The view across the Grisons countryside is magnificent – mountains, meadows, vineyards. The close-up presents a stark contrast to this idyllic picture: heavy diggers trundle through the rubble, hack away rock and load it onto trucks with wheels as high as a man. It is loud and dusty. Hard graft in the quarry of the cement works at Untervaz.

Up on the ridge, in hard hat and short sleeves, stands Mathias Märki and emphasizes his explanations with vigorous gestures. His topic: how high quality cement is produced from the raw materials of limestone and clay marl which are being extracted beneath his feet (see picture below).

**Everything depends on the rock**

Mathias Märki is the right man to explain all this. His job at the Grisons plant of the Holcim building materials company – global number two in the industry and widely known under its old name of Holderbank – is to ensure maximum quality at all stages of cement production. He leaves no doubt as to how this is to be achieved: “We aim to automate our operations as much as possible”.

The place at which he stands offers this engineer in his mid-thirties an excellent opportunity to explain how software can permeate such a “physical” activity. For the Alpine rocks extracted from Untervaz quarry have a heterogeneous consistency which make them a tough nut to crack for cement production. And all the subsequent production steps depend directly on the starting material: “The more reliably we know the mixture which is extracted here, the more accurately can we optimize the entire process”, says Märki.

As a quality manager, he is both a chemist and a mechanical engineer, but not a geologist who would be able to “read” the proportions of calcium or quartz from the mountain. But he has no wish to do that anyway, as it would fall short of his requirements. If the analysis was...
based purely on empirical values, the leeway for undesirable fluctuations in the rock composition would be too great, he points out. Instead, he says: "We are going to automate what used to be done by intuition".

**Software in the quarry**

Change of scene. Down below in the sober works office Mathias Märki explains the theory which will turn what he has been saying into reality: it centers on AutoLab, the Industrial IT solution from the ABB company (see ‘Swiss trial by automation’).

At the moment it’s all at the theoretical stage because the basic installations for the laboratory automation are still being implemented, so that no samples are yet being taken from the hard-to-tackle quarry. This is not expected to happen until 2002, when a dense web of sensors will have been put into place and the number of sampling points has been extended from the present five to ten. For the condition of the material used to make the cement must be apparent at every phase of the manufacturing process – "That makes it easier for us", says the man who is committed to quality, "to get things just right". In concrete terms this may mean adding corrective chemical components such as silicon or iron to the raw material in the exact doses required to achieve the best end product.

However, AutoLab is only one of several IT aids employed in the endeavor to get things right. This is
because the IIT application is part of a family originating from ABB whose members have selected Untervaz as their preferred field of activity. LinkMan has been optimizing the combustion process from as long ago as 1993, and most of the 1,500 or so motors and installations of the cement factory are linked to the TIS information system.

Steep rise in data volumes

“There’s always been a pioneering spirit here,” notes Mathias Märki. That’s firstly because of the challenges presented by the tricky rock situation: whoever succeeds here acquires irreplaceable know-how – “ABB is aware of that too.” Secondly, Untervaz used to be the private works of Holderbank doyen Max Schmidheiny, whose ambition was to run an exemplary plant.

However, the comprehensive automation portfolio introduced in recent times is neither a means to an end nor a whim of the quality manager, but a vital necessity. “Although cement manufacture might seem to be such a solid business, it’s incredibly hard to get to grips with,” says the Holcim expert. This is largely due to the fact that the intermediate product, namely clinker, is no longer heated only with coal but with alternative fuels such as dry slurry or plastic waste. Each of these materials, which often arrive at irregular times, has specific properties which require a flexible response. On-line access to relevant information – thanks to LinkMan – also helps to make correct decisions here.

In addition to the greater complexity of the technical process, the environment has also become more demanding. This applies specially to environmental issues: customers want to know that their cement is not polluted with residues from alternative fuels, official agencies insist on certificates proving that the specified emissions are not exceeded. All this is looked after by the LIMS system, also currently being set up at Untervaz: it can output core parameters relevant to the environment in a suitable form. As a rule, the following applies to the industry: “Administrative loads are increasing throughout the industry. So we must be able to manage and compare ever larger volumes of data”.

Clean IT instead of dry throats

Helmet on head and a move to yet another location. It’s blistering hot next to gigantic Kiln 1, which rotates 24 hours a day, so we’re happy to leave it behind us. Even a little further on where the freshly formed clinker clatters through the hot-meal mill, one’s shirt sticks to one’s body, and the omnipresent dust
scratches one's throat. In this environment, a worker is doing a manual job which will be performed fully automatically in future: he removes a small amount of cement meal from the production plant, places 50 grams of it onto a set of scales and analyzes the material in a stuffy laboratory room to determine its composition.

Less than a hundred meters away as the crow flies we see a total contrast. The brain of the plant, its command center, where high-tech blinks from some twenty monitors. A still-empty room can be discerned through the glass partition. Mathias Märki explains: "That's where the robot laboratory is going to go". AutoLab should be fully operational by the end of the year. The laboratory automation unit will then be integrated into the LIMS management system – true to the basic motto of Industrial IT to network isolated solutions together in a productive way. For the quality manager, "productive" means "where information from one sector controls the processes in another one". A classical example of this is the linking of AutoLab with the expert system known as Raw Meal Proportioning (RMP), another ABB product used in Untervaz, which balances out the fluctuations in the rock composition in an earlier process phase, fully automatically of course.

"We're on the point of advancing into a new dimension of automation," sums up Märki as he bids me farewell near the works gate. Above in the quarry the truck drivers continue to trundle through the grimy rubble: a job for which no clean software is yet available.

Swiss trial by automation

The order for automating the laboratory of the Untervaz cement works has top priority at ABB: project head Hans-Joachim Lau from the building materials section talks about the challenges and the importance of this reference installation located at his doorstep.

"If we are successful in Untervaz, then customers around the world will know that ABB can automate the quality processes of any cement works," says Hans-Joachim Lau, the brain behind the AutoLab application (see main text).

The fruits of dedicated effort

It was by no means obvious from the beginning that the Holcim works near Chur could become a reference plant for ABB. Sure enough, ABB and Holcim have been working together in the sector of integrated information systems for almost a decade, and the entire range of applications is in use in Untervaz (see diagram). However, specialist suppliers such as Polysius and FLS were ahead in the automation of laboratory analyses, provisionally the last link in the system chain.

"We pulled out all the stops on all fronts to land this 2.1 million order," recalls Lau, referring to the involvement of the top management, the performance of specialist preliminary and development work as well as an intelligent choice of partners. Moreover, the benefits of having all the automation systems come from the same family
were clearly apparent: interface problems are eliminated from the outset, completely in line with the policy of Industrial IT.

Start of operations in November
This strong commitment by ABB underscores the strategic importance of Untervaz for the company. “On the one hand, ABB needs a local reference plant”, explains the graduate process engineer. “… and secondly the heterogeneous rock composition in the quarry makes enormously high demands on automation.” Challenges which the project head and two software engineers are happy to face – if necessary with the support of additional specialists.

The installation work is already in full swing: the pneumatic conveyors along which the automatically removed samples will be transported for preparation and analysis to the fully automated laboratory began to be installed a short while ago. The laboratory itself will be set up in October, ready for operation in November. Hans-Joachim Lau is looking forward to it with some excitement and no trace of stress: “We are completely on schedule, everything is running well, we are supplying good technology and I see no insoluble problems.” The constructive relationship with the customer certainly contributes to the good working atmosphere. The whole process has taken place in a spirit of harmonious give-and-take.

Reference plant for ABB and Holcim
And there’s no reason for that to change in the new year. If customer Mathias Märki is satisfied with ABB’s performance, further automatic sampling stations could be implemented in Untervaz to a value of half a million francs.

The significance of a successful completion of the overall order is even more far-reaching for the section within the process industry division concerned with the building materials industry: Holcim also plans to use its Grisons cement works with the IIT automation solutions from ABB internally as a demonstration plant. And with a view to possible follow-on orders which can be discerned on the horizon, Hans-Joachim Lau points out that: “Holcim has plants in 70 countries, and so far none of them is equipped with AutoLab …”

Untervaz in brief
- Started operations: 1957
- Workforce: 108
- Production output 2000: 686,000 tons clinker, 719,000 tons cement
- Rotating kiln 1: 68m long, 4.5m wide, daily capacity 1960 tons
- Rotating kiln 2: 50m long, 3.6m wide, daily capacity 790 tons
- Proportion of alternative fuels: 37%