dnp screen focal length

Choosing the correct screen focal for the installation is essential for achieving the perfect rear projected image.

In the dnp product range you will find that all our screens are available in several focal lengths in each size. This allows you to obtain a perfect match between the projector and the screen, where the Fresnel lens focuses the light perfectly and distributes it straight towards the viewers.

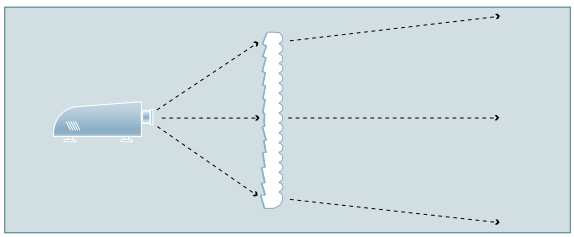
To obtain the ideal configuration, the screen's focal length has to match the projection distance, which is determined by the projector lens.

In most situations, the light needs to exit the screen at right-angles, perpendicular, from the screen to the audience. This requires a perfect match between the screen focal and the projection distance.

The same principal applies to installations where two or more screens are positioned next to each other with a limited seam. This makes the brightness uniformity even more important. And the best brightness uniformity is achieved by having a good match between screen focal and projection distance.

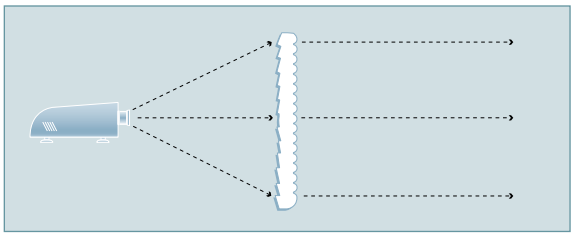
In general there are three different possibilities:

Projection Distance (PD) < Screen Focal Length (SF)



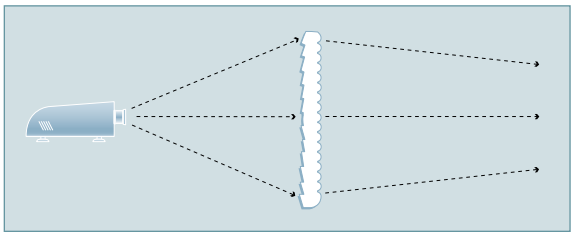
Avoid situations where the projection distance is much shorter than the screen focal, as the screen might exhibit a hot spot – like a diffusion screen.

Projection Distance (PD) = Screen Focal Length (SF)



A projection distance equal to the screen focal is recommended in most cases as all light is directed perpendicularly towards the audience. It also provides the best brightness uniformity.

Projection Distance (PD) > Screen Focal Length (SF)



A projection distance longer than the screen focal can be helpful in situations where you want to install a large screen in a relatively small room. By using this knowledge, you can design a meeting room and place the table closer to the large screen than you would normally do.

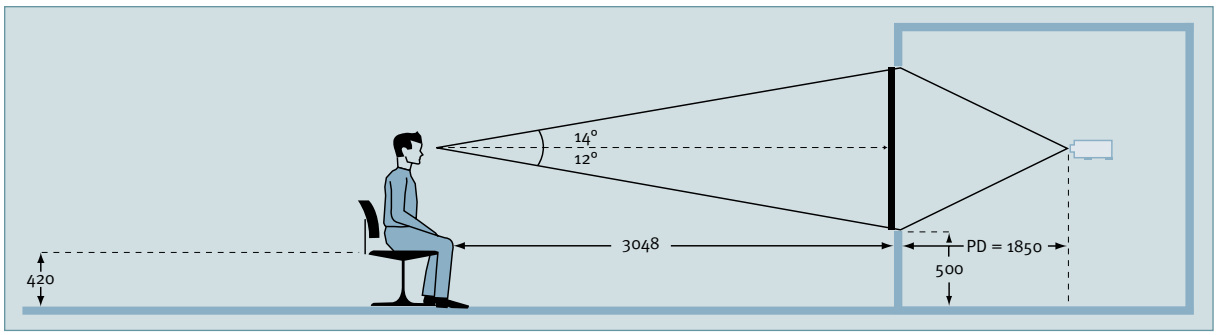
However, please note that the viewer should not be closer to the screen than two times the screen height (3-6 metres for large screens). If seated closer, the viewer cannot see the entire screen, and the steep angles from top to bottom of the image will result in an apparent difference in image brightness uniformity.

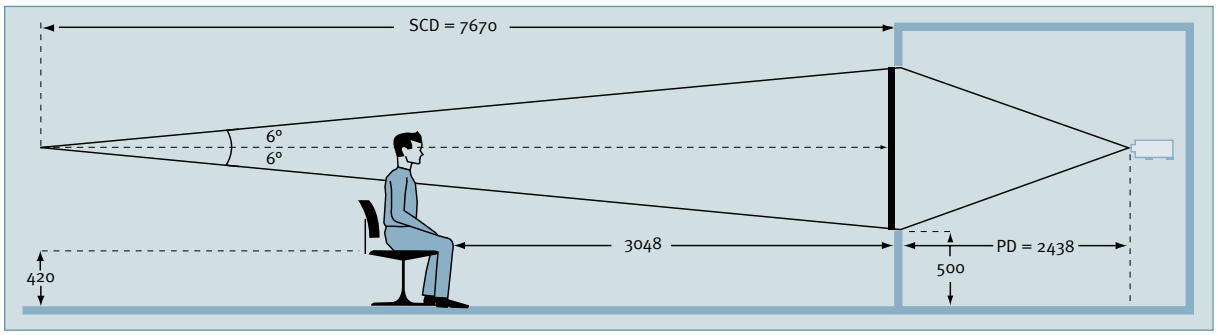
To get the best possible result, you can use the equation below, which only applies in situations where the projection distance is longer or equal to the screen focal:

Formula $\frac{1}{SF} = \frac{1}{PD} + \frac{1}{SCD}$

Definitions

SF = Screen Focal Length
PD = Projection Distance
SCD = Second Conjugate Distance





The second conjugate distance is the distance from the screen where the light path coming from the top of the screen intersects with the light coming from the bottom of the screen.

If we take an example with a 100" Sigma Screen in a meeting room, you will immediately see that the table should be no closer than 2 x 1.524 mm = 3.048 mm to the screen. If the screen focal length is 1.850 mm the screen should normally be used together with a projector lens of 1.850/2.032:1 = 0.91:1 in order to achieve PD=SF and perpendicular light distribution.

If you use an 1.2:1 lens instead, providing a projection distance of 1.2 x 2.032 mm = 2.438 mm you will find that the distance from the screen to the second conjugate point is:

$$\frac{1}{\frac{1}{1.850} - \frac{1}{2.438}} = 7.670 \text{ mm}$$

If the seat height of the chairs is 420 mm and the screen position is 500 mm from the floor, you will have the two situations you can see on the drawings above.

As you can see in the drawings, the brightness uniformity is increased due to the longer projection distance resulting in a second conjugate. The vertical 12˚/14˚ viewing angle is helped by the 6˚ angle of the light. As a general guideline the projection distance should not be more than 40% longer than the screen focal (in the example the projection distance is 32% longer than the screen focal). If the projection distance gets longer, it will have a negative effect on the brightness uniformity.

In general, single element screens should not be used for very short projection distances – e.g. Lens Throw Ratios between 0.6 - 0.9:1 – as this will result in hot spots even though you use an optical screen. dnp only offers single element screens with short focal lengths to allow designers to use the second conjugate for optimizing their installations.

As the above principles indicate, the match between screen focal and projection distance is essential for the quality of the final image. Furthermore, it is clear that we have a strong tool to optimize our installation in the design phase by using the screens ability to focus the light in the direction that we require.

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Screens of the art