# $p_T$ interpolation update

## NPG Meeting

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# $p_T$ interpolation update

- Use results from previous experiements.
- Fit the $p_T$ spectra and extract parameters A and T using parameterization $\frac{Ap_T}{e^{P_T/T}+1}$.
- From the three A and T parameters:
  - Interpolate to get A and T for $\sqrt{s_{NN}} = 2.76$ TeV.
  - Interpolate also contours from error ellipse.

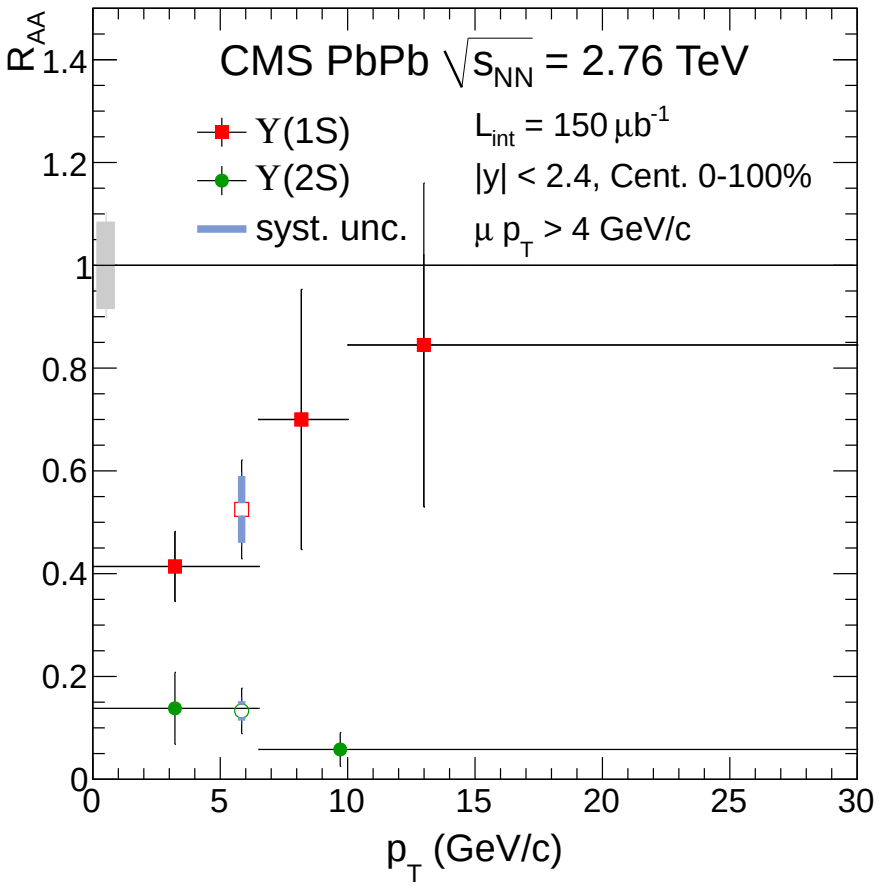
Main goals for this interpolation:

- Use for the $R_{AA}$ vs $p_T$ at $\sqrt{s_{NN}} = 2.76$ TeV.
- Use as a reference for $\sqrt{s_{NN}} = 5.00$ TeV.
- Use to cross check Ramona's theoretical calculations.
- Ramona's results status
  - Working with tuning the mass of the b quark.

# $R_{AA}$ vs $p_T$ using pp data for $\sqrt{s} = 2.76$ TeV

## Example (Results have large uncertainties:)

$p_T \leq 30 GeV/c$ and $-2.4 \leq y \leq 2.4$



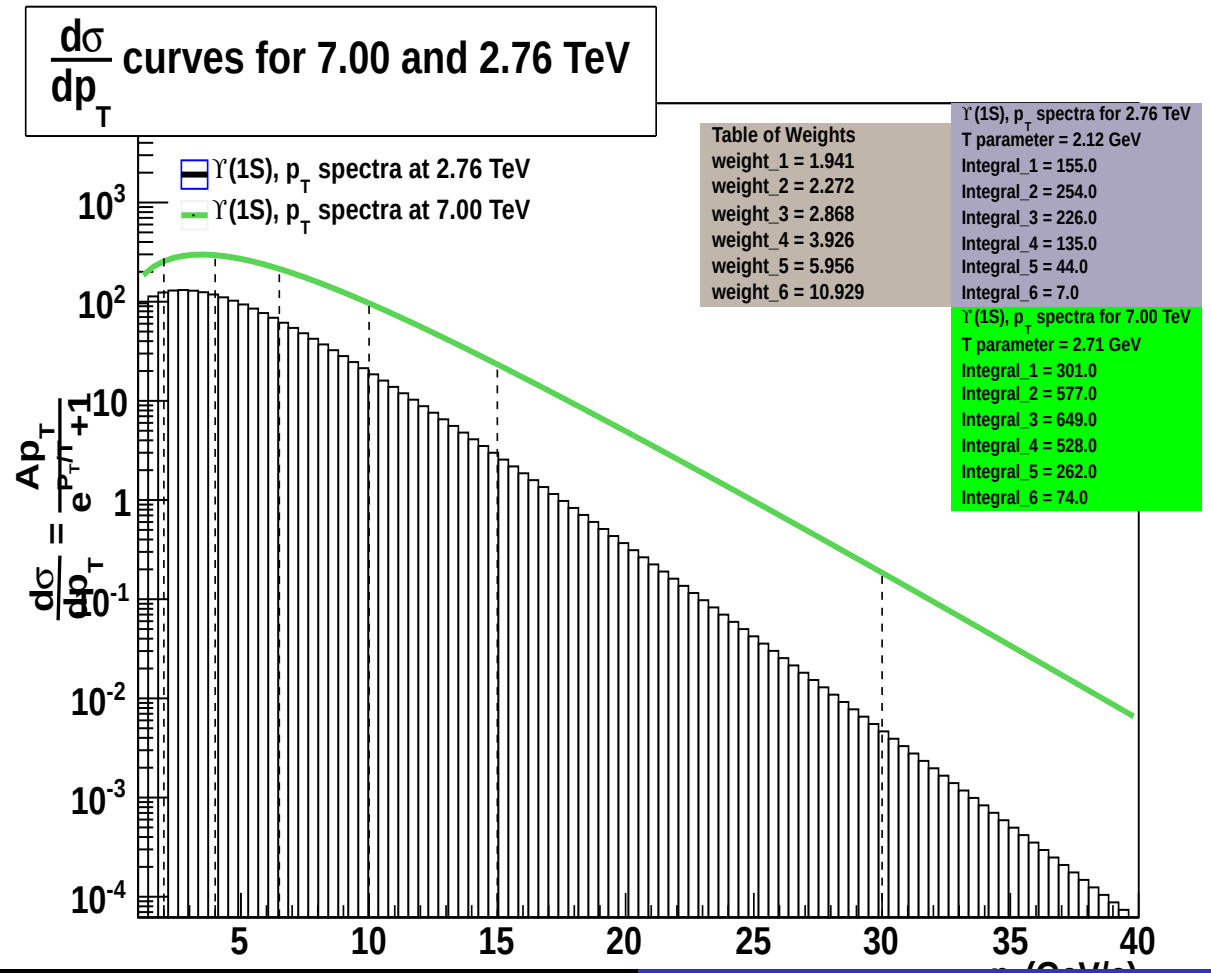

| $\lvert y\rvert$ | $p_T$ [GeV/$c$] | $\langle p_T \rangle$ [GeV/$c$] | $\frac{d\sigma}{dy}$ [nb] |
|---|---|---|---|
| 0.0–2.4 | 0–6.5 | 2.82 | $0.668 \pm 0.091 \pm 0.115 \pm 0.040$ |
| | 6.5–10 | 8.36 | $0.102 \pm 0.031 \pm 0.018 \pm 0.006$ |
| | 10–20 | 13.04 | $0.037 \pm 0.013 \pm 0.006 \pm 0.002$ |
| | 0–20 | 4.73 | $0.764 \pm 0.089 \pm 0.131 \pm 0.046$ |
| 0.0–1.2 | 0–20 | 5.18 | $0.921 \pm 0.128 \pm 0.157 \pm 0.055$ |
| 1.2–2.4 | | 4.03 | $0.586 \pm 0.125 \pm 0.101 \pm 0.035$ |

**Table 13.** Cross section per unit of rapidity of Υ(1S) as a function of rapidity and $p_T$ in pp collisions. The average $p_T$ value for each bin is given. Listed uncertainties are statistical first, systematic second, and global scale third. The latter is the uncertainty on the pp integrated luminosity.

# $p_T$ from A and T parameters for both energies

## Example (Weight definition:)

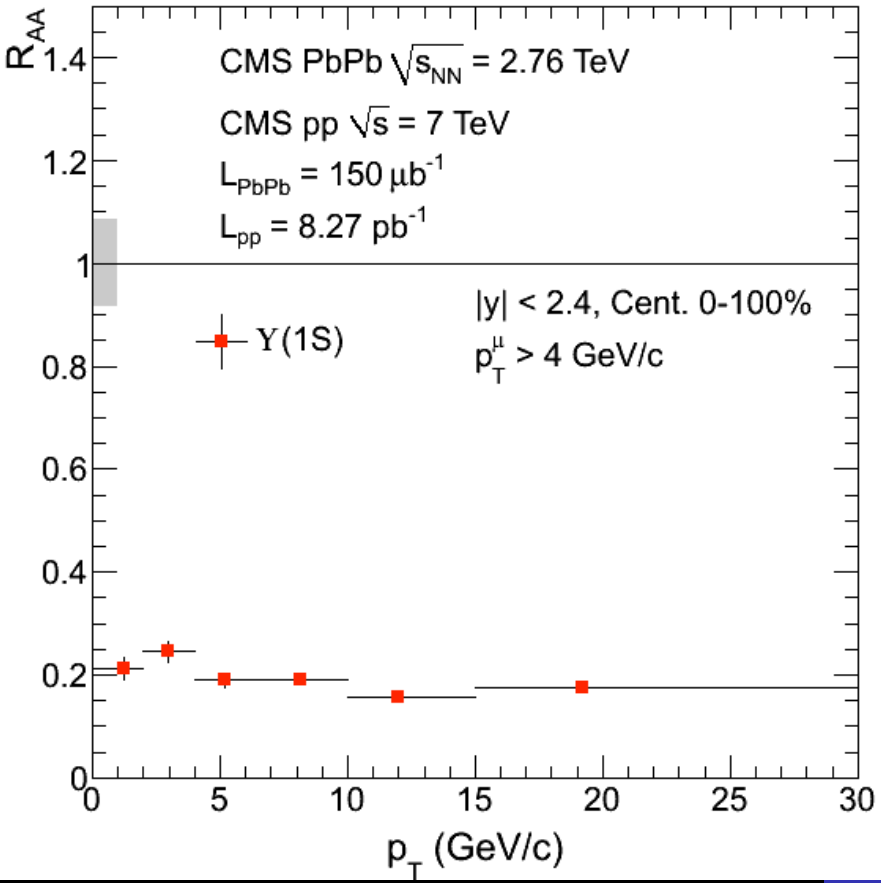
(Weight $= \int_{lo}^{hi} (\sqrt{s_{pp} = 7\,TeV}) / \int_{lo}^{hi} (\sqrt{s_{pp} = 2.76\,TeV})$ where [lo,hi] = [0,2],[2,4]....)

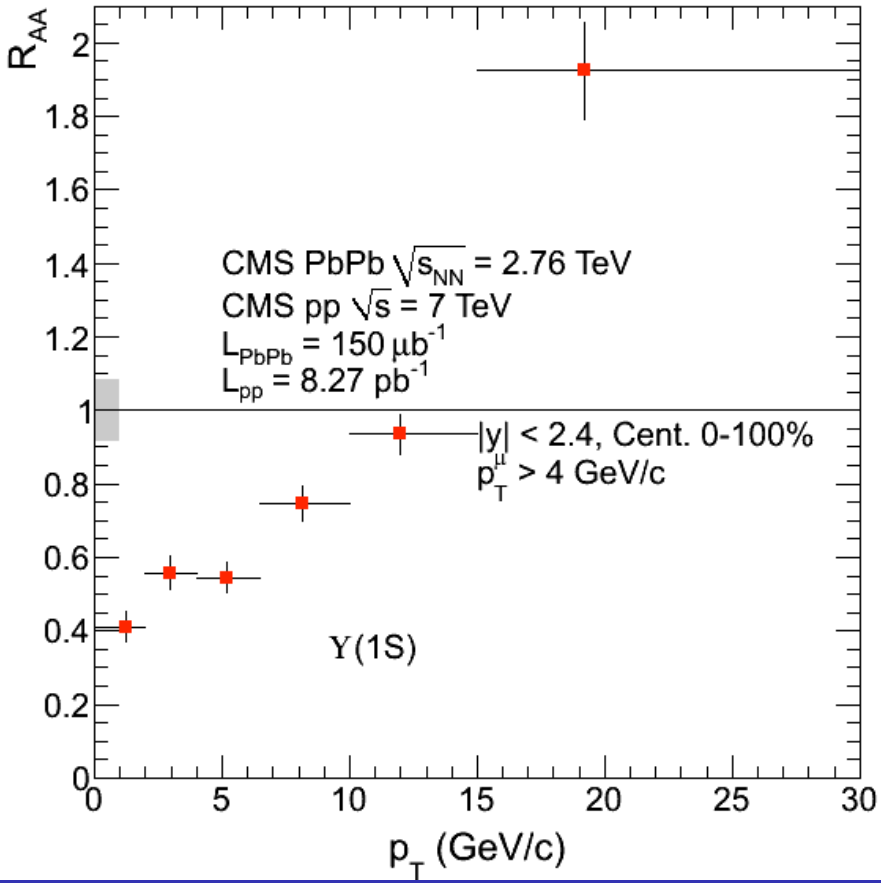


# $R_{AA}$ vs $p_T$ before and after the Weights

## Example (Weight definition:)

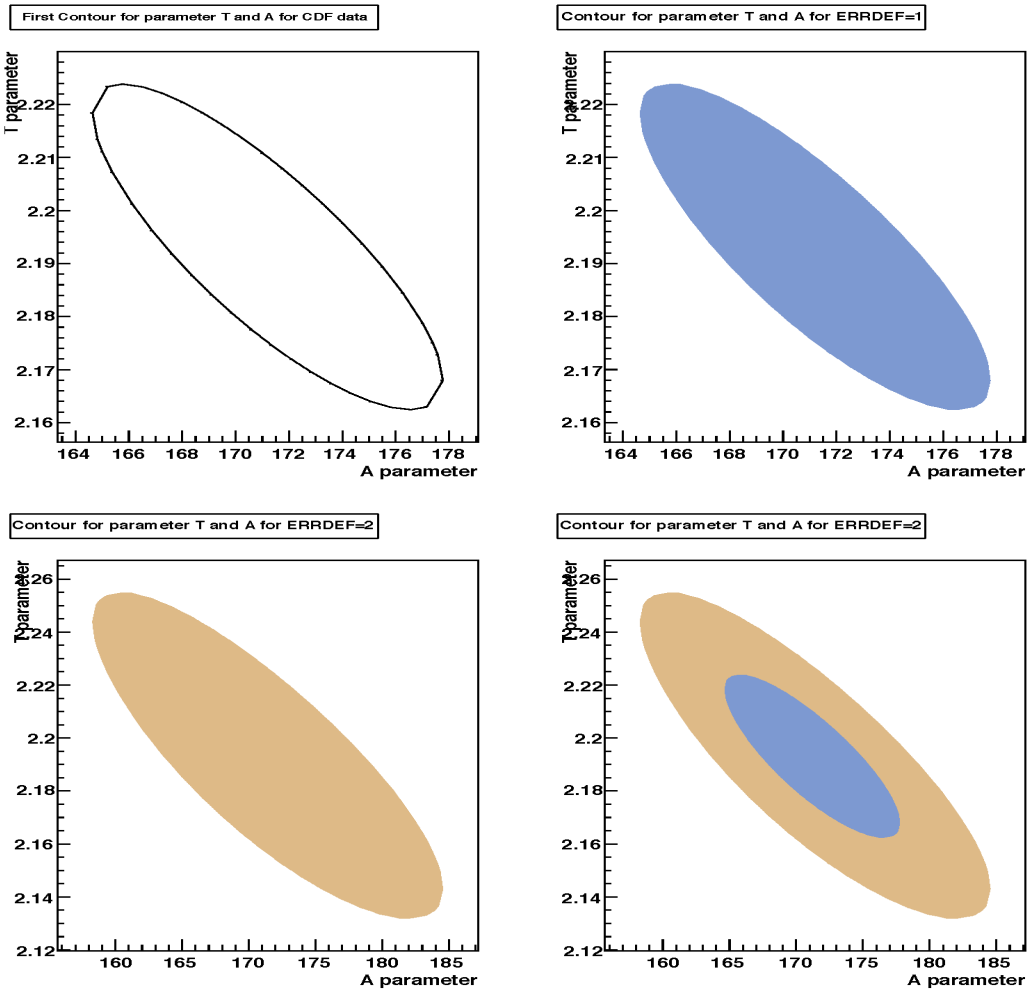
(Weight $= \int_{lo}^{hi} (\sqrt{s_{pp} = 7\,TeV}) / \int_{lo}^{hi} (\sqrt{s_{pp} = 2.76\,TeV})$ where [lo,hi] = [0,2],[2,4]....)



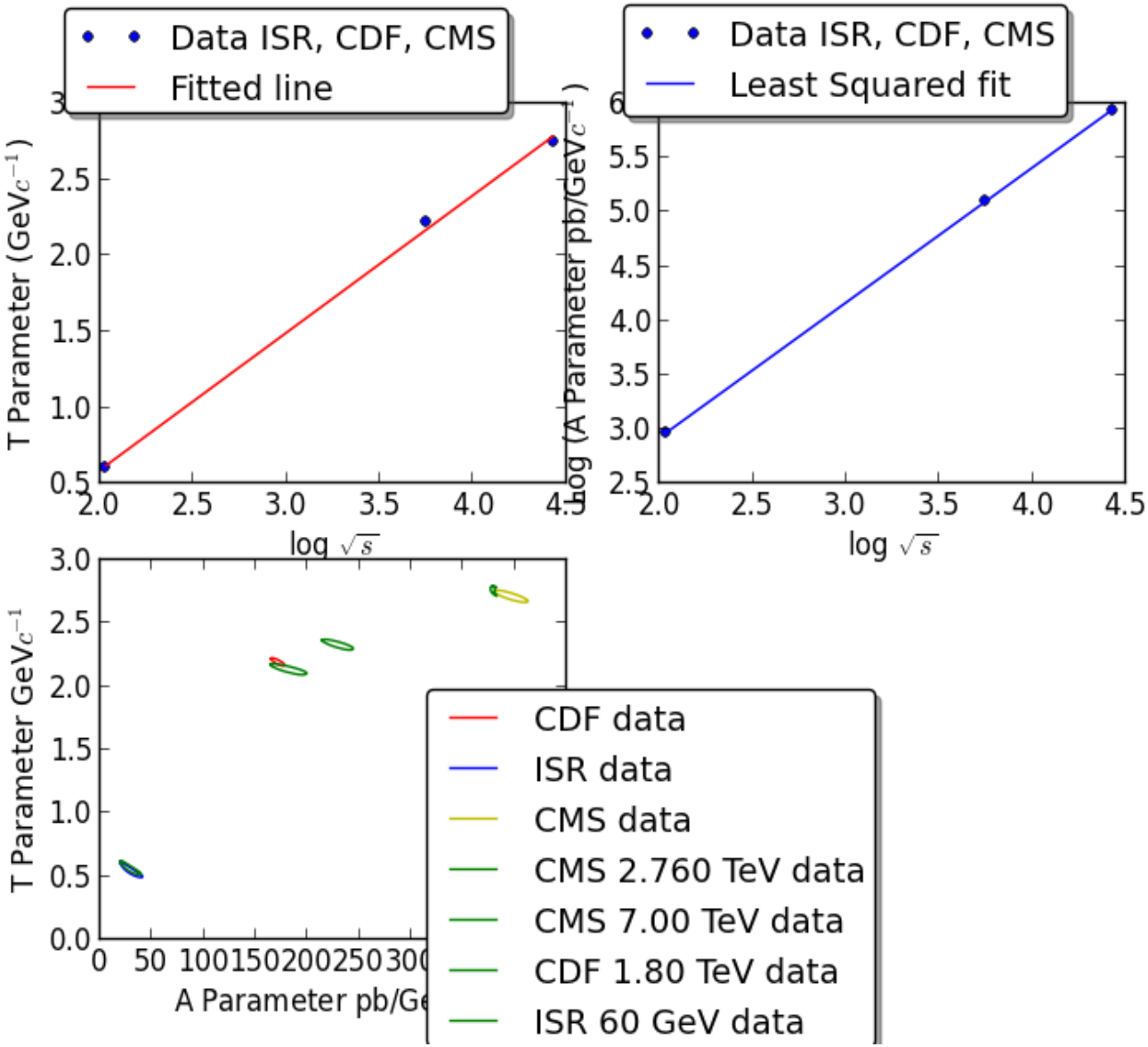



# Systematics on the weights

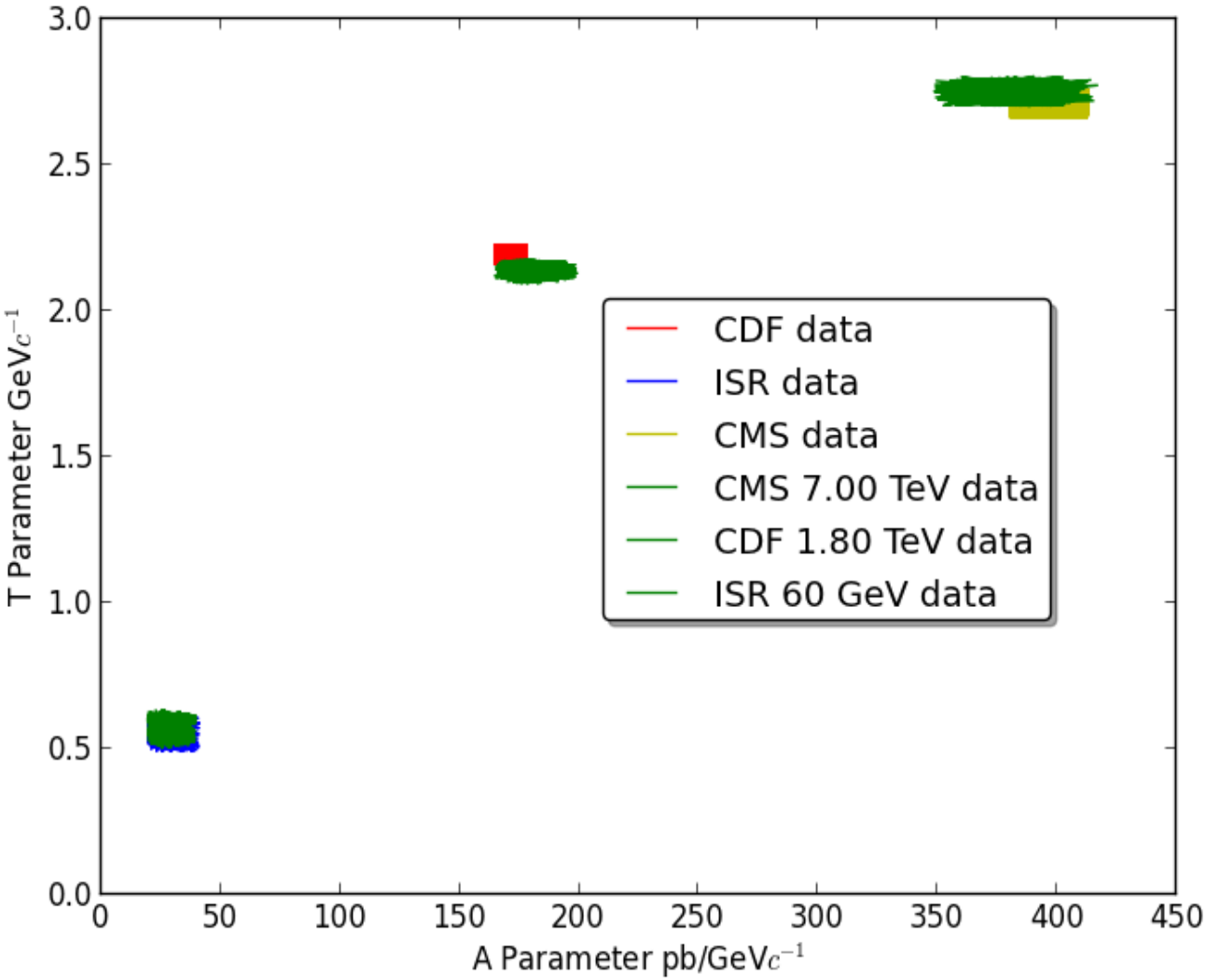
Start with one $\sigma$ error ellipse for the three energies and perform same interpolation as for the center values. Go around the three ellipses and repeat process.



# Systematics on the weights: Interpolating ellipse



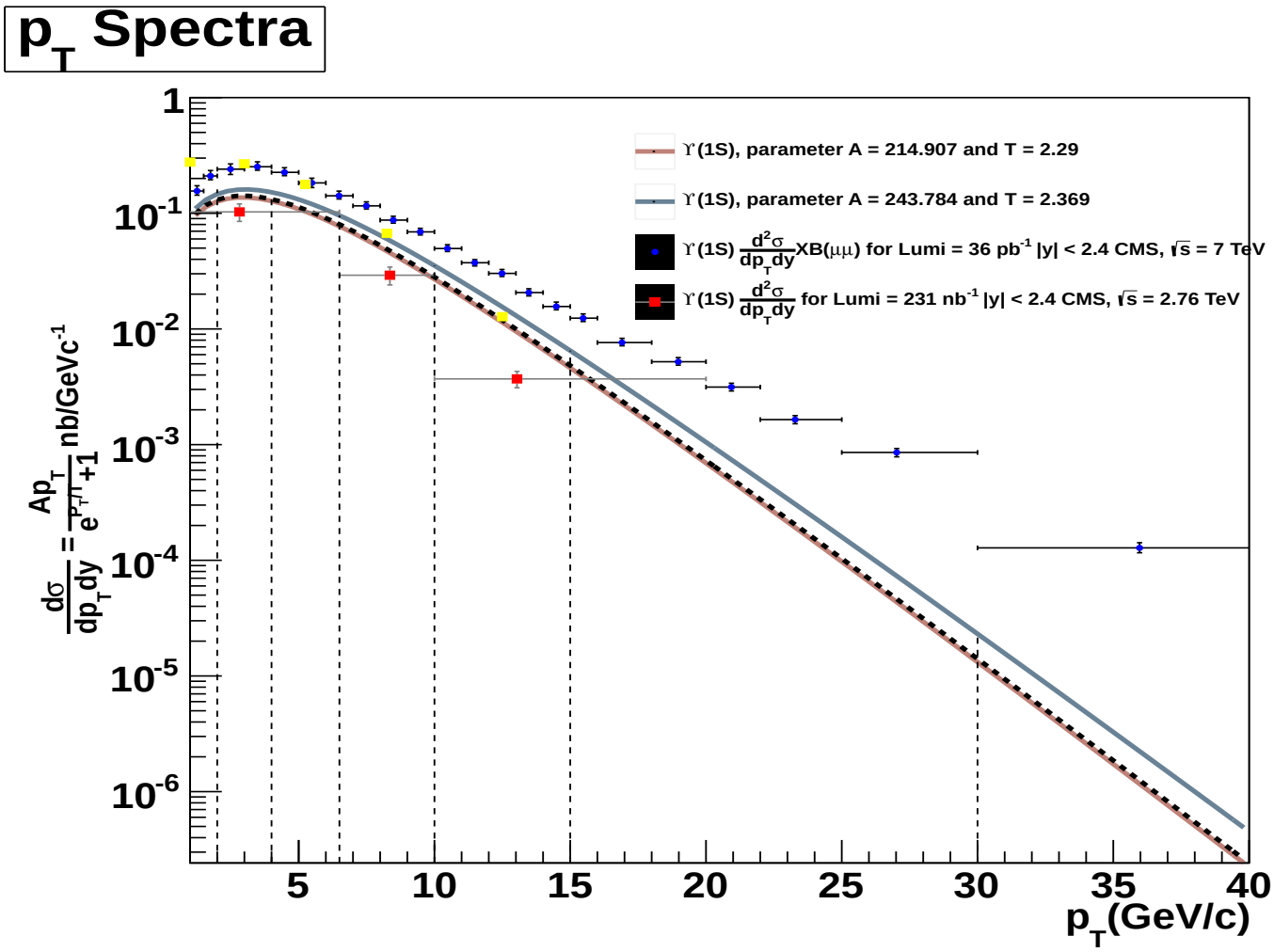
# Systematics on the weights: Randomizing 10000 points from each ellipse



# $p_T$ spectra for $\sqrt{s} = 2.76$ TeV , $\sqrt{s} = 7.00$ TeV

## Example (Notice branching ratio)

Extreme (anticorrelated) A and T parameters



# Conclusions

- Interpolating using linear fits shifts error ellipse off center.
- In order to get proper coverage try different interpolation approach (non linear) or randomizing the $\sigma$ contours.
- Cross check results with Ramona's calculation.
  - What should be the exact definition on the systematic error?
  - Is it just the ratio of the 7 TeV curve over the lowest/highest curve at 2.76 TeV or
  - Does the 7 TeV curve also have a lowest/highest curve.