

CUBE 400c

Representative of a New Species of Black-And-White Films. Made in Germany

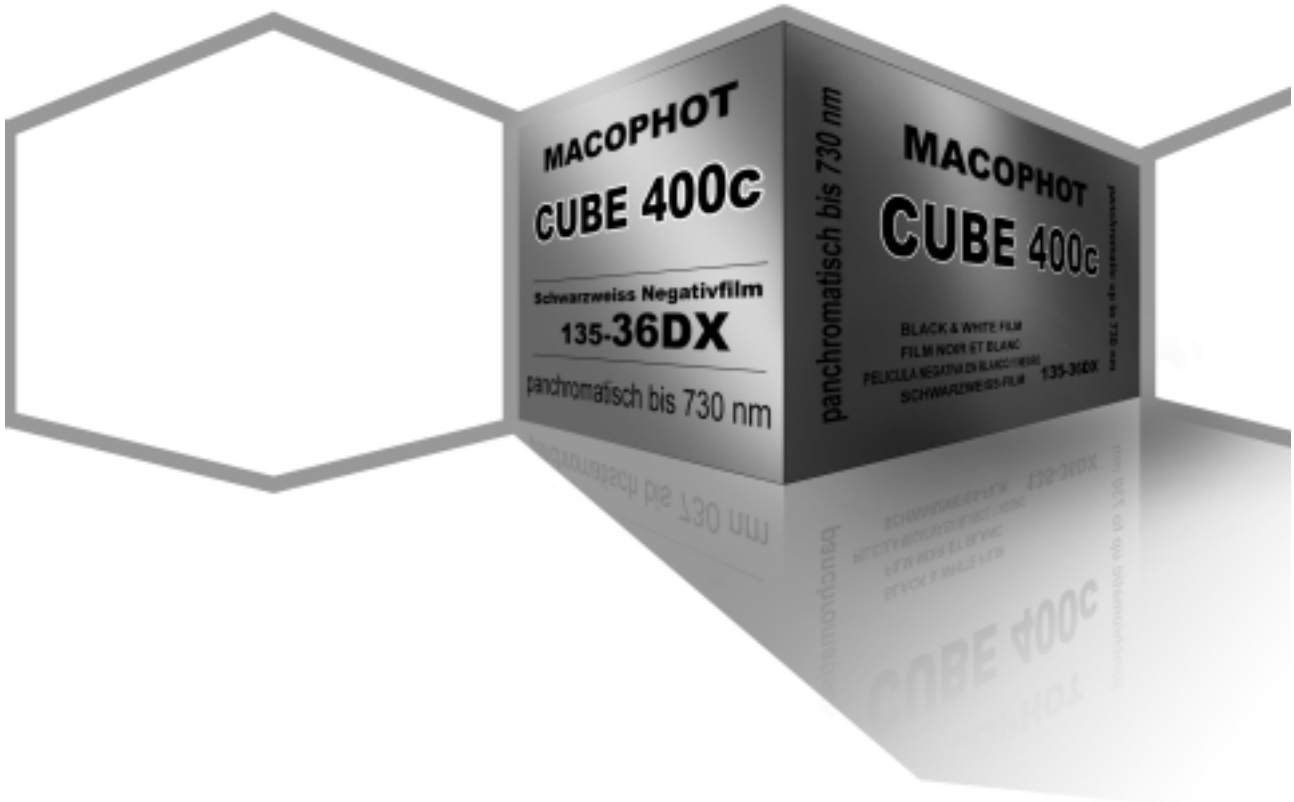


Photo: © 2003 Axel Beckmann

Convincing Characteristics!

- fine grain
- excellent tonality
- flexible use
- effective speed between iso 100/21° and iso 6400/39°
- robust, dimensionally stable, and archivally sound film base

MAGCO
PHOTO PRODUCTS



01_Properties and Application

MACO CUBE 400c is a fast to ultrafast, sharp black-and-white negative film on the basis of classic, cubic crystals. Its sensitisation extends up to about 710 nm. The emulsion of this film consists of three extremely thin emulsion layers, each consisting of different silver halides and having a different speed. This technology allows for extreme adaptation of film characteristics through the choice of developer and development time. MACO CUBE 400c makes use of the entire range from fine-grained images at medium effective speed (ISO 100/21°) up to ultra-fast images (ISO 6400/33°) with considerably improved shadow detail and finer gradation than conventional pushed films.

As a further speciality, the anti-halation backing of MACO CUBE 400c has been coated directly onto the base. This feature improves sharpness by preventing reflections rather than weakening them once they occur.

MACO CUBE 400c is suitable for all types of pictorial applications. We place particular emphasis on its suitability for portrait, stage and available light photography. The film can be processed in all types of black-and-white developers; however, the type of developer exerts a more pronounced influence on the characteristics of the film than it does with other films.

The clear base material allows to use the film for black-and-white transparencies. The polyester base offers the highest standard with respect to archival stability.

02_Formats

35mm roll film	perforated, 135-36 & 30,5 m	
Roll film	120	
Cut sheet film	4 x 5 in	25 sheets
	8 x 10 in	25 sheets

03_Technical Data: Overview

Sensitisation

Extended panchromatic, approx. 380 nm to 710/730 nm

Speed

Nominal speed ISO 400/27°

Effective speed can be varied between ISO 100/21° and ISO 6400/39° through choice of developer and developing time

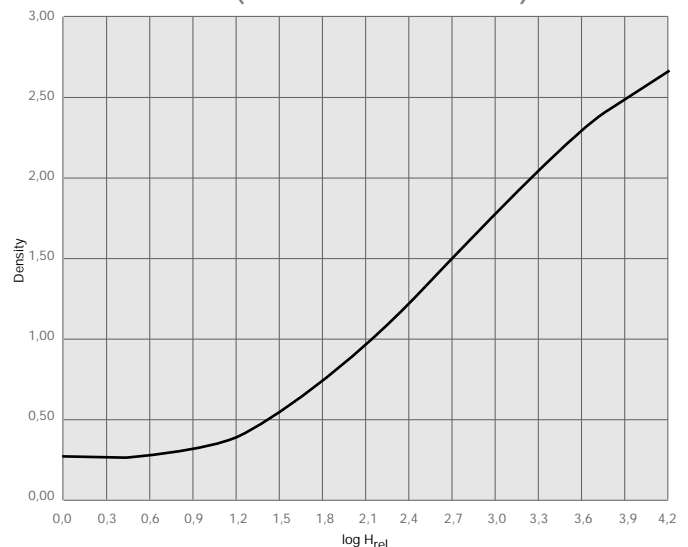
Base material

- 35 mm roll film: Polyester, 100 µm, blue
- Roll film 120: Polyester, 100 µm, blue
- Cut sheet film: Polyester, 175 µm, blue or clear

Resolving power

100 Lp/mm at nominal speed and a contrast of 1:1000

H & D Curve (Characteristic Curve)



04_Storage of Unexposed and Exposed material

As is common with photographic material, it is recommended to avoid exposure of the film to direct sunlight, intense heat (storage in a car) or high humidity.

Storage under refrigeration is possible. Films that were stored under refrigeration should be allowed to reach thermal equilibrium with the environment before being taken from the storage container. When the film is considerably colder than the ambient air, condensate may form on its surface.

05_Loading of Camera

It is recommended to load MACO CUBE 400c into your camera under subdued light, using your body to protect the film from direct sunlight when changing films out of doors.

Complete darkness is required when loading cut sheet film backs.

The polyester base is much more resistant to tearing than common triacetate bases. As a side effect, the stiffness of the material is also greater. With medium-format roll films this may cause the roll to spring open when the paper tag holding it closed is removed. It is therefore recommended to hold the film roll at its centre, securing it against springing open, rather than hold the ends of the spool.

Avoid applying excessive force when advancing the film (e.g. when unexpectedly reaching the end of the film). While conventional triacetate films will just tear when this bad practice is used, MACO CUBE 400c will not usually tear. As a matter of consequence, the entire force acting on the transport lever has to be taken up by the camera mechanism, possibly damaging it.

06_Exposure and Speed

The speeds given for specified combinations of developer and developing time, are primarily daylight values (5 400 K). Due to the extended red sensitivity of MACO CUBE 400c, (see curves at annex) the effective speed may be slightly higher under tungsten hot lights and when the sun is low.

When no exposure meter is available, the following values, based on the nominal speed of ISO 400/27°, may be used for guidance for unfiltered exposures. Where film speed is changed, modify these values accordingly. It is recommended to bracket from one f-stop below the value given in the table to one f-stop above.

Sunshine in mountains	1/500 s, f/22
Beach or snowy landscape in bright sun	1/500 s, f/22
Bright sun (so-called 'Sunny 16 Rule')	1/500 s, f/16
Sunshine and haze	1/500 s, f/11
Cloudy, sun shining	1/500 s, f/5,6
Cloudy, open shade	1/500 s, f/5,6

07_Metering Technique

'Correct' exposure can be determined using various methods the description of which is beyond the scope of this publication. Note, however, that in spite of the unique pushing characteristics of MACO CUBE 400c, increasing the effective film speed by prolonging development will increase contrast, too. Accordingly, appropriate metering technique must be used when using effective speeds higher than the nominal speed of ISO 400/27°. While standardized film speeds are determined on the basis of the minimum exposure needed to produce a specified negative density, i.e. on the basis of shadow exposure, effective speeds, also known as exposure indices (EIs), are based on midtones. This means that particularly when working with increased speeds, selective metering of the light reflected by the midtones (skin tones, 18 % grey) is recommended. Incident-light metering is considered equivalent. Bracketing important shots one f-stop over and under the measured value is recommended in addition, also as an insurance against meter deviations.

08_Filter Factors

Filters block part of the light. This means that with a filter, exposure must always be increased with respect to unfiltered exposures.

Filter	Multiply exposure time by this factor	Open f-stop by this number of stops
Yellow (#8)	1½ to 2	½ bis 1½
Dark yellow (#15)	2 to 3	1 to 1½
Yellow/Green (#11)	2 to 3	1 to 1½
Orange (#21)	3 to 4	1 to 2
Red (#25)	4 to 8	2 to 3
Dark Red (#29)	8 to 16	3 to 4

These values apply to daylight exposures. Tungsten light contains more red light than daylight. Consequently, yellow, orange, and red filters block out a slightly smaller portion of it. Reducing the extension factors for the exposure times by 0,2 to 0,5 or reducing the f-stop correction by ½ to ½ stop is recommended in such cases.

09_Long Exposures and Reciprocity Failure

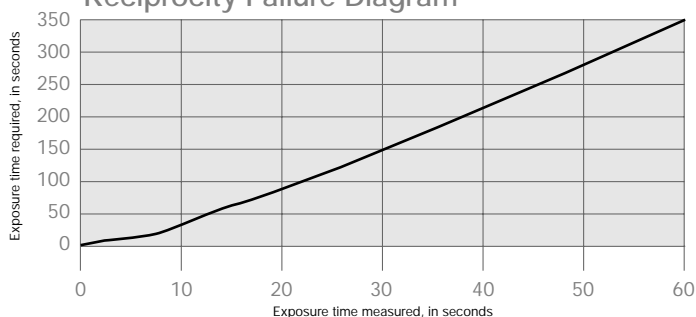
The reciprocity law, stating that the exposure will remain the same when the shutter speed is doubled and the aperture closed by one f-stop, is only true for films where shutter speeds are neither too short nor too long, typically between $\frac{1}{2}$ s and $\frac{1}{1000}$ s. Whenever exposure times are very long, the so-called reciprocity error, or Schwarzschild effect, is encountered. Where the exposure meter indicates an exposure time of, e.g. 4 s, the time actually needed can be assumed to lie between 8 and 10 s. The following corrections may be used for guidance.

Time measured [s]	Time actually required [s]
1	2
2	4
4	10
8	20
15	60
30	150
60	350

In case of important images, the photographer should expose one frame at the selected f-stop and the corrected exposure time, and two more frames at the same exposure time, one each with the aperture closed and opened by one f-stop with respect to the first frame. Bracketing by adjusting the aperture has the advantage of not requiring a new calculation of exposure time.

Reciprocity error will result in increased contrast as the corrections for highlights are less than those for shadows. Films with long exposure times will therefore often profit from compensating development, as, e.g., with LP-SUPERGRAIN.

Reciprocity Failure Diagram



10_Travelling with Films

MACO CUBE 400c films are relatively robust with respect to storage conditions. Precautions required with infrared films (refrigeration, loading of camera in complete darkness) are not required. Storage in a not-too-hot, dry place is recommended for all photographic material.

11_X-ray Baggage Check at Airports

X-ray machines at airports, when labelled "filmsafe", could be shown not to have any detrimental effect on films, even in case of multiple exposures (up to 5 times). Problems may be expected, however, when films are transported in checked baggage. The intensity used to x-ray a checked piece of luggage will be increased automatically if it contains any object that is not easily penetrated by low-intensity x-rays (such as a.c. adaptors or electronic devices). The higher dose used in this case may not be film-safe any more. It is therefore recommended to transport films in your cabin luggage.

Films processed to very high speeds (starting at approximately ISO 1600/33") are an exception. Even weak irradiation in machines labelled "film-safe" may cause fogging and a loss of shadow contrast. Asking the security personnel for manual control is recommended for such films.

12_Processing by Commercial Laboratories

Films exposed at nominal speed can be handed in to any conventional photographic laboratory. In case of over- or underexposure, specialised laboratories are recommended. These require a pertinent note with the film in order to be able to compensate for over- or underexposure by modifying the development time. The developers used in such laboratories are mostly fine-grain compensating developers, which offer a good basis for optimum results.

MACO CUBE 400c being the representative of a new family of black-and-white films, the laboratories developing the films should observe a few rules:

- Store film in the black polyethylene canisters at all times.
- Take out of container immediately prior to processing, and feed into tank or machine taking into account the sensitivity which extends beyond 700 nm.
- Avoid hot drying, if possible. Cold drying is recommended.
- Do not use conventional wetting agent. Special wetting agents, such as LP-MASTERPROOF, are strongly recommended for polyester-based films.
- Return black canister to the photographer.

13_Loading 35-mm Film Into Development Reels

MACO CUBE 400c 35-mm film is delivered in metal cartridges with weld-on and clip-on lids. Opening the cartridges with weld-on lid requires an appropriate tool. Opening by hand is not possible. As mentioned before, the polyester base used for MACO CUBE 400c is much more tear-resistant than common triacetate. It is not usually possible to tear the film end from the spool. When loading MACO CUBE 400c into development reels, either in the darkroom or in a changing bag, a pair of scissors is therefore required.

14_Prewashing/presoaking

MACO CUBE 400c has a water-soluble anti-halation backing. In order to remove this backing, and to improve (actual) film speed and uniformity of development by furthering uniform swelling of the gelatine, presoaking the film for 30 to 60 s under constant, not excessive agitation (invert once every 2,5 to 3 s.), and using water at approximately the same temperature as that intended for subsequent processing steps is urgently recommended.

Experiments have shown that presoaking will increase actual film speed by up to one f-stop in MACO CUBE 400c. Presoaking is therefore strongly recommended.

Note: Having resolved the water-soluble AH backing, the wash water will be blueish when poured out of the tank. This is normal. One washing cycle, as described above, is sufficient. It is not required to wash until the wash water does not show any more signs of dyes.

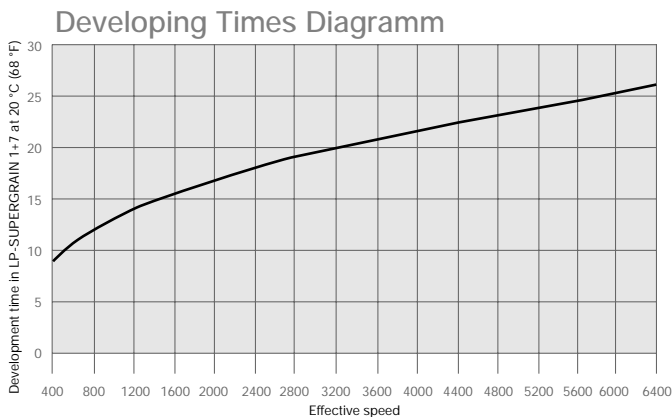
15_Developers and developing times

The development times given below are approximate starting values for optimisation by the user. They were determined for a gamma of 0,65 as considered convenient for enlargers with diffuse lighting systems. The particular way in which the user develops may require these values to be modified.

Due to the unique emulsion design of MACO CUBE 400c, the developer has a strong effect on film speed, grain and sharpness. Choice of developer and developing time allow variation of the effective film speed over an extreme, as yet unequalled range.

MACO CUBE 400c is particularly suitable for low-light photography. Appropriate development allows for effective speeds up to ISO 6400/39°. Grain will then necessarily be coarser. The times for LP-SUPERGRAIN 1+7, given in the table below, are represented in a graph in 10.2. The curve will allow the interpolation between the standard speeds. The following developers could be shown to yield particularly favourable results:

Desired effect	Developer
Finest grain and ultimate sharpness	LP-CUBE XS
Best use of speed and optimum sharpness	LP-SUPERGRAIN Champion Promicrol
Good image quality, nominal speed	Kodak D-76 Ilford ID-11



Developing Times

The development times given apply to film presoaked as recommended in 8.2. The processing temperature is 20 °C, agitation is one inversion every 30 s, unless specified otherwise.

Developer	Effective Film Speed	Developing Time in minutes
LP-SUPERGRAIN 1+7	100*	7
	200*	8
	400	9
	800	12
	1600	15,5
	3200	20
LP-CUBE XS 1+4	6400	26
	100	20 (24°C)
	200	21 (24°C)
Kodak D-76	400	10
Kodak HC-110 Dil. B	400	14
Kodak Xtol 1+2	200 bis 400	22,5
Ilford ID-11	400	10
Ilford Perceptol	400	14
Champion Promicrol 1+14	400	14
	400	10 (24°C)
	1600	21
	1600	15 (24°C)
Champion Promicrol 1+9	400	10
	400	6,5 (24°C)
	1600	14
	1600	9,5 (24°C)

* Reducing effective film speed by curtailing development is possible, but not optimal. Image quality will be better, grain finer, when special developers like LP-CUBE XS are used.

16_Temperature on Processing Time

Generally, where a high degree of reproducibility is required, it is recommended to process all films at the same temperature, usually 20 °C (68 °F). Where other temperatures must be used, the following corrections are recommended.

20°C	No correction
21°C	-5%
22°C	-10%
23°C	-15%
24°C	-20%
25°C	-30%

17_Stop Bath

The stop bath primarily serves to neutralise any alkalinity retained by the film in order to prevent a loss of fixing-bath activity due to increasing pH values. An acid stop bath between alkaline developer and acid fixing bath is not mandatory when processing films.

The following recommendations can be given for the use of stop baths.

Stop Bath	Time in minutes
LP-CITRIN 1+19	1
LP-Citrodur 1+16	1
LP-ECOSTOP 1+7	1

Where a stop bath is not used, two intermediate washing cycles of 30 s each, at 20 °C (68 °F) and permanent agitation, are recommended to avoid the carryover of developer into the fixing bath.

18_Fixing

LP-FIX SUPRA 1+7 to 1+9, a modern high-speed fixing bath based on ammonium thiosulphate, is recommended for MACO CUBE 400c. Ilford Hypam 1+4 is similarly effective.

Testing the clearing time of the fixer prior to fixing the film is recommended. To this end, use an unprocessed piece of film (like the film leader) and stop the time between its immersion in the fixing bath and the moment when it turns completely clear. Three times this time is the fixing time. If fixing baths are re-used, the clearing time will increase with each subsequent film processed. The bath should be discarded when the clearing time reaches twice the time measured with a fresh bath.

Fixing is most effective when the two-bath method is used. This method consists in preparing two identical fixing solutions which are stored in separate containers. The film is first fixed for half the fixing time determined as described above. The first fixing bath is then poured back into its container, and the film is fixed in the second bath for the remaining half of the fixing time. When the determination of the clearing time shows that the first bath has reached its usable capacity, discard the first bath, replacing it by the second one, and prepare a new second bath. This method allows to make good use of fixer capacity while still ensuring safe fixing.

Where clearing time is not measured, fixing for three minutes at 20 °C (68 °F) is recommended.

19_Washing

Washing with running tap water can only be recommended where a supply temperature of approximately 20 °C (68 °F) can be ensured. This is not usually the case in common household systems. In such cases, cascade washing in a fixed volume of water at 20 °C (68 °F) is safer and saves water. The following procedure is recommended:

- 1_ Fill tank with water at 20 °C (68 °F) , invert five times, allow to sit for 5 min.
- 2_ Change water, invert 10 times, allow to sit for 5 min.
- 3_ Change water, invert 20 times, allow to sit for 5 min.
- 4_ Pour out water, finish by applying wetting-agent bath.

The base will remain blue even after complete washing

20_Wetting Agent

A final bath in demineralised, deionised, or distilled water (battery water) is recommended in order to avoid drying marks caused by water hardness and to reduce static charges. Static charges will cause the film to attract dust particles.

It is recommended to use LP-MASTERPROOF 1+200 to 1+100 for one minute, without agitation. (This will avoid the formation of foam, see below.)

Overdosing wetting agents must be avoided. Wetting-agent solutions can only be re-used if several films are processed in one session.

Foam tends to stick to the film surface and will hardly run off. Avoid foam formation when preparing wetting-agent solutions by adding the water slowly. It is convenient to prepare the wetting-agent solution along with the developer. Any foam produced when preparing the solution will then have time to decay before the solution is needed.

21_Drying

Squeegeeing films is not advised as there is a great chance of scratching negatives. Following the wetting-agent treatment, with the film still in the reels, try to shake off as much of the surface water as possible. Then remove the film from the reels and hang it to dry in a dust-free environment for several hours, e.g. over night. Particularly in the case of 120 roll films on polyester bases, it is important that a weighted clip is attached to the lower end of the film in order to improve flatness of the film when dry.

Background information: Common film bases made of cellulose triacetate tend to shrink (up to the point where the emulsion comes off the base) and deteriorate when stored under unfavourable conditions. The Image Permanence Institute has shown that severe damage may occur in as little as 5 years if film is stored in humid, warm environments. This danger does not occur with polyester-based films. Polyester is highly resistant to influences from the environment, dimensionally stable, and offers greater mechanical stability than triacetate. However, polyester bases tend to retain the curvature imparted upon them in manufacture unless forced to lie flat by tensioning over several hours, optimally by using a weighted clip during drying. Using reasonable weights (up to several kilograms), there is no need to be concerned about tearing the film apart. Make sure that the film is suspended firmly at the top end. However, do not use perforating film clips as holes will tear too easily when the film is tensioned using a heavy weight. When drying films in a drying cabinet, it is recommended not to activate the heating.

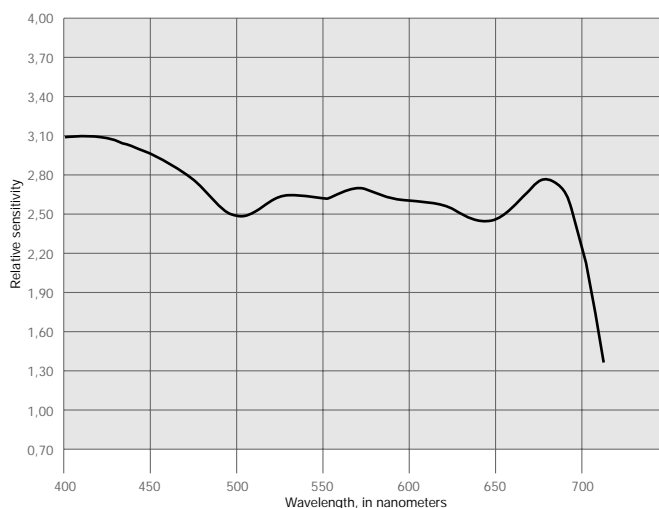
Drying using a hairdryer is not recommended, as, lacking a particle filter, hairdryers will tend to blow dust particles onto the wet, and still sticky surface of the film. Particles adhering to the film like that are difficult to remove without afflicting damage to the film.

The slightly blue colour of the base should be compensated by appropriate yellow filtering when using variable-contrast paper. This will improve shadow contrast.

22_Enlarging

The slightly blue colour of the base should be compensated by appropriate yellow filtering when using variable-contrast paper. This will improve shadow contrast.

23_Sensitisation



24_Scanning Negatives

Its clear base makes MACO CUBE 400c particularly suitable for scanning by film scanners and flatbed scanners with transparency adapter. Proceed as described below to make optimum use of the wide density range of the film and its excellent tonality. For specific details of the steps listed below see the manual of your scanning software.

- 1_ Carry out a preview scan of the negative. Crop the area to be scanned in such a way that the unexposed film rebate is excluded. This serves to keep unexposed areas from influencing the histogram, allowing to distribute pictorial densities over the entire bit range. Where the rebate is to be scanned as part of the image, this can be done after the exposure has been adjusted as described in step 3. It will be safe to appear black in the scan then.
- 2_ Specify resolution and colour mode. Unless a small file is needed for a special purpose, best re-sults are usually obtained at the highest resolution. The same usually applies to gradation: If your scanner can output files with a bit depth of 16 bits (or even higher), use this option. Any reduction in resolution, optical or in tonal values, should only be carried out at the last stage, i.e. prior to output. Some photographers claim that even black-and-white negatives should be scanned in colour mode, and that the conversion to grey-scale mode should only be performed in the image-processing software.
- 3_ Using the preview histogram, adjust exposure and contrast of the scanner in such a way that the range of densities used in the image is distributed over the range of pixel values available (i.e. 0...255 in the case of 8-bit scanning). This excludes that density range of the negative not used for pictorial effect (densities below fog density and above the highest density used in the image), allowing the useful range to be distributed optimally over the available range of greys. Although adaptations are still possible in image-processing software, this step is still important as substantial modifications of contrast in the image processing software can give rise to spikes and gaps in the histogram, which show as posterization and banding in the final image. Fine-tuning, on the other hand, should not be performed in the scanner software. It should, as a rule, be done in the image-processing software where a larger and clearer preview is mostly available.
- 4_ Scan the negative using the settings made as described above. Please note that image cleaning and repair features (dust and scratch reduction) on the basis of infrared scans will not work with silver-based negatives. These features were developed for colour film. In the case of black-and-white photography, they are only useful with chromogenic films because they require the image to be infrared-transparent. This is not the case for silver images. Unsharp masking during scanning is not recommended as it tends to increase the image granularity. If you do wish to use the 'Unsharp masking' feature, save this step for the image-processing software where fine-tuning of the effect is easier.

MACO Black-and-White Products

Negative Films

MACO UP 25p
MACO UP 100p
MACO UP 400p

Clear-base Negative Films

MACO IR 750c
MACO IR 820c + AURA
MACO CUBE 400c
MACO ORT 25c
MACO TP 64c
MACO PO 100c

Special-purpose Films

MACO GENIUS film (Lith film)
MACO GENIUS PRINT film (Line film)
MACO TSX 730c (Traffic surveillance film)
MACO PET 400c (Security camera film)
MACO EM + ES (Electron microscopy film)

RC Papers

MACO Multispeed 1F + 2M
MACO Macospeed 1F
MACO Lithpaper RC-F
MACO expo Ag (Silver metallic)

Barytpapier

MACO expo RF (to be replaced by ORIENTAL New Seagull G)
MACO Multibrom F (to be replaced by ORIENTAL New Seagull VC-FB)
MACO Multibrom WA (to be replaced by ORIENTAL New Seagull VC-FB-WT)

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»» *With my students, I like to explore unknown terrain, and quite frequently – even in digital times – we test different films. CUBE 400c, which I thought I knew pretty well, surprised me once again. Just as the T-grains rang the bell for a change of paradigms 10 years ago, a representative of classical cubic crystals offers a progress that I see as a further change in paradigms. In addition to the extremely high speed, it was the good results in terms of sharpness and grain that surprised me. But first of all the finely graduated tonal rendition and pleasing rendition of skin tones convinced me. This film is the ideal supplement to the slow films from Agfa and Maco, which I otherwise prefer.* ««

Bernd Wille, Assistant Professor at the University of the Arts, 10823 Berlin, GERMANY

»» *I wouldn't have thought it possible that MACO of Hamburg could perform such a pioneering effort with a new b&w film. Trying it, I was convinced by the quality of this new film. The manifold applications make it a perfect allrounder that belongs in every photographer's bag from now on.* ««

Marcel Paulet, 4750 Bötgenbach, BELGIUM

»» *New MACO CUBE 400c gives my demanding customers the best possible chance to obtain excellent photographic results even under the most difficult lighting conditions. MACO CUBE 400c can be pushed considerably without getting too contrasty, all the while keeping surprisingly fine grain. The excellent rendition of skin tones allows us to make creamy enlargements in superb quality – a quality we believed was long gone. Our claims to high quality in classical b&w photography can be realised convincingly by using MACO CUBE 400c.* ««

Robin Gehm, Manager, blow up SW-Fotofachlabor GmbH, 80469 Munich, GERMANY

»» *Dear Mr Schröder, I was able to take the opportunity to experiment with the new films in churches in my region, exposing them at ISO 50/18°. I developed the films as follows: prewash at 24°C for 1 minute, inversion development in LP CUBE XS, 1+4, 19,5 minutes at 24°C in a water bath. Stop was LP CITRODUR 1+16 for 30 seconds. Fixed in LP-FIX SUPRA 1+9, 6,5 at 24°C, washing as prescribed. Then the wetting agent for 1 minute at 1+200. The films were then air-dried with a heavy weight at the end to improve flatness.*

I was dumbfounded by the results. Looking back at 53 years of amateur experience I hadn't expected such extremely positive results. I noted with interest that the reciprocity correction data were confirmed in this test. I exposed between 45 and 240 seconds. The negatives are spot-on. As to the density, visually, I presume that the blue base contributes to making the negatives look "different". Anyway, the negatives are perfect, in the shadows as in the highlights. Congratulations, Mr Schröder, on this allrounder! ««

Alfred Schumacher, 6960 Malmedy, BELGIUM



Photo: © 2003 Axel Beckmann

vita: **Axel Beckmann**
origin: born 1967 in Kleve/Niederrhein, Germany
profession: optician
Since 1982, several seminar trainings of the professional photographer Fritz Getlinger, since that I tried to find my own style, mainly in architecture, bridges and landscape, with various camera systems. The most exciting discovery I made with B/W Infrared Photography. In connection with my favorite camera Voigtländer Bessa L and Ultra Wide Heliar 12 mm I have finally the ideal instrument to express my conceptions, which especially have dramatic character. Ideas and suggestions are welcome.
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