

Report on the
EUSAS-workshop

"Intrusion Detector Testing (IDT)"

9-10 October, 2003
at University Duisburg-Essen

hosted by Siemens Gebäudesicherheit, Munich



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1 Aims and Objectives of the Workshop

National standards specifying the functionality and test requirements for volumetric intrusion detectors exist since many years in several countries. However, in the mid 90's a definite lack was seen concerning the consistency in the requirements between the standards and vastly different test methods. None of them could provide an adequate level of reproducibility for type approval testing. Manufacturers used test methods and equipment for checking performance parameters of their products. However, such equipment was designed for use with their own products and could not be used universally for all detector types throughout Europe.

At that time a standard on intrusion alarm systems was in preparation by Working Group 2 of the Technical Committee TC79 of CENELEC. But WG2 was not able to provide the necessary resource required to develop such tests. In this situation it was decided to ask for the support of the European Commission for a corresponding project called Intrusion Detector Testing, in short IDT. In 1998 a consortium consisting of several manufacturers and all major European test laboratories took over the initiative for this development task.

Last year this task was completed with an exhausting test series on the final prototype of the IDT equipment. A draft proposal for a corresponding test procedure was set-up. In addition it was shown how the system could be adapted to future needs (for the test of future intrusion detectors including those with video sensors). But up to now, neither the technological concepts, benefits and disadvantages, the restrictions in application and options for the future nor the aspects of usage in the product line or in the R&D labs of manufacturers was sufficiently discussed among the experts on an European level. The EUSAS workshop shall provide a platform for this discussion on all important issues. Thus a solid basis for the future exploitation (or not) of the IDT system shall be found.

The IDT system initially was developed as a service for the work of TC79. Therefore, it is important to extend the discussion on pure technological aspects also to standardisation issues. Still there are unsolved standardisation issues of the corresponding working group of TC79. However, during the last months in this respect several important developments took place which are about to change the whole scene of approval testing in Europe. The market and especially the products in the field of intrusion detection are changing with significant speed. Future innovations of such products need to be taken into the standardisation work as soon as possible. Also these issues will play an important role during the EUSAS workshop.

In the workshop viewpoints from the IDT developing team, the standardisation bodies, the testing institution and the European alarm industry are exchanged. In addition the IDT system will be demonstrated and possible future developments concerning the test of volumetric intrusion detectors are discussed. This will include also combined video detection and classical intrusion detection. Thus the workshop will address two key issues. On the one hand all interesting technological aspects (concepts, essential properties, benefits and experiences made with the test system) will be covered. On the other hand latest developments in the standardisation process on intrusion detector testing will be addressed. Both classical and possible future detector types will be dealt with.

2 Agenda

Conference Program:

Thursday, Oct. 9th, 2003

- | | |
|------------------|---|
| 13.00 h- 14.00 h | Registration and coffee |
| 14.00 h | Welcome Prof. H. Luck, chairman EUSAS |
| 14.10 h | Introduction to the EU-project O. Steensen, DELTA, project manager |
| 14.30 h | Inside the Intrusion Detector Testing (IDT) System - Concept and Technology Prof. I. Willms, University Duisburg-Essen |
| 15.00 h | Discussion |
| 15.20 h- 15.45 h | Coffee break |
| 15.45 h | TC79 Achievements and Programs of the current Year Dr. C. Loi, Chairman CLC TC 79 |
| 16.10 h | Collected Viewpoints of the European Alarm Industry on the IDT-project Dr. H. Rieche, ZVEI, Frankfurt |
| 16.35 h | Viewpoints of the Testing Institutions Pro & Contra of the IDT Test Procedure - Results, Costs, Benefits R. Conrads, VdS, Cologne |
| 16:55 h | Technical Specifications -A step towards Unity M. Aris, BRE, Garston |
| 17.15 h | Discussion |
| 19.30 h | Dinner |

Friday, Oct. 10th, 2003

In the laboratory:

- | | |
|---------|---|
| 09.00 h | Hands-on demonstration Ole Olsen, DELTA, senior engineer |
| 09.45 h | Utilisation of the IDT Tester Karsten Kohlert, DELTA, division manager |

In the lecture room:

- | | |
|---------|---|
| 10.15 h | Coffee break |
| 10.30 h | Future Perspectives Prof. I. Willms, University Duisburg-Essen |
| 11.00 h | Questions and discussion |
| 11.45 h | Closure of the meeting Prof. I. Willms |

3 Presentations and Discussion

"Welcome"

Prof. H. Luck, chairman EUSAS

Prof. Luck opened the EUSAS workshop and expressed his thanks for Siemens Gebäudesicherheit, Munich, who served as local host. However, he also showed his self disappointed at the comparably low number of participants.

Prof. Luck then gave a short introduction in the matter of testing volumetric intrusion detectors. He pointed out that ...

... the workshop (and the presented IDT chamber) deals just with carrying out the stability test of intrusion detectors - not with performing the functional test (which also in future shall be carried out by means of the walking test).

To explain in general what the task of EUSAS can be and what it can not be concerning any technical issue Prof. Luck stated that:

"EUSAS is not a platform for decisions in standardisation but a platform for discussion and informal talks".

For further discussion Prof. Luck drew up 5 theses. These theses were meant as possible reasons for the insufficient state of the art at testing and development of (volumetric) intrusion detectors:

- 1 The national as well as the international markets for (volumetric) intrusion detectors & systems suffer from an absence of international standards that establish agreed quality criteria.
- 2 There exists a drop-off in prices for (volumetric) intrusion detectors in the actual markets due this lag of international standards that hinders the development of high quality techniques in this field.
- 3 The actual progress in creating international quality standards for (volumetric) intrusion detectors has been very poor in the last decades.
- 4 The innovation in testing methods & techniques for (volumetric) intrusion detectors was almost zero in this time.
- 5 Testing institutes were not able on this background to establish innovative testing methods because their own testing price level had to remain very low.

"Introduction to the EU-project"
O. Steensen, DELTA, project manager

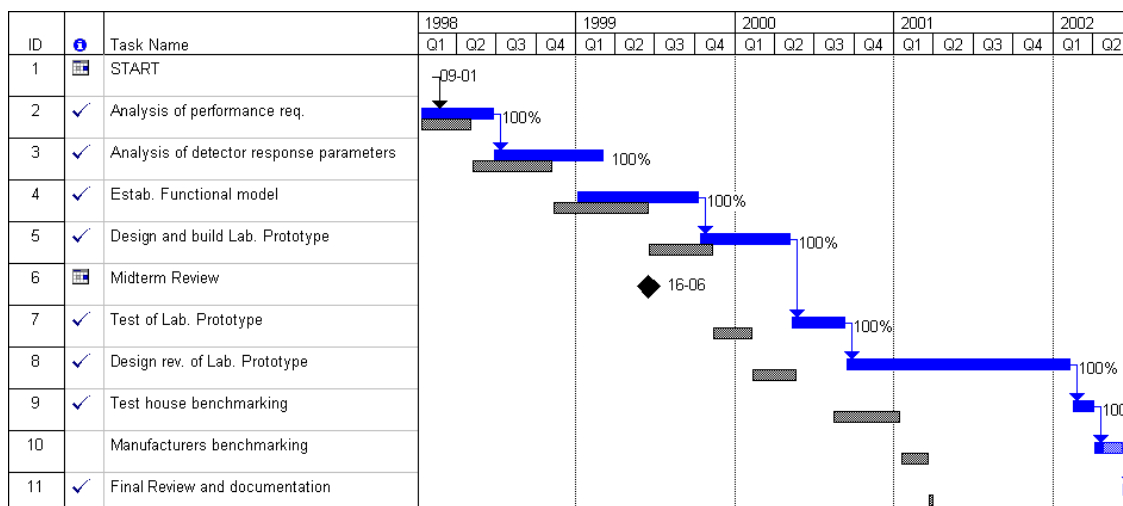
After shortly presenting the company DELTA Mr. Steensen expressed his thanks for all companies which supported the EU-project on IDT, such as ANPI/NVPP, BRE, Cerberus (Siemens), CNPP, Duisburg-Essen University, Interlogix, Securiton and VdS. Mr. Steensen then listed the initial reasons for starting the project which run from 1998 to 2003 and which was funded at 50 % by the EU:

- False alarms are tedious and expensive
- Approval methods vary between European countries
- Approval standards are lacking behind technology
- Reproducibility of the state-of-the-art test methods is poor
- Type-approval testing is critical considering Time-to-Market and foreign competition

A joint effort was supposed to accelerate the development of a future oriented solution.

As a next point Mr. Steensen presented the time schedule (picture 1) and the general achievements of the EU-project. According to Steensen the following developments were achieved, which are still being further developed although the EU-funding has expired:

- prototype of the IDT (with the associated test procedures) for:
 - Passive InfraRed sensors - MW-Doppler sensors
 - US-Doppler sensors - Dual technology sensors
- "MS Windows like" Graphical User Interface
 - Automated calibration- and test procedures
 - Automated test report generation
- Benchmarking by all partners
 - Good repeatability and reproducibility of measurements
- Draft Standard for Intrusion Detector Stability Testing



Picture 1: Time schedule of the IDT EU-project

"Inside the Intrusion Detector Testing (IDT) System"

Prof. I. Willms, University Duisburg-Essen

Prof. Willms started his talk by describing the procedure and the different shortcomings of the use of the "Walk Test Method" with respect to the stability test of intrusion detectors:

- Test engineer tries to walk at certain speed/walking direction
- Possibility of determination of coverage pattern
- Several shortcomings:
 - Repeatability, space consumption, low comparability of results
- Also hand wave method applied
- Only yes-or-no decision
- Nearly no info on possible variations of detector performance

Objectives for a standardized testing instrument

Against the background of the named shortcomings Prof. Willms pointed out the necessity for a standardized testing instrument which allows the performance of defined and repeatable test procedures without any dependency on place, time or testing engineer - a prerequisite for a mutual acceptance of test results among the European testing authorities. Willms then presented a list of further project objectives:

- Only the detector's alarm output shall be used as input parameter for RTV determination
- The sensor stimulation shall be close to real intrusion incidents
- Future „intelligent“ detectors should not realize the test situation as such
- All major detector types shall be taken into account
- A broad range of PIR detectors shall be considered
- A broad range of US and MW carrier frequencies shall be considered
- For the testing instrument there shall be no patent claim

Design of the instrument

As onsets for the design of the testing equipment Prof. Willms mentioned

- a simultaneous IR and Doppler stimulation,
- no simple linear rising stimulation (but sequence of different levels),
- the scaling of simulated intrusion for testing in the chamber,
- a different scaling for long range/normal range detectors and
- the alignment of detectors for good interaction with stimulation devices.

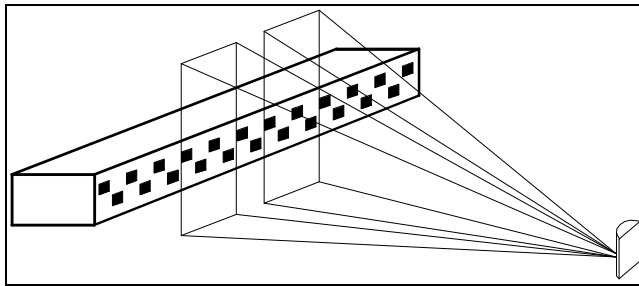
However, according to Willms a couple of design conflicts do exist:

- Test of long range types & Doppler detectors
vs. size of apparatus
- Totally different physical stimulus
vs. low piece part costs

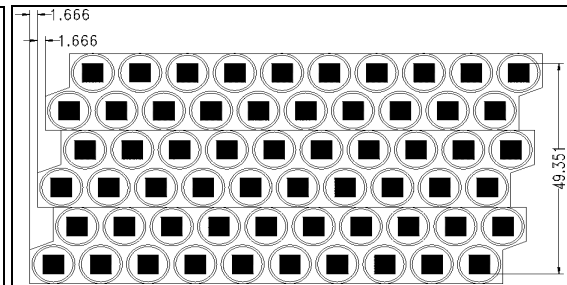
- Implementation of totally new methods vs. limited development time
- Implementation of a test sequence using different stimulus levels vs. duration for one RTV test

IR stimulation

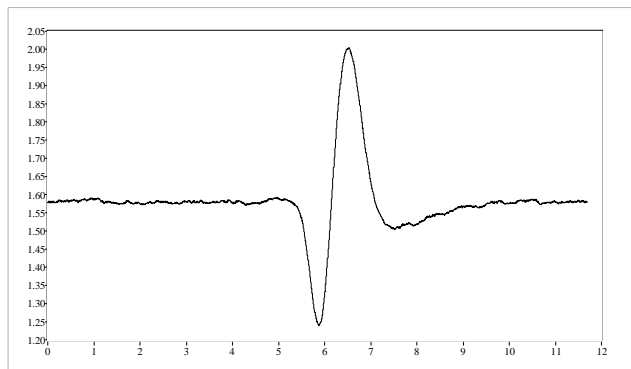
Prof. Willms explained that a solid state stimulation technique is used for testing IR sensors, basing on IR emitters which usually are arranged along a straight line (picture 2) and with the same signal form applied to all emitters. To simulate differences in walking speed & distance the delay between the adjacent emitters can be adjusted. However, according to Willms the superposition of several signals ends up in a smooth IR signal (picture 4). A moving band of IR emission is achieved as a result.



Picture 2: Normal arrangement of IR emitters



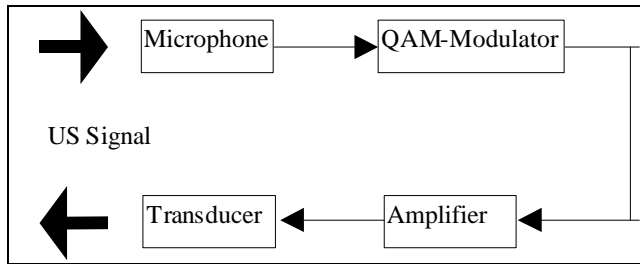
Picture 3: Long range arrangement



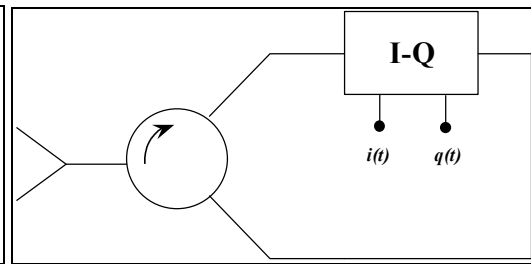
Picture 4: Response of a typical IR sensor (IR-signal over time)

Doppler stimulation

Willms explained that for stimulating intrusion detectors with ultrasonic waves a QAM modulation shall be used. For this purpose the ultrasonic waves (which are emitted by the detector) are received using a microphone and modulated by means of a QAM modulator. The modulated signal then is amplified and transduced. The generated Doppler signal after that is sent back to the detector (picture 5). For Microwave stimulation the same QAM method and the same signal form shall be used. However, the MW stimulation shall be put into action by means of an antenna, a circulator and an IQ modulator (picture 6).



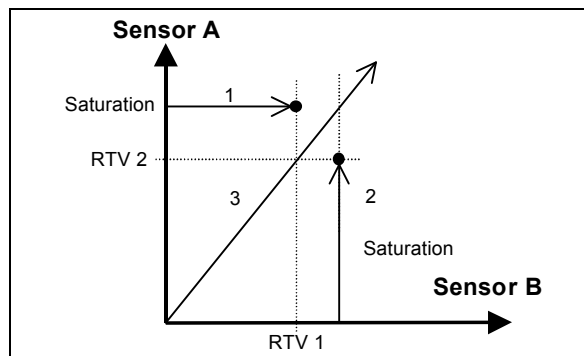
Picture 5: Doppler / US stimulation



Picture 6: Doppler / MW stimulation

RTV determination for IR and / or Doppler stimulation

For the determination of the response threshold value (RTV) Willms suggested to search the lowest level of IR power to which a detector shows response at specified speed, distance and walking direction. The RTV shall be given as a dimensionless value with a range from 0 to 1.0. The same concept shall be used for Doppler sensors. For the simultaneous stimulation of IR and Doppler signals the IR signal shall start later and stop earlier. However, a constant relation of IR / Doppler stimulation shall be kept during the RTV determination (picture 7). In general, the RTV shall be determined as the minimum value out of 6 measurements at different antenna/transducer positions.



Picture 7: IR / Doppler RTV

Prof. Willms listed the following features of the RTV search method:

- Always the same signal form is applied (close to a walk test signal) by keeping suitable detector recovery time between steps
- Corresponding adj. delay time between steps for min. testing time
- Stimulation signal level is modified depending on detector response
- Modified binary search method with 20% overlap for the signal level being closest to the threshold (RTV)
- Modification improves immunity of RTV determination to detectors with low signal-to-noise ratio
- User definable number of search steps and search interval

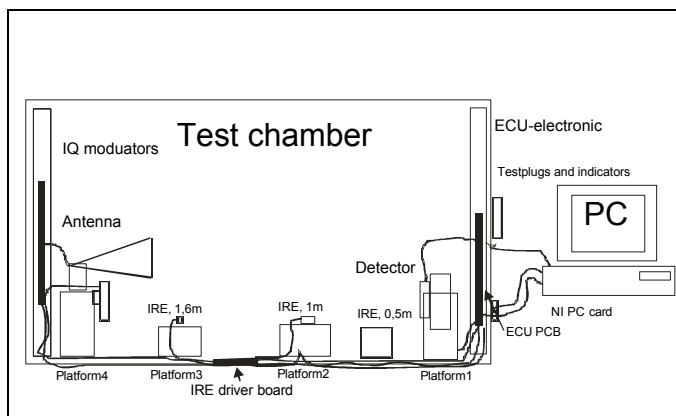
Details of the test apparatus

As a further point Mr. Willms in detail explained the main units of the test apparatus, which basically consists of three major parts (picture 8):

- Anechoic test chamber
- Electronic control unit (Interfaces, drivers, power supply etc.)
- Complete PC control - fully automated test equipment!

The main design features of the apparatus are:

- Mechanical design (rigid construction of test chamber, sandwich form of base plate)
- EMC design (compliance with EMC standard EN50081/2-1)
- Other design features:
 - Easy user interface incl. full computer control of settings
 - Report generator
 - Set of utilities for detector alignment etc.



Picture 8: IDT apparatus

Results and conclusions

In April 2002 an exhaustive test campaign was performed at VdS using the IDT prototype II. For these tests about 20 different types of detector and roughly 100 specimen have been used. The average deviation of the signal value of one detector during the test period was smaller than +/- 3.7 % (at a mean error of 2.3 %). However, different detectors have shown different repeatability and the deviation of the signal value for the different detectors amounted from 1.9 % to 10.7 %. The factor 1.6 was recommended as a maximum deviation factor of a sensor's signal values, which are taken before and after an environmental test.

Finally Prof. Willms explained that the IDT test system is modular and can be tailored to specific applications. At the system testing tasks are running PC-controlled and can be performed in a reasonably short time - also the corresponding test methods have already been developed and thus a nearly impossible mission (IDT Project) has been completed. In analogy to the field of fire detection Willms concluded with the words: "The counterpart to the smoke duct is now available for intrusion detection".

"TC79 Achievements and Programs of the Current Year"

Dr. C. Loi, Chairman CLC TC 79

Missing harmonized standards

Dr. Loi pointed out that the European market of intrusion alarm systems is very fragmented due to the fact that harmonized standards are still missing. So an intrusion alarm system which is installed in a German bank might not be approved in France. As an other example alarm receiving centers are ruled according to local standards which sometimes differ from each other at a large extend. However, from the point of view of a former international director of a large security company Dr. Loi called it "frustrating" to realize that it is impossible to coordinate the activities of single European subsidiaries. So in the end Loi had to leave a great amount of freedom in the product development for each country.

According to Loi's opinion the reason for the difficulties at harmonizing standards in Europe is not a matter of technology (which is rather simple), environment or legislation. However, Loi assumes that these difficulties are basing on different philosophies in different countries concerning how persons and goods can be protected the best way.

Technical Specifications to accelerate harmonized standardization

Nevertheless Loi sees an other problem to be responsible for TC79's slow performance: "Documents that were delivered for vote by working committees - when they were circulated at national committee level - were sent back for many times because they failed to be approved". So for many times the members of the working group and their national committees were not in agreement.

However, Dr. Loi explained that a way out of the TC79 deadlock has already been found: the introduction of the co-called "Technical Specification" (TS) which he sees as a kind of intermediate step on the way to passing the EN standard. Today, the TS has been adopted as a tool of acceleration by the TC79 and - according to Loi - the TS will be used in future each time a document is in danger of being rejected as EN.

As Dr. Loi said, the members of TC 79 not only came up for decision of adopting the TS, but they also decided "to maintain the stand still rule and the date when the TS has to be presented again for voting as EN". However, there is no obligation by National Committees to withdraw conflicting national standards when a TS is published.

Since the procedure to pass a TS document is much faster than the procedure for passing an EN there is the opportunity to spread the TS very soon. This way user and test laboratories as well as manufacturers and insurers have the opportunity to try out the new standards, to gain experience with them and to give a feedback to the corresponding working groups. After a revision of these TS has taken place they shall be delivered into EN standards.

According to Loi the paralyzation of the TC 79 was stopped thanks to the introduction of the TS, so that the TC now is close at publishing an almost complete series of standards (EN and TS) concerning the following fields of intrusion alarm:

- General requirements for intrusion alarm systems (including wireless systems)
- Requirements for control and indicating equipment
- Requirements for a variety of different detectors
- Requirements for warning devices
- Requirements for alarm transmission systems and equipment
- Requirements for power supplies
- Application guidelines

Furthermore Dr. Loi gave some detailed information on the state of the art of standardization work at TC79:

- PrEN 50131-2-2 Passive Infrared Detectors
Now approved for three months vote as TS, stand still agreement,
approval for vote as EN by January 2005
- PrEN 50131-2-3 Microwave Detectors
Now approved for three months vote as TS, stand still agreement,
approval for vote as EN by April 2005
- PrEN 50131-2-4 Combined Passive Infrared and Microwave Detectors
Now approved for three months vote as TS, stand still agreement,
approval for vote as EN by January 2005
- PrEN 50131-2-5 Combined Passive Infrared and Ultrasonic Detectors
Now circulated for three months, voted as TS, stand still agreement,
approval for vote as EN by April 2005
- PrEN 50131-2-6 Opening Contacts (magnetic)
Now approved for three months vote as TS, stand still agreement,
approval for vote as EN by September 2005
- PrEN 50131-2-7 Glass Break Detectors
Restarted work at WG2

"Collected Viewpoints of the European Alarm Industry on the IDT Project"

Dr. H. Rieche, ZVEI, Frankfurt

Dr. Rieche pointed out that the ultimate goal of the European alarm industry is achieving a European "one stop testing / one stop certification" procedure. As a main precondition for reaching this goal Rieche mentioned a range of European standards and specifications which are accepted by the different groups of the business community, such as customers, test and certification bodies and industry. To achieve such an acceptance standards need to be complete and unequivocal, they have to lead to equal results which are transferable between the different test laboratories. Rieche then explained the two different kinds of "Walk Test" which are laid down in the standards TS 50131-2-X, the "Walk Test" using the "Standard Walk Test Target" (SWT) and using the "Basic Detection Target" (BDT). According to Rieche it does exist a need for more accurate, quantitative and reproducible test procedures at acceptable costs and test time. However, concerning the IDT project Dr. Rieche has made the following comments:

- The Final Report is difficult to understand
(... because it is an activity report, not a description of the envisaged test procedure.)
- The IDT chamber does not substitute the walk test
(... because the IDT project was reduced to tests of influences of environmental tests on detector stability.)
- The test criteria ($RTV_{max}/RTV_{mean} < 1.6$) are not derived from physical properties
(The procedures are based on testing the stability of the statistical distribution of a "Reaction Threshold Value" (RTV). The requirements are taken from EN 54-7 which is a physically different test procedure.)

Furthermore, Rieche found the following questions not yet been answered:

- What is the physical relation between the measured values (RTV) and the performance of the detectors in the field application (range; walk distances etc.)?
- What tolerances in the RTV values will be acceptable and what do they mean?
- Is the answer of these test results better than the existing test procedures in terms of stability of performance in the field application?
- Are these tests proposed for development or for production control?
- Will the test results be equal between different test labs?
- What is the expected investment necessary for the industrialized IDT Test System?
(... regarding the necessary number of tests, the test time and the manpower)

Dr. Rieche stated that it is up to the test houses first to evaluate if the IDT test chamber leads to better transferable test results than current test methods. He further expressed his doubt that the benefits for industry might not compensate the necessary expenses for the IDT chamber. He concluded his talk by suggesting a discussion on how the existing IDT work can be used to come to a more scientific testing approach.

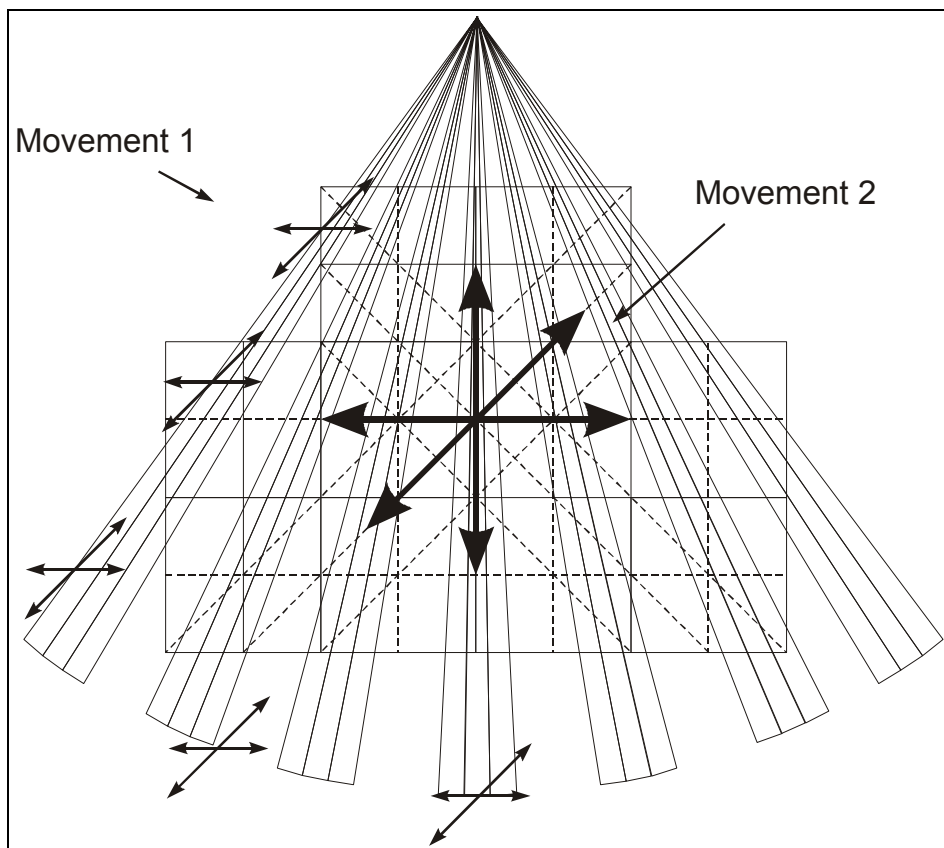
"Viewpoints of the Testing Institutions"

R. Conrads, VdS, Cologne

Testing Intrusion Alarm Systems

Mr. Conrads, head of the VdS security department, first pointed out the experience VdS gained at testing intrusion alarm systems for more than 30 years. As main test items Conrads named "Detection Performance" (range, coverage, sensitivity), "False Alarm Immunity" (climate, EMC, sunlight), "Long-Term Stability" (10 years and more) as well as "Tamper Security". Conrads illustrated that False Alarm Immunity and Long-Term Stability are tested by means of several environmental tests (such as tests on EMC, climate, shock, vibration, light, sound, corrosion, damp heat and sunlight). For these environmental tests the following test schedule is used:

- 1 Basic test of detection performance (using the walk test; see picture 9)
- 2 Subjection to environmental influences (e.g. vibration)
(Monitoring of change of status; e.g. no False alarm)
- 3 2nd basic test of detection performance
No significant change of the detector's performance must be measured compared to the first basic test



Picture 9: Walk Test - procedure, schematic

The results of these environmental tests can be false alarm and/ or change of status. Changes of performance may occur as long-term effects, for instance due to lose components. Furthermore Conrads explained that foils, lenses and other material may change their optical characteristics due to the exposure to sunlight.

IDT Project

Mr. Conrads gave a short overview on the course of the IDT project:

- 1997: First intention
 - Replacement of full-scale walk-tests
- 1998: Second goals
 - Reproducible test methods for motion detectors
 - An apparatus for measuring stability, differences and changings of the sensitivity of detectors before and after an executed environmental tests
- 2002: Final report in November

He then specified the information he found in the project report:

- Description of the project
- Description of the "machine"
- Results of "Machine-Stability-Test"
- Results of test of series of identical detectors
- Results of tests of detectors before/after environmental exposure

Concerning the Machine Stability Test Conrads expressed his uncertainty that the detectors really did not change between the measurements. He criticized that extensive tables of results were given but not properly evaluated. As an example Conrads referred to picture 10.

| Detector ID | min val. | max val. | mean val. | Std. Dev | max-min | Error * | RTV _{max} /RTV _{min} | mean error |
|-------------|----------|----------|-----------|----------|---------|---------|--|------------|
| A15 | 0,3477 | 0,4040 | 0,3839 | 0,0238 | 0,0563 | 14,67% | 1,16 | |
| A16 | 0,3434 | 0,3505 | 0,3459 | 0,0025 | 0,0071 | 2,05% | 1,02 | |
| A17 | 0,3589 | 0,4304 | 0,4048 | 0,0259 | 0,0715 | 17,66% | 1,20 | |
| A18 | 0,3369 | 0,3525 | 0,3484 | 0,0058 | 0,0156 | 4,48% | 1,05 | |
| A19 | 0,3808 | 0,4095 | 0,3934 | 0,0141 | 0,0287 | 7,29% | 1,08 | |
| A20 | 0,4740 | 0,5096 | 0,4933 | 0,0162 | 0,0356 | 7,22% | 1,08 | 10,67% |
| B15 | 0,4846 | 0,5024 | 0,4960 | 0,0072 | 0,0178 | 3,59% | 1,04 | |
| B16 | 0,4293 | 0,4497 | 0,4372 | 0,0091 | 0,0204 | 4,67% | 1,05 | |
| B17 | 0,3337 | 0,3605 | 0,3447 | 0,0111 | 0,0268 | 7,77% | 1,08 | |
| B18 | 0,5345 | 0,5707 | 0,5471 | 0,0140 | 0,0362 | 6,62% | 1,07 | |
| B19 | 0,5027 | 0,5204 | 0,5084 | 0,0065 | 0,0177 | 3,48% | 1,04 | |
| B20 | 0,4216 | 0,4480 | 0,4342 | 0,0103 | 0,0264 | 6,08% | 1,06 | 6,44% |
| C15 | 0,3569 | 0,3656 | 0,3608 | 0,0044 | 0,0087 | 2,41% | 1,02 | |
| C16 | 0,4125 | 0,4181 | 0,4156 | 0,0028 | 0,0056 | 1,35% | 1,01 | |
| C17 | 0,3314 | 0,3330 | 0,3325 | 0,0009 | 0,0016 | 0,48% | 1,00 | |
| C18 | 0,3717 | 0,3802 | 0,3767 | 0,0045 | 0,0085 | 2,26% | 1,02 | |
| C19 | 0,4364 | 0,4412 | 0,4385 | 0,0025 | 0,0048 | 1,09% | 1,01 | |
| C20 | 0,4638 | 0,4734 | 0,4670 | 0,0055 | 0,0096 | 2,06% | 1,02 | 1,93% |
| Y15_PIR | 0,1405 | 0,1478 | 0,1443 | 0,0032 | 0,0073 | 5,06% | 1,05 | |
| Y16_PIR | 0,1659 | 0,1793 | 0,1756 | 0,0051 | 0,0134 | 7,63% | 1,08 | |
| Y17_PIR | 0,1525 | 0,1540 | 0,1535 | 0,0006 | 0,0015 | 0,98% | 1,01 | |
| Y18_PIR | 0,1731 | 0,1818 | 0,1786 | 0,0031 | 0,0087 | 4,87% | 1,05 | |
| Y19_PIR | 0,2003 | 0,2136 | 0,2082 | 0,0049 | 0,0133 | 6,39% | 1,07 | |
| Y20_PIR | 0,2339 | 0,2388 | 0,2365 | 0,0019 | 0,0049 | 2,07% | 1,02 | 5,40% |
| Y15_Dopp. | 0,2162 | 0,2275 | 0,2220 | 0,0050 | 0,0113 | 5,09% | 1,05 | |
| Y16_Dopp. | 0,2537 | 0,2741 | 0,2685 | 0,0078 | 0,0204 | 7,60% | 1,08 | |
| Y17_Dopp. | 0,2203 | 0,2225 | 0,2218 | 0,0008 | 0,0022 | 0,99% | 1,01 | |
| Y18_Dopp. | 0,2693 | 0,2828 | 0,2778 | 0,0048 | 0,0135 | 4,86% | 1,05 | |
| Y19_Dopp. | 0,2337 | 0,2492 | 0,2430 | 0,0057 | 0,0155 | 6,38% | 1,07 | |
| Y20_Dopp. | 0,2331 | 0,2380 | 0,2357 | 0,0019 | 0,0049 | 2,08% | 1,02 | 5,40% |

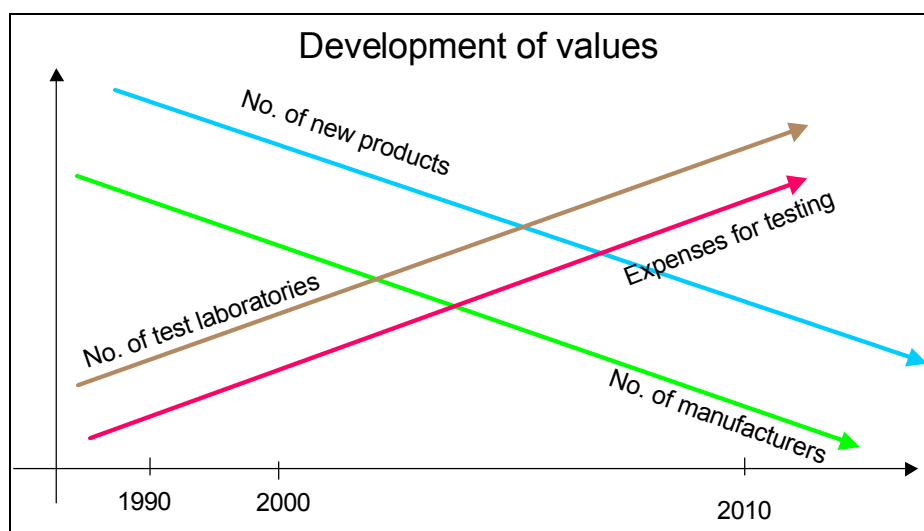
Picture 10: IDT project - repeatability measurements of 4 different detector types

Conrads further expressed his opinion that the "Relation between column of data and practical effects are missing for the time being" and that a "multiplying of the test cycles" both with IDT and full-scale walk-test is required to achieve the necessary relations. According to Conrads gaining this information would require a comparably high amount of costs and time without having the certainty of positive results. However, to Conrads opinion "the today given test methods are definitely adequate. As an example he stated that "a change of the range of a motion detector of e.g. 25 cm does not effect the practice", stressing that "these changes during tests with 'quality'-detectors are very seldom." Thus, the implementation of the IDT chamber in the European standards would cause a considerable increase of the testing price (at about 40 %) while leading to just a marginal improvement of exactness in testing.

As a conclusion Conrads made the following statements:

- Aim of superseding walk-test was not reached
- Until now columns of data are hard(ly) to interpret
- Data are non-referring to practice
- Clarify the correlation data / practice is a large-scale job
- Benefit of IDT-test method is not visible for VdS
- The today test methods do meet the practical needs

However, Conrads claimed that the next generation of movement detectors will not recognize machines but just human beings and he further asked the development which is described in picture 11 to be considered. In the end Conrads said that - if financial resources are available - not "testing with more reproducible test results" is important but "finding detection methods for reducing the false alarms".



Picture 11: Development at the intrusion alarm market

"Technical Specifications - a step towards unity"

M. Aris, BRE, Garston

In the following a paper of Mr. Aris is given which summarizes his talk at the EUSAS IDT workshop:

In the opinion of BRE there are three factors that will contribute to the IDT apparatus being used by industry as a recognised means to assess changes in the detection performance of volumetric intrusion detectors.

These are:

1. The lack of published European test standards for components of intruder alarm systems
2. The cost of purchasing the IDT apparatus
3. How future developments will be implemented

Considering each factor in turn.

The lack of European component test standards

At present each test laboratory has its own particular way of testing for changes in detection performance before and after exposure of the test specimen(s) to various forms of environmental conditioning. These methods range from waiving a hand in front of the detector to applying a mechanically generated stimulus.

Unless standards are published that provide a set of common test requirements throughout the member states of Europe no compelling reason will exist for the testing institutions to change their current procedures and test methods. Without published standards that are accepted across Europe there is unlikely to be a common approach to testing and certification of security equipment.

Ironically among the reasons for the rejection of the first series of draft documents for volumetric intrusion detectors to emerge from CENELEC TC79 Working Group 2, (the committee writing the intrusion detection standards) was the lack of detail behind the test intended to confirm that no significant changes in detection performance had occurred as a result of exposure to the various forms of environmental conditioning.

Working Group 2 was unable to fund the development of such test apparatus capable of testing many different makes and models of detector to the accuracy needed to show if changes in detection performance that occurred. So the European Commission provided money to fund a consortium made up of organisations interested in resolving this problem.

Whilst work was underway to develop the test apparatus the draft detector standards were re-written.

To overcome the problem of not having a suitable method to assess changes in detection performance a very simple GO-NO-GO was written into the new documents. The intention was to replace the simple test with the IDT apparatus once it became available.

However, now that the IDT project is complete there is reluctance on the part of product manufacturers and the testing institutions to adopt the IDT apparatus. Because of this no reference to the IDT apparatus has been added to the new draft standards.

In general the industry is not entirely happy with the content of the new draft standards for passive infrared (PIR), microwave Doppler, and combined PIR/microwave either, and as such the documents have not gathered enough consensus for them to be published as ENs so TC79 has agreed to release them as Technical Specifications.

Technical Specifications – A Step Towards Unity

There are advantages to releasing the draft standards as Technical Specifications as it would permit industry to begin adopting the requirements and could allow the technical problems to be resolved. However there are also disadvantages, for example no body actually has to use Technical Specifications once there are in the public domain, although in this case the national committees are obliged to publish them. TC79 has also determined that a standstill agreement will exist whilst the Technical Specifications are in place, thus preventing further work on similar national standards. The detector Technical Specifications will have a life of two years after which they can be made into European Norms (ENs).

Although this process could be seen as effectively delaying the publication of the ENs for a further two years the alternative is to return the draft standards back to the working group to be rewritten, and this would no doubt take much longer. After 15 years without a single document published this decision by TC79 and the BT should be viewed a significant step towards achieving common requirements.

Technical specifications – Promoting Their Use

If industry is going to benefit from the Technical Specifications it must begin to use them. BRE has already started by using the requirements of the draft detector documents as a basis of test specifications written for use by SEAP, the British Government's Security Equipment Approval Panel. Equipment meeting the requirements of these test specifications will be added to a list of equipment approved for use in Government establishments.

To further assist progress the BRE held a workshop in July 2003 for Working Group 2 members providing the opportunity to try out the Walk Test procedure and to demonstrate it can be performed as described in the text of the draft test standards.

Technical specifications – No reference to the IDT apparatus

As mentioned previously the draft test standards make no reference to the IDT apparatus, instead they include a Basic Detection Test (BDT). In the case of passive infrared detectors the target required for the BDT consists of a small circuit board 120mm x 30mm. Upon this board are mounted 8 x 125 Ohm ¼ Watt resistors positioned in a single line and electrically connected in series. A voltage is applied to the resistors and adjusted until the average surface temperature stabilises a level equal to a temperature of 3°C above the temperature of the background surface directly in front of the PIR. The circuit board containing the resistors is mounted on the end of a rod.

During the test the whole assembly is moved by hand at a distance of 1m from the detector and at a velocity of 0.5 to 1.0m/s*.

* The velocity values referenced are those taken from the draft standard. In practice the most appropriate velocity will depend upon the optical assembly and the maximum detection range capability of the detector specimen being tested.

The advantage of this test method is that it is quick and therefore a cost effective test to make. It can be performed anywhere and the apparatus is simple to make. But it is also likely to yield low test repeatability and high test uncertainties. It is also a GO-NO-GO type of test that will be unlikely to identify changes in detection performance.

In contrast the IDT apparatus is more repeatable, has greater accuracy and better control and is likely to be more acceptable to the laboratory accreditation services than the BDT. Unfortunately tests will take longer and the fee per test is likely to be higher and unlike the BDT the test apparatus is not portable.

The Cost of Purchasing the IDT Apparatus

As with any business the price of purchasing the IDT apparatus must be viable. Capital equipment is judged upon the ability to achieve an expected level of financial return. Although no specific cost figures have been published, the last indication of the manufacturing costs calculated during the IDT development was in the order of 100k DM. This would clearly result in a high purchase price, and probably too high for the BRE to consider buying the apparatus given the number of intruder detector test projects expected per year.

As a guide BRE would expect the price of the current IDT apparatus to be around 15k to 20k Euro in order to make the purchase viable.

The IDT apparatus has limited use at present, being able to test PIR ultrasonic and 3 bands of microwave Doppler detector. The feeling is that any future developments will only add significant extra costs. There is also a risk that a completely new type of test apparatus may

be required very soon after purchasing the current version if manufacturers begin to launch new technology products in the near future.

Future Development

Industry needs to know how future developments may be implemented. The current apparatus has been built using a modular approach so it could be possible to develop add-on modules but the way in which this will be done must be thought through.

Similarly the implementation of improvements must be carried out such that each IDT apparatus can be update simultaneously ensuring that commonality is maintained. Having a common test method and identical test apparatus was the main reason for developing the IDT apparatus.

It is suggested that a user group be set up to share knowledge and experiences. The group could also maintain the control and implementation of improvements.

The success of the IDT Apparatus - In Summary

To ensure the success of the IDT Apparatus the test method must be written into the European detector standards. However industry is questioning whether the expense involved to purchase the apparatus is worth the investment, as manufacturers do not expect to see proportional improvements in product quality.

Clearly the simple (BDT) test method written into the draft Technical Specifications will not help to achieve common test results among the European testing institutions and therefore will at some point in the future need to be improved. The IDT Apparatus offers a solution at least for the types of movement detectors currently on the market, but indications are that the purchase price will be too high for the testing institutions to justify the investment. Significant reductions in the manufacturing costs of the apparatus will be needed to change this view.

Changes in product technology could render the IDT Apparatus redundant in a very short space of time unless it can be suitably adapted, however it is not clear if this will be possible or how such new development will be initiated and funded.

Industry's main priority is to have a set of European product standards published; the question of implementation of the IDT apparatus is of lesser significance at this time. But if there is to be a future for the IDT apparatus the benefits must be promoted now and a realistic balance reached between the initial investment costs and the expected returns.

"Hands-on-Demonstration"

O. Olsen, DELTA, senior engineer

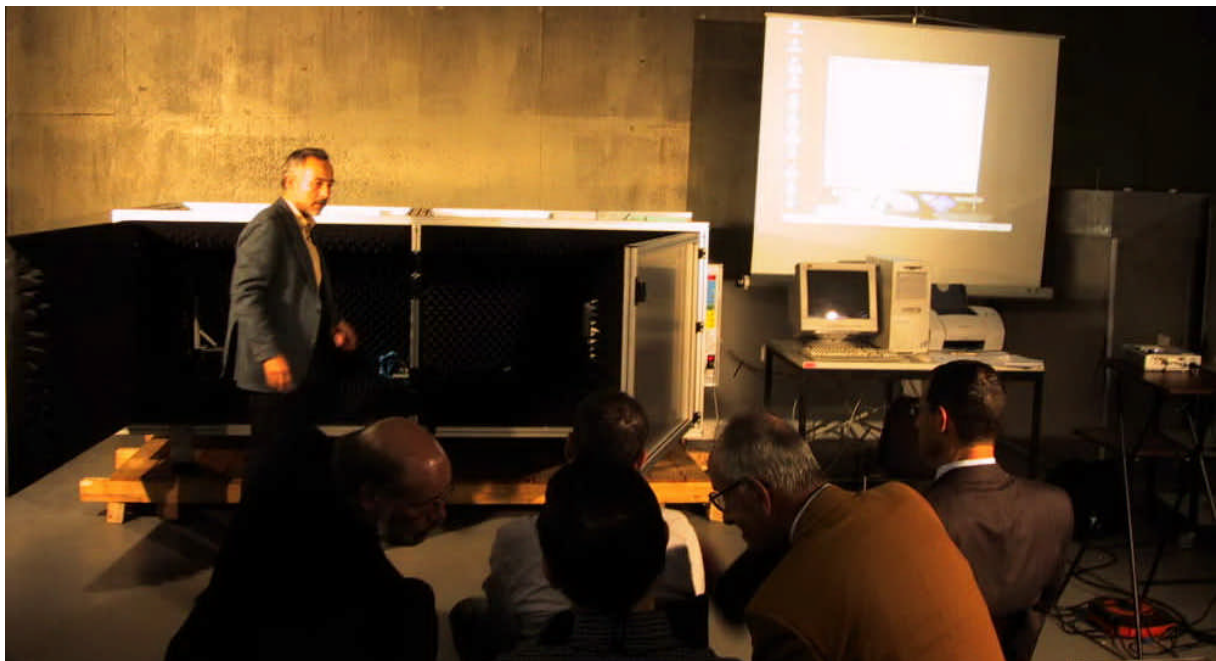
Mr. Olsen presented the IDT chamber which was set up at the fire room of the University Duisburg-Essen. He first showed the results of a 13h over-night test of a US detector being tested at 7 different positions.

Olsen then explained the different physical parts of the system as well as the labview-based software pointing out the automatic report generation and the iterative RTV finding. However, he explained the RTV finding to be dependent on the adjusted accuracy. At an example the RTV of an US detector was found within far less than 2 minutes.

Furthermore, Olsen showed the RTV finding at an PIR and a MW detector. In this respect also the RTV beam-finding feature was shown. During the demonstration it was expressed once more that the IDT chamber is just meant to perform the stability test of intrusion detectors and that the walk-test shall still be used in future to evaluate if a detector does (or does not) properly react on intrusion alarm situations.

After a demonstration of the basic features Mr. Olsen asked a workshop participant to operate the system. The participant then carried out RTV findings mainly on his own.

Answering a question of the audience Mr. Olsen explained that the IDT chamber is able to work without costly temperature compensation because of the downscaling of the scenario and the corresponding use of higher temperatures for the targets.



Picture 12: Ole Olsen: Hands-on-Demonstration of the IDT chamber

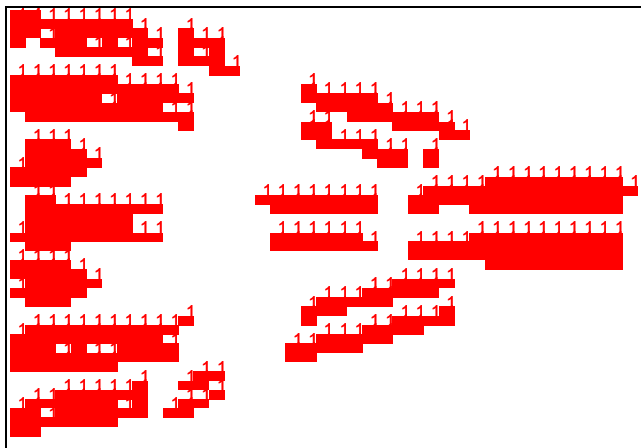
"Utilization of IDT tester"

K. Kohlert, DELTA, division manager

Mr. Kohlert started his talk by giving an overview on what the IDT tester is good for:

- Test of the Reaction Threshold Value of various technologies like PIR, US, MW, S-, X- and K-band sensors
- Well-defined test environment
- High reproducibility of the test values = high quality in testing
- Automated – thus unified – measurement reports

As a special feature Kohlert pointed out the beam-finder function for PIR detectors which can be used to independently measure the RTV of each beam segment and thereby to achieve a kind of fingerprint (see picture 13).



Picture 13: Fingerprint of a PIR detector

Kohlert then mentioned the economic aspects and the main advantages of the IDT tester:

- Estimates based on present pilot unit:
 - 60,000 Euro (IDT Unit in Basic IR version)
 - 30,000 - (MW kit)
 - 20,000 - (US kit)
- 110,000 Euro (completely equipped IDT unit)
- Test performed on the present IDT:
 - 1.500 Euro - test preparation, setup and reporting
 - 200 Euro - per spot measurement (RTV)

- Main advantages:
 - High quality repeatability measurement
 - High quality reproducibility measurement
 - Verification of PIR "beam design"
 - Sample testing of a running sensor production:
Is the product's performance up to the specifications?
 - Test of product degradation over time
 - Comparison testing of various sensor types and products

As being most important Kohlert put stress on the IDT chamber being more than just a test bench but a complete package covering the following aspects:

- Design Testing
e.g. combined with EMC- and environmental testing
or HALT (Highly Accelerated Lifetime Testing)
- Verification Testing
combined with EMC- and environmental testing in
relation to standards and specifications
- Quality Control
sample testing e.g. combined with HASS
(Highly Accelerated Stress Screening)

Kohlert concluded his talk by inviting both industry and testing houses to discuss the following issues:

- Design verification
does the sensor perform as intended?
What is the needed extent of such a verification?
- Which tests could be of interest in a complete package?
- Production control
(e.g. 10 sensors each quarter/month/week):
how often? Remote or on location?
- Degradation testing
how does the sensor cope with electrical, climatic
and mechanical influence? Scope of test?
-?

"Future Perspectives"

Prof. I. Willms, University Duisburg-Essen

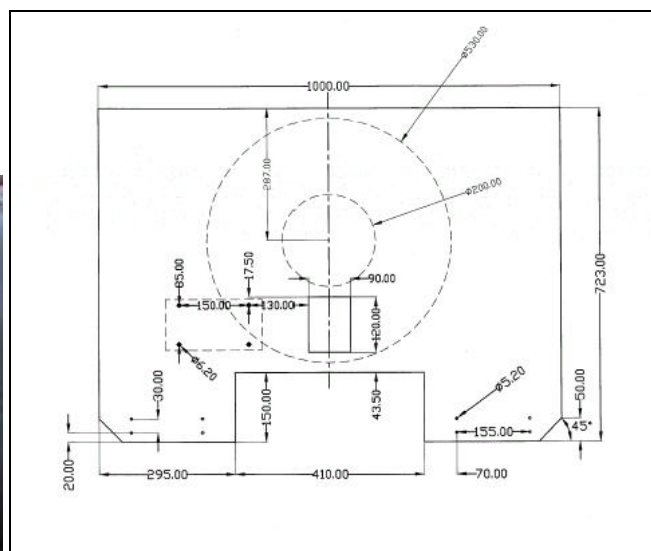
In the last talk of the workshop Prof. Willms presented several concepts for further developing the IDT test chamber in order to enhance the future-proof capability of the IDT system while keeping compatibility to the existing hard- and software.

Mechanical Doppler Generator

Prof. Willms first explained the design goals of the MDG:

- Simulating a Doppler signal
- Replacing the serrodyne modulation of US/ MW of motion detectors
- Achieving a complex signal ("human walk"-like)
- Being suitable for standardization / duplication
- Being compatible for all known technologies
- Being "Future-proofed"
- Optimizing the cost of ownership

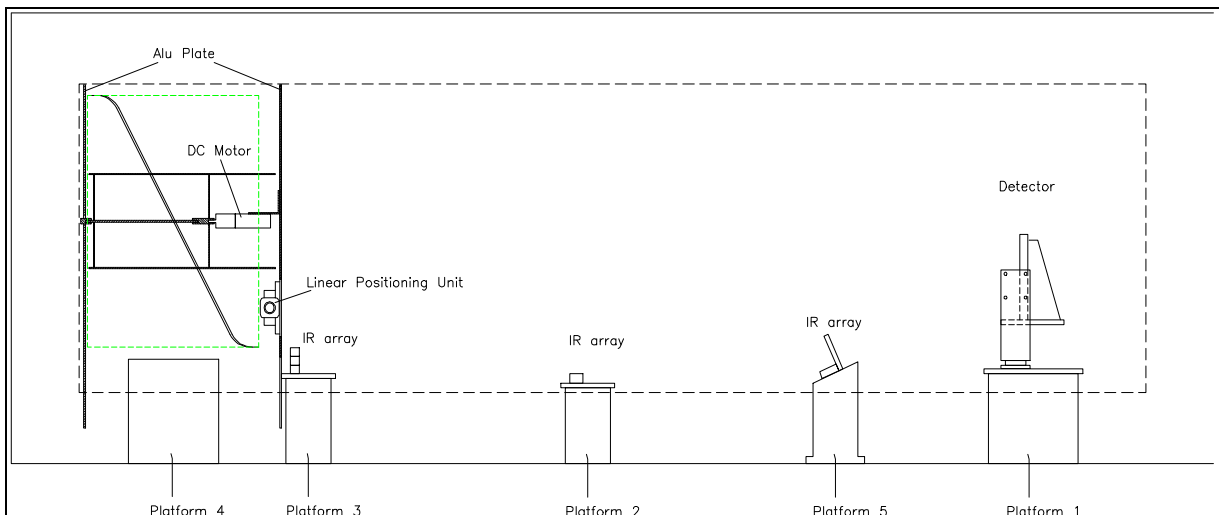
For the test an incoming Doppler signal shall be used with a Doppler speed of about 60 cm /sec (+ human wobble). The signal shall be produced by using a rotating spiral-helix reflector with carbon fiber textile /copper foils in an epoxy layer (pictures 14 to 17). The helix incorporates 2 different speeds (low/high for frequency spreading and human wobble simulation). A secondary reflector shall be used for doubling the Doppler-shift. Start and stop is controlled by the IDT's ECU.



Pictures 14 and 15: Picture and concept drawing of the spiral helix



Picture 16:
View on the part of
the spiral helix which
can be seen from
inside the chamber



Picture 17: Scheme of the MDG setup with the helix placed at one end of the IDT chamber

Furthermore, Wilms has specified the limitations and the benefits of the MDG:

Limitations:

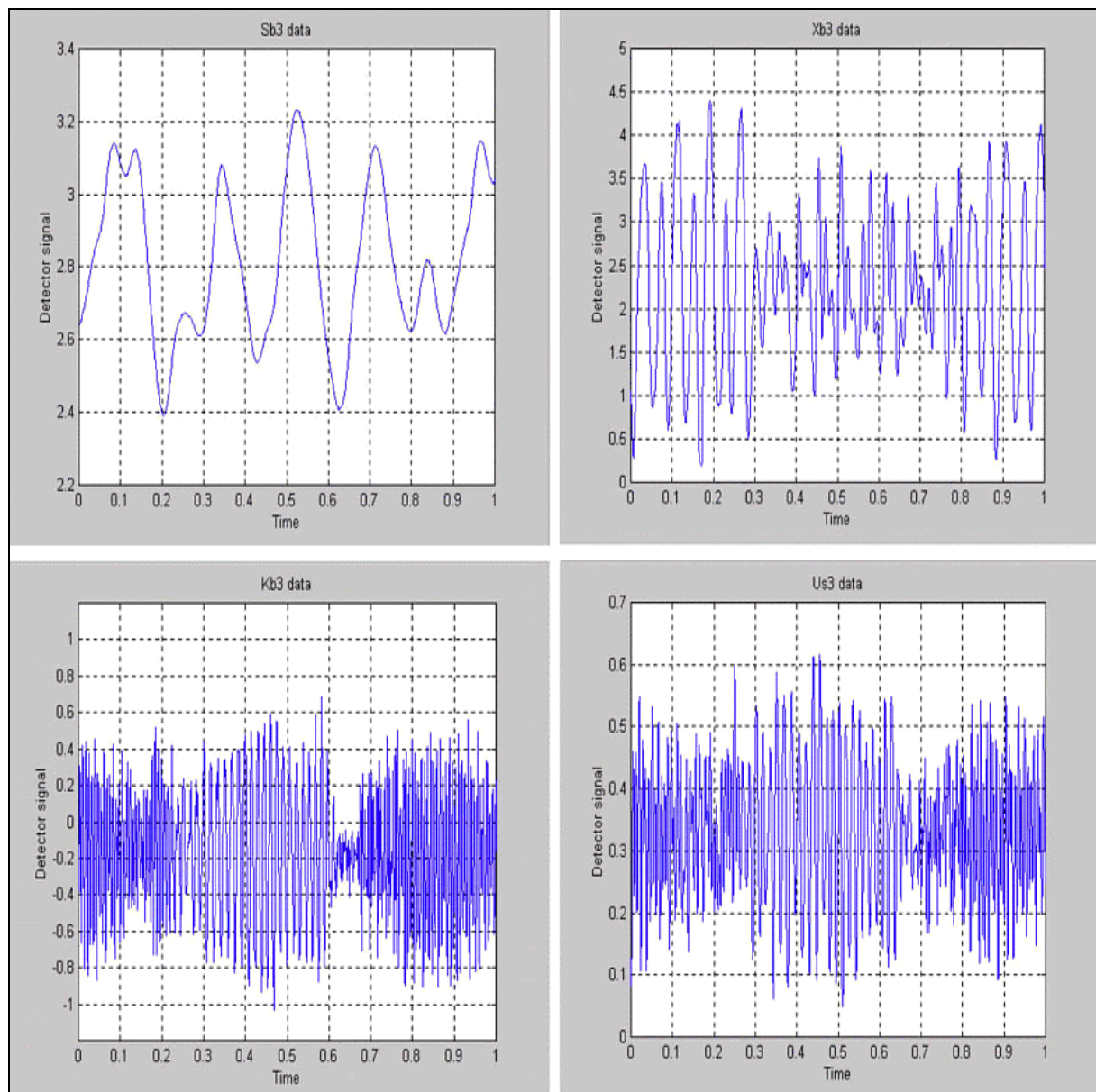
- "Mechanical - ROM" based motion signal (pre-programmed signal form)
- When simpler or more complicated signals are needed, new helix needs to be designed
- Linearization of Doppler Stimulation level
- Aperture moves through diffraction limits
- Limited dynamic range

Benefits:

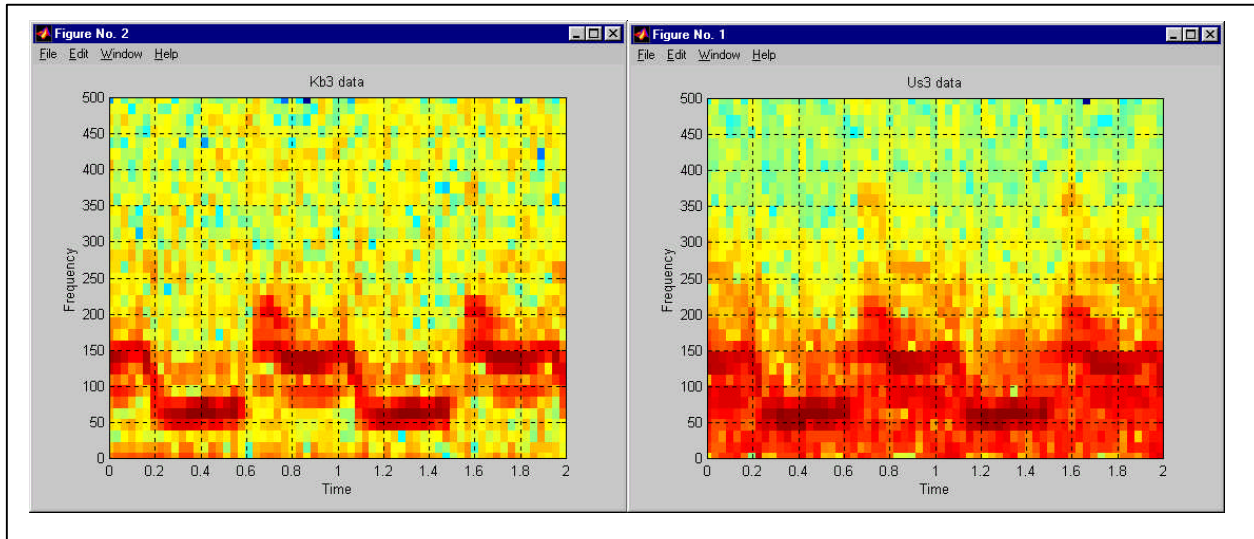
- Works for all MW frequencies 2 GHz ... 50 GHz (and even more)
- Works for all RADAR modes of operation
- CW / Pulsed / FMCW / Balanced/ Spread-spectrum / UWB
- Low complexity
- Low maintenance / high reliability, Low cost of ownership

As results of investigations Prof. Willms presented pictures showing a

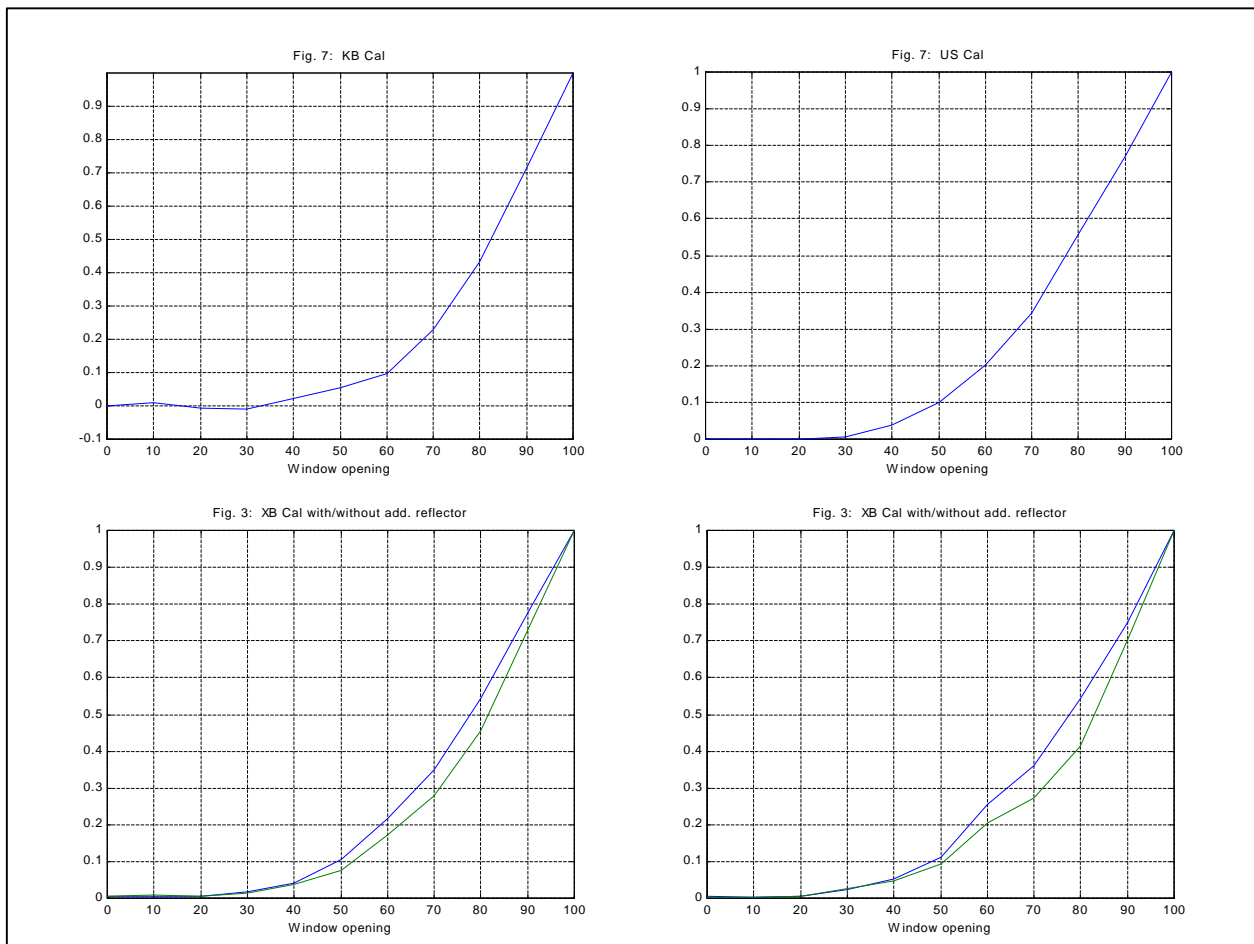
- several signal forms being produced with the MDG for different kinds of detectors (picture 18),
- evolutionary spectra for a K-band and an US detector (picture 19) and
- stimulation levels over window opening for different kinds of detectors (picture 20).



Picture 18: From top left to bottom right: Produced signal form in S-, X- and K-Band and produced ultrasonic signal form



Picture 19: Evolutionary spectrum for a K-Band detector (left) and an US detector (right)



Picture 20: From top left to bottom right: Stimulation level over window opening for a K-Band detector, an ultrasonic detector, an X-Band detector (normally mounted) and an X-Band detector at vertical mounting

Testing of video detectors

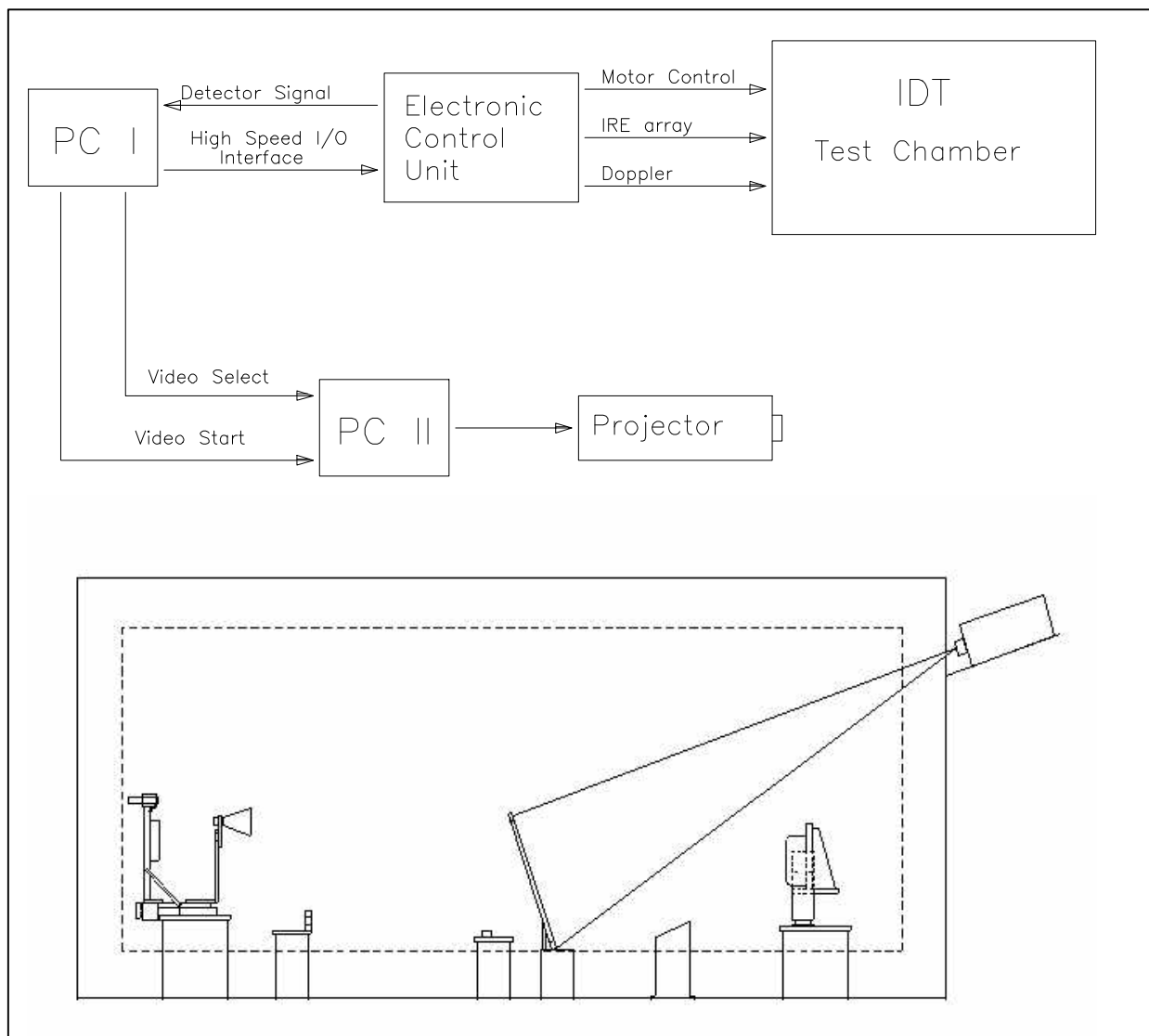
Prof. Willms has shown the following concept for enhancing the IDT chamber with a video detector testing module (picture 21):

Using a modified binary search algorithm of the IDT system which looks for:

- minimum detectable contrast value or
- minimum detectable target size or
- minimum scene illumination value

Using simultaneous stimulation of video and PIR/Doppler sensors

Using different sets of video sequences with different stimulation levels



Picture 21: Upper drawing: concept of the video detector tester; lower drawing: implementation of the setup in the IDT chamber with a video screen being placed in the middle

Prof. Willms then gave a more detailed description on the used video screen:

- Properties of the screen:
Frame area for first tests: 70 cm x 51 cm
- Screen material:
Textile grid with 2 grid sizes (1.7 mm square grids and 0.6 mm diagonally spaced wires)
Resulting in: (40 dpi) (410 X 310) for square grid
- Enhancement due to diagonally spaced wires
- Transparent to IR, US and MW Doppler

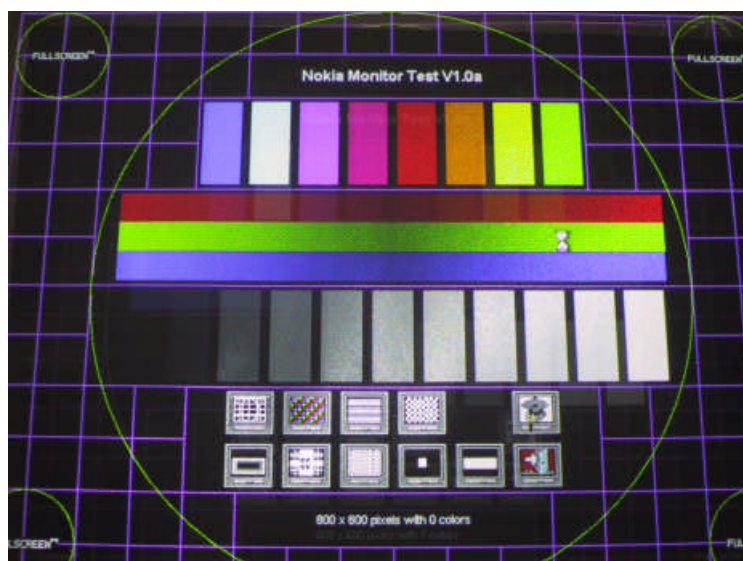
As test conditions Willms used:

- Projector being mounted outside the test chamber
- SVGA resolution (800 X 600 pixels)
- Brightness: 800 lumen class
- Distance to the screen: about 80 cm

Furthermore Willms reported about investigations on the flickering of different monitors and projectors. The following devices have turned out to be free of flicker: a screen of Sony VAIO notebook, an EIZO L656 TFT Monitor, a Toshiba LCD projector and an Infocus LP 260 LCD projector. On the other hand there were negative results for CRT-type TV and computer monitors as well as for a DLP projector.

The color image test at a view on 90% of screen area has lead to the following results (picture 22):

- Only small artifacts
- Color scheme, contrast and gamma level needs further adjustment
- 300 lux at white areas
- Image quality can be used for motion simulation



Picture 22: Color image test

In the end Prof. Willms has drawn the following conclusion:

- A simple MDG unit generates complex wave-shapes in a repeatable manner
- The signals "sound" is as predicted
- The MDG unit perfectly fits into the present IDT system
- There are a few drawbacks: limited dynamic range, fixed signal form
- ... and important advantages: enhanced future proof, low cost etc.
- In the talk the stimulation method and the outline of a test method for combined PIR/Doppler & video detectors was described
- The video detector testing unit also perfectly fits into IDT test chamber
- Further work needs to be done on the video control PC and the production of sets of test videos

(Final) Discussion

During the workshop a lively and controversial discussion has taken place. However, some aspects turned out to be dominant by being put forward for several times:

The representatives of the industry and VdS found that the final report was more kind of an accounting report on what has been done during 4 years of research than a convincing paper. In all, the document was seen as too big and too detailed so that it probably has not been read by too many people. Furthermore, it was stressed that no kind of marketing has taken place which means that results and conclusions have not been worked out sufficiently to convince representatives of the industry at least to take part at the workshop. However, Dr. Rieche, ZVEI, offered his help if convincing facts will be on the table within this year which clearly show the benefits of the IDT chamber for the industry.

As such a main convincing argument the industry's wish for one-stop-testing/certification was advanced. The reason why the IDT chamber shows this benefit lies in the fact that a testing standard needs to be independent of place, time and tester and that it needs to be defined and reproducible enough to achieve a general agreement among the European countries. Prof. Willms also pointed out the suitability of the IDT chamber to be used as a manufacturer's tool for development and quality testing.

Most irritations occurred concerning the "Walk Test". For several times it was pointed out by the representatives of University Duisburg-Essen and DELTA that the IDT chamber shall just be used for the stability test which has to be carried out before and after an environmental test. A detector's ability to detect an intrusion situation still shall be checked by using the Walk Test. Reacting to Mr. Conrads' (VdS) accuse that the "aim of superseding the walk-test was not reached" Prof. Willms explained that this initial aim was crossed out by the majority of project partners to which VdS belonged among others.

Résumé

Prof. H. Luck, chairman EUSAS

Referring to the lively discussion and the correspondingly increased mutual understanding of viewpoints Prof. Luck called the workshop "successful", although he had to express his disappointment about the low participation.

4 List of Participants

| | |
|--------------------|---|
| Aris, Martin | BRE, Garston, Great Britain |
| Berentsen, Martin | University Duisburg-Essen, Duisburg, Germany |
| Conrads, Reinhard | VdS, Cologne, Germany |
| Gesenhues, Dirk | Siemens Gebäudetechnik, Munich, Germany |
| Duft, Armin | Novar GmbH, Albstadt, Germany |
| Kempka, Thorsten | University Duisburg-Essen, Duisburg, Germany |
| Kohlert, Karsten | DELTA, Denmark |
| Krüll, Wolfgang | University Duisburg-Essen, Duisburg, Germany |
| Lahat, Michael | Visonic Ltd., Telaviv, Israel |
| Linden, Oliver | University Duisburg-Essen, Duisburg, Germany |
| Loi, Carlo Renato | CENELEC TC79, Milano, Italy |
| Luck, Heinz | University Duisburg-Essen, Duisburg, Germany |
| Olsen, Ole | DELTA, Denmark |
| Panthus, Math | Weerth, Netherlands |
| Rexfort, Claudia | University Duisburg-Essen, Duisburg, Germany |
| Rieche, Helmut | ZVEI, Germany |
| Shviki, Yehuda | Visonic Ltd., Tel-Aviv, Israel |
| Schneider, Hans | Bundesamt für Sicherheit in der Informationstechnik (BSI), Bonn, Germany |
| Steensen, Ole | DELTA, Denmark |
| Tigros, Chrsto | ANPI, Belgium |
| Watzlawik, Günther | Novar GmbH, Albstadt, Germany |
| Willms, Ingolf | University Duisburg-Essen, Duisburg, Germany |
| Wouter, Huymans | ANPI, Belgium |

(23 participants)

5 List of Speakers

Aris, Martin
Conrads, Reinhard
Kohlert, Karsten
Loi, Carlo Renato
Luck, Heinz
Olsen, Ole
Rieche, Helmut
Steensen, Ole
Willms, Ingolf

(9 speakers)