Cristina Mantilla Suarez (Johns Hopkins University)
(On behalf of the SpinQuest Collaboration and DarkQuest collaborators)

NEW PERSPECTIVES 2020

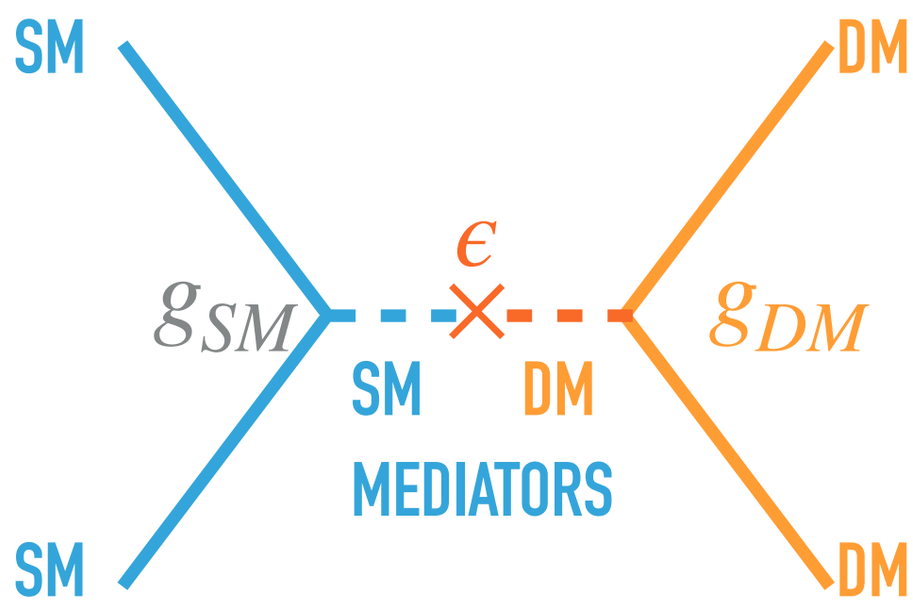
PROBING DARK SECTORS WITH THE SPINQUEST EXPERIMENT

DARK SECTORS : NEW PHYSICS NEUTRAL UNDER SM

From Natalia Toro

Dark matter seems to be a strong hit of a dark sector

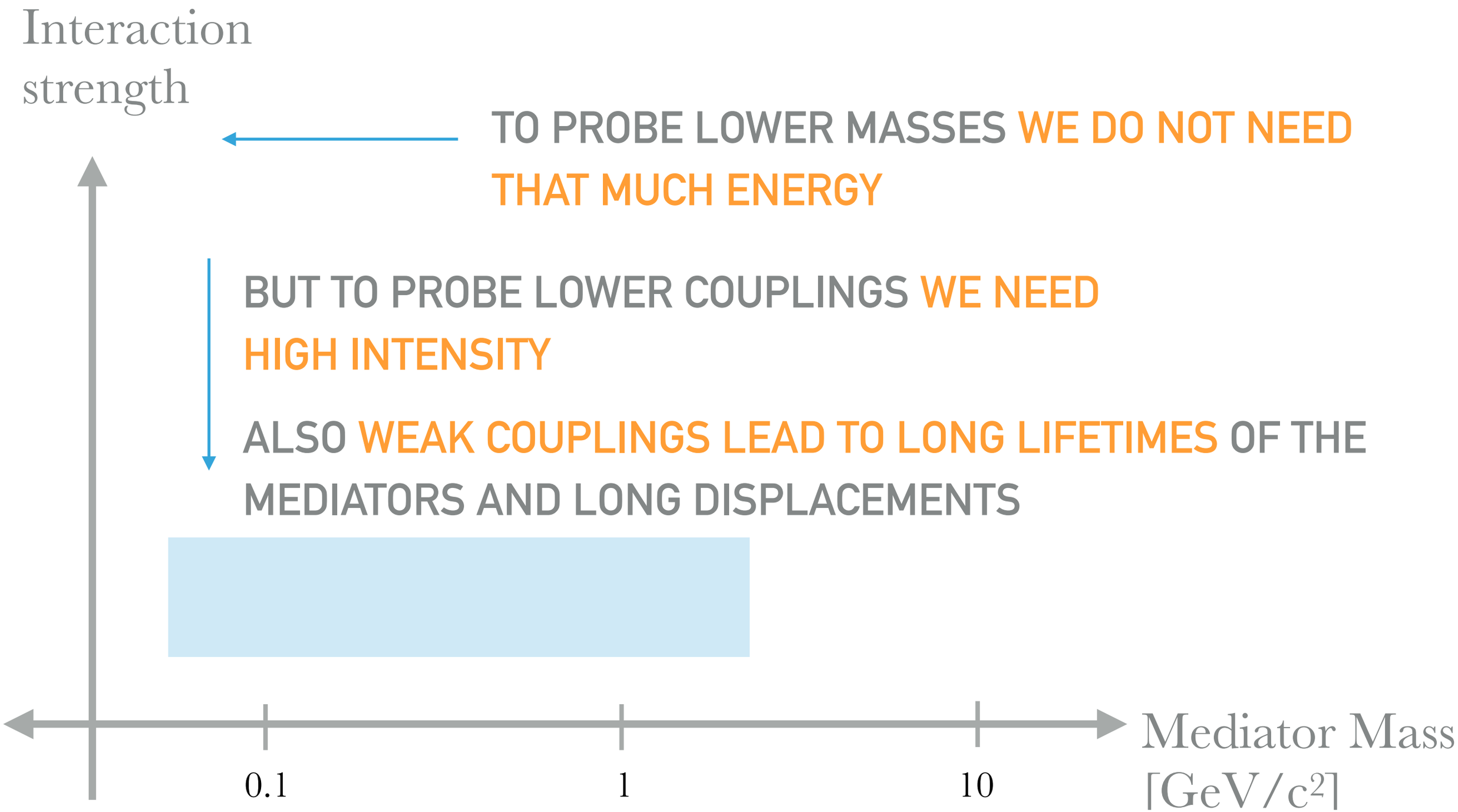
Dark sector = New forces



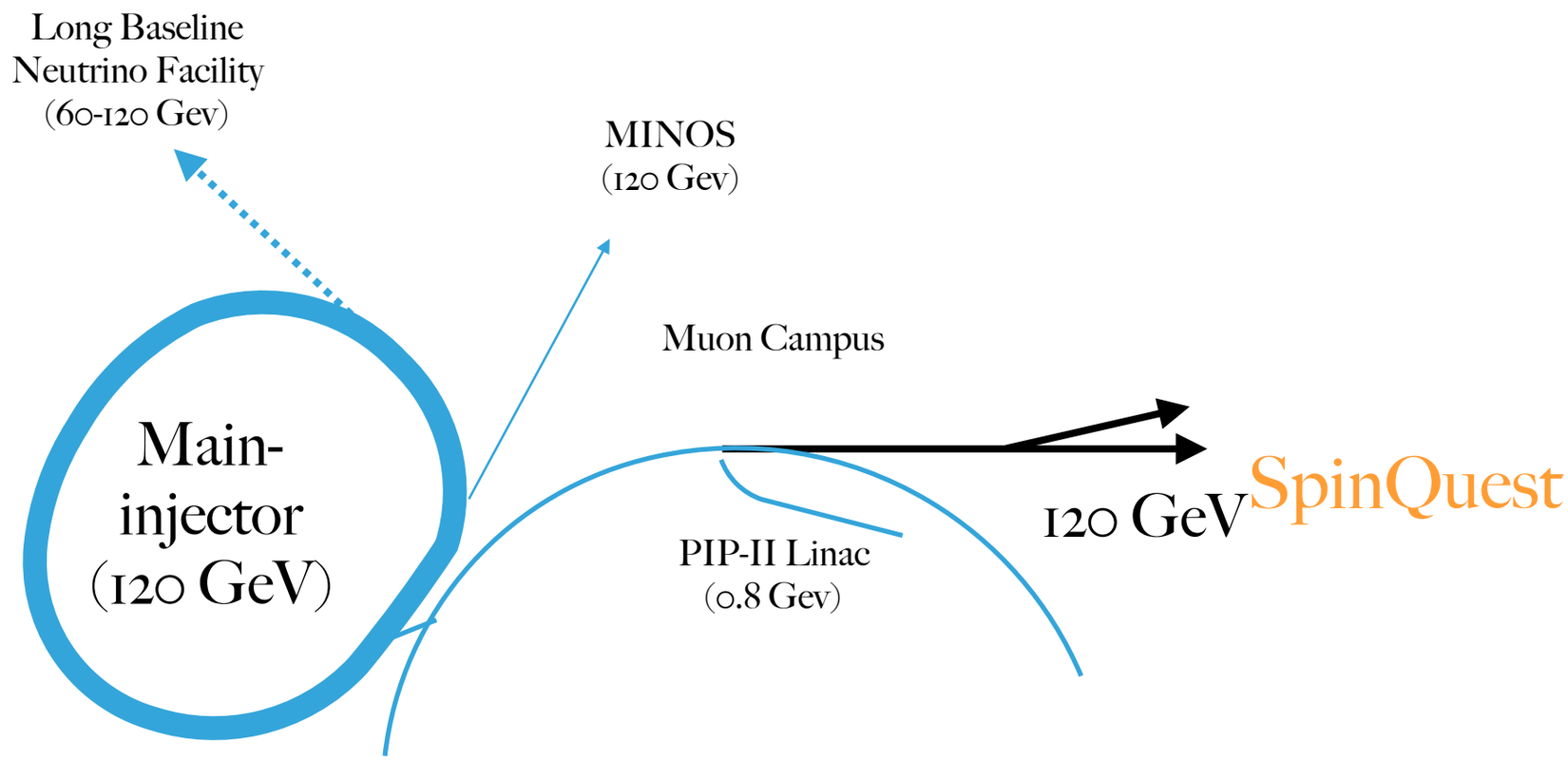
What kind of new force? ⟶ Feebly coupled

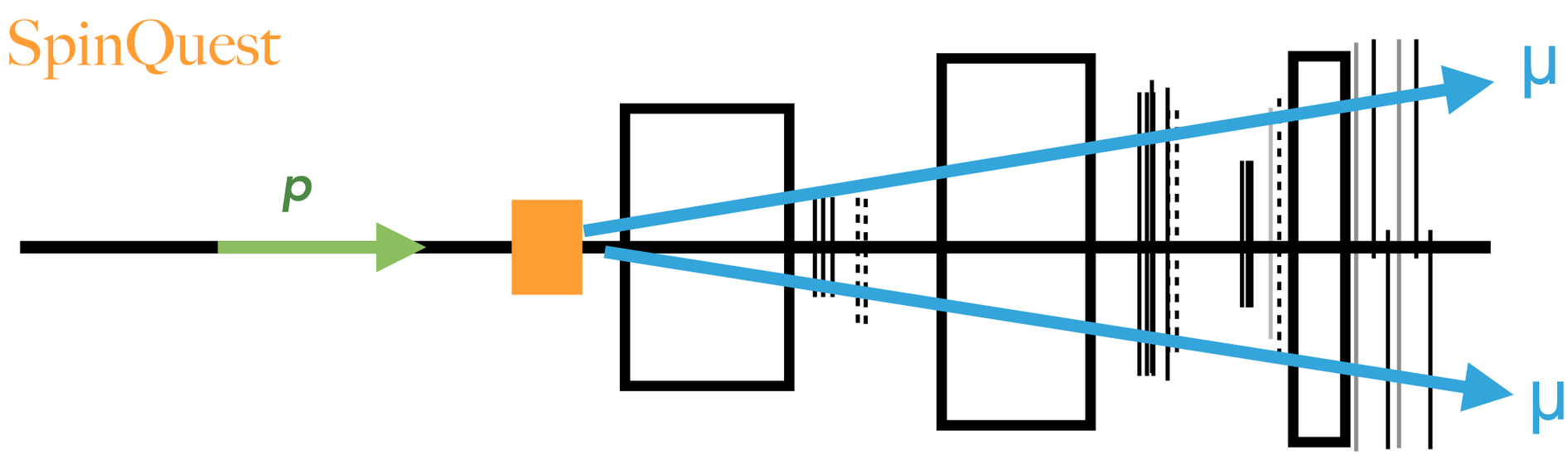
It can nicely produce thermal abundance of light DM

DARK SECTORS AT LOW MASS/COUPLINGS



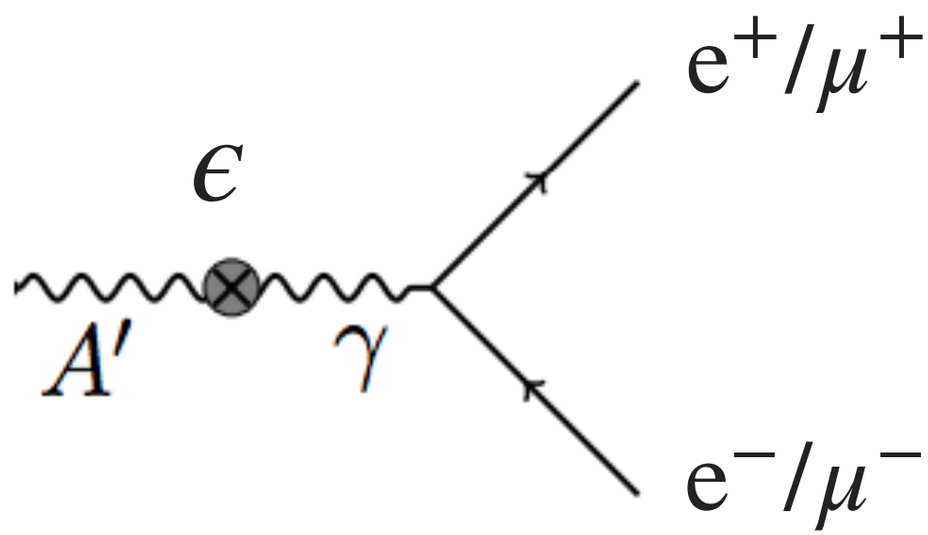
PROTON-BEAM AT FERMILAB

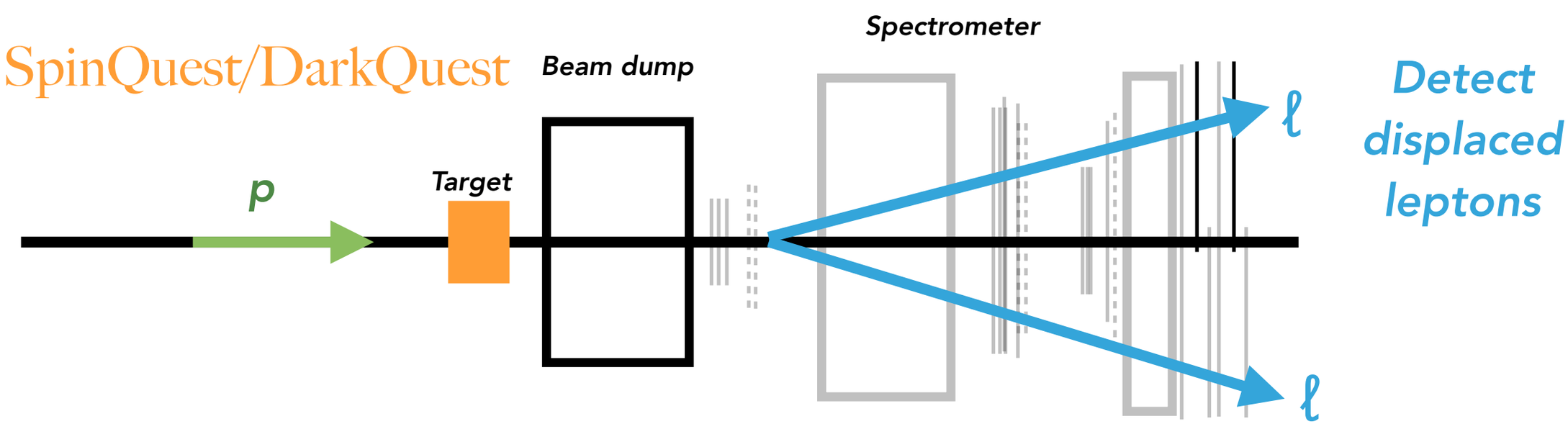




SPINQUEST AS A PROBE OF VISIBLE DM DECAYS

Visible probes of sub-GeV DM particles





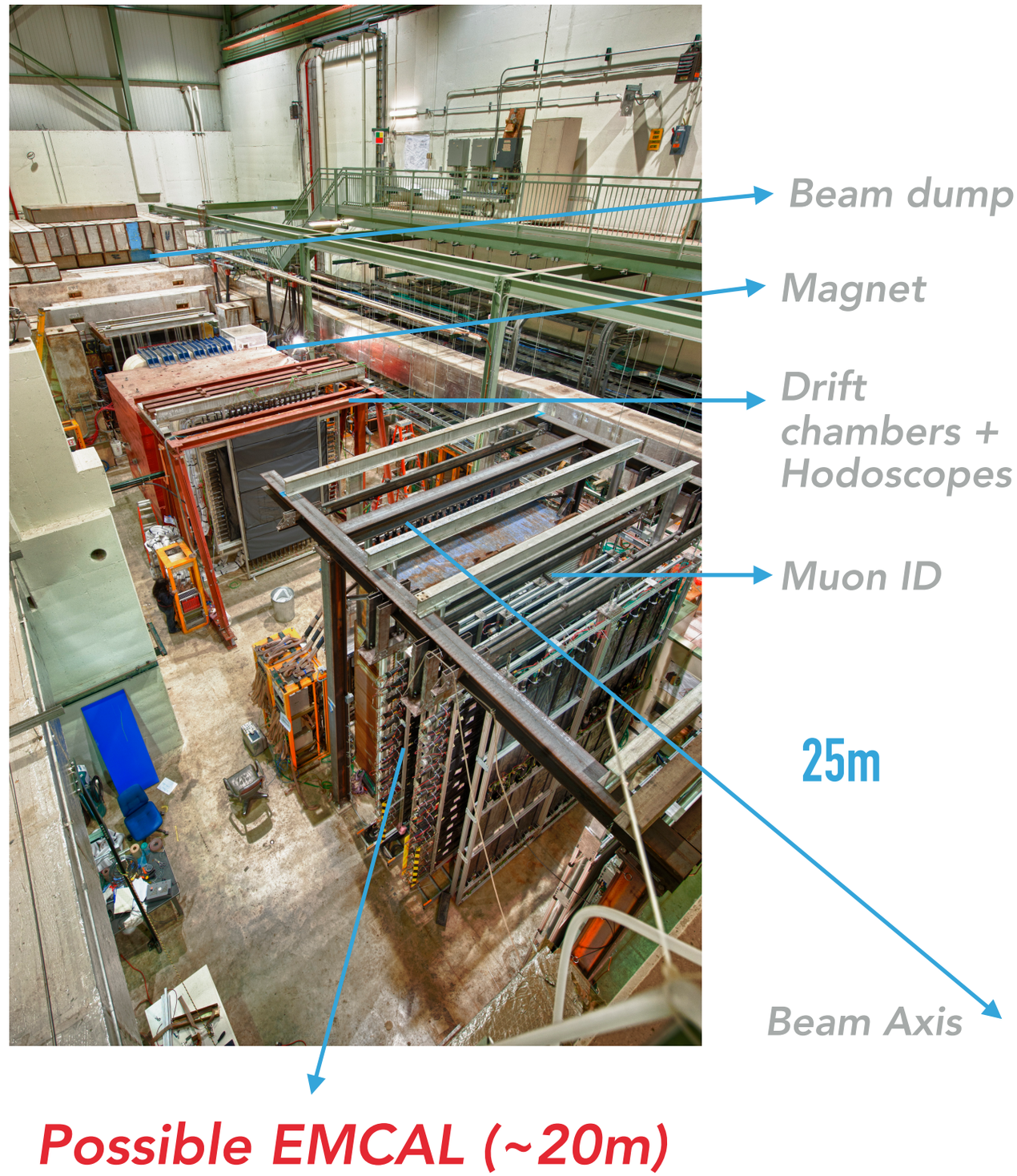
WHY SPINQUEST?

1. High intensity scenarios (10^{18} - 10^{20} POT)
2. Higher effective luminosities ($\sigma_{\text{proton-target}} > \sigma_{\text{lepton-beam}}$)
3. Short baseline: 25 m (LLPs 5-10m)
4. Can identify both e/μ

SpinQuest (up to FY23) will explore displaced muon triggering

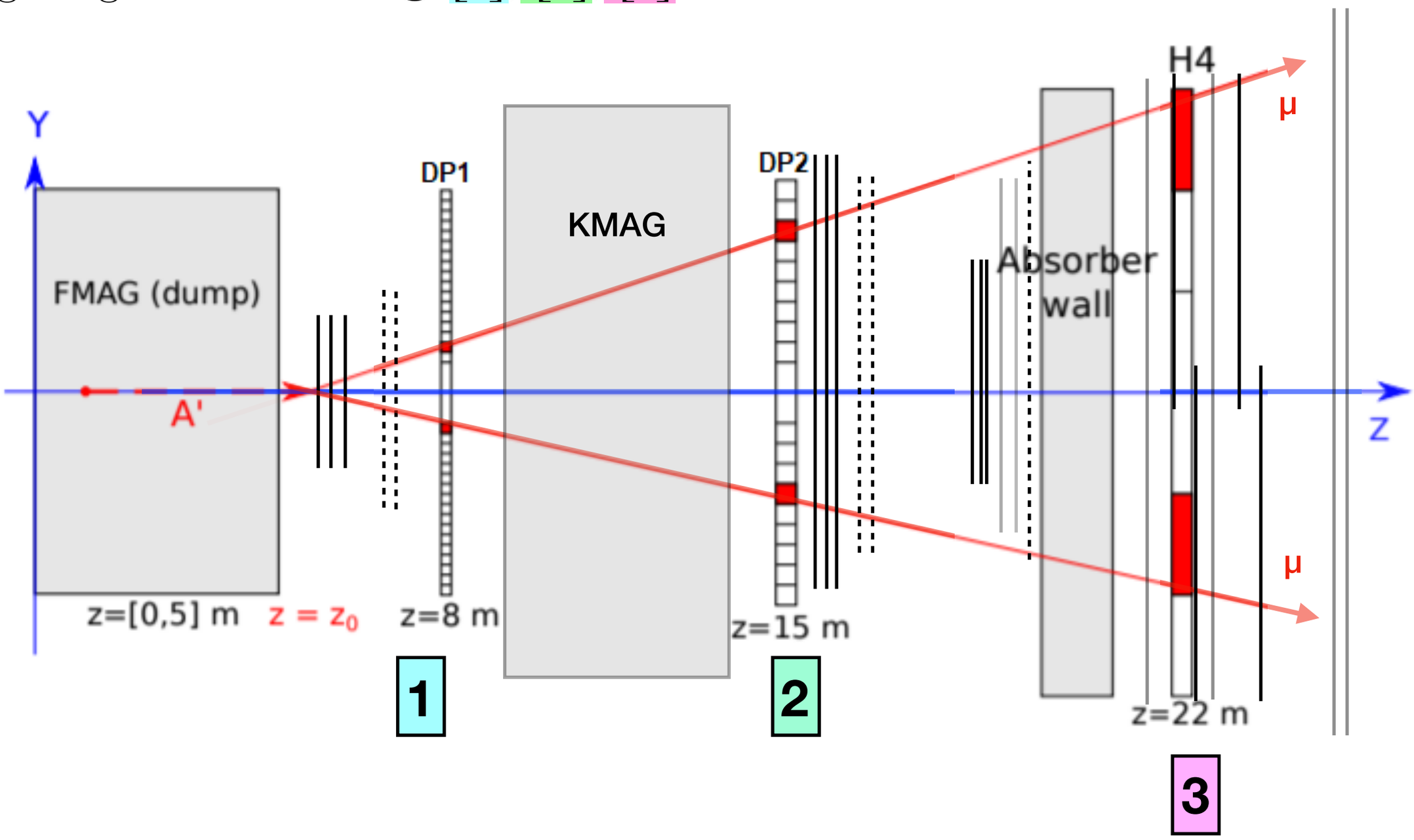
DarkQuest (FY23-forward) would explore displaced muon ID and EMCAL addition for electron ID

EMCAL ADDITION



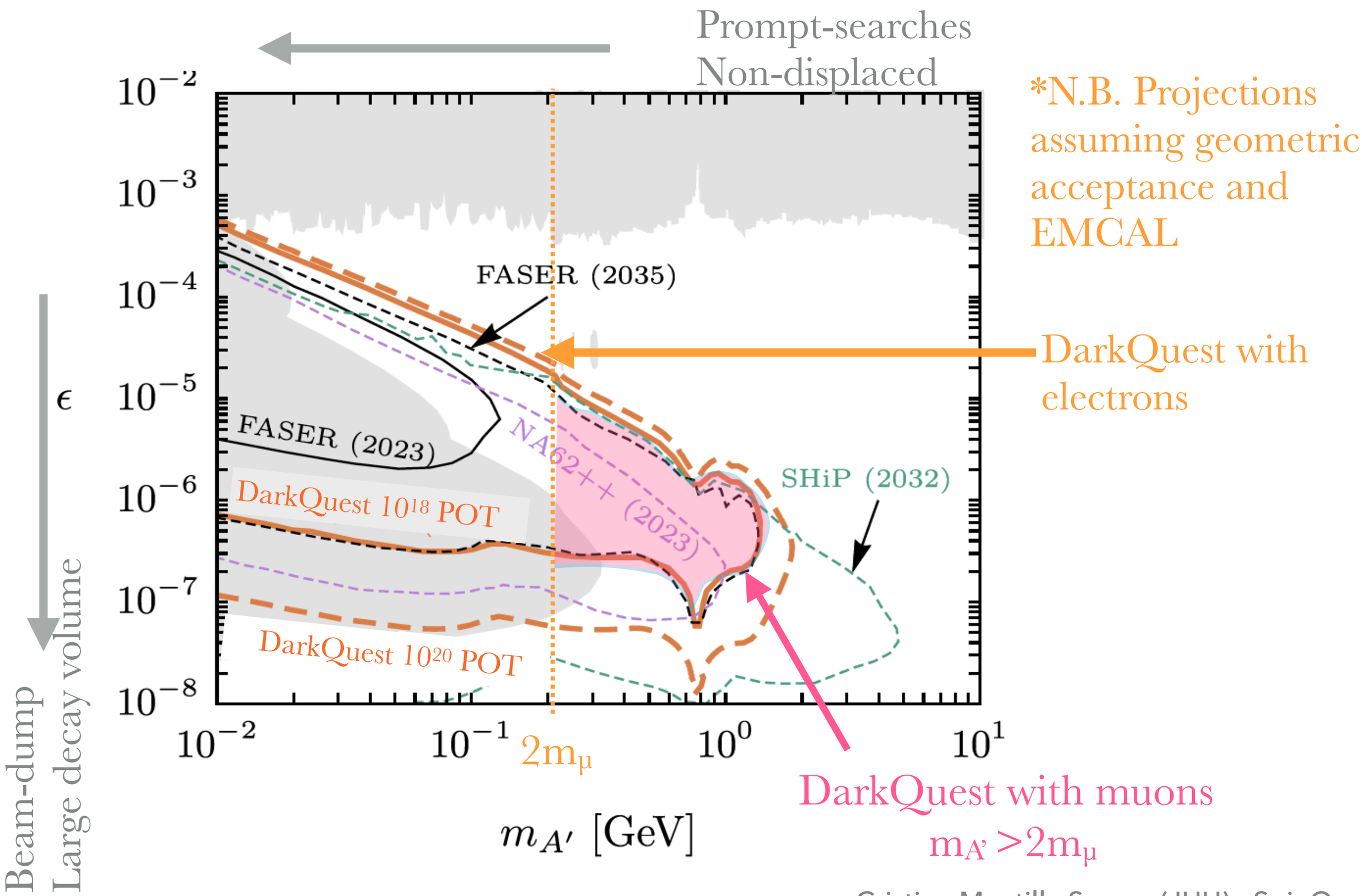
TRIGGERING ON DISPLACED MUONS

Triggering based in hits @ [1], [2], [3]



The displaced vertex trigger is installed and is being commissioned for the upcoming run (Jan 2021)

PROJECTED SENSITIVITY



BEYOND SPINQUEST RUN (STUDIES FOR 2021)

Signals (A', SIMPs,…)

In detector simulation

- Displaced tracking resolution?
- Electron deposits in EMCAL

Backgrounds

In detector simulation

And real data (SQ2021)

- Rejection of γ, $\pi^{\pm}$,$K^0_L \rightarrow \pi^{\pm}e^{\mp}\nu$, …?
- Prompt decay veto?

Detectors

- EMCAL test-stand and readout
- Beyond: timing resolution, silicon fast tracking, particle ID?

IN SUMMARY

SpinQuest/DarkQuest can provide complementarity to sub-GeV long lived dark sectors

Preparing next SpinQuest run with displaced vertex trigger!

Exploring DarkQuest run @2023-24 or after long shutdown for PIP-II

Aiming to provide a comprehensive summary of the detector design, signal ID and rate of relevant background processes

We welcome new collaborators to explore the physics potential of this experiment!