

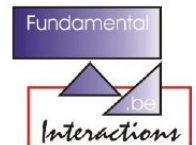
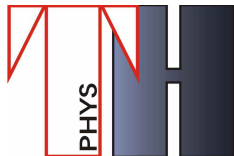
Extra scalar – Direct search vs precision

based on arXiv:1304.0386 with B.Clerbaux, C.Caillol and J.-M.Frère

Simon Mollet

Service de Physique Théorique (ULB)

Scalar Search and Study in Belgium (S3Be)



SM doublet Φ + extra singlet χ

Symmetry Breaking

SM scalar H + extra scalar S

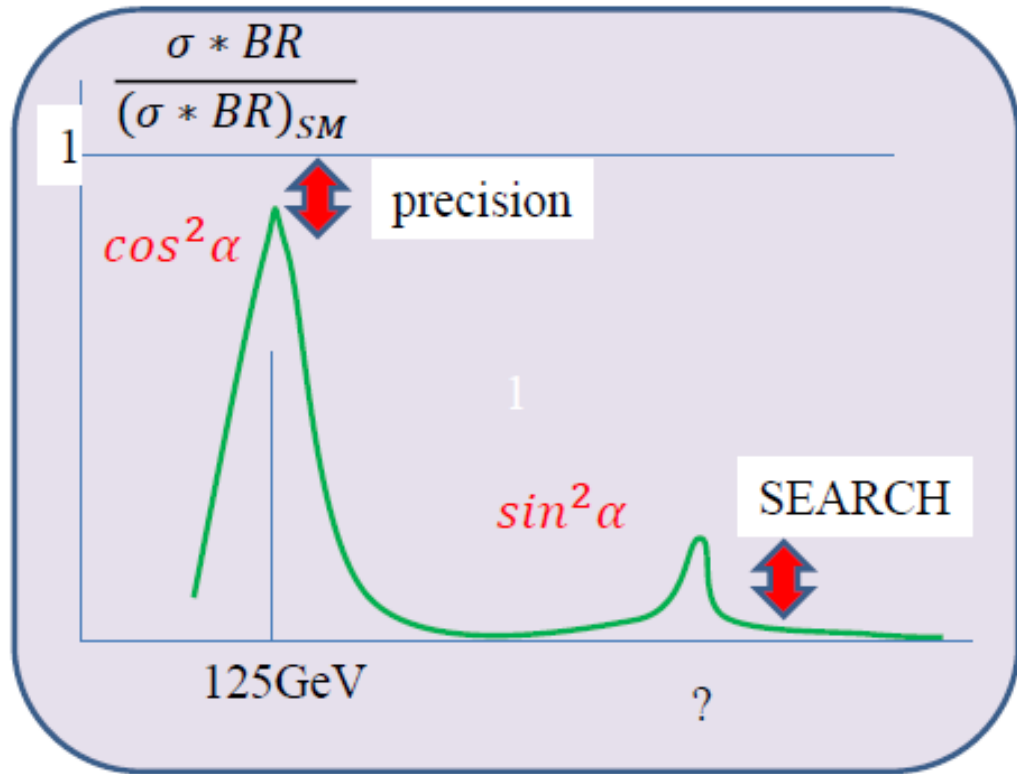
Mixing

$$H_1 = H \cos \alpha + S \sin \alpha$$

$$H_2 = -H \sin \alpha + S \cos \alpha$$

2 « peaks »

A.Hill, J.van der Bij (1987)

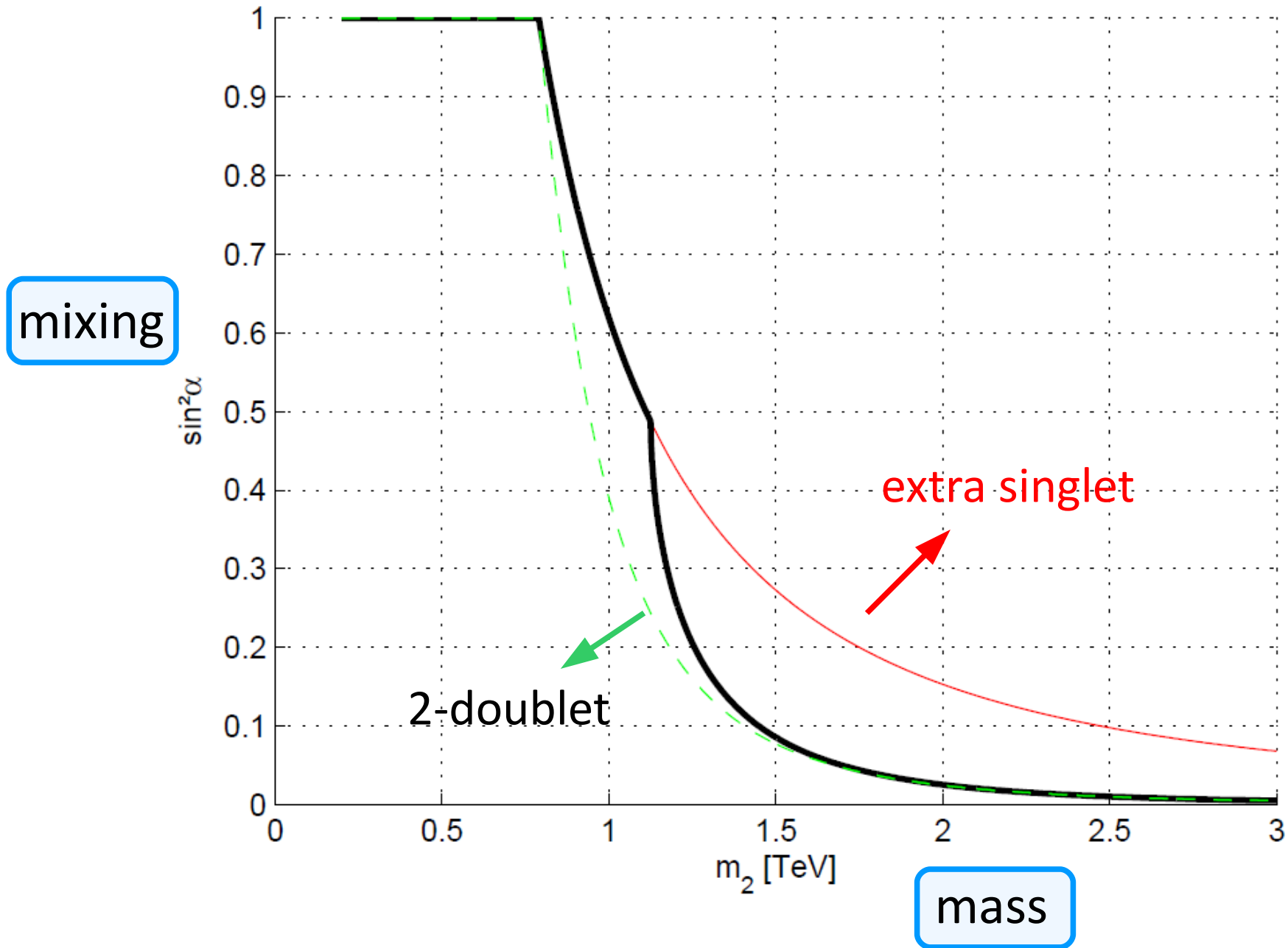


$$H_1 : m_1 = 125 \text{ GeV} \rightarrow (\sigma \times BR)_1 = \cos^2 \alpha (\sigma \times BR)_{SM, m1}$$

$$H_2 : m_2 = ??? \text{ GeV} \rightarrow (\sigma \times BR)_2 = \sin^2 \alpha (\sigma \times BR)_{SM, m2}$$

Which mass range for which mixing ?

Decoupling implies that mixing disappears when the mass of the new particle $\rightarrow \infty$

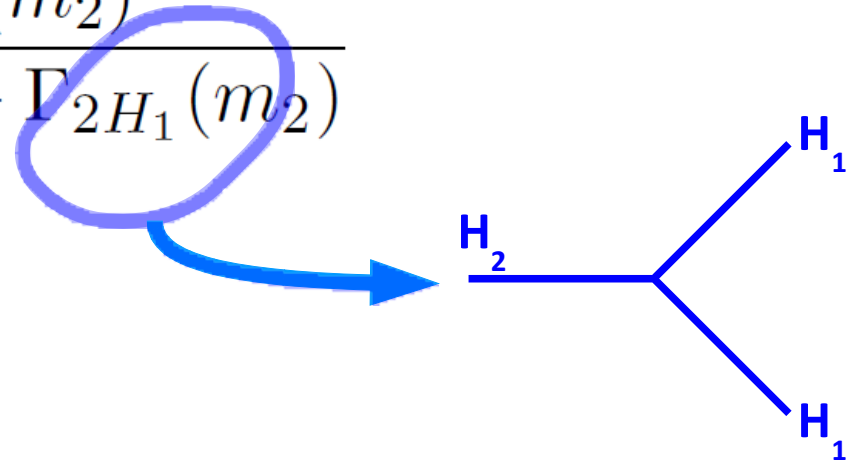


$2m_1 \leq m_2 \rightarrow$ a new channel opens !

$$\frac{(\sigma \times BR)_{\text{obs}}}{(\sigma \times BR)_{\text{exp}}} = \frac{s_\alpha^2 \sigma_{\text{SM}}(m_2)}{\sigma_{\text{SM}}(m_2)} \times \frac{s_\alpha^2 \Gamma_{\text{SM}}(m_2)}{s_\alpha^2 \Gamma_{\text{SM}}(m_2) + \Gamma_{2H_1}(m_2)}$$

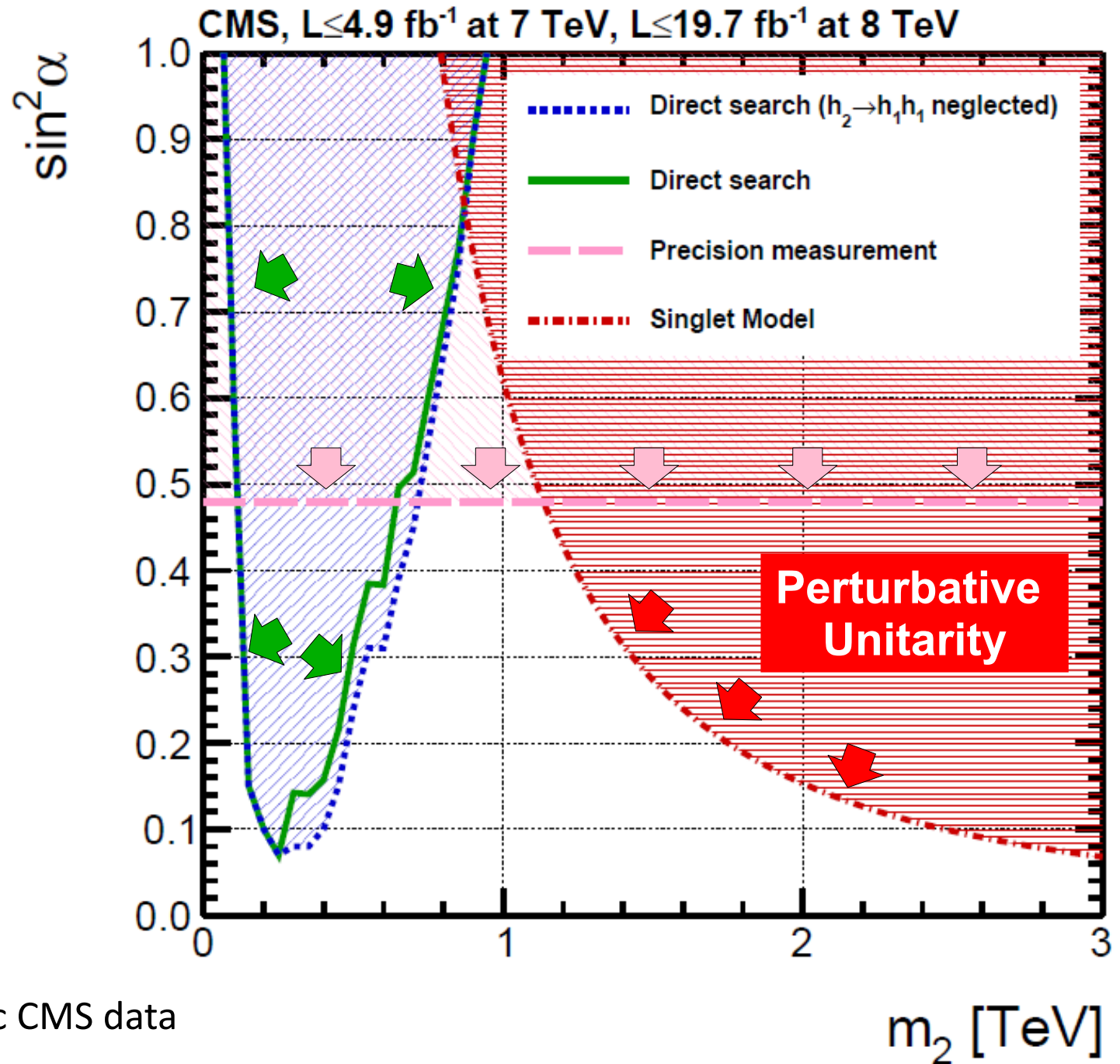
$$= \frac{s_\alpha^4 \Gamma_{\text{SM}}(m_2)}{s_\alpha^2 \Gamma_{\text{SM}}(m_2) + \Gamma_{2H_1}(m_2)}$$

μ



$2m_1 \geq m_2$	$2m_1 \leq m_2$
$\sin^2 \alpha = \mu$	$\sin^2 \alpha = \mu * \text{corr}(m_2)$

Constraints on $\sigma \times \text{Br}(\text{Extra Singlet Model})/\text{SM}$



Based on public CMS data

Constraining the simplest model

