CMS HIGHLIGHTS

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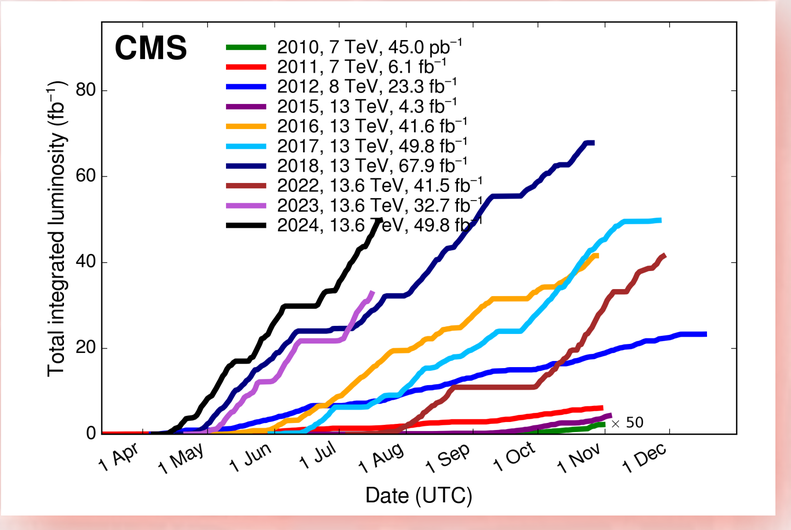
CERN

ICHEP 2024 - Prague

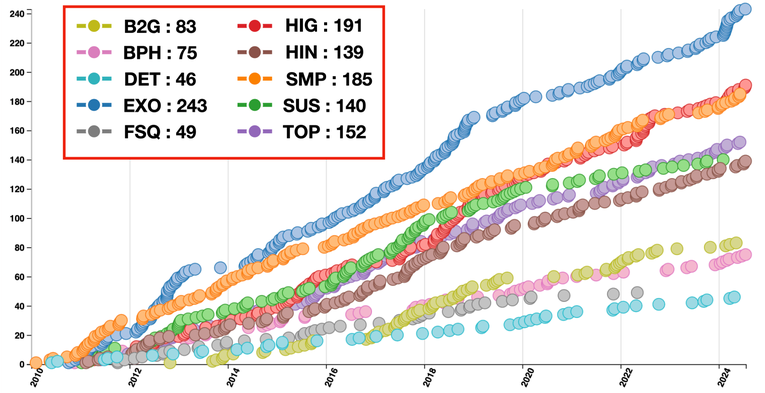
CMS mission

- CMS is many experiments at once
  - At the energy frontier: our search program at the TeV scale
  - At the intensity frontier: our Higgs and EW precision program
  - As a flavor experiment: top physics + dedicated data streams for b, c, and τ
  - As a heavy ion experiment: PbPb and pPb LHC runs
  - As a photon collider experiment: ultra-peripheral Heavy Ion collisions + proton tagging in pp runs, ...
  - As a technology driver for the entire field (reconstruction on GPUs, real-time analysis, AI applications)
- This talk will guide you through all these aspects, presenting the latest news from CMS

Integrated luminosity for various years



1305 papers submitted with Run1, Run2 and Run3 data



At the middle of our journey

- First phase of LHC program to be completed soon
  - Aiming at >300 fb^{-1} (Run2+Run3) by the end of 2025
- Working on upgrading the detector for the High-Luminosity phase
  - The target is 3000 fb^{-1} by 2041
- Meanwhile, we are pushing the detector beyond its limits
  - Recording up to 63 simultaneous collisions/event (2.5x CMS design, 45% of HL-LHC)
  - Collecting data @7 kHz (70% of HL-LHC, 7x Run2 normal operations)

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The future is NOW

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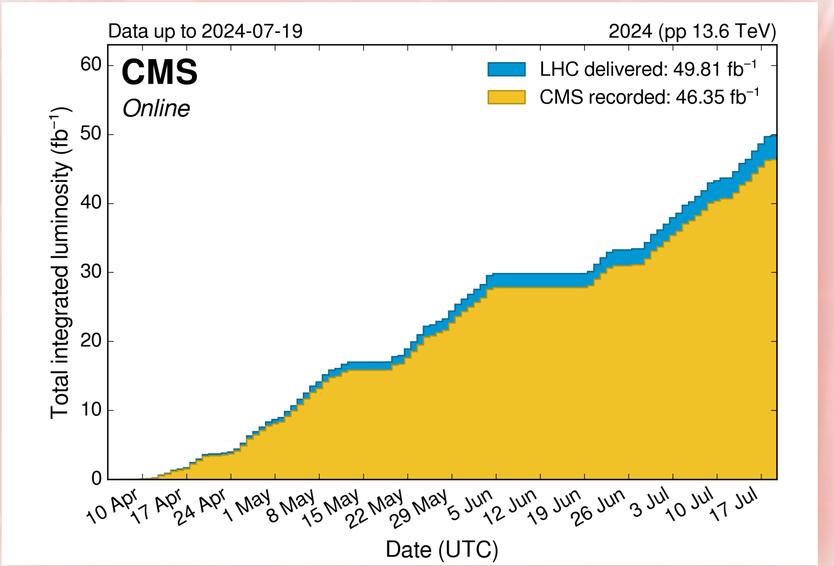
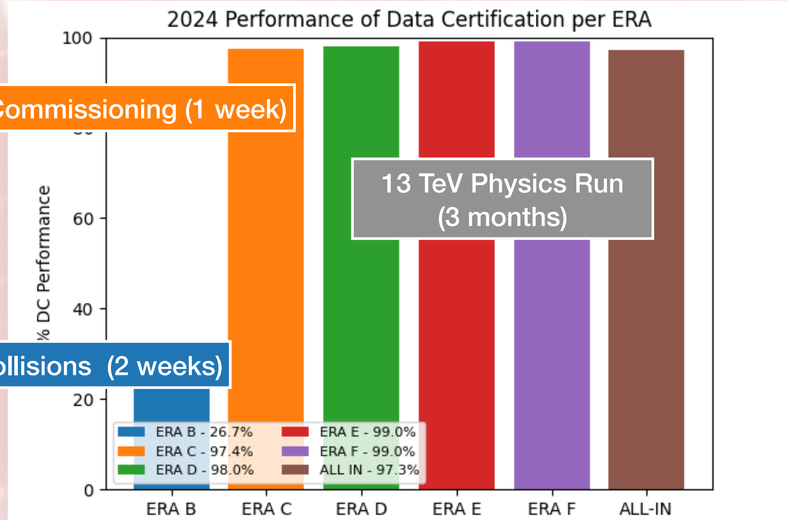
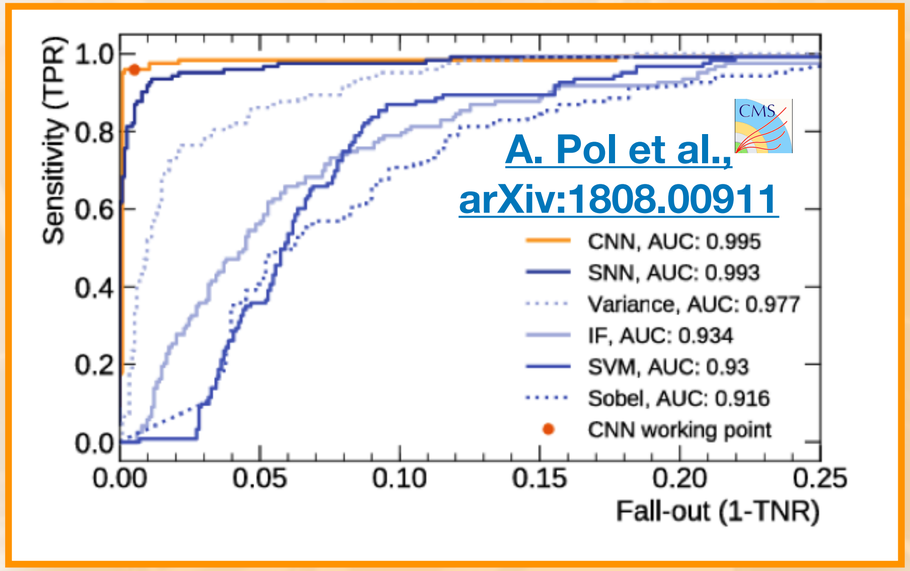
Run3 data taking

- ~63 fb^{-1} good for physics in 2022+2023, currently being analysed (~137 fb^{-1} in Run 2). Already collected ~46 fb^{-1} in 2024 (100+ fb^{-1} expected in total this year)
- Detector operated at ~90% efficiency:
  - ~93% of the delivered data are collected (same as Run2)
  - ~97% of the collected data are good for physics (~93% in Run 2)
    - Improvement largely driven by deployment of AI-based Data Quality Monitoring, which we started developing in 2017





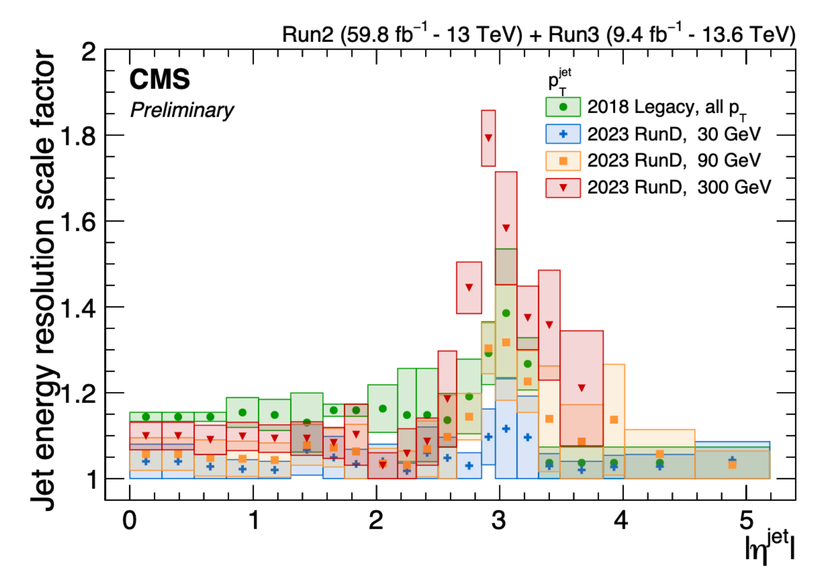


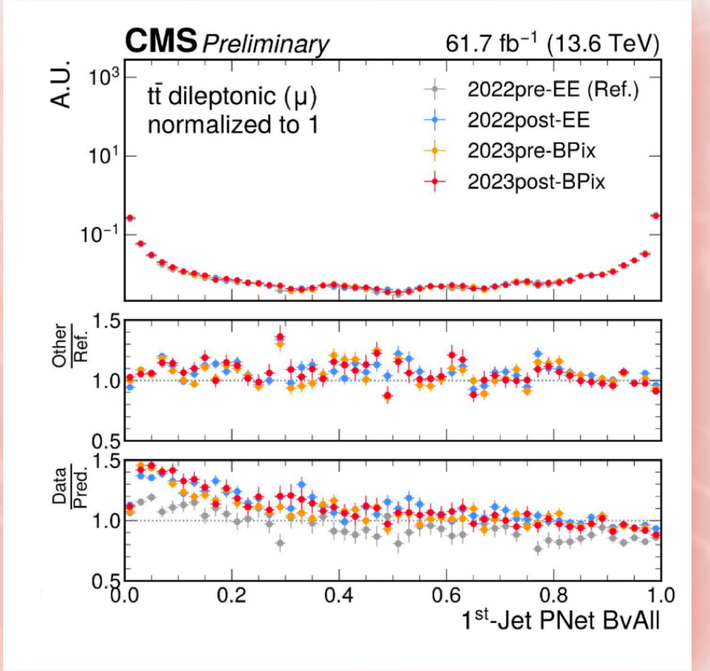
Run3 data taking

- Stable physics performance during data taking
- High quality prompt calibration & reconstruction → (new with Run3) no need for expensive end-of-year re-reco for most of the data

CMS-DP-2024-039

Jet resolution comparable to "legacy"2018 reconstruction



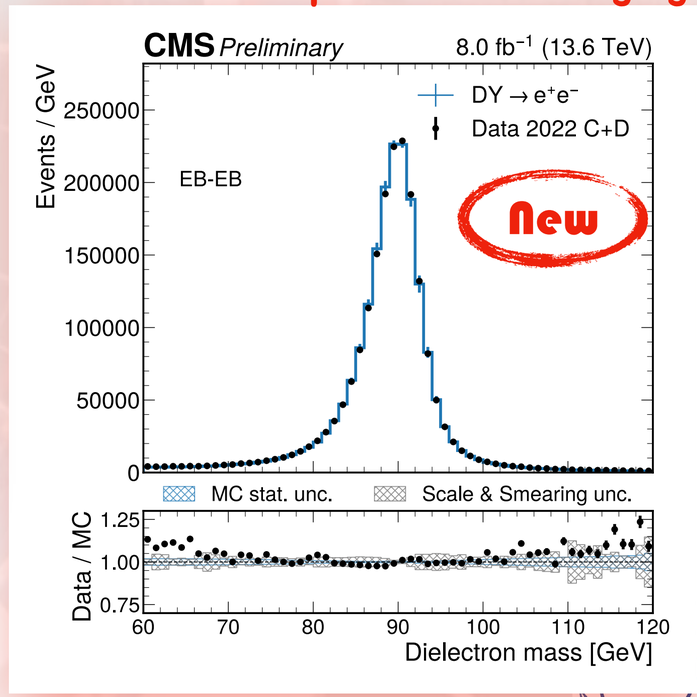


Advanced AI algorithms stable across running periods

CMS-DP-2024-024

CMS-PAS-HIG-23-014

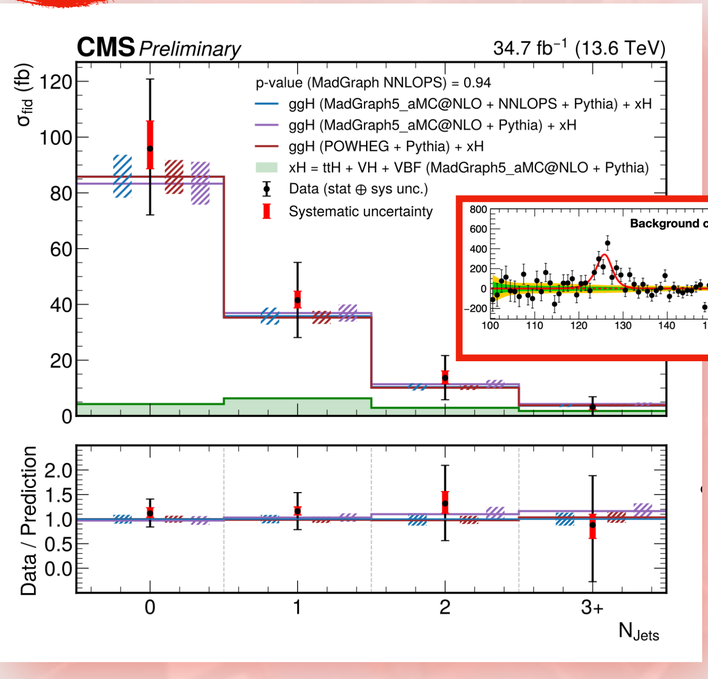
$Z \to ee$ (and $H \to \gamma\gamma$) resolution as good as in Run2, despite detector aging



Physics with Run3 data

- Published already several Run3 results (Top, EW, searches)
- New cross section measurements @13.6 TeV for Higgs and EW processes

New **CMS-PAS-HIG-23-014**

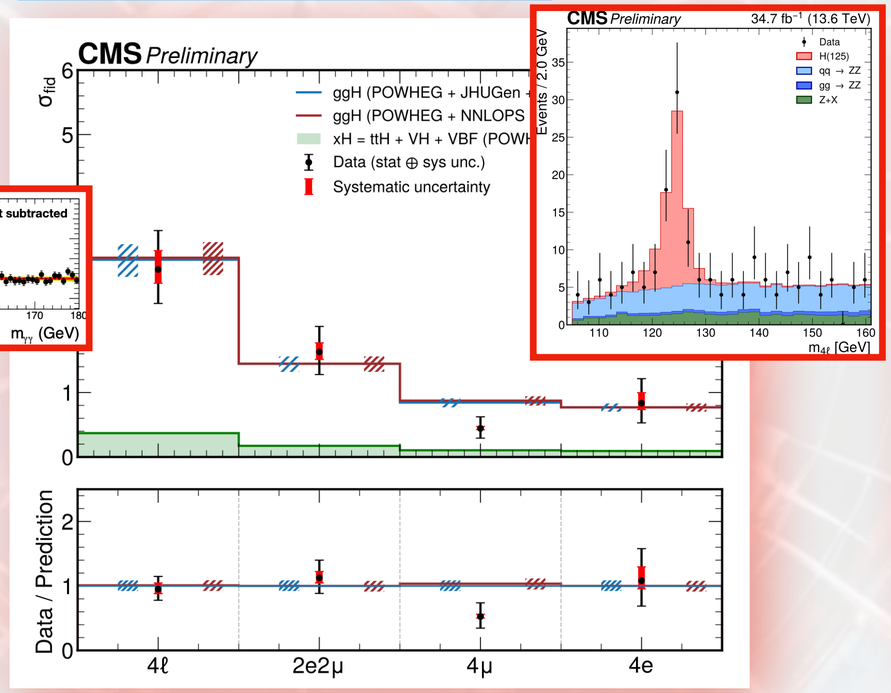


Inclusive and differential

H(γγ) cross section

$\sigma_{fid} = 78 \pm 11$ (stat) ± 6 (sys) fb

CMS-PAS-HIG-24-013 New

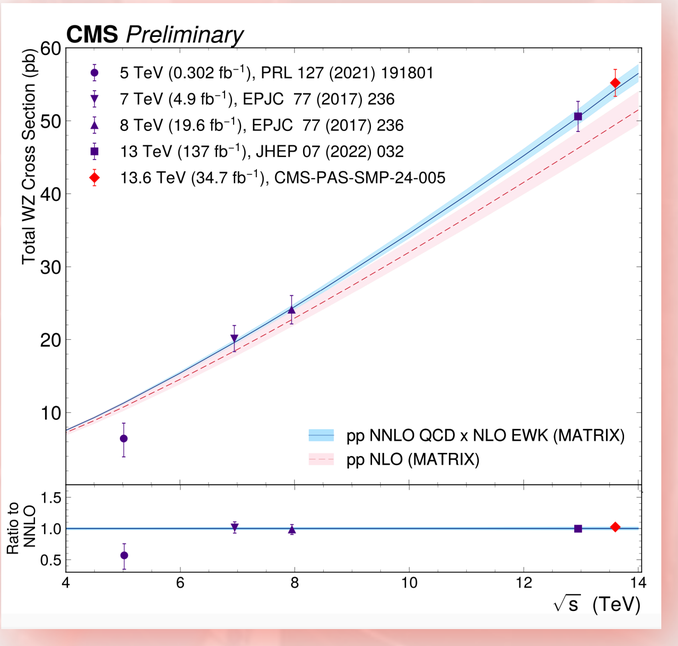


Inclusive and differential

H(ZZ) cross section

$\sigma_{fid} = 2.94^{+0.53}_{-0.49}$ (stat)$^{+0.29}_{-0.22}$ (sys) fb

CMS-PAS-SMP-24-005 New



Inclusive WZ cross section

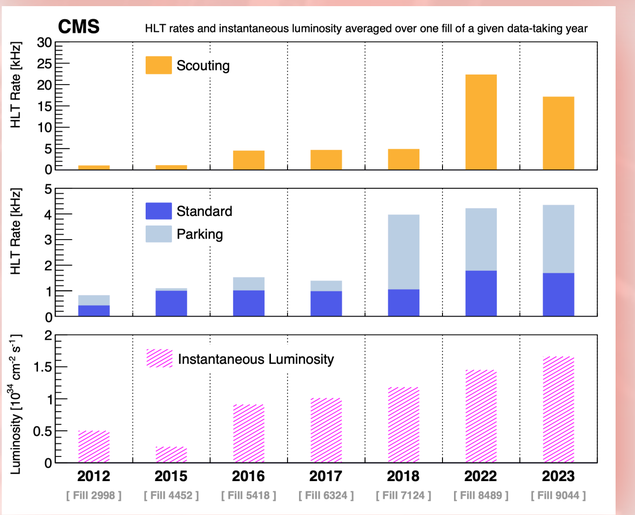
$\sigma_{WZ} = 55.4 \pm 1.2$ (stat) ± 1.2 (sys)

± 0.8 (lumi) ± 0.8 (theo) fb

Rethinking Data Taking Strategy

- LHC high-intensity challenge: retain sensitivity to high rate processes (e.g., low p_T) w/o compromising high-p_T core program. Two solutions:
  - (Since 2011) Scouting Stream to work around trigger constraints: store 10 kB of HLT reco objets rather than the full RAW event (~1 MB)
  - (Since 2012) Parking Stream to work around computing constraints: store extra data on tape and reco them when extra computing resources are available
- For Run3, we pushed this effort to maximum capacity
  - Scouting now covers ~20 kHz out of ~100 kHz of incoming rate (at maximum of available online CPU power)
  - Promoted Parking program to default (not just last-year-of-run effort)
- Big benefits to our core physics program (Higgs physics, searches, etc.) and beyond-core areas (e.g., flavor)

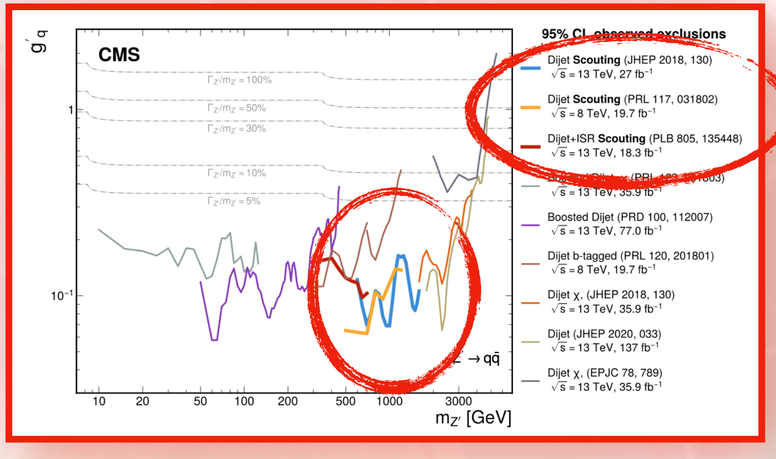
CMS-EXO-23-007

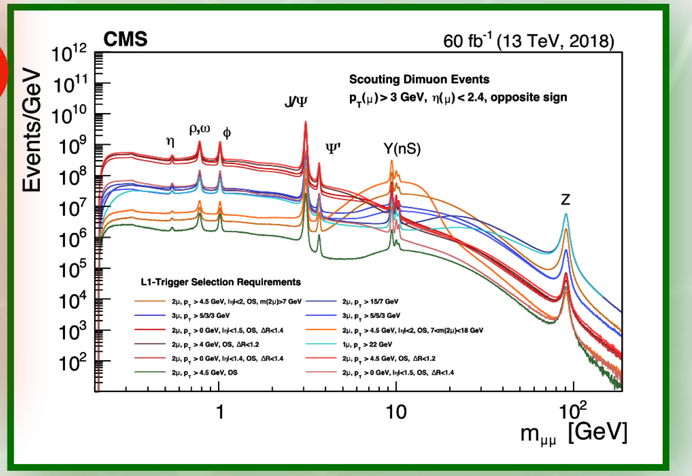


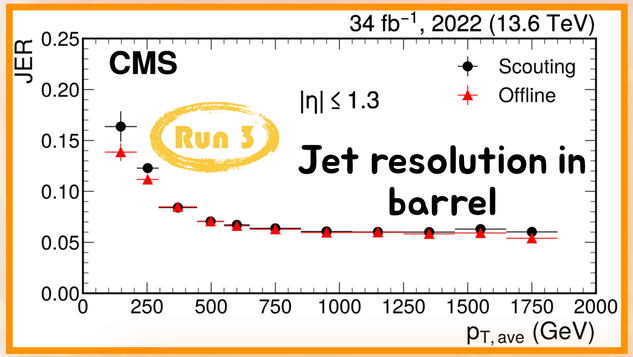
Data Scouting

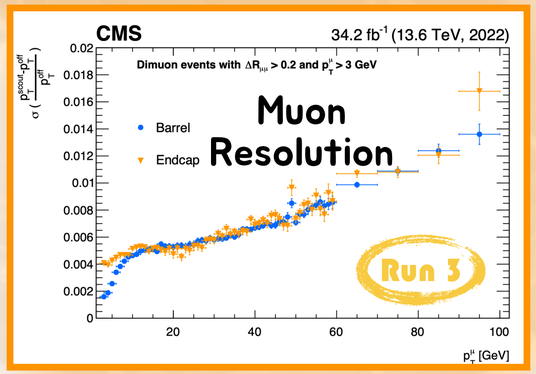
CMS-EXO-23-007

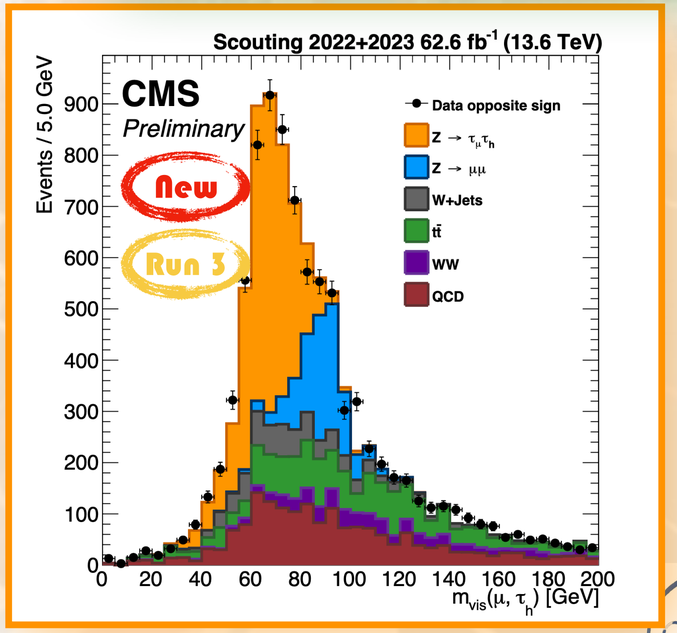
- Scouting introduced to probe light resonances (dijet in Run1 + muons in Run2)
- Generalized to all objets in Run3 (photons,electrons, taus, hadrons)
  - Reached ~ offline-like resolution with excellent HLT calibration & reconstruction
  - It wll extend our physics reach in the 1-100 GeV region (light Z', Heavy Neutral Leptons, long-lived light particles, ...)





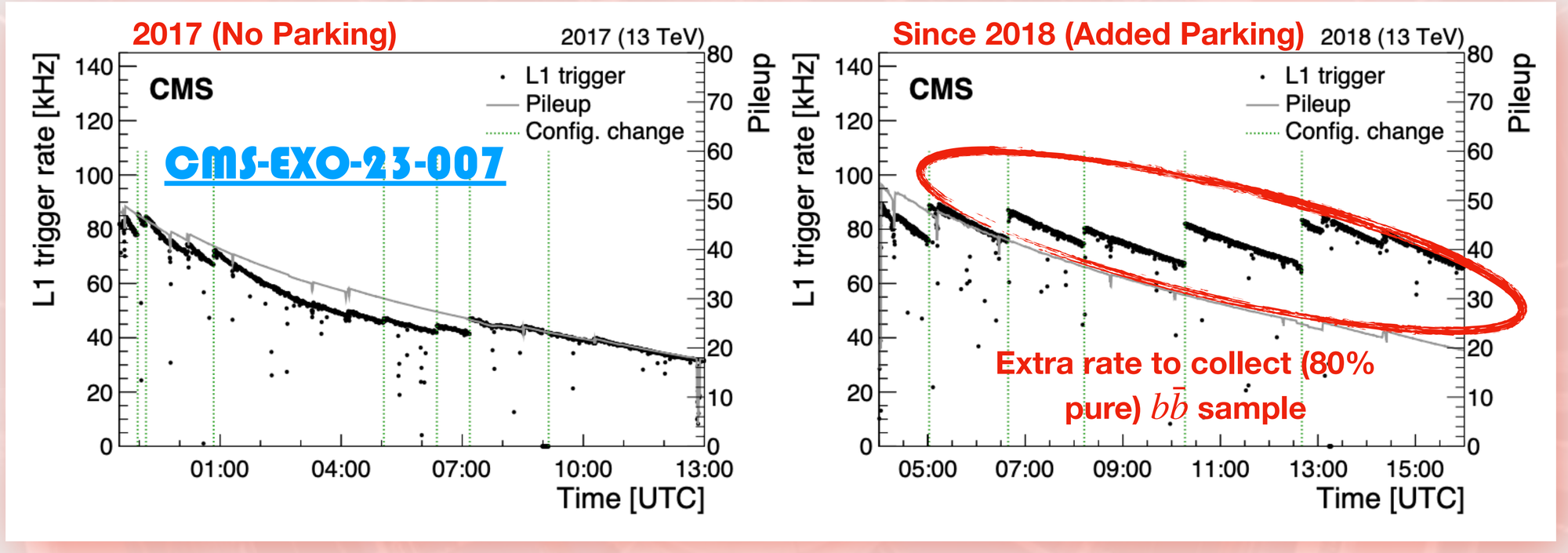






CMS NOTE-2024/006

Rethinking Data Taking Strategy

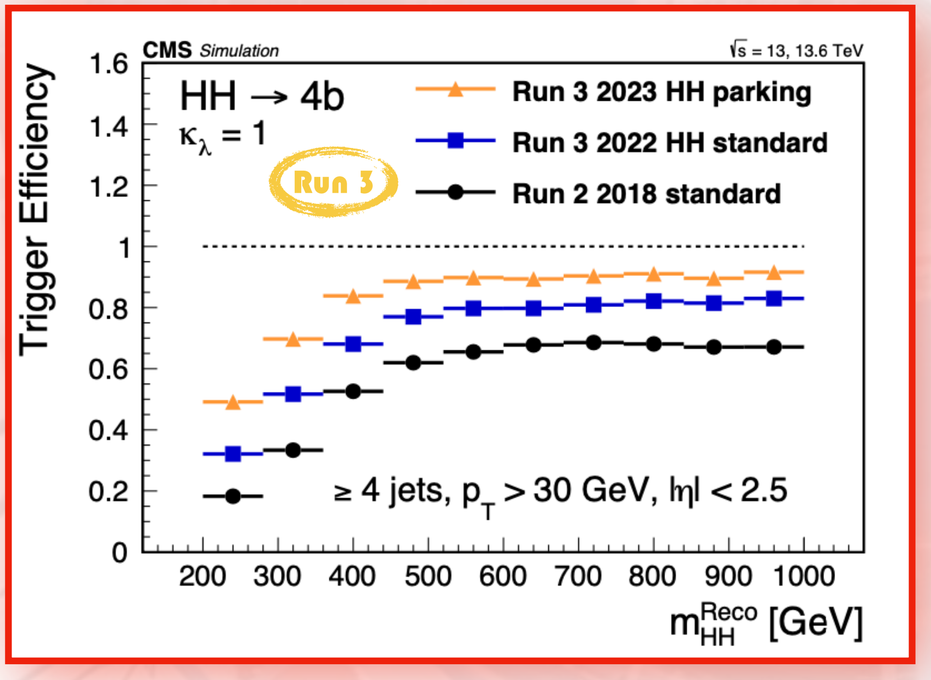


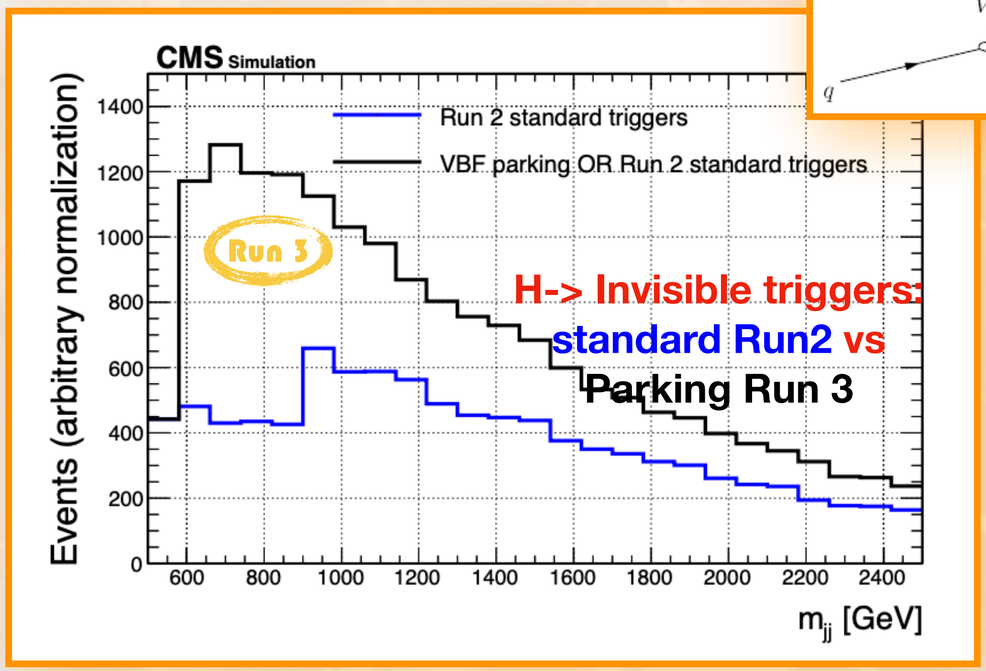
- In Run3, parking is a default
  - Loose triggers that we operate during the entire fill (i.e., we take more data overall)
  - Even looser triggers that we switch on along the LHC fill (single-muon sample as in 2018)

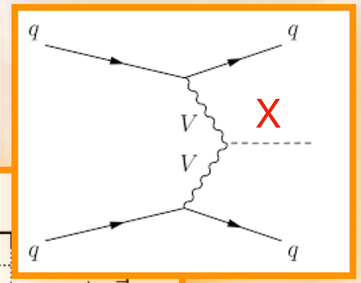
Rethinking Data Taking Strategy

- Parking trigger menu extended to cover topics physics beyond flavor
  - bb+X triggers to improve H and HH acceptance (hence sensitivity)
  - Inclusive and exclusive Vector Boson Fusion triggers: dedicated sample of diboson collisions
  - ...

CMS-EXO-23-007

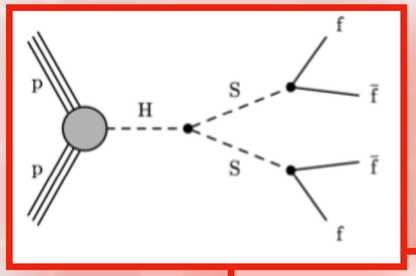






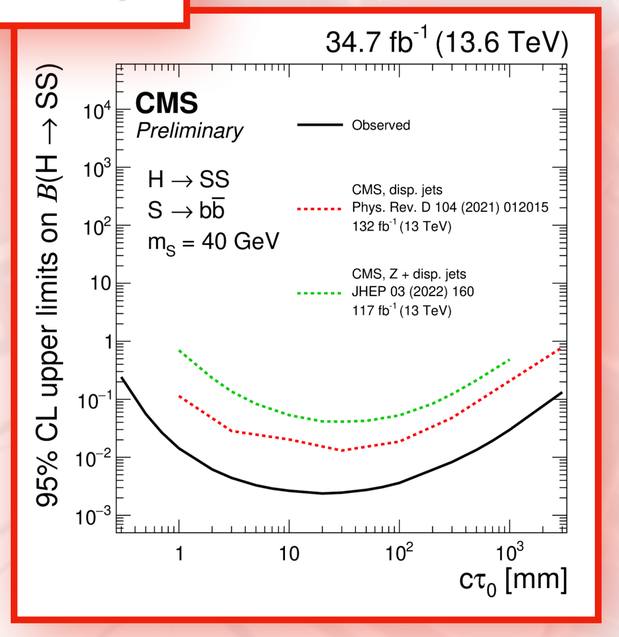
First Results using Run3 Parking

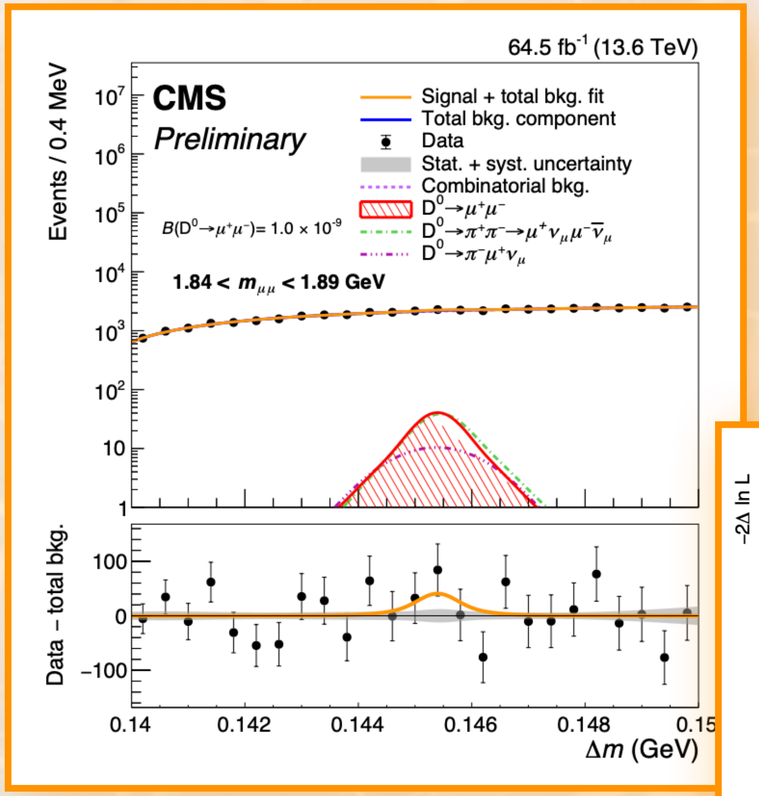
- First Run3 results with parking triggers
  - Exotic signatures of displaced particles for our long-lived particle search program
  - Single- and Double-lepton triggers for flavor & CP violation program



CMS-EXO-23-013

Search for Higgs decays to pairs of long-living dijet resonances

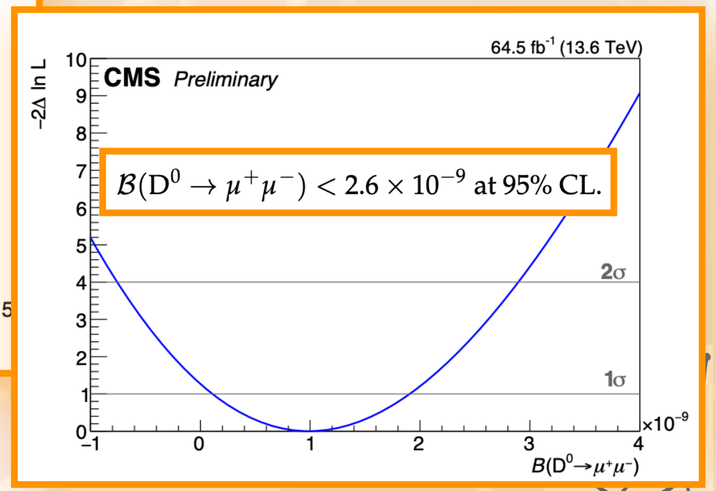




CMS-BPH-23-008 New

Search for $D^0 \to \mu^+\mu^-$

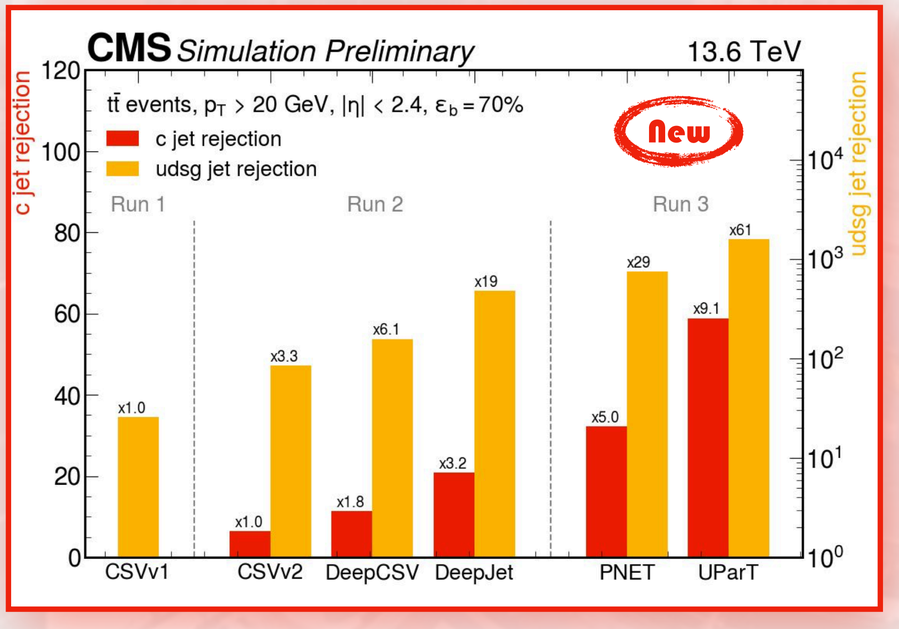
Improved by 35% over previous best limit



The Impact of AI

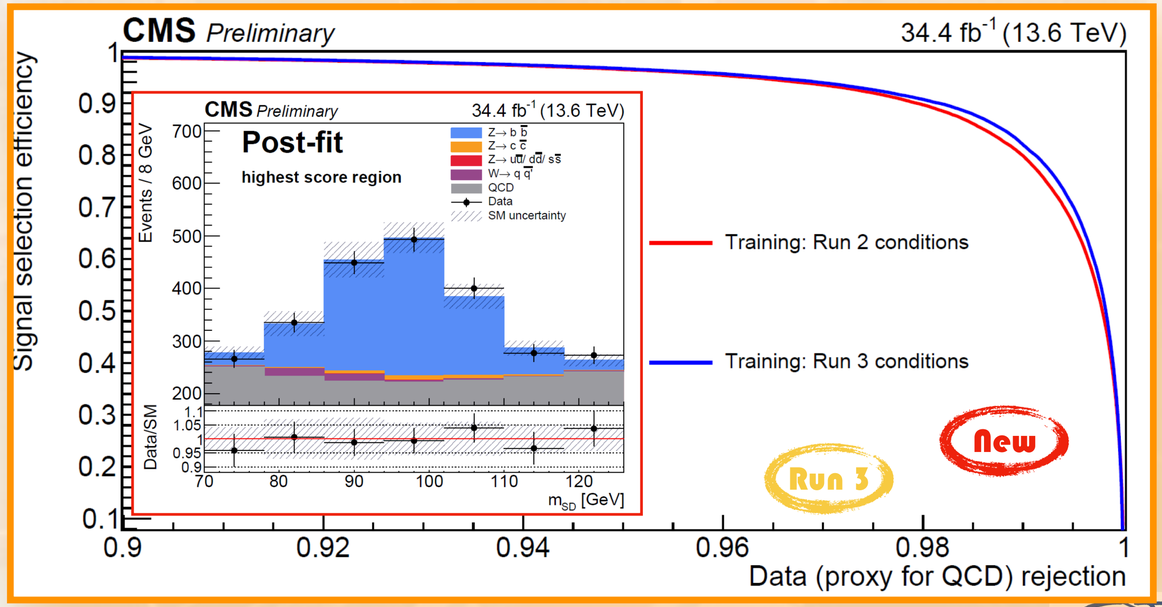
- CMS has been an early adopter of AI solutions:
  - To improve performance on traditional tasks. Example: jet tagging
    - Pioneered b-tagging revolution from rule-based to graph-nets and transformers
    - Extended to multiple kinds of jets (b, c, H→bb, V→qq, t→bbq, ...)

CMS-DP-2024-066



Background discrimination for 70% efficient b tagging

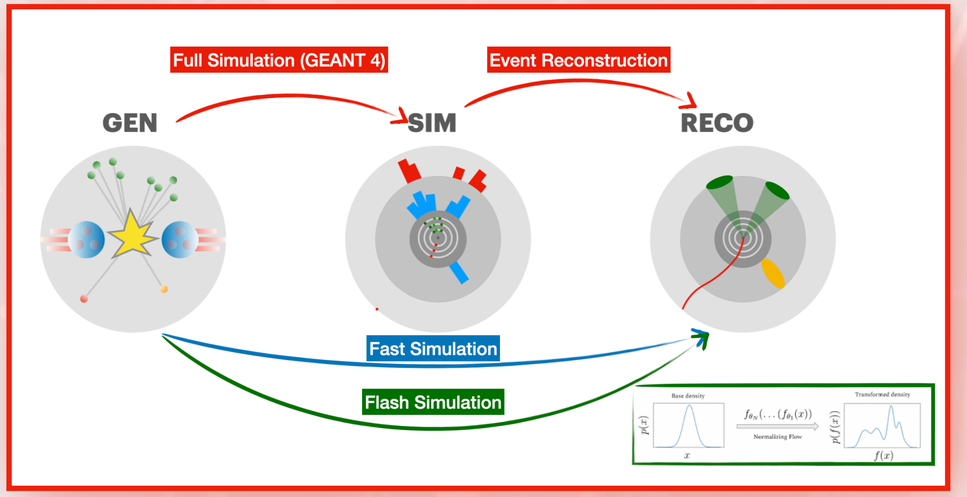
CMS-DP-2024-055

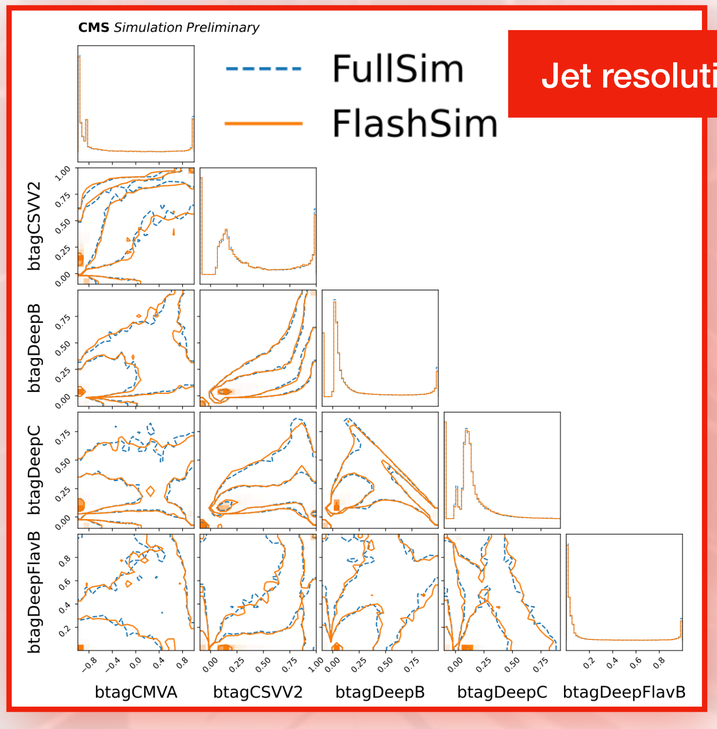


Signal efficiency vs bkg rejection for X->bb tagger with graph network (PNET)

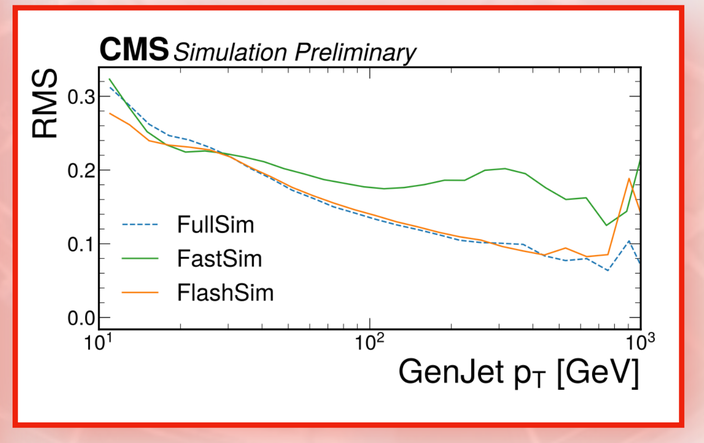
The Impact of AI

- CMS has been an early adopter of AI solutions :
  - To enhance our computational performance, e.g. with AI-based super-fast simulation (FlashSim)
    - Same paradigm now used at analysis level to correct simulation of specific quantities with data control samples

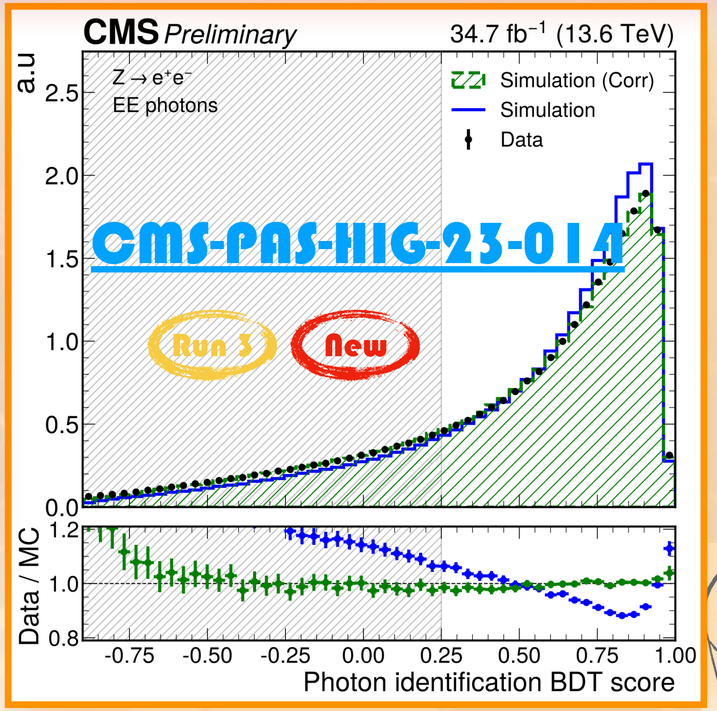




Jet resolution for Full Sim vs Fast Sim vs Flash Sim



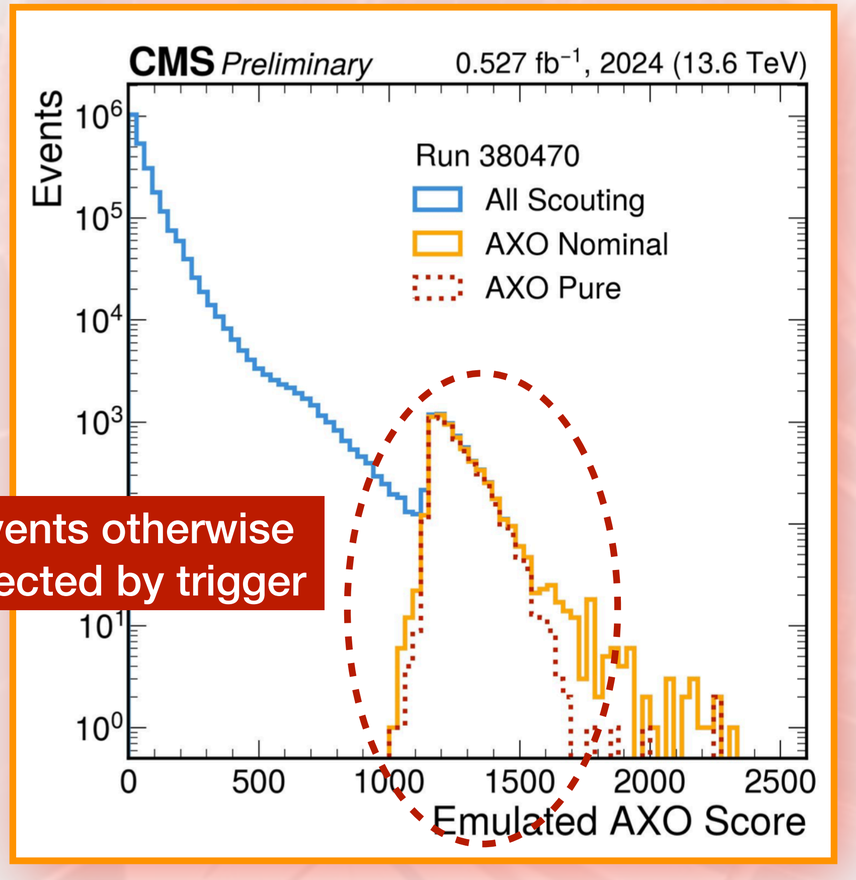
CMS-NOTE-2023-003



The Impact of AI

- CMS has been an early adopter of AI solutions:
  - To expand our physics reach with novel applications, such as anomaly detection in offline analysis and in the L1 (hardware) trigger

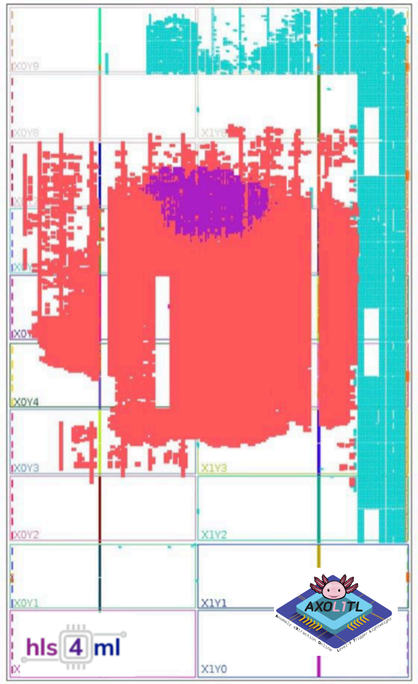
CMS-DP-2024-059



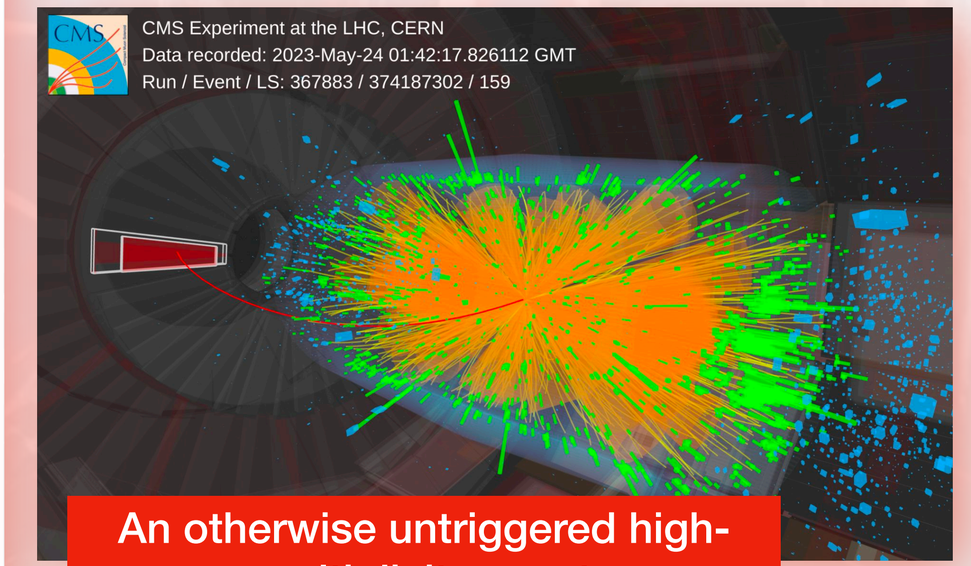
Events otherwise rejected by trigger

Algorithm Footprint on FPGA

Latency	LUTs	FFs	DSPs	BRAMs
2 ticks 50 ns	2.1%	~0	0	0



CMS-DP-2023-079



An otherwise untriggered high-multiplicity event

The Impact of AI

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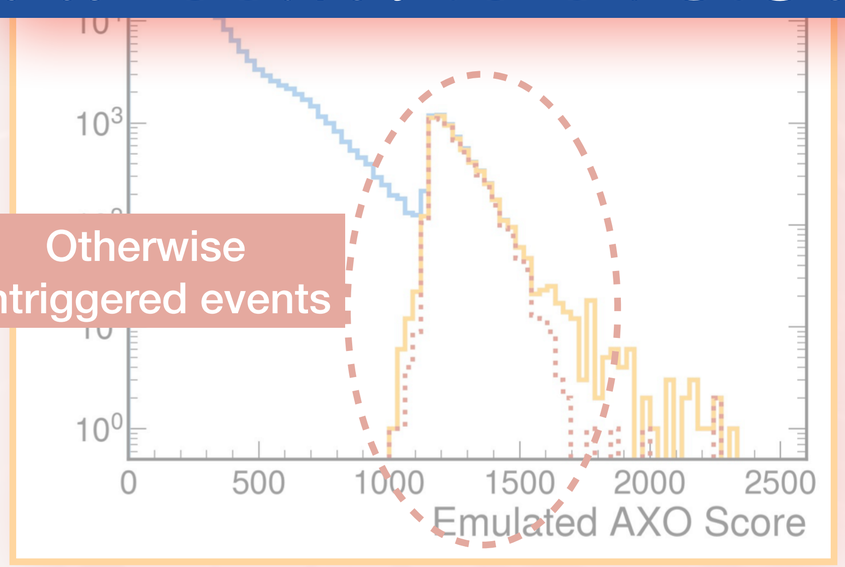
  - To expand our physics reach with novel applications, such as anomaly detection in offline analysis and in the L1 (hardware) trigger

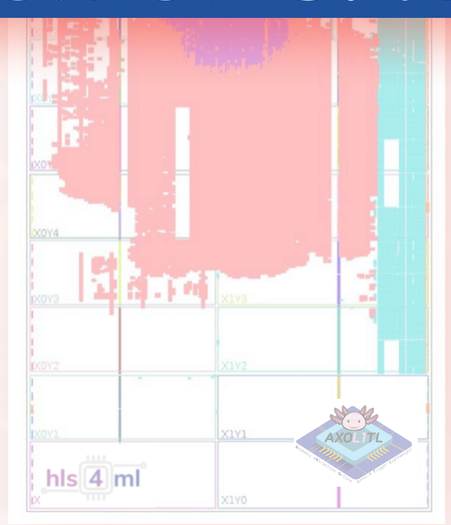
CMS-DP-2024-059

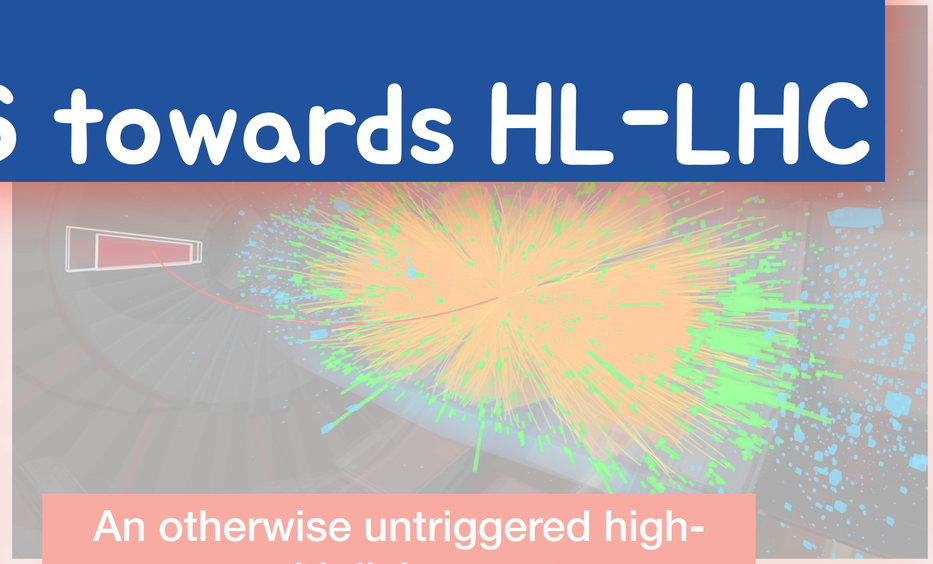
Algorithm Footprint on FPGA

This is just the beginning of an AI-centric evolution of CMS towards HL-LHC



Otherwise untriggered events



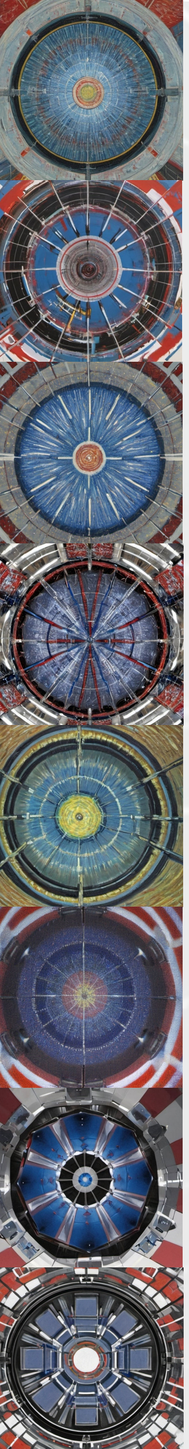


An otherwise untriggered high-multiplicity event

CMS Physics Highlights @ICHEP

37 new results presented at ICHEP

Document	11 on Higgs and Standard Model measurements	Dataset
HIG-23-010	Search for Higgs boson production in association with a charm quark in the diphoton decay channel	Run2
HIG-23-012	Search for highly energetic double Higgs boson production in the two bottom quark and two vector boson all-hadronic fi	Run2
HIG-23-013	Combination and interpretation of fiducia differential Higgs boson production cross sections at $\sqrt{s}$ = 13 TeV	Run2
HIG-23-014	H->γγ Measurements of inclusive and differential Higgs boson production cross sections at 13.6 TeV in the H → γγ decay	**Run3**
HIG-24-001	Constraining HHWW anomalous couplings via production of like-charge WWH through vector boson scattering	Run2
HIG-24-013	Measurements of Higgs boson production cross section in the four-lepton final state at $\sqrt{s}$ = 13.6 TeV	**Run3**
SMP-22-018	Measurement of WZγ production and search for new physics using WZγ events in proton-proton collisions at $\sqrt{s}$ = 13 TeV	Run2
SMP-23-005	Observation of γγ → ττ in proton-proton collisions and limits on the anomalous electromagnetic moments of the τ lepton	Run2
SMP-24-005	Measurement of the inclusive WZ production cross section in pp collisions at $\sqrt{s}$ =13.6 TeV with the CMS experiment	**Run3**
SMP-24-009	Measurement of the W → cq/W → qq^{-}′ decay branching fraction ratio in proton-proton collisions at $\sqrt{s}$ = 13 TeV	Run2
SMP-23-006	Proton reconstruction using the TOTEM Roman pot detectors during the high-β_* data taking period	Run2
Document	**6 on Flavor Physics (Top, Beauty and Charm)**	**Dataset**
TOP-22-011	Search for lepton flavour violation in the top quark interactions with an up-type quark, a muon, and a τh lepton	Run2
TOP-24-001	Measurement of the dineutrino system kinematics in dileptonic top quark pair events in pp collisions at $\sqrt{s}$ = 13 TeV	Run2
BPH-22-007	Measurement of double-differential and total charm cross sections at 7 TeV	Run1
BPH-22-009	Measurement of the polarizations of prompt and non-prompt J/ψ and ψ(2S) mesons produced in pp collisions at $\sqrt{s}$ = 13	Run2
BPH-23-001	Measurement of the ratio of the Bc→J/ψτν and Bc→J/ψμν branching fractions using three-prong τ lepton decays in proto	Run2
BPH-23-008	Search for Rare Charm Decays Into Two Muons	**Run3 Parking**
Document	**3 Heavy Ions**	**Dataset**
HIN-21-019	First measurement of jet axis decorrelation with photon-tagged jets in pp and PbPb collisions at 5.02 TeV	Run2 PbPb
HIN-23-004	Energy-energy correlators from PbPb and pp collisions at 5.02 TeV	Run2 PbPb
LUM-20-002	Luminosity measurement for nucleus-nucleus collisions at $\sqrt{s_{NN}}$ = 5.02 TeV in Run 2	Run2 PbPb
Document	**2 Machine Learning**	**Dataset**
MLG-23-005	Development of systematic-aware neural network trainings for binned-likelihood-analyses at the LHC	Run2
MLG-24-001	Reweighting of simulated events using machine learning techniques in CMS	-



CMS Physics Highlights @ICHEP

37 new results presented at ICHEP

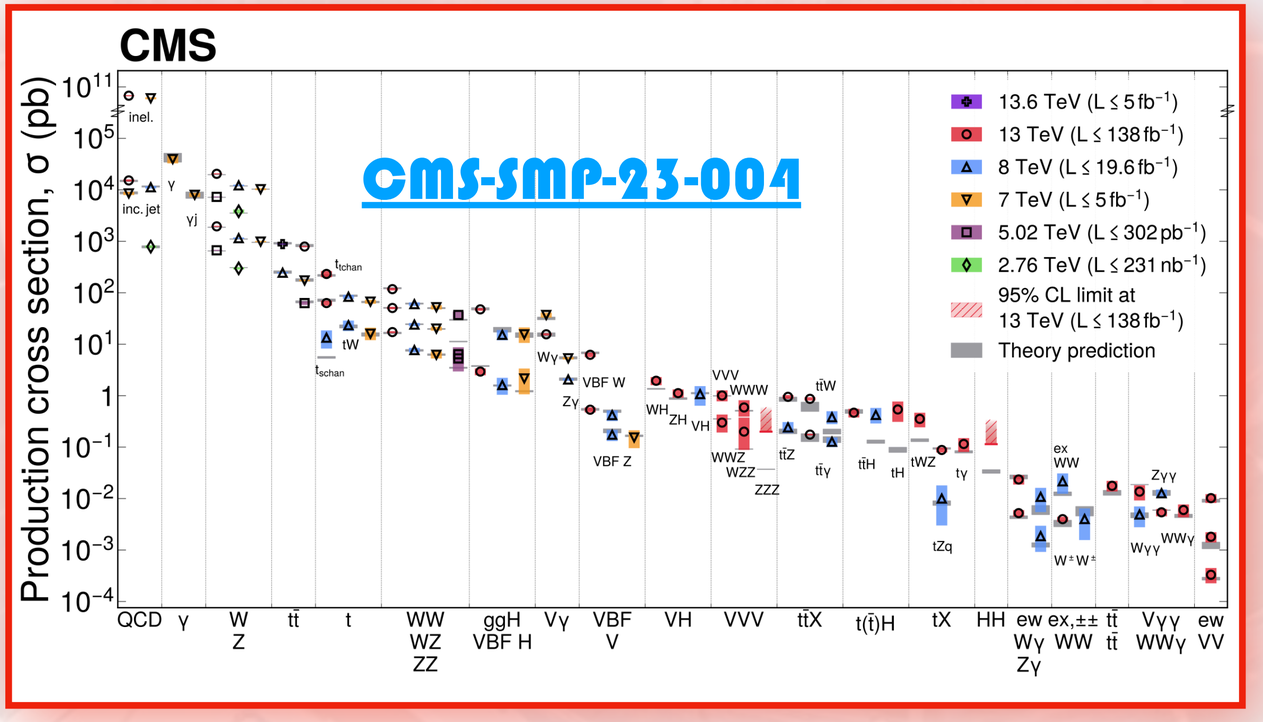
Document	15 Searches	Dataset
B2G-22-005	Search for pair production of heavy particles decaying to a top quark and a gluon in the lepton+jets final state at √s = 13	Run2
EXO-22-006	Search for lepton flavour universality violation via production of a new neutral gauge boson decaying to two muons with	Run2
EXO-23-010	Search for nonresonant new physics in high-mass dilepton events in association with b-tagged jets	Run2
EXO-23-015	Search for Vector-like Leptons with Long-lived Particle Decays in the Muon System	Run2
EXO-24-007	Search for low mass vector and scalar resonances decaying into quark-antiquark pairs	Run2
EXO-22-013	Search for t-channel scalar and vector leptoquark exchange in the high mass dilepton spectrum in proton-proton collisi	Run2
HIG-22-004	Search for a heavy CP-odd Higgs boson decaying into a 125 GeV Higgs boson and a Z boson in final states with two ta	Run2
HIG-24-002	Search for heavy scalar resonances decaying to a pair of Z bosons in the 4-lepton final state at √s = 13 TeV	Run2
SUS-23-002	Search for supersymmetric particle pair production in final states with two oppositely charged leptons and large missing	Run2
SUS-23-003	General search for supersymmetric particles in scenarios with compressed mass spectra using proton-proton collisions	Run2
SUS-23-004	Search for new physics with a monotop signature	Run2
SUS-23-012	Search for dark matter produced in association with a Higgs boson decaying to τ+τ− at √s = 13 TeV	Run2
SUS-23-018	Search for DM in association with b-quarks and lepton pairs	Run2
SUS-24-001	Search for bosons of an extended Higgs sector in b quark final states in proton-proton collisions at √s = 13 TeV	Run2
SUS-24-004	Phenomenological MSSM interpretation of CMS searches in pp collisions at √s = 13 TeV	Run2

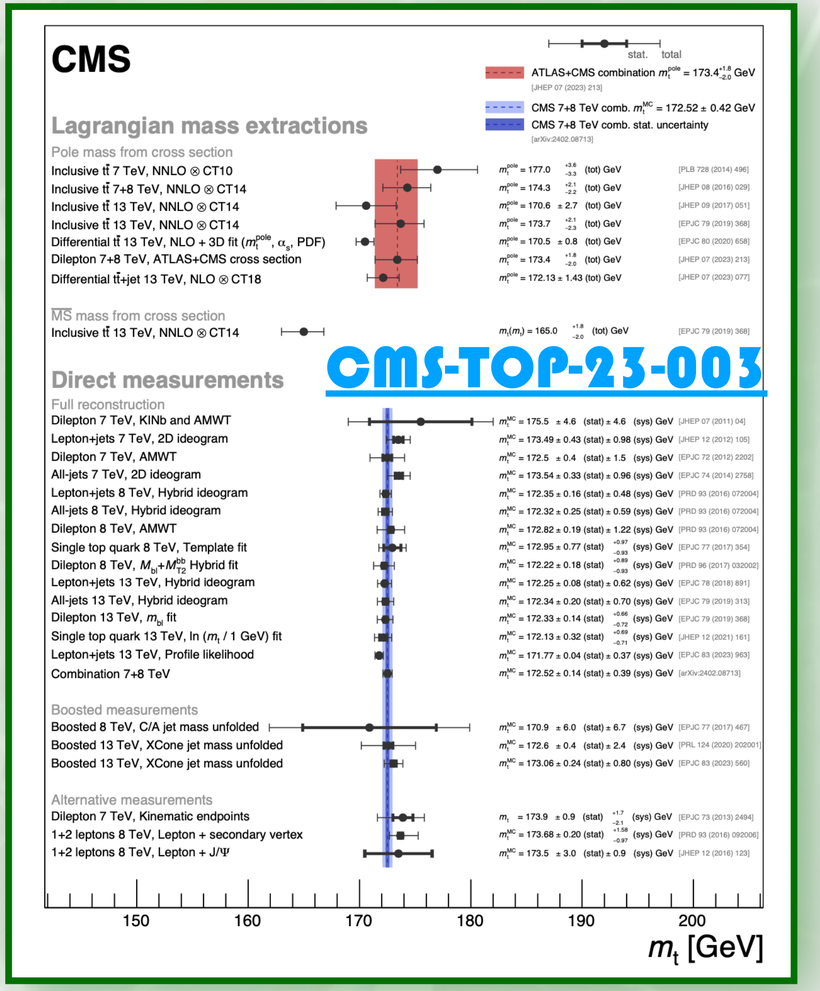
Recently released 7 Review Papers on Run2 Physics Program

EXO-23-005	Dark sector searches with the CMS experiment
EXO-23-006	Review of searches for VLQ, VLL, and HNL in proton-proton collisions at √s = 13 TeV at CMS
EXO-23-007	Enriching the physics program of the CMS experiment via data scouting and data parking
SMP-23-004	Stairway to discovery: a report on the CMS programme of cross section measurements from millibarns to femtobarns
B2G-23-002	Searches for Higgs boson production through decays of heavy resonances
HIN-23-011	Overview of high-density QCD studies with the CMS experiment at the LHC
TOP-23-003	Review of top quark mass measurements in CMS

CMS as a precision physics experiment

- Since Run1, carrying out a fully comprehensive measurement program, to improve our understanding of the SM
- Spanned 14 orders of magnitude in cross sections, going from abundant QCD processes to rare multi boson production
- Measuring fundamental parameters of the Standard Model with multiple techniques at unprecedented precision

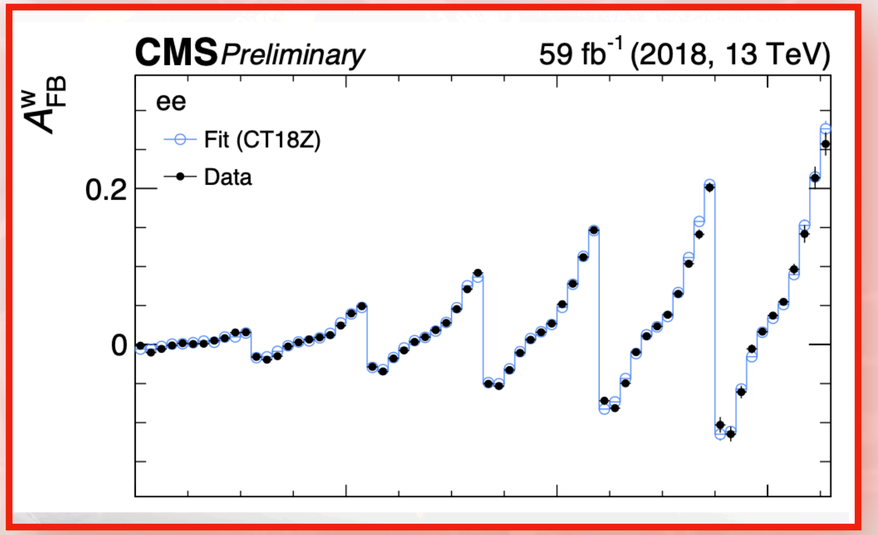


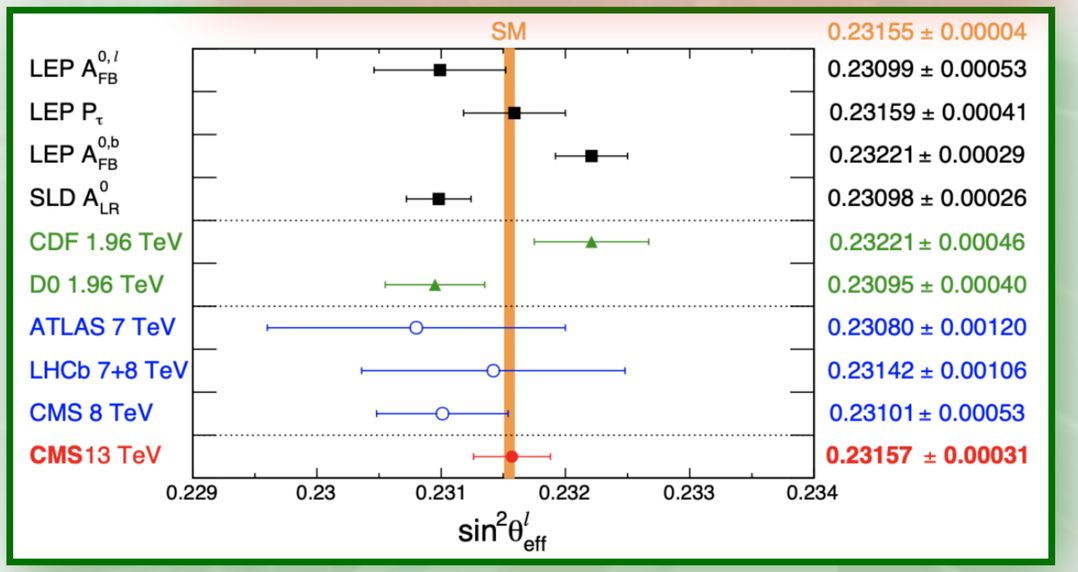


CMS as a precision physics experiment

- Recently released a full-Run2 $\sin^2\theta_W$ measurement using A_{FB} in $pp \to \ell\ell$ events
  - More precise than LEP combination on equivalent quantity
  - Precision comparable to LEP A^b_{FB} and SLD A_{LR} determination
  - Sits in between the two, in perfect agreement with SM prediction
    - adds to understanding of a long-standing tension

CMS-PAS-SMP-22-010



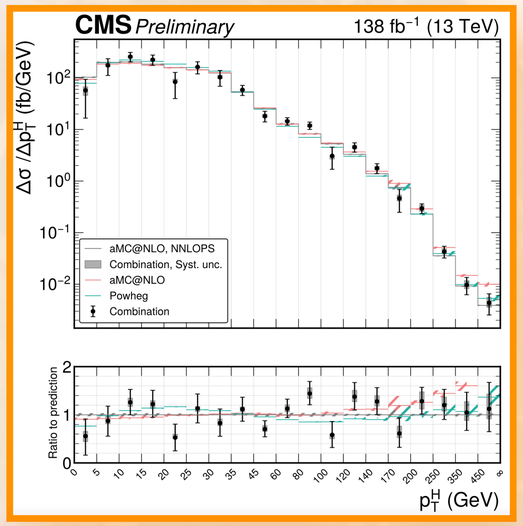


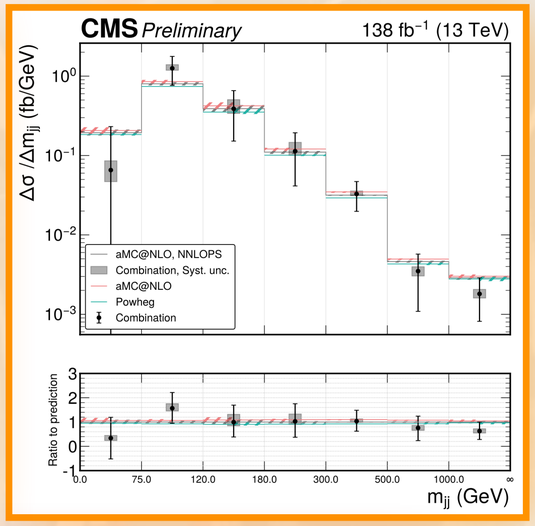
CMS as a precision physics experiment

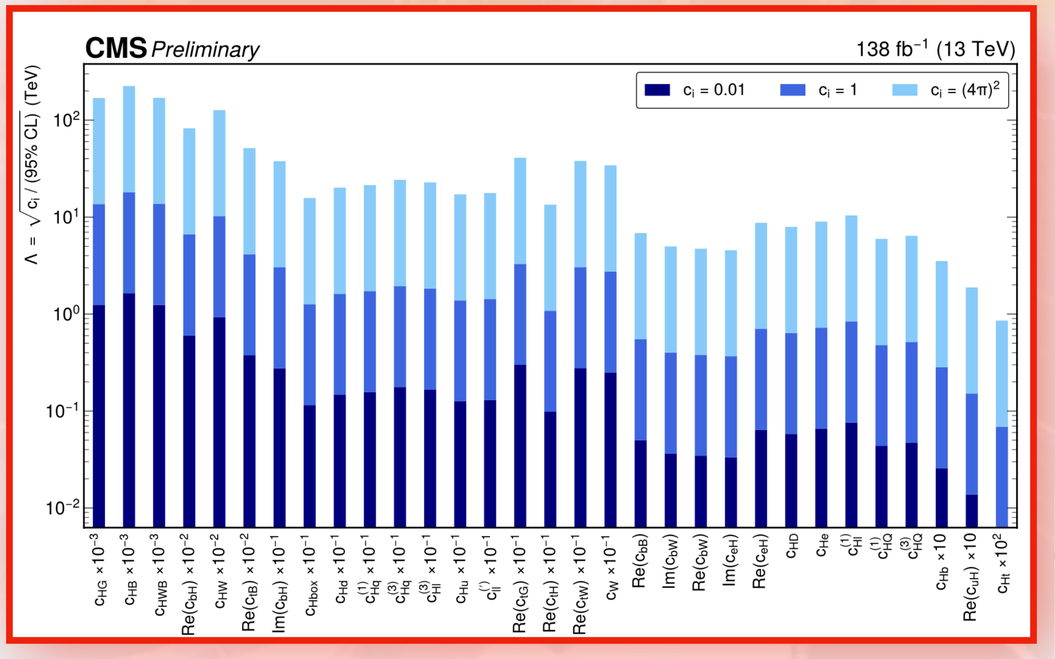
CMS-PAS-HIG-23-013 New

- Studying Higgs differential production cross section as complementary probe to new physics
  - New Physics effects overwhelmed by SM contribution could become visible on tails (e.g., at high energy)
- New combination across various final states (WW, ZZ, γγ, ττ) to reduce uncertainty on tails
- Result can be interpreted in terms of Effective Field Theory or with specific assumptions on UV model

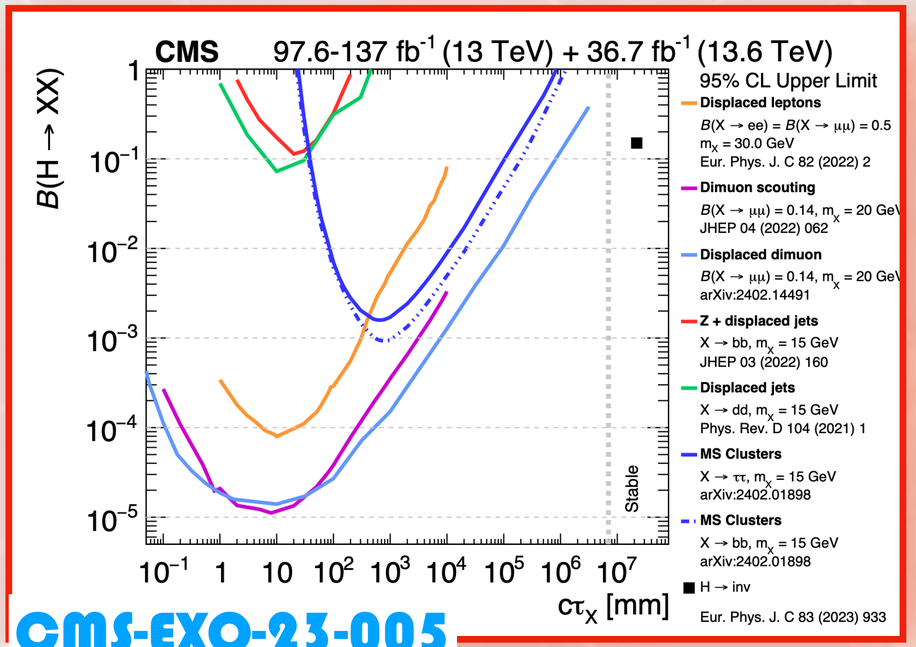
$$\mathcal{L}_{\text{SMEFT}} = \mathcal{L}_{\text{SM}} + \sum_j \frac{c_j}{\Lambda^2} \cdot \mathcal{O}_j^{(6)}$$





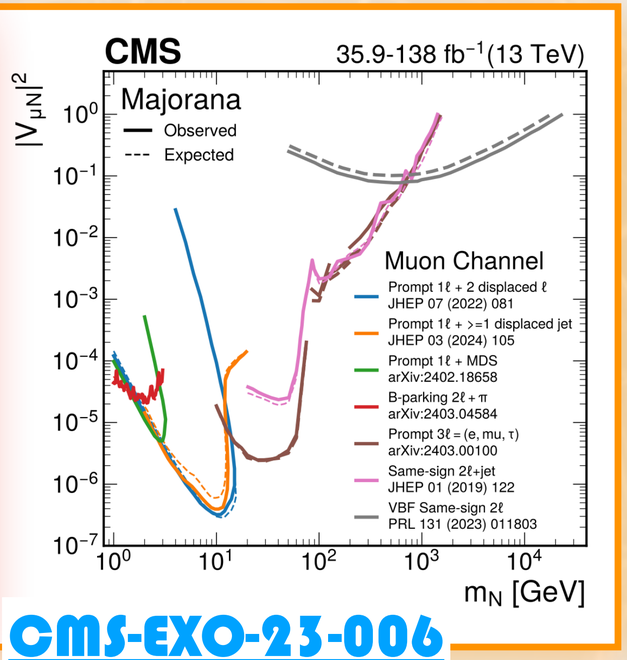


CMS at the Energy frontier



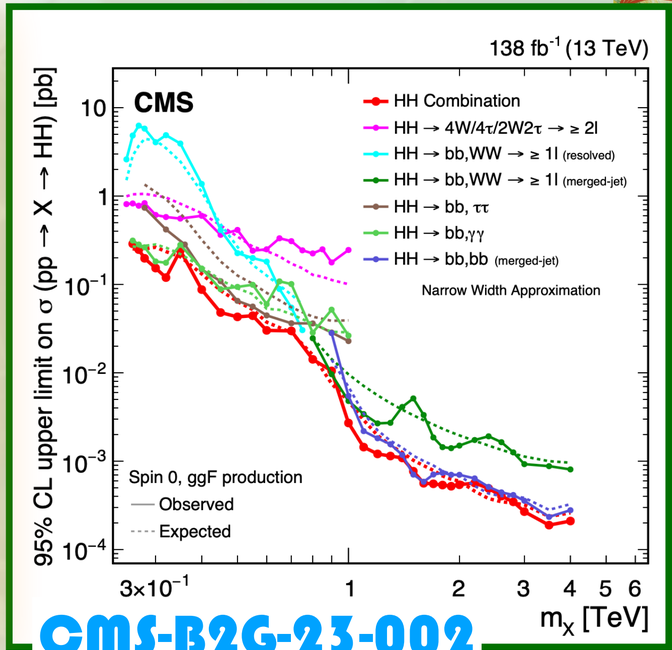
CMS-EXO-23-005

Dark Sector: Higgs decays to long-living particles



CMS-EXO-23-006

Search for new particles in exotic signatures: heavy neutral leptons



CMS-B2G-23-002

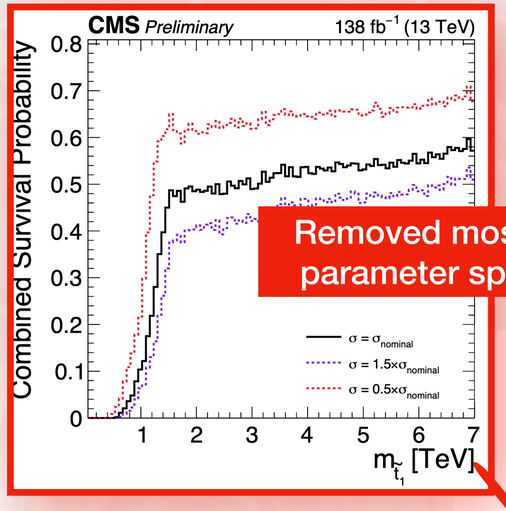
Search for new particles at high mass : scalar $X \to HH$

- Probing various scenarios
  - Dark Sector, exotic signatures, heavy particles, ...
  - Exploiting standard and exotic signatures
  - Boosted jets, disappearing jets, emerging jets (with AI taggers), showers in muon detector, ...

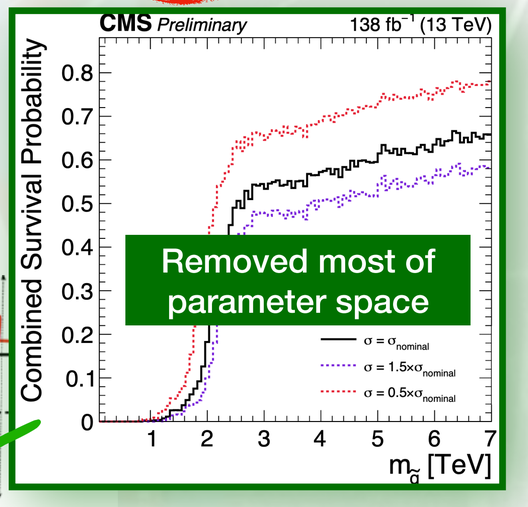
CMS at the Energy frontier

- Performed first statistical combination of SUSY searches with full Run2 luminosity
  - In the framework of phenomenological MSSM (pMSSM): 19 free parameters
  - Useful tool to identify weak spots in our program
  - Gives us a big picture under realistic assumptions (e.g., on relative branching ratios)
    - quantified as fraction of tested models that survive the exclusion

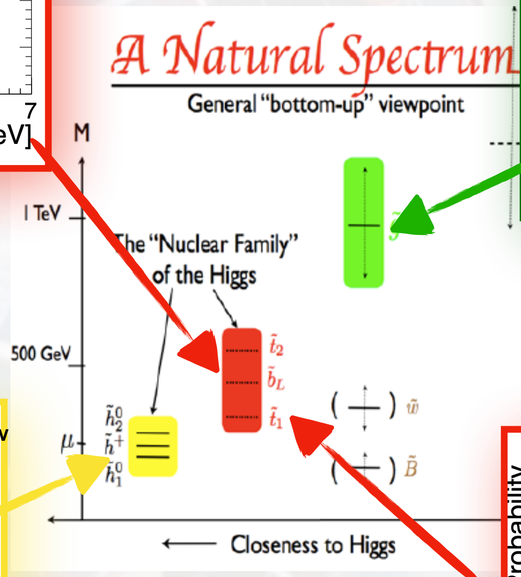
CMS-PAS-SUS-24-004 New

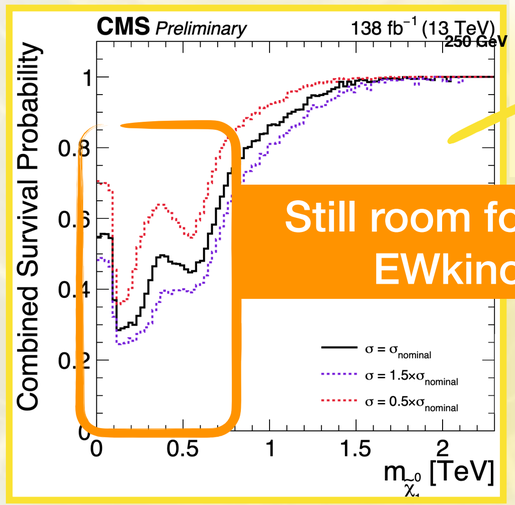


Removed most of parameter space

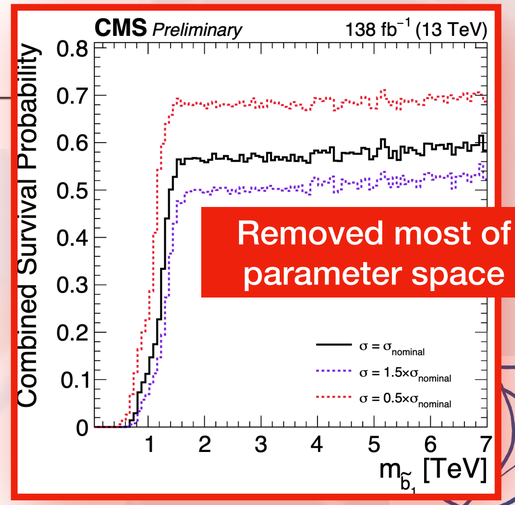


Removed most of parameter space





Still room for light EWkinos

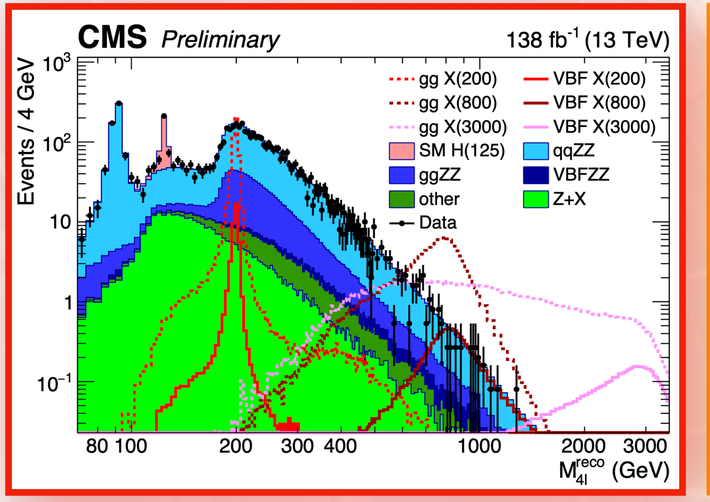


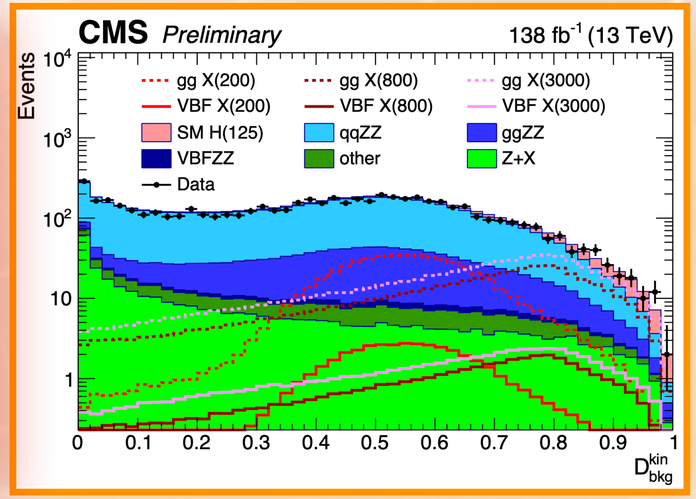
Removed most of parameter space

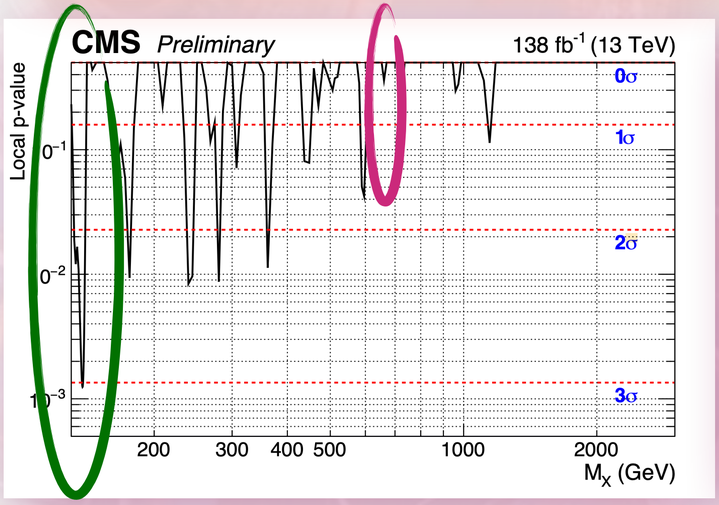
CMS at the Energy frontier

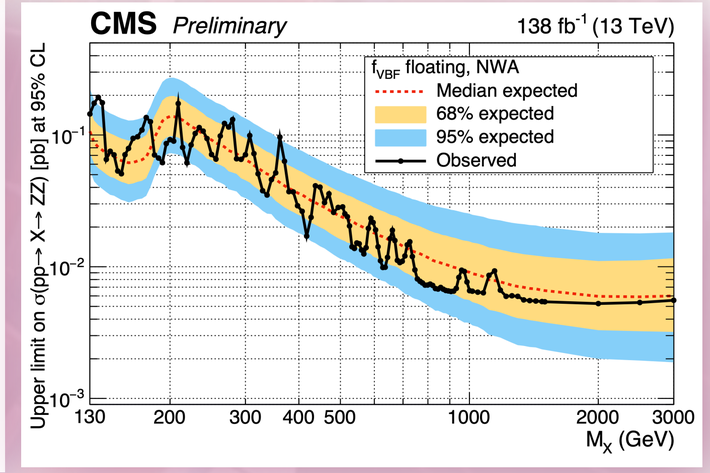
CMS-PAS-HIG-24-002 New

- New search for high-mass scalars $X \to ZZ \to 4\ell$
- Enhanced sensitivity, given by 2D approach: invariant mass vs matrix element discriminant D_{bkg}^{kin}
- Addressing claims for a new boson in 650-680 GeV (based on ATLAS data)
  - No excess observed in 650-680 GeV range
- Small excess at 138 GeV, with 1.9 σ significance after look-elsewhere effect









CMS as a flavor physics experiment

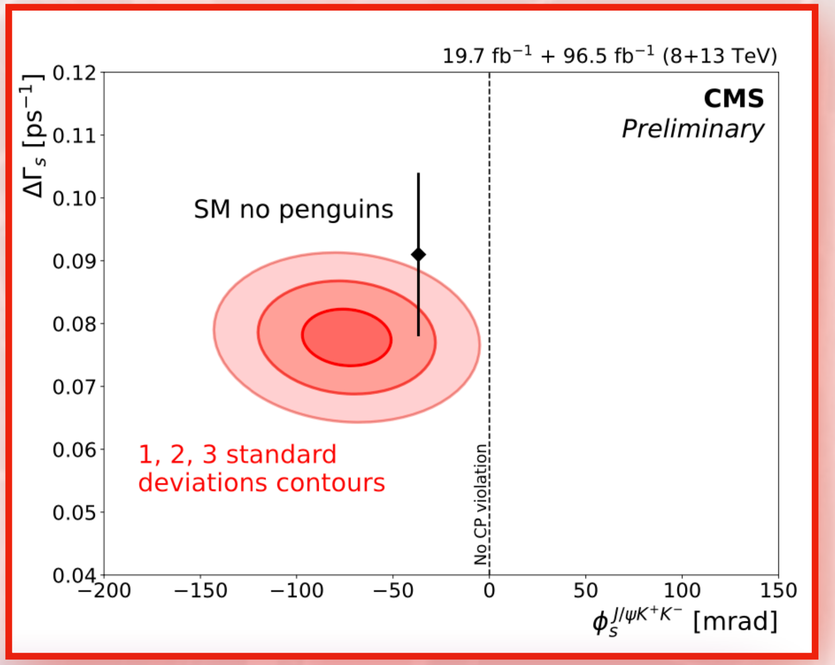
- Probing CP violation with charm and beauty quarks

  - CPV study in fully hadronic charm decays with 2018 parking data (exploiting trigger-unbiased "probe" side)

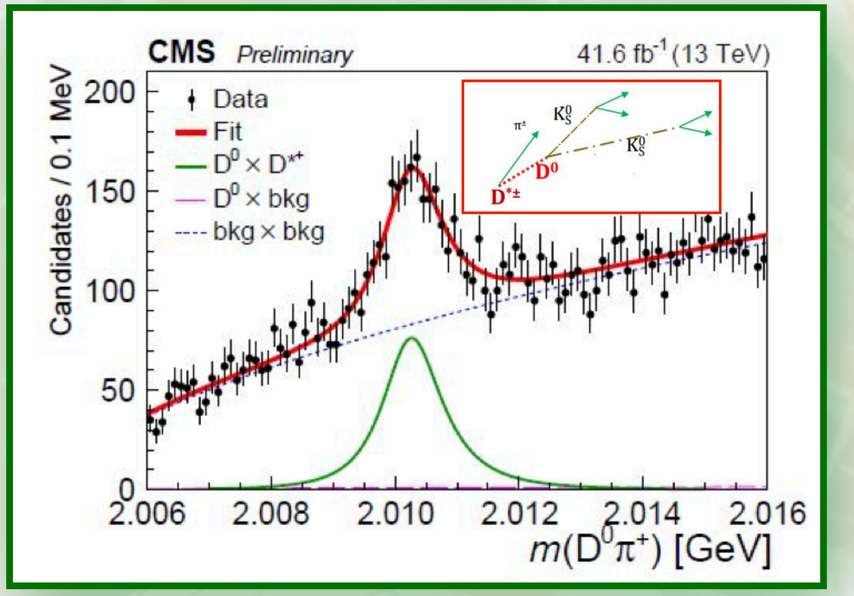
  - First evidence of CP violation in Bs oscillations, thanks to novel AI-powered b flavor tagger (using DeepSets)

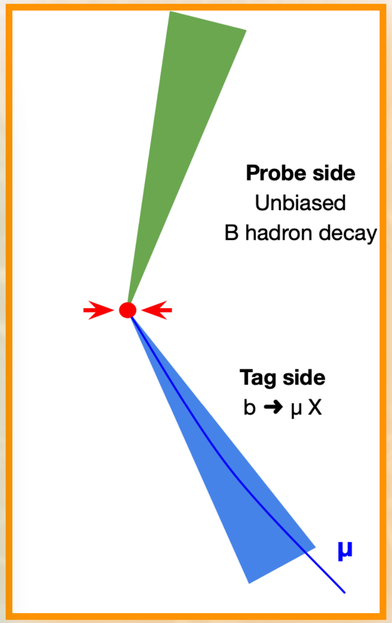
  - Further improvements expected in Run 3 with Parking (see slide 11)

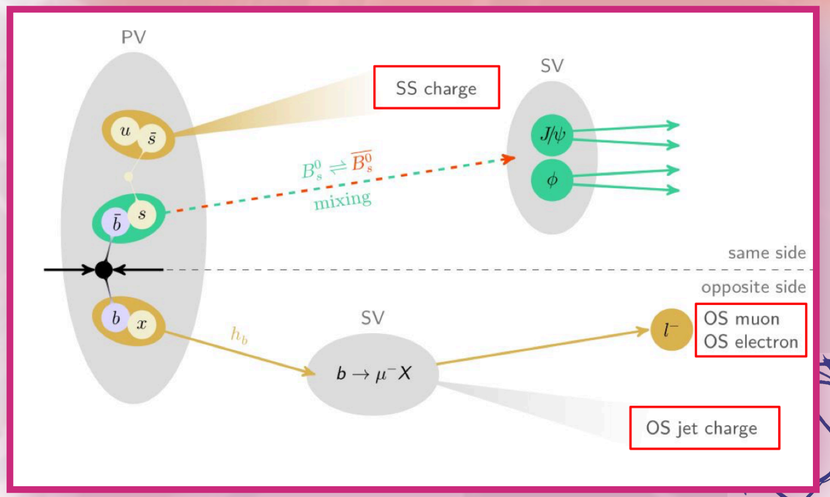
CMS-PAS-BPH-23-004



CMS-PAS-BPH-23-005







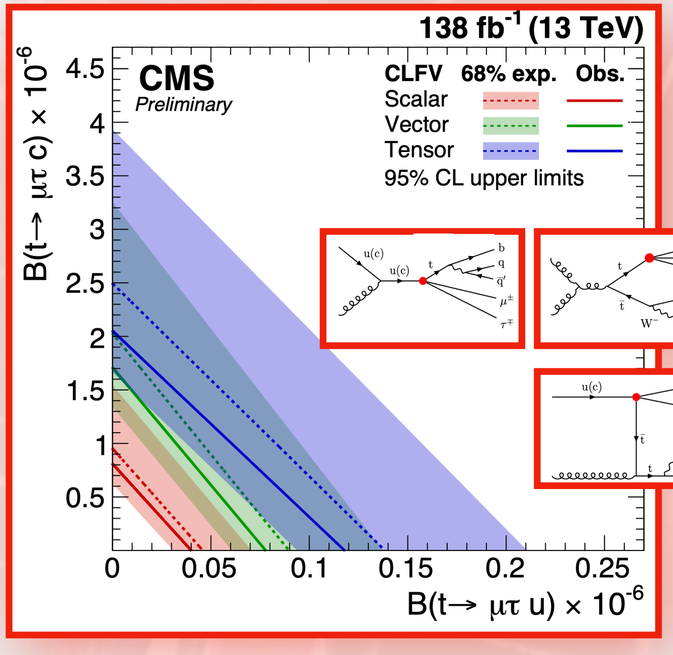
A different flavor of flavor

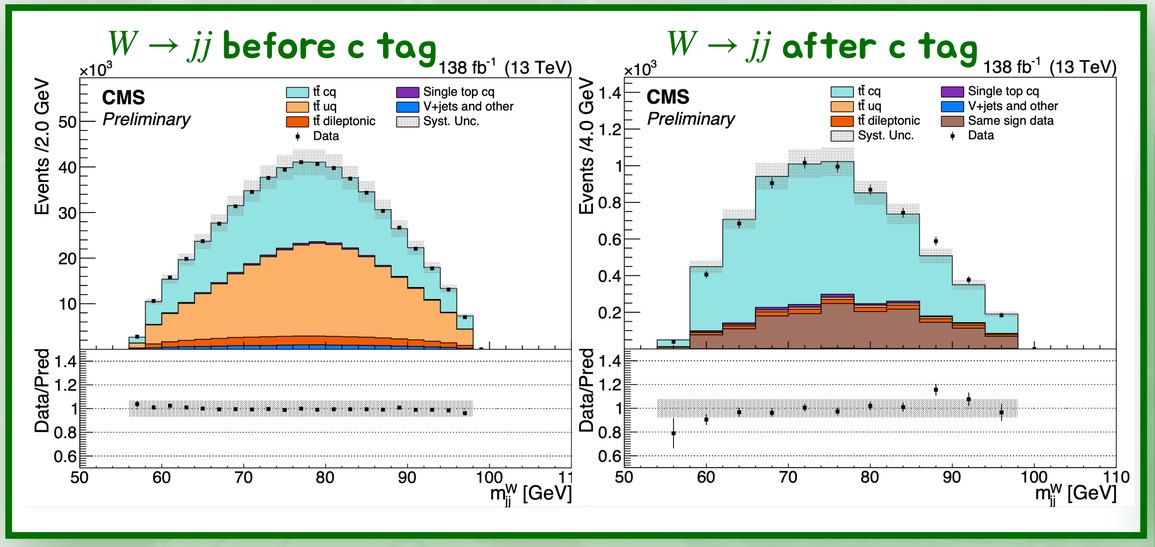
- $t\bar{t}$ production gives us a clean laboratory at higher energy than charm or beauty factories
- Lepton flavor violation in top decays
- Best measurement of $W \to q\bar{q}'$ branching ratios from $t\bar{t}$ events exploiting exclusive $c \to X\mu\nu$ tagging

$$R_c^W = \frac{|V_{cd}|^2 + |V_{cs}|^2 + |V_{cb}|^2}{|V_{ud}|^2 + |V_{us}|^2 + |V_{ub}|^2 + |V_{cd}|^2 + |V_{cs}|^2 + |V_{cb}|^2} = 0.498 \pm 0.005(\text{stat}) \pm 0.019(\text{sys})$$

New

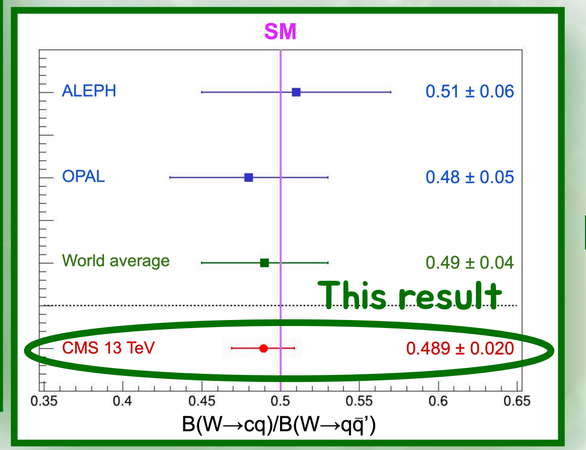
CMS-PAS-TOP-22-011





New

CMS-PAS-SMP-24-009



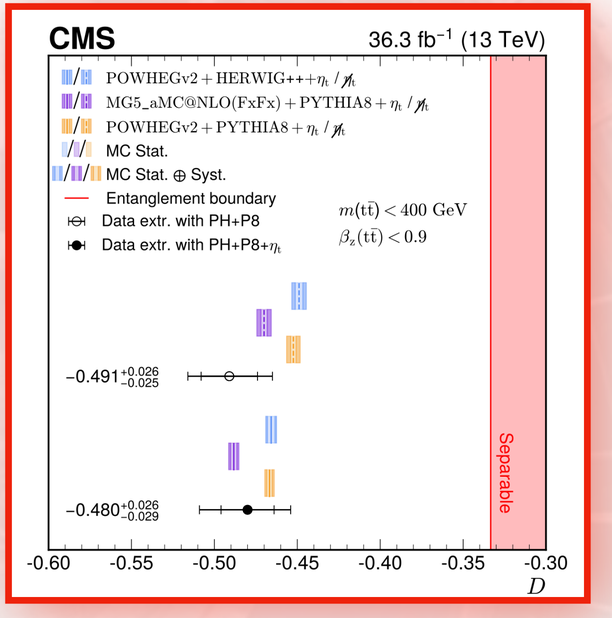
From R_c^W and previous indirect determination of the denominator (from W leptonic BR) we can test CKM unitarity on second row

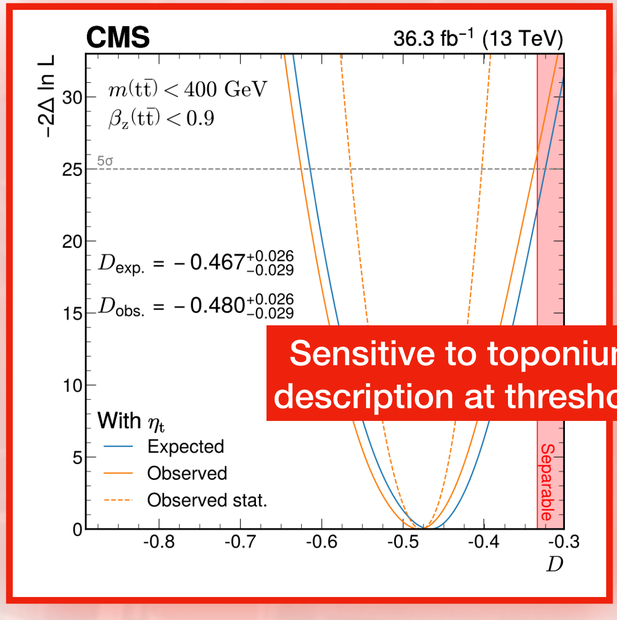
$$|V_{cd}|^2 + |V_{cs}|^2 + |V_{cb}|^2 = 0.970 \pm 0.041$$

CMS to probe Quantum Entanglement

- $t\bar{t}$ is also a laboratory for quantum entanglement studies at the highest energy ever tested
  - Can test SM in different scenarios than traditional search program
- Probe entanglement via spin correlation matrix
  - At production threshold in $t\bar{t} \to b\ell\nu b\ell\nu$ events (phase space dominated by time-like events)
  - At high m_{tt} with $t\bar{t} \to b\ell\nu bq\bar{q}$ events, (phase space dominated by space-like events)
- Both analyses establish entanglement in agreement with SM predictions
- More details in Didar Dobur's talk on Wednesday

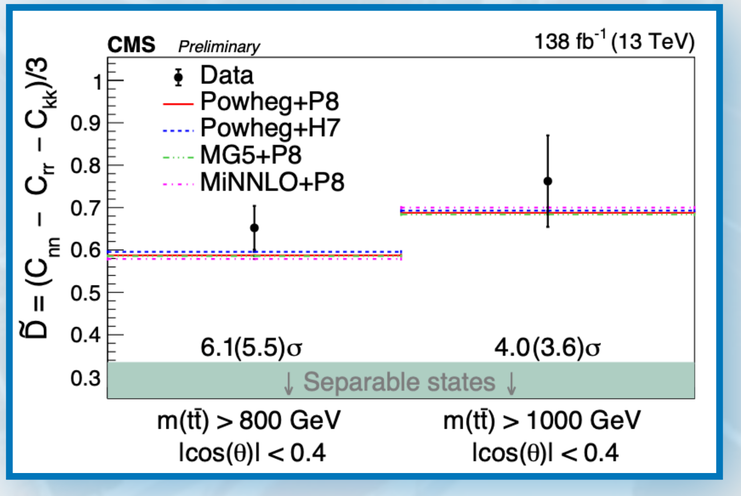
CMS-TOP-23-001





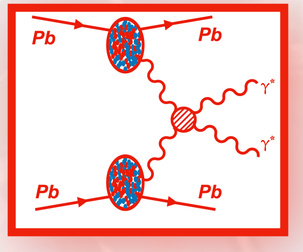
Sensitive to toponium description at threshold

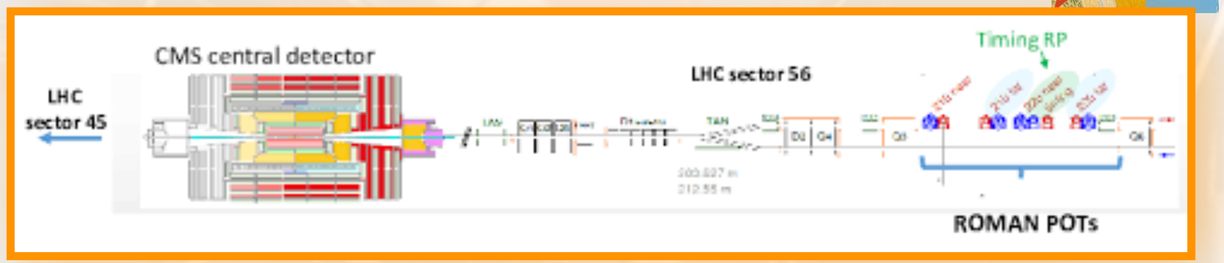
CMS-PAS-TOP-23-007

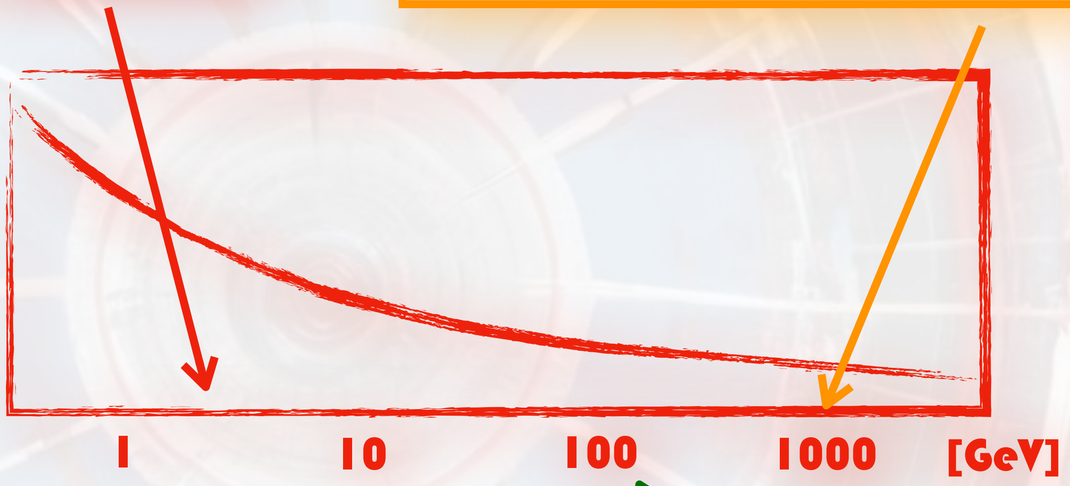


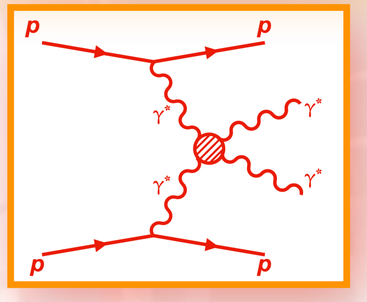
CMS as a photon collider experiment

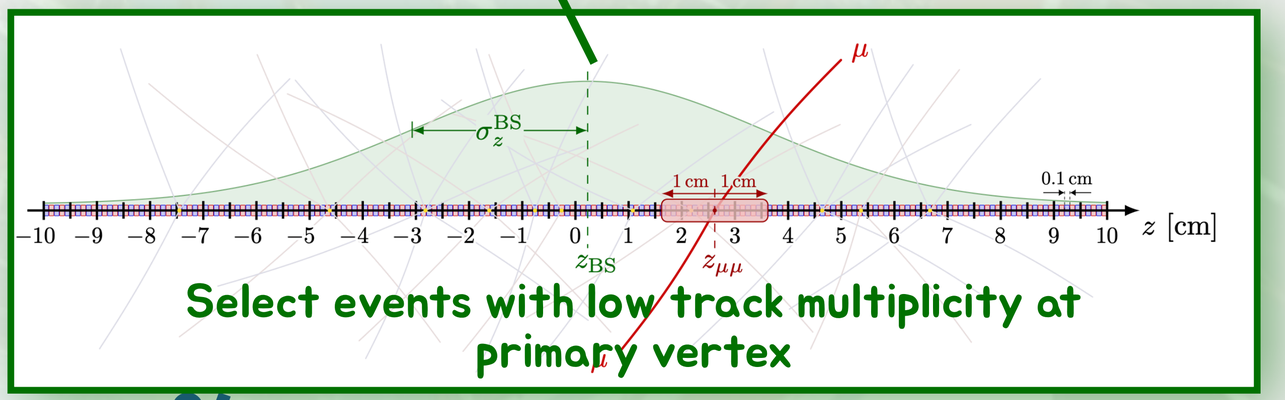
- CMS can study photon collisions at the LHC in complementary ways
  - At low $\sqrt{\hat{s}}$ with Ultra Peripheral Collisions (UPC) in Heavy Ion runs
  - At large $\sqrt{\hat{s}}$, with proton tagging in pp collisions
  - At intermediate $\sqrt{\hat{s}}$, with tailored cuts on primary vertex









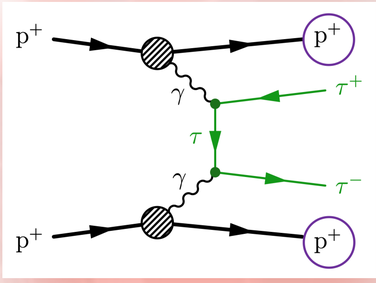


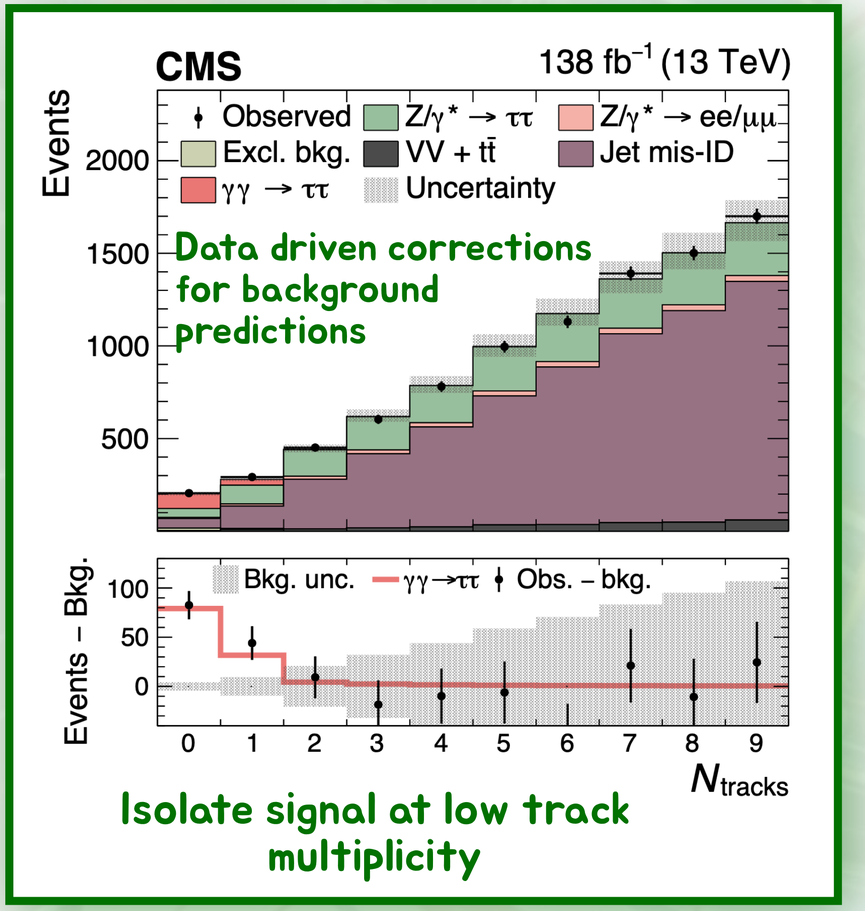
Select events with low track multiplicity at primary vertex

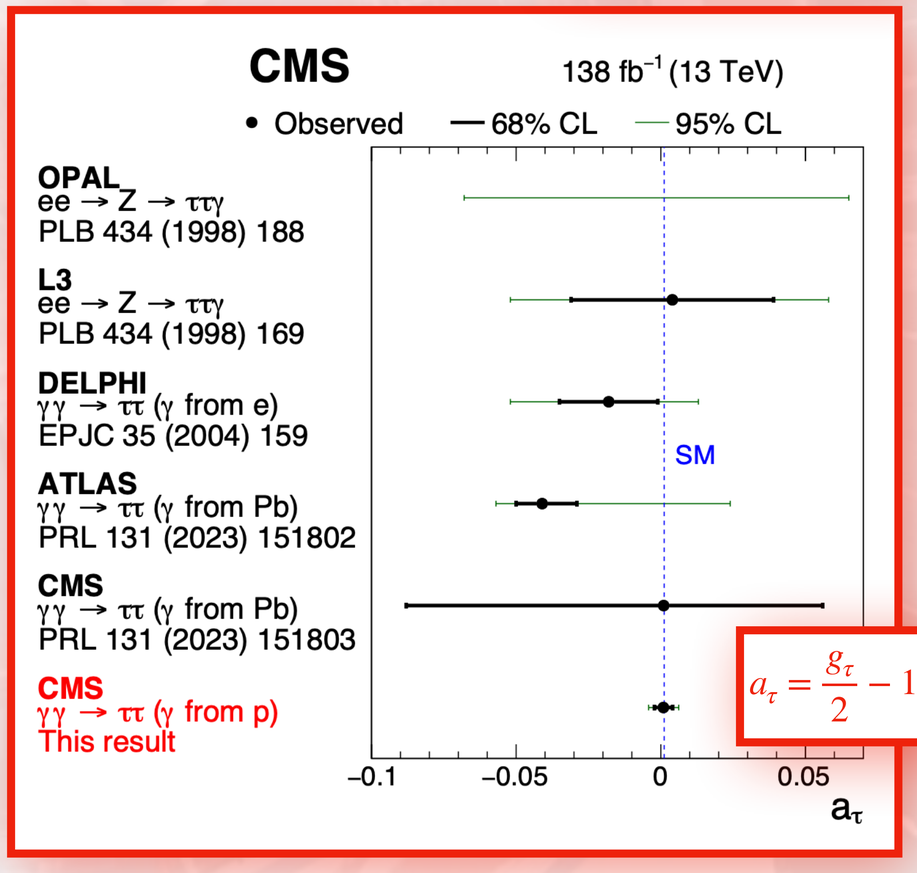
CMS as a photon collider experiment

- Observed $\gamma\gamma \to \tau\tau$ production in pp collisions, exploiting this novel mid-energy range selection
- Probed tau g-2 with unprecedented precision

CMS-SMP-23-005





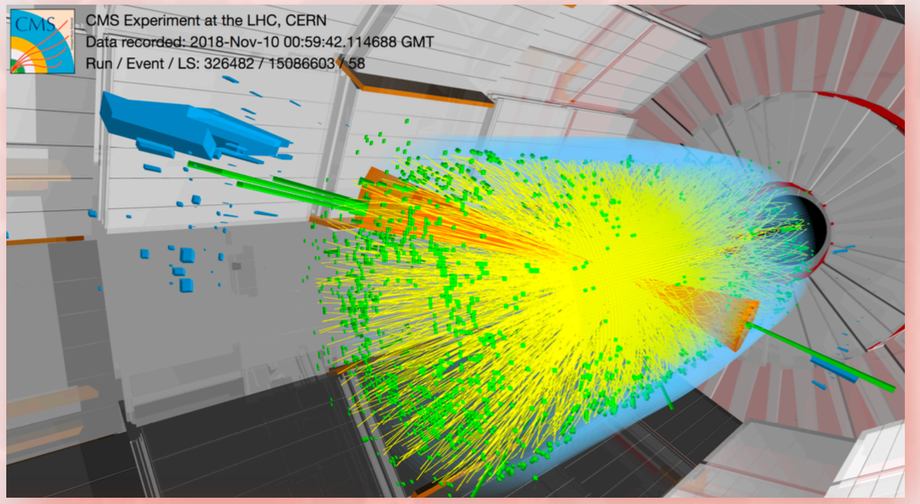


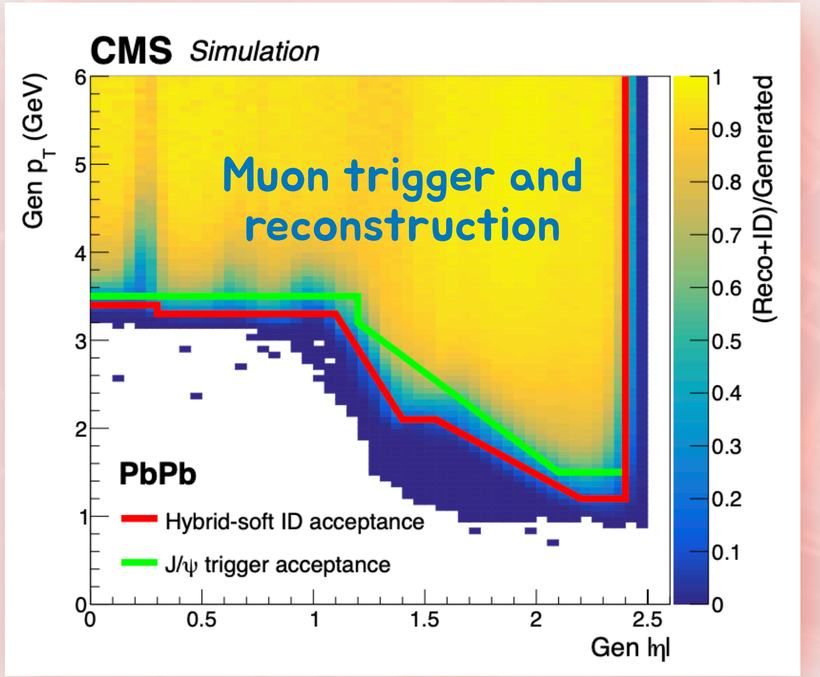
$$a_\tau = \frac{g_\tau}{2} - 1 = 0.0009^{+0.0032}_{-0.0031}$$

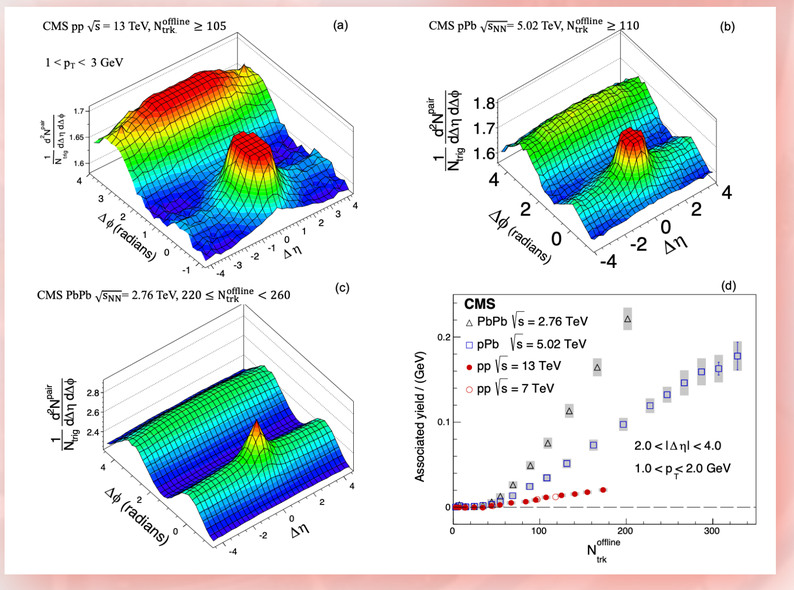
CMS as a Heavy Ion experiment

- CMS is fully engaged to high-density QCD studies in heavy-ion collisions
- Heavy Ion collisions push CMS to its limits
  - occupancy, event size, trigger bandwidth
- Progressed understanding of heavy-ion physics and highlighted new phenomena in large and small systems

CMS-HIN-23-011



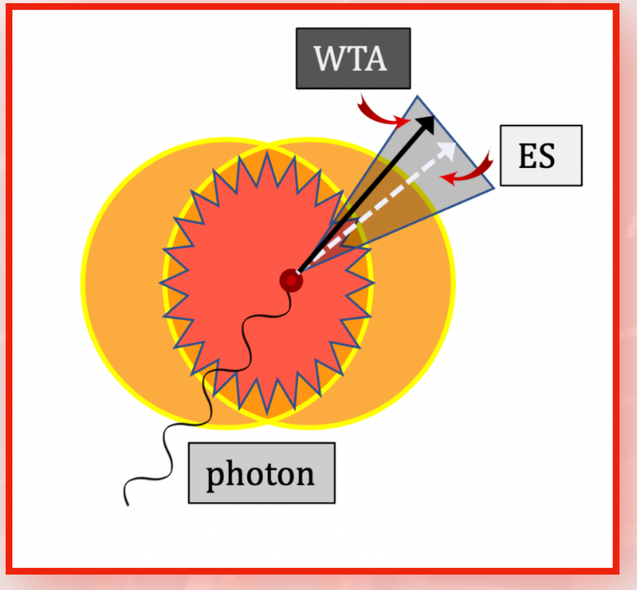




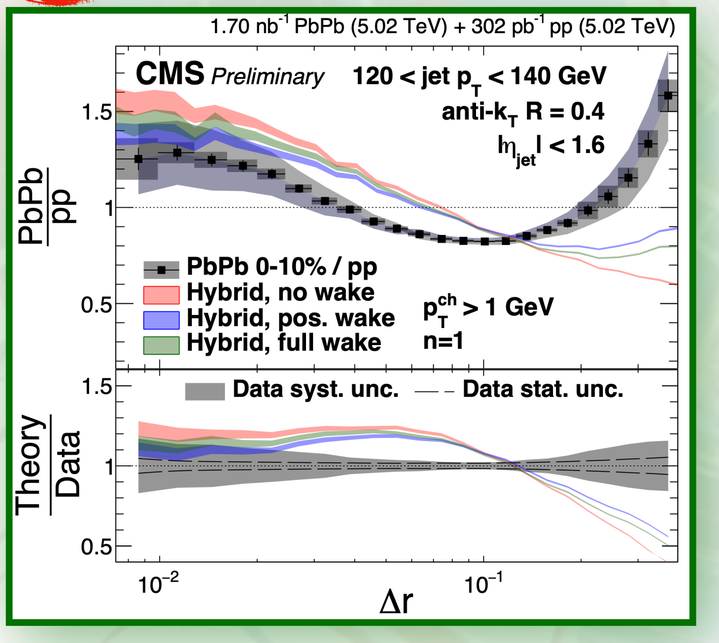
2D particle correlation function and ridge structure

Probing jet propagation in QGP

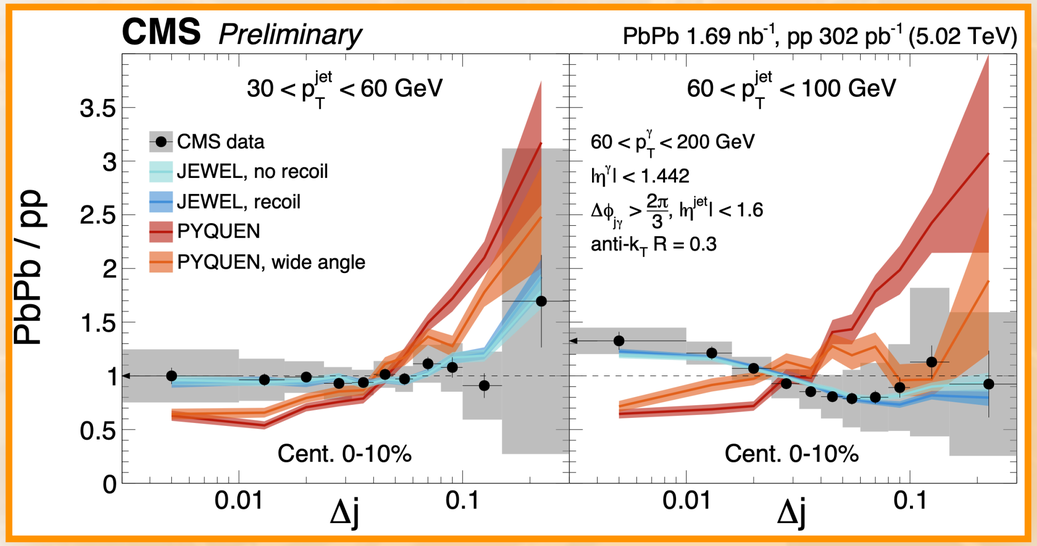
- Probing Quark-Gluon-Plasma interaction with jets emerging from collisions
- With jet studies, probing QGP imprint in energy-energy correlation function.
  - Sensitive to medium excitation when jet propagates
- With γ+jets, measuring decorrelation of jet axis from photon momentum. Sensitive to
  - Photon transparent to QGP, while jet interacts with it

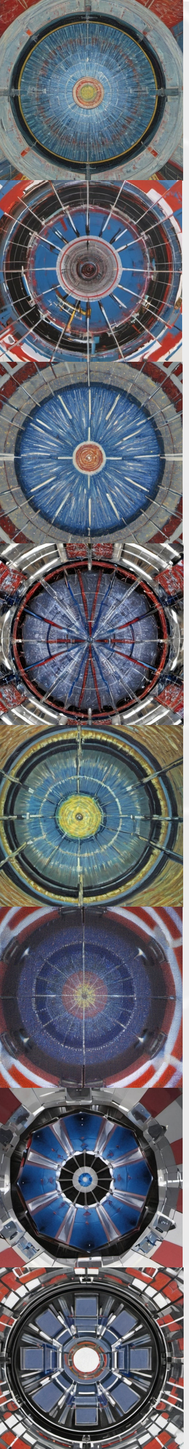


New **CMS-PAS-HIN-23-004**



New **CMS-PAS-HIN-21-019**





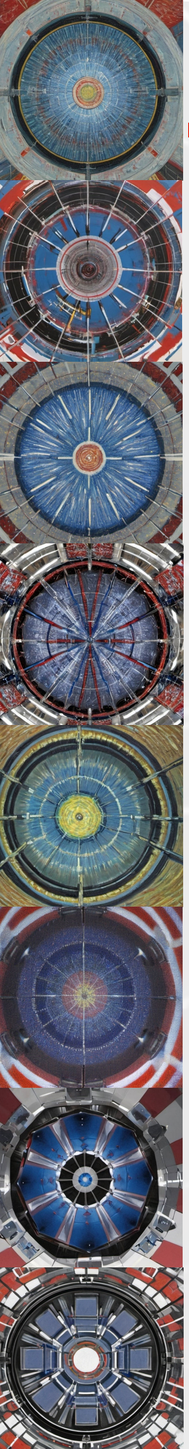
Conclusions: An Outlook to the future

- CMS is producing cutting edge results on all fronts of collider physics
  - Higgs, Electroweak, QCD, Top, Flavor, Heavy Ions, and an extensive Search program
- We are pushing the detector performance beyond design limits
  - rethinking the way we operate it (e.g., with novel data taking strategies)
  - endorsing AI-based algorithms for faster, easier, and more performant solutions
- The collaboration is engaged to this ambitious and innovative program, delivering high-quality physics results while contributing to shape the future of collider physics
- A major upgrade is ahead, that will extend our physics reach even further

Physics Performance Notes: Physics Objects

20 new notes documenting CMS performance, mostly related to Run3

Group	DP Number	Title
BTV	CMS-DP-2024-020	b-hive: a modular training framework for state-of-the-art object-tagging within the Python ecosystem at the CMS experiment
BTV	CMS-DP-2024-024	Run 3 commissioning results of heavy-flavor jet tagging at $\sqrt{s}$=13.6 TeV with CMS data using a modern framework for data processing
BTV	CMS-DP-2024/066	A unified approach for jet tagging in Run 3 at $\sqrt{s}$=13.6 TeV in CMS
BTV	CMS-DP-2024/055	Performance of boosted bb jet tagging at $\sqrt{s}$ = 13.6 TeV with Run 3 CMS data
BTV	CMS-DP-2024-025	Performance summary of AK4 jet b tagging with data from 2022 proton-proton collisions at 13.6 TeV with the CMS detector
EGM	CMS-DP-2024/052	Electron and photon reconstruction and identification performance in 2022 and 2023
JME	CMS-DP-2024/028	Determination of jet identification criteria with proton-proton collision at 13.6 TeV data collected with the CMS detector at the CERN LHC
JME	CMS-DP-2024/039	Jet Energy Scale and Resolution Measurements Using Run3 Data Collected by CMS in 2022 and 2023
JME	CMS-DP-2024/038	Hadronic top quark tagging with variable-sized jets for the CMS experiment
JME	CMS-DP-2024/043	Optimizing the pileup per particle identification algorithm in the context of tau lepton identification in Run3
JME	CMS-DP-2024/044	Distinguishing between W+, W- , and Z jets using a ParticleNet based jet charge tagger
JME	CMS-DP-2024/064	Jet energy scale and resolution of jets with ParticleNet pT regression using Run3 data collected by the CMS experiment in 2023 at 13.6 TeV
LUM	CMS-DP-2024/068	Preliminary luminosity measurement in the 2023 proton-proton collisions at a center-of-mass energy of 13.6 TeV in CMS
MUO	CMS-DP-2024/065	Results on the standard muon momentum calibration with 2022 and 2023 data
MUO	CMS-DP-2024/067	Muon performance in 2024 data
PRO	CMS DP-2024-008	PPS: performance in Run 3 and efficiency of the pixel detector
PRO	CMS DP-2024-009	PPS Performance: first evaluation of the two-arm vertex resolution with timing detectors in 2023
TAU	CMS-DP-2024-063	Performance of the DNN-based tau identification algorithm (DeepTau v2.5) with Domain Adaptation using Adversarial Machine Learning for Run 2
TAU	CMS-DP-2024-053	Tau lepton identification in displaced topologies using machine learning at CMS
TRK	CMS-DP-2024-054	Tracking performance using Tag and Probe with Z->μμ



Physics Performance Notes: Trigger

8 new notes documenting CMS trigger performance

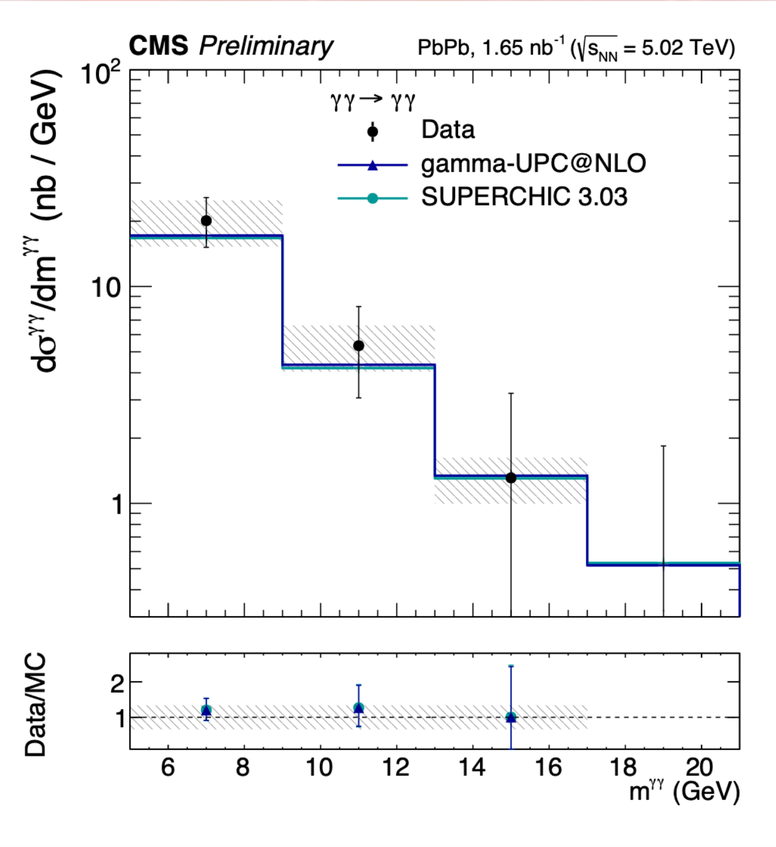
Group	DP Number	Title
EGM/HLT	CMS-DP-2024/041	Electron trigger performance in 2023
L1T	CMS-DP-2024/056	Analysis of muons and calorimeter objects collected by the Level-1 Trigger Data Scouting demonstrator during LHC Run 3
L1T	CMS-DP-2024/058	Level-1 Trigger Algorithm for Long-lived Particle Jets in Run 3
L1T	CMS-DP-2024/057	Standalone barrel e/gamma and calorimeter based jet and tau reconstruction in the Level-1 Phase-2 Calorimeter Trigger
L1T	CMS-DP-2024/032	Displaced Vertex Track Trigger for the CMS Phase-2 Level-1 Trigger Upgrade
L1T/HLT	CMS-DP-2024/059	Data Collected with AXOL1TL Anomaly Detection at the CMS Level-1 Trigger
PF/HLT	CMS-DP-2024-026	Heterogeneous Reconstruction of Hadronic Particle Flow Clusters with Alpaka Portability Library
TAU/HLT	CMS-DP-2024-042	Performance of Tau Lepton Reconstruction at the High Level Trigger using 2023 Data from the CMS Experiment at CERN

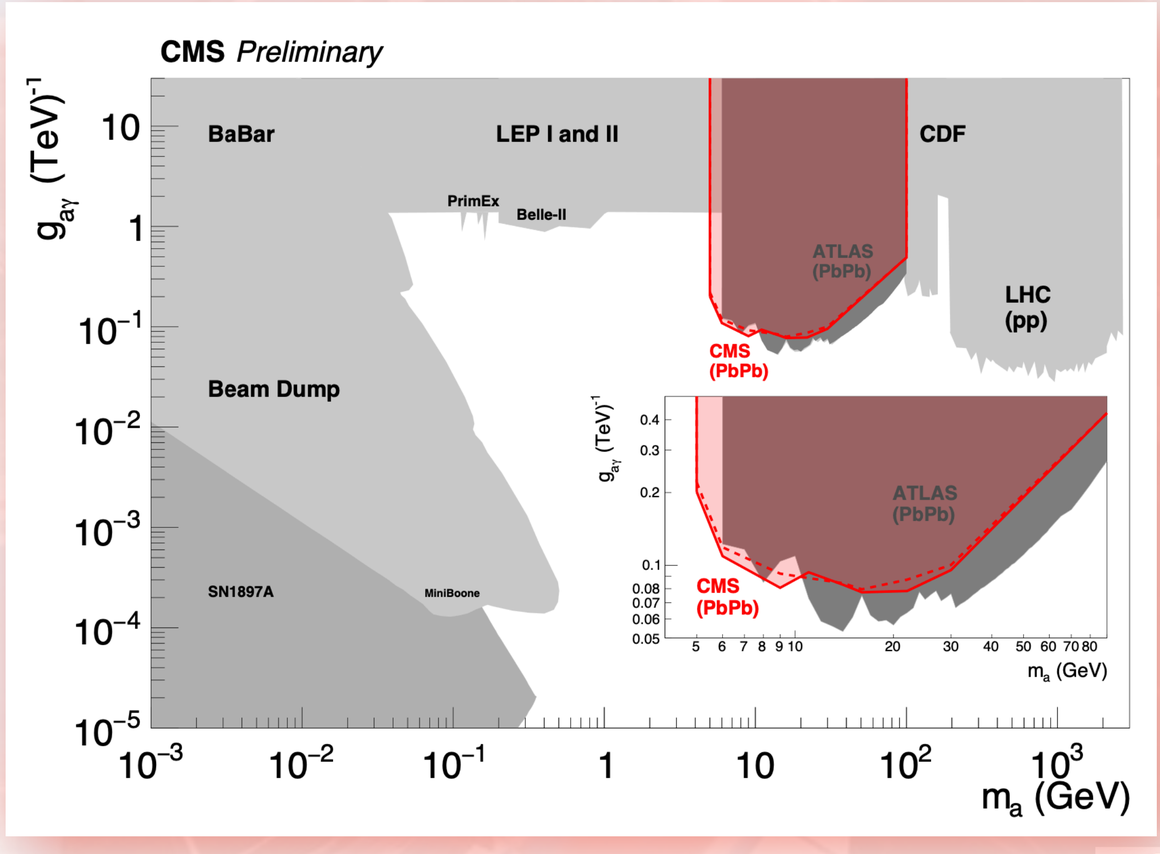

Backup

CMS as a photon collider experiment

- Light-by-light scattering in UPC collisions, with implications on axion models

CMS-PAS-HIN-21-015





CMS and the Dark Sector

- Can probe Dark Matter production in various scenarios
  - in mono-X signatures in portal scenarios
  - from cascade of heavier particles (SUSY,...)
  - probing the portal-particle production directly
- Three new results for ICHEP

CMS-EXO-23-005