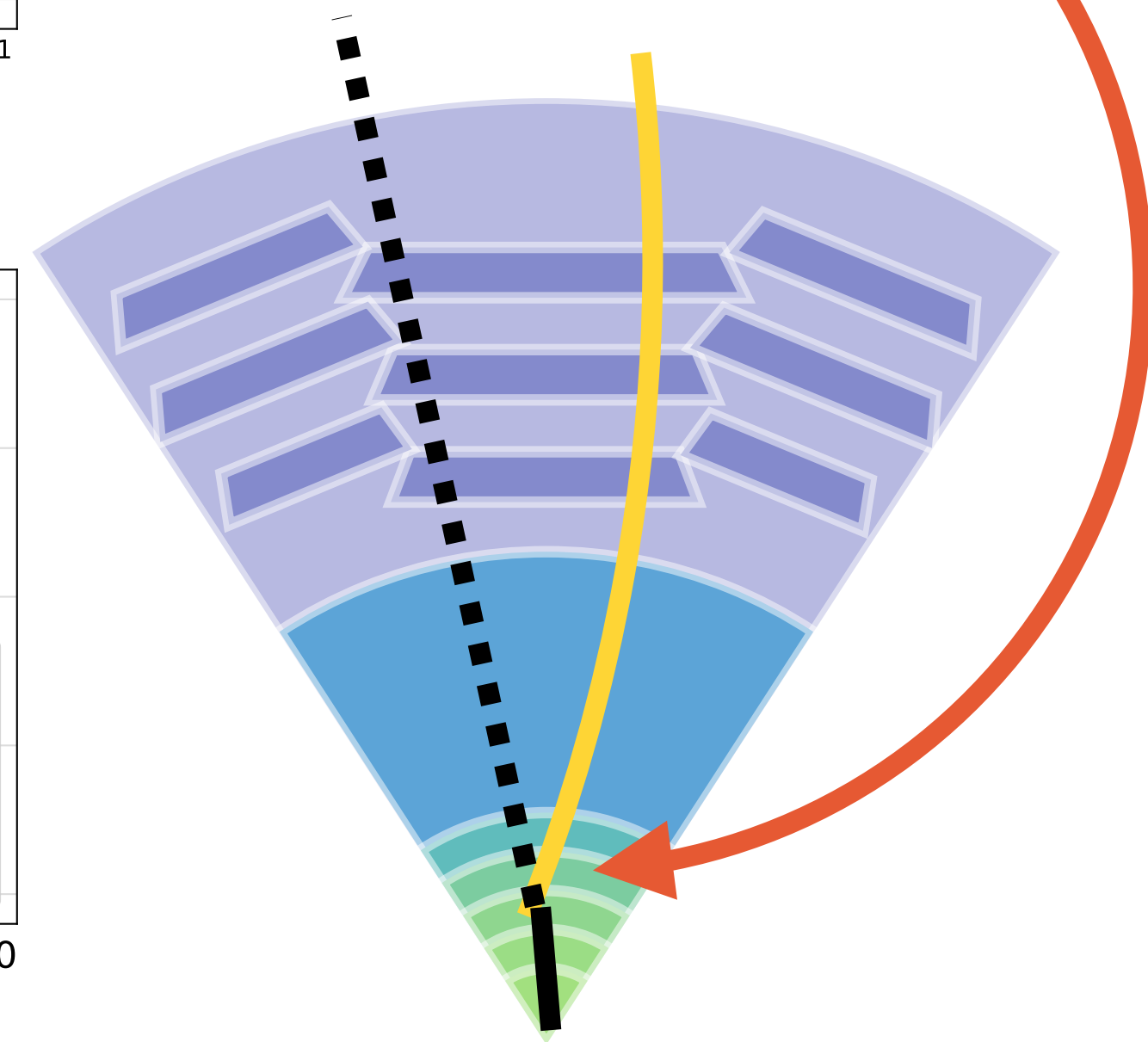
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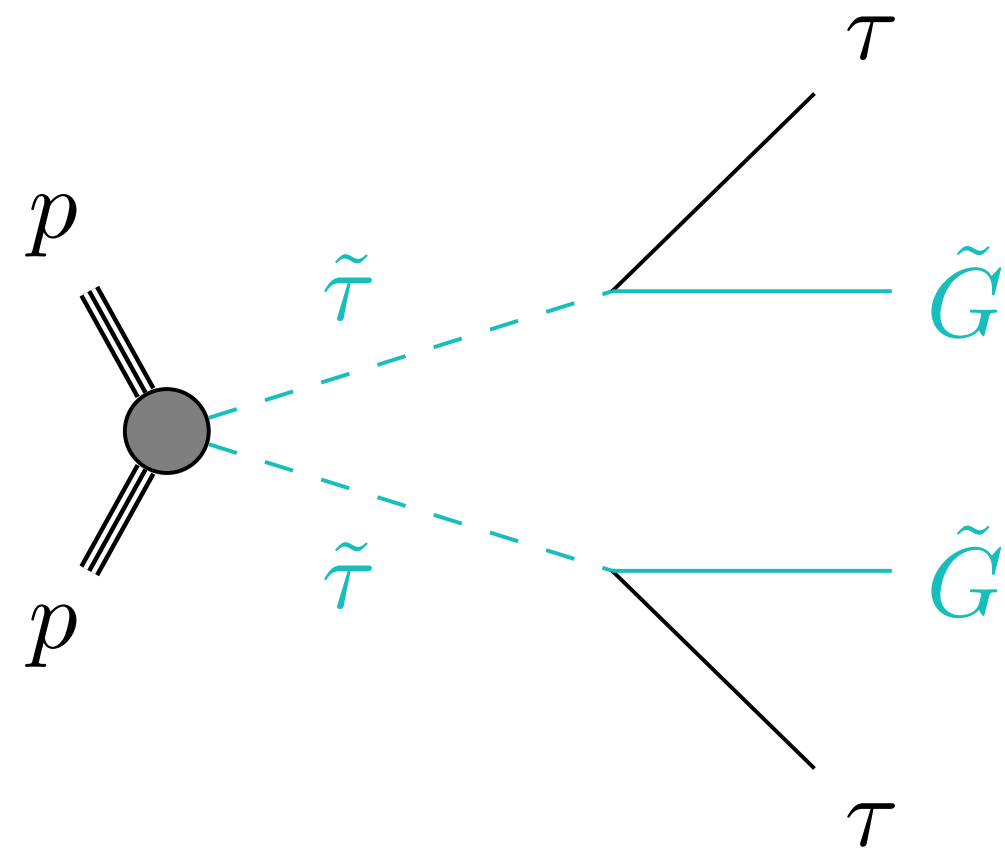
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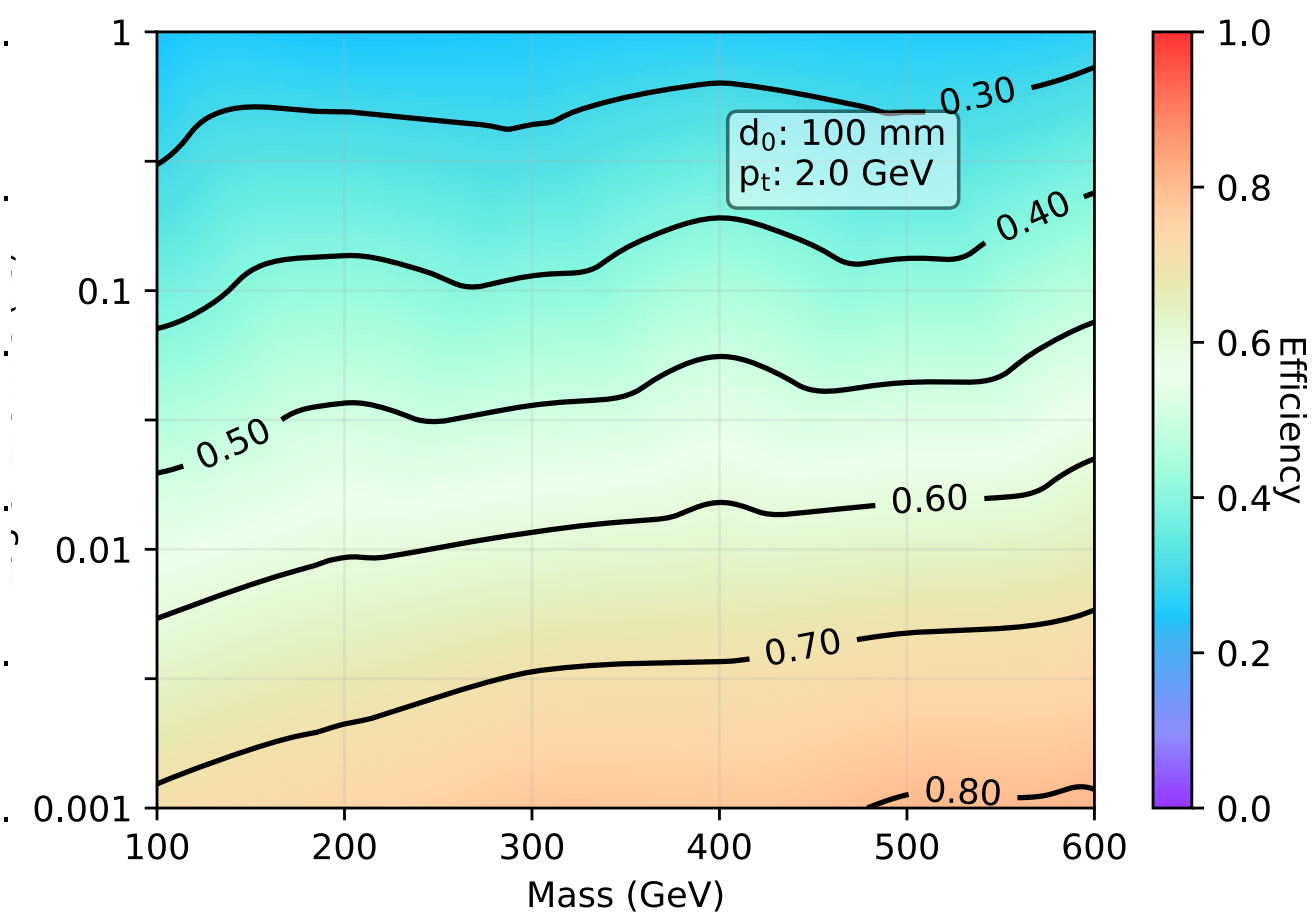
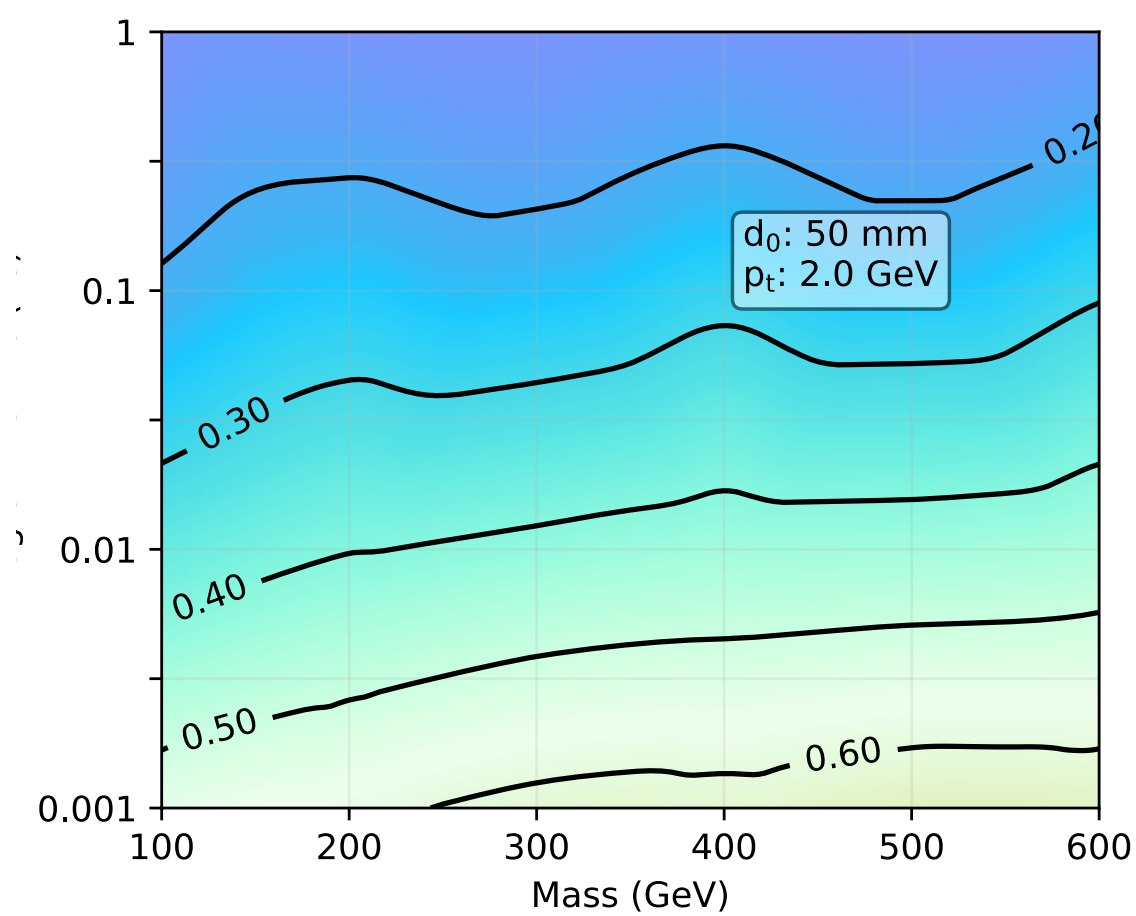
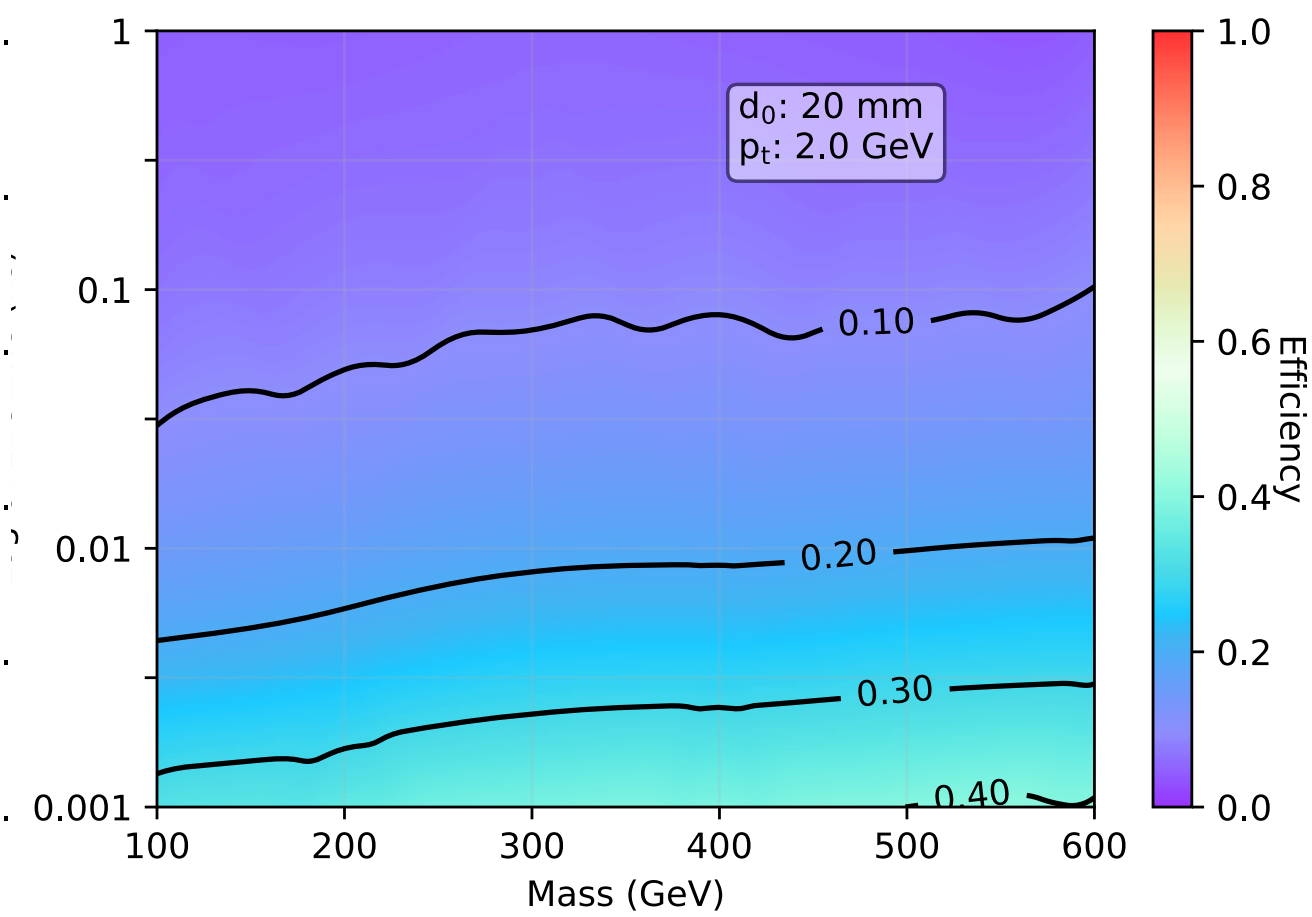
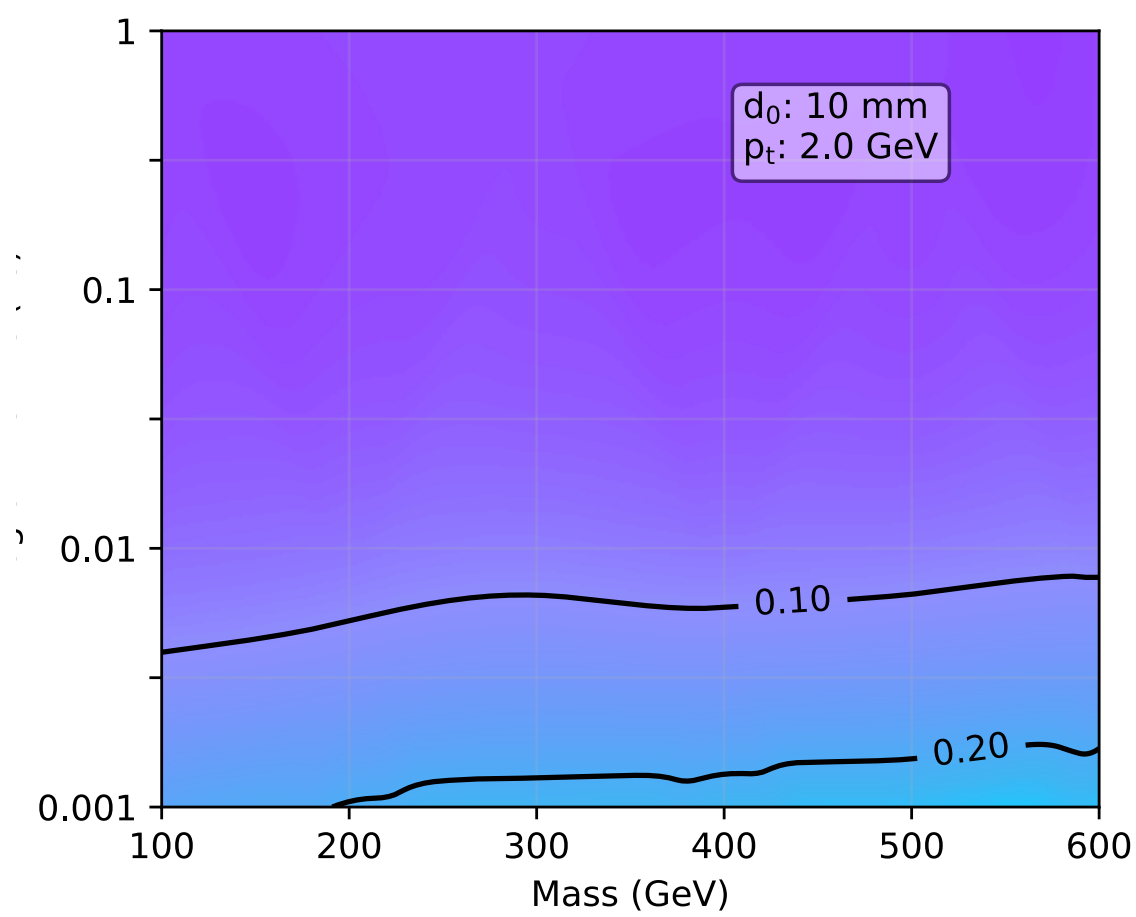
## DISPLACED LEPTON



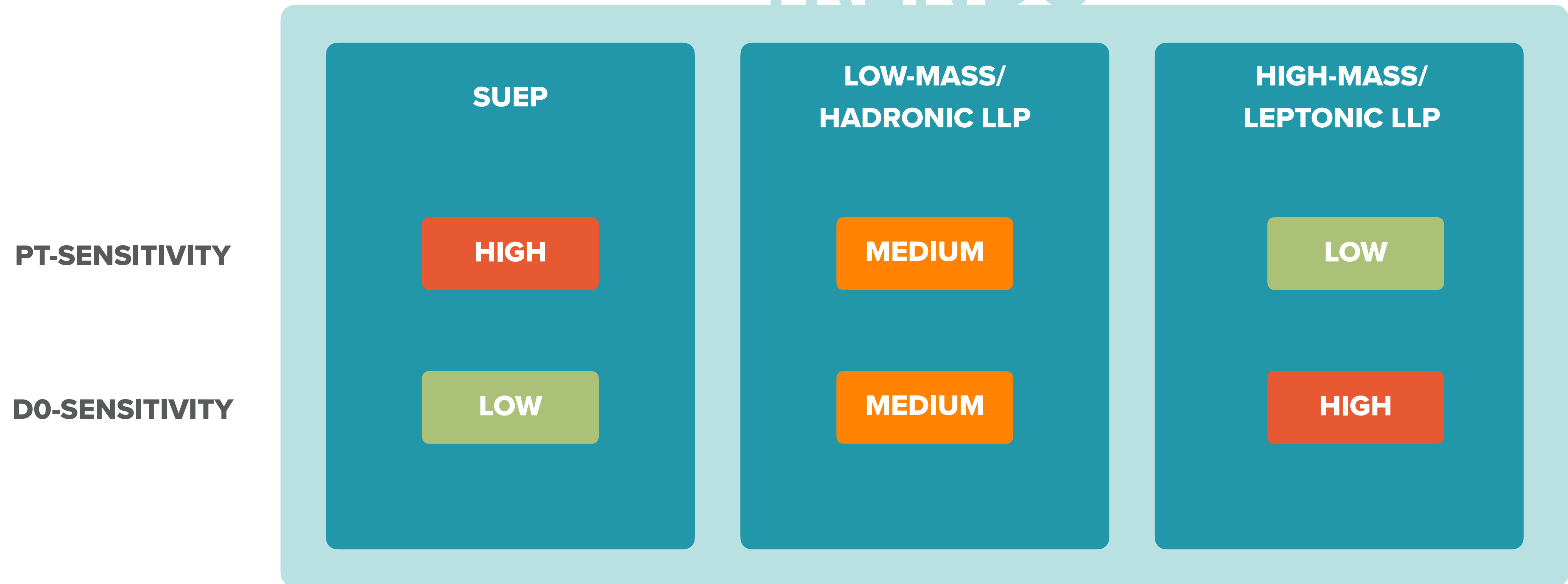
# LONG-LIVED STAU



**MOST IMPORTANT: LARGE DISPLACEMENT RANGE**

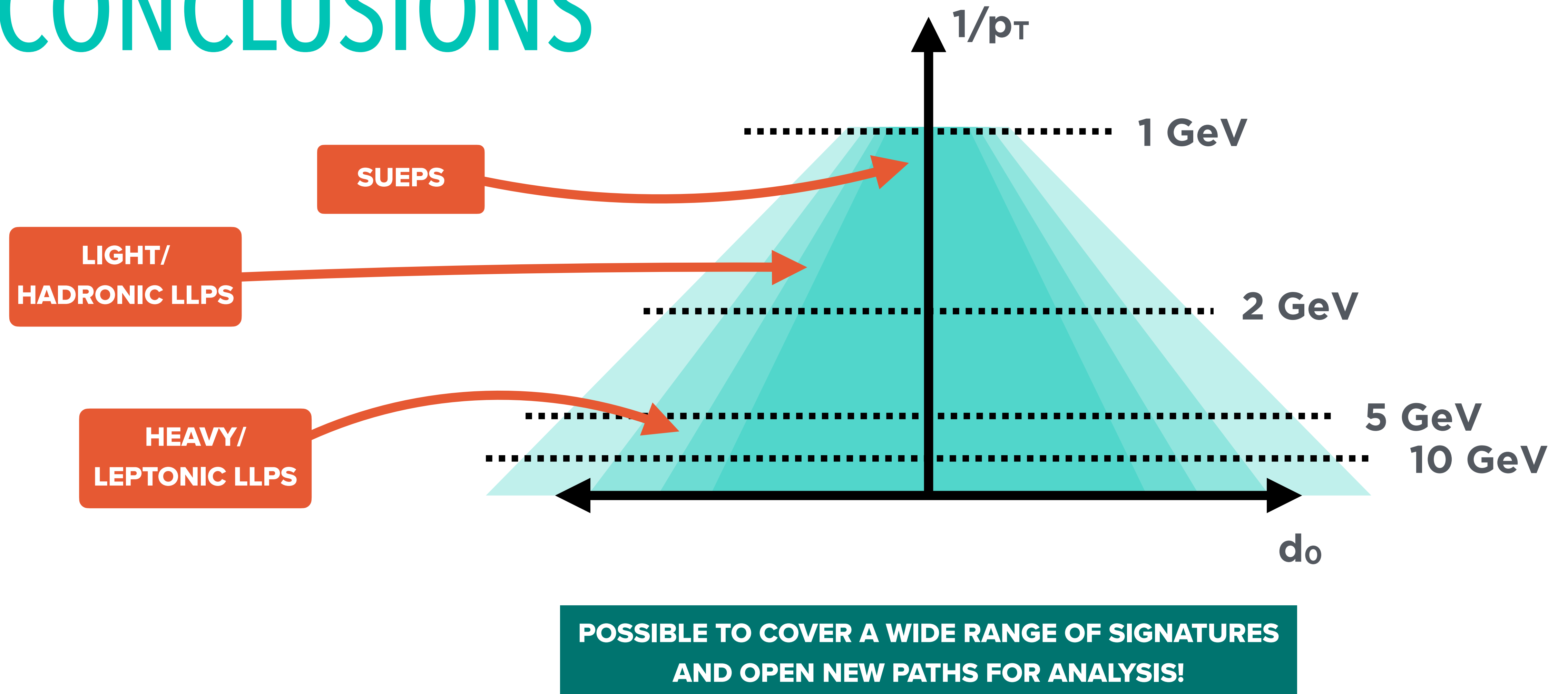


# TRENDS





# CONCLUSIONS



# THANK YOU!

## THE TEAM

