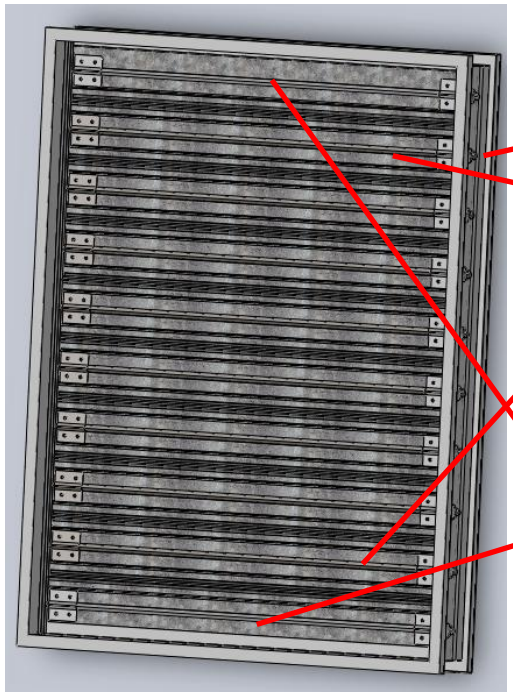
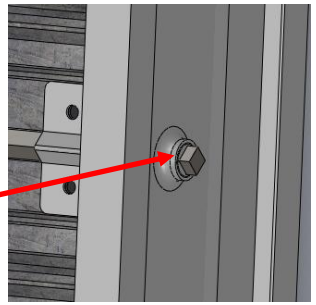
葉片組之結構分析

2012/12/11

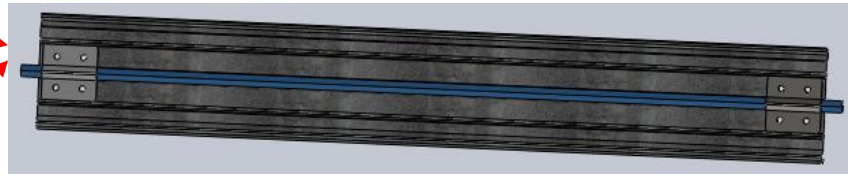
待分析物件

- 現有的5VMD-900X1200 通風道閘門, 結構部分為葉片組件與框架組件.
- 待分析物件是葉片組件,分別為5VMD-03-900 x8+ 5VMD-04-900 x1+ 5VMD-04-901 x1, 其中04-900與04-901視為相同.
- 葉片組件的支撐邊界為軸心軸套(框架孔)接合處.





軸心
軸套



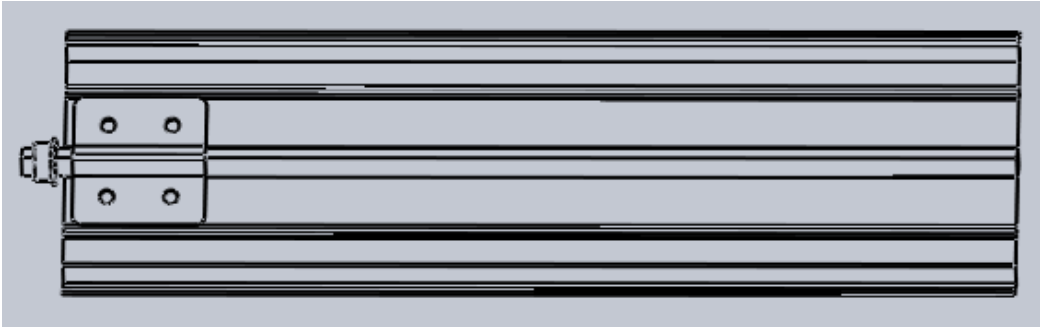
待分析物件: 5VMD-03-900

待分析物件: 5VMD-04-900(901)

簡化模型

- 先分析簡化模型 - 一葉片組半部(左右對稱).
- 其次為比較3葉片組(03-900x3)與5葉片組(03-900x3+04-900+04-901)與全體10葉片組在1.25kPa負載下之計算結果差異.
- 依據之前新葉片的測試結果, 現有葉片的外型與負載模式很類似, 再分析具代表性的3或5葉片組, 作為模擬實際全體10葉片組的結果.

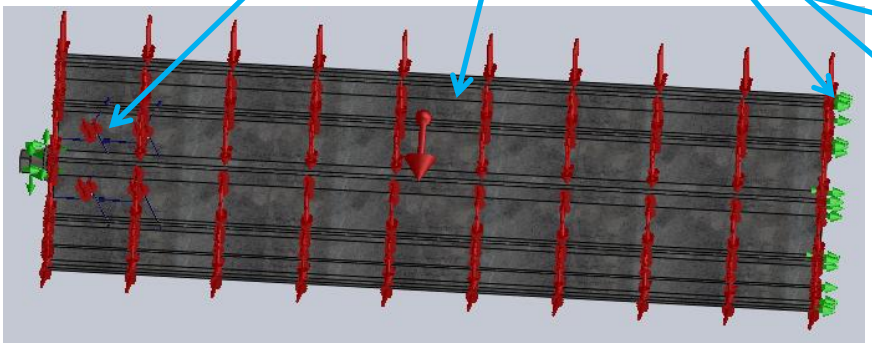
簡化模型-
一葉片組半部



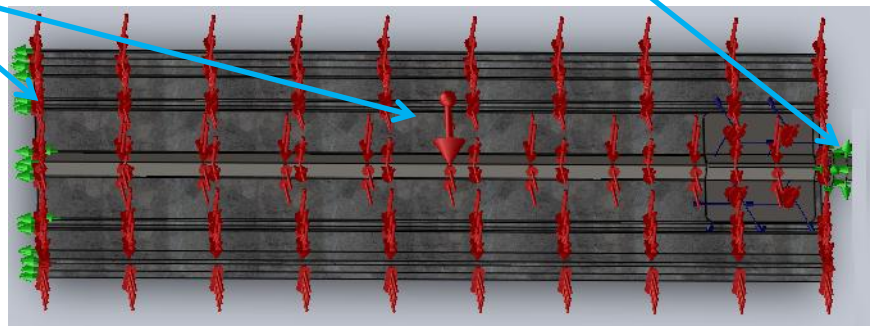
一葉片組分析項目_正反壓力

輸入與設定條件

- 正面壓力與反面壓力為比較項目.
- 採用一葉片組(5VMD-3-900)半部當作簡化模型.
- 預設網格+局部50%細網格
- 固定處: 4螺絲孔(藍色).
- 轉動/滑動面: 軸套與框架孔/軸套與軸心貼合面(綠色).
- 對稱面: 中央切面(綠色).
- 重力與壓力(紅色)1.25與2.25kPa.

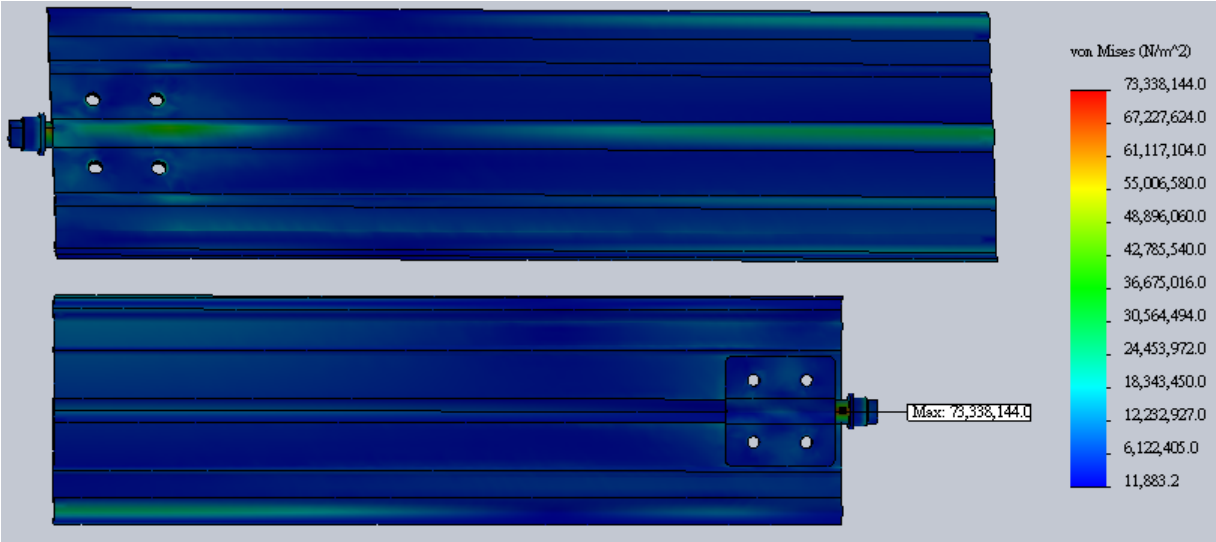


正面壓力



反面壓力

1.25kPa正反壓力之應力分佈圖

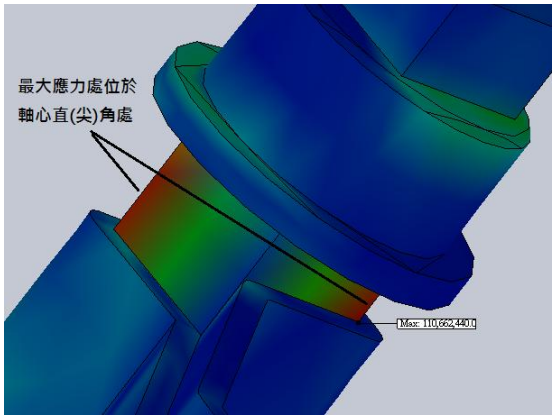


正面壓力

反面壓力

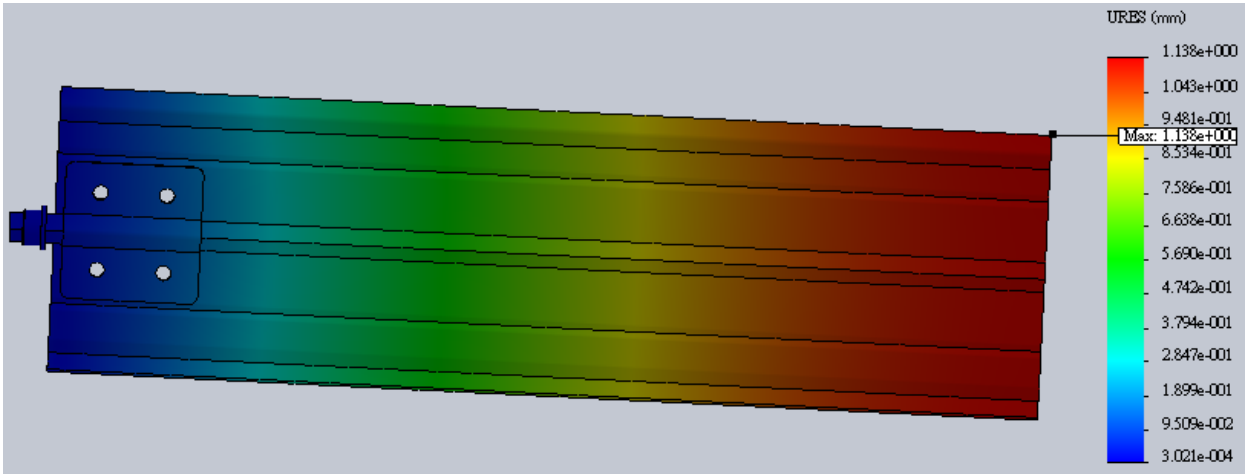
2.25kPa正反壓力之應力分佈圖

正面壓力

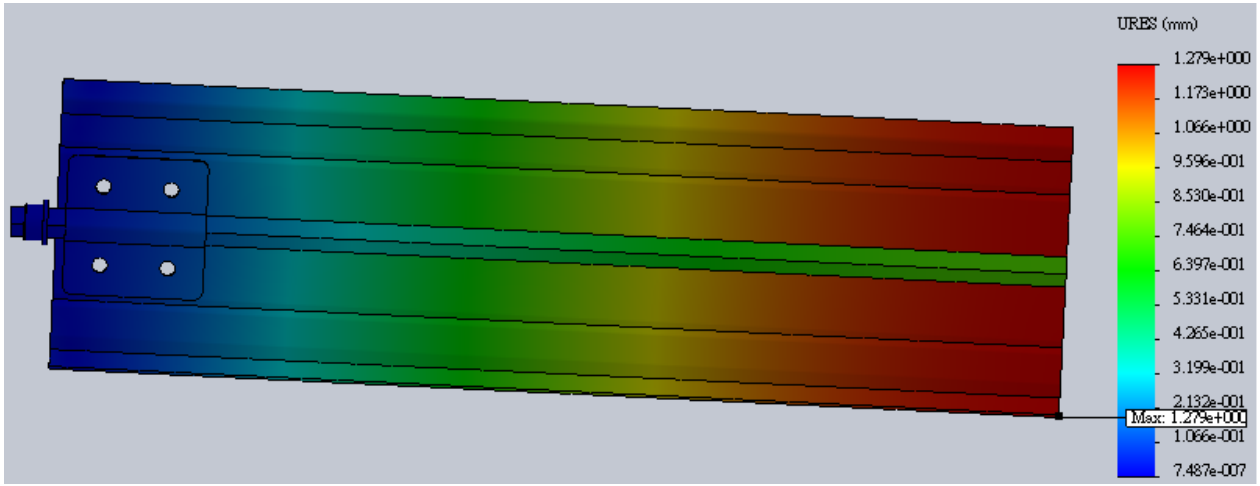


反面壓力

1.25kPa正反壓力之變形量分佈圖

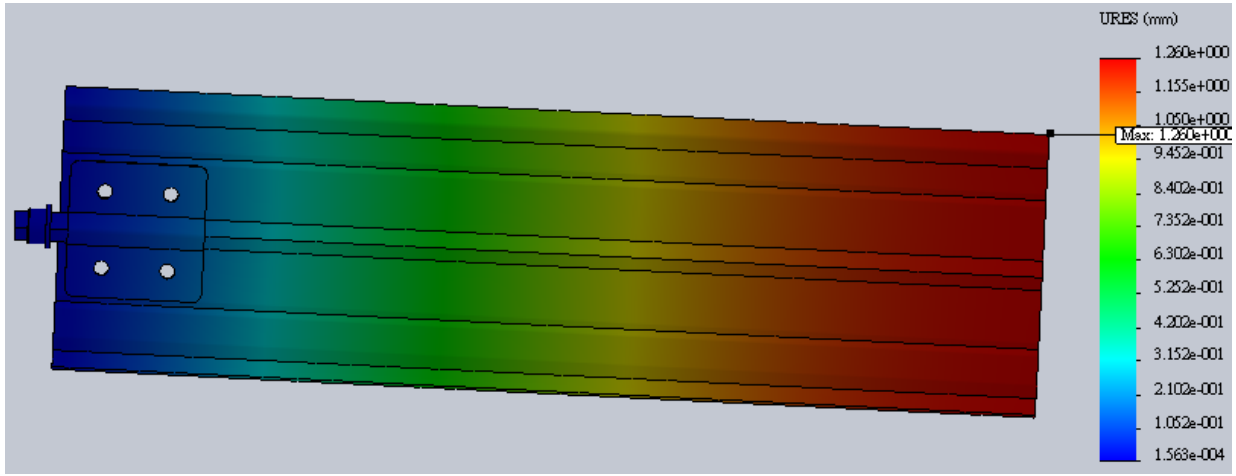


正面壓力

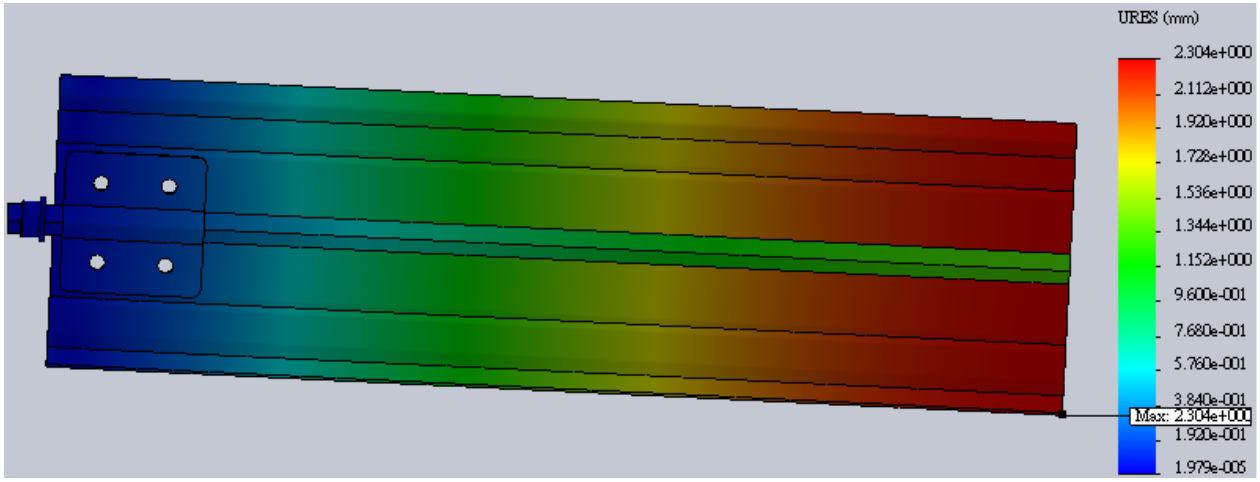


反面壓力

2.25kPa正反壓力之變形量分佈圖

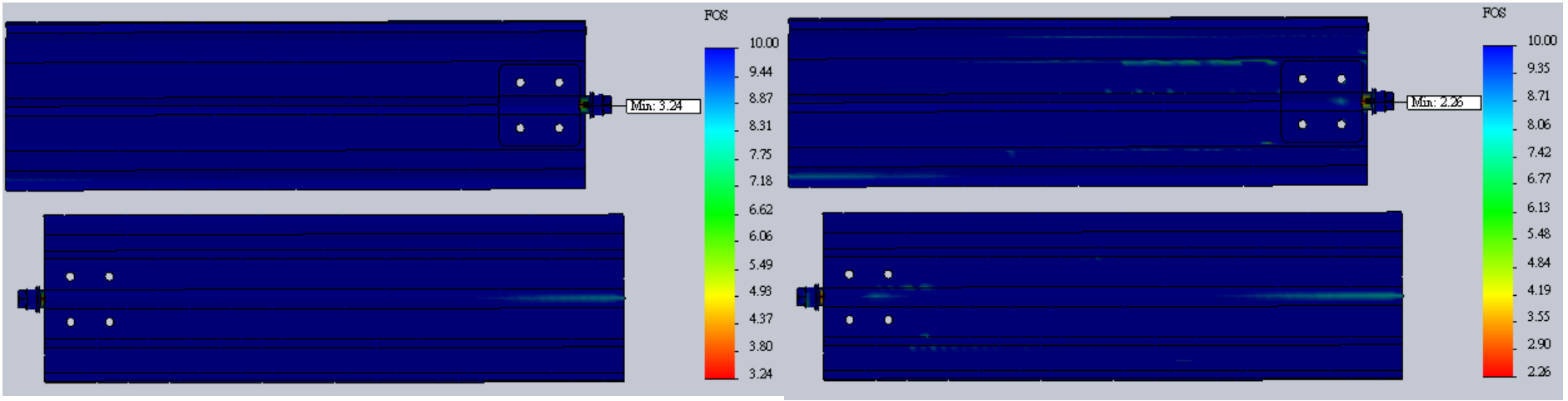


正面壓力



反面壓力

正反壓力之合力與安全係數分佈圖



1.25kPa正面壓力

2.25kPa正面壓力

Reaction Force (N)

Component	Entire Model
Sum X:	12.811
Sum Y:	0.018247
Sum Z:	-71.908
Resultant:	73.04

1.25kPa正壓合力

Reaction Force (N)

Component	Entire Model
Sum X:	13.204
Sum Y:	-0.047128
Sum Z:	-128.91
Resultant:	129.58

2.25kPa正壓合力

Mass properties of 5VMD-03-900_CAE (

Output coordinate System: -- default --

Mass = 1226.68 grams =12.02 N

Volume = 155994.38 cubic millimeters

Surface area = 162439.86 millimeters^2

Center of mass: (millimeters)
X = 0.21
Y = -235.22
Z = -0.87

Reaction Force (N)

Component	Entire Model
Sum X:	11.285
Sum Y:	0.053918
Sum Z:	72.873
Resultant:	73.742

1.25kPa反壓合力

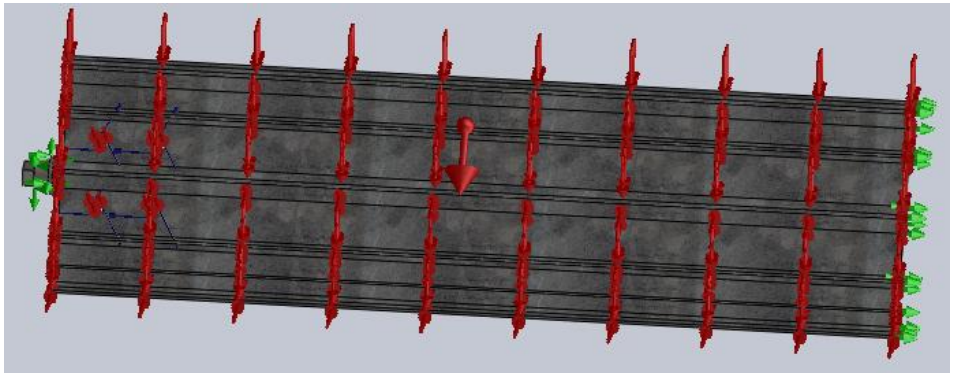
Reaction Force (N)

Component	Entire Model
Sum X:	10.764
Sum Y:	-0.14213
Sum Z:	130.91
Resultant:	131.35

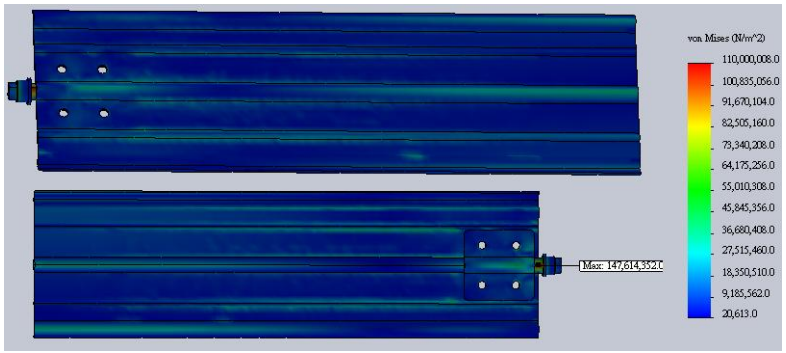
2.25kPa反壓合力

一葉片組分析項目_最大設計壓力

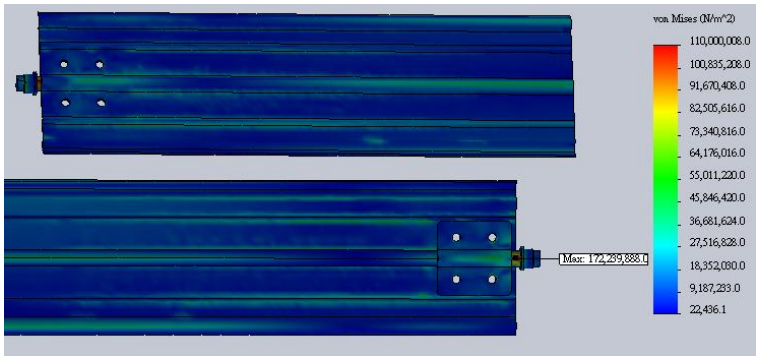
- 為了在短時間內先預估全體10葉片組的計算結果與趨勢,並作為實際10葉片組計算結果是否正確與可靠的對照參考, 先計算一葉片組可承受之最大壓力.
- 其他設定條件如前例, 僅壓力為變數.
- 增加壓力直至發生降伏應力: 2.25kPa, 3kPa, 3.5kPa…….



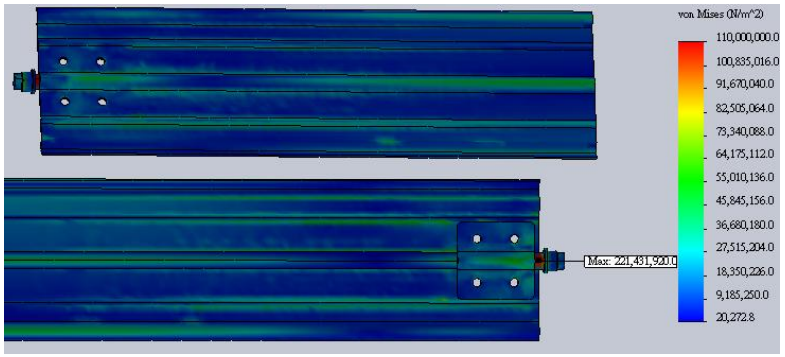
在各正面壓力下的應力分佈圖



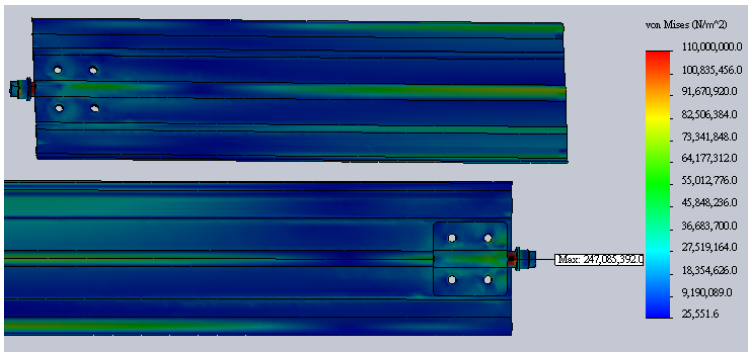
壓力3kPa



壓力3.5kPa



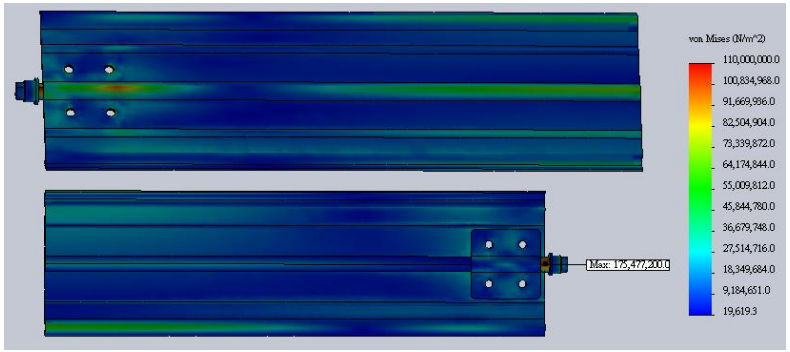
壓力4kPa



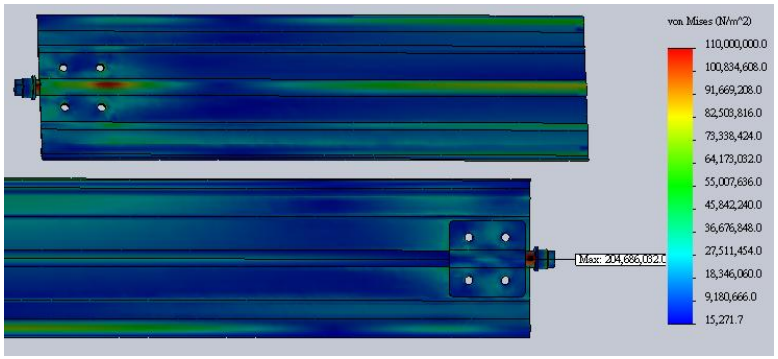
壓力4.5kPa

壓力2.25kPa(參考)

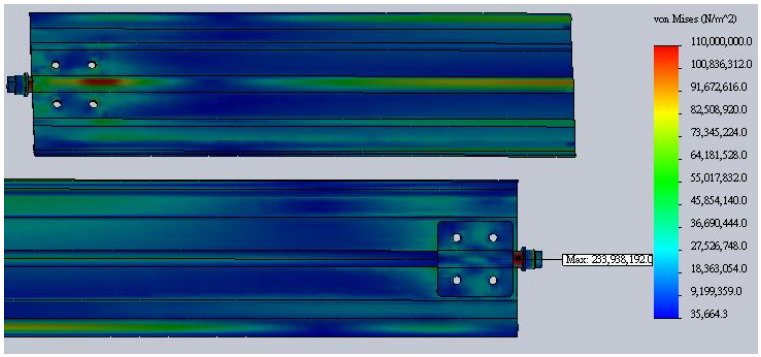
在各反面壓力下的應力分佈圖



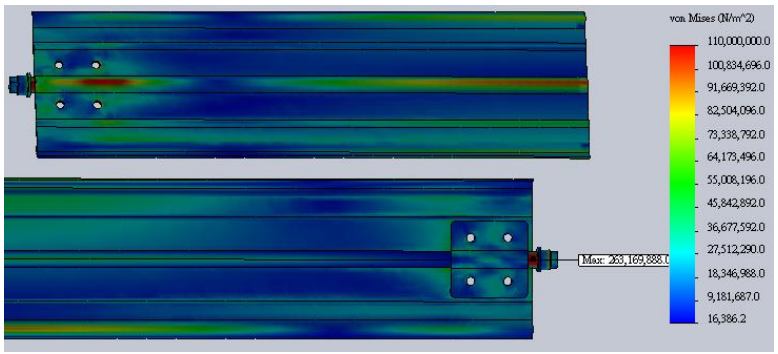
壓力3kPa



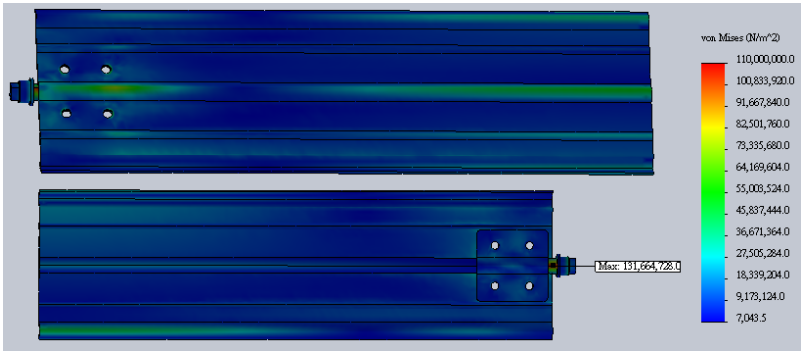
壓力3.5kPa



壓力4kPa

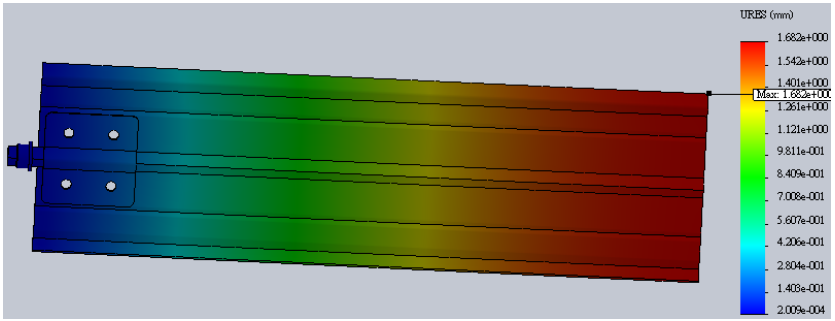


壓力4.5kPa

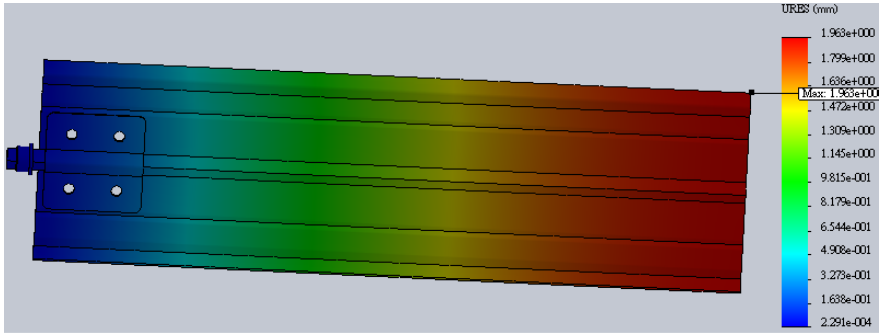


壓力2.25kPa

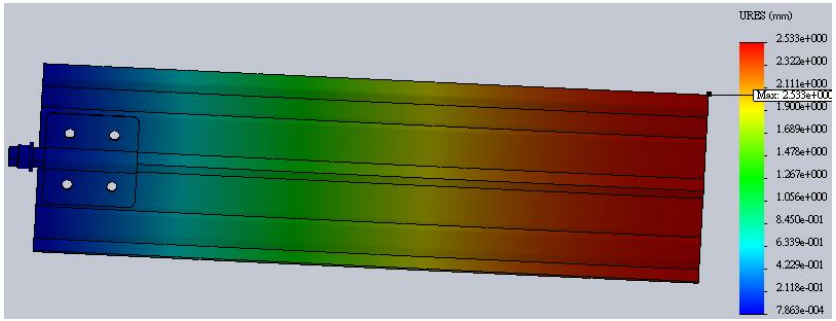
在各正面壓力下的變形量分佈圖



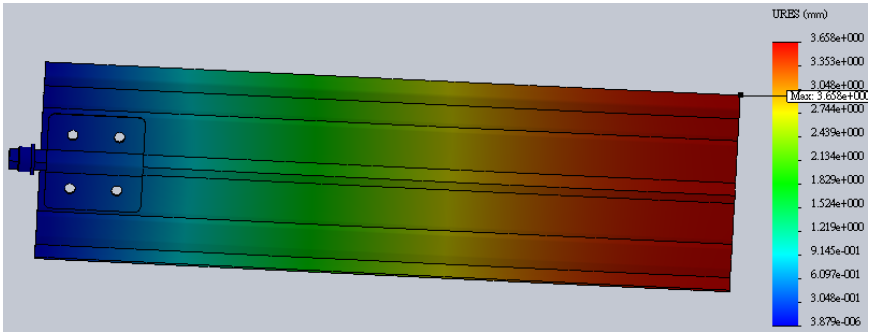
壓力3kPa



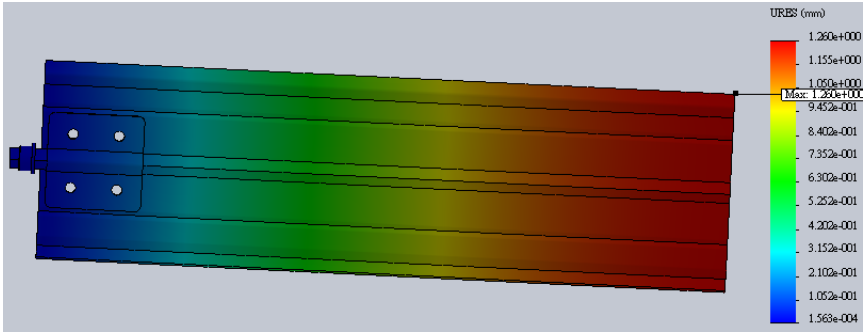
壓力3.5kPa



壓力4kPa

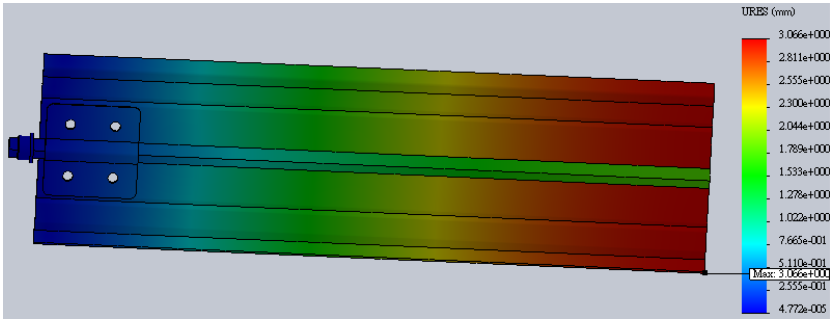


壓力4.5kPa

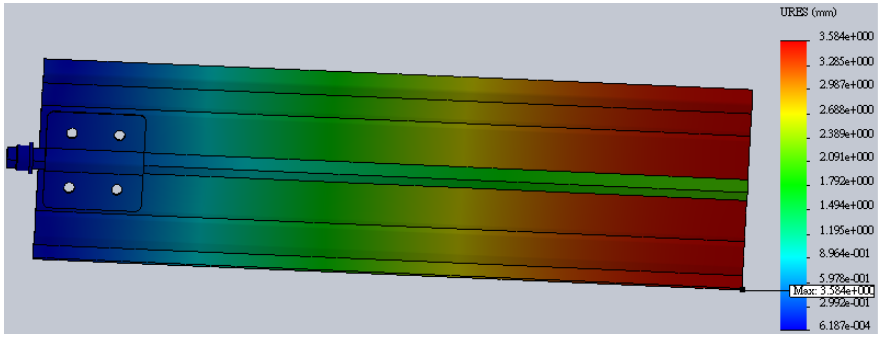


壓力2.25kPa

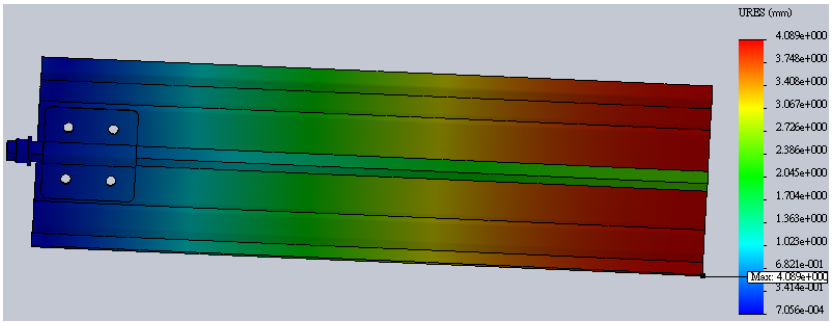
在各反面壓力下的變形量分佈圖



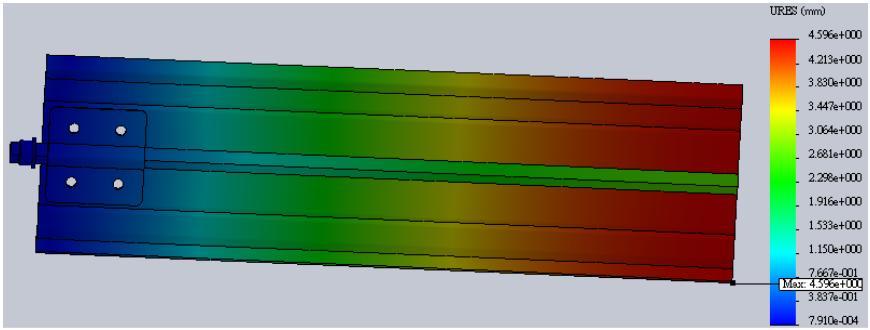
壓力3kPa



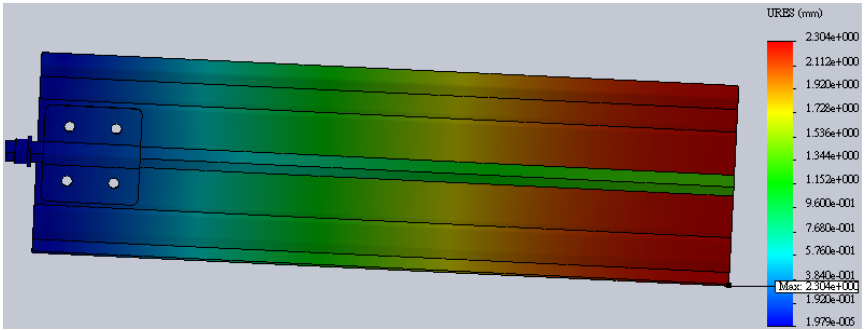
壓力3.5kPa



壓力4kPa



壓力4.5kPa



壓力2.25kPa

計算結果與最大壓力

- 最大應力與變形量隨壓力增加呈線性增大, 尤其是反壓作用時軸心的負載效應與新葉片(另一報告)的短軸心類似, 兩者的直線性特質也相似.
- 一葉片組可承受最大壓力約為4.5kPa, 此參考值可作為實際葉片組的對照與預估值, 但需注意最大變形量(約4.5mm)是否影響氣密.