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THE INSPECTION OF METALLURGICAL BOUNDS IN ELECTRONIC
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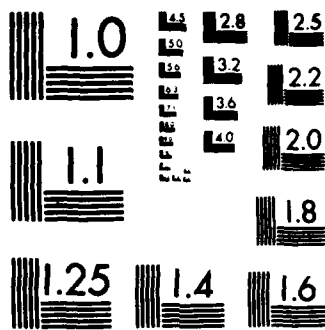
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THE INSPECTION OF METALLURGICAL BONDS IN ELECTRONIC SYSTEMS

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Electronic subassemblies are getting more and more difficult to inspect. Integrated circuits (IC's) are being designed with more input/output (I/O) connections spaced closer together. These new designs make the solder-joint inspections more difficult at the same time that joints are being relied upon to accomodate more demanding mechanical requirements. The higher I/O pin count has forced the adoption of surface mount technology (SMT) which places higher demands on the mechanical strength of the solder bonds due to the shorter and less compliant leads, or the elimination of the leads altogether, on the IC package. In addition the high I/O count is leading to IC package designs with pins or pads in the interior as well as around the package perimeter. There is no inspection technique that is currently capable of inspecting solder joint integrity beneath an IC package. Functional testing of an assembly can detect shorts or opens but cannot detect the many flaws that can cause premature failure of the solder bonds.

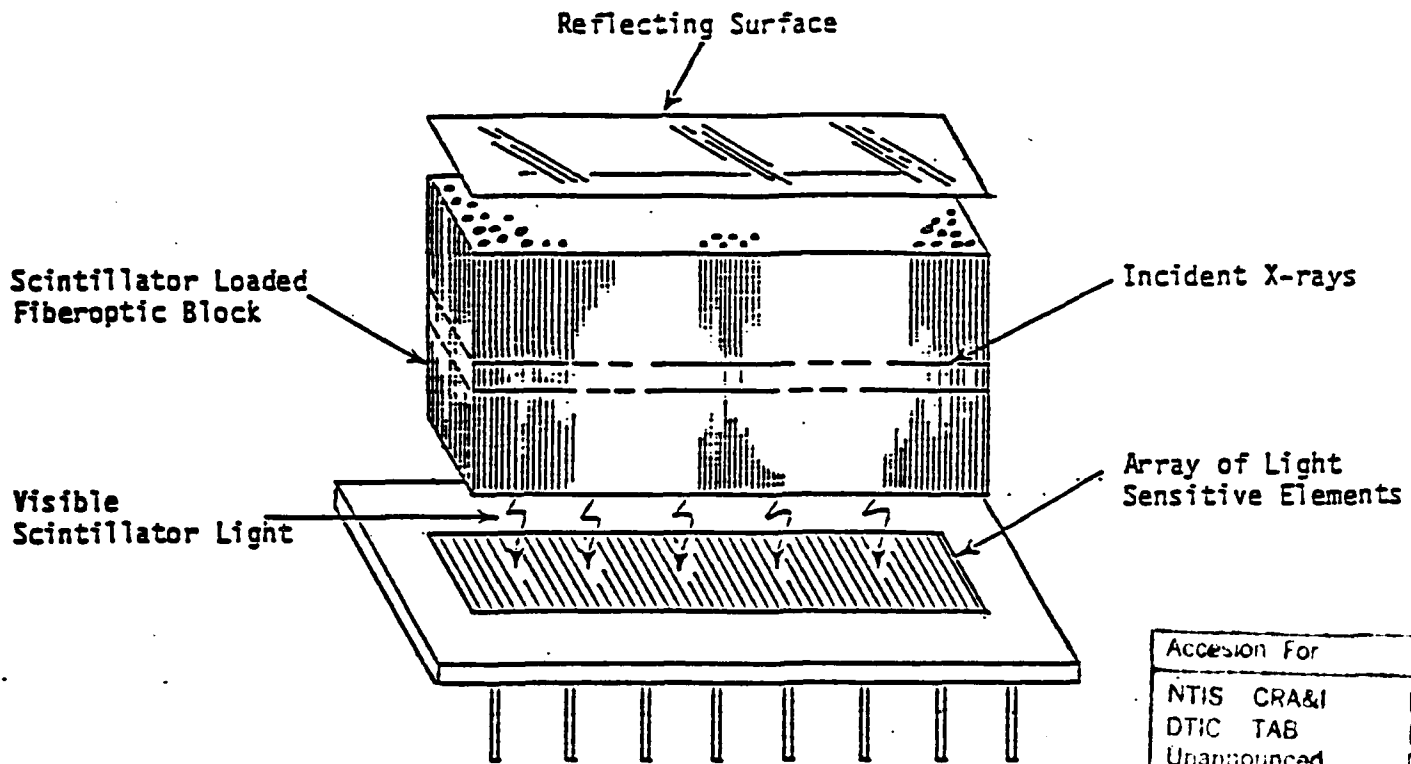
X-ray Computed Tomography (CT) has shown itself in many applications to be an excellent technique for imaging the interior of complex parts or assemblies. This program has studied the types of solder bond flaws that need to be detected by an inspection system and determined CT system performance parameters required to image these flaws. These parameters include resolution, x-ray penetration of high Z materials (such as solder, gold, or copper), inspection throughput, and system cost. Using these CT system parameters as guidelines, a conceptual system design was derived for the inspection of the complex electronic subsystems that are crucial to current and future military systems. The conceptual design parameters were validated by conducting experiments on existing scanners. These experiments showed that the CT inspection technique is very promising. Even existing scanners which do not have the performance required by the application detected most defects known to be present.

The successful outcome of the development of a CT inpection system for solder bonds will provide a benefit both for government and commercial communities. The military has become increasingly dependant on sophisticated electronics for weapons control systems, for communications, and for strategic and tactical surveillance. Improving the reliability of these systems will greatly benefit the military. The commercial sector is also using sophisticated electronics in many products. The reliability and price of these products can be strongly influenced by the inspection techniques used during their fabrication. SMT provides more functions per IC so that the component count of a system is decreased and the reliabilty is increased. The lack of adequate inspection techniques is limiting the adoption of SMT and its many benefits.

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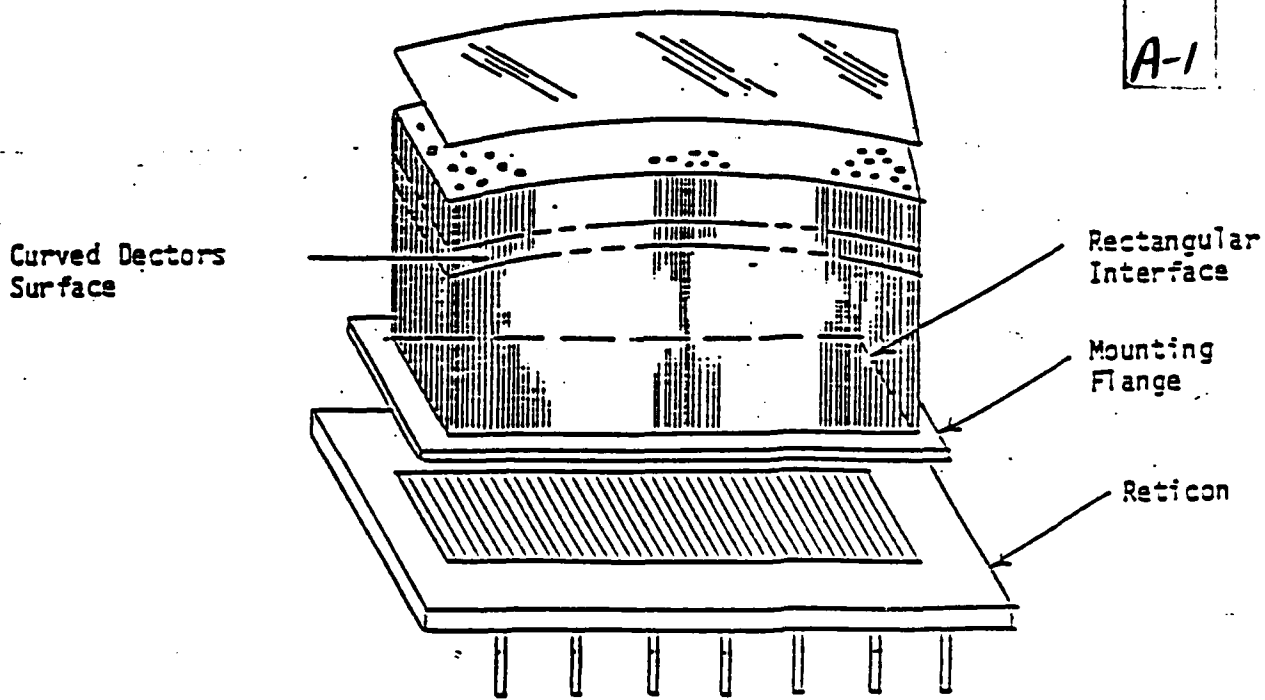


Diagram 1. A High Resolution X-Ray Detector Design

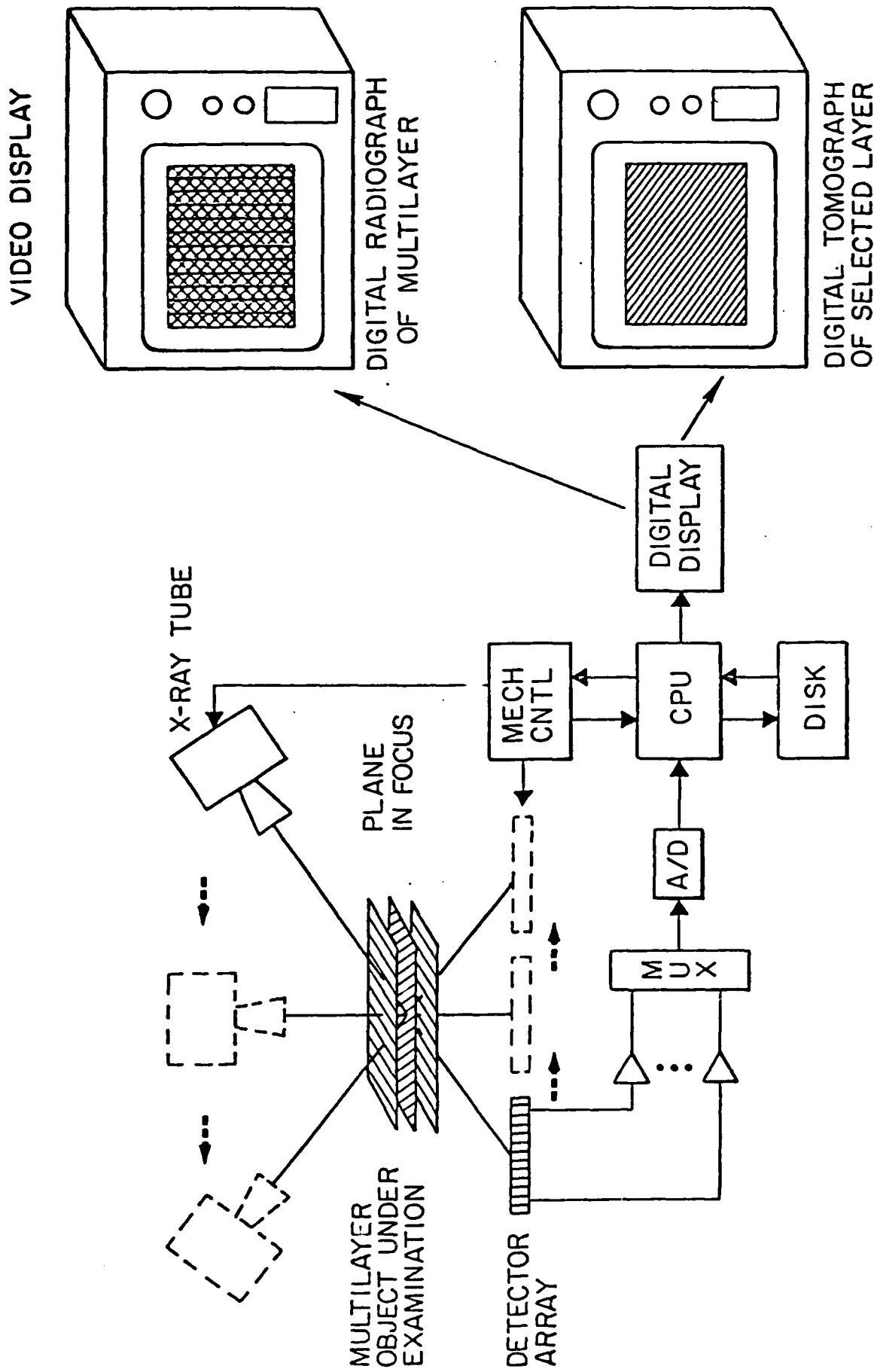


Diagram 2. Schematic Illustration of Digital Tomography System

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