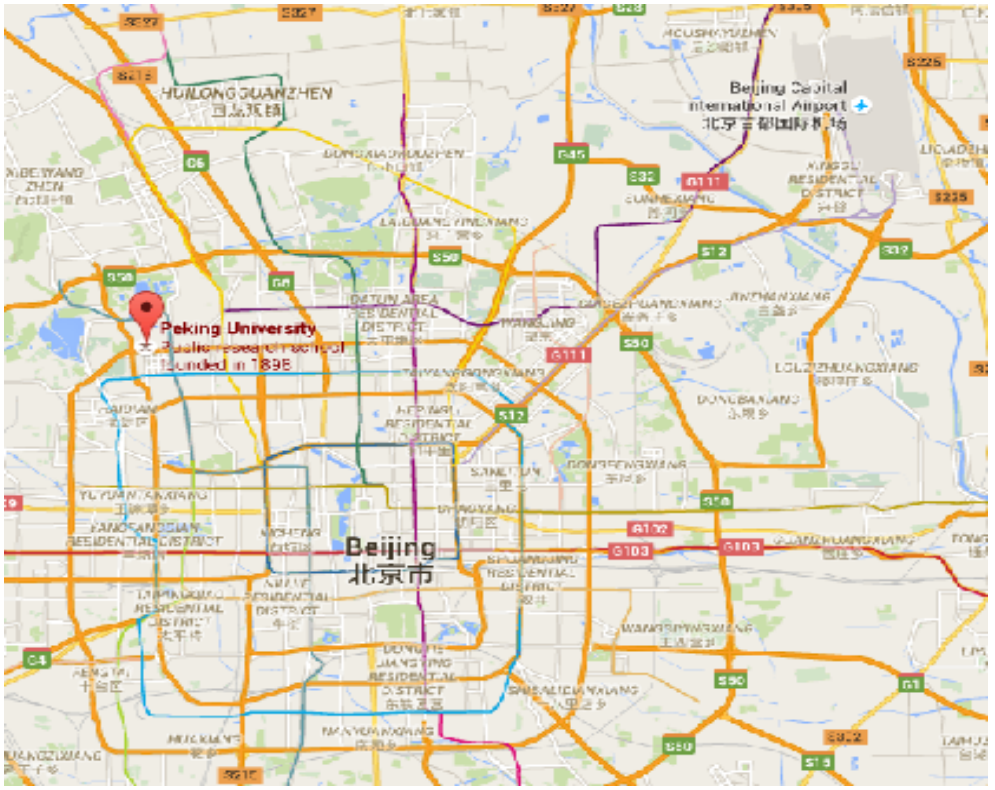
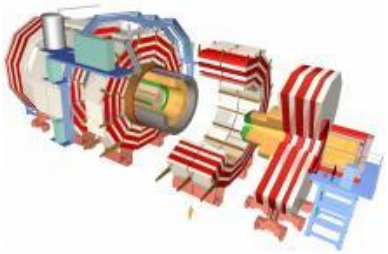
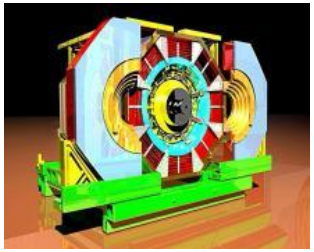
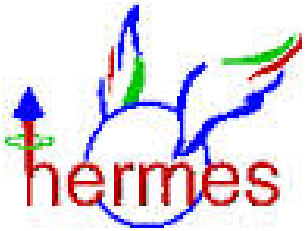

Kazakhstan
Mongolia
Uzbekistan
Kyrgyzstan
Turkmenistan
Sea of Japan
China
South Korea
Japan
Afghanistan
Iran
Pakistan
East China Sea
Nepal
India
Myanmar
(Burma)
Oman
Thailand
South
China Sea
Arabian Sea
Bay of Bengal
Vietnam
Philippines
Gulf of
Thailand


Peking University
Beijing
北京市

HEP Group, Peking Univ., China
http://hepfarm02.phy.pku.edu.cn/drupal/







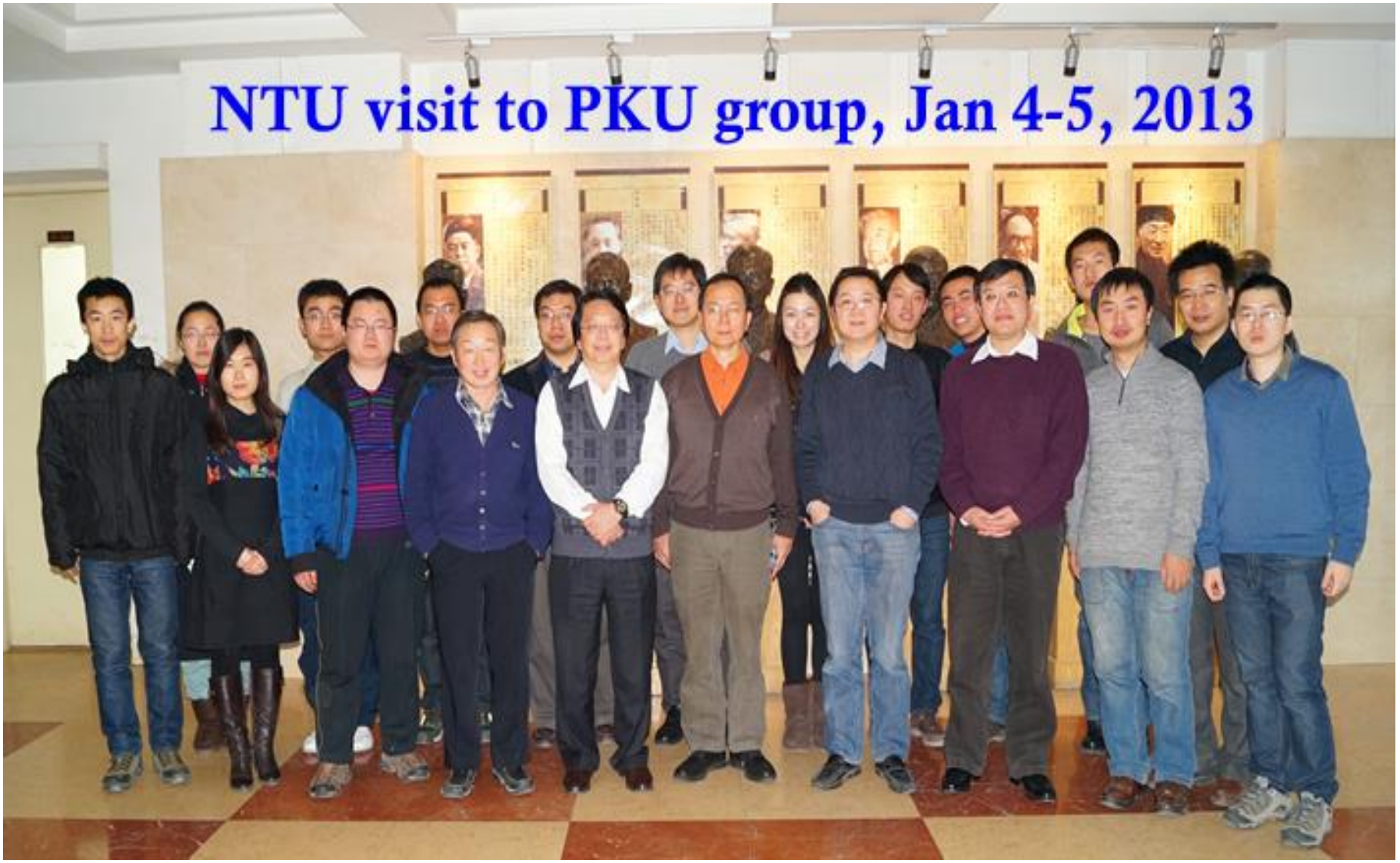
冒亚军， 班勇， 钱思进， 王思广， 王大勇， 李强

Prof. Yajun Mao, Yong Ban, and Sijin Qian

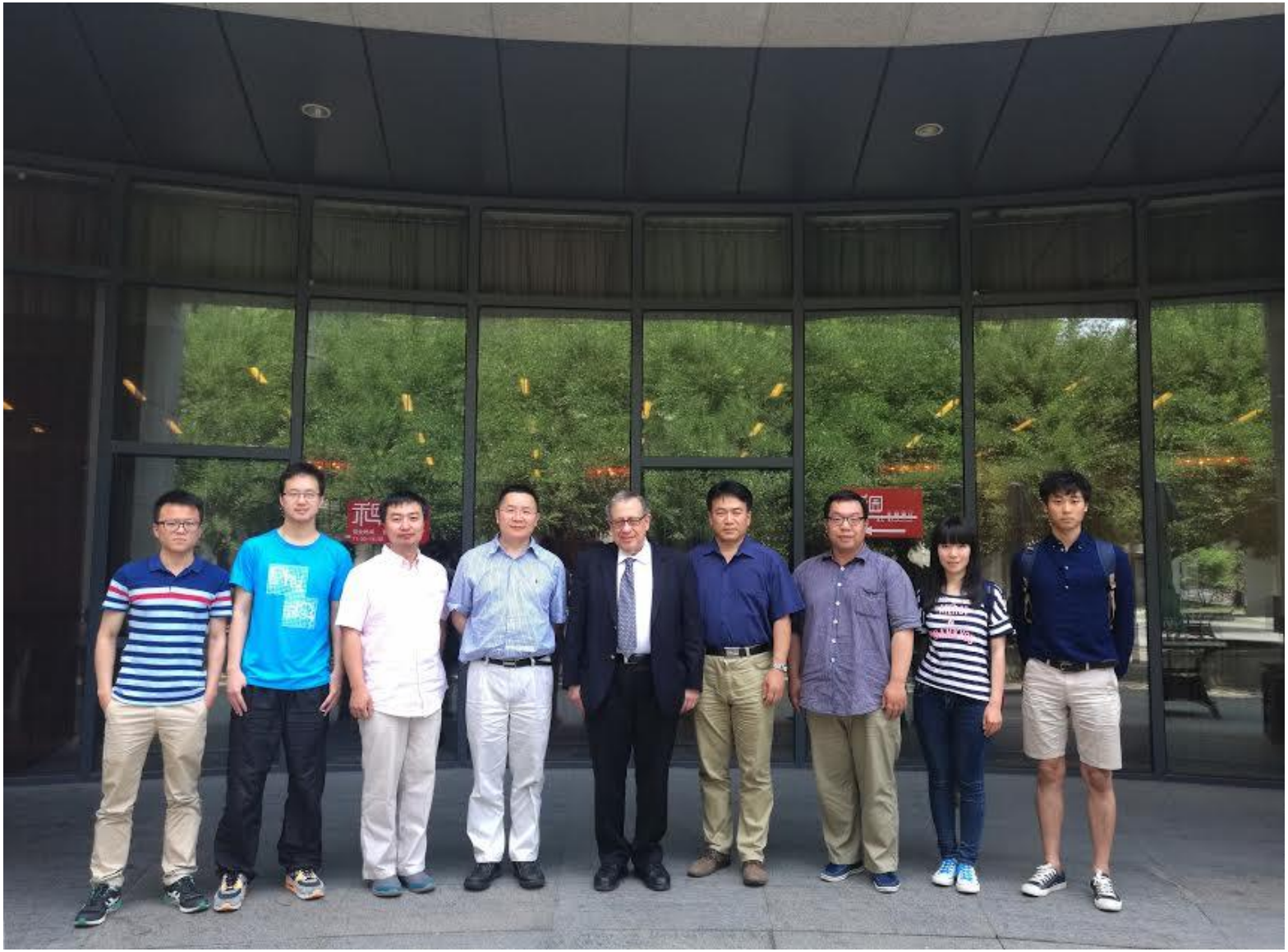
Dr. Siguang Wang, Dayong Wang, and Qiang Li

+ ~20 students

2010/3/12

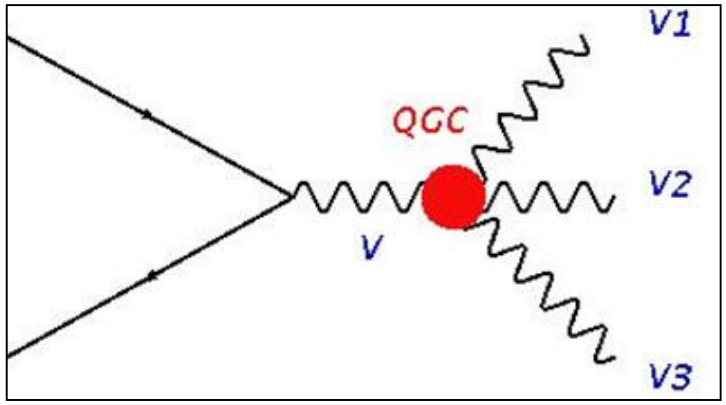

NTU visit to PKU group, Jan 4-5, 2013

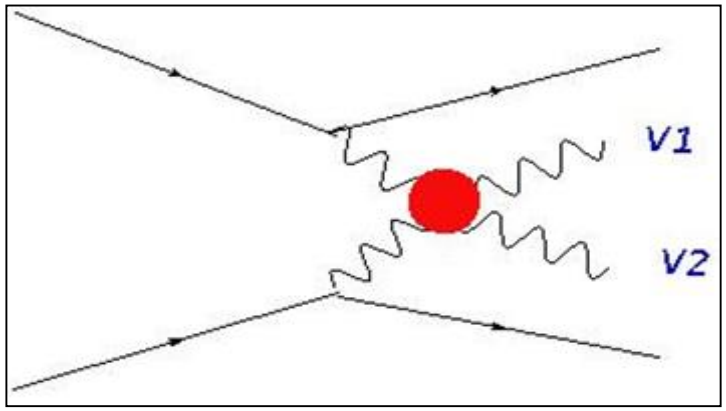
Visit from CMS Spokesperson Dr. Joe Butler, June/2016

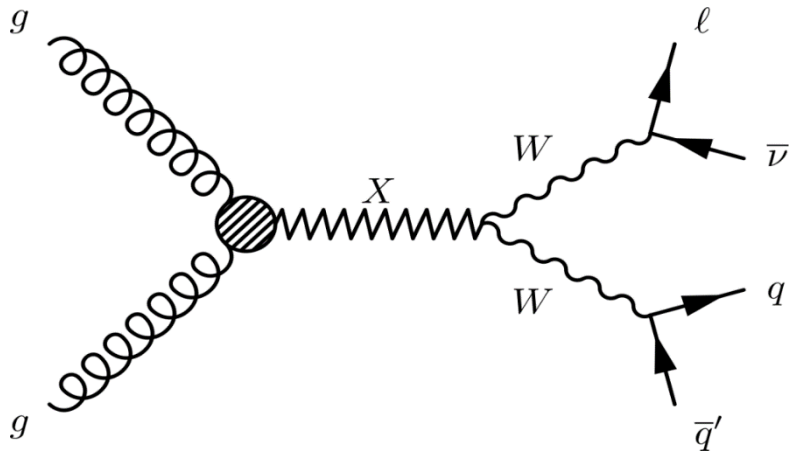


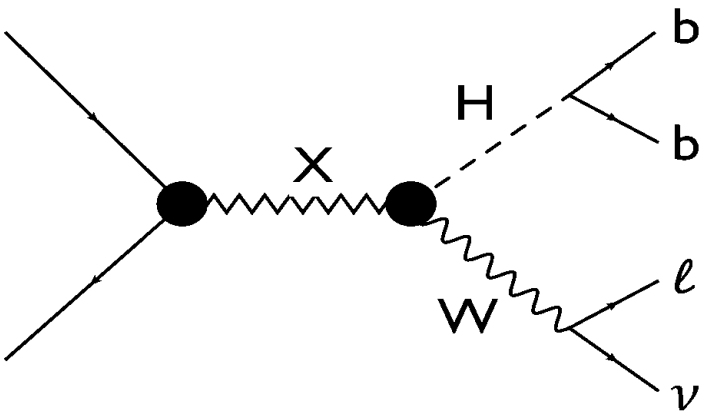
PKU CMS TeV Physics Analyses:

(1) Multi-boson Measurement
and
(2) Exotica VV/VH Searches





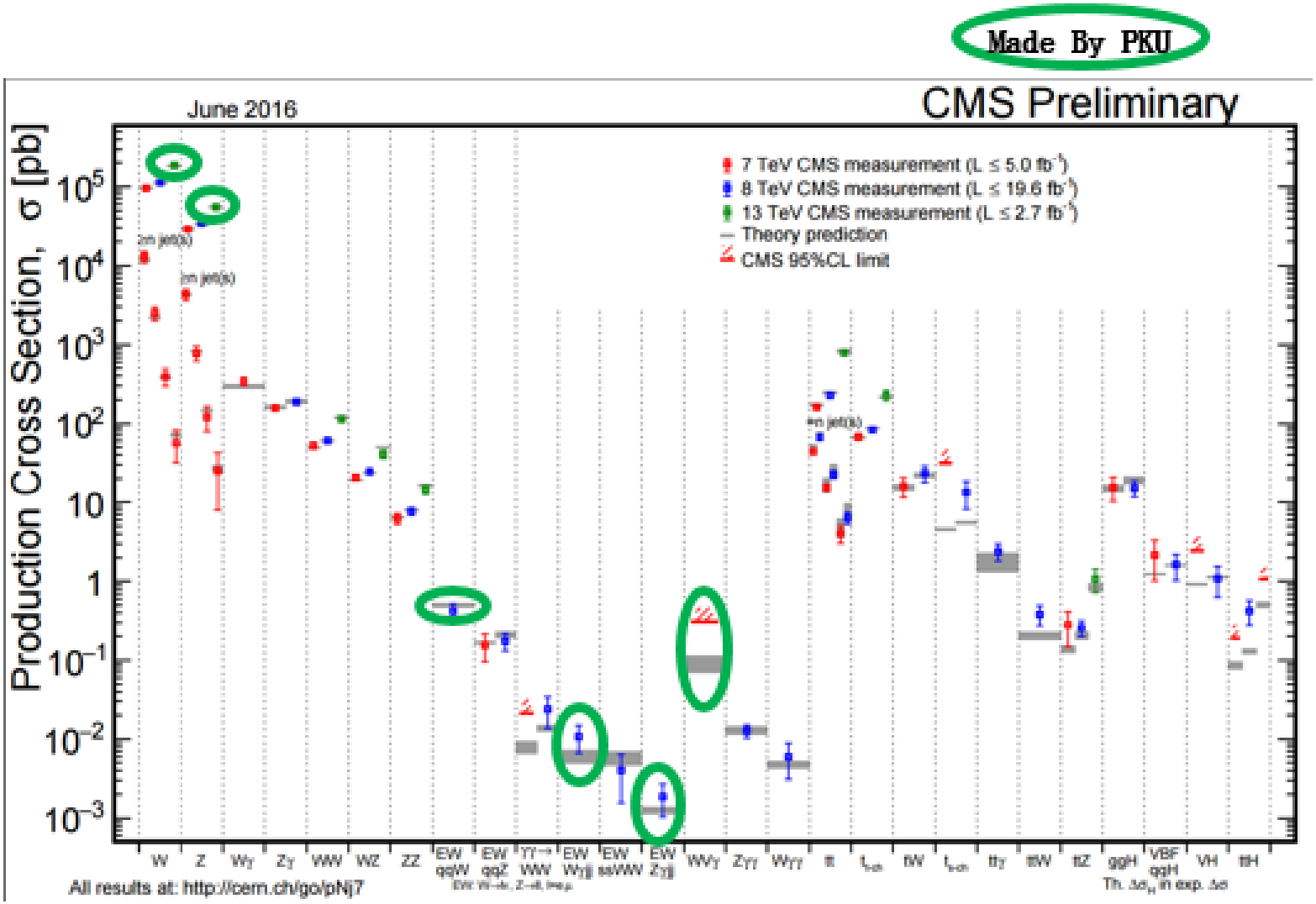




HIG-13-008	HIG-13-013
EXO-14-010	SMP-13-009
JME-13-006	EXO-12-021
EXO-15-002	SMP-13-012
B2G-16-004	SMP-14-011
BPH-15-001	SMP-14-018

……..

PKU SM measurement: 6 analyses



VBF Wjj

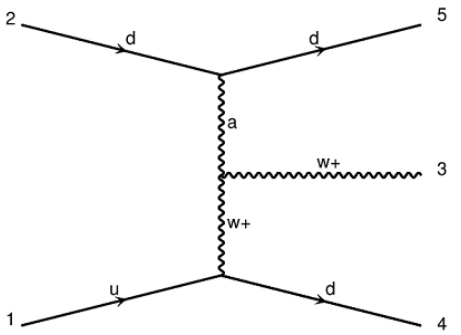
Jing Li as the Analysis Contact
arXiv:1607.06975, Submitted to JHEP

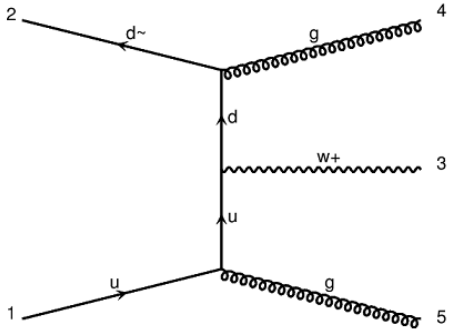
- VBF Wjj simulated by MadGraph at LO, QCD Wjets from MG parton-pythia matching (MLM)
- VBF signal tends to have larger M_{jj} and $|\Delta\eta_{jj}|$
- DATA-driven QCD Wjets normalization from BDT control region
- Signal extracted from unbinned maximum likelihood fit to Mjj

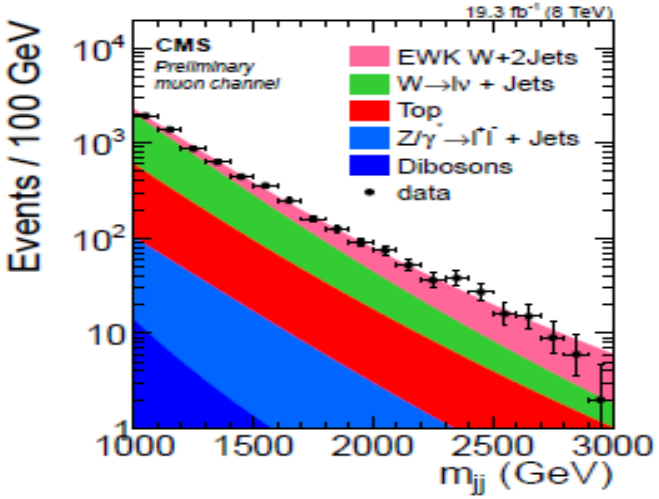
  Floating QCD Wjets shape

$$\mathcal{F} = \frac{1.0}{m_{jj}^{a_0 + a_1 log(m_{jj}/8000)}}$$

- Diff w/o Interference as syst.







- Agreement with SM prediction, significance around 4σ

combined μjj and ejj 0.42 ± 0.04 (stat.) ± 0.09 (syst.) ± 0.01 (lumi.) pb

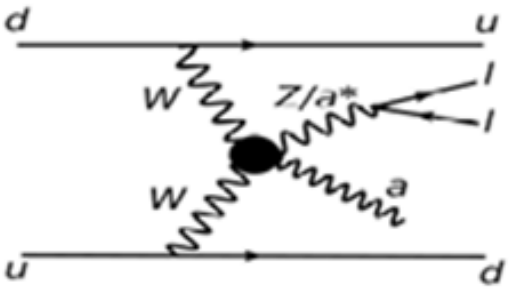
in agreement with the SM prediction of 0.50 ± 0.02(Scale) ± 0.02(PDF) pb

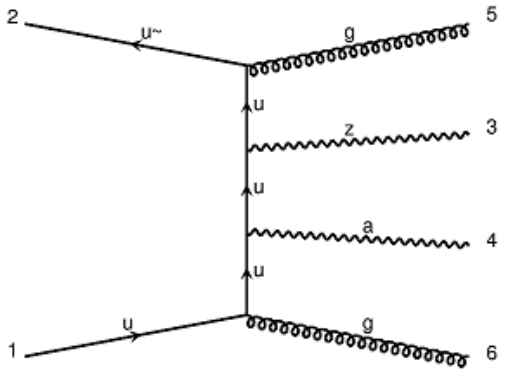
With $p_T^{jet1} > 60$ GeV $p_T^{jet2} > 50$ GeV $|\eta^{jet}| < 4.7$ $m_{jj} > 1$ TeV

VBS Zγjj

Feng Wangdong Zhang, Zhaoru Zhang as Analysis Contacts

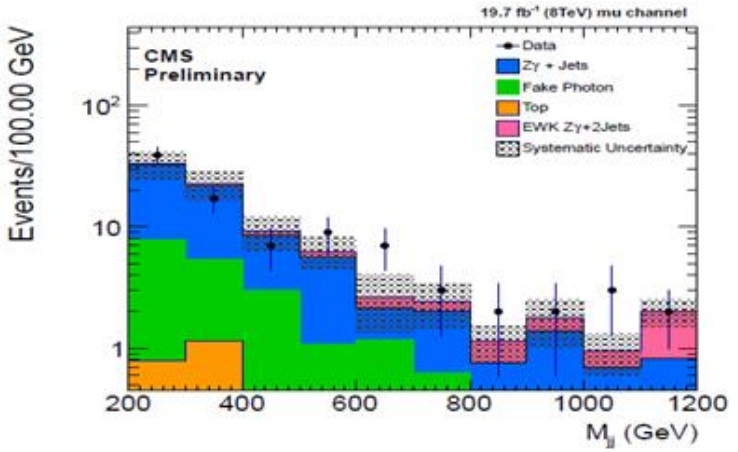
- QCD Zγjj
- Jet/Electron Fake Photon
- Jet fake Electron:
- Signal Extracted from binnec
  Mjj fit [400-800], [800-] GeV

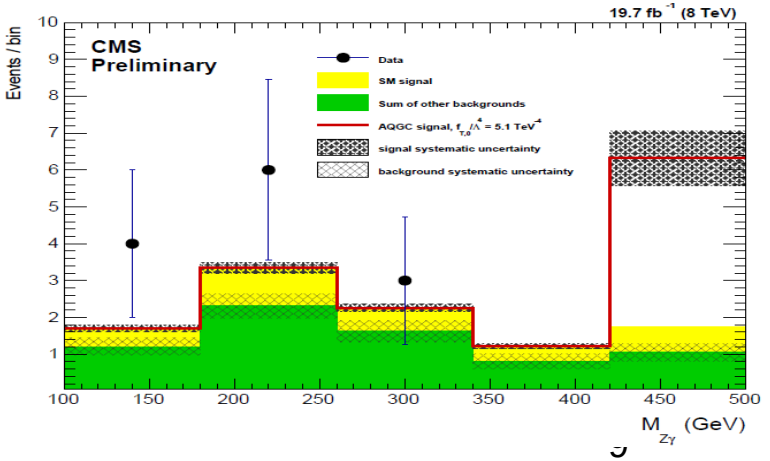




Two Opposite Sign Leptons
with PT>20GeV
Photon PT>25GeV
Two Jets with PT>30GeV
70GeV<mll<110GeV

CMS-PAS-SMP-14-018





First Evidence!

fiducial cross section of EWK

$$1.86^{+0.89}_{-0.75}(stat.)^{+0.41}_{-0.27}(sys.) \pm 0.05(lumi.)\ \text{fb},$$

MadGraph $1.26 \pm 0.11(scale) \pm 0.05(PDF)$ fb

aQGC limit et based on $M_{Z\gamma}$

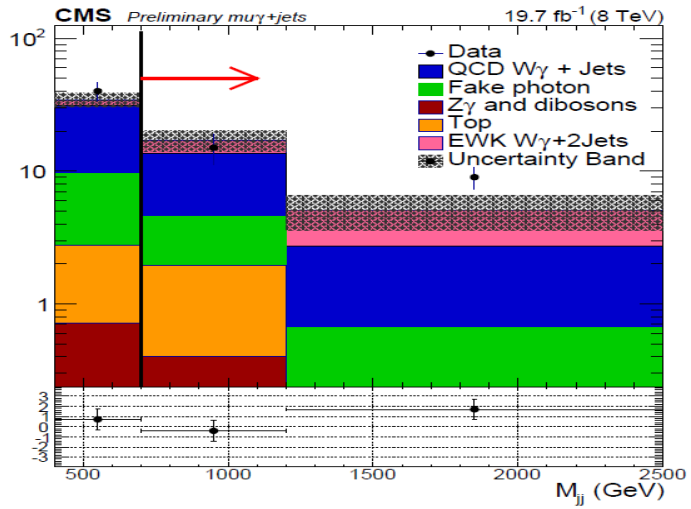
VBS Wγjj

Daneng Yang and Analysis Contact

CMS-PAS-SMP-14-011

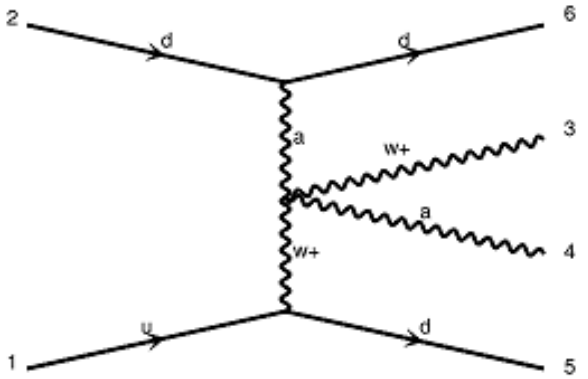
- **Main Bkg from Data-Driven**
  - QCD $W\gamma jj$: MC Shape + DD Normalization
  - Jet/Electron Fake Photon
  - Jet fake Electron
- **Dominate Systematics:**
  - JES & JER
  - Jet Fake Photon
  - QCD $W\gamma jj$ prediction

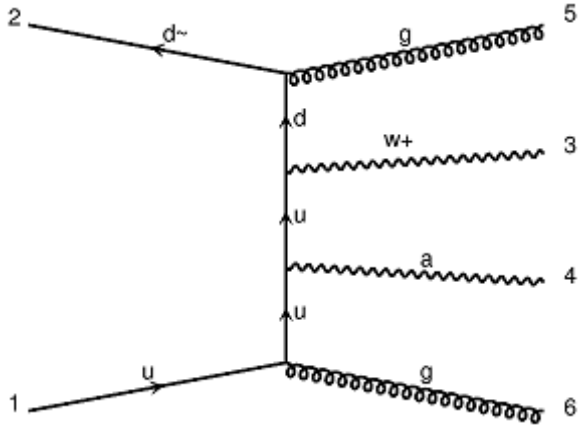
- **Signal Extracted from binned Mjj fit**



Signal: larger M_{jj} and $|\Delta\eta_{jj}|$

- $|y_{W\gamma} - (y_{j1} + y_{j2})/2.0| < 0.6$,
- $|\Delta\phi_{W\gamma,dijet}| > 2.6$,
- $M_{jj} > 700$ GeV,
- $|\Delta\eta(j1, j2)| > 2.4$.





Items	EWK measurement
$\hat{\mu}$	$1.78^{+0.99}_{-0.76}$
EWK fraction (search region)	100%
EWK fraction (fiducial region)	100%
Observed (Expected) significance	2.67(1.52) σ
Theory cross section (fb)	6.1 ± 1.2 (scale) ± 0.2 (PDF)
Measured cross section (fb)	10.8 ± 4.1 (stat.) ± 3.4 (syst.) ± 0.3 (lumi.)

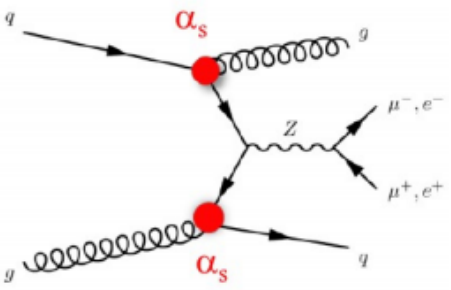
aQGC limit set based on p_T^W

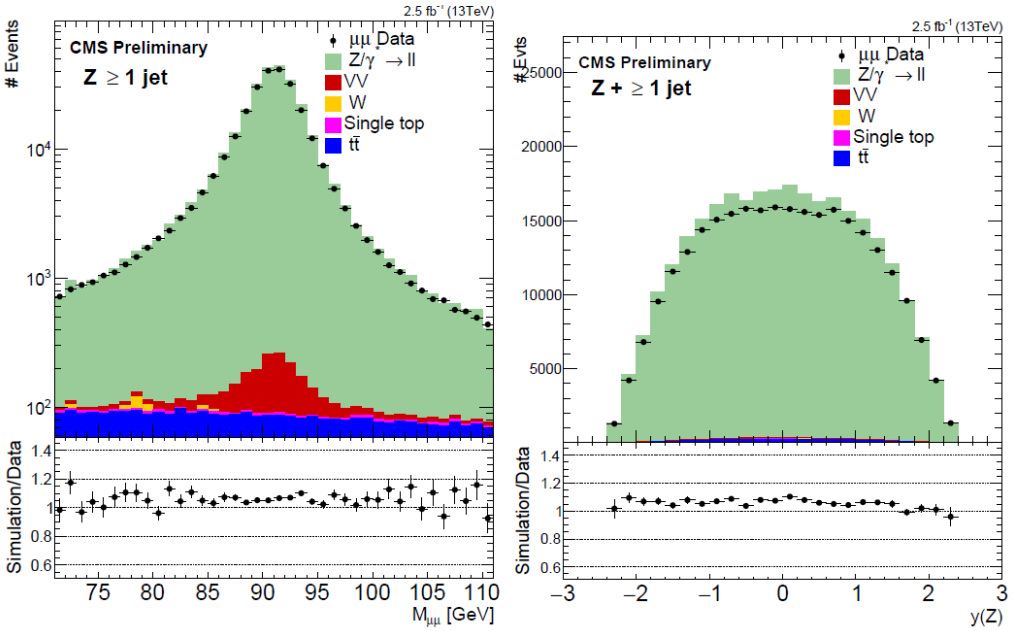
V+Jets

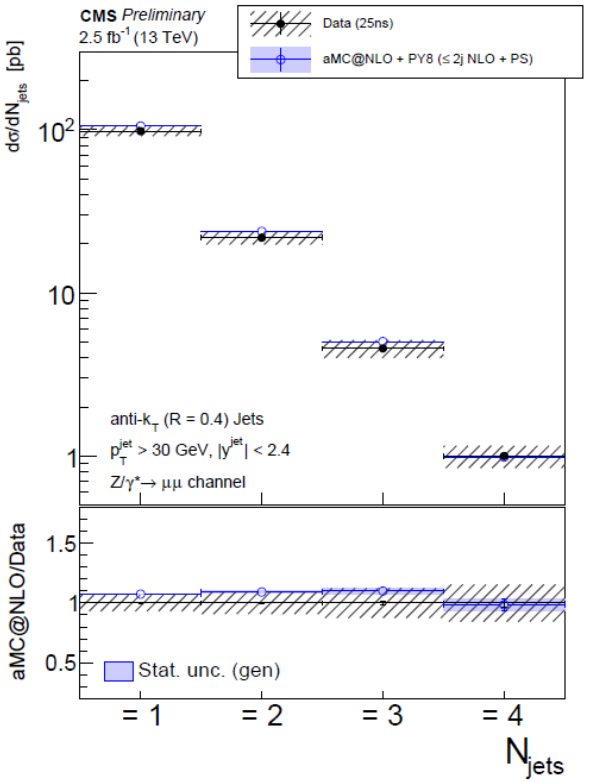
Feng Wangdong Zhang Preapproval

CMS-PAS-SMP-15-010
CMS-PAS-SMP-16-005

- Dominated by QCD interaction → abundant production
- Measurement is test of perturbative QCD (pQCD)
- Sensitive to PDFs models
- Large background to BSM and Higgs searches

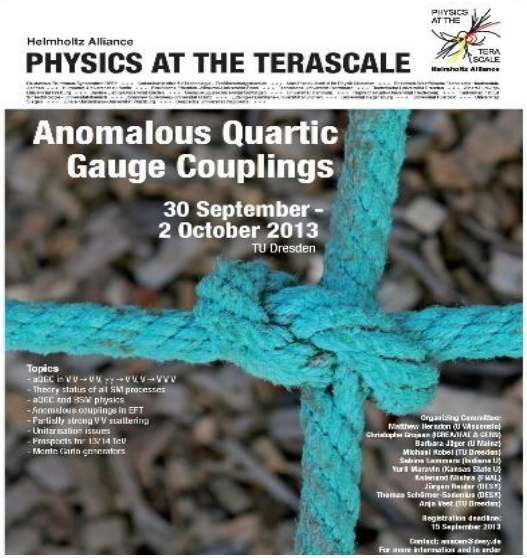


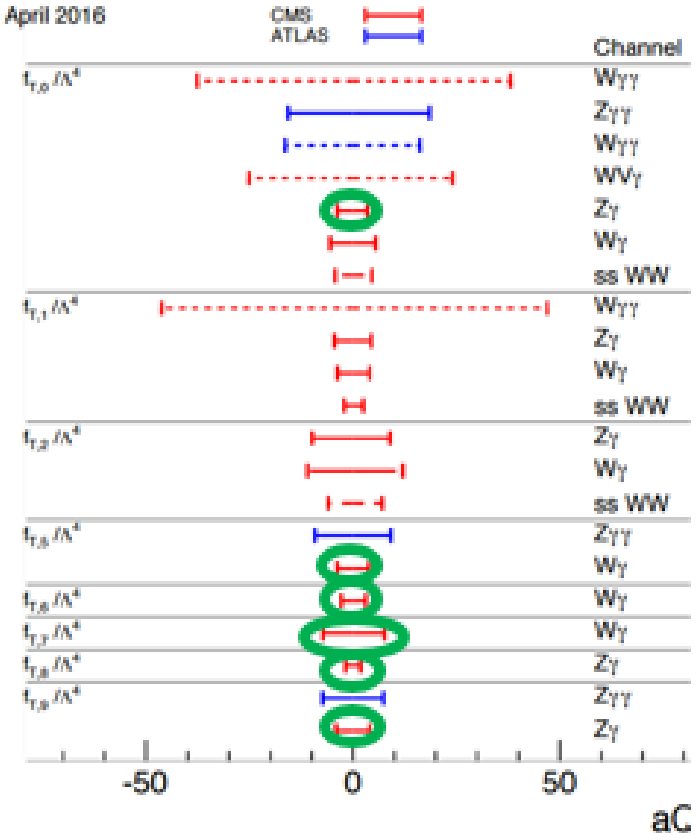


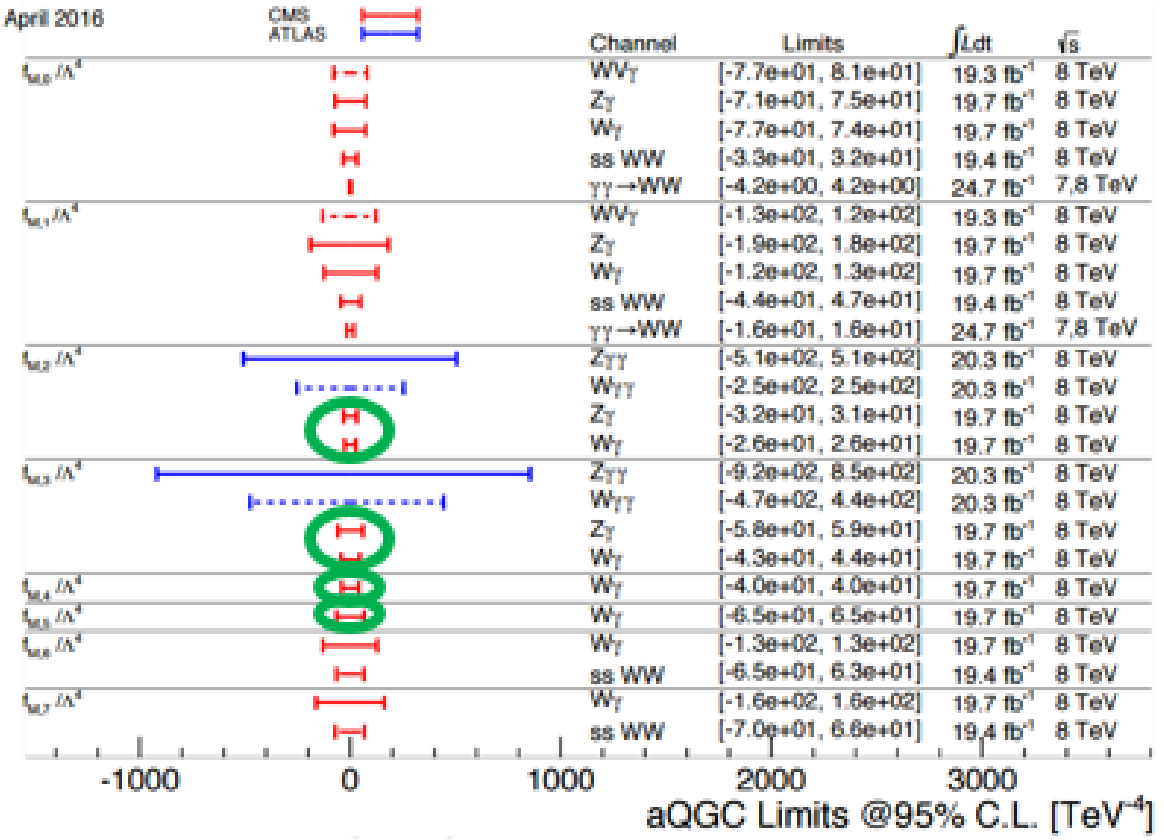


Most stringent limits on aQGC

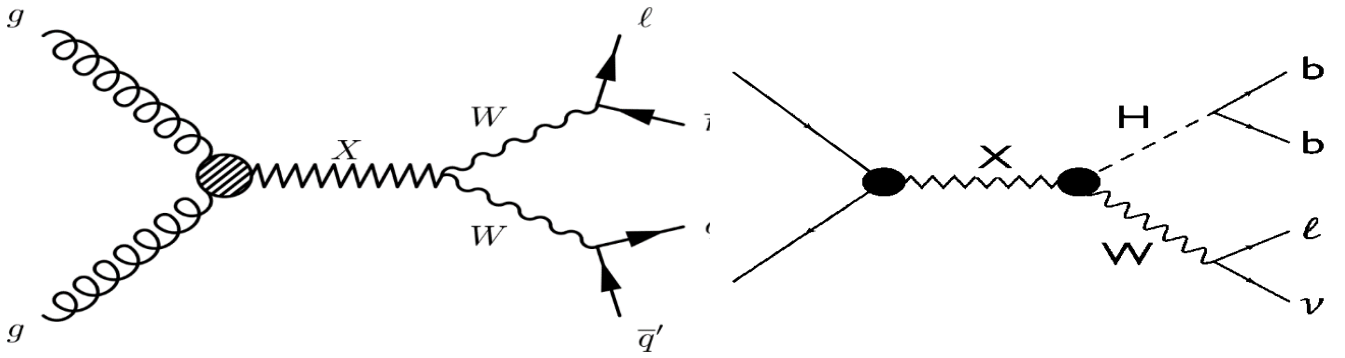
Made By PKU



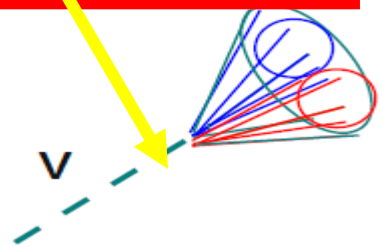




PKU WW/WH Resonance Search: 7 Analyses



Boosted V/H-Jet Technique:
Merged Fat Jet



Run1 20fb-1

CMS W-tagging: JHEP 12(2014)017
Zijun Xu, Wei Zou

Heavy Higgs: JHEP 1510 (2015) 144
Zijun Xu, Approval

EXO-WW: JHEP08(2014)174 ;
Shuai Liu, Pre-approval

EXO-WH: EPJC76 (2016) 237
Mengmeng Wang, Pre-approval
Qiang Li, Analysis Contact

Run2 2015 2.2fb-1

EXO-15-002 0.8-4TeV
Qun Wang, Approval

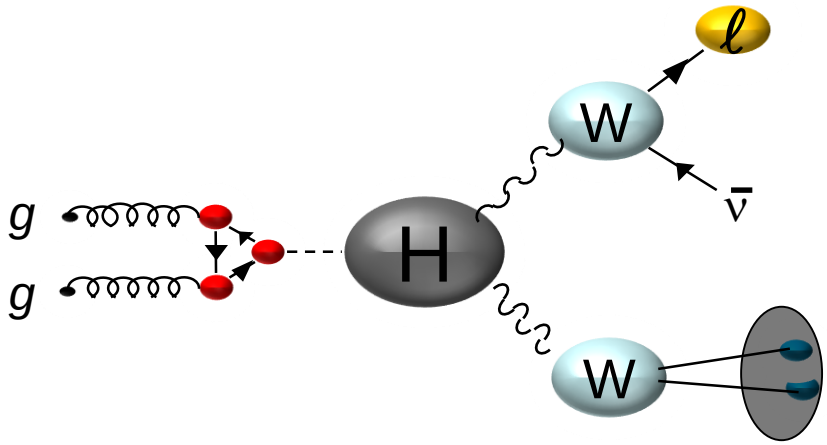
B2G-16-004 0.6-1TeV
Zijun Xu, Pre-Approval

Run2 2016 → ICHEP2016

B2G-16-020 0.6-4.5TeV
Huang Huang, Pre-Approval
Zijun Xu, Approval
Huang Huang , Analysis Contact

H→ WW → lνjj & lνj

JHEP 10 (2015) 144



- **"resolved" & "merged" channels**

  At high Higgs mass, two jets from W decay can merge to form large-R jet

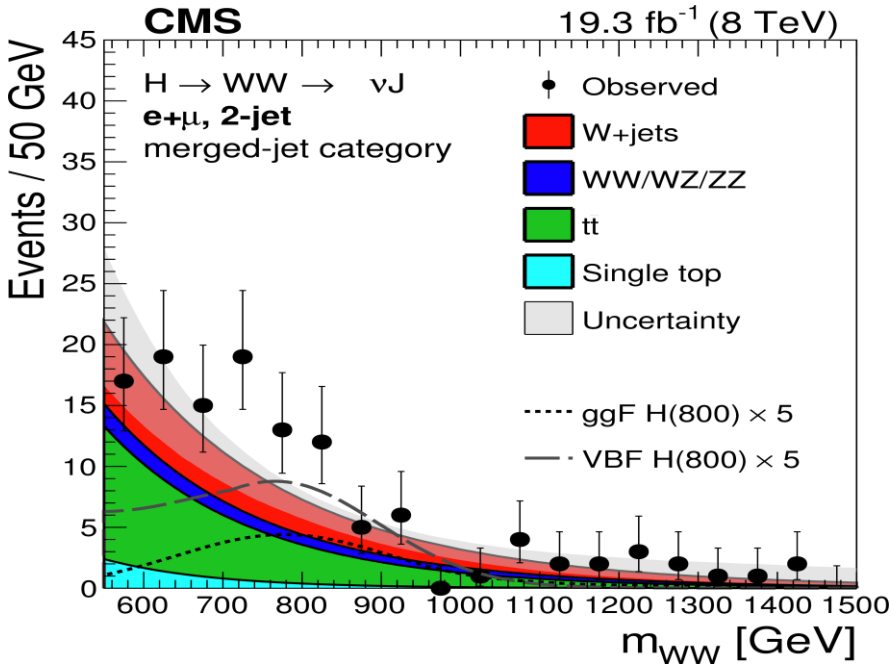
- **Selections**

  One lepton (e or μ), MET

  veto events with extr lepton or b-tag jets

  M_{jj} or M_j consistent with W mass

  Separate events into VBF or non-VBF tagged



- **Dominant background:**

W+jets:

Normalization from M_j sideband

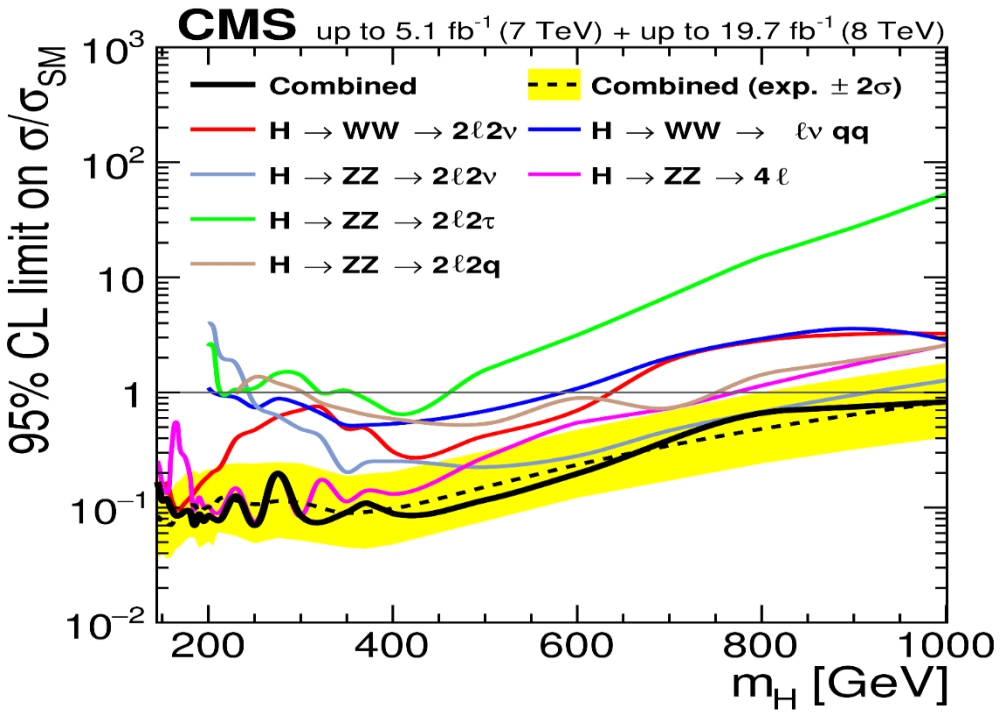
Shape from sideband data extrapolated to signal region

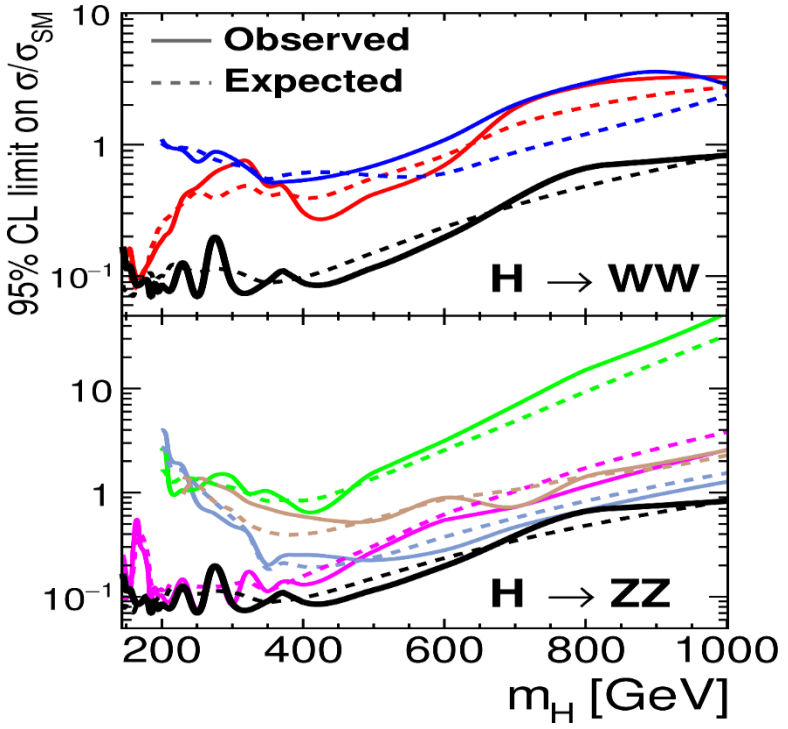
Top & diboson :

Corrected through TTbar control region

H→ WW → lνjj & lνj

JHEP 1510 (2015) 144





PKU contributed to development and application of W-tagging method in heavy Higgs searches;

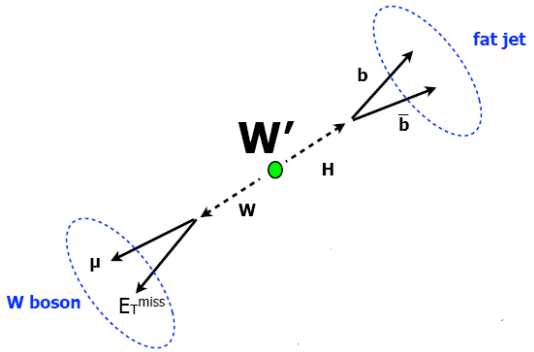
Zijun Xu presented the approval talk for H→ WW → lνj

CMS Exotica WH

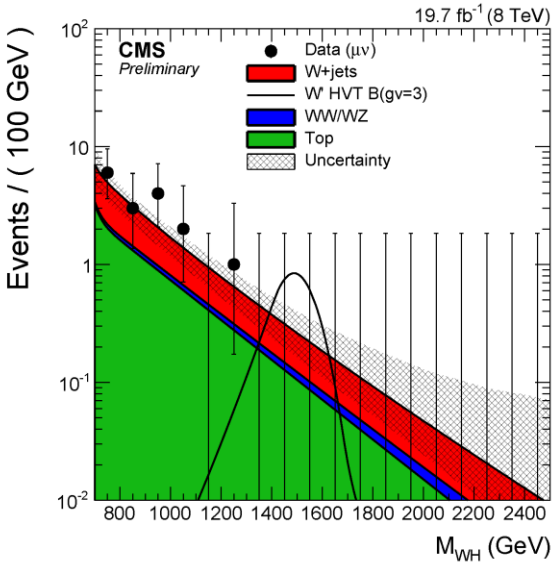
Qiang Li as analysis Contact;
Mengmeng Wang pre-approval

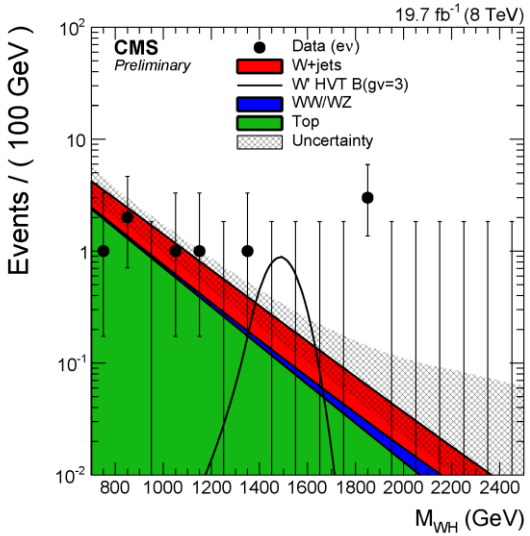
EPJC76 (2016) 237

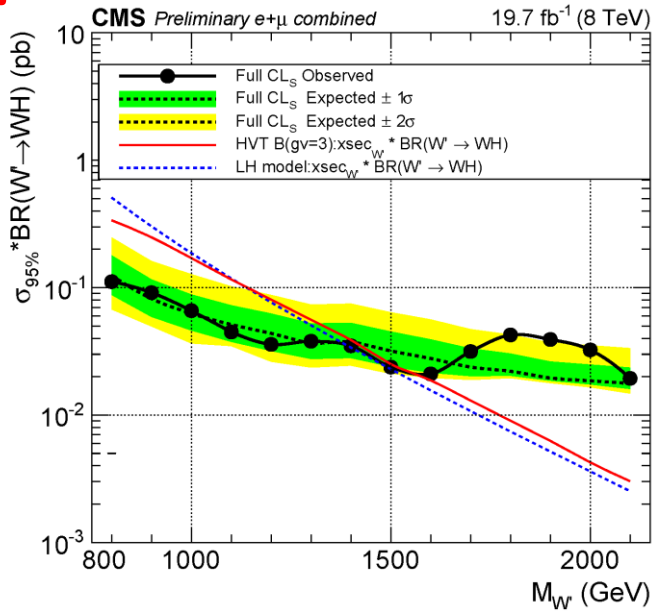
- VV, VH, HH resonance motivated in many nice models
  - Extra Dimension, Composite Higgs, Little Higgs
  - Spin-0 Radion/Higgs; Spin-1 W'/Z'; Spin-2 Gravitons
- Semi-leptonic channels: High rates, reconstructable spectrum
  - Huge QCD Wjets bkg, data-driven estimation
- V/H highly boosted: Jet substructure and Subjet b-tagging
  - TTbar control Region, Scale Factor



1.9σ global significance @1.8TeV
Note favored by Run2





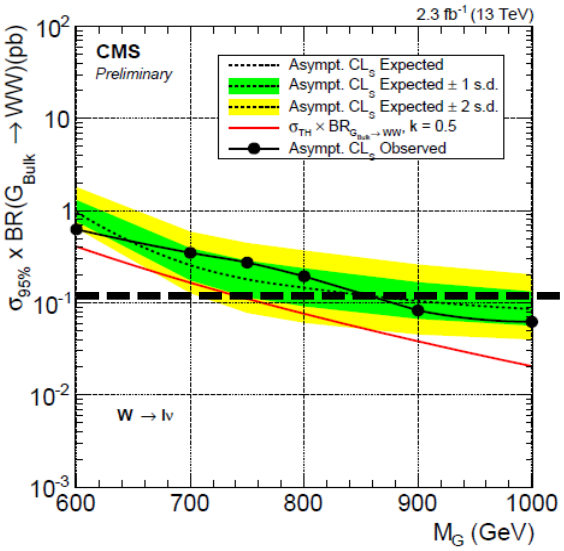


CMS Exotica WW 2015

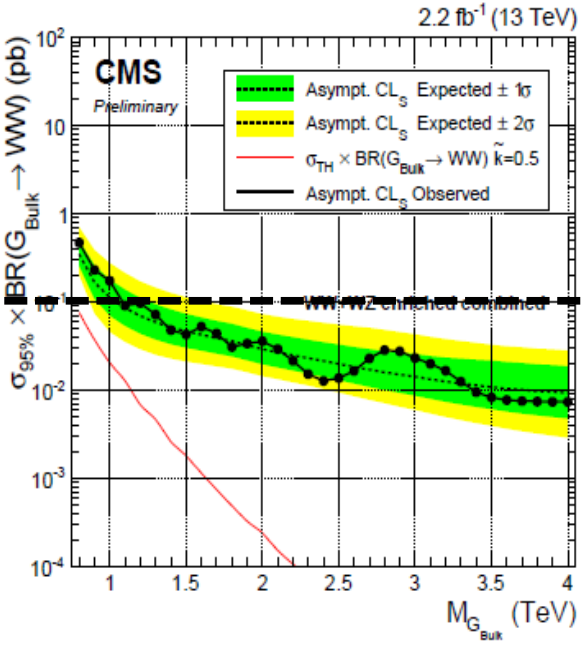
CMS-PAS-EXO-15-002
CMS-PAS-B2G-16-004

Comparison Run2 CMS (low, high) and ATLAS

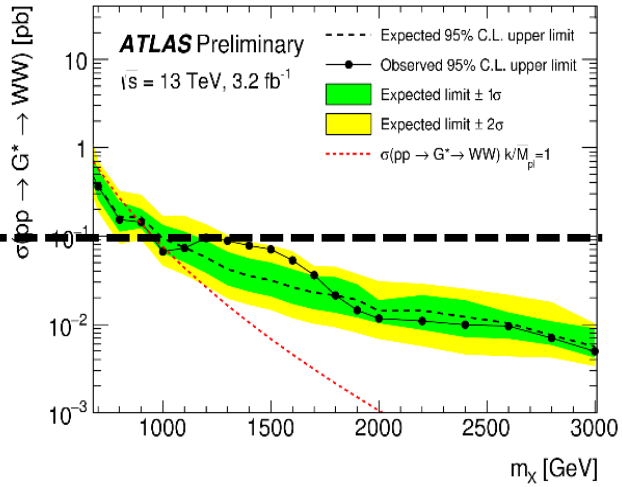
Low mass extension
B2G-16-004



Main analysis
EXO-15-002



ATLAS VW
CONF-2015-075

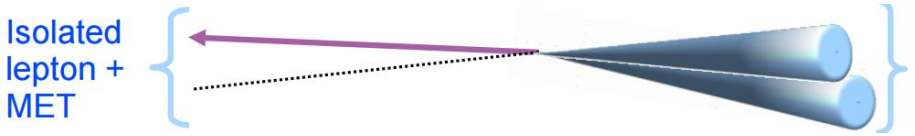


Zijun Xu, Pre-Approval

Qun Wang, Approval

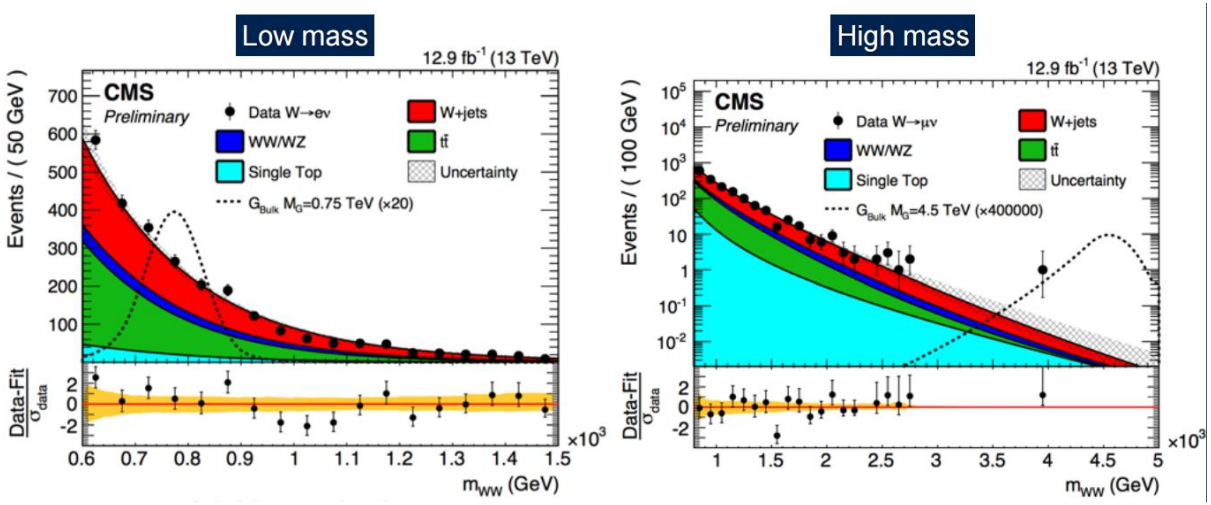
CMS Exotica WW 2016

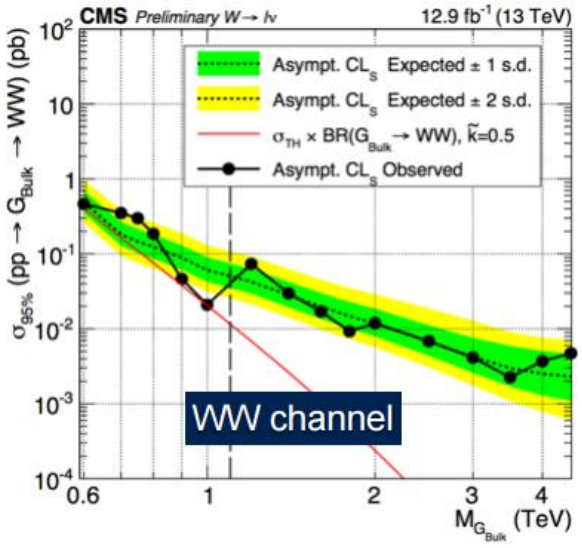
CMS-PAS-B2G-16-020

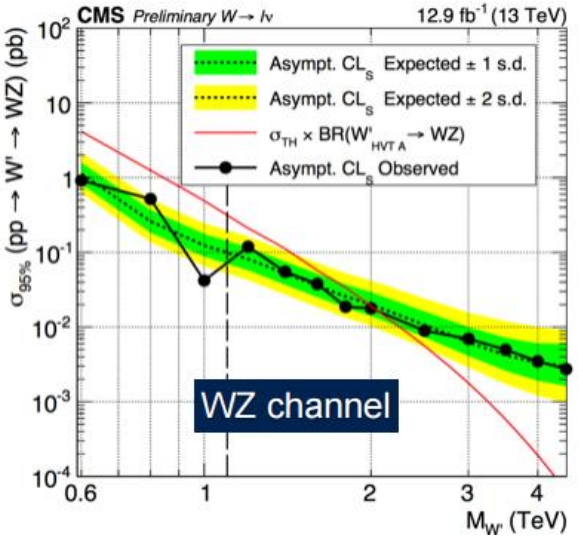


Categorization in e,mu, low and high mass, W and Z regions

Extrapolate jet mass sidebands using MC shapes







Huang Huang as Analysis Contact

Huang Preapproval

Zijun Xu Approval

对FCNC过程B → K(*)μ⁺ μ⁻的测量和研究(PKU)

$B^+ \to K^+ \mu^+\mu^-$ 前后不对称测量
$B^+ \to K^{*+} \mu^+\mu^-$ 前后不对称测量

CMS预审通过

CMS-PAS-BPH-15-001
CMS-PAS-BPH-15-009

物理目标：通过对角分布参数进行精确测量，检验标准模型，寻找FCNC过程的新物理.

K^+分析由北大组提出并主导研究
K^{*+}分析与印度/台湾组合作

参与人：陈耿/王大勇(K^+联系人)

王大勇 April/14/2015做 K^+ Pre-Approval报告

$B^0 \to K^{*0}\mu^+\mu^-$ 角度分析

Unblinded for approval

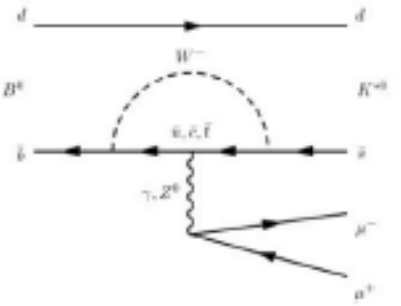
CMS-PAS-BPH-15-008

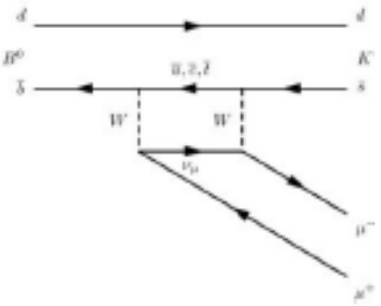
物理目标：通过角度分析，提前形状因子无关的参数，检验标准模型，独立验证或否定LHCb 之前观察到的 3.7/3.4sigma 偏差.

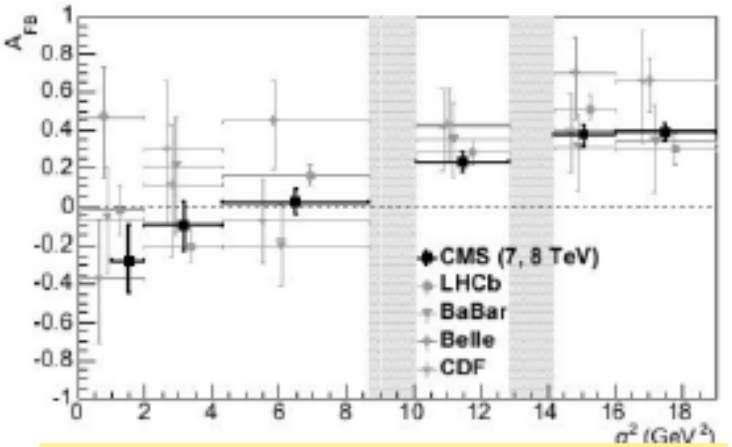
该分析由北大组为主力进行研究

参与人：李林蔚/王大勇
与Milano, Padova分工合作

李林蔚 May/23/2016做 Pre-Approval报告







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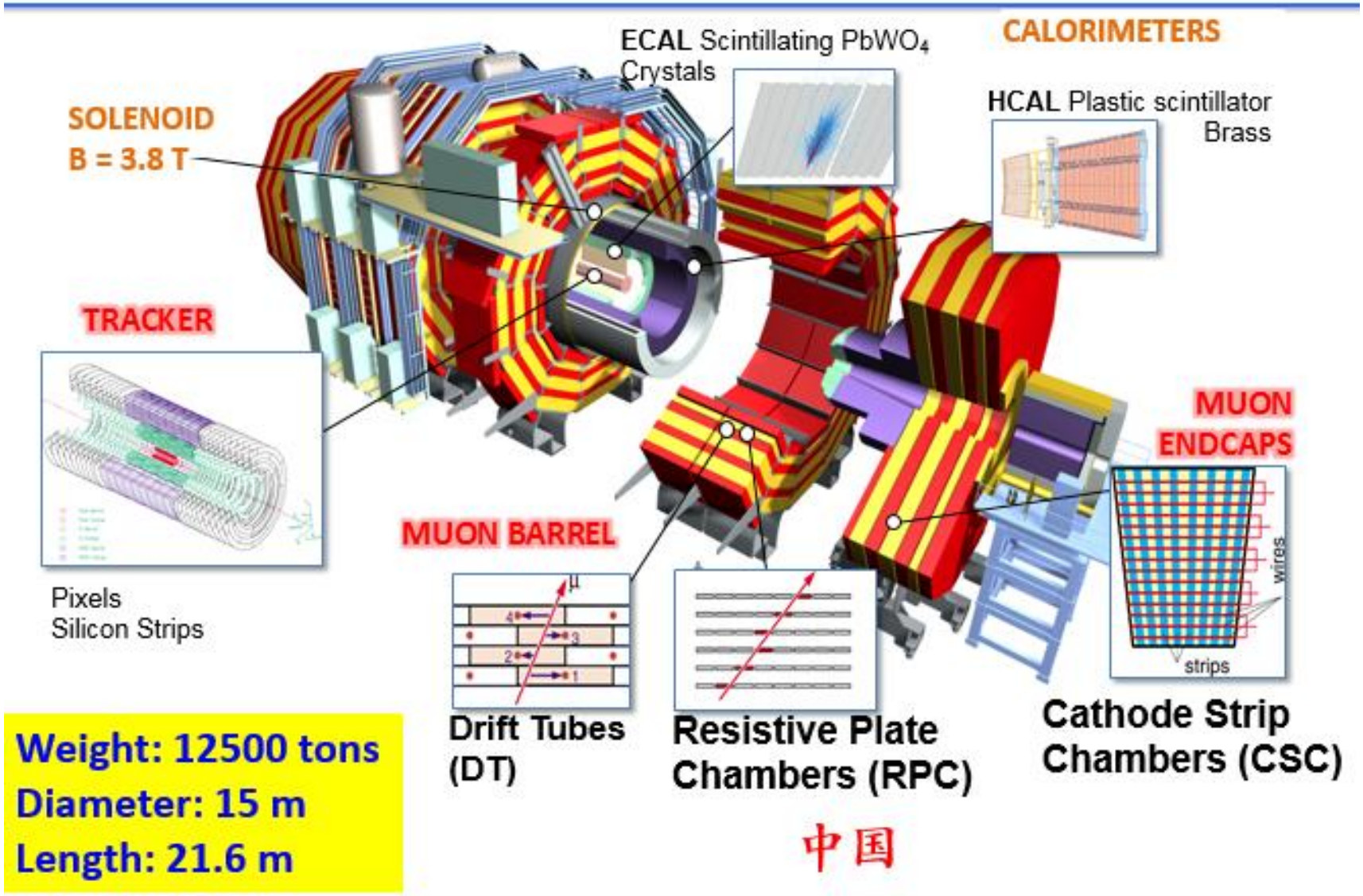
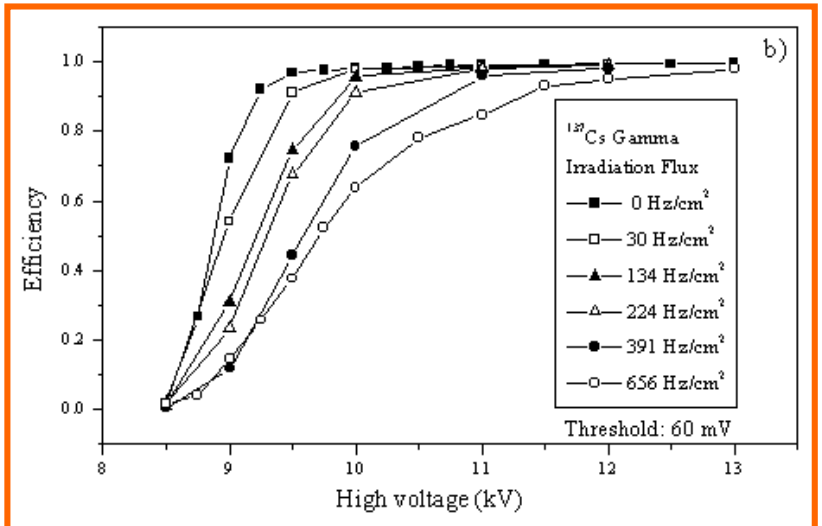
Dayong Wang, Linwei Li, Geng Chen

CMS Detector



PKU has been contributing on RPC since 1998

1999-2002 PKU made RPC passed the beam test at CERN



LHC speeds towards collisions

***AFP*, 23 November**: Atom-smasher aims for maximum power in 2010

LHC and CMS. If you see any other reso
you think would be of interest to other C
readers, please send them to:
cmstimes@cern.ch

People

The Peking University (China) in CMS

Representatives of PKU CMS at CERN

The Peking University (PKU) group has been a member of the CMS collaboration since 1996. Currently consisting of 3 professors, 3 engineers and technicians and about 10 PhD students, the group has been heavily involved in both hardware and physics analysis. As part of the RPC project, the group shares the work on the R&D, assembly and testing, installation and commissioning of the RPC detector for the CMS Muon Trigger System.

The RPC performance has been studied with cosmic ray data and the RPC seed reconstruction has also been developed by the group. In the CMS physics programme, the group's interests include the study of the production mechanism and polarization of heavy flavor quarkonium J/ψ and Upsilon in the high-pT region, a feasibility study on the search for a SM Higgs Bosons in a close collaboration with the Fermi Lab and INFN, as well as Top Physics, forward Physics and b Physics.

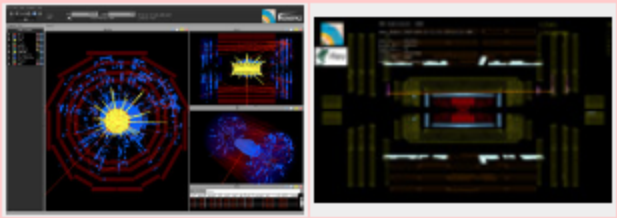
LHC Re-start / First LHC Collisions

The LHC re-started in earnest on a foggy Friday 20th November 2009.

The first step was to pass beam 1 (the clockwise one) around the full ring, proceeding systematically sector-by-sector.

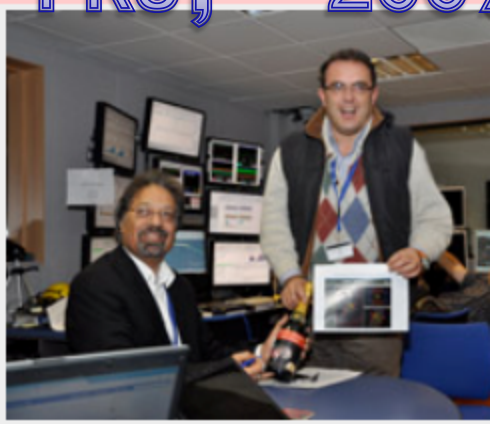
At 19:19 the beam reached CMS producing "splash" events of muons from the beam striking the collimators. These were seen by the calorimeters and muon detectors; the tracker was switched off. By 22:10 the LHC operators had "captured" beam 1 with the Radio Frequency (RF) system and circulated it for several minutes - the beam was under control. They then switched to [illegible] and circulated beam 2 making a total by 23:55 followed by RF capture. This capturing was scheduled to take about eight hours per beam but in fact (for beam 2) took only 10 minutes, a real testament to how well understood this incredible machine is.

The successful re-start of the LHC was declared in a CERN press release (see "The LHC is back"). Splash events and then beam halo events (essentially muons accompanying the circulating proton beams) were seen by the event display programs by the teams at P5 and the CMS Centres at CERN (Meyrin) and Fermilab.



First displays from LHC running on Friday: left - a

A packed CMS Control Room at point 5 [illegible] weekend exc[illegible]



CMS Spokesperson Jim Virdee signs a champagne to commemorate the first coll in CMS, whilst Tiziano Camporesi (CMS Commissioning Coordinator) proudly sho 900 GeV collision event candida

This decision paid-off on Monday when, end of a long difficult day, the LHC circu

CMS Times Interviewed PKU, 2009

CMS Phase 2 Upgrade

端部量能器升级

高能所

端盖μ探测器升级

北京大学, GEM

GE1/1， GE2/1+ME0

端盖μ探测器升级

清华大学, 玻璃mRPC

RE3/1+RE4/1

IHEP PKU THU

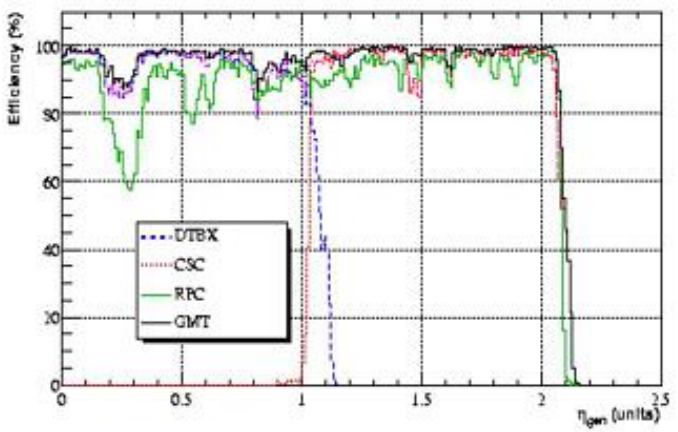
PKU joined GEM R&D for Phase 2 Upgrade

PCB, DAQ, Cosmic ray test, Beam test, Assembling,
Small/Big size mass production, Software

➢ Phase 2升级内圈GEM探测器研制

为了应对内圈高计数率、强辐射的困难，CMS内圈μ探测将采用GEM技术。北京大学2009年加入CMS-GEM组，进行了探测器研发、组装测试、束流测试分析和软件开发等工作；为Phase 2阶段升级作准备。

GE1/1、GE2/1探测器安装位置。
Installation position of the GE1/1 and GE2/1.



CMS端部触发系统由CSC和RPC探测器组成，全部完成后在所有覆盖区域达97%。
After the full RPC+CSC trigger system completed, the efficiency will reach 97% in all area.

GE1/1探测器样机在进行束流测试。 Beam test of the GE1/1 prototype .