

QCD & Colliders overview

Gavin Salam

CERN (80%), Princeton (20%) & LPTHE/CNRS (Paris, on leave)

TH retreat
4 November 2010

QCD & Colliders

Fellows already here last year:

Darren Forde, Terrance Figy, Graeme Watt, Francesco Tramontano

Fellows who arrived recently:

Jan Winter, Chul Kim

Fellows coming soon (~ January):

Daniel Maitre and Alex Mitov

Staff:

Stefano Frixione, Michelangelo Mangano, GPS, Peter Skands

I'll briefly mention activities of those not talking today

Heavy-ions

▶ Fellows:

Jorge Casalderrey Solana, Cyrille Marquet

▶ Staff:

Urs Wiedemann

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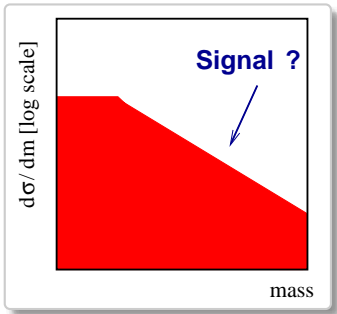
Heavy-ions

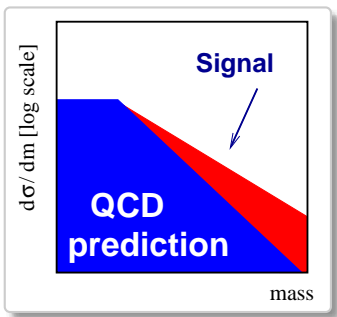
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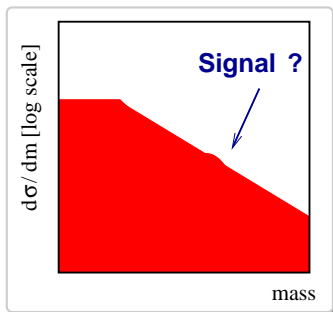
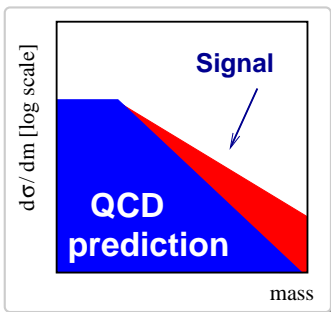
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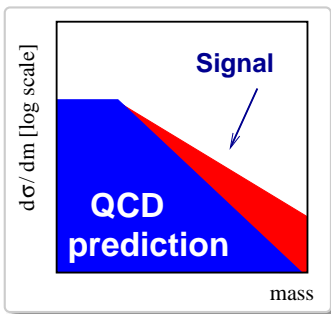




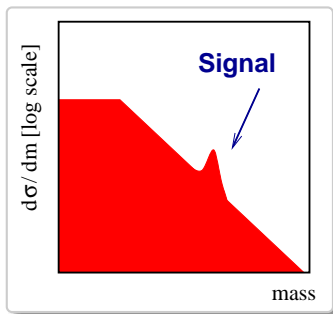
Telling us what the background is, so we can see any excess



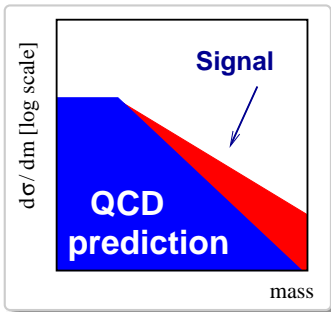
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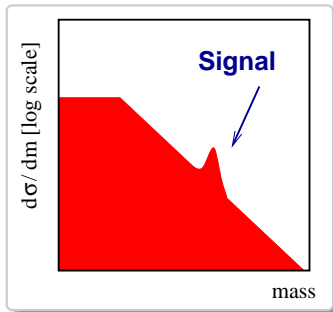
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Teaching us how to reduce the background, sharpen the signal



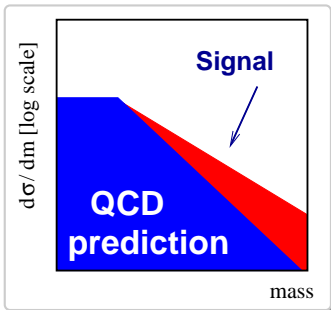
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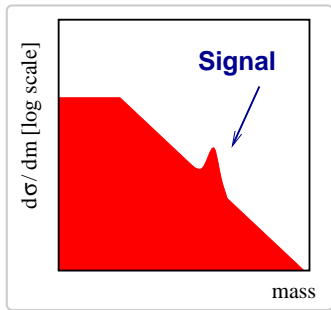
Teaching us how to reduce the background, sharpen the signal

Constraining any discoveries:

mass
couplings
etc.



Telling us what the background is, so we can see any excess



Teaching us how to reduce the background, sharpen the signal

Constraining any discoveries:

mass
couplings
etc.

And as input to nearly all measurements

LHC event

≡

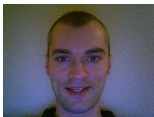
parton showering \otimes matrix-elements \otimes parton-distribution
functions

LHC event

≡

parton showering \otimes matrix-elements \otimes **parton-distribution functions**

The distribution of quarks & gluons inside the proton drives the normalisation of all signals and backgrounds.



MSTW “global fits”

Graeme
Watt

LHC event

≡

parton showering \otimes **matrix-elements** \otimes parton-distribution functions

1-loop (NLO) calculations: getting a modicum of accuracy (10-20%) for the full range of QCD backgrounds [automatically]



Darren
Forde

Blackhat



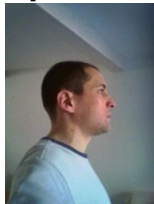
Daniel
Maitre

Blackhat



Francesco
Tramontano

Samurai



Jan
Winter

1-loop on GPUs



Terrance
Figy

NLO & BSM

LHC event

≡

parton showering \otimes **matrix-elements** \otimes parton-distribution
functions

2-loop (NNLO) calculations: getting utmost accuracy (few %) for special processes like top-quark production



Alex Mitov

LHC event



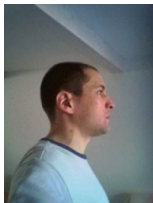
parton showering \otimes matrix-elements \otimes parton-distribution functions

“Parton showering”, because real events involves many tens of particles — but needs to be done consistently with matrix elements



MC@NLO
MadFKS, ...

Stefano
Frixione



Sherpa

Jan Winter

LHC event

≡

parton showering \otimes matrix-elements \otimes parton-distribution functions



Michelangelo
Mangano



Peter
Skands



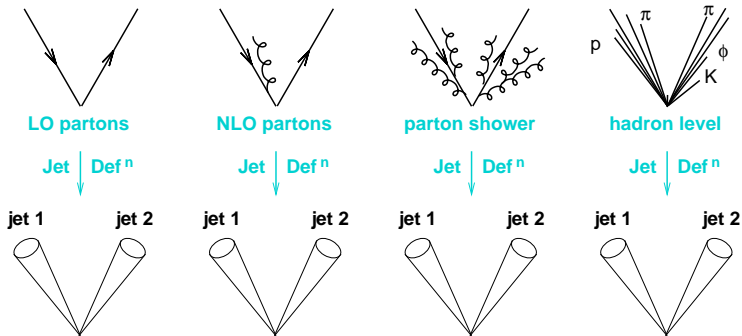
Chul
Kim

Will tell you what they're up to themselves!



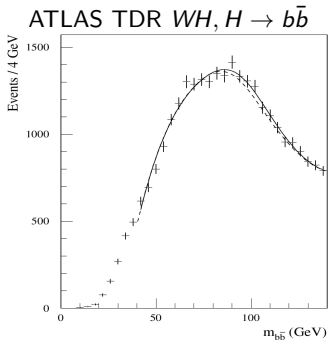
FastJet
etc.

Gavin
Salam

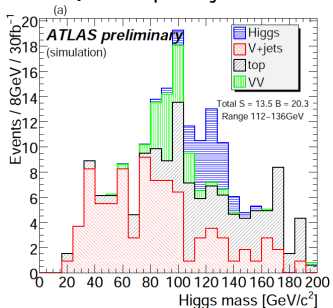


Projection to jets provides "common" view of different event levels

And good use of jets can help LHC make convincing discoveries



after QCD inspired jet “tricks”



- ▶ “TH Theoretical seminar” Wednesdays 2pm
- ▶ “Particle and Astro-Particle Physics Seminars” Fridays 2pm
- ▶ LPCC physics days Topical day, first Friday of each month
More about LPCC in a few minutes from Michelangelo

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NEW: Collider Cross-Talk

Discussion forum for QCD & colliders, with frequent experimental involvement tentatively \sim every other Thursday at 11am, complementary to BSM forum

Main organizers: Nazila Mahmoudi and Jan Winter
with input from Peter Skands & GPS