THU
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H lineshape
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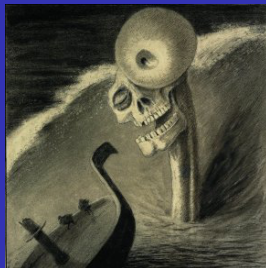
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Future
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Conclusions
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LHC Higgs XS 2011
Towards YR2

A Personal Perspective

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Deductive logic and plausible reasoning

E Adding **PU** and **THU** linearly would imply 100% positive correlations between them **contrary** to the statement that they are linearly independent.

T It does not make sense to talk about correlations with other errors. These correlations are even **not defined!** THU are no statistical objects.

1 If proposition **A** is true, then proposition **B** is true

2 Suppose we are told **A** *is not true*, what can we say about **B**? Logic has nothing to say about this. Intuitvely though, we would not believe that it was less plausible that **B** is true then we previously did

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Hedges

- We have a skewed *pdf* and the data generated according to it. Let it be Log-Normal distribution:

- Let's say, we need to **add some uniform distribution**. OK, we can easily generate uniform distribution. Then we just add the two distributions (either in spatial domain or in Fourier domain using point-wise addition) and get the result.

- Do we need to attenuate the amount of the uniform distribution that we add? The better solution is to generate another uniform distribution $[0, 1]$ and make it like a mask for addition of desired data points. In order to attenuate the influence of the other distribution, we need to add only a few point from the other distribution, etc. etc.
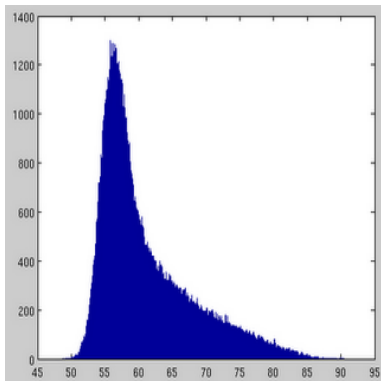
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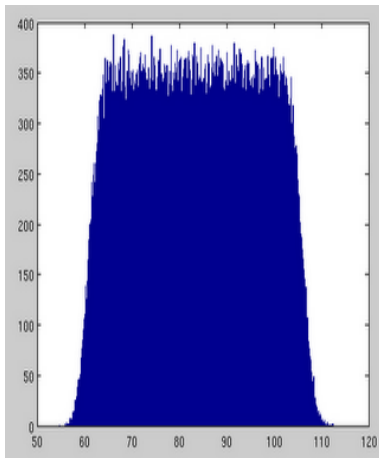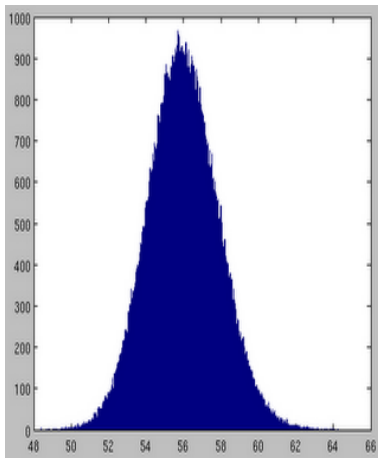
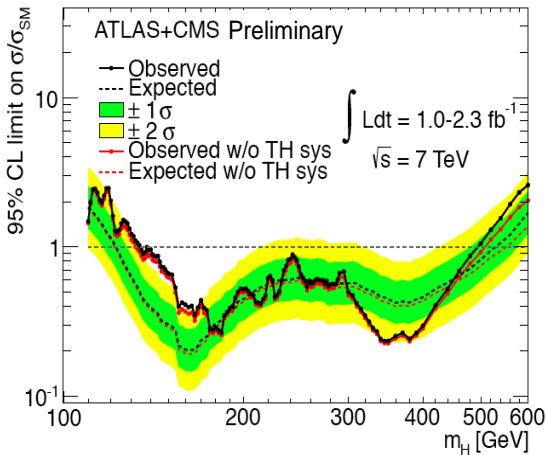# Pleasing the eye

Only when we just add

$I_{\text{add}} = I + I_{\text{long}}$ where I is uniform distribution $\times$ by uniform mask (triangular-like), and I_{long} is long-tailed we get

- the result pleases the eye, the mind and the soul but how many manipulations!

Expected exclusion changes by 1 GeV at low mass and 20 GeV at High mass

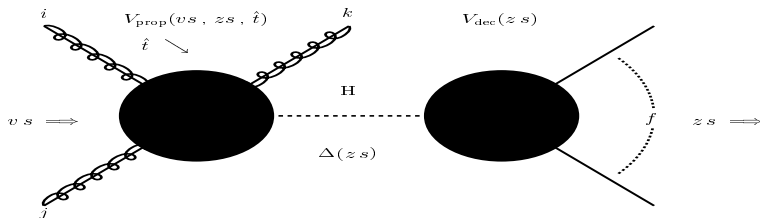Thanks to the advances in theory and to LHC Higgs cross section group !

EW strikes back

$H \to \gamma\gamma$ **SM4**

$$
\begin{aligned}
|A|^2 &= |A_{\mathrm{LO}}|^2 + 2\,\mathrm{Re}\!\left(A_{\mathrm{LO}}^\dagger\right) A_{\mathrm{NLO}} = |A_{\mathrm{LO}}|^2\,(1 + \delta_1)\,, \\
|A|^2 &= |A_{\mathrm{LO}} + A_{\mathrm{NLO}}|^2 = |A_{\mathrm{LO}}|^2\,(1 + \delta_2)
\end{aligned}
$$

M_H [GeV]	δ_1 [%]	δ_2 [%]
100	-319	-65
120	-282	-83
140	-237	-97

$$\Longrightarrow \; \sigma_{ij \to \mathrm{H}+k}(vs \, , \, \hat{t} \, , \, zs) \, \frac{(zs)^2}{\left| zs - s_\mathrm{H} \right|^2} \frac{\Gamma_{\mathrm{H} \to f}(zs)}{(zs)^{1/2}} + \mathrm{NR}$$

$$= \; \sigma_{ij \to \mathrm{H}+k}(vs \, , \, \hat{t} \, , \, s_\mathrm{H}) \, \frac{\left| s_\mathrm{H} \right|^2}{\left| zs - s_\mathrm{H} \right|^2} \frac{\Gamma_{\mathrm{H} \to f}(s_\mathrm{H})}{\left| s_\mathrm{H} \right|^{1/2}} + \mathrm{NR}'$$

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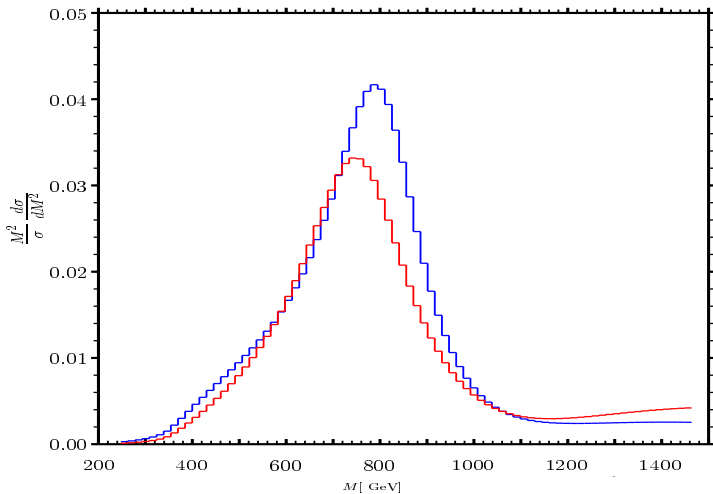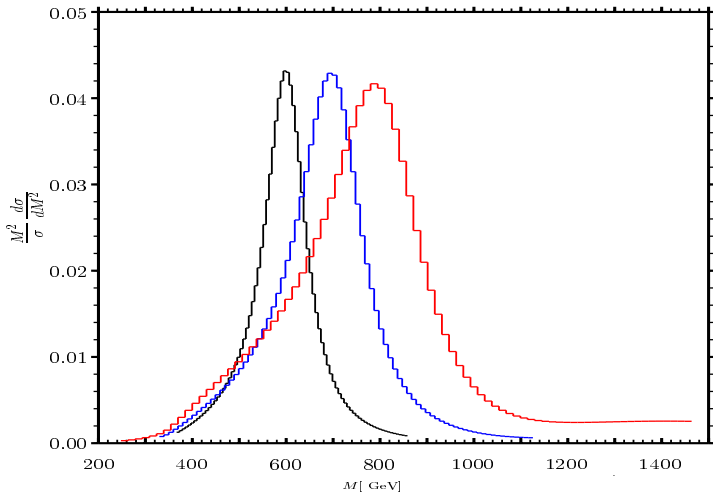
How to present results: Lep - time

$$\mathcal{M}_{ff}^{z} = \overline{u}_f \not{e}_Z \left(\mathcal{G}_V^f + \mathcal{G}_A^f \gamma^5 \right) v_f$$

$$A_{\text{FB}} = \frac{3}{4} \frac{\sigma_{VA}}{\sigma_T}$$

Example

$$\sigma_{VA} = \frac{G_F M_Z^2}{\sqrt{2}} \sqrt{\rho_e \rho_f} \, Q_e Q_f \text{Re}\left[\alpha^*(M_Z^2) \mathcal{G}_V^e \mathcal{G}_A^f \chi(s) \right]$$

$$+ \frac{G_F^2 M_Z^4}{8\pi} \rho_e \rho_f \text{Re}\left[\mathcal{G}_V^e \left(\mathcal{G}_A^e \right)^* \right] \text{Re}\left[\mathcal{G}_V^f \left(\mathcal{G}_A^f \right)^* \right] s \, |\chi(s)|^2$$

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How to present results: Higgs - time

> **Higgs**
>
> Taking advantage that H is a scalar resonance

$$\sigma_{\mathrm{H}}^{\mathrm{prod}} \;=\; \sum_{ij} \int \mathsf{PDF}_{ij} \,\otimes\, \sigma_{ij \to \mathrm{H}+k}(vs,\,\hat{t},\,s_{\mathrm{H}}) \,\frac{vs \left| s_{\mathrm{H}} \right|^{1/2}}{\left| zs - s_{\mathrm{H}} \right|^2} \,\Gamma_{\mathrm{H}}(s_{\mathrm{H}})$$

How to present results: PO

RawData	$\rightarrow$ $\swarrow$	**idealized RO_{exp}**
RO_{exp} **$PO_1^{XM} \ldots PO_n^{XM}$**	$\rightarrow$ **fit** $\leftarrow$ **to model**	**$RO_{th}(PO_1 \ldots PO_n)$** $\downarrow$ **$PO_1 \ldots PO_n$**

How to present results: PO @ LHC

$$\text{Data} \to \quad R_{\text{exp}} \quad \left(\text{pp} \to l\nu_l l'\nu_l'\right)$$

$$\to \text{PDF} \otimes \quad R_{\text{th}} \quad \left(\sigma_{\text{prod}} \,,\, \Gamma_{H\to WW,ZZ} \,,\, \Gamma_{W\to l\nu_l} \,,\, \Gamma_{Z\to ll,\nu_l\nu_l} \,,\, \text{non fact.}\right)$$
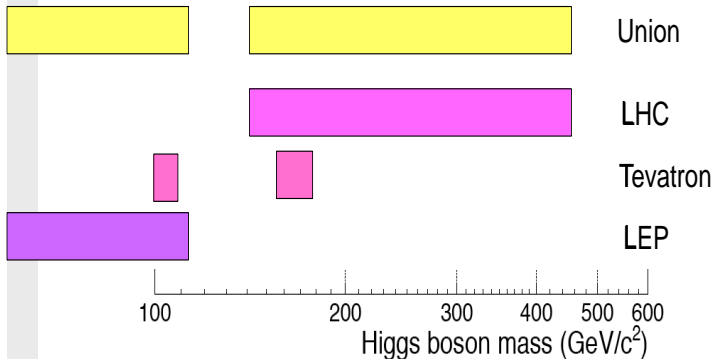
But

W, Z are not scalar, there are spin-correlations, there is interference, realization must be gauge invariant, only idealized cuts can be included in R_{exp}, e.g. Lep

$$\sigma_{VA} \quad \text{is better then} \quad \frac{d\sigma^{cut}}{d\theta}.$$
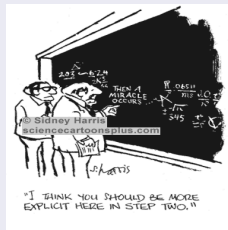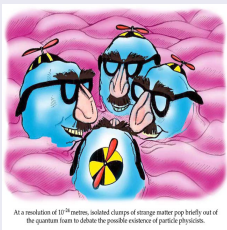
Exclusion Regions SM Higgs

Next year

Favorite option

Please, find a blue particle one mile away from the beam!

Otherwise SP will be homeless and NP orphan. Or try to find a concentration of events from different channels at the same mass window.

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In a few years

"About these experiments you've conducted for twelve years...no one remembers hiring you."

"About these experiments you've conducted for twelve years...no one remembers hiring you."

In the pasture of this world, I endlessly push aside the tall grasses in search of the Higgs. Following unnamed rivers, lost upon the interpenetrating paths of distant mountains, My strength failing and my vitality exhausted, I cannot find the Higgs. I only hear the locusts chirring through the forest at night.