浙江大学CMS组进展

肖朦

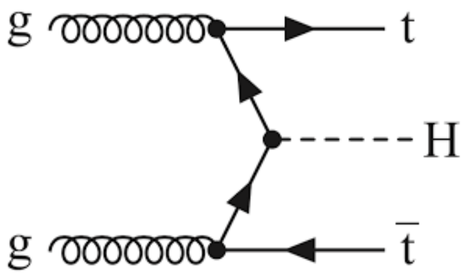
2022.07.15，HEP Summer Days

浙大CMS组概况

- 职工：肖朦
- 博士生：潘仁奇（毕业），陆陈丰，林桢，叶裕雷，宋悦凯，唐旻
- 研究方向：Higgs CP/EFT, QCD精确测量
- 硬件：CMS高粒度量能器，前端电子学设计

Higgs-top CP property

- What's the CP property of Yukawa coupling?
- Higgs-top Yukawa coupling, a promising way to look for CP violation
- Dedicated CP and EFT analysis, better sensitivity, no ambiguity

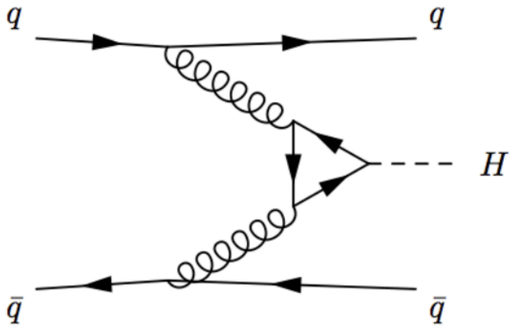


ttH

H→ γγ, first Yukawa CP measurement

PRL 125, 061801 (2020)

Paper editor, pre-approval, approval



ggH+2jets

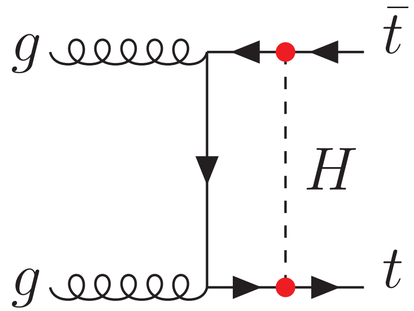
Phys. Rev. D 102, 056022 (2020)
Gritsan, Roskes, Sarica, Schulze, Xiao, and Zhou

Phys. Rev. D 104, 052004 (2021), H→ 4l

Contact, approval

arXiv: 2205.05120, H→ ττ+4l+γγ

Observable design, 4l +ττ+γγ combination

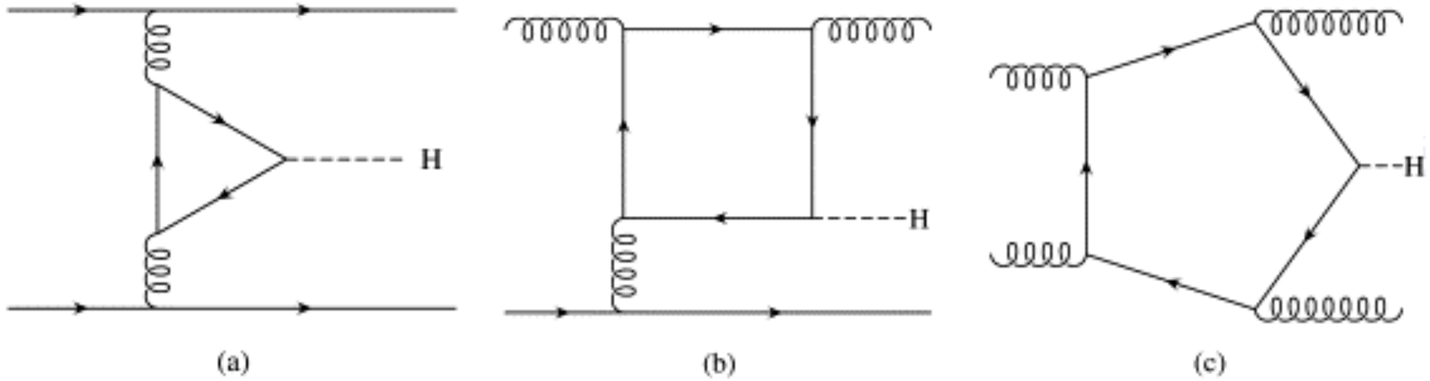


$t\bar{t}$

Phys. Rev. D 104 055045 (2021)
Martini, Pan, Schulze, Xiao

Ongoing CMS analysis

ggH+2 jets



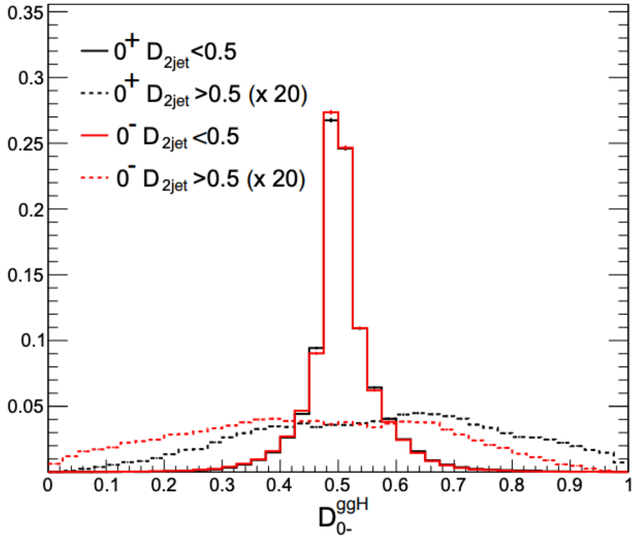
qq→ H+2j **qg→ H+2j** **gg→ H+2j**

Sensitivity mainly from qq initial state

Similar phase space as VBF

Design observables only sensitive to qq process

Phys. Rev. D 102, 056022 (2020)
Pheno paper



ggH+ ttH

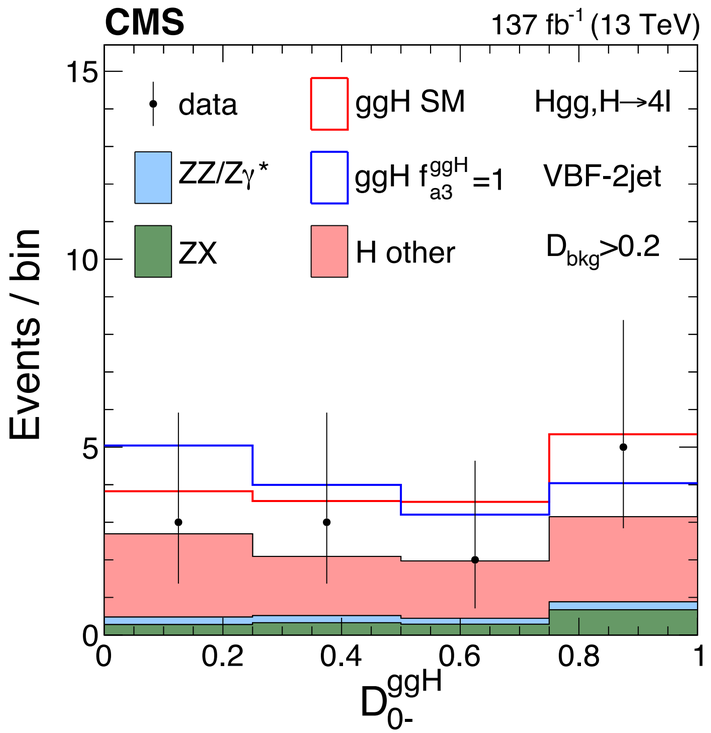
Extra power gained combining ggH + ttH

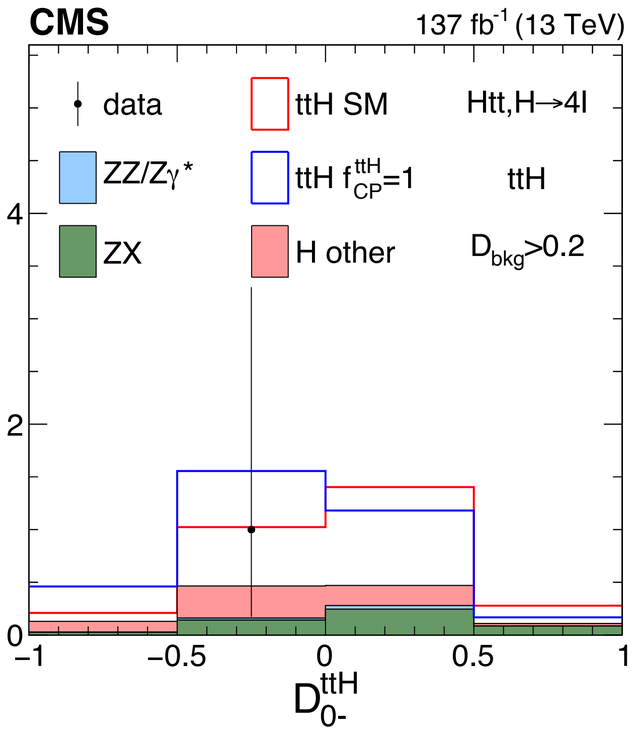
Phys. Rev. D 104, 052004 (2021)

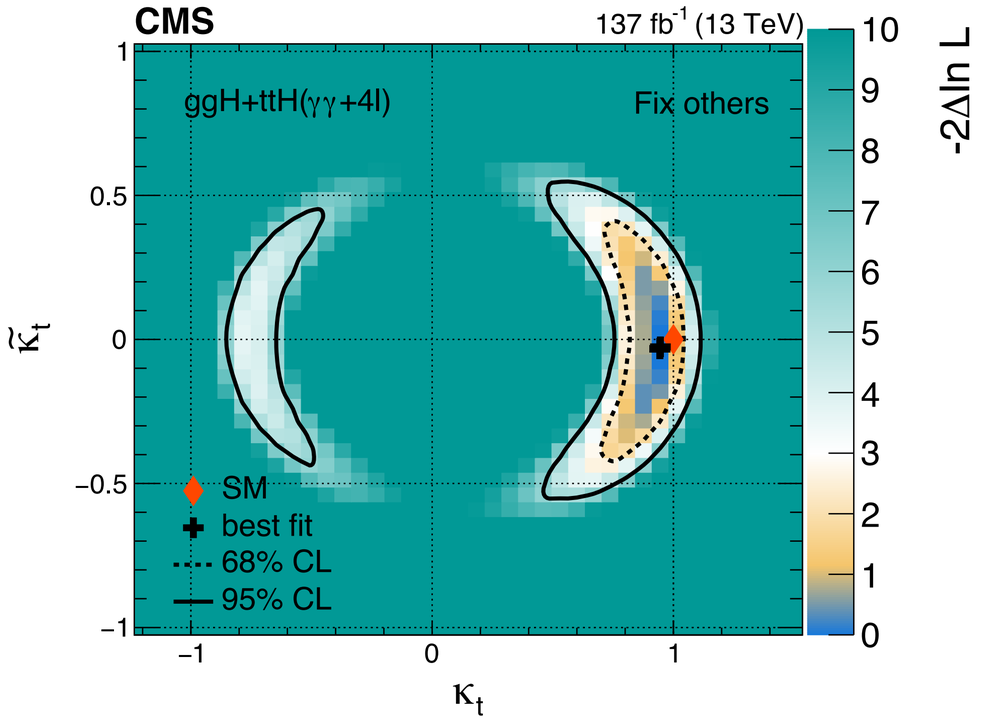
Xsec vary differently

ggH: σ0-/ σ0+ = 2.38

ttH: σ0-/ σ0+ = 1/2.56

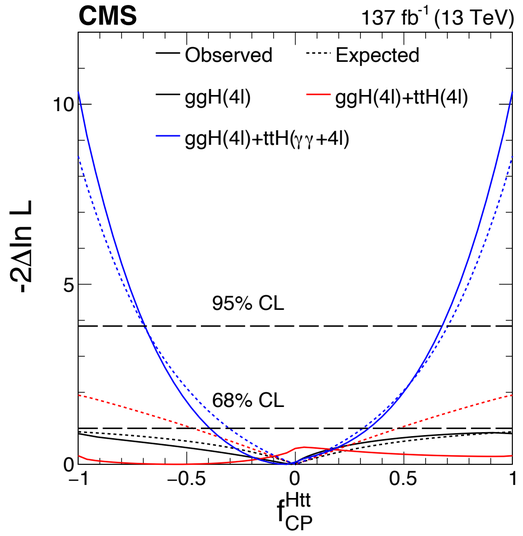






EFT interpretation

- ggH interpretation:
  - Resolved top loop: κ, κ~, Effective ggH vertex: cgg, cgg~
- 4 EFT coefficients measured simultaneously
- First CP measurement using ggH+ttH
  - Contact, approval talk
- Highlights in LHCP2021
- CMS news: "Higgs Scruntizing production and decay kinematics of the Higgs Boson using its golden decay channel", link



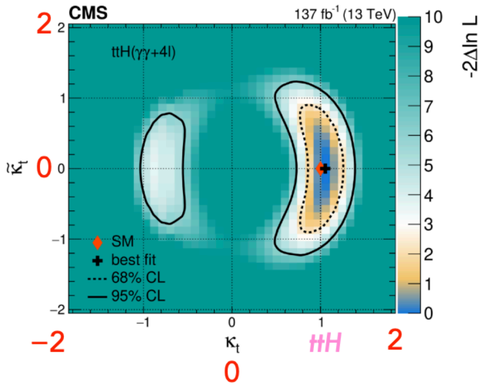
Full Run-2, 137 fb⁻¹

Also: comprehensive study of CP structure and anomalous couplings

CMS-HIG-19-009
Submitted to PRD

Phys. Briefing

Contraints on ttH anomalous CP coupling, combining $H \to 4\ell$ and $H \to \gamma\gamma$



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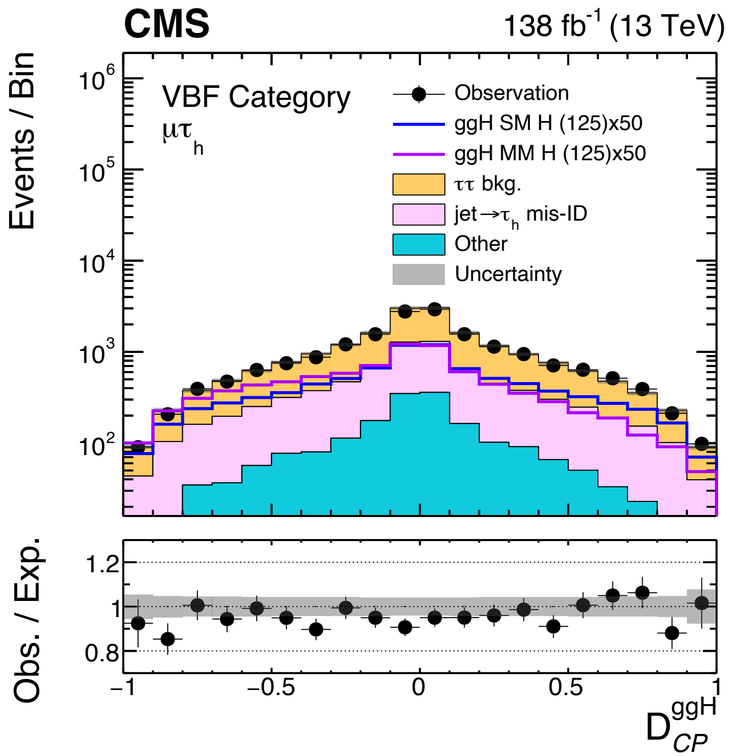
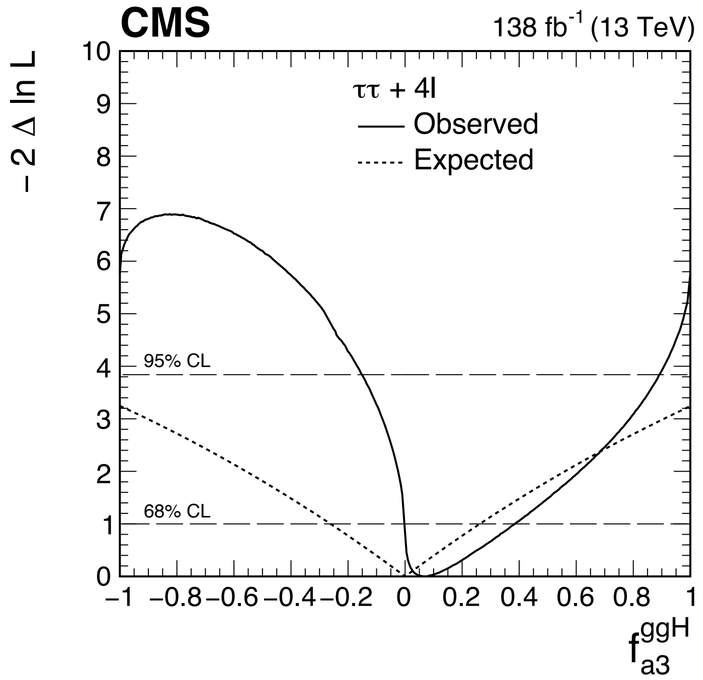
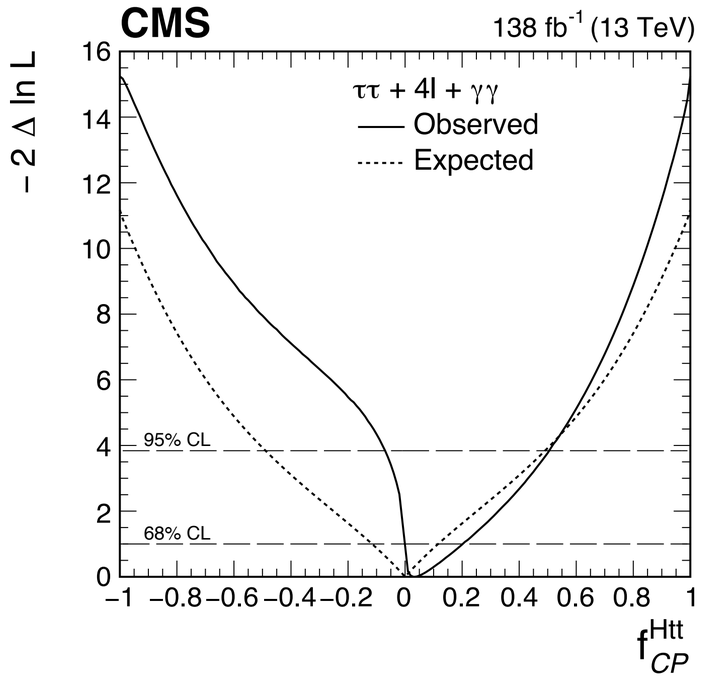
Combination of ττ +4l + γγ







arXiv: 2205.05120, H→ ττ+4l+γγ

Observable design, 4l +ττ+γγ combination

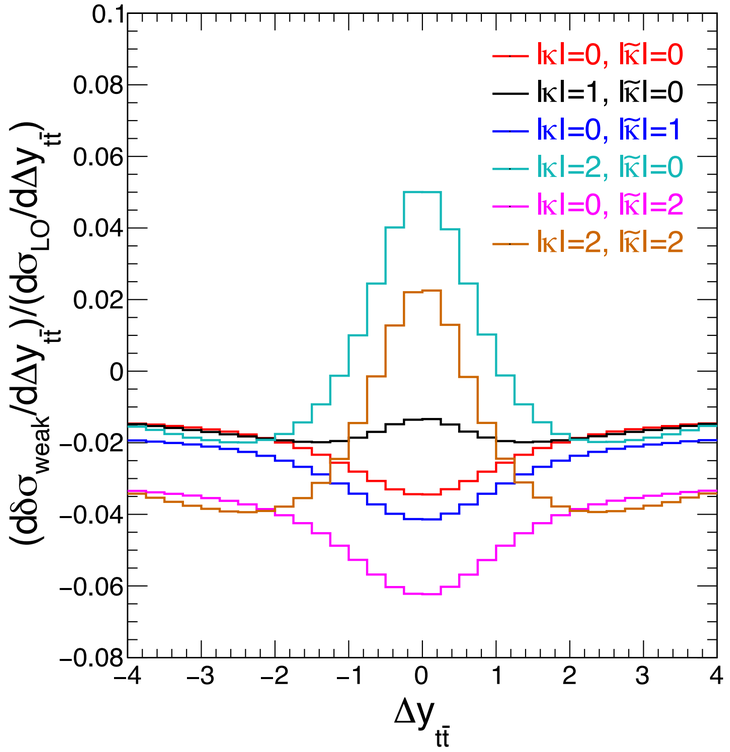
~4σ exclusion on pure Htt CP odd

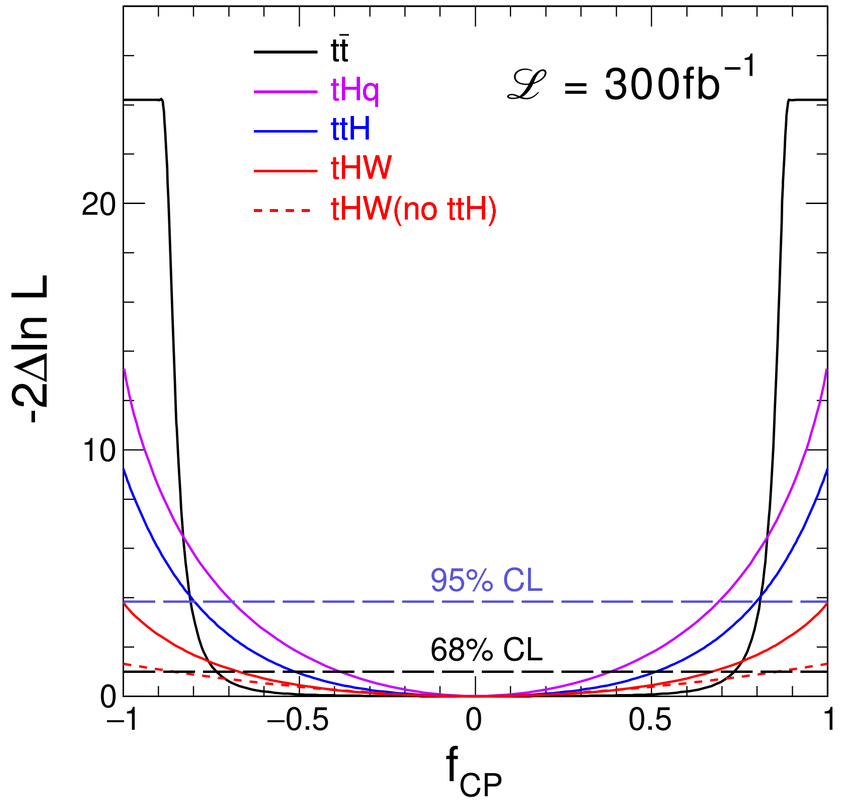
~2.4σ exclusion on pure Hgg CP odd

$t\bar{t}$ probe on Htt CP

Phys. Rev. D 104 055045 (2021)

Martini, Pan, Schulze, Xiao



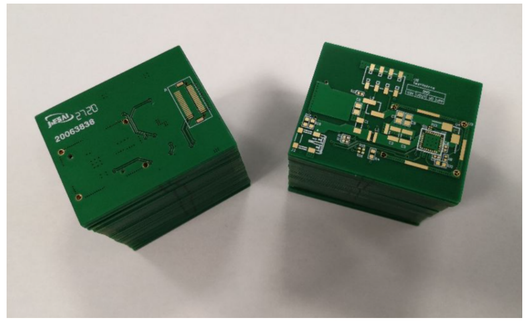


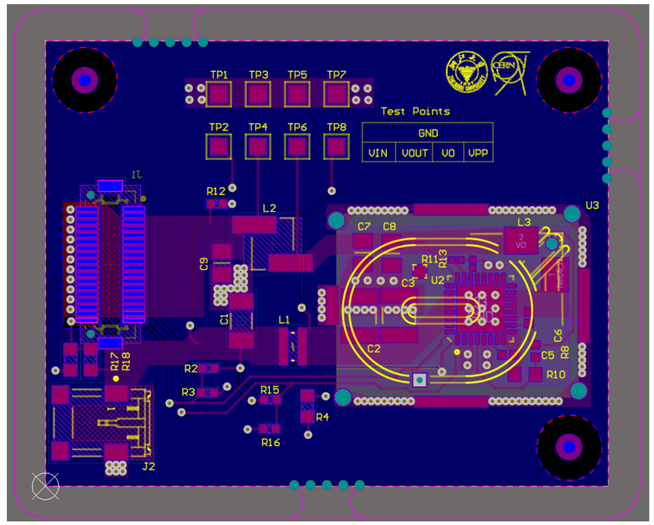
Sensitivity in rather complementary phase space

Ongoing CMS analysis

HGCal front end PCB design

- DCDC PCB design and test production of 60 boards
- Half shape hexaboard design



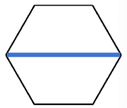


Hexaboards Design Status

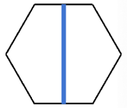
HGCAL Week Workshop
Summer 2022

Hafiza Ayesha Ahmed (CERN/OL-PAK)
Fakhri Alam Khan (CERN/ULB)
Noman Saud (CERN/OL-PAK)
Zhen Lin (ZJU-China)

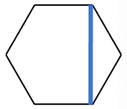
Two Halves : Top & **Bottom**

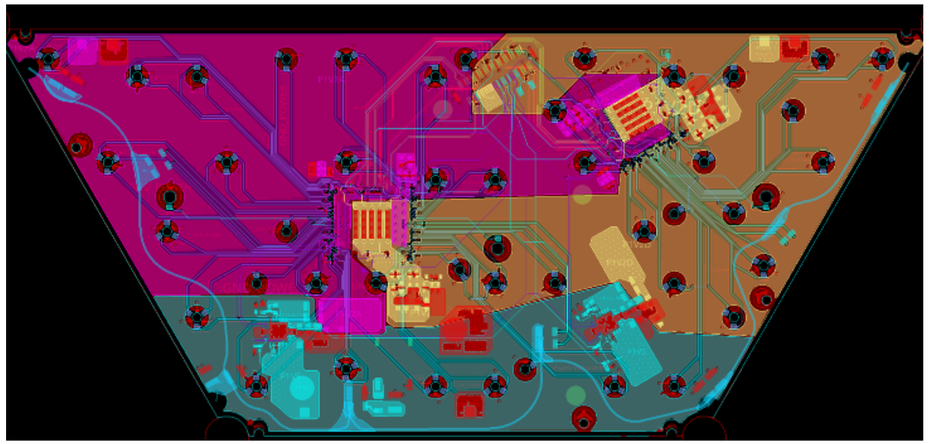


Two Semis : Left & Right



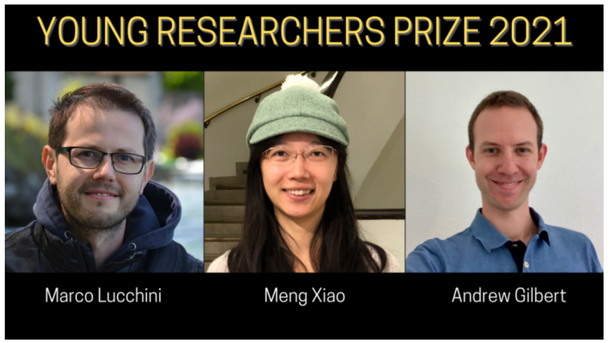
One Five and One Three





其他

- 会议报告
  - 潘仁奇，2021/07, **EPS-HEP**, 分会报告: Probing the CP structure of the top quark Yukawa coupling: Loop sensitivity vs. on-shell sensitivity
  - 陆陈丰：2022/02, **7th Yearly SMP-HAD Workshop**, 报告：Energy correlations inside jets
  - 肖朦，2022/06, **Celebrating a decade of the Higgs**, TIFR, Mumbai, 大会报告: CP measurement of the Higgs boson
- 职务
  - 肖朦：2022-24, Higgs Conference，国际组织委员会成员，Higgs 2022 Program Committee 成员
  - 肖朦：2021 LHCP 希格斯分会召集人，2021 EPS-HEP 希格斯分会召集人
  - 肖朦：2020-22 CMS 多元委员会成员
  - 肖朦：2020-22 CMS 希格斯联合分析组召集人
- 奖项：肖朦，2021年CMS青年研究员奖



"Her crucial and sustained contributions to the analysis of CP and other properties of the Higgs boson in its four-lepton channel, the EFT analysis of the Higgs boson in several of its decay channels, and to the alignment of the inner tracker."