

THE PROBABLE FATE OF THE SM

Krakow, 17 July 09
EPS-HEP

J.R. Espinosa
ICREA @ IFAE, Barcelona

★ M_h determines UV fate of SM

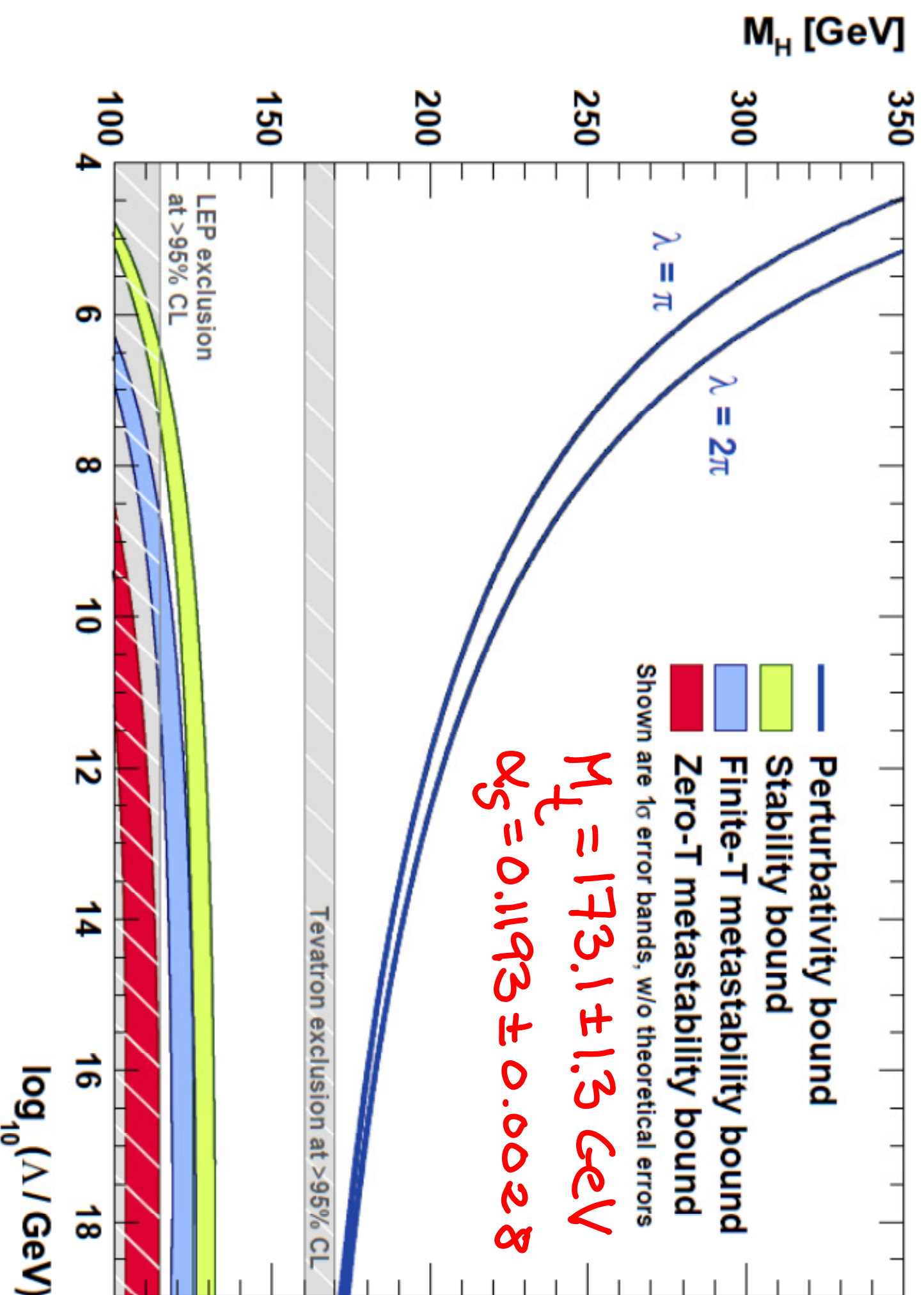
★ Exploit all direct and indirect information on M_h available today (incl. Tevatron) + future prospects

With J. Ellis, G.F. Giudice, A. Hoecker and A. Riotto

[hep-ph/0906.0954]

UV FATE OF THE STANDARD MODEL

Higgs MASS BOUNDS vs SM CUTOFF

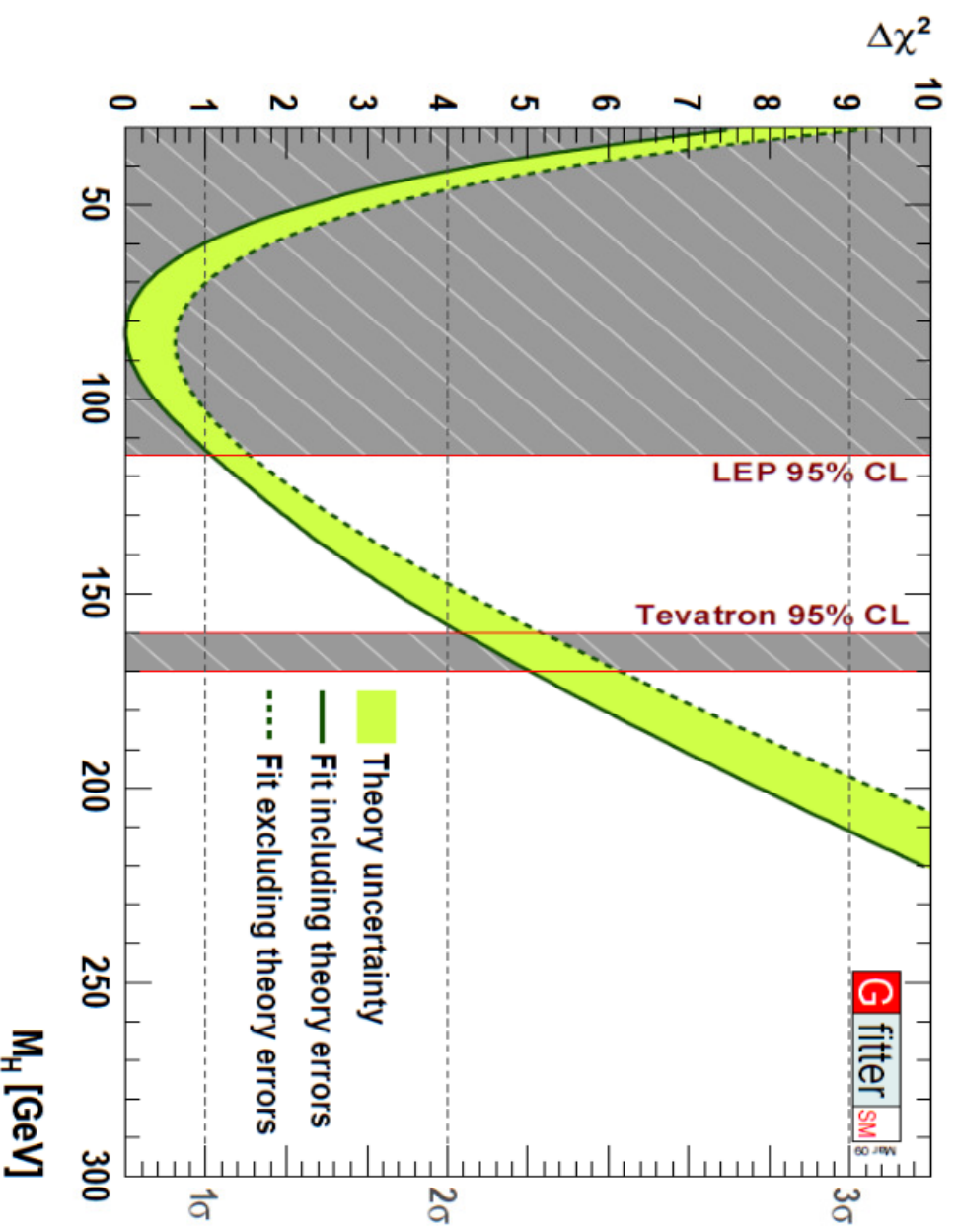


Information on the scale of new physics !

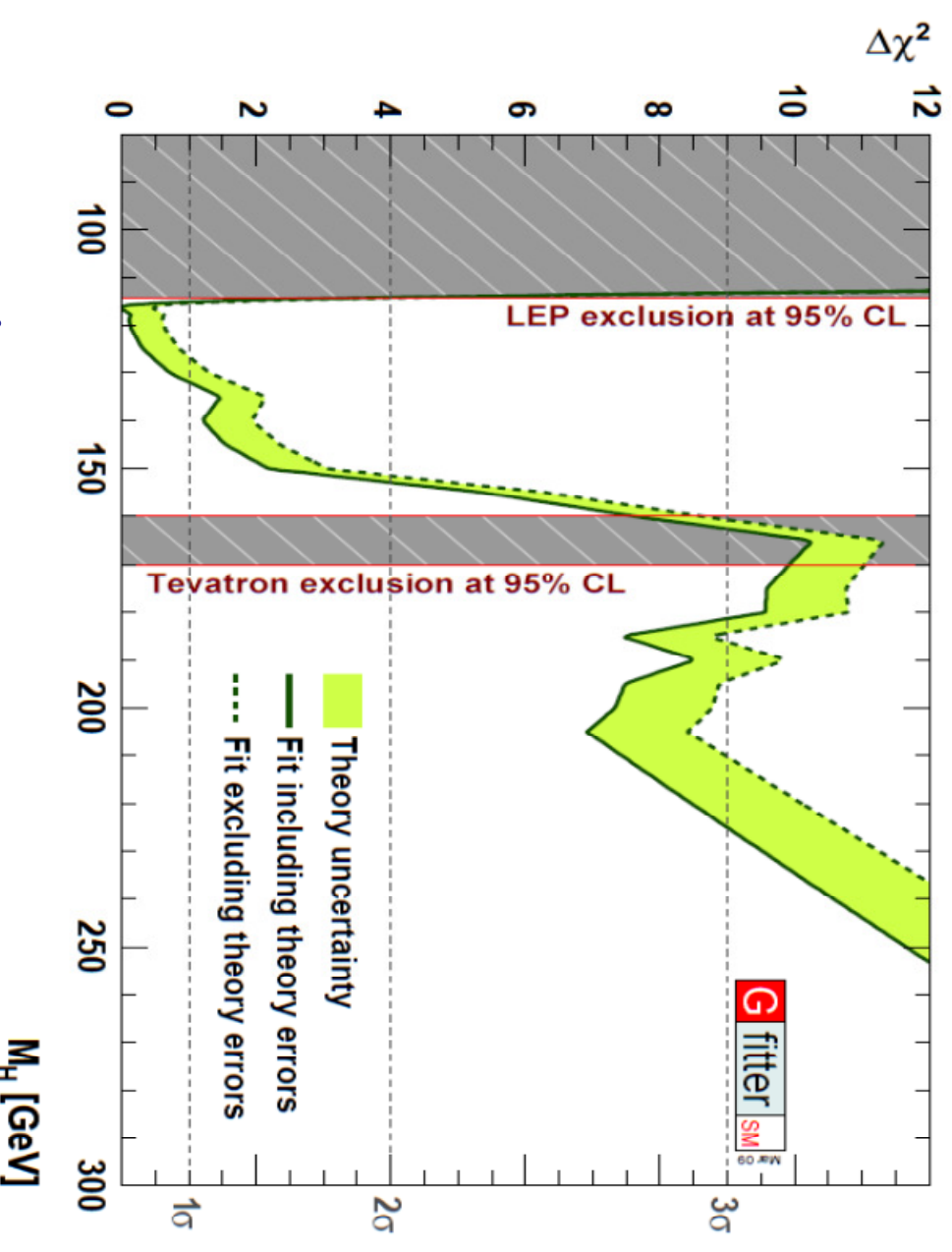
KNOWLEDGE OF M_h : STATE OF THE ART

Global fit to all EW data (Gfitter):

A. Hoecker's talk



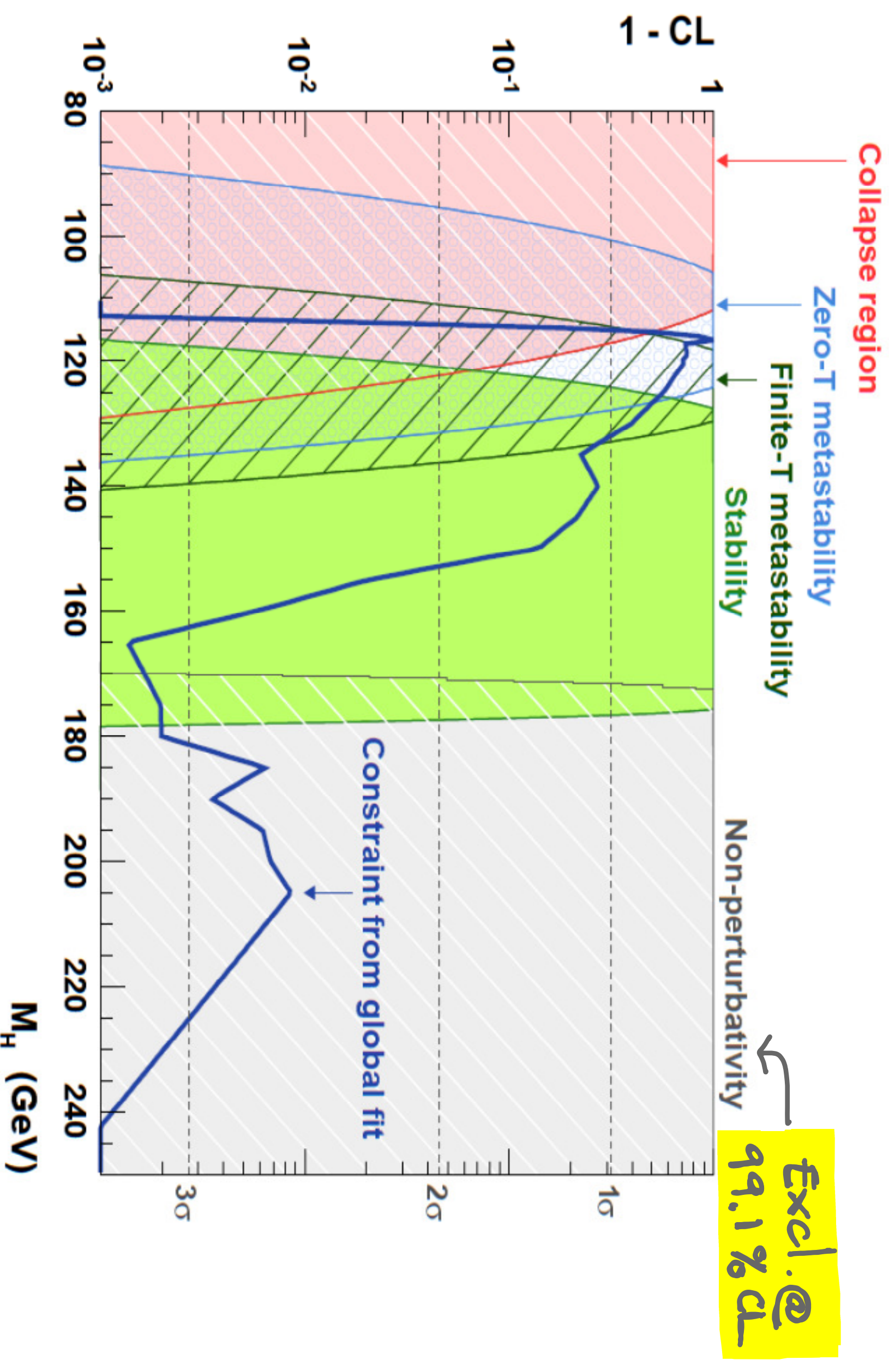
w/o exp. searches



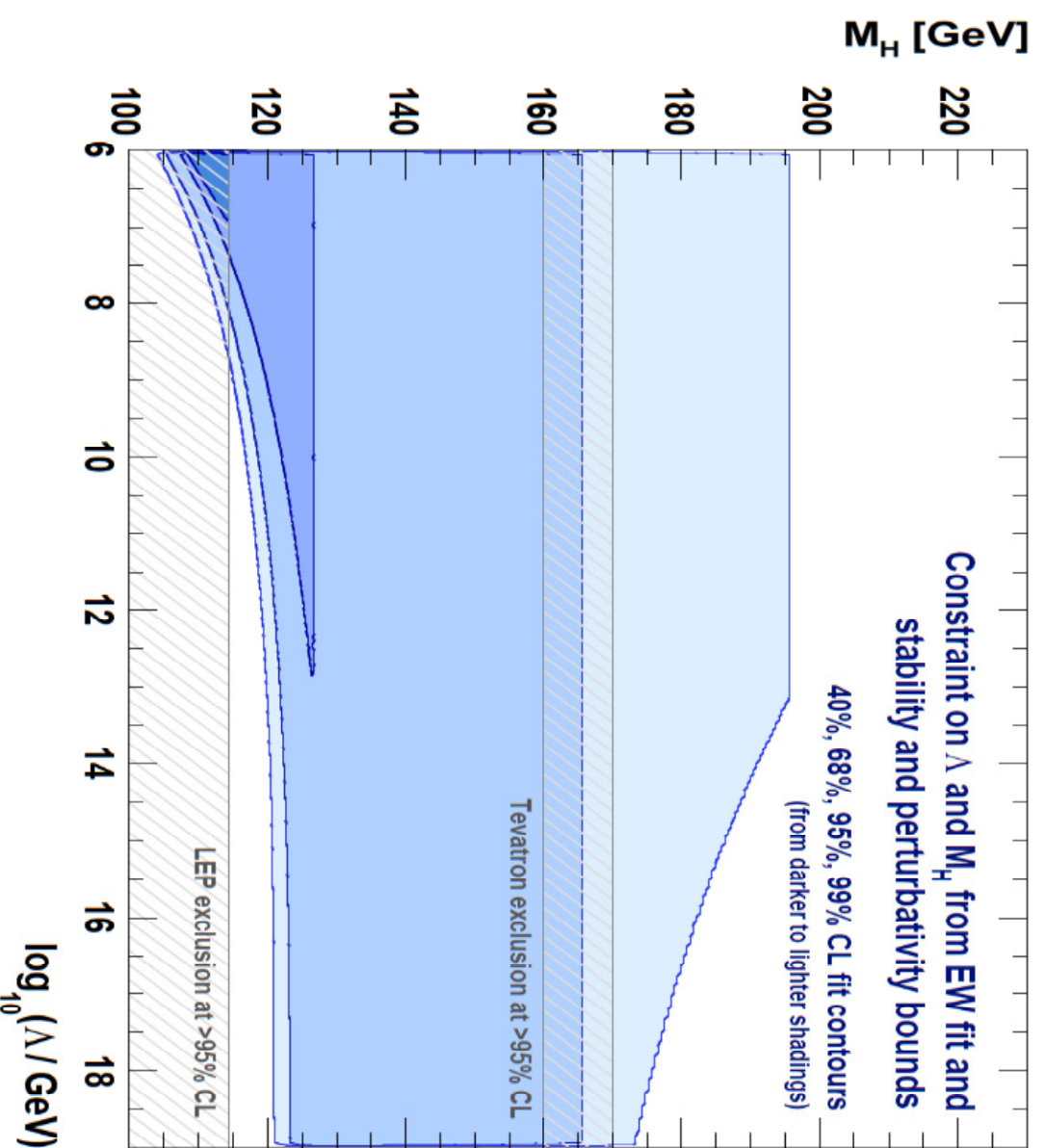
with exp. searches

Big Tevatron impact!

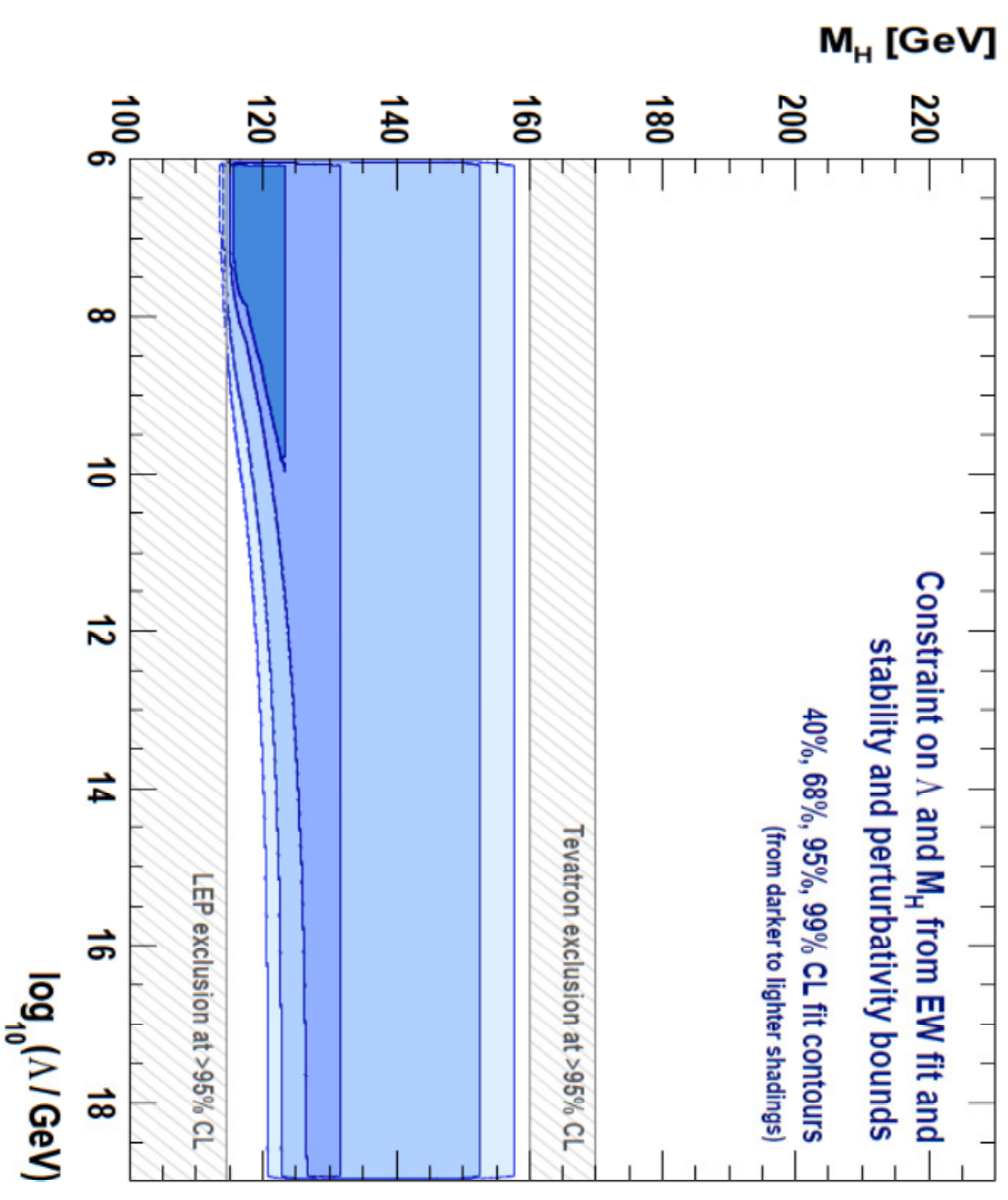
COMBINED INFORMATION ($\lambda = M_H$)



COMBINED INFORMATION (ANY Λ)



w/o exp. searches

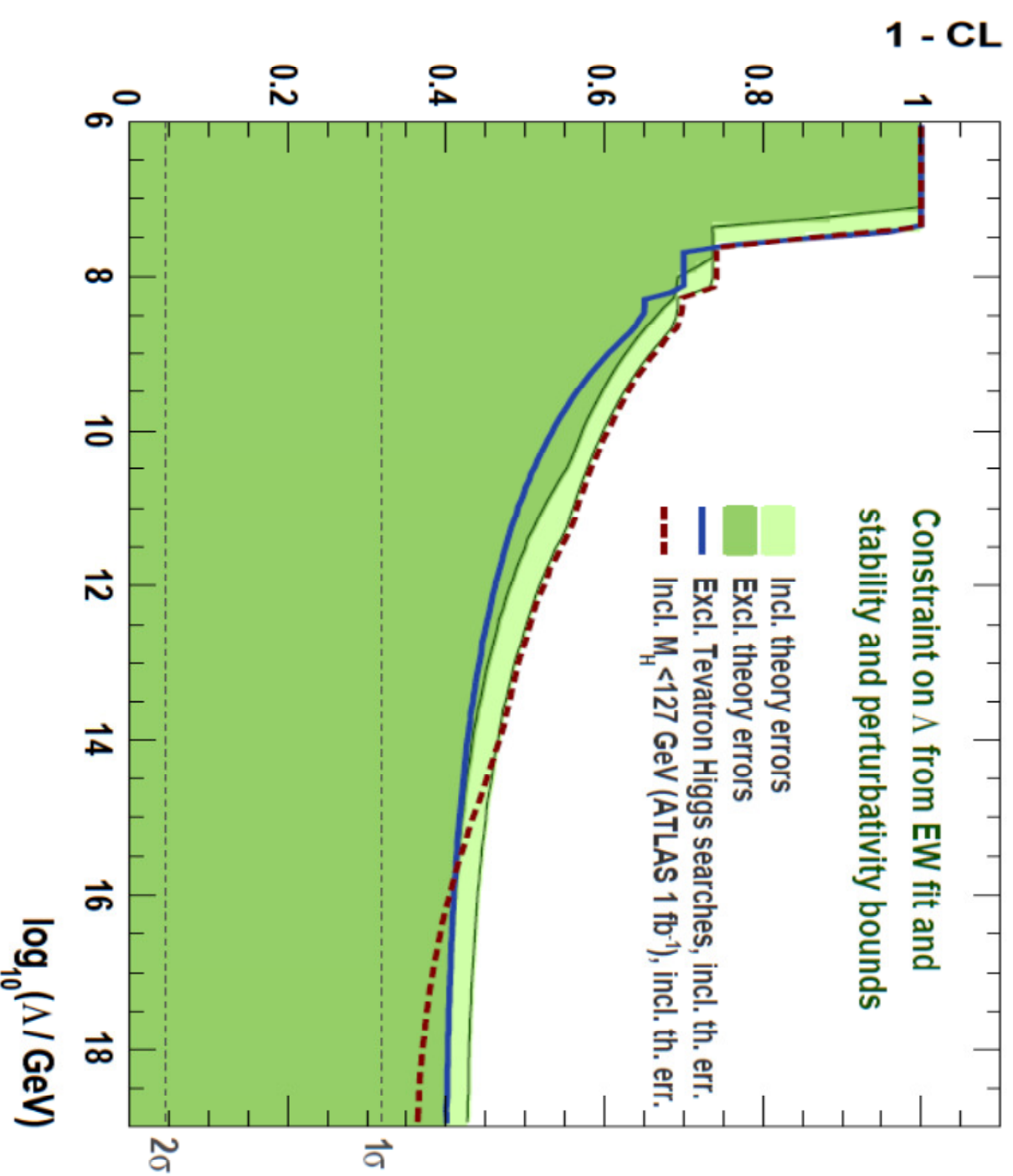


with exp. searches

(Absolute stability imposed)

INDIRECT INFORMATION ON Λ ?

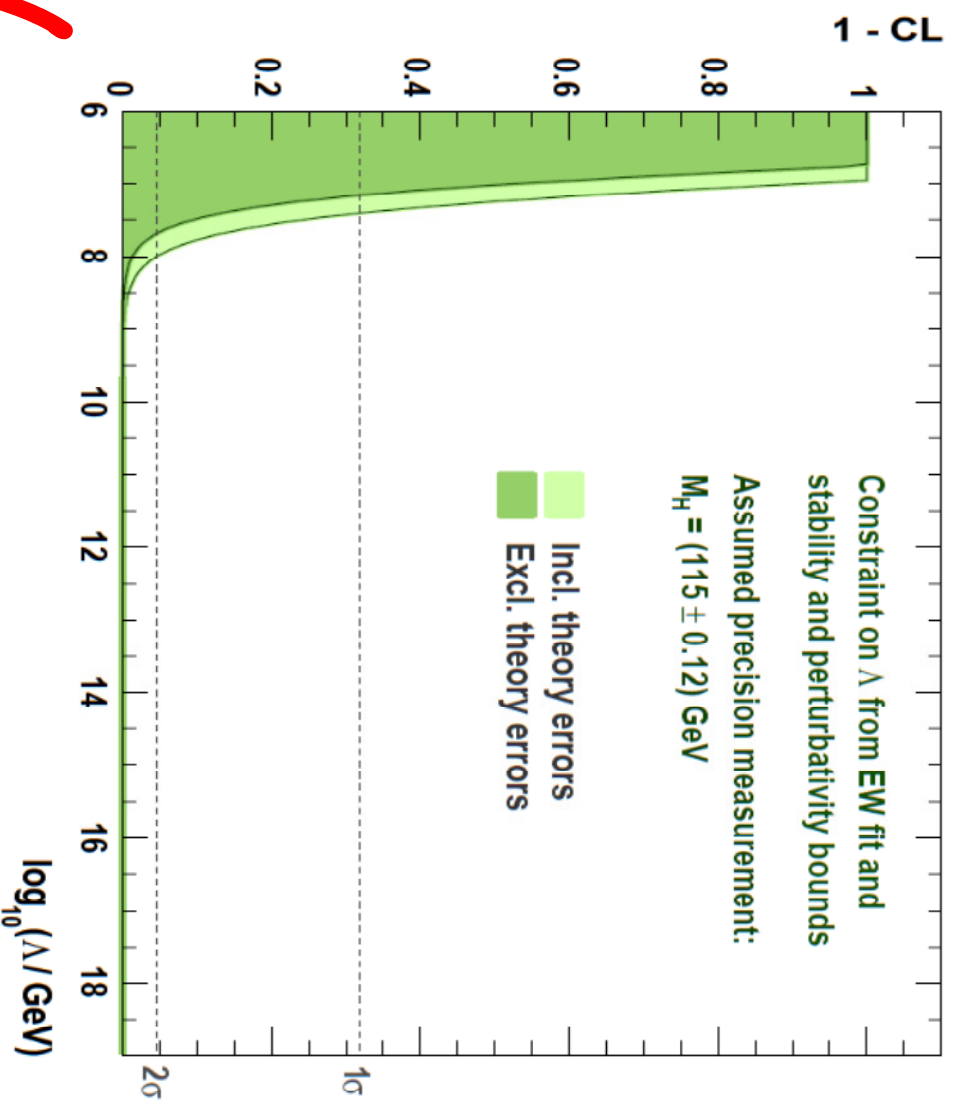
Not yet. Not even assuming a future limit $M_h < 127 \text{ GeV}$ from ATLAS 1fb^{-1} at 14 TeV.



INDIRECT INFORMATION ON Λ ?

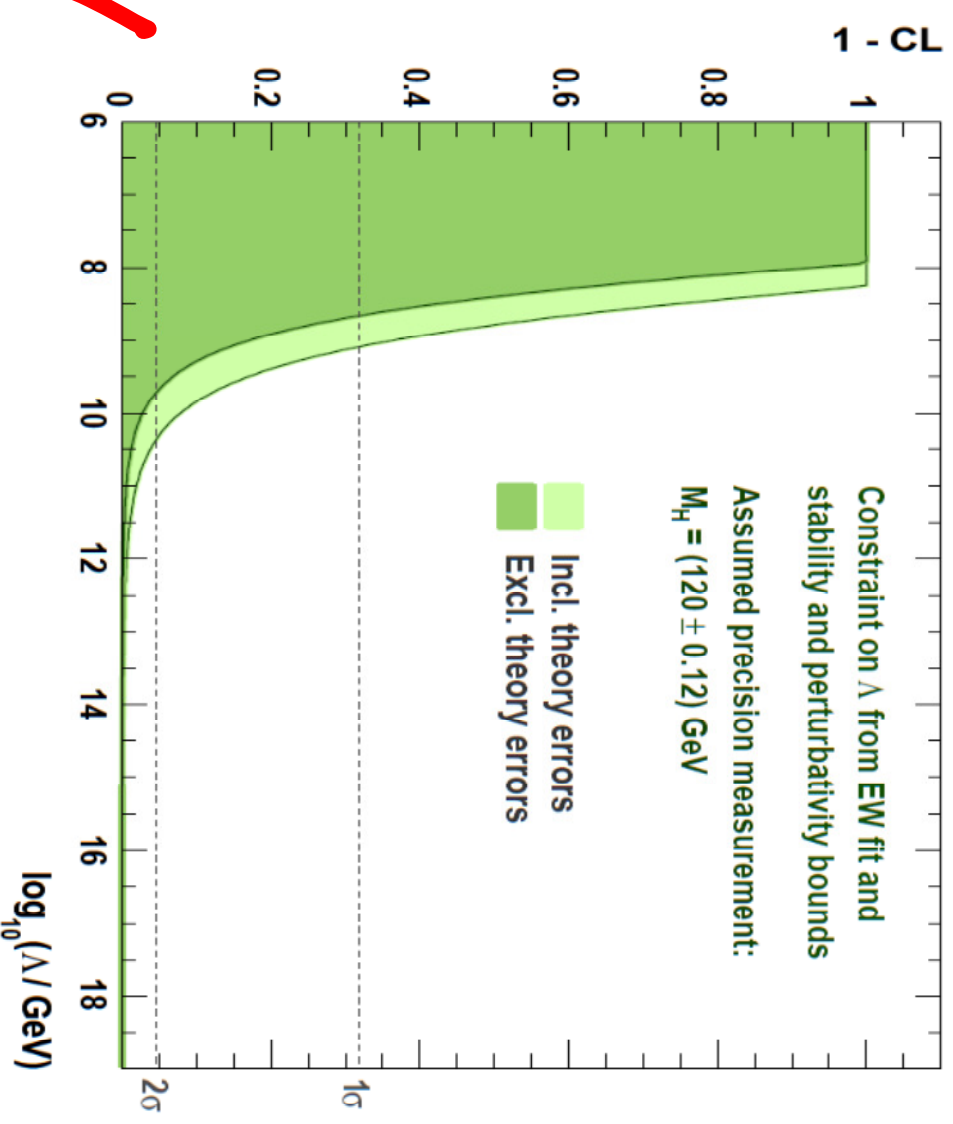
But possible after M_h is measured:

$$M_h = 115 \pm 0.12 \text{ GeV}$$



$$\Lambda \lesssim 10^8 \text{ GeV} \quad (95\%CL)$$

$$M_h = 120 \pm 0.12 \text{ GeV}$$



$$\Lambda \lesssim 2.5 \times 10^8 \text{ GeV} \quad (95\%CL)$$

CONCLUSIONS

★ The measurement of m_h will give hints on the behaviour of the SM at very short distances.

E.g. $m_h = 115 \pm 0.12 \text{ GeV} \Rightarrow$

$$\Lambda \lesssim 10^8 \text{ GeV}$$

★ Before that, indirect information on m_h from global EW fits + exp. searches is already useful

- Non-perturbative regime excluded at 99.1%CL

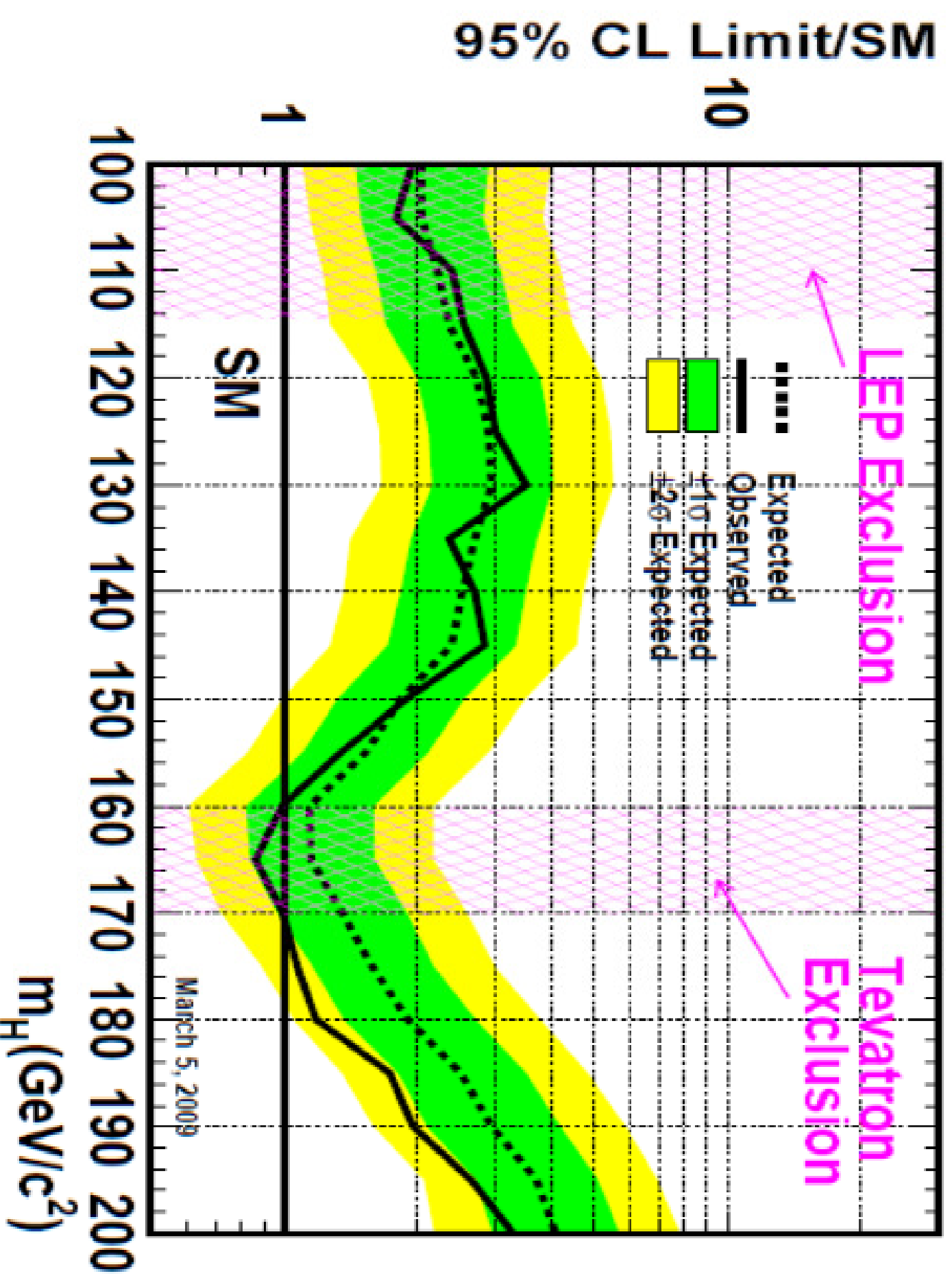
- collapse regime disfavored (p-value = 0.40)

★ Stronger conclusions with more data in near future

SM Higgs Search @ TEVATRON

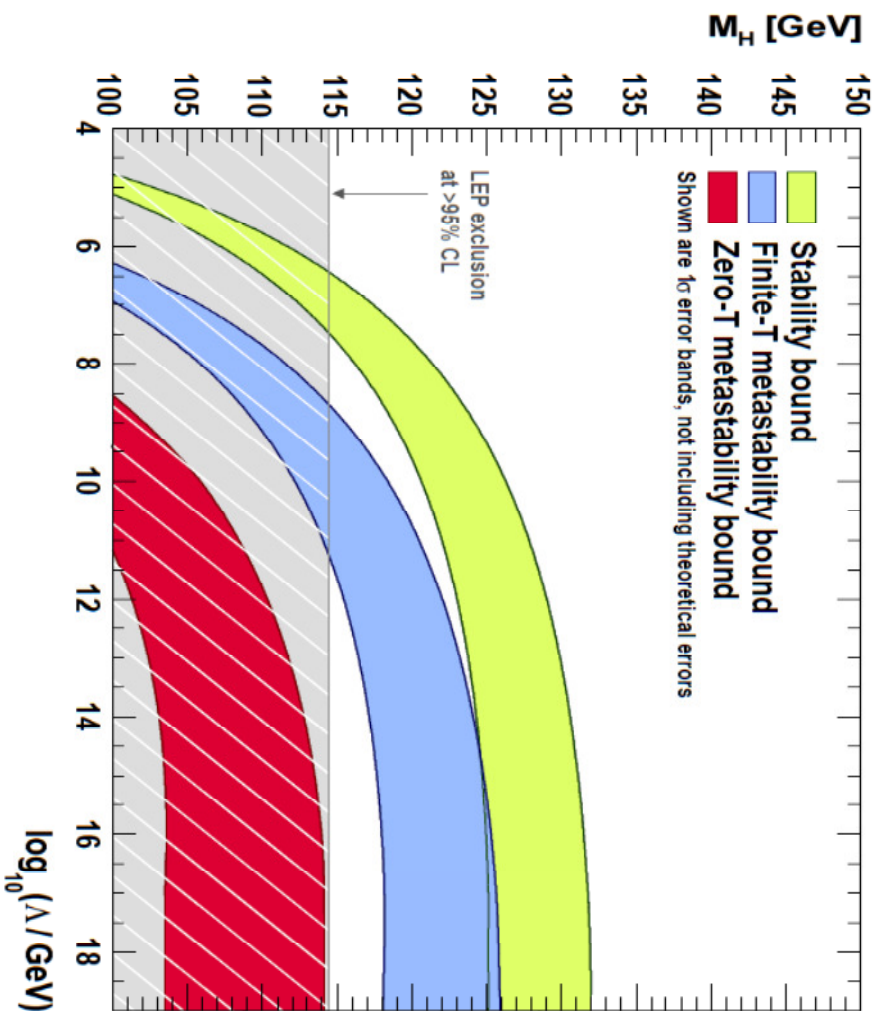
[hep-ex/0903.4061]

Tevatron Run II Preliminary, $L=0.9-4.2 \text{ fb}^{-1}$



HIGGS STABILITY BOUNDS

$$M_t = 173.1 \pm 1.3 \text{ GeV} \quad \alpha_s = 0.1193 \pm 0.0028$$

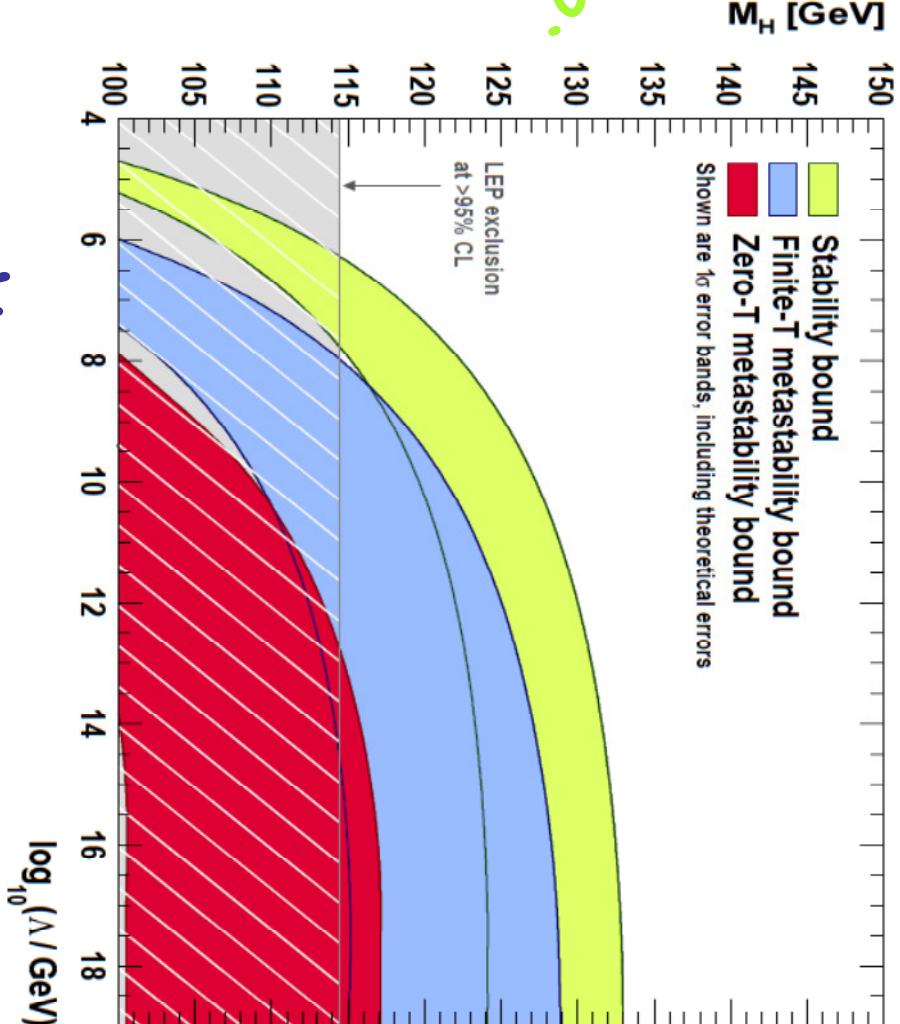


w/o theor. error

Abs. Stab.

$T \neq 0$

$T = 0$



w. theor. error