

## The Energy Histogram

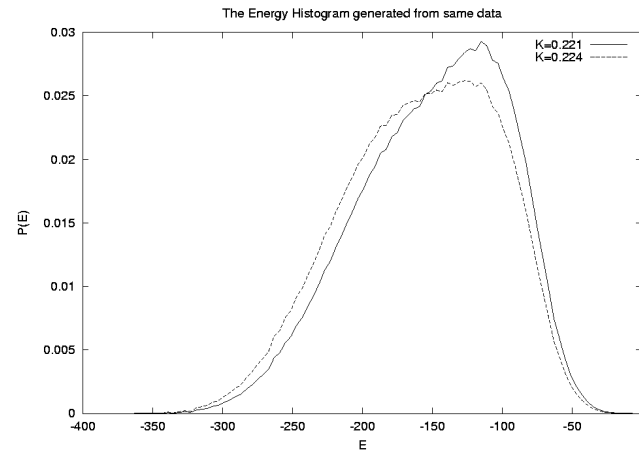


Figure 1: The Energy histogram, the simulation was carried out at 0.221 and extrapolated to 0.224

**Note:** The uncertainty is higher at lower energies. The peak of energy is lower for higher  $K$ , i.e. lower  $T$  as it should be.

Results are reliable only for  $K \approx K_0$ , the estimated histogram shifts away from  $K_0$ , and the peak gradually shifts into the wings, where statistical uncertainty is high.

## The Resuting Curves

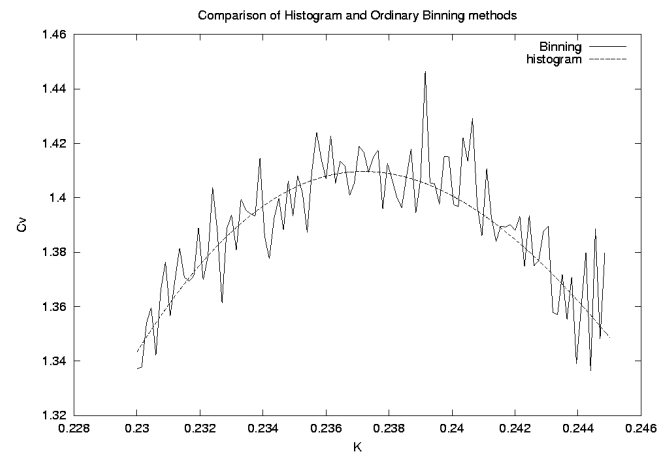
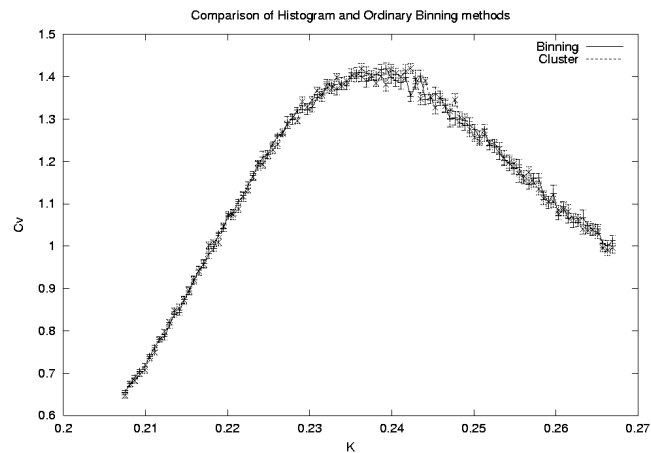


Figure 2: Plot of the susceptibility  $C_v$  from binning and histogram technique

The two plots agree within the errorbars.

## The Resuting Curves

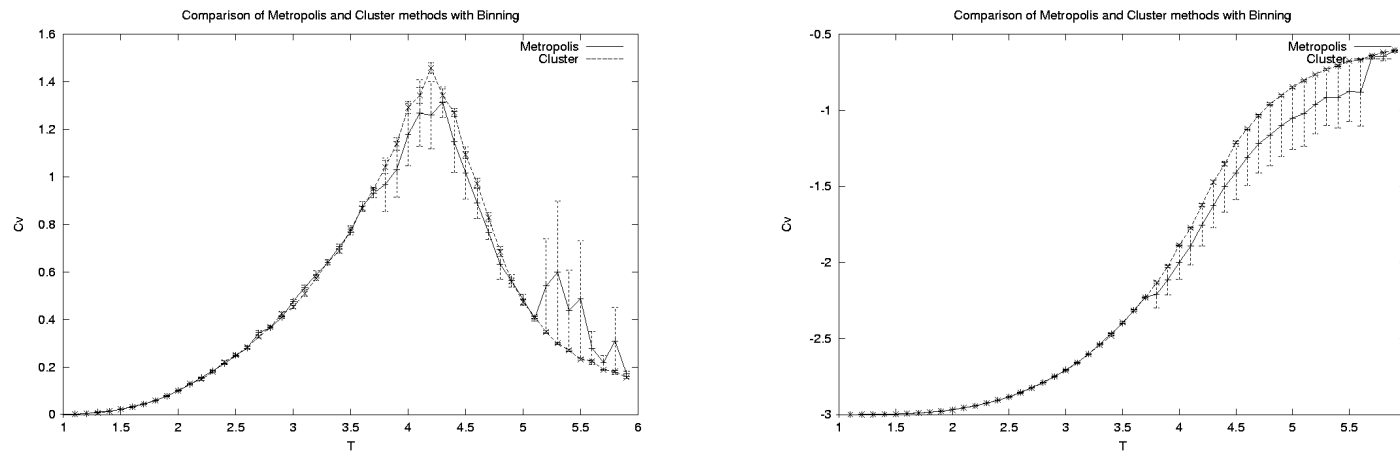


Figure 3: Plot of the susceptibility  $C_v$  and energy  $E$  from Metropolis and Histogram technique.

The errorbars are reduced for the cluster algorithm. Note, energy goes to  $-3$  for low  $T$ .

## Results: Estimation of $\nu$

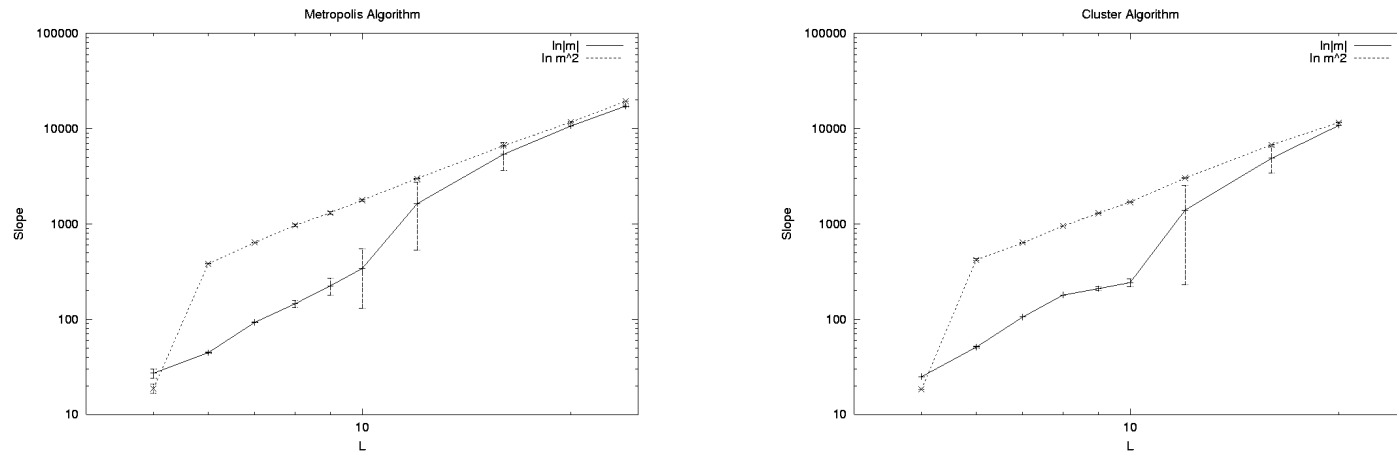


Figure 4: Log-log plot of size dependence of max. values of logarithmic derivatives of thermodynamic quantities

This result is valid for  $L \geq 24$  so this plot becomes a straight line only at high  $L$ .

Metropolis:  $\log m^2 : \nu = 0.368454 \pm 0.004126$

Cluster:  $\log m^2 : \nu = 0.373703 \pm 0.009420$

## Results: Determination of $K_c$

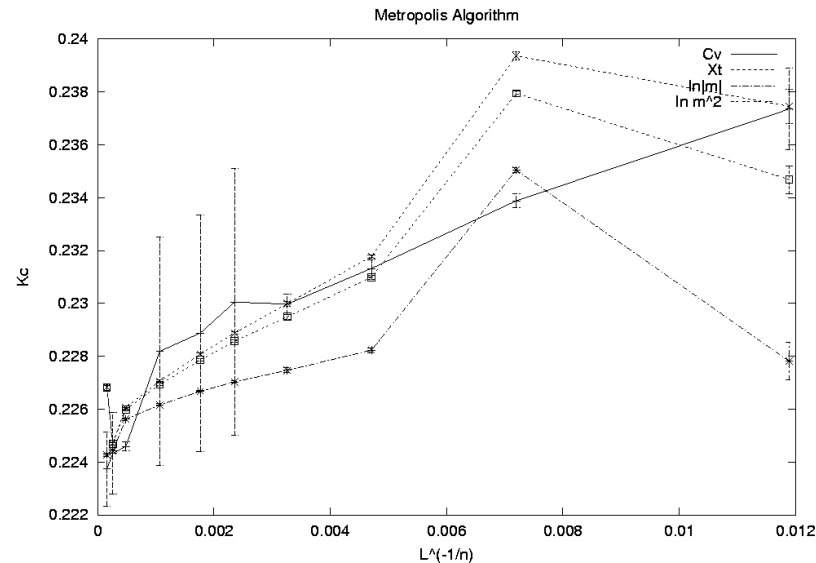
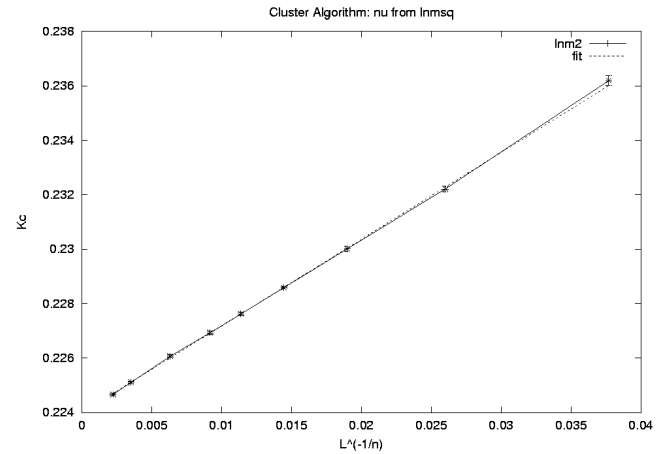
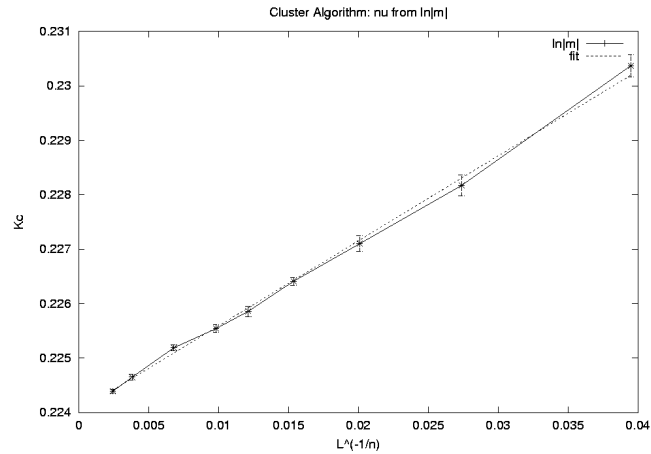
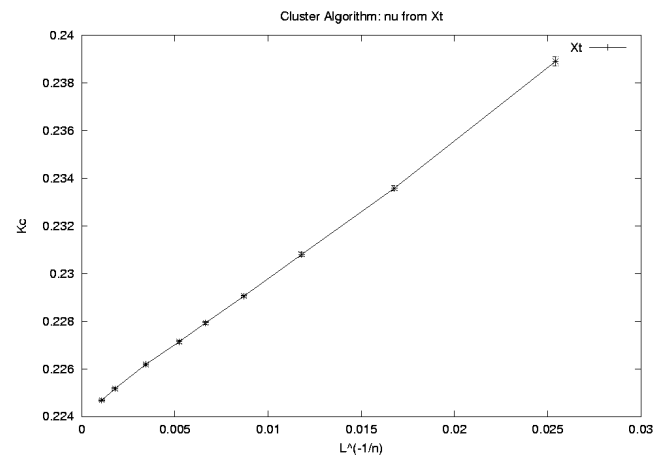
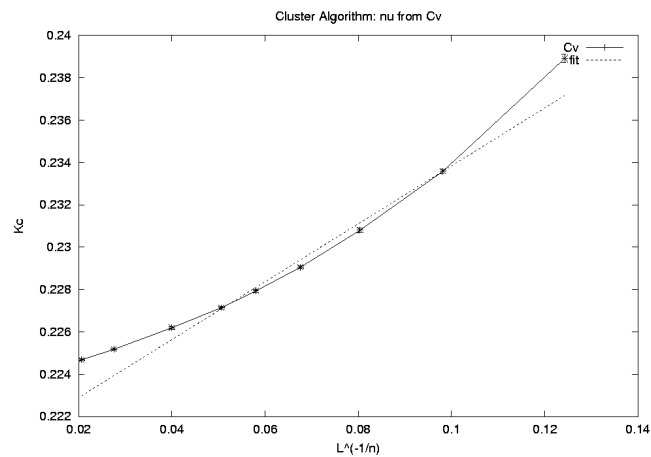


Figure 5: Size dependence of finite lattice effective critical temperatures.

This graph again illustrates that the scaling law is not valid for small lattice size.

## Results: Determination of $K_c$



Independent plot of each of the quantities from the Cluster run, using their individual  $\nu$  values.

## Results: Determination of $K_c$

	Metropolis				Cluster			
	$C_V$	$\chi_T$	$\log  m $	$\log m^2$	$C_V$	$\chi_T$	$\log  m $	$\log m^2$
$K_c$	.221	.224	.224	.225	.221	.224	.224	.224
$\nu$	0.72	0.36	0.32	0.34	0.77	0.43	0.49	0.49

## Reference Values:

$$K_c = 0.221659 \pm 0.0000026$$

$$\nu = 0.6289$$

Probably the estimation of the magnetisation is incorrect.

## Results: Comparison of the time and Efficiency

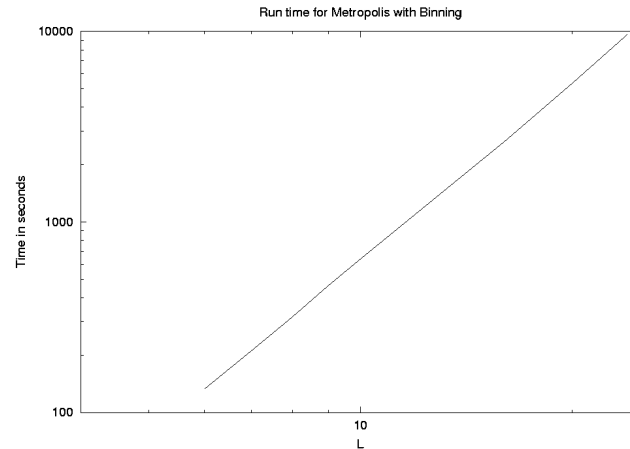


Figure 6: The run time for the Metropolis method with binning scales as  $L$  cube

The scaling for the run time is approximately 2.8 .

### Efficiency

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Metropolis(H)	Metropolis(B)	Cluster(H)	Cluster(B)
15045	403	21026	596

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