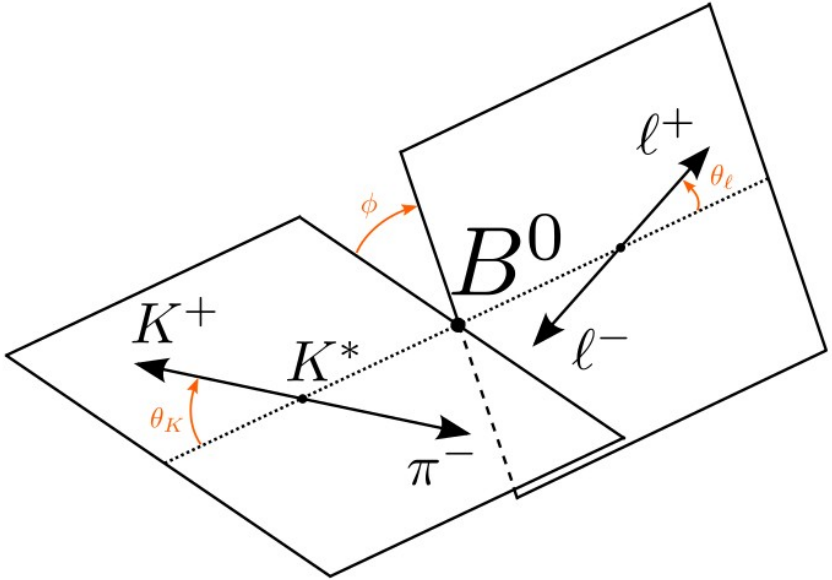
B → Kstll and P5' Analysis

Valencia 2022



Wolfgang Gradl, Martin Sobotzik
Johannes Gutenberg University Mainz

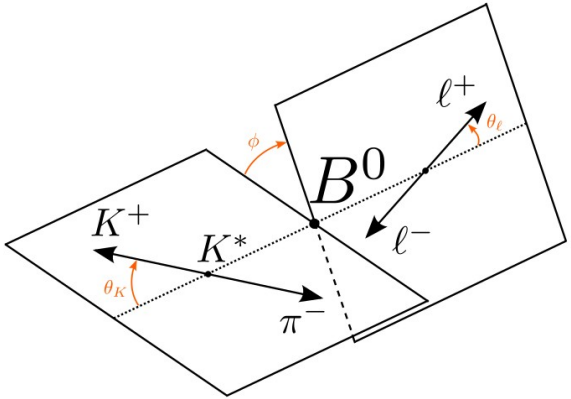
JOHANNES GUTENBERG UNIVERSITÄT MAINZ

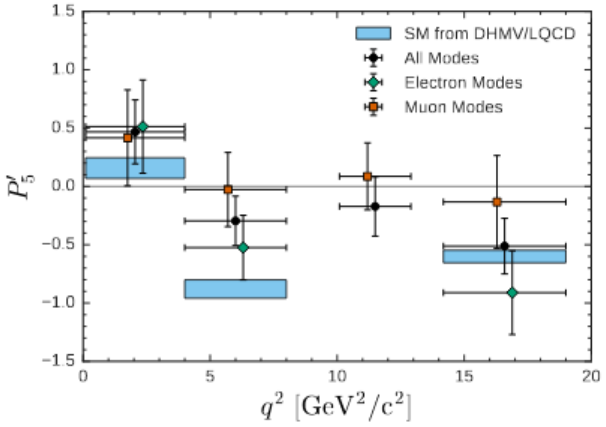
JG|U

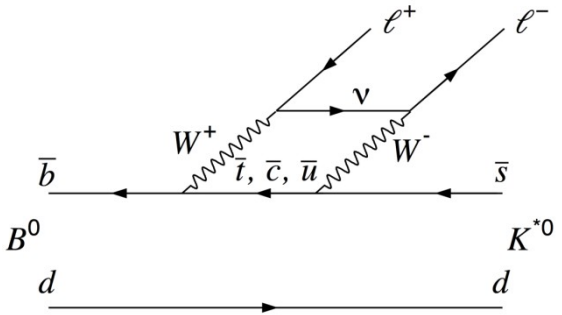
Motivation

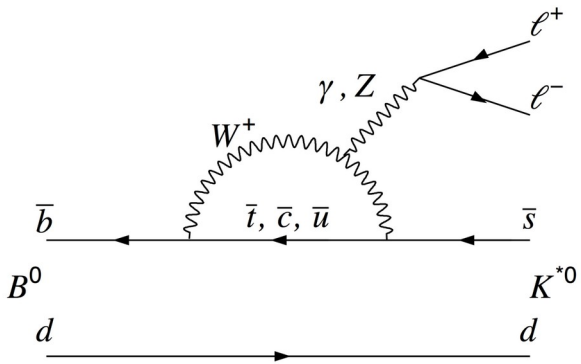
- Anomalies observed in many FCNC
- Highly suppressed and have a very small BR

  → Decay is very sensitive to new physics!
- Today only focus on B0 → Kst(pi+K-)e+e-









Cuts and Selection

- Use MC14:_ri for training; _rd_ex for validation; _rd_cx for analysis
- Skim B→ Kst ll X, |deltaE|<0.3, 0.796 < Kst(M) < 0.996
- LID correction from Moriond 2022
- Then train a Deep-NN based on TensorFlow to suppress background events (CS+BS)
- Only take events with NN_output>0.669 (ROC)

```
'varL':['lm_pValue', 'lp_pValue','lm_p','lm_omega','lp_omega','Kst_K_omega',
        'lm_dx','lm_dy','lm_dz','lp_dx','lp_dy','lp_dz', 'visibleEnergyOfEventCMS',
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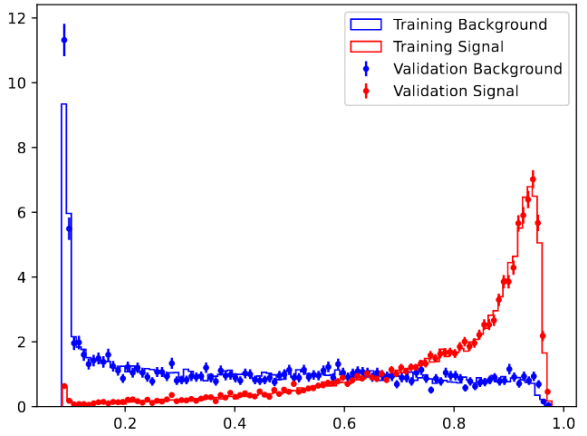
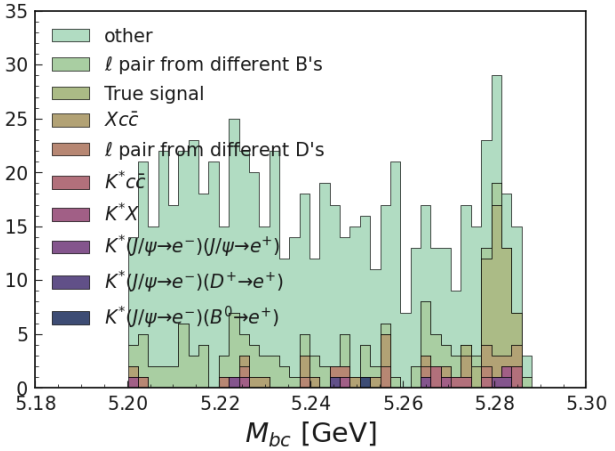
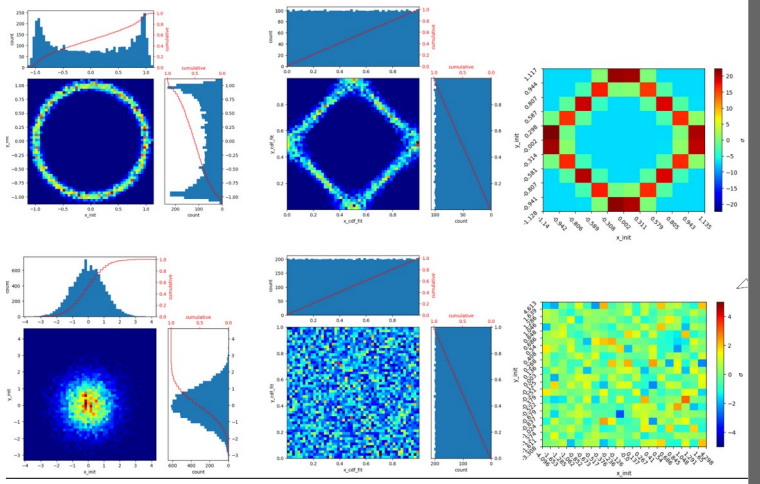
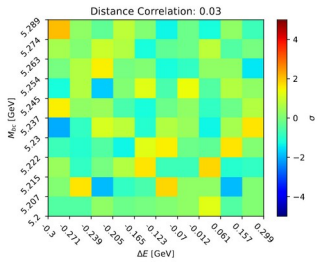


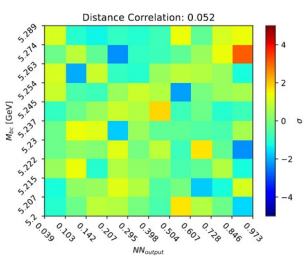


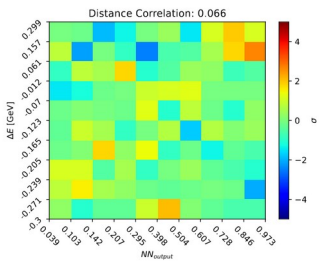
Correlations

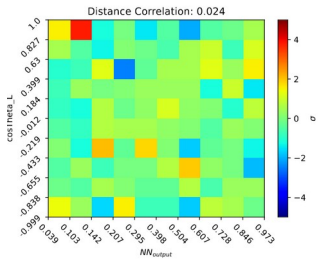
- Check that there are no correlations between NN-output and variables we want to fit on (only look at pure background)
- Find a method to spot correlations between variables → flat correlations
- To perform a 2d fit over deltaE and Mbc they also have to be uncorrelated for background

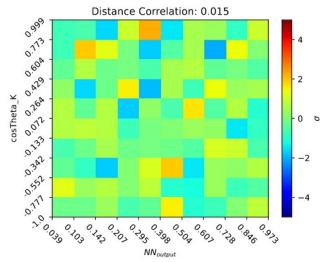


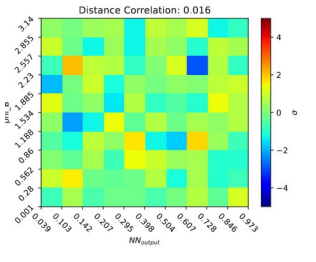






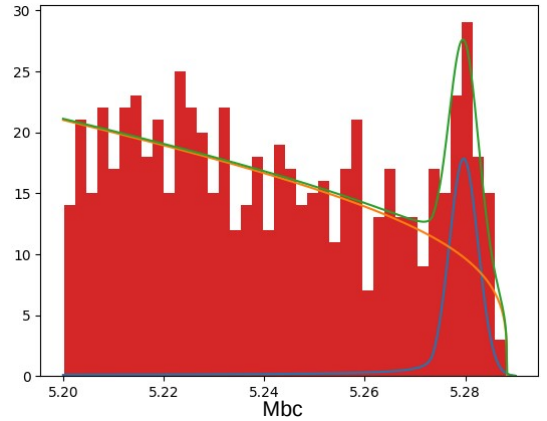


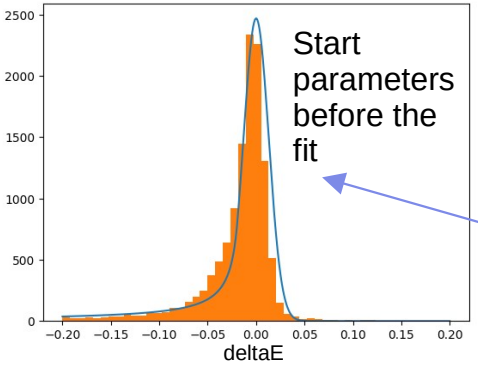




Fitting

- Use z-fit to get the yield by a 2d-unbinnedlikelihood fit over deltaE and Mbc
- The 1d unbinnedlikelihood fit works for Mbc but it fails for deltaE
- It can’t even fit pure signal (Crystal Ball)

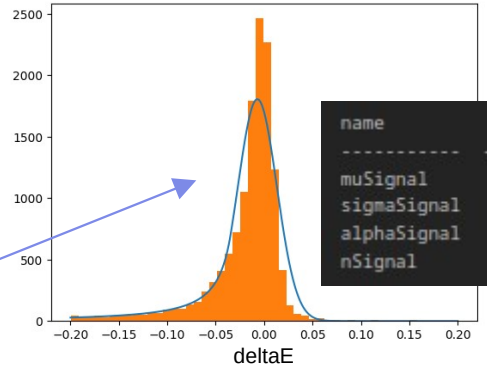




Start parameters before the fit

Pure Signal after NN

Before and after fit



name	value (rounded)	at limit
muSignal	-0.00698576	False
sigmaSignal	0.0201311	False
alphaSignal	1.37444	False
nSignal	1.50672	False

Problems

- Correlations (?)
- Crystal Ball fit for deltaE (signal)
- What function for deltaE background?
- And then the 2d fit for Mbc and deltaE
- Way future: multidimensional simultaneous fit over:
  - 2 yield variables (delta E + Mbc)
  - 3 angle variable (phi_B, cosTheta_K, cosTheta_L)

  → 5D Fit