

THE CCD MOSAIC PROJECT BY ESO¹ AND INSU² / TOULOUSE OBSERVATORY³

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In the last few years, as the CCD cameras have been routinely used in most of the Observatories, there has been a growing concern among the scientific community about the major weakness of this very good detector: the format of the available chips is too small for many applications.

ESO has been particularly interested in acquiring and testing large format CCD's, mainly because of the enormous potential possibilities of the NTT and VLT projects. The instrumentation which was planned for these projects assumed the availability of the large CCD array Tektronix 2048 x 2048. In the beginning of 1987, as it seemed that this circuit would not be available in the near future, ESO and INSU decided to support industrial development of buttable CCD's with Thomson CSF (France).

This contract led to the designing of a new chip (THX 31157), which is derived from the standard CCD THX 7882, but with a very thin ceramic baseplate smaller than the sensitive part of the chip, and the connectors on one side only, to allow for joining the CCD's together with a smaller gap as possible in between. It is a front illuminated array of 579 x 400 pixels, with square pixels of 23 x 23 μm . The general properties are similar to those of the THX 7882, but the charge transfer efficiency has been improved. The quantum efficiency reaches about 45% at 600 nm and the read-out noise can be as low as 5 e^- .

A special machine for assembling these chips, MAM (Mounting and Alignment Machine), has been designed and built in Toulouse Observatory, with financial support from ESO and INSU. The idea was to align the chips and stick them on a sapphire baseplate with a minimal gap in-between. In this way large matrices of two rows of CCD's can be mounted on the same baseplate. The expected accuracy for aligning the chips is about $\pm 3 \mu\text{m}$, and the coplanarity requirement about $\pm 15 \mu\text{m}$. Designed for moving the chip in all directions, with 6 degrees of freedom, the machine allows for assembling matrices of CCD's up to 2 x 12. The first mechanical tests were performed with 4 chips in Toulouse in spring 1988.

A multipurpose electronic control camera is being developed jointly by ESO / Toulouse Observatory for data acquisition and pre-processing. The core of the system is a microcode programmable sequencer (clock pattern generator) supplying all the digital signals necessary to run a CCD. It will be able to control up to 16 buttable 579 x 400 CCD's, or four 1024 x 1024, or two 2048 x 2048. The first images with a 4 x 4 matrix are expected before the end of the year.

ESO/INSU also participated to the development of large monolithic 1024 x 1024 CCD's with Thomson CSF. This led to the new chip THX 31156. The performances are still to be evaluated accurately, but from the first measurements made at Photometrics (Tucson, USA) it seems that they are similar to those of the buttable THX 31157, which is very encouraging. Further tests should be done in September-October 1988 in Toulouse Observatory.

In collaboration with the French CNES/CEA¹ Thomson has also started the development of thinned back-illuminated CCD's. Though the results are still preliminary and many problems remain to be solved, chips with good quantum efficiency in the blue could become available in the near future.

Despite its financial participation with Thomson, ESO is open to any other alternative solution to obtain large CCD arrays, and ready to test any other large format CCD which would be available on the market. The multi-purpose camera which is in development can be easily modified to control any other chip, only by programming a new RAM. In the next few years, the large 1024 x 1024 THX 31156 matrices could also be transformed for butting them together, as the THX 31157, to form large 2048 x 2048 matrices. We can therefore be rather confident for the future and think that, provided that the financial choices are made, large format CCD's will be available for use on the VLT instruments in the middle 1990's.

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- Vigroux, L., 1988, *Internal report on the thinned THX 7882*, CEA Saclay/Gif sur Yvette, France

DISCUSSION

Bessel, M.S.: *What is the likely cost of the new buttable CCD's? Will ESO sell 2x2 or larger joined matrices? Will ESO sell the controller (camera)?*

Prieur, J.L.: *THX 31156 would cost about twice the price of current THX 7882, so about \$ 3000. Though ESO is not a commercial company, special requests may be satisfied by discussing directly with ESO.*

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