# Table of Contents

CMS Exotica Summary plots for 13 data........................................................................................................1

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPS-HEP 2019</td>
<td>1</td>
</tr>
<tr>
<td>LHCP 2019</td>
<td>1</td>
</tr>
<tr>
<td>Dijet summary plots</td>
<td>1</td>
</tr>
<tr>
<td>Moriond 2019</td>
<td>2</td>
</tr>
<tr>
<td>Dijet summary plots</td>
<td>3</td>
</tr>
<tr>
<td>January 2019</td>
<td>4</td>
</tr>
<tr>
<td>2016 data EXO summary bar chart</td>
<td>4</td>
</tr>
<tr>
<td>ICHEP 2018</td>
<td>5</td>
</tr>
<tr>
<td>Dark Matter Summary plots</td>
<td>5</td>
</tr>
<tr>
<td>LHCP 2018</td>
<td>9</td>
</tr>
<tr>
<td>Leptoquark summary</td>
<td>9</td>
</tr>
<tr>
<td>Dijet summary plots</td>
<td>9</td>
</tr>
<tr>
<td>Moriond 2018</td>
<td>11</td>
</tr>
<tr>
<td>Long-lived summary plots</td>
<td>11</td>
</tr>
<tr>
<td>Dijet summary plots</td>
<td>11</td>
</tr>
</tbody>
</table>
CMS Exotica Summary plots for 13 data

EPS-HEP 2019

A bar chart representing the lifetime reach of CMS long-lived particle analyses for a selected set of new physics phenomena.

draft version of this document is in preperation.

LHCP 2019

Dijet summary plots

Limits on the universal coupling $g'_q$ between a leptophobic $Z'$ boson and quarks [arXiv:1611.03568] from various CMS dijet analyses. The expected limits are shown in dashed lines, and the corresponding observed limits are shown in solid lines. The hashed areas show the direction of the excluded area from the observed limits. The grey dashed lines show the $g'_q$ values at fixed values of $\Gamma_{Z'}/M_{Z'}$. Most of the analyses, with the exception of Dijet and Broad Dijet, assume that the intrinsic width is negligible compared to the experimental resolution, and hence are valid for $\Gamma_{Z'}/M_{Z'} < 10\%$. The $tt$ resonance analysis is valid for $\Gamma_{Z'}/M_{Z'} < 5\%$, the Broad Dijet analysis is valid for $\Gamma_{Z'}/M_{Z'} < 30\%$, and the Dijet analysis is valid for $\Gamma_{Z'}/M_{Z'} < 100\%$.

Limits on the universal coupling $g'_q$ between a leptophobic $Z'$ boson and quarks [arXiv:1611.03568] from various CMS dijet analyses. The expected limits are shown in dashed lines, and the corresponding observed limits are shown in solid lines. The hashed areas show the direction of the excluded area from the observed limits. The grey dashed lines show the $g'_q$ values at fixed values of $\Gamma_{Z'}/M_{Z'}$. Most of the analyses, with the exception of Dijet and Broad Dijet, assume that the intrinsic width is negligible compared to the experimental resolution, and hence are valid for $\Gamma_{Z'}/M_{Z'} < 10\%$. The $tt$ resonance analysis is valid for $\Gamma_{Z'}/M_{Z'} < 5\%$, the Broad Dijet analysis is valid for $\Gamma_{Z'}/M_{Z'} < 30\%$, and the Dijet analysis is valid for $\Gamma_{Z'}/M_{Z'} < 100\%$. 

CMS Exotica Summary plots for 13 TeV data

1
The tt resonance analysis is valid for $\Gamma_{Z'}/M_{Z'}$ 5%, the Broad Dijet analysis is valid for $\Gamma_{Z'}/M_{Z'}$ 30%, and the Dijet $\chi$ analysis is valid for $\Gamma_{Z'}/M_{Z'}$ 100%.

Limits on the universal coupling $g'_{q}$ between a leptophobic $Z'$ boson and quarks [arXiv:1611.03568] from various dijet analyses from CMS, ATLAS, CDF, and UA2. The limits are shown in solid lines, with the excluded area above the lines. The hashed areas show the direction of the excluded area from the observed limits. The grey dashed lines show the $g'_{q}$ values at fixed values of $\Gamma_{Z'}/M_{Z'}$. Most of the analyses, with the exception of Dijet $\chi$ and Broad Dijet, assume that the intrinsic width is negligible compared to the experimental resolution, and hence are valid for $\Gamma_{Z'}/M_{Z'}$ 10%. The tt resonance analysis is valid for $\Gamma_{Z'}/M_{Z'}$ 5%, the Broad Dijet analysis is valid for $\Gamma_{Z'}/M_{Z'}$ 30%, and the Dijet $\chi$ analysis is valid for $\Gamma_{Z'}/M_{Z'}$ 100%. Also shown are indirect constraints on $g'_{q}$ from the $\Upsilon$ and Z boson widths, which are valid for all values of $\Gamma_{Z'}/M_{Z'}$. 

Moriond 2019

Dijet summary plots
Limits on the universal coupling $g'_q$ between a leptophobic $Z'$ boson and quarks [arXiv:1611.03568] from various CMS dijet analyses. The expected limits are shown in dashed lines, and the corresponding observed limits are shown in solid lines. The hashed areas show the direction of the excluded area from the observed limits. The grey dashed lines show the $g'_q$ values at fixed values of $\frac{\Gamma_{Z'}}{M_{Z'}}$. Most of the analyses, with the exception of Dijet $\chi$ and Broad Dijet, assume that the intrinsic width is negligible compared to the experimental resolution, and hence are valid for $\frac{\Gamma_{Z'}}{M_{Z'}} \lesssim 10\%$. The Broad Dijet analysis is valid for $\frac{\Gamma_{Z'}}{M_{Z'}} \lesssim 30\%$, and the Dijet $\chi$ analysis is valid for $\frac{\Gamma_{Z'}}{M_{Z'}} \lesssim 100\%$. 

**Diagram:**

- **Top Panel:** CMS Preliminary, Moriond 2019
- **Central Panel:** CMS Preliminary, Moriond 2019
- **Bottom Panel:** CMS Preliminary, Moriond 2019
Limits on the universal coupling $g'_{q}$ between a leptophobic $Z'$ boson and quarks [arXiv:1611.03568] from various dijet analyses from CMS, ATLAS, CDF, and UA2. The limits are shown in solid lines, with the excluded area above the lines. The hashed areas show the direction of the excluded area from the observed limits. The grey dashed lines show the $g'_{q}$ values at fixed values of $\frac{\Gamma_{Z'}}{M_{Z'}}$. Most of the analyses, with the exception of Dijet and Broad Dijet, assume that the intrinsic width is negligible compared to the experimental resolution, and hence are valid for $\frac{\Gamma_{Z'}}{M_{Z'}}$ 10%. The Broad Dijet analysis is valid for $\frac{\Gamma_{Z'}}{M_{Z'}}$ 30%, and the Dijet analysis is valid for $\frac{\Gamma_{Z'}}{M_{Z'}}$ 100%. Also shown are indirect constraints on $g'_{q}$ from the $\Upsilon$ and $Z$ boson widths, which are valid for all values of $\frac{\Gamma_{Z'}}{M_{Z'}}$.

January 2019

2016 data EXO summary bar chart

A bar chart representing the mass scale reach of CMS EXO analyses using data collected in 2016 for a selected set of new physics phenomena.
95% CL observed and expected exclusion regions in mMed-mDM plane for di-jet searches and different MET based DM searches from CMS in the lepto-phobic Axial-vector model. Following the recommendation of the LHC DM working group ([arXiv:1603.04156], [arXiv:1703.05703]), the exclusions are computed for a universal quark coupling of $g_q = 0.25$ and for a DM coupling of $g_{DM} = 1.0$. It should also be noted that the absolute exclusion of the different searches as well as their relative importance, will strongly depend on the chosen coupling and model scenario. Therefore, the exclusion regions, relic density contours, and unitarity curve shown in this plot are not applicable to other choices of coupling values or model.

95% CL observed and expected exclusion regions in mMed-mDM plane for di-jet searches and different MET based DM searches from CMS in the lepto-phobic Vector model. Following the recommendation of the LHC DM working group ([arXiv:1603.04156], [arXiv:1703.05703]), the exclusions are computed for a universal quark coupling of $g_q = 0.25$ and for a DM coupling of $g_{DM} = 1.0$. It should also be noted that the absolute exclusion of the different searches as well as their relative importance, will strongly depend on the chosen coupling and model scenario. Therefore, the exclusion regions, relic density contours, and unitarity curve shown in this plot are not applicable to other choices of coupling values or model.

95% CL observed and expected exclusion regions in mMed-mDM plane for different MET based DM searches from CMS in the lepto-phobic Axial-vector model. Following the recommendation of the LHC DM working group ([arXiv:1603.04156], [arXiv:1703.05703]), the exclusions are computed for a universal quark coupling of $g_q = 0.25$ and for a DM coupling of $g_{DM} = 1.0$. It should also be noted that the
absolute exclusion of the different searches as well as their relative importance, will strongly depend on the chosen coupling and model scenario. Therefore, the exclusion regions, relic density contours, and unitarity curve shown in this plot are not applicable to other choices of coupling values or model.

95% CL observed and expected exclusion regions in mMed-mDM plane for different MET based DM searches from CMS in the lepto-phobic Vector model. Following the recommendation of the LHC DM working group ([arXiv:1603.04156], [arXiv:1703.05703]), the exclusions are computed for a universal quark coupling of \( g_q = 0.25 \) and for a DM coupling of \( g_{DM} = 1.0 \). It should also be noted that the absolute exclusion of the different searches as well as their relative importance, will strongly depend on the chosen coupling and model scenario. Therefore, the exclusion regions, relic density contours, and unitarity curve shown in this plot are not applicable to other choices of coupling values or model.

95% CL observed and expected exclusion regions in mMed-mDM plane for di-jet and di-lepton searches from CMS in the Axial-vector model. Following the recommendation of the LHC DM working group ([arXiv:1603.04156], [arXiv:1703.05703]), the exclusions are computed for a universal quark coupling of \( g_q = 0.1 \), lepton coupling \( g_l = 0.1 \), and for a DM coupling of \( g_{DM} = 1.0 \). It should also be noted that the absolute exclusion of the different searches as well as their relative importance, will strongly depend on the chosen coupling and model scenario. Therefore, the exclusion regions, relic density contours, and unitarity curve shown in this plot are not applicable to other choices of coupling values or model.
95% CL observed and expected exclusion regions in mMed-mDM plane for di-jet and di-lepton searches from CMS in the Vector model. Following the recommendation of the LHC DM working group ([arXiv:1603.04156], [arXiv:1703.05703]), the exclusions are computed for a universal quark coupling of $g_q = 0.1$, lepton coupling $g_l = 0.01$, and for a DM coupling of $g_{DM} = 1.0$. It should also be noted that the absolute exclusion of the different searches as well as their relative importance, will strongly depend on the chosen coupling and model scenario. Therefore, the exclusion regions, relic density contours, and unitarity curve shown in this plot are not applicable to other choices of coupling values or model.

95% CL observed (full-line) and expected (dashed-line) exclusion limits for the Pseudo-scalar model as a function of Mmed for different MET based DM searches from CMS. Following the recommendation of the LHC DM working group ([arXiv:1603.04156], [arXiv:1703.05703]), the exclusions are computed for quark coupling of $g_q = 1.0$ and for a DM coupling of $g_{DM} = 1.0$. It should be noted that an exclusion away from $\sigma / \sigma_{\text{theory}} = 1$ only applies to coupling combinations that yield the same kinematic distributions as the benchmark model considered here.

95% CL observed (full-line) and expected (dashed-line) exclusion limits for the Scalar model as a function of Mmed for different MET based DM searches from CMS. Following the recommendation of the LHC DM working group ([arXiv:1603.04156], [arXiv:1703.05703]), the exclusions are computed for quark coupling of $g_q = 1.0$ and for a DM coupling of $g_{DM} = 1.0$. It should be noted that an exclusion away from $\sigma / \sigma_{\text{theory}} = 1$ only applies to coupling combinations that yield the same kinematic distributions as the benchmark model considered here.
A comparison of CMS results to the mDM-sigma_SD plane. Unlike in the mass-mass plane, the limits are shown at 90% CL. The CMS contour in the SD plane is for an Axial-vector mediator, Dirac DM and couplings g_q = 0.25 and gDM = 1.0. The SD exclusion contour is compared with limits from PICASSO and PICO experiments, the IceCube limit for the tbar, bbar annihilation channels, and the Super-Kamiokande limit for the bbar annihilation channel. It should be noted that the CMS limits do not include a constraint on the relic density and also the absolute exclusion of the different CMS searches as well as their relative importance will strongly depend on the chosen coupling and model scenario. Therefore, the shown CMS exclusion regions in this plot are not applicable to other choices of coupling values or models.

A comparison of CMS results to the mDM-sigma_SI plane. Unlike in the mass-mass plane, the limits are shown at 90% CL. The CMS contour in the SI plane is for a Vector mediator, Dirac DM and couplings g_q = 0.25 and gDM = 1.0. The CMS SI exclusion contour is compared with the XENON1T 2017, LUX 2016, PandaX-II 2016, CDMSLite 2015 and CRESST-II 2015 limits, which constitutes the strongest documented constraints in the shown mass range. It should be noted that the CMS limits do not include a constraint on the relic density and also the absolute exclusion of the different CMS searches as well as their relative importance will strongly depend on the chosen coupling and model scenario. Therefore, the shown CMS exclusion regions in this plot are not applicable to other choices of coupling values or models.

A comparison of CMS results to the mDM-sigma_SI plane. Unlike in the mass-mass plane, the limits are shown at 90% CL. The CMS contour in the SI plane is for a Scalar mediator, Dirac DM and couplings g_q = 0.25 and gDM = 1.0. The CMS SI exclusion contour is compared with the XENON1T 2017, LUX 2016, PandaX-II 2016, CDMSLite 2015 and CRESST-II 2015 limits, which constitutes the strongest documented constraints in the shown mass range. It should be noted that the CMS limits do not include a constraint on the relic density and also the absolute exclusion of the different CMS searches as well as their relative importance will strongly depend on the chosen coupling and model scenario. Therefore, the shown CMS exclusion regions in this plot are not applicable to other choices of coupling values or models.
density and also the absolute exclusion of the different CMS searches as well as their relative importance will strongly depend on the chosen coupling and model scenario. Therefore, the shown CMS exclusion regions in this plot are not applicable to other choices of coupling values or models.

A comparison of CMS results exclusion limits to the velocity averaged DM annihilation cross section upper limits from Fermi-LAT. Unlike in the mass-mass plane, the limits are shown at 90% CL. The CMS contours are for a Pseudoscalar mediator, Dirac DM and couplings \( g_{q} = 0.25 \) and \( g_{DM} = 1.0 \). It should be noted that the CMS limits do not include a constraint on the relic density and also the absolute exclusion of the different CMS searches as well as their relative importance will strongly depend on the chosen coupling and model scenario. Therefore, the shown CMS exclusion regions in this plot are not applicable to other choices of coupling values or models.

## LHCP 2018

### Leptoquark summary

<table>
<thead>
<tr>
<th>caption</th>
<th>plot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview of CMS leptoquark 95% CL mass exclusion limits.</td>
<td></td>
</tr>
</tbody>
</table>

### Dijet summary plots

Changes for LHCP since Moriond: the broad dijet result has been added, the CMS 2016 dijet reference (EXO-16-056) has been set to arXiv:1806.00843, and the ATLAS TLA dijet result has been updated to the published result.
Limits on the universal coupling $g’_q$ between a leptophobic $Z'$ boson and quarks [arXiv:1611.03568] from various CMS dijet analyses from CMS, ATLAS, CDF, and UA2. The limits are shown in solid lines, with the excluded area above the lines. The grey dashed lines show the $g’_q$ values at fixed values of $\frac{\Gamma_{Z'}}{M_{Z'}}$. Most of the analyses, with the exception of Dijet and Broad Dijet, assume that the intrinsic width is negligible compared to the experimental resolution, and hence are valid for $\frac{\Gamma_{Z'}}{M_{Z'}} \leq 10\%$. The Broad Dijet analysis is valid for $\frac{\Gamma_{Z'}}{M_{Z'}} \leq 30\%$, and the Dijet analysis is valid for $\frac{\Gamma_{Z'}}{M_{Z'}} \leq 100\%$. Also shown is an indirect constraint on $g’_q$ from the $Z$ boson width, which is valid for all values of $\frac{\Gamma_{Z'}}{M_{Z'}}$.

Limits on the universal coupling $g’_q$ between a leptophobic $Z'$ boson and quarks [arXiv:1611.03568] from various CMS dijet analyses. The expected limits are shown in dashed lines, and the corresponding observed limits are shown in solid lines. The hashed areas show the direction of the excluded area from the observed limits. The grey dashed lines show the $g’_q$ values at fixed values of $\frac{\Gamma_{Z'}}{M_{Z'}}$. Most of the analyses, with the exception of Dijet and Broad Dijet, assume that the intrinsic width is negligible compared to the experimental resolution, and hence are valid for $\frac{\Gamma_{Z'}}{M_{Z'}} \leq 10\%$. The Broad Dijet analysis is valid for $\frac{\Gamma_{Z'}}{M_{Z'}} \leq 30\%$, and the Dijet analysis is valid for $\frac{\Gamma_{Z'}}{M_{Z'}} \leq 100\%$.
Long-lived summary plots

Observed and expected gluino mass exclusions at 95% CL (indicated, respectively, by solid and dashed contours) for simplified models that assume the production of pairs of long-lived gluinos that each form an R-hadron bound state, before decaying via highly virtual light-flavour squarks to the neutralino and a quark-antiquark pair. The mass exclusions are presented as a function of the gluino proper decay length $c\tau$ and lifetime $\tau$. The mass exclusions are shown as obtained from three searches under various model assumptions, as indicated in the figure legend. The charge suppressed scenario assumes that the R-hadron does not undergo nuclear interactions with the detector material. The fraction $f_{g\tilde{g}}$ specifies the probability that the R-hadron is formed as a gluino-gluon bound state. Exclusions for scenarios that involve the prompt decay of the gluino or a stable gluino are also indicated by circular markers.

Dijet summary plots

Limits on the universal coupling $g'_q$ between a leptophobic $Z'$ boson and quarks [arXiv:1611.03568] from various CMS dijet analyses. The expected limits are shown in dashed lines, and the corresponding observed limits are shown in solid lines. The hashed areas show the direction of the excluded area from the observed limits. The grey dashed lines show the $g'_q$ values at fixed values of $\Gamma_{Z'}/M_{Z'}$. Most of the analyses, with the exception of Dijet $\chi$, assume that the intrinsic width is negligible compared to the experimental resolution, and hence are valid for $\Gamma_{Z'}/M_{Z'} < 10\%$. The Dijet $\chi$ analysis is valid for $\Gamma_{Z'}/M_{Z'} < 100\%$. 
Limits on the universal coupling $g'_q$ between a leptophobic $Z'$ boson and quarks [arXiv:1611.03568] from various CMS dijet analyses. The expected limits are shown in dashed lines, and the corresponding observed limits are shown in solid lines. The hashed areas show the direction of the excluded area from the observed limits. The grey dashed lines show the $g'_q$ values at fixed values of $\frac{\Gamma_{Z'}}{M_{Z'}}$. Most of the analyses, with the exception of Dijetχ, assume that the intrinsic width is negligible compared to the experimental resolution, and hence are valid for $\frac{\Gamma_{Z'}}{M_{Z'}} \leq 10\%$. The Dijet analysis is valid for $\frac{\Gamma_{Z'}}{M_{Z'}} \leq 100\%$. Also shown is an indirect constraint on $g'_q$ from the $Z$ boson width, which is valid for all values of $\frac{\Gamma_{Z'}}{M_{Z'}}$. 

Limits on the universal coupling $g'_q$ between a leptophobic $Z'$ boson and quarks [arXiv:1611.03568] from various dijet analyses from CMS, ATLAS, CDF, and UA2. The limits are shown in solid lines, with the excluded area above the lines. The hashed areas show the direction of the excluded area from the observed limits. The grey dashed lines show the $g'_q$ values at fixed values of $\frac{\Gamma_{Z'}}{M_{Z'}}$. Most of the analyses, with the exception of Dijetχ, assume that the intrinsic width is negligible compared to the experimental resolution, and hence are valid for $\frac{\Gamma_{Z'}}{M_{Z'}} \leq 10\%$. The Dijet χ analysis is valid for $\frac{\Gamma_{Z'}}{M_{Z'}} \leq 100\%$. 

This topic: CMSPublic > SummaryPlotsEXO13TeV
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