

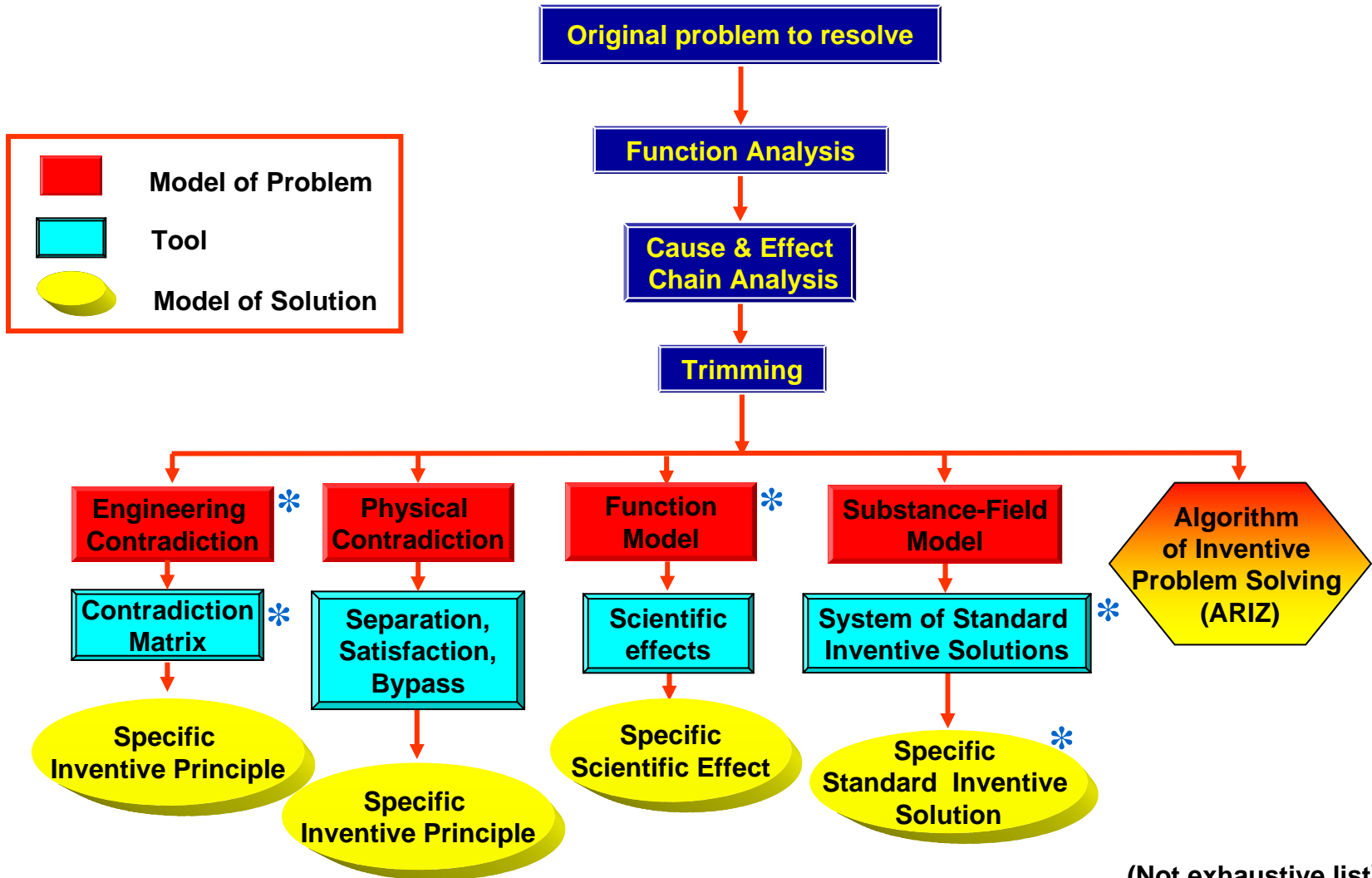
# **An Innovative Approach on Module Ionizer efficiency Management**

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INTEL Malaysia*

*Sept 10-12 2009, Japan*



# Where TRIZ fits in INTEL...



**Toolbox which contains root cause analysis and solution generation tools**

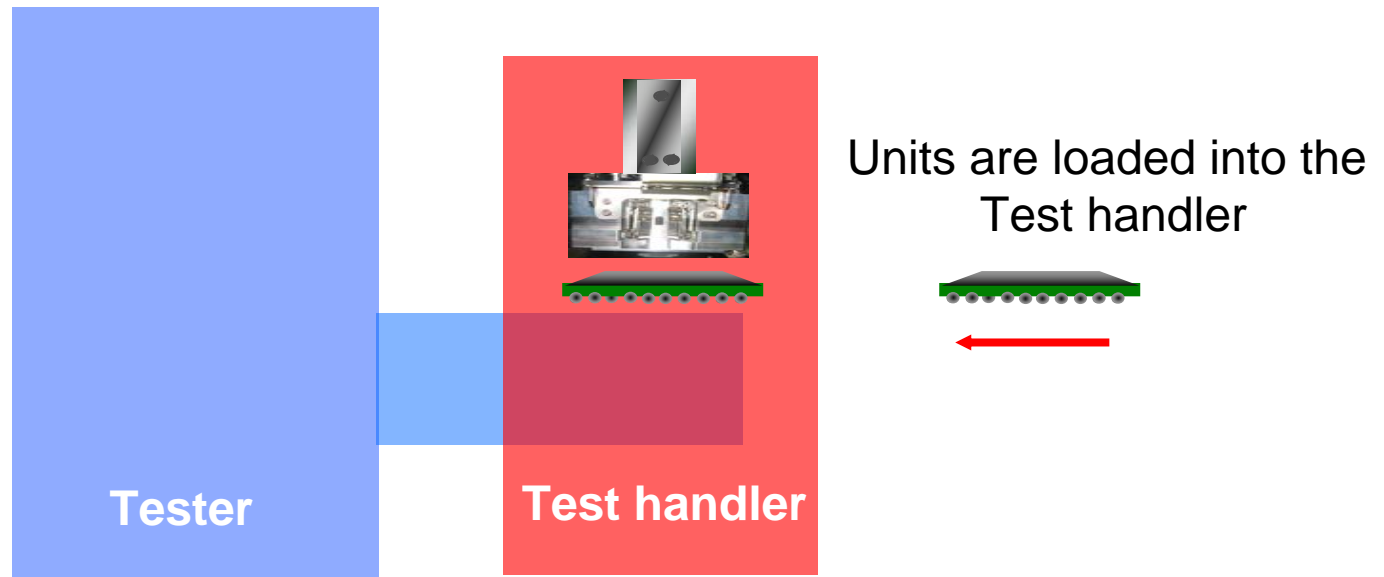
\* These aspects will be covered in the scope of this presentation



# Background

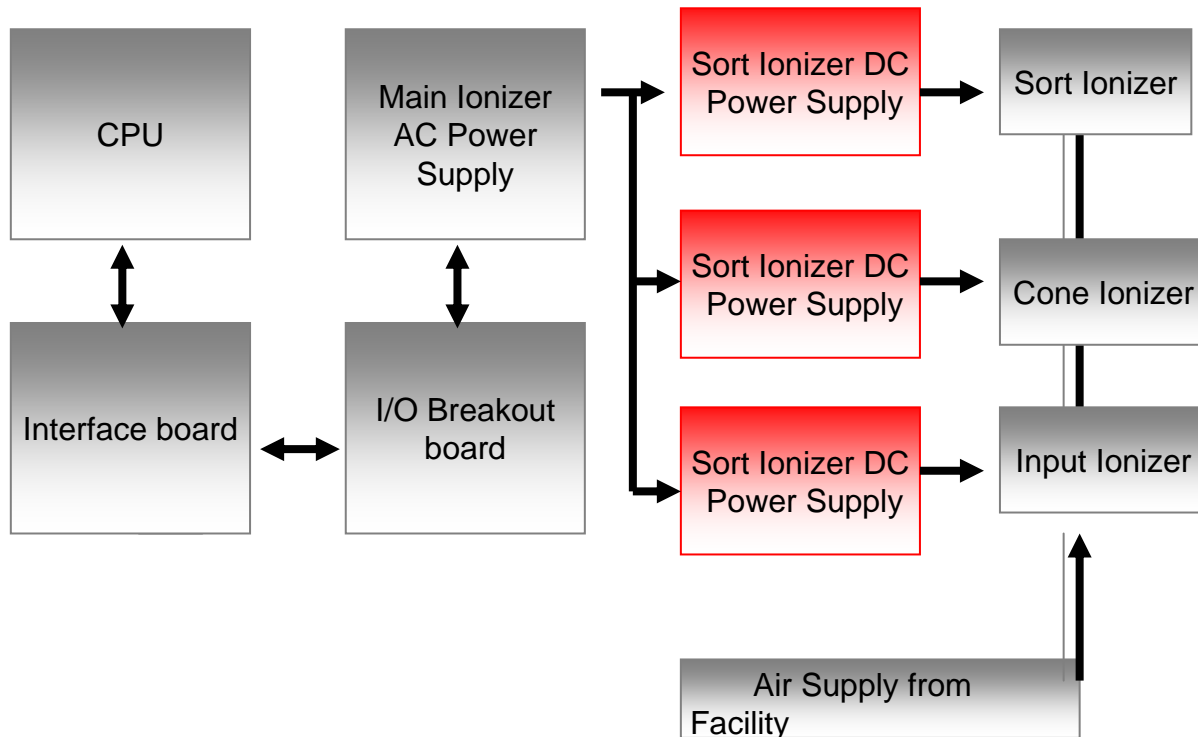
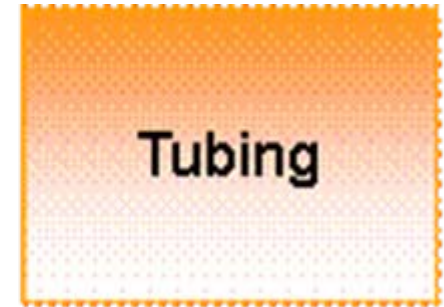
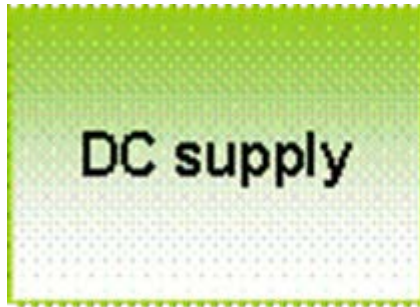
## TEST

**The Test handler is an ATE (Automated Test Equipment) which is capable to handle Semiconductor devices into test sockets (which are attached to testers) and bin them out as pass or fail.**

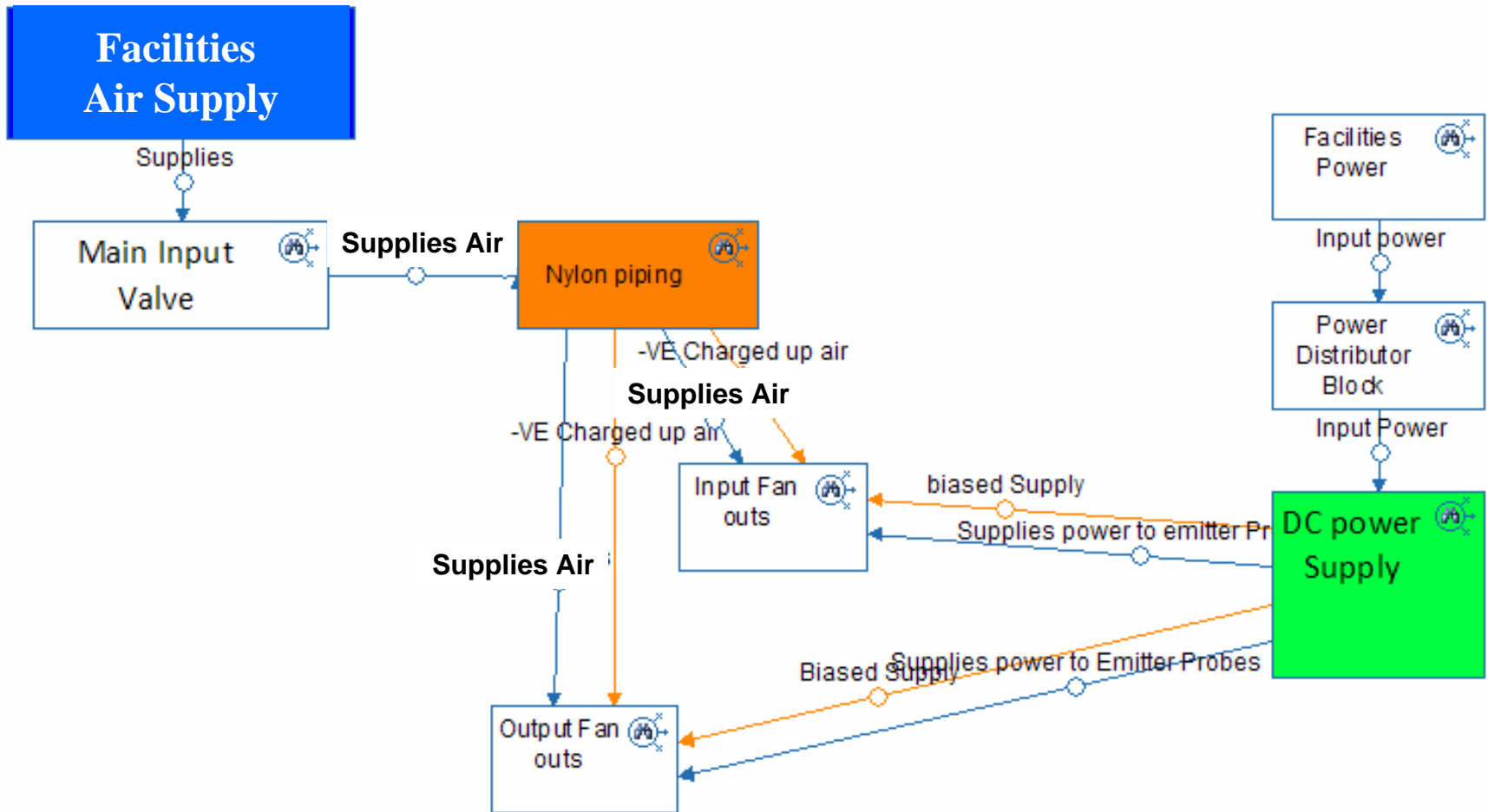


MODEL OF A TYPICAL TEST CELL

# Functional Diagram of the Handler Ionizing System



# Simplified Function Model of the Handler Ionizing System



# Problem Statement

## **Original Problem Statement:**

Semiconductor Devices that are run through the Test Handlers are Not effectively Neutralized.

## **Actual Problem Statement:**

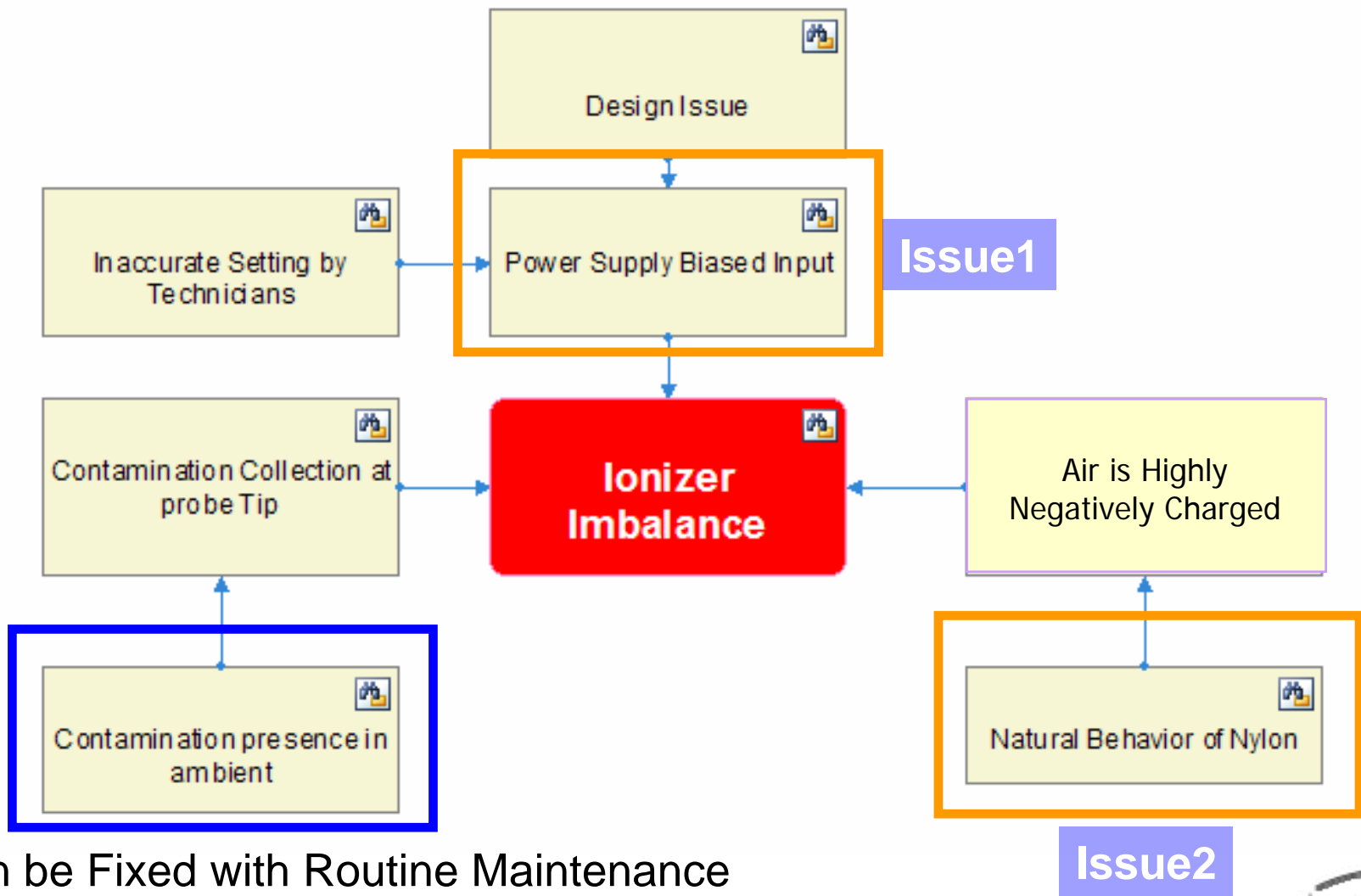
- 1) Ionizer's are imbalanced because of biased current DC supply to the cathode probes
- 2) Nylon Cables which are supplying the air from facilities themselves Negatively charge up units

## **Impact:**

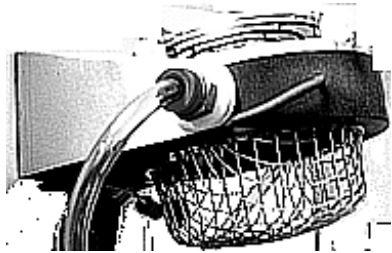
Productivity loss of about 1.5% and High Maintenance Cost.



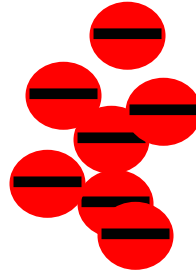
# Cause and Effect Chain of the Ionizing System



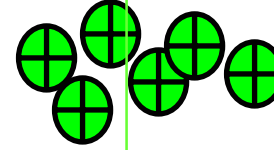
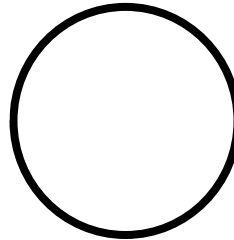
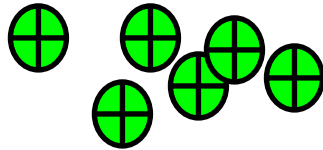
# Explanation from the Cause and Effect Chain – Issue 1



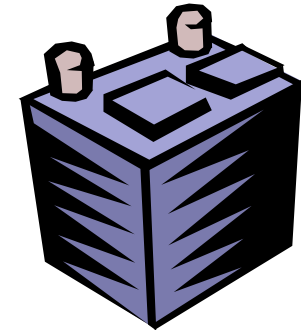
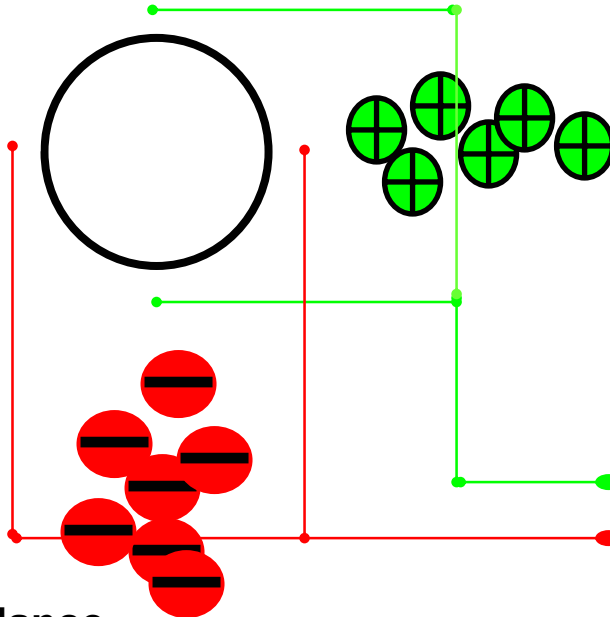
**Ionizer Exhaust**



Proper operation of this system should yield equal amount of ions (+ve and -ve) through the cathode and anode probes



The issue starts when the power supply output current is not equal for both channels resulting in ionizer imbalance



**DC Power Supply**



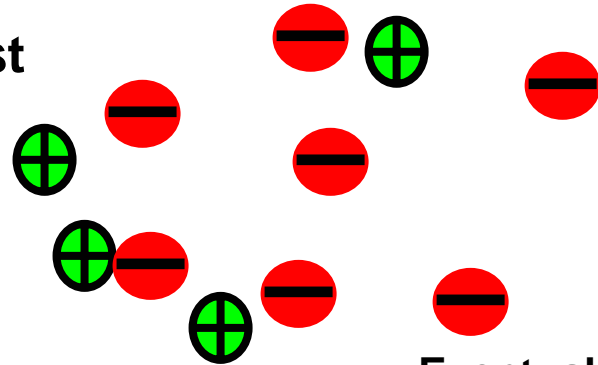
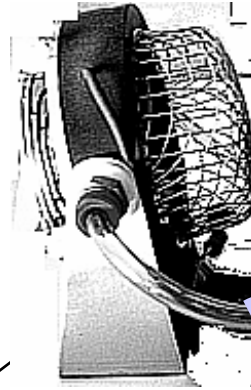


## UNWANTED PRE-CHARGE UP OF Air:

As the Air travels through these tubes, there is a tendency to charge the Air highly negatively because of the material property of Nylon

Nylon Tubing

Ionizer Exhaust



Eventually when the air arrives on the device, it's still highly negatively charged!! (up-to-500V)

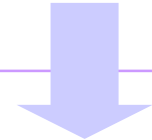
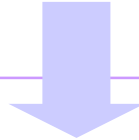
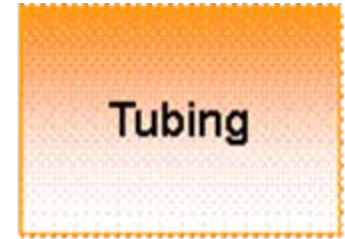
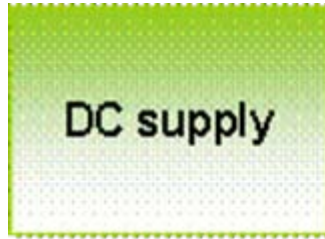
Air supplied from Facility



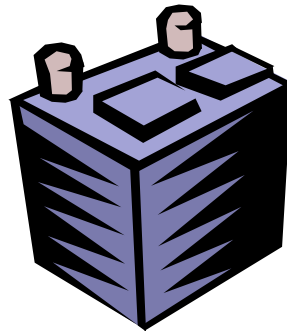
# Component Level Summary

## Summary of Issues mentioned

**Major Components Of the Ionizing System**



**Our 2 Issues**



# Contradictions...

## Technical Contradictions:

1) Multi Component Integration (Air+DC Power Supply+ Nylon cable) has eased Maintenance but has caused reliability issues.

Maintenance but has caused reliability issues.

2) If the components of the system (Air+DC Power Supply+ Nylon cable) are integrated together then it enables an effective Closed loop system with software response But productivity suffers severely because of unreliability of the System.

Worsening Feature →	Reliability	
Improving Feature ↓	Reliability	
		27
Measurement accuracy		5, 11, 1, 23

Worsening Feature →	Reliability	
Improving Feature ↓	Reliability	
		27
Loss of Information		10, 28, 23

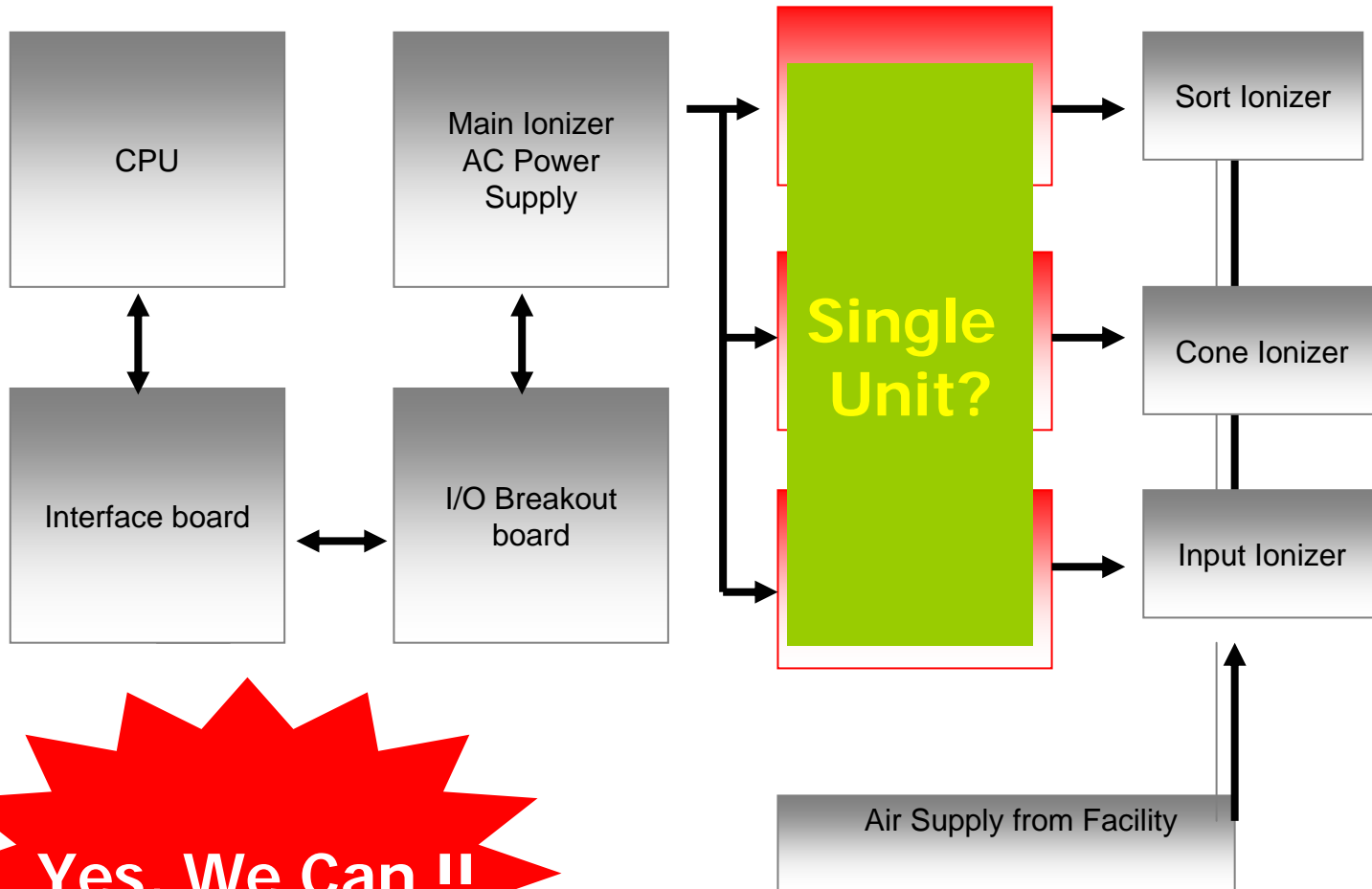
Worsening Feature →	Loss of Energy	
Improving Feature ↓	Loss of Energy	
		22
Stability of the object's composition		14, 2, 39, 6

## Selected Applicable Principles:

#5 MERGING #6 MULTIFUNCTION #23 FEEDBACK



# Can we TRIM OFF some of the Components?



**Yes, We Can !!**

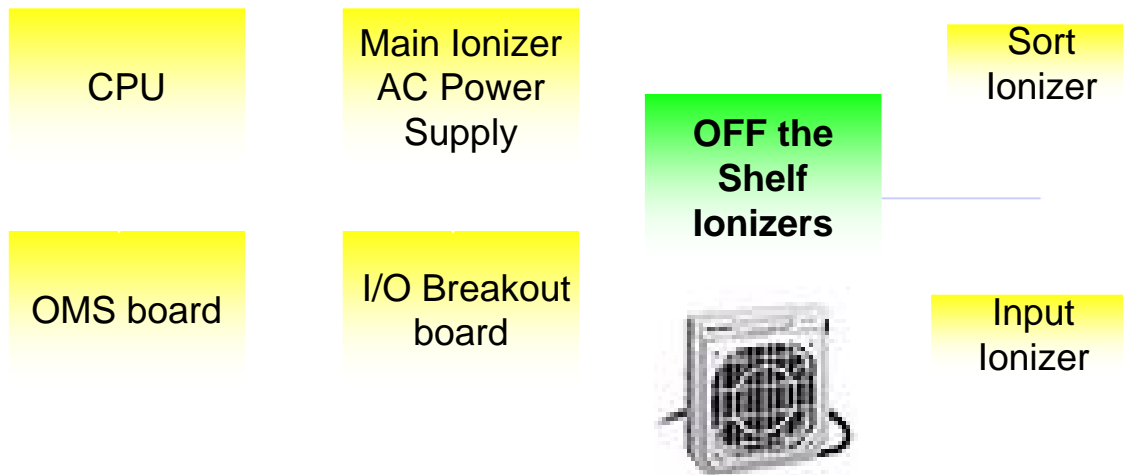


# The Solutions - Overview



- **The first step is to merge the function of all 3 units into 1 or 2 units and eliminate the problems systematically.** (TRIZ Principle #5 MERGING and #6 MULTIFUNCTION)

**The following is the concept we have in mind**



The New System  
Block Diagram



# The Solutions – the Actual Concept

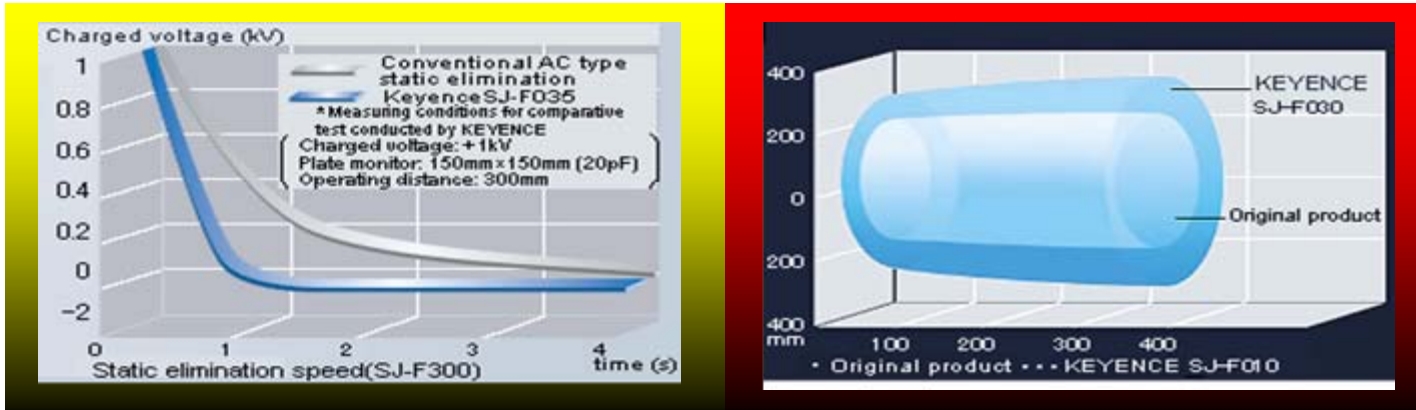
This concept is ...

- A single unit that uses its own DC full-pulse mode supply.
- A fan is used merely to propel the neutralized air.
- The fan also is tuned to propel at higher revolution/sec which displaces a greater volume of Neutralizing air.

**(TRIZ Principle # 5 MERGING and #6 MULTIFUNCTION)**



# Result Orientation



This graph shows the measurable improvement (about 20%) in Ionizing efficiency. This also reduced the un-scheduled downtime as the new DC mode supply is far more stable and long lasting

# Key Challenges and Answers

## Key challenges faced by the Team:

- **The ability to software trigger and stop the handler if the ionizing balancing is out or if the power input is bad.**

**SOLUTION:** To overcome this problem, the team applied TRIZ principle #23 FEEDBACK and introduce an external feedback mechanism (a sensor, relay and a comparator) in a form of electronic circuitry to interface with the Handler Mainframe CPU via optional I/O channels and provide similar sensing ability that the legacy system had. The circuitry provides feedback to the handler CPU on two conditions:

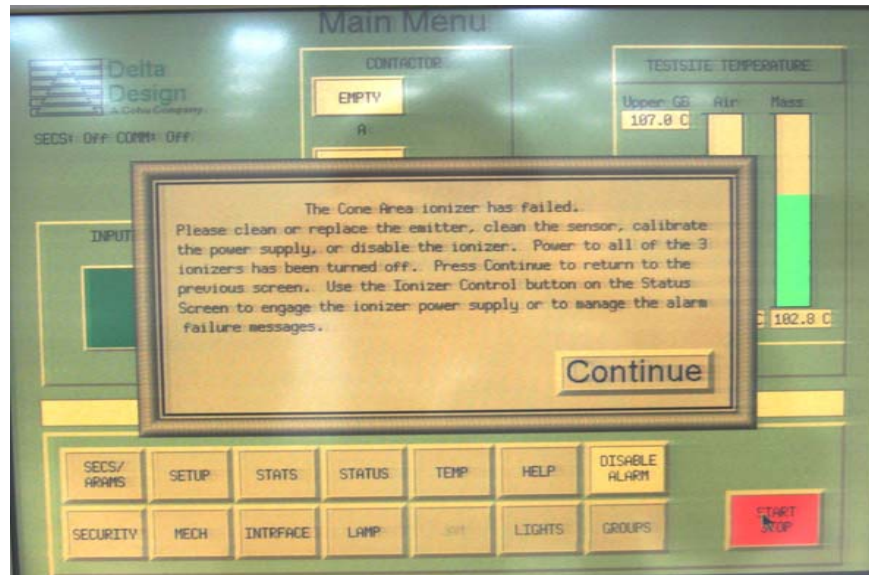
- (I) Ionizer imbalance
- (II) Ionizer supply cutoff





# Key Challenges Met!!

**The following is the electronic circuit employed in providing the feedback to the handler CPU.**



**Handler is triggered promptly whereby the capability that is highly valued in Maintenance is RESTORED!**

# Results and Discussion

Our solutions met and **exceeded** our requirements. Compared to the cost of implementing this solution, the potential ROI was far reaching which justified the implementation of the Project easily.

This Change improved our productivity by 1.5%. This been seen and **verified**.

## **Result Orientation:**

**Problem Statement;** Ionizer Imbalance issue causes productivity Loss Of about 1.5 %.

**Conclusion:** With the gain of 1.5% here this problem is verified Solved



# TRIZ VS Non-TRIZ Method of Solution

	CONVENTIONAL WAY	TRIZ WAY
Duration	5 years	6 Months
Method	<ul style="list-style-type: none"><li>• Data Collection</li><li>• Fish Bone Analysis</li></ul>	<ul style="list-style-type: none"><li>• Functional Analysis</li><li>• CEC</li><li>• Contradiction Matrix</li></ul>
Cost	100% of the Budget	5% of the Budget
Outcome	FAILED	PASS



# Conclusion

The solution that was developed also depended largely on our application of TRIZ problem solving concepts. As a whole, we've applied 3 TRIZ principles in arriving at the solution:

- #5 MERGING
- #6 MULTIFUNCTION
- #23 FEEDBACK

This project was implemented. This 5 years old problem was effectively SOLVED!!



# Acknowledgement

- The authors would like to acknowledge the NCO6 management (**CTSoon /Paul Chung**) for all the support and encouragement.
- special thanks to **Spoobalan, Bin Romli, Azir and Ong, Kok Beng, A.V.Darin, Jtleong and Vickneswaran** for coordinating the implementation activities
- We'd also like to extend our appreciation to **TSYeoh, TJYeoh and Song Chia Li** who's guidance with TRIZ helped us to develop a well conceive idea.

