

## **Finding the needs of customer by the SN Matrix and TRIZ process**

- The functional approach for connecting methods and 7 solutions-

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1. About Olympus
2. Promotion of scientific methods in Olympus
3. QFD for connecting to TRIZ
4. What is the tool to realize the voice of engineer ?
5. Olympus original new SN Matrix
6. Creating the Seeds by expanding engineer's desire
7. Bringing out the Needs from the Seeds
8. The idea of realizing the functions to meet the Needs
9. Reaction of using SN matrix and logical tree of desire
10. Summary

# 1. About Olympus

## Medical Business



EVIS EUS Endoscopic Ultrasound Center  
EU-ME2 PREMIER PLUS



Established : October 12, 1919  
Head office : Shinjuku-ku, Tokyo, Japan  
Capital : ¥124,520 million (As of March 31, 2014)  
Consolidated net sales : ¥713,286 million  
(Fiscal Year Ended March 2014)  
Consolidated headcount : 30,702 (As of March 31, 2014)

## Imaging Business

## Scientific Solutions Business



OM-D E-M10



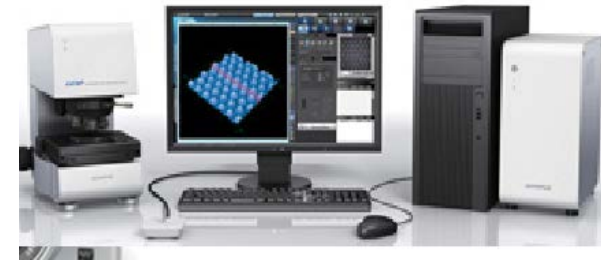
PEN Lite E-PL6



TG-3



DS-902



3D Measuring Laser Microscope  
LEXT OLS4100



IPLEX RX Industrial  
Videoscope

Flaw Detectors  
EPOCH 600



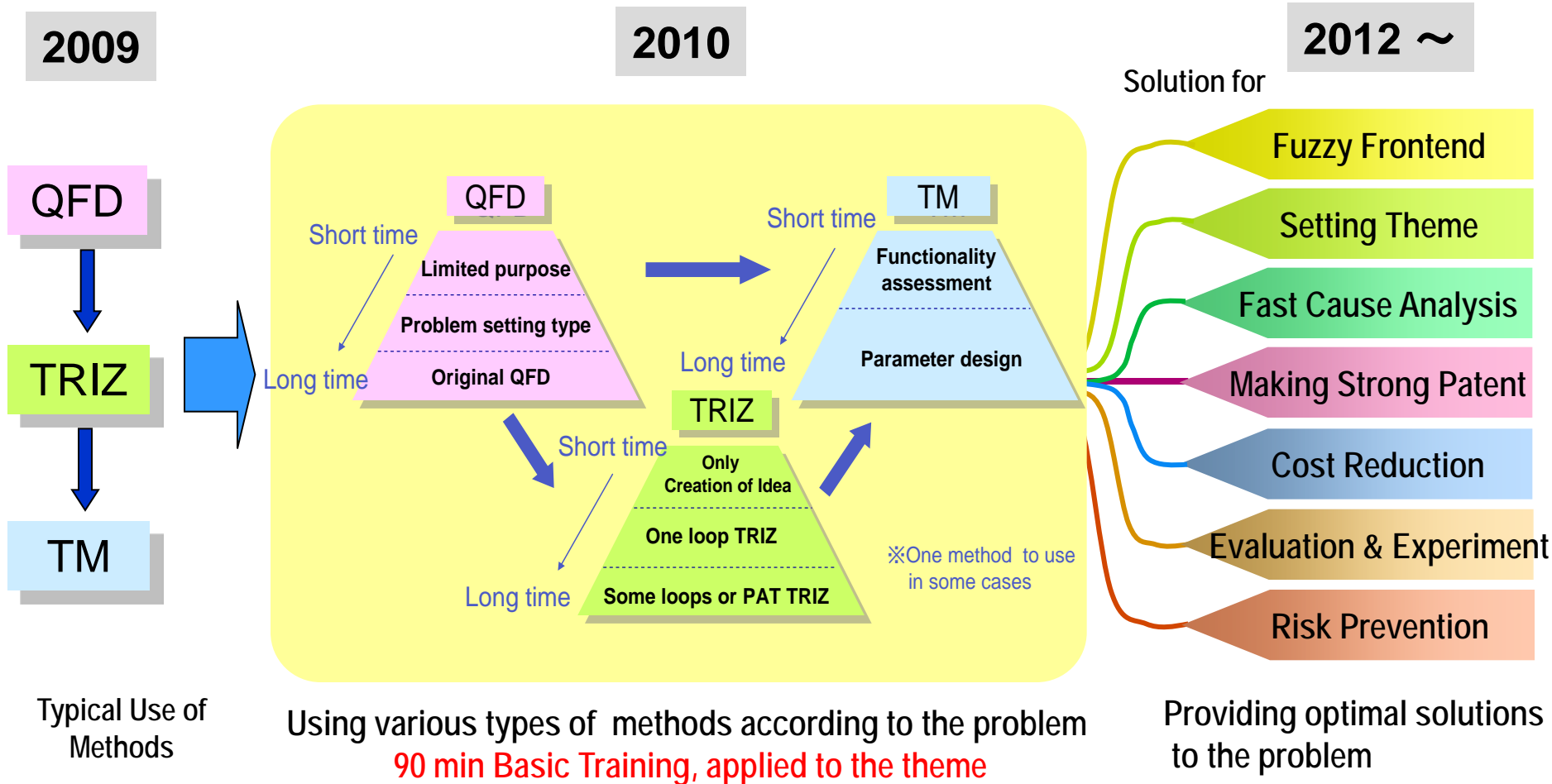
Surgical Energy Device THUNDERBEAT



EVIS LUCERA ELITE BRONCHOVIDEOSCOPE  
OLYMPUS BF-P290

# 2. Promotion of scientific methods in Olympus ( 1 )

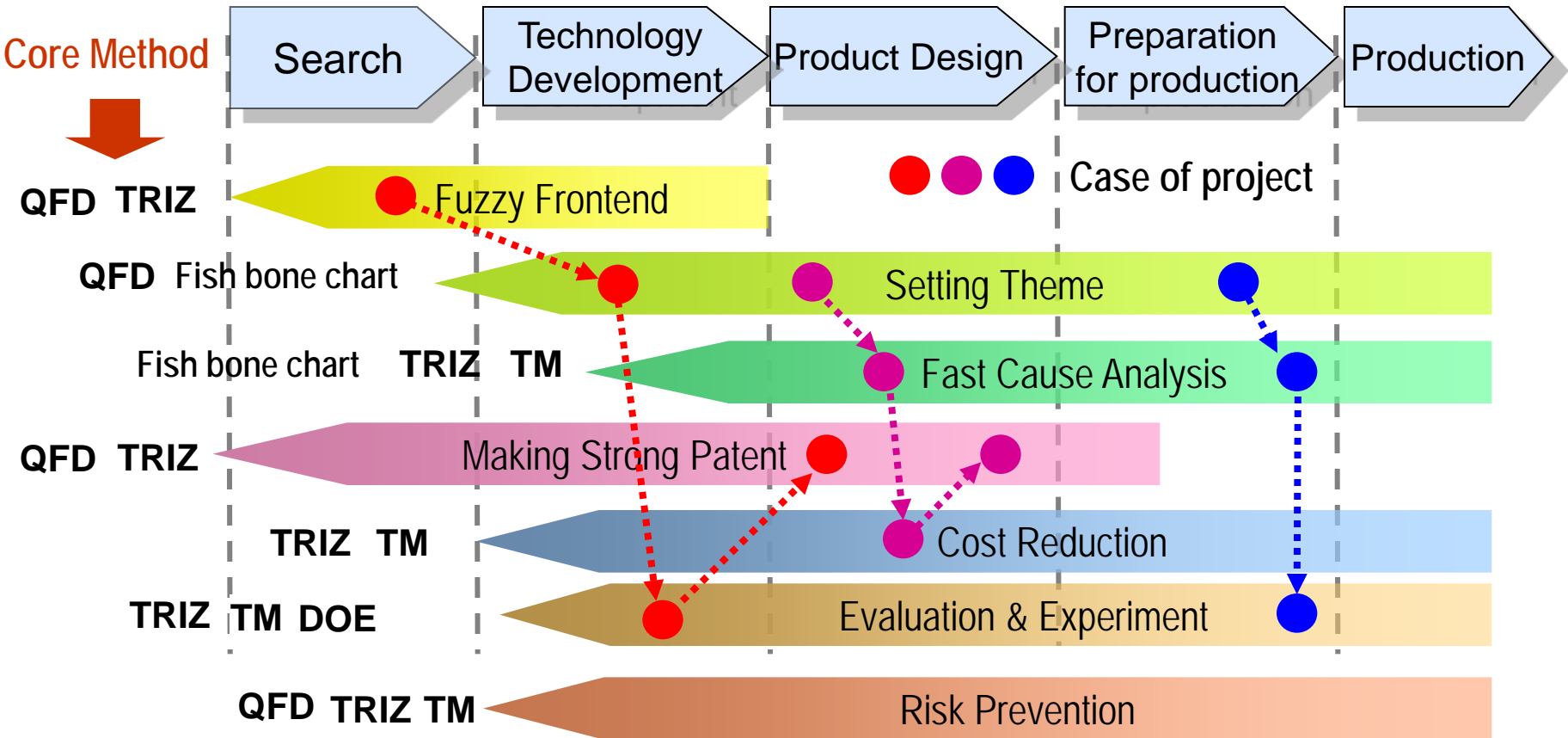
## Providing 7 solutions for the purpose



## 2. Promotion of scientific methods in Olympus ( 2 )

### The functions of system can connect 7 solutions and methods

Process is connected by the concept of function wherever you open the drawer

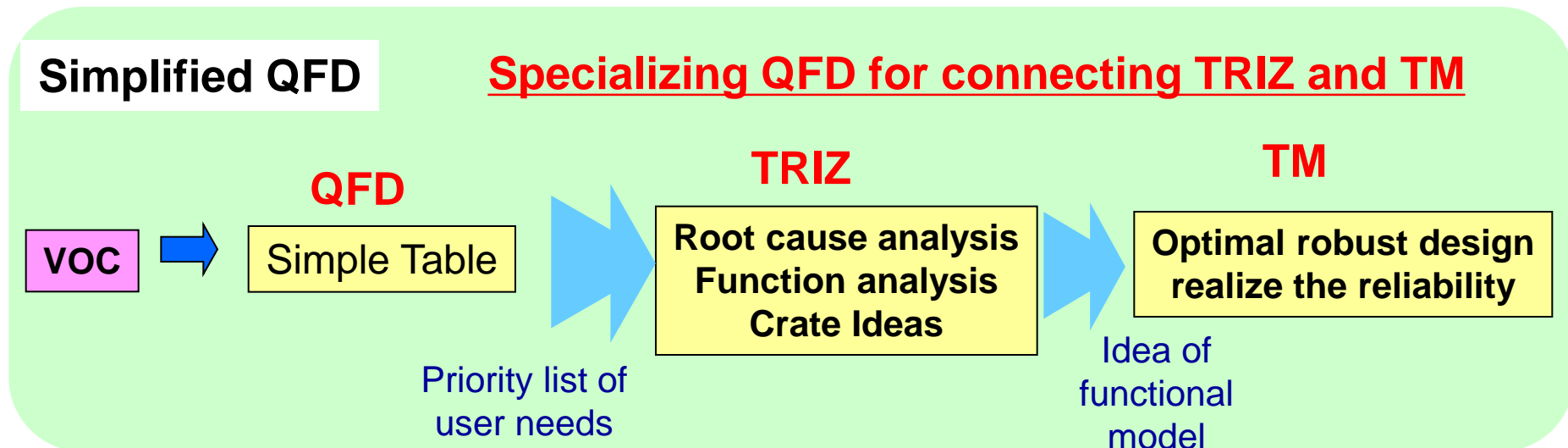
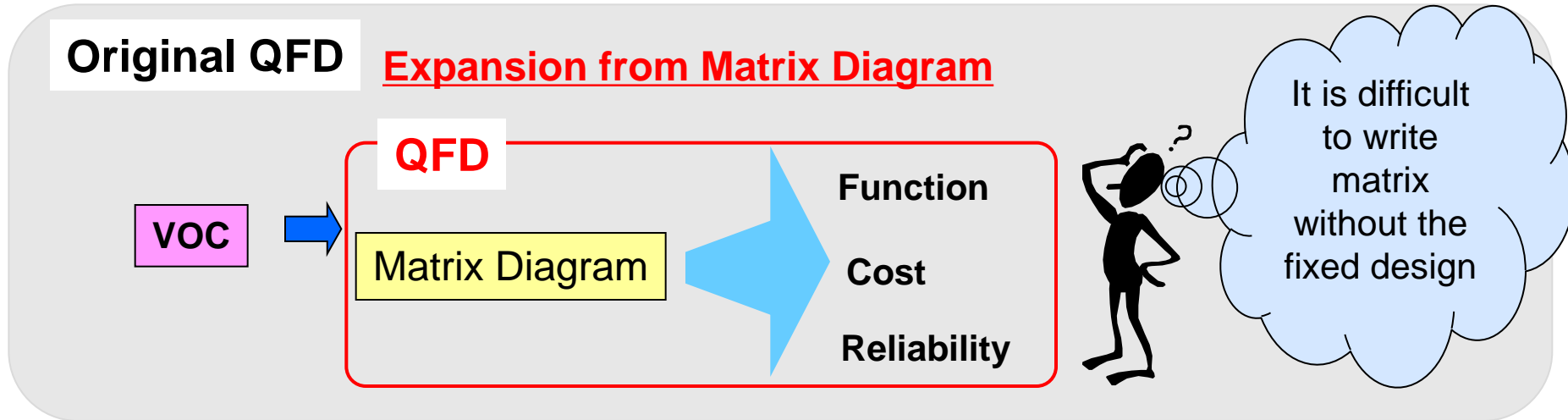


※ TRIZ includes Functional approach and Root cause analysis.

### 3. QFD for connecting to TRIZ ( 1 )

## The simplified QFD to determine the priority of user needs

(Reference to the paper of OLYMPUS in TRIZ Symposium 2011)



# 3. QFD for connecting to TRIZ ( 2 )

## Simplified QFD is not effective in the early development stage

### Voice of engineers in the field

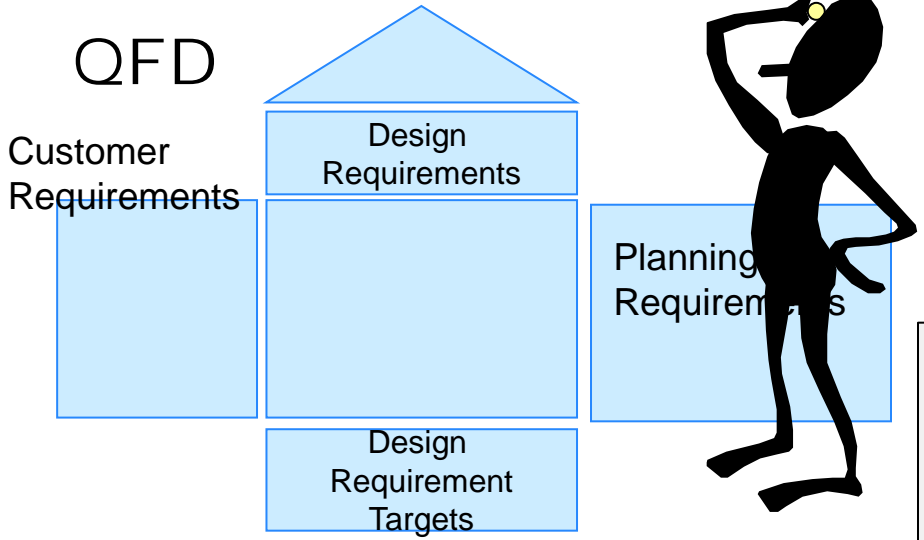
I want to use QFD.  
But QFD does not  
work well.

In the new product, it is impossible to grasp the customer requirements sufficiently

We want to make use of our own technology, but application of technology has not been fully investigated without detailed specs and drawings in the early stages of development.

It is very difficult to find the potential needs and attractive quality from only the voice of the customer.

Too much input, for example business strategy, technology strategy, market analysis, etc. confuse my head in the early stages of development.



# 4. What is the tool to realize the voice of engineer ?

## Tool for connecting the needs and seeds by the function will be effective

### Needs

Customer Needs are the level of functions and requests for the function system does not have



I want the pot to boil the water in 1 minute.

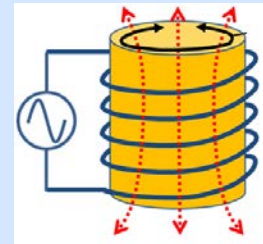
The specifications are the achievement level of the function

### Seeds

Technique is a means for realizing the functions

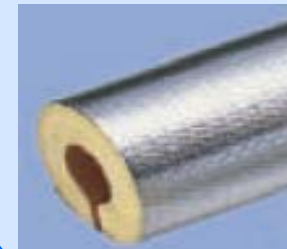
Means of heating

Heater , Induction heating

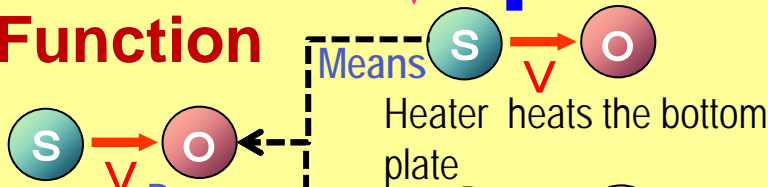


Means of keeping temperature

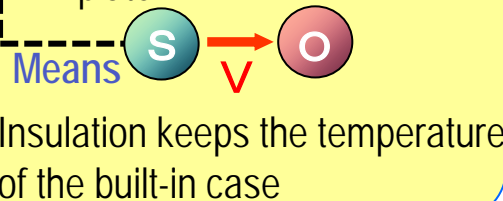
Wool insulation , Vacuum insulation



### Function



Purpose



Pot boils the water

Needs Driven

Seeds Driven

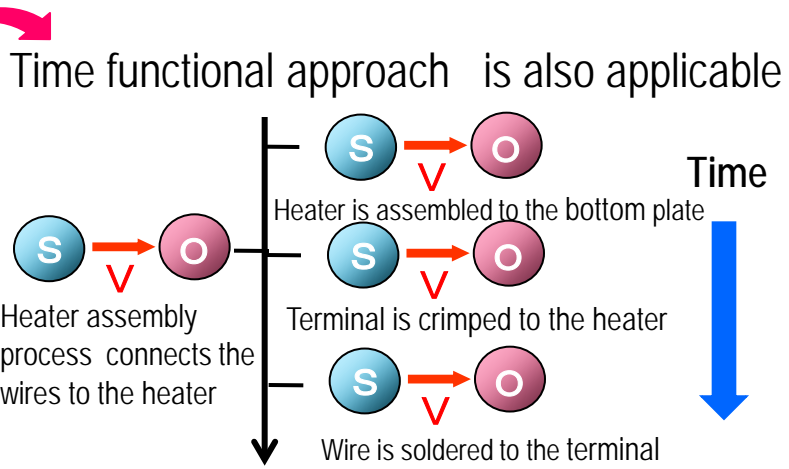
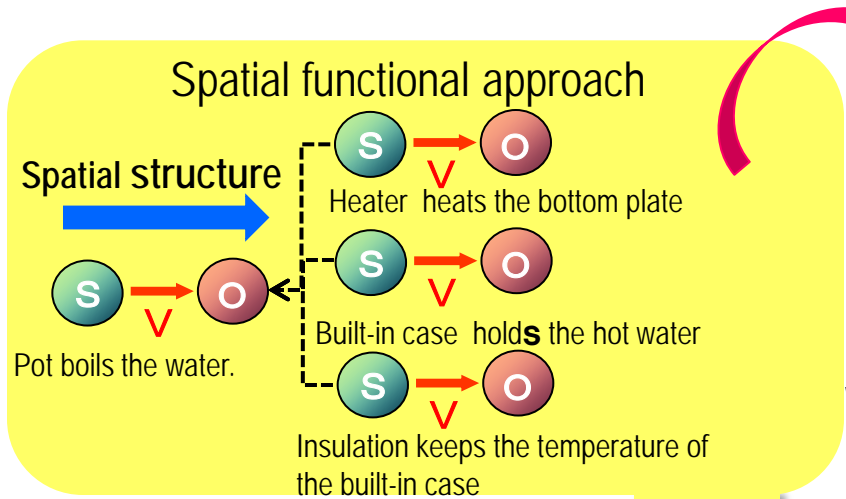
Seeds Driven

Needs Driven



# 5. Olympus original new SN Matrix

## Breaking down to the level and function from the view of time and space



Determining the priorities in the concept of the planning requirement of QFD

### Seeds

Our own technology is broken down into the level and function

Technology of competitors are searched for each function

### Needs

Hearing the Customer Needs based on the function

Functional Layer	Priority	Functional Level		Function (S+V+O)	Technology of competitors		Needs of Customer
		Target	Current level		Level	Detail	
	◎	1 min	2 min	Pot boils the water.	1.5 min	Technology X PAT No.	To boil the water in 1 min.
				Water heats ...			

## 6. Creating the Seeds by expanding engineer's desire ( 1 )

### Searching the Needs by expanding the Seeds from desire

Idea and research of technology by expanding the desire, and focusing

Investigation of what you want to do (by Logical tree of desire and Goldfire\*)

Clarification  
of Seeds

Expanding the seeds from desire (Free thinking by **TRIZ**)

Focusing the technology to affinity with the strategy

Finding virtual the Needs for the focused Seeds ,  
research, and verification

Clarification  
of Needs

Finding the virtual Needs by the Seeds Needs Matrix

Proposal of virtual Needs to the customer and hearing the voice of customer

Verification of Needs (Questionnaire survey, Virtual catalog survey)

Clarification  
of Seeds

Technology development that meets the Needs

# 6. Creating the Seeds by expanding engineer's desire ( 2 )

## Original new " Logic tree of desire" for expanding the technology seeds

Expand our technology to upstream (Deployment of applications ) and downstream (Deployment of means) by using the logic tree of desire. And survey results and ideas are added to the logic tree of desire .

**Remove the psychological inertia of engineers by TRIZ !**

**Deployment of applications :** TRIZ 9-Window method, Effects

**Deployment of means :** TRIZ Functional approach + Effects

### OLYMPUS Original "Logic tree of desire"

Examples of laser processing

**Deployment of applications**

**Deployment of applications**

Adjustment control of the microscope optics

Drive control of the medical optics

Control of the production facilities of the camera

High-precision position control

High-efficiency power control

High-precision optical system

**High-precision Laser processing**

**Deployment of means**

Parts processing of medical equipment

Surface treatment of camera parts

Parts processing of the microscope

# 6. Creation of Seeds by expanding engineer's desire ( 3 )

## Deployment of applications : Technical survey based on the function ( TRIZ Effects)

Multifaceted information in "Knowledge Navigator" stimulate the idea of engineers

Finding of the application of laser annealing

Searching for "Laser anneal" by Goldfire \*

Various information about the surface annealing are found

Information by the search lead to new ideas.

The screenshot shows the Goldfire 'Knowledge Navigator' interface with the search query 'レーザーでアニールする' (Annealing with laser). The search results are organized into eight panels:

- Definition:** Lists terms like '180度以上の研究のための典型的...' (2), 'シリコン再結晶方法' (2), 'クリスタル粒を持つ多結晶の半...' (1), '電子デバイス作製内の技術' (1), '技術の部' (1), '薄膜層のアニールの技術' (1), and '組み合わせ材料内の低い多結...' (1).
- Detailed terms:** Lists terms like 'レーザーアニール' (6), 'レーザーアニール処理' (5), 'レーザー熱アニール' (4), '局所アニール' (4), 'レーザーアニールリング' (4), 'レーザーアニール過程' (4), and 'フェムトアニール' (2).
- Concept:** Lists terms like 'アニールの方法' (29), 'アニール過程' (19), 'アニールステップ' (18), '低温アニール段階' (17), 'アニール治療' (16), 'アニール効果' (15), and 'アニール利田光エネII.ゼー' (15).
- Advantages:** Lists terms like '結晶化度の改善' (10), 'Se層を通じる伝送の改善' (3), '良い局所加熱' (2), '高温過程内の有効' (1), 'トラックの側の上の磁性膜の...' (1), 'どうとどこeposited状態内の原...' (1), and '蒸着時の半品質の改善' (1).
- Disadvantages:** Lists terms like '伝送...' (2).
- Applications:** Lists terms like 'N+エミッタ領域の形成' (3), 'P+エミッタ領域の形成' (3), '結晶化の方法として' (1), 'Zn拡散を行って活性層の共...' (1), '粒度の拡大' (1), 'シリコン層に変える' (1), '軟容剤に平らにする' (1), '高温過程' (1), and 'laserノットによる過渡アニ...' (1).
- Methods:** Lists terms like '構成' (5), 'ステップの介在物' (5), '半導体の斜視図の取り付け' (4), 'トータルエネルギーが出力の...' (3), '通過後にレーザービームの非...' (3), '分割したビームで形成するの...' (3), 'レーザー発振器から射出したレ...' (3), '一方向の走査' (2), and 'レーザーが絶縁層を透過し発光...' (2).
- Conditions:** Lists terms like 'レーザーエネルギー密度' (9), '温度' (5), '19.98mmにレーザービームピッ...' (4), 'レーザーエネルギー' (4), 'レーザーエネルギー密度' (4), 'ガラス基板の上のポリシリコ...' (3), '低いレーザー力' (3), '低いレーザーエネルギー' (3), and '低いレーザーフルエンス' (3).

"Knowledge Navigator" of Goldfire\*

\* Goldfire : Innovation support software Invention Machine Corporation under IHS

# 6. Creation of Seeds by expanding engineer's desire ( 4 )

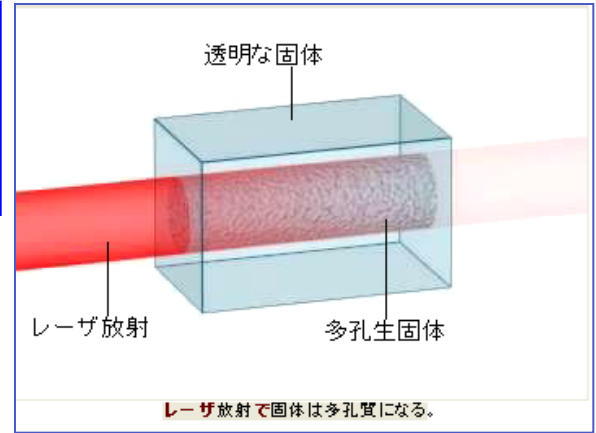
## Deployment of applications : Idea of using TRIZ Effects based on function

Finding the application for **laser annealing** micro-region of the metal to 500 °C over

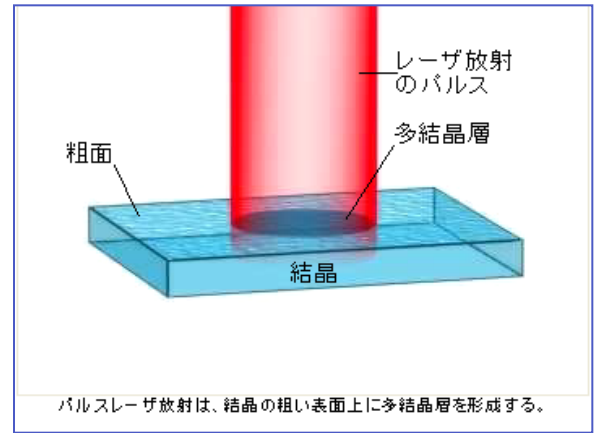


Using TRIZ Effects of "Laser annealing" by Goldfire

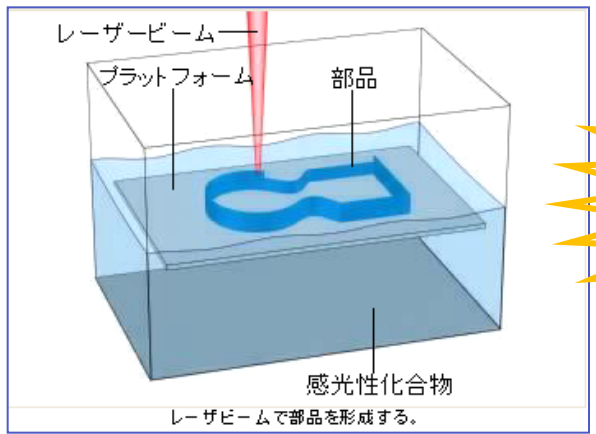
I found the application to eliminate surface defects as well as annealing !



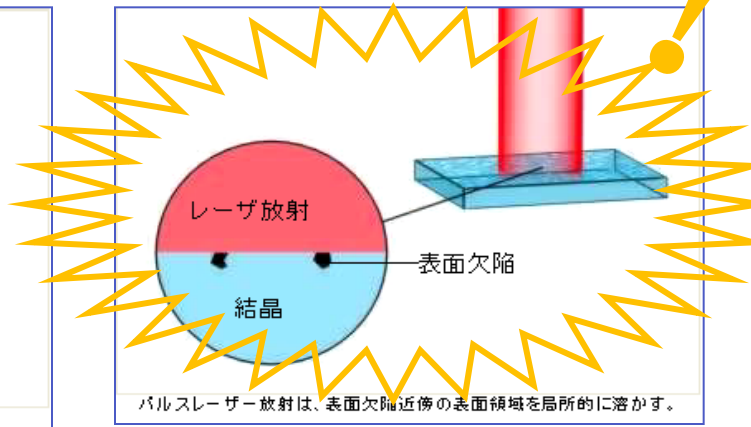
Making porous transparent solid



Generating a polycrystalline



Forming a part



Melting the surface defect

# 6. Creation of Seeds by expanding engineer's desire ( 5 )

## Deployment of applications : Technology forecast by TRIZ 9-Window method

Upper layer corresponds to infrastructure products and lower layer corresponds to the element technology and parts.

### Virtual case of medical device

	Past six years ago	Present	Future after 3 years
Upper Layer	Adopting a special shape to key parts of the medical device	Miniaturization of key components due to downsizing of the medical device	Change of sterilization process requires high durability in key parts
Our own Technology	Introduction of technology for cutting of metal with a laser	Drilling and welding technology of micro region of metal with a laser	?
Lower Layer	He-Ne, Ar, YAG Laser	Multifunction machine in combination of CO2 laser	Nanofabrication technology by femtosecond laser pulse

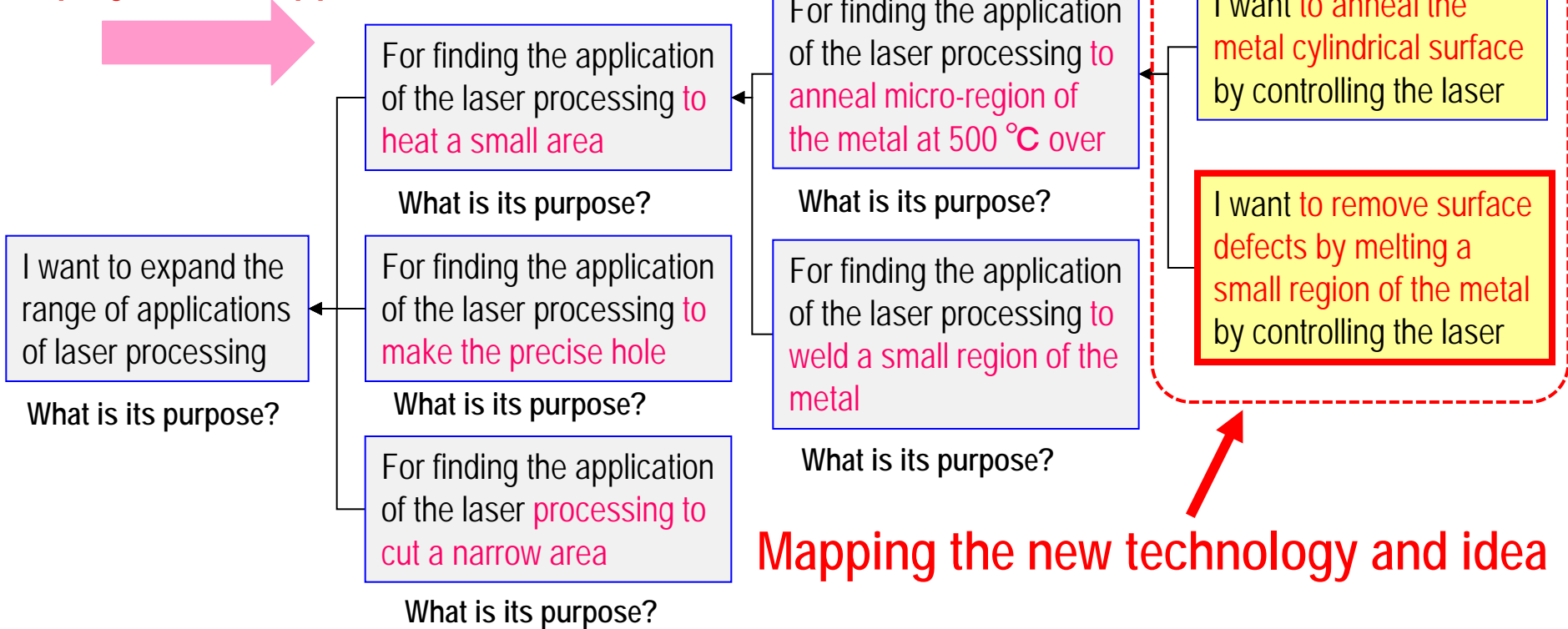
*What technology do you want when you are sandwiched between the upper and lower of layer?*

# 6. Creation of Seeds by expanding engineer's desire ( 6 )

## Mapping the new technology and idea on the Logic tree of desire

Positioning on the Logic tree of desire can prevent the unregulated divergence of technology, and control the direction and grain size of ideas and information.

### Deployment of applications

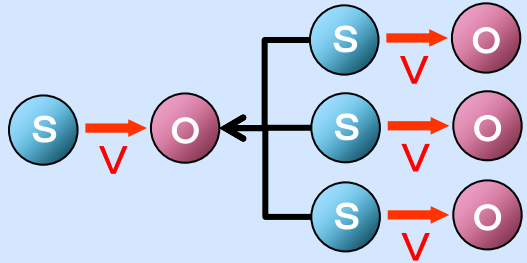


# 7. Bringing out the Needs from the Seeds ( 1 )

## Focusing the technology to affinity with the strategy, and finding the needs by SN matrix

**Step 1** **Matching with the strategy of our company**  
**Narrowing the technology** ( 1 ) Taking advantage of the my company's strengths  
 ( 2 ) Avoiding the strong technology area of competitors

**Step 2**  
**Functional expression**



**Step 3**  
**Listening to the voice of customer**

Do you want how much functional level?



### SN Matrix

Functional Layer	Priority	Functional Level		Function (S+V+O)	Competitor 's Technology		Voice of Customer
		Target	Current level		Level	Contents	
	◎	1 min	2 min	Pot heats the water	1.5 min	□ □ PAT No.○○	boil in 1 minute
				The Heater ...			



# 7. Bringing out the Needs from the Seeds ( 2 )

The technological seeds actualize the potential needs (attractive quality)



It is possible to provide the unexpected level of the function

- ① Strengthening of basic functions
- ② Reducing side effects

**Keywords for providing the level above the expected**

- ① The basic function outstandingly high
- ② Reduction of side effects far more than expected
- ③ Functional level only for a particular user
- ④ The function with a very high degree of freedom
- ⑤ The extremely simple operation
- ⑥ The design that gives great impression (Color, shape)

Desire (Function + Level)      Realization model

I hope the pot to supply high temperature hot water at any time

I hope the pot to boil the water in 1 min.

I hope the pot to boil the water in 30 second with power consumption of conventional level or less.

The Pot with a function to keep the temperature

The Pot to boil water at the moment

?



**Providing excitement to the customer by the unexpected achievement level and adding new function**

# 8. The idea of realizing the functions to meet the Needs

## The idea for realizing the focused functions by using TRIZ (Type of fulfilling the desire)

Realizing by the different means without involvement in the conventional system

### Example of Pot

I hope the pot to **boil the water in 1 min**

**Desire**



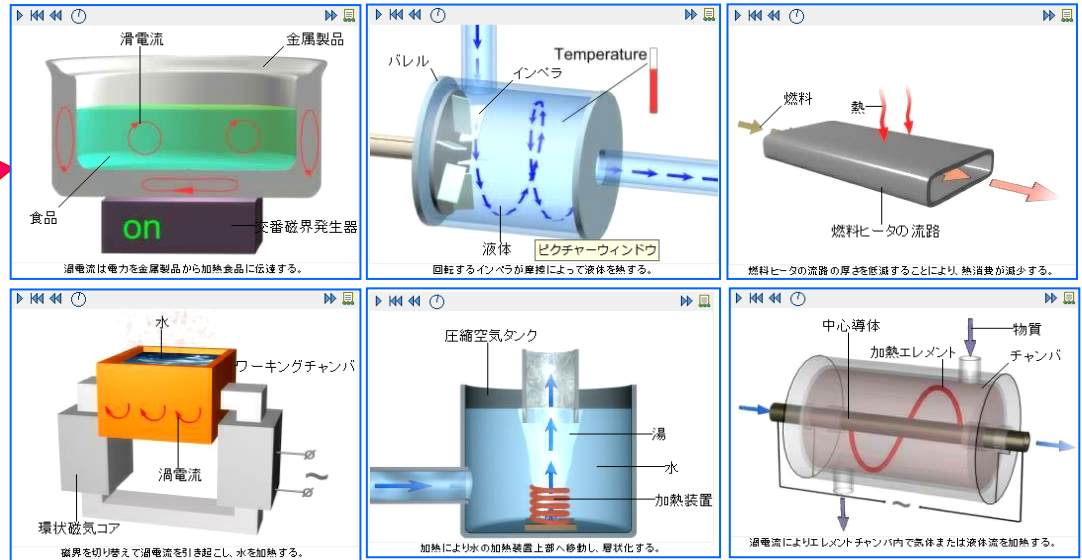
Heater unit to **heat efficiently built-in case** to  $\bigcirc$  °C in 1min

Heater to **heat efficiently the base plate** to  $\bigcirc$  °C in 1min

Insulation to keep the temperature of the built-in case at  $\bigcirc$  °C below

Heater Fixed Part to **fix the heater with little heat dissipation**

**TRIZ Effects**  
 " Heating the liquid "  
 (Goldfire\*)



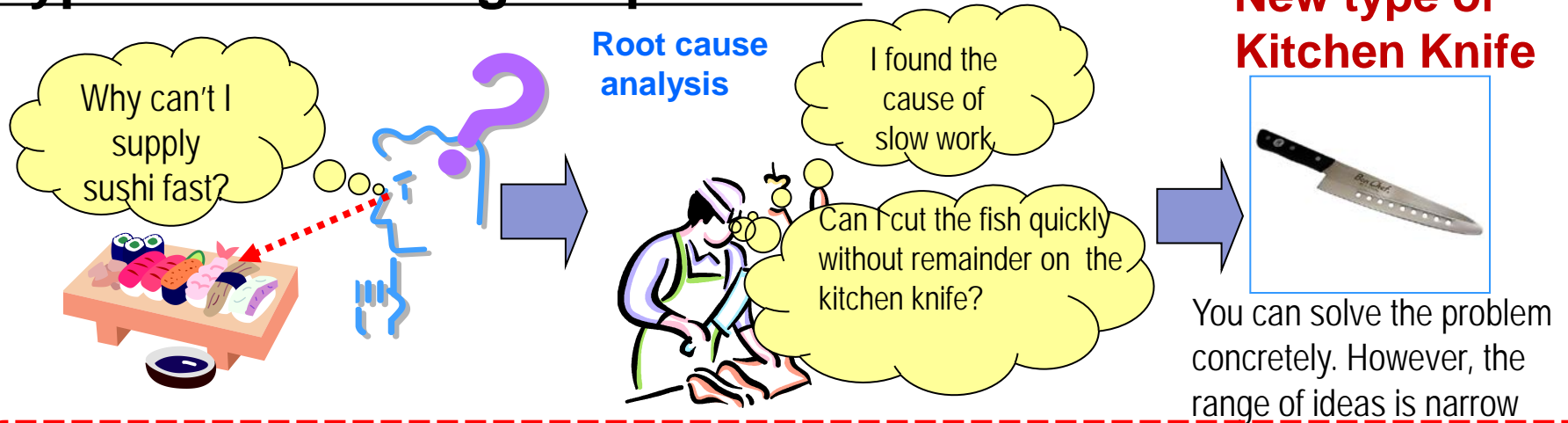
\* Goldfire : Innovation support software Invention Machine Corporation under IHS

# 《 Reference 》 Two types of TRIZ approach

## Selecting two approaches in accordance with the purpose

### In Sushi Bar

#### Type of eradicating the problem



#### New type of Kitchen Knife



#### Type of fulfilling the desire



#### Belt-conveyor Sushi bar



## 9. Reaction of using SN matrix and Logic tree of desire

### SN matrix and Logic tree of desire are used by more than our expectations

- ◆ You can hearing the customer needs on the basis of the function without the detailed drawings of the system.
- ◆ Needs assessment based on the functions is possible to improve the coverage of needs and specifications.
- ◆ By clarifying customer expectations for the function, we can connect smoothly to TRIZ. As a result, it is easy to facilitate the solutions of cause analysis, risk analysis, and cost reduction.
- ◆ Logic tree of desire can explore widely the potential of your own technology.
- ◆ By functional analysis of time and space, SN matrix can also be applied to the wide range of problems including the process and usability.
- ◆ By searching the technology and patents of competitors on a functional basis, coverage of the survey can be improved.

- ① The New SN Matrix makes it easy to find the needs of customer by separating the (quality goals) achieved level and function. And engineers came to be able to determine the priority of technical problems with the customer needs and technology of competitors in each function.
- ② The New SN Matrix is applied to a wide range of technical issues by analyzing the function from the point of view of space and time.
- ③ In the process to actualize the seeds, the New Logic tree of desire and TRIZ process can remove the boundaries of knowledge and experience of the engineers. This process can lead to find a variety of potential needs.

By introducing the above approach to the early development stage, it was easy to find the customer needs on the basis of the function.

As a result, it has become possible to connect smoothly the solution that contains the TRIZ solve problems.

Thanks to Mr. Mamoru Zenko and Mr. Hajime Kasai of **IDEA,INC.**  
They provided the chance of using scientific methods (QFD + TRIZ)  
and support for our activities at **OLYMPUS.**

Thank you for your attention

**OLYMPUS**

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