

Branching ratio measurement of $h \rightarrow \mu^+ \mu^-$ at the ILC

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ILD Software/Analysis Meeting

2018/May/23

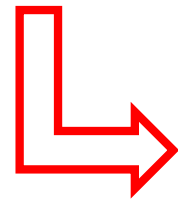


HELMHOLTZ

RESEARCH FOR GRAND CHALLENGES

Impact of Momentum Resolution

- The variable $M_{\mu^+\mu^-}$ is most important and essential for this analysis. Thus, the momentum resolution (P_t resolution) has a crucial role.
- Studied what will happen when we change the momentum resolution artificially
 - 13 benchmark points



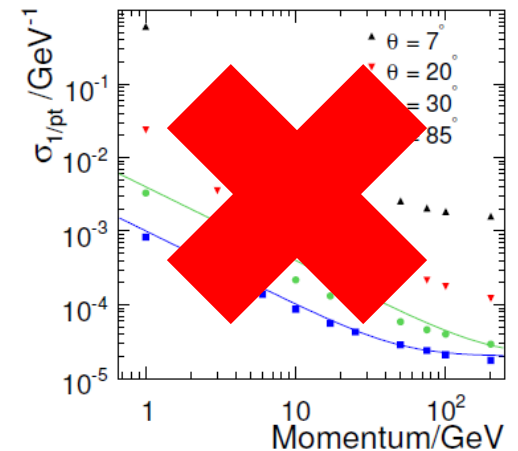
Resolution (GeV ⁻¹)			
1*10 ⁻³	5*10 ⁻⁴	5*10 ⁻⁵	5*10 ⁻⁶
	3*10 ⁻⁴	3*10 ⁻⁵	3*10 ⁻⁶
	2*10 ⁻⁴	2*10 ⁻⁵	2*10 ⁻⁶
	1*10 ⁻⁴	1*10 ⁻⁵	1*10 ⁻⁶

Impact of Momentum Resolution

- smeared MCParticle momentum of $h \rightarrow \mu^+ \mu^-$ candidate
 - Gaussian-smeared with **constant number**
 - no momentum/angular dependencies
 - Not 100% correct, but muons will fly everywhere. On average, this is still good approximation.
 - replace $M_{\mu^+ \mu^-}$ to $M_{\mu^+ \mu^-}^{\text{smear}}$ in toy MC
 - (for specialist) 200 MeV/bin \rightarrow 2 MeV/bin

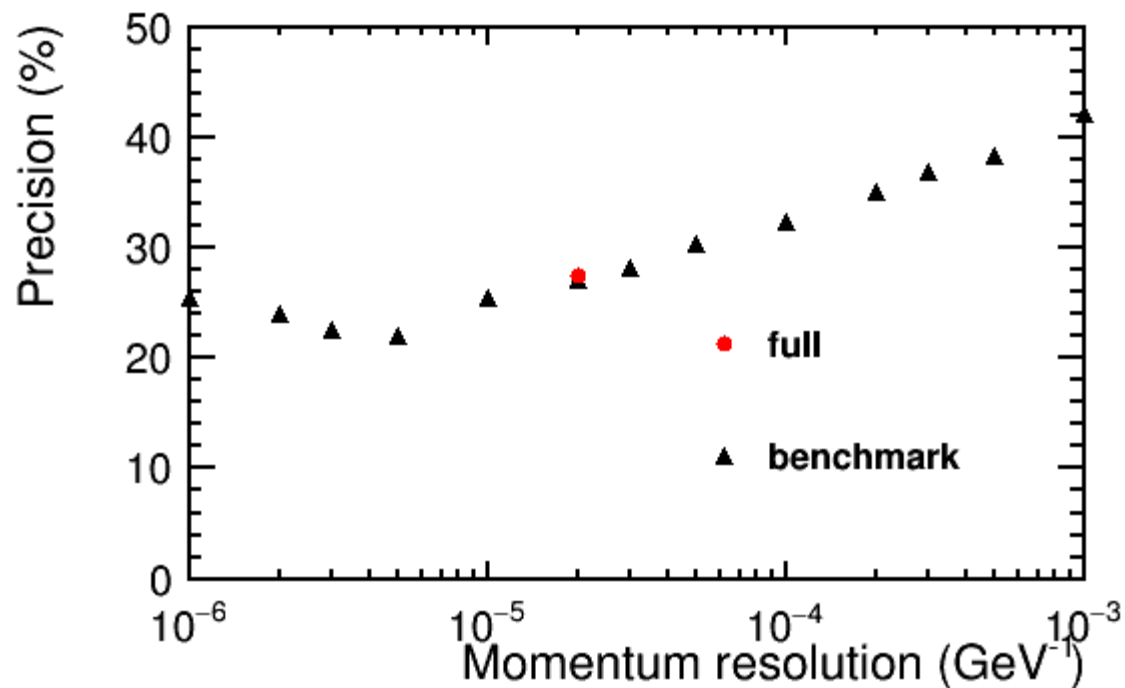
Studied the impact to final number:

$$\frac{\Delta(\sigma \times \text{BR})}{(\sigma \times \text{BR})} \text{ in this study}$$

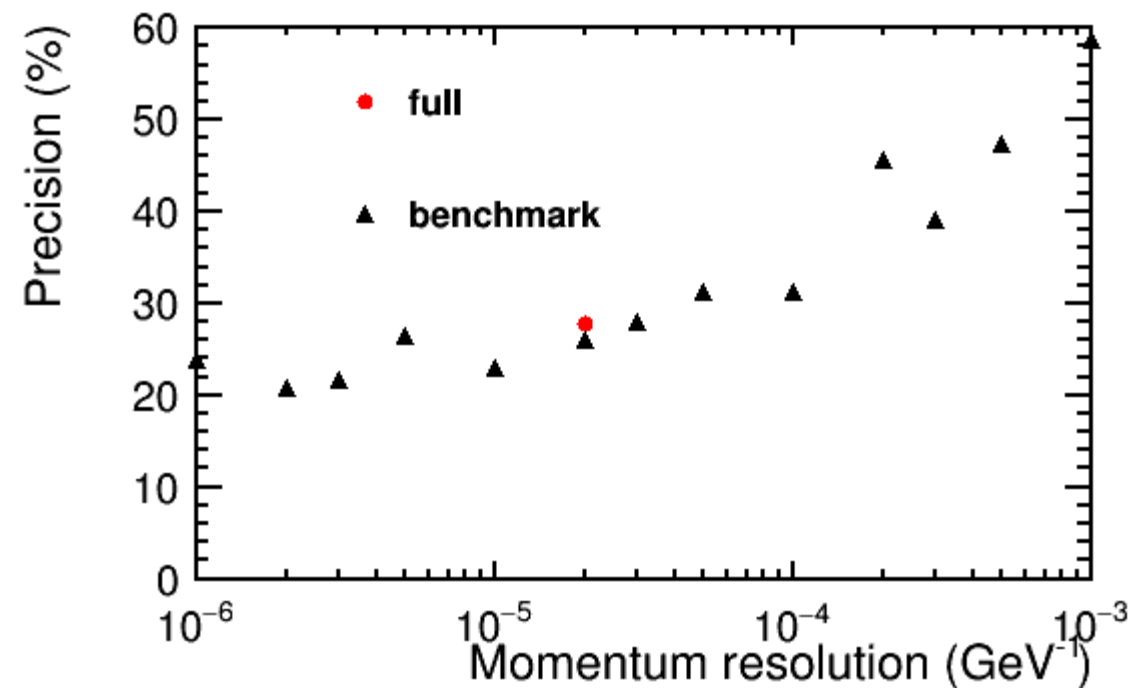


arXiv:1306.632
[physics.ins-det]

Results (Major Channel)

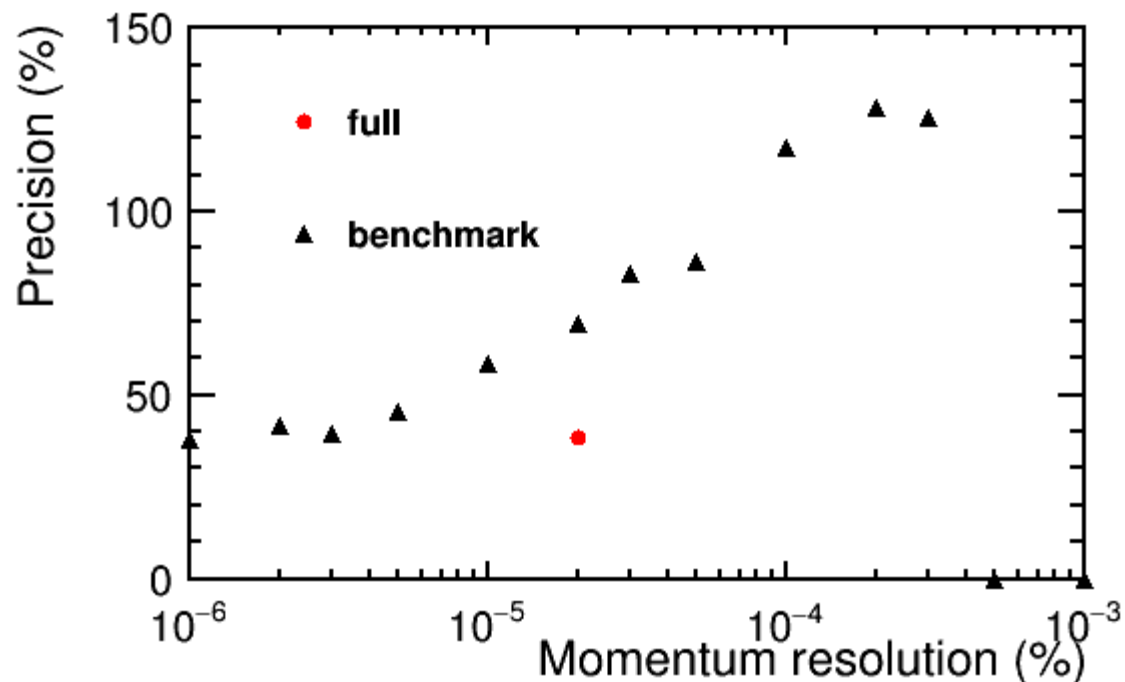


qqh250-L
full: 27.6%



nnh500-L
full: 27.8%

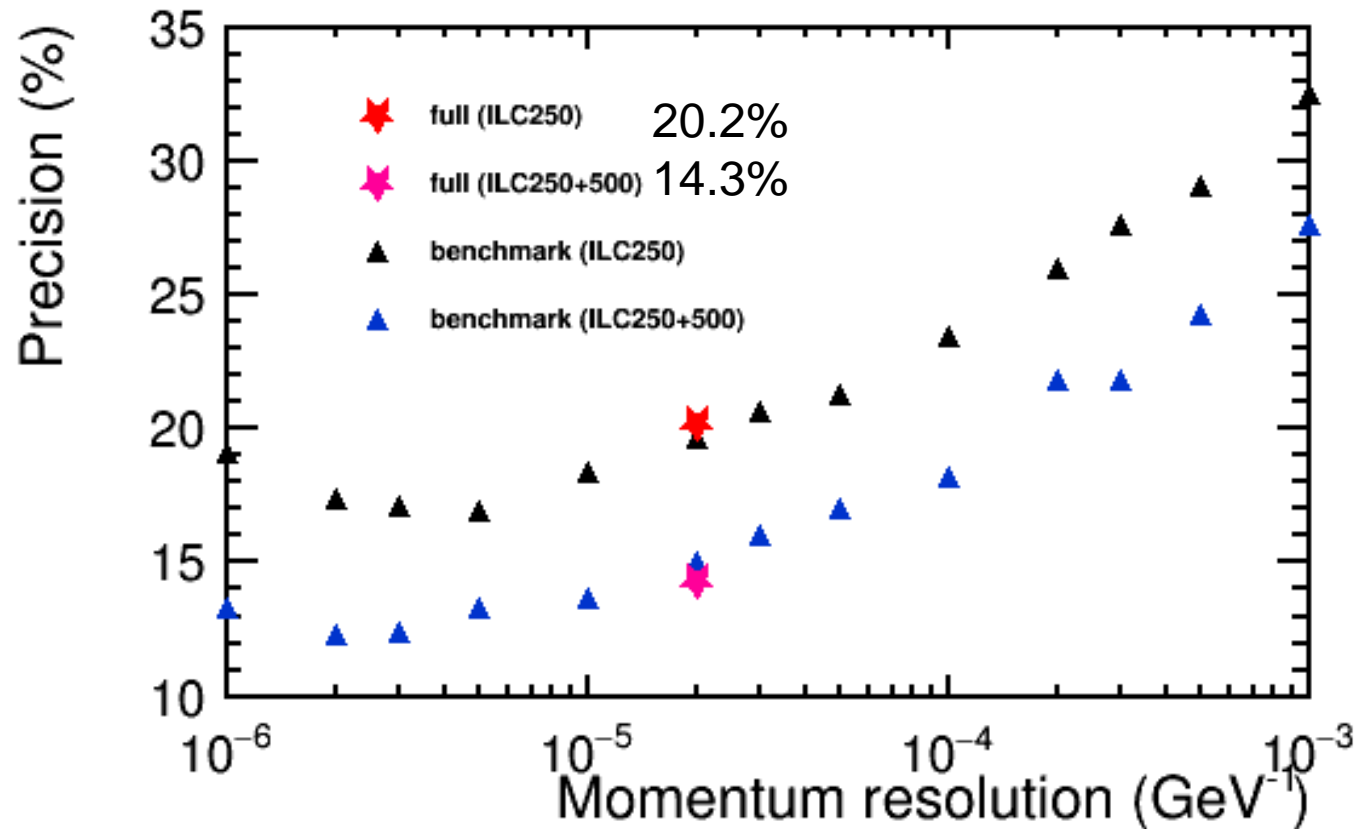
Results (???)



qqh500-L
full: 38.4%

- Fittings are failed many times.
- Probably related too small number of events, or too small number of bkg MC events after all cuts.
- Smearing is applied signal and bkg.
- Planning to test: fix bkg, and smear only signal

Combined Results



ILC250:

~17-20% precision

ILC250+500:

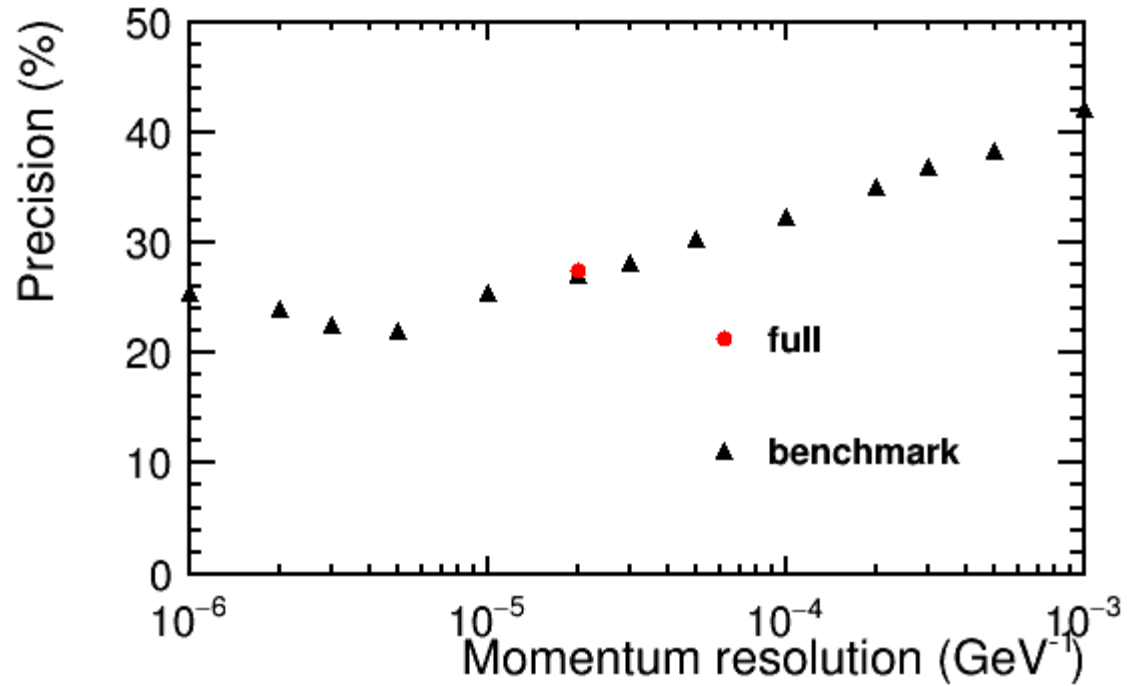
~12-15% precision

- relatively up to ~15% better results compare to full
- not drastic differences among better resolution cases

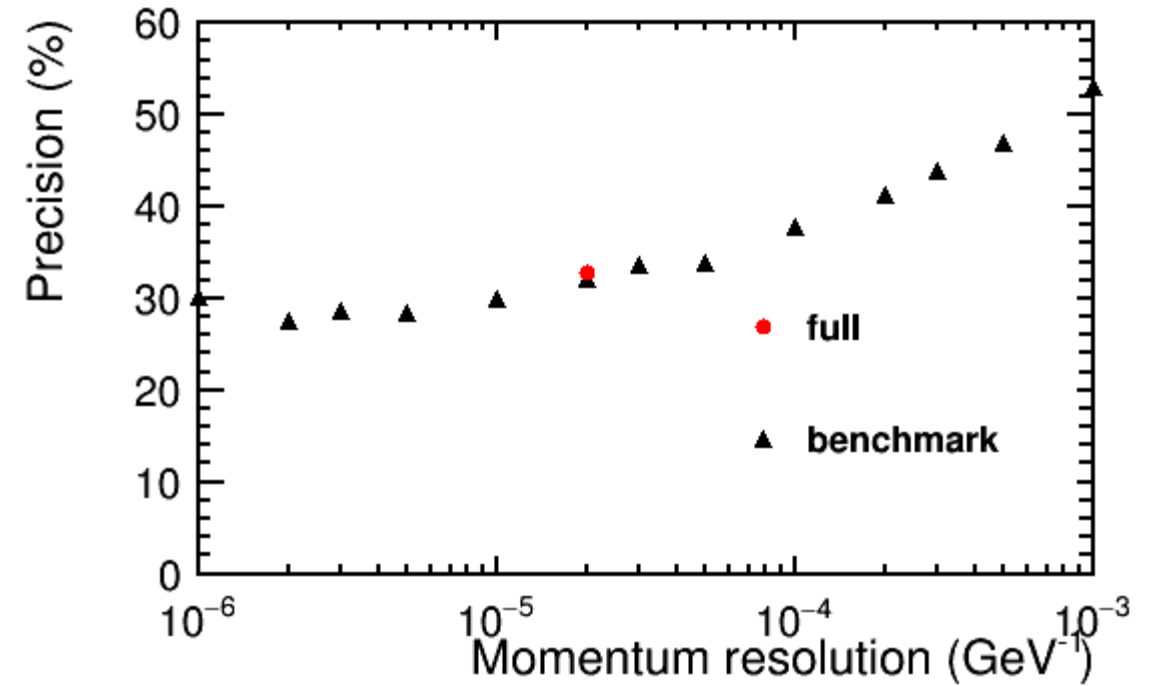
BACKUP



Results: qqh250

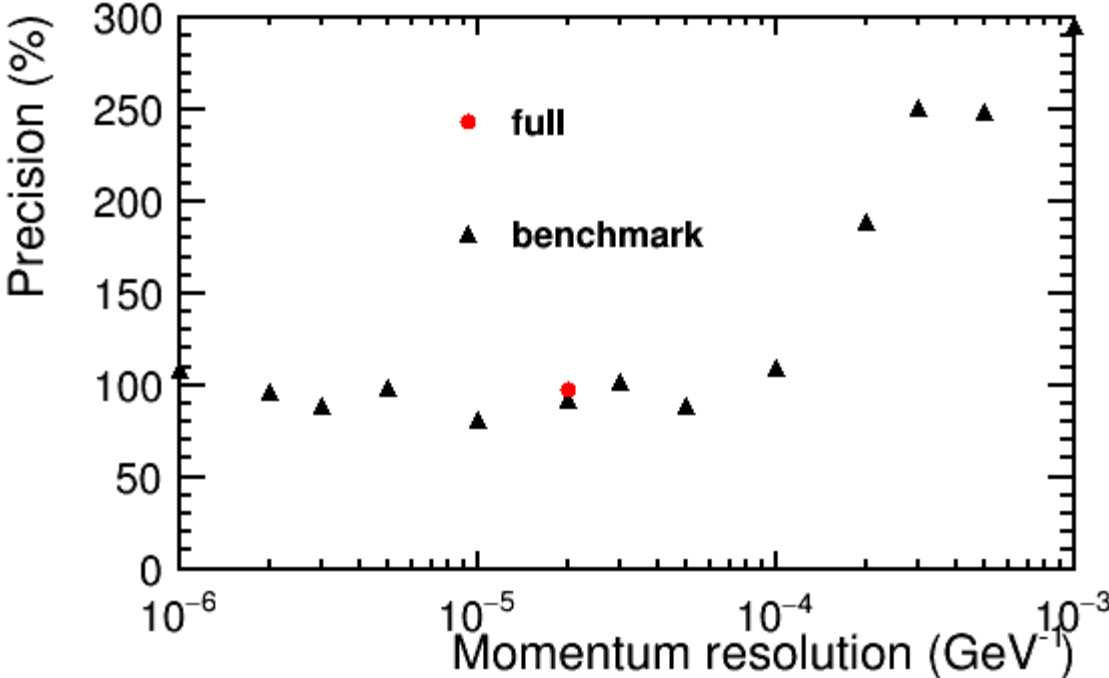


qqh250-L
full: 27.6%

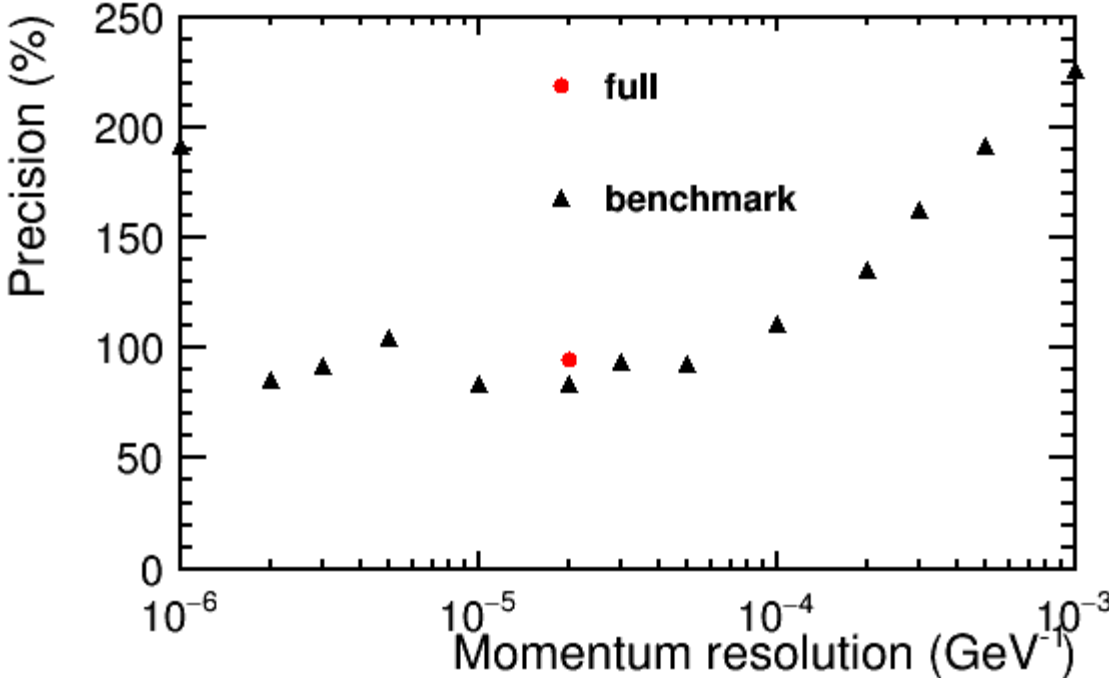


qqh250-R
full: 32.9%

Results: nnh250

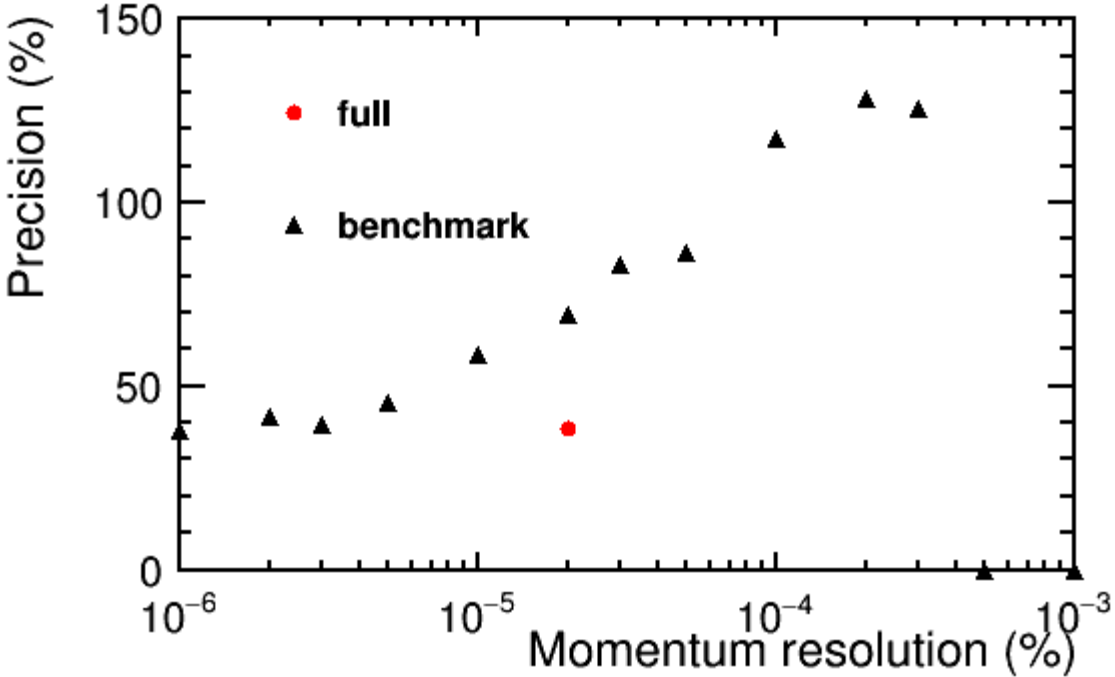


nnh250-L
full: 97.5%

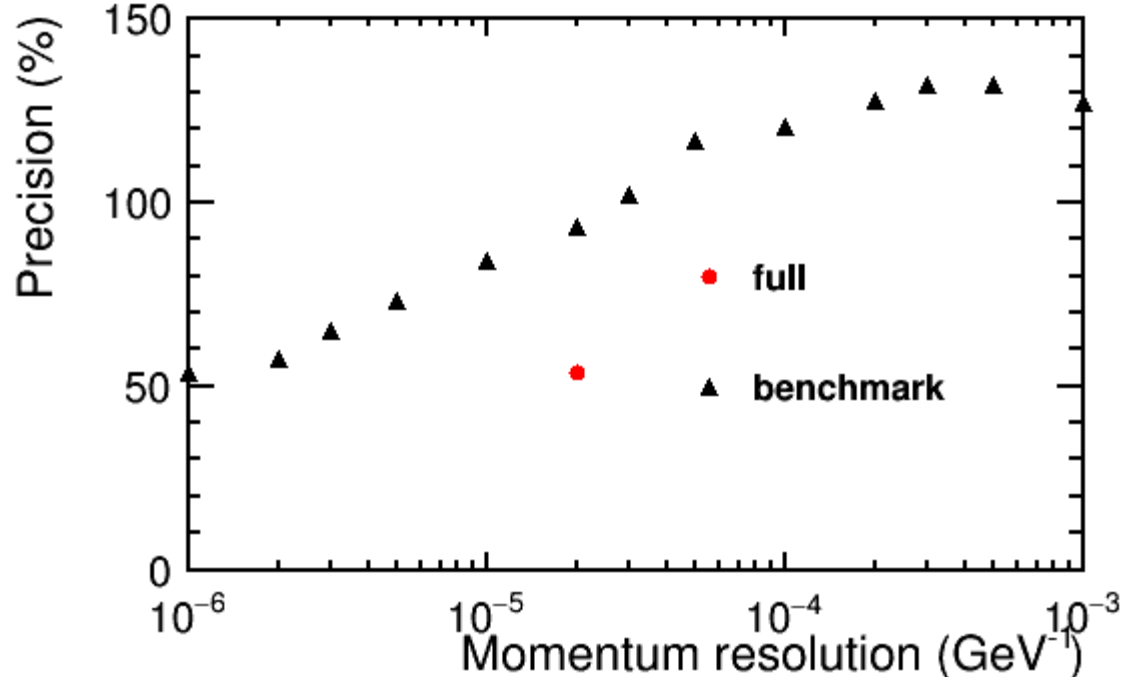


nnh250-R
full: 94.7%

Results: qqh500

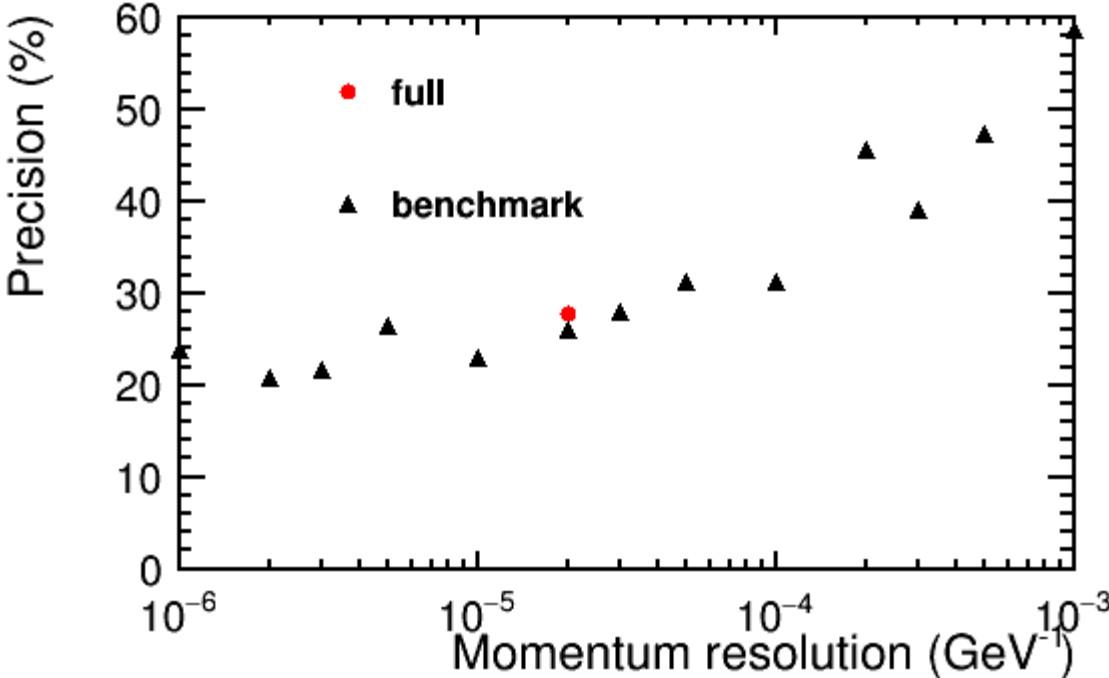


qqh500-L
full: 38.4%

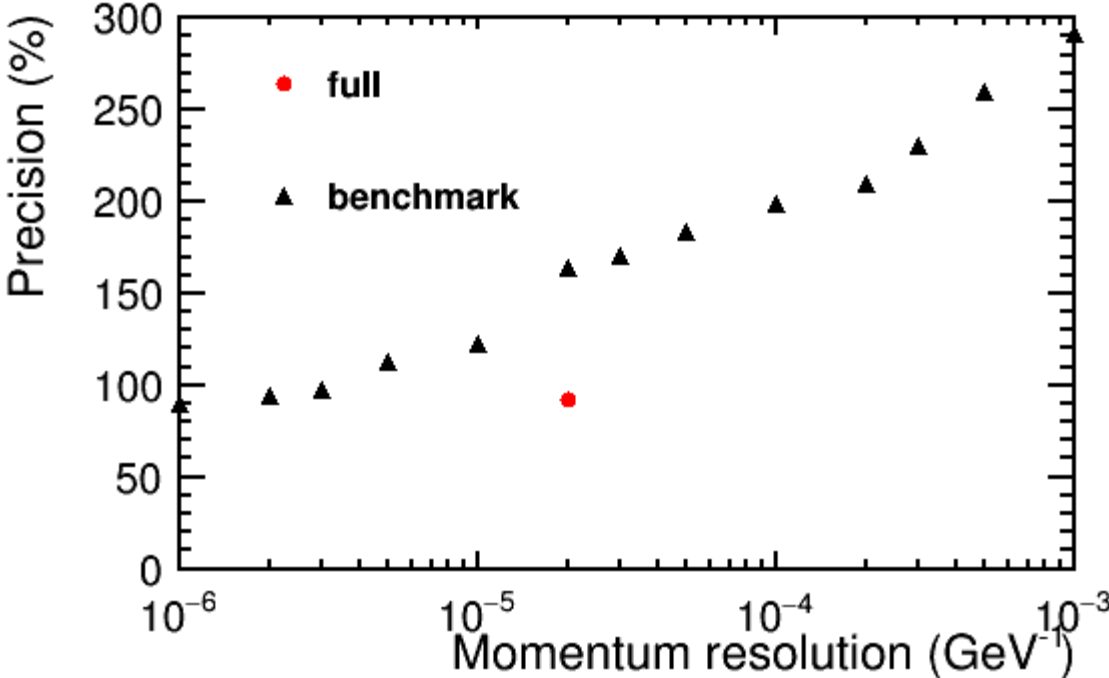


qqh500-R
full: 53.9%

Results: nnh500



nnh500-L
full: 27.8%



nnh500-R
full: 92.5%