Since 1985

Long Win

Science & Technology Corporation

Position

TEL:+886-3-464-3221
E-mail: longwin@longwin.com
Web Site: www.longwin.com

V 1.5 ENG

ISO 9001 & ISO 17025 Certified

CERTECH

Certificate of Registration

Quality Management System – ISO 9001:2015

This is to certify that:

Long Win Science and Technology Corporation

No.7, Shih 2nd Road, Youth Industrial Park, Yangmei, Taoyuan, 32657 Taiwan (R.O.C.)

Has earned certificate number: 18/2197

Long Win Science and Technology Corporation's system conforms to the requirements of ISO 9001:2015 for the following scope:

Design, manufacture, installation and maintenance of industrial, testing and educational apparatus

Signed for and on behalf of Certech Registration Inc.

President and CEO

Certification granted on: February 23, 2018
Last scope change: N/A
Certificate renewal date: January 25, 2021
Certificate expiry date: February 07, 2024

File number: TW11036Q
One location covered under this certification.

ANAB IAF

CERTECH REGISTRATION INC

TAF

財團法人全國認證基金會
Taiwan Accreditation Foundation

Certification Accreditation

(Certificate No：L3919-220715)

This is to certify that

LONG WIN SCIENCE AND TECHNOLOGY CORPORATION

Laboratory of Long Win Research & Development Center

No. 7, Shi 2nd Rd., Yangmei Dist., Taoyuan City, Taiwan (R.O.C.)

is accredited in respect of laboratory

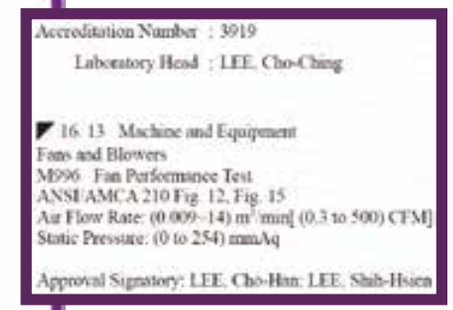
Accreditation Criteria ： ISO/IEC 17025:2017 ; CNS 17025:2018
Accreditation Number ： 3919
Originally Accredited ： February 15, 2022
Effective Period ： February 15, 2022 to February 14, 2025
Accredited Scope ： Testing Field, see described in the Appendix

Ching-Chang Lien

Ching-Chang Lien
President, Taiwan Accreditation Foundation
July 15, 2022

Pl. total 2 pages

The Appendix forms an integral part of this Certificate, which shall be invalid when use without the Appendix



Accreditation Number ：3919
Laboratory Head ：LEE, Cho-Ching

16. 13 Machine and Equipment
Fans and Blowers
M996 Fan Performance Test
ANSI/AMCA 210 Fig. 12, Fig. 15
Air Flow Rate: (0.009~14) m^3/min[(0.3 to 500) CFM]
Static Pressure: (0 to 254) mmAq

Approval Signatory: LEE, Cho-Hsu; LEE, Shih-Hsien

ilac-MRA

TAF
Testing Laboratory
3919

Knowledge-Based

Advanced Liquid Cooling & Immersion Cooling for HPC.

Resolution & Revolution & Action

Innovation

Know-How: Automation, Software, Machining, System Integration

All-in-one Factory

Know-Why: Physics, Chemistry, Mechanics, Fluid & Material Science, Thermodynamics

Company values

- Do what we love;
- Contribute to human beings
- Profit is not our 1st priority;
- We earn from bigger benefits of our clients

Long Win's Capability & Core Value

LongWin
Fundamental, Forward & First
Since 1985

Commitment
Legacy & Devotion

Our Research Centers

A. Information & communication lab
Airflow bench/Heat pipe/VC/
Cold plate/L-L & L-A CDU/Pump
Immersion cooling/Heat exchanger
POC immersion cooling/dummy load
Stiffness test/Natural convection
Chamber/TIM tester/Liquid flow tester

B. Semi-conductor lab
JEDEC Standard
for IC package
1. Rjc tester
2. Rja wind tunnel
vertical / horizontal

C. Fluid mechanics lab
Micro 16CH temperature/anemometer
16CH PSV for gas / 16CH PSV for liquid
100 kHz 6CH pressure / LDA ~ 220 m/s
2D PIV / 3D PTV / high-speed camera
hot wire & hot film anemometer /
supersonic, subsonic, acceleration wint tunnel
closed-loop water & glycerin tunnel & channel

D. Thermal lab
IR imaging camera
High-frequency non-contact
heater / TIM transient tester
K: 0.02-20 W/m·K / TIM
long-term reliability tester
Thermal diffusivity &
conductivity tester

E. Material analysis lab
X-ray fluorescence / PY-GC-MS
ICP-OES-MS / DSC / Photoionization
detector(PID) / Salt spray tester /
Metallographic microscope / Confocal
Laser Scanning Microscope LSCM
Accelerated aging environmental test /
Ambient plasma generator / Contact
angle meter / Supersonic viscometer...

F. Structure lab
Vibration platform/
Universal tester/Mental &
rubber hardness tester/
High-strain-rate split
Hopkinson bar/Image profile/
240 kV、320W X-ray
Computed Tomography
Rotating power
balancer/Fully
anechoic chamber...

G. Bio-medical lab
Scanning phase contrast &
polarizing microscope &
3D imaging software
Micron 3D platform

H. Work stations

-Goal-
Become a
World-known lab
& participate
leading-edge
research

Talents wanted
Integrity
Responsibility
Passion

-Attitude-
Nothing
is
impossible

-Lab-
Yangmei Taiwan
Silicon Valley USA
&
All-in-one
factory in TW

-Opportunity-
>700
projects &
inquiries
annually

-Clients-
>90%
companies
in ICT industry

Long Win
Science and Technology
Corporation
TEL: 03-464-3221
Email: longwin@longwin.com
URL: http://www.longwin.com

Core Values

Long Win's Attitude

Nothing is Impossible
by our
hardworking & knowledge

Current Long Win

Research, design & manufacture apparatuses in material and fluid mechanics, thermodynamics and automation for research and test purposes

>1,000 successful customized products

1. **Professional and full-time engineers for system, structure and automation design, software, machining, plumbing & HVAC.**

2. **Customized products in 2022 > USD 13 million**
   Newly designed apparatuses > 20 types

3. **Hundreds of clients;**

4. **80% of products are exported worldwide.**

Group Photo - 2023 Chinese New Year

Know-why and Know-how in ICT thermal solutions

Including the following fields,
Physics, chemistry, mechanics, fluid & material science, thermodynamics, automation software, machining

system integration and innovation

Research Center-Labs

- Explore know-why & know-how
- Deepen our insight
- Broaden our horizon
- We can innovate

Laboratory Scale

1. Taiwan:3,300 m^2
   Value>USD 10 Million
   Annual investment on
   research apparatus: >USD 1,500K

2. Silicon Valley, CA, USA

3. China

Long Win's Lab in Taiwan
Apparatuses owned >USD 15 Million

A. Information, Communication Technology(ICT) Lab

B. Semiconductor Lab

C. Fluid Mechanics Lab

D. Material Analysis Lab

E. Thermodynamics Lab

F. Bio-Medical Lab

G. Structural and Measurement Lab

H. Calibration and Test Laboratory

I.6 Work Stations

A. Information, Communication Technology (ICT) Lab-1/4

1. Airflow bench for fan PQ, system resistance curve (SRC), and heat sink's RQ performance, torque measurement, etc; 0.05~30000 CFM; > 20 models
2 Heat sink RQ tester; 5~800 CFM; 6 models
3. Heat Pipe-HP-Thermal Performance Tester
4. Micro Heat Pipe-MHP- Thermal Performance Tester
5. Vapor Chamber-VC-Thermal Performance Tester
6. Ultra-Thin Vapor Chamber-UTVC-Non-contact Transient & Static Thermal Performance Tester
7. Cold Plate- Thermal Performance Tester
8. Impedance tester for connectors, piping & Manifolds

A. Information, Communication Technology (ICT) -2/4

9. Liquid Burst Pressure Tester
10. 4U Liquid to Liquid CDU
11. 4U Liquid to Air CDU
12. 8U Liquid to Liquid CDU
13. 8U Liquid to Air CDU
14. Single-phase immersion cooling tester for heat sinks
15. Two-phase immersion cooling tester for boilers
16. Two-phase immersion cooling tester for condensers
17. Air-liquid heat exchanger thermal performance tester
    Heat loading: 1~100 kW
    Airflow range: 50-11,000 CFM

A. Information, Communication Technology (ICT) -3/4

18. Pumper performance tester
    Flow rate: 0.1-300 LPM; Pressure: 1-600 kPa
19. POC single-phase immersion cooling tester 1U, 24~54U
20. POC two-phase immersion cooling tester 1U, 24~54U
21. Dummy server: 15, 30, 40, 60, 80, 100 kW
22. Stiffness tester for heat sinks in servers
23. Natural convection chamber: Ambient + 5~70 °C;
    Small, Standard, Medium, and Large types
24. Natural convection chamber - High temp. Ambient + 5~90 °C
25. Natural convection chamber - Ultra high temp. Ambient + 5~150 °C
26. Natural convection chamber - Room Temp. 20~70 °C
27. Sunlight natural convection chamber, temperature range
    40~70 ℃, Irradiance 1200 w/m^2

A. Information, Communication Technology (ICT) - 4/4

28. TIM thermal impedance and conductivity tester;
    K: 0.02-20 W/m·K

29. TIM transient & long-term reliability tester

30. Thermal diffusivity tester for highly-conductive thin-film materials

31. Isolated Liquid flow measurement for metal & non-metal piping
    Flow rate: 0.01-60 LPM; Diameter: 3-32 mm

32. Various CDU, RPU, back door performance testers

33. 9 seats of walk-in chambers:To simulate data centers and to test air-cooled, L-A , L-L ,and immersion rack-level systems and rate their performance and reliability
    Refer to page 52

B. Semiconductor Lab

JEDEC Standard for IC Package

1. Rjc tester: 10-1,500 W

2. Rja vertical wind tunnel Temperature: 20-80 °C
   Wind speed: 0.5-5 m/s

3. Rja horizontal wind tunnel Temperature: 20-60 °C
   Wind speed: 0.5-5 m/s

4. High-power semiconductor single-phase immersion thermal tester

5. High-power semiconductor two-phase immersion thermal tester

C. Fluid Mechanics Lab-1

1. Micro 16CH temperature measurement / 16CH anemometer
2. 2K Hz dynamic 16CH PSV for gas
3. 800 Hz dynamic 16CH PSV for liquid
4. 100KHz 6CH Pressure Transducer
5. LDA 0.01 ~ 220 m/s
6. 2D PIV, 5,000 FPS high-speed camera
7. 3D PTV, 3 sets high-speed camera
8. High-frequency hot wire anemometer
9. High-frequency hot film anemometer
10. Fx · Fy-50 N · Fz-200 N · Mxyz-1 Nm 6-component

C. Fluid Mechanics Lab-2

11. Supersonic wind tunnel 1-3.2 Mach
12. Subsonic wind tunnel: Test section 1x1 m; ~60 m/s
13. Subsonic wind tunnel: Test section 0.3x0.3 m; ~100 m/s
14. Subsonic wind tunnel: Test section 0.2x0.2 m; ~ 30 m/s
15. Closed-loop water tunnel: Test section 0.2x0.3 m; ~3 m/s
16. Closed-loop water channel: Test section 0.3x0.4 m; ~0.6 m/s
17. Closed-loop water channel: Test section 0.2x0.3 m; ~0.6 m/s
18. Closed-loop glycerin channel: Test section 0.2x0.3 m; ~1 m/s
19. Acceleration water tunnel: 2m/s, 2 m/s^2 (to be built)
20. Variable velocity field wind tunnel: 2-30 m/s;resolution 20mm (in production)
21. Acceleration wind tunnel: 30m/s, 15 m/s^2 (in production)

D. Material Analysis Lab

A must-do before commercializing any liquid-cooled solution

All-round studies on organic, inorganic, electrochemistry, corrosion, material science, and fabrication

1. X-ray Fluorescence	13. Contact angle meter
2. PY-GC-MS	14. Supersonic viscometer
3. ICP-OES	15. Liquid density meter
4. DSC	16. Confocal Laser Scanning Microscope LSCM
5. TGA	17. Metallographic microscope and peripherals
6. SEM	18. Aging environmental test
7. FTIR	19. Thermal Chamber -40~1600 °C
8. Spectrometer	20. Photoionization Detector
9. pH & Conductivity meter	21. More Liquid Cooling Testers
10. Liquid polariscope	22. White Light Interferometry, WLI
11. Salt spray tester	23. Flash point tester
12. Ambient plasma generator	24. Vapor pressure tester

E. Thermodynamics Lab

1. IR imaging camera
2. High-frequency non-contact closed-loop heater - 18W, 808nm
3. TIM static thermal performance tester K:0.02-20 W/m・K
4. TIM transient & long-term reliability tester
5. Non-contact thermal diffusivity tester for highly-conductive thin-film materials
6. Non-contact thermal conductivity tester
7. TIM1 tester

F. Bio-Medical Lab

1. Scanning phase contrast microscope & 3D imaging software

2. Scanning polarizing microscope & 3D imaging software

3. Micron 3D platform

G. Structural and Measurement Lab

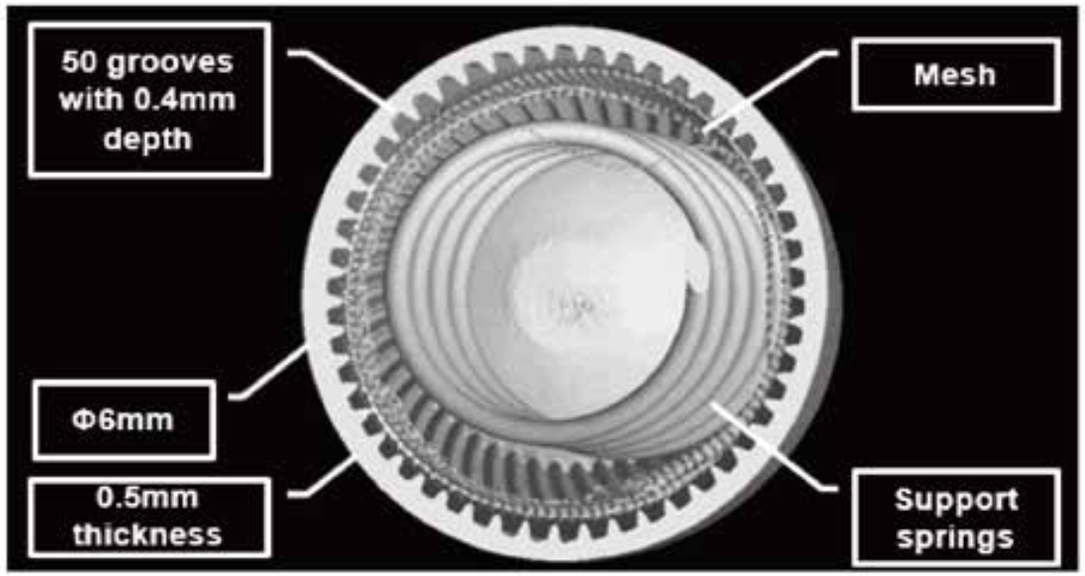
1. Vibration platform 100N; Accelerometer; Impact hammer; Measurement of natural frequency
2. Universal tester: 1 MN, 50 kN, 1 kN
3. Metal hardness tester
4. Rubber hardness tester
5. High-strain-rate split Hopkinson bar tester: Compression, tension and torsion
6. Helium leak detector
7. White light interferometric scanning profilometer
8. Industrial stereo microscope
9. 240 KV, 320 W X-ray Computed Tomography
10. Rotating power balancer
11. 100 MHz dynamic strain amplifier 6CH
12. 200 MHz digital storage oscilloscope
13. Earthquake simulation test platform: Richter Level 7; Loading 2,000 kg (in production)
14. Fully anechoic chamber (to be built)

Long Win's X-Ray CT Test Services

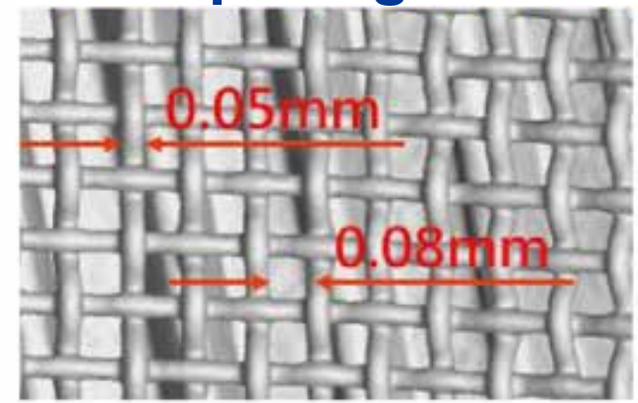
DUT

1. Solid, any material
2. Mass: <10kg
3. Dimension (mm)
   200 x 200 x 300H
4. 3D scanning
5. X-Ray 240 kV/320 W
   180 kV/15 W
6. Resolution 100 nm

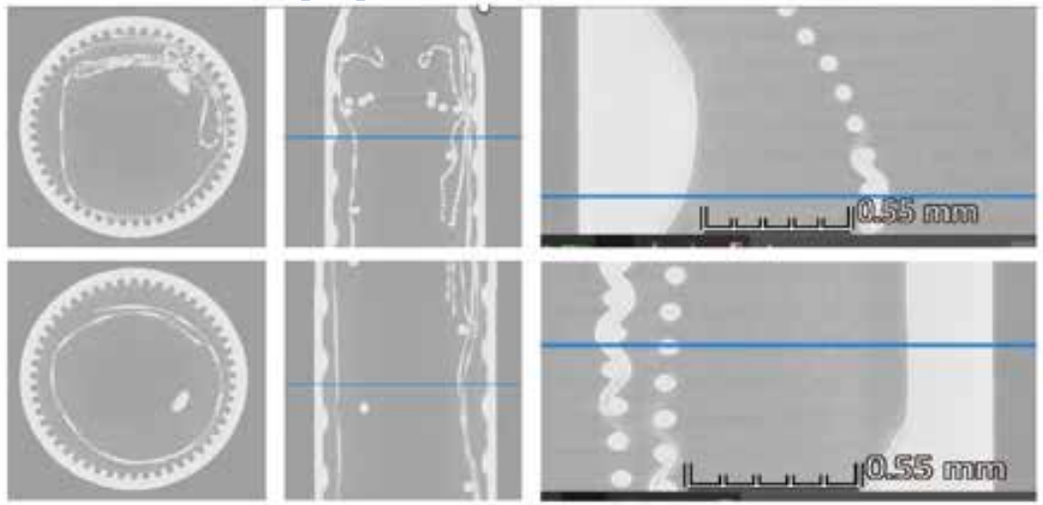
Heat Pipe tomographic analysis



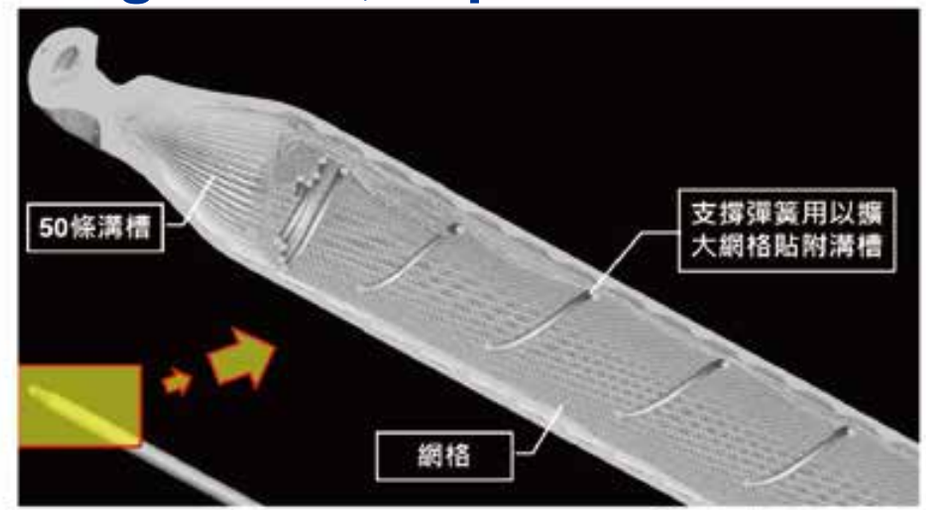
grid
Line width 0.05mm
Line spacing 0.08mm



The distance between the grid and the pipe wall is 0.55 mm



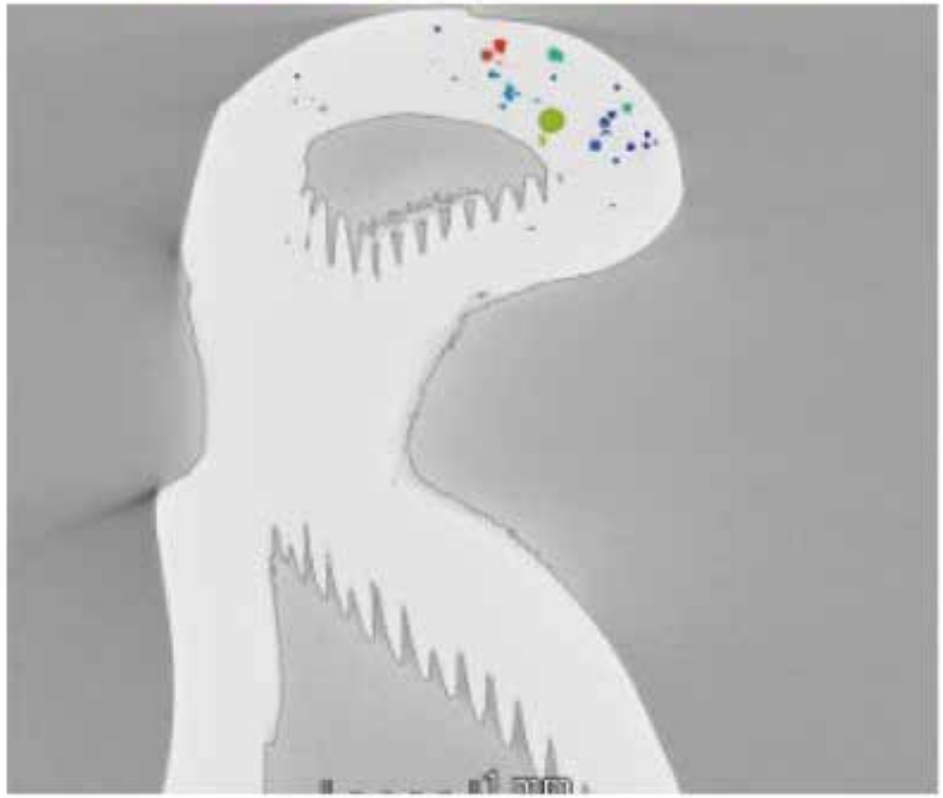
50 grooves, depth 0.2 mm



Tomographic Analysis
-Welded Ends of a Heat Pipe

Upper End

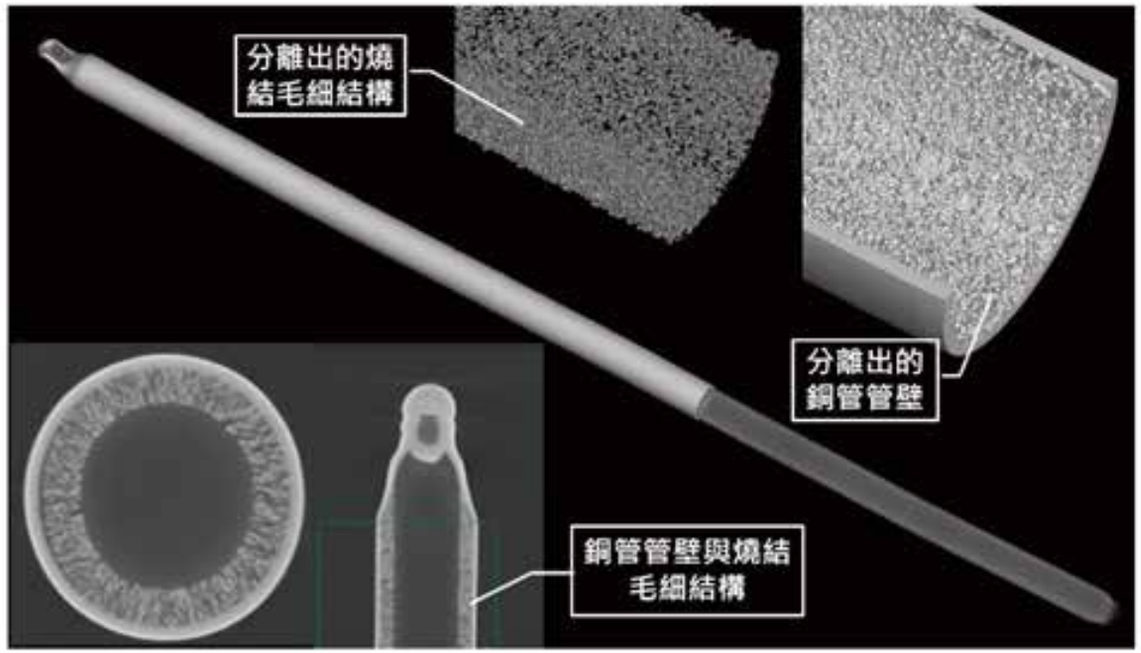
No porosity at the pressed part
There are a few tiny pores
at the welded part

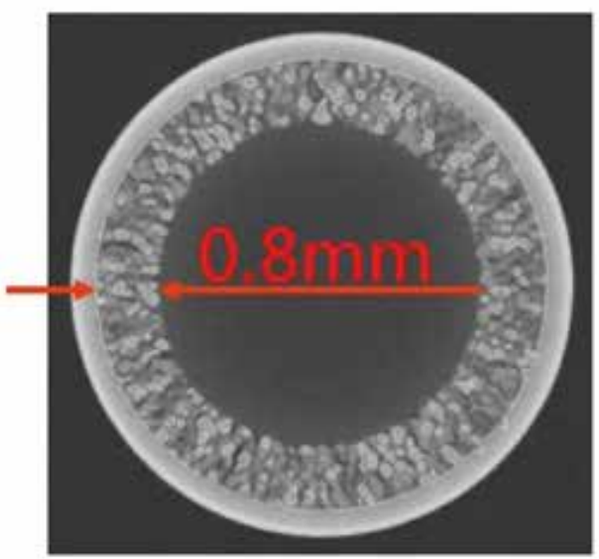


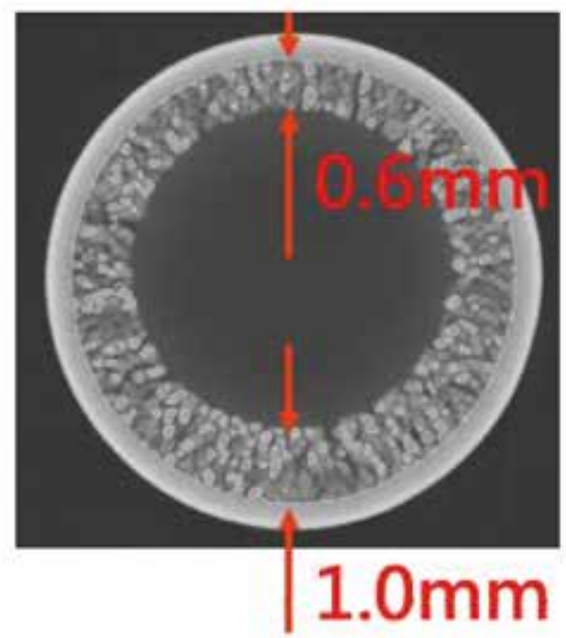
Lower End

There are a few tiny pores
at the welded part

Heat Pipe Sintered Structure







Heat Pipe tomography video

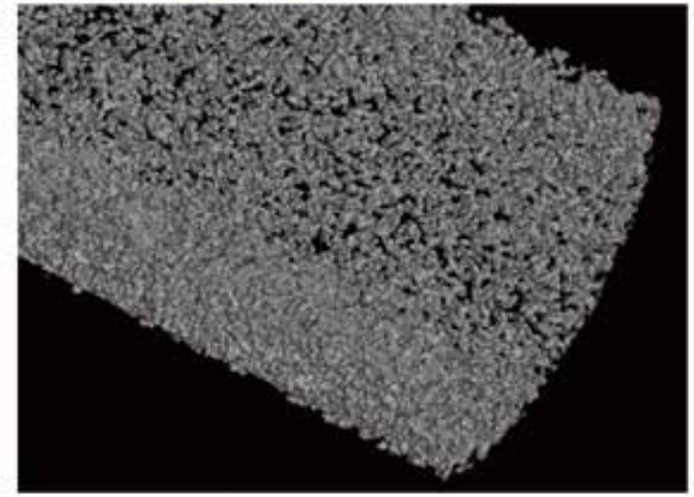
YouTube & Bilibili

https://youtu.be/K4nbbuAvj6g

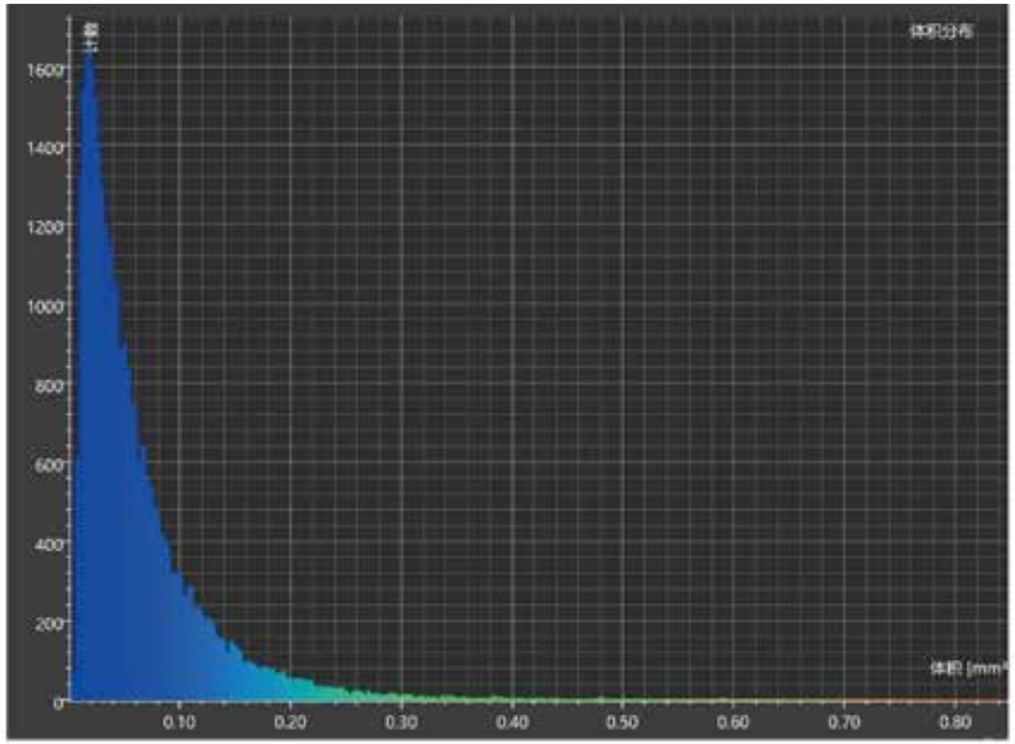
https://www.bilibili.com/video/BV1AT411V72i/?vd_source=5cb310a9f2f2961eb9fed59e48c6df07

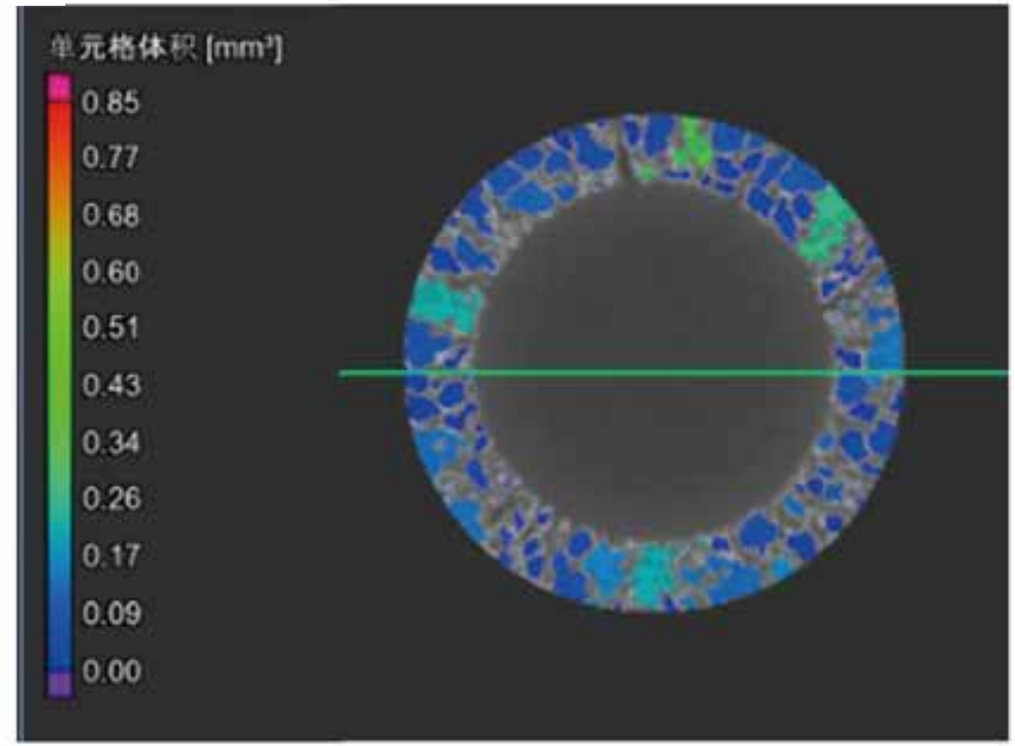
Sintered thickness distribution uniform area:0.8 mm
Unevenness 0.6-1.0 mm

Analysis of Pore Structure of Heat Pipe Sintering



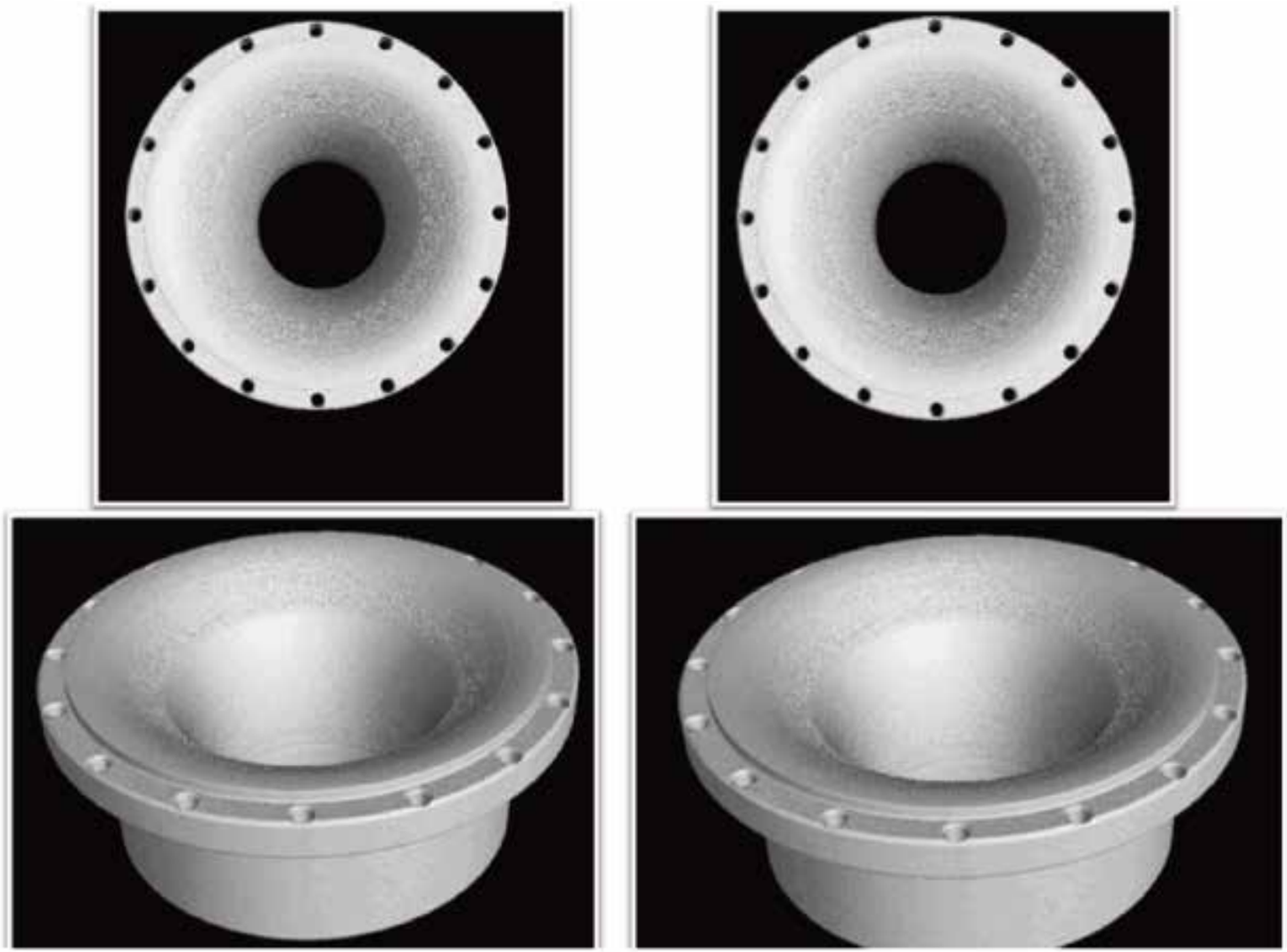
The volume of the sintered layer is 2173 mm^3.
After analysis, the total volume of the sintered material is 1844 mm^3 and the porosity is 15.1%.

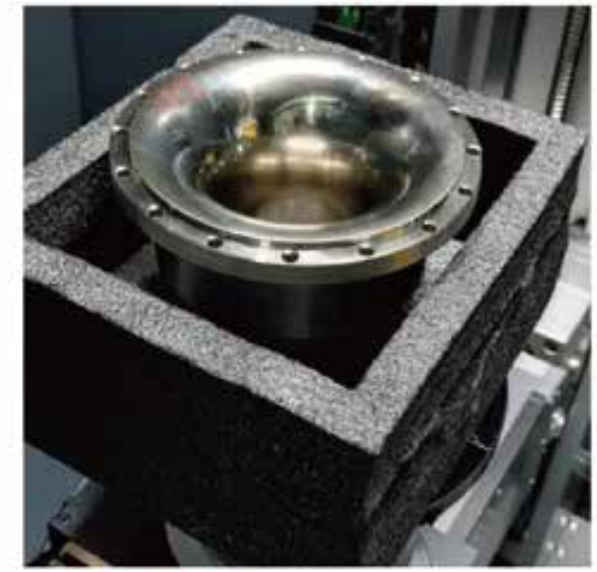




Nozzle Contour Profile Detection

Accuracy: 1 μm





- Nozzle diameter: Ø 53 mm
- Processing path:

$$\frac{x^2}{(35.26)^2}+\frac{y^2}{(52.87)^2}=1$$

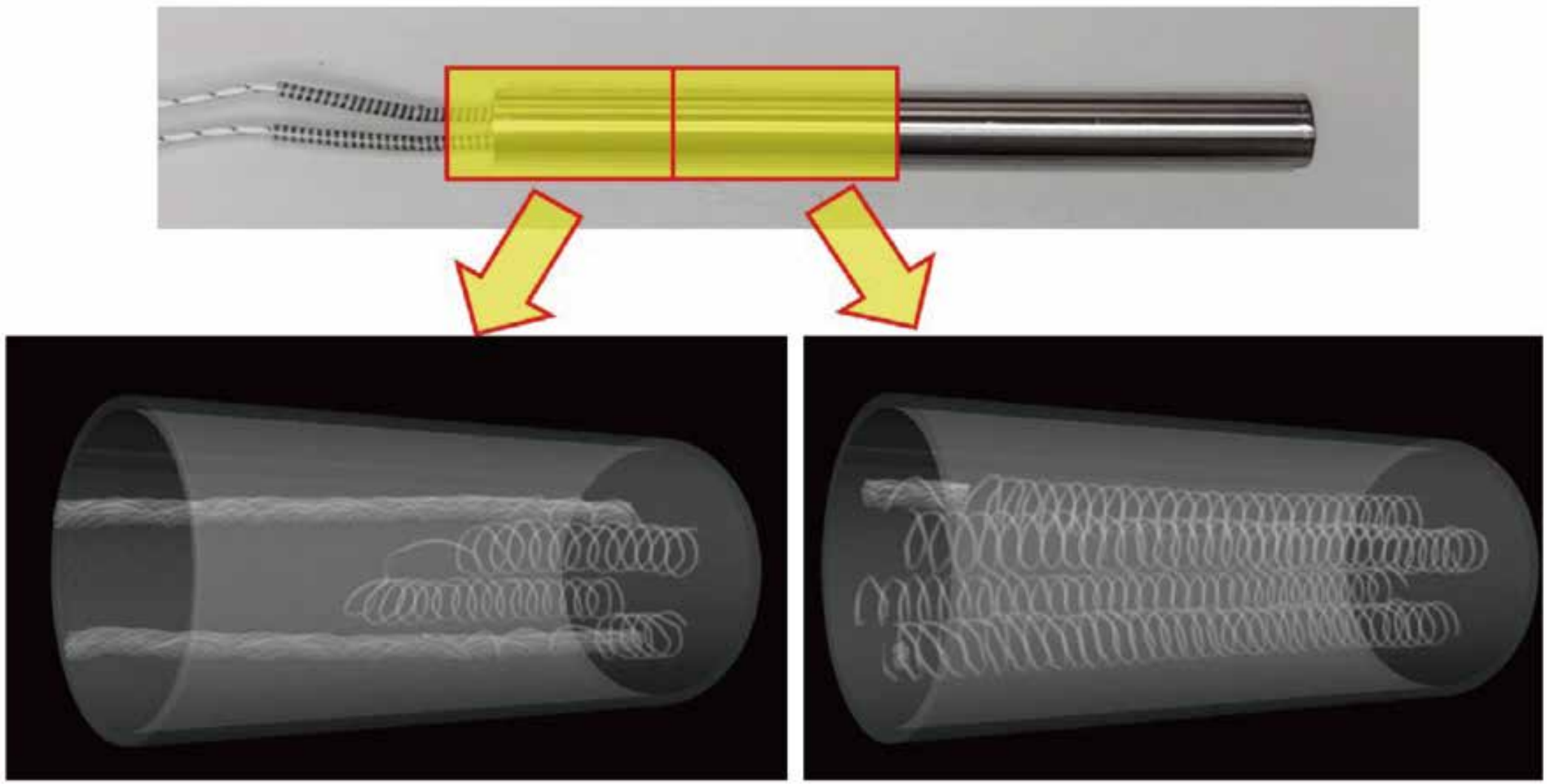
- CT test results:

$$\frac{x^2}{(35.292)^2}+\frac{y^2}{(53.077)^2}=1$$

- Maximum processing deviation rate:

0.39%

Structural Tomography of Heaters



H. Calibration and Test Laboratory.

Calibration lab:
Airflow rate, water flow rate, temperature,pressure, and mass

Testing lab:
Fan performance, Pump performance,
Thermal module thermal resistance performance,
HP thermal apparent conductivity,
VC apparent thermal conductivity,
CP thermal resistance, Boiler thermal resistance

- **Rack - level thermal performance test, including air-cooled, L-A ,L-L ,systems**
- **Immersion tank thermal performance test, including 1-P and 2-P systems**
- **Material Compatibility Testing**

Refer to page 52

TAF 3919 / ILAC-MRA Fan Performance Test Laboratory

I. 6 work stations

To See, To Trust - Lab 1

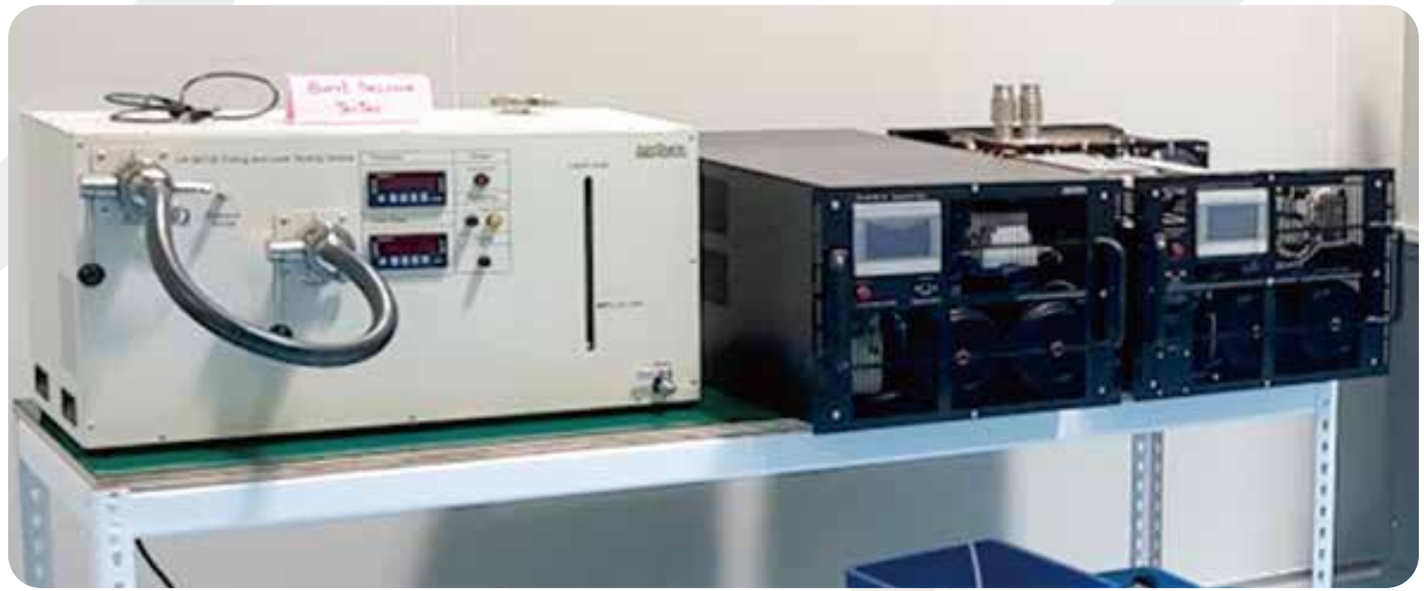
To See, To Trust - Lab 2

To See, To Trust - Lab 3

To See, To Trust - Lab 4

To See, To Trust - Lab 5

To See, To Trust - Lab 6



To See, To Trust - Lab 7

To See, To Trust - Lab 8

To see to trust – In-house factory

1. **All-in-One:**
   CNC machining, laser cutting, metal sheet processing, welding, painting, plumbing, HVAC, electrical distribution, PLC_PC control and software

2. **Efficient parts supply**

3. **Effective quality control**

To See, To Trust - Factory 1

To See, To Trust - Factory 2

Long Win's Clients

90% market share in ICT industry

The whole supply chain

1. Key component manufacturer
2. Brand technology company
3. System ODM & OEM company
4. Component and material supplier
5. Visionary End User

We are their vender & partner

Business Strategy

Research, design and test of thermal solutions in ICT industry

1. Keep our neutrality by providing advanced research apparatuses and technical services

2. Provide authorizations of advanced mass-production-related technology

3. Fundamental academic research

All Product & Technology for ICT chain of thermal

1. Airflow rate system- test & study
2. Servers and rack- thermal tests
3. T I M: Thermal property test & study
4. Cooler modules property test & study - heat sink, heat pipe, VC…
5. Liquid cooling: L-L & L-A CDU, components test & study
6. Immersion cooling: facilities-tank ,components test & study
7. Stiffness test: for thermal modules in a server
8. Chambers: Reliability tests

Vision for Products & Technology

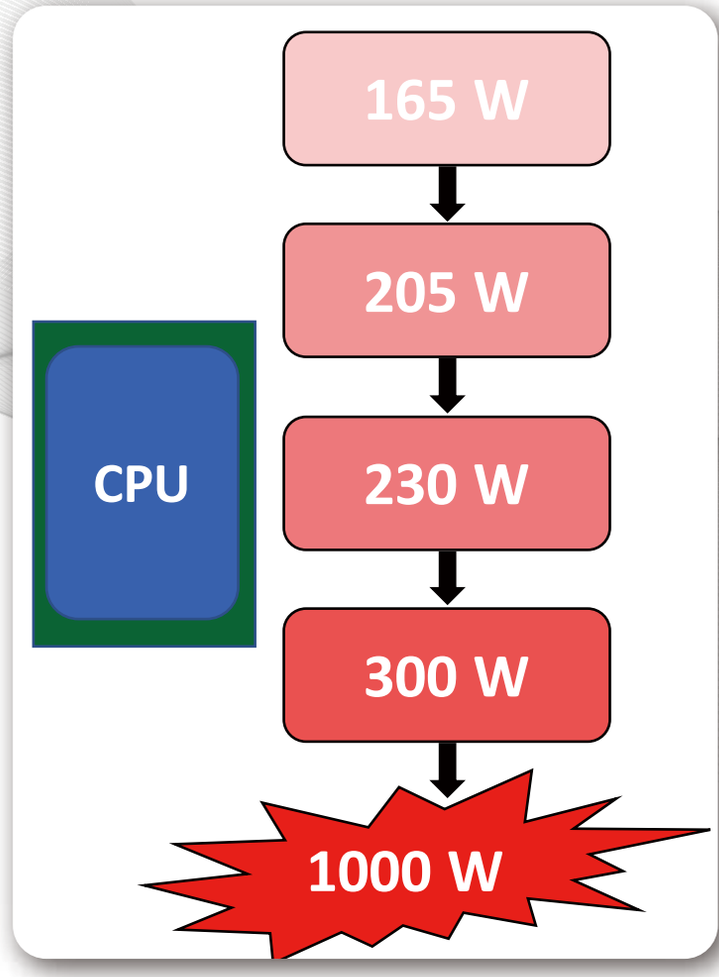
Short-Term and Medium-Term Commercial Strategy

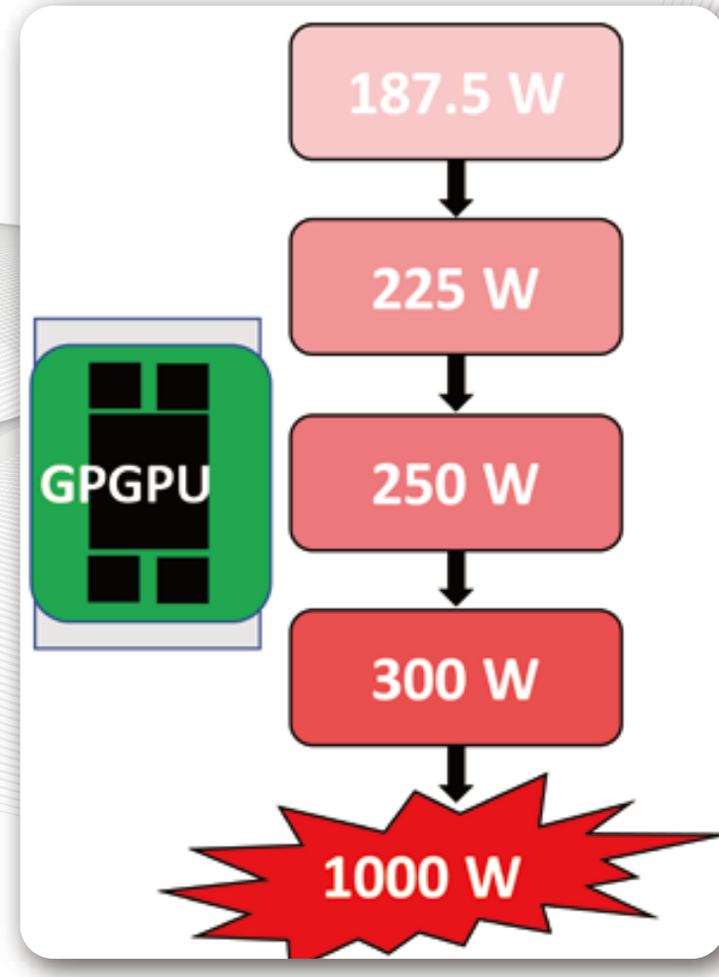
HPC of Data Center

Long Win has studied this emerging technology since 2016.

Background

In Data Centers, TDP is getting higher and higher





What can we apply next?

1. Closed-Loop Liquid Cooling !
2. Opened-Loop Liquid Cooling !
3. Two Phase Liquid Cooling !!!
4. Single phase Immersion Cooling ?
5. Two Phase Immersion Cooling ??

Long Win involves in all the projects above.

Advanced Thermal Solutions about Data Centers

1. Liquid Cooling Tester : >20 finished projects
2. Liquid – Air CDU and Rack : >16 finished projects / various types
3. Liquid – Liquid CDU and Rack : >8 finished projects / various types
4. Single-Phase Immersion POC : >10 finished projects / various types
5. Single-Phase Immersion Rack Level Tank : >10 finished projects / various types
6. Two-Phase Immersion POC : >10 finished projects / various types
7. Two-Phase Immersion Rack Level Tank :>2 finished projects / various types

Rack Level Performance & Reliability Test Chambers

Third-party Research and Validation Laboratories.

Rack Level Performance & Reliability Test Chamber

No	Type	Test Capacity & Test	Qty.
#1- #4	L-A Rack	15- 45°C/ 11,000 CFM Capacity:45 kW, 2Rack	4
#5- #6	L-L Rack	17- 45°C/ 100 LPM Capacity:100 kW, 2Rack	2
#7- #8	1-Phase / 2-Phase Immersion Cooling Tank	27- 45 / 100 LPM Capacity:100 kW, 1Tank 1.System performance test 2.PUE performance test 3.Heat dissipation test 4.Liquid dissipation rate test 5.Study on the distribution of working fluid vapor 6.Design of ventilation	2
#9	Pressure Tank	15- 45°C Atmospheric pressure 0.7-1.2 bar	1

Vision for Academics

Long-Term Knowledge Strategy

The Beauty of Flow

Article Published in Physics of Fluids

Cite as: POF 33 083607(2021)

doi: 10.1063/5.0056885

Published date: 2021/08/12

Title: **Source-like Patterns of Flow past a Circular Cylinder of Finite Span at Low Reynolds Numbers**

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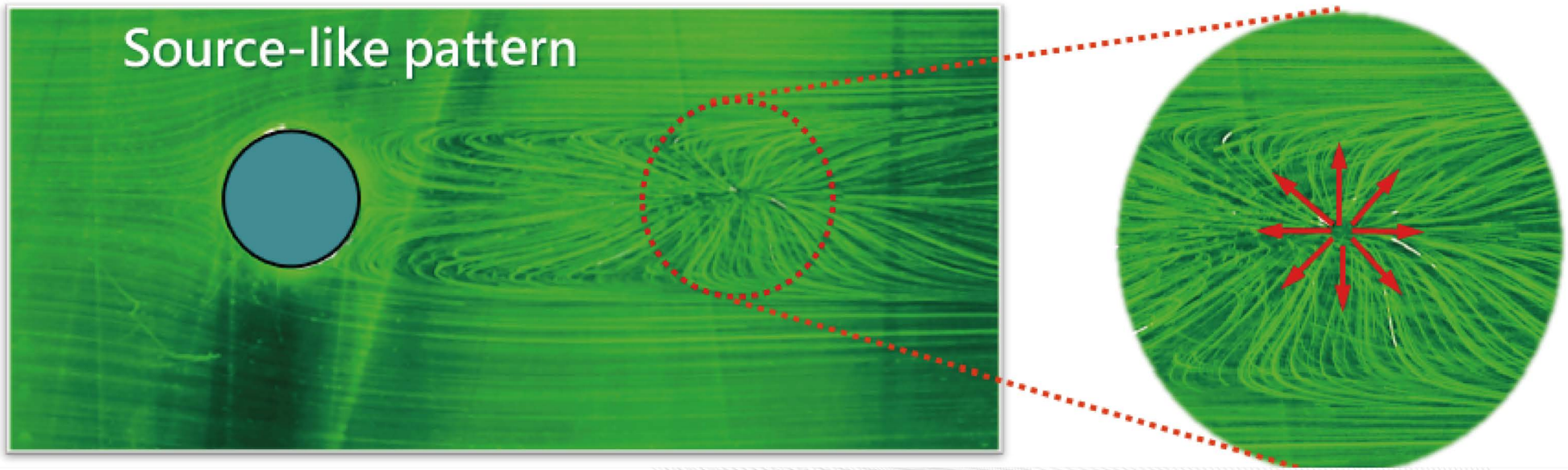
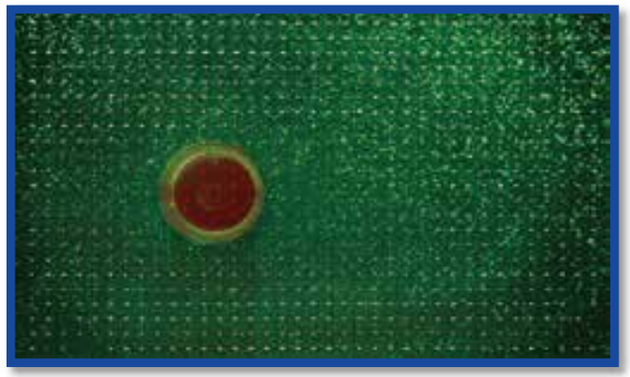
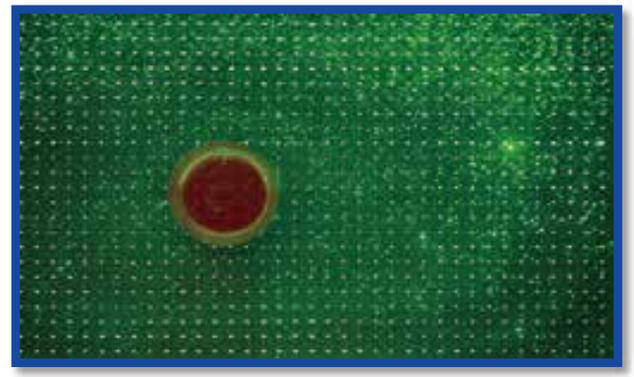


Digital Resolution - Velocity Fields

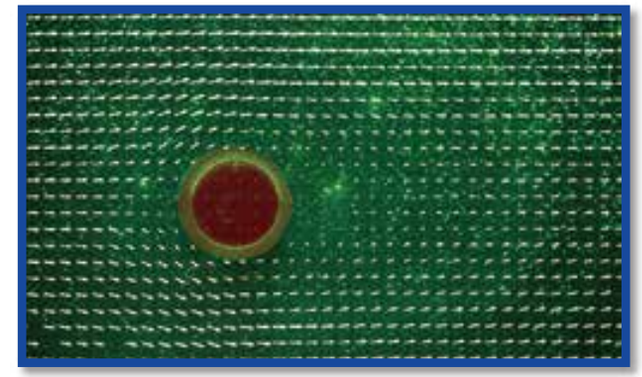
Re = 0.5, U = 0.01 m/s



Re = 1, U = 0.03 m/s

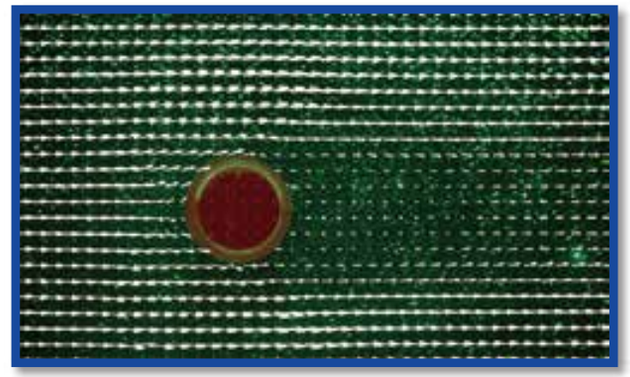


Re = 5, U = 0.15 m/s

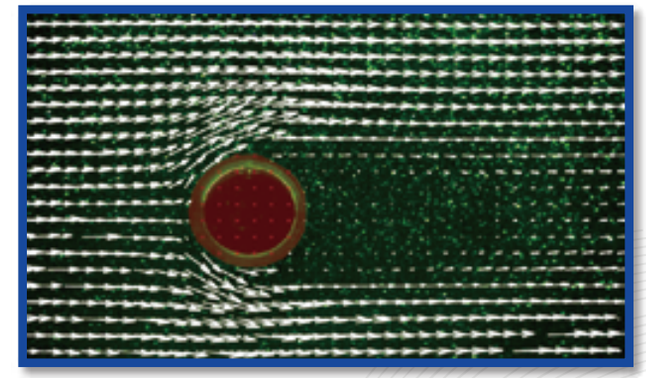


Re = 10, U = 0.3 m/s

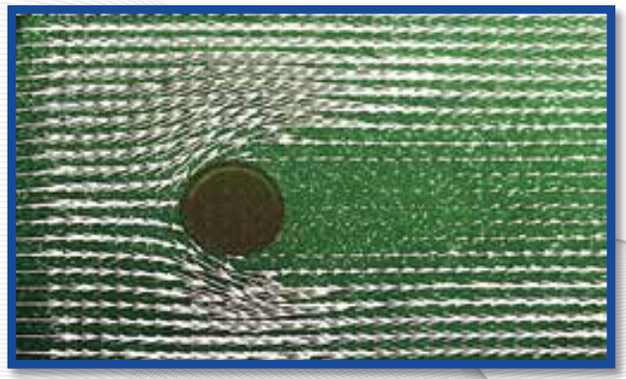
Re = 17, U = 0.42 m/s



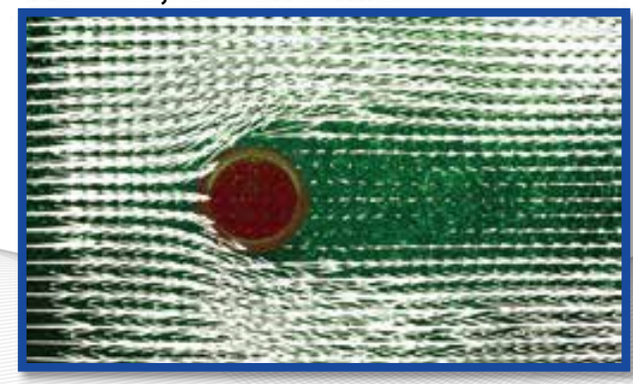
Re = 25, U = 0.6 m/s



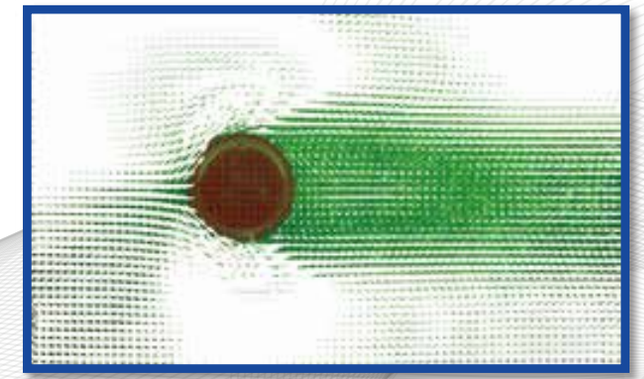
Re = 28, U = 0.68 m/s



Re = 30, U = 0.75 m/s

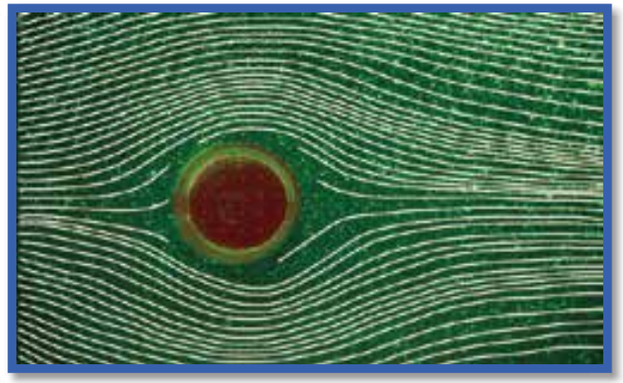


Re = 36, U = 0.9 m/s

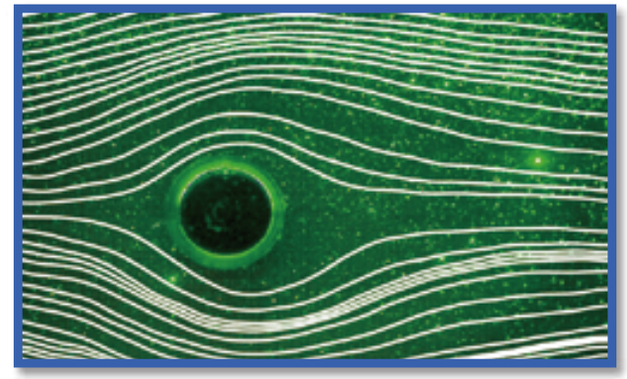


Digital Resolution - Streamlines

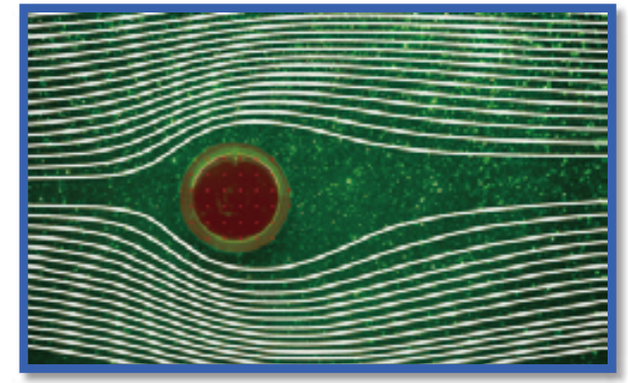
Re = 0.5, U = 0.01 m/s



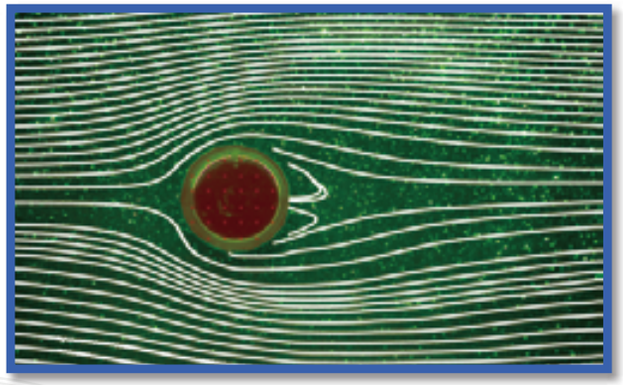
Re = 1, U = 0.03 m/s



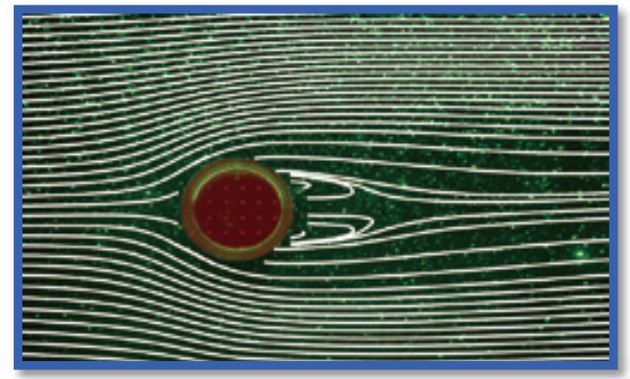
Re = 5, U = 0.15 m/s



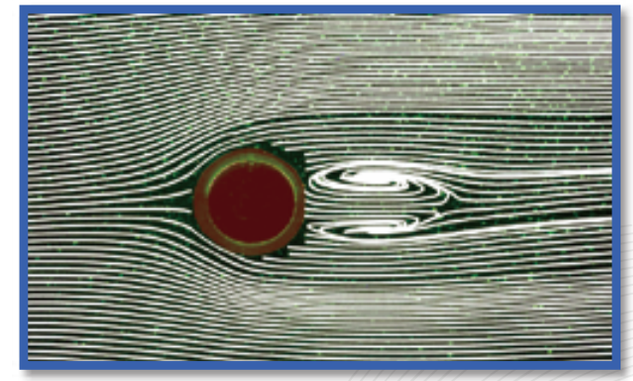
Re = 10, U = 0.3 m/s



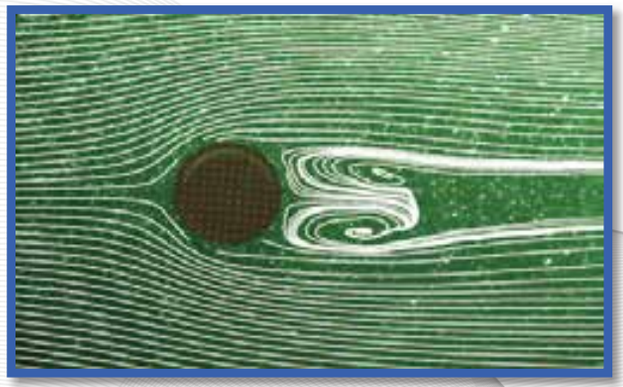
Re = 17, U = 0.42 m/s



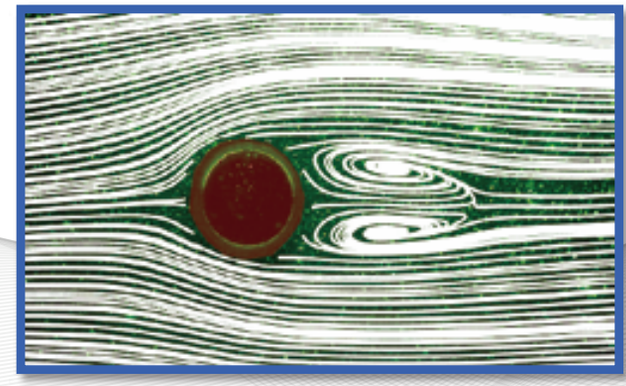
Re = 25, U = 0.6 m/s



Re = 28, U = 0.68 m/s

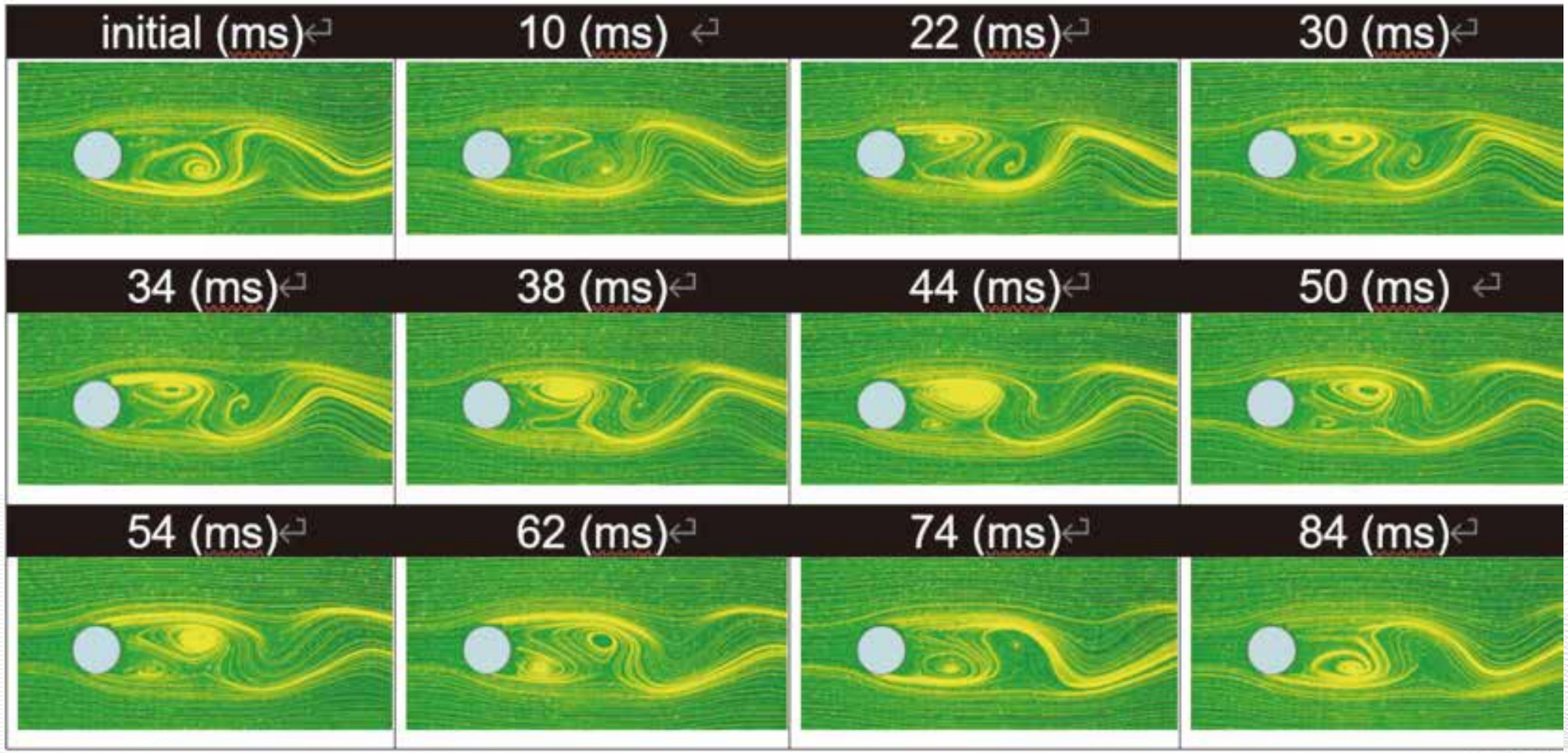


Re = 30, U = 0.75 m/s



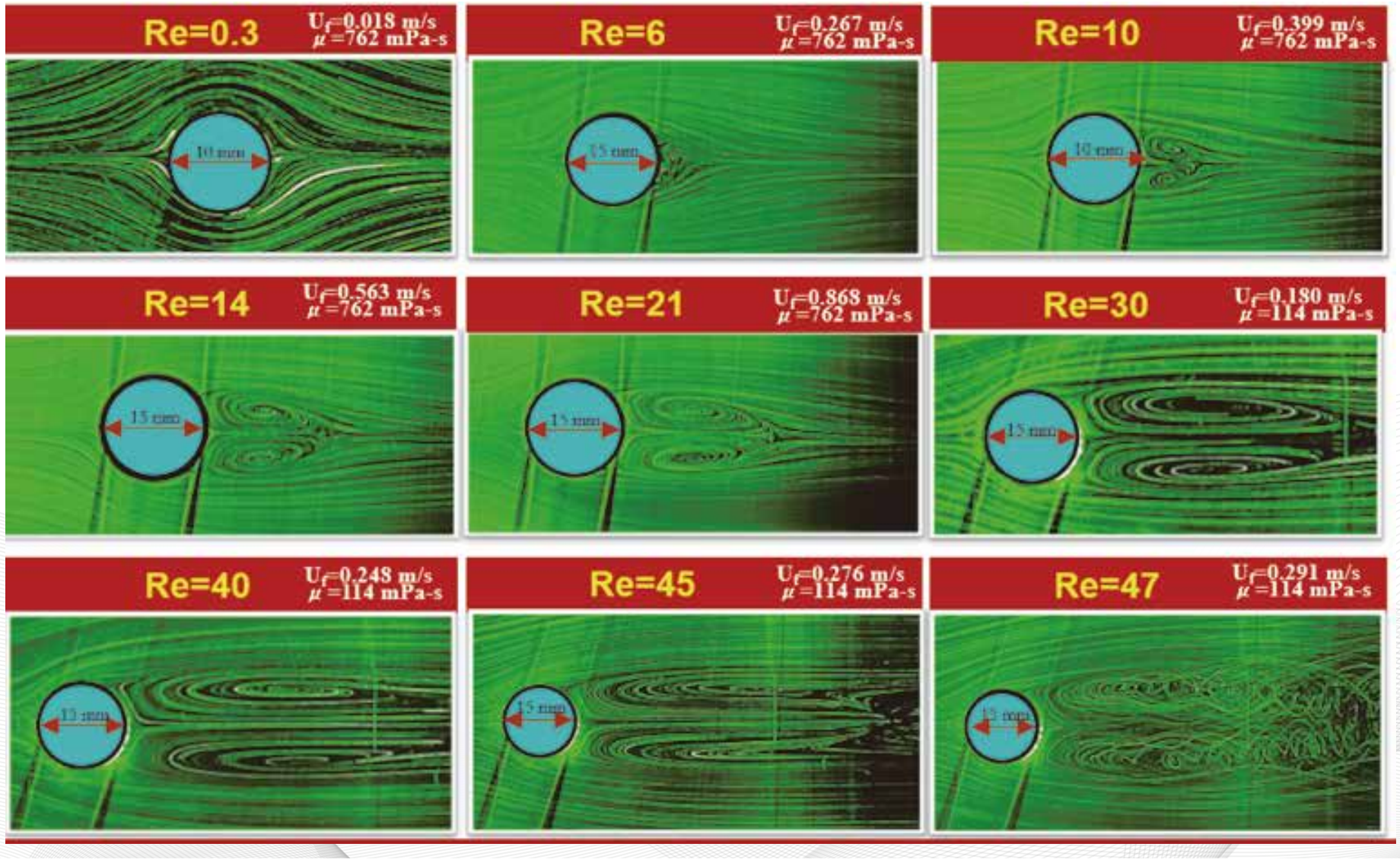
Re = 36, U = 0.9 m/s

Vortex shedding on a circular cylinder using PIV (Re=131)



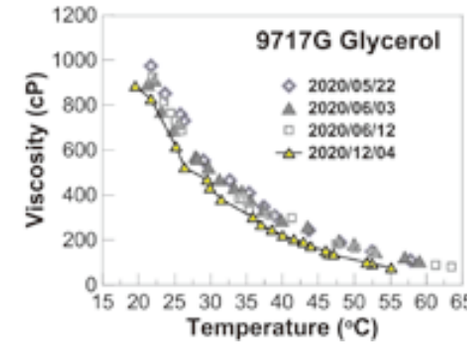
Streamlines of Flow past a Circular Cylinder of Low Reynolds Numbers

- Fluid: Glycerin - Density: 1235 kg/m^3 - Temperature 22 & 50 °C

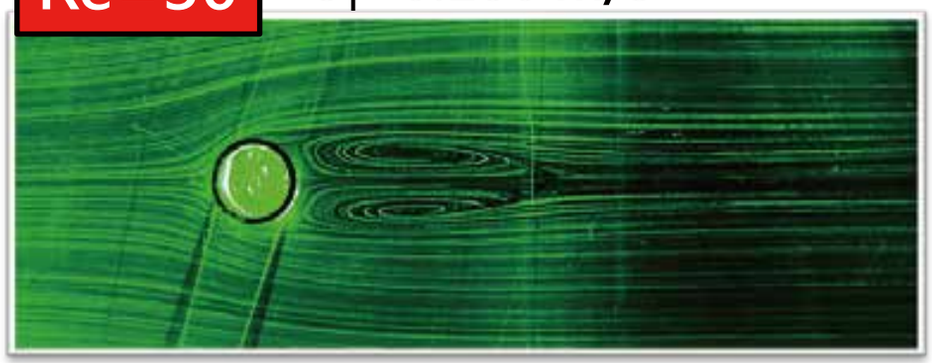


Critical Reynolds number

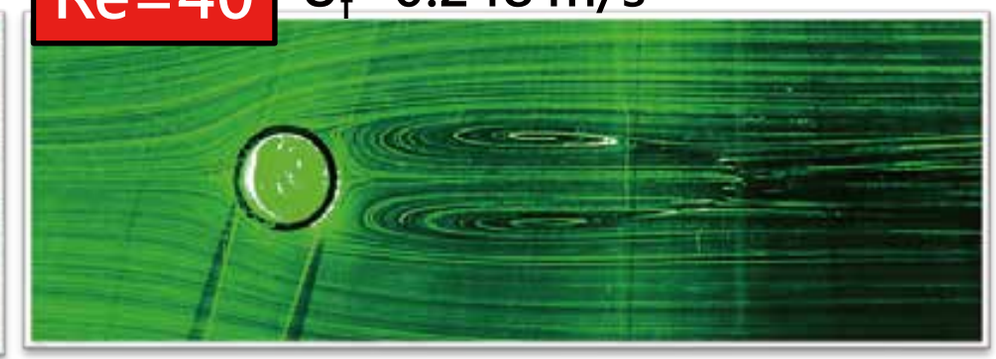
- Cylinder diameter: 15 mm
- Opening of butterfly valve : 2#
- density: 1235 kg/m^3
- dynamic viscosity: 114 mPa-s
- shutter: 13”
- aperture: f16
- ISO: 100



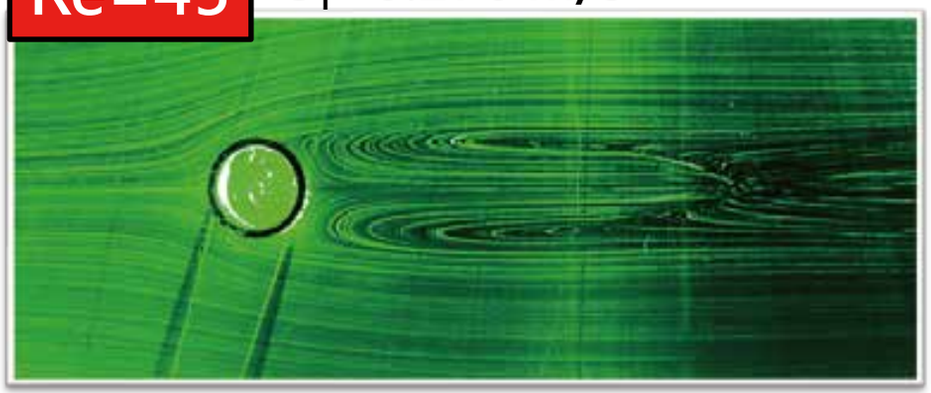
Re=30 U_f=0.180 m/s



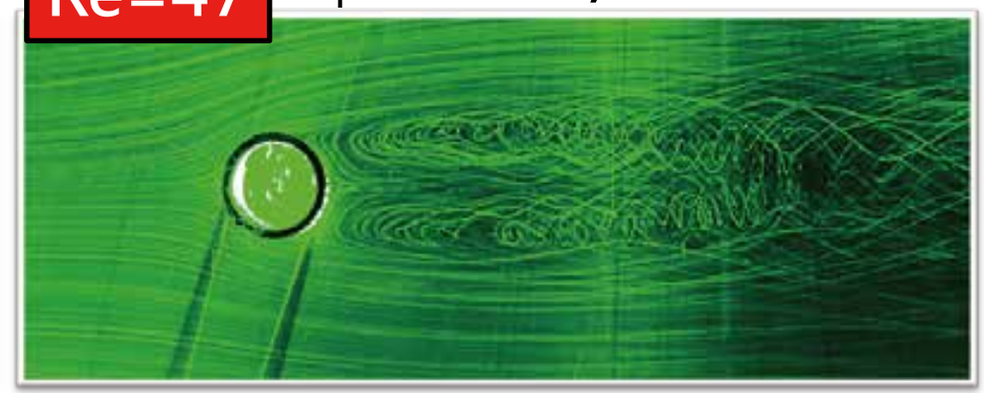
Re=40 U_f=0.248 m/s



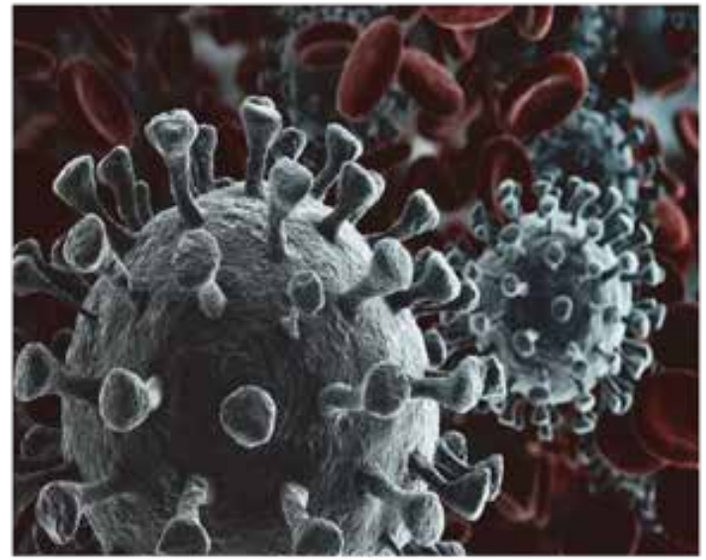
Re=45 U_f=0.276 m/s



Re=47 U_f=0.291 m/s



What you know determines what you see

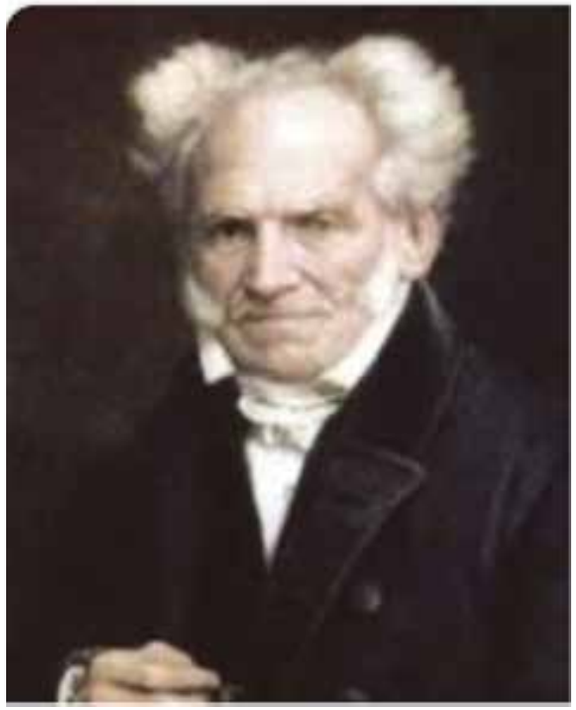


Do you use what you learned?

The knowledge you can use represents how competitive you are now.

How you give a judgement?

By instinct? Experiences? Or knowledge?



The Foresight
Arthur Schopenhauer

TALENT hits a target that no one else can hit;
Existed Demand

GENIUS hits a target that no one else can see.
Innovation, Creating Demand

The value of knowledge

A word before is worth two behind.

LongWin

Fundamental, Forward & First

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E-mail: longwin@longwin.com

URL:http://www.longwin.com

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