



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

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Project Title Marx Bank Driven Flash X-ray Generator: A Powerful Tool to Study High Speed Phenomena	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this project was to develop a low cost compact flash X-ray source that would produce high energy, extremely short x-ray pulses for the study of high speed phenomena. The concept was to use a Marx Bank high voltage generator to produce a very short high voltage pulse to drive a simple x-ray tube to get a short yet powerful x-ray pulse.</p> <p>Methods/Materials A series of Marx generators were built with each succeeding design using lessons learned from the previous designs. The final design was a 12 stage triggerable Marx bank that was optimized through distributed stage to ground capacitance, pressurization to 7atm, optical spark gap coupling, and low inductance interstage coupling. This design utilized 30KV 2700pF strontium titanate dielectric capacitors and 1M ohm 2W ceramic composition resistors with a charging voltage of 30KV. This final Marx was efficiently coupled to a simple tungsten anode cold cathode x-ray tube. Finally a digital delay generator with 10usec resolution was developed to provide the delayed triggering required in many research applications.</p> <p>Results The final Marx design produced an output of >300KV with a rise time of <2ns and an output pulse width of <20ns. When coupled to an inexpensive x-ray tube, a variety of dynamic (>1000 m/s) phenomena were captured on Polaroid 3000 speed film loaded in Polaroid XR-7 film pack.</p> <p>Conclusions/Discussion The combination of an optimized Marx high voltage generator with a simple x-ray tube results in a low cost compact, yet high performance flash x-ray source capable of recording phenomena moving at extremely high velocities (calculated to be >10 km/s). Such a device is a useful research tool in both academic and commercial environments.</p>	
Summary Statement A high performance flash x-ray source can be constructed at reasonable cost by using an optimized Marx Bank high voltage generator to drive a simple x-ray tube.	
Help Received Dr. David Platts of LANL advised me on this project; Used lab and machine shop equipment at Sage Instruments; Machining help from Jim Schierenbeck.	