the cluster redshift ($z = 0.3$). Most likely the majority of the variables are faint QSO's roughly in agreement with statistics of QSO's around 22^m (3) predicting approximately 1/3 object per CCD-frame.

After the first 5 runs we have been able to do 48 comparisons of fields. The expected number of SN I events in 2 according to the supernova-rate given above, but we have found non until now. Why? Part of the answer may be that although many of the clusters are really impressive some are less rich than Coma. One should also notice that the local supernova-rate is uncertain with a factor of 2 according to Tammann (private communication). Further, there is at present no evidence of the rate at earlier epochs of the universe.

This campaign will at the very least put important limits on the supernova rate at cosmological distances. A valuable spin-off will also be the nice selection of high quality cluster images, because sub-arcsecond seeing is not an unusual event at the Danish 1.5-m. However, the primary purpose is to discover SNe. The first season has convinced us that our technique works. If a supernova appears we will find it!

References

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NEWS ON ESO INSTRUMENTATION

On the Rates of Radiation Events in ESO CCDs

Radiation events (cosmic rays and local radiation) stand out in exposures taken with thinned CCD devices as spikes covering 1–4 pixels. Their intensities vary from about one hundredth electrons (the lower detection limit) above the background to a few thousand for the most energetic events. In front-illuminated, thick CCDs energetic particles can produce a short track of electrons as they cut diagonally through the silicon layer.

The number of radiation events per unit time is such that they contribute in a significant way to the noise in the astronomical data extracted from the CCD frames. In direct imaging they can be distinguished from stars on the basis of the point spread function. The problem is more serious for spectroscopic observations. In long-slit spectra where the dispersion direction is aligned with the rows or the columns of the CCD, the area where the sky is sampled can be efficiently cleaned with a median filter running in a window which moves perpendicular to the dispersion (RBLEMISH command in the ESO IHAP data reduction system). For spectra in the echelle format, the only effective way to identify the radiation events is by comparison of two, or possibly more, spectra taken with an identical configuration. Pixels affected by a cosmic ray in a single exposure can be sorted out and rejected when their signal value is compared with that measured on the average frame. Routines operating on this basis exist in both the MIDAS and IHAP data analysis systems. To achieve good cleaning without degradation of the astronomical data, it is necessary that parameters like sky transparency, seeing and sky emission line intensities do not vary too much during the sequence of exposures.

Billions of radiation events have been duly recorded by CCDs used for astronomy in the last 10 years, but being considered essentially a nuisance, little has been published on their rate or energy distribution. As a step towards a better understanding of this phenomenon, we have counted radiation events in a number of long (typically one hour) dark exposures obtained in the last four years with ESO CCDs both in the Garching lab and at different instruments at La Silla. We list in Table 1 the event rates derived from these exposures. Typical values for some of the ESO CCDs have been reported occasionally in the Operating Manuals of the instruments (CASPEC, EFOSC). The data collected here are more systematic and give the possibility to draw a few simple conclusions. A batch programme based on a filtering technique was used to identify the events with intensities larger then about 5 σ of the background noise. The rates are not very sensitive to the value of this lower cut, most of the events being of sufficient energy to be detected. No systematic difference is found between measurements at Garching and La Silla, with variations being observed in both directions at the 10–20 % level. The rates do not seem to correlate with the telescope or the instrument type. It is worth noting that

Table 1: *Radiation event frequency in CCDs*

ESO CCD Number	Type	Telescope	Instrument	Number cm^{-2} min^{-1}	No. Exposures
3	RCA SID 501 EX (thinned)	3.6 m	CASPEC	5.8	3
3	RCA SID 501 EX (thinned)	3.6 m	EFOSC	5.2	5
3	RCA SID 501 EX (thinned)	2.2 m	B & C	5.7	3
5	RCA SID 501 EX (thinned)	3.6 m	CASPEC	6.6	4
5	RCA SID 501 EX (thinned)	2.2 m	Imaging	6.1	3
6	GEC 8603⁺	2.2 m	B & C	1.2	2
7	GEC 8603⁺	2.2 m	B & C	2.1°	3
7	GEC 8603⁺	3.6 m	CASPEC	2.3°	2
8	RCA* SID 006 ES	3.6 m	EFOSC	5.2	2
12	TEK 512 M –11⁺	3.6 m	CASPEC	1.4	3

* 15 μm pixels ⁺ Coated to improve UV-blue sensitivity
° Possibly contaminated by electronic noise

the same CCD # 3 was used with dewar windows made of two different types of fused silica when on CASPEC or EFOSC (see Table 1). Event rates in RCA CCDs are relatively constant and a factor of 3–4 higher than in GEC and TEK CCDs. As the dewars are the same for all CCD types, the high rates are probably related to some radioactive component in the RCA CCD package, the support glass being the most likely candidate. It is not clear whether the difference between GEC and TEK is significant. The count rates in GEC CCDs may have been slightly affected by electronic noise which can imitate radiation events.

The values are very close to the low limits quoted by C.D. Mac Kay in his review article in the 1986 Annual Review of *Astronomy and Astrophysics*. The question remains open as to whether a fraction of these counts observed in GEC and TEK CCDs is still of local origin, and further tests are planned in the near future.

Astronomers who have measured or suspect that the event rates in their CCD exposures are significantly different from the values given in Table 1 are strongly encouraged to send their data to ESO for further analysis. It would be of particular interest to measure using the same algorithm rates from CCDs of different types and/or located at other Observatories.

S. D'Odorico and S. Deiries

New Technology Telescope Taking Shape

M. TARENGHI, ESO

As an intermediate step towards a very large telescope (VLT), ESO decided to design and build a New Technology Telescope (NTT) with a mirror measuring 3.5 m in diameter. This telescope will help reduce demand on the 3.6 m telescope and will offer an opportunity for practical testing of new ideas for telescope design.

The NTT project includes a number of innovations:

(i) thin primary mirror with active optical control of the mirror geometry,
(ii) active control of the collimation and of the focusing of the secondary mirror,
(iii) maximum exposure of the telescope to the external environment during observations (better seeing),
(iv) fast switching of the light beam between two different instruments,
(v) alt-azimuth mount with high pointing and tracking accuracy,
(vi) flexible and easy control system,
(vii) remote control,
(viii) rotating compact building.

The optical system is a Ritchey-Chretien type. The primary M1 as well as the M2 and M3 mirrors consist of Zerodur glass ceramic manufactured by Schott Glaswerke, Mainz, FRG. The meniscus shape and the diameter-to-thickness ratio of only 15 of the primary mirror is thinner than that of any other large optical telescope built in recent years.

The optical figuring is now being carried out by Carl Zeiss, Oberkochen, FRG. The optical quality specification to the manufacturer for the combined optical train (Nasmyth image) is 80 % of the geometrical optical energy within 0.4 arcsec. However, after correction with the ESO active optics support, the optics should maintain an image quality of 80 % of the geometrical optical energy within 0.15 arcsec.

The telescope mechanics is made of box-shaped parts in order to achieve high stiffness with low mass. The NTT is expected to have an eigenfrequency of about 8 Hz. The result is a structure with the turning part weighing approximately 110 tons. The manufacturing of the main steel structure and the assembly in Europe of the complete telescope is being carried out by Innocenti-Santeustacchio, INNSE, Brescia, Italy.

The azimuth axis is mounted on an axial multipad hydrostatic bearing of 3.5 metre diameter. The radial location is defined by an axially pre-loaded angular contact ball bearing. The altitude axis is mounted on large self-aligning internally pre-loaded ball bearings.

The function of the azimuth axial hydrostatic bearing system is to provide a stiff support and to allow the accurate and low-friction rotation of the telescope fork on the supporting ring. This is accomplished by using an oil low-pressure, multipad (24), hydrostatic bearing with a large carrying surface. In addition to the low-pressure design of the hydrostatic supports, which allows for a low consumption of oil and a limited temperature increase of the oil in the pads, an active, high-acccuracy oil temperature control system avoids major exchanges of heat between oil, telescope structure and environment.

The two axes of the telescope are both controlled by a group of four servodrives. The altitude drive system is composed of two toothed wheels, one

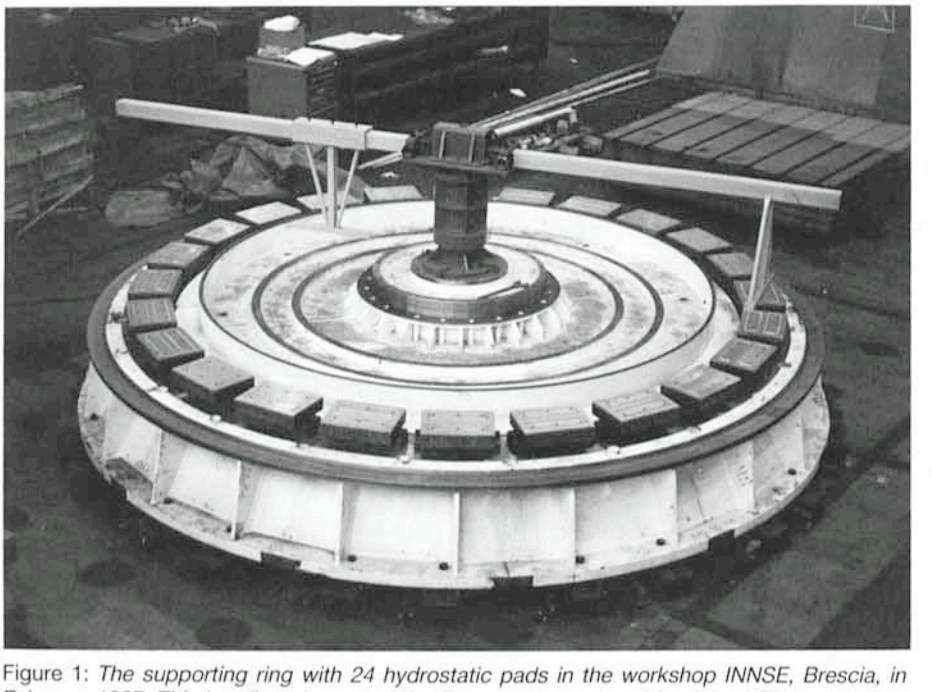

Figure 1: *The supporting ring with 24 hydrostatic pads in the workshop INNSE, Brescia, in February 1987. This is a first element of the European pre-assembly of the NTT.*