# RACE at Texas A&M University and The University of Texas at Austin

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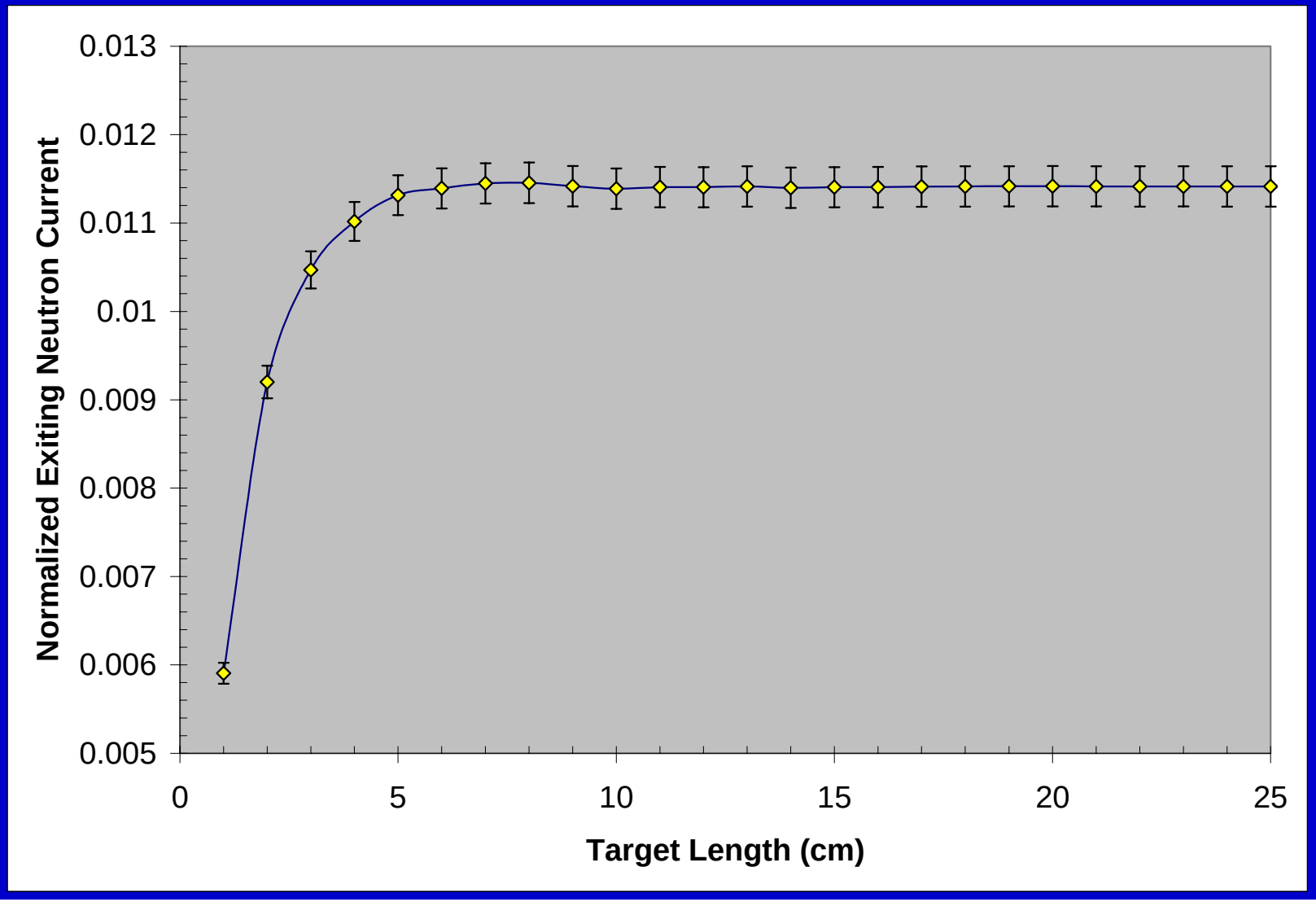
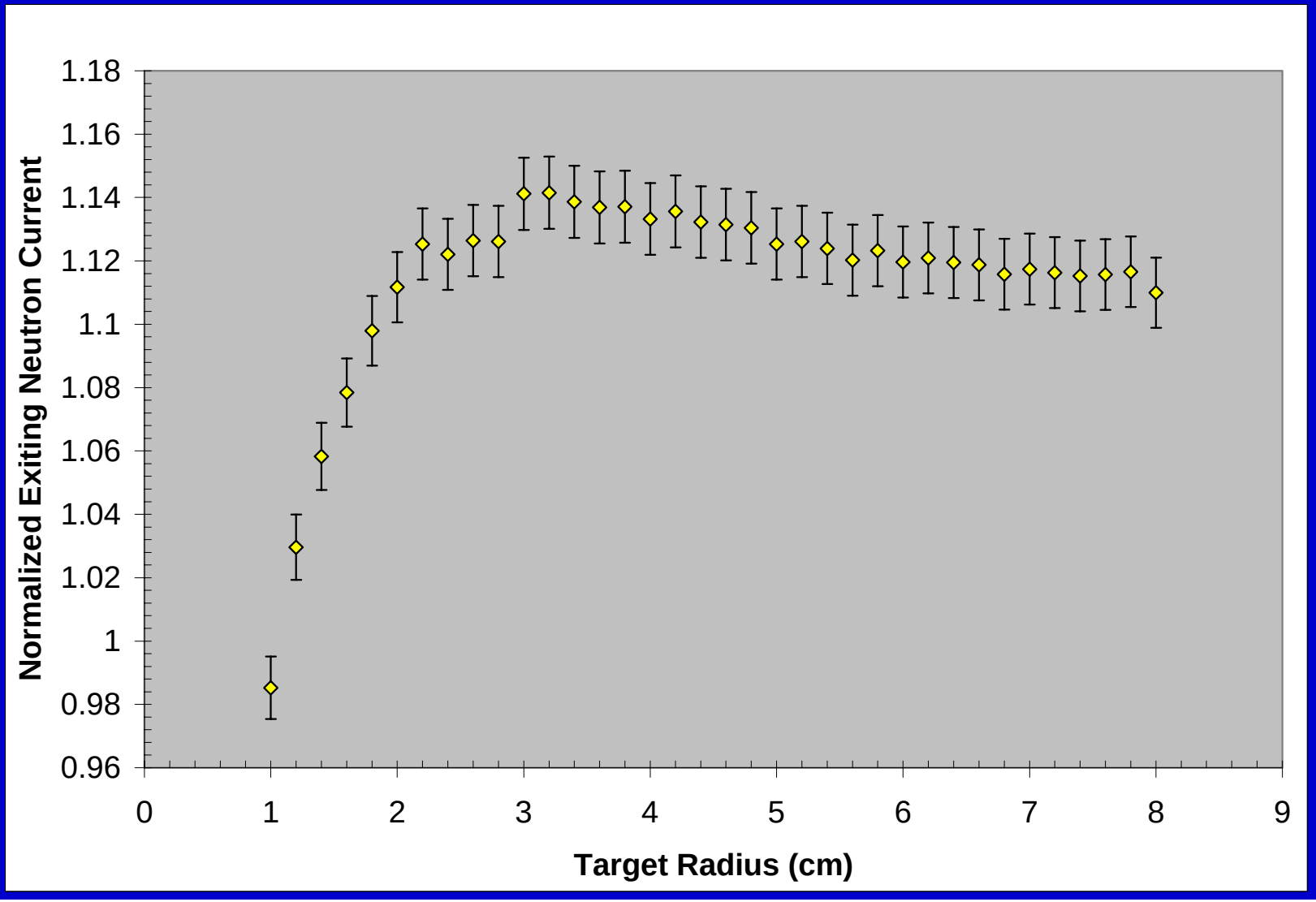
# Neutron Source Evaluations

- We modeled several electron accelerator driven neutron sources
  - to determine exiting neutron currents as a function of source radius and source length
- Accelerator of interest:
  - 25-MeV electron beam
  - 1-cm diameter beam spot
  - 2.5 kW beam power
- These evaluations were intended for optimization
  - later found to be irrelevant since the target must be optimized within the reactor system (not bare)

# Current Versus W-Cu Target Length



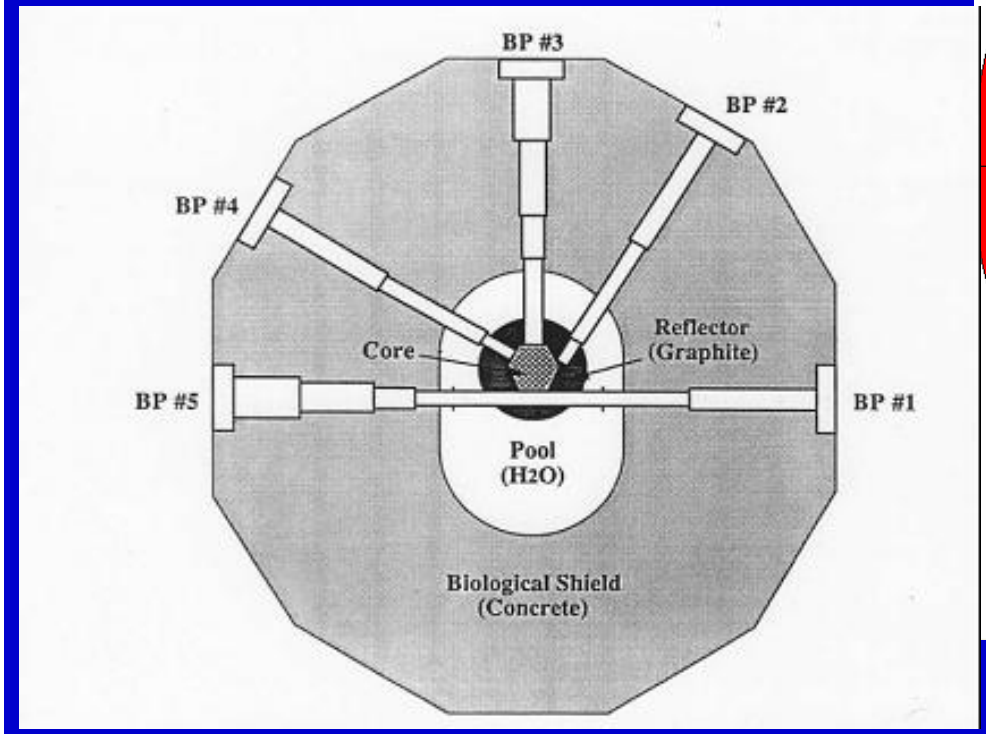
# Current Versus W-Cu Target Radius



# UT-NETL Simulations

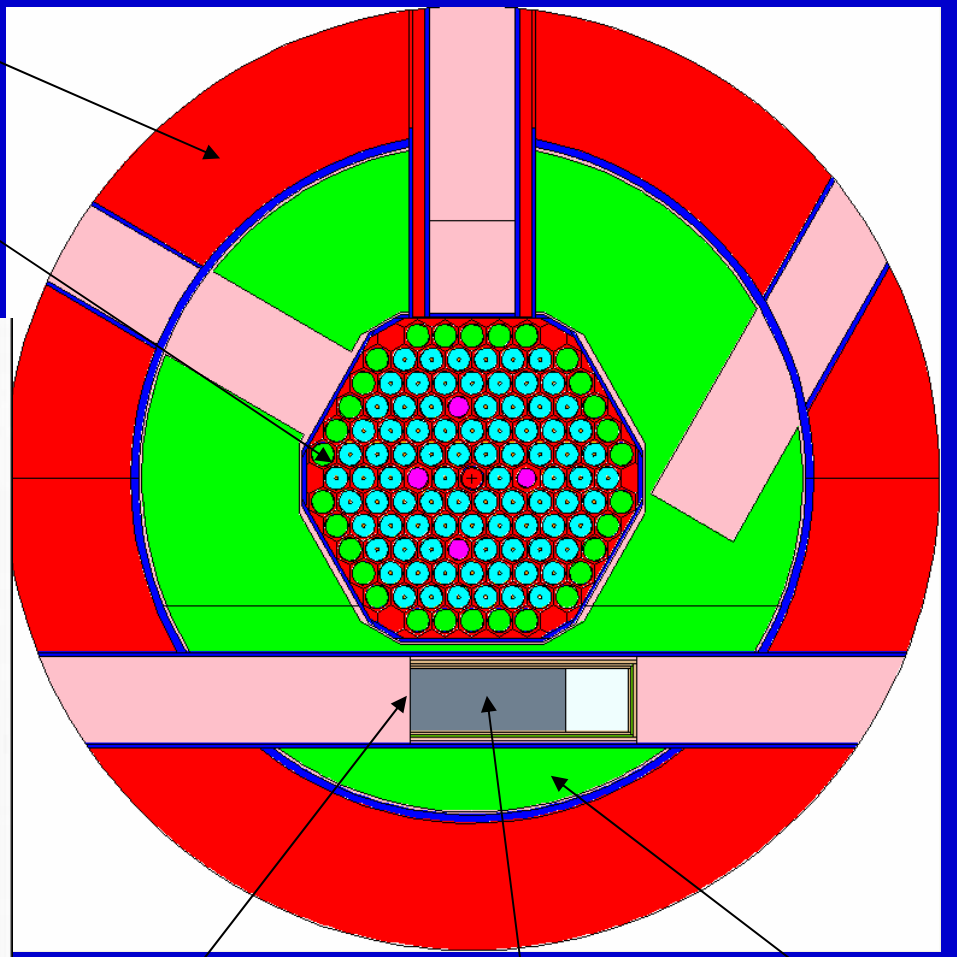
- Simulations used MCNP-5
  - core was modeled explicitly
    - including each fuel rod, control rods, coolant, graphite reflector, and the pool water
- Several simulations performed with different control rod level
  - $k_{eff}$ of approximately 0.95, 0.98, and 0.99
  - determined using kcode calculations
- Source driven simulations performed and heat generation in the fuel tallied

# UT NETL Geometry




pool

standard TRIGA fuel



electron beam location

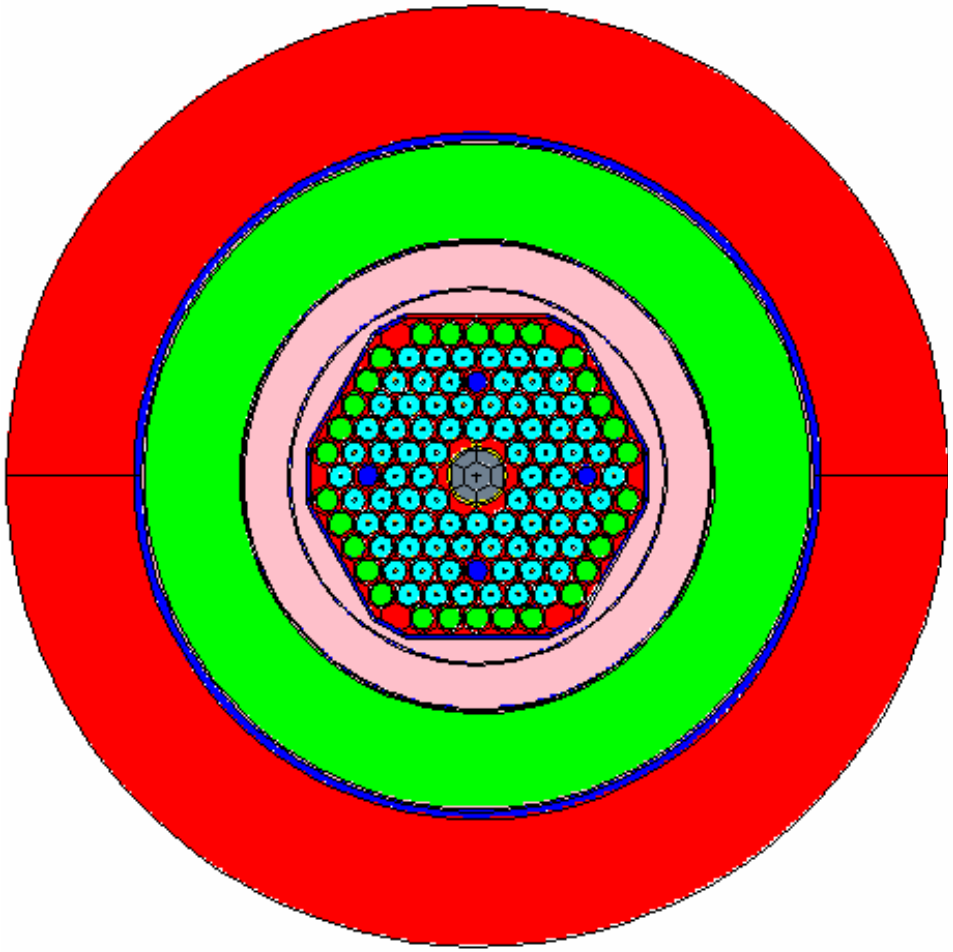
target

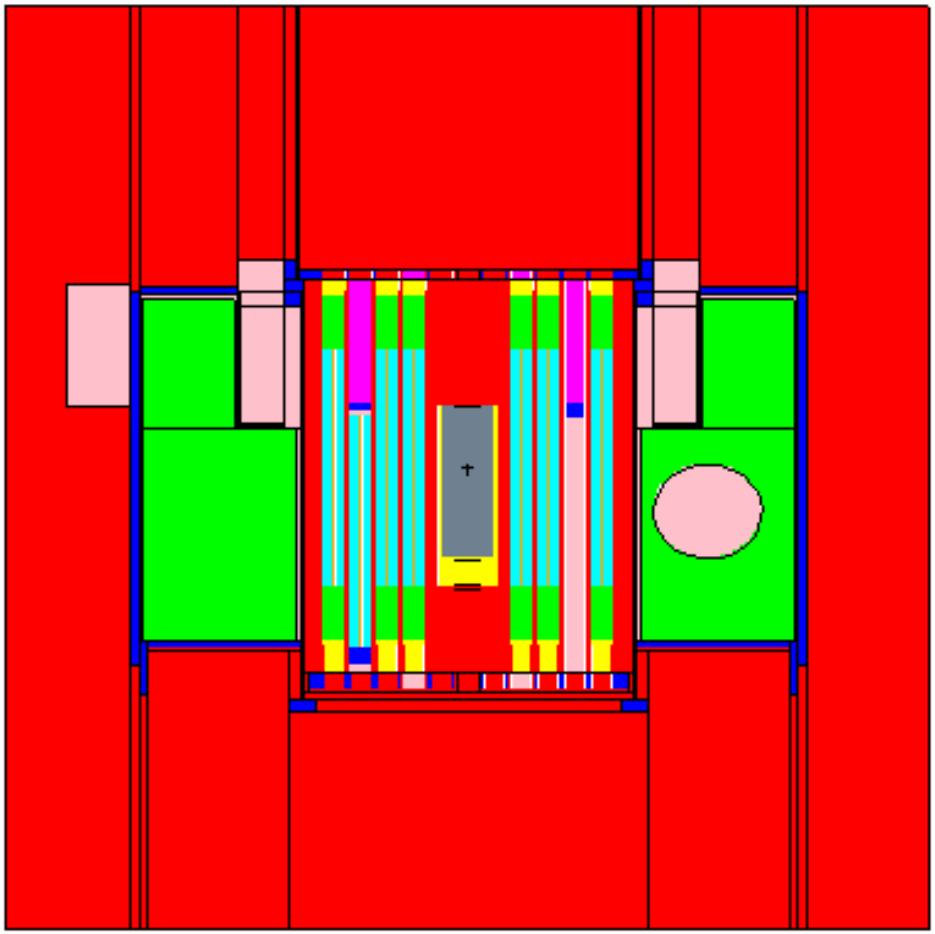
graphite reflector

# Heat Generation Rate in UT NETL with BP#5 Source

| $k_{eff}$ | Heat Generation Rate (kW) |
|---|---|
| 0.9896 | 2.15 ± 0.15 |
| 0.9810 | 1.21 ± 0.08 |
| 0.9510 | 0.56 ± 0.04 |

# Centralized Source in UT-NETL



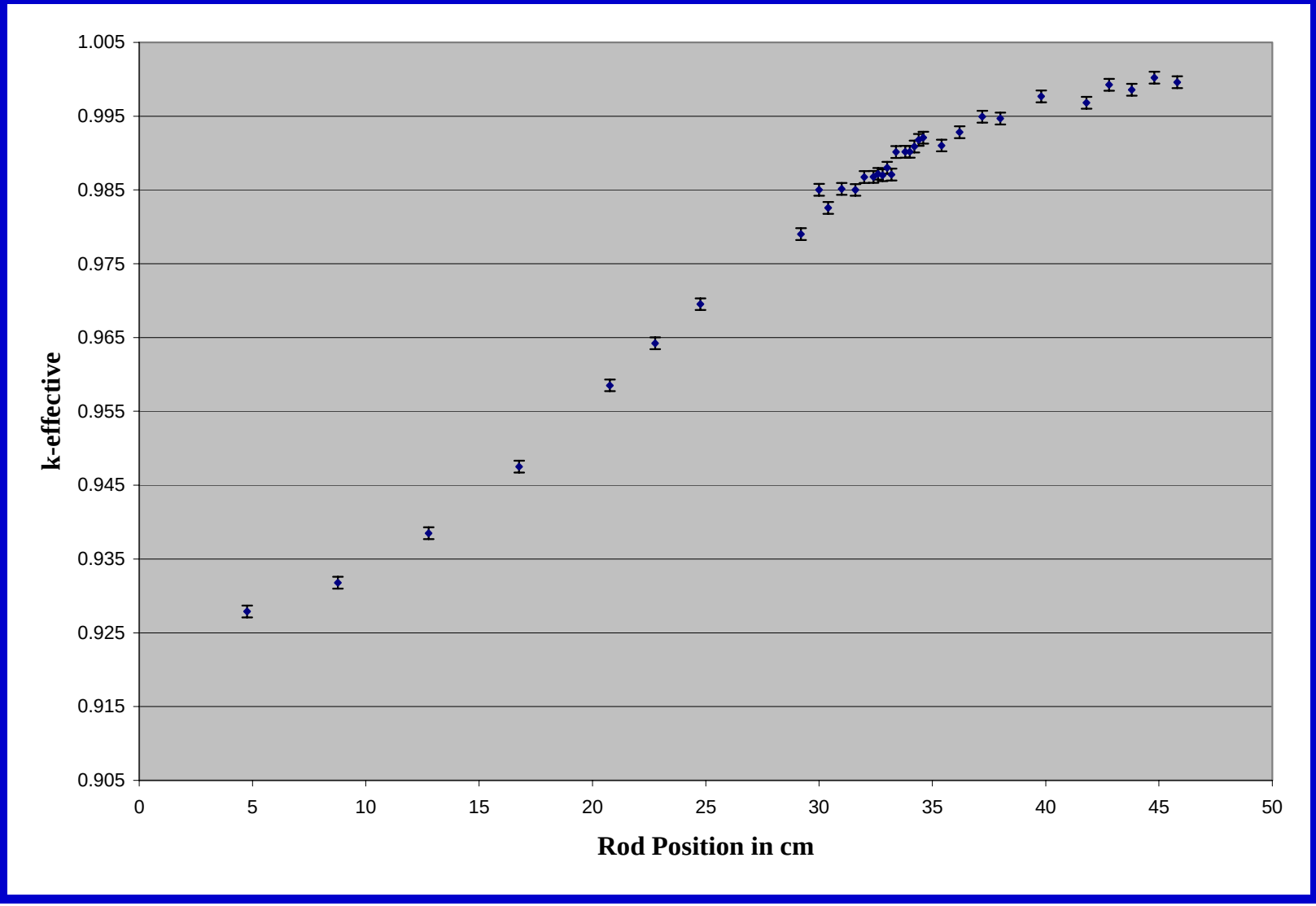


# Heat Generation Rate in UT NETL with Central Source

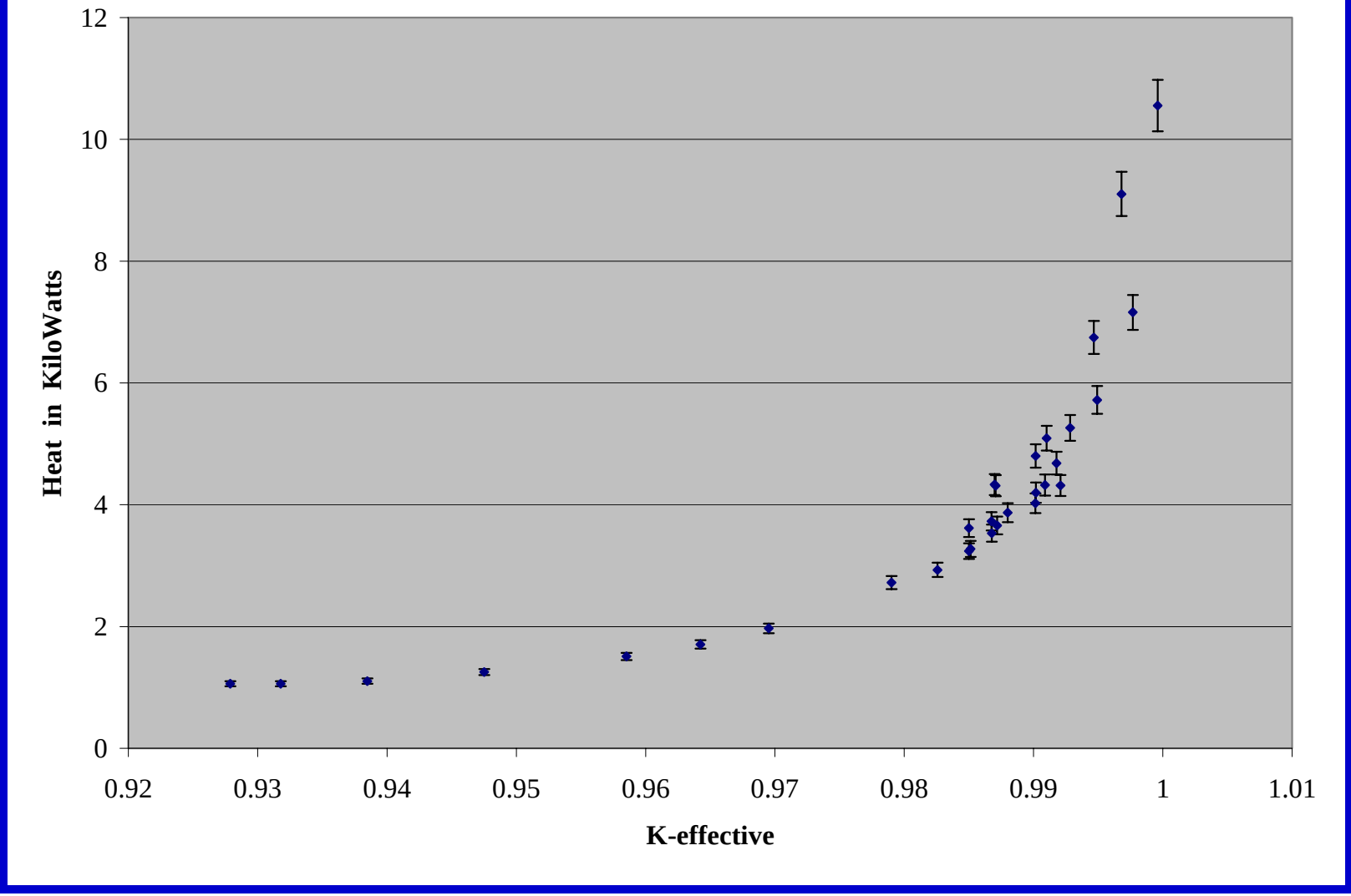
| Axial Height of Target | Heat Generation Rate (kW) |
|---|---|
| 8 cm below fuel meat | 5.06 ± 0.29 |
| 4 cm below fuel meat | 3.48 ± 0.21 |
| parallel with fuel meat | 3.05 ± 0.35 |

* all at $k_{eff}$ = 0.99 and 2.5 kW beam power

# $k_{eff}$ versus Control Rod Position



# Heat Generation Rate Versus $k_{eff}$



# UT NETL Conclusions

- These calculations are all for a 25 MeV and 2.5 kW electron accelerator
- We intend to use a 25 MeV and 25 kW accelerator
  - thus all results can be scaled by a factor of 10
- In both cases we will produce heat rates of interest to RACE
- For full temperature feedback, we will use the 25 kW beam and have heat rates above 50 kW in the reactor