

The design of a Master Thesis

Appendix: Thesis Defence

Andrea Donini

(curso organizado y supervisado con Pilar Hernández)

General view

1. **Online class(es) on basic rules to write the Master's thesis**
2. **Practical exercise: organising the Thesis (email submission)**
3. **Correction of the practical exercise (either by mail or skype)**
4. **Presentation to the class of one or two exercises**
5. **Online class on basic rules to present your Master's thesis**

Outline of the lecture

- 1. STARTING**
 1. Choosing a language
 2. Choosing a presentation software
 3. Choosing an AI?


- 2. ORGANIZATION OF THE SLIDES**
 1. Understanding your subject
 2. What is “old”
 3. Appendices
 4. What is “new”
 5. Introduction and conclusions

- 3. GRAPHICS AND EQUATIONS**
 1. Drawing and inserting plots
 2. Equations

- 4. REFERENCING**

1.

Outline of the lecture

1. **STARTING**
 1. Choosing a language
 2. Choosing a presentation software
 3. Choosing an AI?
2. **ORGANIZATION OF THE SLIDES**
 1. Understanding your subject
 2. What is “old”
 3. Appendices  Backup slides
 4. What is “new”
 5. Introduction and conclusions
3. **GRAPHICS AND EQUATIONS**
 1. Drawing and inserting plots
 2. Equations
4. **REFERENCING**

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What this class it is not

We are not teaching you **to speak in public**

We are not teaching you **the language** you use to speak
(english...?)

We are not teaching you **physics**

Part I: STARTING

1. Choose a language to talk

Possible choices:

ENGLISH

CASTELLANO

VALENCIÁ

Part I: STARTING

1. Choose a language to talk

Possible choices:

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I strongly suggest **ENGLISH**:

1. It is the language of science
2. You read books and articles in english
3. It may be your first chance to TALK in english
4. Possibly, you have written the thesis in english...

Part I: STARTING

2. Choose a presentation software

In this case, the choice mainly depend on the hardware on which you work

MAC: Keynote or Powerpoint, or ...

WINDOWS: Powerpoint or ...

LINUX: whatever works for you

I am using Keynote, but what I will say does not depend on the particular software

Part I: STARTING

3. Choose an AI?

**Not clear to me how to optimize
the usage of AI to prepare
the talk**

**I'm asking now to prepare a Beamer talk in latex,
then I compile it to produce a .pdf
then I cut&paste the relevant parts of the pdf slides
into my favourite software (keynote)**

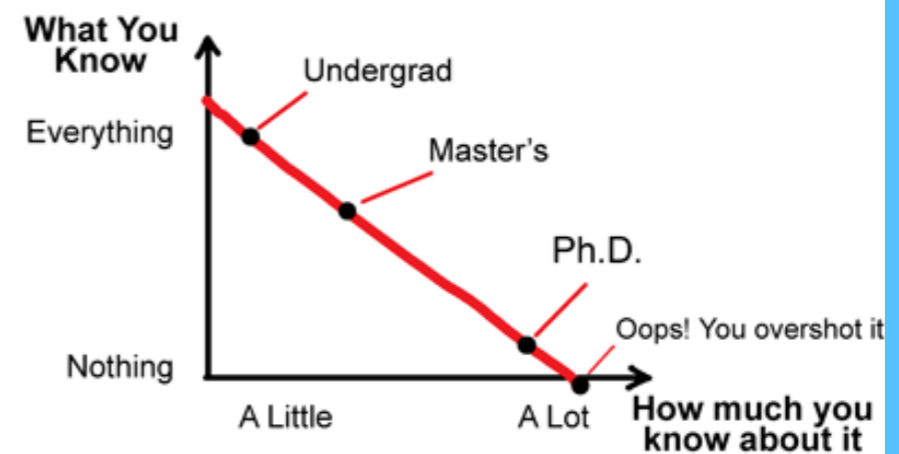
Part II: ORGANIZATION

1. Understanding your subject

Usually, you and your advisor are **the two persons that understand most of your thesis**

Sometimes, **only your advisor understand (most of) your thesis**

What You Know vs How much you know about it



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Part II: ORGANIZATION

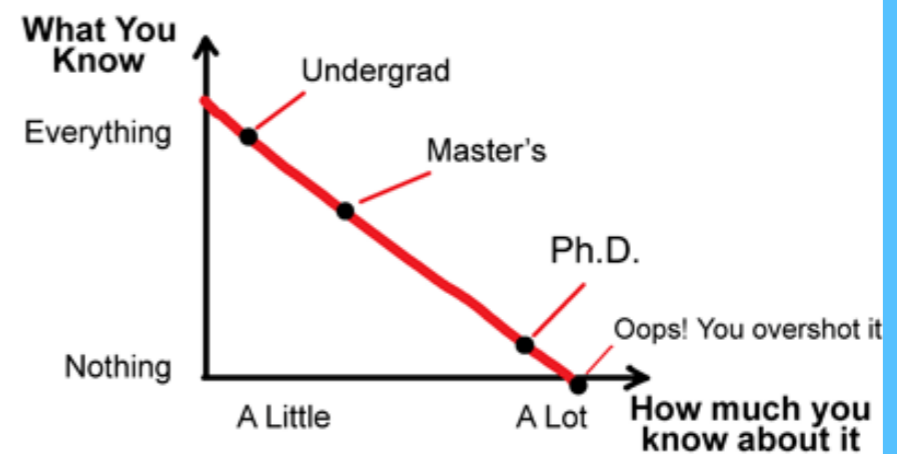
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THIS IS STILL TRUE!

What You Know vs How much you know about it



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Part II: ORGANIZATION

1. Understanding your subject

Usually, you and your advisor are **the two persons that understand most of your thesis**

The rest of the physicists divide into:
those that **know the subject**
and those that **do not know the subject**

Part II: ORGANIZATION

1. Understanding your subject

Usually, you and your advisor are **the two persons that understand most of your thesis**

The rest of the physicists divide into:
those that **know the subject**
and those that **do not know the subject**

The jury that will examine you will be composed
by both

Part II: ORGANIZATION

1. Understanding your subject

Usually, you will have two people who are the two persons that will read most of your thesis

These two people are physicists divide into:
those that know the subject
and those that do not know the subject

The jury that will examine you will be composed
by both

THIS IS ALSO STILL TRUE!

Part II: ORGANIZATION

THIS GROUP IS THE PUBLIC ON WHICH YOU MUST FOCUS

subject

**the two
of your thesis**

The rest of the physicists divide into:
those that **know the subject**
and those that **do not know the subject**

The jury that will examine you will be composed
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Part II: ORGANIZATION

1. Understanding your subject

You should imagine that those that ~~read~~ have read

**STILL DO NOT KNOW DEEPLY THE SUBJECT
OF YOUR THESIS**

(give an overview of the subject)

but

THEY KNOW AND UNDERSTAND THE BASICS

(do not start with undergraduate stuff)

Part II: ORGANIZATION

1. Understanding your subject

You should imagine that those that ~~read~~ have read

**STILL DO NOT KNOW DEEPLY THE SUBJECT
OF YOUR THESIS
(overview of the subject)**

SAME AS WHEN WRITING!

but

**THEY KNOW AND UNDERSTAND THE BASICS
(do not start with undergraduate stuff)**

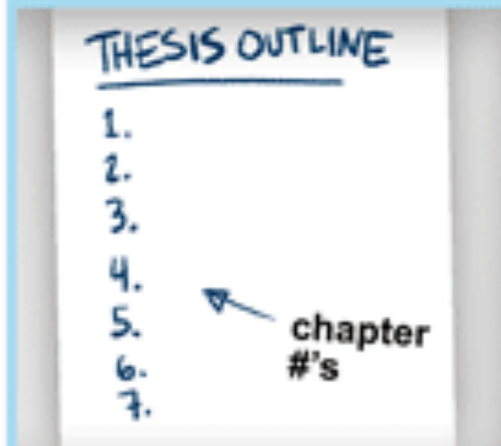
Part II: ORGANIZATION

Do you remember this? It is still the same: old, new, intro and conclusions...

WRITING YOUR THESIS OUTLINE

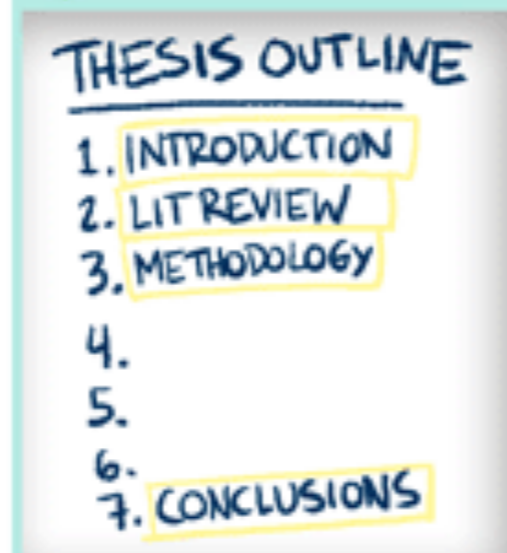
NOTHING SAYS "I'M ALMOST DONE" TO YOUR ADVISOR/ SPOUSE/PARENTS LIKE PRETENDING YOU HAVE A PLAN

STEP 1 Aim for a respectable number of chapters:



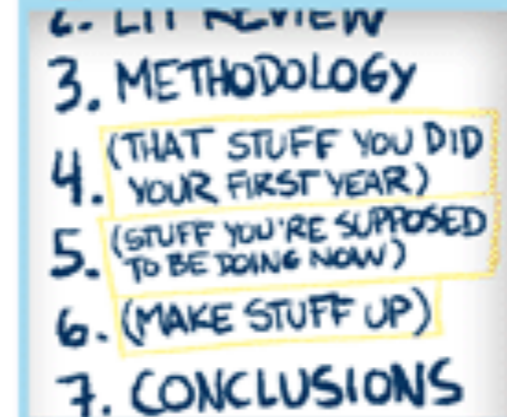
5 = "That's IT??"
6-7 = "Not bad"
8+ = "Are you crazy??"

STEP 2 Fill in the "freebies":



You're half way done!

STEP 3 Make up titles for the "meat" chapters:



(It'll be years before you actually have to work on that later chapter, and by then your thesis topic will have changed anyway)

STEP 4 Voilà! You just bought yourself another two years



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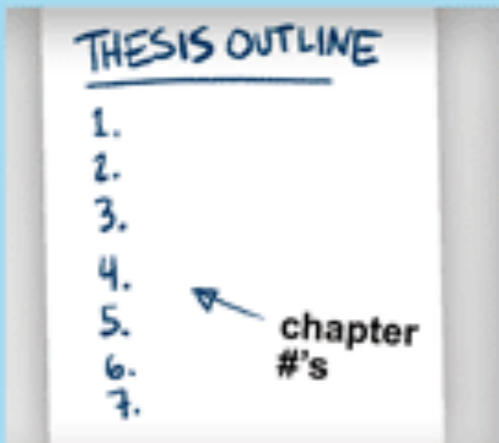
Part II: ORGANIZATION

Make a plan! Do not start writing from page 1

WRITING YOUR THESIS OUTLINE

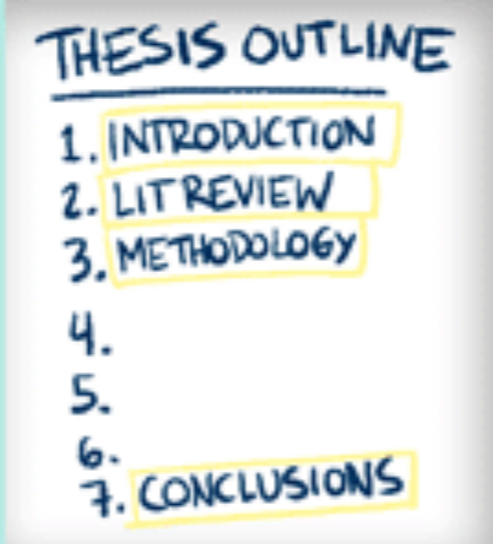
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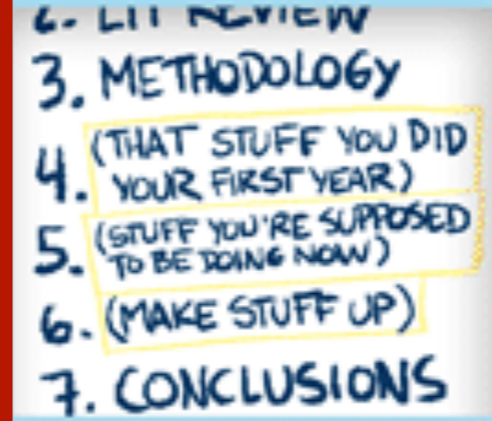
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What you need to know

First thing to know when you prepare a presentation:

How much time do I have?

This is an easy question with an easy answer....

Second thing to know:

How much time do I spend on each slide?

This is not an easy question, and it has multiple answers...

First: how many slides?

Hypothetical syllogism:

1. You have **20 minutes**
2. More or less, a slide takes you **1 minute**
3. Then, you have to prepare **20 slides**

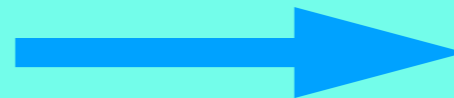
**NOT ALWAYS
TRUE!**

You should modify these inputs according to your specific situation, in order to derive a reasonable output. **Make some tests....**
Remember that you will be **a bit nervous**, and nervous people use to speak **FASTER!**

Second: make a time-sheet

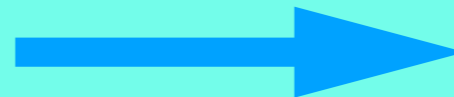
Once you know how many slides you need,
you must organise your time and space

Introduction/motivation



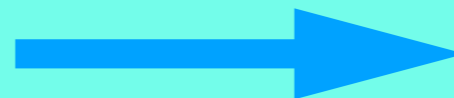
Some pages

“Old” stuff



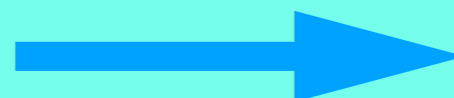
Some pages

“New” stuff (your work)



Some pages

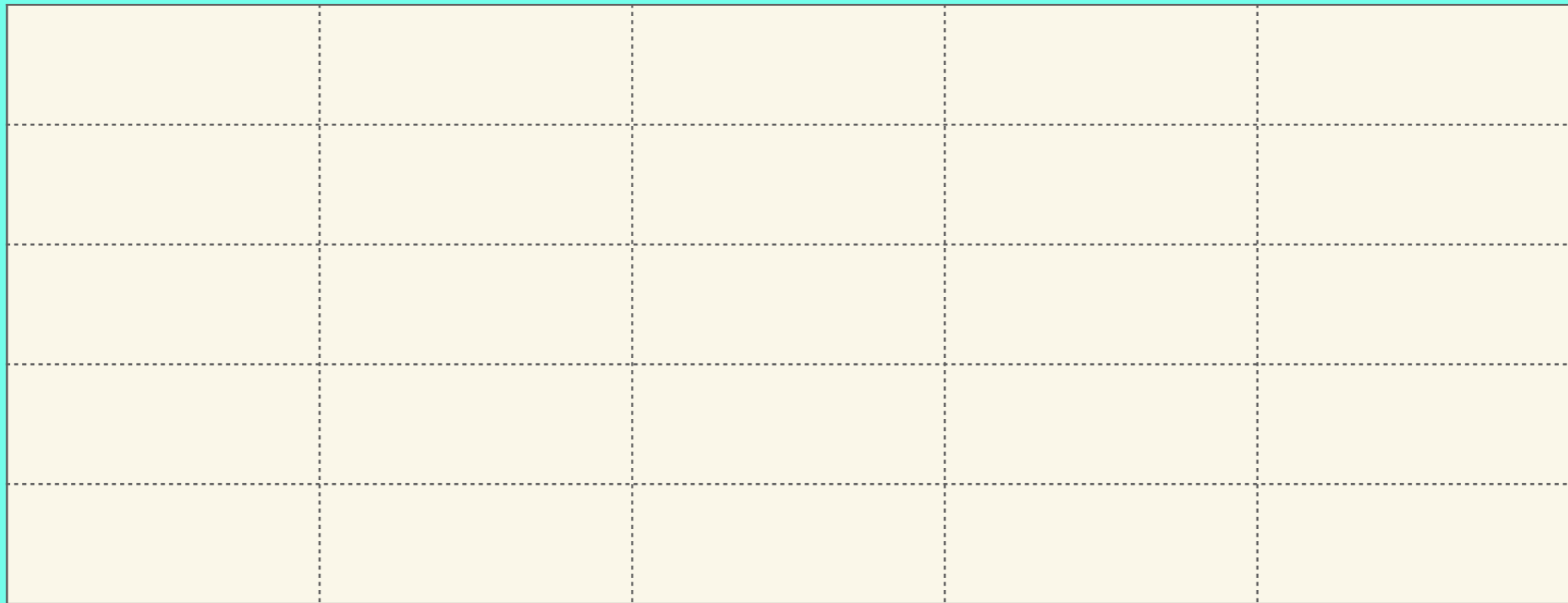
Conclusions and outlook



Some pages

A trick: make a time-sheet

The title page does not count.



Example with 20 slides

A trick: make a time-sheet

The title page does not count.

Outline				

Example with 20 slides

A trick: make a time-sheet

The title page does not count.

Outline	Which is my field	The SM of my field	Which open problem?	Why do I do what I do?

Example with 20 slides

A trick: make a time-sheet

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Old stuff 1	Old stuff 2	Old stuff 3	Old stuff 4	What is not working

Example with 20 slides

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Outline	Which is my field	The SM of my field	Which open problem?	Why do I do what I do?
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What I can change	My model	Virtues of my model	How I solve The problem	Parameters, ranges, ...

Example with 20 slides

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Results 1	Results 2	Plot 1	Plot 2	Comparison with literature
"Old vs new" plot	Advantages	Still to do		

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"Old vs new" plot	Advantages	Still to do	Conclusions	Outlook

Example with 20 slides

Third: start to fill

Once you have a reasonable layout of the talk, you could start to prepare a **“storyboard”**

You need not to be an artist!
It is just to organise things,
having a general overview



Select plots

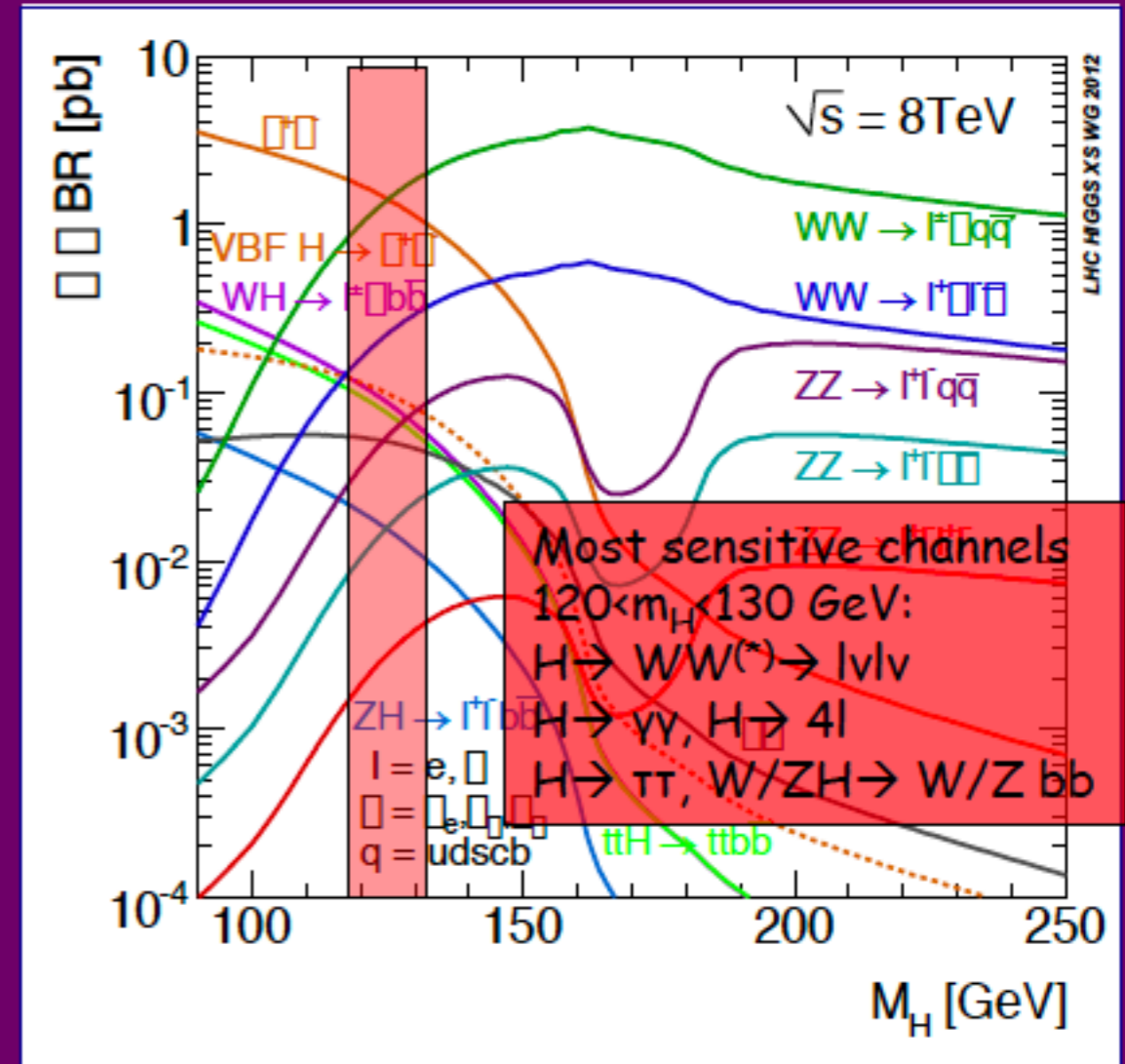
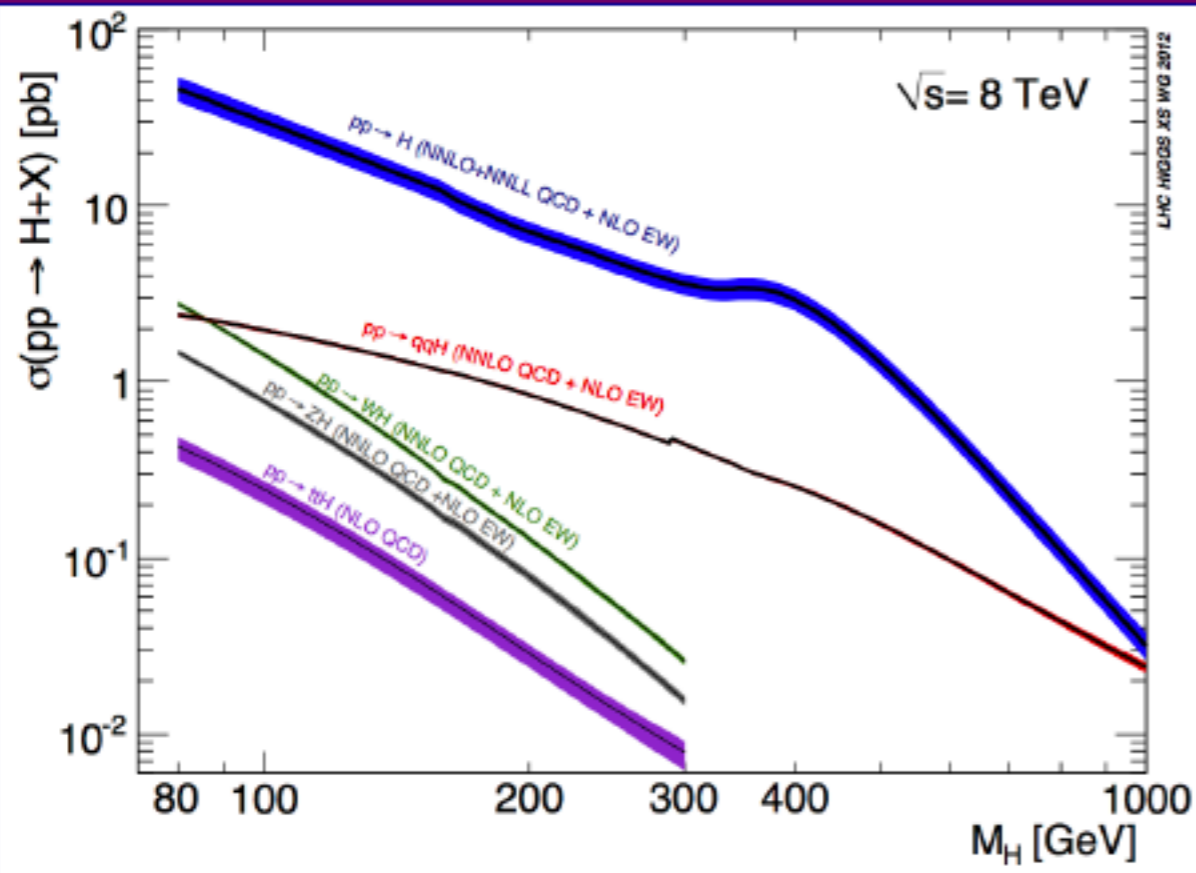
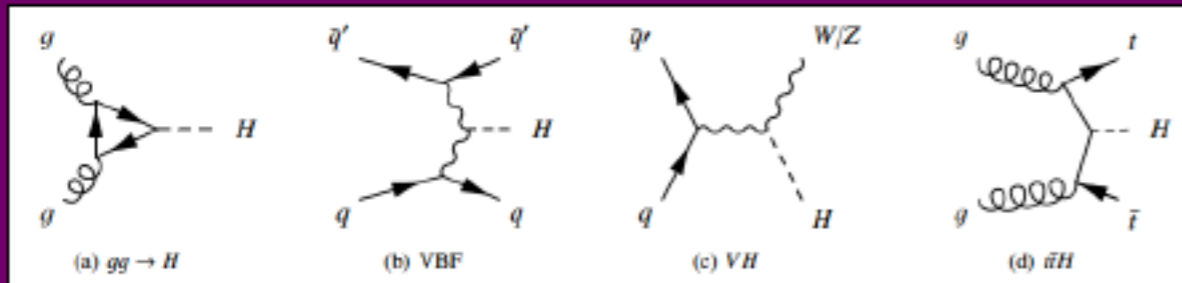
When preparing the talk, you should understand that:

PLOTS are the most important **TOOL** a physicist
may use to present and explain results
(more than equations)

PLOTS are tricky
You cannot put too many!

**EXPERIMENTALISTS,
BEWARE!**

SM Higgs production cross-section and decay modes

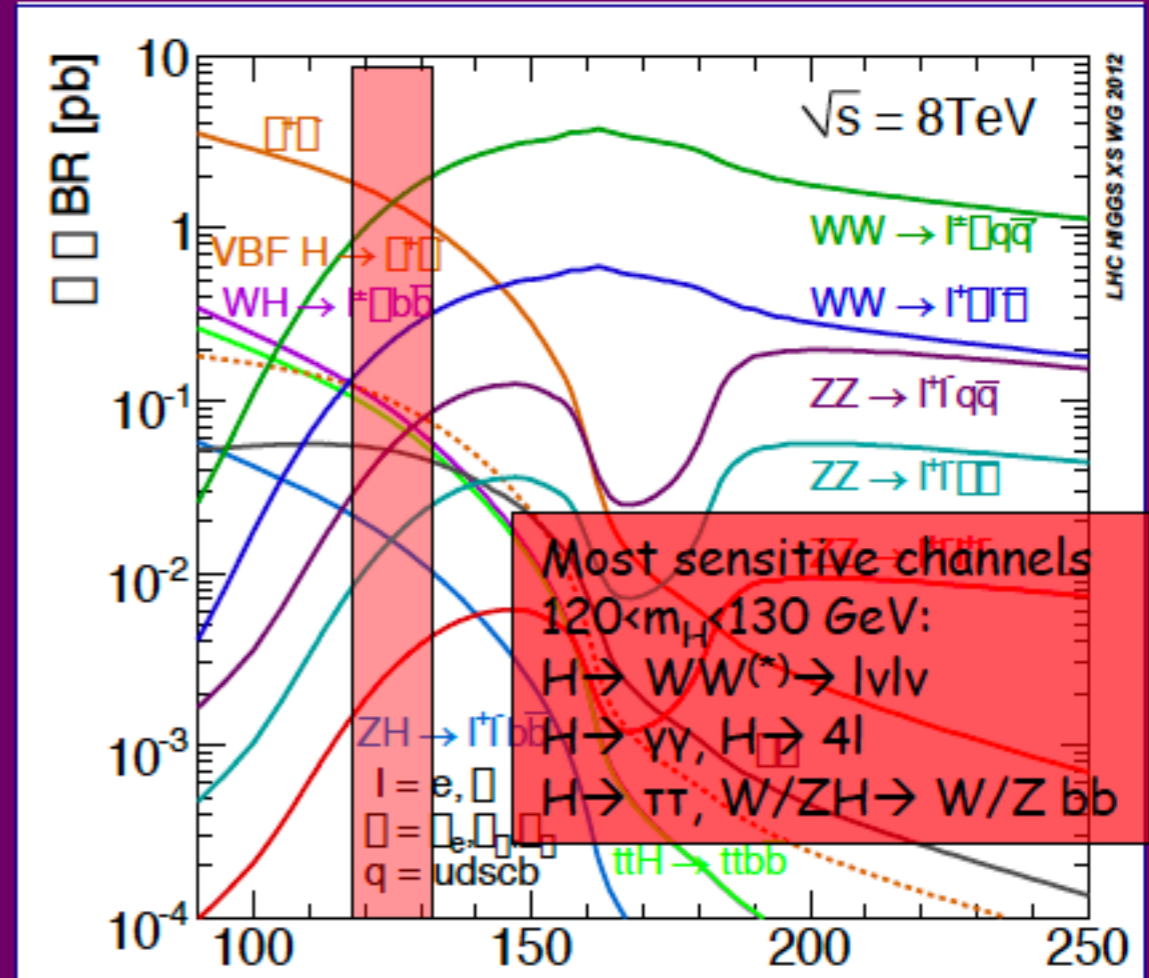
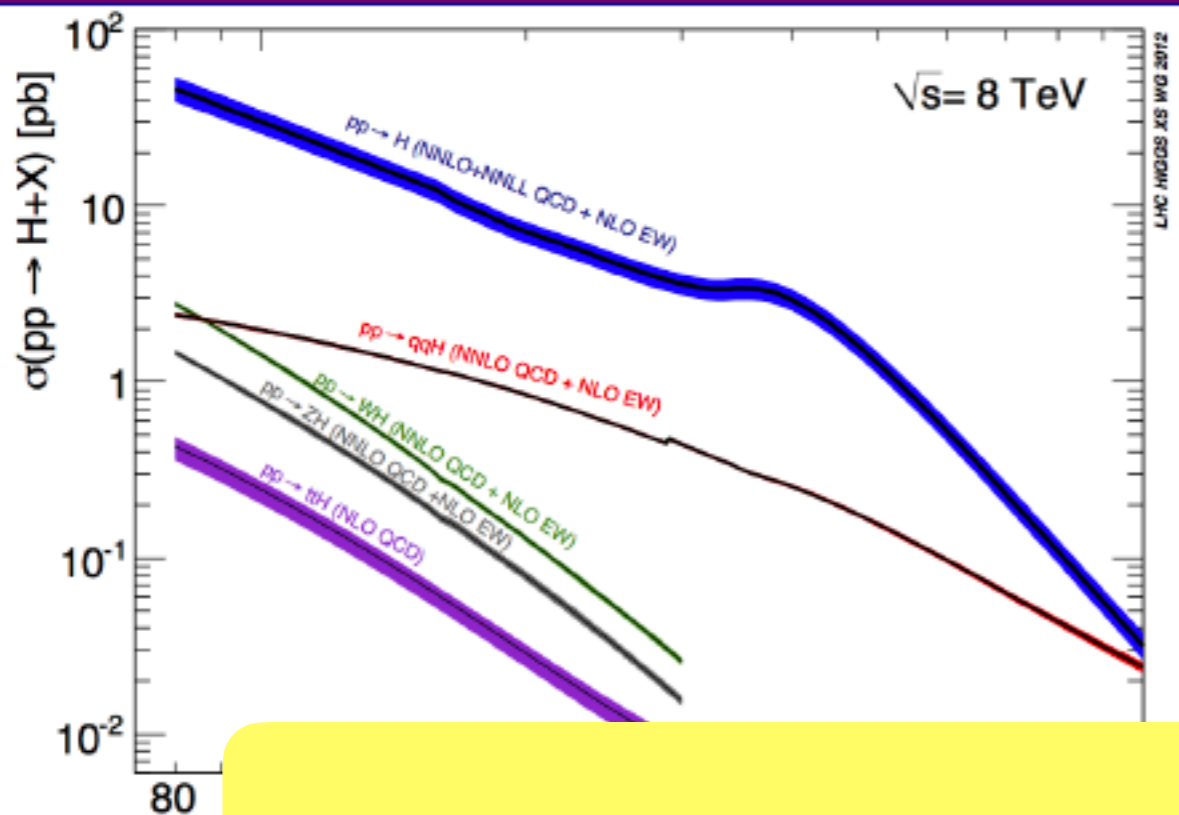
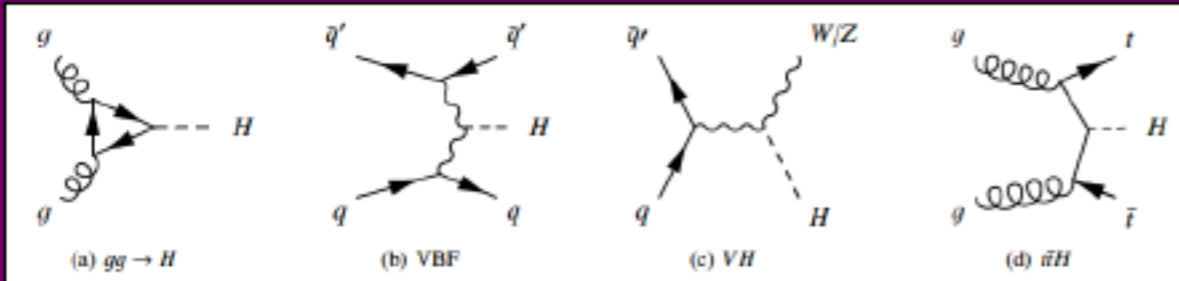


$\sqrt{s}=7 \rightarrow 8 \text{ TeV}$:

- Higgs cross-section increases by ~ 1.3 for $m_H \sim 125 \text{ GeV}$
- Similar increase for several irreducible backgrounds: e.g. 1.2-1.25 for $\gamma\gamma$, di-bosons
- Reducible backgrounds increase more: e.g. 1.3-1.4 for tt , Zbb
- Expected increase in Higgs sensitivity: 10-15%

Note: huge efforts and progress from theory community to compute NLO/NNLO cross-sections for Higgs production and for (often complex!) backgrounds

SM Higgs production cross-section and decay modes



This is a very much typical experimentalist's slide

(Talk on the Higgs discovery at LHC,
 July 4th, 2012, CERN Auditorium)

**TOO MANY PLOTS, WITH THE ILLUSION TO COVER EVERYTHING
 FROM THEORY TO ALL POSSIBLE SIGNALS**

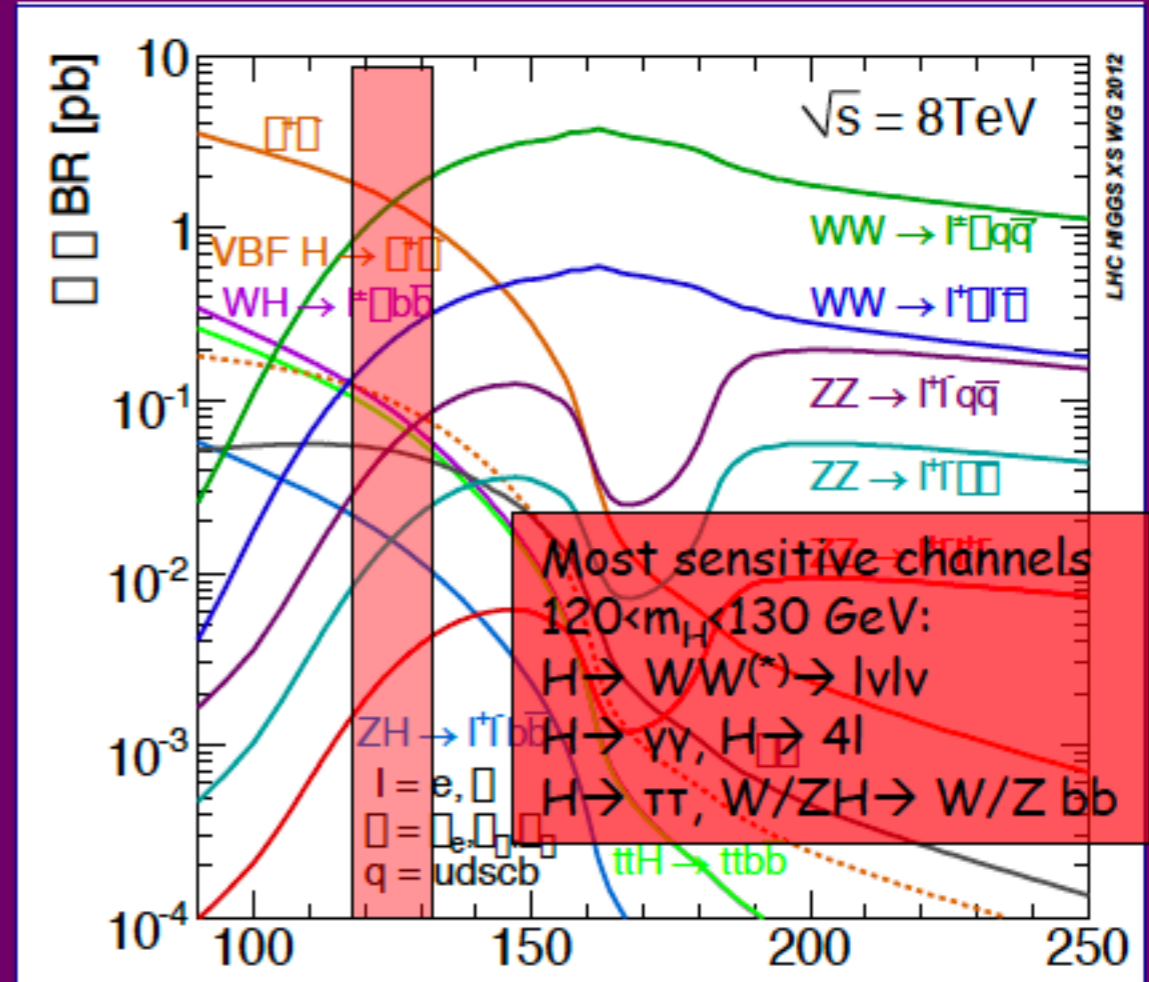
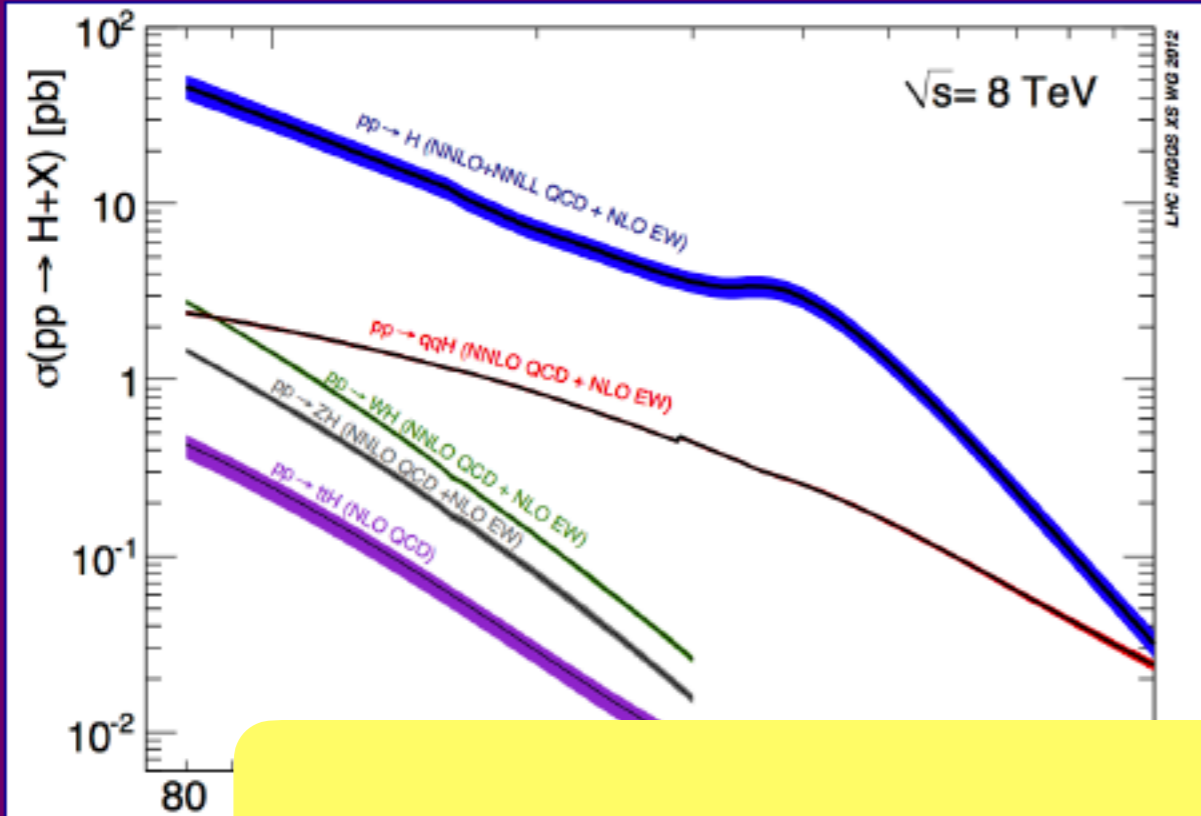
$\sqrt{s}=7 \rightarrow$
 \square Higgs
 \square Simi
 \square Red
 \rightarrow Expe

Note: h
 cross-sections for Higgs production and for (often complex :) backgrounds

SM Higgs production cross-section and decay modes



No need for this!



Most sensitive channels
 $120 < m_H < 130 \text{ GeV}$:
 $H \rightarrow WW^{(*)} \rightarrow l\nu l\nu$
 $H \rightarrow \gamma\gamma, H \rightarrow 4l$
 $H \rightarrow \tau\tau, W/ZH \rightarrow W/Z bb$

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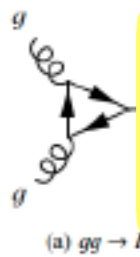
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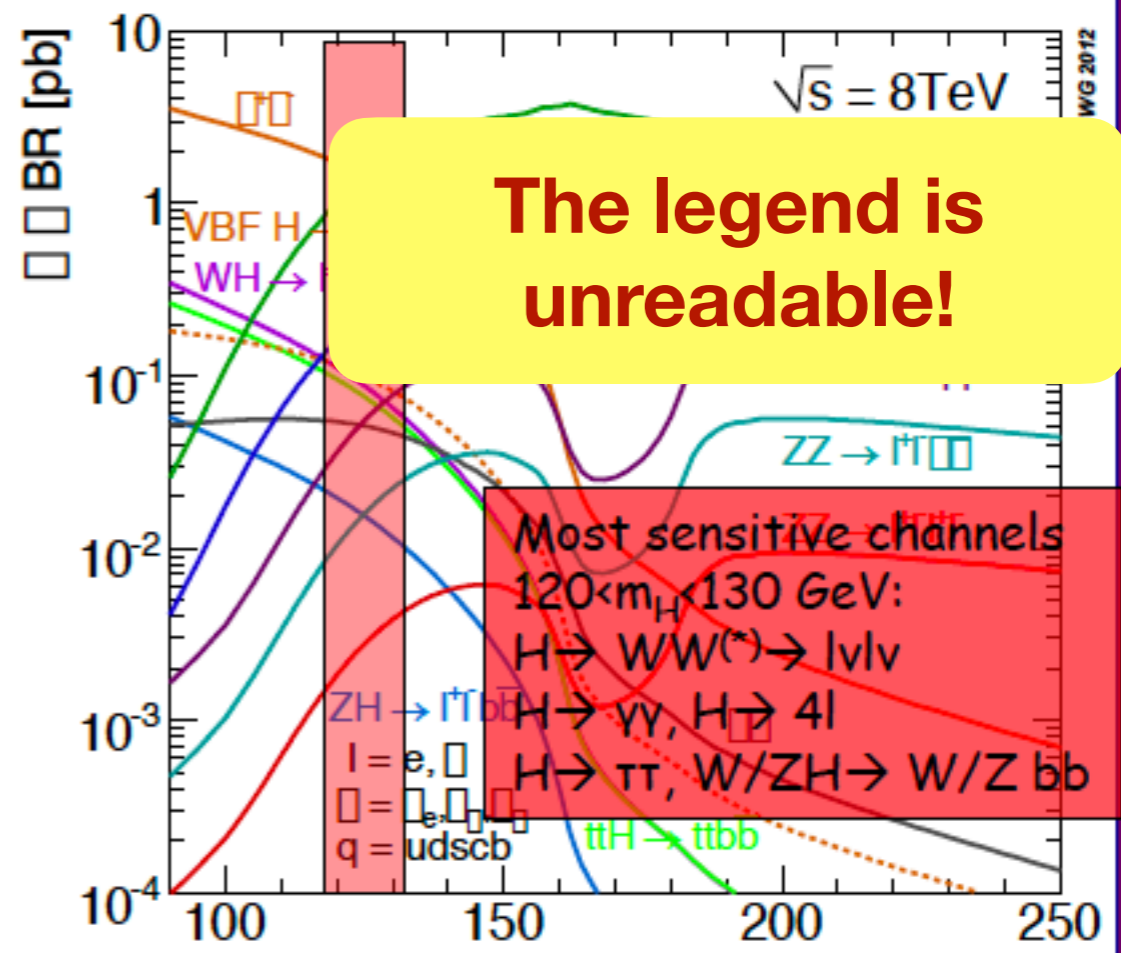
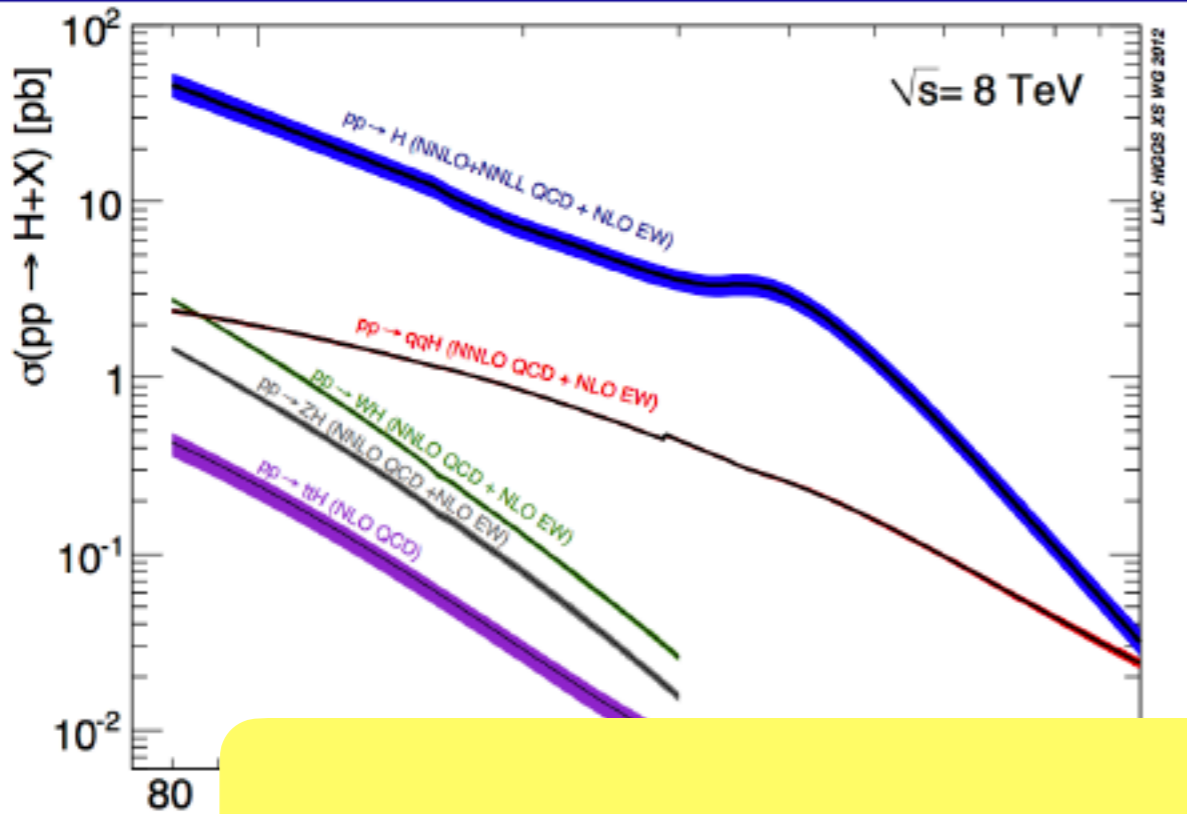
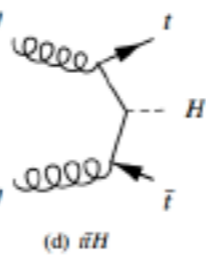
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SM Higgs production cross-section and decay modes



No need for this!



The legend is unreadable!

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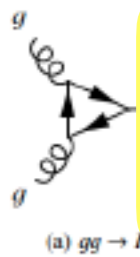
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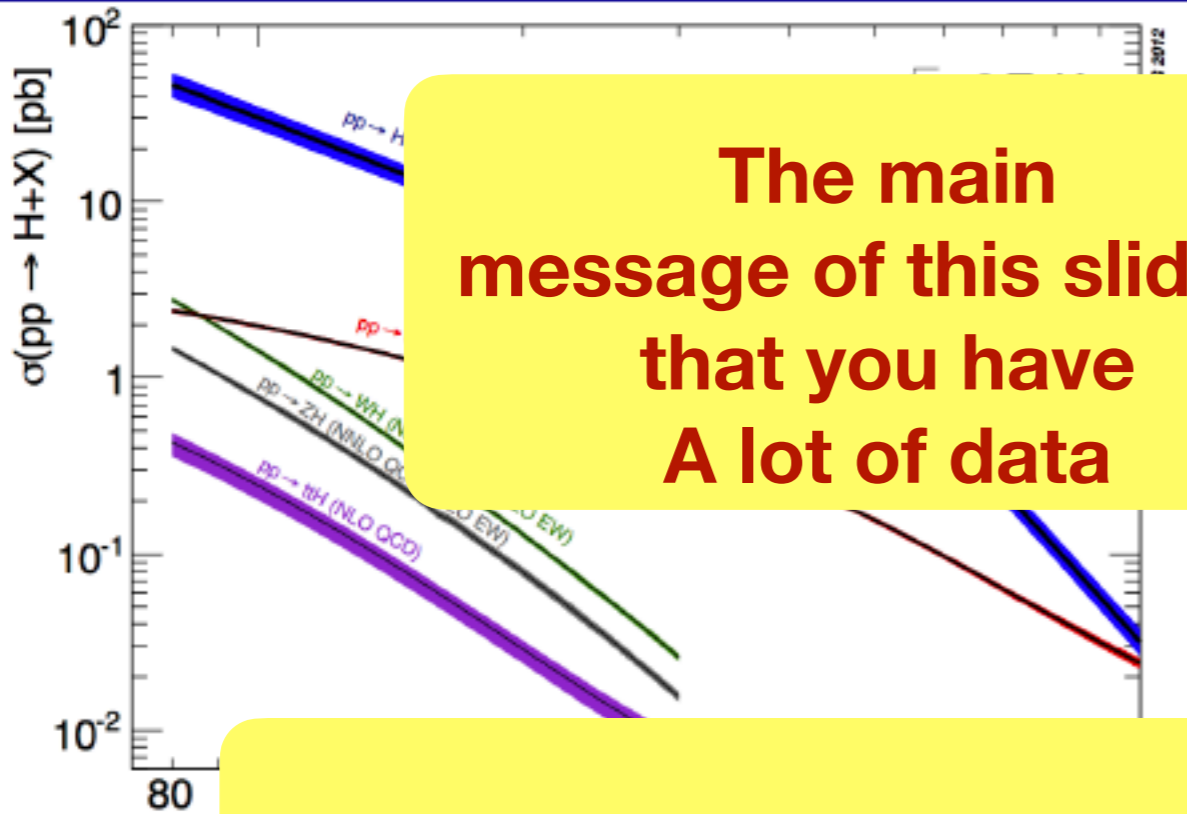
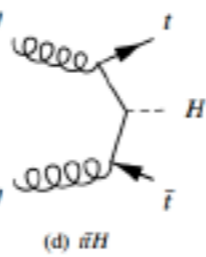
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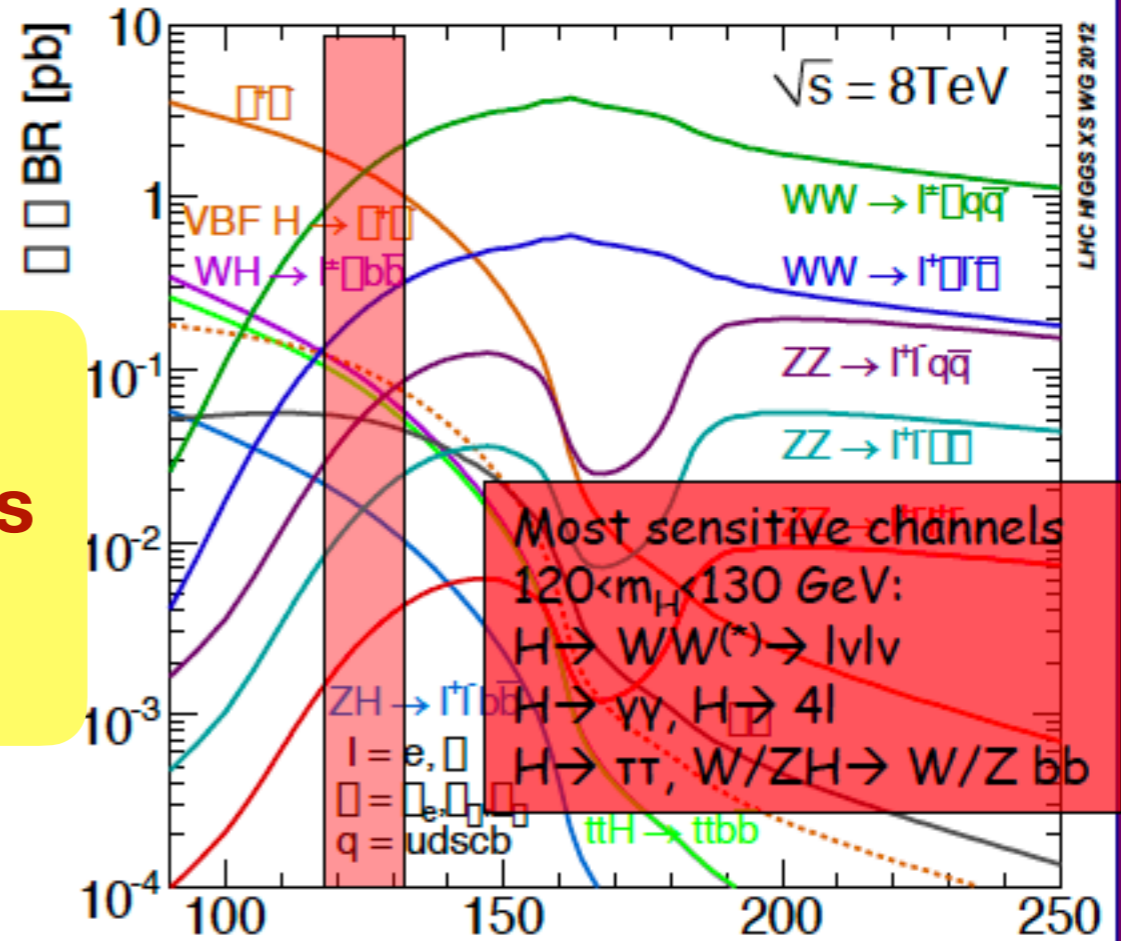
SM Higgs production cross-section and decay modes



No need for this!



The main message of this slide is that you have A lot of data



Most sensitive channels
 $120 < m_H < 130 \text{ GeV}$:
 $H \rightarrow WW^{(*)} \rightarrow l\nu l\nu$
 $H \rightarrow \gamma\gamma, H \rightarrow 4l$
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(Talk on the Higgs discovery at LHC, July 4th, 2012, CERN Auditorium)

TOO MANY PLOTS, WITH THE ILLUSION TO COVER EVERYTHING FROM THEORY TO ALL POSSIBLE SIGNALS

- $\sqrt{s}=7 \rightarrow$
- \square Higgs
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- \square Red
- \rightarrow Expe

Note: h
 cross-sections for Higgs production and for (often complex :) backgrounds

Select equations

When preparing the talk, you should understand that:

EQUATIONS are the second most important **TOOL** a physicist may use to present and explain results
(more than sentences)

EQUATIONS are also tricky
You cannot put too many!

**THEORISTS,
BEWARE!**

Model independent approach to $b \rightarrow sll$

$$\mathcal{H}_{\text{eff}} = -\frac{4G_F}{\sqrt{2}} V_{tb} V_{ts}^* \sum_i C_i \mathcal{O}_i$$

$$\left. \begin{aligned} \mathcal{O}_7 &= \frac{e}{16\pi^2} m_b (\bar{s} \sigma_{\mu\nu} P_R b) F^{\mu\nu}, \\ \mathcal{O}_{7'} &= \frac{e}{16\pi^2} m_b (\bar{s} \sigma_{\mu\nu} P_L b) F^{\mu\nu}, \end{aligned} \right\}$$

$$\mathcal{O}_{9\ell} = \frac{e^2}{16\pi^2} (\bar{s} \gamma_\mu P_L b) (\bar{\ell} \gamma^\mu \ell),$$

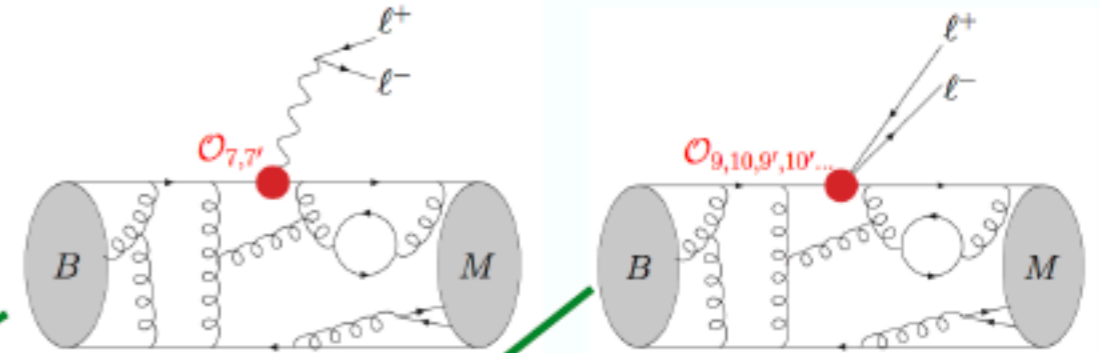
$$\mathcal{O}_{9\ell'} = \frac{e^2}{16\pi^2} (\bar{s} \gamma_\mu P_R b) (\bar{\ell} \gamma^\mu \ell),$$

$$\mathcal{O}_{10\ell} = \frac{e^2}{16\pi^2} (\bar{s} \gamma_\mu P_L b) (\bar{\ell} \gamma^\mu \gamma_5 \ell),$$

$$\mathcal{O}_{10\ell'} = \frac{e^2}{16\pi^2} (\bar{s} \gamma_\mu P_R b) (\bar{\ell} \gamma^\mu \gamma_5 \ell),$$

At the $\mu_b = 4.8$ GeV scale:

$$C_7^{\text{SM}} = -0.29, \quad C_9^{\text{SM}} = 4.1, \quad C_{10}^{\text{SM}} = -4.3$$



$$C_i = C_i^{\text{SM}} + C_i^{\text{NP}}$$

Interesting Directions:

$$C_9 = -C_{10} \Rightarrow L_q \otimes L_\ell$$

$$C_{9'} = -C_{10'} \Rightarrow R_q \otimes L_\ell$$

$$C_9 = -C_{9'} \Rightarrow A_q \otimes V_\ell$$

We explore not only directions BUT new BASIS

=> standard muon and electron basis
=> new LFUV and LFU basis

Model independent approach to $b \rightarrow sll$

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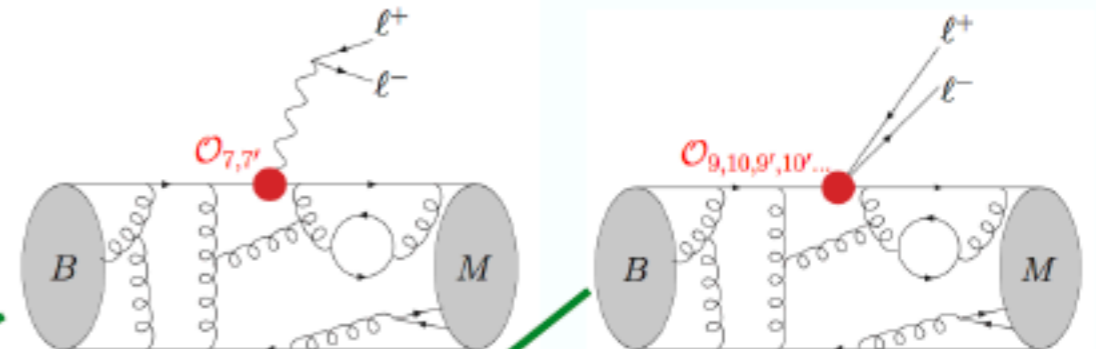
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$$\mathcal{O}_{10\ell}$$

$$\mathcal{O}_{10\ell'}$$

$$C_7^{\text{SM}} =$$



$$C_i = C_i^{\text{SM}} + C_i^{\text{NP}}$$

Interesting Directions:

$$C_9 = -C_{10} \Rightarrow L_q \otimes L_\ell$$

This is a very much typical theorist's slide

(Talk on Flavour Anomalies)

TOO MANY EQUATIONS, TRYING TO CONVEY THE ILLUSION THAT THE THEORETICAL APPROACH IS COMPLETE (IF COMPLETE, WHERE ARE OPERATORS FROM 1 TO 6?)

WHAT ABOUT OPERATORS WITH q AND NOT ℓ ?)

Model independent approach to $b \rightarrow sll$

$$\mathcal{H}_{\text{eff}} = -\frac{4G_F}{\sqrt{2}} V_{tb} V_{ts}^* \sum_i C_i \mathcal{O}_i$$

$$\left. \begin{aligned} \mathcal{O}_7 &= \frac{e}{16\pi^2} m_b (\bar{s} \sigma_{\mu\nu} P_R b) F^{\mu\nu}, \\ \mathcal{O}_{7'} &= \frac{e}{16\pi^2} m_b (\bar{s} \sigma_{\mu\nu} P_L b) F^{\mu\nu}, \end{aligned} \right\}$$

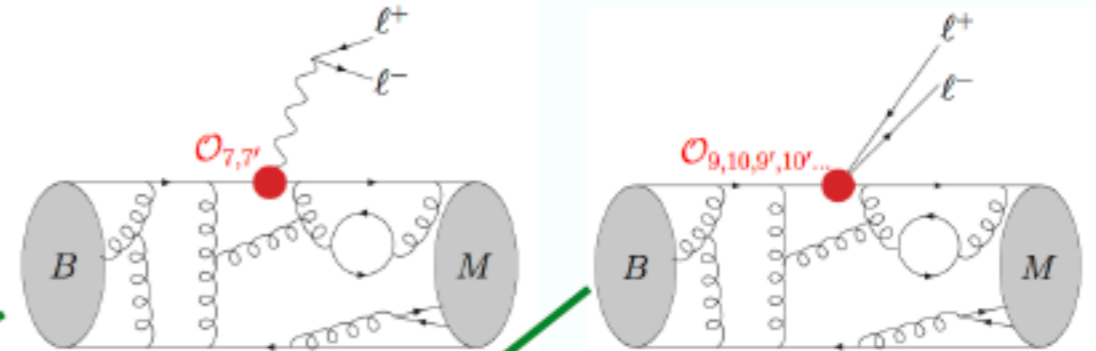
$$\mathcal{O}_{9\ell} = \frac{e^2}{16\pi^2} (\bar{s} \gamma_\mu P_L b) (\bar{\ell} \gamma^\mu \ell),$$

$$\mathcal{O}_{9\ell'} = \frac{e^2}{16\pi^2} (\bar{s} \gamma_\mu P_R b) (\bar{\ell} \gamma^\mu \ell),$$

$$\mathcal{O}_{10\ell}$$

$$\mathcal{O}_{10\ell'}$$

$$C_7^{\text{SM}} =$$



Do you understand from these graphs the difference between Penguins and Current-Current Operators?

$$C_9 = -C_{10} \Rightarrow L_q \otimes L_\ell$$

This is a very much typical theorist's slide

(Talk on Flavour Anomalies)

TOO MANY EQUATIONS, TRYING TO CONVEY THE ILLUSION THAT THE THEORETICAL APPROACH IS COMPLETE (IF COMPLETE, WHERE ARE OPERATORS FROM 1 TO 6?)

WHAT ABOUT OPERATORS WITH q AND NOT ℓ ?

Plots and equations

MY SUGGESTION:

One plot per slide (two only if you are comparing them)

NEVER EVER put plots representing different things on the same slide; it breaks the flow of your speech

Identify the really relevant equations;
no passages to go from eq. 1 to eq. N,
(only if your original work is to derive eq. N)

Plots and equations

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One plot per slide (two only if you are comparing them)

NEVER EVER put plots representing different things on the same slide; it breaks the flow of your speech

Identify the really relevant equations;
no passages to go from eq. 1 to eq. N,
(or if you must, then only one equation, eq. N)

**This is even more important
than in the Thesis**

Introduction

YOUR THESIS COMMITTEE

Also known as: an impossibly difficult group to get together in one room but who nevertheless hold your future in their hands depending on their ability to reach a civilized consensus.



Your Professor

Simultaneously your biggest ally and your worst enemy. Will be the first to suggest you do more work.



The Guru

Only here for the free cookies. Don't forget to bring cookies.



The Adversary

Has bitter rivalry with your Professor and will argue the exact opposite view. Work this to your advantage.



The Strawman/woman

Nice guy. No opinions.



The Assistant Professor

Still doesn't believe just a few months ago they were on the other side just like you. Pretends to be an adult.

NONE OF THEM WILL ACTUALLY READ YOUR ENTIRE THESIS.

Introduction

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Professor**

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NONE OF THEM WILL ACTUALLY READ YOUR ENTIRE THESIS.

This sounds as a joke, but many times overlaps one-to-one with reality

This means that now it is the time to explain them what you have done

Introduction

It is a complete **summary of the thesis**:
one should understand what is written in the main body just from
reading this. **If you succeed, the reader will feel happy!**

Introduction

It is a complete waste of time to write the introduction of a thesis: one should understand what is in the main body just from reading this. **If you do it right, the reader will feel happy!**

NOT TRUE IN A PRESENTATION!

This time, you present your field,
explain the existing status,
review briefly the open problems
and
MOTIVATE YOUR OWN WORK
(before or after this, give an outline of the talk)

Introduction

It is a complete waste of time to write an introduction to a thesis: one should understand what is in the main body just from reading this. **If you write an introduction, the reader will feel happy!**

NOT TRUE IN A PRESENTATION!

**Some text framing
your area of research**

Examples:

“Standard Model”
“General Relativity”
“Complex systems”

Introduction

It is a complete introduction to the thesis:
one should understand what is in the main body just from
reading this. **If you are the reader will feel happy!**

**NOT TRUE IN A
PRESENTATION!**

**Some text framing
your area of research**

Examples:

“Standard Model”
“General Relativity”
“Complex systems”

**Motivation for your
specific research**

**Most important part of
the Introduction:
show that you know
WHY you have done
what you have done!**

Introduction

It is a complete sentence. The thesis: one should understand what is in the main body just from reading this. If you do not, the reader will feel happy!

NOT TRUE IN A PRESENTATION!

Some text framing your area of research

Examples:

“Standard Model”
“General Relativity”
“Complex systems”

Motivation for your specific research

Most important part of the Introduction:
show that you know WHY you have done what you have done!

Short summary of your results

“We have found that... within this hypothesis... this problem **may/may not** be solved”

Introduction

It is a complete waste of time to write the thesis: one should understand what is going on in the main body just from reading this. **If you do not, the reader will feel happy!**

NOT TRUE IN A PRESENTATION!

Some text framing your research

Example

“Standard model”
“General relativity”
“Complex systems”



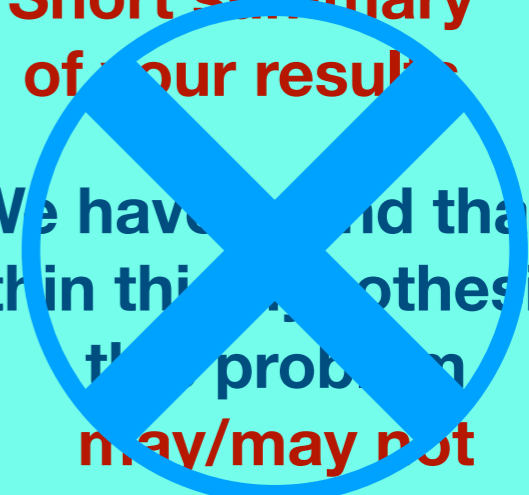
Motivation for your specific research

Most important part of the introduction: **show that you know WHY you have done what you have done!**



Short summary of your results

“We have found that... within this hypothesis... the problem **may/may not** be solved”



The “old” section

Again, you should determine which amount of basic information is needed to introduce the subject

Who is your audience: a physicist that understand what you are doing, but do not know the basic literature on the subject (except for textbooks)

The “old” section

**This time it may be useful to design
“old” and “new” sections
together**

**Do you have a plot to compare them?
Do you have an equation
that differ by just one new term?
Prepare to use them to COMPARE “old” and “new”**

YOUR GOAL: LET THEM UNDERSTAND WHAT YOU HAVE DONE!

Usage of equations

Two ways to scan the Earth

- Neutrino oscillations (< 1 TeV)

$$P_{ee}^{\pm} = 1 - \left(\frac{\Delta_{23}}{B_{\mp}}\right)^2 \sin^2(2\theta_{13}) \sin^2\left(\frac{B_{\mp} L}{2}\right) - \left(\frac{\Delta_{12}}{A}\right)^2 \sin^2(2\theta_{12}) \sin^2\left(\frac{AL}{2}\right)$$

PAHEN, Berlin, 27-9-2019

12

See, e.g., W. Winter, Nucl. Phys. B 908 (2016) 250; Km3Net, PoS ICRC2017 (2018) 1020

- Neutrino flux attenuation (> 1 TeV)

$$\frac{d\phi_{\nu}(E, \tau)}{d\tau} = -\sigma_{tot}(E)\phi_{\nu}(E, \tau)$$

PAHEN, Berlin, 27-9-2019

14

Two ways to scan the Earth

- Neutrino oscillations (< 1 TeV)

$$P_{ee}^{\pm} = 1 - \left(\frac{\Delta_{23}}{B_{\mp}}\right)^2 \sin^2(2\theta_{13}) \sin^2\left(\frac{B_{\mp} L}{2}\right) - \left(\frac{\Delta_{12}}{A}\right)^2 \sin^2(2\theta_{12}) \sin^2\left(\frac{AL}{2}\right)$$

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PAHEN, Berlin, 27-9-2019

13

See, e.g., W. Winter, Nucl. Phys. B 908 (2016) 250; Km3Net, PoS ICRC2017 (2018) 1020

- Neutrino flux attenuation (> 1 TeV)

$$\frac{d\phi_{\nu}(E, \tau)}{d\tau} = -\sigma_{tot}(E)\phi_{\nu}(E, \tau) \quad \sigma_{tot} = \sigma_{\nu N} \times \rho$$

Gonzalez-García, Halzen, Maltoni, Tanaka, Phys. Rev. Lett. 100 (2008)

PAHEN, Berlin, 27-9-2019

15

The “new” section

**It must be very clear
WHAT is NEW, and WHAT is NOT NEW**

A typical question at the defense:

**“Ok, very nice. But....
Can you explain me **PRECISELY** which is the
difference between what **YOU** have done
and the **LITERATURE?**”**

The “new” section

**Literature:
first section**

**INTRODUCE
WHAT IS OLD**

**You should have written
this first; it is useful for you
to explain differences**

**Your work:
last section**

The “new” section

**Literature:
first section**

**INTRODUCE
WHAT IS OLD**

**You should have written
this first; it is useful for you
to explain differences**



**Your work:
last section**

**COMPARE WITH
WHAT IS OLD**

The “new” section

**Literature:
first section**

**INTRODUCE
WHAT IS OLD**

**You should have written
this first; it is useful for you
to explain differences**

**Your work:
last section**

**COMPARE WITH
WHAT IS OLD**

**ELABORATE ON THIS:
feel free!**

Graphics

A Figure is made out of two pieces:

1. The graphic object

2. The caption

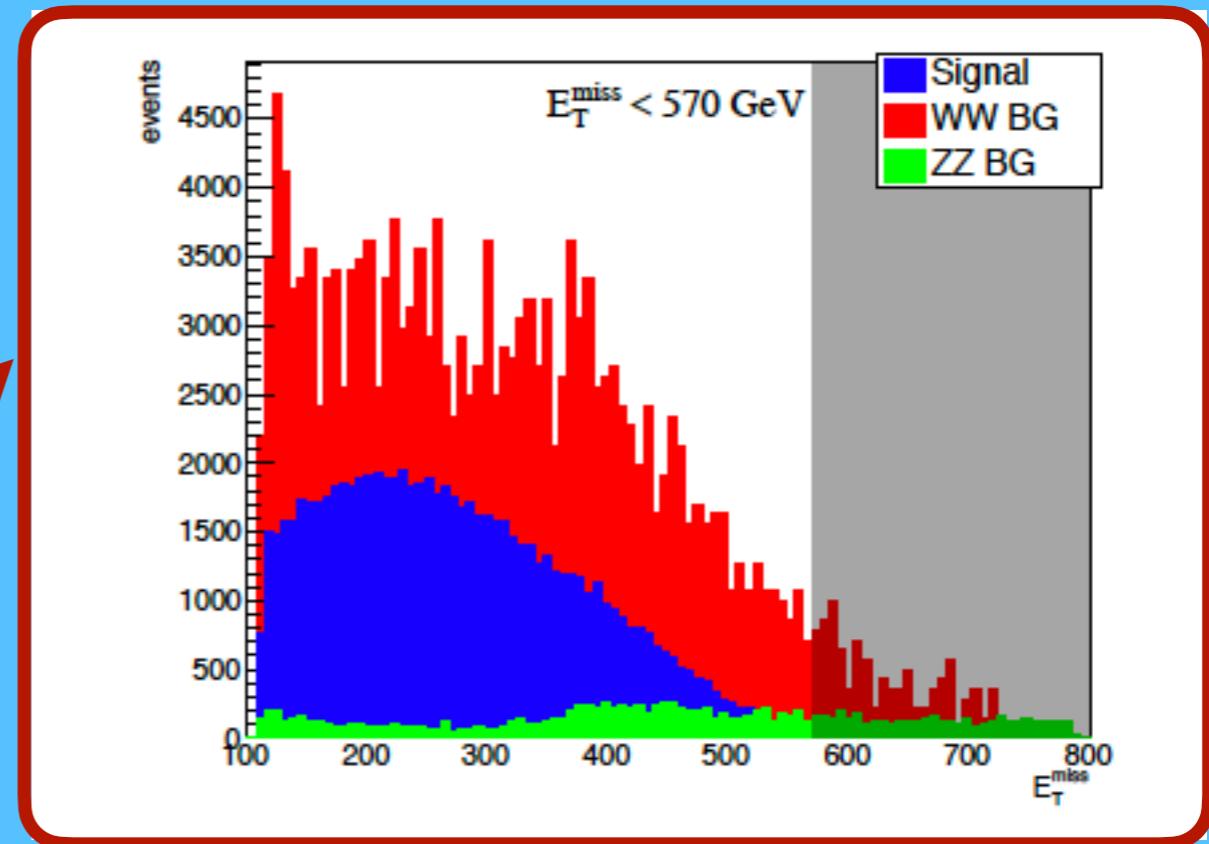


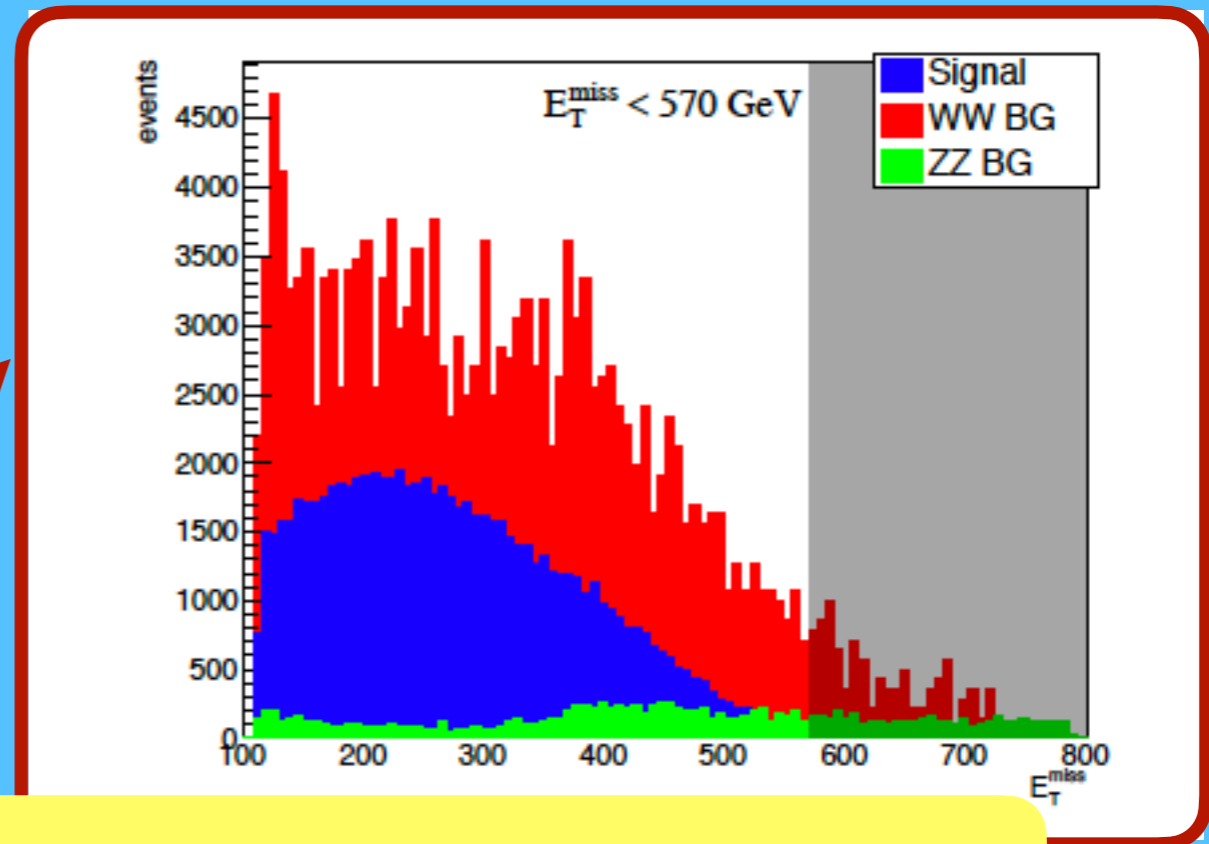
Figure 5.6: Histogram showing all the cuts being applied for the E_T^{miss} . Here we have scaled the number of events in accordance with equation 5.3.29.

Graphics

A Figure is made out of two pieces:

1. The graphic object

2. The caption



NO REAL NEED FOR A CAPTION!
What you need is a **GOOD LEGEND** and
CLEAR AXES LABELS

Figure 5.6. Histogram showing all the cuts being applied for the E_T^{miss} . Here we have scaled the number of events in accordance with equation 5.3.29.

Graphics

Graphic objects:

legends should be **simple and clear** (not too many items)

This time, take full advantage of colours!

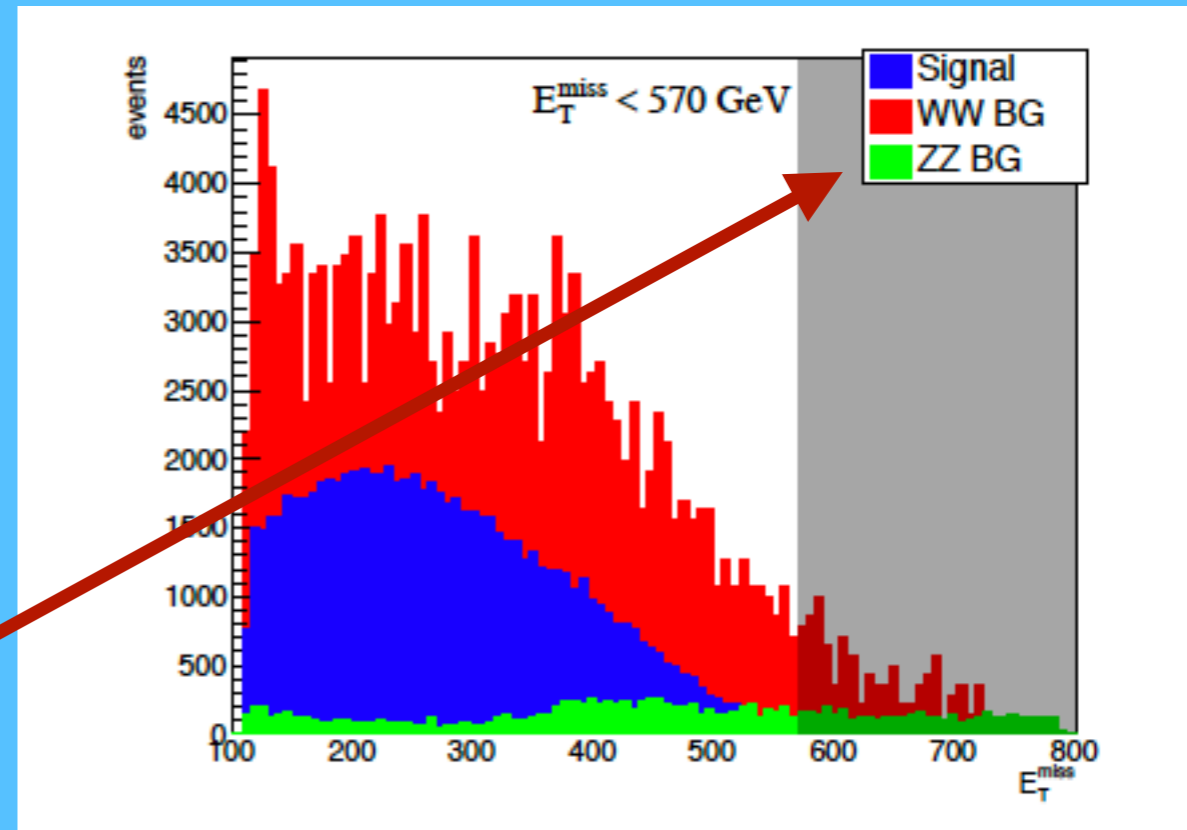


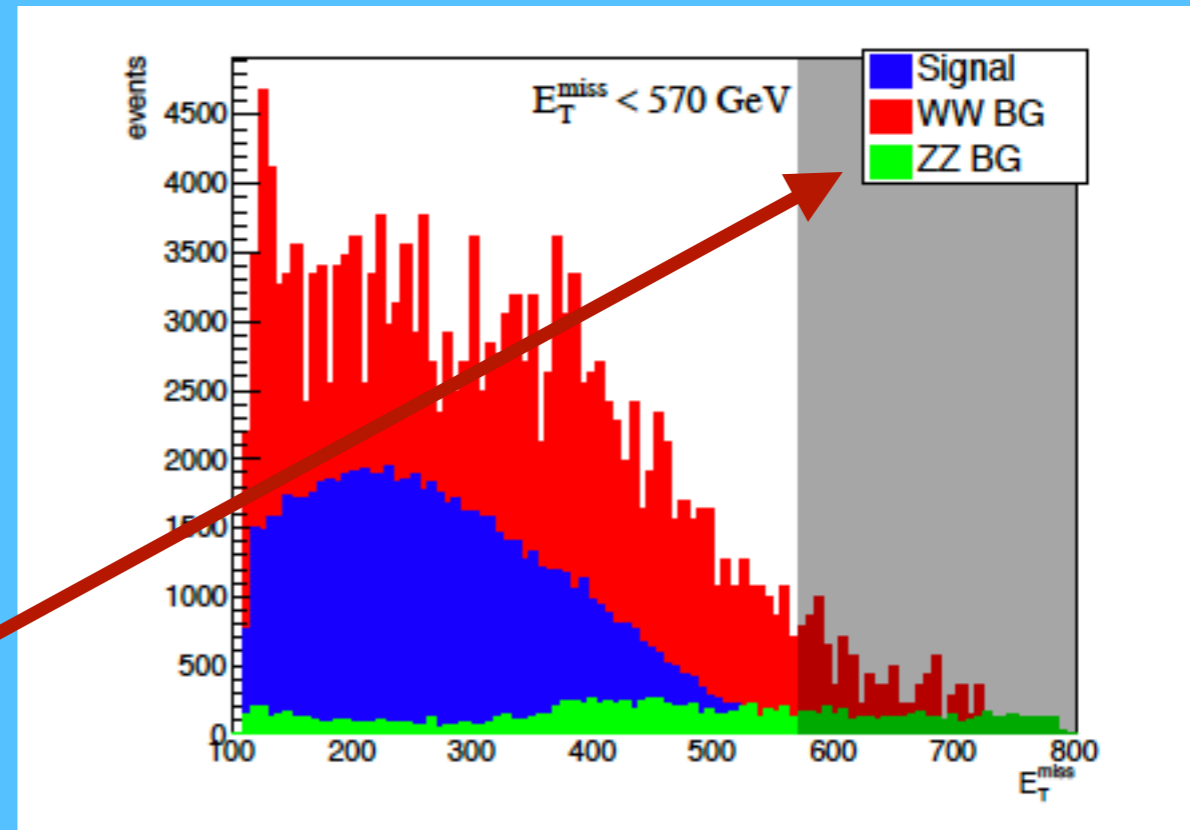
Figure 5.6: Histogram showing all the cuts being applied for the E_T^{miss} . Here we have scaled the number of events in accordance with equation 5.3.29.

Graphics

Graphic objects:

legends should be **simple and clear** (not too many items)

This time, take full advantage of colours!



You may want to modify your plots for the presentation!

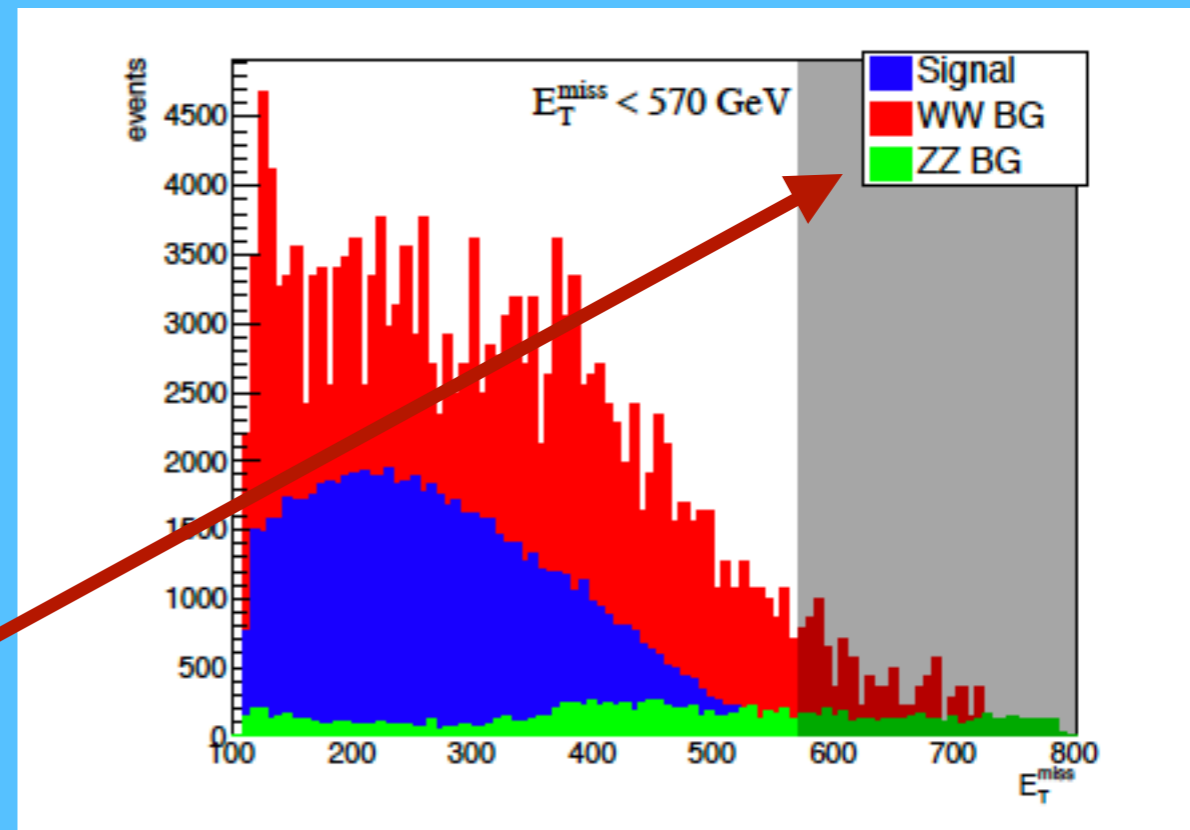
re we have scaled

Graphics

Graphic objects:

legends should be **simple and clear** (not too many items)

This time, take full advantage of colours!



If the audience need to understand the plot, you should take time to explain it (but then, the slide will last longer: take note of this)

Equations

An equation is not just as an aesthetic tool!

It should be written **ONLY if is
necessary to explain something**

**Put intermediate equations, or supplementary ones,
in the **BACKUP SLIDES!****

Equations

An equation is not just as an aesthetic tool!

You should define ALL components in an equation

NOT TRUE IN A PRESENTATION!

$$\delta\phi^* = \epsilon^\dagger\psi^\dagger, \tag{3.1.3}$$

where ϵ^α is an infinitesimal, anticommuting, two-component Weyl fermion object that parameterizes

If the audience need to understand the equation, you should take time to explain it (but then, the slide will last longer: take note of this)

Equations

An equation is not just an aesthetic tool!

It is not compulsory to be able to derive the equation

$$\frac{dn_{\text{DM}}}{dt} = -3H(T) n_{\text{DM}} - \langle \sigma v \rangle [n_{\text{DM}}^2 - (n_{\text{DM}}^{\text{eq}})^2]$$

However, you should be able to explain what the equation means (what are left and right hand sides)

Referencing

**It is extremely important to quote
the relevant bibliography
in a thesis!**

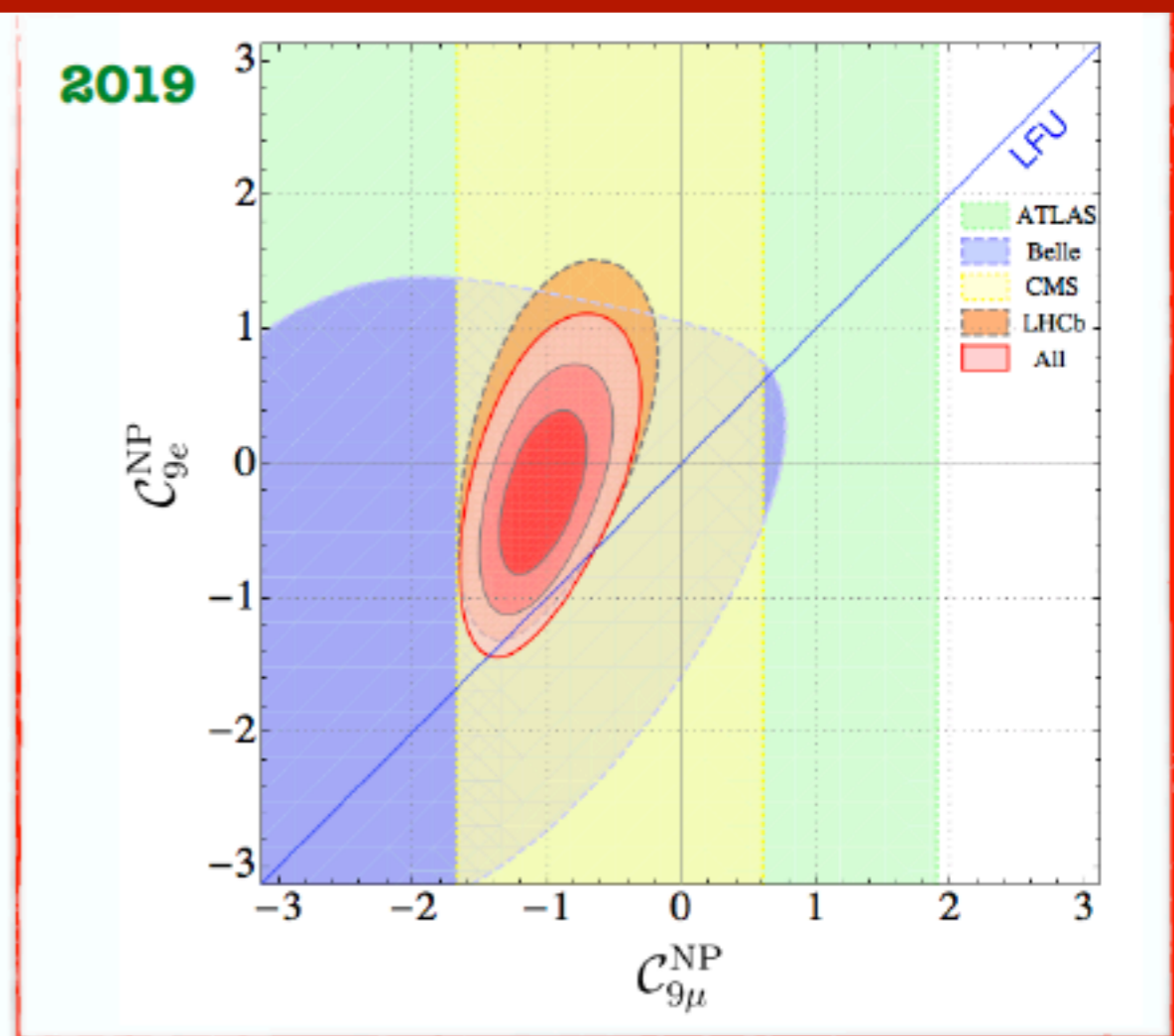
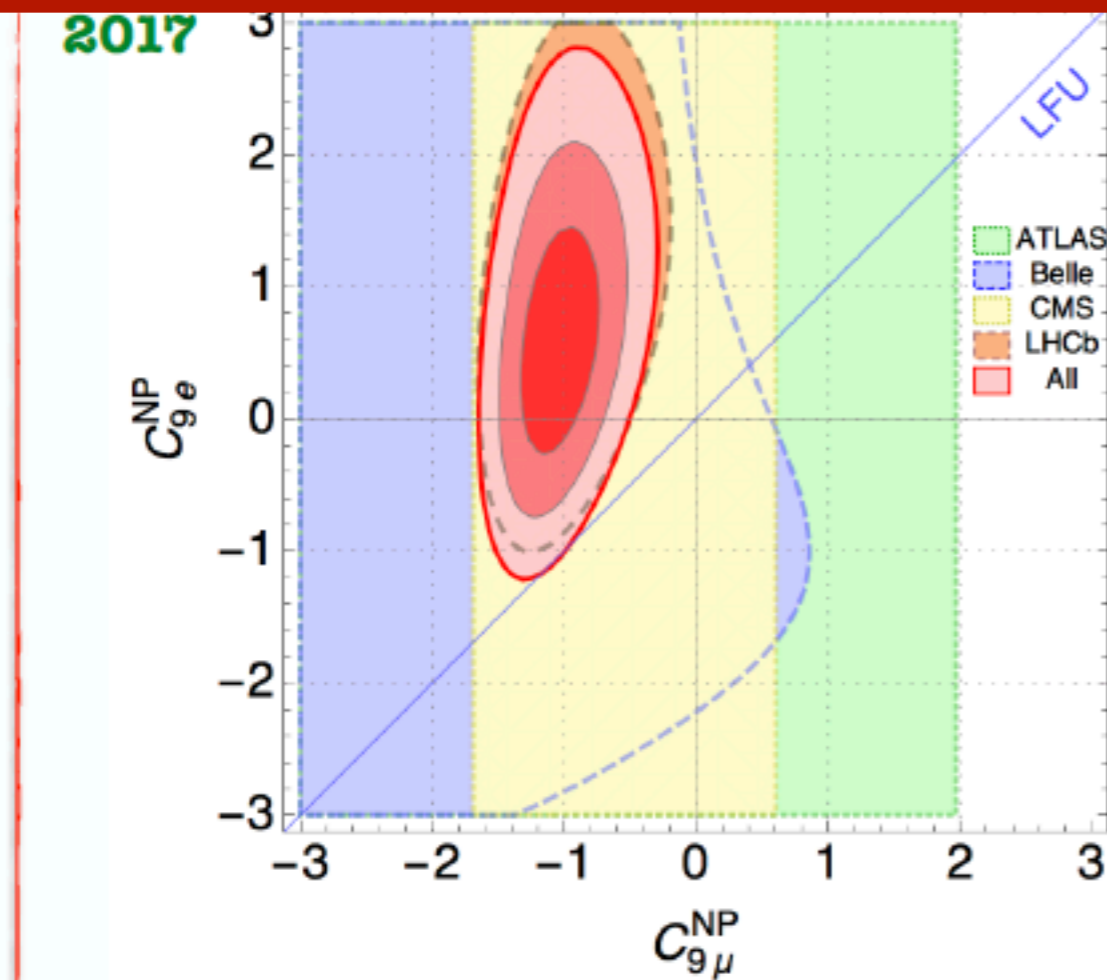
You should quote **the original source where something
important for what you are telling was first published**

Implications of the new updates on $R_K, R_{K^*}, B_s \rightarrow \mu\mu$

New Physics in electrons slightly more compatible with zero.

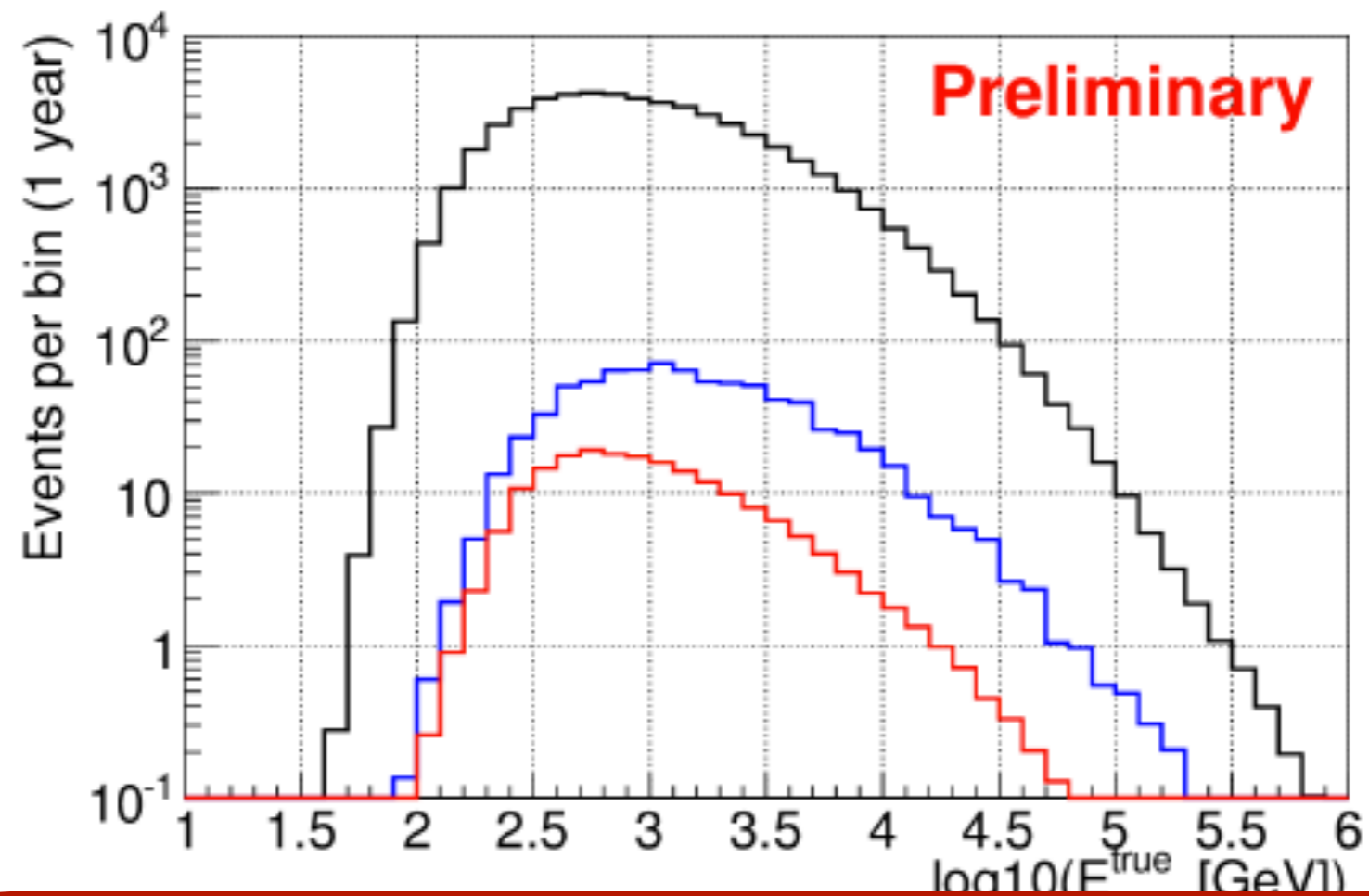
[JHEP 1801(2018) 093]

[1903.09578]



It is then natural to expect some impact in the significance of LFUV+LFU scenarios

Let's use atmospheric neutrinos!



IceCube contribution to ICRC 2015, arXiv:1510.05223

Dip. Fisica, Università di Roma "La

Sapienza", 27.2.2016

Referencing your own work

In the “new” section, usually you may quote your own publications

First possibility:
the trick to put
your initials only

Second possibility:
to quote it as
any other reference

Linking charged and neutral anomalies (step 1)

Let's move to SMEFT ($\Lambda_{NP} \gg m_{t,w,z}$)

[Grzadkowski, Iskrzynski, Misiak, Rosiek; Alonso, Grinstein, Camalich]

• NP contribution to : $[\bar{c}\gamma^\mu P_L b][\bar{\tau}\gamma_\mu P_L \nu_\tau] \xrightarrow{G_F \text{ rescaling}} R_D/R_D^{SM} \simeq R_{D^*}/R_{D^*}^{SM}$

BUT who order that

(at high energy)? Only Two $SU(2)_L$ invariant operators in SMEFT @ 1st order

$$\mathcal{O}_{ijkl}^{(1)} = [\bar{Q}_i \gamma_\mu Q_j][\bar{L}_k \gamma^\mu L_l],$$

$$\mathcal{O}_{ijkl}^{(3)} = [\bar{Q}_i \gamma_\mu \sigma^I Q_j][\bar{L}_k \gamma^\mu \sigma^I L_l],$$

After EWSB $i=2, j=k=l=3$

if $C^{(1)}=C^{(3)}$

[Capdevila, Crivellin, SDG, Hofer, JM, PRL'18]

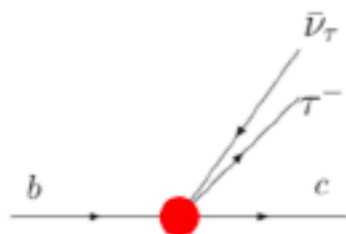
$b \rightarrow c$

$b \rightarrow s$

Accommodate charged $R_{D^{(*)}}$.

OK constraints:

- Bc lifetime, q^2 distributions, but also $B \rightarrow K^* \nu \bar{\nu}$, direct searches and EWP data.



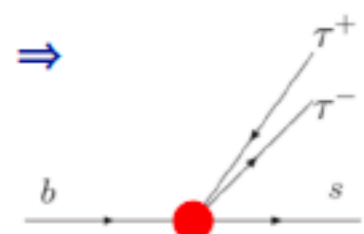
Contribution to neutral $b \rightarrow s \tau \tau$

with a pattern: $C_{9(10)\tau} \simeq C_{9,10}^{SM} - (+)\Delta$ (40)

$$\Delta = 2 \frac{\pi}{\alpha_{em}} \frac{V_{cb}}{V_{tb} V_{ts}^*} \left(\sqrt{\frac{R_X}{R_X^{SM}}} - 1 \right) \simeq \mathcal{O}(100)$$

- 10% NP w.r.t. tree-level SM \Rightarrow

Huge contrib. w.r.t. loop-induced SM.



Linking charged and neutral anomalies (step 1)

Let's move to SMEFT ($\Lambda_{NP} \gg m_{t,W,Z}$)

[Grzadkowski, Iskrzynski, Misiak, Rosiek; Alonso, Grinstein, Camalich]

• NP contribution to : $[\bar{c}\gamma^\mu P_L b][\bar{\tau}\gamma_\mu P_L \nu_\tau] \longrightarrow R_D/R_D^{SM} \simeq R_{D^*}/R_{D^*}^{SM}$
 G_F rescaling

BUT who order that

(at high energy)? Only Two $SU(2)_L$ invariant operators in SMEFT @ 1st order

$$O^{(1)} = [\bar{Q}_i \gamma^\mu \sigma^I Q_i][\bar{L}_j \gamma_\mu \sigma^I L_j] \quad O^{(3)} = [\bar{Q}_i \gamma^\mu \sigma^I Q_i][\bar{L}_j \gamma_\mu \sigma^I L_j]$$

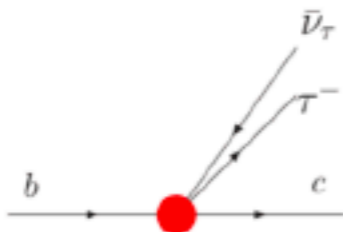
Lost within all of this informations, there is a self-citation....

[Capdevila, Crivellin, SDG, Hofer, JM, PRL'18]
b → s

Accommodate charged R_{D^*} .

OK constraints:

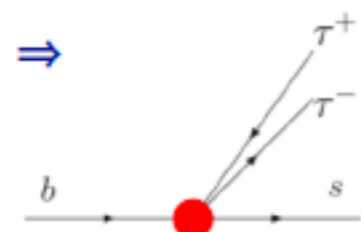
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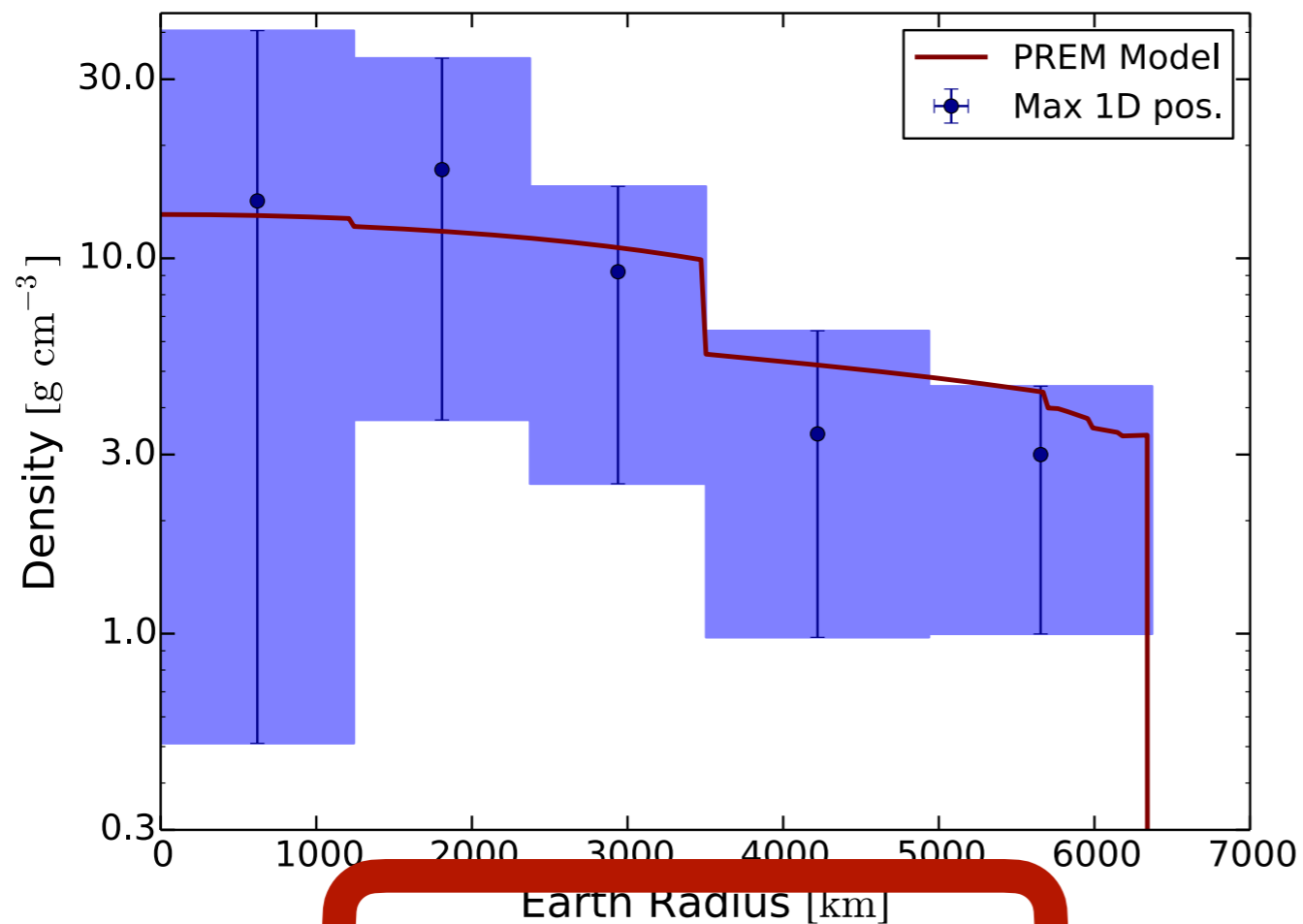
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- 10% NP w.r.t. tree-level SM \Rightarrow Huge contrib. w.r.t. loop-induced SM.



First 1-d density profile with neutrinos



Analysis performed with MultiNest

5 Earth layers densities

and

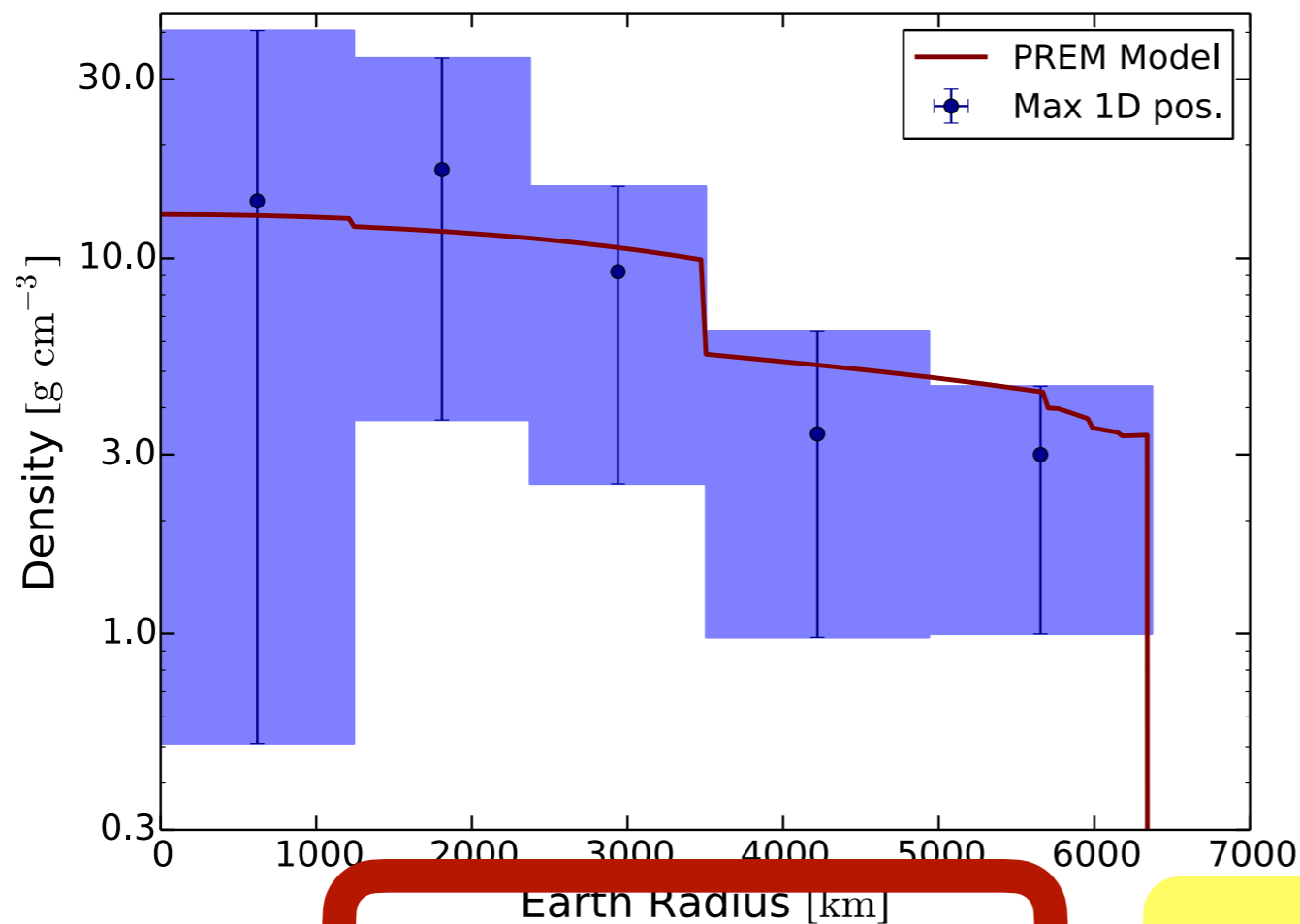
4 systematic errors:

- Flux normalization
- Pion-to-kaon ratio
- Spectral shape
- DOM Efficiency

Nature Physics 15 (2019) 37



First 1-d density profile with neutrinos



Analysis performed with MultiNest

5 Earth layers densities

and

4 systematic errors:

- Flux normalization
- Pion-to-kaon ratio
- Spectral shape

Nature Physics 15 (2019) 37

(A. Donini, S. Palomares-Ruiz, J. Salvado)



Conclusions

It is a short **summary of the thesis:**
remind shortly the motivation and the results
with respect to the literature

This is the place to insert your work as
just **one single brick in a big construction**

Use a few words (or an extra slide) to explain possible
future development,
“beyond the scope of this thesis.”

Once your done...

**TAKE YOUR TIME
TO
PRACTICE!**

In particular, TIMING!

Once your done...

**Try to foresee
the possible questions
and
prepare **BACKUP SLIDES** for them**

Appendices become **BACKUP SLIDES**

They are the place where you must move

TECHNICAL STUFF

that you used but is:

- A) boring to explain in the talk**
- B) something that may be skipped**

Appendices become **BACKUP SLIDES**

They are the place where you must move
TECHNICAL STUFF
that you used but is:

- A) boring to explain in the talk
- B) something that may be skipped

As many as you need....

Thank you!

And remember.....

Thank you!

And remember.....

Try to avoid your
worst nightmare:
the “sleeping member”
of the Jury

