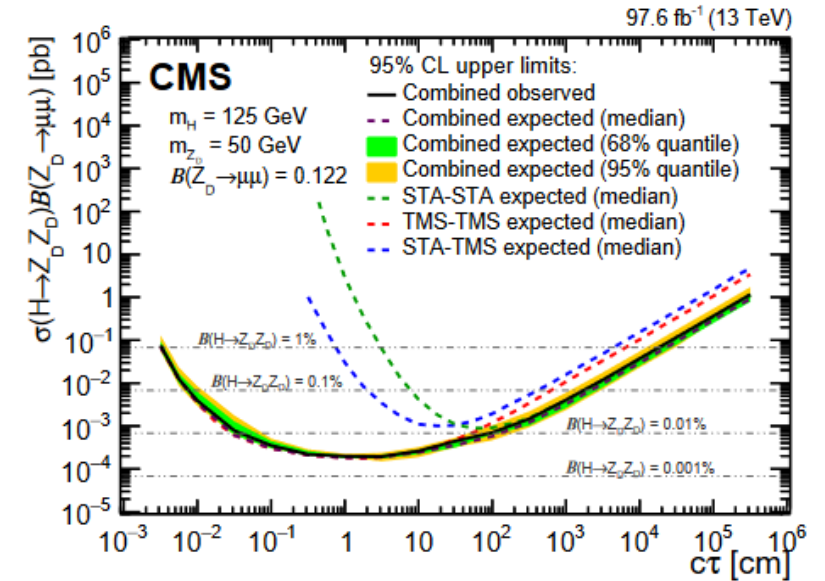
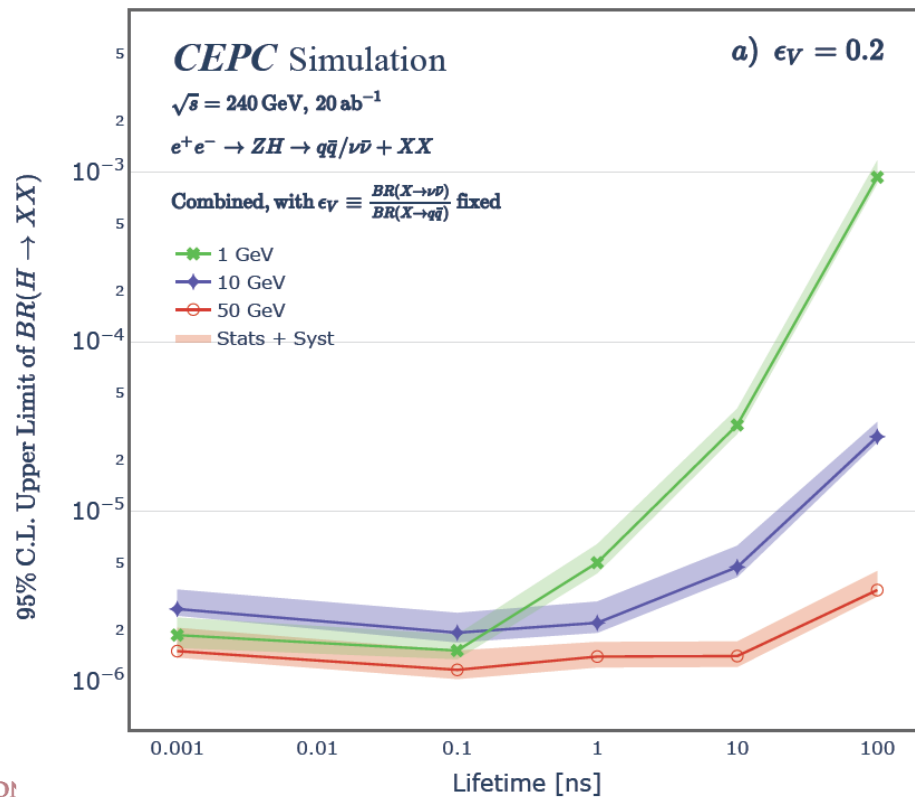
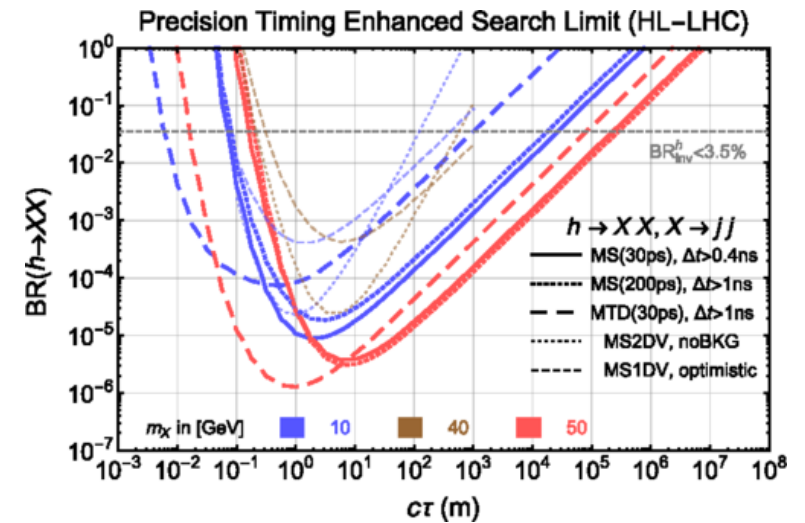


Comparison to Traditional Method

- Orders of magnitude improvement
- “Flatten the curve” for short lifetime
 - Power of deep machine learning
 - Maximize signal efficiency



CMS Result [JHEP 05 (2023) 228]



HL-LHC Projection [PRL 122, 13180]

Far Detector Gain Estimation

An external detector covering distance of $\Delta L=100$ meters

	Gain		Lifetime [ns]				
	Mass [GeV]	0.001	0.1	1	10	100	
Ext. Detector	1	1	1	3.2	11.6	16.2	
	10	1	1	1	3.3	11.8	
	50	1	1	1	1.1	3.6	

$$F_{gain} = \frac{\Delta\Omega}{4\pi} \frac{\Delta L}{d} e^{-\frac{L}{d}}$$

- Improvement factor (F_{gain}) depends on detector length
- Best scenario: “flatten the curve” for the long lifetime case
 - Geometric acceptance
 - Detector volume, cost

