

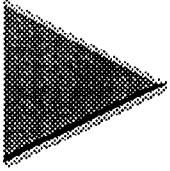
*NWTRB
Structural Geology
and Geoengineering
Panel Meeting*

Sensitivity Studies on Volcanic Hazard at Yucca Mountain

**San Francisco, CA
March 9 1994**

Peter C. Wallmann





Volcanic Disruptive Events

- How frequently does an event occur?
E1 - Event rate (events/yr)
- Does the event disrupt the repository?
E2 - Disruption probability
(disruptions/events)
- Disruptive event rate
E1*E2 - Disruptive events/yr
- Consequences of disruption

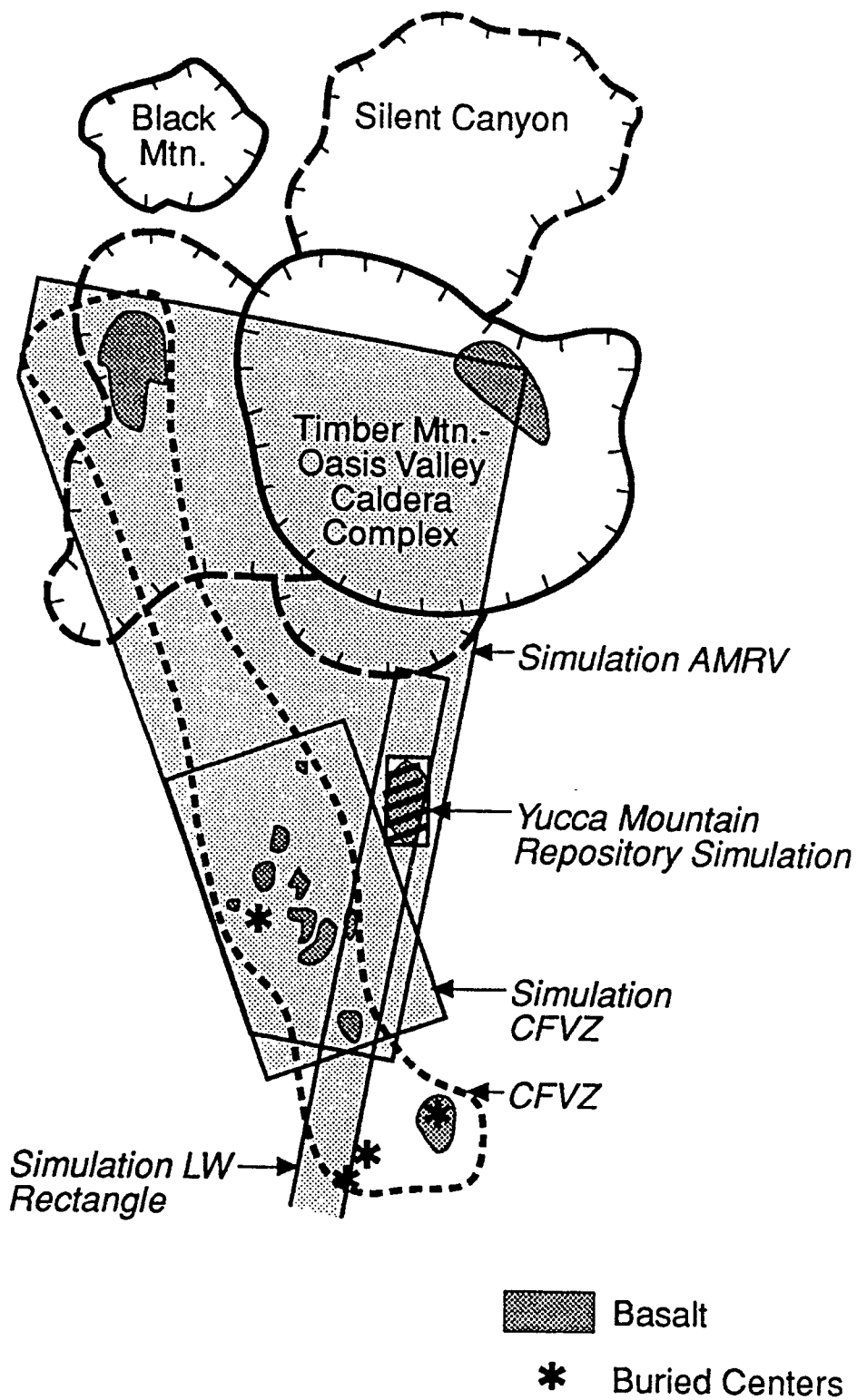
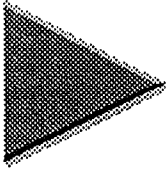
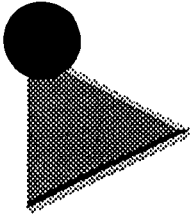


Figure 1. Location map for post-caldera basaltic volcanism in the Yucca Mountain region.



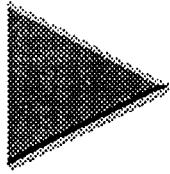
FracMan Discrete Feature Model

- **Discrete feature analysis and generation program**
- **Used in fluid flow fracture network modelling at Stripa and Äspö sites in Sweden, Kamaishi Mine in Japan, Yucca Mountain in USA**
- **Contains multiple distributions for fracture radius and orientation, and multiple models for spatial distribution of fracture centers**



Model Simulations

- Fracture centers represent "initiation point" for dike propagation; each generated feature represents 2 dikes propagating in opposite directions
- Poisson distribution for "initiation points"
- 10 realizations of 10,000 fractures simulates 200,000 dikes



Example FracMan Dike Simulations

● Dike Orientation

- Bivariate Normal Distribution

Mean Pole (Trend, Plunge) = 110, 0
1 StdDev Trend = 20°
1 StdDev Plunge = 10°

● Dike Length*

- Uniform Distribution

Mean = 7500 meters
Maximum Deviation = 6500 meters

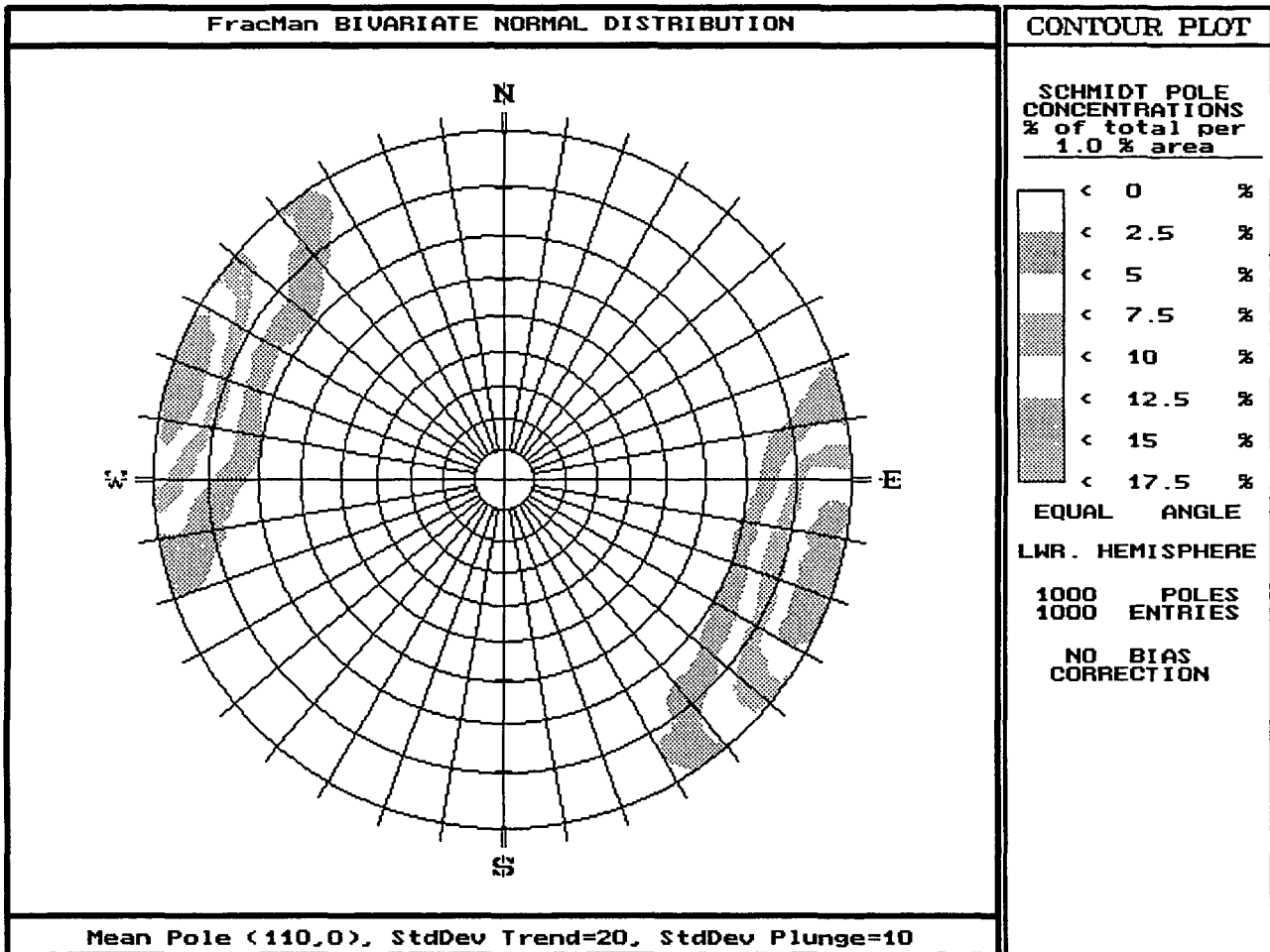
*Single feature in FracMan; represents 2 dikes

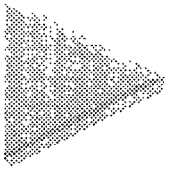
● Dike Height

- Uniform Distribution

Mean = 1500 meters
Maximum Deviation = 500 meters

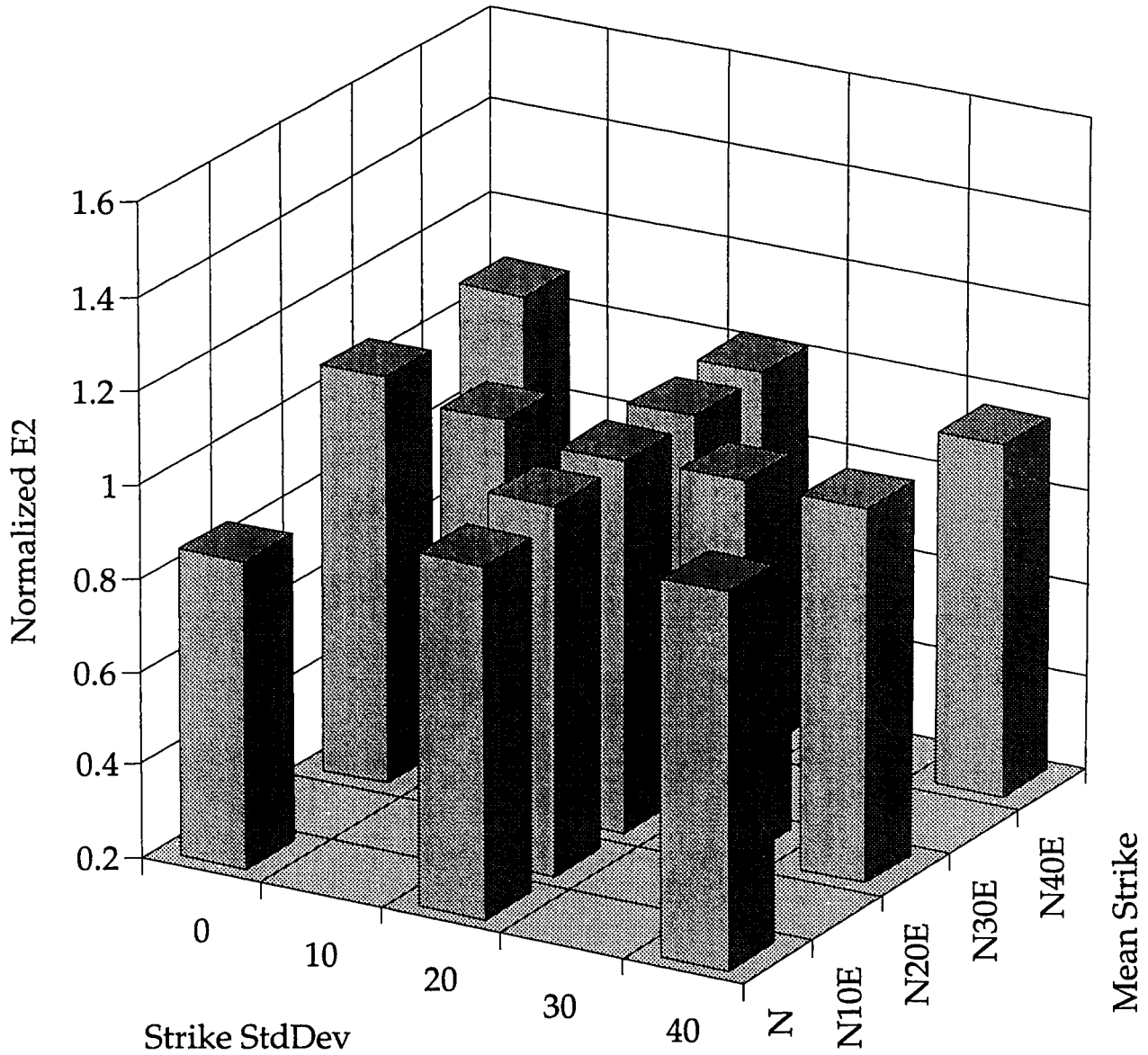
Bivariate Normal Distribution

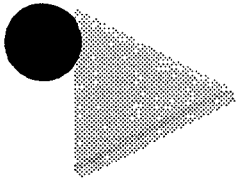




AMRV Model

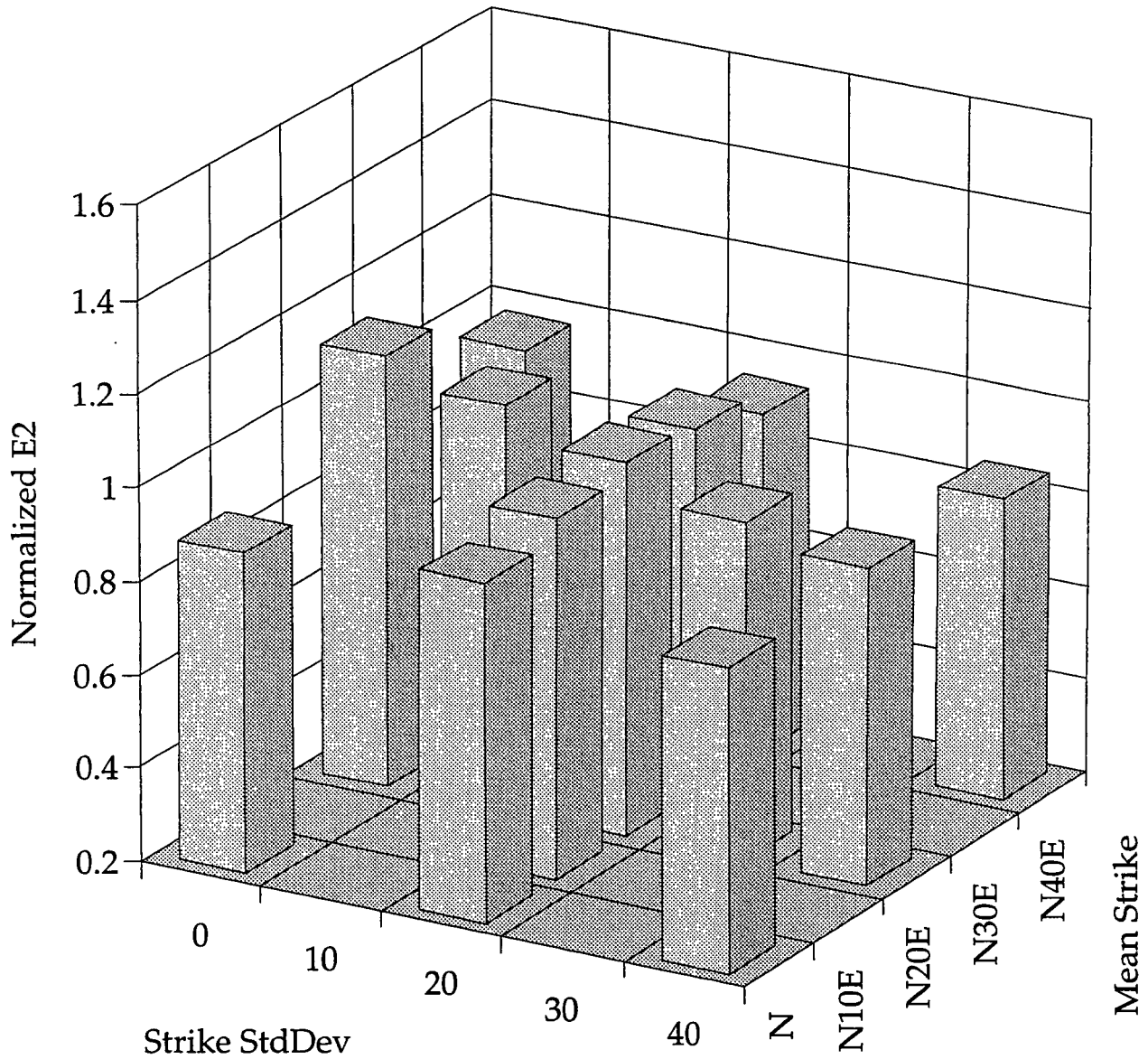
(Smith et al.)

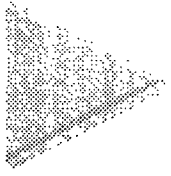




LW Rectangle Model

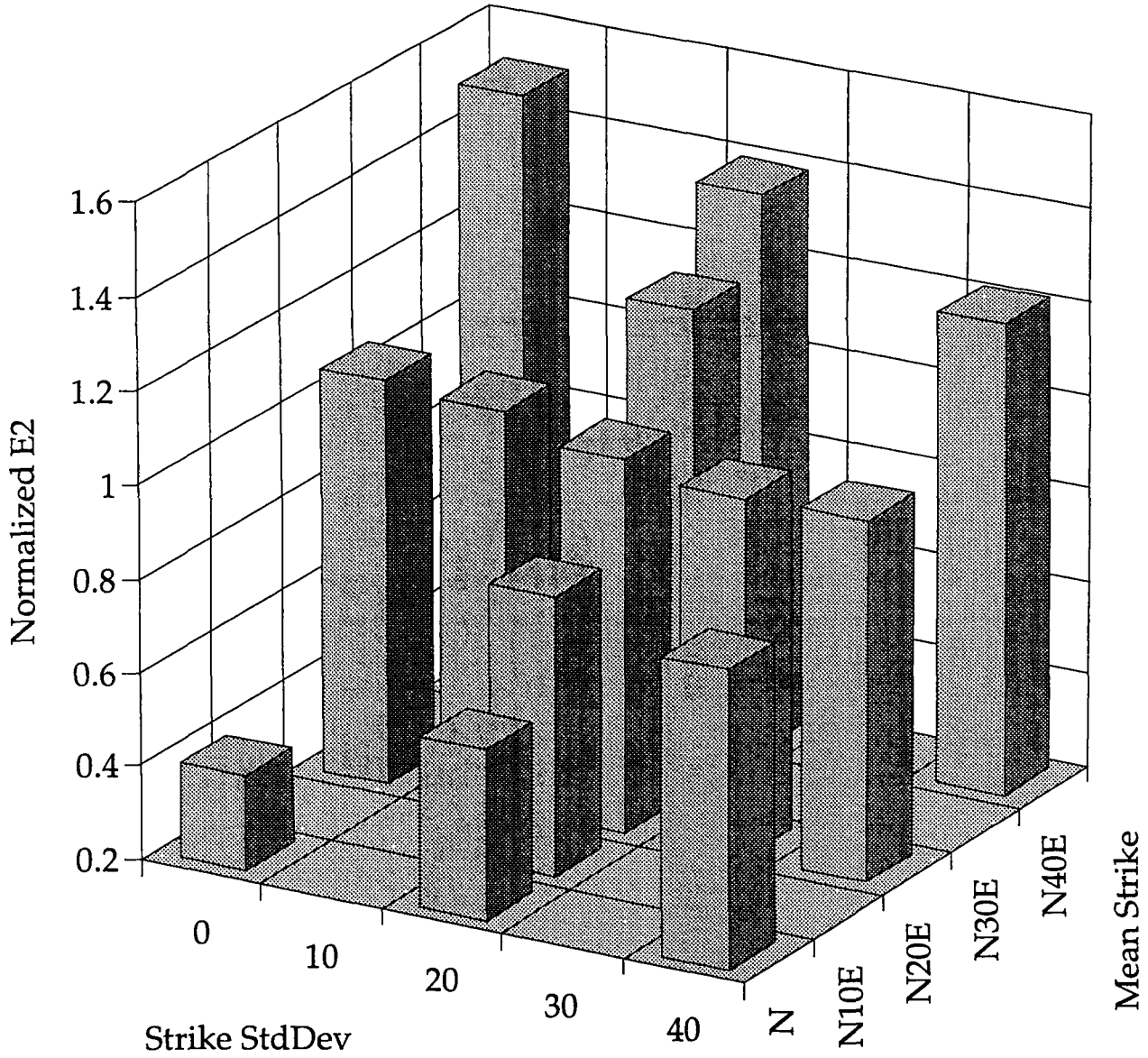
(Smith et al.)



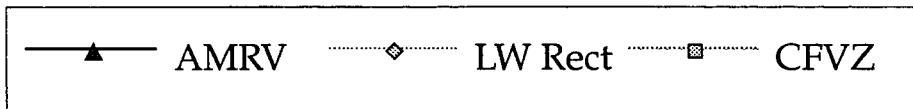
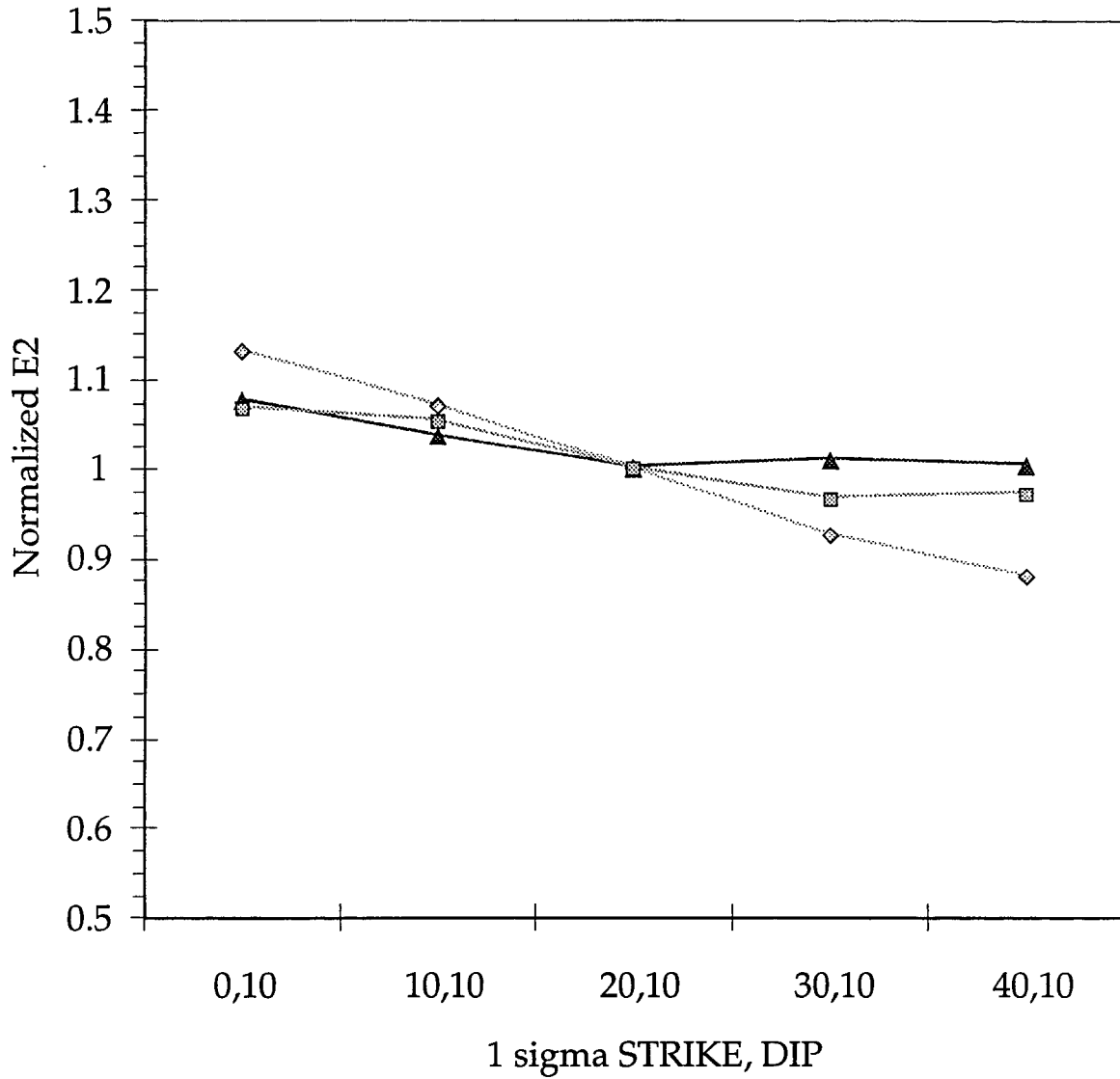


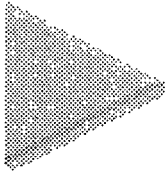
CFVZ Model

(Crowe and Perry)

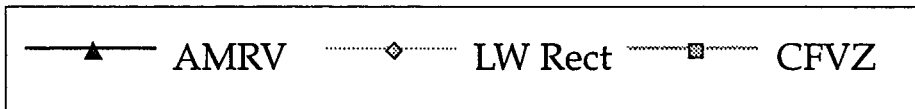
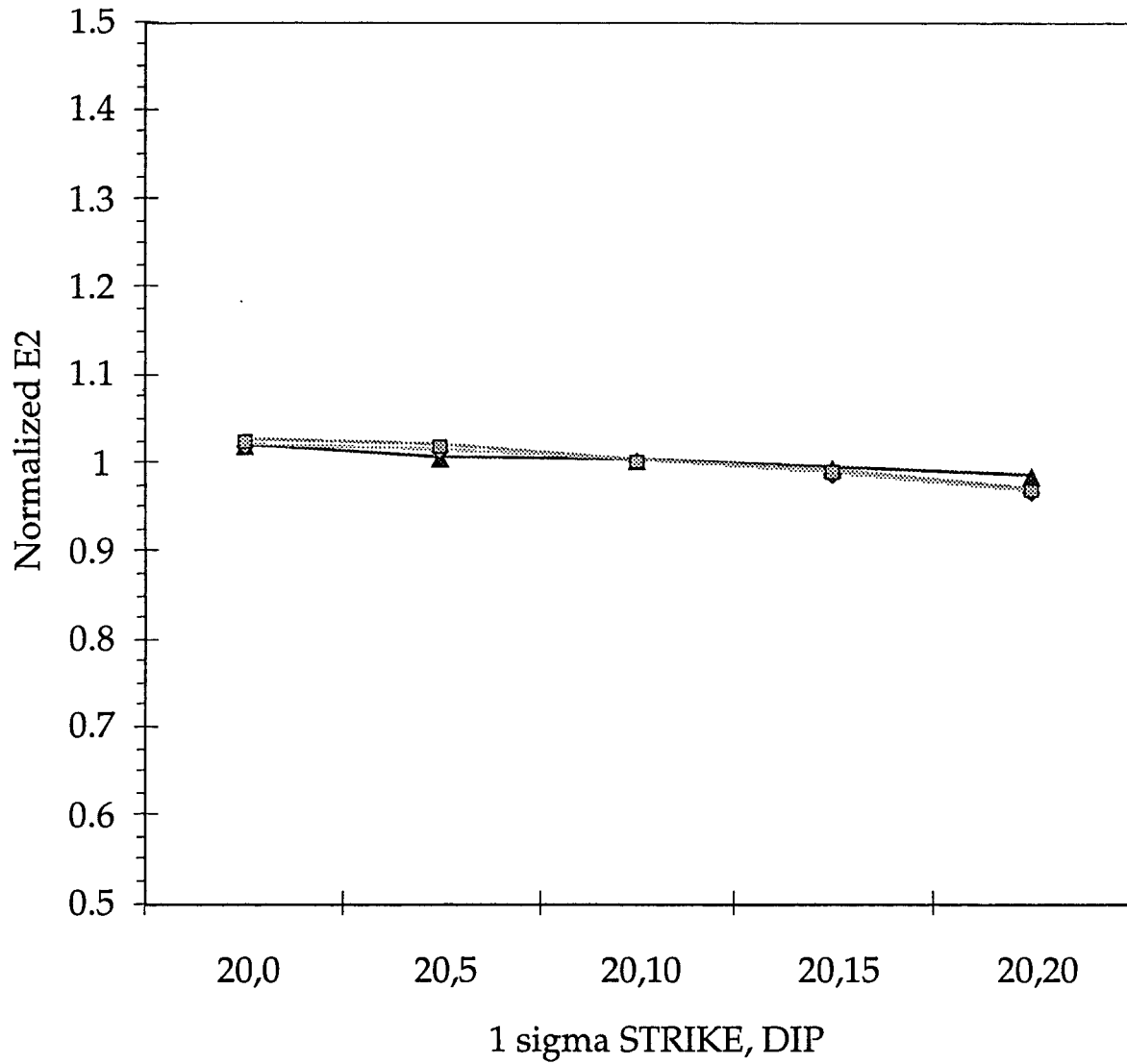


STRIKE Variation (Normalized to Base)

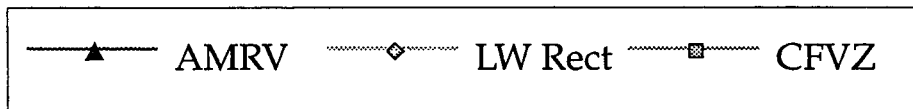
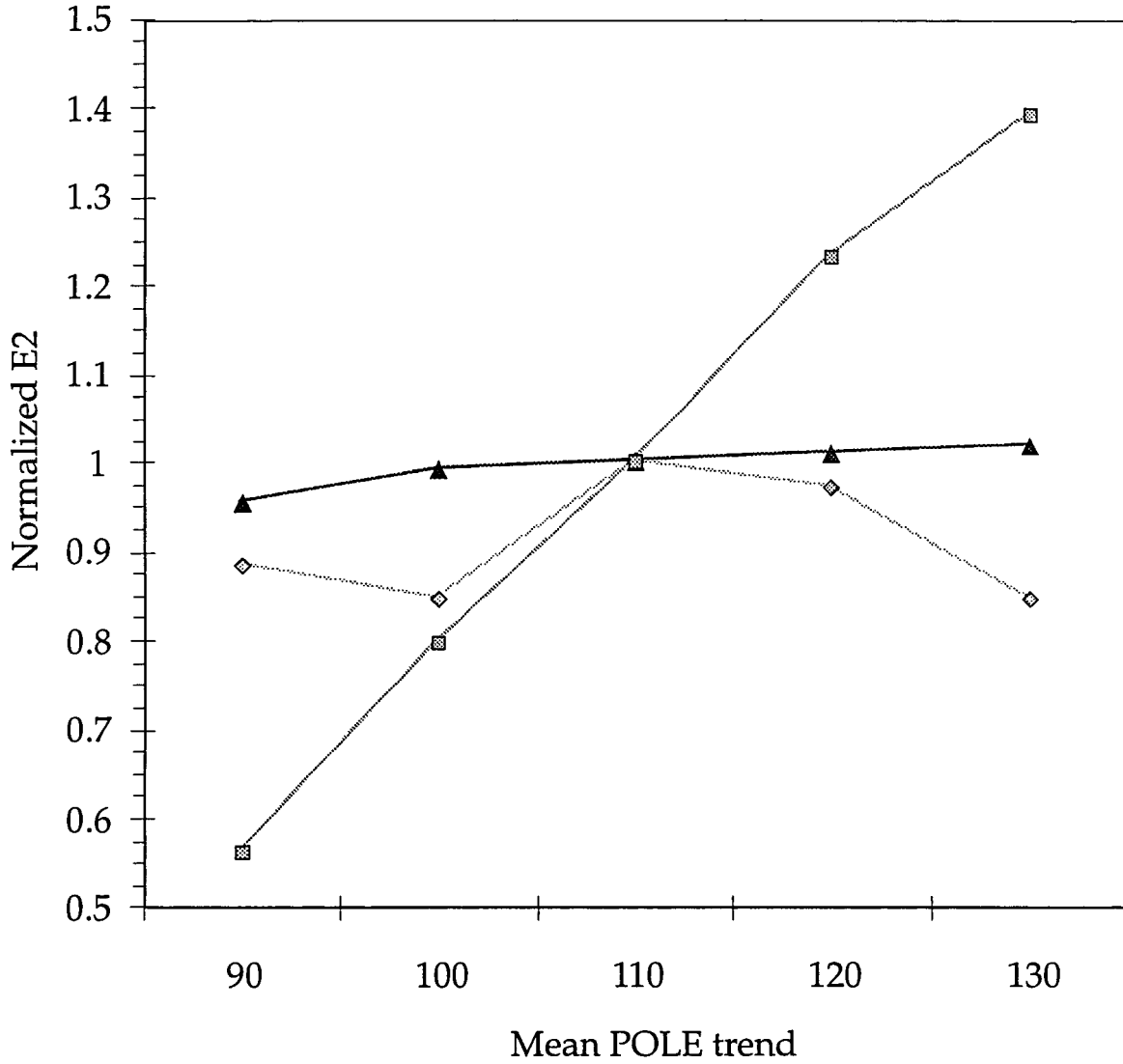


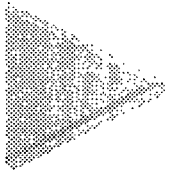


DIP Variation (Normalized to Base)

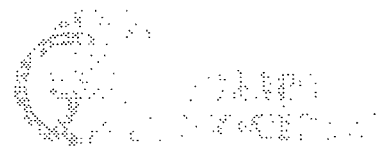
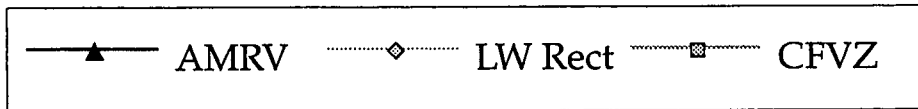
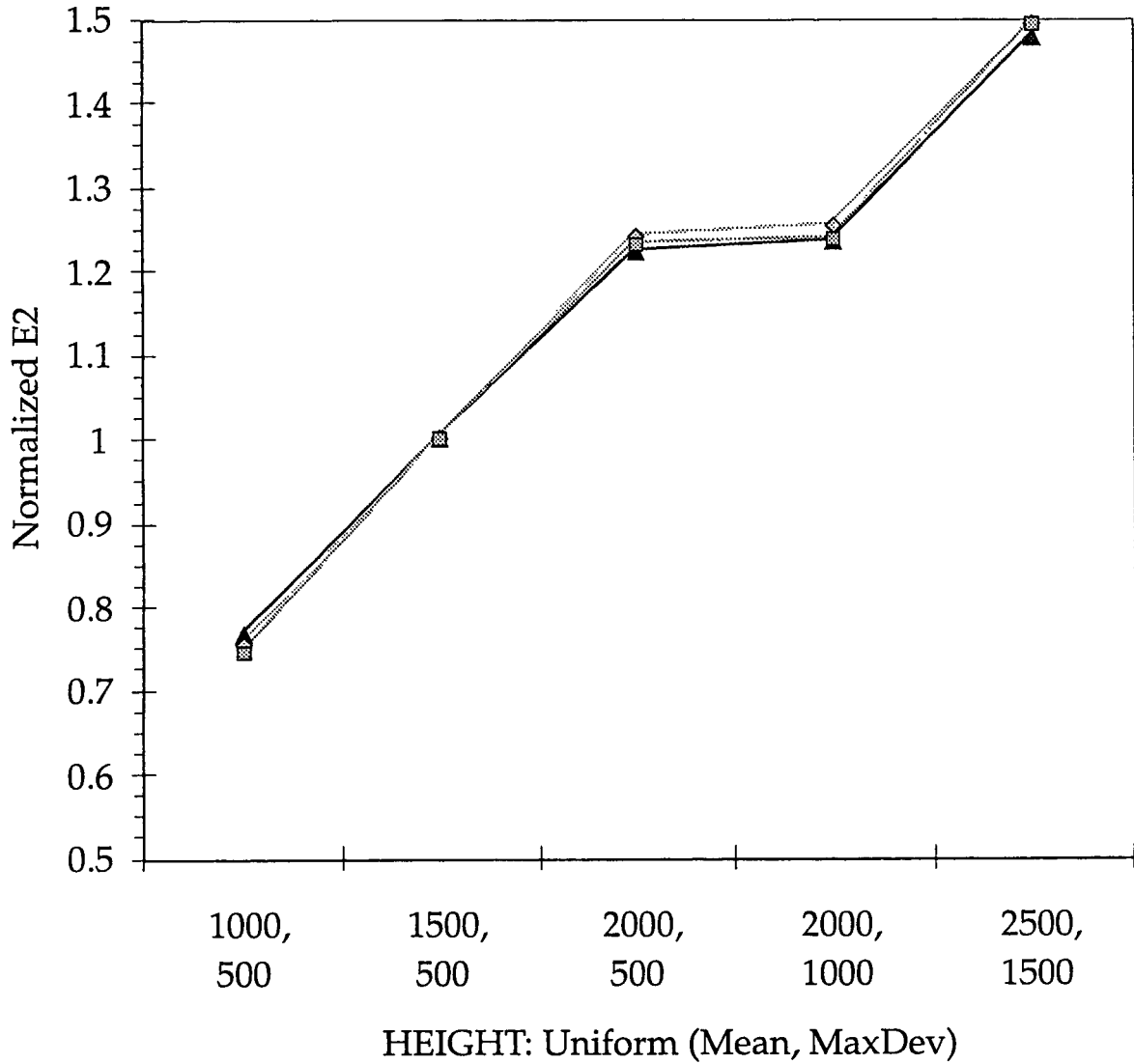


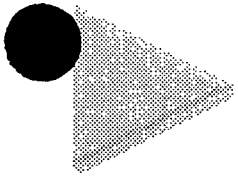
Mean POLE Variation (Normalized to Base)



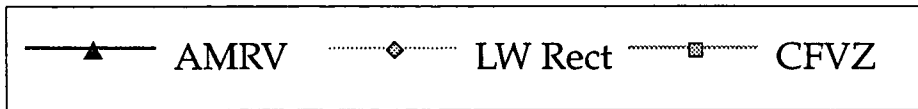
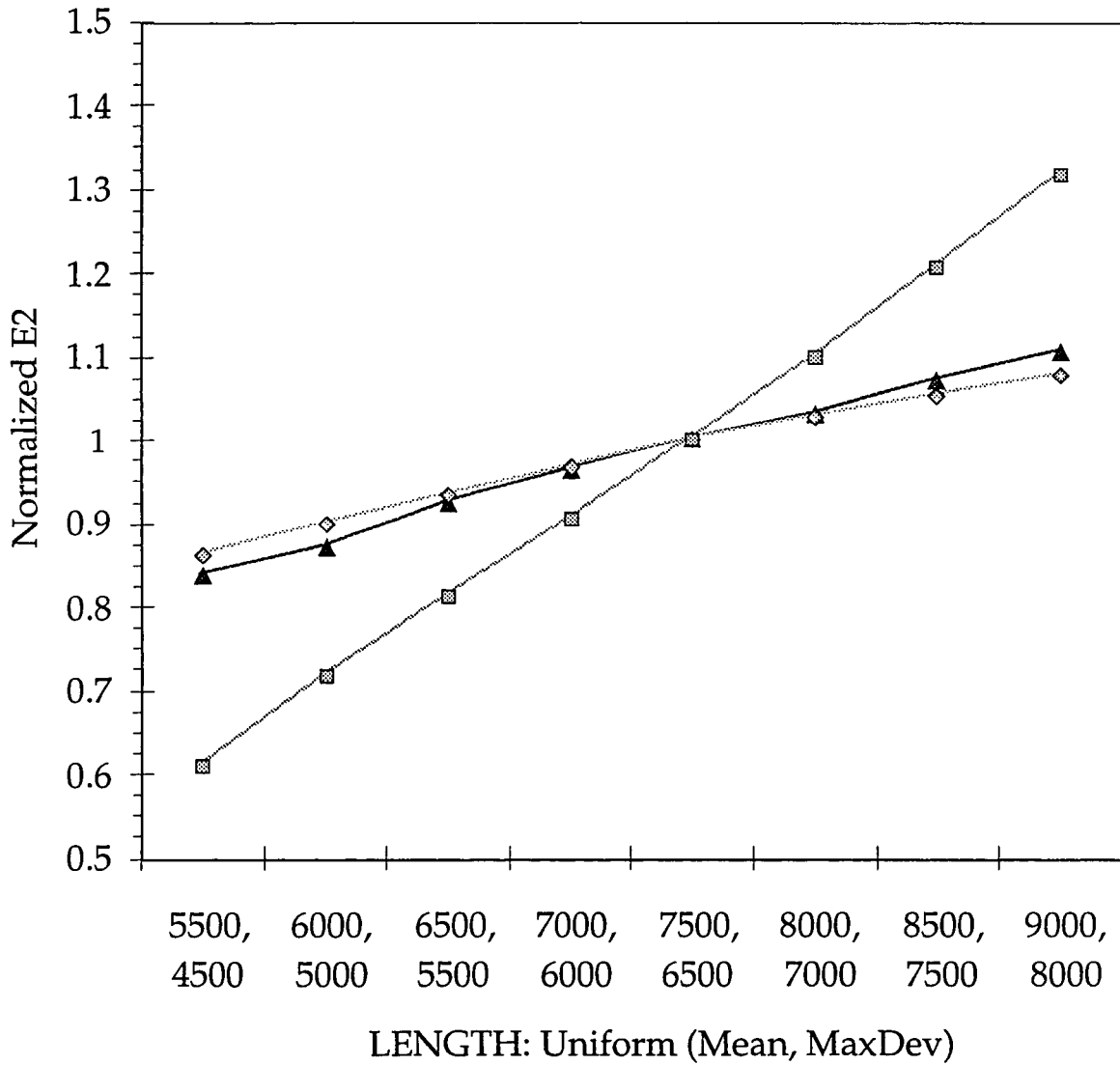


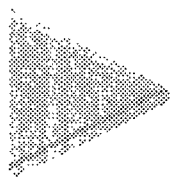
HEIGHT Variation (Normalized to Base)





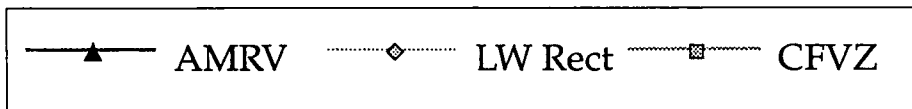
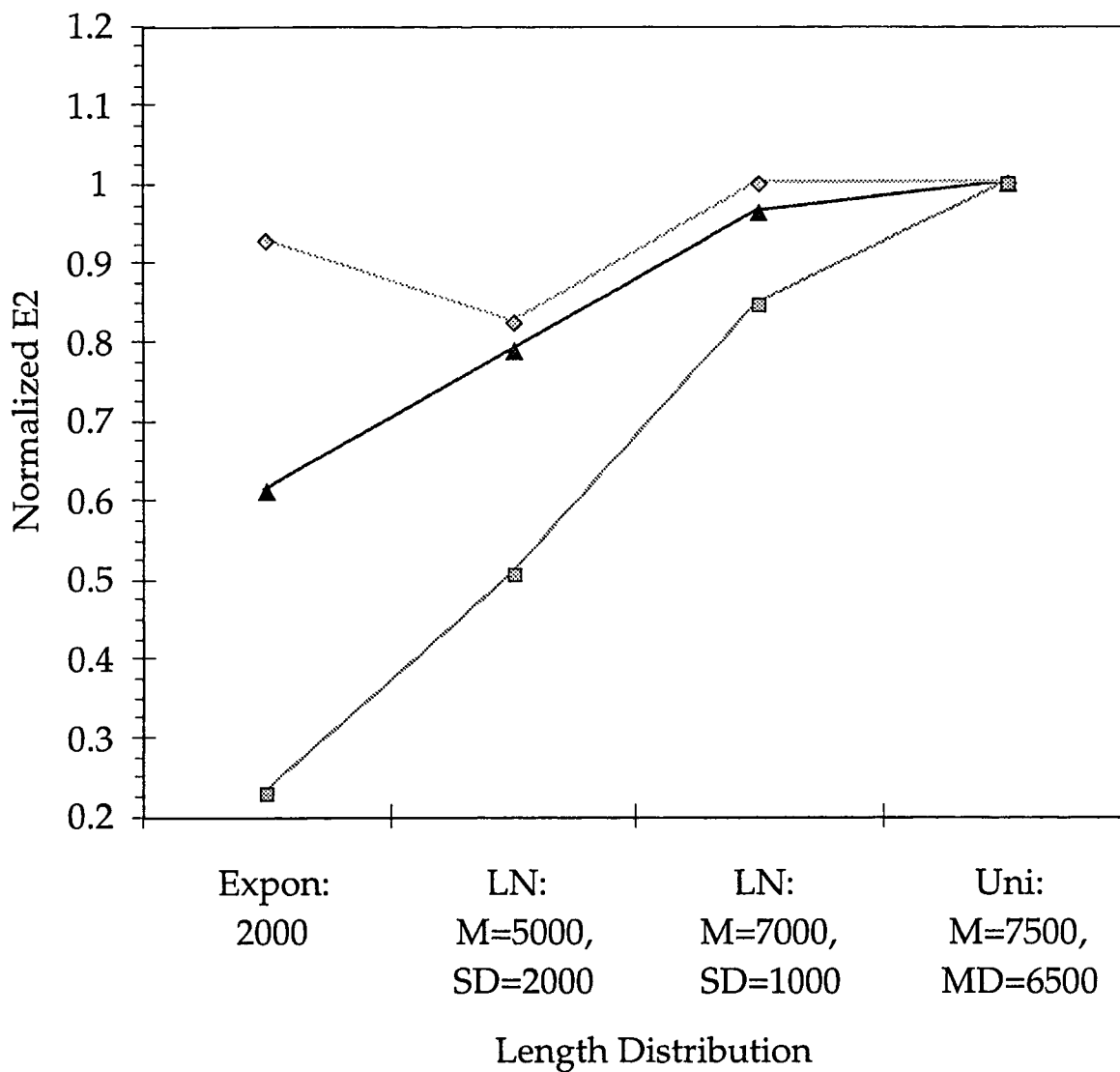
LENGTH Variation (Normalized to Base)



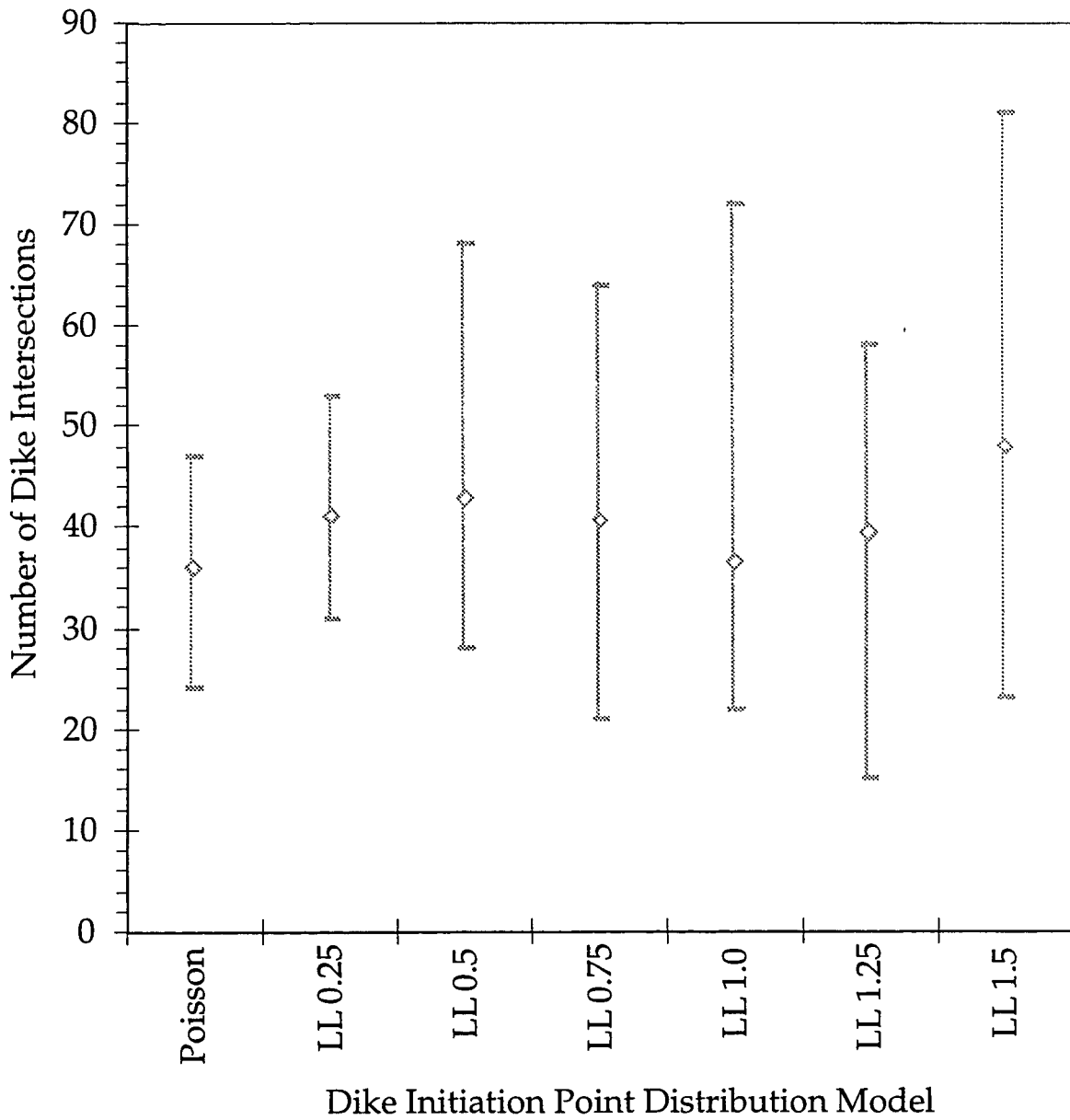


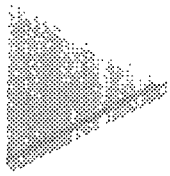
DISTRIBUTION Variation

(Normalized to Base)

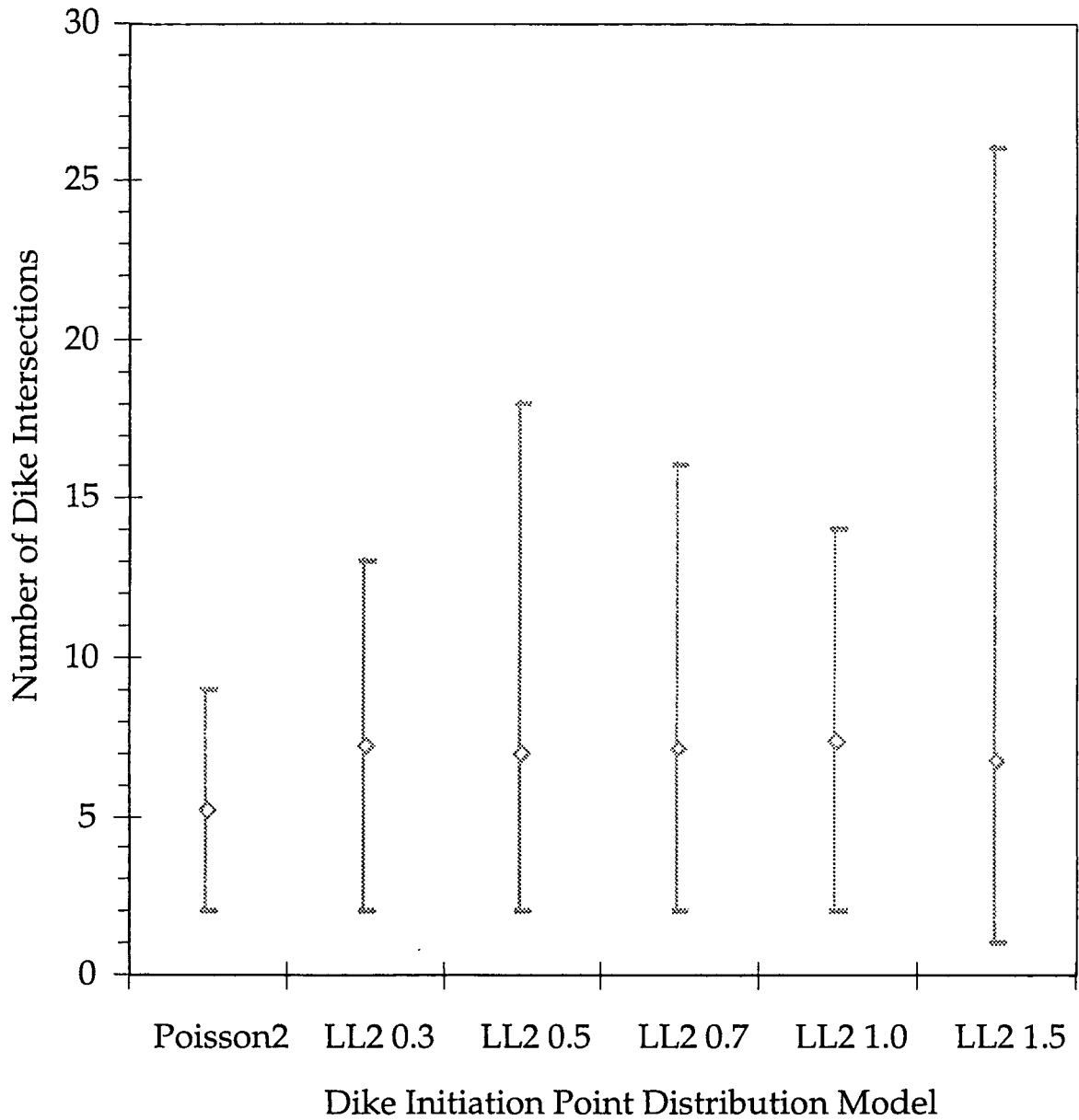


Poisson vs Clustering Models

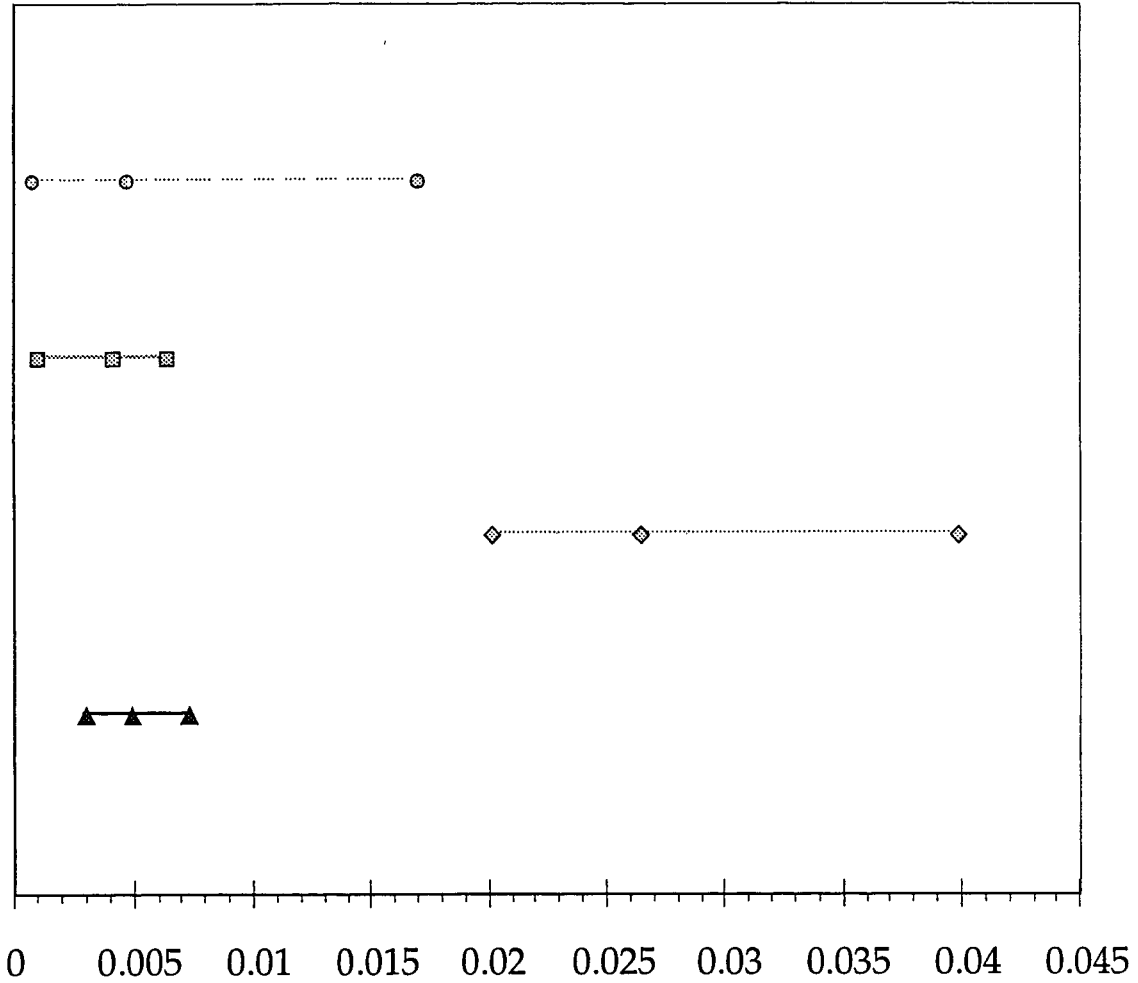




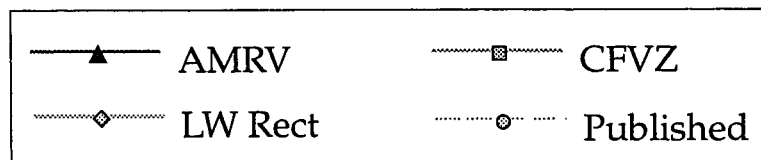
Poisson vs Clustering Models

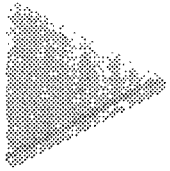


Range of E2 Values

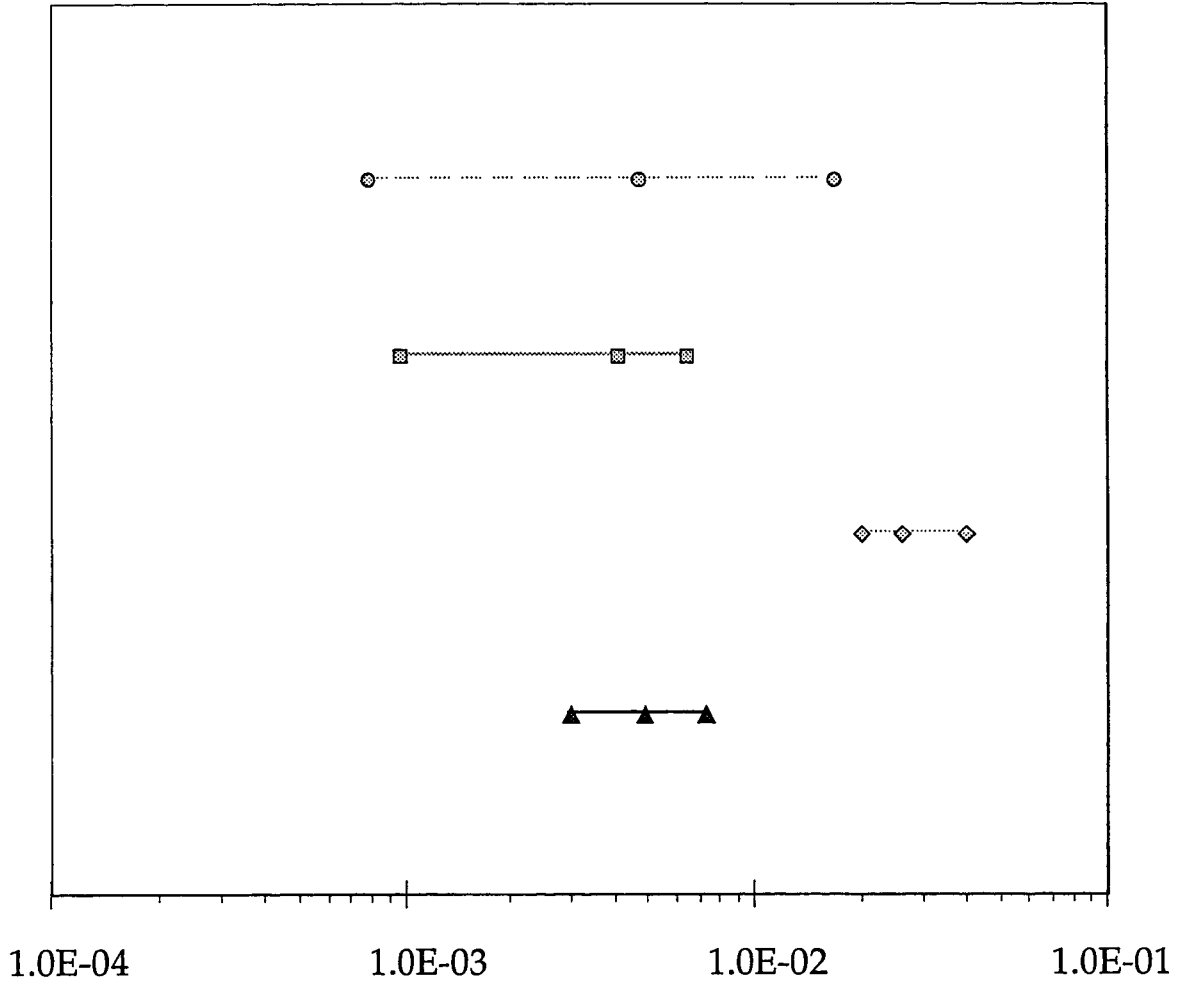


E2 -- Probability of disruption given a volcanic event

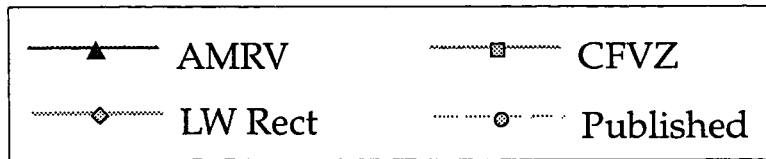




Range of E2 Values



E2 -- Probability of disruption given a volcanic event



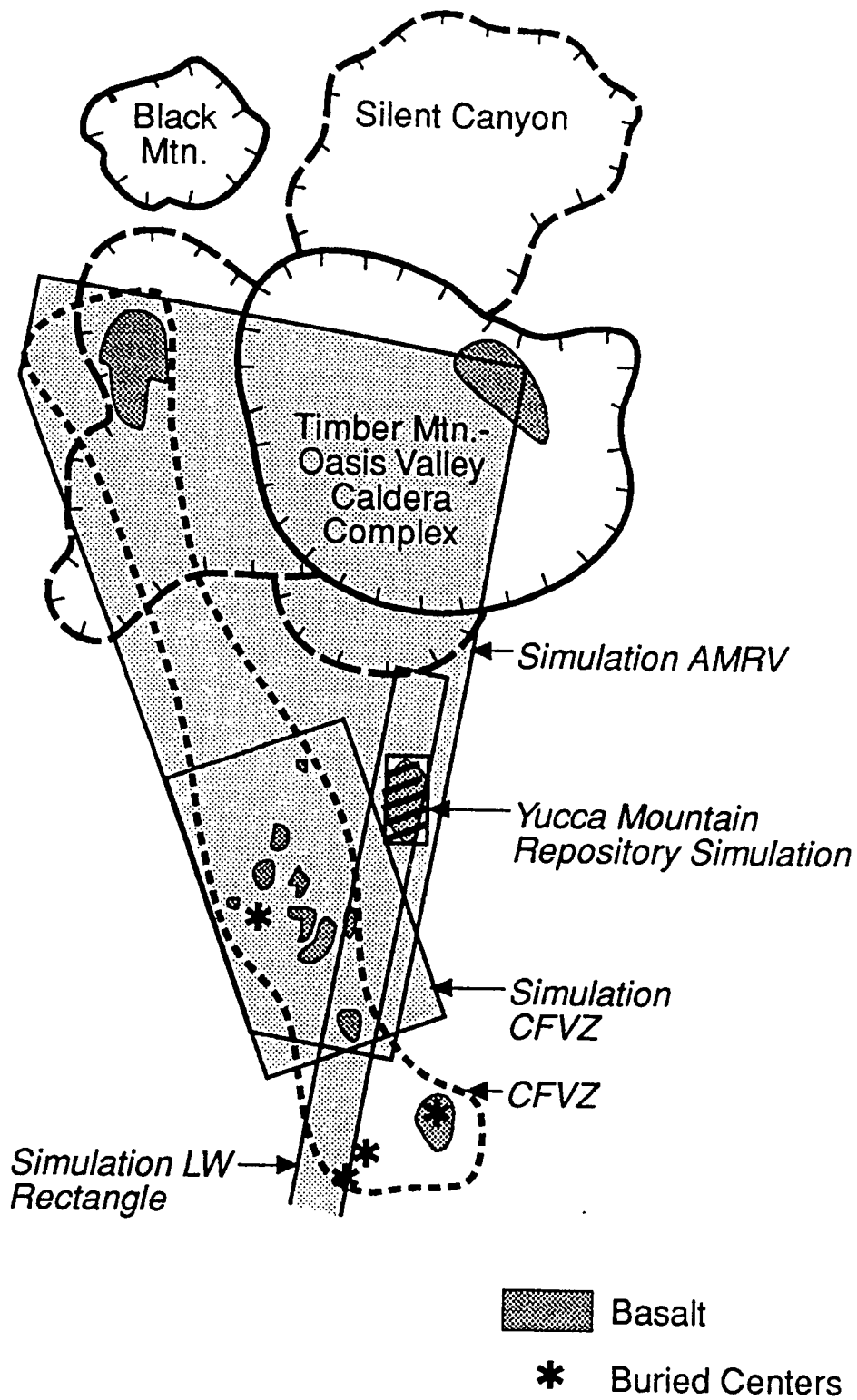
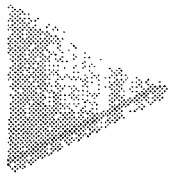
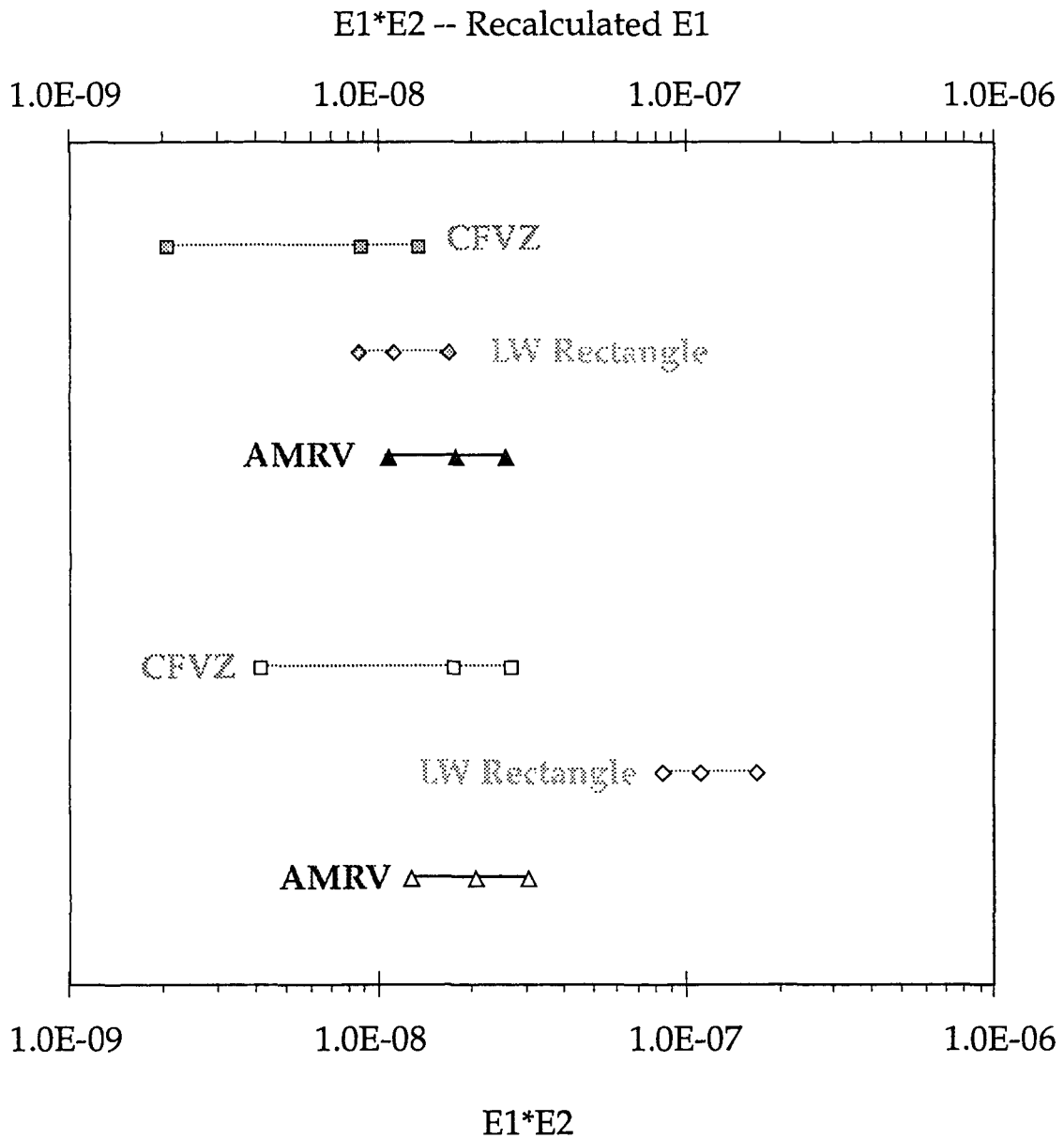


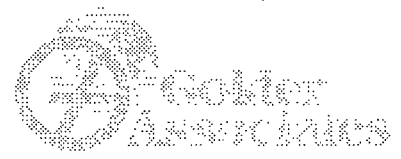
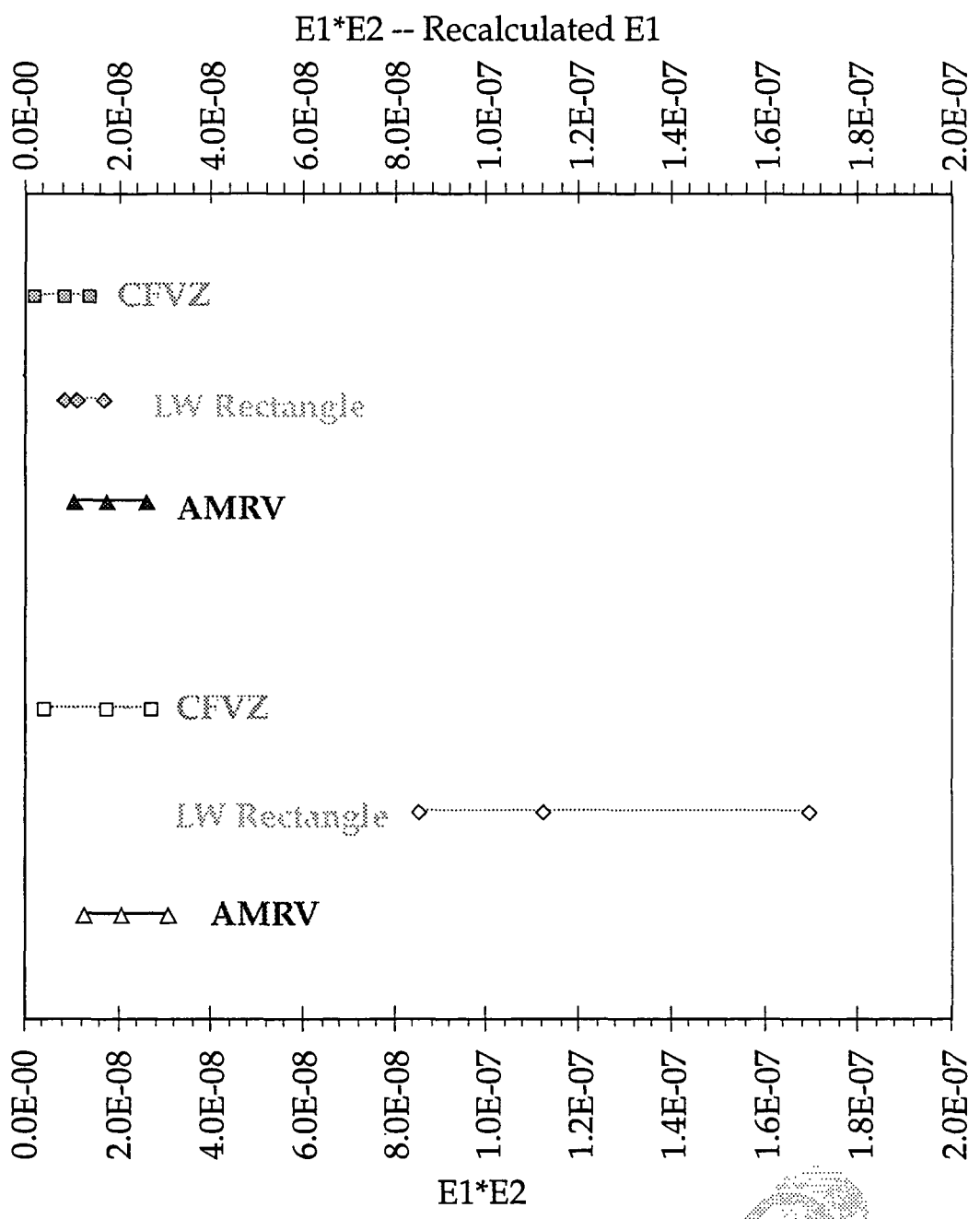
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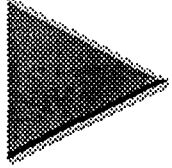


Effect of Recalculating E1 on E1*E2



Effect of Recalculating E1 on E1*E2





Conclusions

- **Sensitivity of disruptive probability to input parameters dependent on E2 conceptual model**
- **Clustering does not increase disruptive probability**
- **Recalculation of E1 given E2 conceptual model is essential for valid disruptive event rate**