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Report on detector cleaning operation and subsequent detector damage caused by this.

Peter Moore 7th February 2002.

The INGRID Hawaii detector was seen to have become contaminated after the last stand down carried out in February 2000. Three large 'dust' spots covering tens of pixels were present and hundreds of smaller two or three pixel areas were affected. In addition the grease stain, affectionately called the finger print, in quadrant two was still obvious.

After warming up the cryostat during the weekend of the 2nd and 3rd of February, the cryostat was flushed with nitrogen gas and opened to atmosphere on the morning of the 4th. The focus drive with the detector mount was electrically isolated, made safe from static discharge, and removed from the internal casting. The complete focus drive was mounted and clamped to the optical table in a vertical position. The detectors binocular microscope was mounted to allow inspection of the detector. During the afternoon it was determined that the large 'dust' spots were still adhered to the detector surface. These were seen to be two pieces of debris from a paper towel and one piece of aluminium shaving, probably from work carried out in the previous stand down or material that was left from the initial commissioning phase. The surface was cleaned of the large debris with a 'one hair brush' as is normal practice. The smaller particulate matter was mostly dust and more 'paper towel' material. Many of the smaller particles were adhered to the

surface of the detector by what appeared to be frozen or dehydrated grease. In removing these particles it left a pear shaped whitish mark on the surface where the effort pulled away the 'glue'. A reduction in the number of contamination spots of about 60 percent was achieved during the afternoon. Cleaning efforts were stopped for the day to allow a fresh evaluation to be made on the 5th.

After evaluation of the remaining contamination on the morning of the 6th it was obvious that the principle component of the surface 'glue' was evaporated grease that had condensed onto the surface. Whether from stepper motor bearings, axial bearing lubricant, or vacuum grease is unknown. I conducted an information search to determine safe solvent chemicals that could be used. Using sapphire as the base with a supposed hard metallic antireflection coating revealed that Propanol, water with ethanol, and neutral pH detergent are suitable. A Propanol test was carried out on a glass substrate suitably contaminated with light mechanical grease and proved to be reasonably effective. After careful consideration I decided to try Propanol on the extreme corner of the Hawaii array to assess the potential of the method. I deposited a tiny quantity in one corner using a fine hair. Upon contact the solvent flashed across a large surface area from, I presume, surface tension effects. Unfortunately the amount of solvent was just sufficient to liquefy the grease in the affected area (about 30% of the detector surface) which turned into grey 'mud'. Therefore I had no alternative other than employ the solvent across the whole surface of the detector.

Using miniature swabs cut from clean room swabbing material and a repeating process of solvent application then sweeping with a dry swab, approximately 90% of the contamination material was removed. I then stopped work to allow the fumes to escape from the detector surface.

An inspection was performed on the morning of the 6th. This showed that the remaining grease was still liquefied and further swabbing could potentially reduce the amount present. However, during the inspection it was noticed that a bond wire was lying underneath the detector level in the gap between the detector and package. This bond wire was recovered but unfortunately lost when it fell to the bench. Further inspection revealed that the bond wire was missing from pin 34 (labelled DSUB - Detector Substrate). No other damage can be observed to any other bond wire. I assume that during the swabbing process the swab touched and picked up the bond wire, tearing it from the detector pad. Just how it came to rest in the channel under the detector remains a mystery.

Contact was made with Mr. John Montroy at Rockwell Scientific. He confirmed that the loss of the DSUB connection will disable the detector completely. John has offered the services of Rockwell Scientific to re-bond the missing wire and retest the detector for functionality. In addition I will attempt to have the detector cleaned of the remaining contaminants.

