Neutron-Induced Signal Measurements in Coaxial Cables on OMEGA



Neutron induced signals in coaxial cables will be one of the harsh environment challenges on the NIF and LMJ

- Neutron interactions create an electrical signal in a coaxial cable.
- Neutron-induced signals vary substantially by cable type
 - CH dielectric (Heliax, LMR) produces higher signals
 - Teflon dielectric produces lower signals
- Signals are much higher in cables under high voltage.
- Careful cable selection and routing is needed for the NIF and LMJ.
- A new model of neutron-induced signals is under development.



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The neutron-induced signal in coaxial cables was measured using high-yield implosions on OMEGA



Coaxial cables on OMEGA Target Chamber at 165 cm from TCC



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Coaxial cables in re-entrant tube at 42 cm from TCC

Cables: 60 ft long Input: Open circuit with EMP cover Output: 50 Ω , 1 GHz, 5 GS/s Tektronix 684 scope

Neutron-induced signals in coaxial cable with CH dielectric vary substantially by cable type

Shot 46827, DT, $Y = 2.5 \times 10^{13}$, at 42 cm from TCC 0.05 0.00 -0.05 Signal (V) -0.10 -0.15 -0.20 LMR-400 Heliax 1/2 in. _MR-600 -0.25 Heliax 3/8 in. -0.30 210 220 230 240 200 Time (ns)

Neutron-induced signals in LMR cables are proportional to the neutron yield

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Similar yield dependence was measured for Heliax cables

The neutron-induced signal varies substantially for different kinds of coaxial cable



The neutron-induced signal is much higher in coaxial cable with HV applied



It is important to maximize the average distance between n source and cables



The CEA scientists are working on a model to explain neutron-induced signals



Since coaxial cables are difficult to model, CEA uses a simple test platform to study* neutron-induced signals.

All mitigation techniques will be implemented in the NIF nTOF diagnostic for the ignition campaign



Cables to high-yield detectors will be located outside of neutron beam

NIF multichannel nTOF prototype with CVD diamond detectors



Best solution—2 m of concrete shielding

Summary/Conclusions

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