UNIVERSITÄT BONN

Belle II

BBAM: SEPT. 23, 2020

STATUS UPDATE: IMPLEMENTATION OF SIGNAL EXTRACTION SCRIPT

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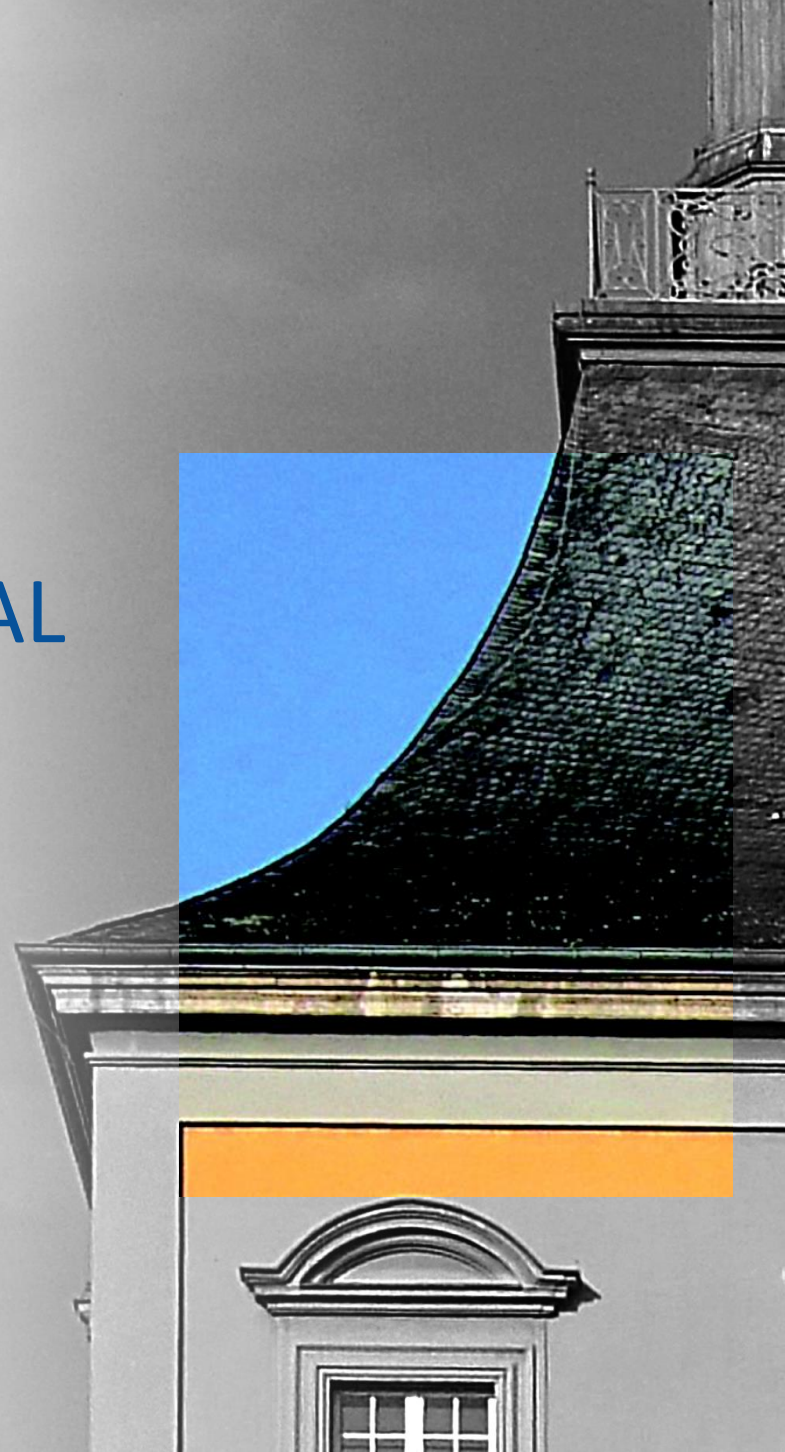
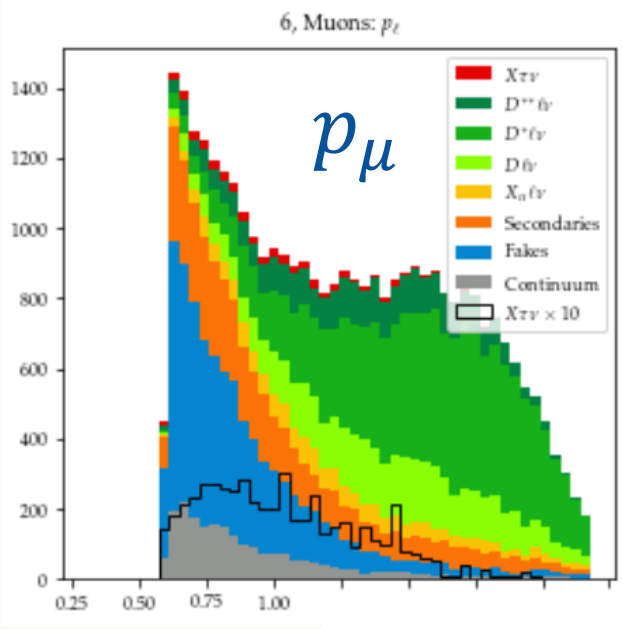


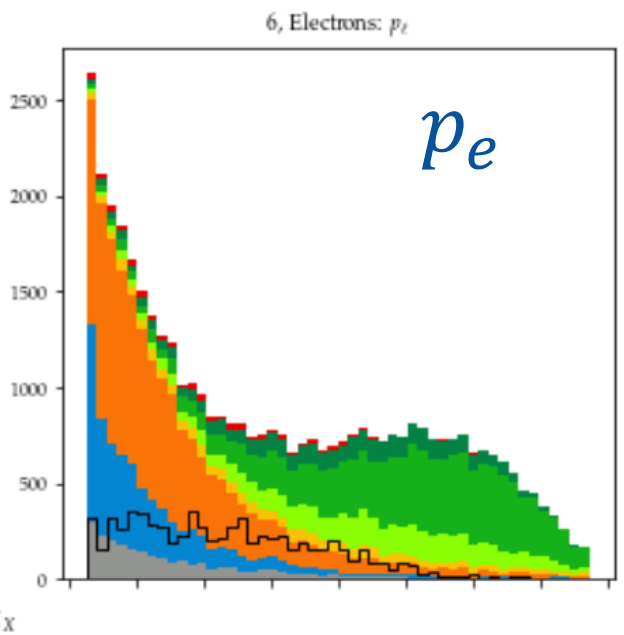
MOTIVATION

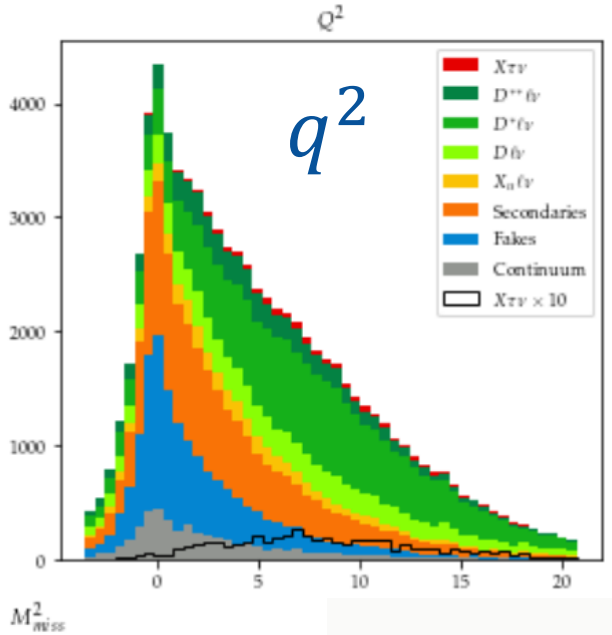
- Evaluation of several analysis steps not necessarily straight forward:
  - Best m_X reconstruction (separate $X\ell\nu$ / $X\tau\nu$ from Continuum/Fakes or aim for highest resolution?)
  - Best lepton candidate selection
  - Best fake rejection
  - …

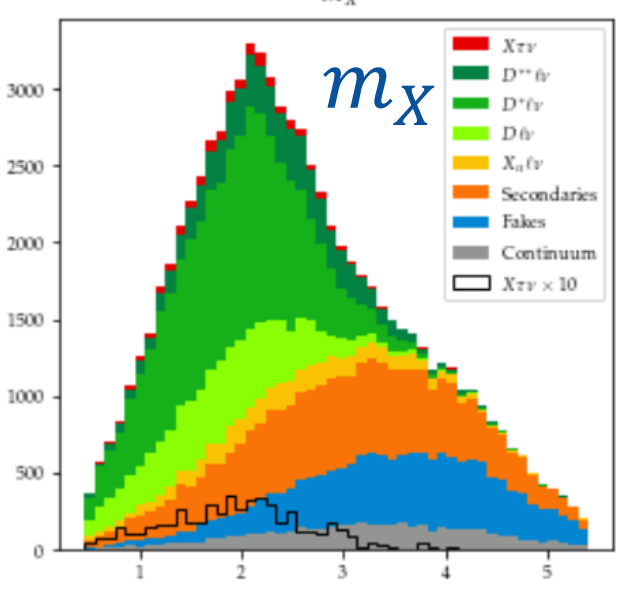
➢ Implement first basic fitting routine which is easy and straight forward to use (and can be improved during the ongoing analysis)

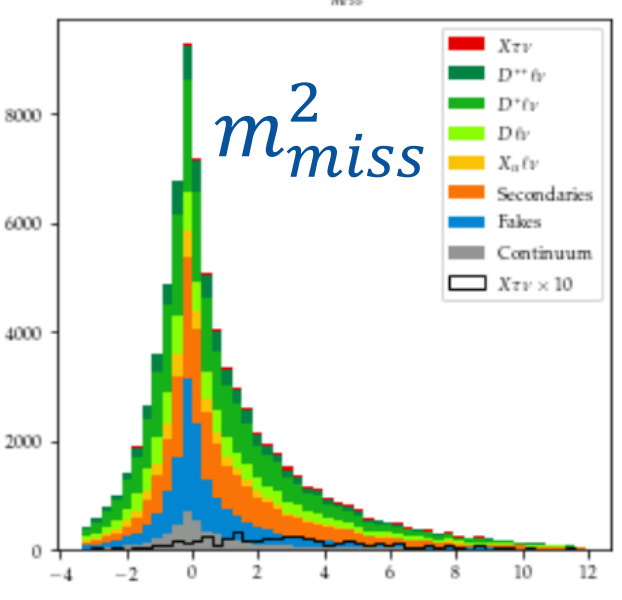
SIGNAL EXTRACTION VARIABLES



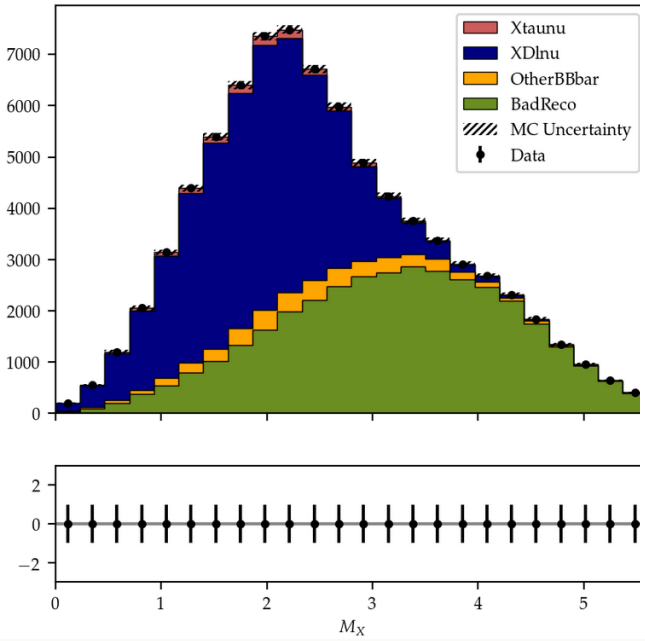


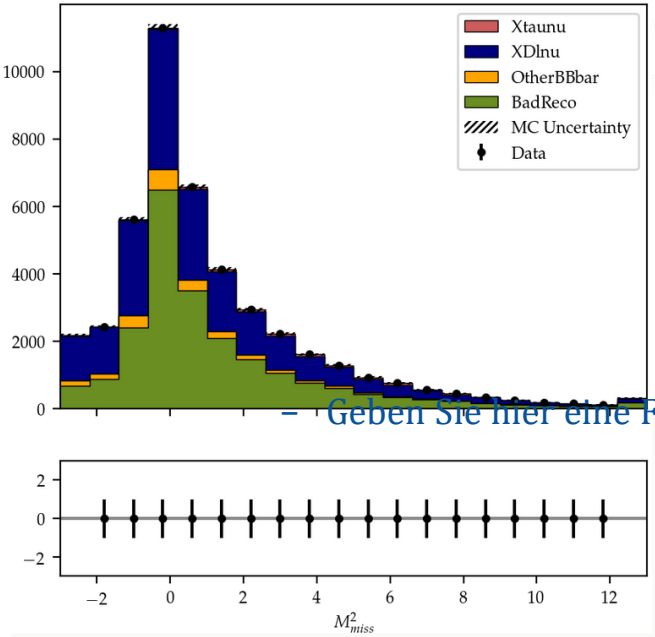


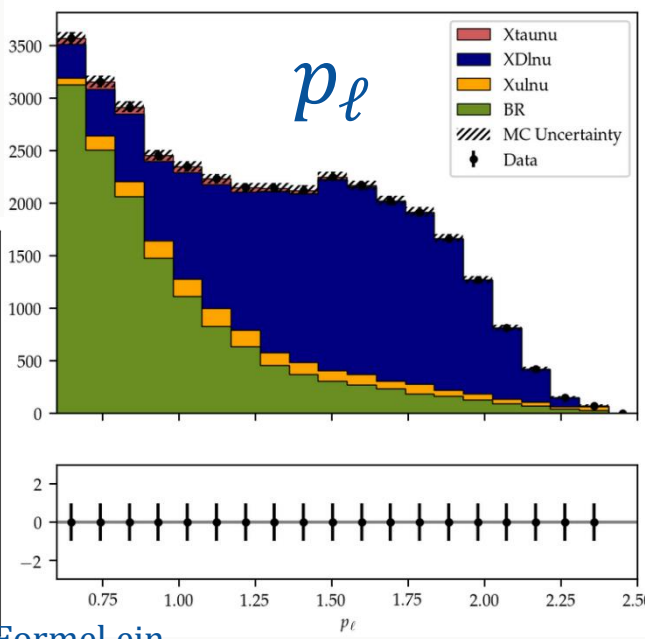




1D RESULTS







– Geben Sie hier eine Formel ein.

m_X

```
BadReco_yield :  35964.0 +- 579.3
OtherBBbar_yield :  4066.0 +- 1156.0
XDlnu_yield :  38935.0 +- 1949.8
Xtaunu_yield :  1214.0 +- 1854.9
Correlation matrix:
[[ 1.    -0.882  0.223  0.032]
 [-0.882  1.    -0.288 -0.037]
 [ 0.223 -0.288  1.    -0.935]
 [ 0.032 -0.037 -0.935  1.   ]]
```

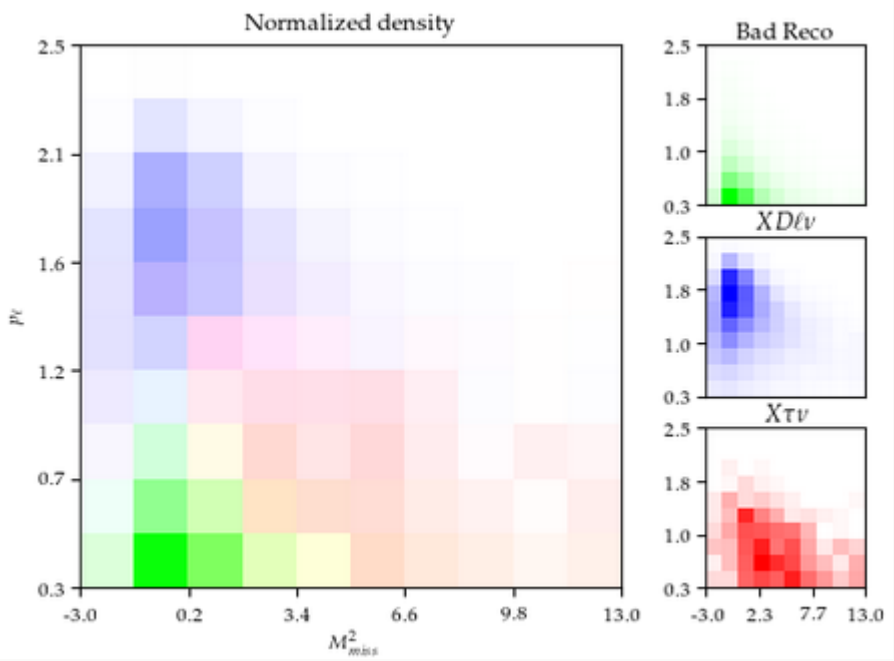
m^2_{miss}

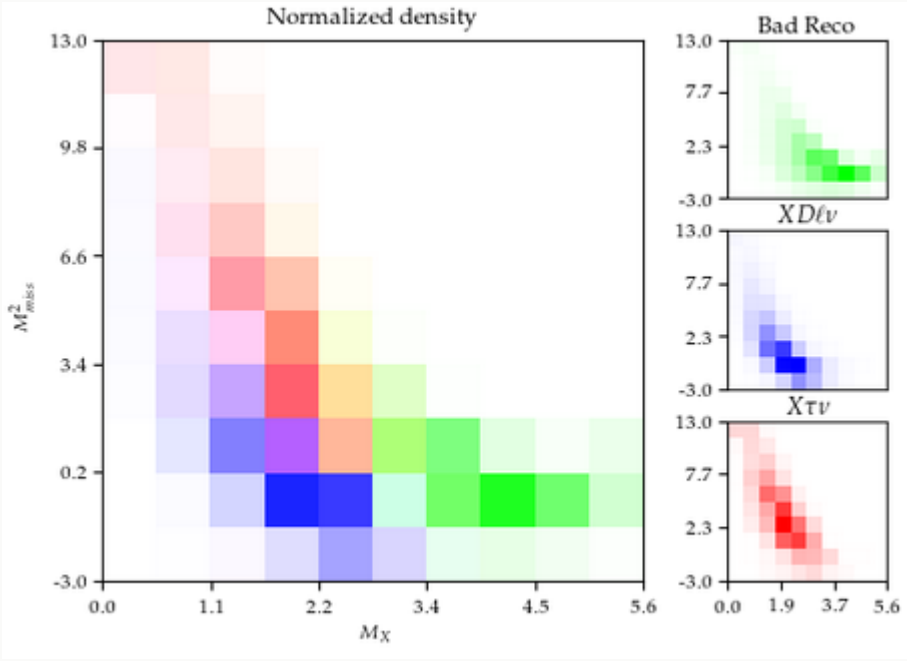
```
BR_yield :  36400.0 +- 1324.0
Xulnu_yield :  4070.0 +- 4449.3
XDlnu_yield :  38941.0 +- 4286.7
Xtaunu_yield :  1214.0 +- 718.3
Correlation matrix:
[[ 1.    -0.712  0.543 -0.639]
 [-0.712  1.    -0.973  0.925]
 [ 0.543 -0.973  1.    -0.93 ]
 [-0.639  0.925 -0.93   1.   ]]
```

p_ℓ

```
BadReco_yield :  36400.0 +- 489.7
OtherBBbar_yield :  4070.0 +- 716.1
XDlnu_yield :  38941.0 +- 452.4
Xtaunu_yield :  1214.0 +- 703.8
Correlation matrix:
[[ 1.     0.082  0.111 -0.738]
 [ 0.082  1.    -0.747 -0.568]
 [ 0.111 -0.747  1.     0.161]
 [-0.738 -0.568  0.161  1.   ]]
----------------------------------------
Channel no.  1  of  2
BadReco_yield :  22261.0 +- 305.2
OtherBBbar_yield :  2229.0 +- 585.4
XDlnu_yield :  19536.0 +- 341.9
Xtaunu_yield :  704.0 +- 495.2
----------------------------------------
----------------------------------------
Channel no.  2  of  2
BadReco_yield :  14139.0 +- 383.0
OtherBBbar_yield :  1841.0 +- 412.5
XDlnu_yield :  19405.0 +- 296.2
Xtaunu_yield :  510.0 +- 500.1
----------------------------------------
```

2D RESULTS





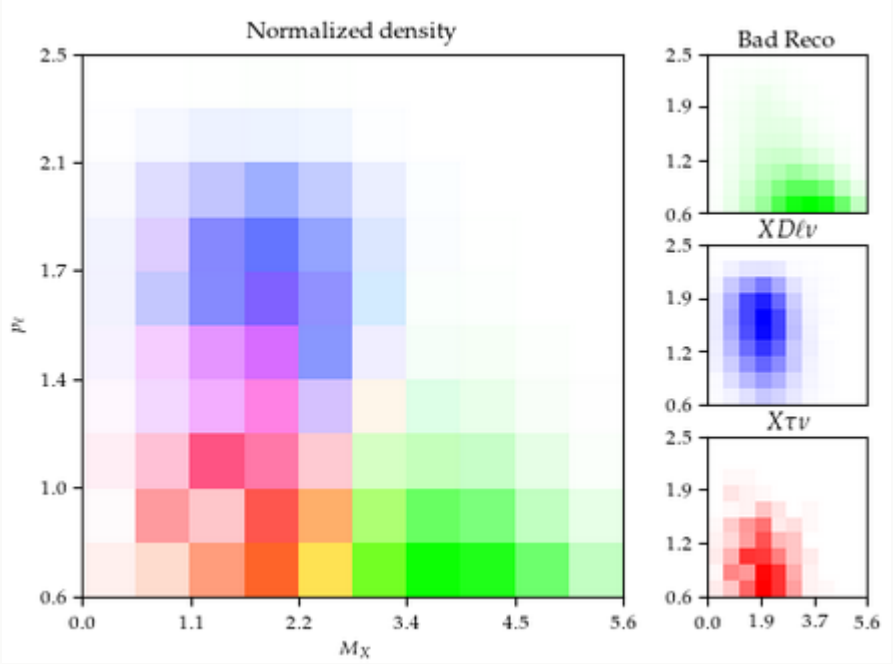
m^2_{miss} vs p_ℓ

```
BadReco_yield :  36400.0 +- 325.4
OtherBBbar_yield :  4070.0 +- 471.7
XDlnu_yield :  38941.0 +- 386.7
Xtaunu_yield :  1214.0 +- 212.8
Correlation matrix:
[[ 1.    -0.535  0.3   -0.373]
 [-0.535  1.    -0.728 -0.026]
 [ 0.3   -0.728  1.    -0.188]
 [-0.373 -0.026 -0.188  1.   ]]
```

m_X vs m^2_{miss}

```
BR_yield :  35964.0 +- 314.8
Xulnu_yield :  4066.0 +- 429.7
XDlnu_yield :  38935.0 +- 335.9
Xtaunu_yield :  1214.0 +- 211.6
Correlation matrix:
[[ 1.    -0.576  0.295 -0.247]
 [-0.576  1.    -0.626 -0.135]
 [ 0.295 -0.626  1.    -0.209]
 [-0.247 -0.135 -0.209  1.   ]]
```

2D RESULTS CONTINUED

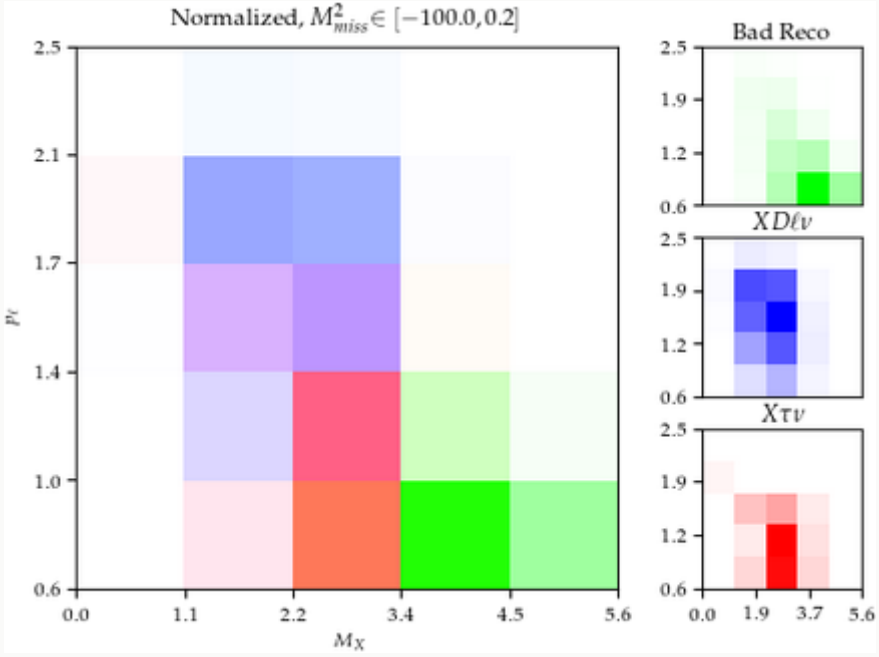


m_X vs p_ℓ

```
BadReco_yield :  35964.0 +- 304.3
OtherBBbar_yield :  4066.0 +- 420.4
XDlnu_yield :  38935.0 +- 357.3
Xtaunu_yield :  1214.0 +- 237.6
Correlation matrix:
[[ 1.    -0.54   0.322 -0.317]
 [-0.54   1.    -0.649 -0.061]
 [ 0.322 -0.649  1.    -0.309]
 [-0.317 -0.061 -0.309  1.   ]]
```

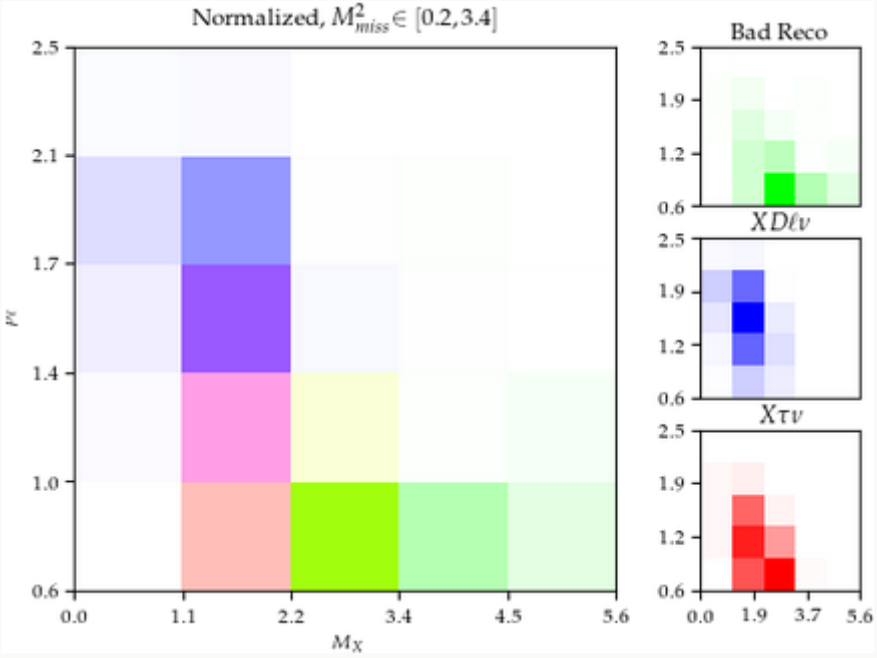
3D RESULTS

m_X vs $p_\ell, m^2_{miss} \in [-\infty, 0.2]$GeV



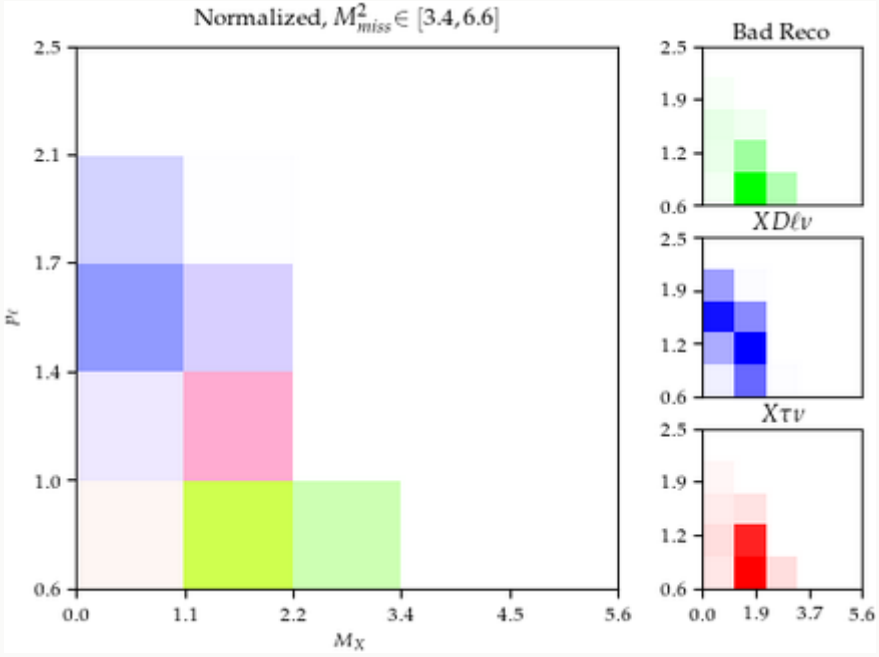
3D RESULTS

m_X vs p_ℓ, $m^2_{miss} \in [0.2, 3.4]$GeV



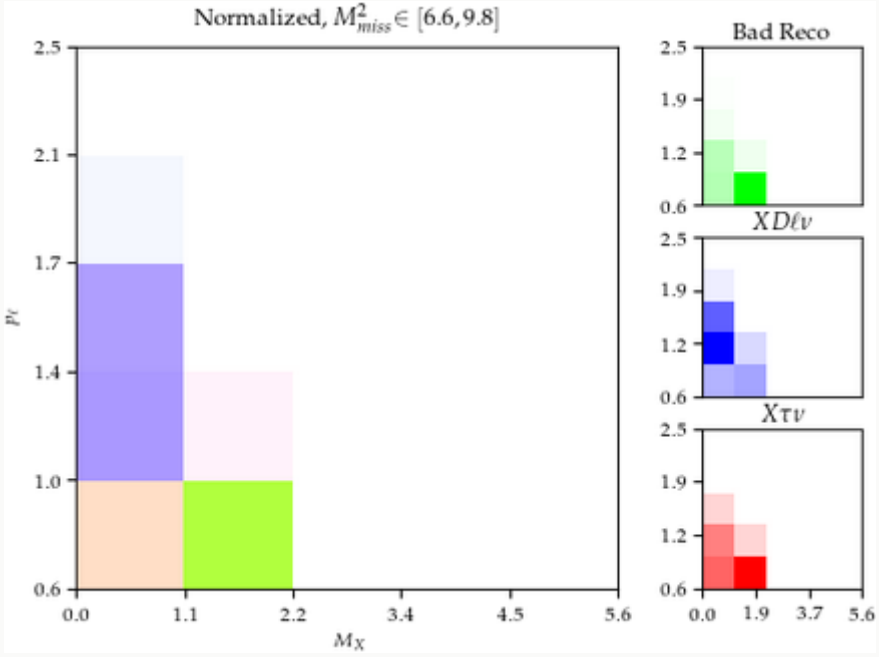
3D RESULTS

m_X vs p_ℓ, $m^2_{miss} \in [3.4, 6.6]$GeV



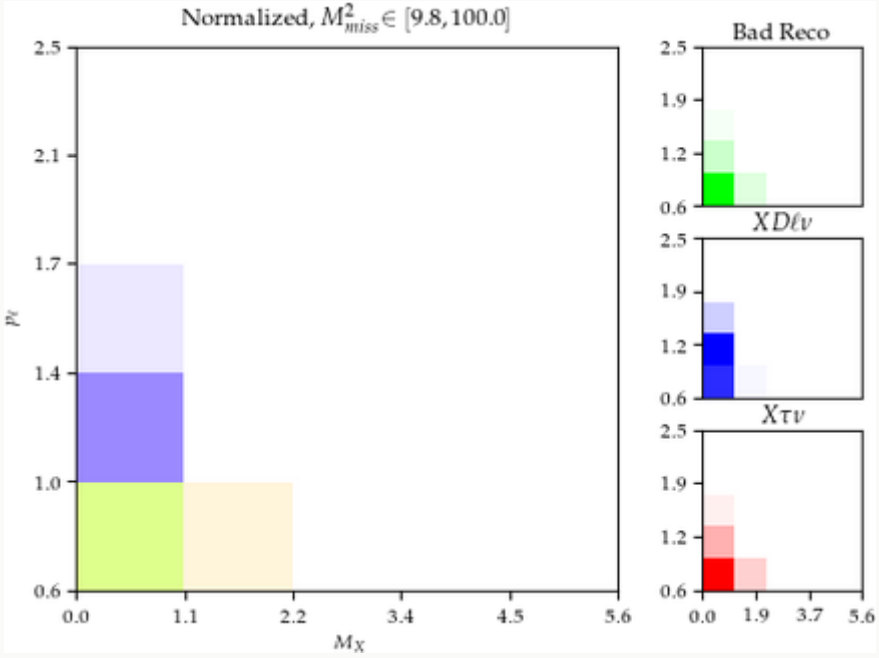
3D RESULTS

m_X vs p_ℓ, $m^2_{miss} \in [6.6, 9.8]$GeV



3D RESULTS

m_X vs $p_\ell, m^2_{miss} \in [9.8, \infty]$GeV



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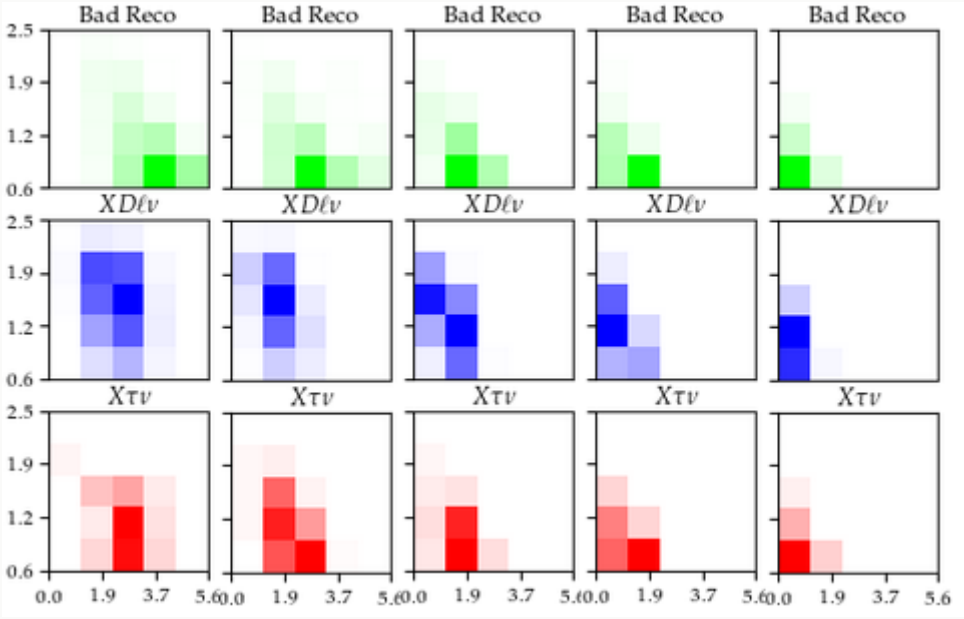
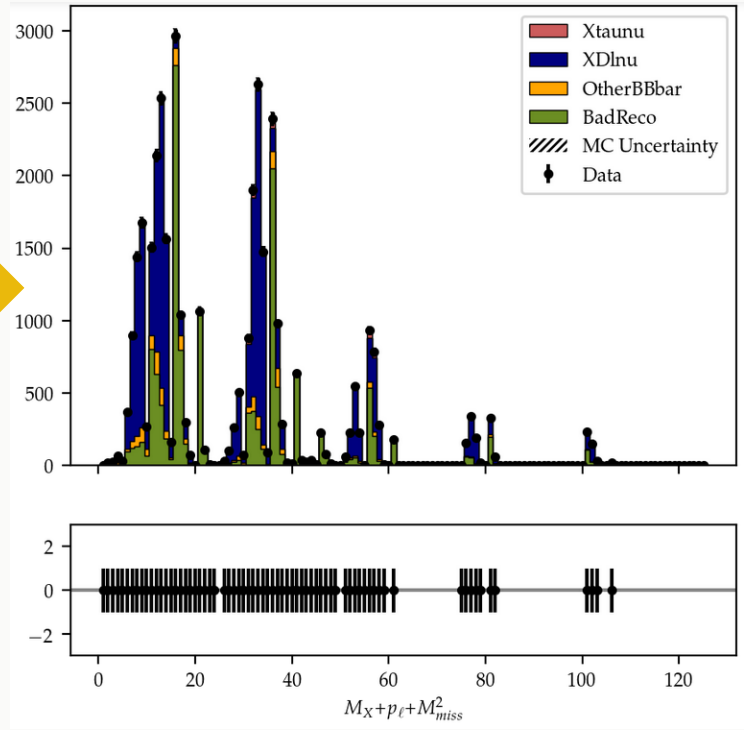
3D RESULTS





m_X vs p_ℓ vs m^2_{miss}

```
BadReco_yield :  35964.0 +- 307.1
OtherBBbar_yield :  4066.0 +- 412.3
XDlnu_yield :  38935.0 +- 343.4
Xtaunu_yield :  1214.0 +- 221.5
Correlation matrix:
[[ 1.    -0.541  0.313 -0.339]
 [-0.541  1.    -0.653 -0.056]
 [ 0.313 -0.653  1.    -0.257]
 [-0.339 -0.056 -0.257  1.   ]]
```

BIN OPTIMIZATION

Problem:

- The performance can be optimized significantly by nifty binning
- Comparability of investigated effects becomes questionable

➢ What is the best procedure here without spending a lot of time per variable?

Example:

➢ Maximize the squared sum of all bin significances?!

- Cut of x% of the signal to both borders: two framing bins
- Find significance maximum: take e.g. 3 equally sized bins around
- Take another 2 equally sized bins from central bins to border ones