NEWS 2012

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SINTRA presents the NEW GENERATION PLANTS

FOR THE FIRST TIME IN THE HISTORY OF AIR CONDITIONING, ONE SINGLE TECHNOLOGY MANAGES TO OBTAIN ALL THE MAXIMUM POSSIBLE PERFORMANCES IN TERMS OF ENERGY, ECONOMICS AND COMFORT.
IN ORDER TO EASILY DESIGN THESE NEW GENERATION PLANTS, SINTRA PROPOSES AN ORIGINAL SERVICE OF TECHNICAL ASSISTANCE TO THE PLANT'S PLANNING, SIMPLE AND EFFECTIVE.

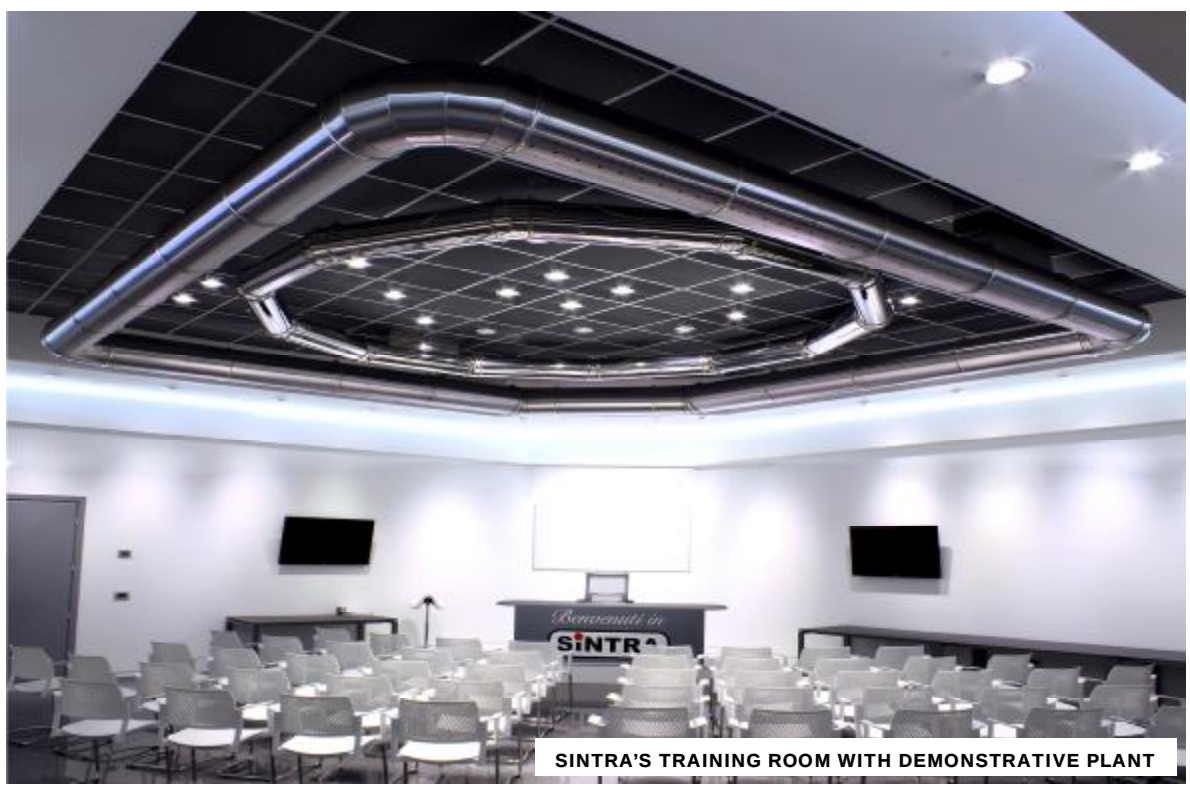
SINTRA has conceived some new technologies, defined QPE (quality, performance, efficiency) which allow to design plants able to guarantee extremely high performances with very contained costs.
The **QPE technologies** derive from the **primary MIX-IND® technology** of **environment air PULSION**, which uses particular perforated ducts called **PULSERS®** or **DLP® (Linear Pulsion Dispositives)** custom realized for each plant.
These new designing techniques allow today some highly innovative technical solutions, with truly exceptional performances, which considerably widen the limits of the traditional technology of **DIFFUSION of the input air**.
This **NEW GENERATION** of plants brings forward an important cultural evolution on the way HVAC plants are conceived, without settling uniquely for environmental comfort, but also introducing three new concepts:

- **MULTIFUNCTION**: kind of plant that employs a particular regulation system, through a PLC, which allows to easily adapt to the evolution of the environmental needs, connected particularly to the activity carried out in the premises.
- **ENERGY MINIMUM**, intended as **maximum technically possible energy saving,** always maintaining the **maximum desired comfort conditions** and completely cancelling all the energy waste connected to the constant air flow, to the heat stratification and to the plant's set up time.
- **VARIABLE COMFORT**: intended as the possibility to choose and easily change the residual air speed at floor level, always keeping the maximum de-stratification and the maximum homogeneity of the temperatures in the environment.

In order to easily design these **NEW GENERATION** plants, which are so peculiar, SINTRA provides the Project Manager with its 30 year experience in the designing of PULSION plants, with over 10.000 plants realised, offering two innovative services of design assistance: **TECHNICAL ORIENTATION** and **ASSISTED DESIGN**. The aim of these new services is to help the Project Manager to easily locate the MIX-IND® environment air PULSION technical solution which best meets their needs, appreciating risks and performances to their right value.

MIX-IND®
The **PULSION** technology of the environment air

SPIROPACK™
CIRCULAR DUCTS WITH AN OPEN CIRCUMFERENCE



SINTRA'S TRAINING ROOM WITH DEMONSTRATIVE PLANT

THE NEW ★★★★★ PLANTS

ENERGY SAVINGS possible up to:

80% on the fan's electrical consumption thanks to **EXTREME VARIABLE AIR FLOW**
40% on winter consumption thanks to **TOTAL DESTRATIFICATION**
30% on winter consumption for **REDUCTION OF THE SET IN MOTION TIMES**
30% on winter consumption for **EXTREME WINTER FREE-COOLING**
50% on existing plants in industrial buildings, for **TOTAL ENERGY REQUALIFICATION**

ECONOMICAL SAVINGS possible up to:

60% **ON THE INITIAL COST OF THE PLANT**
50% **ON THE RUNNING COSTS**
80% **ON THE FILTERS REPLACEMENT COSTS**

OTHER possible ADVANTAGES

- Maximum homogeneity of temperature and humidity in the environment
- Variable comfort
- Assistance to the plant's designing
- Total recovery of the endogenous heat
- Air speed control
- No air recovery ducts
- No need for ducts isolation
- Better dilution of the input external air
- Reduction of the assembly times
- Reduction of the transport volumes
- No limitations for the installation's height
- Extreme performances even in great height buildings
- Horizontal air throws possible even beyond 80m
- Easy to inspect
- Reduction of the encumbrances in the environment
- Reduction of the weights on the structures
- Maximum quality of the materials
- Increase of the plant's life span
- Increase of the filter's efficiency

THE MOST EVOLVED TECHNOLOGY
of perforated DLP® ducts for the environment air PULSION

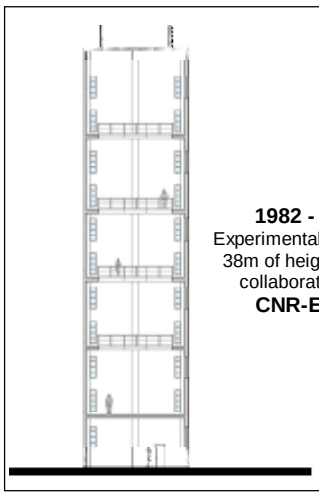
TODAY COMPLETES ITSELF WITH NEW

THE MOST COMPETITIVE PRODUCT
of perforated DLD ducts for the input air DIFFUSION

THE MIX-IND® TECHNOLOGY
30 YEARS OF EVOLUTION

In **1981** the **MIX-IND® technology** is born by analyzing the stratification and depression problems in a building of 10.000m², 18m of height, in the Pirelli Cavi establishment of Milano Bicocca.
Marco Zambolin, current president of SINTRA, then registers the first international patent, which originates four more patents, registered in the following year.

1982 and **1983** are two years of "base research" and experimentation, with the collaboration and the contribution of the National Committee for the Research and for the development of the Nuclear Energy and of the Alternative Energies (CNR-ENEA), within the project "Civil and industrial utilizations, energy and environment" of the PFE-2.
For the two years of research, a piezometric tower of 38m of height has been equipped as a laboratory, in order to define the calculation technique on the evolutionary and incremental parameters connected to the heat stratification and to the roofing's dispersion in great volume buildings, and the interactions relative to the height of the neutral area and to the permeability of the structures. Even with the most advanced calculation systems provided by CNR-ENEA, one can appreciate the great difficulty in creating a reliable mathematic model.



1982 - 1983
Experimental laboratory 38m of height used in collaboration with
CNR-ENEA

In the 12 following years, the testing carries on in guise of "applied research", both in Italy and in France, realizing turnkey plants in great volume buildings, allowing in this way to validate the hole punching designing and calculation techniques in always more extreme environmental functioning conditions.
In particular, the MIX-IND® technology develops itself in the automobile industry field, both Italian and French (Fiat group, Peugeot, Citroen, etc.), which constitutes an important experience base in great volume buildings, both with particular issues (oily fogs, welding fumes, ozone, heat presses, foundries, etc.) and with particular requirements (painting plants, metrologies, maceration, storage, assembling, loading and unloading, etc.).
The planning and realization experiences are developing also in other industry branches, not only as far as comfort is concerned but also the productive process, particularly in the aviation, spatial, pharmaceutical, concrete, ceramic, paper, electronic and textile industries.
These 14 years of research, testing and finalising of the technology, allowed to build a database of calculation experiences which are not only theoretical, but validated on field.
These experiences allowed the realization of the current calculation system for the sizing of the PULSION plants, based on 30 years of experience in designing and realisation of over 10.000 plants.

In **1995 SINTRA** is **constituted**, with the precise aim of developing the MIX-IND® technology, without giving turnkey plants anymore, but uniquely supplying the PULSER® DLP® ducts, and the engineering to support the plant's design.
In this way, the applications in almost all the industry and tertiary fields are multiplied with full success.

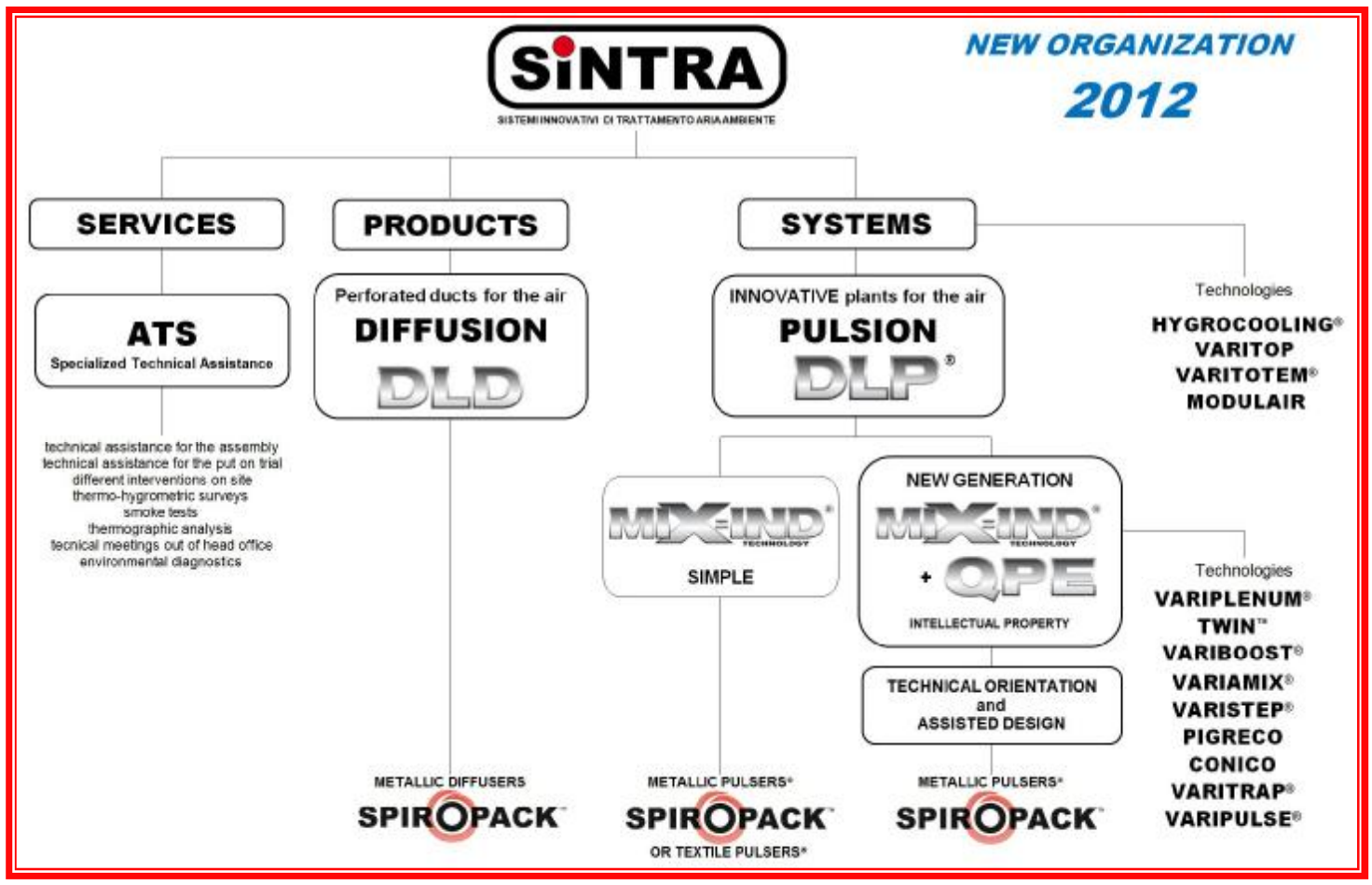
In **2009** the **SPIROPACK™** system is patented for the production of the metallic ducts with an open circumference and a programmed warpage of the diameter.
The new **workshop-laboratory** is also inaugurated, with the experimental, didactic and demonstrative plants for the applications in the industrial and tertiary field of great volume.
The new **QPE technologies** are also starting to be prepared and improved, and they are destined to revolution the way HVAC plants are designed.

In **2011** there is the realization of the new **offices-laboratory** which have experimental, didactic and demonstrative plants for the applications in the residential and tertiary field of small and medium volume.
The last patents inherent to the **QPE technologies** are registered, and the new technical and commercial organization is prepared for the official introduction on the market foreseen in 2012.

2012 is the year of the big changes, in which SINTRA introduces on the market its internal "revolution", which requires more than three years of preparations and important investments:

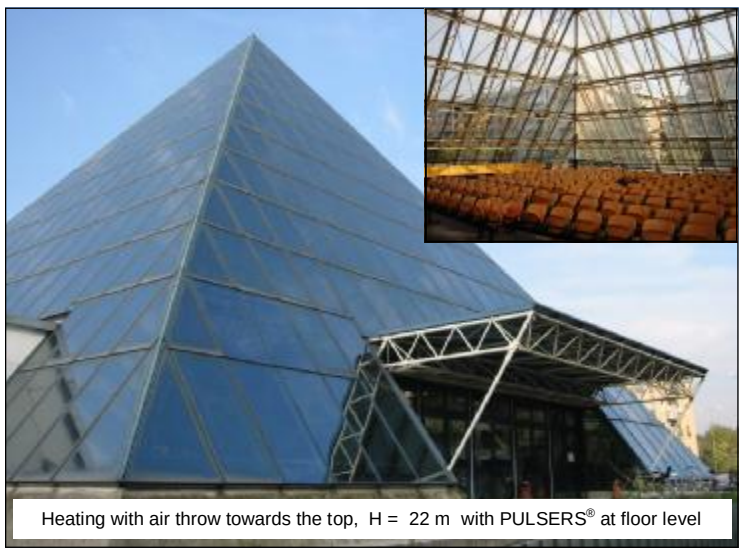
- **New** technical and commercial **organisation**
- Complete and updated presentation of the **new QPE technologies**
- New services of **TECHNICAL ORIENTATION** and **ASSISTED DESIGN**
- New **training courses** and technical updating courses on the PULSION plants
- New perforated **DLD** input air diffusion ducts
- Inauguration of the new **demonstrative plants**
- new **technical documentation**
- New **Website**

Ever since the beginning, **SINTRA** has not been constituted to simply sell products, but to develop and divulge on the market innovative technological systems, based on the MIX-IND® technology and finalize to the intelligent use of the energy in the



Examples of extreme performances achievable uniquely with
PULSION plants

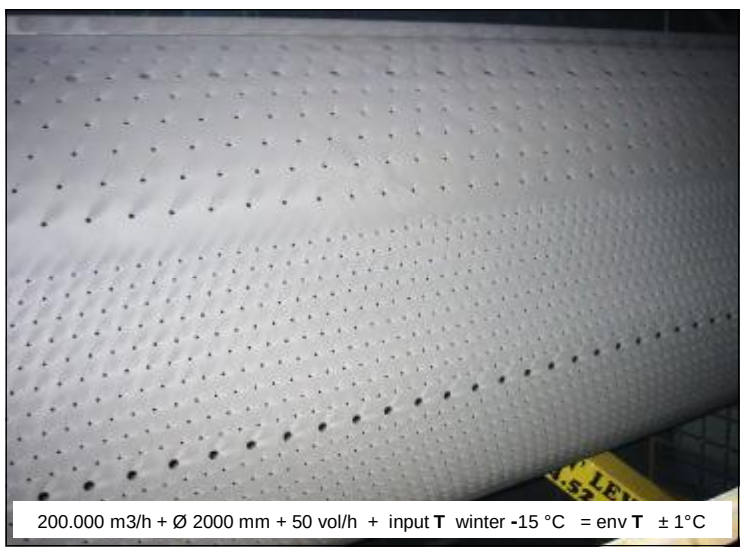
MIX-IND® TECHNOLOGY

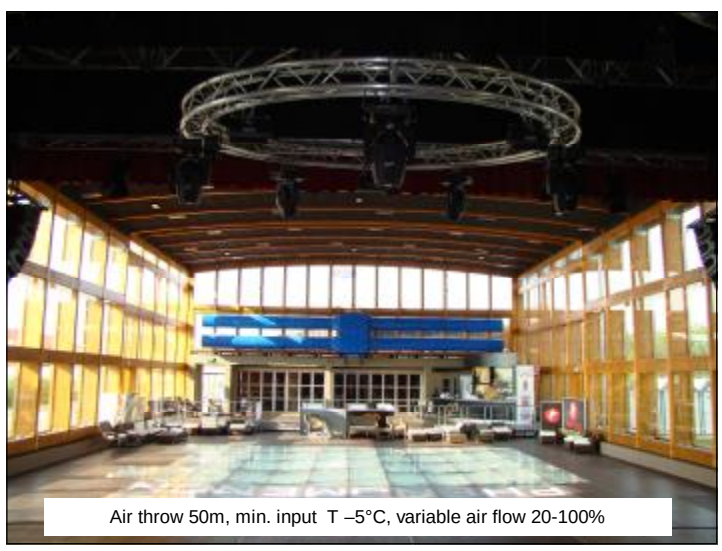

Heating with air throw towards the top, H = 22 m with PULSERS® at floor level


H = 32 m + great encumbrances in the environment + air recovery on top = stratification 0,9 °C

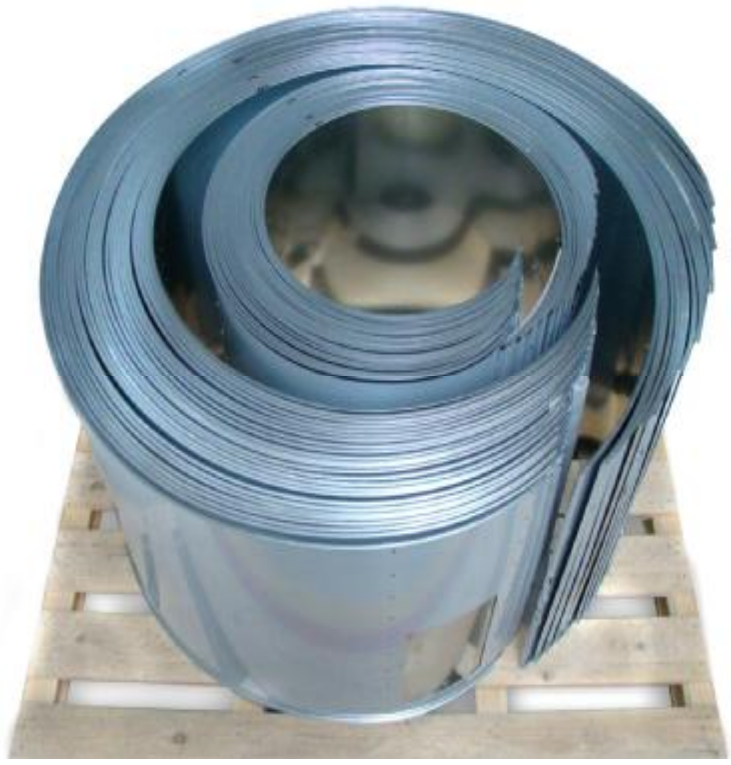

Air throw 60 m + installation height 27 m = env. **T** ± 1°C


Installation height 40 m + air throw 50m = env. **T** ± 1°C


200.000 m3/h + Ø 2000 mm + 50 vol/h + input **T** winter **-**15 °C = env **T** ± 1°C


Air throw 50m, min. input T –5°C, variable air flow 20-100%

CIRCULAR DUCTS WITH AN OPEN CIRCUMFERENCE



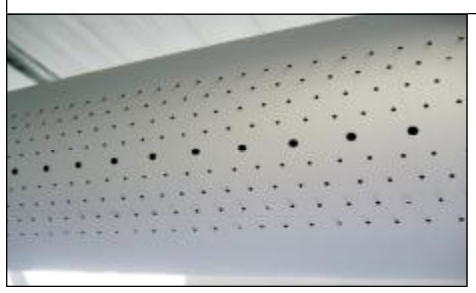
The new **GREEN TECHNOLOGY** (patent pending) for the production of the circular metallic ducts for the transportation and the distribution of the air, revolutionized the market with high quality products at very competitive prices.

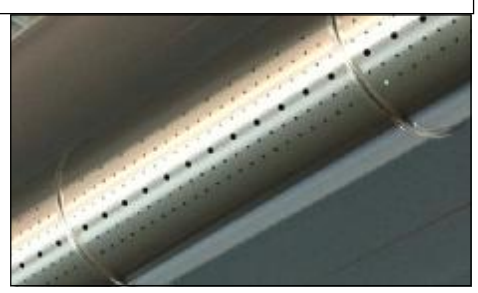
- lower initial cost
- high quality of the materials
- reduction of the assembly costs
- reduction of the transportation costs
- reduction of the encumbrances on site
- reduction of the production times
- easiness to assembly on site
- easy to inspect
- high air-proofability of the junctions
- good aesthetical appearance
- possibility to rotate each module

Supplied Kit

Example of encumbrancy volume for about 700m of DLP® SPIROPACK™ Ø 1600 mm, first on the truck, then on site...

FROM TEXTILE TO METALLIC





In these last years, the base MIX-IND® technology of environment air PULSION has gone through some deep evolutions.
The MIX-IND® perforated high induction ducts are born in 1981, and they are textile in order to better adapt to the particular needs of the great volume industrial environments, characterized by:

- big diameters
- few vol/h available
- long air throws
- great heights
- need for high air speed at the entrance of the PULSER®

Actually, the PULSER® was born textile exactly for the specific characteristics of the employed fabric materials, which allow to bear air speeds at the entrance of the PULSER® up to 22m/sec, not acceptable for metallic ducts.
The high quality of the rails, the carriage wheels, the fabrics and their manufacturing method, allows SINTRA to give a 10 year warranty with no need for ordinary maintenance.
But the longevity of the textile PULSER® ducts depends essentially from the turbulence risks created by collector ducts at the beginning, and above all from the risks of reversing strokes at the start-up of the fan.
This binds to a strict observance of particular INSTALLATION RULES.
In the last 15 years the applications have multiplied, above all in the tertiary sector, where the heights and the volumes are not always as important as they are in the industrial sector, and the needs are different:

- curves, connections, branches, etc. which tend to produce turbulences, not acceptable for textile PULSERS®
- low heights of installation which bind to the aesthetical perfection and cleanliness of the PULSER®
- need for small diameters and low pressures which, for the correct inflation of the PULSERS®, force to the use of light fabrics, therefore much more fragile and less long-lived
- air throws often very short, which require low pressures and don't ease the inflation of the PULSER®

These characteristics bring the textile PULSERS® to get closer and often to overlap the typical application field of the very much different traditional textile diffusers (perforated, porous or with slots), lighter and more economic fabrics are used, which can be supported also by simple steel cables, but characterised by a low longevity and by high maintenance costs.
From 1995 SINTRA starts to apply the MIX-IND® technology of the environment air PULSION to metallic ducts, with a remarkable success despite the higher costs. i
From 2009 the patent SPIROPACK™ allowed to considerably lower the prices for the metallic PULSERS®.
Thanks to this new production technique, today the production cost for the metallic PULSERS® of small and medium diameter is actually lower than the production cost for the fabric ones.
Moreover, the new legislation now binds to the use of class 0 (fire resistance) fabrics, realized with materials which aren't suitable for the PULSERS®.
The lowering of the prices propelled the development of those QPE™ technologies which could provoke turbulences inside the ducts, not acceptable for textile PULSERS®.
Compared to textile PULSERS® metallic PULSERS® offer numerous advantages:

- Possibility to mechanically bear air turbulences, allowing the use of technologies such as VARIPLENUM®, TWIN™, VARIBOOST®, PIGRECO and VARIPULSE®
- Aesthetical appearance without imperfections, therefore much more suitable for the architecturally more demanding applications
- Possibility to be painted with any colour
- Possibility to use noble materials such as Inox and copper
- Higher mechanical resistance
- Maximum fire resistance
- Higher longevity

For these reasons today, fabric PULSERS® are suggested uniquely for some specific applications, such as:

- Big diameter PULSERS® (> Ø 1700 mm)
- Industrial applications which require to privilege the "coaxial PULSION" rather than

THE NEW AIR DIFFUSION PERFORATED DUCTS

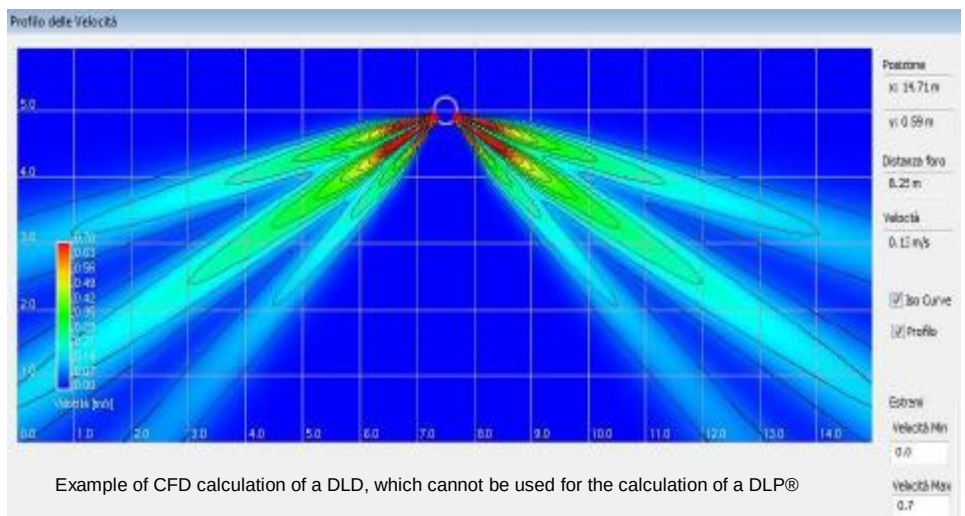
DLD

The air diffusion perforated ducts DLD represent an important innovation in 2012.
Taking advantage of the great production capacity of the new SPIROPACK™ line, five times higher than the actual needs, SINTRA completes its range of perforated metallic ducts.
In this way, the most evolved technology of perforated **DLP®** ducts for the **environment air PULSION** completes itself with the most competitive product of perforated **DLD** ducts for the **input air DIFFUSION**.
The aim is to satisfy the demand of the market range which asks for perforated ducts with optimal technical traditional performances at a very competitive price.
In the air DIFFUSION field, the DLD represents a diffusing terminal of high performances and high quality. Compared to the majority of the diffusers offered by the market, the DLD is characterised by its high induction, about 30 times higher than the input air.
This characteristic allows the DLD to dilute the input air temperature which a great quantity of environment air.
In this way, the "air throw trajectory deformation" is reduced to a minimum, since it is influenced by the temperature of the air which is put in motion.
The advantages of the DLD perforated ducts compared to traditional systems of the air DIFFUSION, constituted by ducts with air vents or diffusers, are the following:

- high quality of the air diffusion
- easy to calculate
- variety of available materials
- no need for thermal isolation

And thanks to the **SPIROPACK™** production technology:

- lower initial cost
- high quality of the materials
- reduction of the assembly costs
- reduction of the transportation costs
- reduction of the encumbrances on site
- reduction of the production times
- easiness to assembly on site
- easy to inspect
- high air-proofability of the junctions
- good aesthetical appearance
- possibility to regulate the air throw angle



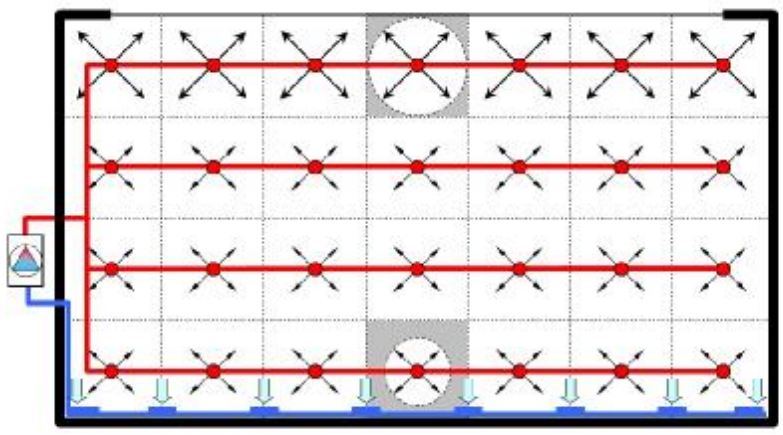
Example of CFD calculation of a DLD, which cannot be used for the calculation of a DLP®

the supply air
DIFFUSION

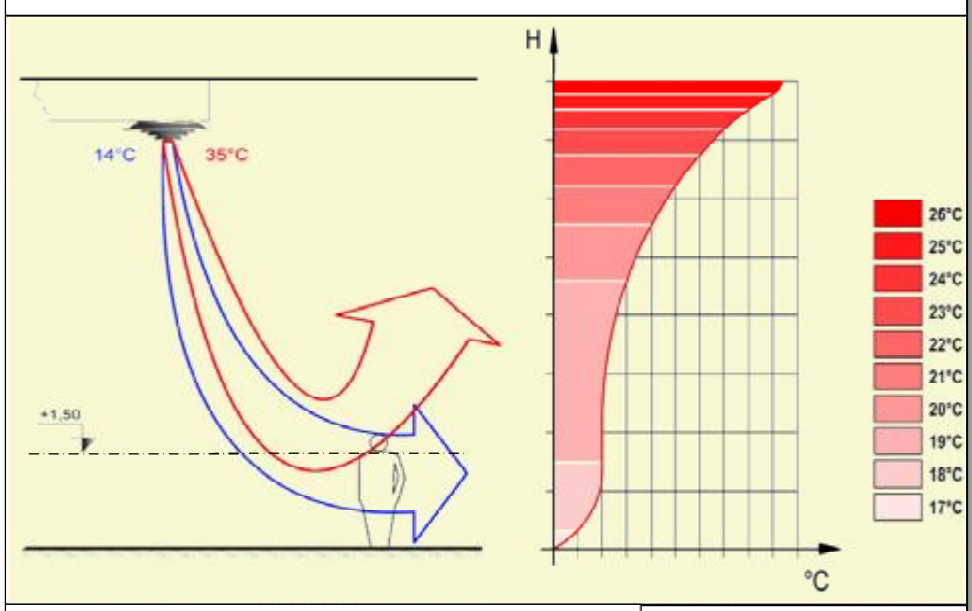
Traditional systems for the supply air DIFFUSION

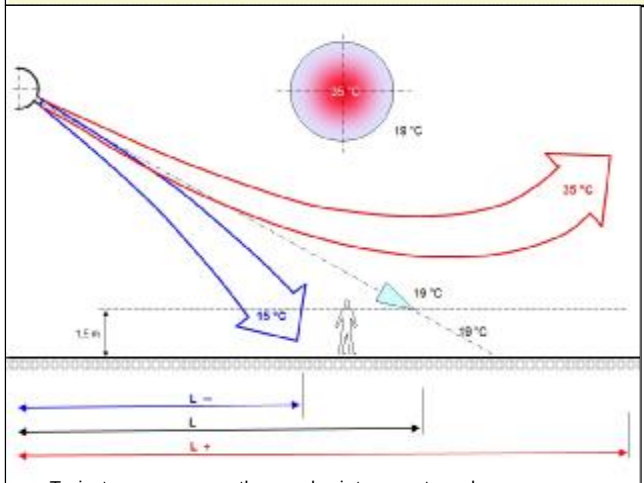
THE TRADITIONAL SYSTEMS FOR THE SUPPLY AIR
DIFFUSION

The traditional **systems for the air DIFFUSION**, are designed to "distribute" the supply air in the environment according to the repartition of the winter dispersions and of the summer heat supplies in the environment .
The **DIFFUSION terminals**, such as air vents, diffusers, nozzles, etc. generally tend to favour the heat stratification under the roofing, as the supply air temperature in the environment increases.
When the supply air temperature lowers itself instead, they tend to create air currents at floor level.
By increasing the installation height and the air throw length, the difficulties increase proportionally.
The induction factor, therefore the ability to blend the supply air with the environment air, is generally a very positive factor, but as its value increases, the air throw ability and the possible installation height are proportionally reduced. The limited air throw capability induces therefore the necessity to increase the number of ducts and diffusers in the environment, in addition to the obvious need for a sufficient repartition of the air recovery points.
Even the terminals with a long air throw and an optimal induction factor, become very sensitive to the supply air temperature's variation as the air throw increases, proportionally increasing both the stratification and air currents risk.
For this reason, the plants are generally calibrated on the supply air's minimum temperature comfort, in order to control the maximum speed at ground level, tolerating stratification as the supply air temperature increases.
However, the energy consumptions are penalized, particularly during the plant's set in motion phase in winter.



Typical scheme for the air flow's **repartition**, used in the traditional plants of **supply air DIFFUSION**





Trajectory warpage as the supply air temperature changes

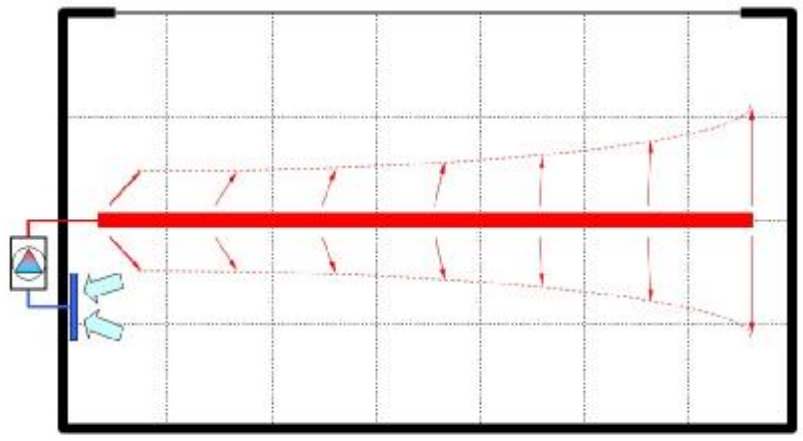
long range terminals for the supply air
DIFFUSION

The long range DIFFUSION TERMINALS (eg. nozzles) are very efficient when they supply isothermal air, but they warp the air throw's trajectory as the supply air temperature changes. As the supply air temperature rises, they extend the air throw distance and favour the stratification of the heat under the roofing.
As the supply air temperature lowers, they shorten the air throw distance and they tend to favour the formation of air drafts at floor level.

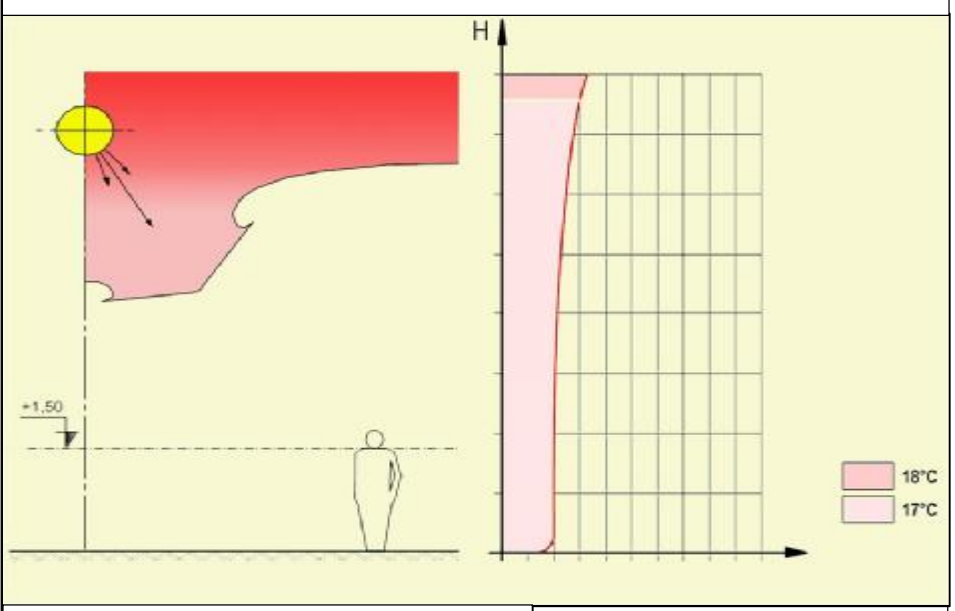
the environment air
PULSION

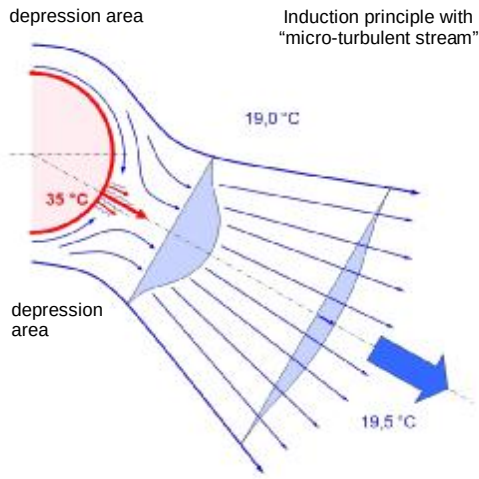
THE INNOVATIVE TECHNOLOGY OF THE ENVIRONMENT AIR
PULSION

The environment air PULSION technology answers to criteria which are very much different from those of the supply air diffusion.
In the PULSION plants, the base principle consists in using the supply air to set in motion **the entirety** of the environment's air volume in the desired direction and at the desired speed.
In order to reach this target, particular perforated ducts, called **PULSERS®** or more precisely **DLP® (Linear Pulsion Devices)** are used. These DLP® are able to create a "pressure field" along their axis, so that they can push the **totality** of the environment air mass in order to put it in motion at the desired speed.
A **DLP®** is constituted by a textile or metallic canalization, preferably of circular shape, in order to better advantage the air induction from the surrounding environment.
A particular hole punching pattern is applied on the PULSER®'s surface. This pattern is constituted by two kinds of holes:
The induction holes, which are smaller, determinate the quantity of the air that needs to be recalled by induction from the surrounding environment, in order to perfectly lend it with the supply air.
The guide holes, which are bigger, determinate the direction, the speed and the distance at which the environment air mass, pre-blended by the induction holes, must be moved.
The exit air speed from the holes compared to their diameter, the distance between them, their position on the **DLP®**'s surface, the **DLP®**'s position in the environment and to the minimum and maximum supply air temperature's differences, determinate the **DLP®**'s skill to create the necessary "pressure field".
By operating in this way, it is possible to "push" the environment air mass to distances which are far superior to the air throw capacity of any kind of diffusion terminal which, in order to achieve the desired distance, will always encounter the environment air's opposition.
With the PULSION technology, in each minute about the entirety of the environment air completes its course in the room, returning to the **DLP®**'s "depression area" to blend again with the supply air.
By operating in this way, the moving air flow perfectly homogenizes all the temperatures in the environment, easily clearing all the obstacles which are along its path.



Typical scheme of a **MIX-IND® DLP®** , used in the innovative plants of **environment air PULSION**





terminals for the environment air
PULSION

The air coming out of the holes in a non-guided way, causes a very turbulent "fraying" of the air's fluid fillets.
In this way, the "micro-whirlwinds" created on the hole's circumference, produce a strong depression around each single hole, which is able to recall the air from the surrounding environment in a quantity which is generally 30 times higher than the air coming out of the hole.
The combined action of the group of holes, opportunely sized and opportunely distributed on the PULSER®'s surface, create a particular "pressure field" able to set in motion **the totality** of the environment air mass at the desired speed.

The important differences between:

perforated DLD DIFFUSION ducts and perforated DLP® PULSION ducts

DLD or DLP® ? It is impossible to perceive it with sight

DIFFUSION Linear Devices

PULSION Linear Devices

The **DLD**s are micro-perforated inductive ducts with a hole punching pattern which is visually very similar to the DLP® 's one, therefore it is easy to confuse them. However, the DLDs have a deeply different way of functioning from the DLPs®.
The DLD hole punching pattern is calculated following the traditional rules of the air DIFFUSION.
The holes are therefore calculated to "throw" the supply air at the desired distance, exactly the same way as it's done for an air vent or a traditional air diffuser.
Each 1m DLD module has then to be considered as a section of duct on which a diffuser or an air vent can be positioned.
Compared to traditional air vents and nozzles, the DLD is positioned at the highest performances levels, It is uniquely the hole punching pattern which determinates the DLD's diffusion characteristics, and the same hole punching pattern can be applied to DLDs of any diameter.
As for the diffusers, the hole punching patterns that can be applied to a DLD module of any diameter are tested in laboratory, where their effective air throw capability and their air diffusion quality are calculated and verified.
The module calculated in this way can therefore be repeated for the desired length, in order to form a linear diffuser duct, which will be able to be perforated in a continuous or even alternated way.
The only limit is determined by the fact that the air flow coming out of the holes for each module cannot be regulated.
It is important to notice that, if the air speed at the DLD's entrance is too high, there is the risk to create air drafts in the environment.
This is due to the well-known issues rising from the dynamic pressure's recovery into static pressure.
It is also important to notice that, if the DLD's length is excessive, the temperature loss throughout the duct will cause a dishomogeneity of the temperatures in the environment.
In order to correct this effect, if we were to compensate by increasing the hole punching in the final part of the DLD, the air drafts and heat stratification risks will increase.
Therefore, to have a DLD function at its best, we strongly recommend not to exceed an air speed of 5 m/sec at the entrance of the DLP®, 30 m of length and not to go above 10°C temperature difference between the supply air and the environment air.
It is also important to remind that, in the same way as all the best air DIFFUSION systems, even the DLDs will be subject to:

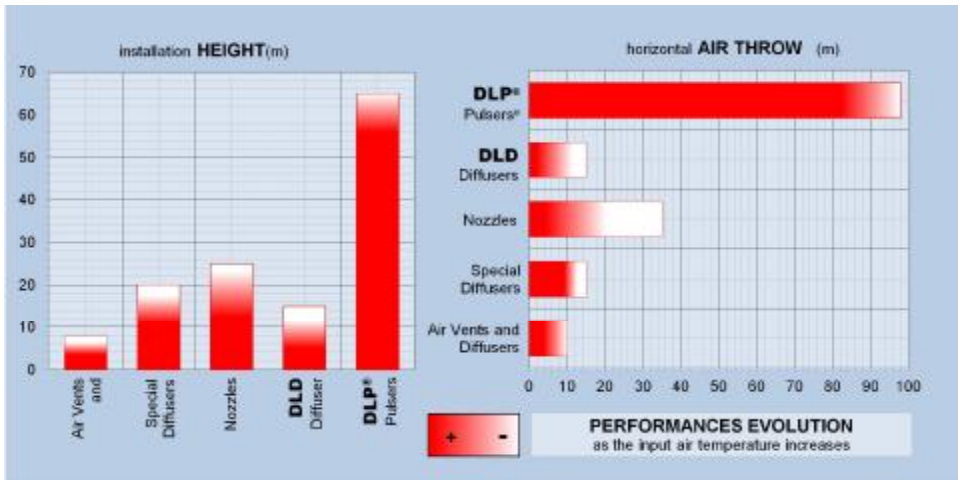
- stratification risk, when hot air is supplied
- air draft risk, when cold air is supplied
- as induction increases, the air throw reduces
- as the air throw increases, the stratification and air draft risks also increase
- need for environment air recovery at floor level in the winter seasson, in order not to increase stratification, extending the plant's set in motion times.

For a **DLP®** or **PULSER®** the matter is much more elaborate.
A DLP® is conceived in order to create a "pressure field" along its axis, able to give a *boost* (PULSION) to the environment air, in order to set it in motion for its whole mass, at the desired speed and for the desired distance.
The correct positioning of the PULSERs® in the environment, in function of the kind of activity carried out on the premises, is fundamental for the good functioning of a PULSION plant.
According to the building's shape and to the PULSER®'s disposition in the environment, each PULSER® has to be sized to privilege the *coaxial PULSION* rather than the *tangential PULSION* and vice-versa.
A DLP® has an induction skill similar to the one of a DLD, but simply having a high induction is not enough to manage to set in motion **the totality** of the environment air's volume.
In a DLP®, each hole has a different function and behaviour compared to the hole that precedes it, and the hole that follows it.
A DLP® cannot be calculated for each meter as it is done for a DLD, but it works uniquely as a one single element, in its whole length.
For example, if a 1m module is taken from a DLP® with a 50m air throw, and it is put in operation as a single duct, it would probably have an air throw of just 5 or 6m, and it would become a DLD.
If a DLP®'s functioning would be modified beyond 10% compared to its calculation condition, it wouldn't be able to set in motion the totality of the environment's air volume, losing all performances and causing functioning issues.
The principal characteristics of a DLP®, compared to a DLD, as to any other kind of diffuser, are:

- maximum homogeneity of the temperatures in the environment even in great height buildings
- no need for air recovery ducts
- considerably higher air throw capacity, therefore fewer ducts in the environment

CONCLUSIONS

The DLD finds its best application in medium or low height buildings, where a high quality of air diffusion is demanded, with no particular performances.
The DLP® can be applied to any kind of building, with no height limit, where high performances are demanded, but it needs SINTRA's engineering support.
In order to transform a plant conceived with DLDs into a PULSION plant with DLPs®, it is necessary to re-design the plant with SINTRA's engineering support.
Vice-versa, to transform a plant conceived with DLPs® into a DLD DIFFUSION plant, it is necessary to re-design the plant, generally increasing the number of ducts in the environment.



THE PATENTED* TECHNOLOGIES

QPE
QUALITY - PERFORMANCES - EFFICIENCY

VARIPLENUM®: patented designing technology with COMPENSATED GATHERING PLENUM, which combines together all the AHUs and all the PULSERS® in one single aeraulic circuit. This technology allows to reduce the PULSER®'s diameter, and allows the functioning of the MULTI -FUNCTION PLANTS.

TWIN™ : patent pending technology of multi-functional splitting of the PULSERS®, with the aim of giving each PULSER® different duties, variable between them. Also this technology allows the realization of MULTI-FUNCTION plants. Instead of having just one duct with a big diameter, there are two or more parallel ducts, so that they can have different functions. In this way the primary PULSER® easily recovers, by induction, the variable air flow from the secondary PULSER®.

PIGRECO : patent pending connection between lines of the "started up flow" kind, for TWIN™ and VARIPLENUM® connections. This connecting system allows to join together two parallel ducts (TWIN™) to a perpendicular duct, with two 45° Y branches opposite to each other, reducing turbulences to a minimum.

VARIAMIX® : calculation technique (know-how SINTRA) of the variable modulating air flow perforations, which allows the variation of the exit air speed from the holes which, depending on the circumstances, can be extended up to 50-100% without significant performance loss.

VARISTEP® : calculation technique (know-how SINTRA) of the perforations which privileges the "passive influence areas", allowing the plant's functioning at a variable air flow by steps, keeping a constant exit air speed from the holes. This technology allows to increase the PULSION efficiency even in the "passive influence areas", next to the air throw area. Therefore, in a plant constituted by several PULSERS®, equal and parallel between each other, each equipped with its own AHU (or roof-top), it is possible to obtain excellent performances even by intercepting the functioning of two PULSERS® out of three. With regards to the plant's total air flow, this allows a variable air flow by steps, intercepting the AHUs in an apposite sequence.

VARIBOOST®: patented technology, finalized to obtain the acceleration of the plant's set in motion times and the running of a multi-function plant. This technology allows the increase of the "PULSION power" at set time periods, by intercepting the secondary PULSERS® with special dampers, in order to boost the functioning of either the primary PULSERS®, or the dedicated technical ones.

SPLIT: designing technique (know-how SINTRA) for the TOTAL energy upgrading of the heating plant, which separates the introduction of thermal power from the homogenization plant for the environment's temperatures. This technology uses autonomous self-sufficient PULSERS®, each of them supplied by a special fan, in order to perfectly blend all the heat sources in the environment, in a totally independent way from the heating plant. As an extremely powerful destratifier, it allows to elevate any existing and obsolete plant to the maximum levels of energy efficiency. This technology also allows to realize new plants with "simple heaters" (hot air generators, unit heaters, heating panels, etc.), also badly distributed in the environment, by homogenizing all temperatures, both vertical and horizontal in the environment, through the autonomous SELF-SUFFICIENT PULSERS® , conveniently conceived for each plant.

CONICO : patented PULSER® with a conical shape which exploits the calculation of the PULSER®'s final diameter with the aim to privilege the "coaxial PULSION" rather than the "tangential PULSION". This particular technology allows to increase the "PULSION efficiency" particularly useful in some great volume buildings, where it is necessary to set in controlled motion the big mass of the environment air with a little available air.

VARIPULSE®: patented motorized PULSER® able to rotate on its own axis, so that the air throw angle is adapted as the air flow and the supply air temperature vary. (Commercialization foreseen for end of 2013).

VARITRAP® : patented mechanical calibration system for the manual regulation of the residual air speed at floor level. This system allows to calculate a PULSER®'s hole punching pattern in the maximum yield conditions, also risking residual air drafts. In the case of eventual air drafts, during the calibration phase of the plant, it is possible to partially open the VARITRAP® placed at the beginning of the PULSER®, "discharging" in this way part of the supply air in the upper part of the PULSER®. This air is then immediately and totally "retrieved" from the induction in the first meters of hole punching. In this way, the PULSER® 's nominal air flow is reduced, consequently reducing the air exit speed from the holes and the "PULSION power".

VARITOP : air diffusion system (know-how SINTRA) by means of false-ceiling panels with a calibrated hole punching, for laboratories, industrial kitchens and low environments with great air volumes circulating. This system does not foresee the use of PULSERS®, but foresees simple perforated diffusion ducts which partition the great quantity of supply air inside an area delimited by a false ceiling. The air is then diffused in the environment through panels with calibrated holes, positioned on a traditional false-ceiling structure. For each single plant, SINTRA dimensions the different holes to be applied to part of the false-ceiling panels, whereas the remaining part of the panels is left without holes. In this way, the customer will have the possibility to position the non-perforated panels as they like, above the areas they want to protect from air drafts risks, and the panels with a differentiated hole punching will be positioned in the areas where the air drafts are better tolerated.

HYGROCOOLING®: patented system for the humidification and adiabatic cooling at high efficiency , which utilizes the PULSER® 's depression area to exploit the "micro-turbulent flow" induction, in order to easily vaporize the atomized water drops. A high pressure pump, equipped with all the necessary control and protection systems, feeds apposite nozzles which are positioned in the upper part of the PULSER® by a network of flexible hoses custom assembled for each plant. This high power humidification system generally has a lower cost compared to the ones introduced inside an AHU, and it has an evaporation capacity up to 20 times higher, profiting from the evaporation skill derived from the endogenous heat and from the quantity of induced air, which is about 30 times higher than the fan's one. The PULSION also guarantees the perfect repartition of the humidity in the environment. A further advantage is given by the fact that the supply air ducts keep dry internally, avoiding all risks connected to bacterial proliferation.

COMPLEMENTARY PRODUCTS

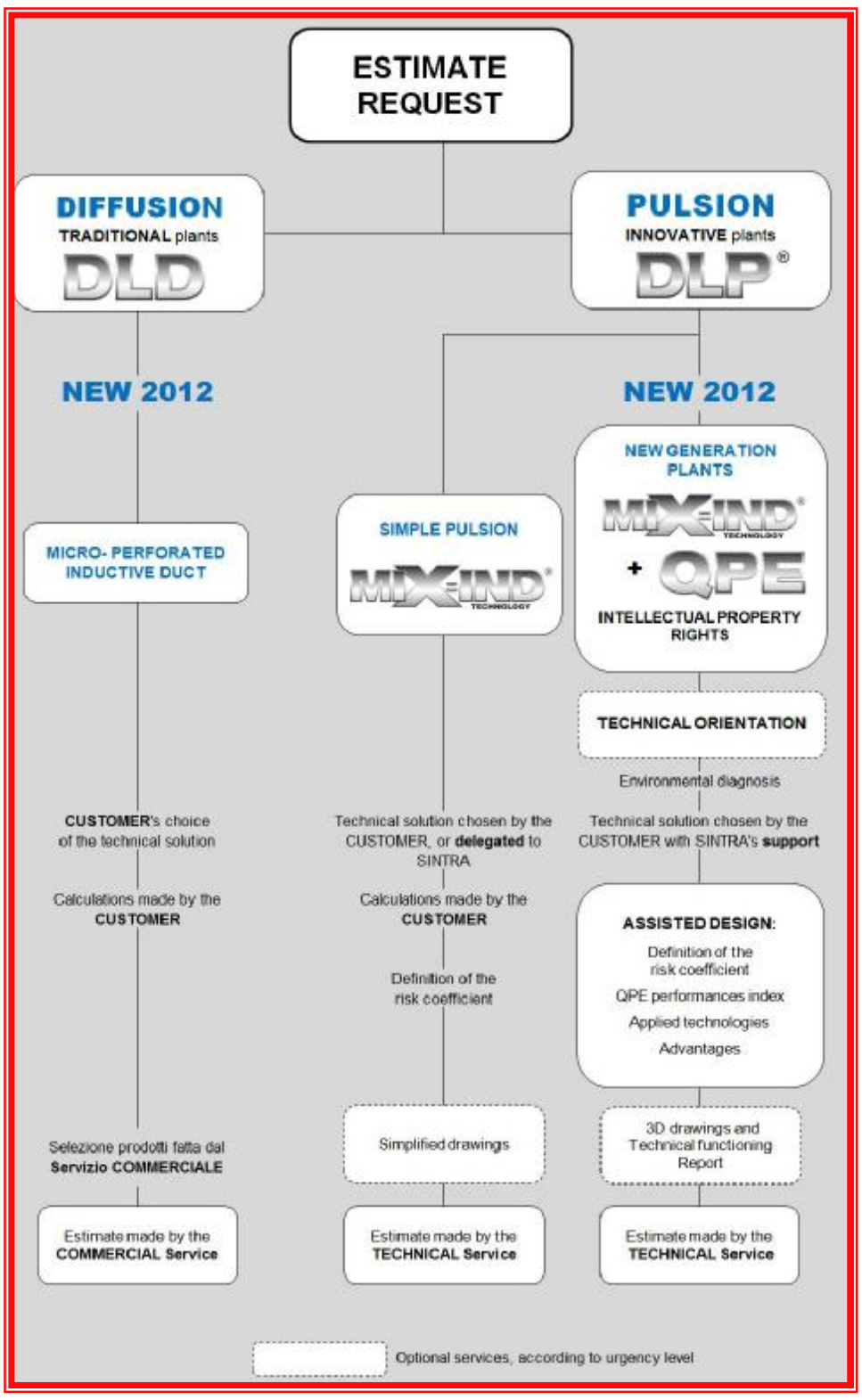
VARITOTEM®: patented system of air barriers with non-heated external or environment air for industrial doors , with an adjustable azimuth angle in function of the height of the building's "neutral area". The system foresees a group of independent cylindrical modules of 1m of length, simple and powerful, which can be assembles between themselves to constitute two columns of variable height to be placed on the door's sides. (Commercialization foreseen for end of 2013).

MODULAIR : summer de-superheating system (know-how SINTRA) for great volume buildings which uses low energy vertical towers from 40.000m3/h and with an installed power of just 1kW. These high performance vertical towers allow to realize a correct ventilation of the industrial buildings, particularly with the presence of endogenous heat, with great air flows (10-20 vol/h) at a very low cost both for the installation and for the running. As a general principle, to be adapted case by case to the single needs, the system consists in concentrating on just one wall, right under the roofing, the entirety of the towers, leaving all the openings to the outside, such as doors and windows, on the opposite wall. In case of insufficient openings, another series of supply air fans is realized, always on the opposite wall to the extraction ones. In this way a great air draft is created in the upper part of the building, able to carry all the heat which tends to stratify under the roofing. Therefore the heat produced in the lower part of the building will tend to rise more easily, in order to be then removed by the air draft itself.

*Patented, patent pending or SINTRA's know-how

DESIGNING A DIFFUSION PLANT WITH DLD

For the designing of an air diffusion plant which uses perforated diffusion DLD ducts, the process is exactly the same as for the sizing of a traditional plant with air vents or diffusers.
For the winter season, the project's designer calculates the static loss of the building and the dynamic loss due to external air infiltrations in the environment, without considering the external renew air.
This way, the total thermal power necessary for the environment to keep the internal required temperature is calculated.
By dividing the total thermal power for the air's specific heat and for the desired temperature difference, we obtain the minimum air flow which the plant needs to introduce the supply air at the desired temperature.
Generally, for almost all the air vents and the diffusers suggested by the market, it is recommended not to exceed the temperature difference of 10-12 °C between the supply air temperature and the environment air temperature. This has the purpose to reduce the stratification risk and the air draft risk to a minimum.
By excessively increasing the supply air temperature in the applications in medium height buildings, one can even run the risk of not being able to bring the environment to temperature.
This is suggested also for the use of the DLDs which, by having a higher induction skill, have a more reduced air throw skill as a natural consequence.
If the plant is not just for heating, but also for the air conditioning, the air flow which is necessary to introduce the cooling power in the environment is generally higher than the one calculated for the winter season alone.
For the calculation of the summer cooling power, the procedure is different.
The project designer calculates the maximum concurrent load from the heat coming back from the structures and the endogenous thermal load both sensitive and latent.
The relation between the sensitive and the total power, defines the supply air's temperature.
The heat content difference between the supply air conditions and the environment air ones, define the plant's air flow. For the maximum load conditions, a different air supply temperature modifies the relative humidity of the environment.
Once the total air flow of the plant is defined, it has to be "partitioned" homogeneously in the building, proportionally to the "repartition" of the present thermal and cooling loads.
The supply air is then channelled in the environment through some canalizations which feed some Terminal Diffusion Units (UTD), such as air vents, diffusers or DLD perforated ducts.
The distance between the UTDs is defined by their air throw capacity.
For the DLDs, the maximum suggested lateral air throw is 5-6m, in order to keep the maximum working performances.
Beyond this limit, the risks of dishomogeneity of the temperatures in the environment and of air drafts increase proportionally, also lengthening the times for the plant's set in motion.
The determination of the diameter (or rectangular section) of the connecting canalizations, as well as the DLD's diameter, are defined according to the traditional methods for the calculation of the aeraulic canalizations.
Considering the impossibility to regulate the air flow between the holes, it is recommended not to exceed the air speed of 5-6 m/sec at the DLD's entrance.
When possible, it is suggested to select the DLD's hole punching pattern on just one side, in order to be able to possibly vary the air throw angle during the plant's initial calibration phase, by rotating the modules on their own axis, simply loosing the junction collars between them.
For the selection of the most suitable hole punching pattern for each single plant, SINTRA supplies a dedicated technical documentation, also available on their new website.
The new website also offers the possibility of a selection and estimation on-line.
The DLDs are realized only with a circular section, with the new SPIROPACK™ production technology.



DESIGNING A PULSION PLANT WITH DLP

Innovative MIX-IND® SIMPLE PULSION plants

The **simple PULSION** plants are conceived with the 30 year design experience of the **MIX-IND® technology**, which is able to achieve exceptional performances compared to traditional air DIFFUSION plants.
Designing a PULSION plant isn't more difficult than designing a DIFFUSION plant, it is just a lot different since the PULSION technology answers to very different parameters to the usual DIFFUSION ones.
For the sizing of a PULSION plant, there are fundamental parameters which aren't normally considered in the sizing of a traditional plant:

- PULSER®'s position in the environment, according to the building's shape, the position of the principal encumbrances and the kind of activity carried out on the premises
- PULSION power, according to the partial circulating air volumes
- definition of the number of PULSERS®, according to the building's shape, to the unit air flow and the available static pressure
- ratio between the active and passive influence areas, according to the air drafts risk
- definition of the distance between the PULSER® 's end and the wall, according to the building's height and to the partial circulating air volumes
- Definition of the PULSER®'s diameter, according to the ratio between the "coaxial PULSION" and the "tangential PULSION", relative to the building's height and the total circulating air volumes
- unit air flow according to the minimum and maximum air supply temperatures, and to the kind of application
- feasibility analysis on the possibility to reduce the initial calculated air flows
- etc.

Also the most experienced designer will find evident difficulties in designing a PULSION plant at its best, having to manage parameters which are unusual to him.
The designer will then have the understandable tendency to choose technical solutions which are typical for traditional plants, then asking to adapt them to a PULSION plant.
It is possible to accept this kind of compromise, but it limits the performances otherwise achievable, also economically, often even forcing the acceptance of technical compromises on the good functioning of the plant.
It is then important for the designer to be able to benefit from the technical support offered free of charge by SINTRA, which gathered more than 30 years designing experience in PULSION plants, with over 10.000 plants realized for the best international customers.
In order to be able to achieve the best performances in a PULSION plant, it is important to ask for SINTRA's technical support from the early stages of the preliminary draft, when the architectural limits are less binding, offering in this way a higher possibility of choice for the ideal solution.
In order to help the designer to better compare each proposed technical solution, SINTRA calculates a **risk coefficient** which allows to evaluate on a quality level the possible compromise degree for each PULSER® , compared to the ideal condition.
Coefficient 1 represents the perfect functioning condition.
With a coefficient higher than 1,2 there is the risk of air drafts, which proportionally increases as the coefficient rises.
With a coefficient lower than 0,8 there is the risk of stratification and dishomogeneity of the temperatures in the environment, lengthening in this way the plant's set in motion times.
As the coefficient 0,8 excessively decreases, there is the risk of not being able to correctly heat the environment, particularly for environments with a height above 4m.
The coefficient included between 0,8 and 1,2, but different from 1, represents a situation of controlled risk, which can be compensated by the hole punching pattern's calculation.
With this coefficient, the designer will have the possibility to better appreciate at its right value the eventual technical compromise level between the

NEW GENERATION PULSION plants

MIX-IND® with QPE technologies

The **NEW GENERATION** plants are evolved PULSION plants, with even higher performances, designed with new and innovative concepts which are represented in the **QPE technologies**, derived from them **MIX-IND® base technology**.
With the QPE technologies and SINTRA's engineering support, the designer can conceive innovative plants which adopt highly innovative technical plant solutions, able to reach the highest performances, difficult to equal with the best traditional technologies.
With these NEW TECHNOLOGIES it is possible today to achieve the maximum energy performances with contained running costs, and with the possibility to regulate the desired comfort level, which is easily adjustable at any time.
Furthermore, the NEW GENERATION plants often have an initial cost which is lower than the cost of a traditional plant, particularly in the applications concerning great volume plants.
In order to design this NEW GENERATION plants in a simple and effective way, SINTRA offers an original service of technical assistance to the design which is divided in two phases: **TECHNICAL ORIENTATION** and **ASSISTED DESIGN**.
In the first phase of TECHNICAL ORIENTATION, SINTRA gathers and elaborates all the technical information given by the applicant about the plant under review.
SINTRA then organizes a "telephone meeting" with the applicant, possibly in conference with all the interlocutors which the applicant wishes to have participating.
During this meeting SINTRA examines, together with the applicant, the most suitable PULSION technical solutions which best answer to their technical, economical and architectural needs.
A peculiarity of the NEW GENERATION plants is that the ideal technical solution is generally defined in function of the kind of activity which is carried out on the premises
The maximum number of information gathered will simplify and improve the TECHNICAL ORIENTATION's quality.
During the "telephone meeting" for the TECHNICAL ORIENTATION, SINTRA will make in real time some simulations on its calculation programme, in order to be able to immediately give the feasibility and the respective risk coefficients for each of the analyzed technical solutions.
At the end of the telephone meeting, the applicant will then have the possibility to identify and choose, with full knowledge of the facts, the technical solution(s) which best meet their needs.
In the second phase, called ASSISTED DESIGN, SINTRA will elaborate in detail the technical solutions defined during the TECHNICAL ORIENTATION, validating their functioning conditions.
SINTRA will then develop a document which will quote the following information:

- **Given information**: collection of the information given by the applicant during the TECHNICAL ORIENTATION phase.
- **Environmental diagnosis**: it quotes the essential data, relating to the building's characteristics, the environmental characteristics and the plant's peculiarities tied to the kind of activity carried out on the premises.
- **Applied technologies**: it quotes the list of the QPE technologies chosen for each of the proposed technical solutions.
- **Advantages:** list of the principal estimated advantages achievable with the applied QPE technologies.
- **Performance index**: value calculated by SINTRA on the basis of subjective criteria, able to give to the applicant a comparative performance value between the different proposed solutions.
- **Simplified drawings**: showing the layout position of the PULSERS® for each proposed technical solution.
- **Technical data sheet**: it quotes the significant calculation data, complete with the risk coefficient for each single PULSER® , and for each of the proposed technical solutions.
- **Economical quotation**: lump sum for each single proposed solution, complete with all the variant quotations for the different kind of materials that can be used.

According to the project's importance and to the urgency degree, SINTRA can also supply, upon request, the following documents:

- 3D drawings: showing the layout position of the PULSERS® for each single proposed technical solution. .
- Technical report: descriptive and comparative, on the functioning of the proposed different technical solutions.

The TECHNICAL ORIENTATION and ASSISTED DESIGN services are free of charge, but subordinated to the use of the proposed materials.
The QPE technologies are almost all patented, or conceived with SINTRA's specific know-how.
Therefore, it is not possible to use patented technical solutions, conceived with the QPE technologies and the engineering support of TECHNICAL ORIENTATION and ASSISTED DESIGN, with a different material from the one proposed by SINTRA for the specific plant.
Beyond any purely legal aspect bound to counterfeiting, it is obvious that a different material, conceived without the specific experience of the technical solutions created and patented by SINTRA, will not be able to have the same performances.
For this kind of plants, SINTRA asks therefore to their customers to pre-emptively recognize the intellectual property of the technical solutions proposed during the phases of TECHNICAL ORIENTATION and ASSISTED DESIGN. This consultancy service is free of charge and doesn't impose any utilization commitment of the technical solutions proposed by SINTRA.
Only in case of adoption, even if partial, of a technical solution proposed or validated by SINTRA, the

EXTREME VARIABLE AIR FLOW

The market offers different systems for the air diffusion at variable air flow, but these systems are expensive and complex.
For this reason, the majority of the HVAC plants are realized with a constant air flow.
On a traditional air diffusion plant with a constant air flow, if the air flow is reduced compared to what is foreseen on the project, the consequence is the heat stratification in winter, with difficulties to keep the required temperature in the environment and the creation of air drafts when supplying colder air in summer.
Today, with the new QPE technologies, it is possible to use uniquely the minimum air flow which is necessary to introduce the thermal or cooling power required by the environment, avoiding all energy waste relating to the fan's electrical consumption.
SINTRA's 30 years designing experience allows today to employ a minimum quantity of the supply air in order to keep the room's temperatures constant.
This plant's typology is defined at **extreme variable air flow**, as it manages to employ the absolute minimum air quantity necessary to keep the perfect homogeneity of the temperatures and the maximum environmental comfort.
The plant's air flow excess can be then dedicated uniquely to the introduction of the required power only when it is necessary.
In this way it is possible to vary the plant's air flow for a value corresponding to the excess air flow, without compromising the homogeneity of the temperatures in the environment.
When employing, for example, the **TWIN™** or **VARIPLENUM®** technologies, after having studied the most suitable position in the environment, a different function can be given to each PULSER® :

primary PULSERS® have the function of keeping homogeneous temperatures in the environment by using a minimum supply air quantity, defined: **functional air flow**.

secondary PULSERS® have the function of introducing the excess air flow, necessary for the power introduction, in such a way not to perturb the primary PULSERS®' functioning. This excess air flow is called: **secondary air flow**.

In this way it is possible to vary the plant's total air flow for a value corresponding to the secondary air flow, always maintaining the maximum homogeneity of the temperatures in the environment, as the functional air flow is kept constant.
This kind of plant is called: **MULTIFUNCTION PLANT** and it needs a specific running system through a **PLC**, whose functioning logic is given by SINTRA for each single plant.
In the MULTI FUNCTION PLANTS it is the room thermostat which regulates the air flow required from the environment, whereas the three-way valve is regulated by the supply air temperature, which is in turn run by the PLC.
A modulating pressure switch guarantees the maintaining of the air flow and the pressure inside the primary PULSER®, reducing the secondary PULSER®'s air flow by a special modulating motorized damper.
In this way the secondary air flow's variable flow, which is not necessary for the maintaining of the environmental comfort, can also be used for other purposes, giving specific different functions to the **secondary PULSERS®:**

- **discharge PULSERS®**, which have the simple goal to introduce the excess air, with a very high induction and with no specific direction
- **support PULSERS®**, which have the duty to support the functioning of the primary PULSER® S
- **technical PULSERS®**, which have been given particular functions, such as:

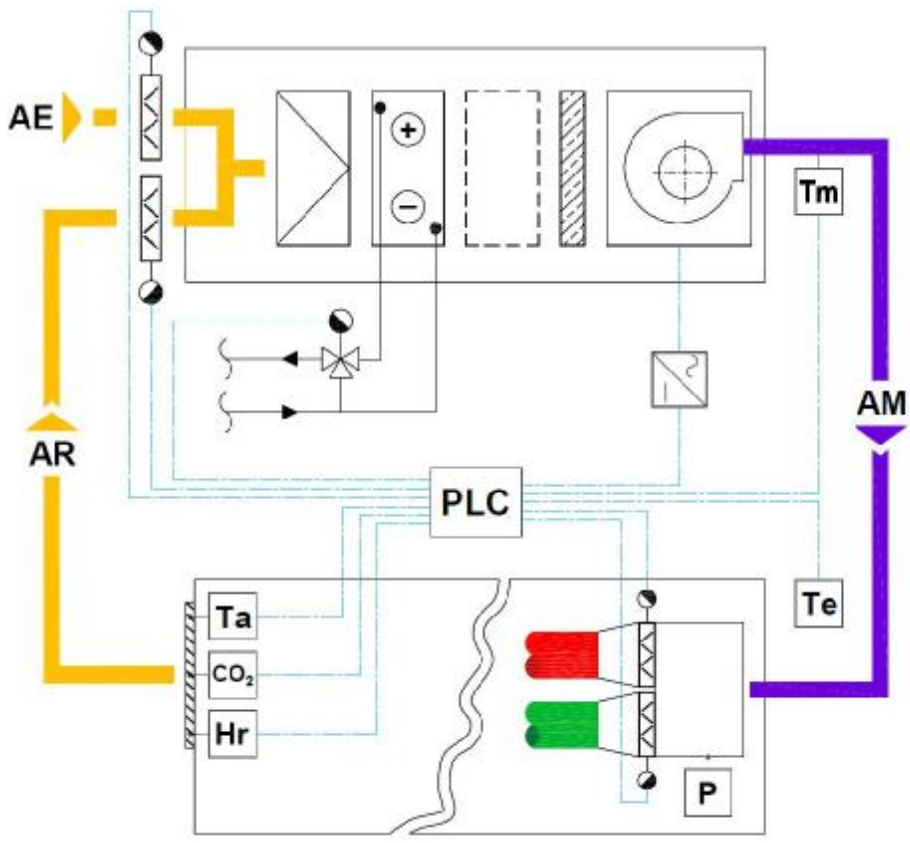
  * VARIBOOST® for the acceleration of the plant's set in motion times

  * Air barriers next to doors and main doors

  * Anti-condensation on the transportation ducts

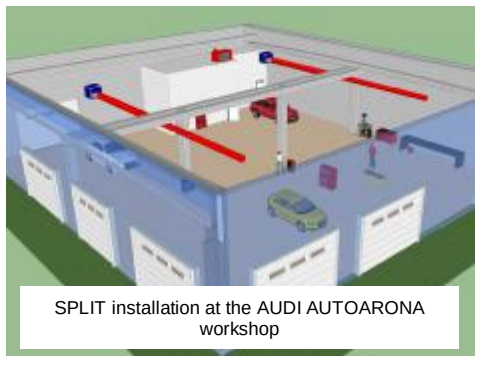
  * etc.

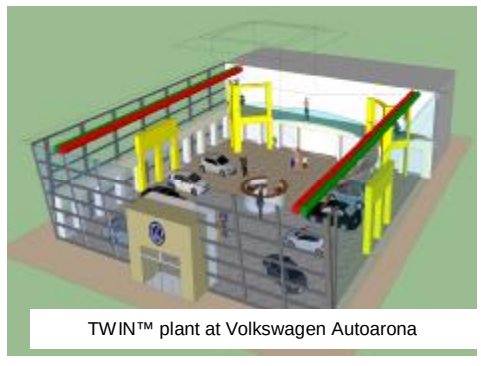
FUNCTIONAL SCHEME FOR NEW GENERATION PLANTS



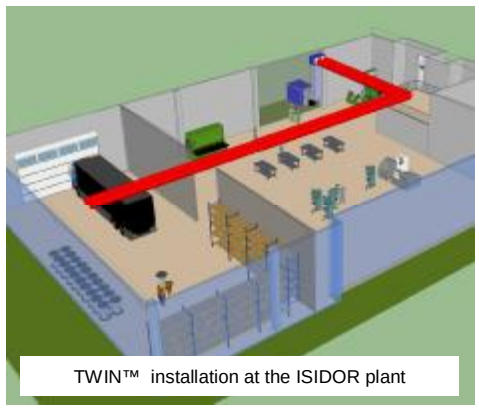
TRAINING COURSES AND TECHNICAL UPDATING

Technologies which are so different from the traditional ones, such as the environment air PULSION one, and the innovative QPE technologies require to be known better.
In particular, the more experienced "senior technicians", which have the task to choose the technology which best adapts itself to their project, are the most interested in knowing these new technologies, which open new horizons in the designing of the HVAC plants.
On the occasion of the establishment of the new operative base, SINTRA organized itself to equip the new workshop and the new offices with new generation HVAC plants with a demonstrative and experimental aim.
SINTRA has then defined: **WORKSHOP-LABORATORY** and **OFFICES-LABORATORY** are the new operative base.
Together with other demonstrative plants realized in the nearness of the WORKSHOP-LABORATORY, SINTRA has constituted a group of NEW GENERATION plants which apply the totality of the QPE technologies.
In the new OFFICES-LABORATORY, SINTRA equipped itself with a training room where TRAINING and TECHNICAL UPDATE days are organized. During these days SINTRA presents its technologies and its experiences.
During these days, about ten demonstrative plants are visited and analyzed, with smoke tests.
SINTRA gathers the applications to join and organizes the courses in small groups of about 30 people.
According to requests, SINTRA also organizes technical training days on specific subjects.

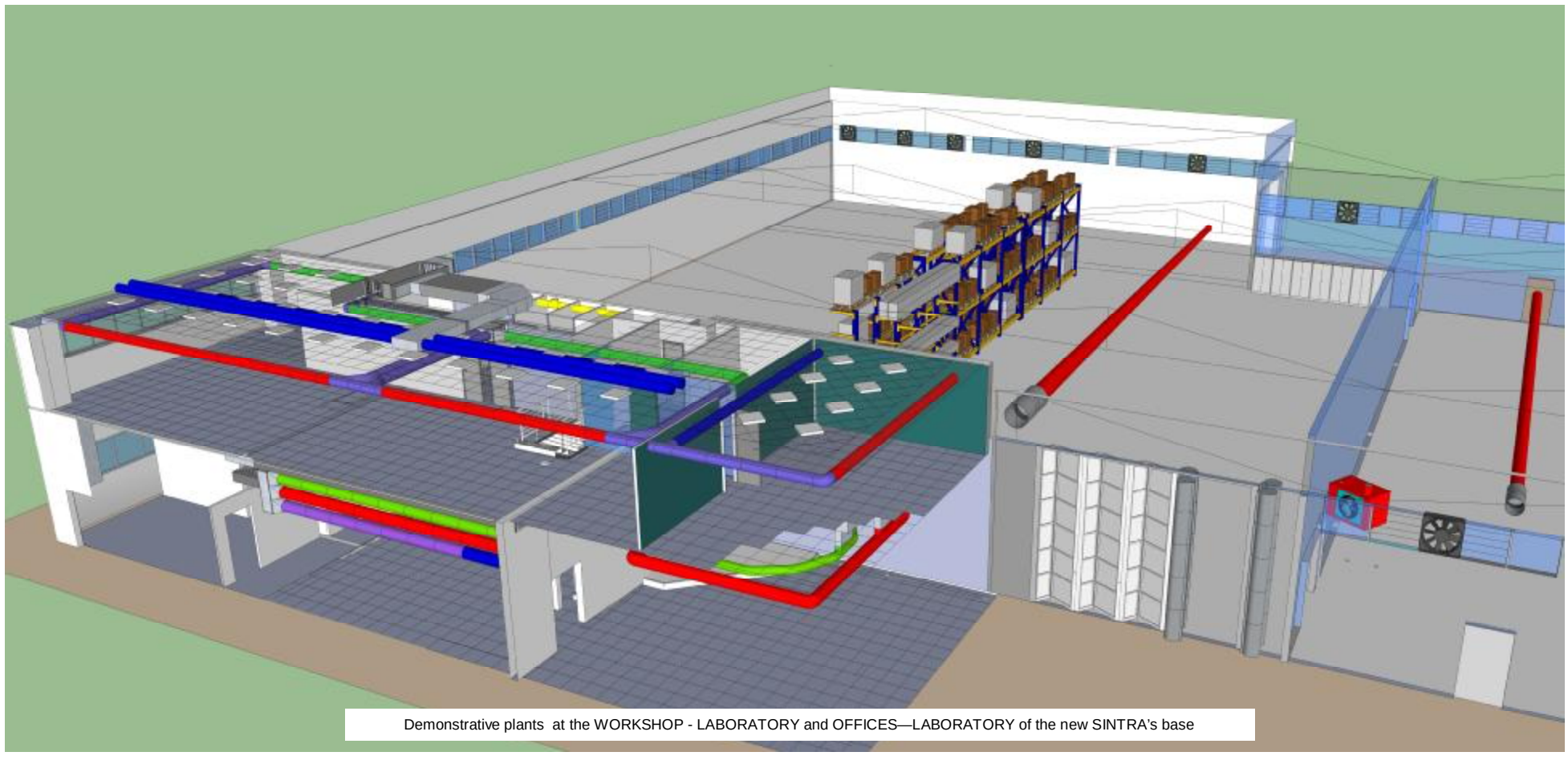

SPLIT installation at the AUDI AUTOARONA workshop


TWIN™ plant at Volkswagen Autoarona


VARIBOOST® plant at Audi Autoarona


TWIN™ installation at the ISIDOR plant


Smoke tests on the SPLIT installation at the new SINTRA'S WORKSHOP - LABORATORY


Demonstrative plants at the WORKSHOP - LABORATORY and OFFICES—LABORATORY of the new SINTRA's base

SINTRA's WORSKHOP-LABORATORY, with demonstrative plants

MODULAIR™ vertical towers for the summer ventilation

Axial fan for the self-sufficient PULSER® , and industrial door with vertical VARITOTEM® air barrier

SPLIT™ plant for the metal department

Two condensation unit heaters with 100kW each throw the hot air under the roofing, specifically favouring the stratification.
A **textile self-sufficient PULSER®**, equipped with an independent axial fan, homogenizes all of the environment's temperatures in just 10 minutes, despite:

- PULSER®'s end at 20m from the end wall
- Air throw of 30m with great obstacles at 10m
- No air throw on the opposite side (10 m)

The complete self-sufficient PULSER® is mounted on a motorized tie rod system which allows to lower it to the ground during its functioning, for demonstrative and experimental purposes.

SPLIT™ plant for the textile department

One condensation unit heater with 100kW throws the hot air under the roofing.
A **metallic self-sufficient PULSER®**, equipped with an independent centrifugal fan, homogenizes all of the environment's temperatures.
The PULSER® is of the **VARIPULSE®** kind, and it rotates on its own axis in order to be able to regulate the desired air throw.

HYGROCOOLING® plant

Installed in the upper part of the self-sufficient PULSER® in the metal department, it allows the adiabatic cooling in the summer season, with an evaporation capacity variable up to 8 l/min (480 l/h).

MODULAIR™ plant

Constituted by 8 vertical towers MODULAIR, for a total of 320.000 m3/h, with just 8kW installed, with a cascade functioning, they guarantee the correct summer de-superheating and ventilation.

Vertical VARITOTEM® air barrier

Constituted by two internal columns and by two external columns, both adjustable, it allows the control of the external air infiltrations from the main door.
The special main door structure, with an internal and an external column installed on the last panel, allows to simulate the air barrier's behaviour on industrial doors from 1 to 8m of width.
The cascading use of the vertical towers MODULAIR allows to effectively simulate the VARITOTEM® efficiency, even with the presence of wind.

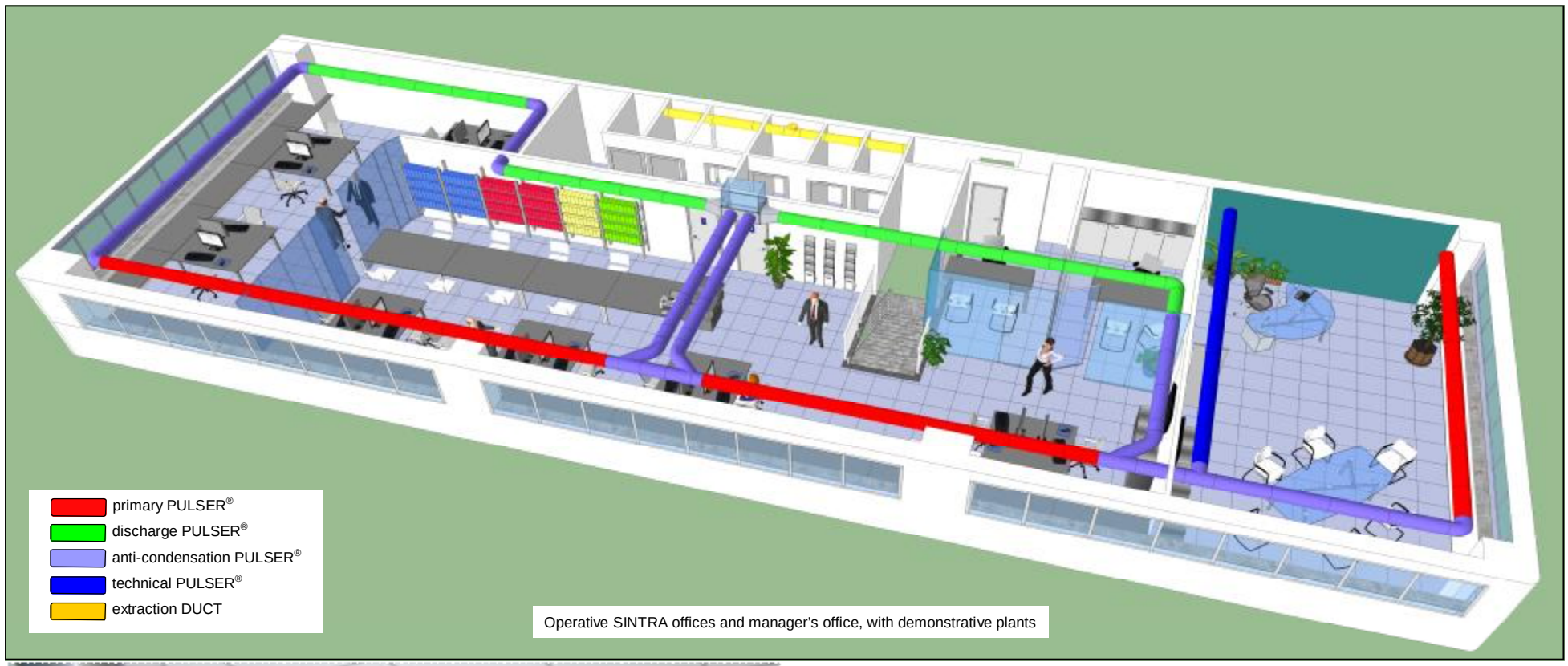
Horizontal air barrier CHECKOUT AREA

Normally used to stabilize the environment's temperatures in the shopping malls' checkout areas,

Self-sufficient textile PULSER® in the metallic department, with unit heaters and VARITOTEM®

DEMONSTRATIVE PLANTS

SINTRA'S OFFICES-LABORATORY



Operative SINTRA offices and manager's office, with demonstrative plants

DEFINITION OF THE KIND OF PLANT

MULTI-FUNCTION plant of the COMPENSATED GATHERING RING type, with a variable air flow 40-100% and with a dependent plant for the manager's office.

Additional plant of the VARITOP kind, for a merely demonstrative use.

ENVIRONMENTAL DIAGNOSIS

Low height environment with the need for a high comfort level, and characterized by big windows exposed to east, south and west.
The manager's office is used with a strong intermittence and requires the maximum acceleration of the set in motion times.

APPLIED TECHNOLOGIES

Extreme variable air flow
Winter free-cooling
Variable comfort
Energy minimum

VARIPLENUM®
TWIN™
PIGRECO
VARIAMIX®
VARISTEP®
VARIBOOST®
VARITRAP®
VARITOP

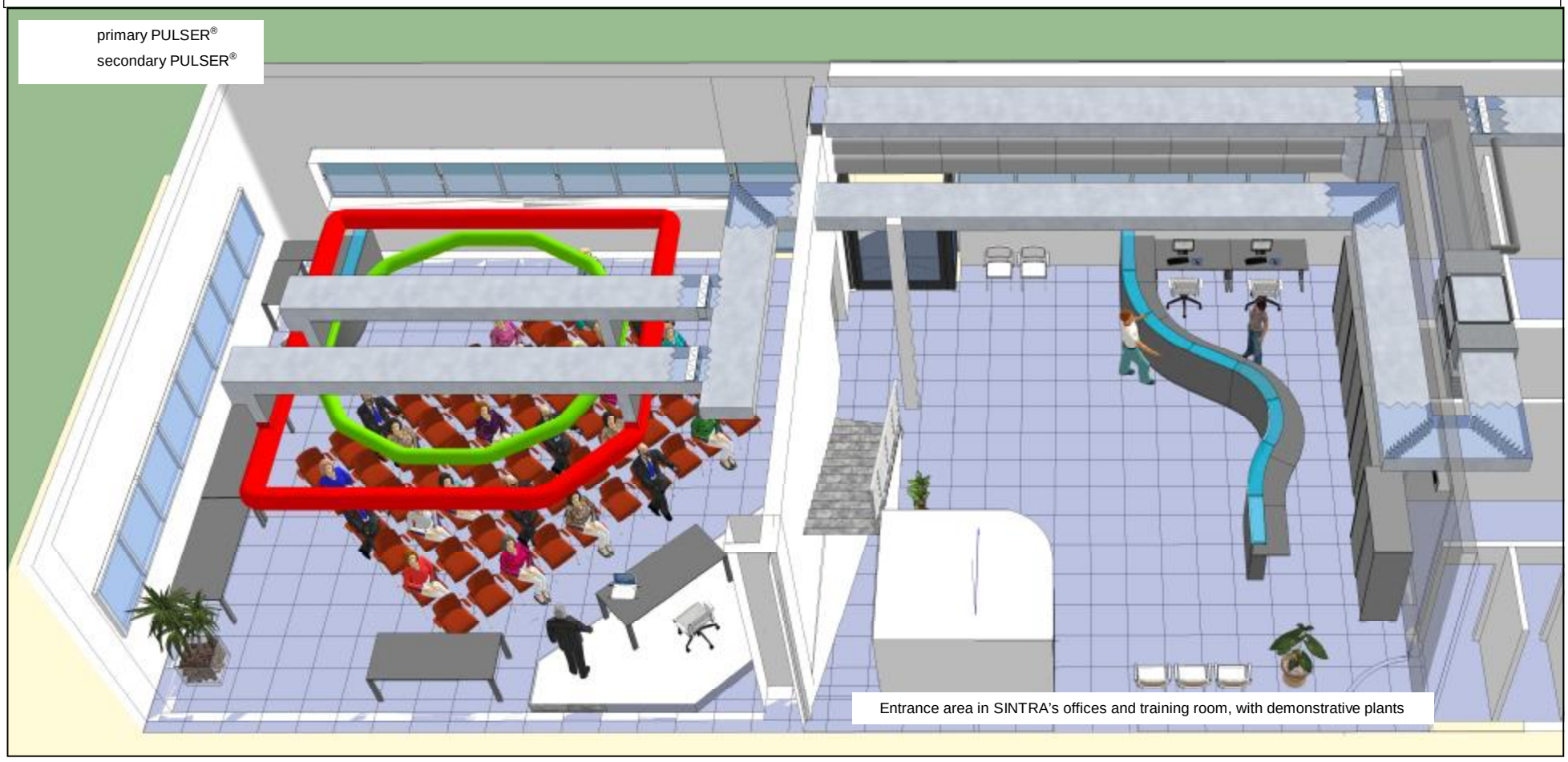
WORKING DESCRIPTION

As the supply air enters the room, a plenum splits the air flow between four ducts in order to reduce the ducts' diameter in the environment.
Two anti-condensation PULSERS® in a TWIN™ disposition feed the two primary PULSERS® with a constant air flow.
The plenum is equipped with two motorized dampers, one for each of the secondary discharge PULSERS®.
As the air flow changes when regulated by the room thermostat, a modulating differential pressure switch inside the plenum runs the two dampers in order to keep a constant pressure in the primary PULSERS®.
During the plant's set in motion phase, which lasts about 10 minutes, the primary PULSER®'s pressure automatically sets itself from 120 Pa to 190 Pa.
The primary PULSERS® are aeraulically separated from the secondary PULSERS® by a hidden metallic disc, put inside the PULSERS®.
Inside the false ceiling, there are two couples of DLD which feed a VARITOP system of air diffusion through the false ceiling.
The manager's office is considered a dependent plant and it is equipped with an apposite motorized damper, run by the room thermostat and hidden inside the primary PULSER® .
The secondary PULSER® is largely sized in terms of air flow, in order to accelerate the plant's set in motion time to a maximum (< 5 min.).
As a mere point of demonstration, the secondary PULSER® has a special hole punching pattern, of the

Demonstrative VARITOP plant, installed inside the false ceiling

DEMONSTRATIVE PLANTS

SINTRA' OFFICES-LABORATORY



Entrance area in SINTRA's offices and training room, with demonstrative plants

TRAINING ROOM

DEFINITION OF THE KIND OF PLANT

MULTI-FUNCTION full-air system plant, with double COMPENSATED GATHERING RING in TWIN™ version, with variable air flow 40-100%.

ENVIRONMENTAL DIAGNOSIS

Medium height environment with strong functioning intermittency and highly variable endogenous load for crowding.
The maximum comfort level, adjustable, is required for this environment.

APPLIED TECHNOLOGIES

Extreme variable air flow
Extreme winter free-cooling
Variable comfort
Energy minimum

VARIPLENUM®
TWIN™
VARIAMIX®
VARIBOOST®
VARITRAP®

WORKING DESCRIPTION

The plant is constituted by two rings, one of them with a square shape with blunt corners, and the other with a dodecagonal shape, to represent a circular shape.
Each ring has the aim to partition 50% of the air flow at full regime conditions.
The external ring has a primary PULSER® function, and it has a bigger diameter in order to be able to bear 100% of the air flow during the plant's set in motion phase (VARIBOOST®).
This ring has a hole punching angle oriented towards the junction point between the floor and the walls, in order to create an environment air movement which brushes the walls first and then the floor towards the centre of the room.
This layout allows to increase the convection on the room's surfaces during the plant's set in motion times, allowing therefore a better thermal exchange with the room's structures.
In this way, the central area of the room is better protected from the risk of air drafts, since it is occupied by people in a static position.
A differential pressure switch keeps a constant pressure, therefore a constant air flow and residual speed at floor level for the primary PULSER®, by regulating the motorized damper which feeds the secondary discharge PULSER® ring.
In normal regime conditions, the internal ring has instead the function of secondary discharge PULSER®, with a particular hole punching at very high induction , oriented towards above.
The false ceiling of the room's central area is made by panels realized in a very fine metallic mesh, which allows the passing of the air thrown towards the ceiling from the internal ring.
The return environment air grid is located in an invisible way inside the false ceiling area.
During the winter season, when the PLC detects a superheating of the environment due to the crowding, it automatically reverses the functions between the two rings, therefore running the internal ring as a primary PULSER®.
In this way, the winter free-cooling function is started, and it increases the introduction of cold external air with the aim of de-superheating the environment, up to the introduction in the environment of non-heated external air at –5°C.
An air quality probe guarantees, with no waste, the right amount of external air, with priority on any kind of regulation already going on.
The PLC regulates, in a precise way, the air input temperature, detecting the temperature difference between the environment and the air supply.
The modulating environment hygrostat, during the summer season corrects the air input temperature in order to perfectly regulate the relative humidity in the environment.

Entrance area in SINTRA's offices with demonstrative plants

ENTRANCE AREA

DEFINITION OF THE KIND OF PLANT

MULTI-FUNCTION plant of the TWIN-3 kind, with a variable air flow 40-100%, with integrated air barrier.

ENVIRONMENTAL DIAGNOSIS

Medium height building with frequent opening of the entrance door.

APPLIED TECHNOLOGIES

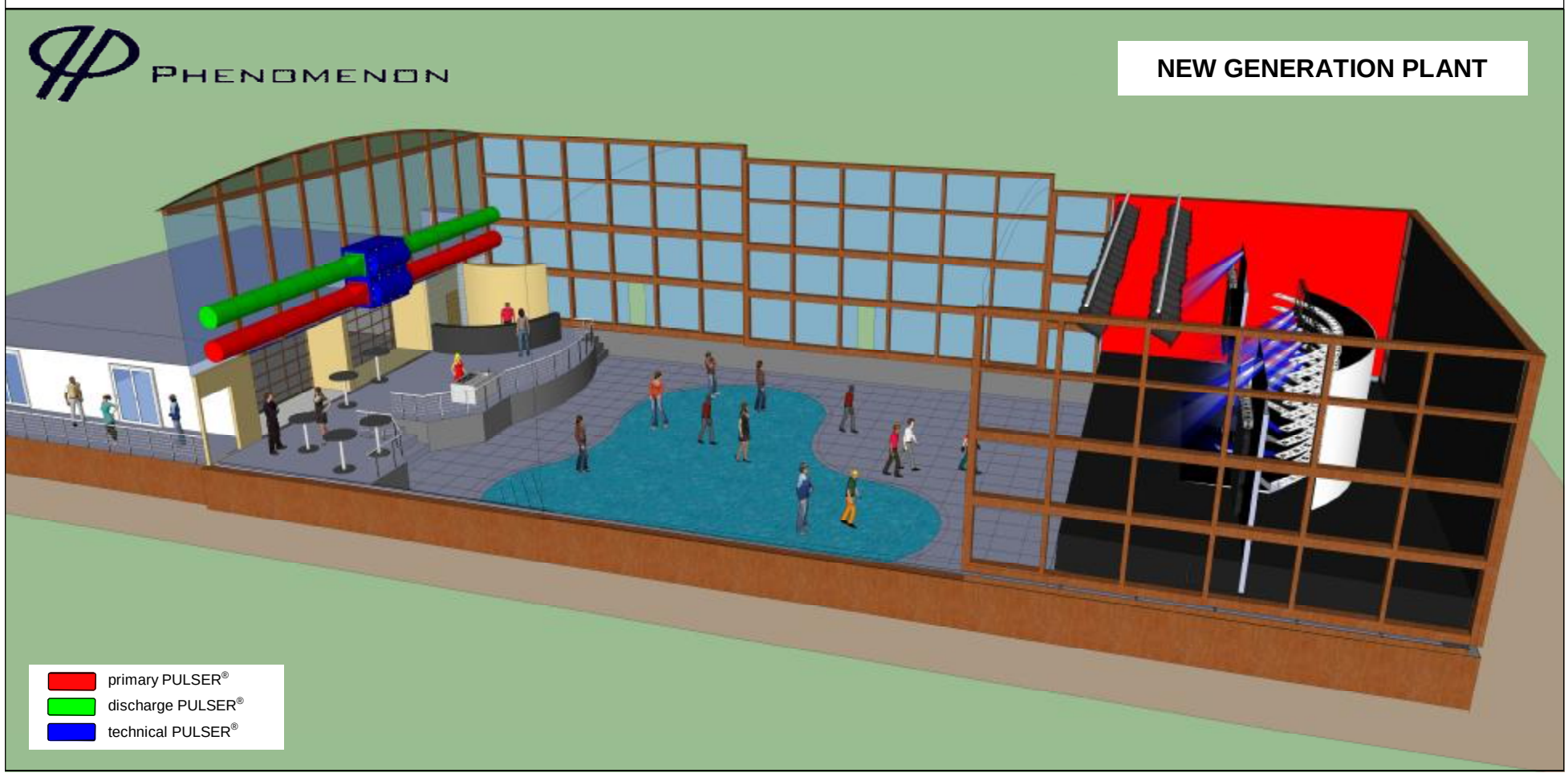
Extreme variable air flow
Variable comfort
Horizontal air barrier
Energy minimum

TWIN™
VARIAMIX®
VARIBOOST®
VARITRAP®

WORKING DESCRIPTION

As the supply air enters the room, a plenum splits the air flow between three DLPS®, arranged vertically, which have different functions:
A **technical PULSER®** , in the lower position, is made up of two DLP® modules with a particular air barrier hole punching pattern, and they are positioned by the entrance door.
The two modules are connected to the feeding plenum with some **anti-condensation PULSERS®**.
A manual calibration damper, positioned inside the plenum, allows to adjust the speed of the air which is descending towards the door.
The **primary PULSER®** , in the intermediate position, always guarantees the maximum homogeneity of the temperatures in the environment with its constant air flow, perfectly controlling the desired residual speed at floor level.
The **discharge PULSER®** , in the higher position, introduces the remaining variable air quantity, without interfering with the technical PULSER®'s function.
This PULSER® has the only aim to introduce the air flow which is necessary to introduce the required thermal power in the environment.
The room thermostat regulates the air flow between 40 and 100%.
The PLC regulates, in a precise way, the air supply temperature, detecting the temperature difference between the environment and the supply air.
The modulating environment hygrostat, during the summer season, corrects the input air temperature in order to perfectly adjust the environment's relative

DEMONSTRATIVE PLANTS ENTERTAINMENT HALL: PHENOMENON



DEFINITION OF THE KIND OF PLANT

MULTI-FUNCTION plant with 35.000 m3/h, running only for the heating, of the vertical B-TWIN kind with a central technical PULSER®, variable air flow 20-100%, maximum air throw of 50m and minimum air supply temperature –5°C.

ENVIRONMENTAL DIAGNOSIS

Medium height environment, with a strong operation intermittence and highly variable endogenous load depending on the crowding.
For this environment, the quickest set in motion time is required.
The endogenous load regularly exceeds the winter thermal load, therefore it needs a very powerful extreme free-cooling.
The building's structure is telescopic, made by three modules mounted on rails, in order to be able to be opened during the summer season, when the central dancefloor is turned into a swimming pool.
Considering the great number of slits in the structure, and the constantly opened doors (entrance door and smoking area), the environment needs the maximum pressurization.
The telescopic structure does note allow the installation of ducts right below the ceiling, or on the side walls.

APPLIED TECHNOLOGIES

Extreme variable air flow
Extreme winter free-cooling
Variable comfort
Extreme pressurization
Energy minimum

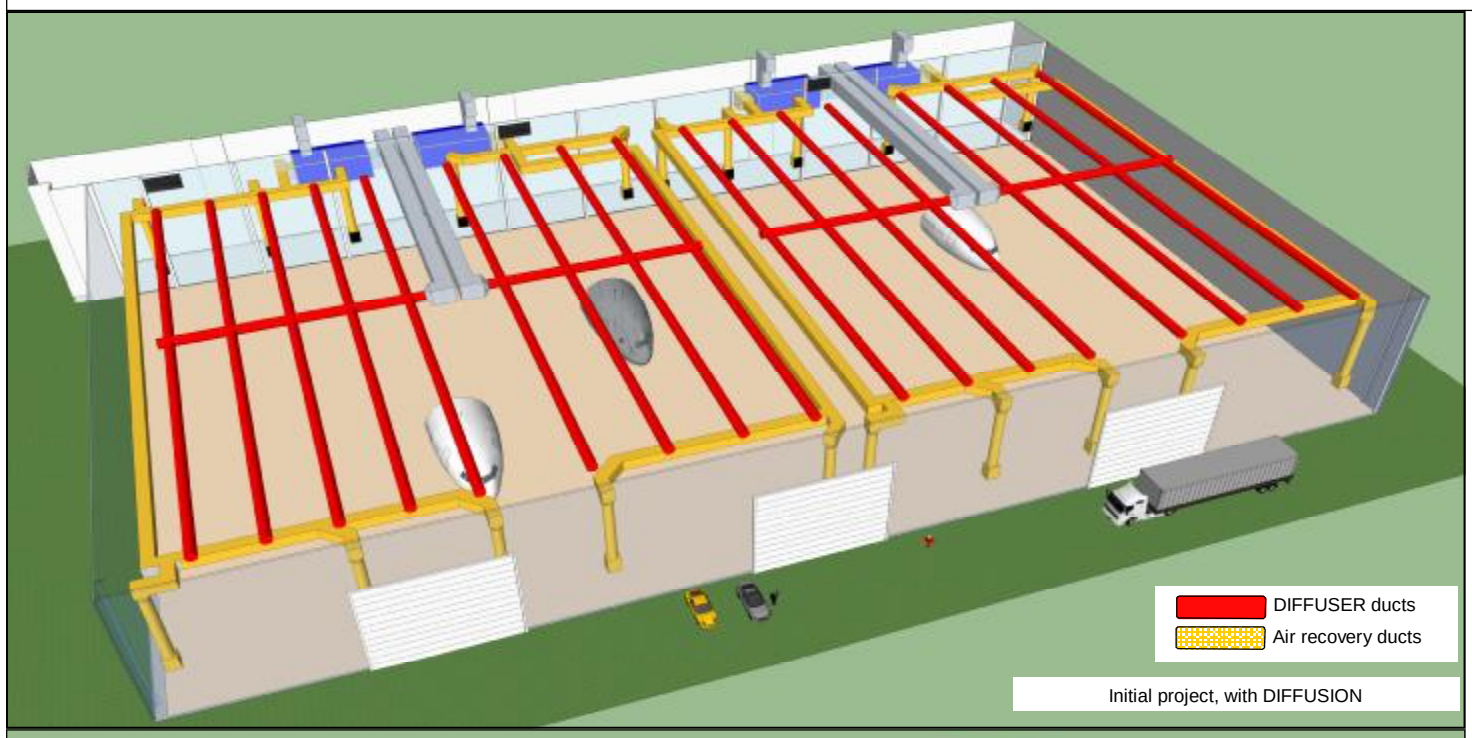
TWIN™
VARIAMIX®
VARIBOOST®
VARITRAP®
HYGROCOOLING®

WORKING DESCRIPTION

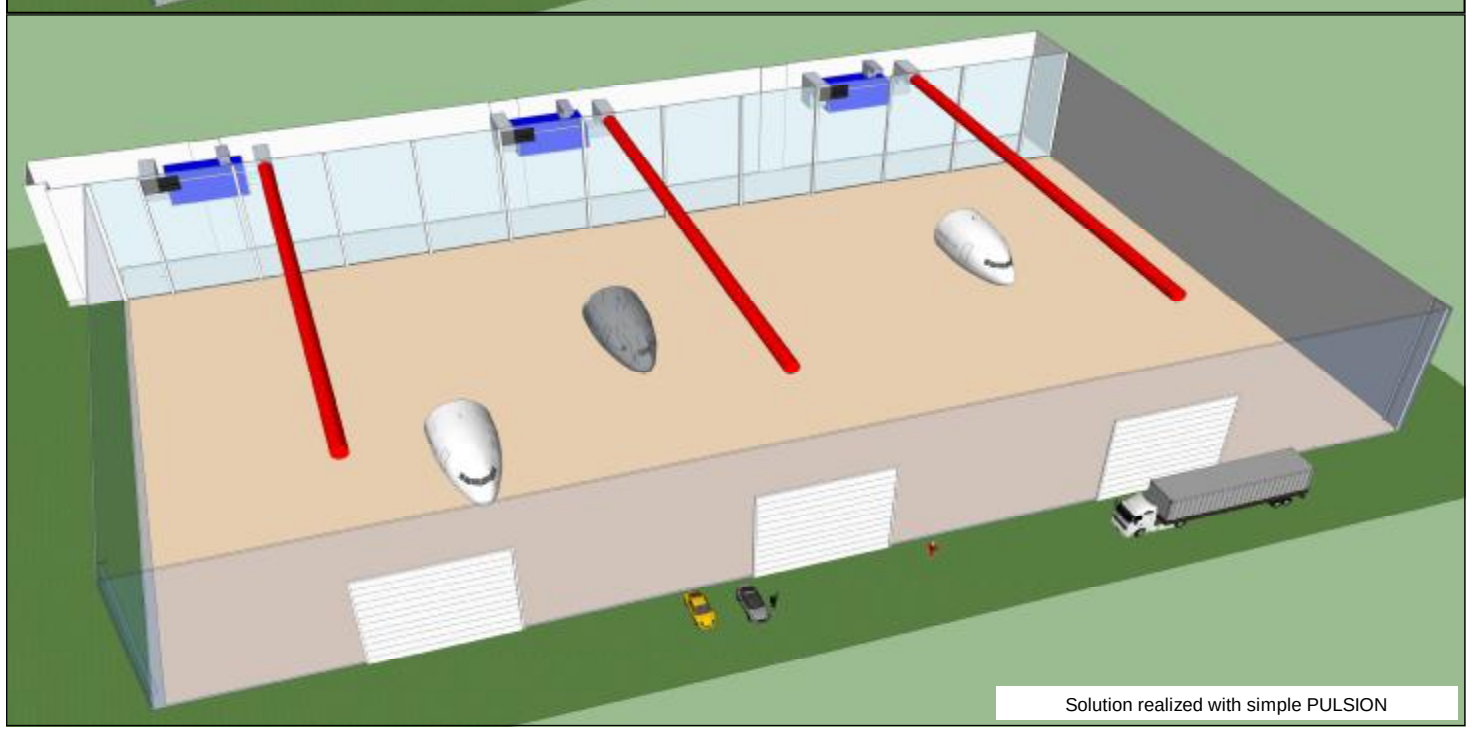
The plant is constituted by a TWIN™, centrally fed by a plenum equipped with dampers.
The plenum is made by a special technical PULSER®, realized on the central wall, which guarantees the correct ventilation of the central dancefloor, independently from any regulation of the PULSERS®.
The other two PULSERS®, positioned in the lower part of the TWIN™ , work as primary PULSERS® and guarantee the homogeneity of the temperatures in the environment with a 50m air throw.
The perfect homogeneity of the temperatures in the environment is guaranteed also with the running of just one primary PULSER® .
The two secondary discharge PULSER®, positioned in the higher part of the TWIN™, compensate the air flow's variation.
During the plant's set in motion phase, with the plant running only for air recirculation, the two discharge PULSERS® are closed, increasing therefore the PULSION power of the primary PULSERS®.
By operating in this way, the perfect homogeneity of the set up environment temperatures is achieved in a time lapse lower than 30 minutes, even with an external air temperature of –5°C.
A HYGROCOOLING® plant, installed inside the secondary PULSERS® with the nozzles emerging on the PULSER®'s surface, guarantees the correct winter humidification of the air.
The plant is calculated for the extreme winter free-cooling, which allows to also input non-heated external air directly into the environment, up to the minimum supply temperature of -5 °C.
This kind of plant allows therefore to always use the maximum quantity of external air for the best environmental hygiene and in order to always have the maximum possible pressurization of the room.
Taking into consideration the big openings in the room, the plant does not need any mechanical extraction, since the hot air, which is heated solely by those present, by coming out of the openings it helps

to keep the temperatures homogeneous, even in their proximity.
This extreme pressurization effect (with no mechanical extractions) is particularly important for this kind of application, as the hot air flux coming out of the constantly opened doors is at the advantage of the people waiting at the front door and keeps the best environment conditions in the whole entrance area.
The same principle also works for the smoking area, which is placed on the outside in an indentation of the building made in a corridor shape: the hot air coming out of the entertainment hall heats all the smoking area for free, with the maximum possible ventilation.
This technical solution guarantees therefore the maximum winter energy saving, and the best possible comfort conditions both inside and outside the room.

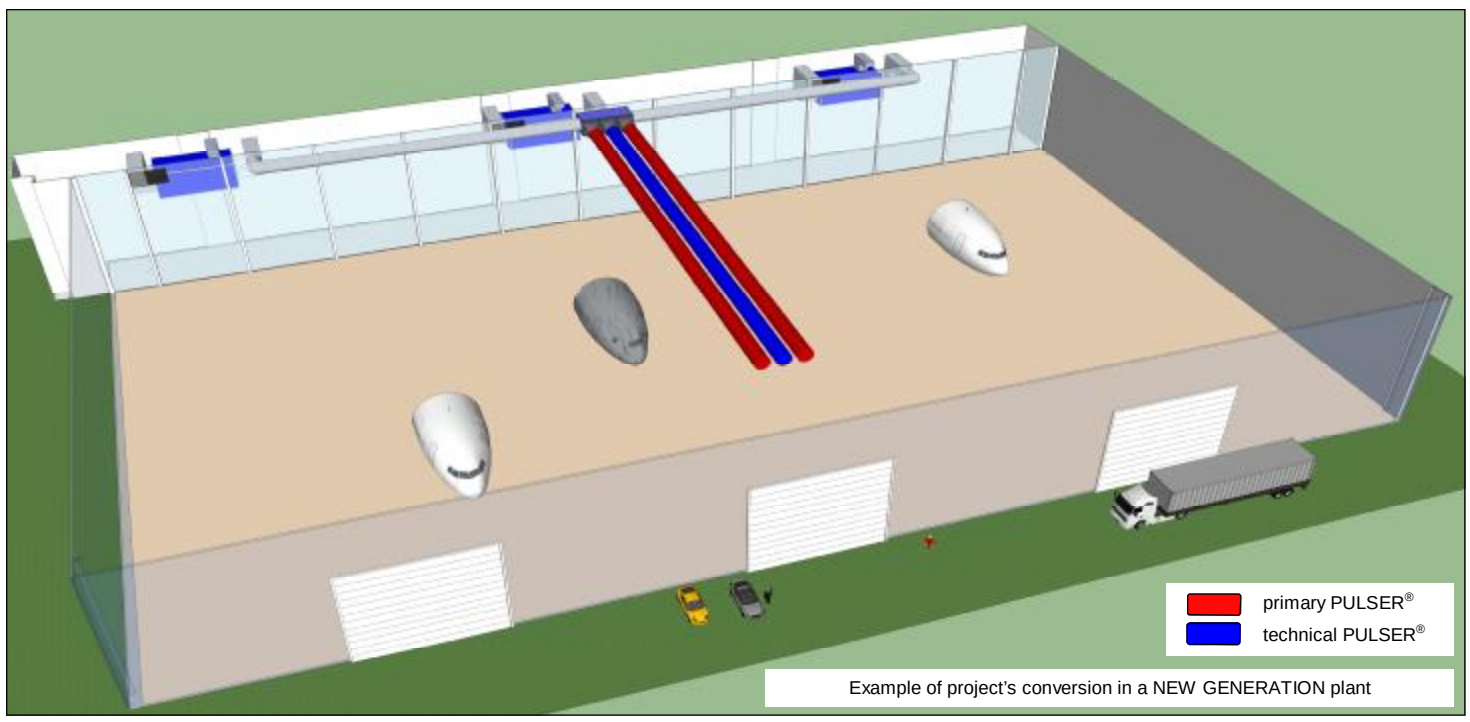
DEMONSTRATIVE PROJECT — AIRBUS ESTABLISHMENT



Initial project, with DIFFUSION



Solution realized with simple PULSION



Example of project's conversion in a NEW GENERATION plant

NOTE :

The example here quoted shows how it is possible to further ameliorate, with the new **QPE technologies**, the already exceptional performances of a plant realized with the **simple MIX-IND® technology**, compared to the initially foreseen traditional DIFFUSION plant of high technical level-

INITIAL PROJECT WITH DIFFUSION

• Air flow	340.000	m3/h
• Fan's electrical power	300	kW
• Maximum stratification	2	°C
• Total length of the perforated textile DIFFUSER ducts	704	meters
• Air recovery ducts	yes	

PLANT REALIZED WITH PULSION

• Air flow	150.000	m3/h
• Fan's electrical power	90	kW
• Maximum stratification	0,8	°C
• Total length of the **textile PULSER®** ducts	159	meters
• Air recovery ducts	no	

EXAMPLE OF A NEW GENERATION MIX-IND® PLANT

• Air flow	150.000	m3/h
• Fan's electrical power	90	kW
• Maximum stratification	0,8	°C
• Total length of the **metallic PULSER®** ducts	159	meters
• Air recovery ducts	no	

DEFINITION OF THE KIND OF PLANT

MULTI-FUNCTION plant of the TWIN-3 kind, with central discharge, useable as BOOST.

ENVIRONMENTAL DIAGNOSIS

Building with 15m height, in ISO 8 class, for the assembly of AIRBUS A 350 structures, made out of carbon fibre of big dimensions.
The needs for the maximum homogeneity of the temperatures, finalized to the control of the carbon structure's expansion during the assembly phase, predominate on the environmental comfort characteristics.
Functioning of the plant without intermittence.
When the main doors are closed, it is very important to immediately re-establish the maximum homogeneity of the temperatures in the environment, and the stabilization of the new introduced structures.

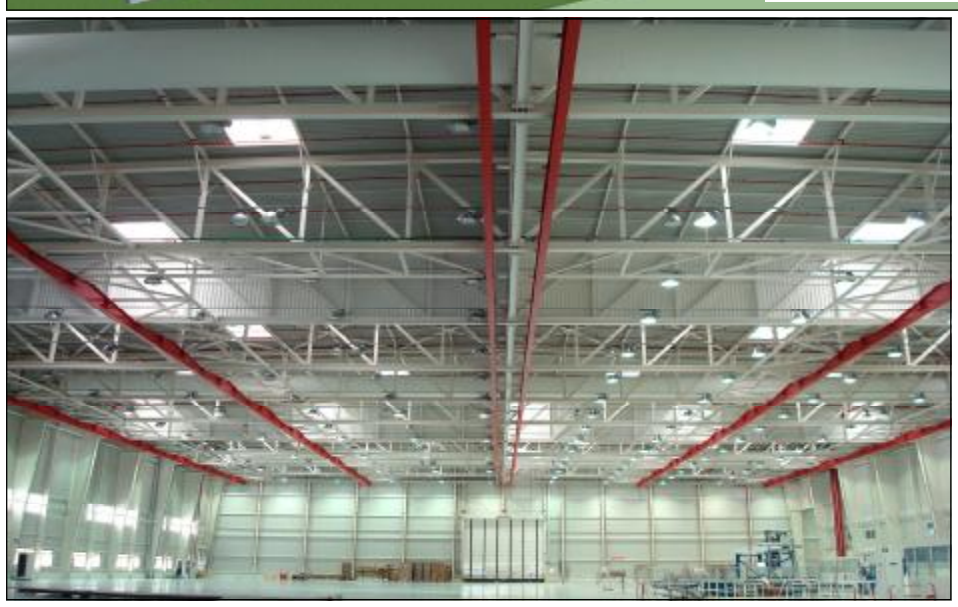
APPLICABLE TECHNOLOGIES

Extreme variable air flow
Variable comfort
Energy minimum

TWIN™
VARIAMIX®
VARIBOOST®
VARITRAP®
HYGROCOOLING®

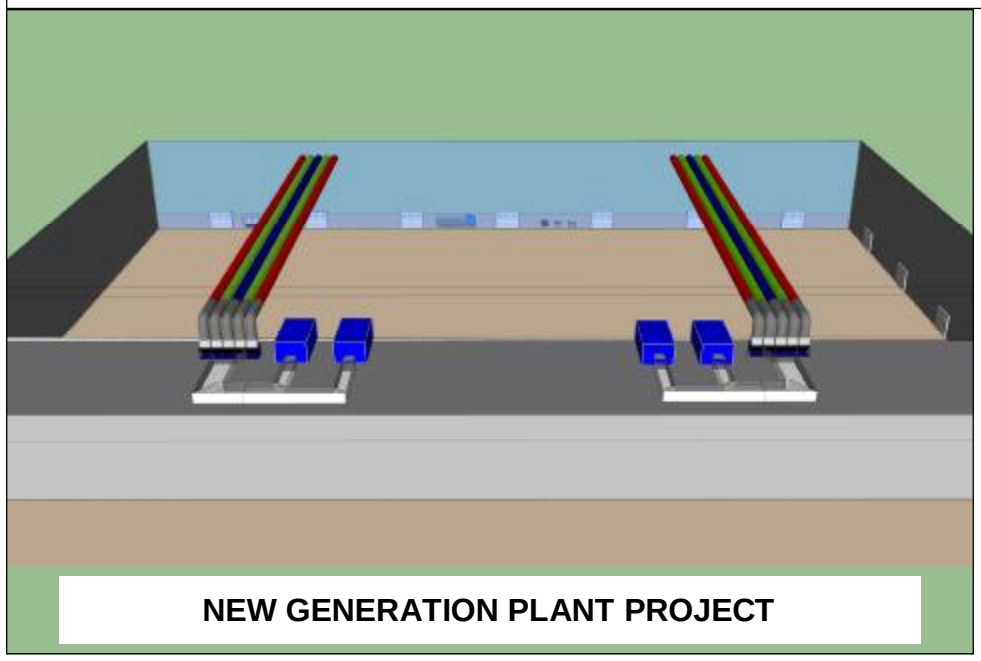
WORKING DESCRIPTION

The room thermostat manages the fans' functioning through the inverter and the PLC in order to vary the air flow between 60 and 100%.
The supply air temperature probe for each AHU runs in a precise way its own three-way valve.
The two **primary PULSERS®**, arranged laterally on the TWIN-3, work with a constant air flow and guarantee the perfect homogeneity of the temperatures in the environment.
The secondary central PULSER® works as a power discharge, in standard regime working conditions.
As the main doors are closed, it can work as BOOST for the quick temperature stabilization both of the environment and of the introduced materials.

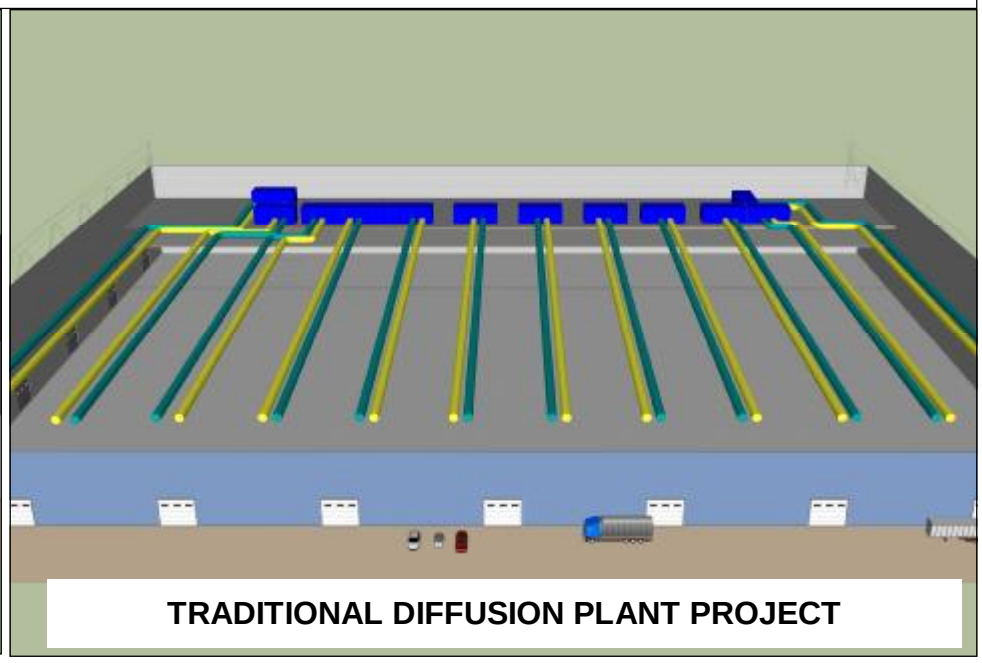


DEMONSTRATIVE PROJECT

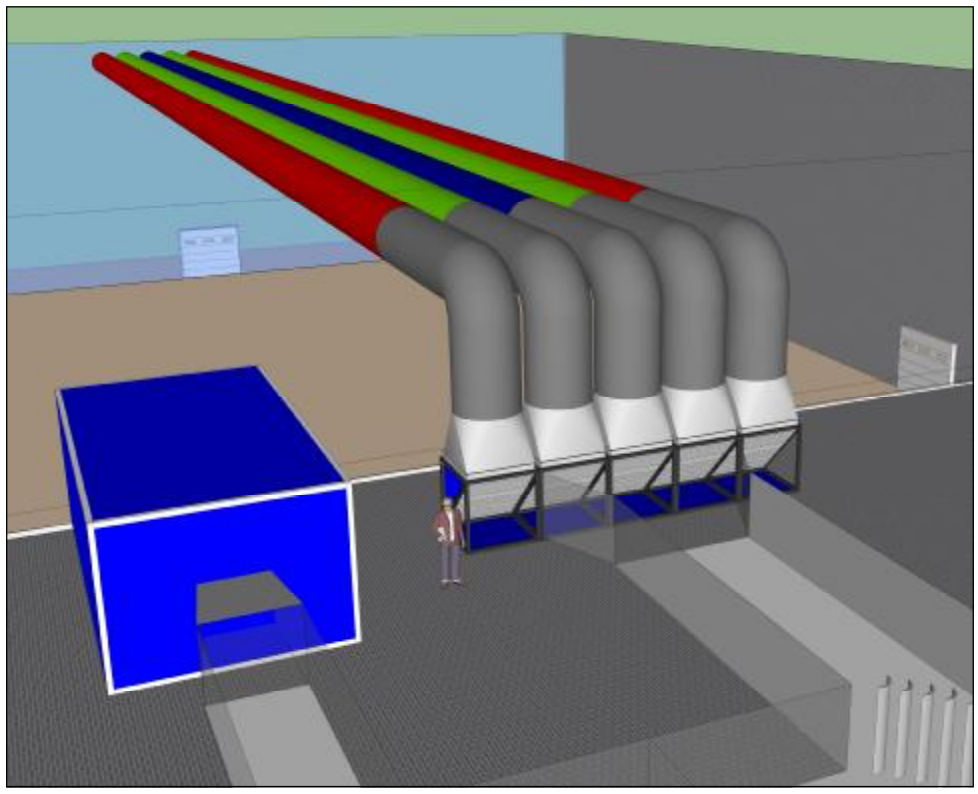
EXHIBITION PAVILION



NEW GENERATION PLANT PROJECT



TRADITIONAL DIFFUSION PLANT PROJECT



primary PULSER®
discharge PULSER®
technical PULSER®
Supply air duct
Return air duct

MIX-IND® TECHNOLOGY

INITIAL PROJECT

- n° 12 roof-tops 36.000 m3/h
- Total air flow 432.000 m3/h
- Air diffusion with thermostat-run air vents

NEW GENERATION MIX-IND® PLANT PROJECT

- n° 4 AHUs 70.000 m3/h
- Total air flow 280.000 m3/h
- Separated and increased introduction of the thermal heating power

DEFINITION OF THE KIND OF PLANT

MULTI-FUNCTION plant of the SPLIT and double TWIN-5 kind, with intermediate discharge and central BOOST.

ENVIRONMENTAL DIAGNOSIS

Great height building, characterized by a great thermal inertia of the floor, due to the strong use intermittence of the pavilion.
High endogenous heat, highly variable depending on the crowding.
The main problems are the reduction of the plant's set in motion times, and the winter free-cooling.

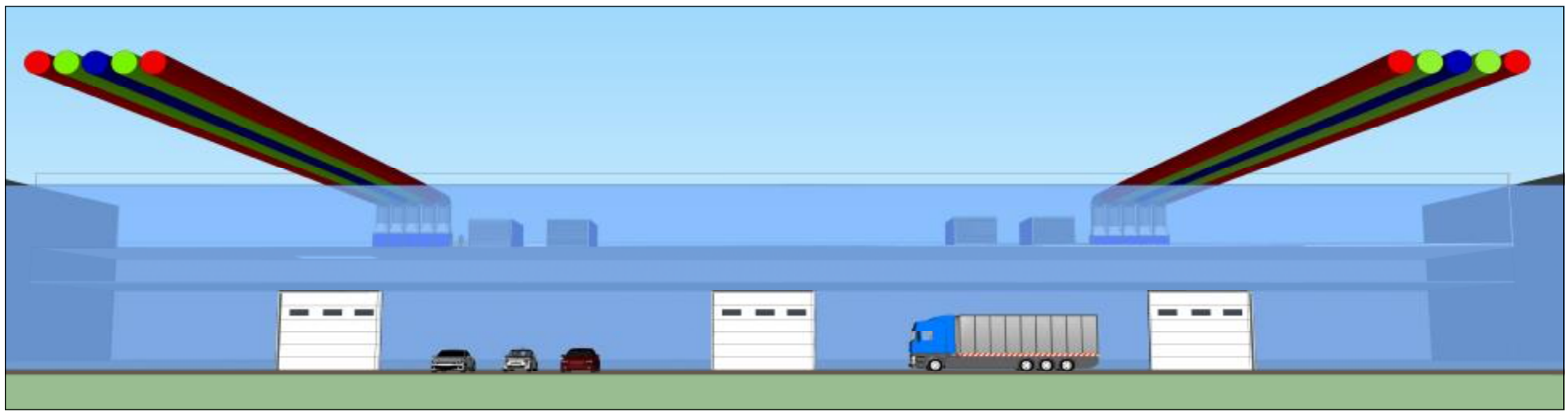
APPLIED TECHNICAL SOLUTIONS

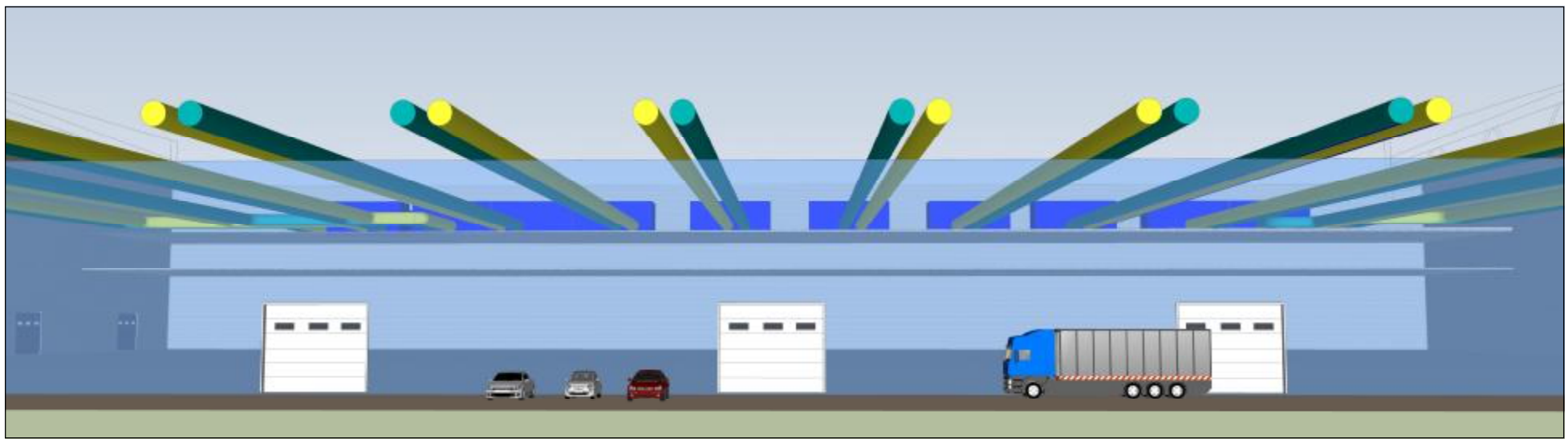
Extreme variable air flow
Extreme winter free-cooling
Variable comfort
Extreme pressurization
Energy minimum

SPLIT
TWIN™
VARIAMIX®
VARIBOOST®
VARITRAP®
HYGRO COOLING®

WORKING DESCRIPTION

The room thermostat manages the fan's functioning through the inverter and the PLC, in order to vary the air flow between 40 and 10%.
The supply air temperature probe for each AHU runs in a precise way its own three-way valve.
During the winter season, a series of high power hot air generators, introduce the maximum available thermal power directly under the roofing, with no need for the repartition in the environment.
During the plant's set in motion phase, the central PULSER® of each TWIN™ , retrieves by induction the hot air introduced buy the generators under the roofing and it carries it to the ground, creating air drafts.
The central PULSER® has then the function of a technical PULSER® during the plant's set in motion time, and of a partial discharge PULSER® during the normal regime working time.
In this way, it is possible to quickly heat the air mass contained in the environment.
The descending air draft increases the thermal exchange by convection on the floor's surface, accelerating its temperature's set-up times.
During the plant's set in motion phase, the two **primary PULSERS®** arranged laterally on the TWIN-5, work with a constant air flow and guarantee the perfect homogeneity of the temperatures in the whole environment.
The two intermediate PULSERS® of each TWIN™ -5 work as **discharge PULSERS®**, which, thanks to a hole punching oriented towards above, put in motion the environment air which tends to stagnate under the roofing.
During the winter season, when the PLC detects a super-heating of the environment due to the crowding, it automatically inverts the functions between the primary PULSERS® and the secondary discharge PULSERS®.
In this way, the winter free-cooling function in started, increasing the introduction of external cold air in order to de-superheat the environment, up to the introduction of non-heated external air at –5°C.
An air quality probe guarantees, with no waste, the right amount of external air, with priority on any other kind of regulation already going on.





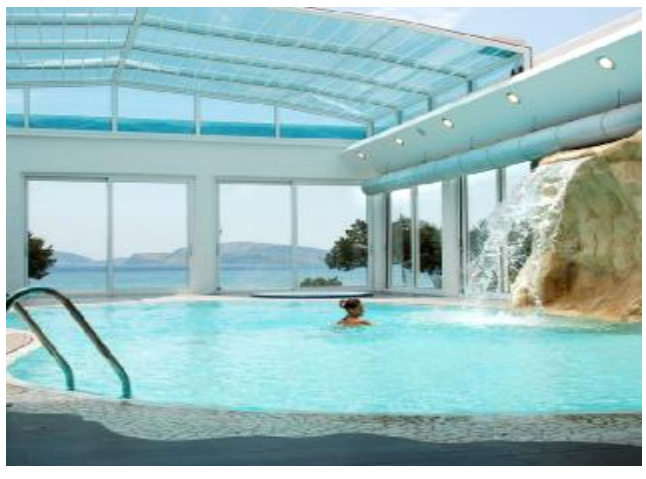














SINTRA

SISTEMI INNOVATIVI DI TRATTAMENTO ARIA AMBIENTE

SINTRA s.r.l. Corso Europa,24 - 28010 Z.I. Fontaneto d'Agogna (NO) - Tel. +39.0322.863601 - Fax +39.0322.863688

http://www.MIX-IND.com **Email:** sintra@MIX-IND.it

Bureau de liaison France: 31-33, Rue des Clotais - 94360 Bry sur MARNE - Tél. +33.(0)1.55.12.18.96. Fax +33.(0)1.48.85.67.23