



Simcenter Flotherm與HEEDS
整合進行優化設計分析

HEEDS 是什麼？

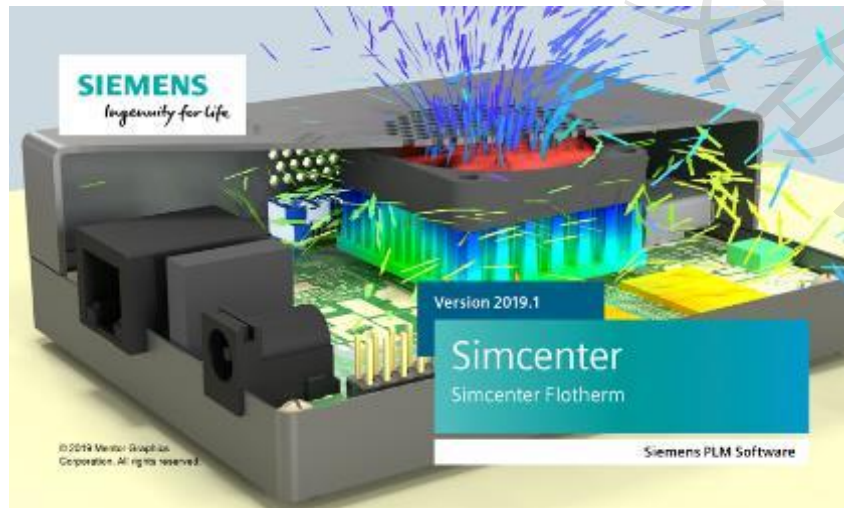


- ∞ HEEDS 是一套多學科設計優化軟體，不論是結構問題、流體力學問題、熱力學問題，或者聲學問題、NVH問題、動力學問題以及同時存在以上幾項問題，HEEDS 都可以幫助用戶尋找最佳解決方案。HEEDS 可與諸多 CAE 工具連接，使設計優化過程自動化。它還能調用多種軟體工具進行前處理，後處理，分析計算和多學科優化。

使用工具

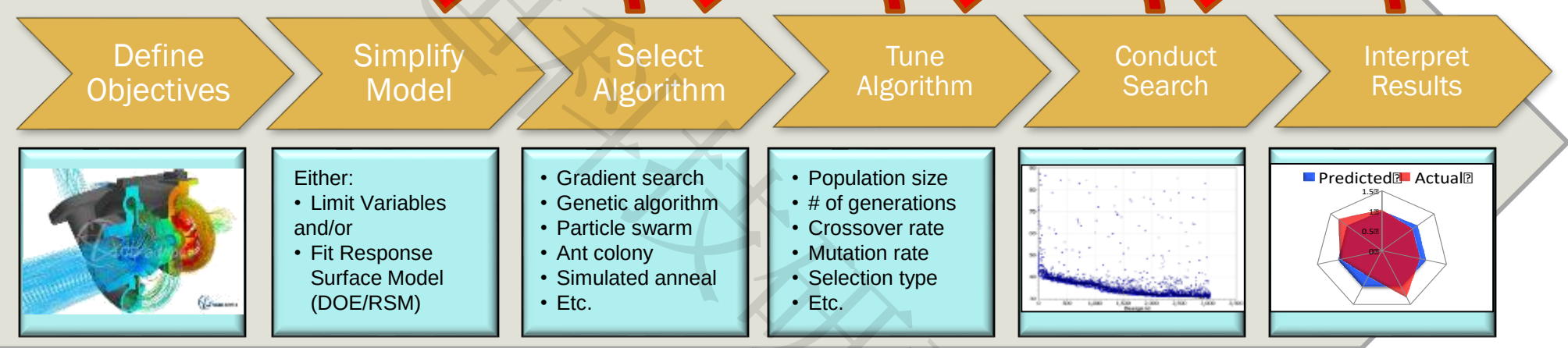


- Simcenter Flotherm
- Simcenter HEEDS

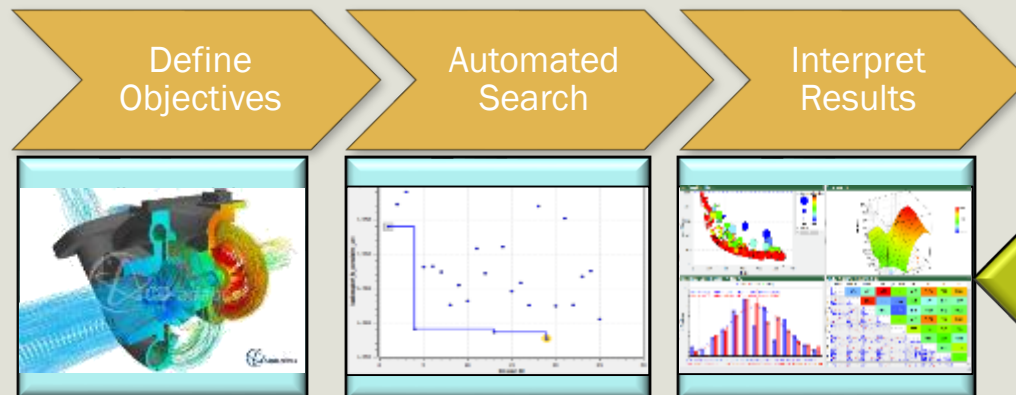


設計探索的新思維模式

Traditional Process



Modern Process (HEEDS)



"HEEDS surpasses anything on the market in its ability to help us drive innovation."
-- Anders Ahlström, Scania Truck

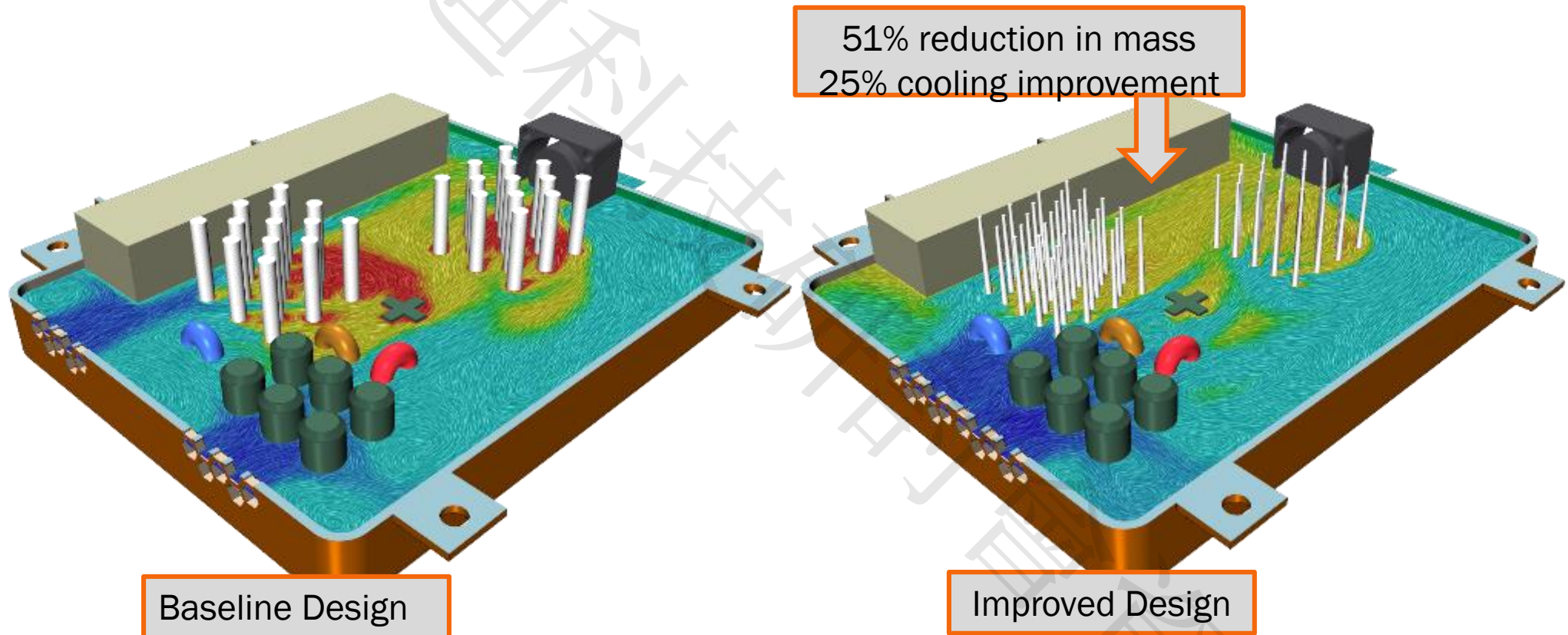


Time Savings
Discover Better Designs, Faster

Driving Innovation Through Design Exploration



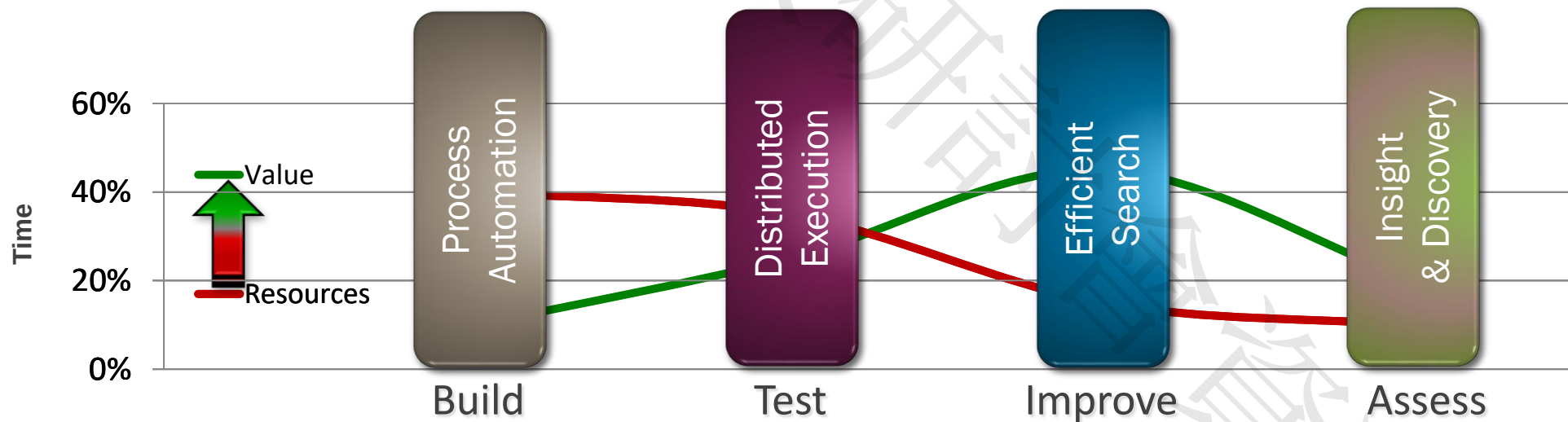
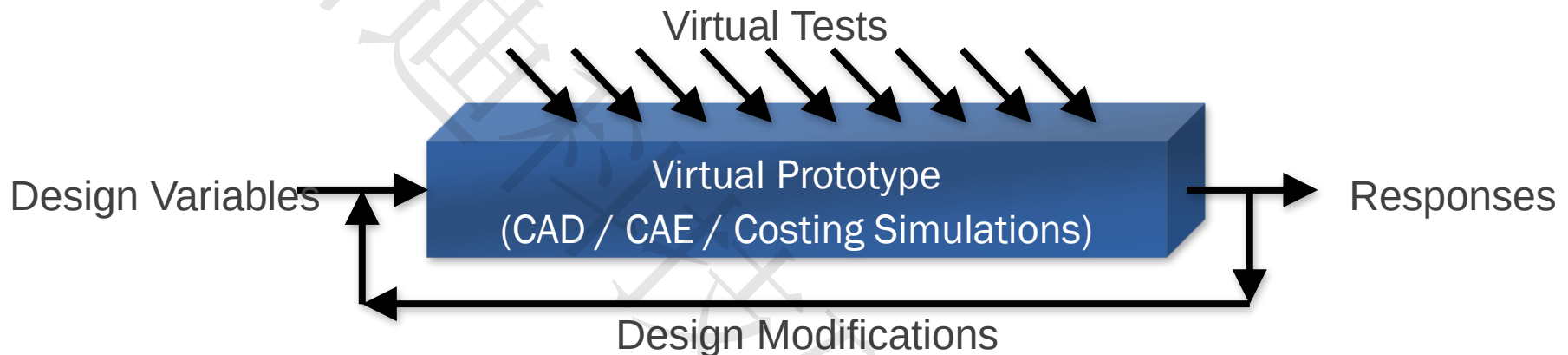
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Discover Better Designs, *Faster* – with HEEDS



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Agenda



Quadro P5000 MXM module featuring 2048 Pascal CUDA cores, 16GB memory, 192GB/s peak memory bandwidth and a TDP of 100W.

- ⌘ Heatsink performance result comparison
- ⌘ Fan selection countermeasure
- ⌘ Heatsink combine Fan performance comparison
- ⌘ System performance test result comparison

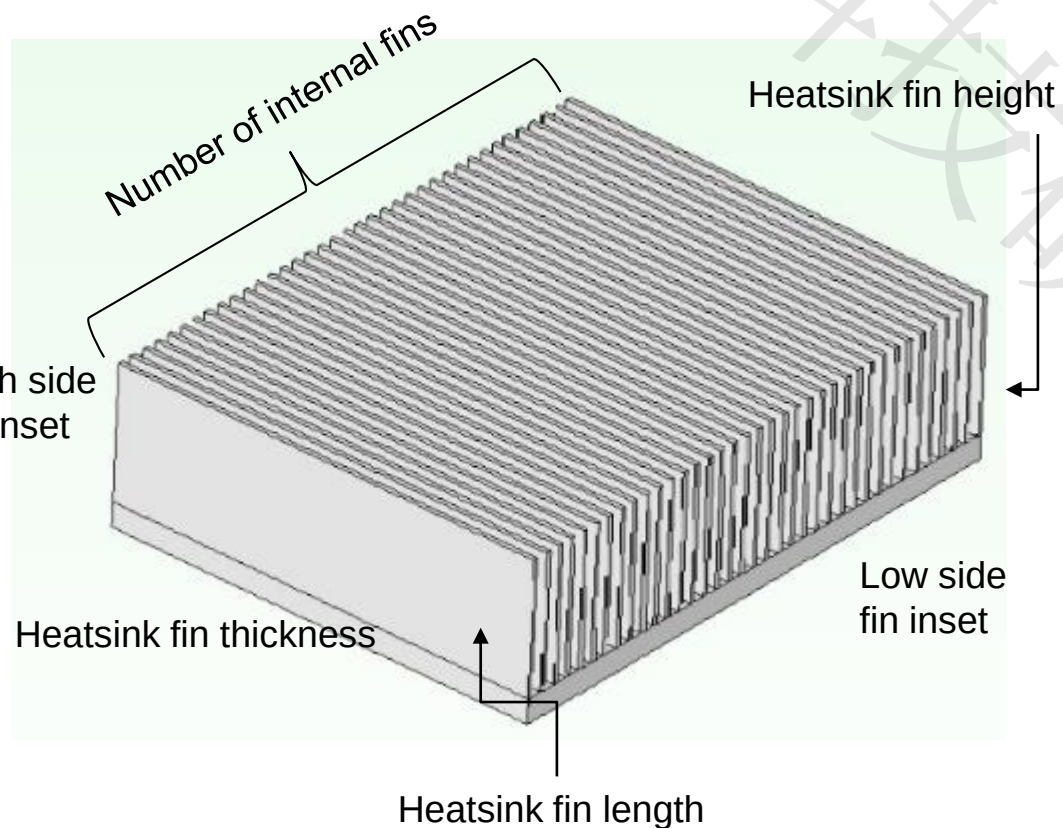
Pain point & Countermeasures



Situation	1. Heatsink 是否可以達到溫度規範與免模具費設計 2. Heatsink 減重設計,效能維持 3. Fan 單體噪音過大,降噪需求 4. 系統優化改善.安全 節能 降噪
Task	1. Heatsink製程彈性:擠製(Extrusion)/鏟齒(Skived),落實到兩地現有供應商技術 2. Heatsink 優化設計導入 性能與重量兼顧 3. Fan 噪音,評估節能低噪音. 4. 系統整體 散熱改善: Ex:阻抗.溫度.流量.噪音
Action	1. Heatsink 單體優化設計 (仿真&打樣) 2. Fan 單體性能比較 (P-Q) 3. 散熱模組單體性能比較 (R-Q) 4. 系統整體性能比較
Result	?

變更參數

變更散熱片幾何尺寸，共以下六個參數



Variable Name	Baseline	Range
Heatsink_fin_hight	27.45	24~32mm
Heatsink_highside Inset	0	0~15mm
Heatsink_length	90	65~90
Heatsink_lowside Inset	0	0~15mm
Heatsink_number of internal fins	35	30~55
Heatsink width	1	0.4~4mm

Flotherm 需準備事項

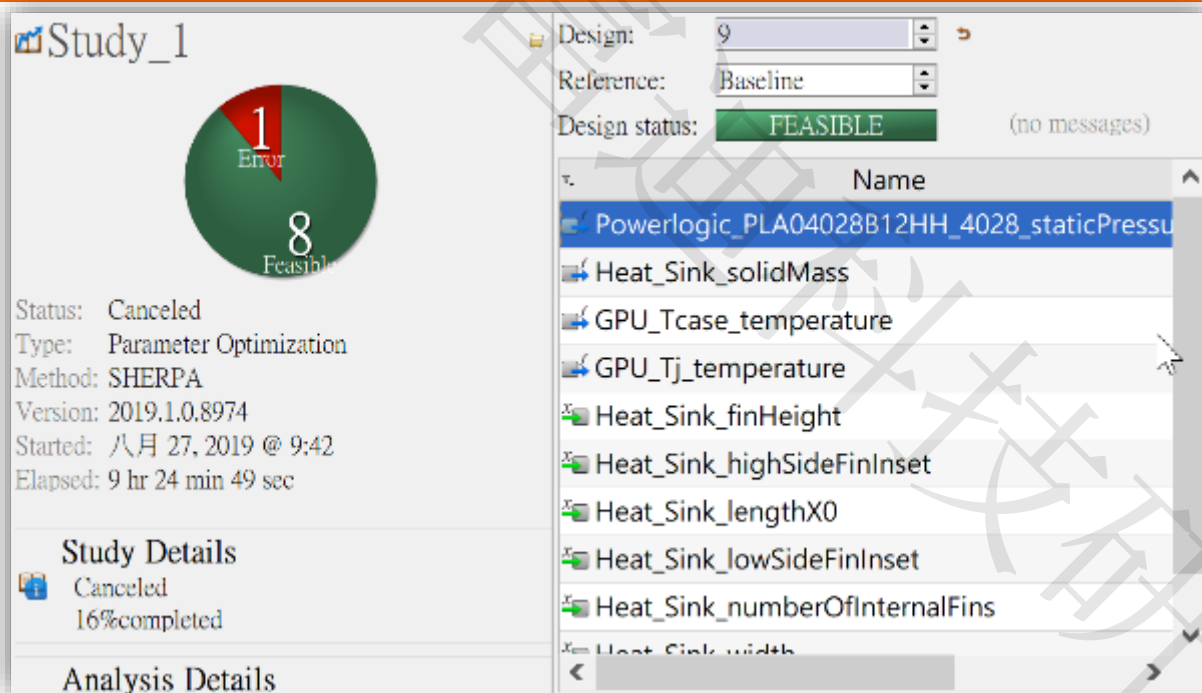


- 需輸出 PDML 或 PACK 檔給 HEEDS
- 需設定 Command Center 中 Base Project 的參數
- 建議確保 Base Project 模型可以收斂

	Base Project	Append Scenario
Heatsink : Center Gap (mm)	0	
Heatsink : High Side Fin Inset (mm)	0	
Heatsink : Internal Fin Height (mm)	8	
Heatsink : Internal Fin Uniform Width (mm)	1	
Heatsink : Low Side Fin Inset (mm)	0	
Heatsink : Number of Internal Fins	13	
Solution Status	All Monitor Points Converged	
Store Results?	Full	
Initialize From	No Project	
U1[CBGAFC_27x27mm_2R] : Hottest Junction Temperature (°C)	99.235	
Heatsink : Solid Mass (kg)	0.036585	

Input VariablesOutput VariablesScenario TableScenario ViewerSolution Monitoring

Design Search Strategy



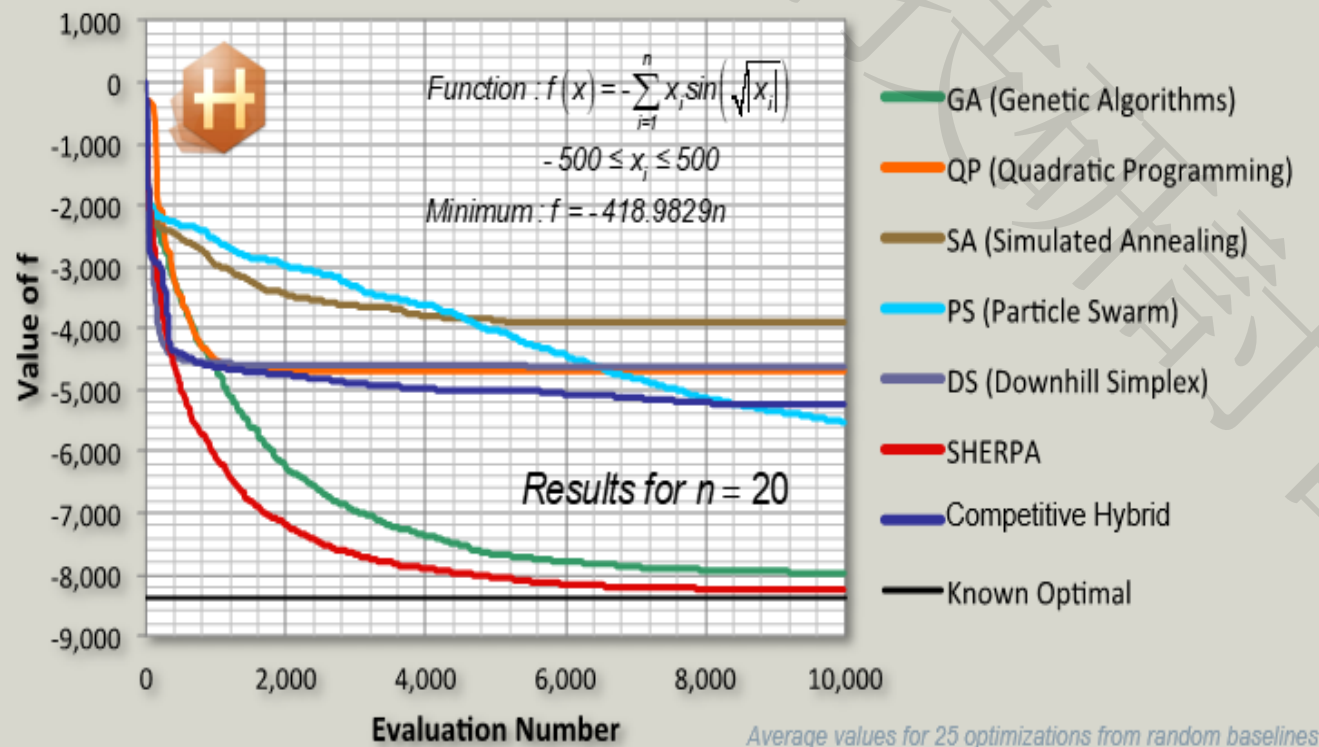
SHERPA Algorithm

Challenge:

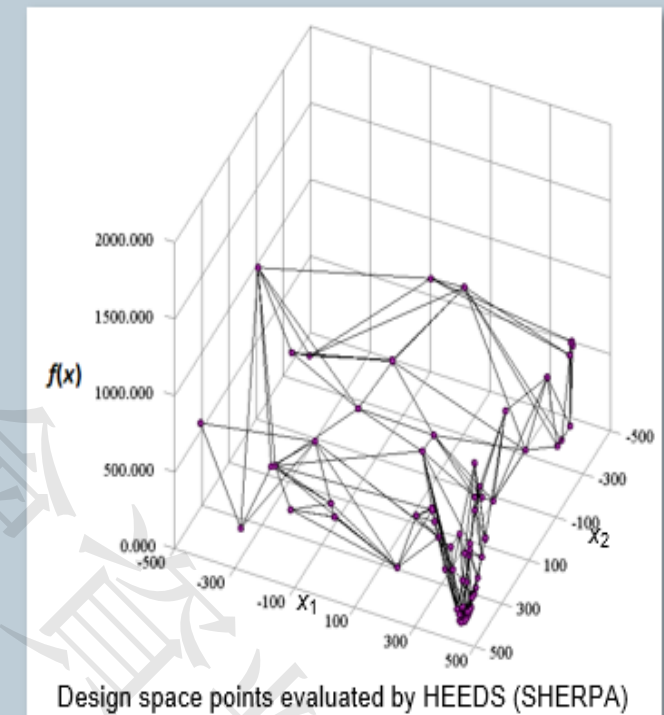
- Find minimal function value in least number of evaluations

Results:

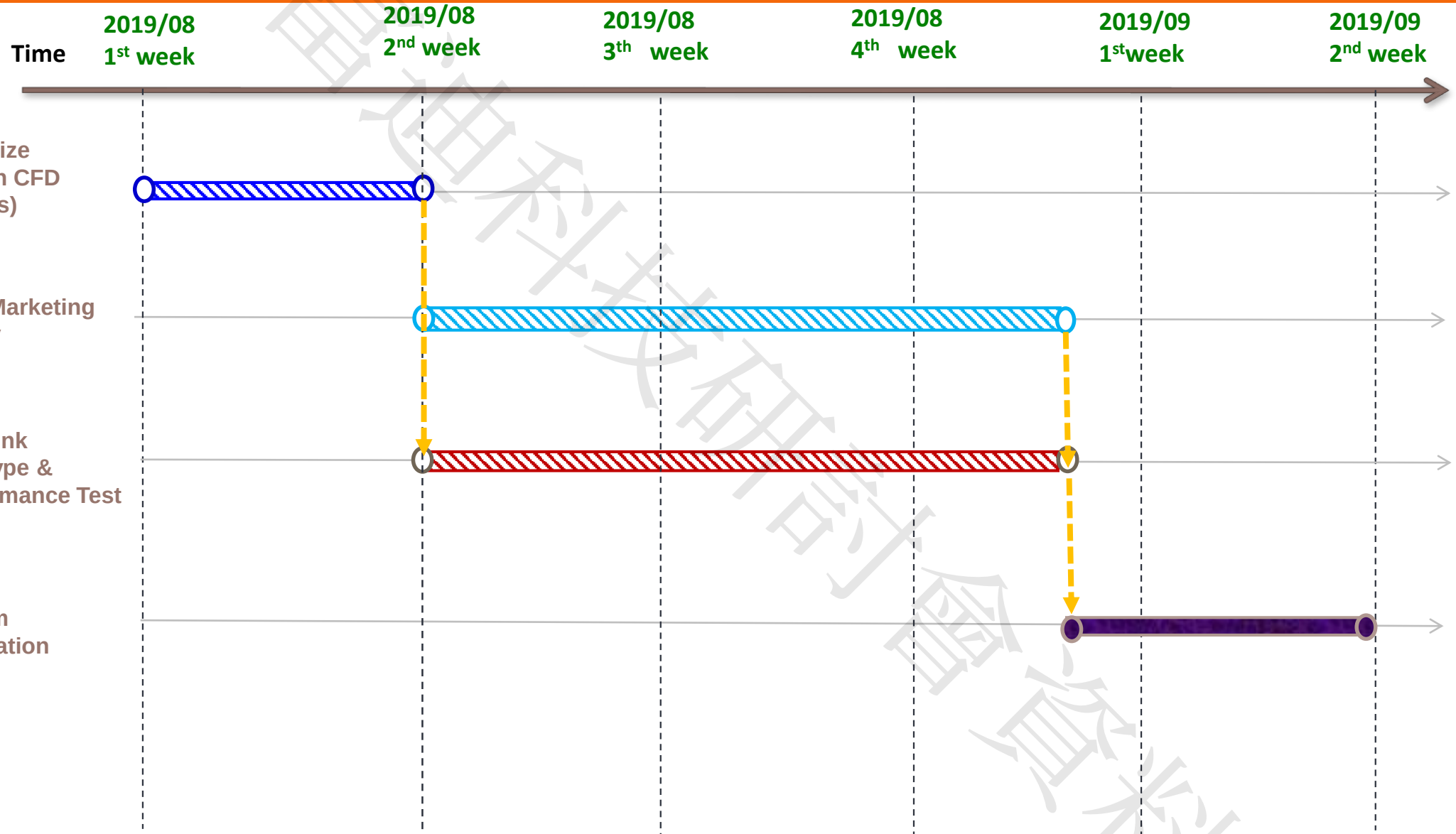
- In 2000 evaluations, SHERPA performed >10% better than any other algorithm and >30% better than the nearest hybrid algorithm



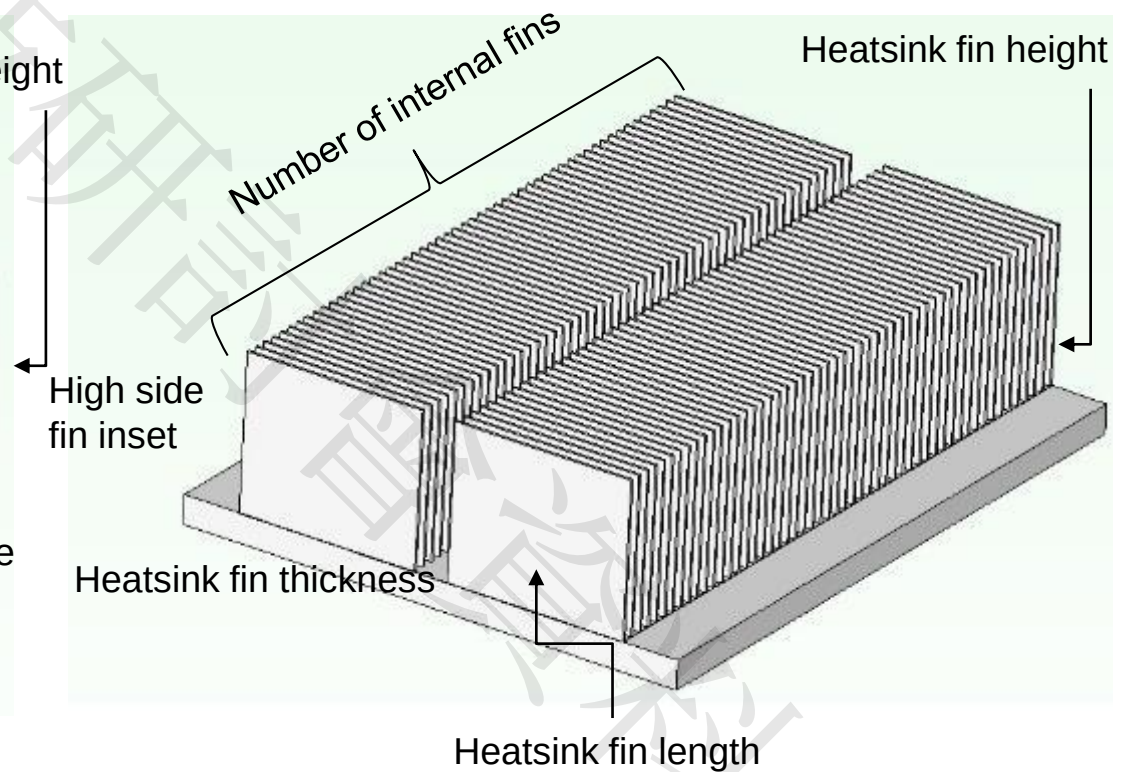
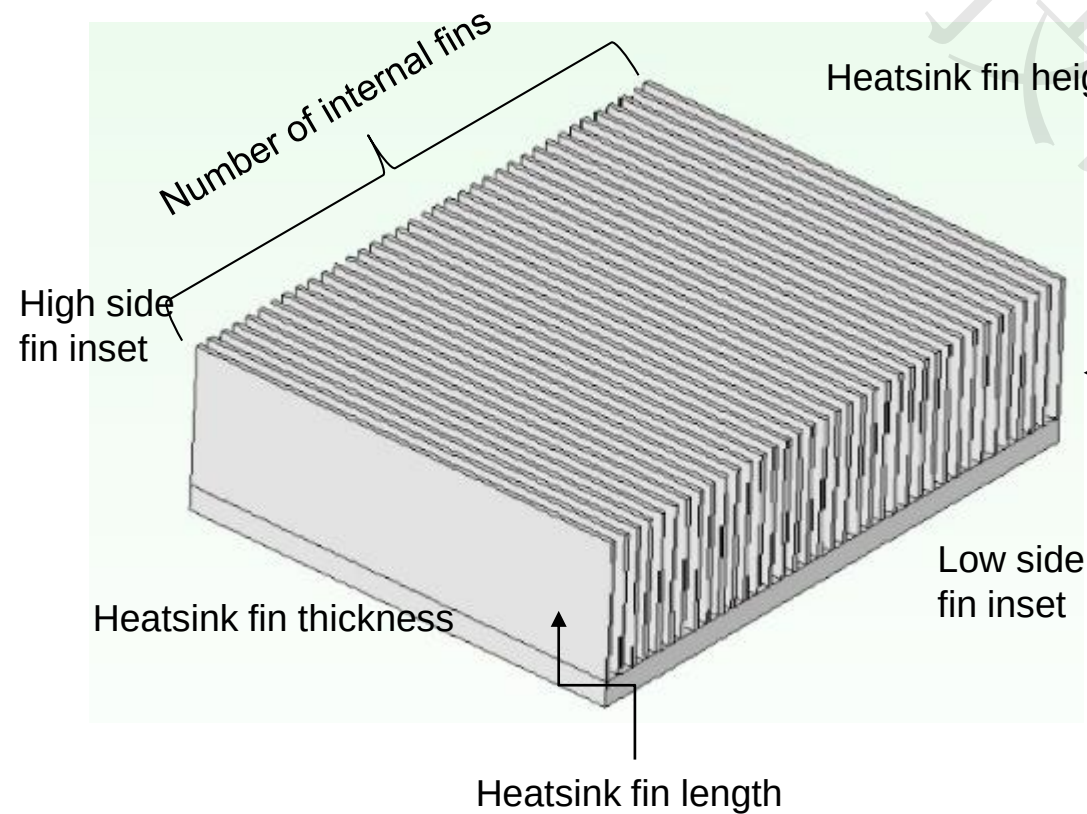
Graph showing function for two variables ($n=2$)



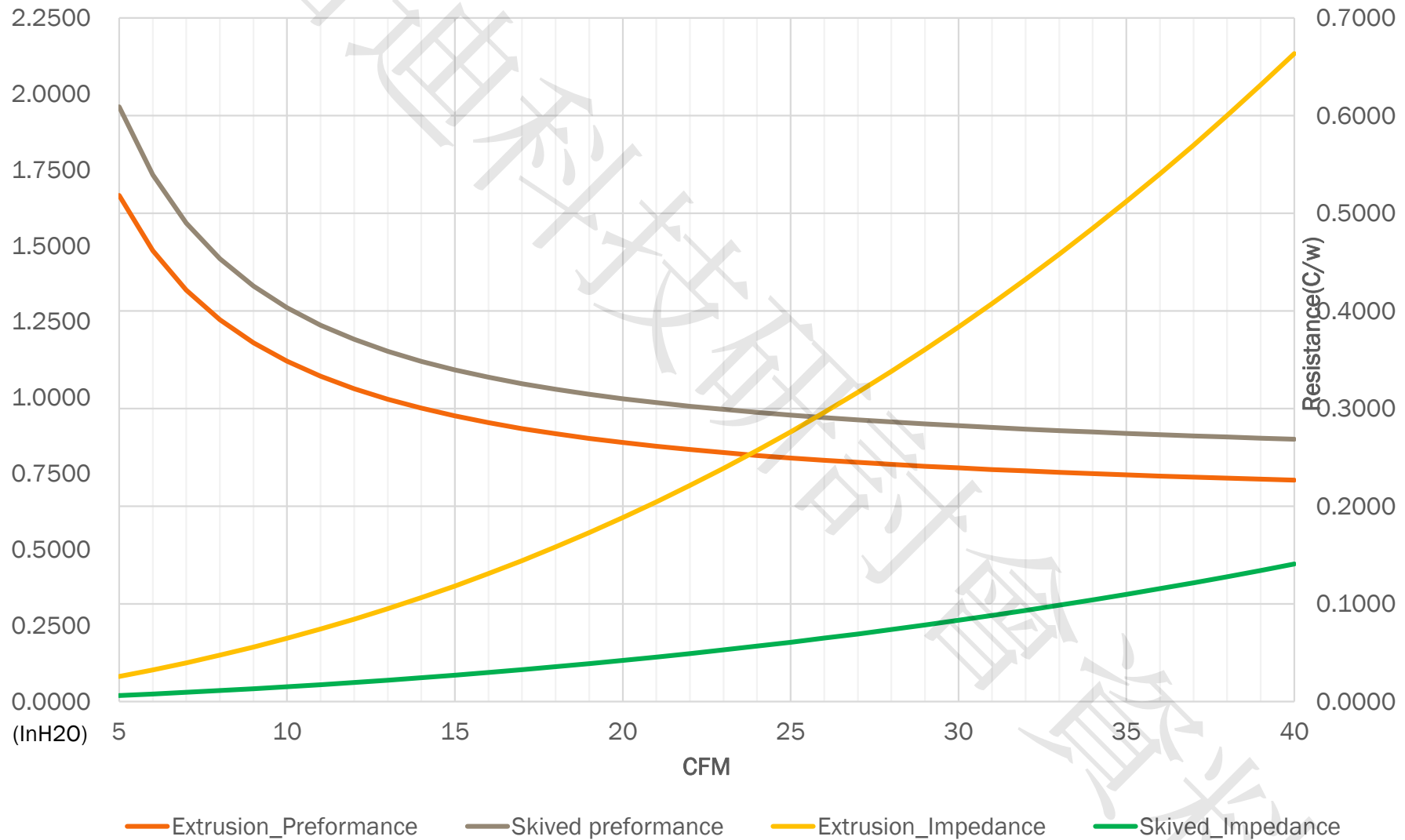
Milestone -2019



Variable Name	Baseline	Range	Optimize
Heatsink_fin_hight	27.45	24~32mm	27 mm
Heatsink_highside Inset	0	0~15 mm	10 mm
Heatsink length	90	65~90	70 mm
Heatsink_lowside Inset	0	0~15 mm	10 mm
Heatsink_number of internal fins	35	30~55	53
Heatsink width	1	0.4~4 mm	0.5 mm



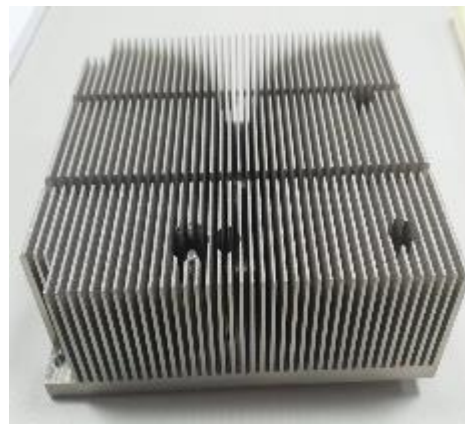
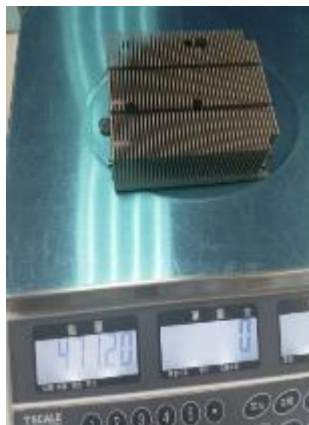
Heatsink performance chart



Heatsink Performance



TDP (100W)	Extrusion Heatsink	Skived Heatsink
Weight(g)	471	325 
Resistance(C/W) @Fan duty 100%	0.247 	0.295
Resistance(C/W) @Fan duty 50%	0.298 	0.319
Sample fee(NTD)	8,000	3,000 
Model fee (NTD)	130,000	NA
Through Heatsink flow(CFM)	23	30 



Fan Selection_I



∞ 設計目標:省電低電流.高風量.低噪音

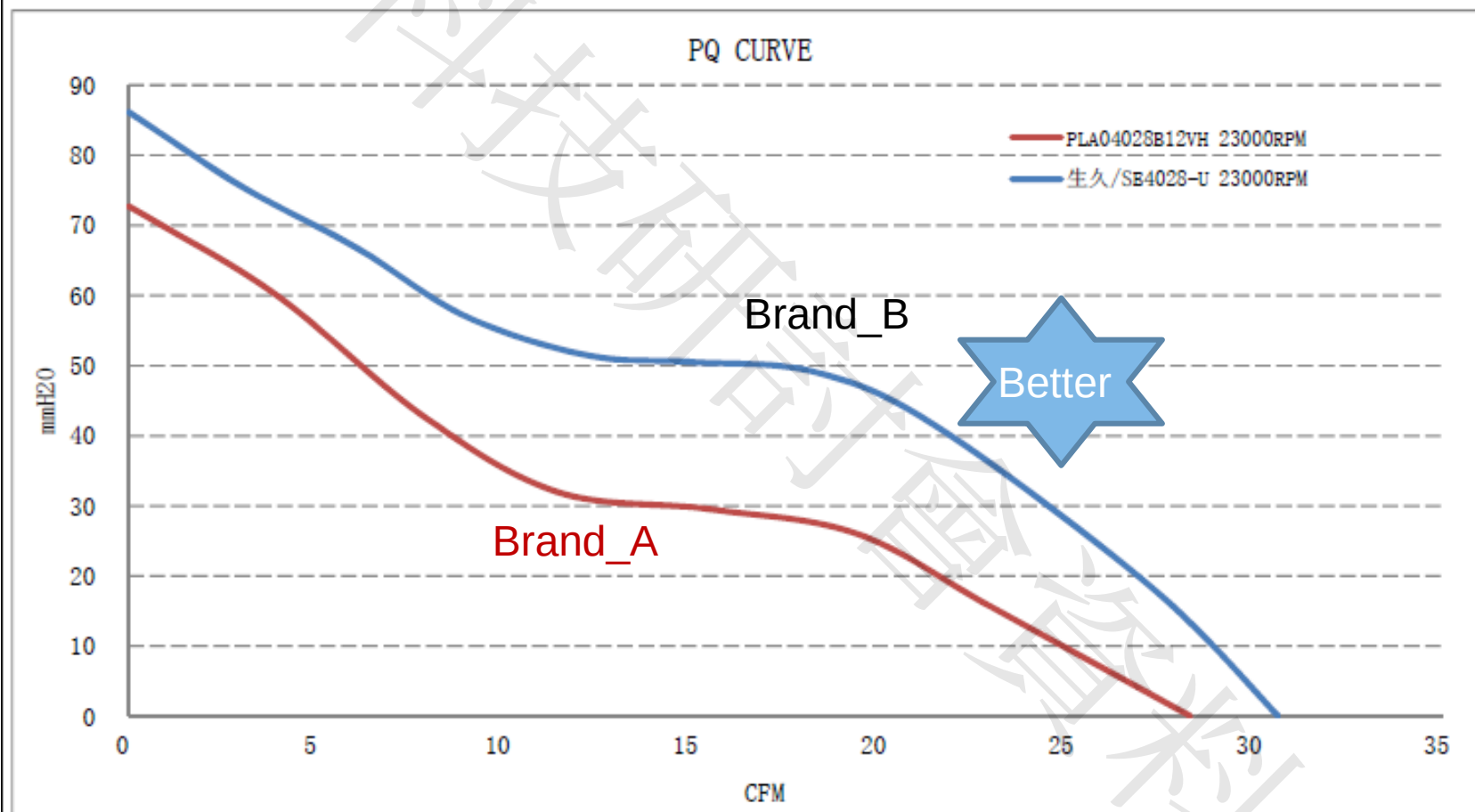
	Brand_A	Brand_B
Size(mm)	40*40*28	40*40*28
Nosie (dBA)	68.3	60.2 
Rated Speed(RPM)	23,000	23,000
Current(A)	1.6	1.2 
Pressure(mmH2O)	72.76	86.18 
Max flow(CFM)	28.28	30.62 
MOQ 500 (NTD)	193	197

Fan Selection_II



Brand_A
Brand_B

品牌/型号 BRAND/MODEL	电压(V) Rated Voltage	电流(A) Rated Current	转速(RPM) Speed	风量(CFM) Air Flow	静压(mmH ₂ O) Air Pressure	噪声(dBA) Noise	数据来源
PLA04028B12VH 23000RPM	12	1.60	23000	28.28	72.76	68.3	规格书
生久/SE4028-U 23000RPM	12	1.20	23000	30.62	86.18	60.2	样品实测



Heatsink with Fan Performance list



改善目標:重量輕.性能維持.降低環境測試風險

Heater(100W)	Extrusion Heatsink + Fan_Brand A	Skived Heatsink + Fan_Brand B	Note
Weight(g)	578	432	↓ 30%
Resistance(C/W)@100 %	0.247	0.295	↑ 19%
100% Noise (dBA) @ 2 fan	71.3	63.2	↓ 11%
Fan Flow (CFM)	23	33	↑ 43%
Sample fee(NTD)	8,000	3000	↓ 62%
HS molding fee (NTD)	130,000	NA	
Module MOQ 300 (NTD)	1,610	1,787	↑ 10%

System test result

改善目標:低噪音.性能與溫度符合規範



Nvidia P5000(100W)/ Tj=91C	Extrusion Heatsink + Fan Brand A	Skived Heatsink + Fan Brand B
GPU loading 100%	Full loading	Full loading
Ta 50°C @Fan 60%,Tj /Tc (°C)	Tj:84.8 / 80.8 (Tj Spec:91)	👍 Tj:82.8 / 78.5 (Tj Spec:91)
Ta 50°C @Fan 100%,Tj /Tc (°C)	Tj:79.25 / 75.25 (Tj Spec:91)	Tj:81.0 / 77.2 (Tj Spec:91)
@Fan 60%, noise(dBA) 4028*2+6025*1	57.21	👍 52.45
@Fan 100%, noise(dBA) 4028*2+6025*1	72.24	👍 63.77



MVP-6100-MXM Series



Countermeasures & Result



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Result	1. Skived工藝能支援兩地生產,排除特定地區製造束縛,增加生產彈性 2. 透過設計改善:Heatsink重量減少30%,效能維持並符合元件溫度規範 3. 透過風扇選擇,能優化性能並降噪 8 dBA 4. 系統性能方面@50°C,系統測試/GPU溫度下降2度,整體噪音下降8.3%

Edge Computing



- 5G討論火熱，如今應用，包括AR/VR、無人機等。要達到低延遲，需要仰賴邊緣運算，而未來雲端與邊緣端的運算模式，與在地的電信營運商共同合作的型態。
- AWS、微軟Azure等公有雲業者，未來可能會向電信營運商租用邊緣運算資料中心，部分從終端蒐集的資料，先在邊緣運算資料中心計算後，需要留下的資料，再轉送至公有雲資料中心，否則就在邊緣處理完畢。邊緣運算最重要的項目，推估將是即時影像分析資訊。此型態，將會帶動大批邊緣運算的建置需求。



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