Search for H+ →W+A
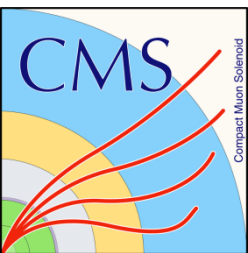# in 3l final states
in pp collisions at 13 TeV (CMS)
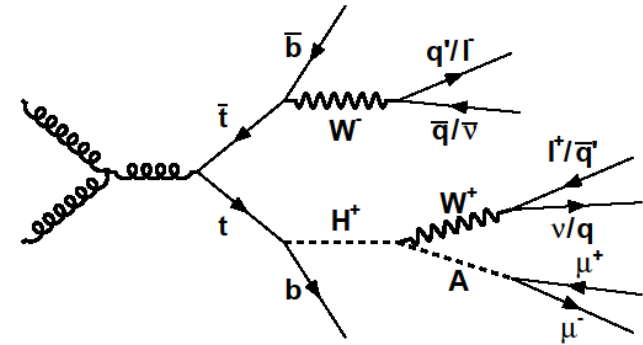
Ji Hwan Bhyun

on behalf of the CMS Collaboration

Search for H⁺→W⁺A

- Singly charged (H^+), CP-odd neutral (A) Higgs boson expected in BSM Higgs models (e.g. 2HDM)

- Search for new phenomena from BSM Higgs sector

  - $pp \rightarrow t\bar{t} \rightarrow b\bar{b}H^+W^-, H^+ \rightarrow W^+A$

    - $WW \rightarrow \ell\nu q'\bar{q}$, $A \rightarrow \mu^+\mu^-$ ($\ell = e$ or μ)

  - mass range: m_A :[15, 75], m_{H+}:[m_A+85, 160] GeV

- Data set: pp collisions at $\sqrt{s}$=13 TeV, L=35.9 fb⁻¹, recorded using the CMS detector

- Event selection

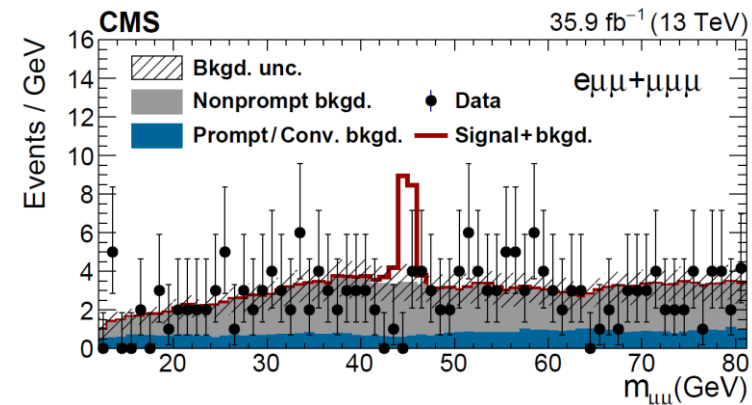 - $\mu^+\mu^-$ + e/μ + ≥2j (≥1b-tag)

  - $m_{\mu\mu}$>12 GeV, |$m_{\mu\mu}$- 91.2|>10 GeV (for all opposite-sign pairs)

- Analyze $m_{\mu\mu}$ distribution to look for the $A \rightarrow \mu\mu$ resonance

  - non-resonant background distribution

    - mainly from $t\bar{t}$+jets (≥1 nonprompt lepton)

Search for H⁺→W⁺A

- No significant excess is found, and upper limits at 95% CL are set on

  $$B_{sig} = B(t \rightarrow bH^+)B(H^+ \rightarrow W^+A)B(A \rightarrow \mu^+\mu^-)$$

- $B_{sig} < 1.9 \times 10^{-6} - 8.6 \times 10^{-6}$

$\rightarrow B(t \rightarrow bH^+)B(H^+ \rightarrow W^+A) < O(10^{-2(-3)})$ in 2HDM type 1,2 (X)

  - tighter than previous results at $O(10^{-1})$ (2HDM type 2, CDF)

  - $H^+ \rightarrow W^+A$: major H^+ decay mode when light A is present

  - constrains possibility that H^+ is produced at large rate

    and mainly decaying in this bosonic mode

- First result on $H^+ \rightarrow W^+A \rightarrow W^+\mu^+\mu^-$

- Published result can be found in:

  - Phys. Rev. Lett. 123 (2019) 131802, arXiv:1905.07453