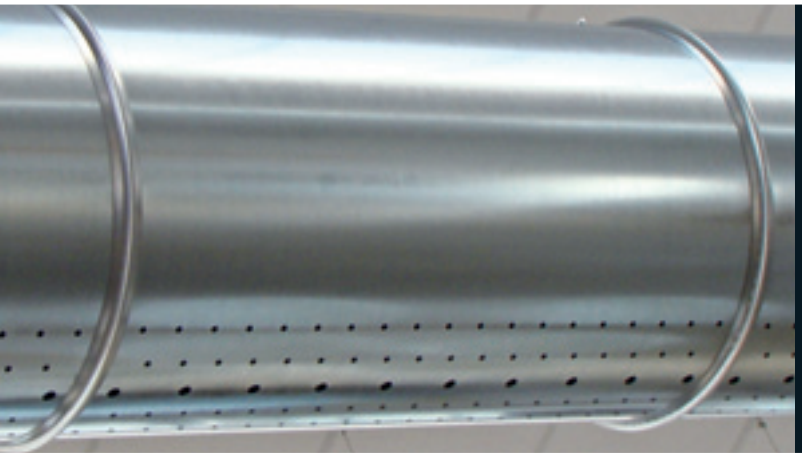
DLD

DISPOSITIVI LINEARI DI DIFFUSIONE

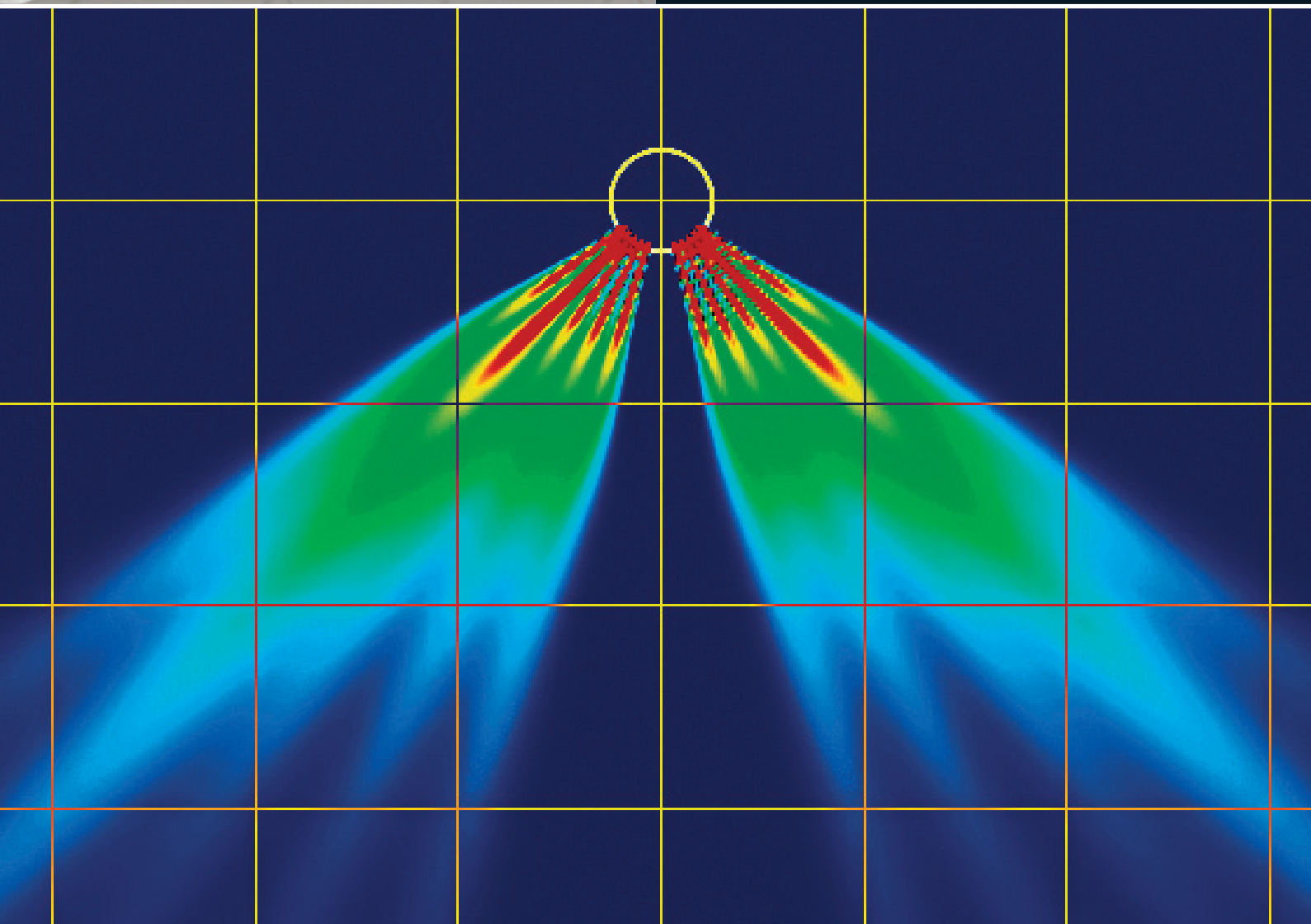
SINTRA

SISTEMI INNOVATIVI TRATTAMENTO ARIA AMBIENTE



AIR DIFFUSION INDUCTIVE MICRO-PERFORATED DUCTS

SELECTION CATALOGUE



SiNTRA

SISTEMI INNOVATIVI DI TRATTAMENTO ARIA AMBIENTE

JULY 2012 EDITION

INTRODUCTION

The DLD air diffusion perforated ducts are born with the aim to satisfy the demand coming from that market range which asks for perforated ducts with excellent traditional technical performances with a very competitive price.
In the air DIFFUSION field, the DLD represents a diffuser terminal with high performances and quality.
Compared to the majority of the diffusers offered by the market, the DLD characterizes itself for its high induction, about 30 times higher than the input air.
This characteristic allows the DLD to dilute the input air temperature with a great quantity of environment air.
In this way, the “air throw’s trajectory’s warpage” is influenced by the temperature of the air which is set in motion.
The advantages of the DLD perforated ducts, compared to traditional air DIFFUSION systems which are constituted of ducts with air vents or diffusers, are the following:

- High quality of the air diffusion
- Easy to dimension
- 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 assembling costs
- Reduction of the transport costs
- Reduction of the encumbrances on site
- Reduction of the production times
- Easy to install on site
- Easy to inspect
- High air-tightness of the junction
- Excellent aesthetical appearance
- Possibility of regulation

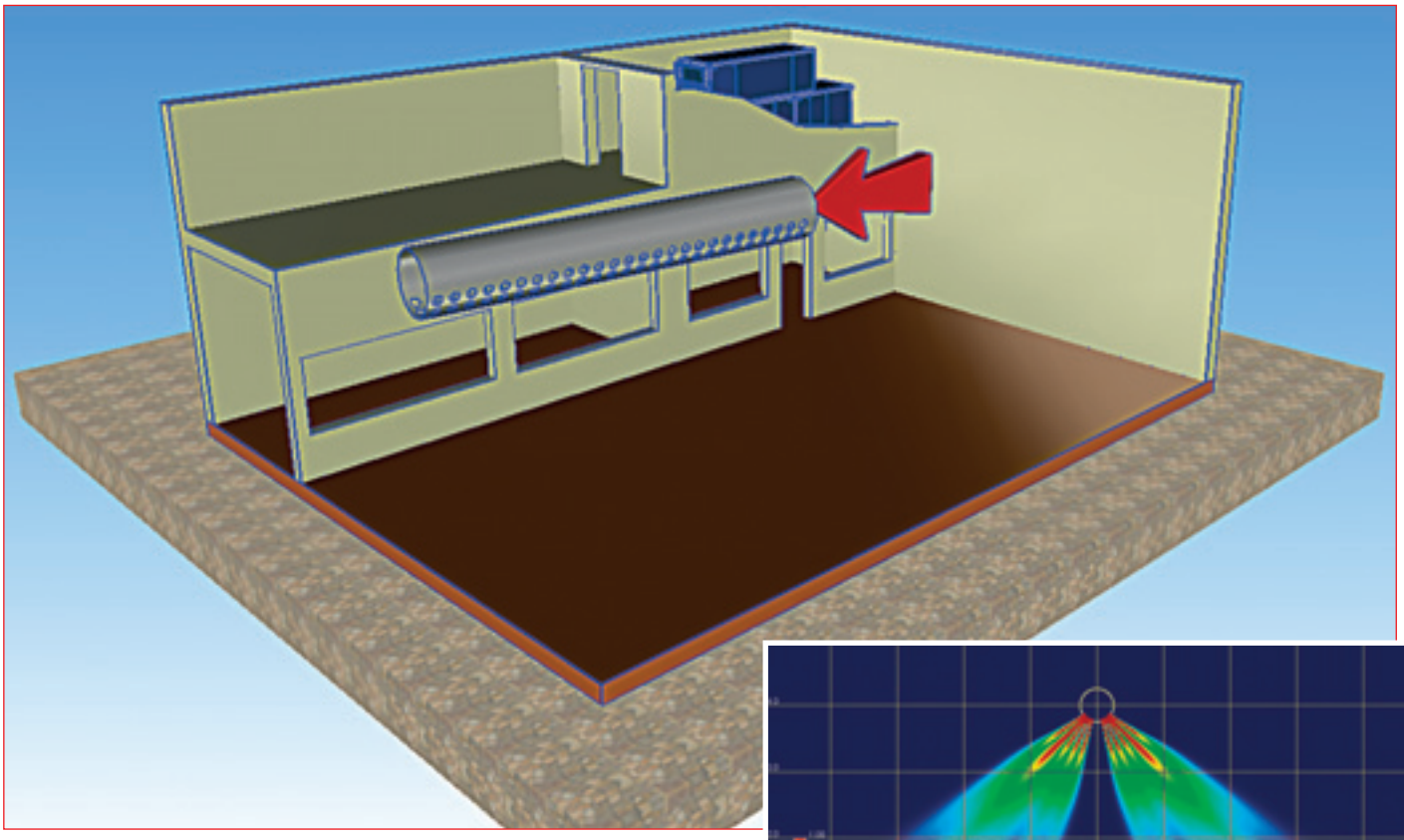
A DLD’s perforation pattern is calculated following the traditional rules for the air DIFFUSION.
The holes are therefore calculated in order to “throw” the input air at the desired distance, exactly in the same way as it is done for an air vent or a traditional diffuser.
Each 1 m DLD module has then to be considered as a section of a duct on which an air vent or a diffuser can be placed.
Compared to traditional air vents and diffusers, the DLD reaches the maximum performances levels, thanks to its elevated induction skills.
It is solely the perforation which determines the diffusion characteristic of the DLD, and the same perforation pattern can be applied to a DLD of any diameter.
In the same way as the traditional diffusers, the perforation patterns, which are applicable to a DLD module of any diameter, are tested in laboratory, where their effective air throw capacity and their air diffusion qualities are calculated and verified.
The module calculated in this way can then be repeated at will for the desired length, in order to constitute a linear diffuser duct which can be perforated in a continuous or alternated way.
The only limit is given by the fact that the air flow coming out from the holes of each module can not 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 coming from the recovery of the dynamic pressure into static pressure.
It is also important to notice that, if a DLD’s length is excessive, the temperature drop along the duct’s length will cause a dishomogeneity of the temperatures in the environment.
If, in order to correct this effect, we were to compensate by increasing the perforation in the last part of the DLD, we will also increase the risk of air drafts and heat stratification.
Therefore, to obtain the best performances of a DLD, it is strongly suggested not to exceed the air speed of 5 m/sec at the DLD’s entrance, 30m of length, and not to exceed 10°C temperature difference between the input air temperature and the environment air temperature.
It is also important to remind that, as for all the best air DIFFUSION systems, also the DLDs will be subject to:

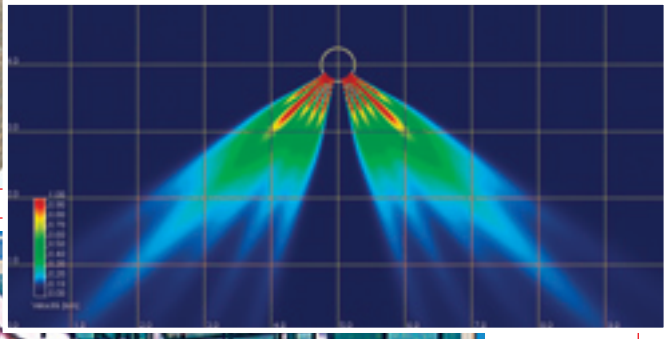
- Stratification risk, when there is the input of hot air
- Air drafts risk, when there is the input of cold air
- As the induction increases, the air throw is reduced
- As the air throw increases, the stratification and air drafts risk also increase
- Need to recover the environment air at floor level during the winter season, in order not to increase the stratification, lengthening the set-up times

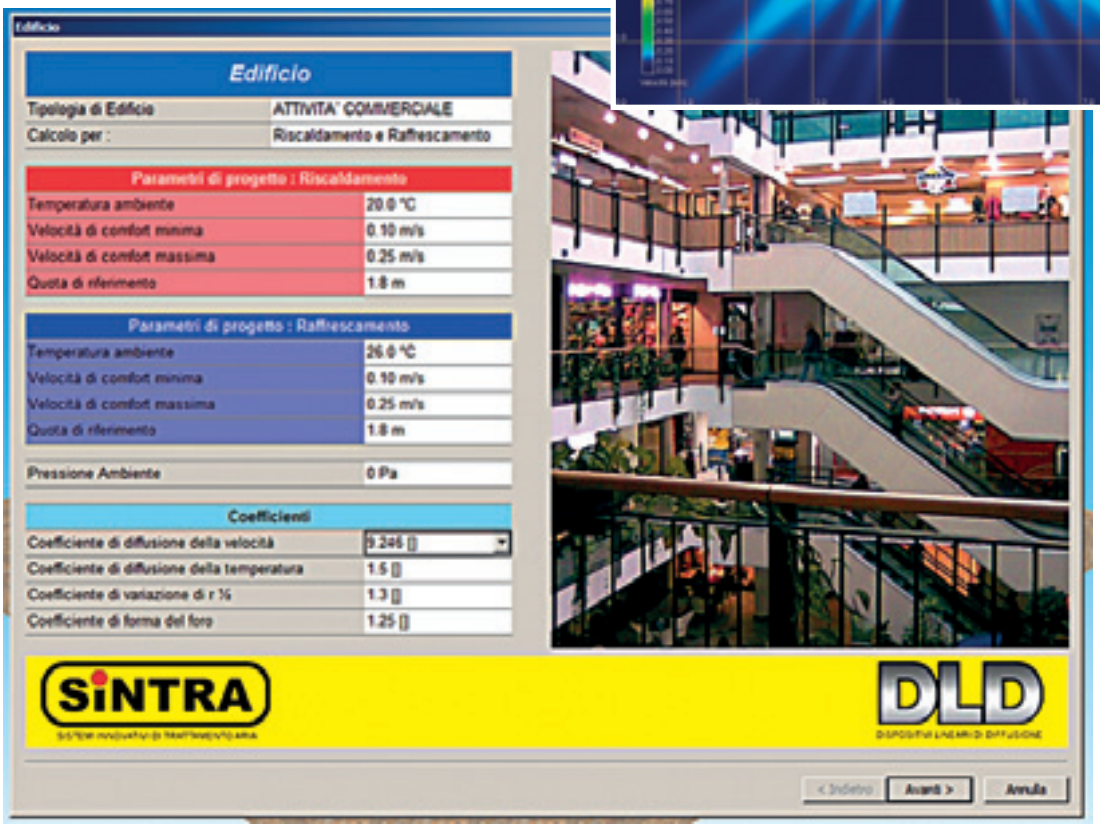
The DLD finds its best application in medium-low buildings, where there is the need for an optimal air diffusion quality with no particular performances.

CALCULATION SOFTWARE

DLD inductive micro-perforated ducts are designed with a calculation software which, through mathematical models, allows to choose both the diameters and the perforations which are more suitable, according to the project's conditions, in order to realize a perforated DIFFUSION duct.

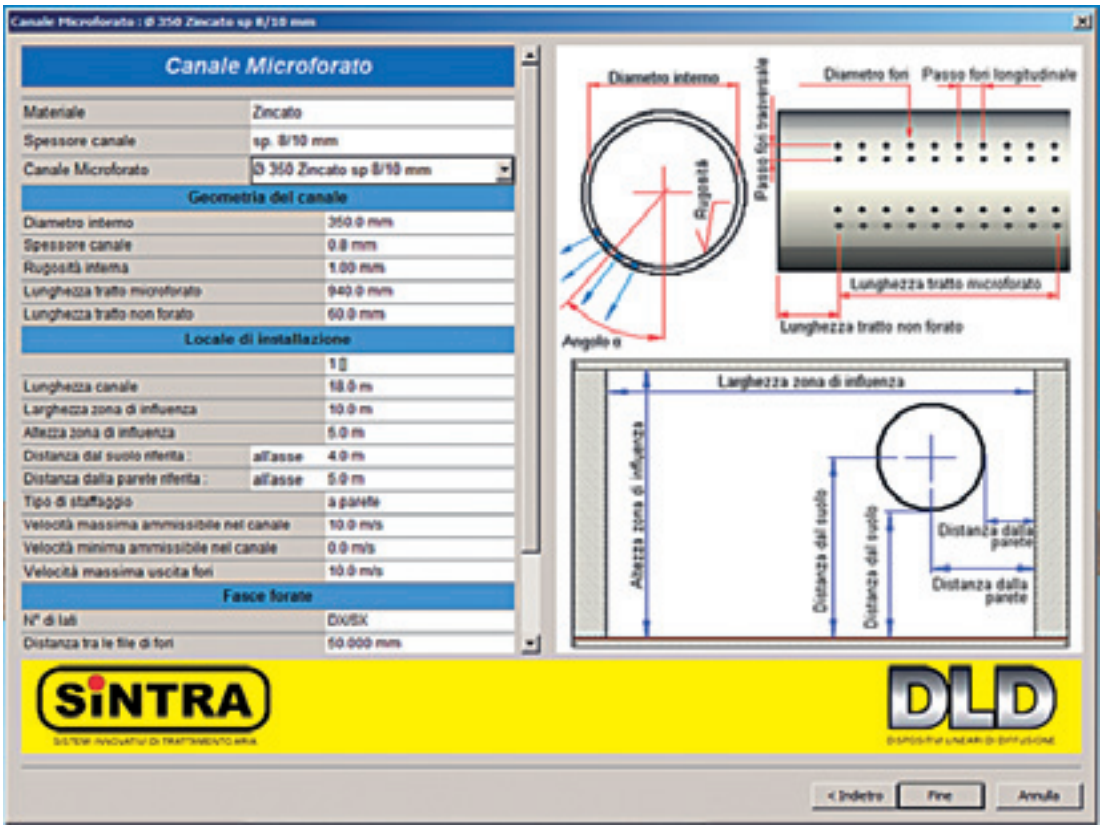


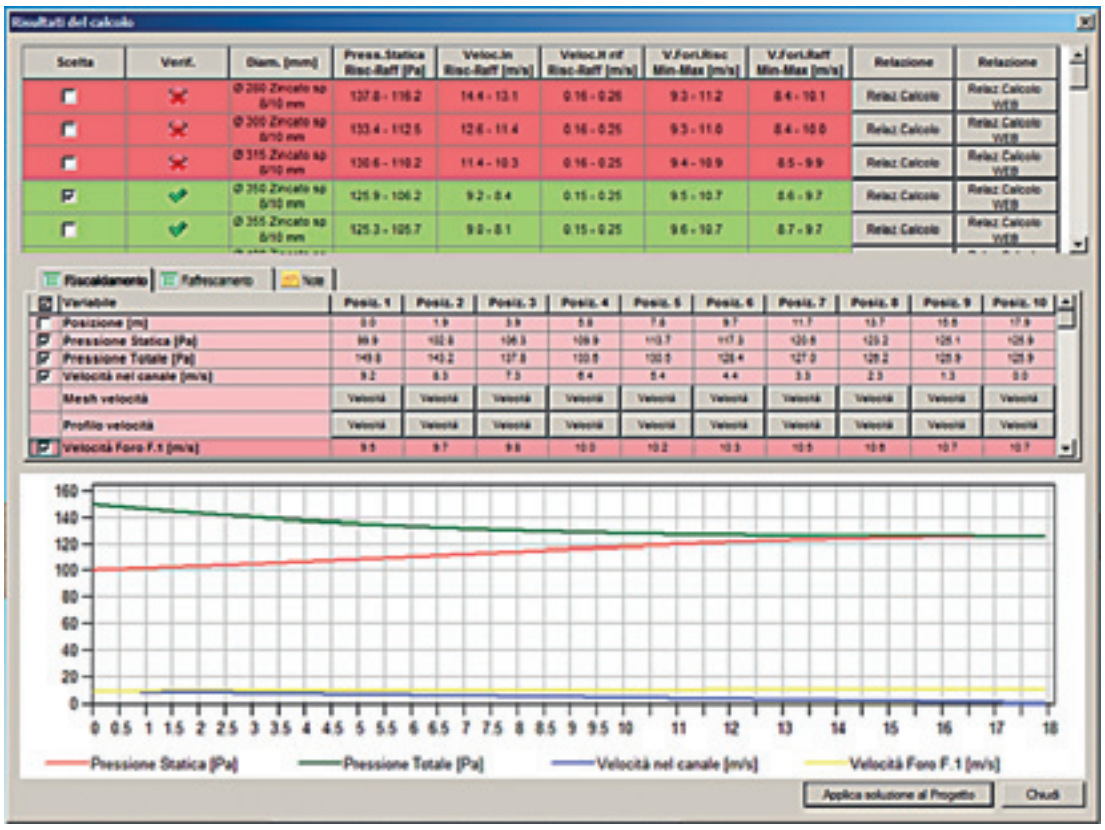




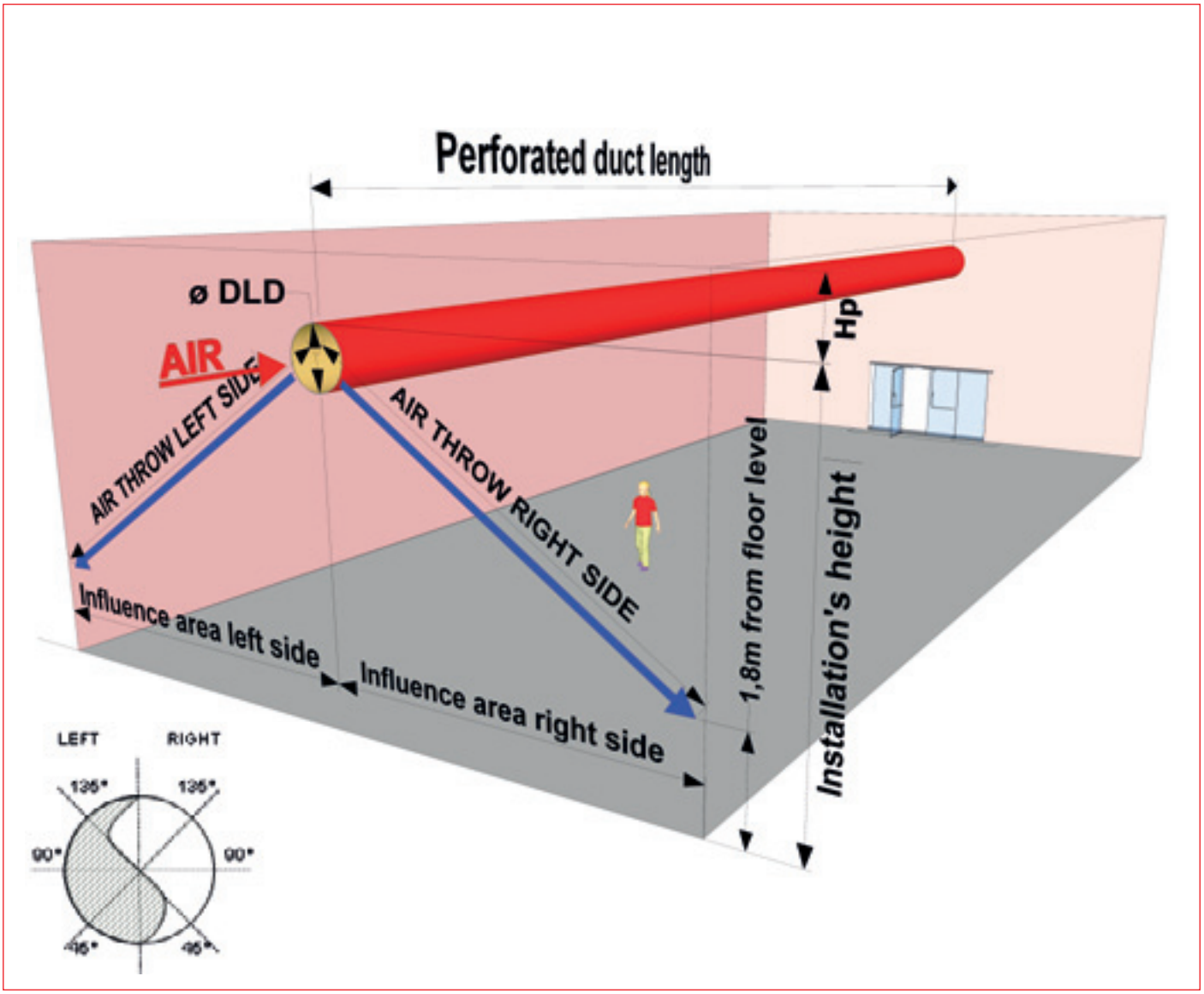
CALCULATION SOFTWARE

All the results obtained from the mathematical model are then elaborated by the calculation software which positively verifies all the project's comfort requirements according to the UNI 10339 rule.





SELECTION PARAMETERS



Here following there is a list of all the information to be looking for in the desired installation's type, which are useful to choose the more indicated DLD type in the selection graphs:

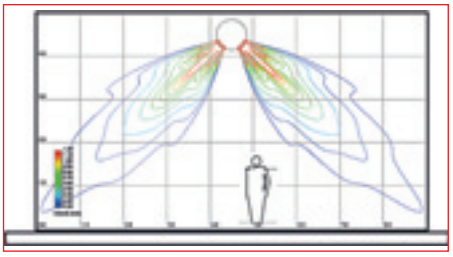
- **Lenght of the perforated duct:** the total DLD length is given by the distance between its extremities
- **AIR:** input air flow
- **Installation height (H):** installation height taken at the DLD's upper edge in relation to the floor level
- **ø DLD:** initial diameter of the perforated duct
- **Hp:** distance between the DLD and the ceiling (passive height). The maximum suggested distance from the ceiling at which a DLD can be installed answers to the following logic: ***HP = H * 0,15***
- **Influence area:** distance between the DLD's axis and the limit area for the active influence of the perforation
- **°α:** perforation's angle inclination (α) compared to the orthogonal DLD's axis. Generally it is resulting from the relation between influence area, installation height and control area situated at 1,8m from floor level. The customer can anyways vary this parameter as he likes, in order to adapt the DLD to the desired diffusion needs.

PERFORATION ANGLES

The dimensioning of the perforated high induction DLD ducts requires particular attention on the positioning of the perforation pattern on the duct's circumference.
According to the installation height, the influence areas, the thermal conditions of the input air and the air flow per linear meter, it is necessary to choose a correct perforation angle in order to guarantee the proper functioning of the plant.
The choice can be done according to the data quoted in the following technical file.

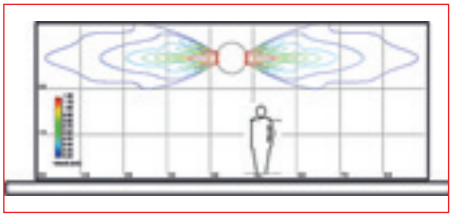
STANDARD ANGLE

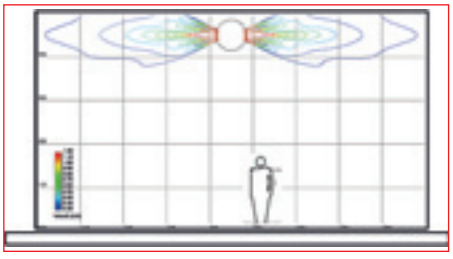
- DLD installed between 3,5 and 8 meters of height
- Heating and conditioning with ΔT_{max} =10°C
- Core distance betwen DLDs included between 3,5 and 18 meters (see selection tables)
- Distance from the opposite wall included between 2 and 9 meters (see selection tables)



This angle represents the right compromise between good temperature homogeneity and air drafts risk.

90° ANGLE





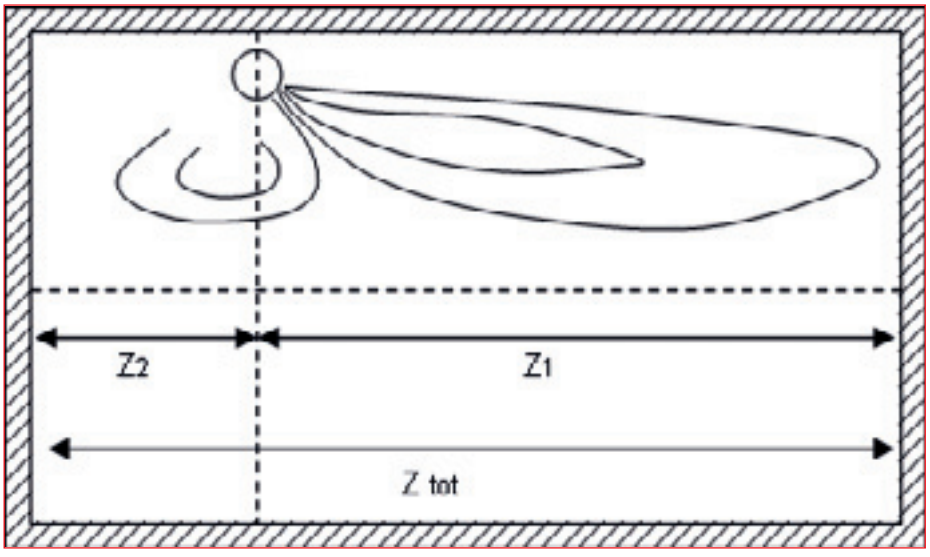
- DLD installed between 2,7 and 3,5 meters of height for plants which do both heating and air-conditioning
- Heating and air-conditioning with ΔT_{max} =10°C
- Core distance between DLDs included between 4 and 16 meters (see selection tables)
- Distance from the opposite wall included between 2 and 8 meters (see selection tables)

This angle is also used for:

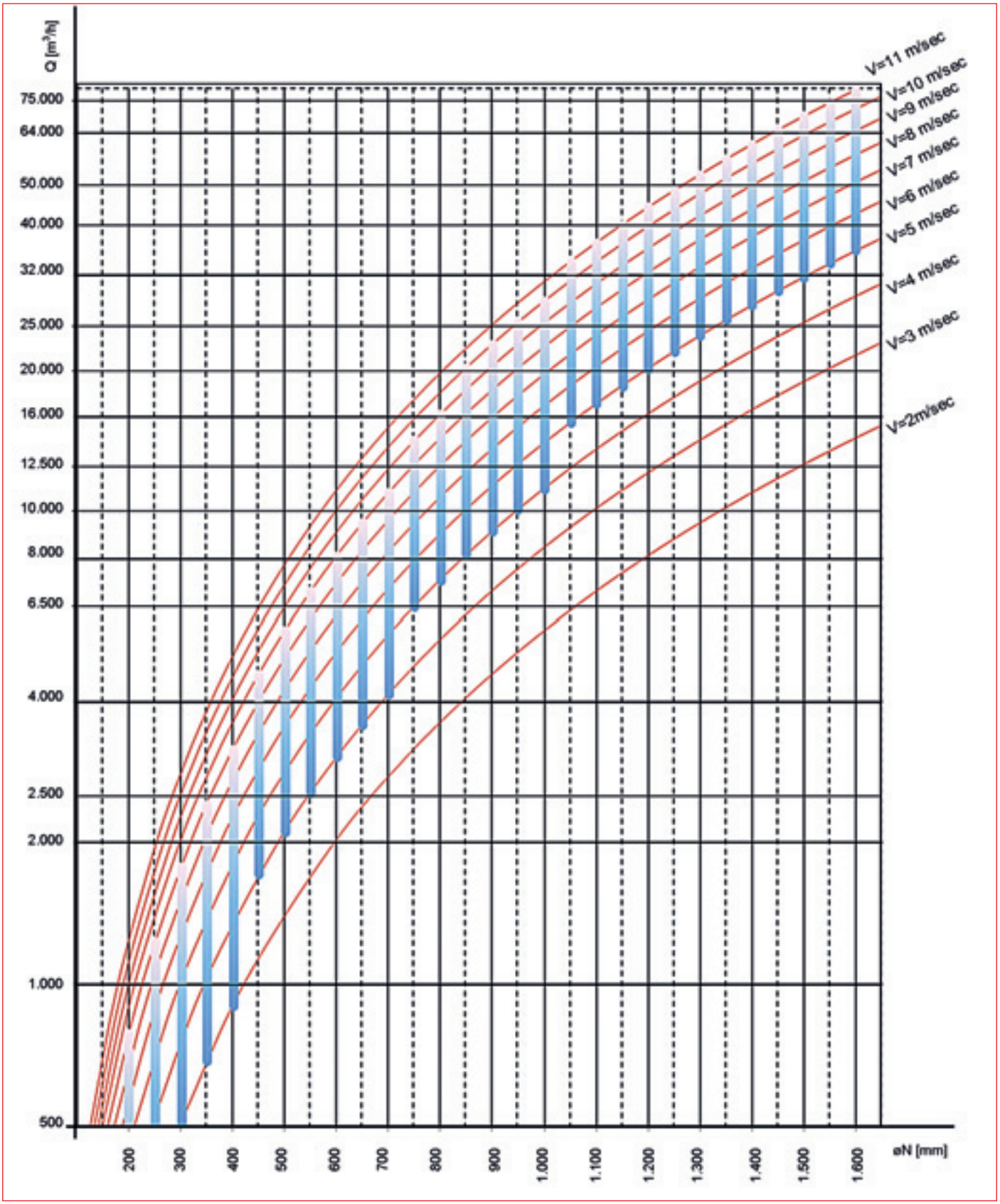
- Low height environments: it privileges the residual speed control over the stratification risk.
- DLD installed between 2,7 and 8 meters of height for only air-conditioning plants or air exchange with isothermal air input temperatures
- Plants where the control of the residual speed needs to be privileged to the detriment of the stratification risk

In order to function correctly and not to create contrasting depressional fields, the DLDs have to have a symmetrical air throw or a perforation on just one side.
In the case there is a perforation on just one side, the influence area which is in the opposite side compared to the perforation follows this logic:

Z2= Z tot * 0.2



CHART



Legend:

Q [m3/h]: *Input air flow*

ØN [mm]: *nominal diameter*

V [m/s]: *Air speed in the duct according to the initial section*

PERFORMANCES

+ -

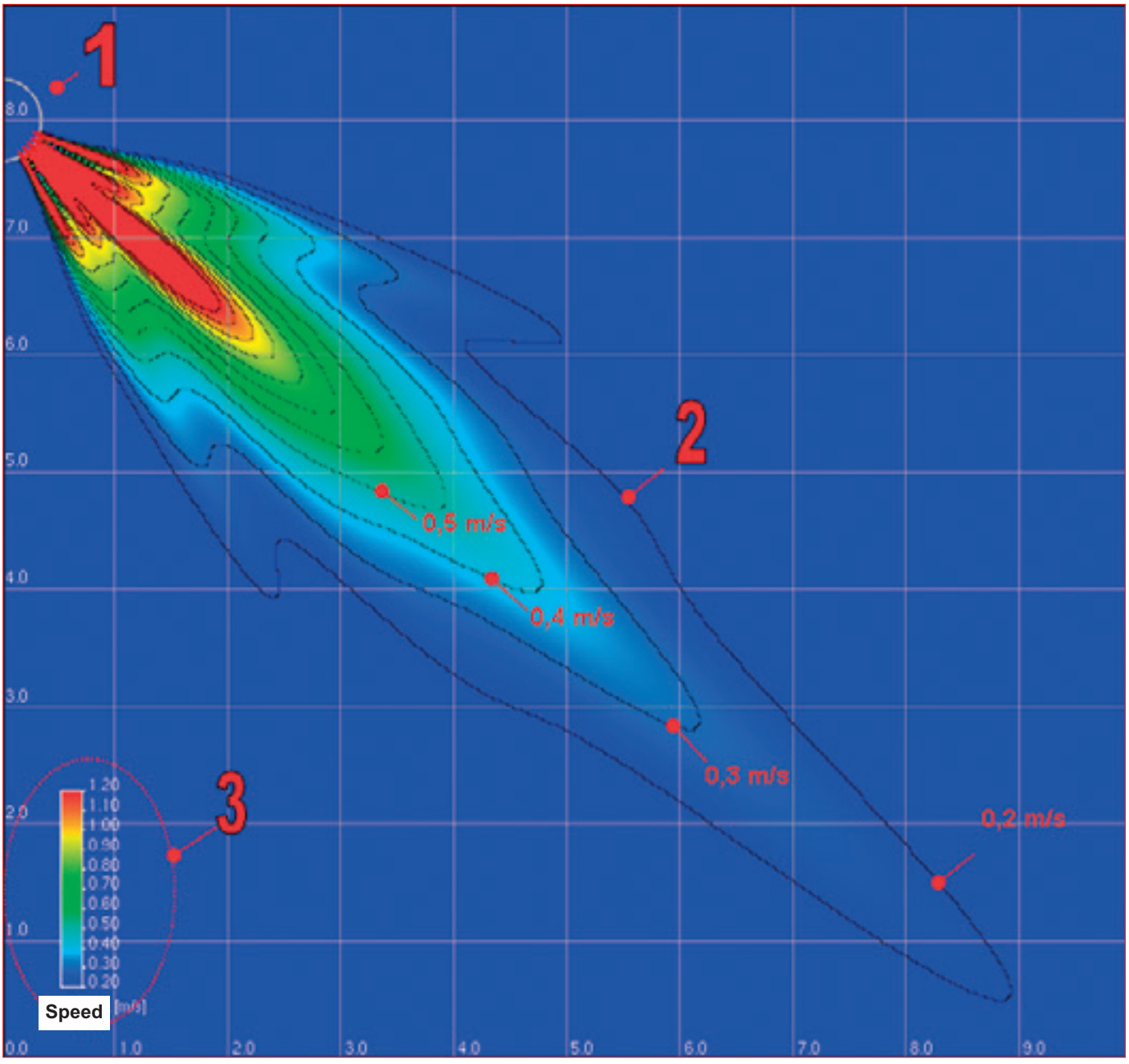
CHART

DLDs WEIGHT AND EXPANSION CHART		GALVANIZED STEEL				STAINLESS STEEL			ALLUMINIUM	COPPER
ØN	EXPANSION	8/10	10/10	12/10	15/10	8/10	10/10	12/10	10/10	10/10
mm	mm	Kg/m	Kg/m	Kg/m	Kg/m	Kg/m	Kg/m	Kg/m	Kg/m	Kg/m
280	879	5,7	7,0	8,8	11,4	5,7	7,0	8,8	2,4	6,3
300	942	6,1	7,5	9,4	11,3	6,1	7,5	9,4	2,5	6,8
315	989	6,4	7,9	9,9	11,9	6,4	7,9	9,9	2,7	7,1
350	1.099	7,1	8,8	11,0	13,2	7,1	8,8	11,0	3,0	7,9
355	1.115	7,2	8,9	11,1	13,4	7,2	8,9	11,1	3,0	8,0
400	1.256	8,2	10,0	12,6	15,1	8,2	10,0	12,6	3,4	9,0
450	1.413	9,2	11,3	14,1	17,0	9,2	11,3	14,1	3,8	10,2
500	1.570	10,2	12,6	15,7	18,8	10,2	12,6	15,7	4,2	11,3
550	1.727	11,2	13,8	17,3	20,7	11,2	13,8	17,3	4,7	12,4
560	1.758	11,4	14,1	17,6	21,1	11,4	14,1	17,6	4,7	12,7
600	1.884	12,2	15,1	18,8	22,6	12,2	15,1	18,8	5,1	13,6
630	1.978	12,9	15,8	19,8	23,7	12,9	15,8	19,8	5,3	14,2
650	2.041	13,3	16,3	20,4	24,5	13,3	16,3	20,4	5,5	14,7
700	2.198	14,3	17,6	22,0	26,4	14,3	17,6	22,0	5,9	15,8
710	2.229	14,5	17,8	22,3	26,8	14,5	17,8	22,3	6,0	16,1
750	2.355	15,3	18,8	23,6	28,3	15,3	18,8	23,6	6,4	17,0
800	2.512	16,3	20,1	25,1	30,1	16,3	20,1	25,1	6,8	18,1
850	2.669	17,3	21,4	26,7	32,0	17,3	21,4	26,7	7,2	19,2
900	2.826	18,4	22,6	28,3	33,9	18,4	22,6	28,3	7,6	20,3
950	2.983	19,4	23,9	29,8	35,8	19,4	23,9	29,8	8,1	21,5
1.000	3.140	20,4	25,1	31,4	37,7	20,4	25,1	31,4	8,5	22,6
1.050	3.297	21,4	26,4	33,0	39,6	21,4	26,4	33,0	8,9	23,7
1.100	3.454	22,5	27,6	34,5	41,4	22,5	27,6	34,5	9,3	24,9
1.150	3.611	23,5	28,9	36,1	43,3	23,5	28,9	36,1	9,7	26,0
1.200	3.768	24,5	30,1	37,7	45,2	24,5	30,1	37,7	10,2	27,1
1.250	3.925	25,5	31,4	39,3	47,1	25,5	31,4	39,3	10,6	28,3
1.300	4.082	26,5	32,7	40,8	49,0	26,5	32,7	40,8	11,0	29,4
1.350	4.239	27,6	33,9	42,4	50,9	27,6	33,9	42,4	11,4	30,5
1.400	4.396	28,6	35,2	44,0	52,8	28,6	35,2	44,0	11,9	31,7
1.450	4.553	29,6	36,4	45,5	54,6	29,6	36,4	45,5	12,3	32,8
1.500	4.710	30,6	37,7	47,1	56,5	30,6	37,7	47,1	12,7	33,9
1.550	4.867	31,6	38,9	48,7	58,4	31,6	38,9	48,7	13,1	35,0
1.600	5.024	32,7	40,2	50,2	60,3	32,7	40,2	50,2	13,6	36,2

Suggested thickness

INTRODUCTION

EXAMPLE OF CFD

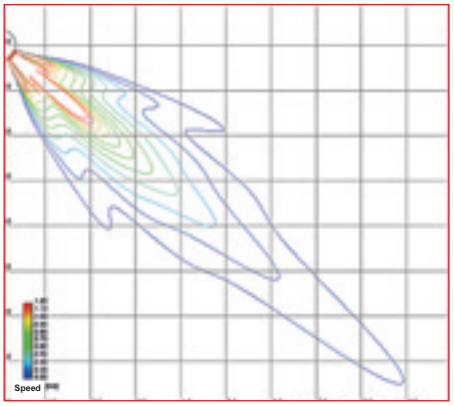


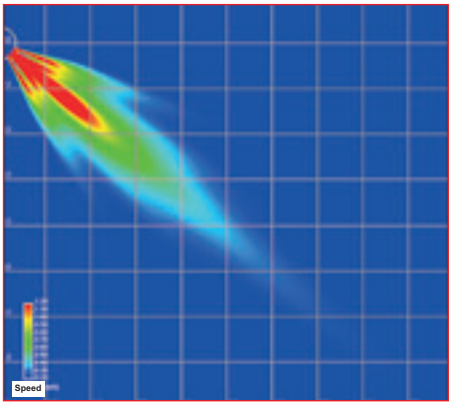
Legend:

1: DLD - perforated duct

2: speed profile

3: speed profile legend





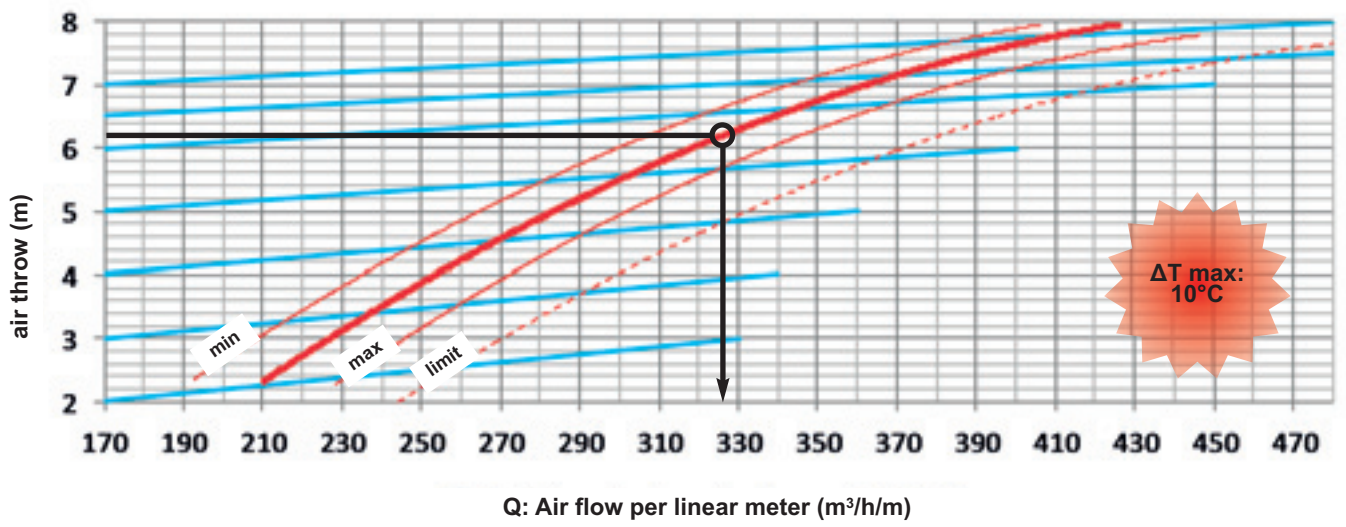
All graphs in this page and in the following pages have been calculated with an isothermal air input temperature exempt from thermal dispersions.

INTRODUCTION

Suggestions for a correct dimensioning:

- Since the following graphs have been calculated with an isothermal air input temperatures exempt from thermal dispersions, they can be used merely to ha an approximate indication on the choice of the number of ducts to be installed in relation to the room's dimensions.
- The ideal installation height for the perforated high induction ducts is included between 2,5m and i 6 m, with maximum air throws of 6m. Beyond these heights and air throws there is a progressive loss of performances.
- In order to be able to regulate the DLD and calibrate it in a thorough way, it is advisable to always use the mono-perforation which allows to regulate the air throw angle in relation to the evolutions on the environment.
- The choice of the initial diameter is binding for the correct functioning of the plant. The increase of the initial speed inside the DLD increases the outgoing air flow's difference between the first hole of the first module and the last hole of the last module caused by the recovery of the dynamic pressure. It is suggested therefore, in order to avoid air drafts towards the end, to dimension the ducts which have a great length with reduced air speeds at the entrance (5m/sec).
- For the DLDs, as for the traditional air diffusion systems, it is suggested to create air recovery points at floor level according to the rules of aeraulic designing.
- ***The maximum thermal gap between environment air temperature and air input temperature, which has to be observed to allow a correct functioning of the perforated duct, is 10°C***

Selection graph example



Legend:

- HORIZONTAL AXIS: it shows the air flow per linear meter which the DLD can distribute
- VERTICAL AXIS: it shows the influence area (AIR THROW) which the DLD can treat

It represents the ideal air flow per linear meter

Max: it represents the maximum air flow per linear meter which the DLD can diffuse, beyond which there can be the risk of air drafts

Min: it represents the minimum air flow per linear meter which the DLD can diffuse, beyond which there can be the risk of stratification and extended set-up times

Limit: It represents the air flow per linear meter beyond the limits of the correct functioning. By accepting a slight risk of air drafts, it is possible to intervene with some compensation perforation in order to allow the DLD's functioning

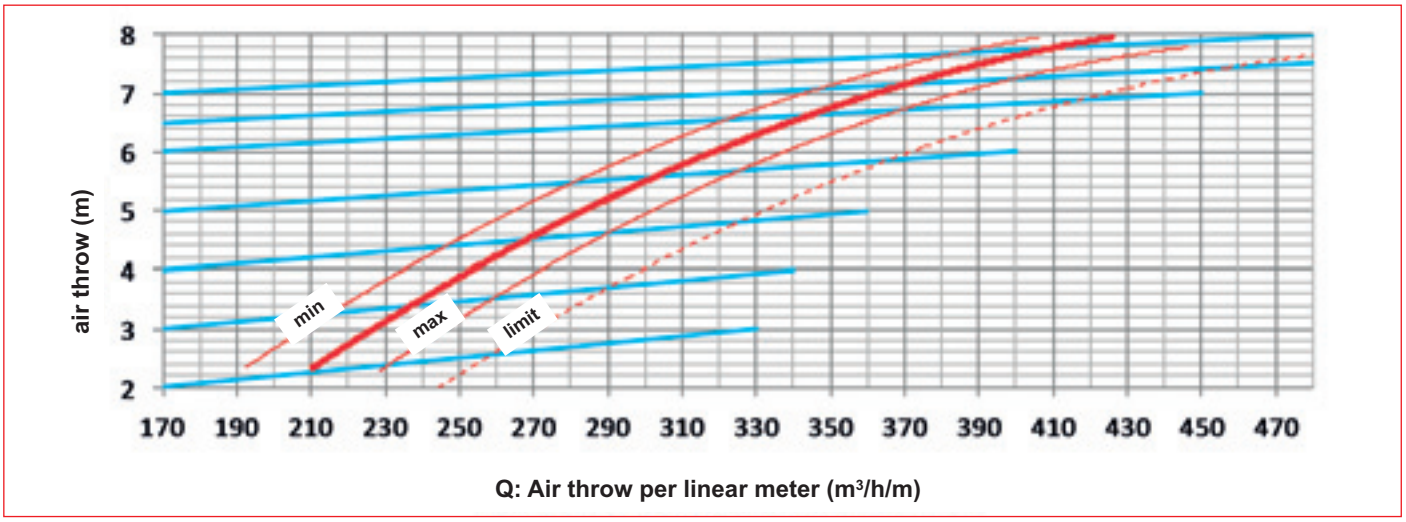
Pa: it represents the pressure losses which derive from the perforation which needs to cover the influence area from the foreseen installation height

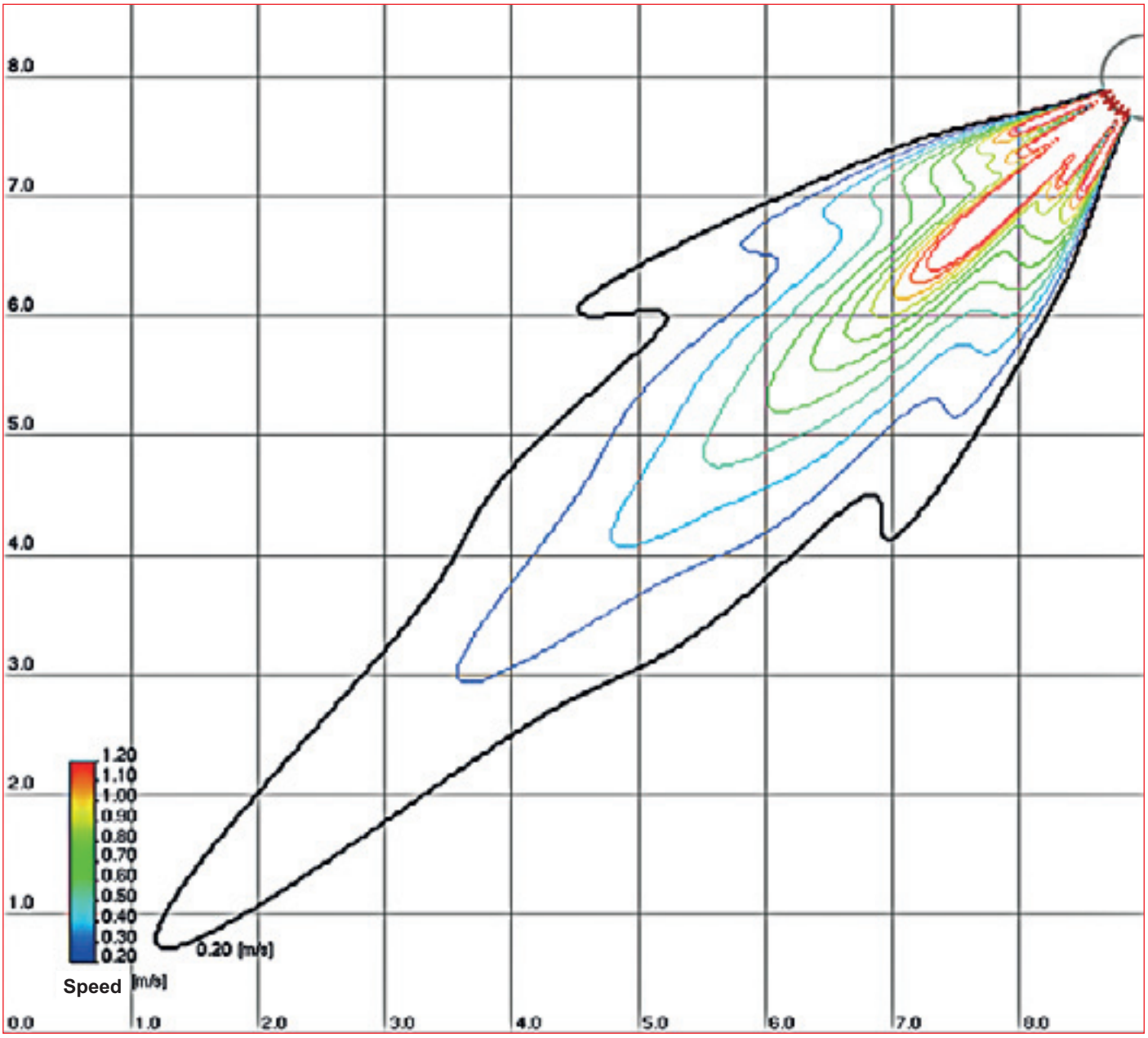
FOR DLDs WITH SYMMETRICAL AIR THROWS IT IS SUFFICIENT TO MULTIPLY THE VALUES OF AIR FLOW PER METER WHICH ARE REPRESENTED IN THE GRAPHS FOR THE COEFFICIENT EQUAL TO 2.00.

$Q_{LR} = Q * 2.00$

ON ONE SIDE

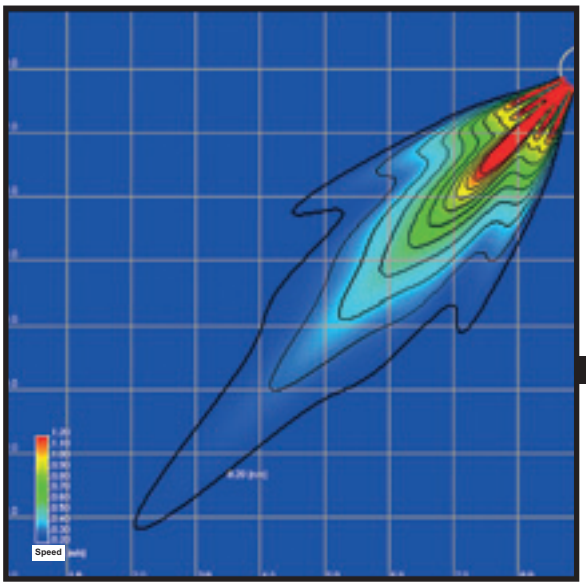
INSTALLATION HEIGHT: 8 METER



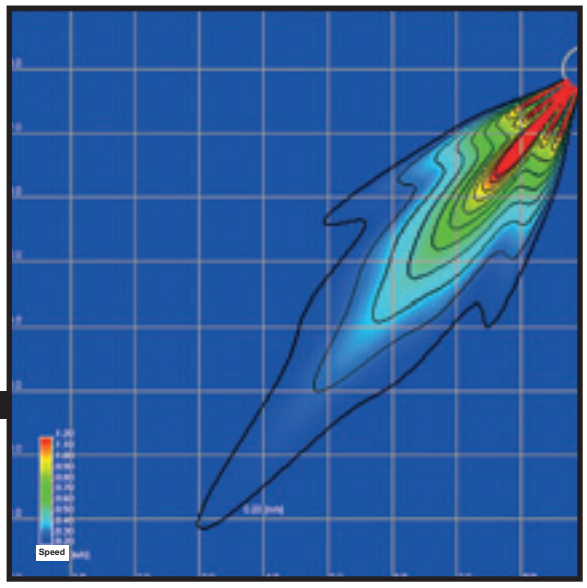


ON ONE SIDE

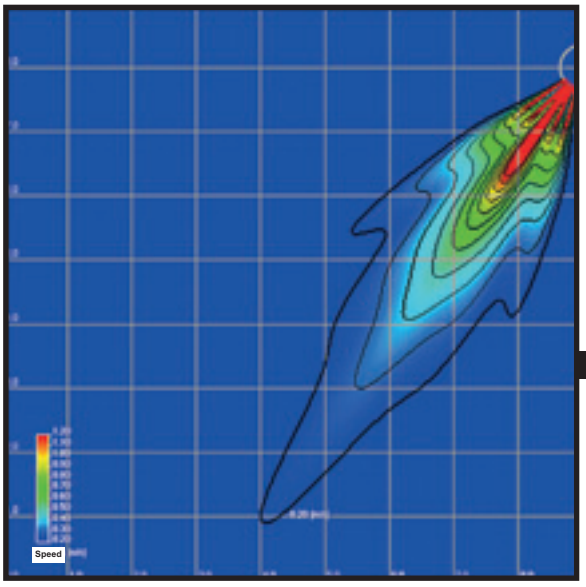
INSTALLATION HEIGHT: 8 METER



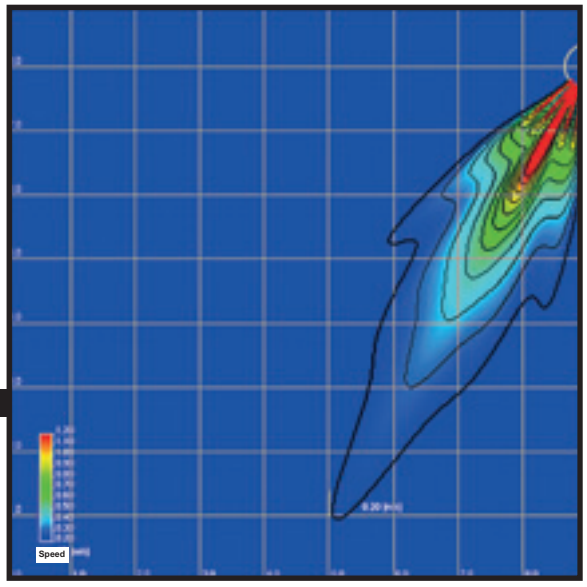
7 m air throw



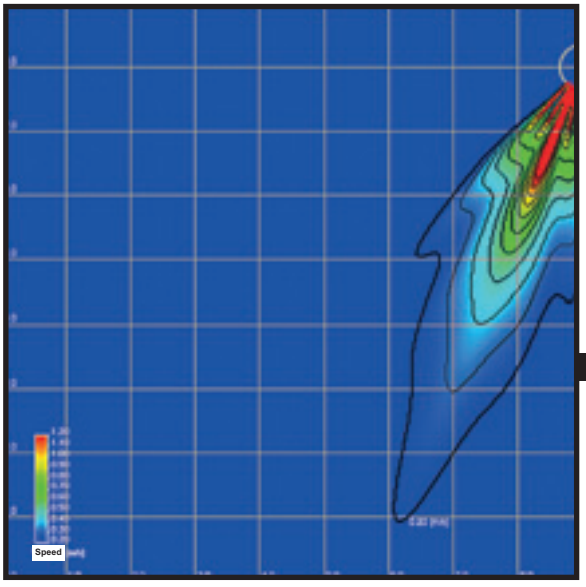
6 m air throw



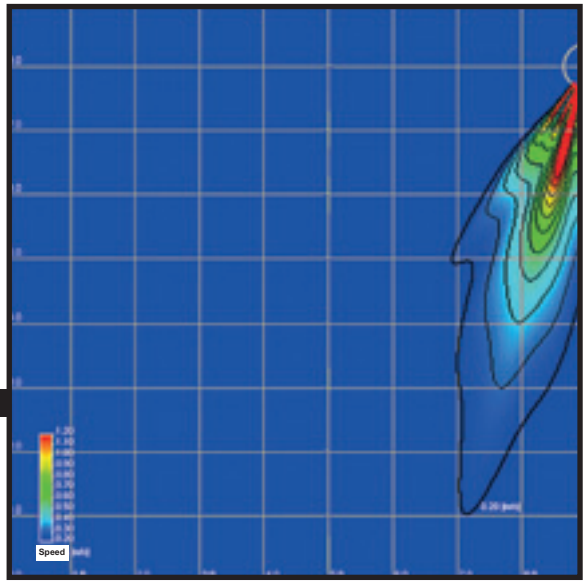
5 m air throw



4 m air throw



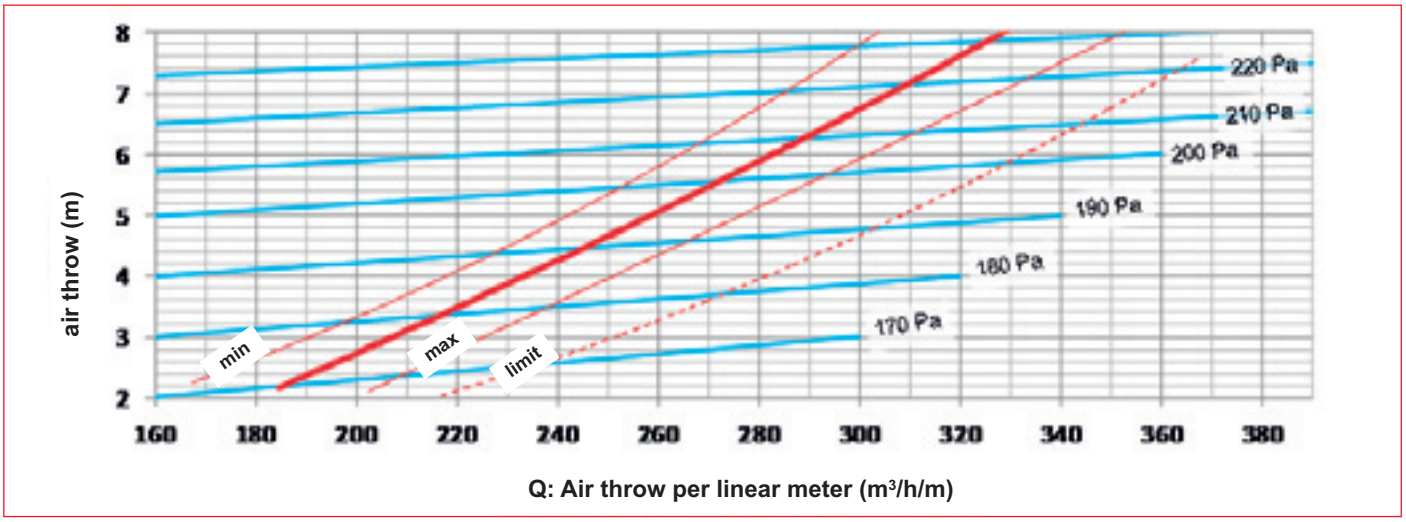
3 m air throw

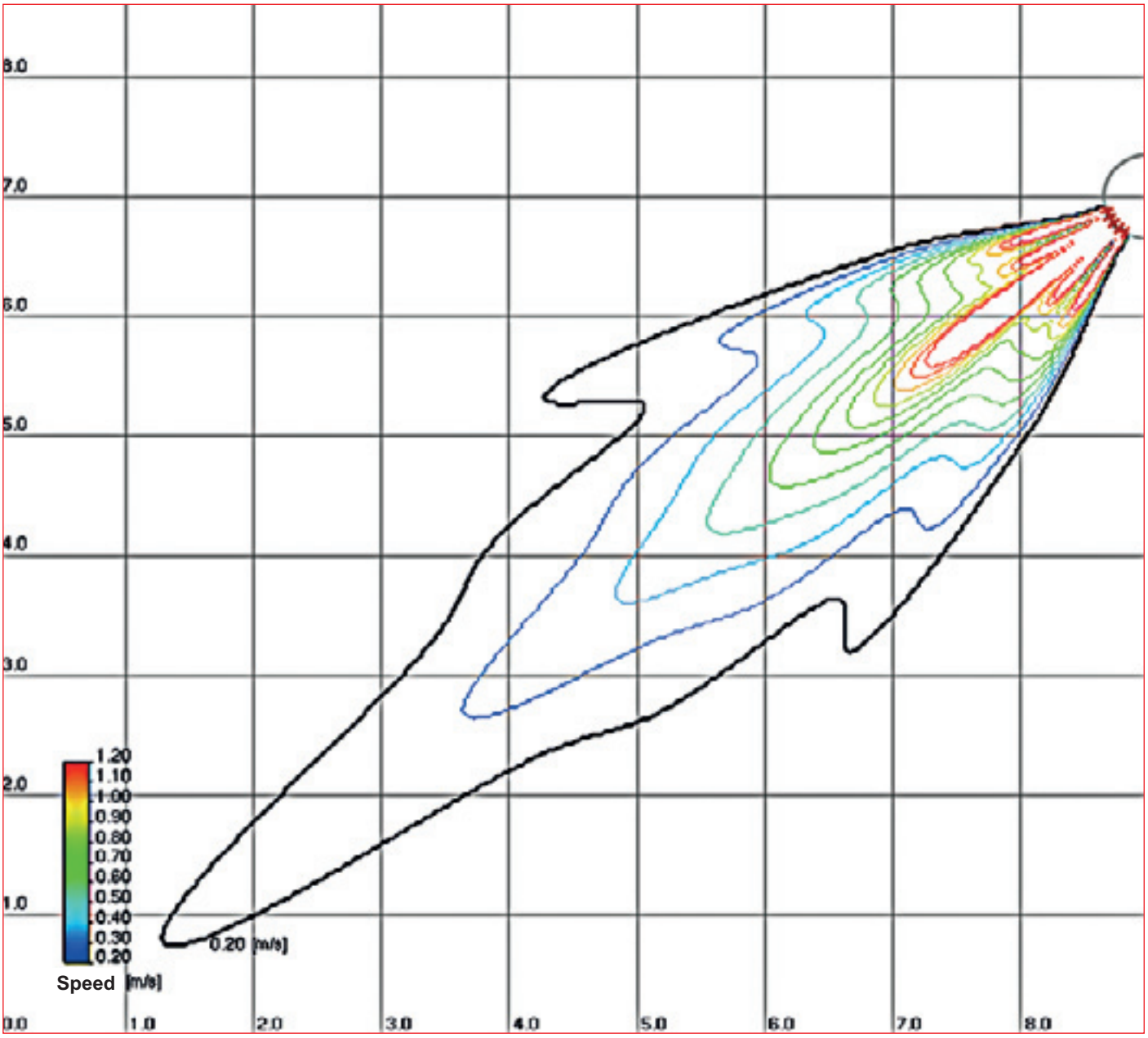


2 m air throw

ON ONE SIDE

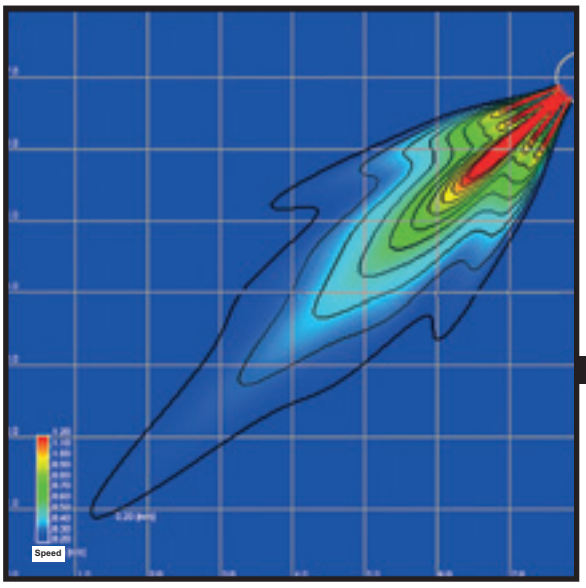
INSTALLATION HEIGHT: 7 METER



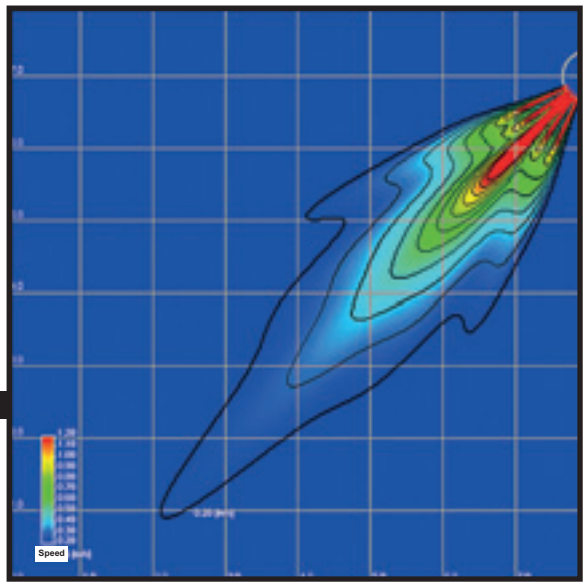


ON ONE SIDE

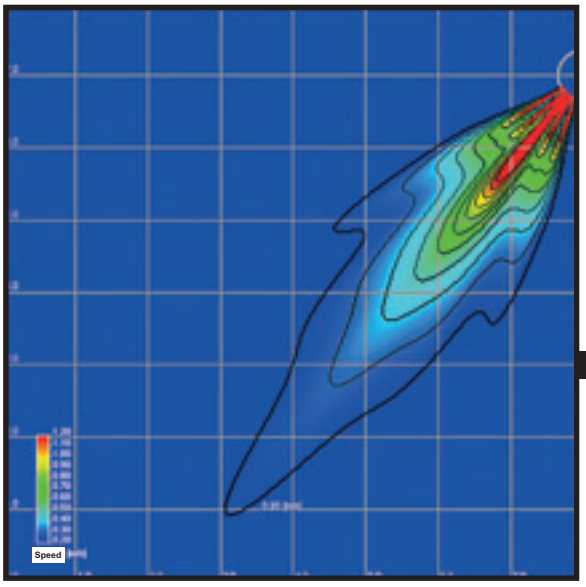
INSTALLATION HEIGHT: 7 METER



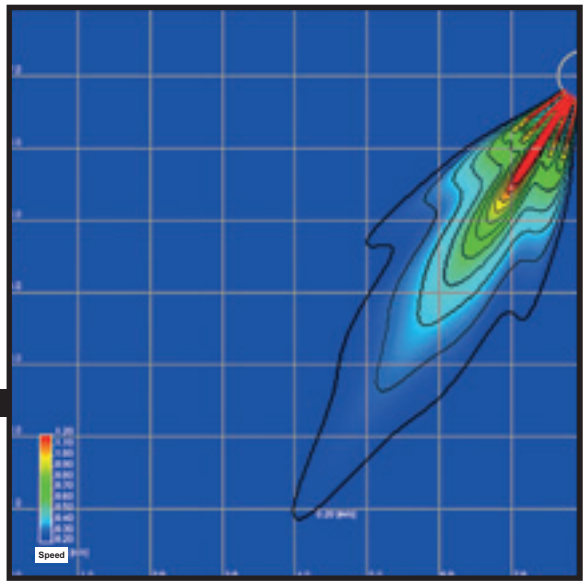
7 m air throw



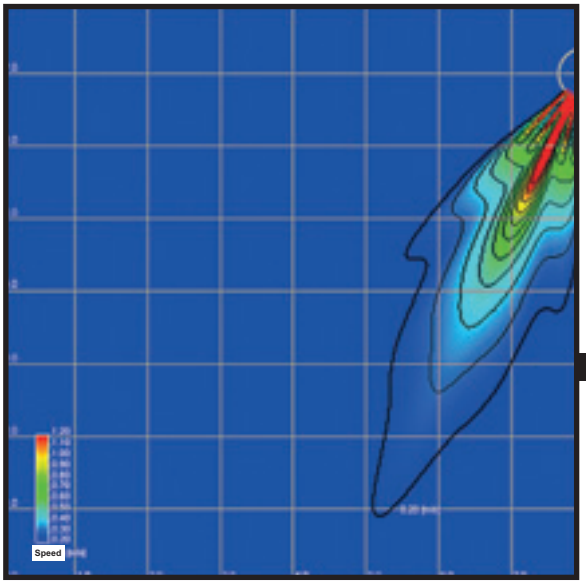
6 m air throw



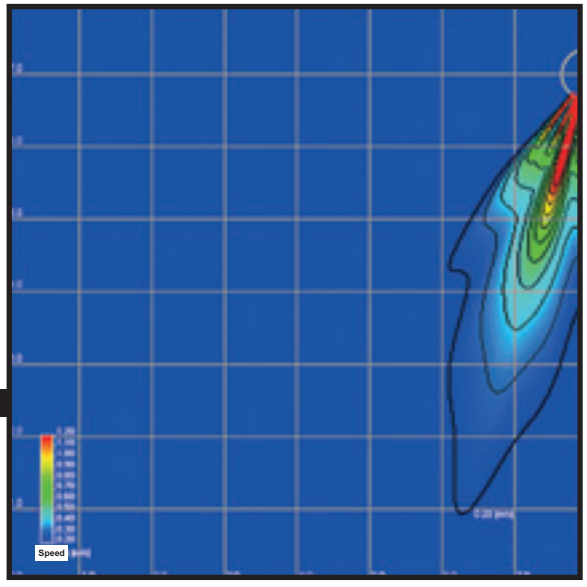
5 m air throw



4 m air throw



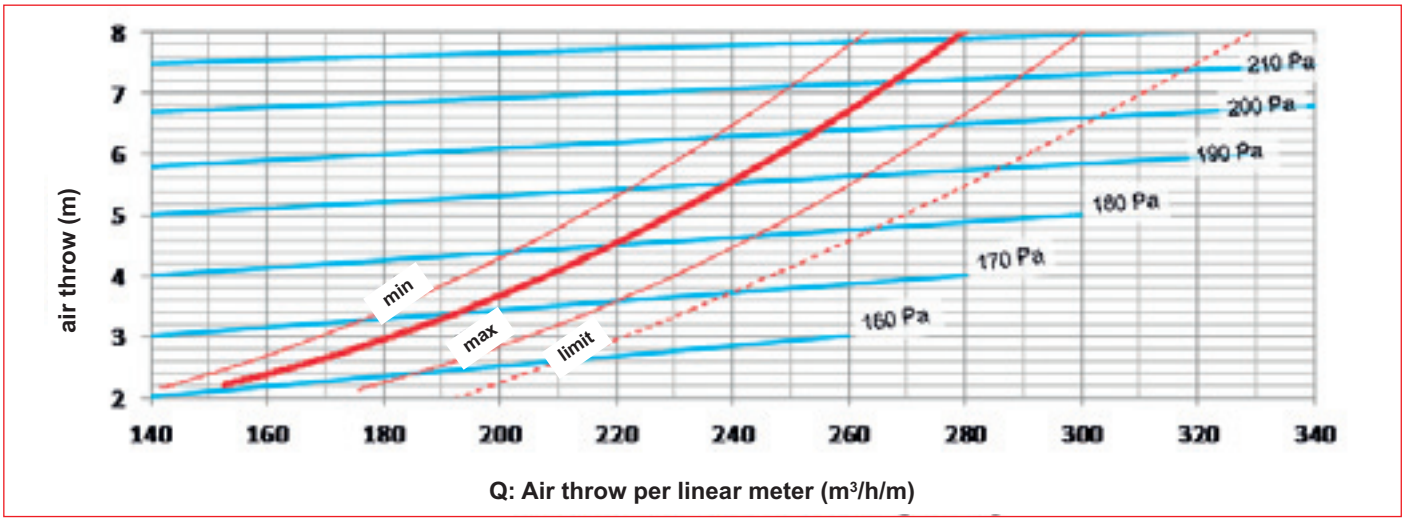
3 m air throw

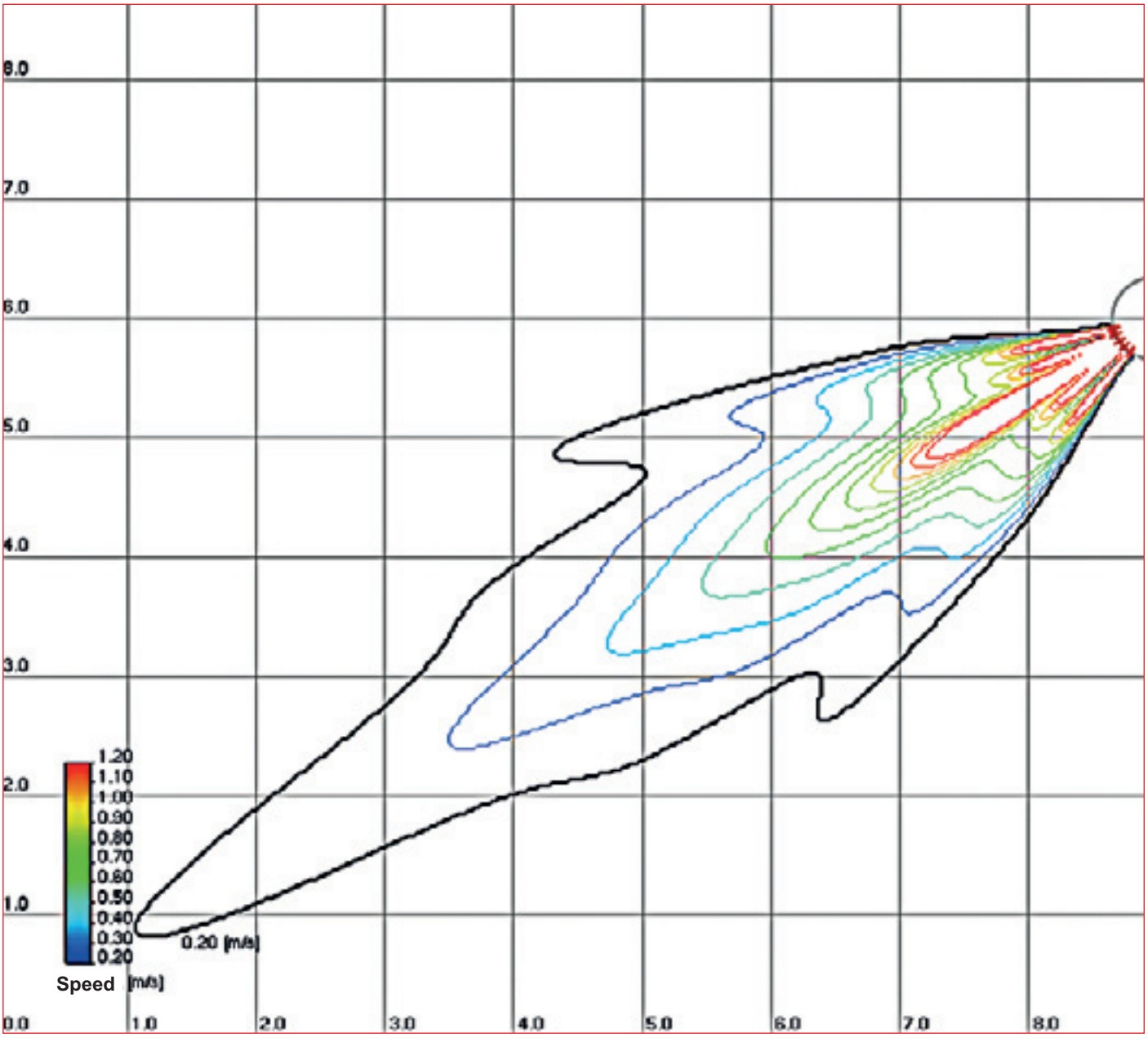


2 m air throw

ON ONE SIDE

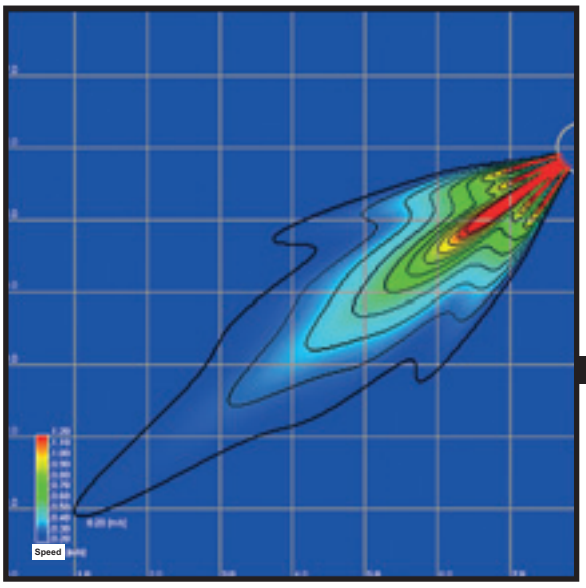
INSTALLATION HEIGHT: 6 METER



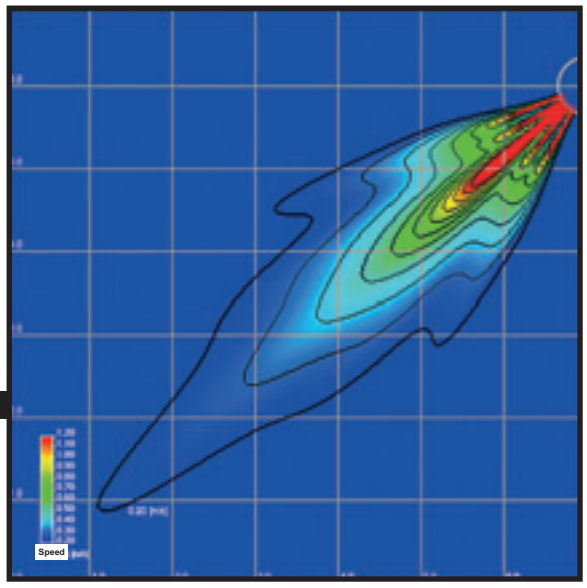


ON ONE SIDE

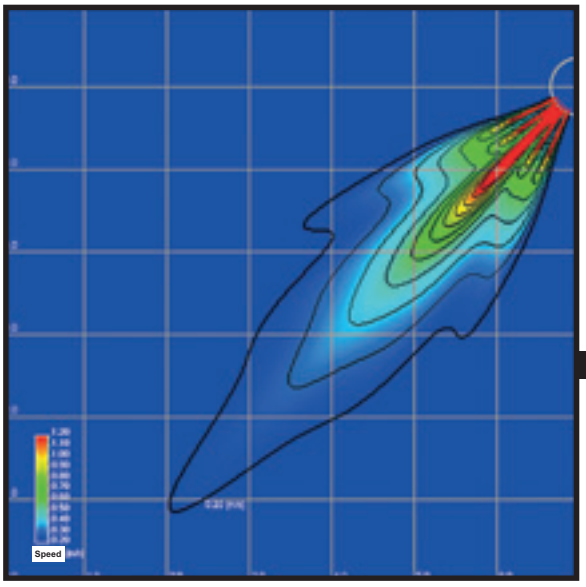
INSTALLATION HEIGHT: 6 METER



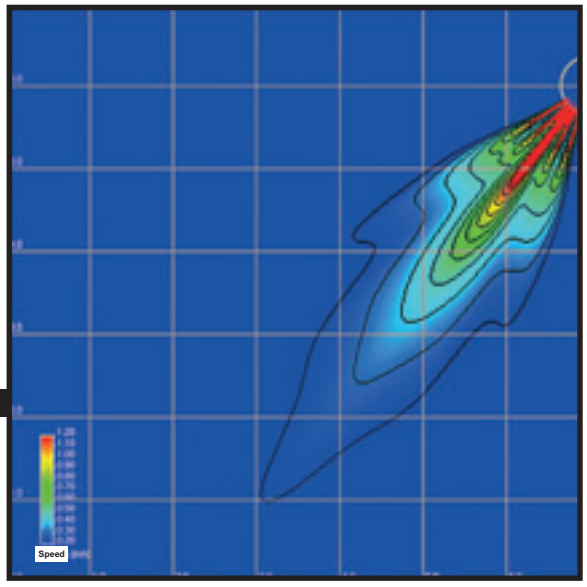
7 m air throw



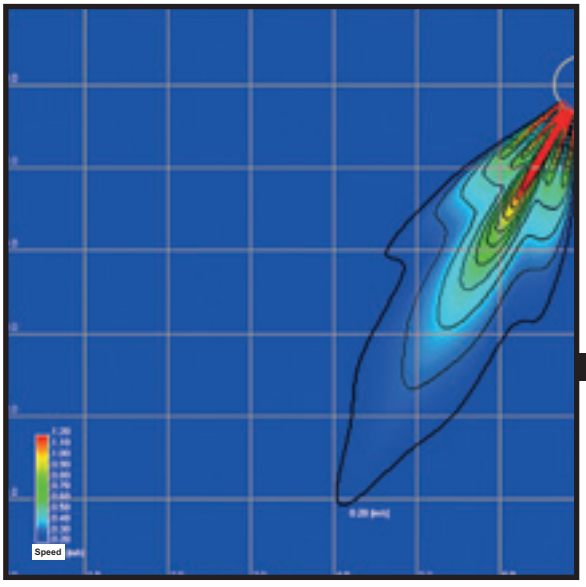
6 m air throw



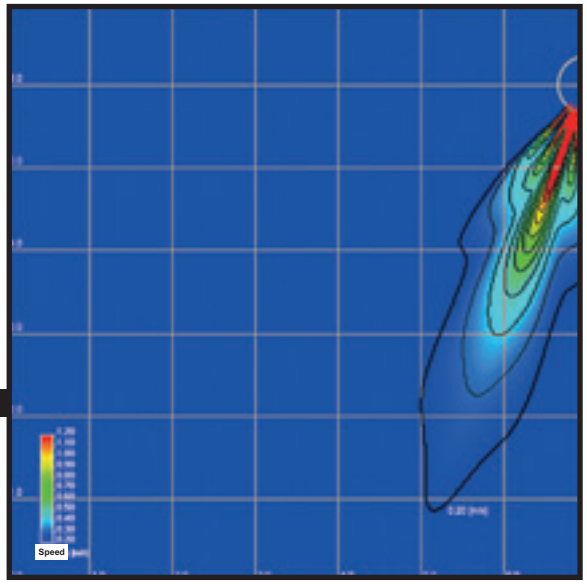
5 m air throw



4 m air throw



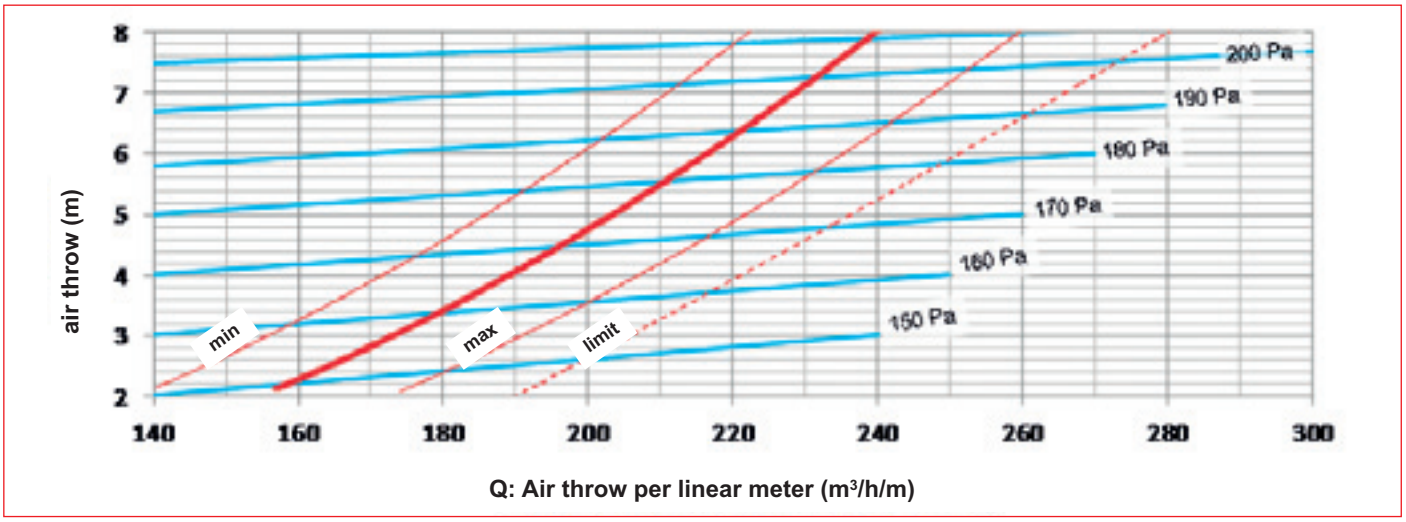
3 m air throw

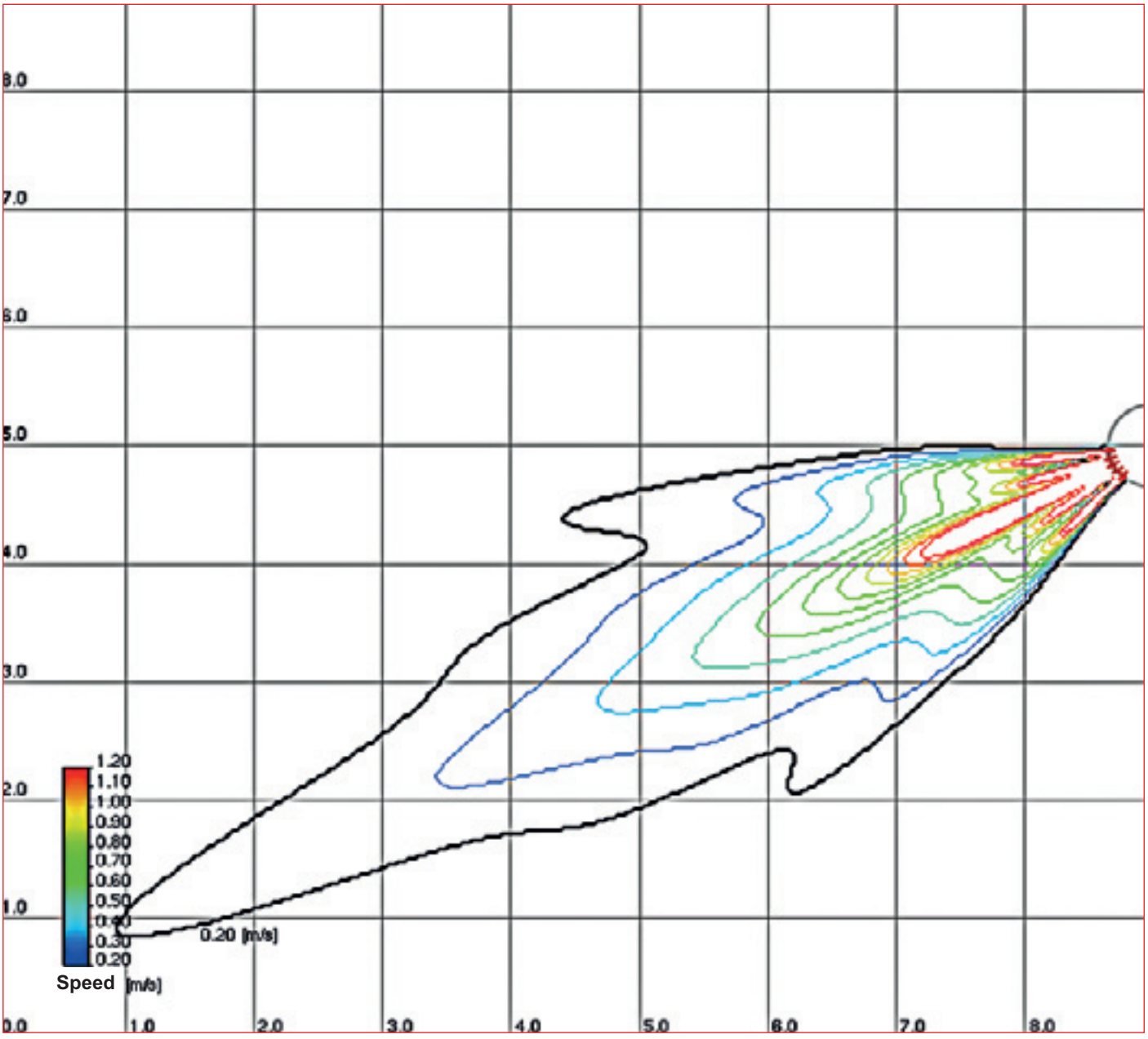


2 m air throw

ON ONE SIDE

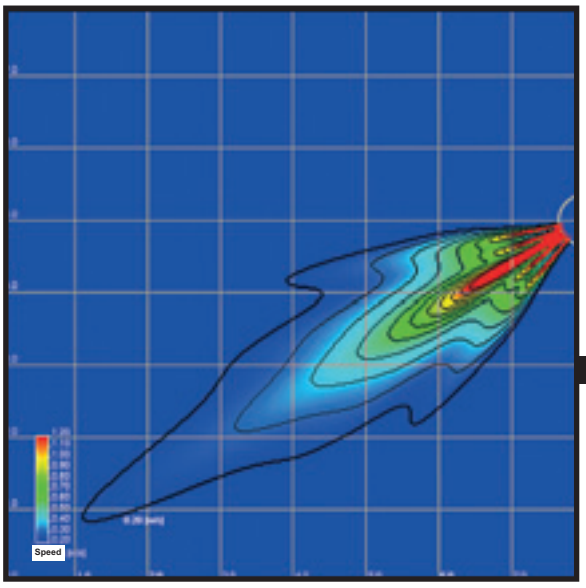
INSTALLATION HEIGHT: 5 METER



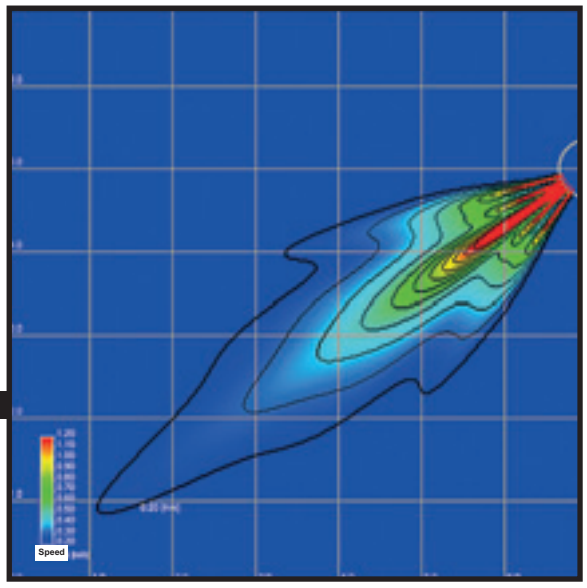


ON ONE SIDE

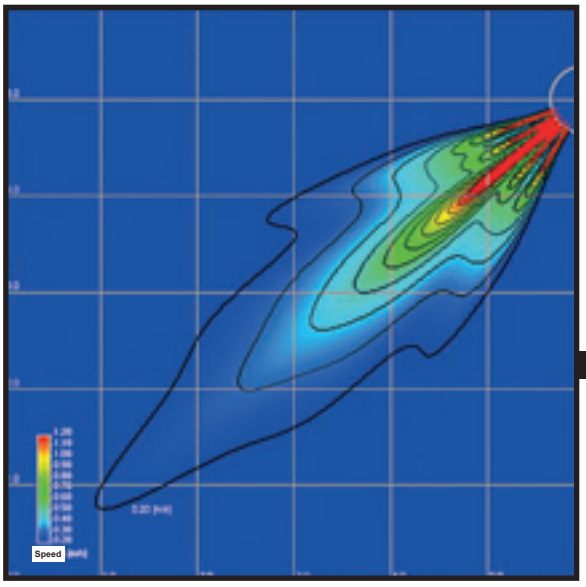
INSTALLATION HEIGHT: 5 METER



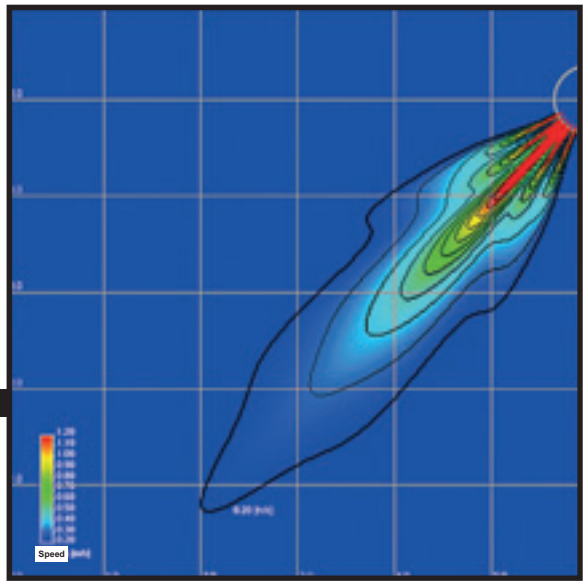
7 m air throw



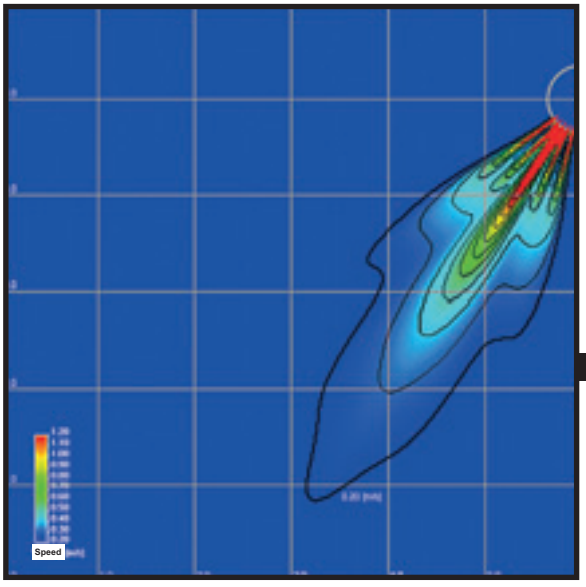
6 m air throw



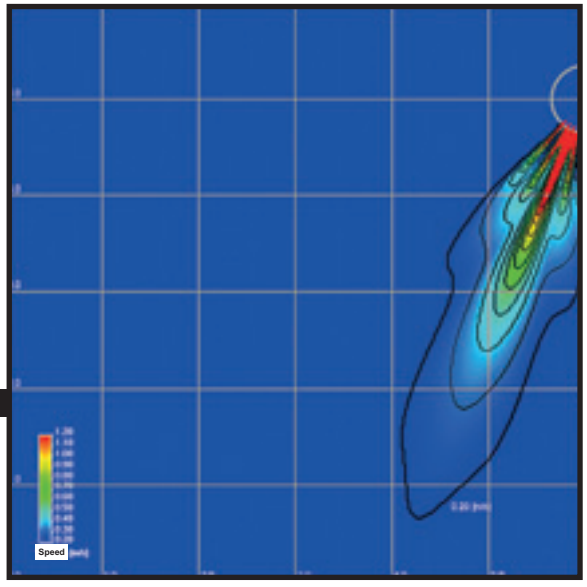
5 m air throw



4 m air throw



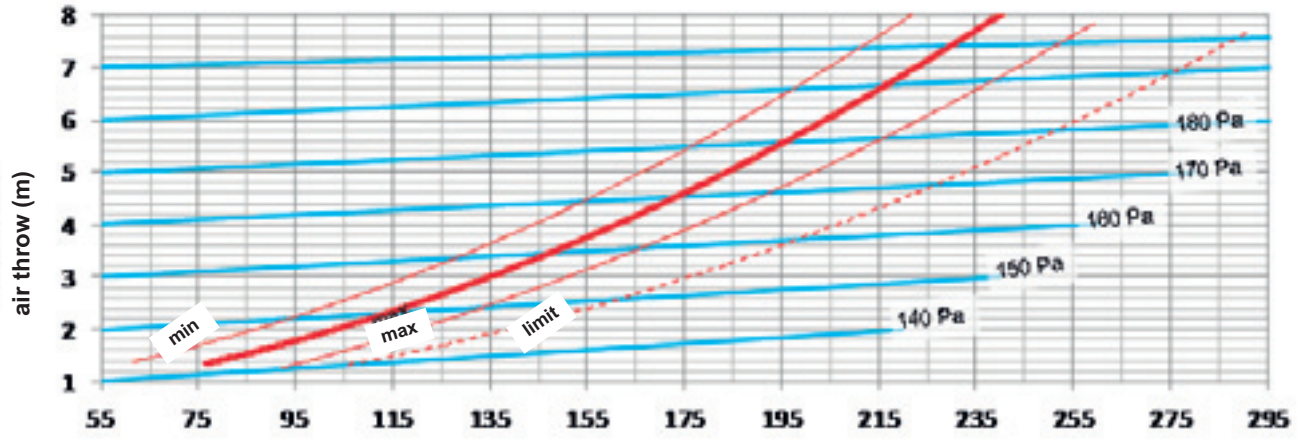
3 m air throw



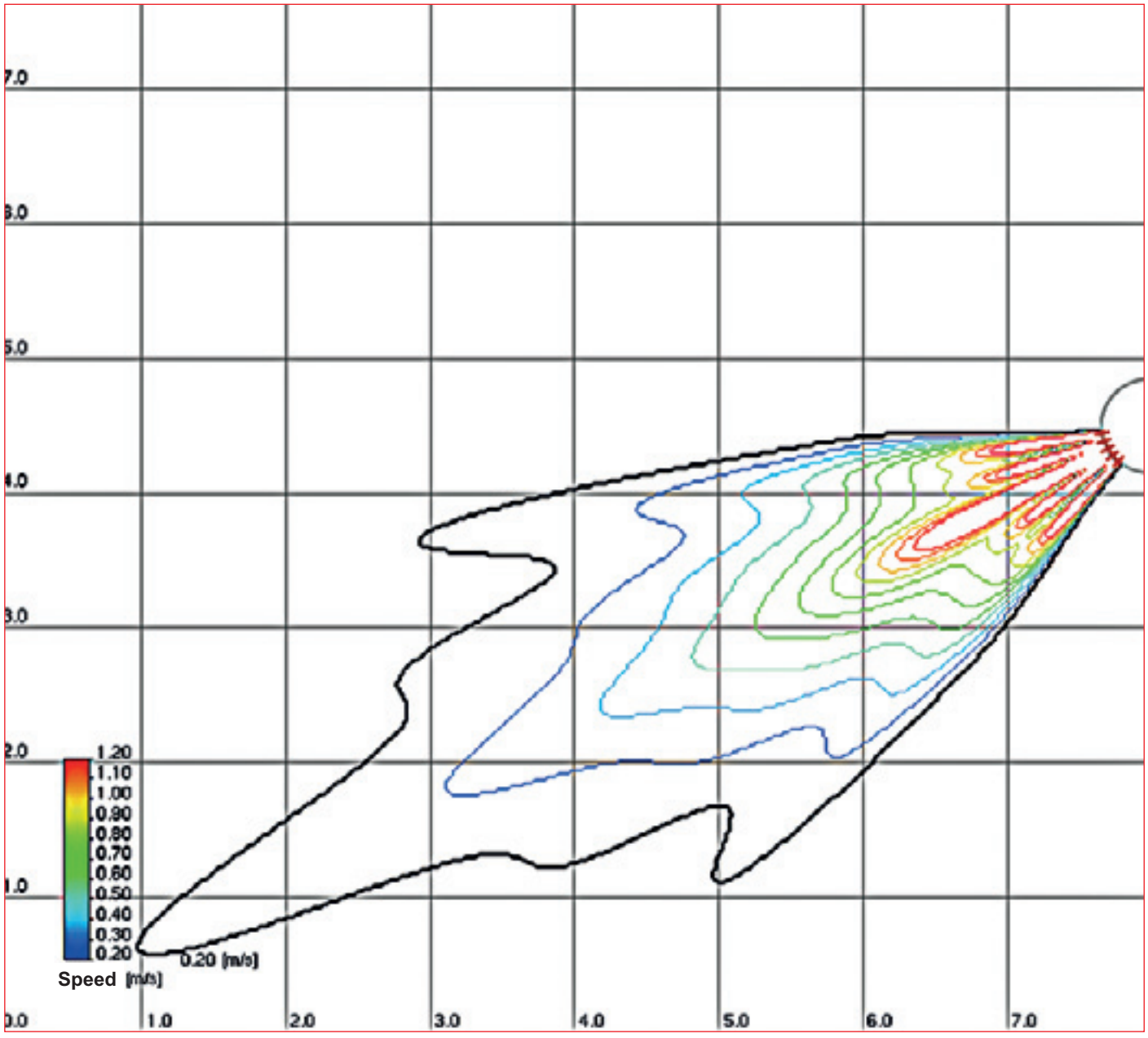
2 m air throw

ON ONE SIDE

INSTALLATION HEIGHT: 4,5 METER

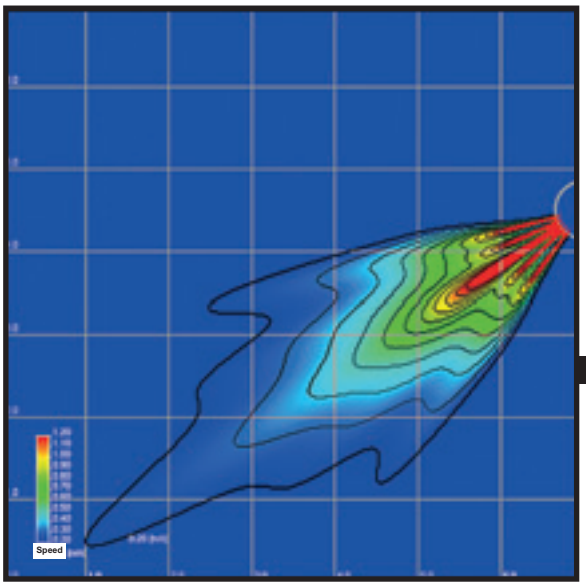


Q: Air throw per linear meter (m³/h/m)

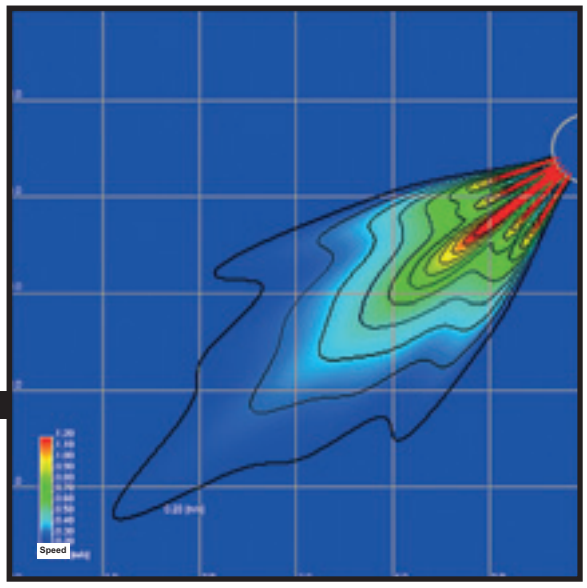


ON ONE SIDE

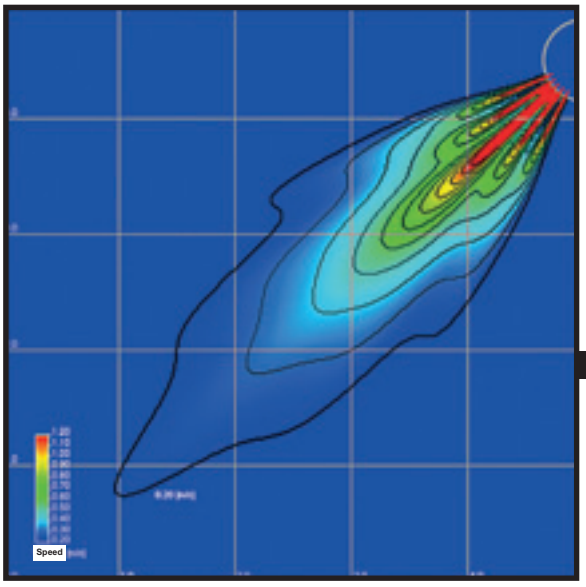
INSTALLATION HEIGHT: 4,5 METER



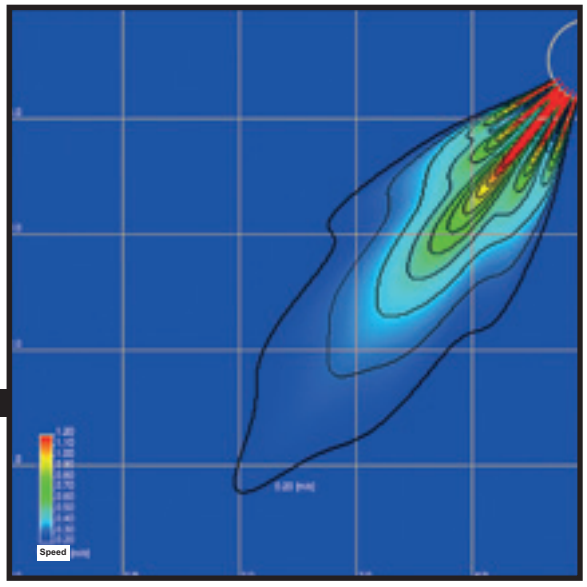
7 m air throw



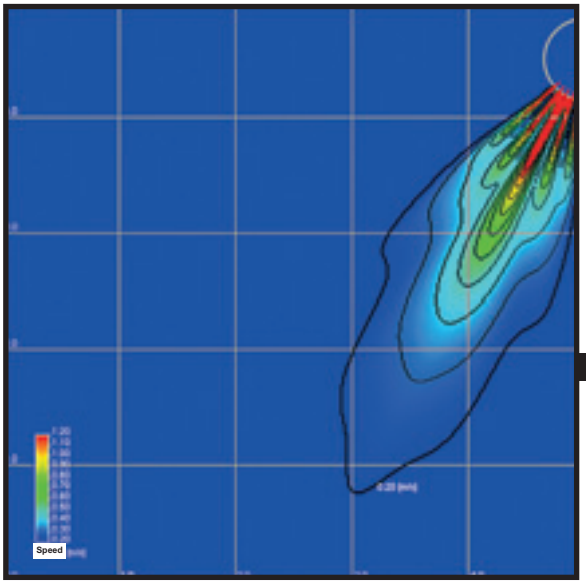
6 m air throw



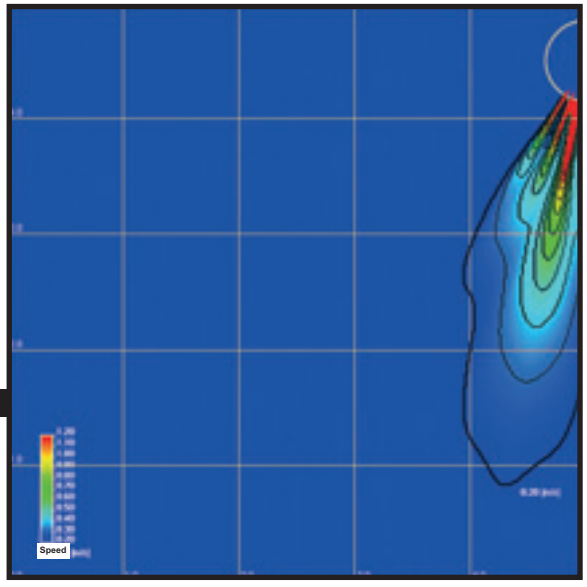
5 m air throw



4 m air throw



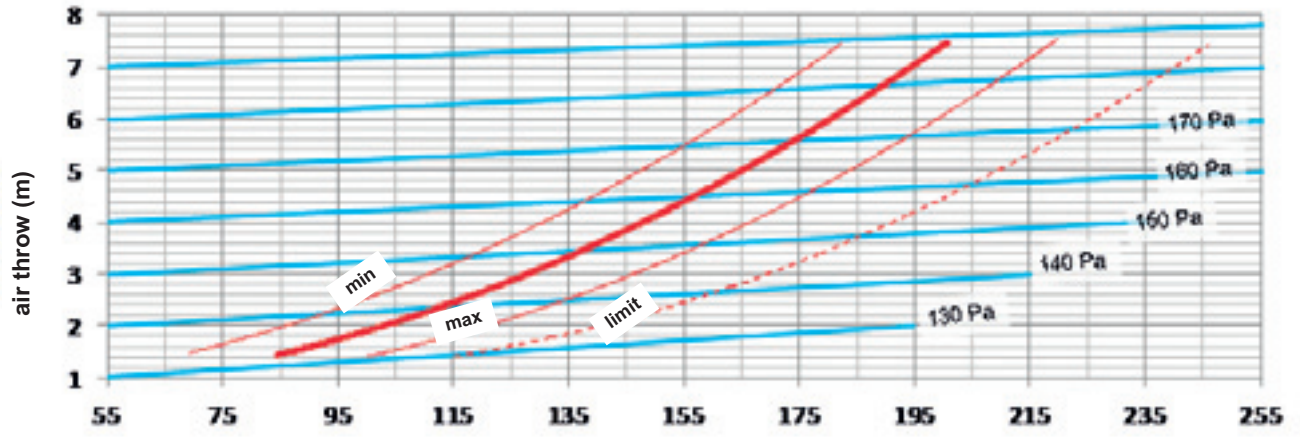
3 m air throw



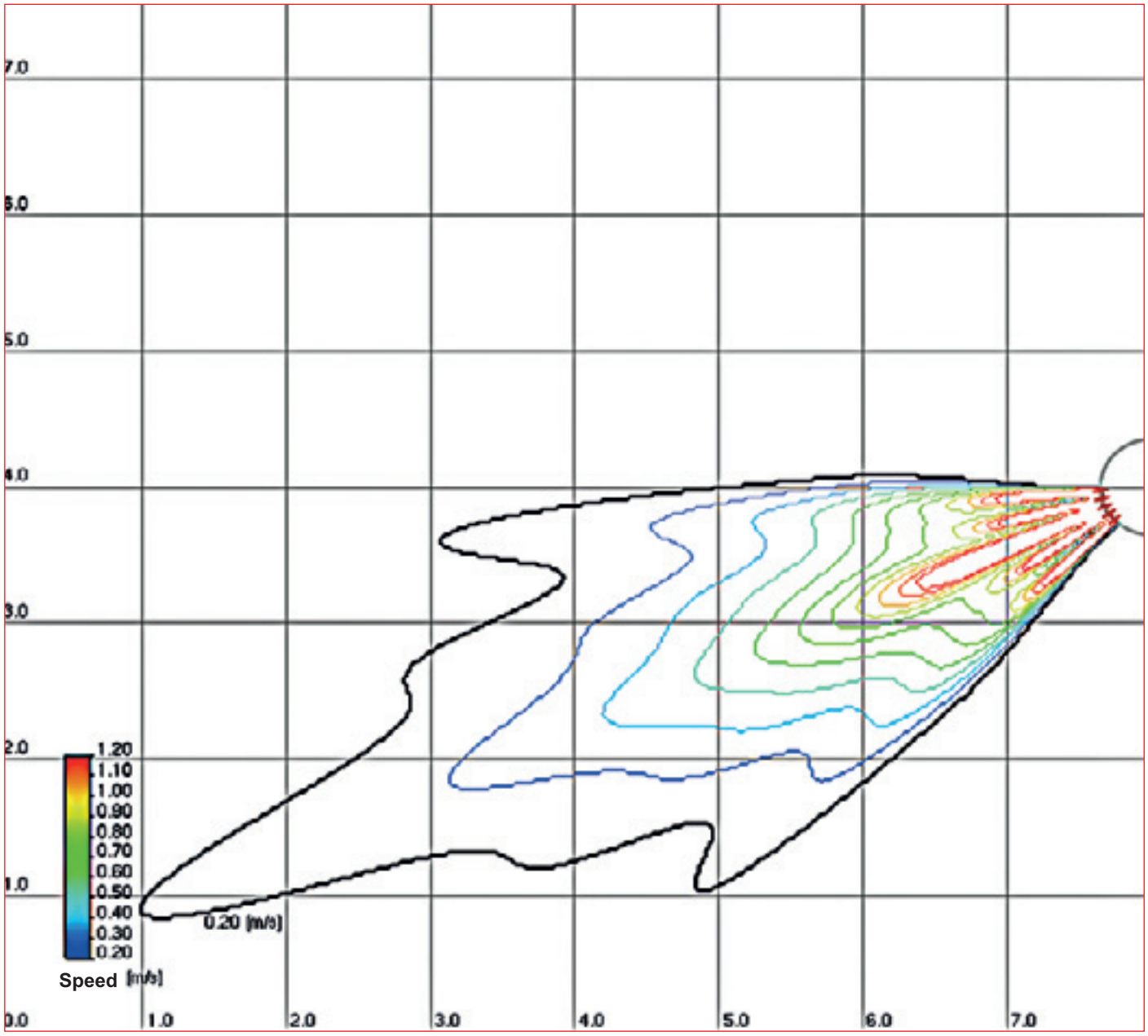
2 m air throw

ON ONE SIDE

INSTALLATION HEIGHT: 4 METER

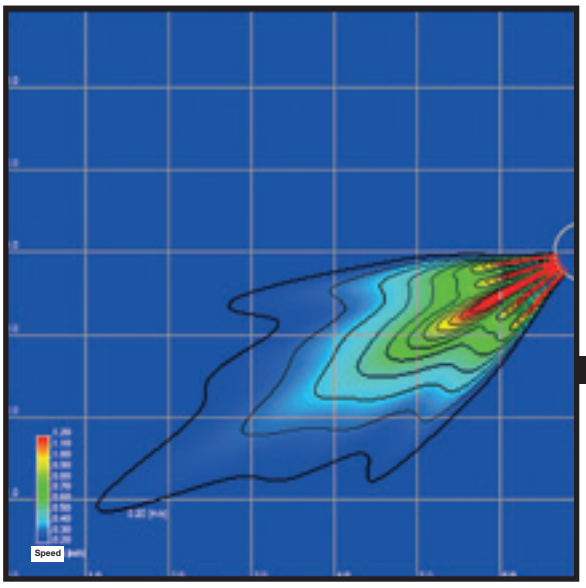


Q: Air throw per linear meter (m³/h/m)

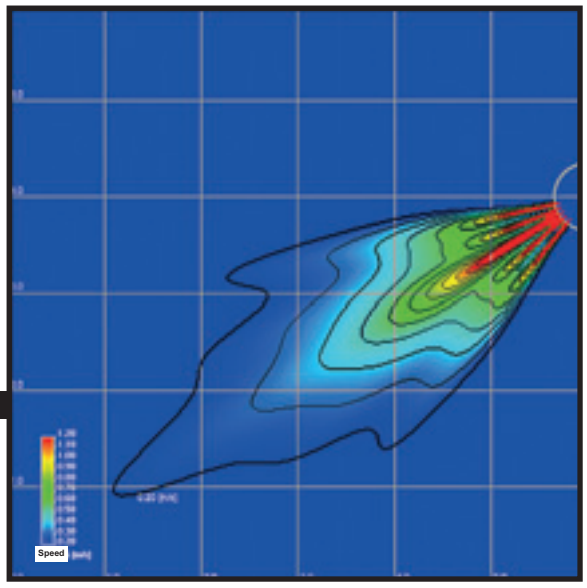


ON ONE SIDE

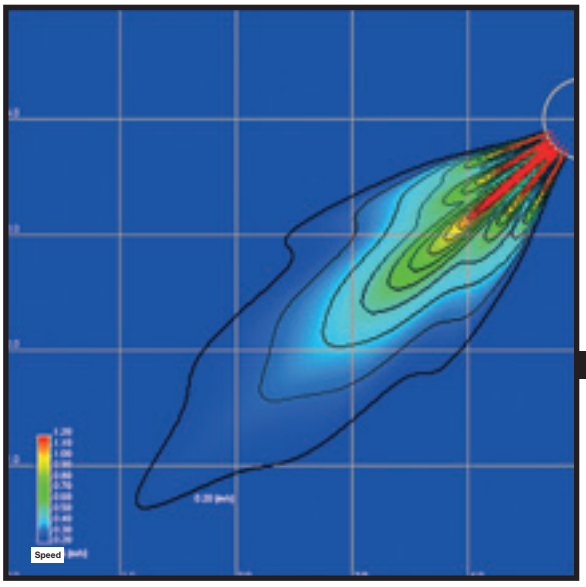
INSTALLATION HEIGHT: 4 METER



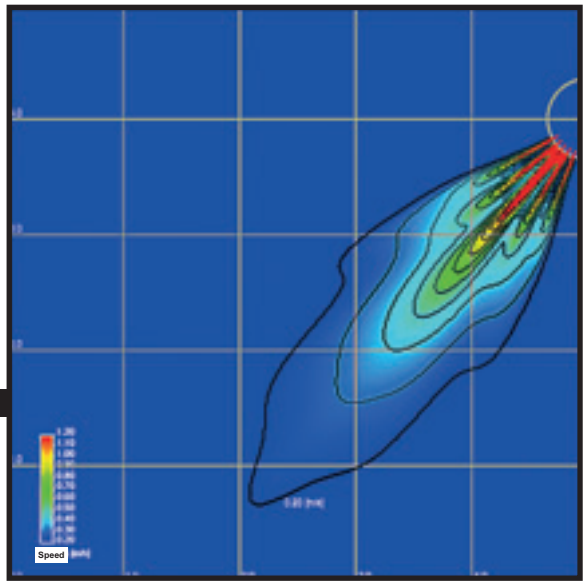
7 m air throw



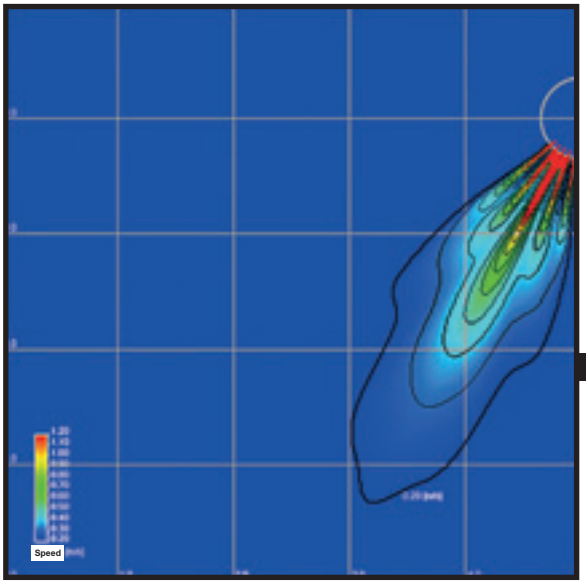
6 m air throw



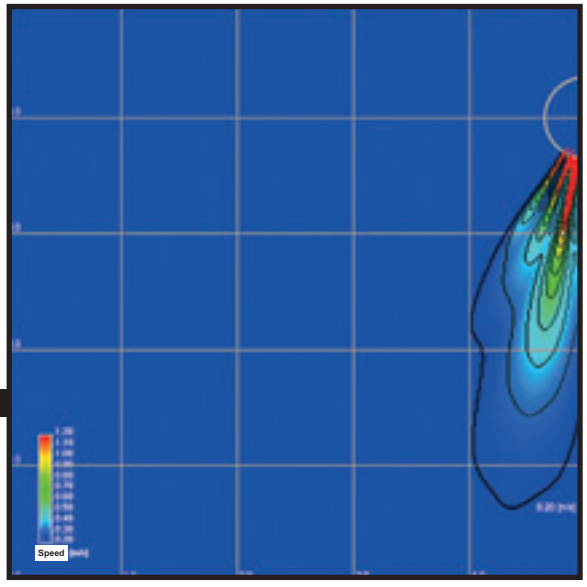
5 m air throw



4 m air throw



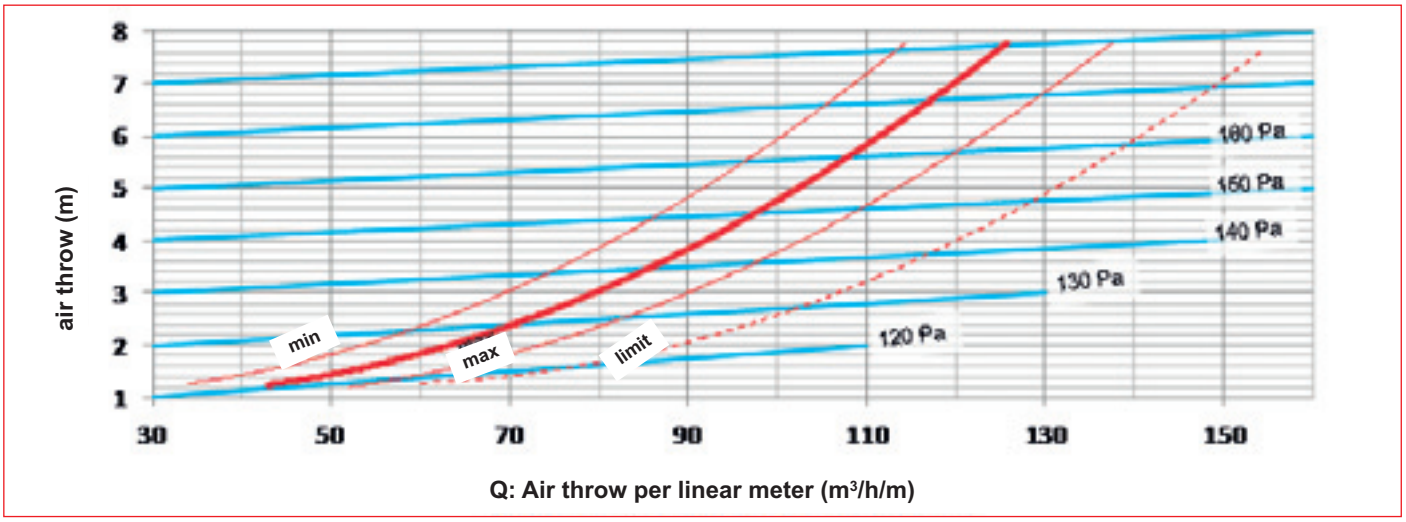
3 m air throw

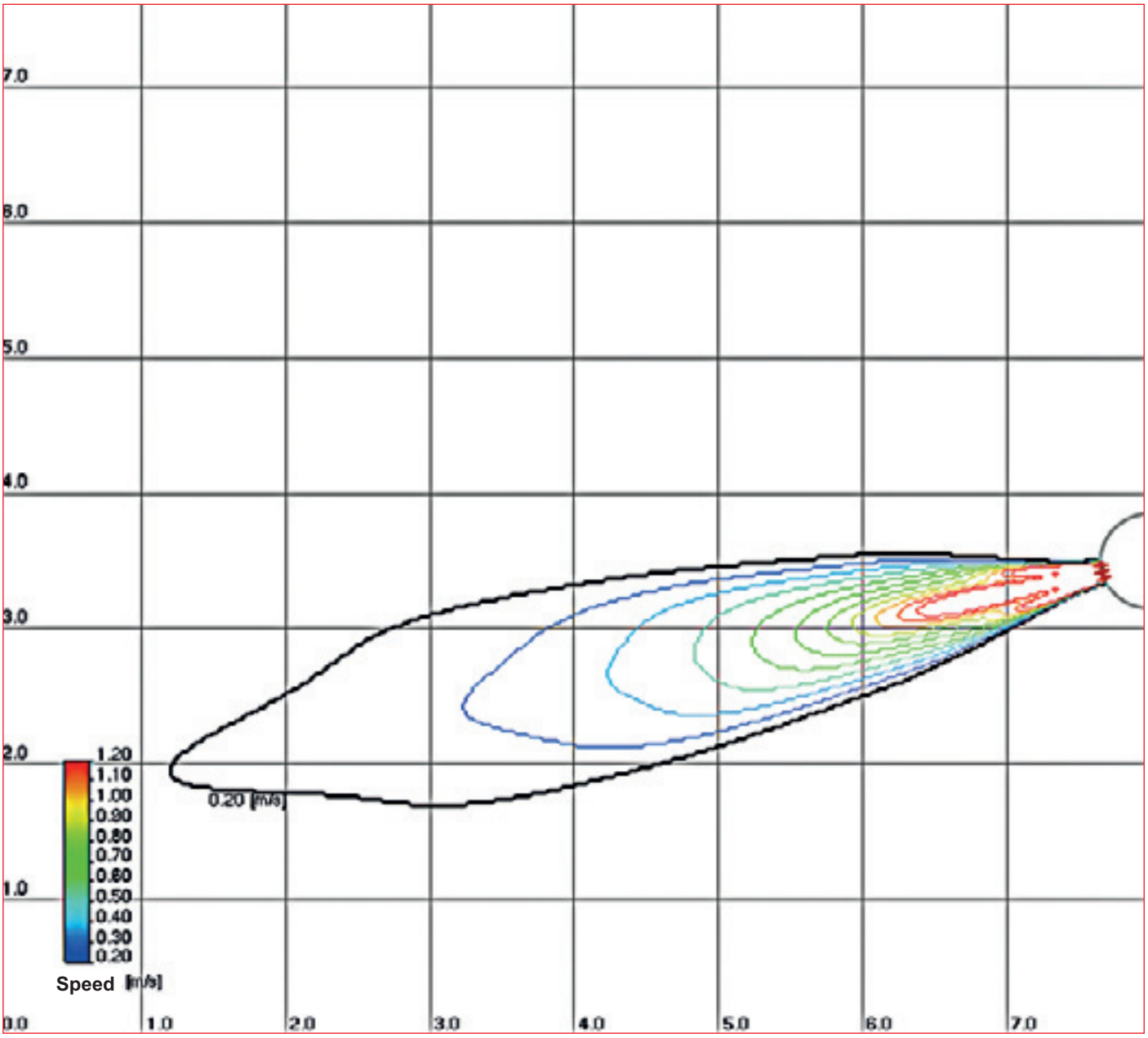


2 m air throw

ON ONE SIDE

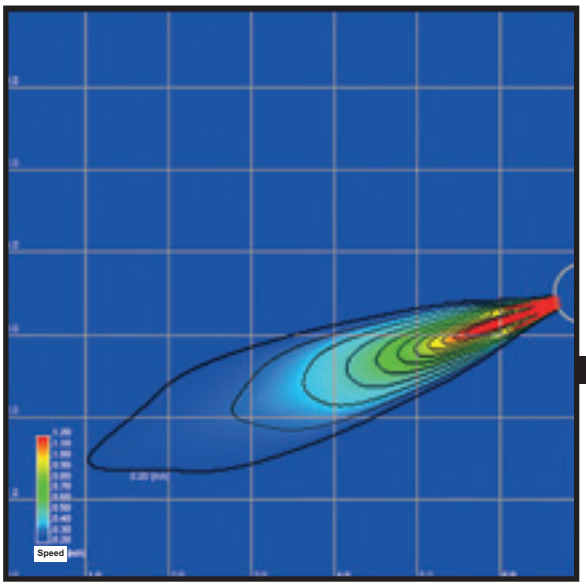
INSTALLATION HEIGHT: 3,5 METER



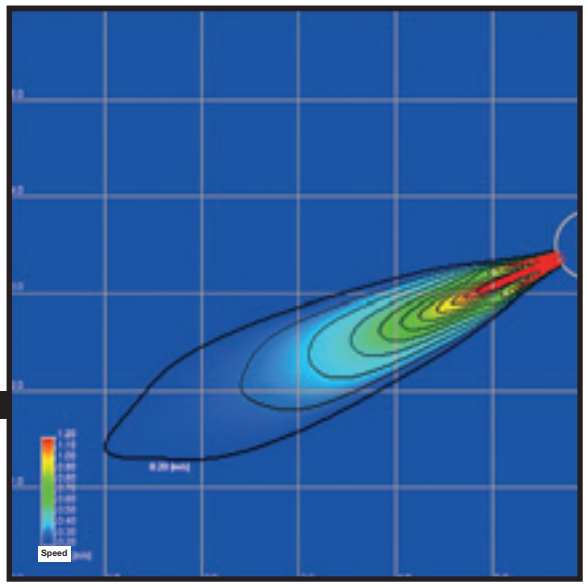


ON ONE SIDE

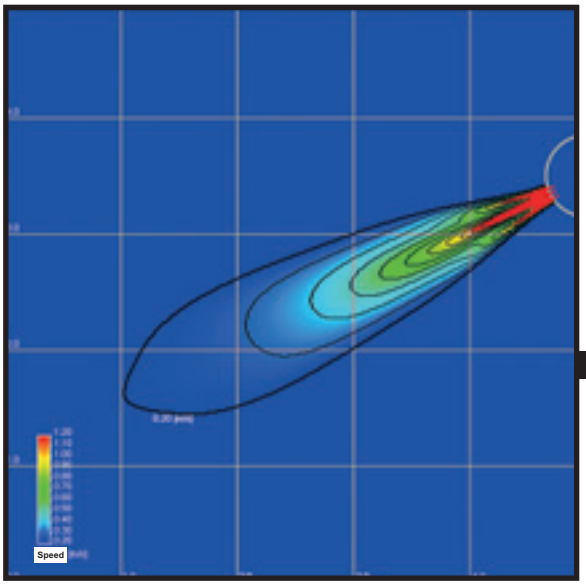
INSTALLATION HEIGHT: 3,5 METER



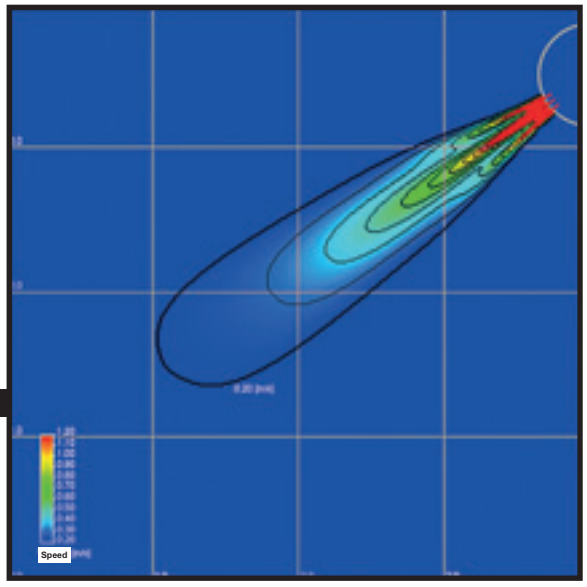
7 m air throw



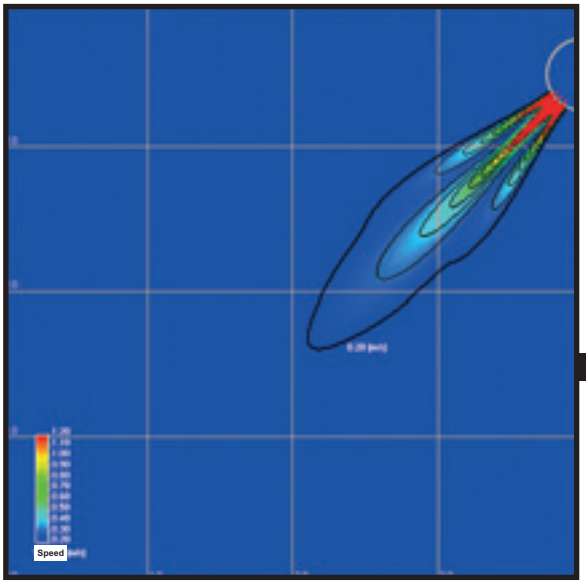
6 m air throw



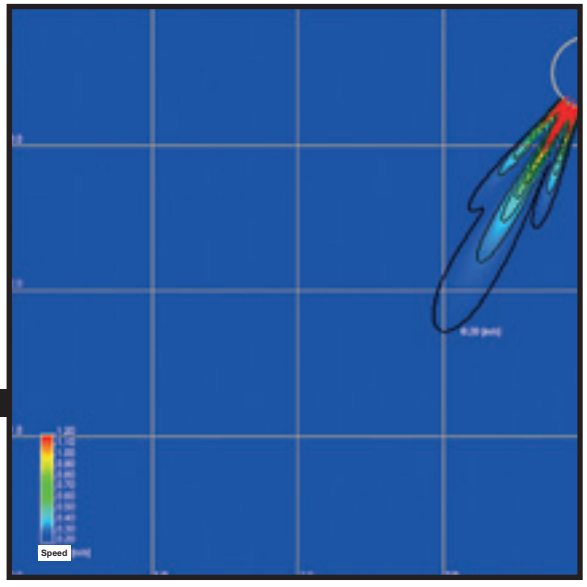
5 m air throw



4 m air throw



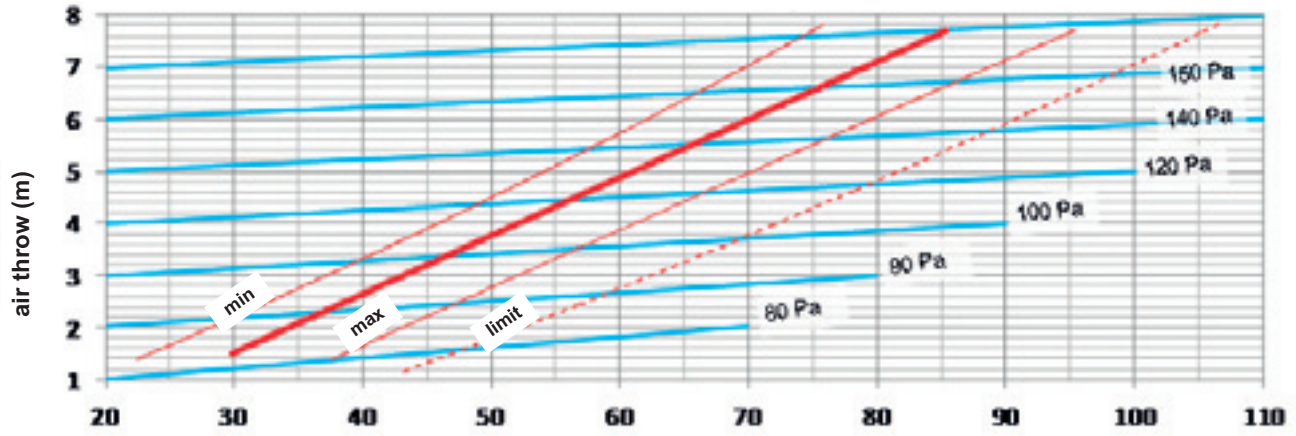
3 m air throw



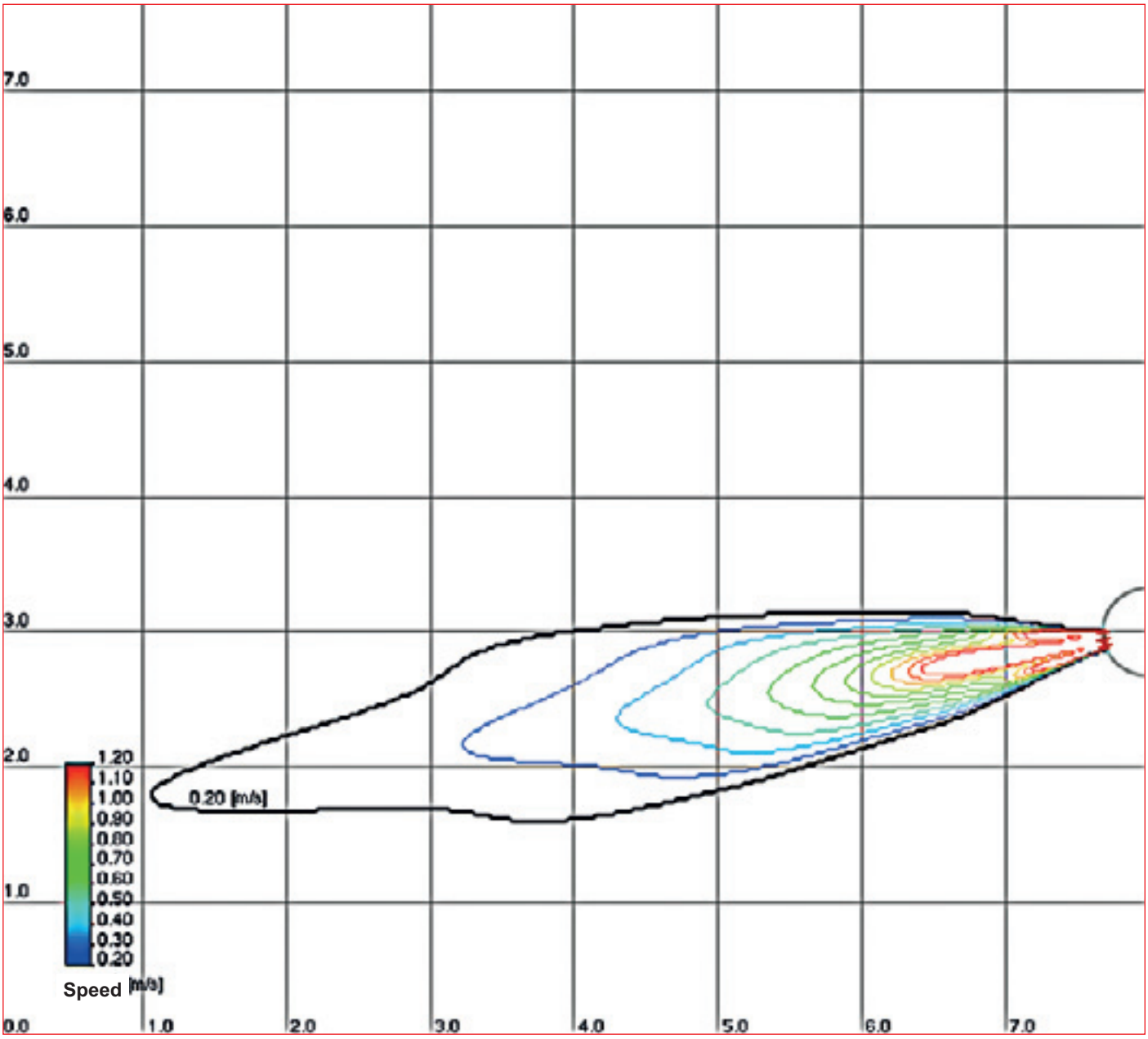
2 m air throw

ON ONE SIDE

INSTALLATION HEIGHT: 3 METER

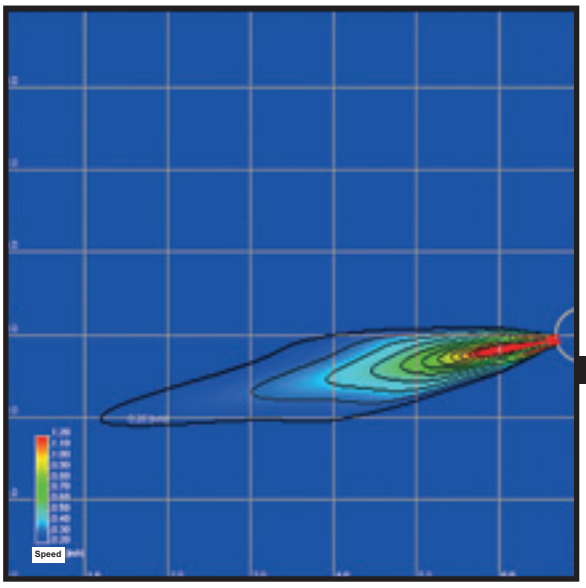


Q: Air throw per linear meter (m³/h/m)

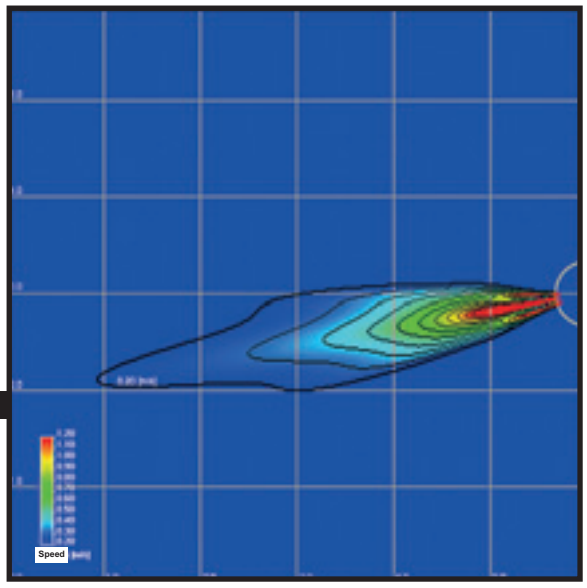


ON ONE SIDE

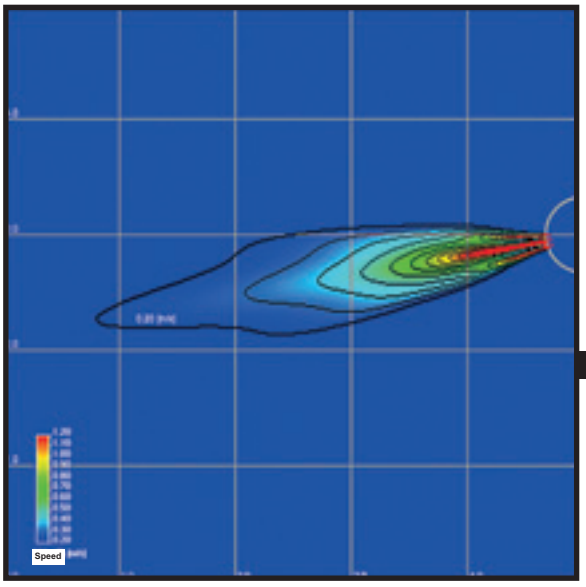
INSTALLATION HEIGHT: 3 METER



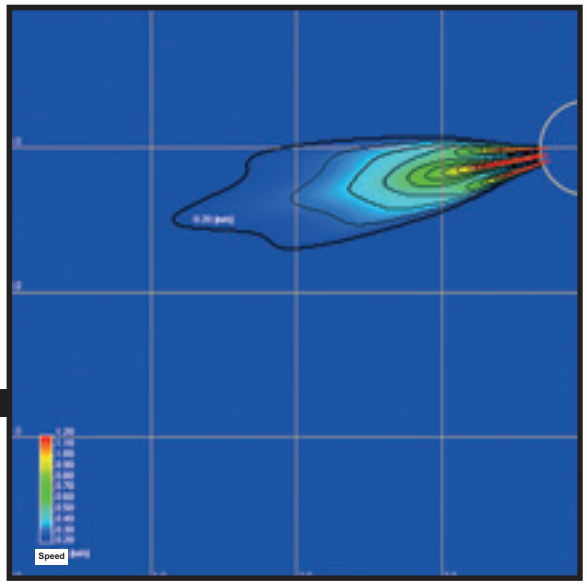
7 m air throw



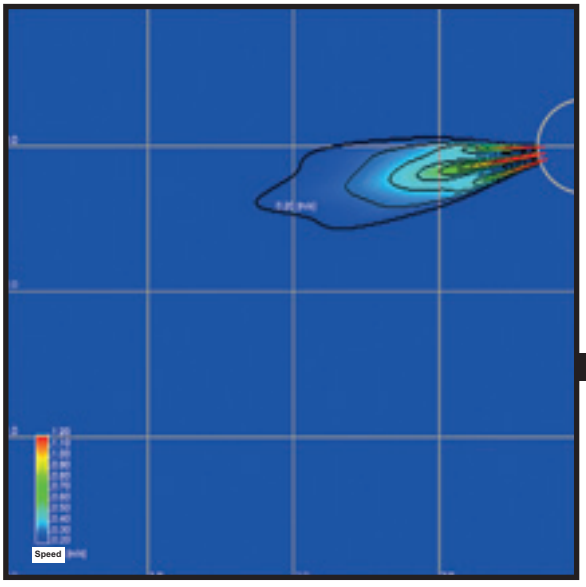
6 m air throw



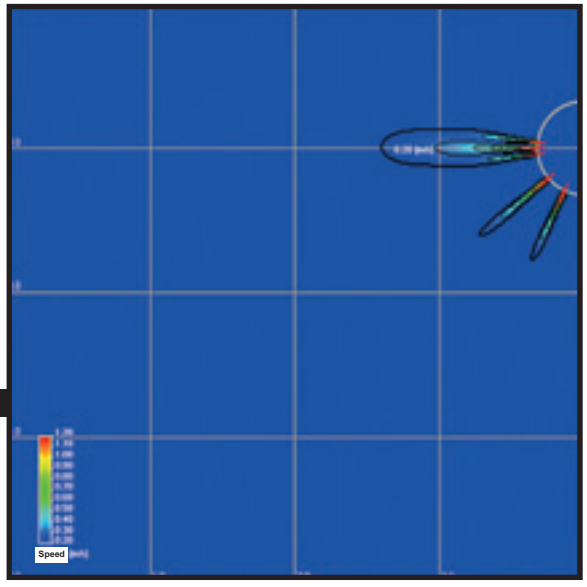
5 m air throw



4 m air throw



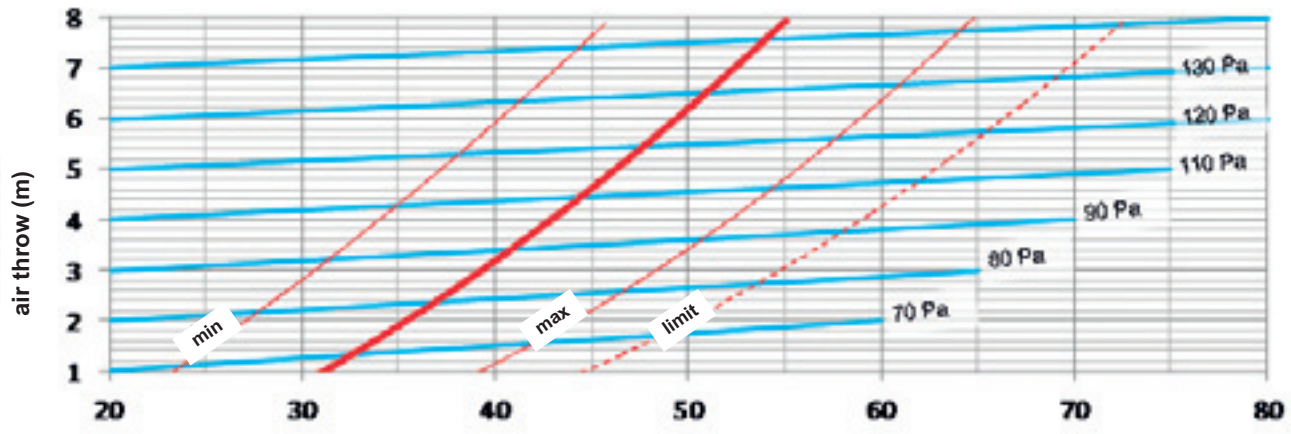
3 m air throw



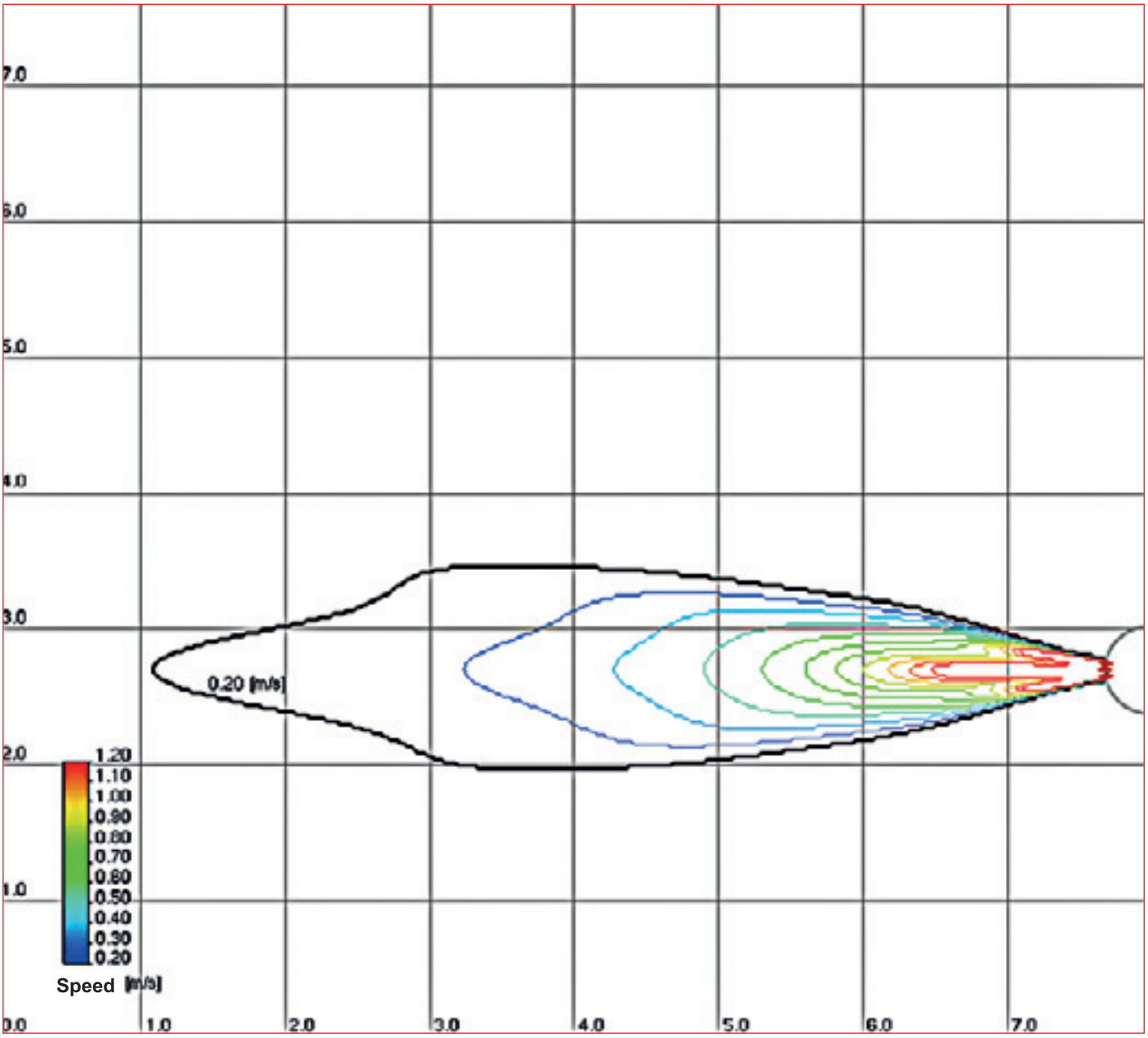
2 m air throw

ON ONE SIDE

INSTALLATION HEIGHT: 2,7 METER

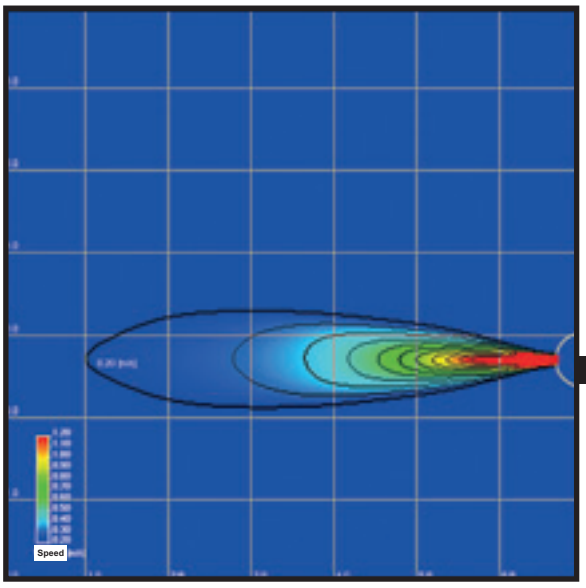


Q: Air throw per linear meter (m³/h/m)

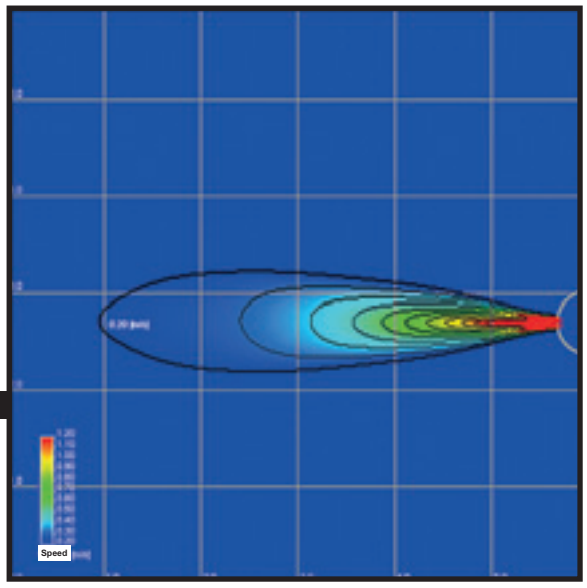


ON ONE SIDE

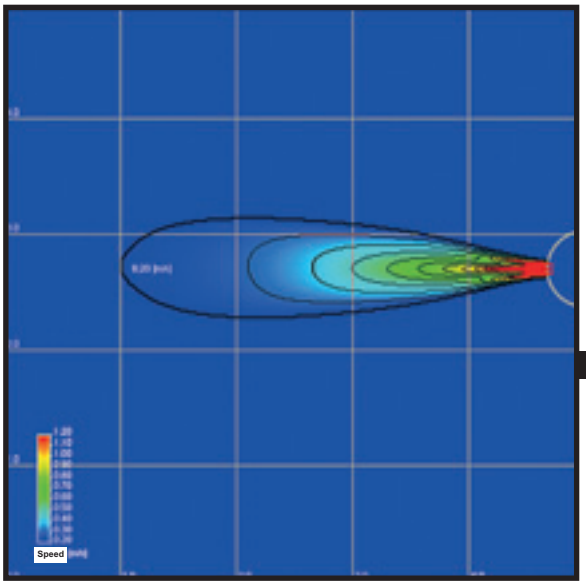
INSTALLATION HEIGHT: 2,7 METER



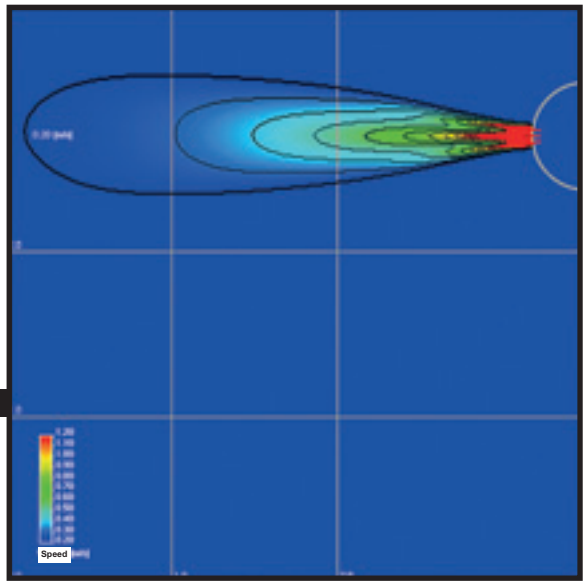
7 m air throw



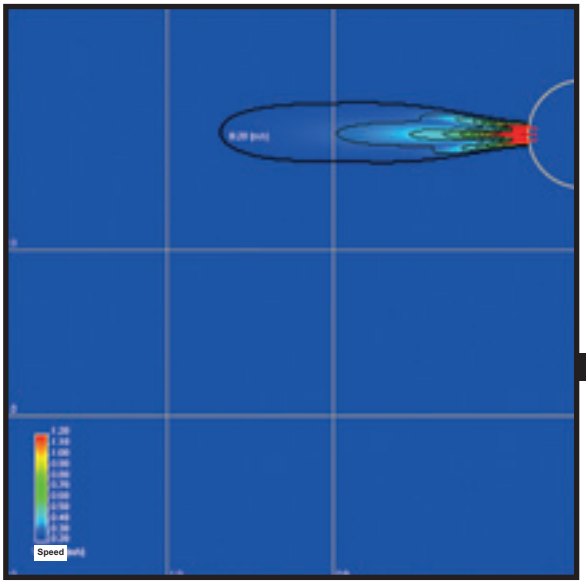
6 m air throw



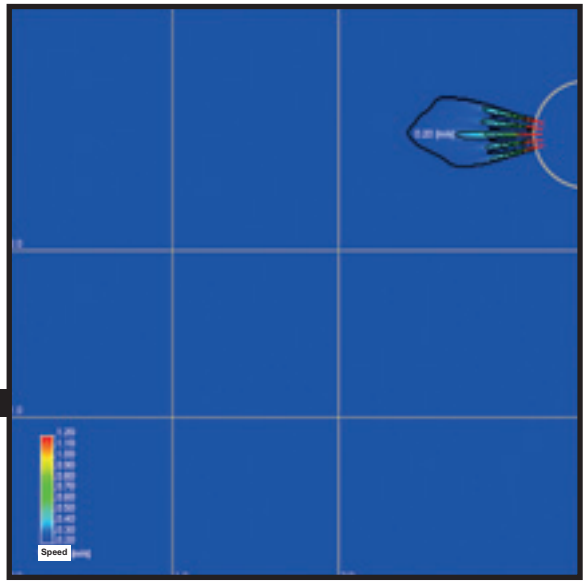
5 m air throw



4 m air throw



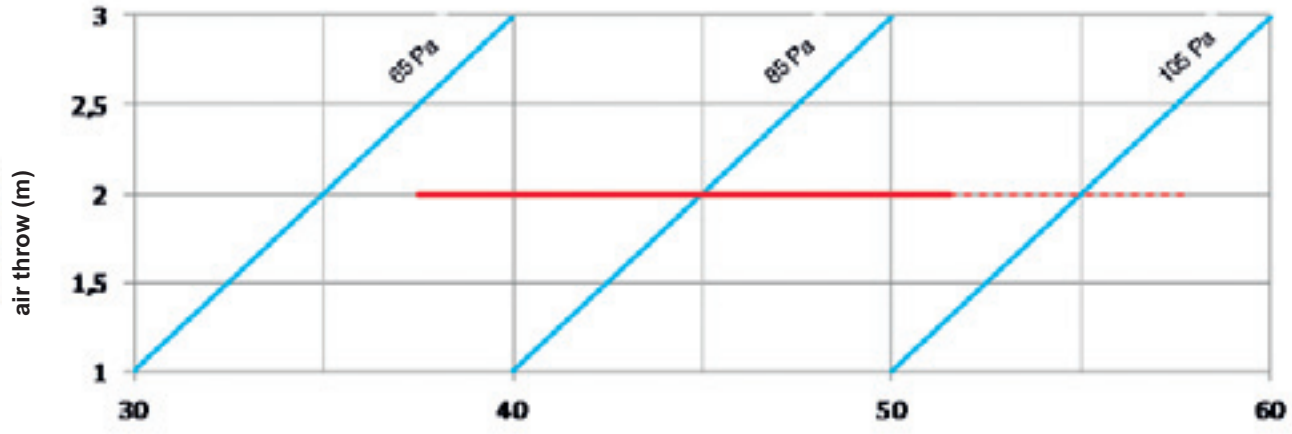
3 m air throw

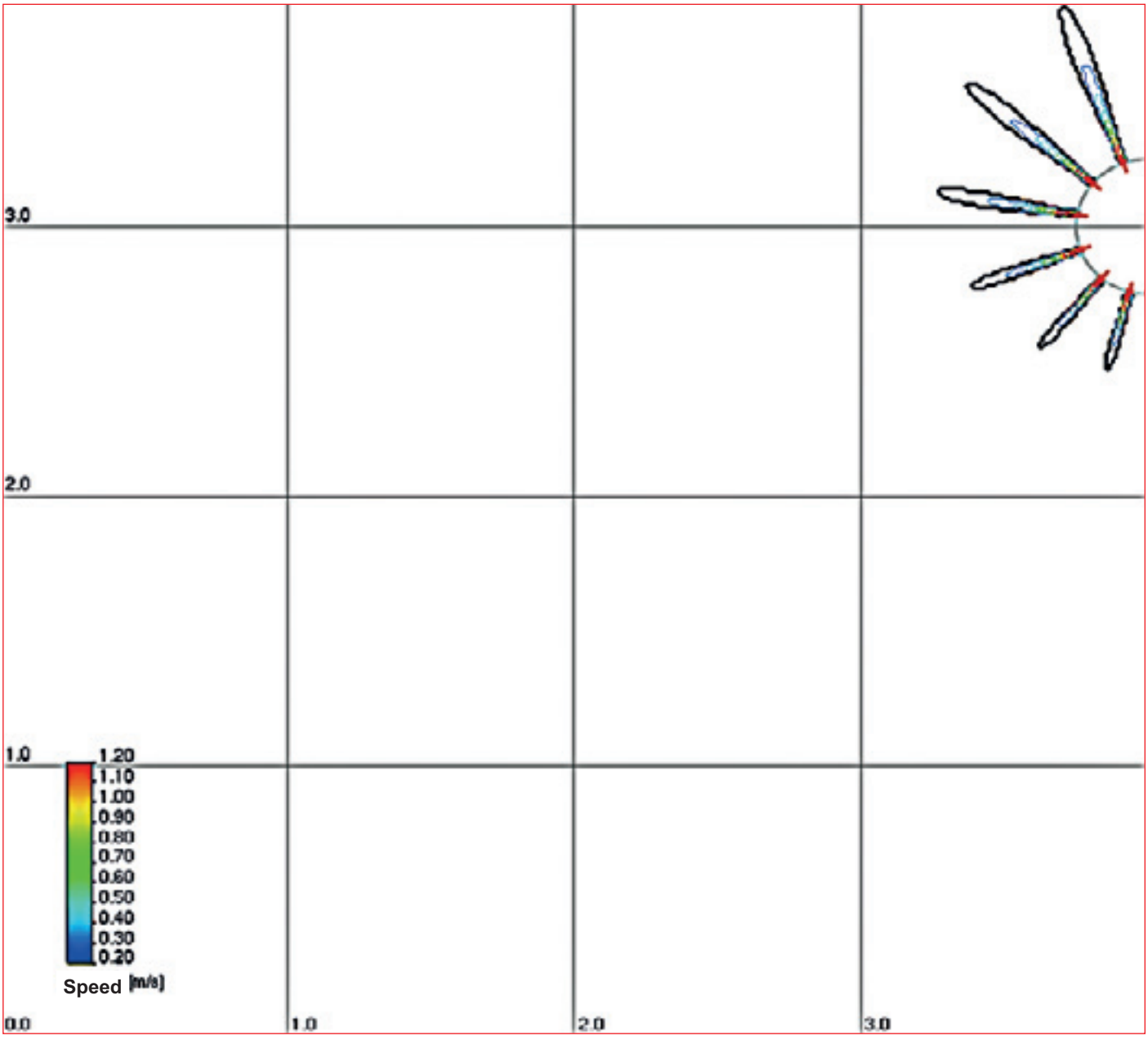


2 m air throw

ON ONE SIDE

PERFORATION: ANTI-CONDENSATION





SiNTRA

SISTEMI INNOVATIVI DI TRATTAMENTO ARIA AMBIENTE

Corso Europa 24
28010 Fontaneto d'Agogna (NO)
Tel.: (+39) 0322 863601
Fax: (+39) 0322 863688
E-mail: sintra@mix-ind.it
www.mix-ind.it