中国科学院高能物理研究所
Institute of High Energy Physics
Chinese Academy of Sciences

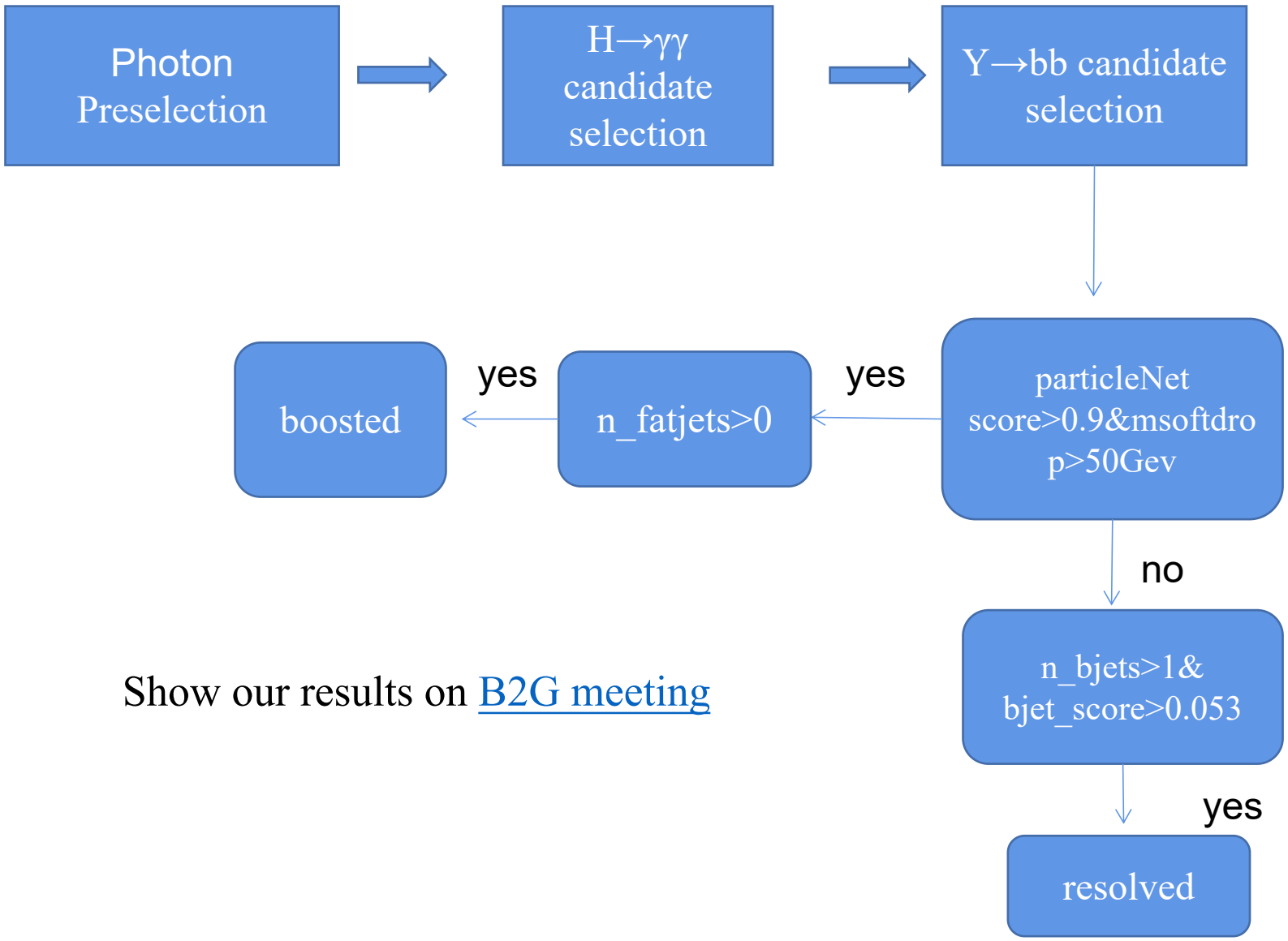
# IHEP 1-4月考核

汇报人：张杰
导师：王锦

# Outline

- Resonant HY→bbγγ analysis
  - Analysis strategy
  - DNN and Categories Optimisation studying
  - Preliminary results
- HGCal bonding
- Summary

# Analysis Strategy

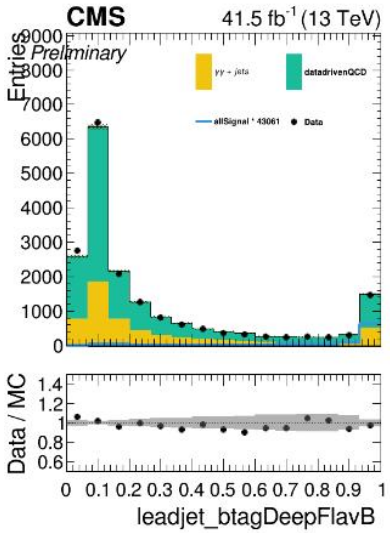


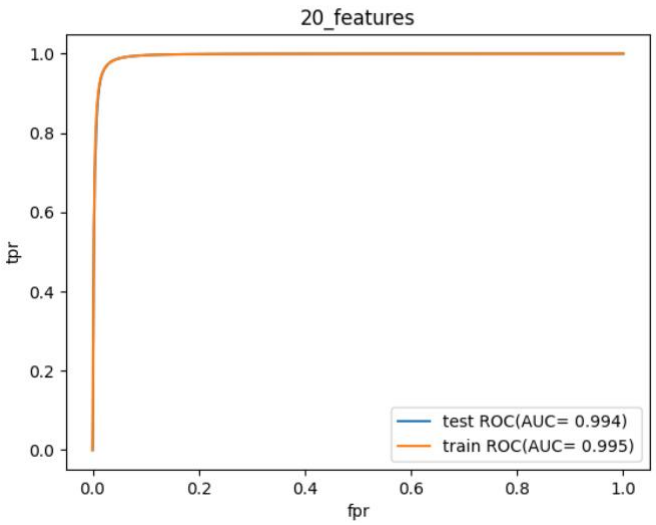

Show our results on B2G meeting

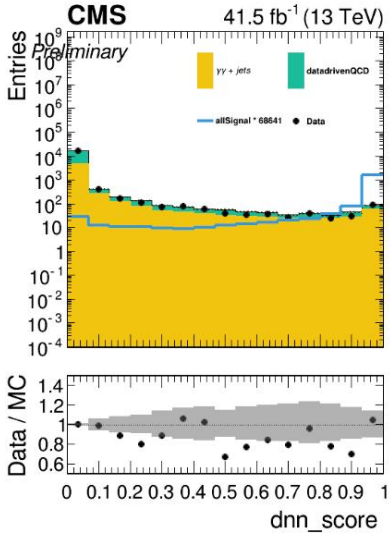
- In the nanoAOD.there are:
  - Fatjet_particleNetMD_Xbb(QCD)
    for X->bb vs QCD tagging,
    use xbb/(xbb+qcd)
  - bjet_score:Jet_btagDeepFlavB
- We use 0.053 the official loose working point to improve the significance
- Used Dnn score to do category optimisation in resolved
- Used particleNet score to do category optimisation in boostd

# HY→bbγγ analysis

- **For boosted:**the statistics is not large enough to train a DNN classifier.so we used the particleNet working points to do categories optimisation.
- **For resolved**:
  - Train a good DNN classifier
  - Main background: γγ+jets and data-driven QCD
  - All input features have good Data/MC agreements
  - Ymass is also consided as a input feature to develop a MVA that discriminates well at different mass points.(parameterised Neural Network as in HIG-22-012)

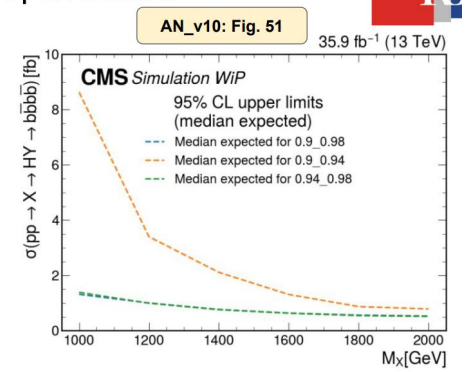



ParticleNet working point optimization

- The ParticleNet working points were chosen between the three for which the ParticleNet scale factors were available for 2016 EOY datasets: 0.9, 0.94 and 0.98
- Expected exclusion limits were calculated with the three possible choice of (L,T) working points
- The working point sets (0.94,0.98) and (0.9,0.98) show similar performance
  - Former was chosen to have more similar statistics in the two signal regions

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B2G-21-003 ： HY—bbbb(boosted)

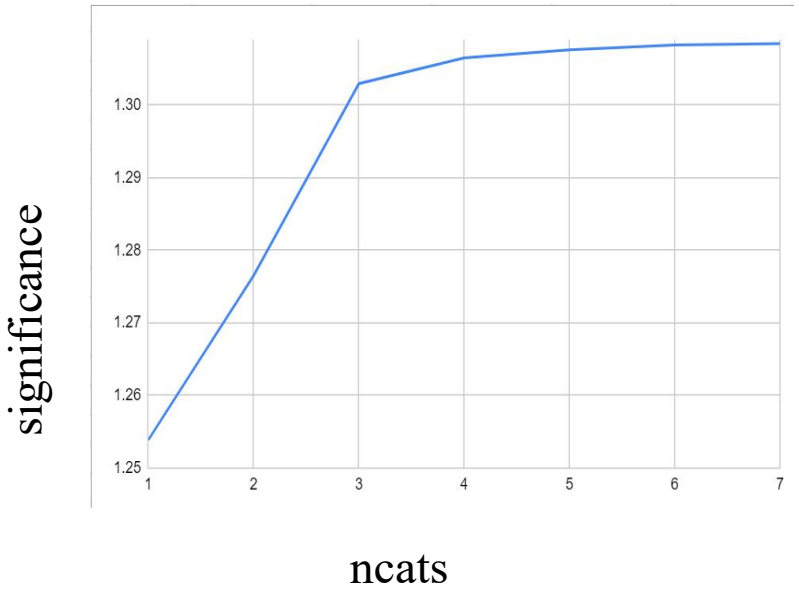
- Event weighting:
  - Signal weight is normalized to background
- All features are normalized with Z-Score Scaling method

$$z = \frac{x - \mu}{\sigma}$$

# Categories Optimization

- The MC signal and background Dnn score are used for category optimization
- Simultaneous optimization of number of categories and boundaries based on total naive significance
- The category boundaries were based on all signal (merge all mass points),and then for each mass,used the same boundaries.

$$\text{significance} = \sqrt{2((S+B)ln(1+\frac{S}{B})-S)}$$




➢ New method can be applied to each mass point more conveniently and improve the significance.

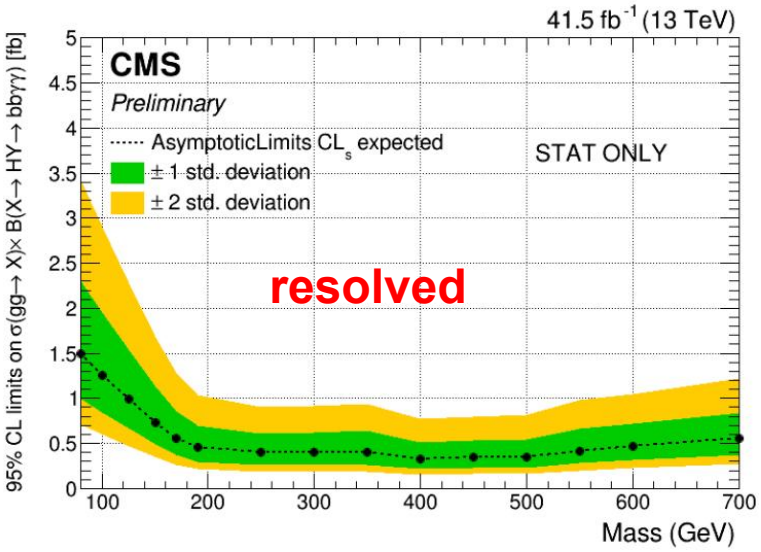
- Choose to define categories based on $N$ data events in the sidebands
- Optimisation procedure:
  1. Define first category to have $N_{data}^{side} = 20$ (highest scoring 20 events)
  2. Consider next category also with $N_{data}^{side} = 20$
     1. Compare changes in expected limits when adding this new category
     2. If any of the masses show an improvement of $\geq 1\%$, confirm this as a new category
     3. If not enough improvement, consider instead a category with $2\times N_{data}^{side}$
  3. Repeat until no further categories found which improve limit by $\geq 1\%$

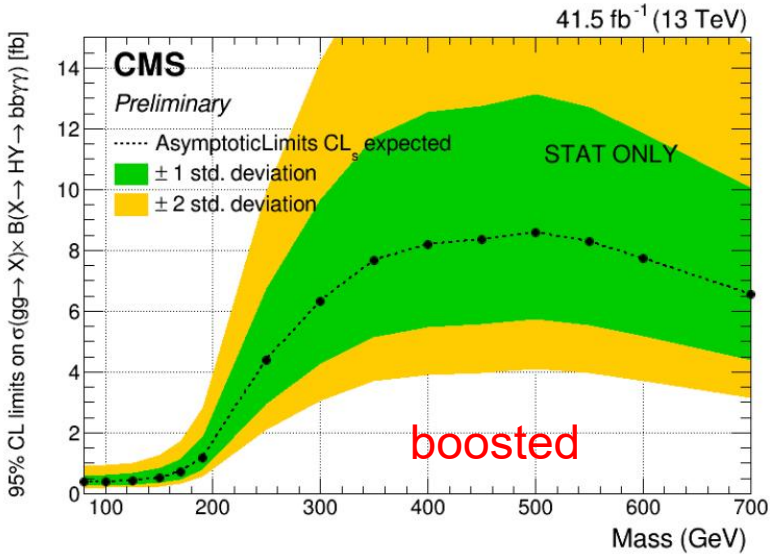
HIG-22-012: HY→ ττγγ

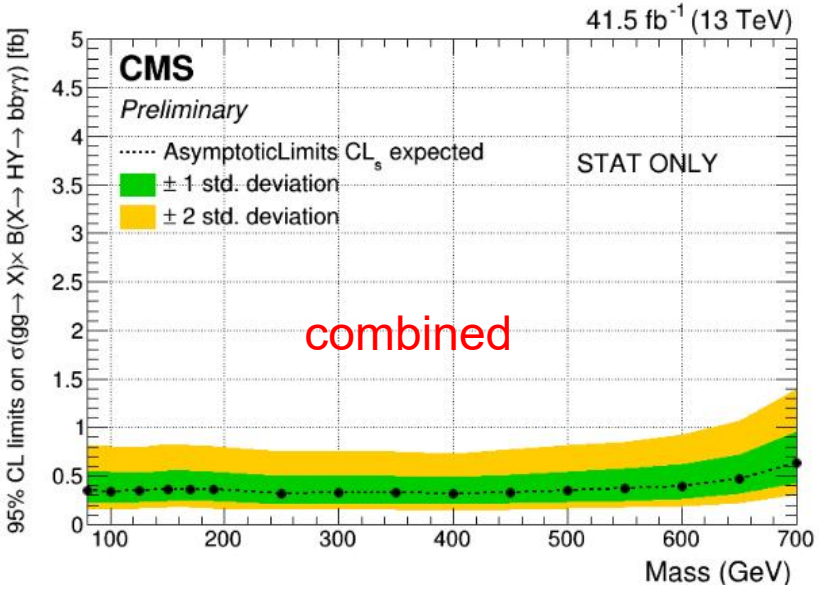
# Preliminary results

**Summary:**

- We present preliminary results of HY→bbγγ at Xmass=1000GeV ,2017.
- Plan to include other mass points and combine three years

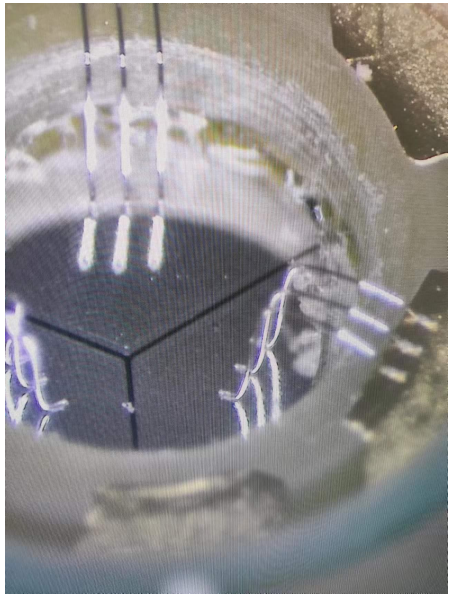


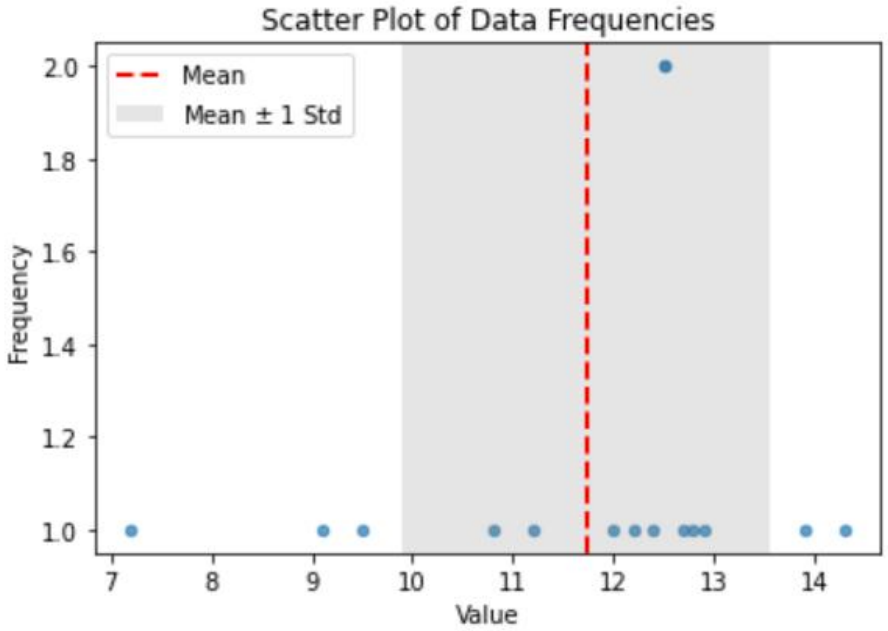



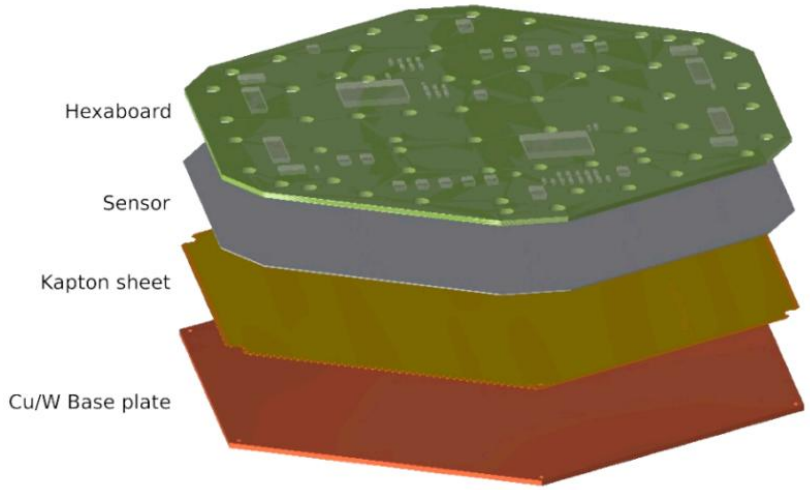



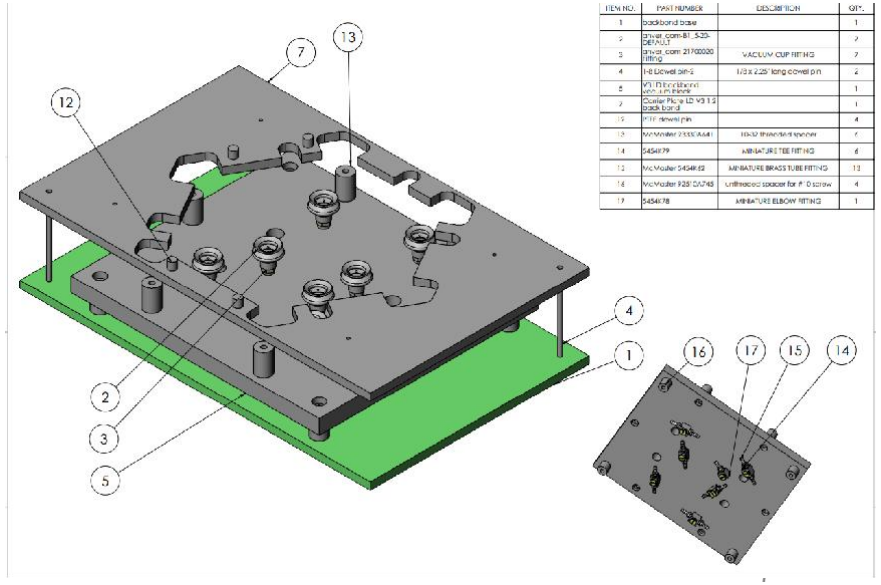

95% CL upper limit Xmass = 1000Gev
x-axis :Ymass

- **HGCal bonding**:
  - Replacemeng procedure from LD V2 to LD V3
  - Wire bonding of LD V3 module production and pull test
  - Back-bonding fixture and carrier plate





# Summary

## Resonant analysis:

- We present preliminary results of HY→bbγγ at 2017.
- Have updated the progress at B2G group meeting
- Plan to include other mass points and combine three years

## HGCal bonding:

- Wire bonding of LD V3 module and pull test
- Next step will continue to optimize parameters

# Thank you!