Search for structures near $\Upsilon(1S)\Upsilon(1S)$ mass threshold

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Introduction

- Existence of full heavy tetraquark state has been theoretically predicated since several decades ago

- Observation of X(6900) by LHCb[1] provided strong evidence for the existence of four heavy quarks resonances

- Theoretical work gave some predictions about the mass spectrum of $bb\bar{b}\bar{b}$ recently[2,3]

- The search for the four bottom tetraquarks by CMS RunII data is launched.
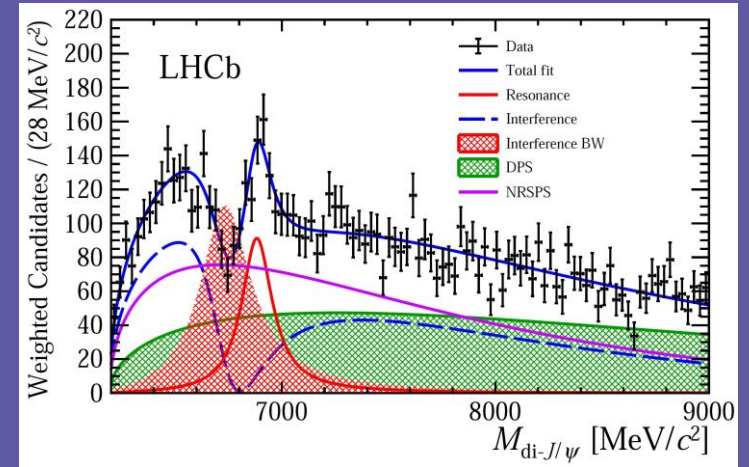

X(6900) observed by LHCb collaboration[1]
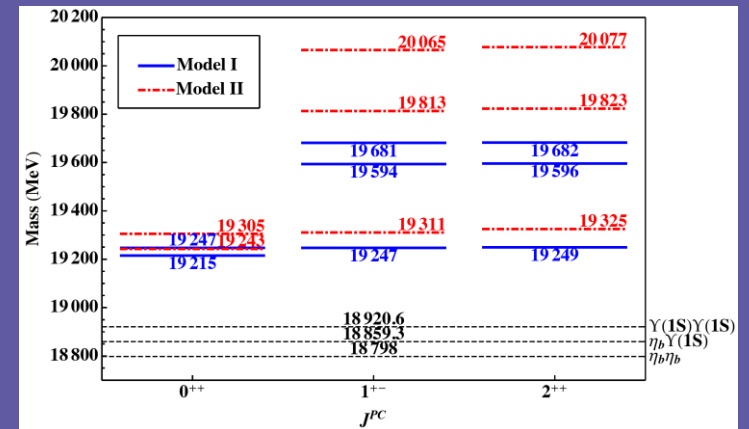
Theoretical spectrum of $bb\bar{b}\bar{b}$ configuration[2]

[1]. LHCb Collaboration. Observation of structure in the J/ψ-pair mass spectrum - ScienceDirect[J]. Science Bulletin, 2020.
[2]. Wang, G. J. , Meng L. , Zhu S. L. . Spectrum of the fully-heavy tetraquark state "$qq\bar{q}\bar{q}$"[J]. 2019.
[3]. Wu J. , Liu Y. R. , Chen K. , et al. Heavy-flavored tetraquark states with the $qq\bar{q}\bar{q}$ configuration[J]. Phys. Rev. D, 2018.
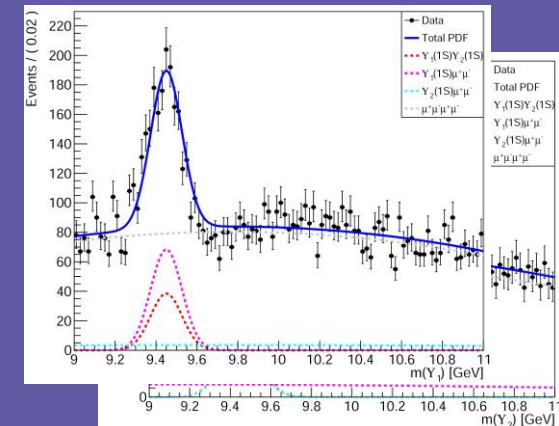
Data sample

- **MC**
  - Signal MC samples are produced by JHUGen with different mass centers (0^{++})
  - Background MC (SPS and DPS) samples are produced by Pythia8
- **Data**
  - CMS RunII datasets will be used, ΥΥ signal has been observed by 2D fit in advance
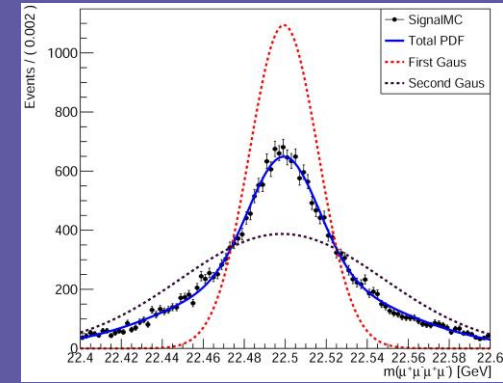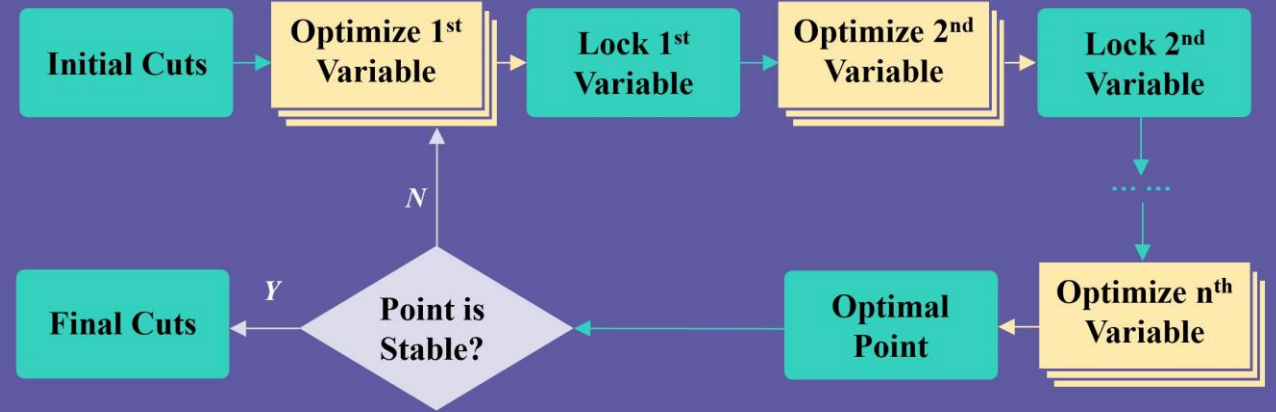

Signal MC sample, fitted with double gaussian functions
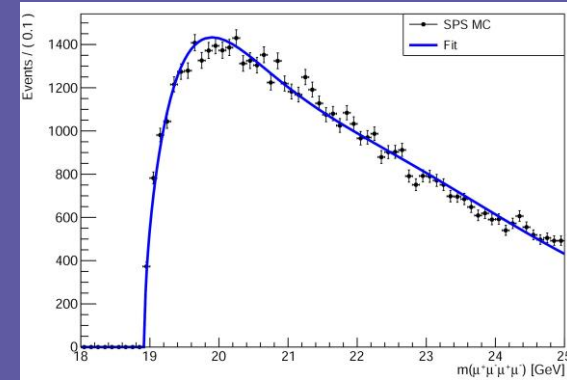
SPS MC sample

2D fit of data sample

Future Plan

- Background MC will be modelled
- Event selection will be optimized
- ΥΥ mass spectrum will be fitted
- System error will be calculated

Process of cut optimization

Thank You

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