



On-line Measurements and Control New solutions









<u>Kurschat Systems</u> and <u>Betacontrol Systems</u>, members of Electronic Systems - Group, Italy

Your worldwide partner for measurement and inspection systems

- Private company established in 1979
- ✓ over 100 employees worldwide Headquarters in MOMO (NO), Italy
- ✓ R&D for different production fields
- ✓ More than 4000 installations worldwide.

- Process Automation
- Process Controls
- ☐ Thickness , Weight, Moisture Gauging
- Special Optical Inspection Systems
- Special Machinery for Tire and Plastic Industry







Online Quality Control



A NUMBER OF ASPECTS NEED TO BE CONSIDERED FOR REDUCING THE OPERATING COST OF THE PRODUCTION AND TO IMPROVE THE QUALITY OF THE FINAL PRODUCT

- 1. DURING PRODUCTION AND AFTER A RECIPE CHANGE CHECK IF THE TARGET IS MAINTAINED
- 2. MINIMIZE THE THICKNESS VARIABILITY TO MINIMIZE THE USE OF RAW MATERIAL.
- 3. CERTIFY THE QUALITY OF THE FINAL PRODUCT AND GUARANTEE THE TRACEABILITY OF THE PRODUCTION
- 4. ACHIEVE AN OPTIMAL AUTOMATIC REGULATION USING THE MOST RECENT TECHNOLOGIES
- 5. REDUCING THE TIME NECESSARY TO CHANGE PRODUCTION MINIMIZING WASTE OF MATERIAL
- 6. REDUCE SCRAP DURING PRODUCTION
- 7. SAVE ENERGY AND RAW MATERIAL

MOST OF THE ABOVE POINTS INVOLVE THE USE OF THICKNESS OR BASIS WEIGHT MEASUREMENTS
AS WELL AS AUTOMATIC REGULATION





Online Quality Control



SPECIFIC FEATURES ARE REQUESTED FOR ONLINE MEASUREMENTS

ONLINE INSTRUMENTS HAVE TO COLLECT ENOUGH MEASUREMENTS TO GIVE A GOOD REPRESENTATION OF THE WHOLE PRODUCTION

THEY HAVE TO BE ACCURATE ENOUGH COMPARED WITH THE EFFECTIVE CAPABILITY OF THE PRODUCTION PLANT.

THE MEASUREMENTS MUST BE SUITABLE TO BE USED AS FEEDBACK OF AN AUTOMATIC REGULATION

THE MEASURE SHOULD BE EFFECTUATED WITHOUT TOUCHING THE PRODUCT

THE THICKNESS OR BASIS WEIGHT OF THE FILM IS OBTAINED BY INDIRECT MEASUREMENTS OF OTHER PHYSICAL QUANTITIES THAT MAINLY CHANGE WITH THE THICKNESS OR BASIS WEIGHT VARIATION

THIS IS POSSIBLE BY INTERACTING ONE SPECIFIC KIND OF ENERGY WITH THE FILM AND MEASURING THE RESULTING EFFECT

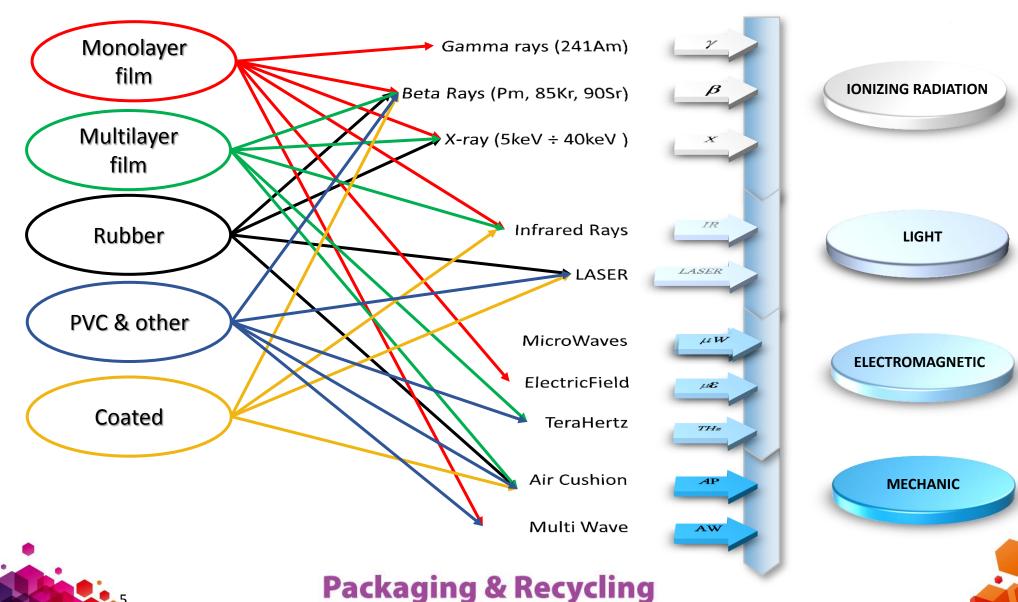
AS CONSEQUENCE, THE PHYSICAL CHARACTERISTIC OF THE PRODUCT, ITS CHEMICAL COMPOSITION AND GEOMETRICAL STRUCTURE, COULD HAVE A NOT NEGLIGIBLE INFLUENCE ON THE RESULTS.





COMMON USED TECHNOLOGIES FOR ON LINE MEASUREMENTS









TECNOLOGY	FAMILY MODEL	[]	1,0	2.0	3,0	4,0	5,0	0′9	2,0	8,0	0′6	10,0	20,0	30,0	40,0	50,0	60,0	70,0	80,0	0'06	100,0	200,0	300,0	400,0	200,0	0′009	200,0	0′008	0'006	1.000	2.000	3.000	4.000	3.000	9.000	7.000	8.000	9.000	10.000	15.000	20.000	30 000	35.000	40.000	45.000	20.000
BETA RAY	ISOSINT	g/m²	!				5																						10	00			550	00												
X RAY	PREXISION	g/m²	2				5																													800	00									
AIR CUSHION	ESSAIR	μm																	80																								40	0000		
LASER	LASER	μm																	80																										50	000
INFRARED	IR/DIGILAYER	μm								8									80		100	3	300																							
MICROWAVE	MICROWAVES	g/m²	1															70							(500																				
TERAHERTZ	THZ	μm																	80														500	0												
CAPACITIVE	C - SWAN	μm											15									3	300																							

ISOSINT	BASIS WEIGHT / THICKNESS	TRANSMISSION. ABSORBANCE OF THE RADIATION THROUGH THE MATERIAL
PREXISION	BASIS WEIGHT / THICKNESS	TRANSMISSION. ABSORBANCE OF THE RADIATION THROUGH THE MATERIAL
ESSAIR	THICKNESS	SINGLE AND DOUBLE REFLECTION. WIDE RANGE OF MATERIAL, PATENTED AUTOCALIBRATION SYSTEM
LASER	THICKNESS	SINGLE AND DOUBLE REFLECTION. TRIGONOMETRIC PRINCIPLE OR SHADOW PRINCIPLE.
IR/ DIGILAYER	THICKNESS / MOISTURE	TRANSMISSION AND REFLECTION. USE THE IR "SIGNATURE" WAVELENGTHS OF THE POLYMERS.
MICROWAVES	MOISTURE	TRANSMISSION. RESONANCE SHIFT OF THE MICROWAVE DUE TO THE DIELECTRIC CONSTANT
THZ	THICKNESS	REFLECTION: TIME TO FLIGHT ANALYSIS OF REFLECTED PULSES. TRASMISSION: RADIATION ABSORBANCE
CAPACITIVE	THICKNESS	RESONANT SHIFT DUE TO THE DIELECTRIC CONSTANT.





SYSTEMS USING IONIZING RADIATIONS









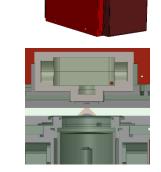


OPTIMAL FOR EVERY TYPE OF MATERIAL, THE MEASUREMENT CAN BE INFLUENCED BY THE MATERIAL STRUCTURE.

FOR THIS REASON IT IS NECESSARY TO CALIBRATE THE SENSOR ON SPECIFIC PRODUCT OR FAMILY OF SIMILAR PRODUCTS.

THE PRESENCE OF THE RADIOACTIVE CAPSULE REQUIRES THE END-USER TO APPLY FOR SPECIAL COMPULSORY PROCEDURES TO THE LOCAL NUCLEAR AUTHORITY FOR OBTAINING THE AUTHORIZATION OF THEIR USE.





Where possible, is a good alternative to the use of beta ray, mainly in case of very thin products.

DUE TO THE NATURE OF X-RAY RADIATION, THE MEASURING CAN BE INFLUENCED BY THE MATERIAL STRUCTURE AND COMPOSITION MORE THAN THE BETA-RAY IS.

FOR THIS REASON IT IS NECESSARY TO CALIBRATE THE SENSOR ON SPECIFIC PRODUCT OR FAMILY OF SIMILAR PRODUCTS AND BE CONFIDENT THAT THE COMPOSITION OF THE PRODUCT BEING MEASURED IS QUITE HOMOGENEOUS.

The use of X-ray with energy less than 5KeV is accepted in almost world wide. In most countries the range is increased to 30KeV but with a radiation leakage outside the device less than $1\,\mu\text{S/h}$.

Packaging & Recycling





SYSTEMS USING SUB MILLIMETRIC MAGNETIC WAVES











THIS SENSOR MEASURES THE SURFACE WEIGHT OR THICKNESS OF FLAT SHEET MATERIALS, USING NON-IONISING, ELECTROMAGNETIC WAVES FOR THE CONTACT-FREE MEASURING PROCESS. IT IS SUITABLE FOR ACCURATE AND RAPID MEASUREMENT OF POLYMER-BASED MONO AND MULTILAYER FILMS.

COMPARED WITH SENSORS BASED ON IONISING RADIATION, THE NATIONAL OR INTERNATIONAL OFFICIAL REQUIREMENTS IN THIS RESPECT IN TERMS OF TRANSPORT, OPERATION AND DISPOSAL DO NOT APPLY TO THIS SENSOR. ITS OUTSTANDING EMC PROPERTIES MAKES MULTIWAVE SENSOR A HARMLESS AND RELIABLE CHOICE FOR A WIDE RANGE OF MEASUREMENT TASKS.

THERE IS NO INTERFERENCE WITH OTHER DEVICES AND THERE ARE NO HEALTH HAZARDS.

In case of homogeneous film it is a good alternative to sensor based on β -ray and X-ray technologies over a rather wide range, up to $2000 \, g/m^2$.





SYSTEMS USING INFRA RED RADIATIONS





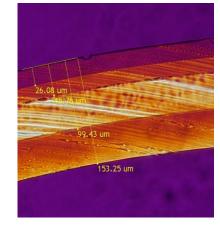
DIGILAYER



THE THICKNESS MEASURE OF THE FILM IS DONE BY COMPARING THE ABSORBANCE OF THE IR RADIATION AT DIFFERENT WAVELENGTHS (UP TO 11 — NEW)
THAT ARE TYPICAL FOR THE SPECIFIC POLYMERS.

IN THIS WAY IT IS POSSIBLE TO MEASURE NOT ONLY THE TOTAL THICKNESS OF THE FILM, BUT IN CASE OF BARRIER FILMS ALSO THE LAYERS OF THE DIFFERENT POLYMERS. MEASUREMENT IS POSSIBLE ALSO IN CASE OF LIGHT COLOURED FILMS.

Typical measure range up to 250µm







Sensor working similarly to **DIGILAYER** but with max 6 different wavelengts taken simultaneously and in same spot, that is a relevant feature in case of very not homogeneous film.



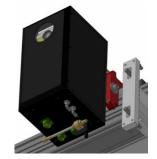




SYSTEMS USING INFRA RED RADIATIONS







Sensor working similarly to QT-IREX but in reflection against the product. High performance in measuring coated layer on paper or aluminium.



Q-INDISPECTRO





INNOVATIVE TECHNOLOGY.

THE MEASUREMENT IS BASED ON THE COMPARISON OF THE OPTICAL LAYER THICKNESSES WITH THE WAVE LENGTHS OF THE LIGHT. LIGHT IRRADIATED ON A TRANSPARENT LAYER IS PARTIALLY REFLECTED AT THE UPPER AS WELL AS AT THE LOWER INTERFACE.

BY THE SUPERPOSITION OF BOTH REFLECTED BEAMS AN INTERFERENCE SPECTRUM ARISES, DEPENDING ON THE THICKNESS OF THE IRRADIATED LAYER.

FAST DIGITAL SIGNAL PROCESSING PROVIDES A PRECISE CALCULATION OF THE LAYER THICKNESS







SYSTEMS USING AIR JET CUSHION







THE THICKNESS MEASUREMENT OF THE FILM IS DONE BY MEASURING THE PRESSURE OF THE AIR FLOWING OUTSIDE A SMALL NOZZLE, PLACED AT A SMALL DISTANCE, LESS THAN 2mm, JUST IN FRONT OF THE FILM. THE PRESSURE VALUE IS RELATED TO THIS DISTANCE AND CONSEQUENTLY TO THE THICKNESS.

A PATENTED AUTOMATIC CALIBRATION PROCEDURE, RELATES THE PRESSURE VALUES AT DIFFERENT DISTANCES, MAKES POSSIBLE TO HAVE THE DISTANCE ONCE THE PRESSURE VALUE IS MEASURED. IN ADDITION TO THE PRESSURE OF THE AIR FLOW, THE DISTANCE FROM A ROLL WHERE THE FILM IS ROLLING IS MEASURED USING AN INDUCTIVE SENSOR.

THE THICKNESS IS THE RESULT OF BOTH MEASUREMENTS.

THE MEASURED THICKNESS RANGE CAN GO FROM ABOUT 0,08mm TO 40mm, DEPENDING OF THE MODEL OF THIS SENSOR.







SYSTEMS USING AIR JET CUSHION







In case the film is very thick and rigid and cannot wrap around a roll, it can be used a double ESSAIR sensor. Each sensor measure its distance P1 and P2 from the top and bottom surface of the film, the distance M1 between the two ESSAIRs is measured by one of the inductive sensors. The thickness is calculated from these values.

THE MEASURED THICKNESS RANGE CAN GO FROM ABOUT 0,5mm to 20mm, depending of the model of this sensor.





SYSTEMS USING CAPACITIVE MEASURE

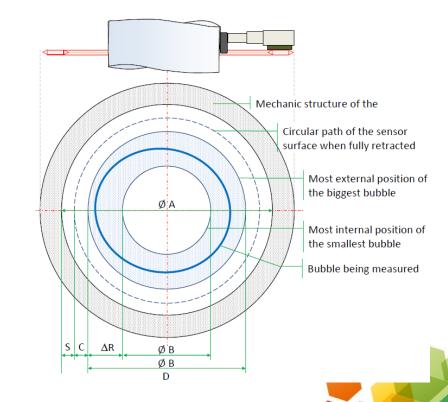






THE CAPACITIVE SENSOR IS A REFLECTION GAUGE ENGINEERED FOR THICKNESS MEASUREMENT. THE GAUGE BASES ITS FUNCTIONING ON CAPACITIVE TECHNOLOGY, IT FOUND ITS MAJOR APPLICATION IN BLOWN FILM OR DOUBLE BUBBLE PLANTS, INSTALLED IN A WAY TO MEASURE DIRECTLY ON THE BUBBLE, BEFORE THE COLLAPSING FRAMES.

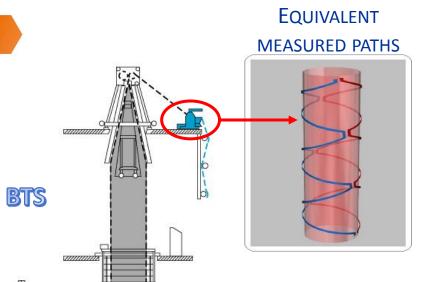
THE SENSOR IS INSTALLED ON A SPECIAL REVERSING CIRCULAR SCANNER, ABLE TO MEASURE THE BUBBLE OVER ITS WHOLE CIRCUMFERENCE. A TELESCOPIC ARM HOLDS THE CAPACITIVE PROBE AND IT IS CONTROLLED TO FOLLOW THE FLUCTUATION OF THE BUBBLE IN ORDER TO MAINTAIN THE OPTIMAL ADHERENCE ON IT. THE REVERSING SCANNER IS AVAILABLE ON A WIDE RANGE OF DIAMETERS, SUITABLE TO BE FITTED IN ALL TYPES OF BLOWN FILM INSTALLATION.





BTS SOLUTION FOR SINGLE BUBBLE AND DOUBLE BUBBLE LINES





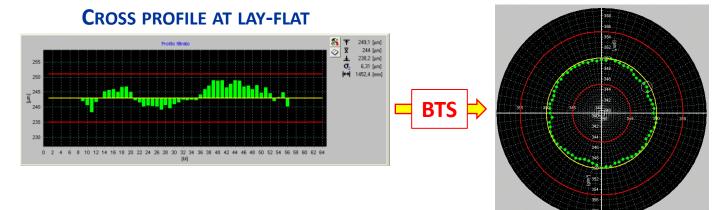
AN INTERESTING ALTERNATIVE TO A DIRECT MEASURE ON THE BUBBLE IS THE MEASUREMENT ON LAY-FLAT FILM, AFTER THE HAUL-OFF UNIT.

IN THIS POSITION IT IS USED A STANDARD O-FRAME WITH ALL THE TYPE OF SENSORS DESCRIBED IN THE PREVIOUS SLIDES.

THE BTS SPECIAL ALGORITHM, SEPARATES THE MEASUREMENTS TAKEN BY THE SENSOR AT ALL THE CROSS POSITION ALONG THE LAY-FLAT, TO HAVE THE EQUIVALENT THICKNESS PROFILE OF THE FILM ACROSS THE WHOLE CIRCUMFERENCE.

THANK TO THIS METHOD IT IS POSSIBLE TO USE, FOR EXAMPLE, THE **DIGILAYER** SENSOR TO MEASURE THE DIFFERENT LAYER OF THE BARRIER FILM.

POLAR PROFILE OF THE FILM







SOLUTION FOR CAST FILM LINES



F – BOOSTER Functionality

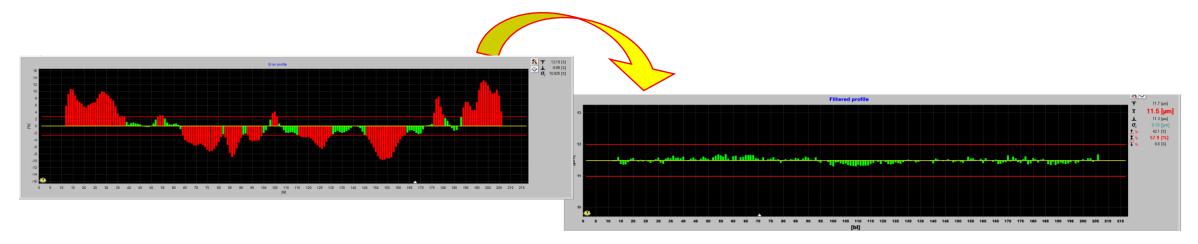


IS A FUNCTIONALITY AVAILABLE IN THE AUTOMATIC REGULATION **AUTOBOLT**, THAT CAN BE ACTIVATED WITH THE SCOPE OF REDUCING THE TIME TO RECOVER SIGNIFICANT ERRORS IN THE CROSS PROFILE.

BOOSTER ACTION USES THE FULL POWER RANGE AVAILABLE FOR THE CONTROLLED THERMAL BOLT, BY KEEPING IT AT THE MINIMUM OR MAXIMUM VALUE, FOR A SPECIFIC TIME.

THE BOOSTER ACTION IS INTRODUCED AS "ENHANCEMENT" TO THE ONE ALREADY CALCULATED BY THE PID CONTROLLER, SO IT REPEATS WITH THE SAME PERIODICITY USED BY THE AUTOMATIC REGULATION.

THE TIME OF THE "ENHANCEMENT" DEPENDS FROM THE AVAILABLE POWER CHANGE AND FROM THE THICKNESS ERROR TO ADJUST.









SOLUTION FOR CAST FILM LINES



AUTOMAPPING Functionality

IS A FUNCTIONALITY AVAILABLE IN THE AUTOMATIC REGULATION AUTOBOLT, THAT CAN BE ACTIVATED WITH THE SCOPE OF MAPPING THE NECK-IN EFFECT ON THE EDGES OF THE FILM.

ONCE ACTIVATED, THE AUTOMAPPING PROCEDURE CHANGES THE POWER OF A NUMBER OF THERMAL BOLTS SUPPOSED BELONGING TO THE NECK-IN REGION, ON THE BASE OF A SPECIFIC RULE.

Due to this action the cross profile changes generating a sort of wave in correspondence of these thermal bolts. The automapping algoritm correlates the shape of the profile to the thermal bolts that produced it, generating the relation between the physical position of the bolts and their position at the scanning frame where the film is being measured. This procedure save time and does not require skilled operators in using it.





WEB INSPECTION



SYSTEM FLEXIN, WITH THE PREVIOUS DESCRIBED MEASURING SYSTEMS, BUILDING UP A VERY COMPLETE AND

EFFECTIVE ON-LINE QUALITY CONTROL SYSTEM.

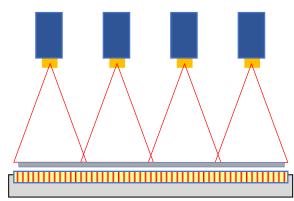
CCD - Linear Camera Technology

CCD camera: 2048 / 4096 / 8192 pixels

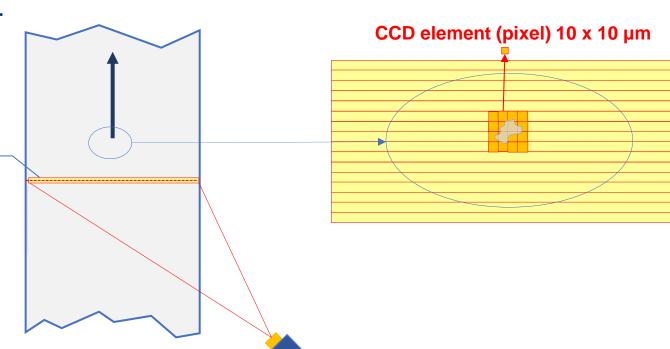
Line frequency up to 80KHz

Line detected by the camera

Multiple cameras to fit the requested inspection width and detection resolution



Light blade generated by an array of high efficiency LEDs Programmable intensity light blade



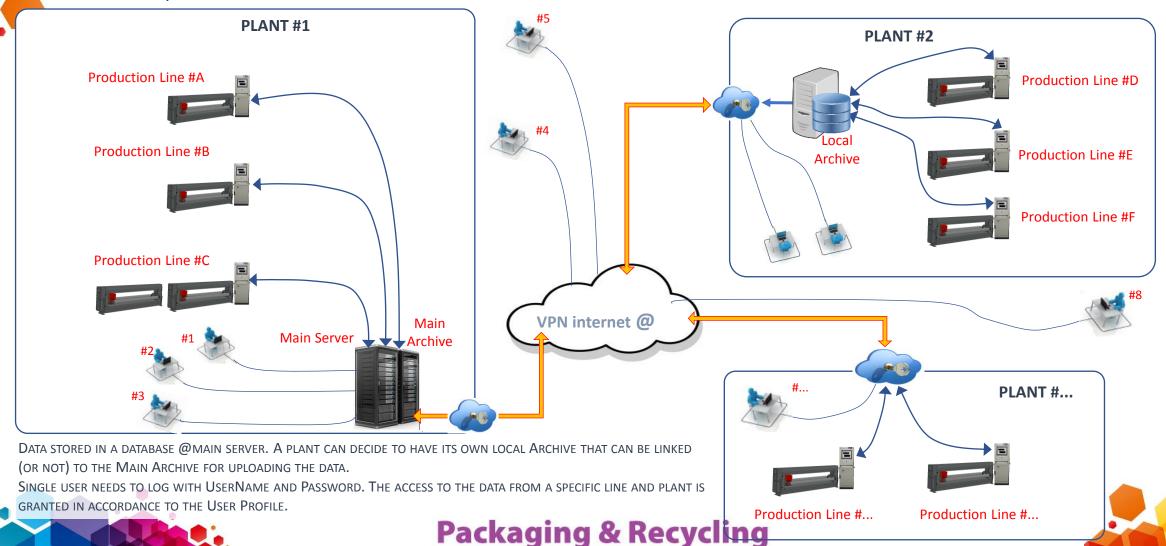
The 2D image of the defect is obtained thanks to the movement of the product, by storing next lines from the camera



14.0



FINALLY THE DATA COMING FROM THE DESCRIBED SYSTEMS INSTALLED ON DIFFERENT PRODUCTION LINES SPREAD IN DIFFERENT PLANTS WORLDWIDE, CAN BE COLLECTED AND ORGANIZED IN A CENTRALIZED DATABASE THROUGH THE ARCHIVING PACKAGE ELSY DB4.0







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THANK YOU FOR YOUR ATTENTION

Stay in touch











