

Your Vision, Our Future

## Design risk prevention by the SN Matrix and TRIZ process

 $\sim$ The functional approach for connecting the methods and 7 solutions $\sim$ 

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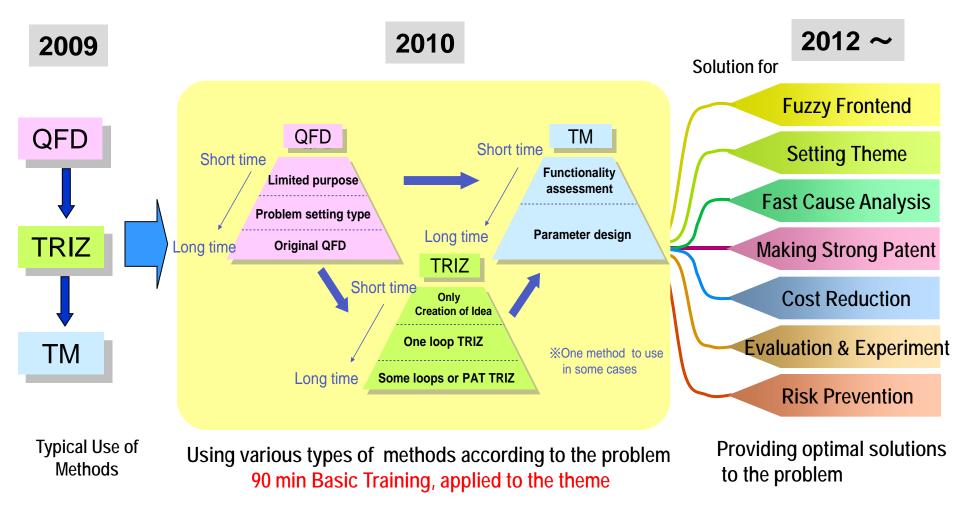
## **1. About Olympus**

Medical Business		tober 12, 1919 njuku-ku, Tokyo, Japan 24,520 million (As of March 31, 2014)
C/V	Consolidated net sales : ¥7	
		scal Year Ended March 2014)
	Consolidated headcount: 30	,702 (AS OT March 31, 2014)
AND	Imaging Business	Scientific Solutions Business
EVIS EUS Endoscopic Ultrasound Center	$\bigcirc$	
EU-ME2 PREMIER PLUS		
UNDERBEAT		UIS2 objective lens
THURLE	<b>0M-D</b> E-M10	Laser scanning microscope for
	STYLUS	organism
Surgical Energy Device THUNDERBEAT	SP-100E	
to	(Eagle's	Eye) 📩
8000 File Control Cont	140	
	STYLUS	Imaging software
+=====+==+==+==+==+==+==+==+==+==+===	SH-1	Ultrasonic thickness for Biological
Disposable guide wire		gauge microscope
[VisiGlide 2™]		[27MG] [cellSens®]
2 2014/9/6 No data conv / No data transfer permitted		OLYMPUS

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### 2. Promotion of scientific methods in Olympus (1) 4

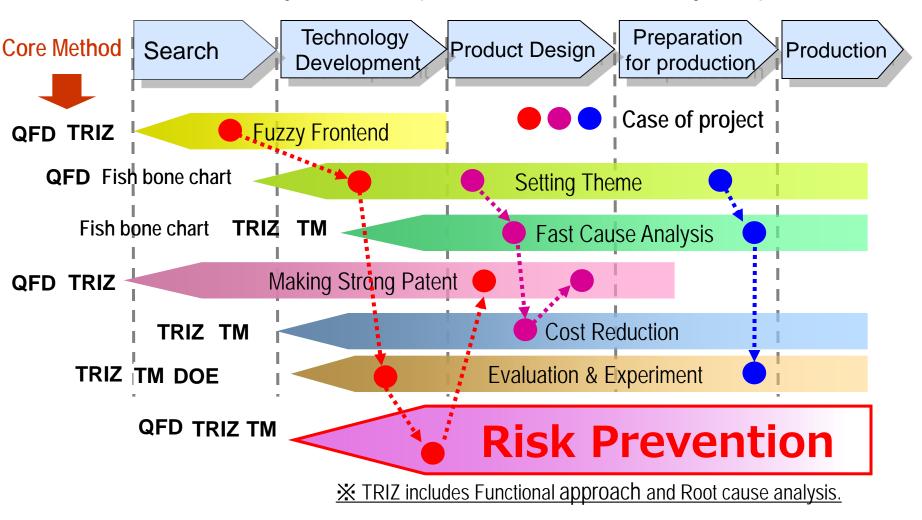
### **Providing 7 solutions for the purpose.**





### 2. Promotion of scientific methods in Olympus (2) 5

The functions of system can connect 7 solutions and methods. Process is connected by the concept of function wherever you open the drawer





2. Promotion of scientific methods in Olympus (3) 6

# What is "risk " in risk prevention solution at Olympus ?

For regarding "risk" handled here, it is to predict safety and quality of products and processes, and to avoid it when the engineers design products and processes.

To be analyze efficiently by adding scientific approach to general FMEA.

## 3. Request for risk analysis from engineers (1) 7

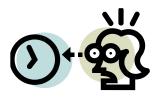
# Our engineers opinions for risk analysis are as follows.



# Unexpected failures have occurred, even if veteran members analyzes risk.

⇒ We have checked the drawing over time with veteran members. Mistakes occur at inexperienced new design particularly.

#### **Risk analysis is inefficient.**



⇒ Risk analysis need long time, because of to need analysis on component level in entire system. But want to exclude big risk even for short time.



## 3. Request for risk analysis from engineers(2)

## **Reason why these opinions happen?**

#### Why not enough with veteran?

- Veteran has "Belief" that rely on past experience. It is not enough for inexperienced new design.
- Factors at movement and flow can not find at the drawing.

### Why need long time?

- •Without sufficient understanding of the purpose, begin to analysis.
- To use time uniformly for each factors, with or without effect.

How should we do to reduce time and to raise the completeness for risk analysis?









## 4. New approach for risk analysis

#### **Comparison of general FMEA and our approach.**

	Purpose	Our Approach	General Approach		
1	To determine target	Focusing the target by fish bone chart and function diagram follow the purpose.	Choosing target with actual experience and actual knowledge.		
2	To extract factors ( Completeness improvement 1 )	Extracting factors with multi- faceted from the point of view of time and space by SN matrix.	Extracting risk with experience and stored data by reliability block diagram and the drawing, failure mode table		
3	To extract risk ( Completeness improvement 2 )	Extracting risk by TRIZ effects in the broad view and generalized functions.	drawing ,failure mode table.		
4	To evaluate risk	Evaluating each risk by SN matrix, follow the purpose ,competitor, and user needs.	Evaluating risk with general items.		
5	To avoid risk	Clarifying resolution parts with function, for to use TM and TRIZ.	Use Brainstorming or other general method.		



## 5. To determine target follow the purpose (1)

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### **Determining target by fish bone chart.**

D	Purpose	Modification	New design
F M E A	To ensure the safety	Focusing to the large energy part accessed by human, and the part that design changes.	Focusing to the large energy part accessed by human.
	To ensure the quality	Focusing to the main function of the product, and the part that design changes.	Focusing the main function of the product.

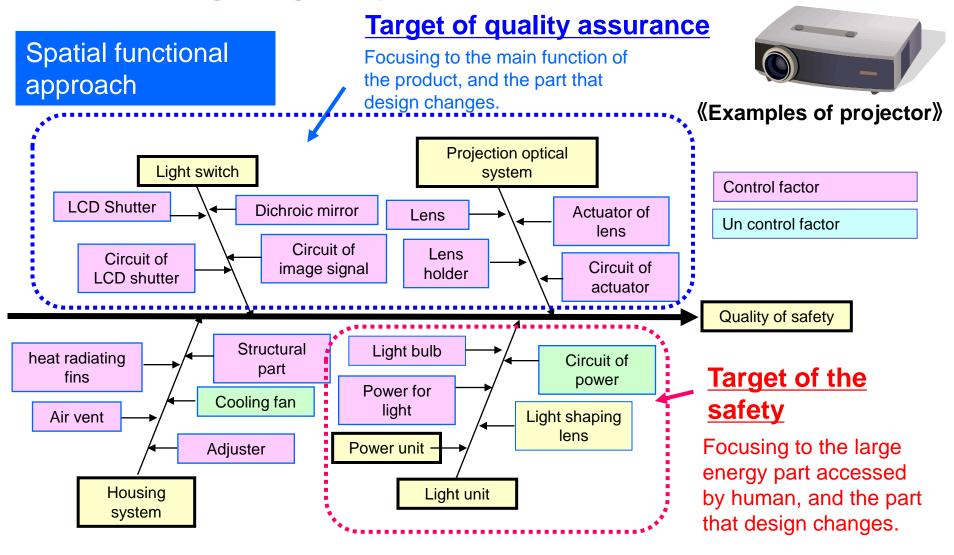
For safety, to focus on part having an energy that human can touch.

For quality, to focus on deviating the main function of the product.



## 5. To determine target follow the purpose (2)

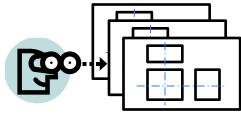
#### **Determining target by fish bone chart.**



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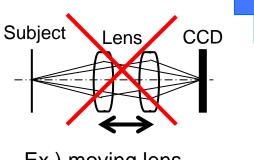
## 6. To extract factors (1)

#### Analyzing functions by SN matrix. (function tree)



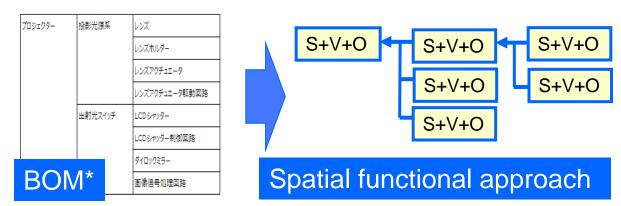
Drawing (Still image)

Missed function at moving mechanism.

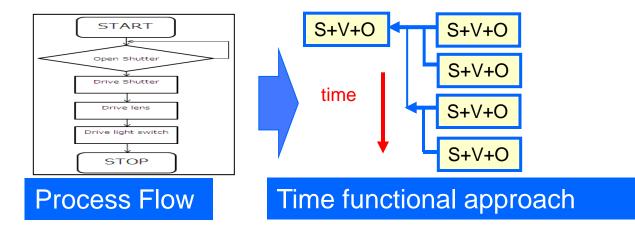


Ex.) moving lens

\* BOM: Bill of material



**1**Eliminating leakage with the spatial function approach that is based on the BOM.



②Eliminating leakage with the time function approach that include process flow.



6. To extract factors (2)

## ①Eliminating leakage with the spatial function approach that is based on the BOM. Spatial functional approach

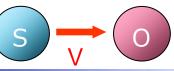
			_
Projector	Projection	Lens	
	optical	Lens holder	
	system	Actuator of lens	
		Circuit of actuator	
	Light	LCD Shutter	
	Switch	Circuit of LCD Shutter	
		Dichroic mirror	7
		Circuit of image signal	
TBOM			-

According to layer, fill in the table

only the function.

Layer		Function (S+V+O)				
1		Projection optical system collect light to the screen				
	11	Lens collect light				
	12	Lens holder hold the lens				
	13	Lens actuator drive the lens				
	14	Circuit of actuator sends an electrical signal to the lens actuator				
2		Light switch control the emitted light				
	21	LCD shutter open(close) the emitted light				
	22	Circuit of LCD shutter drive the LCD shutter				

Attention to V of S+V+O.





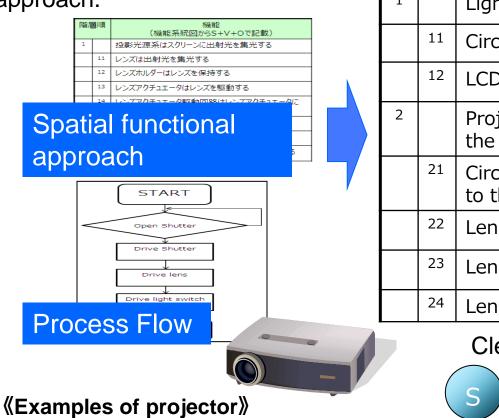
**«Examples of projector»** 

6. To extract factors (3)

#### ②Eliminating leakage with the time function approach that include process flow. Time functional approach

According to process flow, fill the table from time functional approach.

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Function

Tir flc	ne w	Function (S+V+O)
1		Light switch control the emitted light
	11	Circuit of LCD shutter drive the LCD shutter
	12	LCD shutter open(close) the emitted light
2		Projection optical system collect light to the screen
	21	Circuit of actuator sends an electrical signal to the lens actuator
	22	Lens actuator drive the lens
	23	Lens holder hold the lens
	24	Lens collect light
		Cleary S+V+O.





## 7. To use new SN matrix for risk analysis

# Analyzing risk of each function by time and spatial analysis and TRIZ.

	Time       Function (S+V+O)         1       Light switch control the emitted light         12       Circuit of LCD shutter drive the LCD shutter         12       LCD shutter open(close) the emitted light         12       LCD shutter open(close) the emitted light         13       Time functional approach         Time functional approach							TRI	Z Effe				
Priorities follow concept of QFD.							y other anies te	Nee echnology.	ds Customer request				
_	uncti Laye	-	Prior ity	Risk of Function(S+V+O)		RPN		RPN		RPN		petitor's nnology	Voice of Customer
					S	0	D	RPN	Level	Contents			
			$\bigcirc$	Deterioration of the	3	3	2	18	•••	Patent A	Want to use outdoor		
				lens due to sunlight									
			Ø	V-oscillator circuit distort the image	3	4	2	24	•••	Patent B	Want to show in detail		

## 8. To extract risk (1)

## Extracting risk by TRIZ Effects.

Investigating problems at each function with expand function. (Use Goldfire\*)

Can refer problems of other fields by generalized function of system.

⇒New discoveries and awareness can be obtained. By dispel the belief and experience, it is no longer missing leakage of risk analysis.



Left products are using light. By generalized function of system , it is possible to refer to common problem.

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



## 8. To extract risk (2)

#### Investigating the problem at each functions. (Use Goldfire\*)

Want to find risk for "to collect light".

Investigating cause of "Can't collect light" by cause finder of Goldfire.

Found new risk ! "Influence from sunlight"



In vehicle headlights, risk of degradation, corruption from sunlight has. If you do not know user want to use at outdoor, this risk will not to think.

#### ⇒Add to SN matrix, of found risk.



## 8. To extract risk (3)

#### Investigating the problem at each functions. (Use Goldfire\*)

Want to find risk for "to collect light".

You can find cause of "Can't collect light". Investigating cause of "distort image" by cause finder of Goldfire.

#### Found new risk ! "Influence from Voltage controlled oscillator circuit"

🍋 原因ファインダー 原因検索 原因定式化ガイド 影響である光を集光できないに合致する原因を選択してください 画像がゆがむ 原因を検索(F) 語: 日本語 同義語とオントロジーセットを表示>> 107.検索結果 原因カテゴリ 原内 知識へーえより 転写 開示の装置で乳がんの診断をする 診断 探触子の移動速度を測定中に変更する 触子 Cause finder of Goldfire

In printer, distortion of the image is generated by varying the reference voltage of the voltage controlled oscillator circuit at the time of printing. By generalized in function, it was possible to extract risk from the case of other fields.

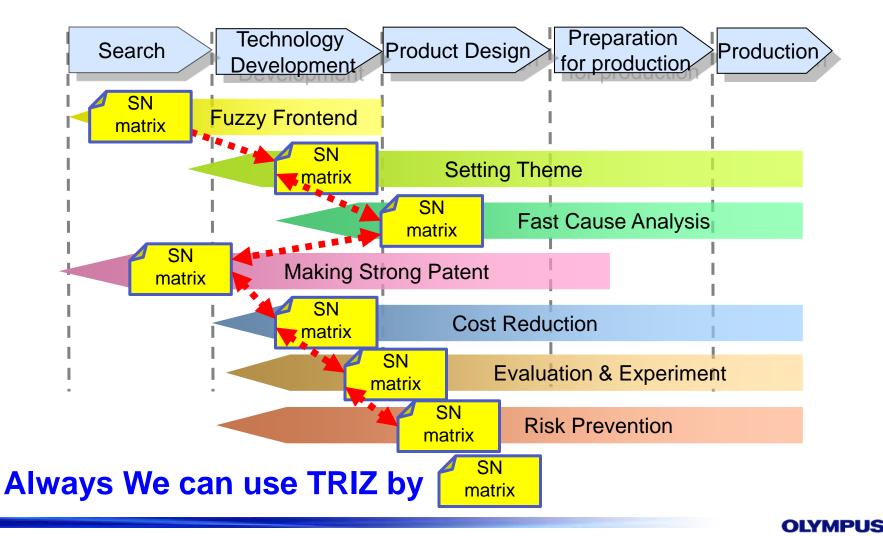
#### ⇒Add to SN matrix, of found risk.



## 9. Using new SN matrix at all solution

## **SN matrix for connecting 7 solutions.**

Solution use same process with function and customer needs, competitor.



## 10. Summary

- By determining the target according to the purpose, Risk analysis has enabled more efficient and short-time.
- ② Seeds and Needs matrix (SN matrix) and TRIZ can be raise completeness for risk analysis.
- ③ By thinking of function, TRIZ has become easier to use at all solution.

By using TRIZ, reducing time, reducing leakage and dispel the belief, it had become possible to efficient analysis.

<Challenges for the future> For process design, considering how to raise the completeness for risk by "human error".



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## Thank you for your attention

