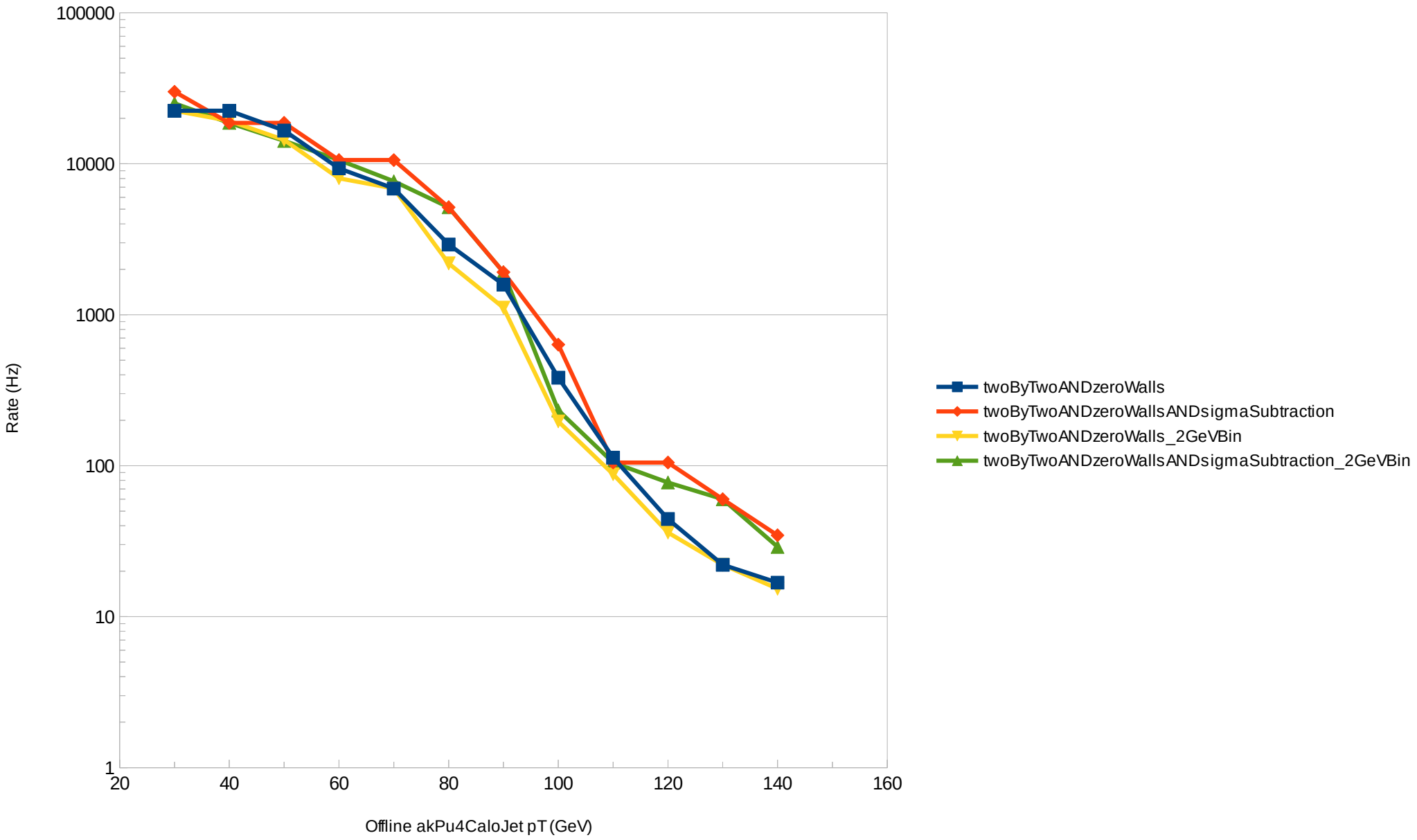
Finalizing Jet and Photon L1

- Shown today:
  - final comparison of different L1 jet algorithms
  - Rate tables for jets and photons
- Plan moving forward:
  - Get jet algorithm and photon RCT configuration into official CMSSW (already in official l1t-devel branch)
  - make request for new L1 menu with updated L1 seeds
  - request larger embedded samples and new Hydjet GEN-SIM

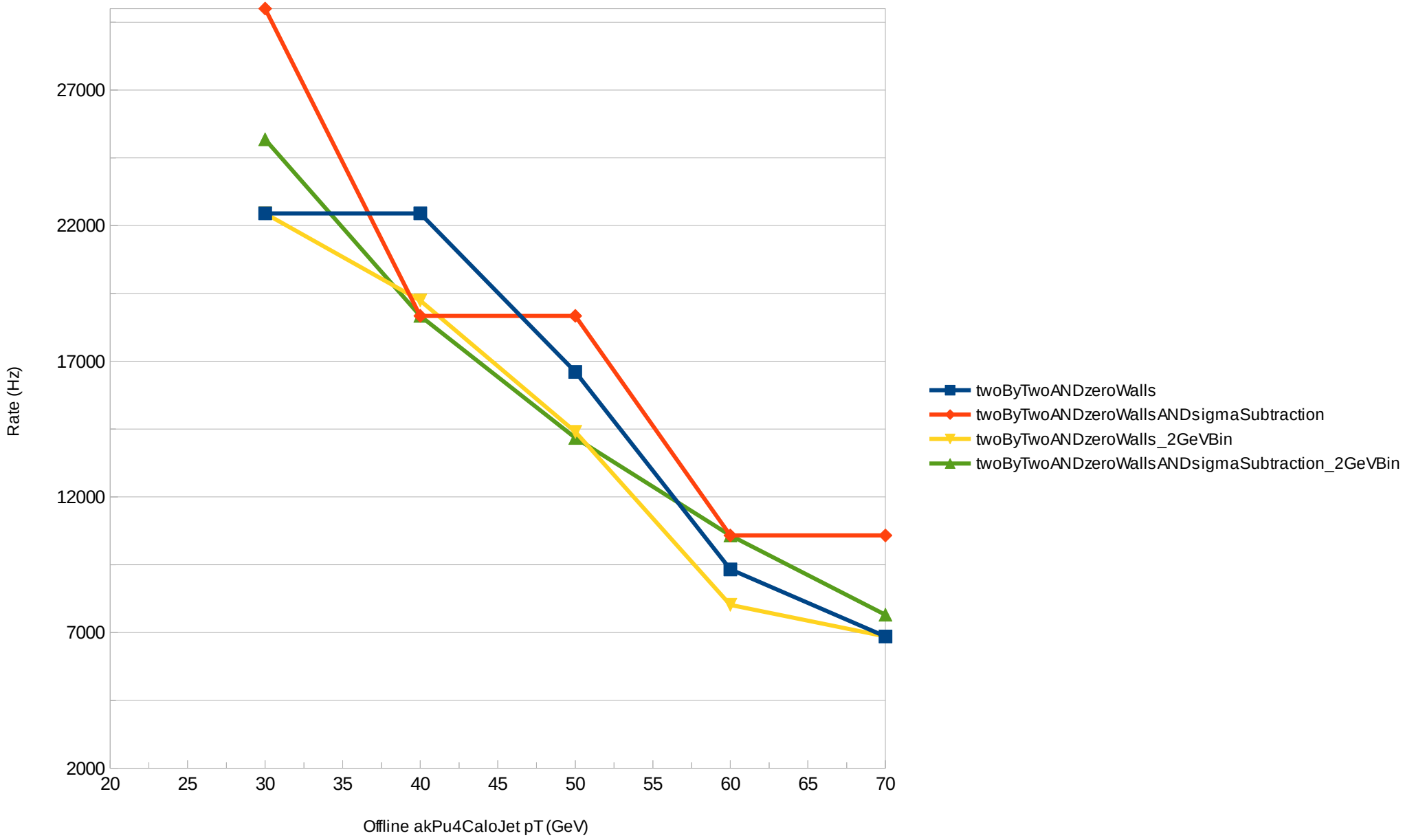
Methodology

- We have MB and embedded samples available
  - Jets: MB, Jet30, Jet80
  - Photons: MB, AllQCD30 w/ 20GeV photon cut
- To make the most conservative estimate, find the lowest L1 threshold such that:
  - the turn-on curve reaches 100% at-or-before the offline threshold
  - the turn-on curve remains at absolutely 100% for the rest of the bins
  - the minimum L1 threshold necessary across all available samples is used

L1 Jet Rate comparison



L1 Jet Rate comparison (zoom)

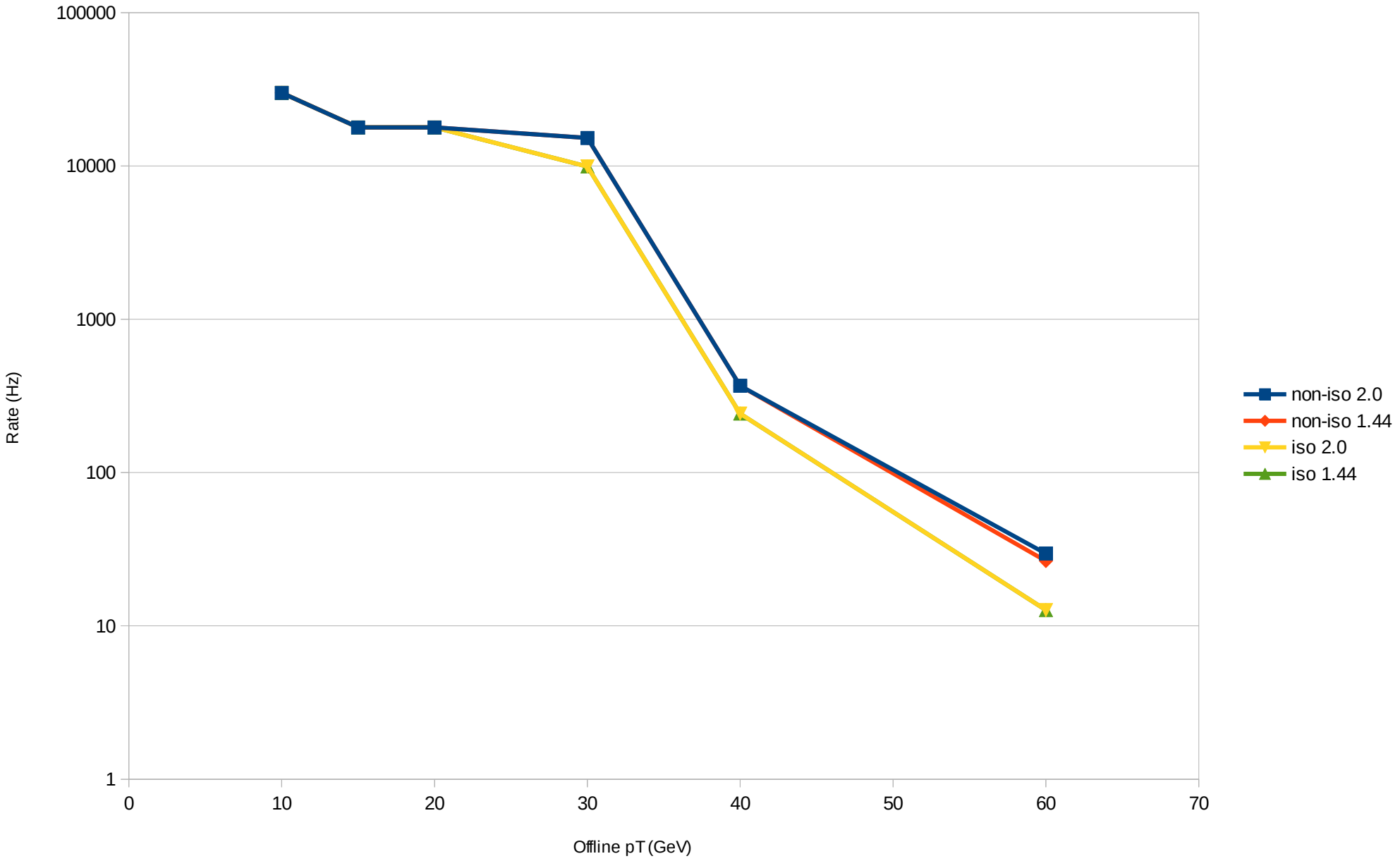


L1 Jet rate table

- Conclusion:
  - sigma subtraction performs poorly at high pT (loses single jets, see backup)
  - 2GeV binning is better everywhere, but not better “enough” to warrant changing scale (to be discussed)

Offline akPu4CaloJet pT (GeV)	L1 Seed	twoByTwoANDzero Walls rate (Hz)
30	4	22451.9
40	4	22451.9
50	8	16609
60	16	9328.46
70	20	6853.18
80	28	2922.61
90	32	1585.08
100	40	383.258
110	48	112.984
120	56	44.3044
130	64	22.0698
140	68	16.7994

L1 Photon Rate graph



L1 Photon rate table

- Loosest offline requirement under consideration is non-isolated photons, |eta| <2.0
- No significant rate reduction when considering only |eta| <1.44

Offline photon pT (GeV)	L1 Seed	non-iso 2.0
10	0	30000
15	3	17827.7
20	3	17827.7
30	4	15233.2
40	21	368.433
60	33	29.6459

L1 Seeds Requested

- Conservative estimate:
  - HLT trigger are not expected to be 100% efficient at their stated value
  - If we require that the L1 seed *is* 100% efficient at the HLT stated value across all available samples this gives us some safety buffer
- Jets
  - L1_SingleJet28 (seeds HLT Jet 80)
  - L1_SingleJet40 (seeds HLT Jet 100, hopefully no prescale)
  - L1_SingleJet56 (seeds HLT Jet 120, backup no prescale)
  - Lower thresholds probably not worth it, depending on MB prescale (e.g. to seed Jet 50 requires O(1000) prescale at L1)
- Photons
  - L1_SingleEG21 (seeds photon 40, hopefully no prescale)
  - L1_SingleEG33 (seeds photon 60, backup no prescale)
  - as with jets, lower thresholds hard to justify vs. MB, photon 30 seed rate is similar to jet 50 seed rate

Samples needed

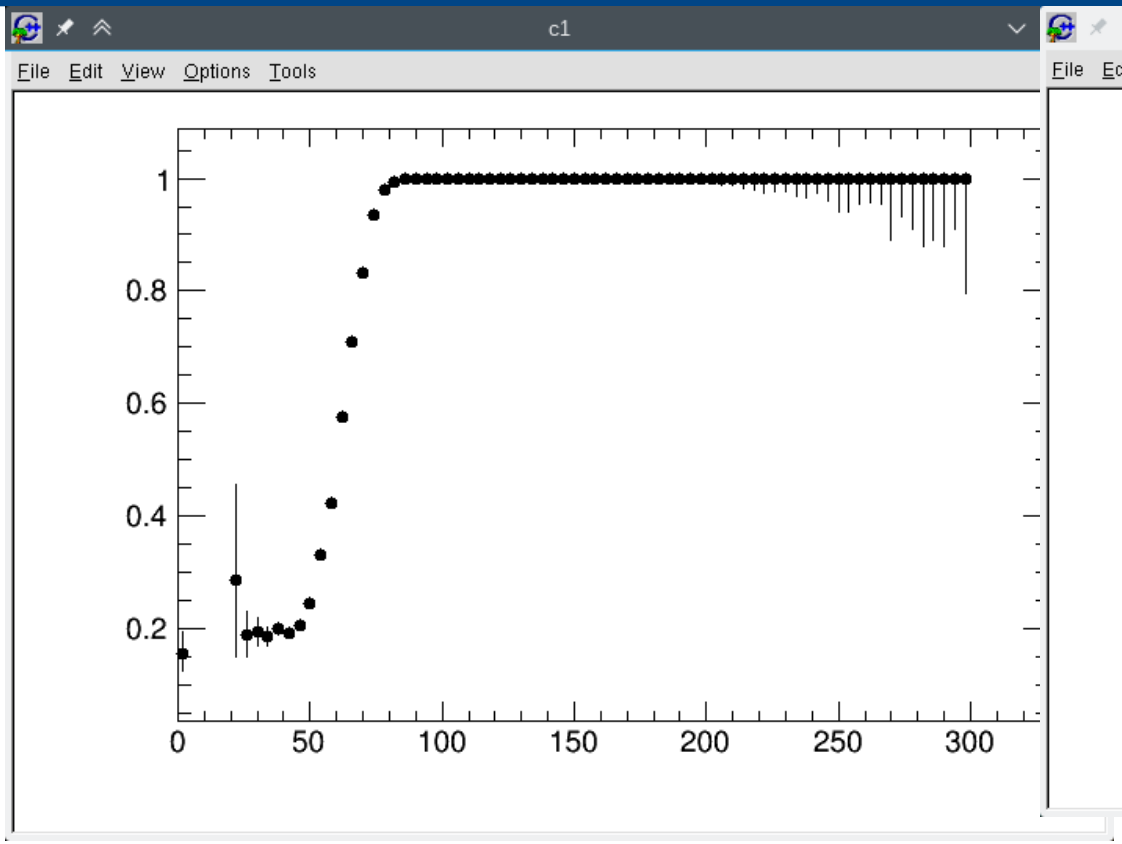
- Centrally-produced large statistics MB, jet, photon samples needed to verify L1 and HLT
  - Can we go ahead and make the request now, or are there still technical difficulties?
  - I have the GEN-SIM fragments ready
  - A new Hydjet GEN-SIM will help HLT development considerably – event matching not currently possible due to odd problems in original Hydjet GEN-SIM
    - HLT turn-around will go from ~24 hours re-running forest to ~2 hours only re-running HLT

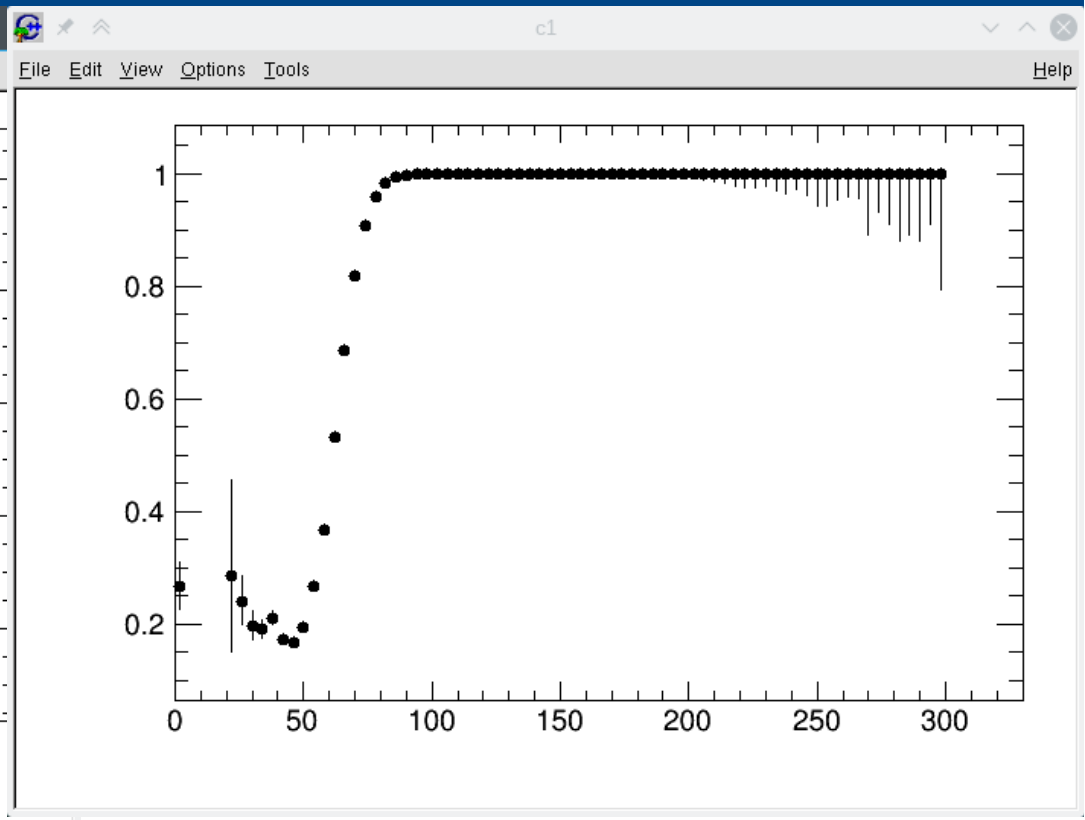
Code details

- twoByTwoANDzeroWalls algorithm is in l1t-offline development branch
  - will request integration with Mulhearn today
- no guard against overlapping L1 jets – only the LEADING L1 jet is trustworthy
  - Only known L1 2-jet customer was 3-jet HLT trigger, Doga says not actually necessary at L1
- How configurable should the zeroWalls part be?
  - simple boolean on/off zeroing?
  - detector map made to arbitrarily zero-out regions?
  - zeroing done during background subtraction, or jet-finding?

backup

sigmaSubtraction failure

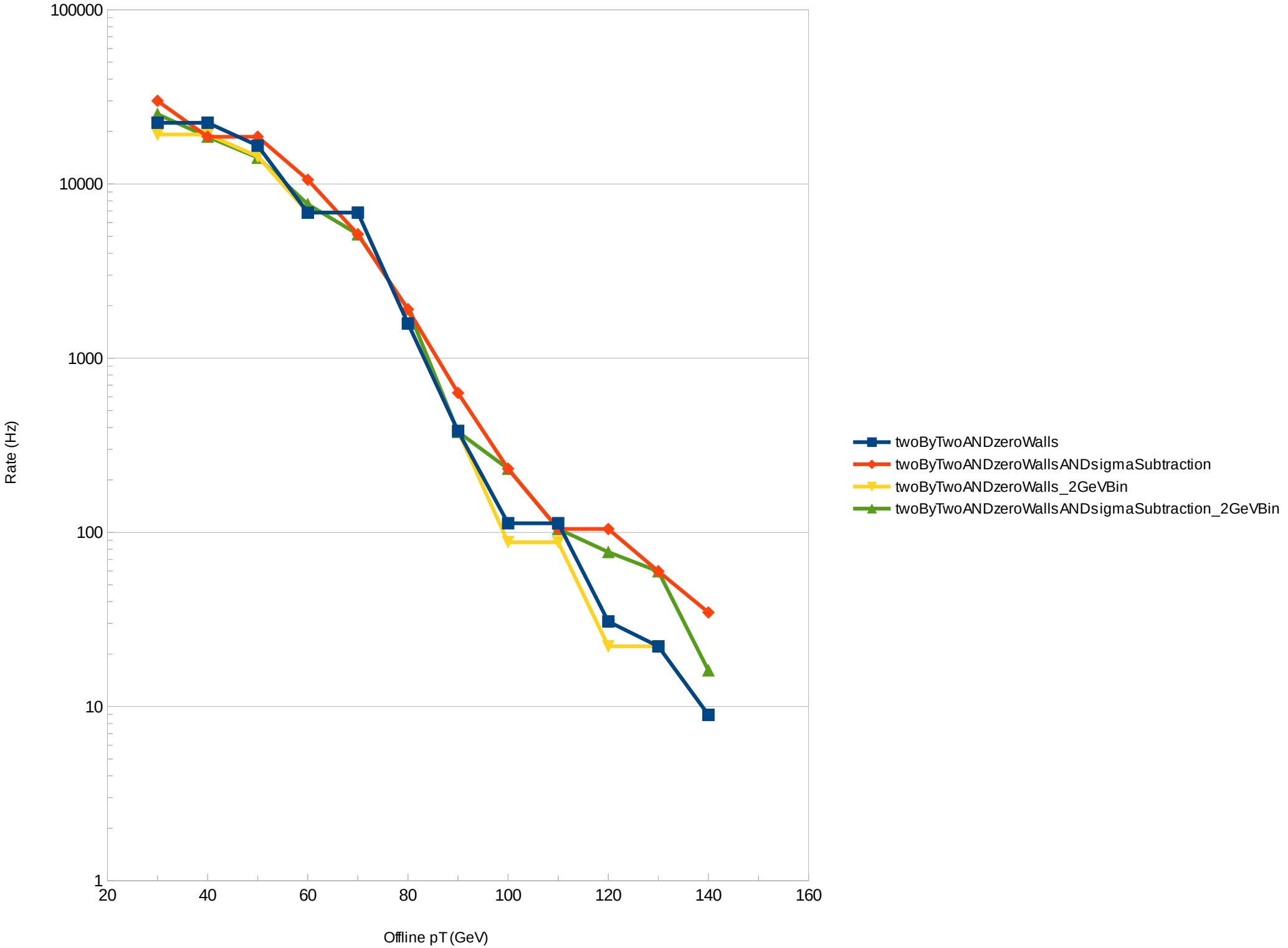


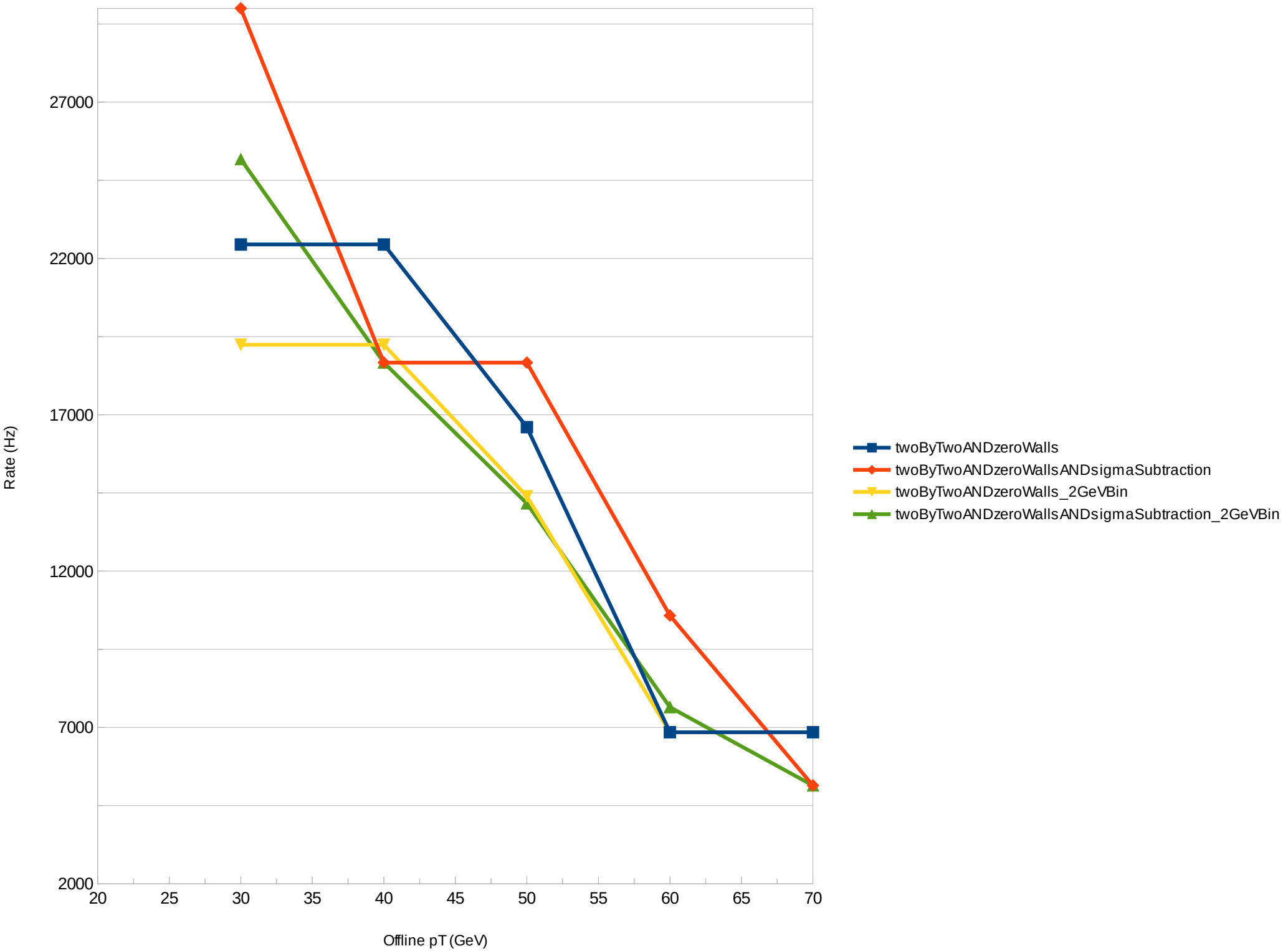


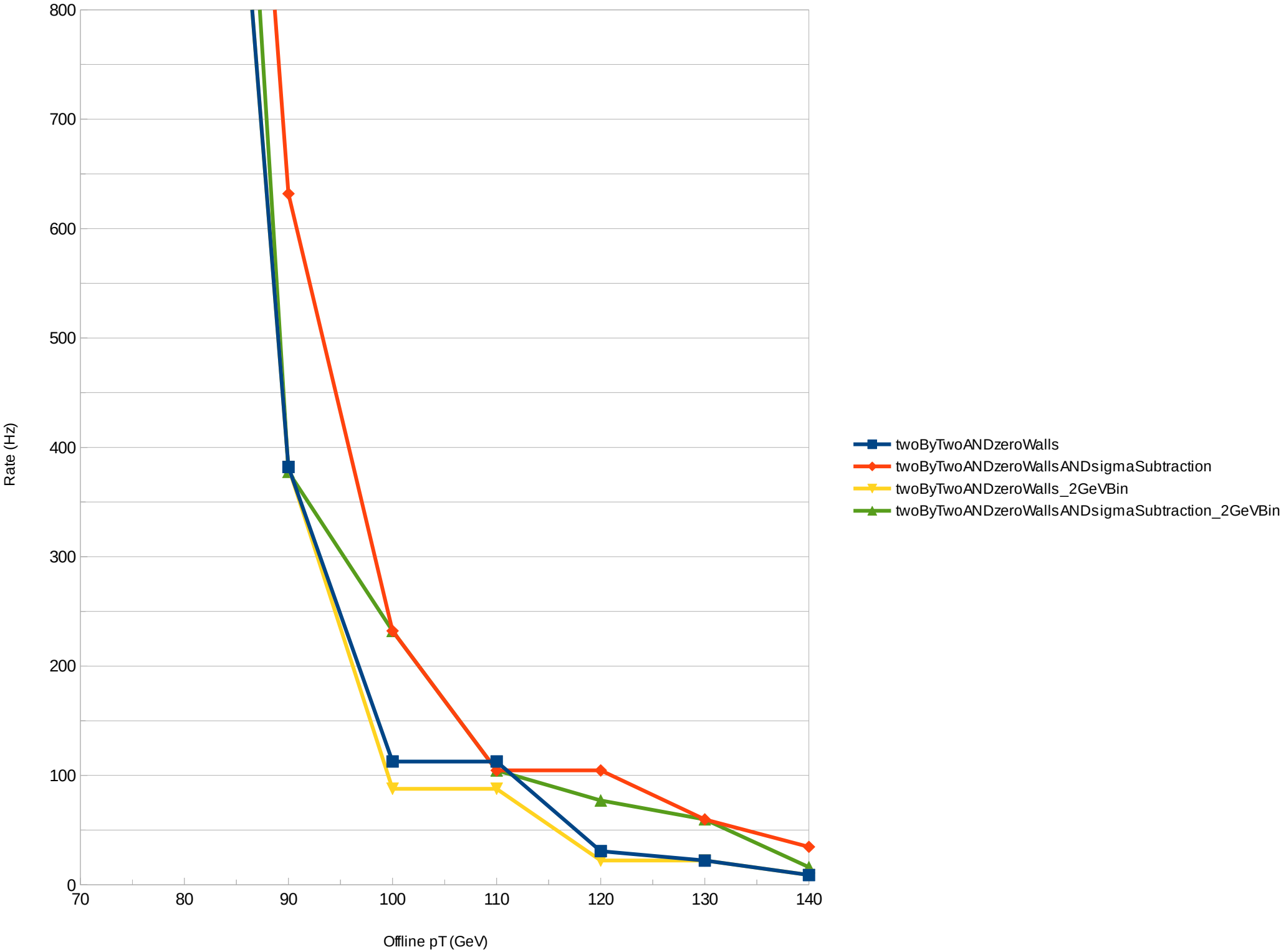
Jet80 sample
twoByTwoANDzeroWalls
L1 40 (fully efficient at 100)

Jet80 sample
twoByTwoANDzeroWallsANDsigmaSubtraction
L1 24 (not fully efficient at 100)
has shallow turn-on right at 100

sigmaSubtraction failure


100000
10000
1000
100
10
1
Rate (Hz)
20
40
60
80
100
120
140
160
Offline pT (GeV)
twoByTwoANDzeroWalls
twoByTwoANDzeroWallsANDsigmaSubtraction
twoByTwoANDzeroWalls_2GeVBin
twoByTwoANDzeroWallsANDsigmaSubtraction_2GeVBin


27000
22000
17000
12000
7000
2000
Rate (Hz)
20
25
30
35
40
45
50
55
60
65
70
Offline pT (GeV)
twoByTwoANDzeroWalls
twoByTwoANDzeroWallsANDsigmaSubtraction
twoByTwoANDzeroWalls_2GeVBin
twoByTwoANDzeroWallsANDsigmaSubtraction_2GeVBin


800
700
600
500
400
300
200
100
0
Rate (Hz)
70
80
90
100
110
120
130
140
Offline pT (GeV)
twoByTwoANDzeroWalls
twoByTwoANDzeroWallsANDsigmaSubtraction
twoByTwoANDzeroWalls_2GeVBin
twoByTwoANDzeroWallsANDsigmaSubtraction_2GeVBin