Determine the experimental mass resolution

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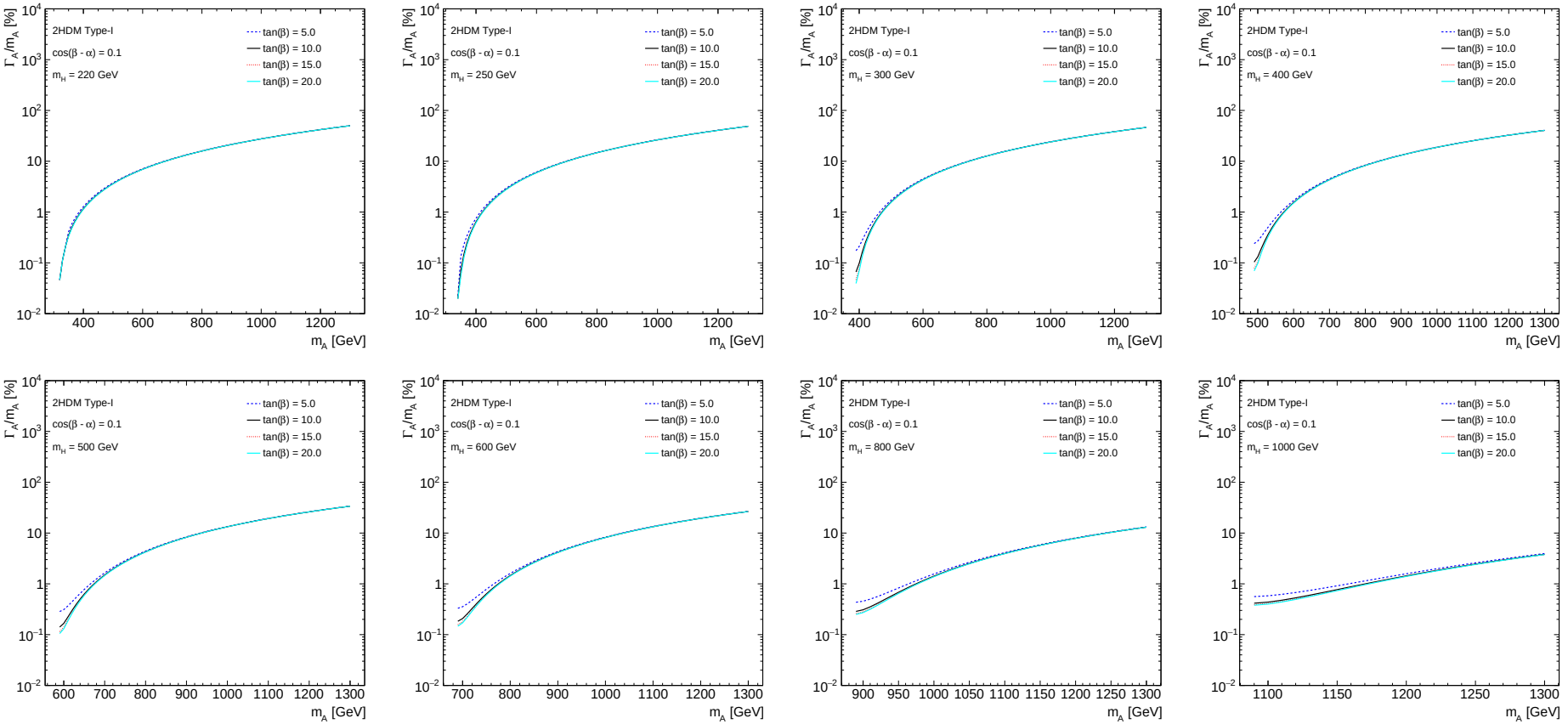
Introduction

- **Determination of the experimental mass resolution:**
  - MC samples for the $A \to Z(\to X)H(\to 4\ell)$ signal are used
  - A total of 72 samples are used for the study which is all the generated samples.
  - The resolution is calculated by the Full Width at Half Maximum (FWHM) divided by m_H

- **Determination of the resolution required for the LWA samples generation:**
  We use the following to figure out the resolution for A and H width that we can use to generate the LWA testing samples:
  - Using the calculated theoretical widths for A and H
  - Fixing $cos(\beta - \alpha)$ to 0.1 and $\tan(\beta) = 5, 10, 15, 20$
  - Fixing m_H and calculating the experimental resolution Γ_A/m_A
  - Fixing m_A and calculating the experimental resolution Γ_H/m_H
  - Perform the study on 2HDM Type-I

Experimental resolution from the theory

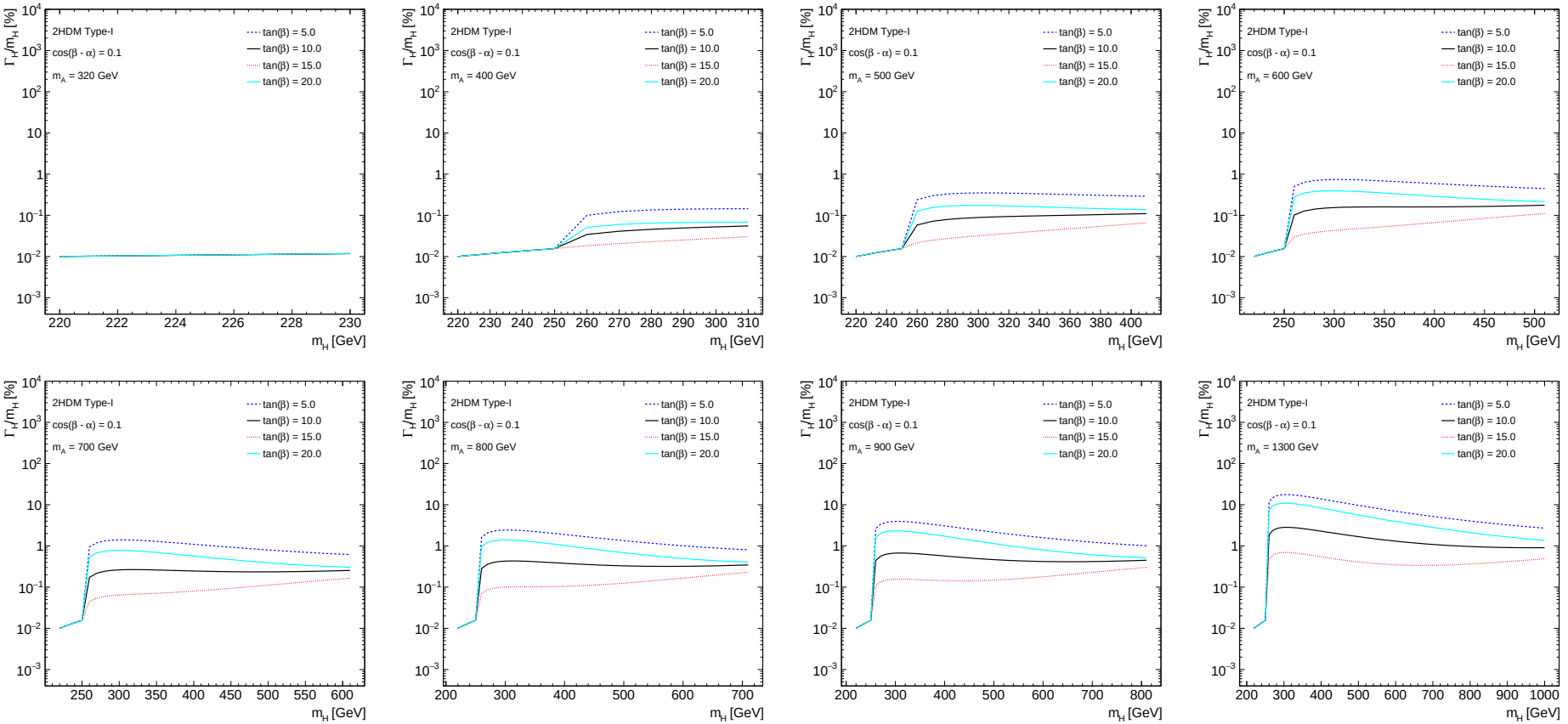
Resolution $= \Gamma_H / m_H$ with fixed m_H



- For m_A at the lower mass region the width is less than $\sim 1\%$ of the experimental mass resolution.
- The width increases rapidly for lower values of the H mass and higher A mass:
  - $\sim 50\%$ for $m_H = 220$ GeV, $m_H = 250$ GeV and $m_H = 300$ GeV
  - $\sim 40\%$ for $m_H = 400$ GeV, $\sim 34\%$ for $m_H = 500$ GeV and $\sim 27\%$ for $m_H = 600$ GeV
- The width becomes $\sim 13\%$ for $m_H = 800$ GeV and $\sim 4\%$ for $m_H = 1000$ GeV of the mass resolution.

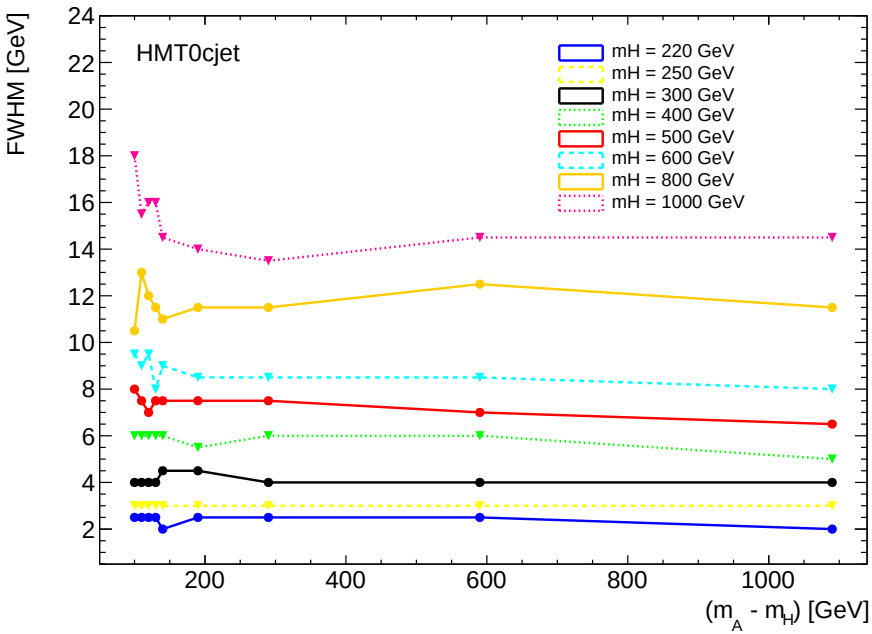
Experimental resolution from the theory

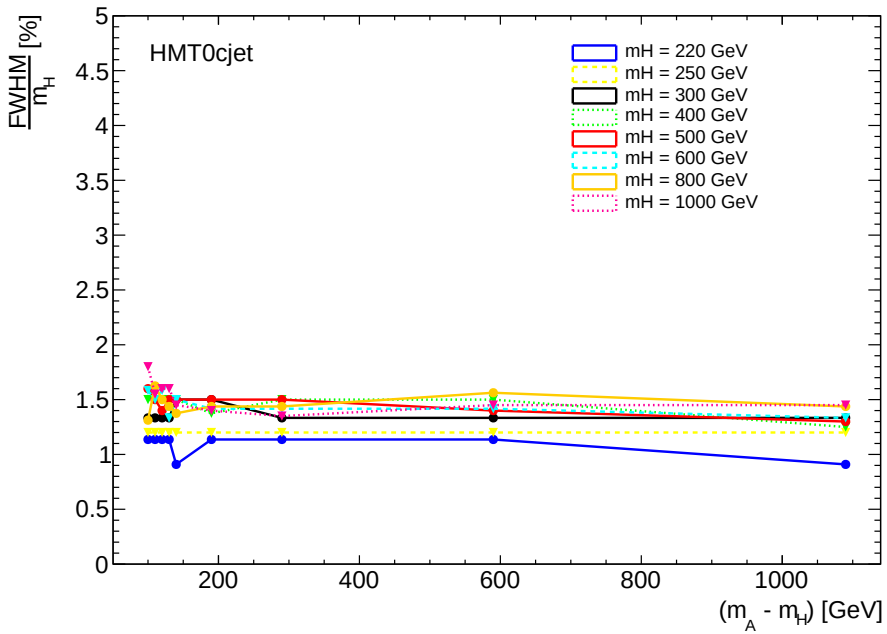
Resolution $= \Gamma_H / m_H$ with fixed m_A



- The width is less than $\sim 1\%$ of the experimental mass resolution for $m_A = (320, 400, 500, 600)$ GeV.
- For $tan(\beta) = 5$ the width is about 1% for m_H between 270 GeV and 420 GeV, and $< 1\%$ otherwise.
- m_A showed similar behaviour for $tan(\beta) = 5$ and 20 with width around 2% for m_H between 270 GeV and 380 GeV.
- Width of up to 18% and 10% of the mass resolution is seen with $tan(\beta) = 5$ and 20.

Experimental resolution from MC





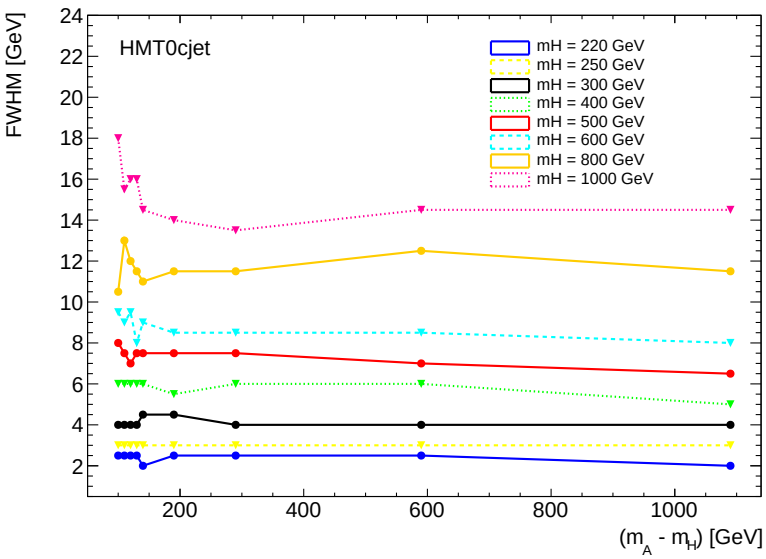
- The FWHM (right) and the resolution, FWHM/m_H, (right) as a function of $m_A - m_H$
- The resolution is less than 2% and about 1% in all the signal regions,
- except the HMT1cjet category the resolution is to 2.5%

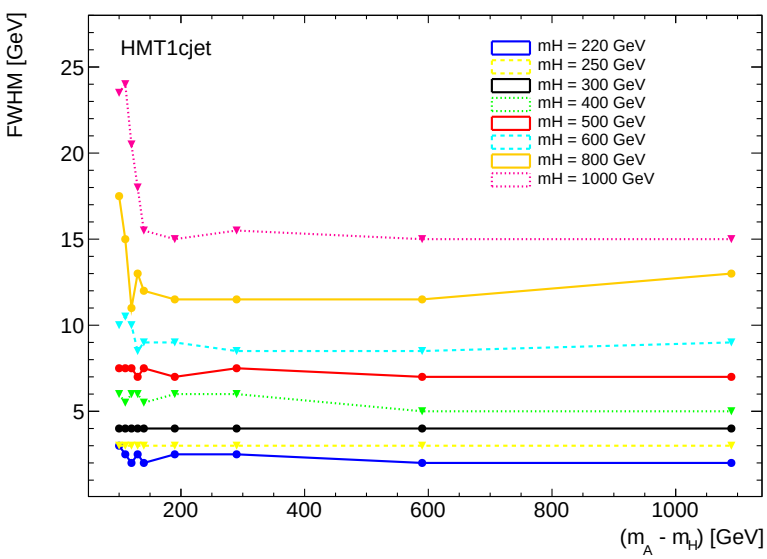
Summary

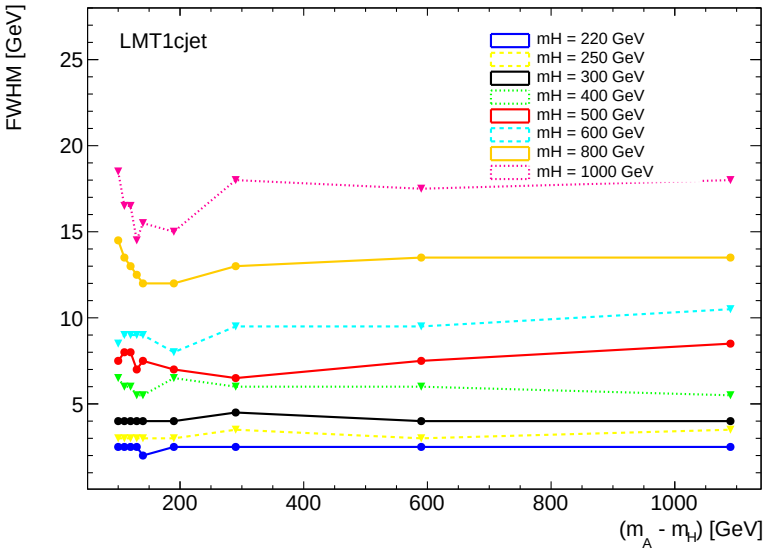
- The experimental mass resolution is up to 2.5% for the simulated samples for the HMT1cjet
- For the rest of the signal regions the experimental resolution is about 2%.
- The resolution needed to generate LWA samples is performed using 2HDM Type-I.
- The 2HDM parameters used are $cos(\beta - \alpha) = 0.1$ and $\mathbf{tan}(\beta) = 5, 10, 15, 20$.
- The effect of different $\mathbf{tan}(\beta)$ on the $\Gamma(A \to ZH)$ and $\Gamma(H \to ZZ)$ is negligible.
- Using 30% for A width and 10% for the H width of their experimental mass resolution might be better.

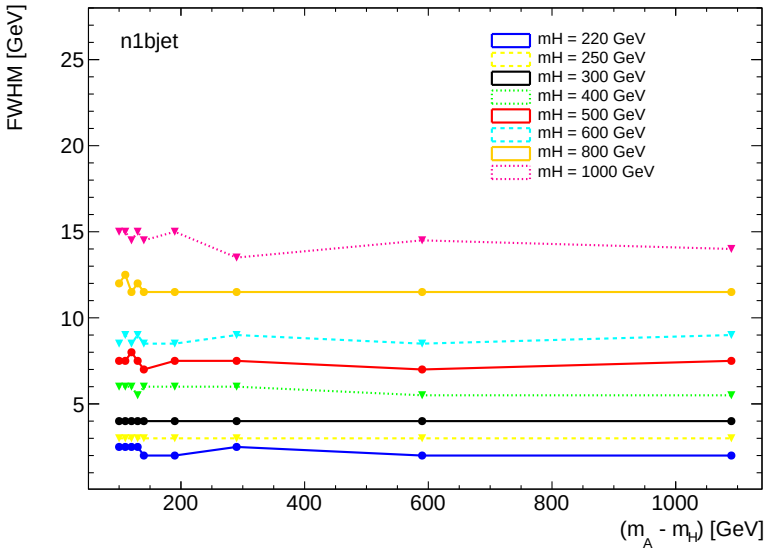
Additional slides

Experimental resolution from MC

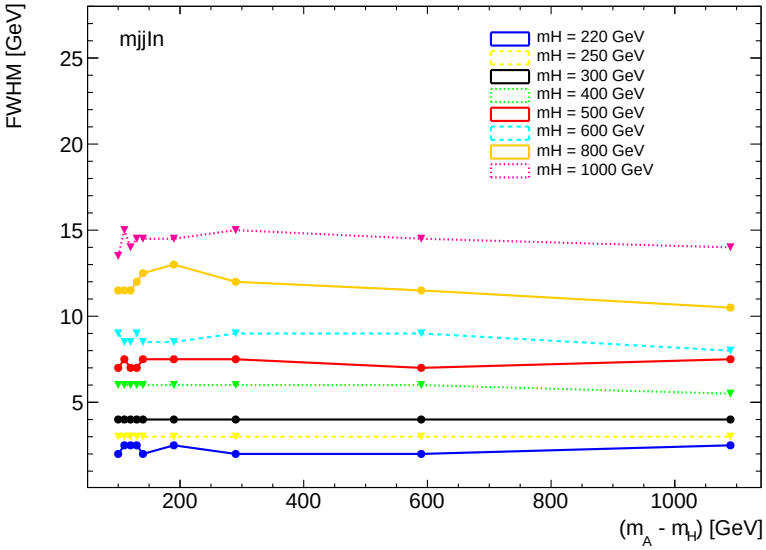


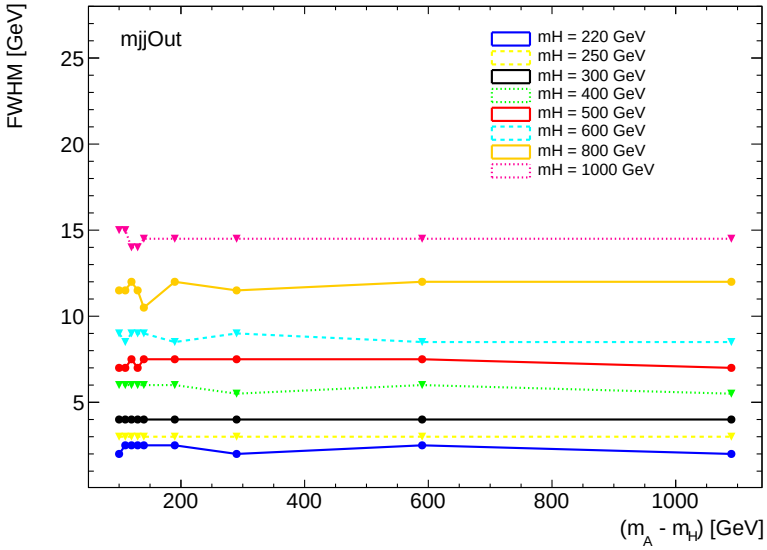


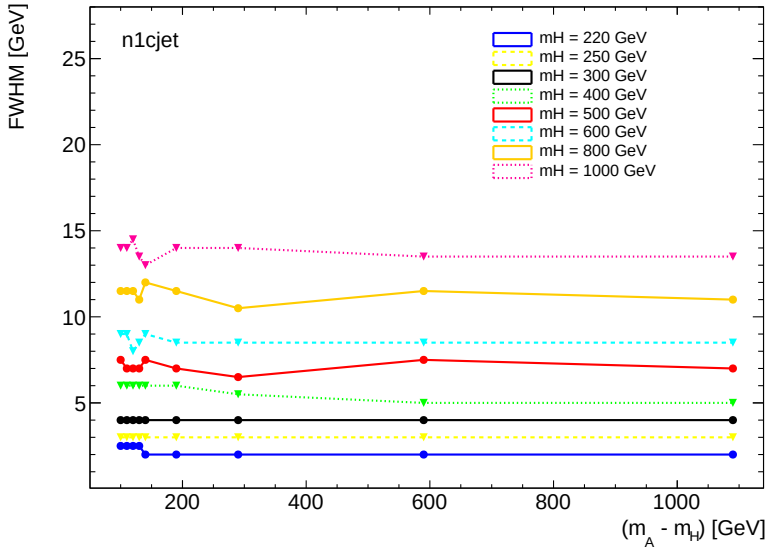




Additional slides
Experimental resolution from MC







Additional slides

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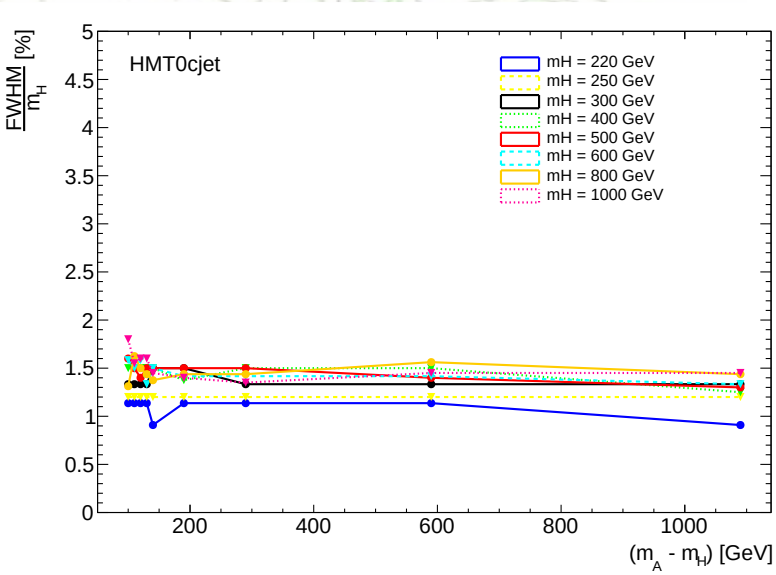

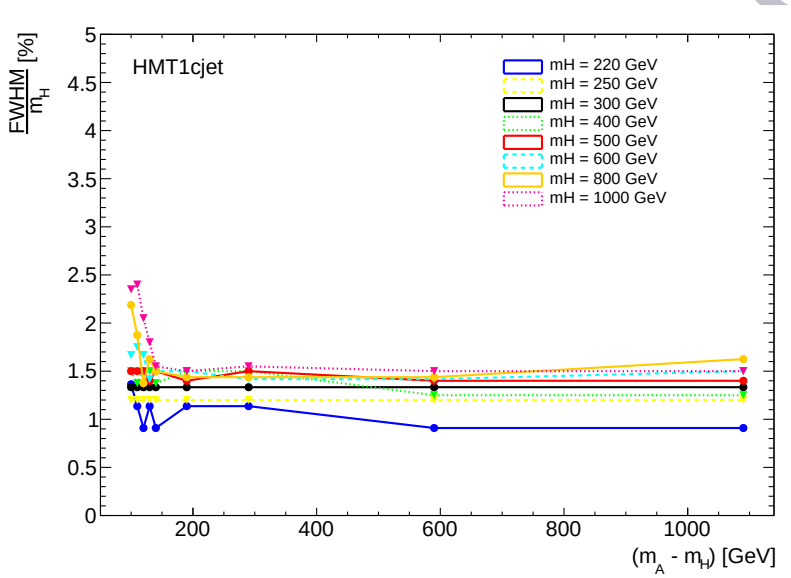

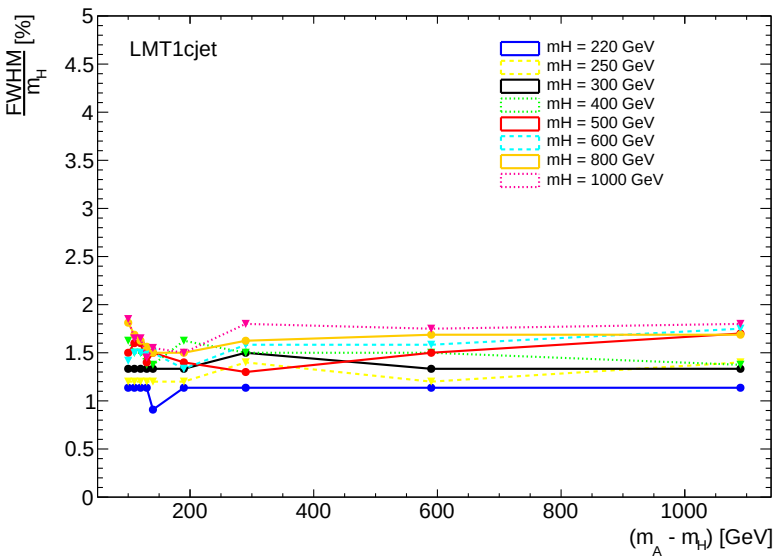

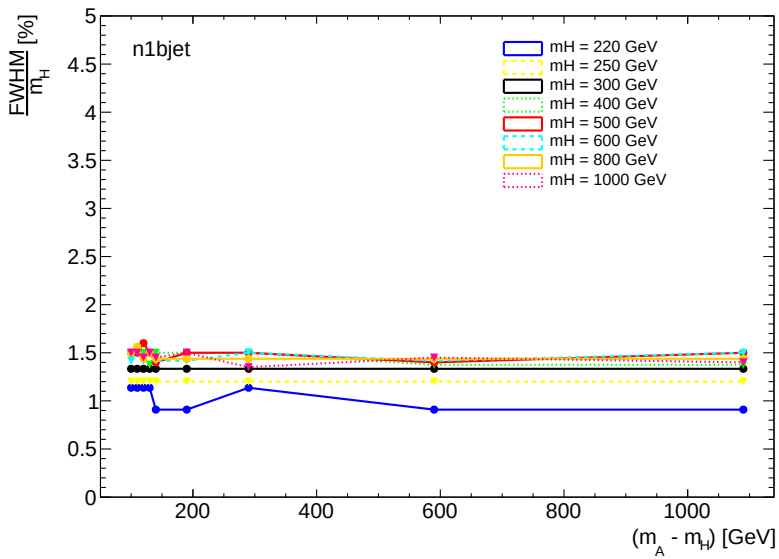

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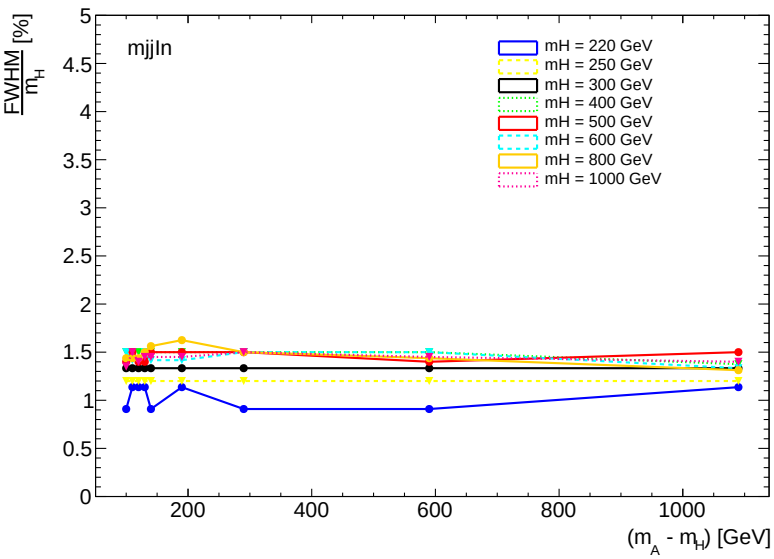

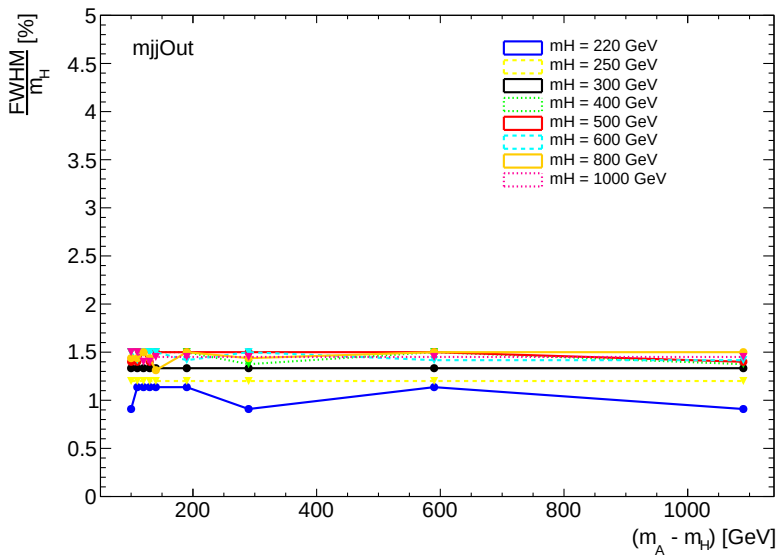

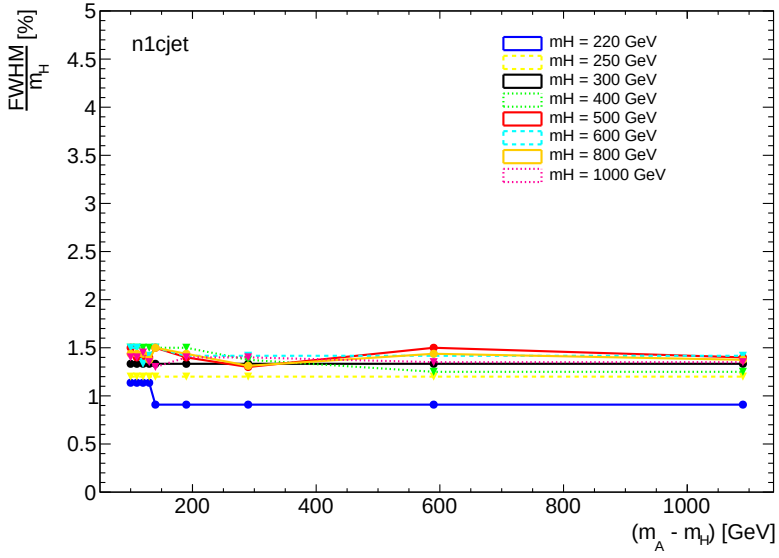

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