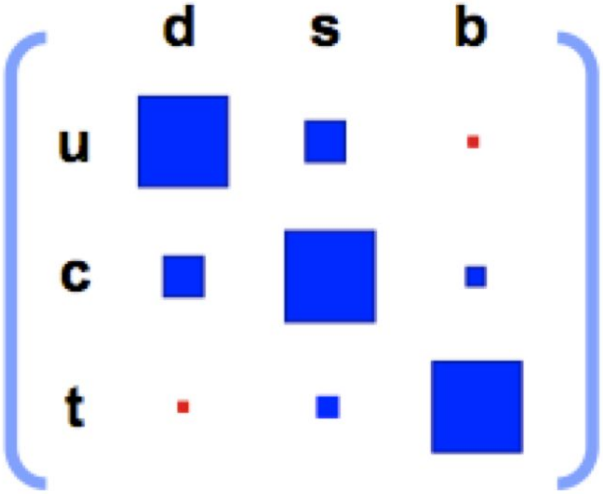
CMS NA Physics news

CMSNA analysis meeting 21/11/2019

O.Iorio

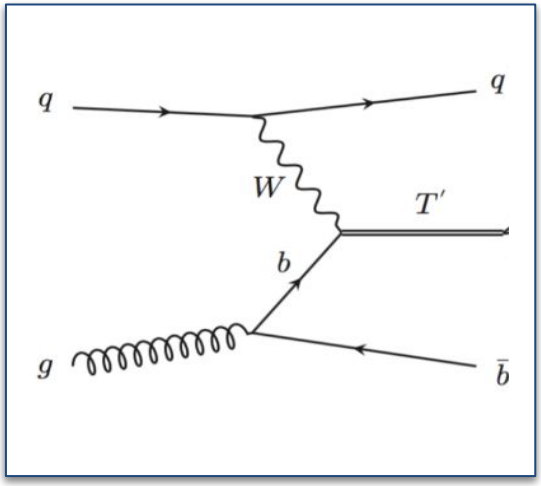
Overview
- Brief status of the analyses
- Physics update form CMS Italia

Activities overview



Single top CKM ME analysis

- 2016 analysis : PAS out! Talk at LHCTopWG (Agostino, Lukas, Luca, AOMI)
- Update with resolved top tagger and Multi-classifier : next meeting! (Valeria)



Beyond Standard Model searches:

T' → tZ, (top → had, Z → νν) : In Object review, work ongoing! (Francesco F., Lukas, AOMI)

T' → tZ (top → lνb , Z → had) : ML-based top id, update today! (Francesco C.)

W' → tb: progress on MC and Meeting with theory group (Agostino, Andrea, AOMI)

TOP-17-012 public! PAS Out @ LHCTopWG

CMS Physics Analysis Summaries

Report number	CMS-PAS-TOP-17-012
Title	**Extraction of CKM matrix elements in single top quark t-channel events in proton-proton collisions at $\sqrt{s} = 13$ TeV**
Corporate author(s)	CMS Collaboration
Collaboration	CMS Collaboration
Subject category	Particle Physics - Experiment
Accelerator/Facility, Experiment	CERN LHC ; CMS

CDS document: https://cds.cern.ch/record/2701464?ln=en
Talk on thursday: https://indico.cern.ch/event/843509/timetable/

Physics Analysis Summary Out!

Next steps towards publication:

⟶ CWR finishing next Tuesday 26/11

⟶ FR probably early January

Aiming at **PLB**

Analysis upgrade plan (Valeria):

1) Factorise **best top selection** and **top kinematic quantities** description.

2) Define a **restricted** phase space region to reduce systematics

3) Potential **ancillary measurements?**

W' update #1: modeling

At work to produce first samples!

—> In contact with theorists from abroad (Benjamin Fuks), and from our institute (Tramontano, Morisi, Miele)

Collaboration for a Master thesis: Roberta Calabrese working on defining **benchmarks for W' searches at LHC - possible pheno paper to take as reference for the collaborations-**

Modello	g_R^q	g_R^l	g_L^q	g_L^l
Minimal 331 model ($\beta=\sqrt{3}$) SU(3)XSU(3)XU(1)	no	si	si	Si
331 model SU(3)XSU(3)XU(1)	no	no	si	Si
L-R model SU(3)XSU(2)XSU(2)XU(1)	si	si	no	no
Topflavor model SU(3)XSU(2)XSU(2)XU(1)	no	no	si	Si
Little Higgs model SU(3)XSU(2)XU(1)XSU(2)XU(1)	no	no	si	si

W' update #2: work and personpower

Lepton channels:

—> Agostino is finalizing the MC samples and working on

—> Andrea is coming back to the analysis! The Perugia group is also looking forward to the collaboration. **Welcome (back? Have you really left?) to the team!**

Hadron channels:

—> Suman Chetterjee from India is working on the hadronic channels. Work is more advanced and aiming at Moriond. We are working closely, we can schedule probably a semi-official working meeting every week.

Last week @ Bari: CMS Italia

- A lot of good **discussions on Upgrade**

- A glimpse into Run-III possible **physics cases** and **challenges**

Follows an overview on the **analysis side only**, with some integration and comment!

Run-III physics prospects

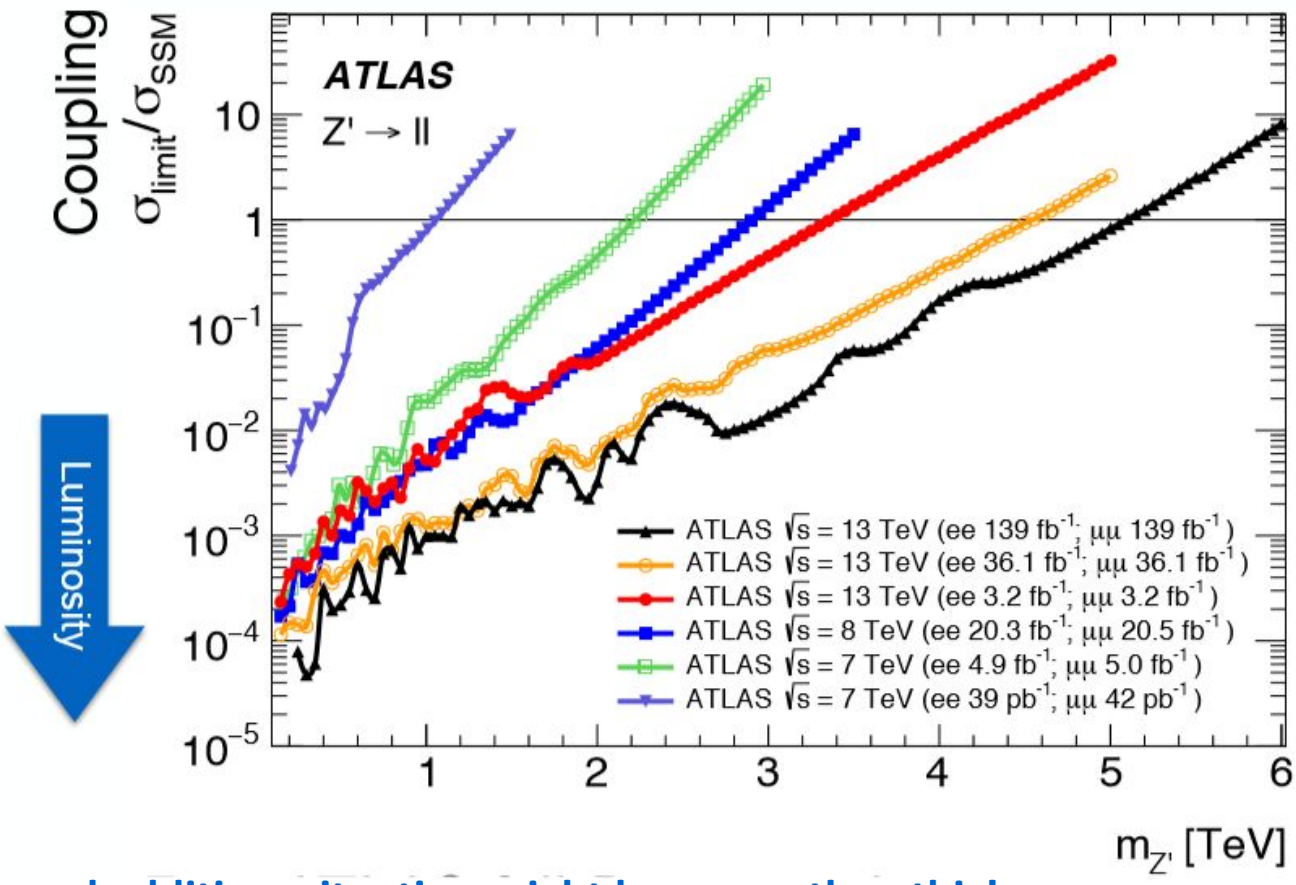
Run-III "middle ground" between current state and HL-LHC conditions

- **13 → 14 TeV cross section**: small improvement, not uniform across the board

- **Factor 3 statistics** → factor 1.7 significance

- **not much to gain from Run-III** until probably end of 2021 or even 2022 (**unless we see something in data before that ofc**)

Energy and lumi: diminishing returns!

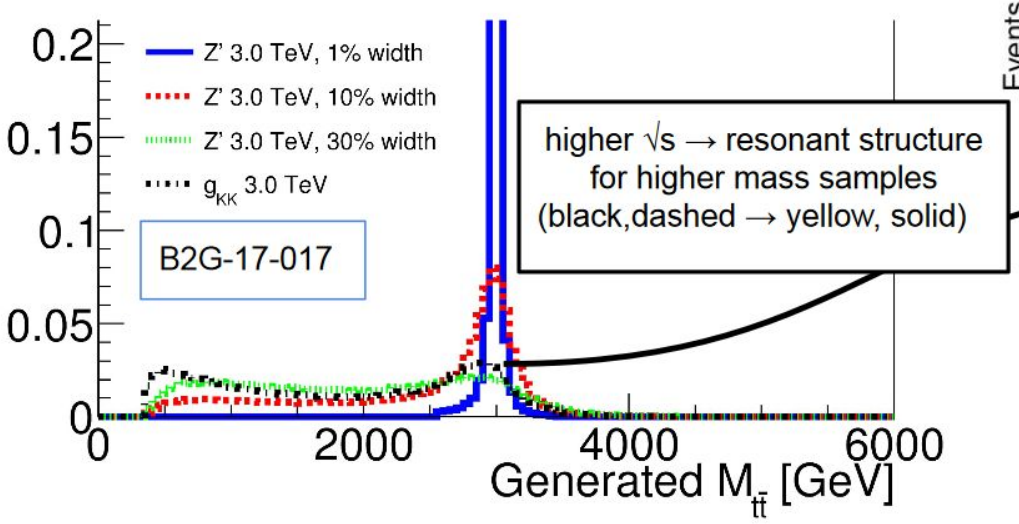


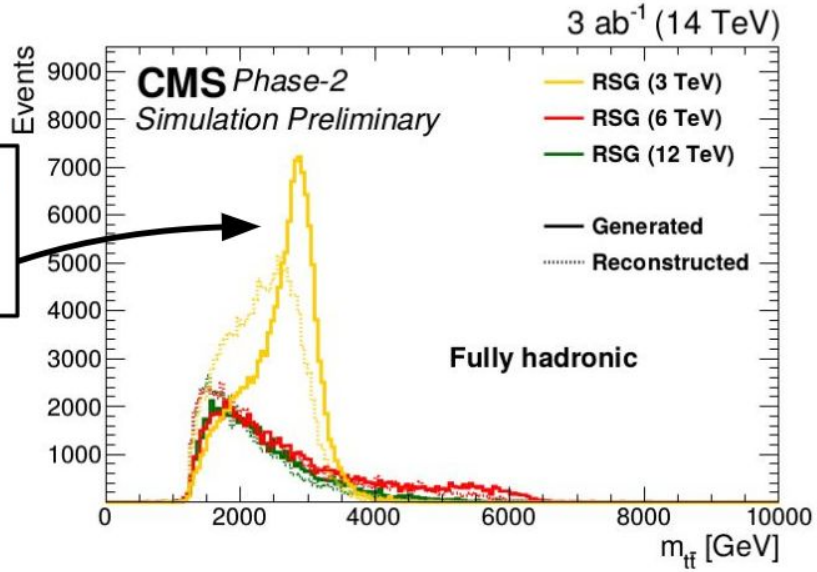
Collision energy

Personal addition: situation might be worse than this!

- Higher mass → **broader resonances** → **harder bump-hunt searches**

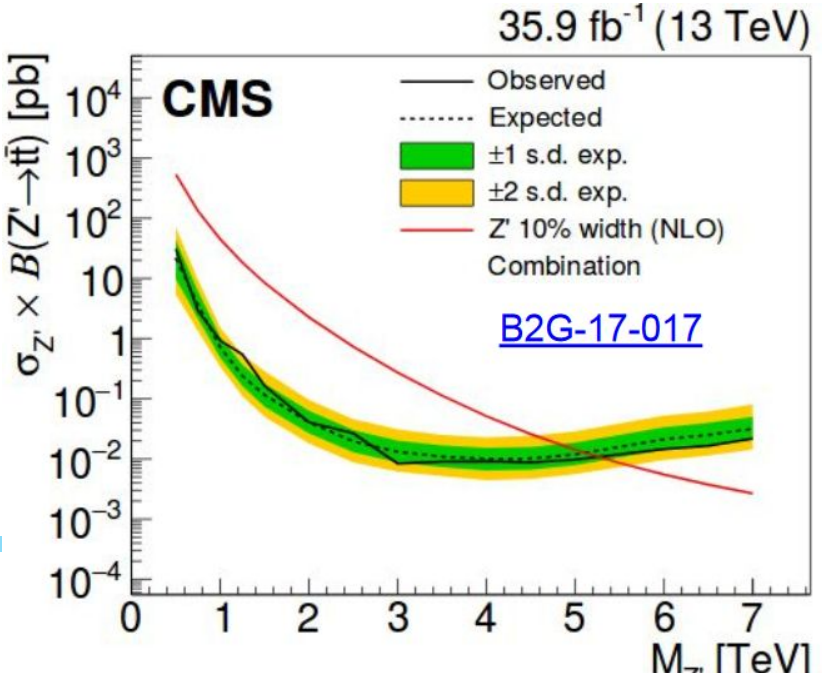
Problem of fat resonances





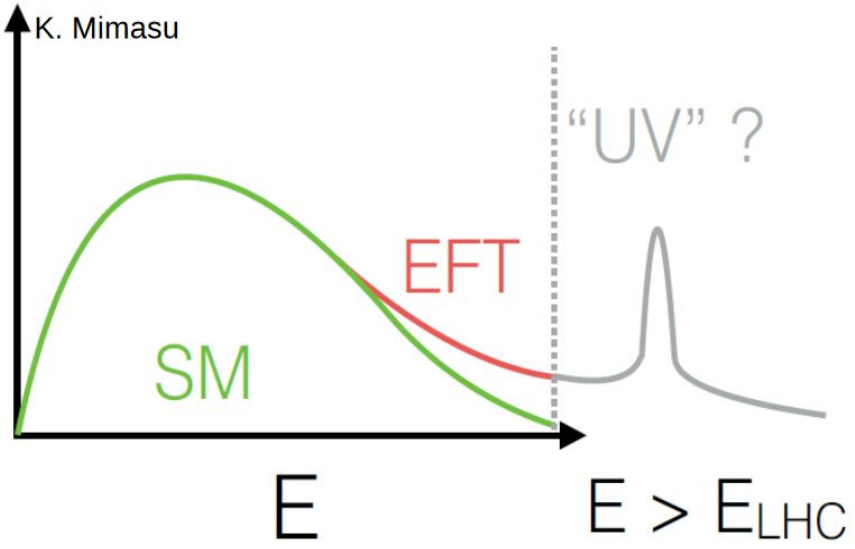
Gravitons become more and more fat !

- **Limits go up** unless we become smart!

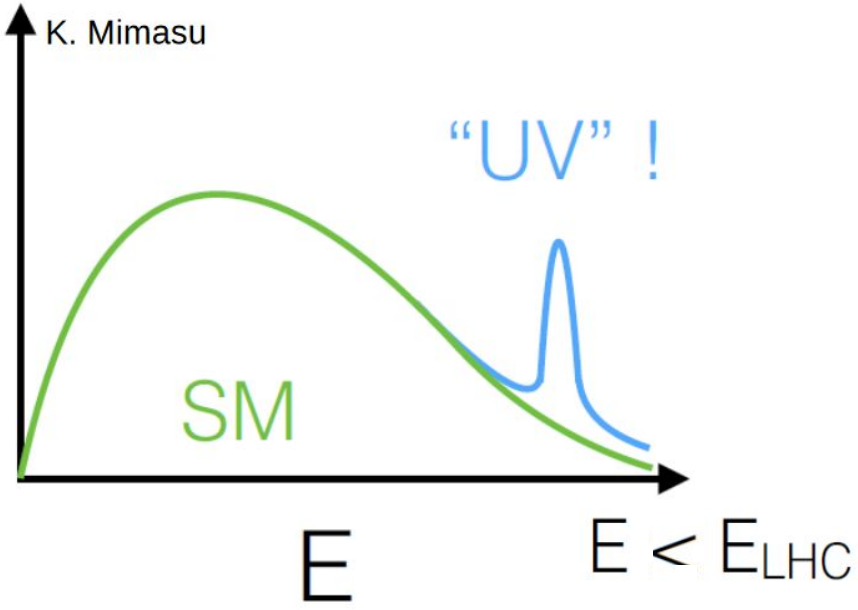


Resonant or non-resonant - that is the question!

Indirect searches



Direct searches



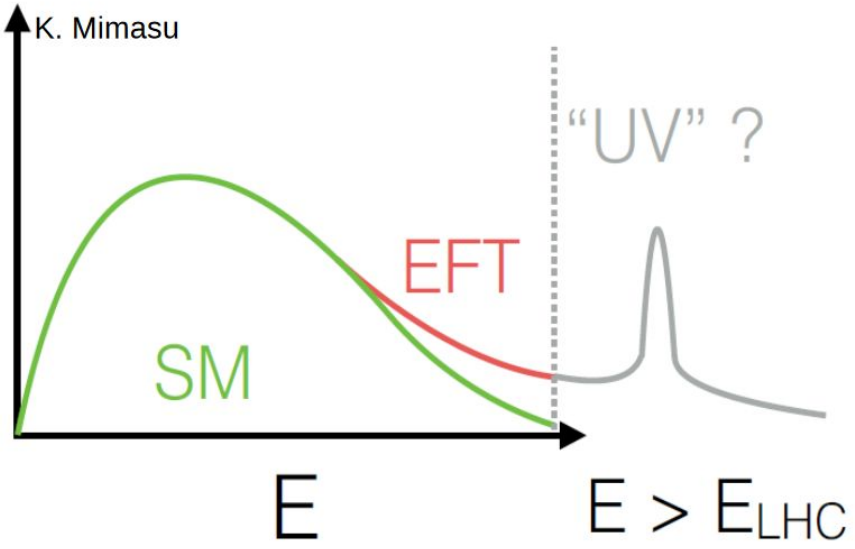
So how are we supposed to search for new physics if we can't look for bumps?


FANCY NEW PHYSICS
FANCY NEW PHYSICS

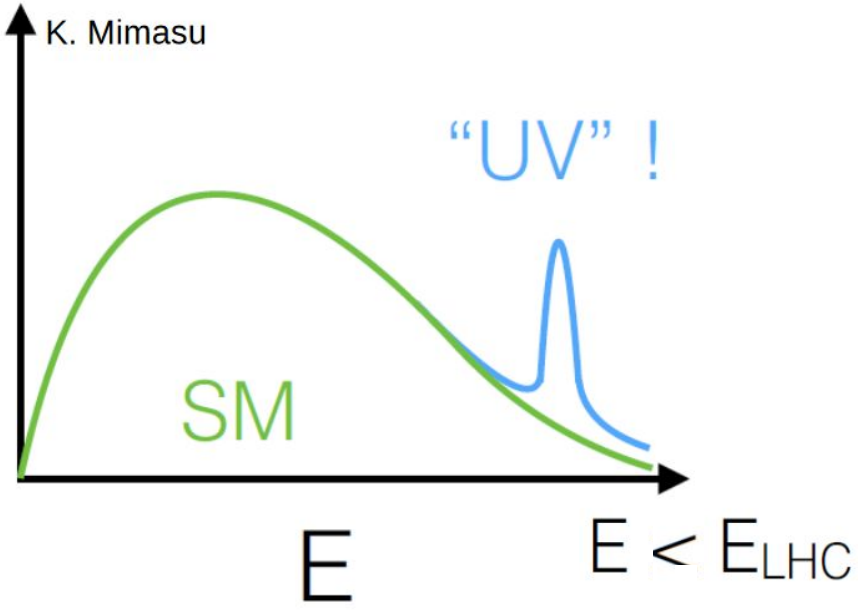

FANCY NEW PHYSICS
FANCY NEW PHYSICS
PRECISION MEASUREMENT
HAH, IT WAS YOU ALL ALONG, STANDARD MODEL

Resonant or non-resonant - that is the question!

Indirect searches



Direct searches

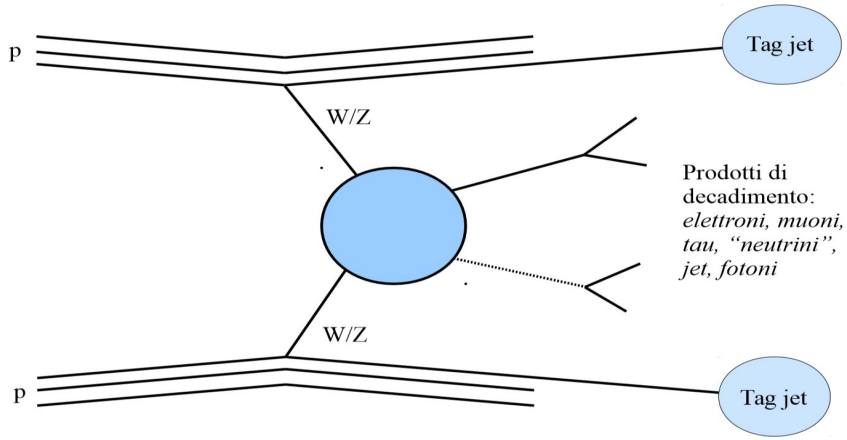


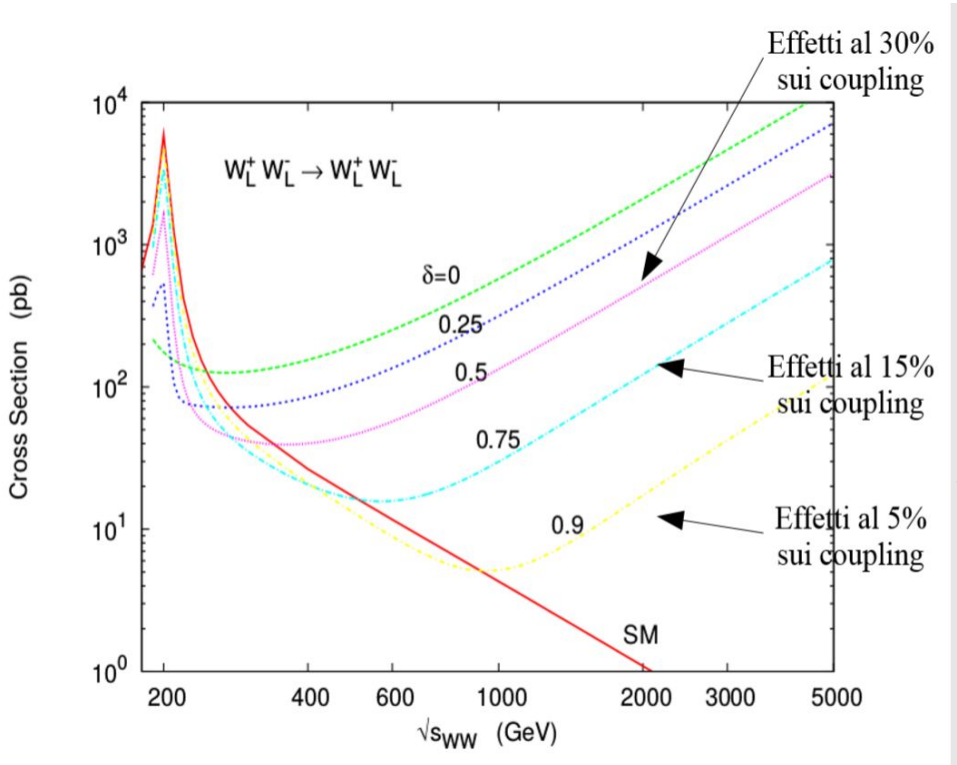
We are basically going up with the precision measurements

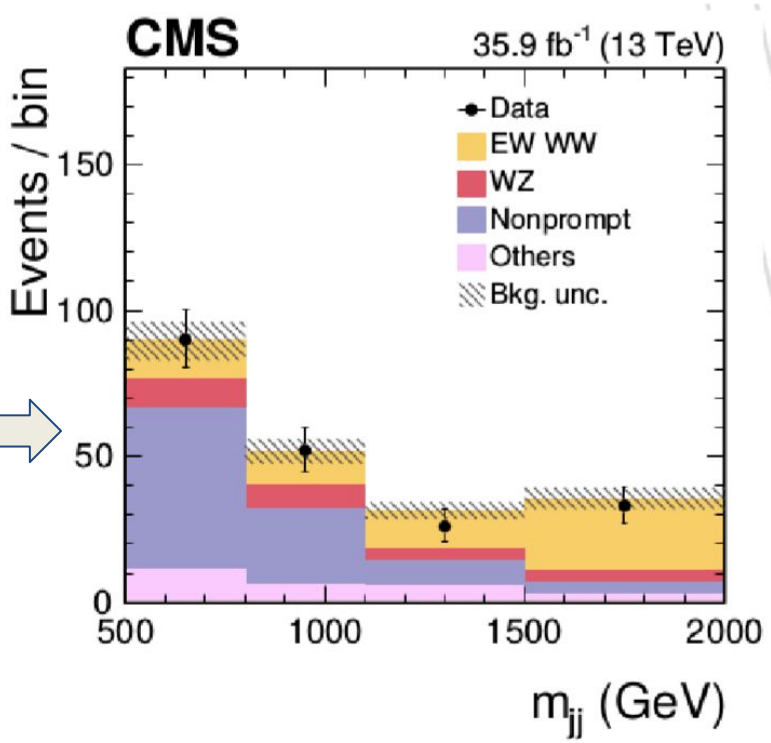
- Looking for small effects over tails, or on rare processes

- At some point in the future, the treatment of **searches and SM measurements will meet**...

Example at the CMS week: VBS

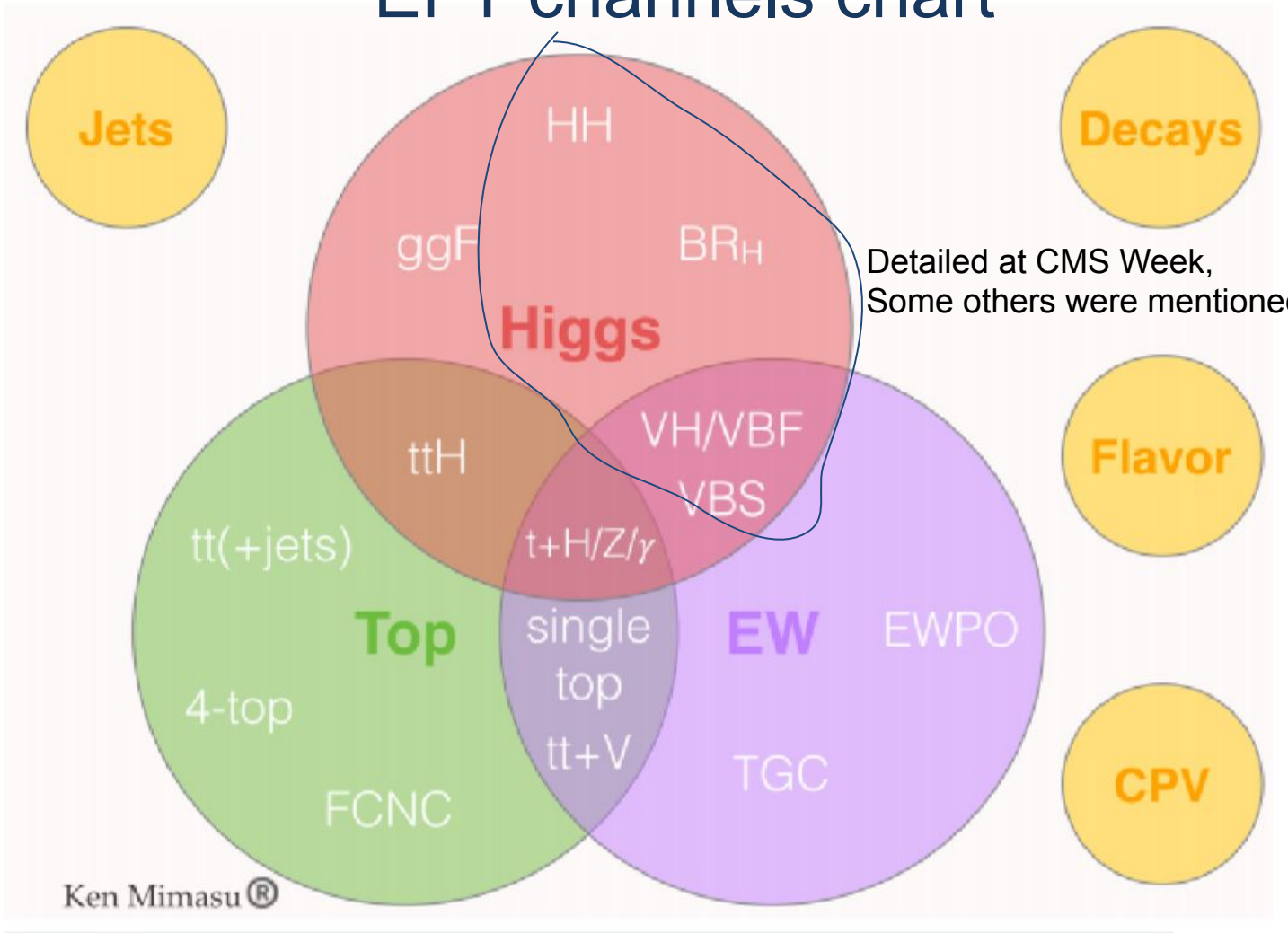






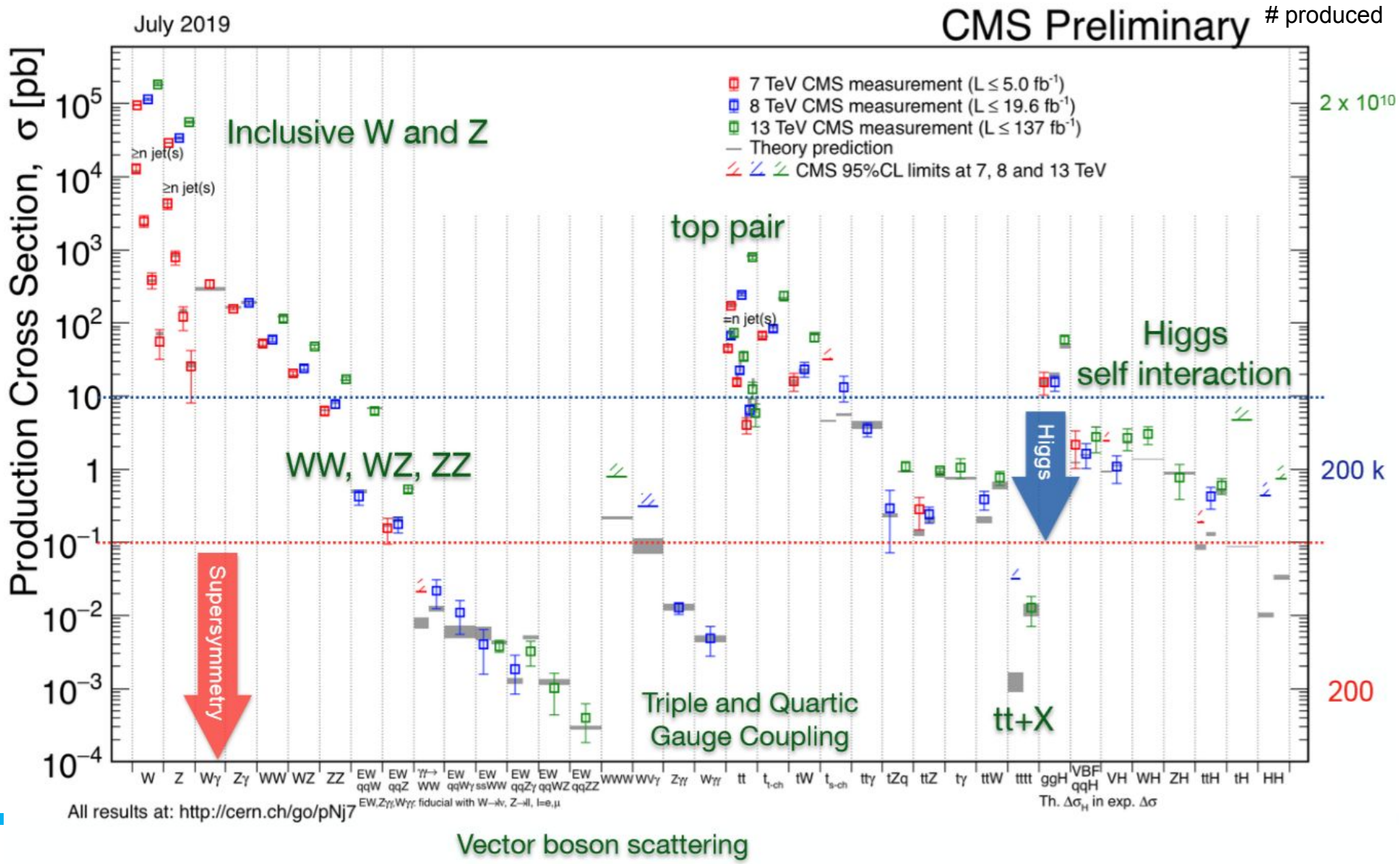
Maria

EFT channels chart



Remember the tH? It might be an interesting prospect for Run-III… or more!

Accessible SM processes now!



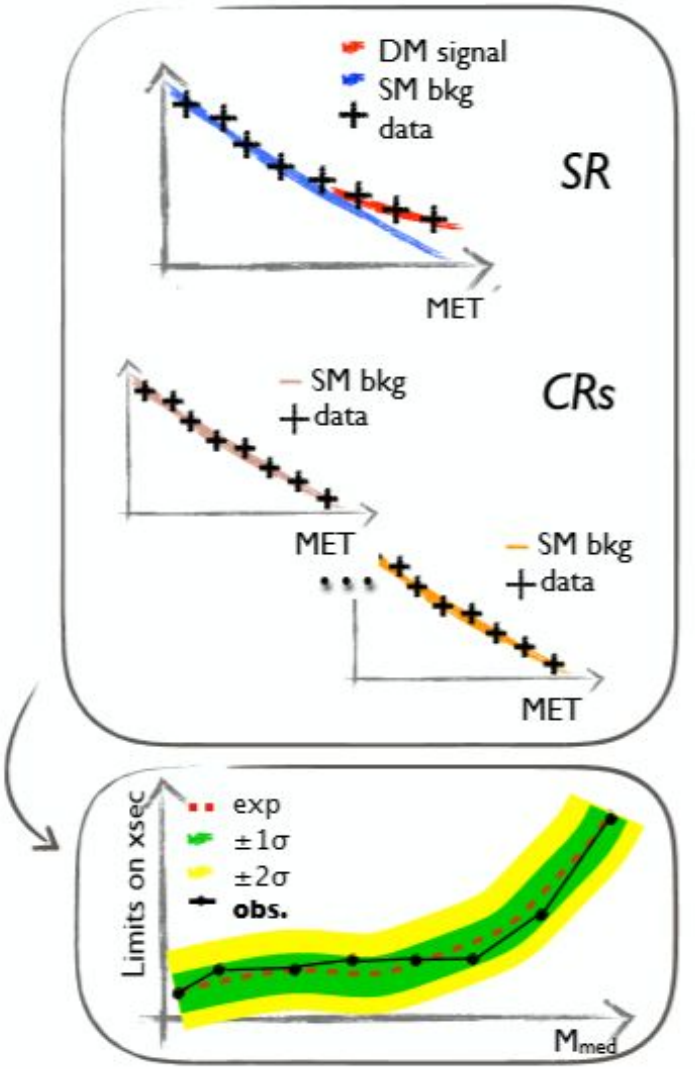
Other topics, too broad to cover here

Dark matter

- Evergreen, still looking for it.
- We might be interested to chime in again:
  speaking to the MET+X convener (Deborah Pinna)
  At some point will suffer from diminishing returns as well...

Exotic channels → several non standard signatures possible

- Low mass
- High lifetime
- Complex or stealth signals



Technological challenges

High-Lumi :

- Non-sustainable (with current tech. of course) **computing time**

- Worse **PU conditions**

- Increasingly **funky models**

Buzzwords :

1) GPU and parallel computing

2) Machine Learning

See also brainstorming session at the end of this meeting!

Last-minute: Unitarity workshop in Perugia!

27-28 January, organized by Perugia, Padova:

- Compositeness and EFT
- Of interest also for theory community?

COMPOSE-IT: Unitarity for composite models and beyond in the HL-LHC era

27-28 January 2020
Dipartimento di Fisica, Università degli Studi di Perugia
Europe/Rome timezone

- Overview
- Call for Abstracts
- Workshop venue
- How to reach Perugia
- Accomodation
- Timetable
- Book of Abstracts
- Registration
- Participant List

The workshop has the goal to bring together theorists and experimentalists working actively in the field of fermion composite models and the effective interactions of the hypothetical excited states with the ordinary SM particles. We shall focus on the issue of perturbative unitarity, which has been overlooked in these models, and assess its impact in the related experimental searches.

We plan to discuss such effective models, and possibly affine ones, in connection with the Run III of the LHC and of its forthcoming High-Luminosity and High-Energy options with respect to possible signatures not yet covered and/or due to new exotic states.

Starts 27 Jan 2020, 10:00
Ends 28 Jan 2020, 19:00
Europe/Rome

Dipartimento di Fisica, Università degli Studi di Perugia
Via A. Pascoli, Perugia