Global Alignment of the AFP
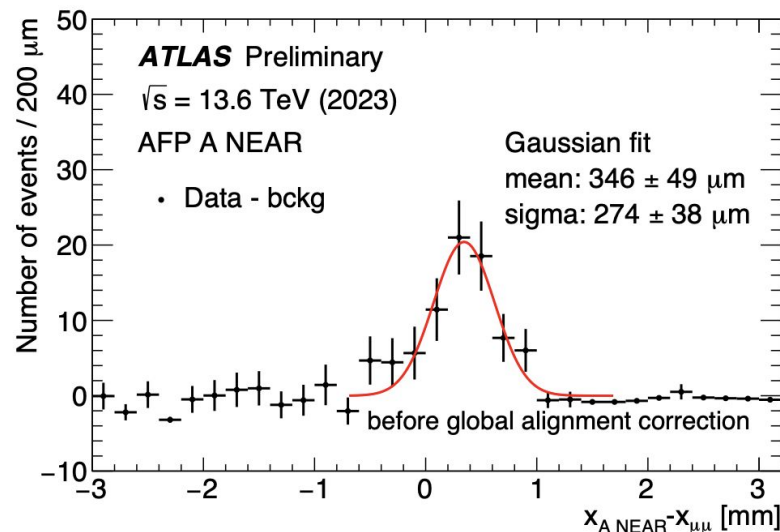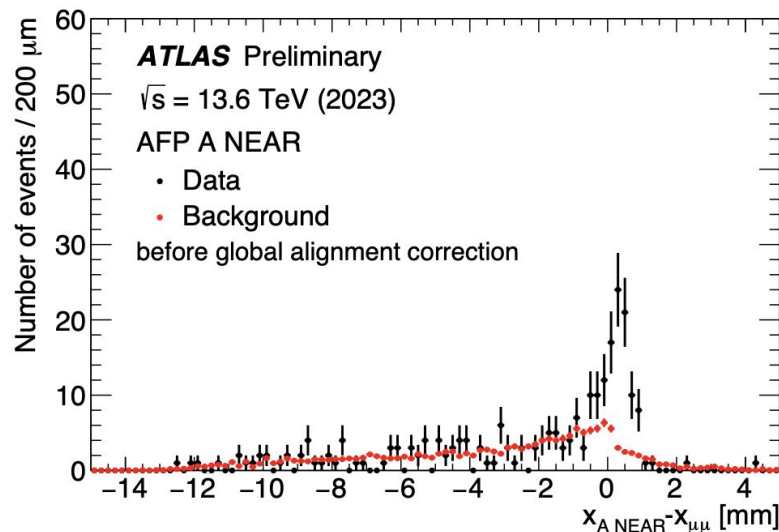
- 2023 plots are finally published: ATL-COM-FWD-2024-038

- Next steps: publish 2022 global alignment plots
- In future, perform global alignment using 2024 data

Tau g-2 analysis

Corrections for EM Pileup

- EM pileup - more than one electromagnetic interaction per bunch crossing (EM dissociation process, EDM)
- It causes the additional neutron rate in the ZDC: the correction can be added to **0n0n weights**
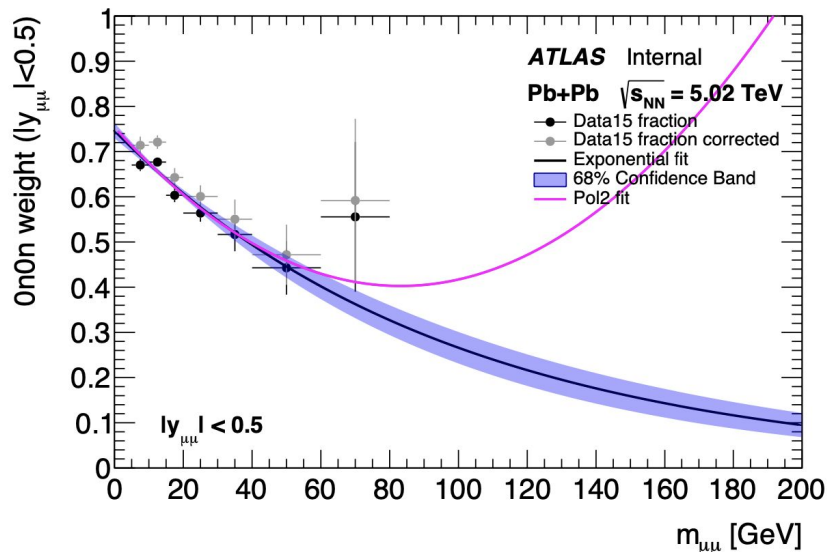
0n0n = no neutrons detected on both sides of ZDC

- Provides large suppression of photonuclear background
- MC doesn't include ZDC information - need extra reweighting to account for 0n0n topology
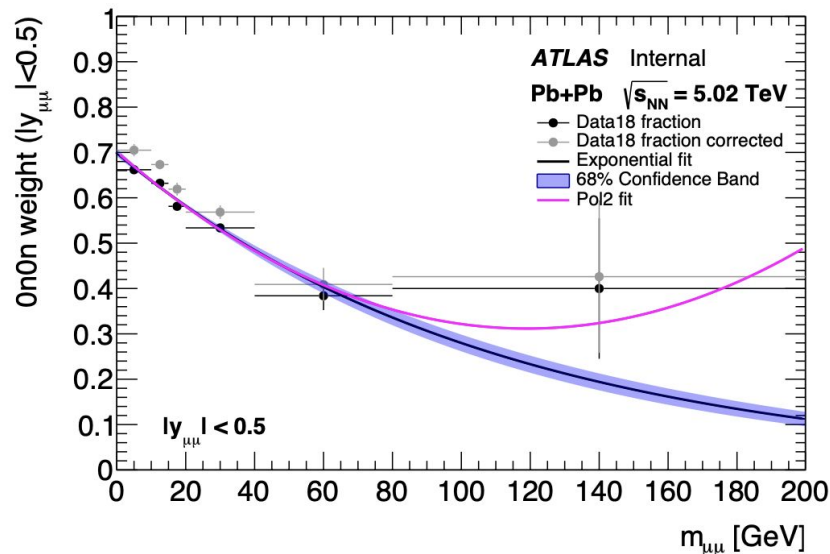- Fraction of 0n0n events is calculated from data

Tau g-2 analysis

Corrections for EM Pileup

2015 data

2018 data

- polynomial fit as systematic uncertainty?
- 0n0n weights at truth level
- EM Pileup correction to data

Backup

EM Pileup

- EM pileup - more than one electromagnetic interaction per bunch crossing (EM dissociation process, EDM)
- it causes the additional neutron rate in the ZDC

- mean hadronic interaction rate per bunch crossing μ_{had} in Pb+Pb is low (0.2%)

- we can estimate electromagnetic μ_{EM} for single and mutual EMD:

$$\mu_{EM,single} = \mu_{had} \cdot \frac{\text{cross section for single EMD}}{\text{cross section for hadronic interaction}}$$

$$\mu_{EM,mutual} = \mu_{had} \cdot \frac{\text{cross section for mutual EMD}}{\text{cross section for hadronic interaction}}$$

[dielectron production supporting note]

actIntPerXing

htemp	
Entries	4335070
Mean	0.002443
Std Dev	0.001392
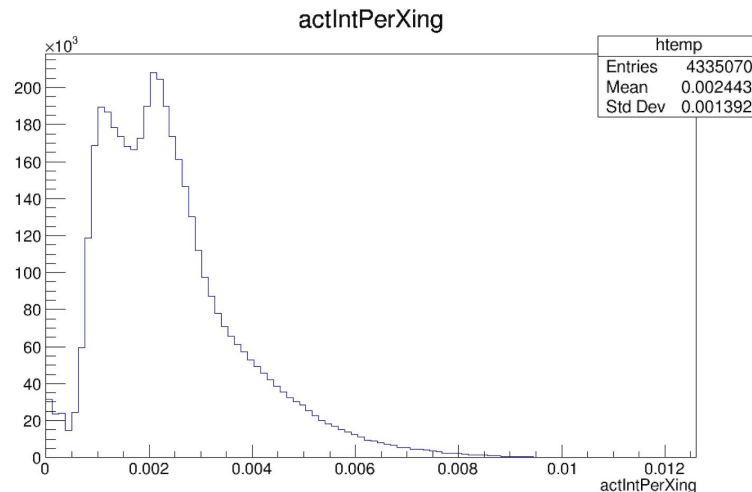
- probability of at least one interaction per bunch crossing is the mean value of $1 - P(0) = 1 - \exp(-\mu)$

EM Pileup

- distribution of 1 - P(0) probability is considered separately for single and mutual EMD. It is plotted for every event and the mean value provides probability of single Ps and mutual Pm dissociation.
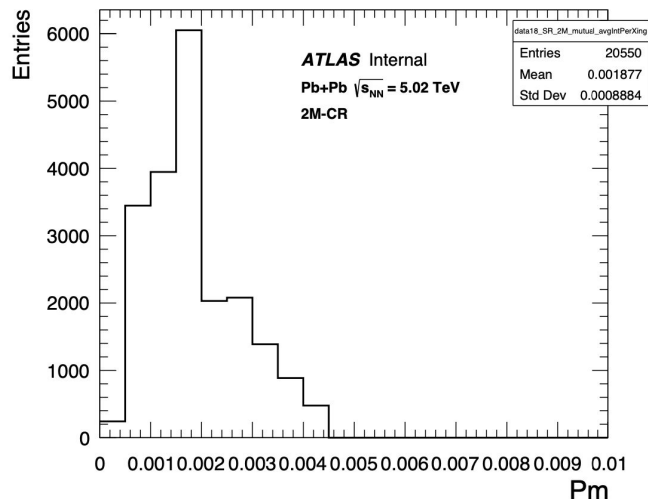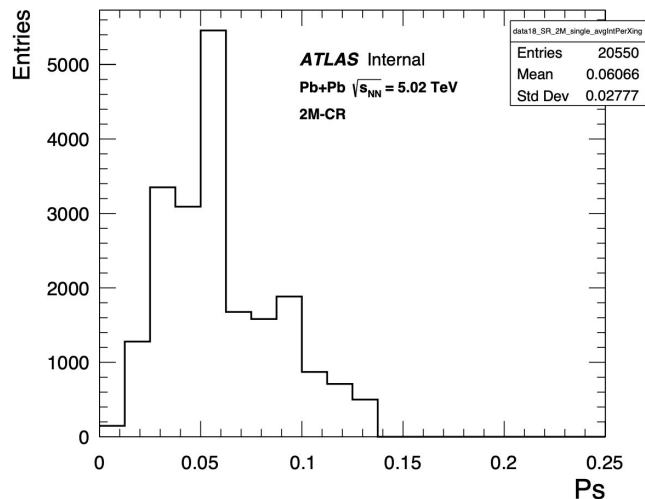
2015 probabilities (from UPC dimuon measurement):

$$p_S = 5.67^{+0.37}_{-0.32} \times 10^{-2}$$
$$p_M = 1.74 \pm 0.12 \times 10^{-3}$$

2018 probabilities (from UPC dielectron measurement):

$$p_S = 6.362^{+0.429}_{-0.367} \times 10^{-2}$$
$$p_M = 1.978 \pm 0.136 \times 10^{-3}$$

We use a different GRL so the Ps and Pm values from 2018 may be different – need to check and derive them

EM Pileup: deriving 2018 correction

2018 probabilities (from [UPC dielectron](#) measurement):

$$p_S = 6.362^{+0.429}_{-0.367} \times 10^{-2}$$

$$p_M = 1.978 \pm 0.136 \times 10^{-3}$$

$$P_s = 6.066^{+0.412}_{-0.352} \times 10^{-2}$$

$$P_m = 1.877 \pm 0.129 \times 10^{-3}$$

EM Pileup: corrected ZDC fractions

observed fractions

corrected fractions

$$
\begin{bmatrix} f'_{0n0n} \\ f'_{Xn0n} \\ f'_{XnXn} \end{bmatrix} = \begin{bmatrix} (1-p_s)(1-p_m) & 0 & 0 \\ 2p_s(1-p_s-p_m+p_mp_s/2) & (1-p_s)(1-p_m) & 0 \\ p_m+p_s^2 & p_m+p_s-p_mp_s & 1 \end{bmatrix} \begin{bmatrix} f_{0n0n} \\ f_{Xn0n} \\ f_{XnXn} \end{bmatrix}
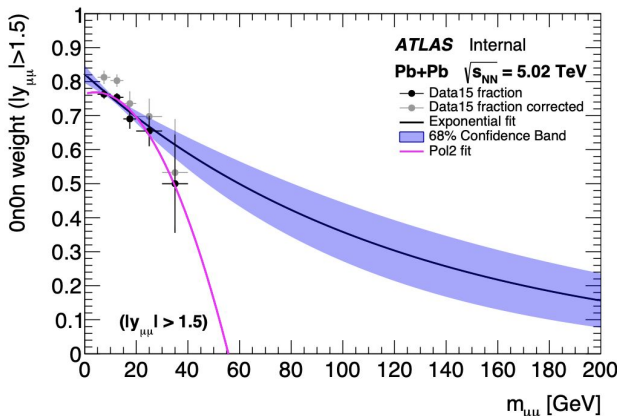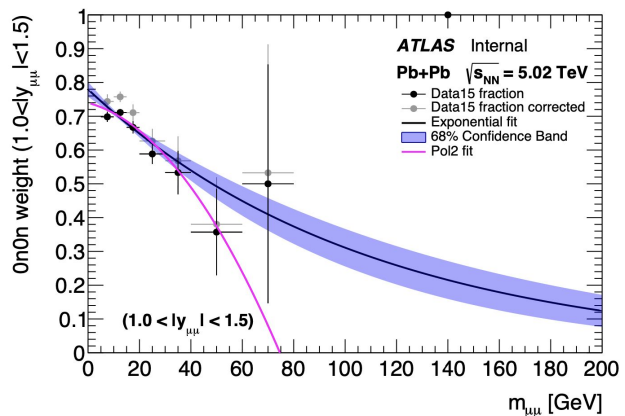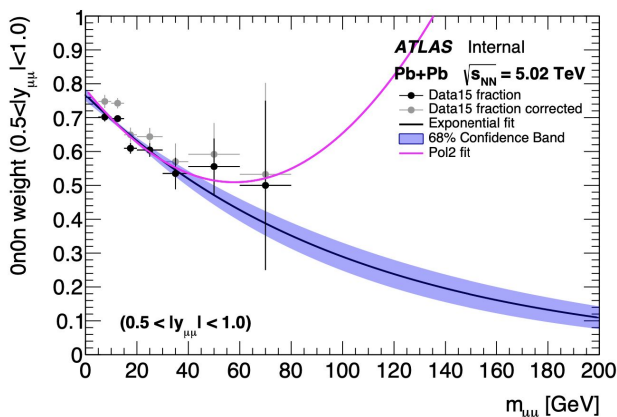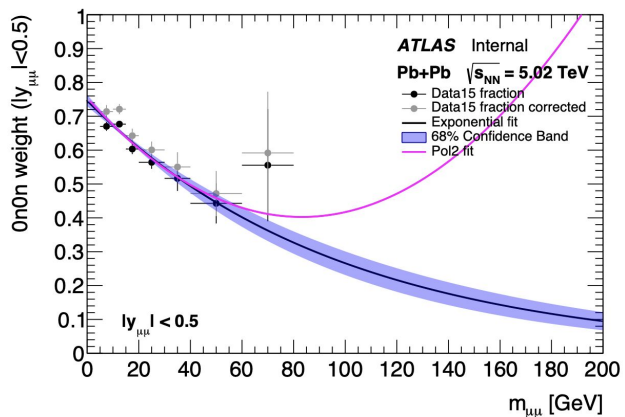$$

$$
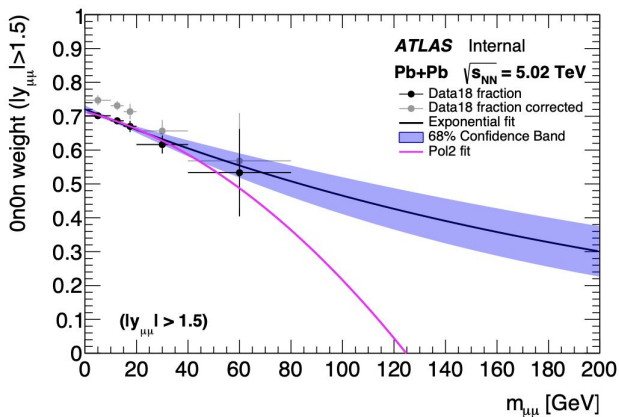f_{0n0n} = f'_{0n0n}/(1 - ps)(1 - pm) = \text{const} * f'_{0n0n}
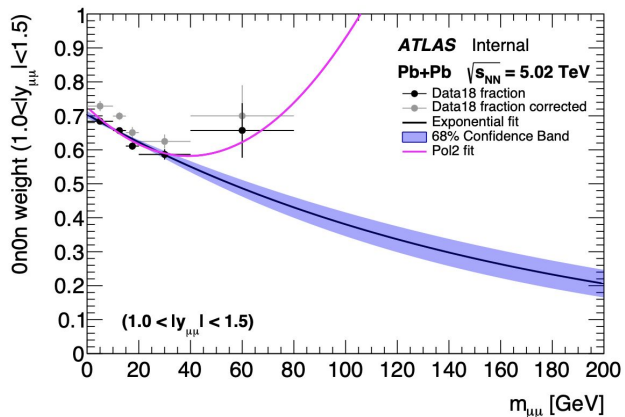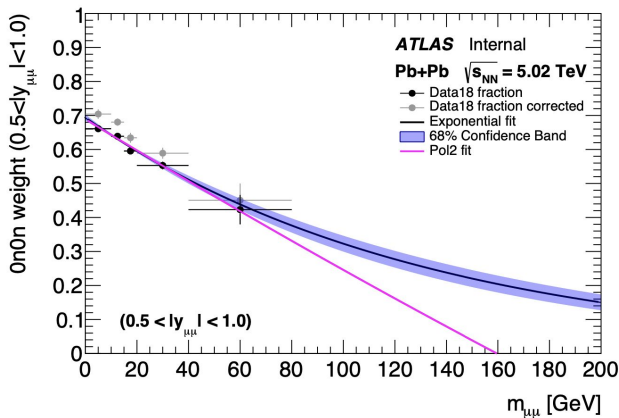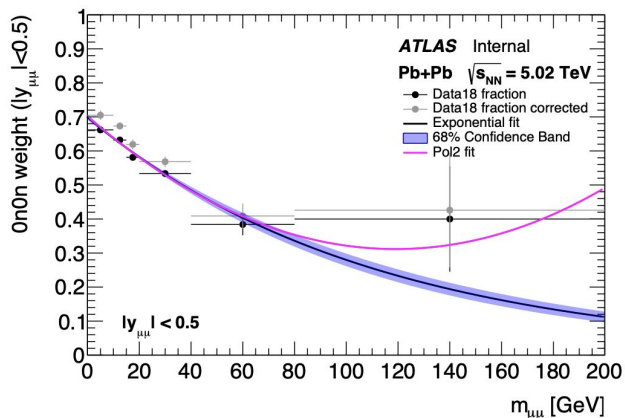$$

- **we only consider 0n0n weights - no need to solve the whole matrix**

EM Pileup: corrected 2015 ZDC fractions

- only added corrected fractions as grey points

- all fits are still to uncorrected fractions

EM Pileup: corrected 2018 ZDC fractions

- only added corrected fractions as grey points

- all fits are still to uncorrected fractions