



南開大學
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Rb measurement updates

Systematics variation method

Vary the probability according a shifted Gaussian error

$$p_b \Rightarrow p_b \times \{1 \pm \epsilon \times [\text{rand}(\text{Gaussian}(1, 1))]\}$$

pc and pq also varied to have sum of probability to be 1

Tried $\epsilon = 0.001$

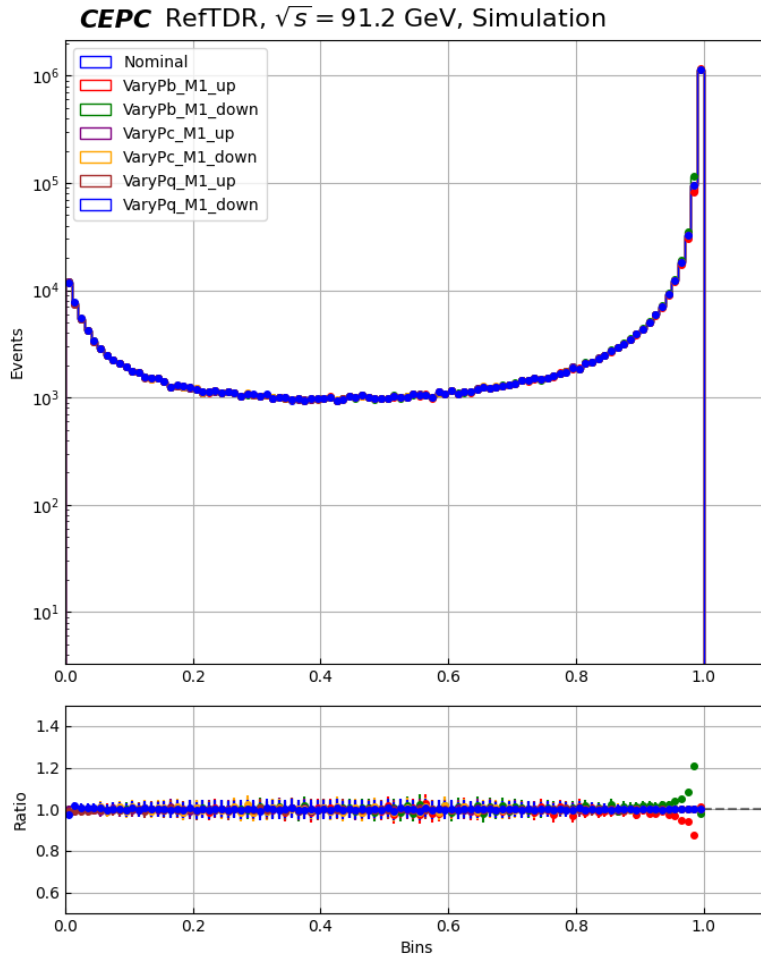
After varying the pb/pc/pq, tag both jets with

$$\text{b-tagged} \leftarrow \max(p_b, p_c, p_q) = p_b$$

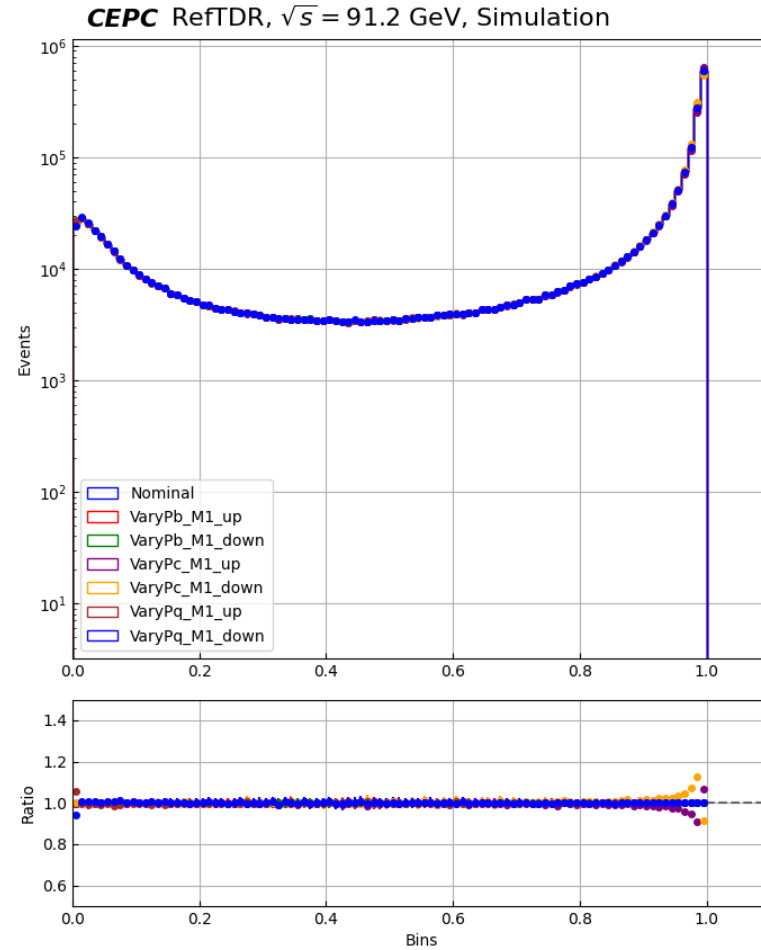


Variations on pb,pc,pq

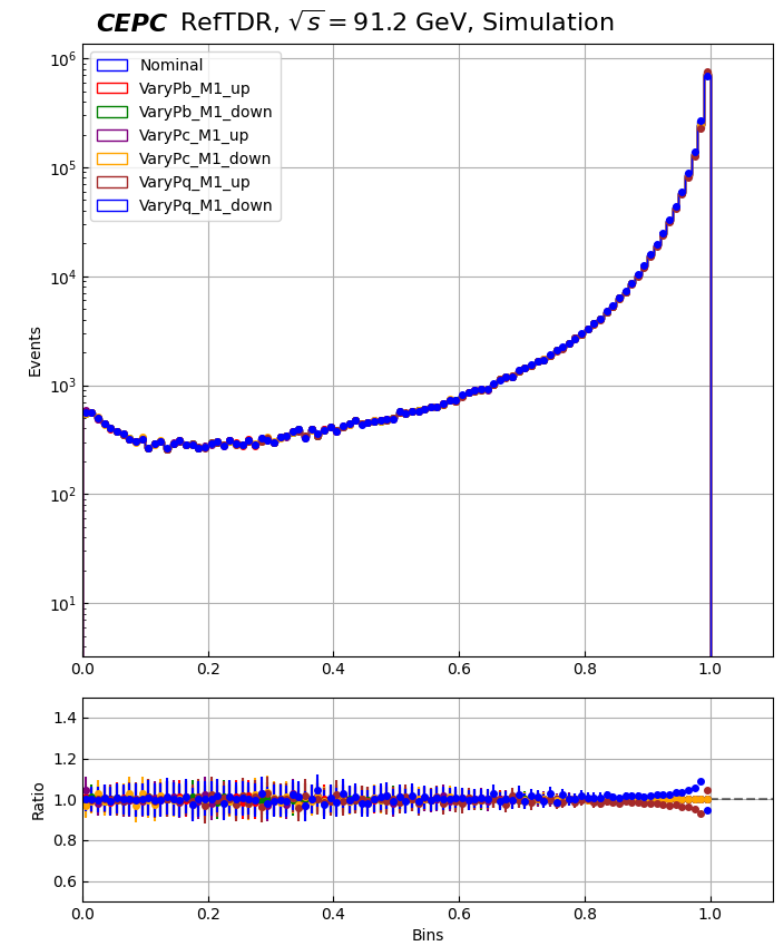
$$\epsilon = 0.001$$



Pb in Zbb

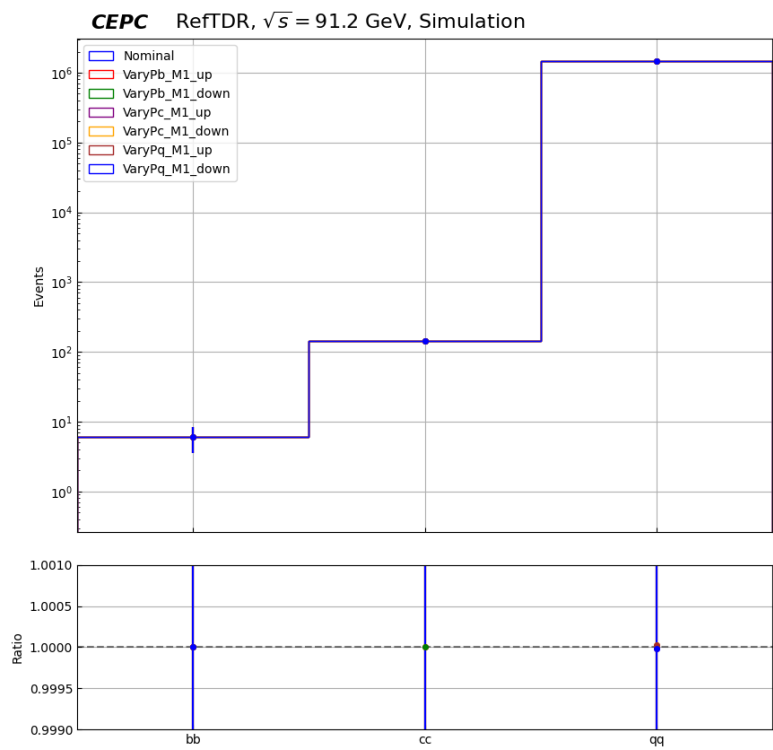
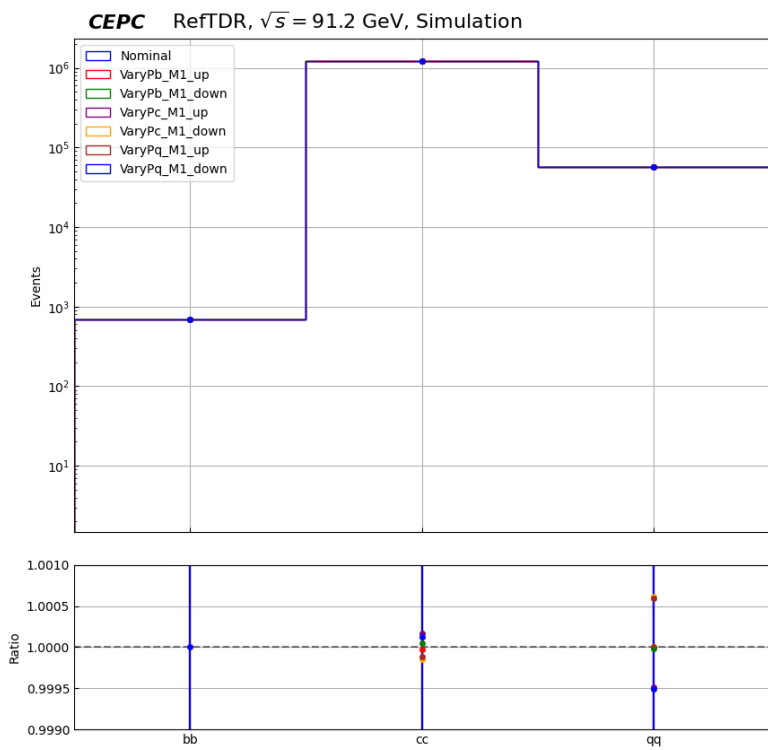
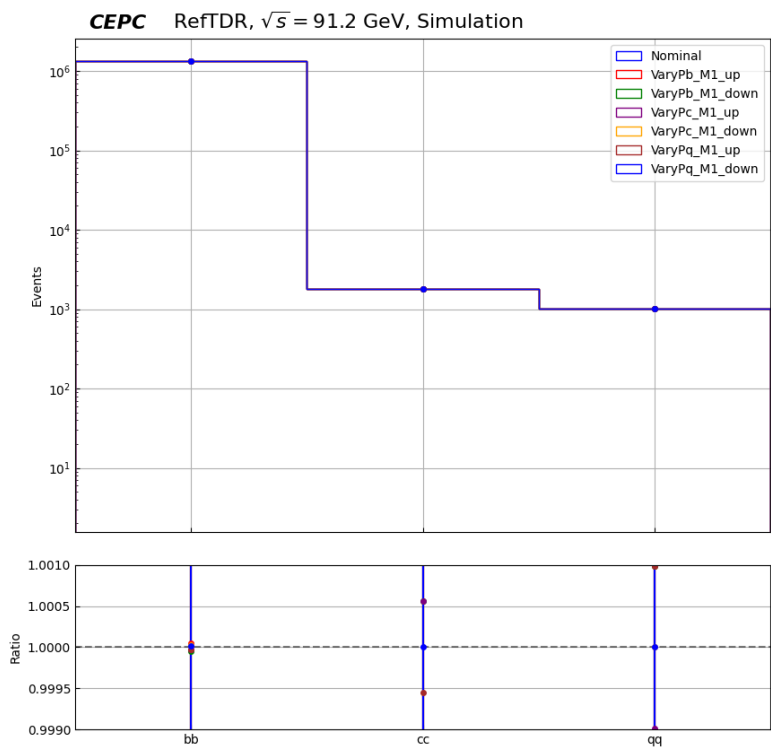


Pc in Zcc



Pq in Zdd

Impact on fit variable



Impact less than 0.02% ($\sim 1e-4$)



Impact on results

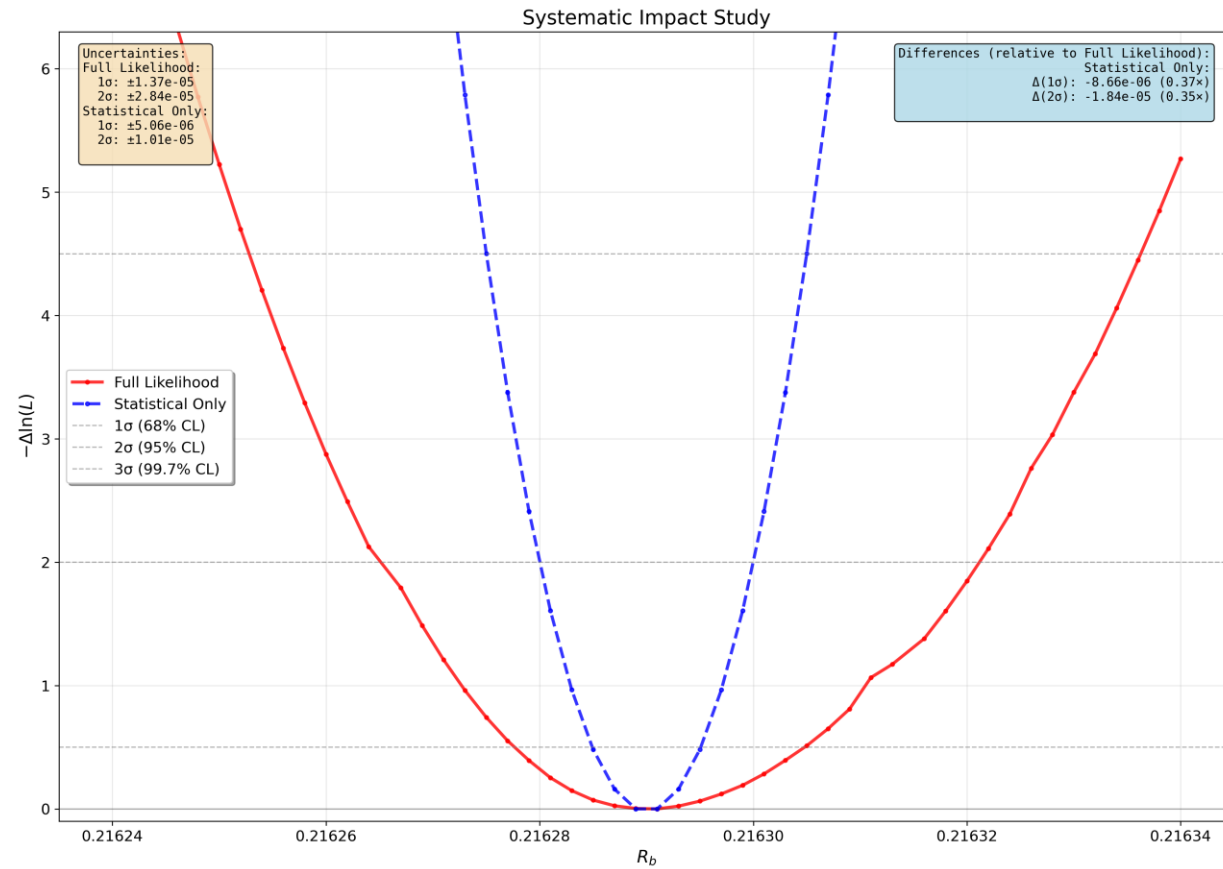
- Scale to have 1e10 Z bosons to evaluate systematic uncertainty impact
- Binned likelihood fit with three bins
- Systematic uncertainty include Rhad(hadronic branching fraction, from PGD), VaryPb
- Can not directly obtain results from fit due to precision problem, extract results from Profiled Likelihood scan

$$\mathcal{L}(N_{\text{obs}}^{ii} | R_b, R_c, \vec{\theta}) = \prod_{i=b,c,q} \text{Pois}(N_{\text{obs}}^{ii} | \nu^{ii}) \times \prod_{\theta} \text{Gaus}(0 | \theta)$$

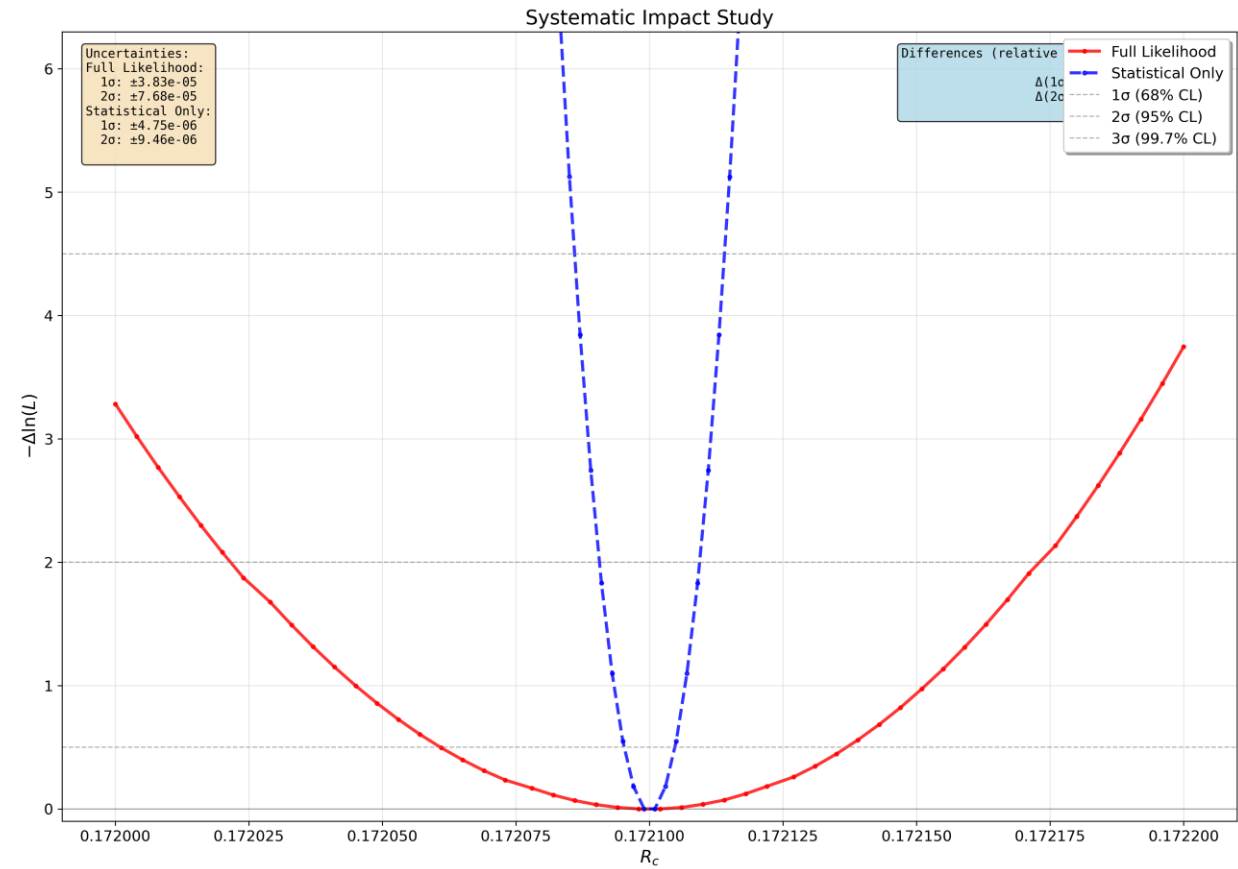
$$\nu^{bb} = \mathbf{R}_b N_{bb}(\vec{\theta}) + \mathbf{R}_c N_{cc}(\vec{\theta}) + R_q N_{qq}(\vec{\theta})$$



Results

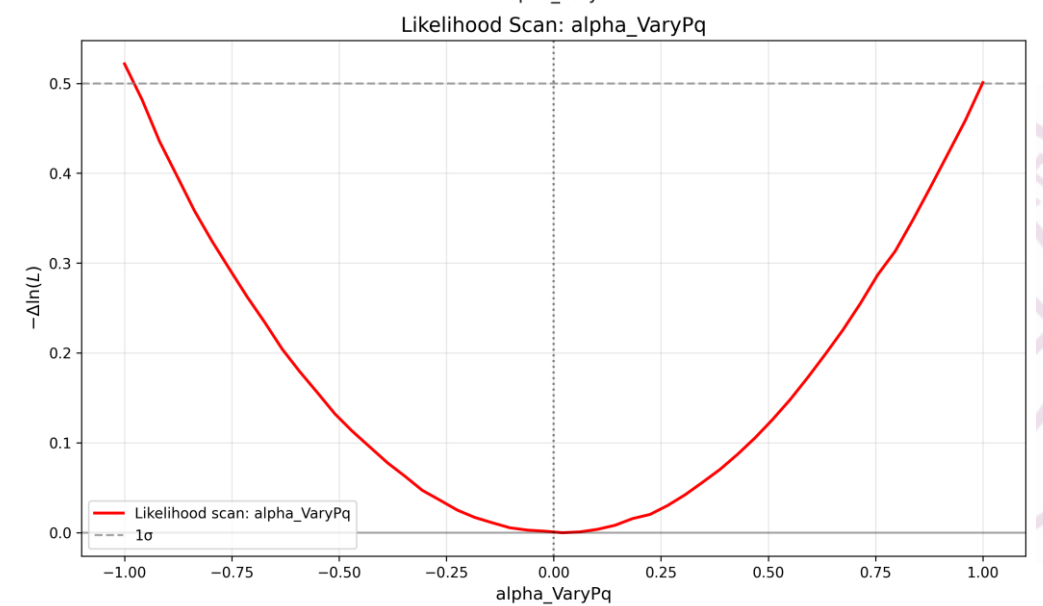
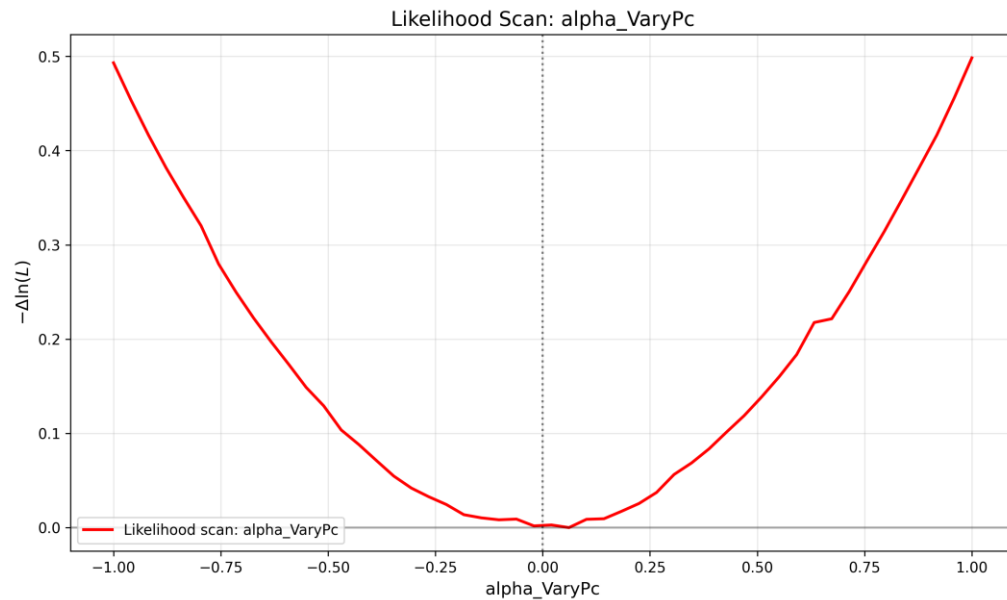
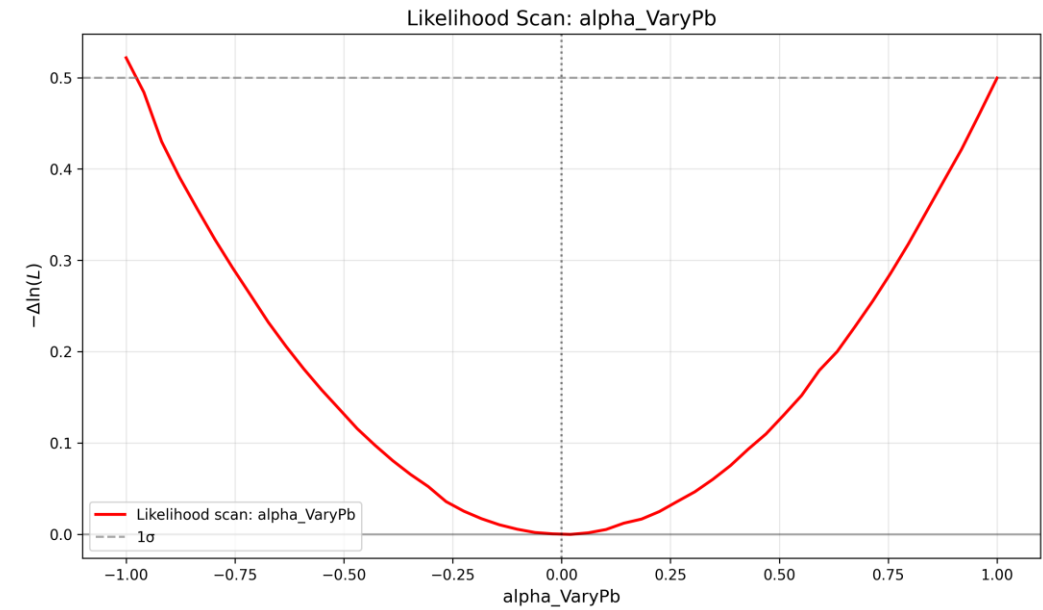
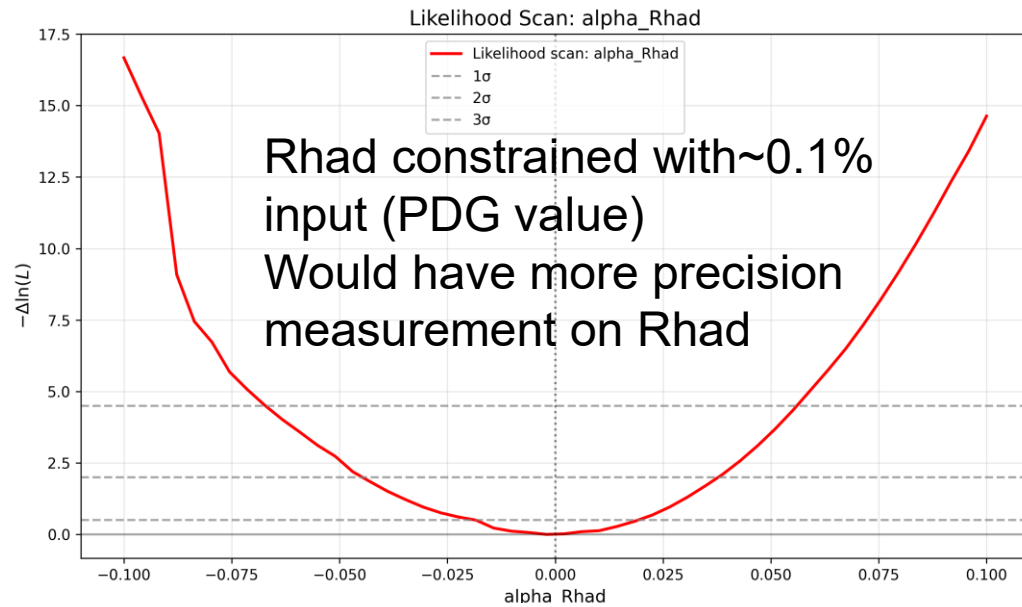


Systematic uncertainty dominant already.
~5e-6 (stat. uncert.)
~1e-5 (syst. uncert.)

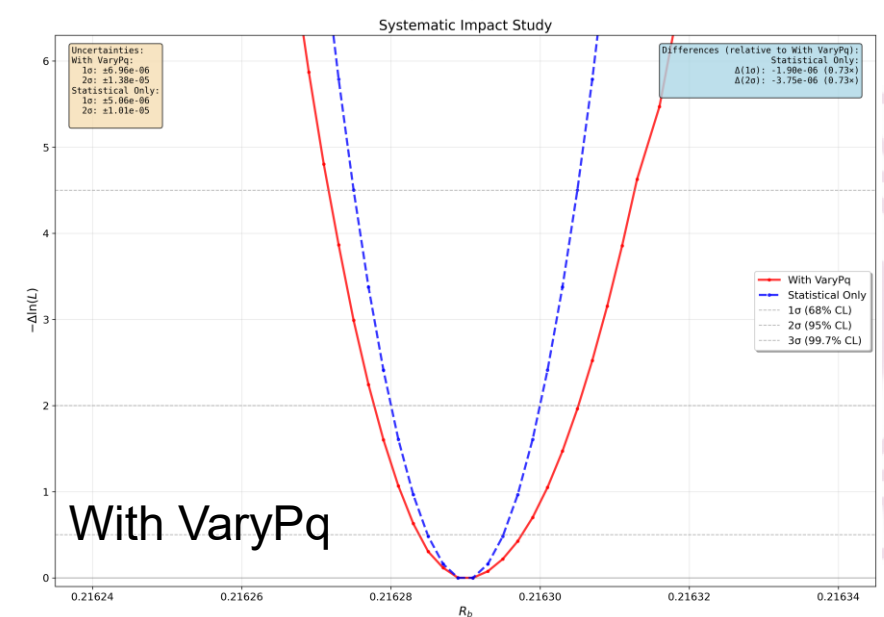
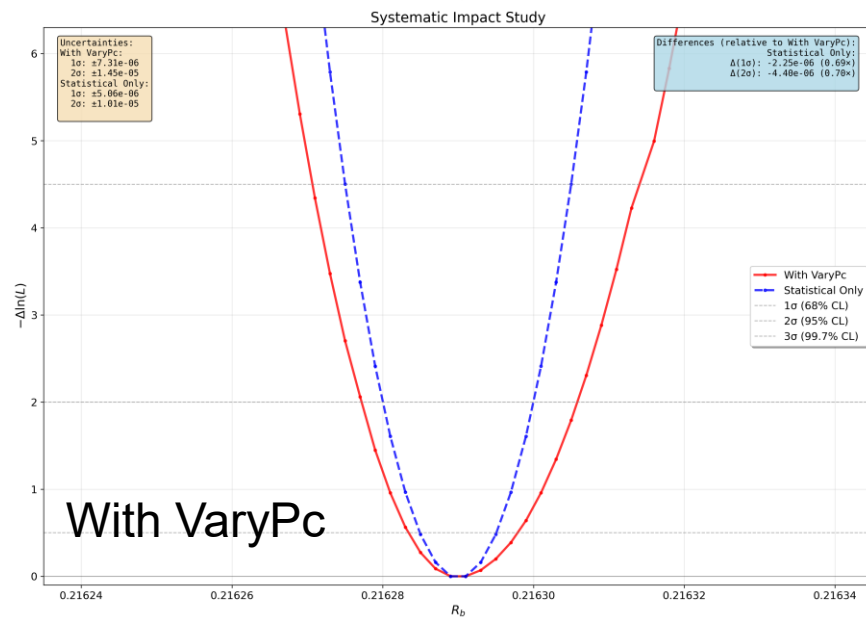
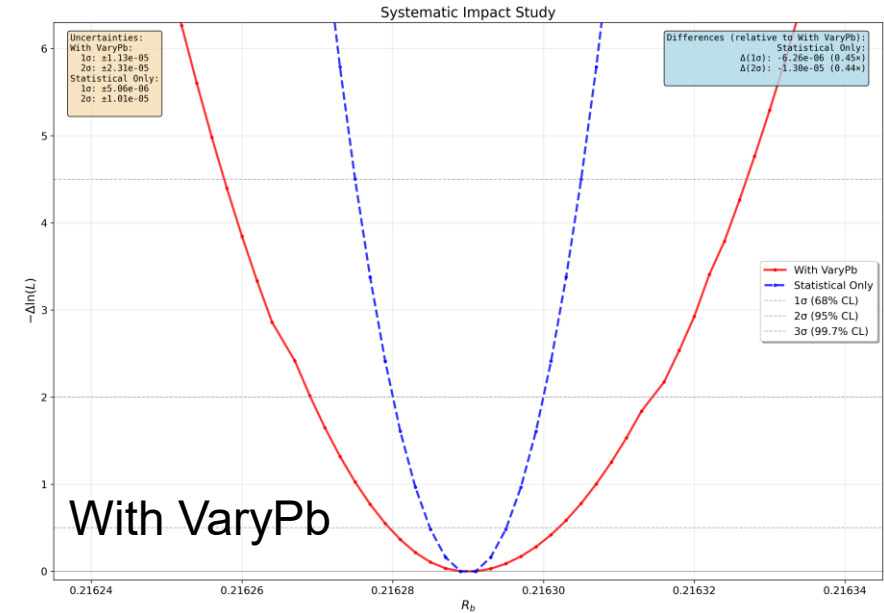
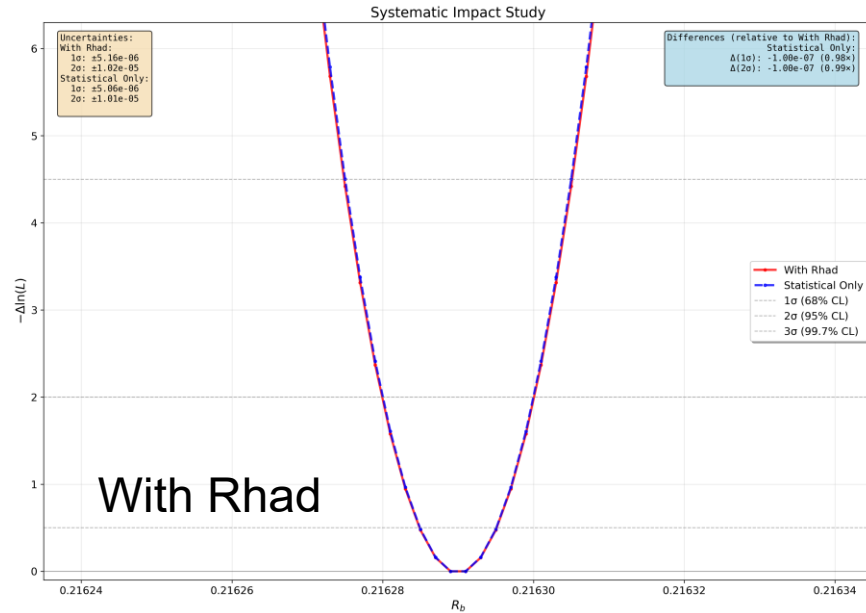


Systematic uncertainty dominant already.
~5e-6 (stat. uncert.)
~4e-5 (syst. uncert.)

Systematic impact



Systematic impact



Systematic impact

