

Update: SIMBA in python

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1 What I did

Chisq()

$$\chi^2(a) = (V_{\text{meas}} - V_{\text{pred}}(a)) \cdot M_{\text{cov}}^{-1} \cdot (V_{\text{meas}} - V_{\text{pred}}(a))$$

Vpred(C(a))

$$V_{\text{pred}}(C(a)) = \begin{pmatrix} V_{\text{pred},1}(C(a)) \\ V_{\text{pred},2}(C(a)) \\ \vdots \\ V_{\text{pred},i}(C(a)) \end{pmatrix}$$

ConvertPars()

$$C(a) = \begin{pmatrix} a_1 \\ a_2 \\ \vdots \\ a_N \end{pmatrix} \cdot \frac{1}{(1 + \sum_i a_i^2)^{1/2}}$$

a₀ = n²

i - Index for experiment

BsgPrediction.Full()

$$V_{\text{pred},i}(C(n)) = M_{\text{meas}} \cdot \left(\sum_{t \in \{ \}} b_t(C) \cdot P_t(n) + S(C) \cdot P_S(n) \right)$$

BsgPrediction()

$$b_n(C, n) = (\exp(\sum_{h,j,k} b_{hjk} \cdot C_j \cdot C_k)) \cdot n \Rightarrow b(C, n) = \begin{pmatrix} b_0 \\ b_1 \\ \vdots \\ b_N \end{pmatrix}$$

t ∈ {"NNLLNNLO", "MS27NNLO", ...}

S(C) is Subleading theory prediction

h - Index for Bin

SSF27-1
or
SSF27-2

P_{t,ts}(n)

$$P_{t,ts}(n) = N_0 \cdot \begin{cases} C_2 C_i \cdot \frac{1}{n} \cdot (V_{tb} V_{ts} \cdot m_b)^2 & \text{if } 22 \text{ in } t \\ C_2 C_7 \cdot \frac{1}{n} \cdot V_{tb} V_{ts} \cdot \frac{m_b}{\lambda_2} & \text{if subleading theory} \\ C_2 C_7 \cdot \frac{1}{n} \cdot V_{tb} V_{ts} \cdot m_b & \text{if } 27 \text{ in } t \\ C_2 C_8 \cdot \frac{1}{n} \cdot (V_{tb} V_{ts} \cdot m_b)^2 & \text{if } 28 \text{ in } t \\ C_8 C_8 \cdot \frac{1}{n} \cdot (V_{tb} V_{ts} \cdot m_b)^2 & \text{if } 88 \text{ in } t \\ C_8 C_7 \cdot \frac{1}{n} \cdot V_{tb} V_{ts} \cdot m_b & \text{if } 78 \text{ in } t \end{cases}$$

N₀ ≈ 794
λ₂ ≈ 0.12
V_{tb} V_{ts} ≈ 0.041
m_B = 5.279

m_b(C) = $\frac{1}{6} \cdot (5 \cdot (m_B - M^*(C)) - \frac{P}{u} + u)$

λ(C) = $3 \cdot \lambda_2 + 2 \cdot m_b(C) \cdot (m_B - M^*(C) - m_b(C))$

order → **M^{*}(C) =** $F_{\text{elm}} \cdot C_m \cdot C_n$

BsgSubLeadingPrediction()

$$S_h(f(C), n) = (SSF_{hj} \cdot f_j(C)) \cdot n \Rightarrow S(C, n) = \begin{pmatrix} S_0 \\ S_1 \\ \vdots \\ S_{Bn} \end{pmatrix}$$

F(C, d₂) = $\begin{pmatrix} 1-x \\ x \cdot (1-d_2) \\ x \cdot d_2 \end{pmatrix}$, where $x = \begin{cases} (0.65 \cdot (m_B - m_b) - 0.86 \cdot \lambda + 0.33 \cdot \frac{P_2}{\lambda_2}) / (1.85 \cdot \lambda - d_2 \cdot \lambda) & \{\text{SSF27-1}\} \\ (0.47 \cdot (m_B - m_b) - 0.57 \cdot \lambda + 0.24 \cdot \frac{P_2}{\lambda_2}) / (1.40 \cdot \lambda - d_2 \cdot \lambda) & \{\text{SSF27-2}\} \end{cases}$

Figure 1: Equations according to my python code

A problem could be the d_2 . In my code it's constantly zero. I got this information from the *fit.config* file.

```
#####
# Subleading theory coefficients
#####

## Default value is
SSF27_1055.d2: 0.
SSF27_2055.d2: 0.
```

Figure 2: Information in *fit.config* file

2 Comparisons

As you can see in the following, something is off with the subleading theory. To compare different fits, I always plotted the Fit with the subleading prediction added on the leading prediction and with just the leading prediction. For the fitting I used 4 to 7 start parameters, which gave different results for the prediction, as it is shown in the columns. Every pair of rows has more amount of measurements included in the fit (*"babar-incl"*,

"babar_hadtag", "babar_sem", "belle"/).

The **red dots** show my calculated prediction.

The **black dots** show the experimental values, which I extracted from the root files.

The **green line** shows the fit I extracted from the root files.

The **blue line** shows the difference between the green line and the red dots.

2.1 Babar hadronic tag

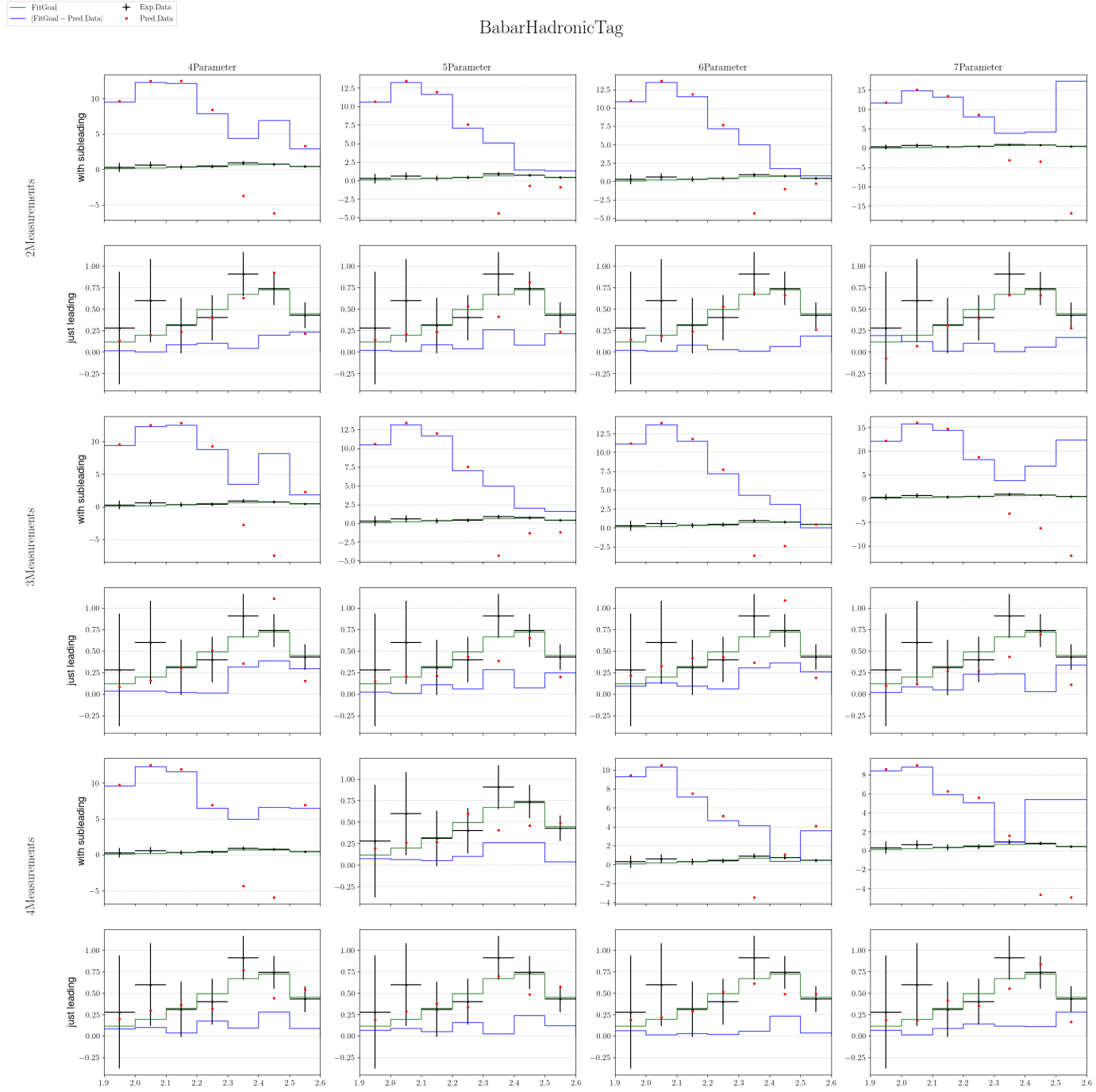


Figure 3: Fit Comparison for 'babar_hadtag'

2.2 Babar inclusive spectra

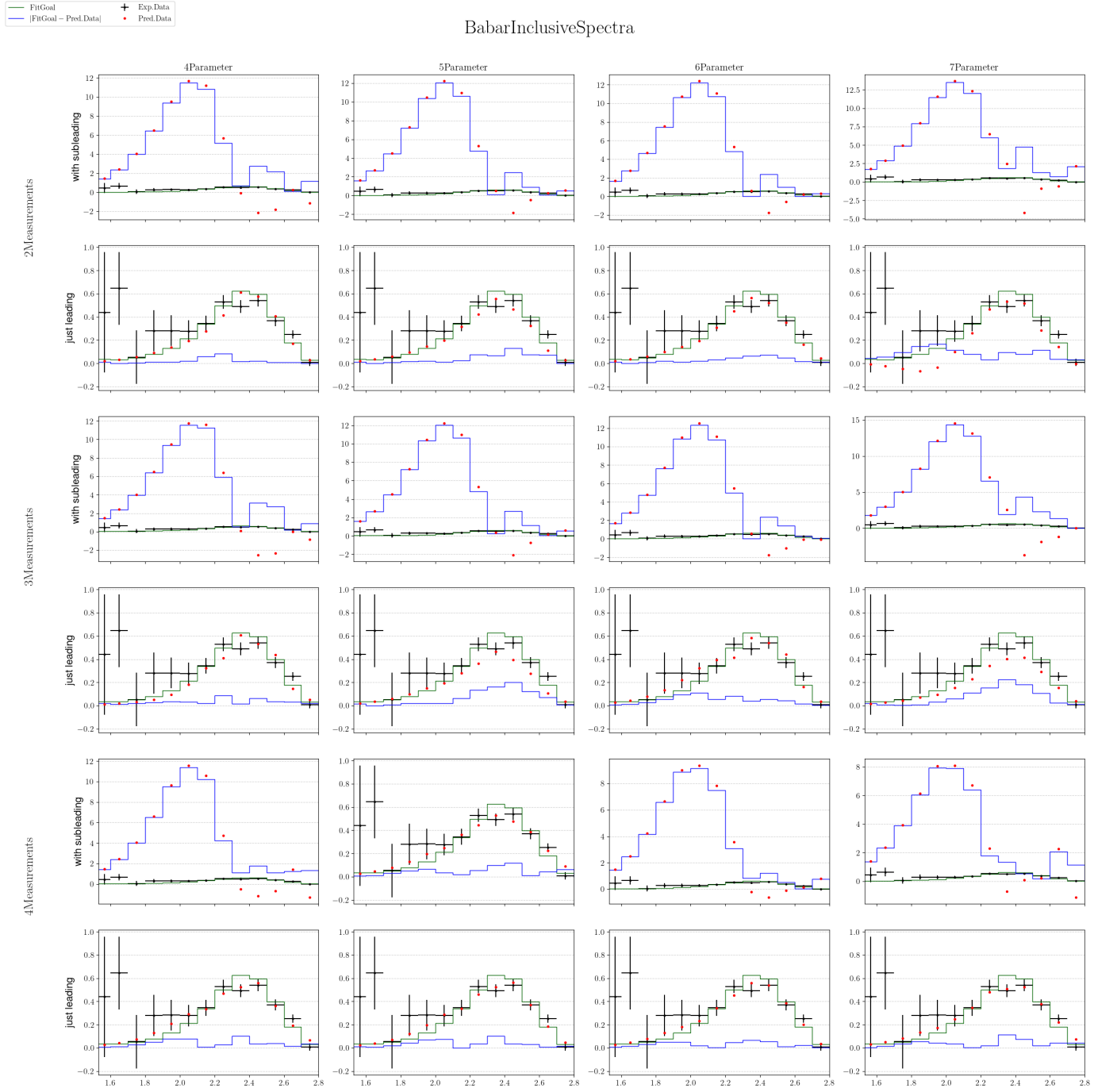


Figure 4: Fit Comparison for 'babar_incl'

2.3 Babar semileptonic

□

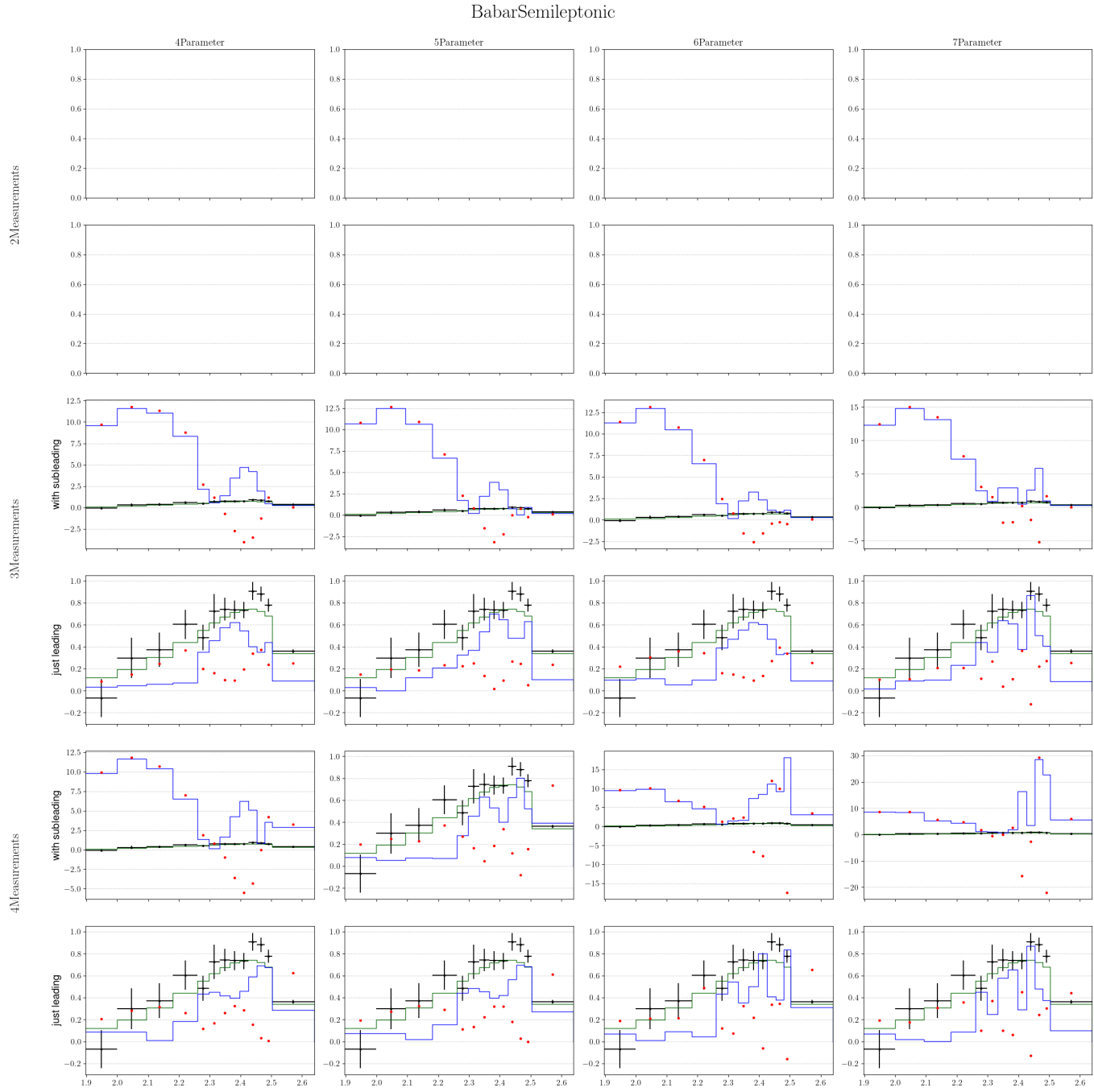


Figure 5: Fit Comparison for 'babar_sem'

2.4 Belle

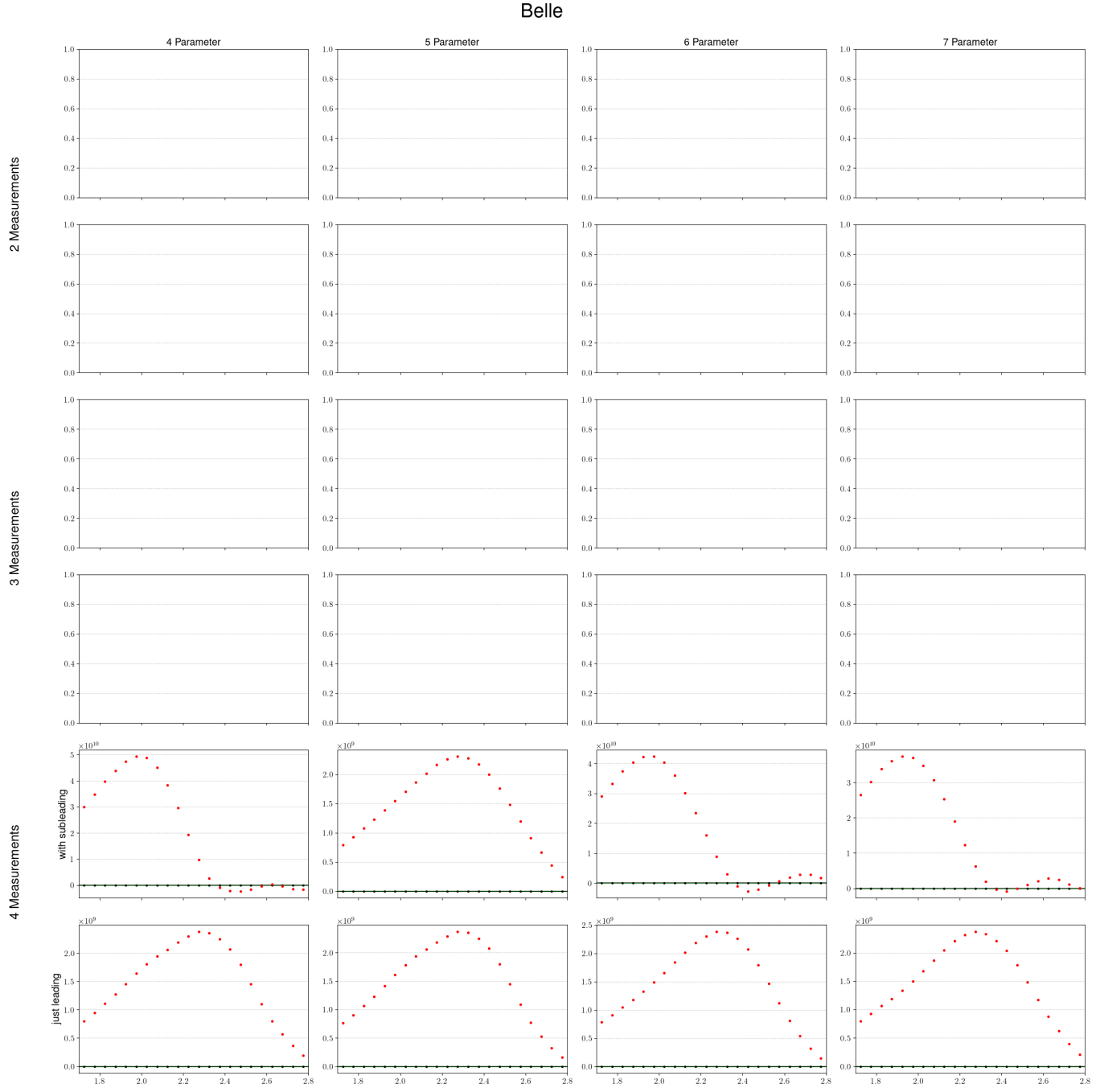


Figure 6: Fit Comparison for 'belle'