Signatures of Dark Sectors at SeaQuest

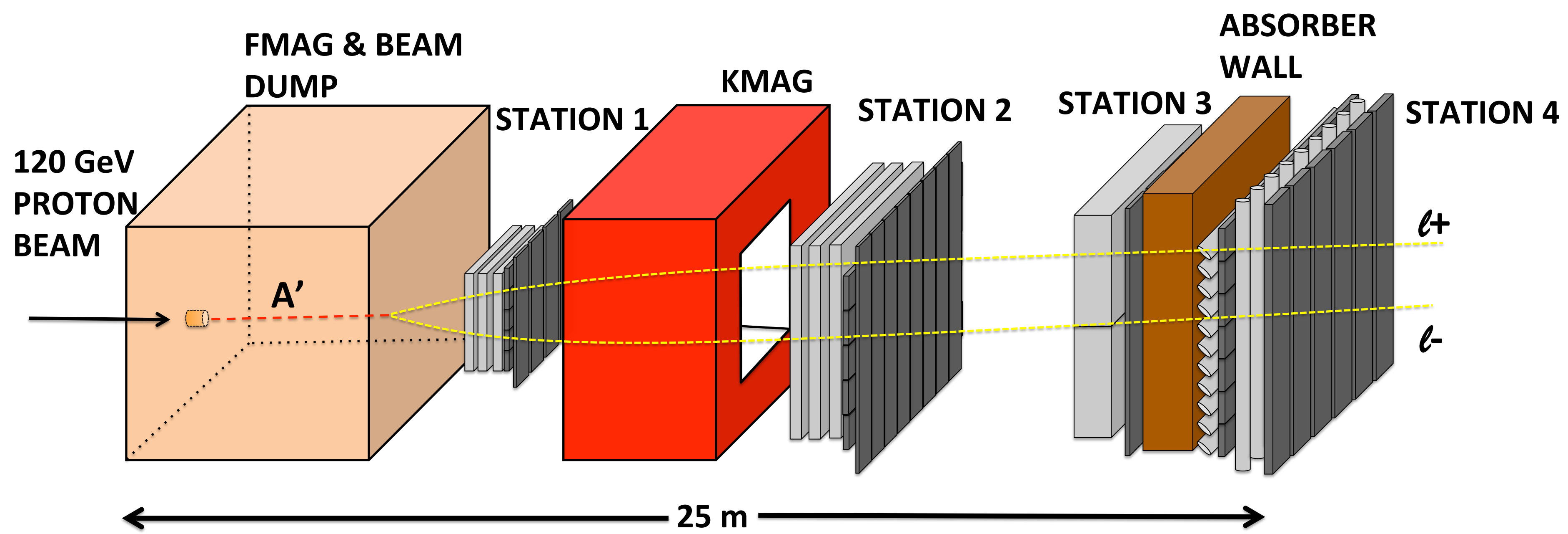
ASHER BERLIN

HPS, Hidden Sectors Mini-Symposium
SLAC, October 26, 2017

SLAC NATIONAL ACCELERATOR LABORATORY

collaboration with Nikita Blinov, Stefania Gori, Philip Schuster, & Natalia Toro

SeaQuest

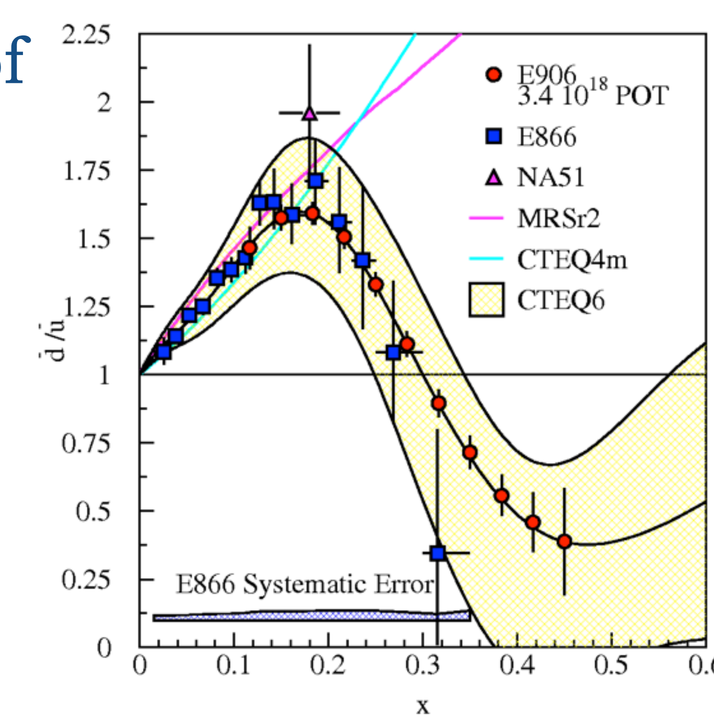


- Study Drell-Yan to measure sea quark content of proton.

- Started data taking this year.

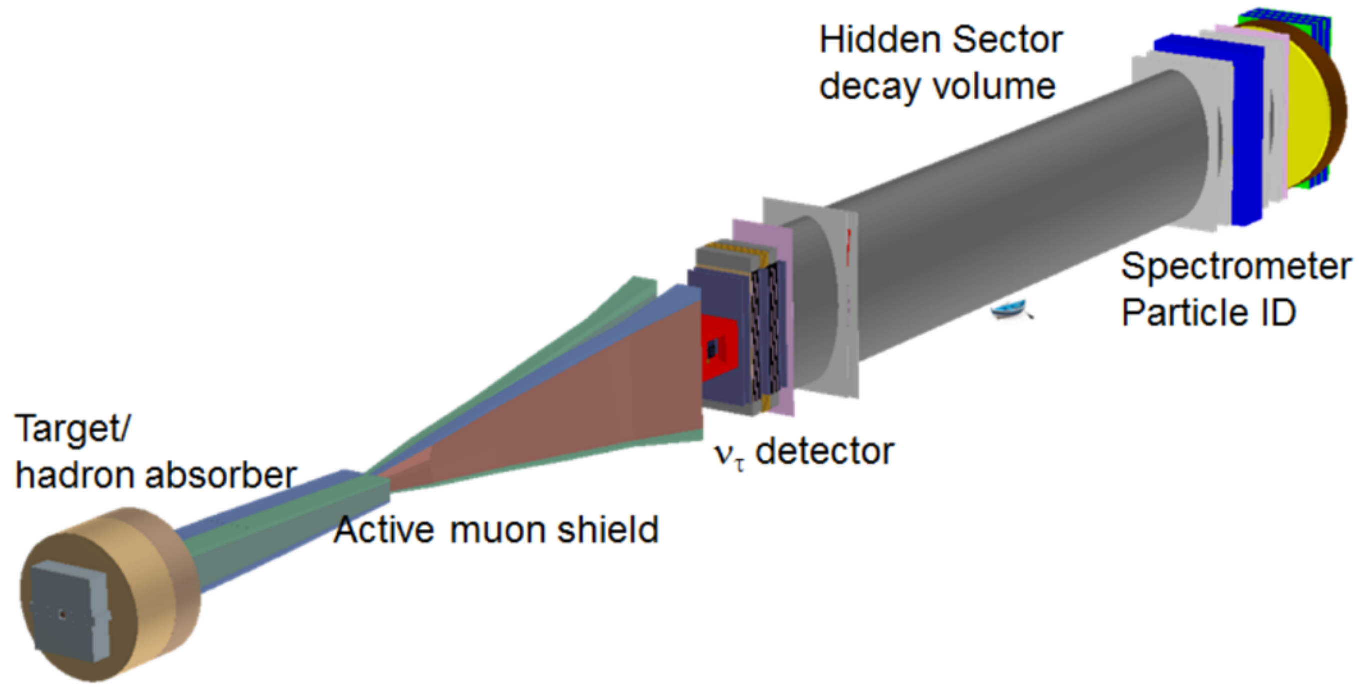
- 10^{18} POT ~ 35 ab^{-1} in ~2 years of parasitic run.

- ECAL upgrade possible within the year.



displaced electrons (minimal background)

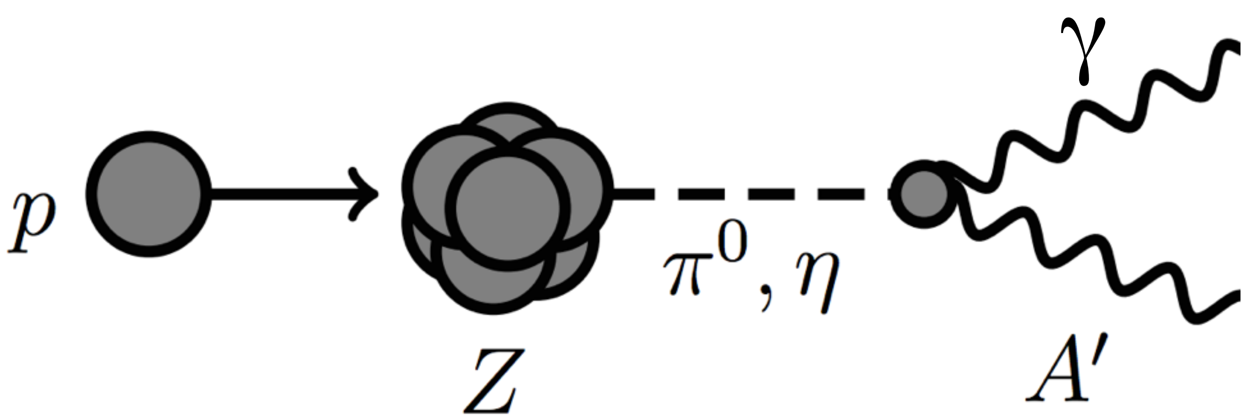
SHiP

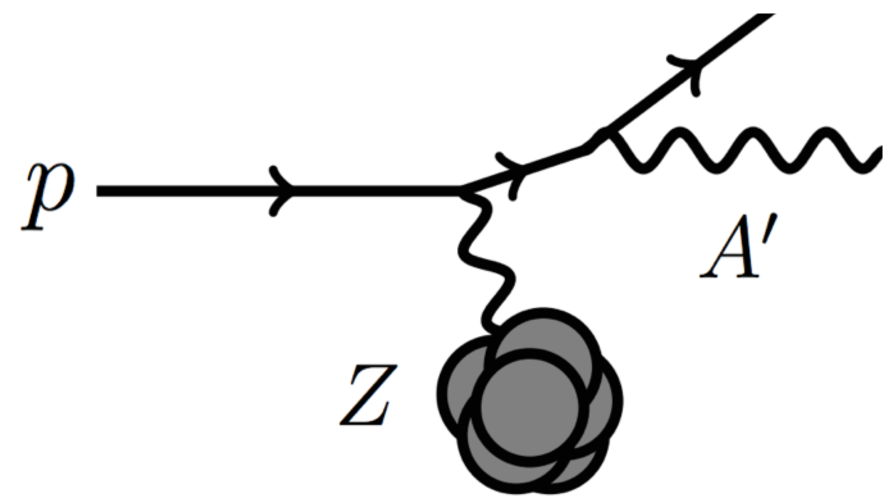


	Location	Timeline	E_{beam} (GeV)	POT	Baseline (m)
SeaQuest	Fermilab	2017	120	$1.44 \times 10^{18} \to 10^{20}$?	5 – 10
SHiP	CERN	2026 ?	400	2×10^{20}	60 – 110

arXiv:1504.04956

Production from Protons



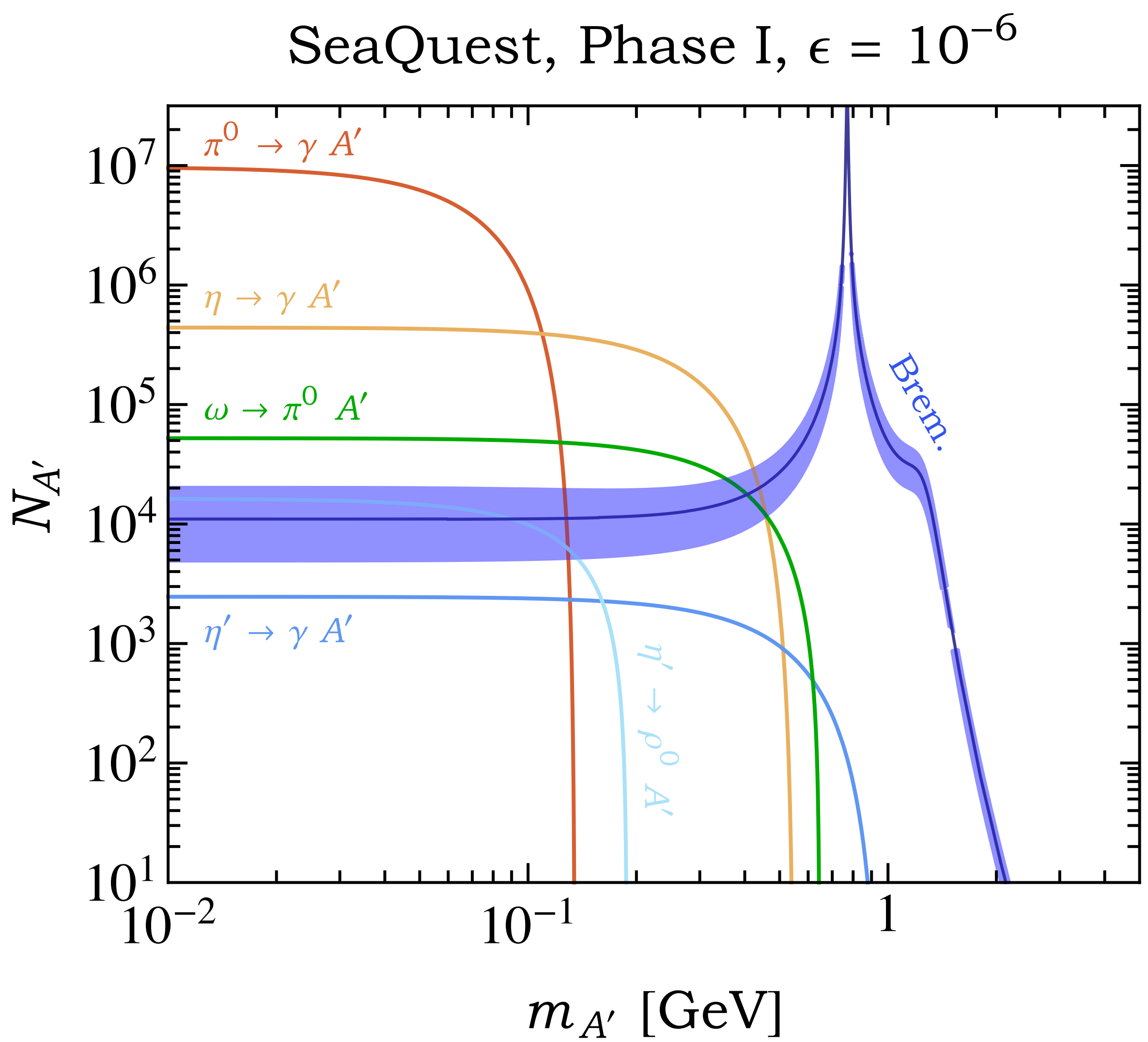


$m_{A'} \lesssim 100$ MeV

$m_{A'} \lesssim 1$ GeV

+ Drell-Yan at higher masses

Production from Protons

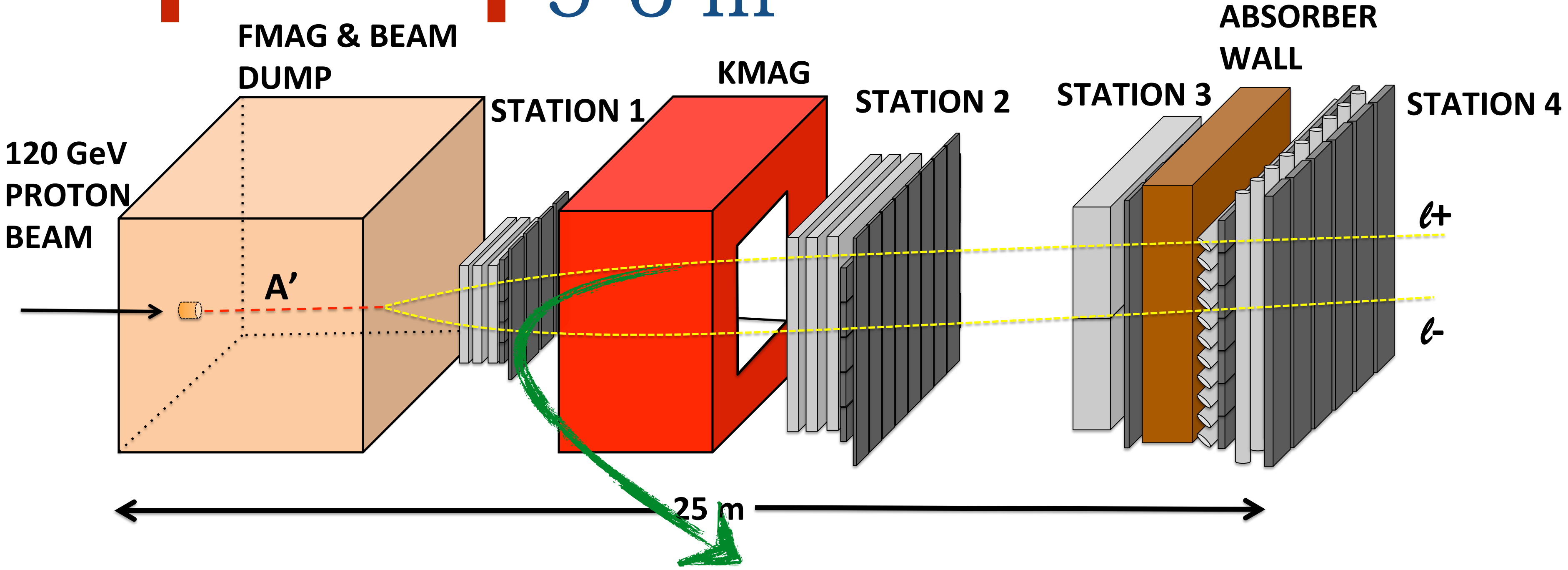


Displaced Electrons at SeaQuest

5-12 m (partial Δp_T kick)

5-9 m

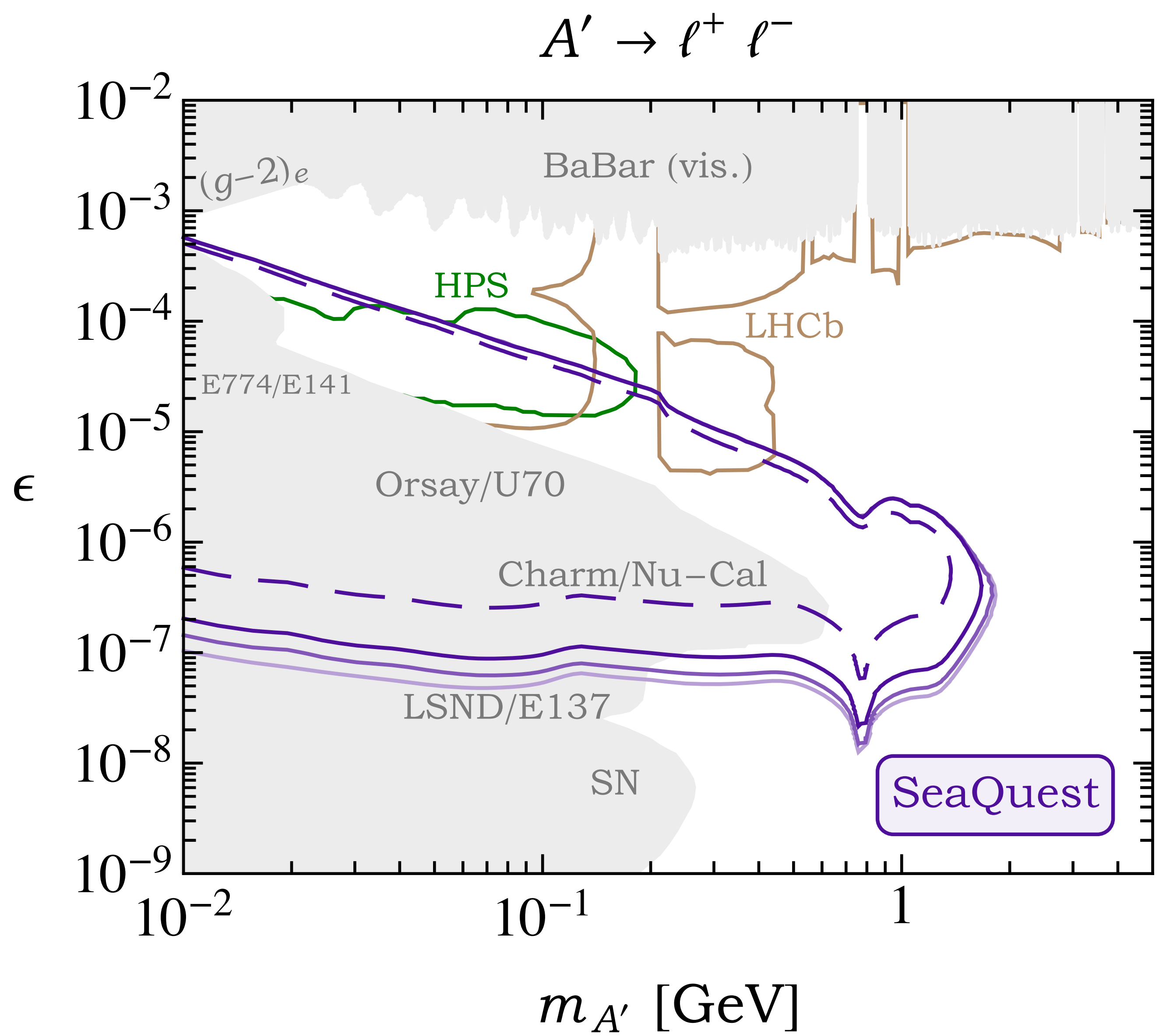
5-6 m



(Δp_T kick ~ 0.4 GeV)

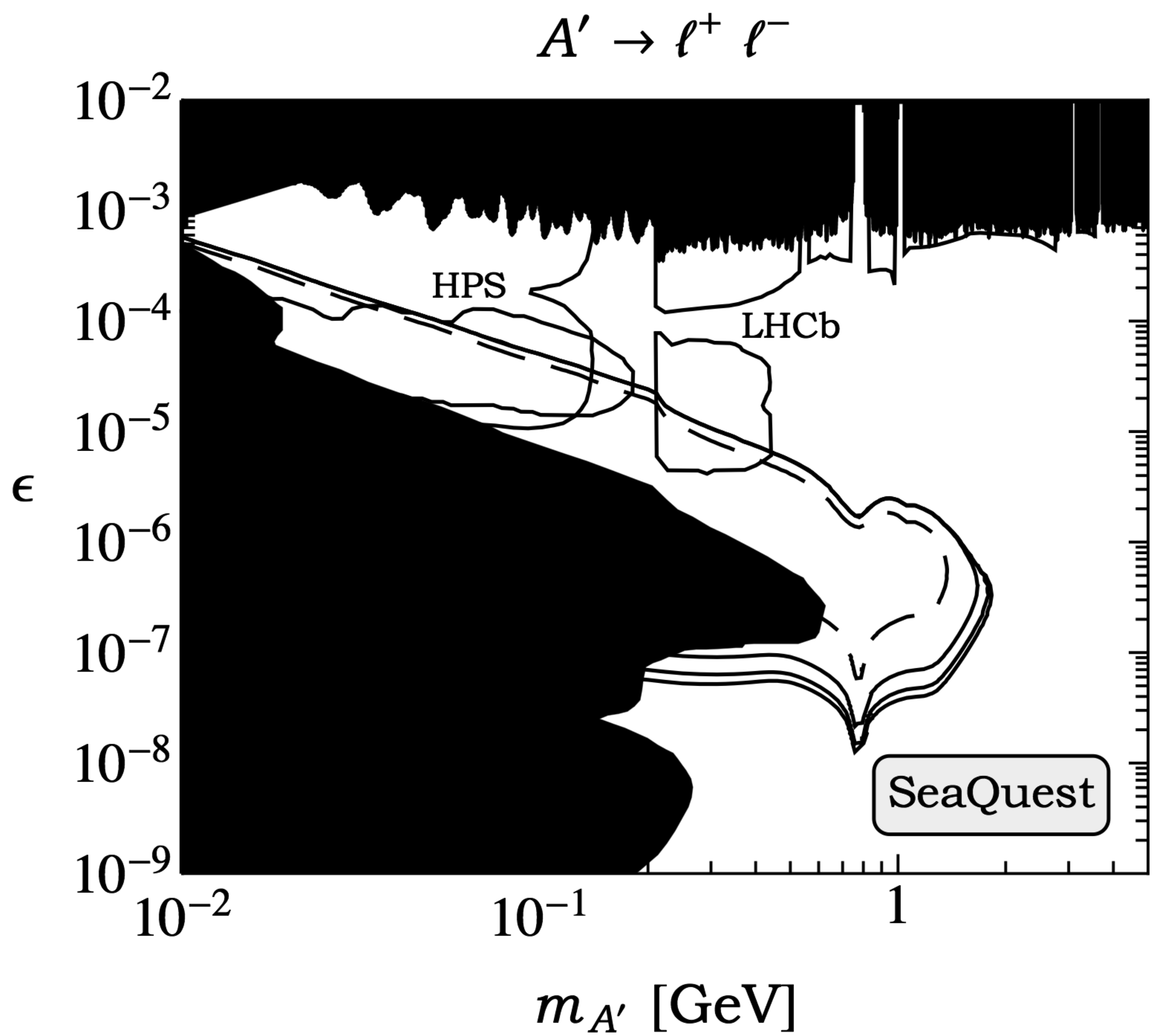
10^{18} - 10^{20} POT + decay + geometric acceptance

SeaQuest Reach



Berlin, Gori, Schuster, Toro
arXiv:1XXX.XXXX

SeaQuest Reach



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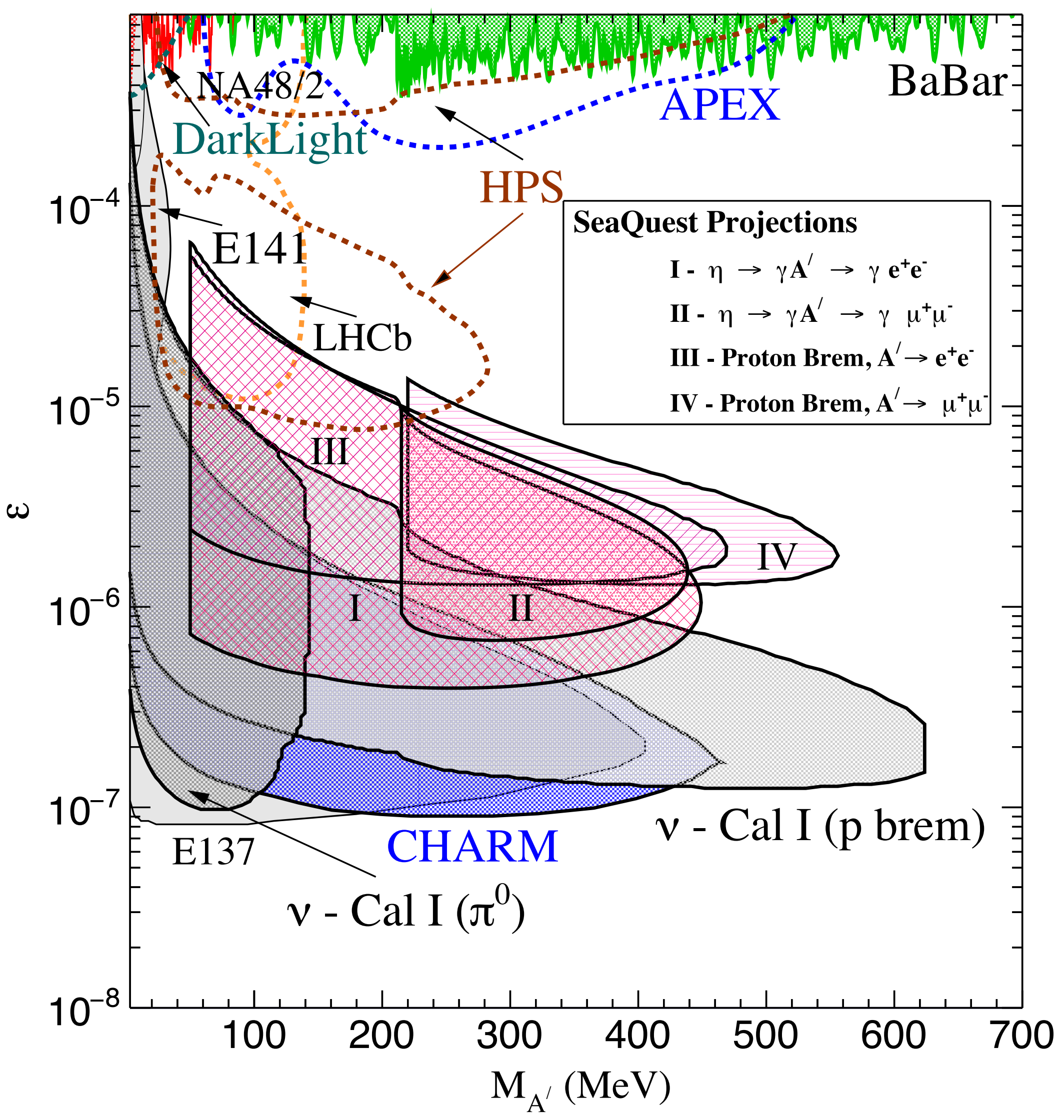
SeaQuest Reach



S. Gardner et al., arXiv:1509.00050

$$N_{\rm dec} = N_0 \mathcal{B}(A' \to \ell^+\ell^-) \exp\left(-\frac{l_{\rm dump}}{c\tau_{A'}} \frac{m_{A'}}{|\mathbf{p}_{A'}|}\right) \times \left[1 - \exp\left(-\frac{l_{\rm fid}}{c\tau_{A'}} \frac{m_{A'}}{|\mathbf{p}_{A'}|}\right)\right], \qquad (36)$$

+ GEANT4

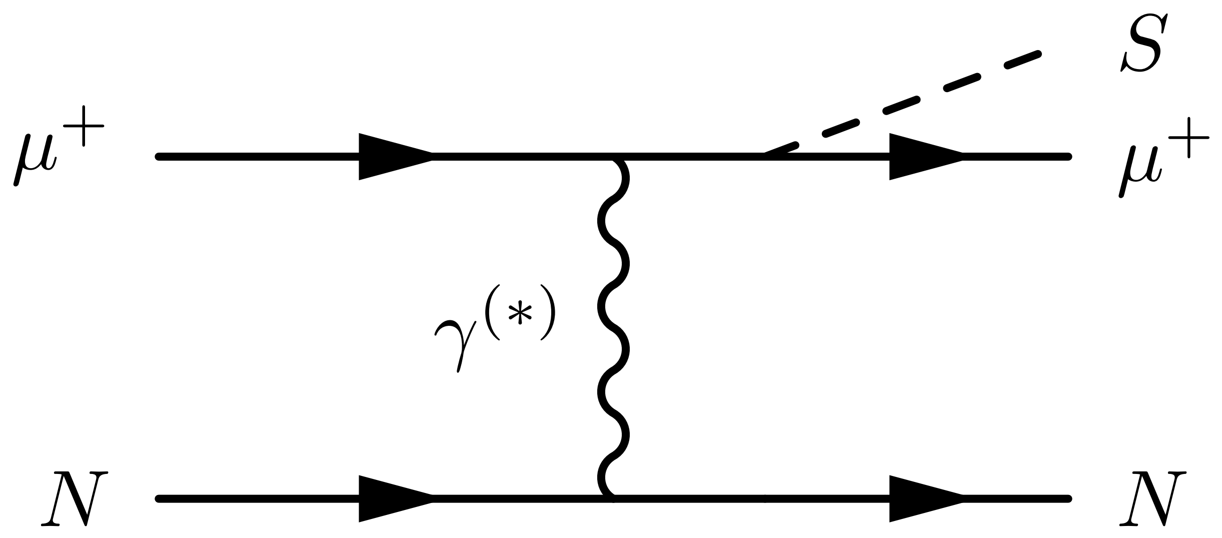
VS.

$$\text{total efficiency} = \frac{m\,\Gamma}{N_{\rm tot}} \int_{\ell_{\rm min}}^{\ell_{\rm max}} d\ell \sum_{i \in \text{geom. criteria}(\ell)} \frac{e^{-\frac{\ell\,\Gamma\,m}{p_{\ell i}}}}{p_{\ell i}}$$

Displaced Muons at SeaQuest

S = leptophilic scalar

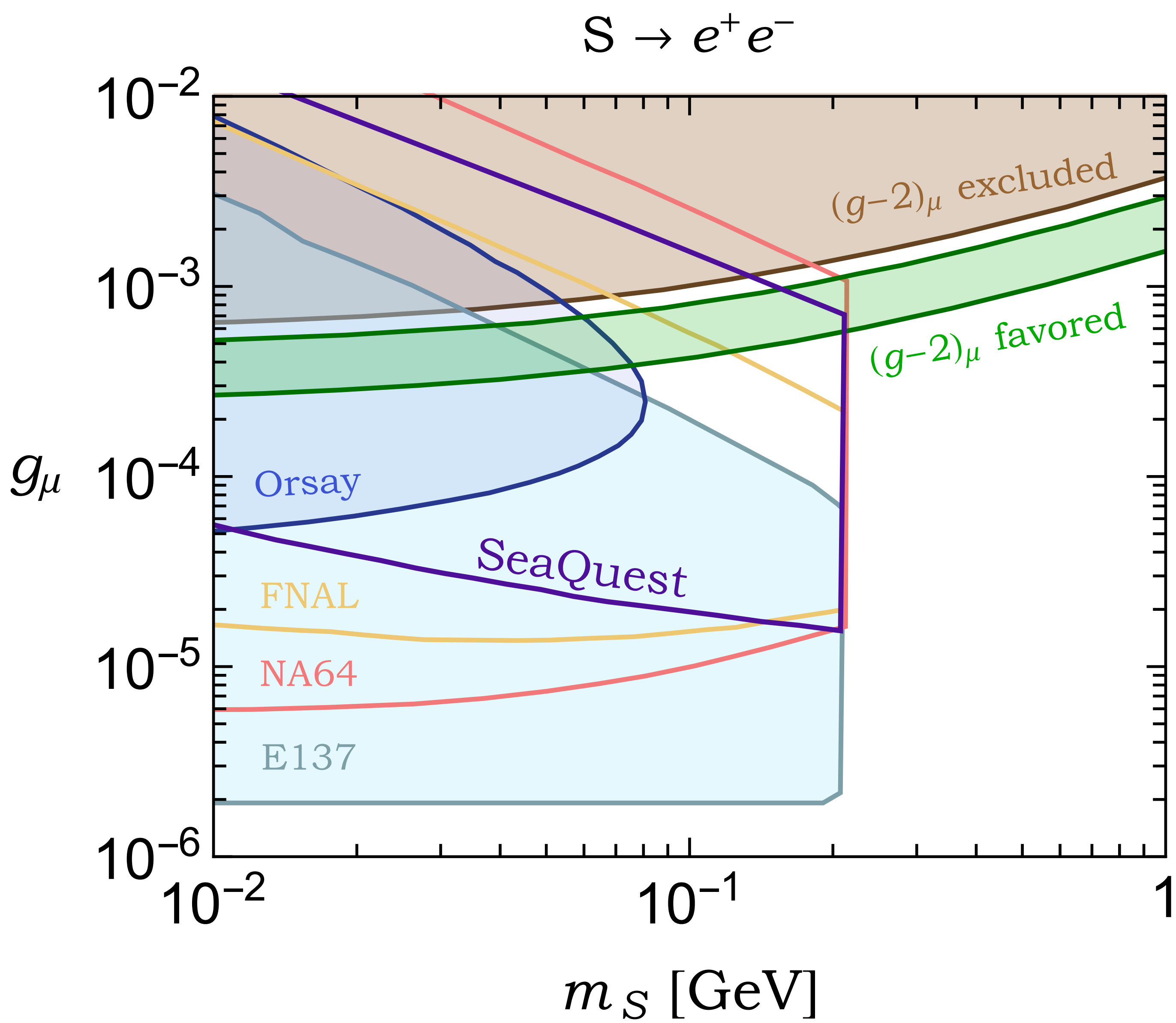
$\pi^{\pm} \rightarrow \mu^{\pm}\, \nu_{\mu}$ +



minimal model for $(g\text{-}2)_{\mu}$

M. Pospelov et al.
arXiv:1701.07437

SeaQuest Reach



10^{20} POT + decay + geometric acceptance


Hidden Valley
SHiP
SeaQuest