

# GIS UHF PD Measurement And Case Study

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Forum International Fisuel – Séoul / Corée du Sud – 04 et 05 Novembre 2015  
Fisuel International Forum – Seoul / Korea – 04th & 05th of November, 2015

만나뵈게 되어서 반갑습니다.

GIS UHF PD란 주제로 발표를 하게된 성장동력처 소속 전홍록 입니다.  
식사 후 가장 나쁜 시간인데 그래도 열심히 준비 했으니깐 관심있게  
봐주시기 바랍니다.

그럼 시작하도록 하겠습니다.

- ➔ **UHF PD Measurement**
- ➔ **Sensor Sensitivity Test**
- ➔ **Noise Gating**
- ➔ **Case Study**

발표순서를 보시면

먼저 UHF PD에 대해서 간략한 설명을 드리고

두번째 센스감도 테스트

노이즈게이팅

마지막으로 현장사례순 으로 진행하도록 하겠습니다.



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# UHF PD Measurement

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▣ **Standard**

◆ **IEC 60270**

**Partial discharge detection system for GIS**

: Sensitivity verification for the UHF method and the acoustic Method

◆ **IEC 62271-203**

**High-voltage switchgear and controlgear**

Part 203 : Gas-insulated metal-enclosed switchgear for rated voltages above 52kV

◆ **CIGRE TF 15/33.03.05**

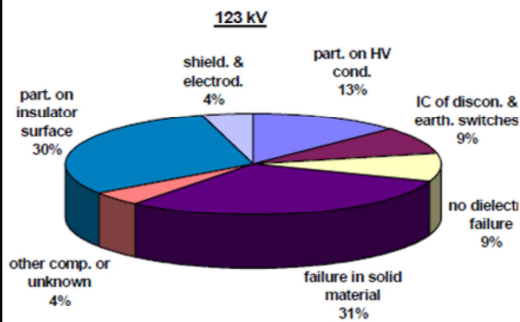
**Partial Discharge Detection System for GIS**

: Sensitivity Verification for The UHF Method and The Acoustic Method



## Service Experience

PD measurements on GIS of different designs by non-conventional UHF sensors



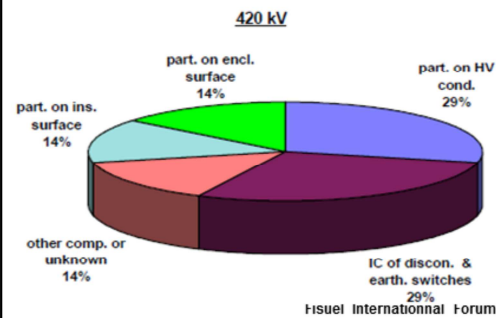
### ◆ In Case of 123kV GIS

- Particles : 43%

- Insulator Surface : 30%

- HV Conductor : 13%

- Solid Insulation : 31%



### ◆ In Case of 420kV GIS

- Particles : 57%

- Surface : 28%

- HV Conductor : 29%

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This data from cigre15-305.

In 123kV gis with an average failure rate of 0.27% per bay year

The majority of failures were caused by particles either on the insulator surface or on the HV conductor or by an insufficient long term strength of solid insulation

This data from cigre15-305.

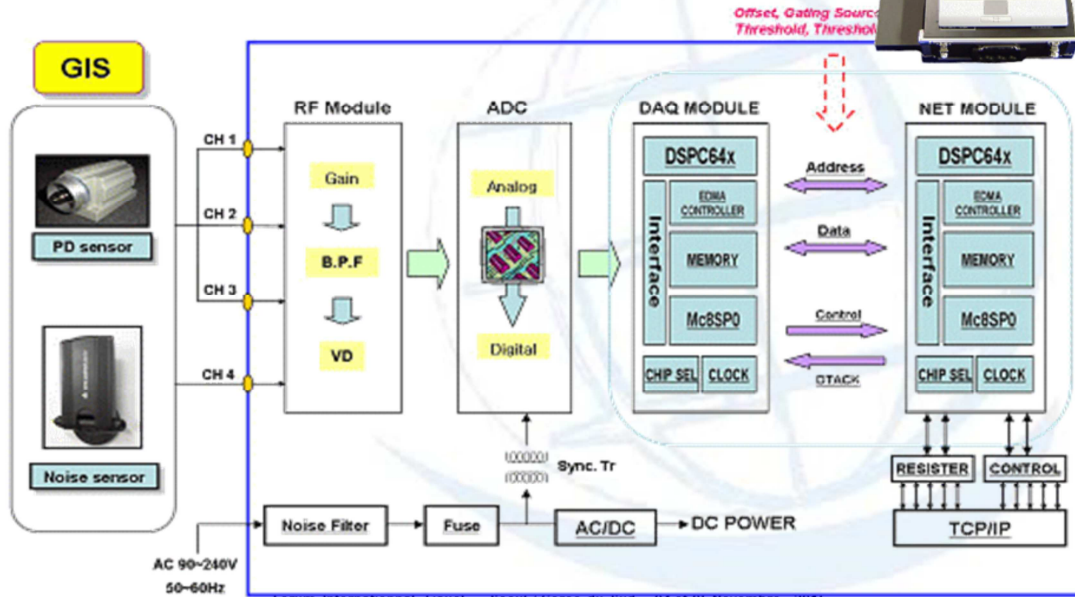
In 420kV gis with an average failure rate of 0.95% per bay year

The majority of failures were caused by particles, free moving, fix on the HV conductor or on the insulator surface

- ▣ **Ultra High Frequency : 300MHz – 3GHz**
  
- ▣ **Typical Sensor Frequency**
  - **Built-In Sensor : 100MHz – 2.0GHz**
  - **Barrier Sensor : 500MHz - 1.5GHz**
  - **Noise Sensor : 300MHz - 3.0GHz**
  
- ▣ **Application at GIS, TR and Cable Termination**
  
- ▣ **Broad/Narrow Band Test Method**



## ■ Broad Band UHF PD : Block Diagram of PAMOS



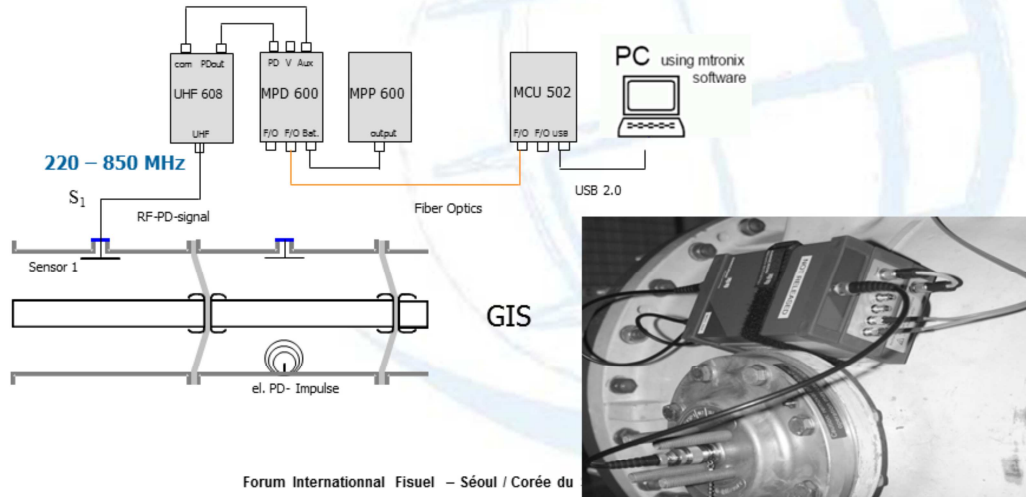
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## ■ Narrow Band UHF PD

### OMICRON UHF Converter

for PD measurements in the Ultra High Frequency range in combination with the MPD 600



네로밴드를 이용한 오미크론 장비입니다.

이 장비는 MPD600이라는 HF부분방전 장비인데 추가로 UHF608을 사용하면 GIS진단도 가능합니다.

그림을 보시면 센스1번에 UHF608을 연결한 후 MPD600에서 신호를 받아 광케이블로 전달하면

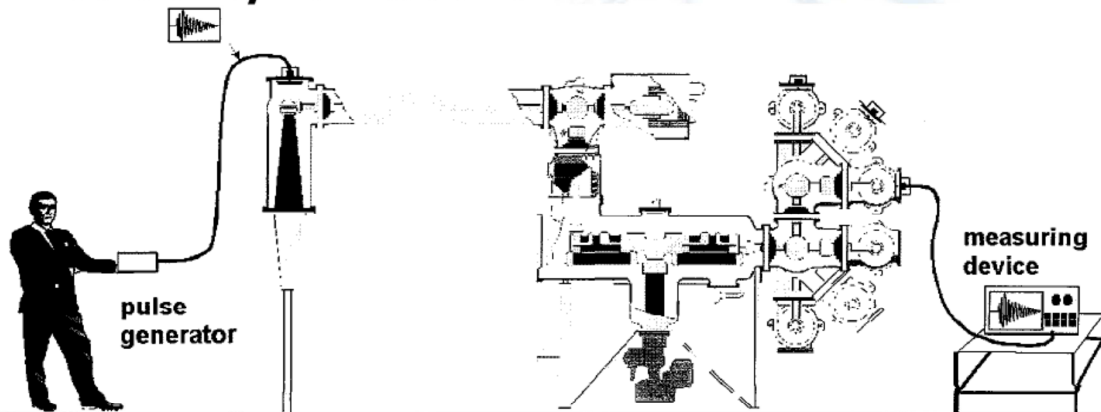
MCU 502에서 신호를 변환하여 모니터링하는 방법입니다.



## Sensor Sensitivity Test

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## ▣ Sensitivity Verification on-site



- Artificial pulse of the same shape and magnitude are injected into a sensor of the GIS on-site
- If the signal can be measured at a neighboring sensor,  
The sensitivity verification is successful for GIS section between both sensor

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## Reason of Sensor Sensitivity Test Fail

Paper presented at:  
 10th International Symposium on High Voltage Engineering, August 1997, Montréal

### UHF Partial Discharge Monitoring for 132 kV GIS

M. D. Judd  
 Centre for Electrical  
 Power Engineering,  
 University of Strathclyde,  
 Glasgow, UK

B. F. Hampton  
 Diagnostic Monitoring  
 Systems Limited,  
 204 George Street,  
 Glasgow, UK

W. L. Brown  
 China Light and Power  
 Company Limited,  
 Kowloon,  
 Hong Kong

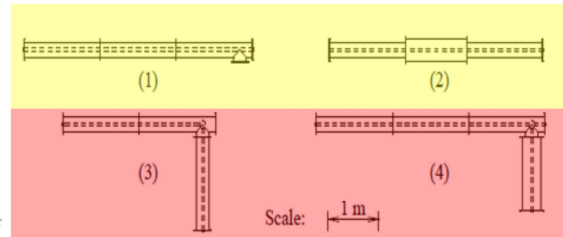


Fig. 7 Four configurations of the 132 kV GIS test chambers.

- A uniform straight GIS section of up to 4.5 m in length appeared to be loss-free. In some instances slightly more
- Signal power measured in a side compartment (such as a corner or T-junction) at 90° to the chamber containing the source was in the range 5-9 dB below that in the main chamber. The termination of the side compartment had a

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Because of bus section is include angle point..

\*\*\*\*\*

Usually straight section is not attenuated up to 4m ..

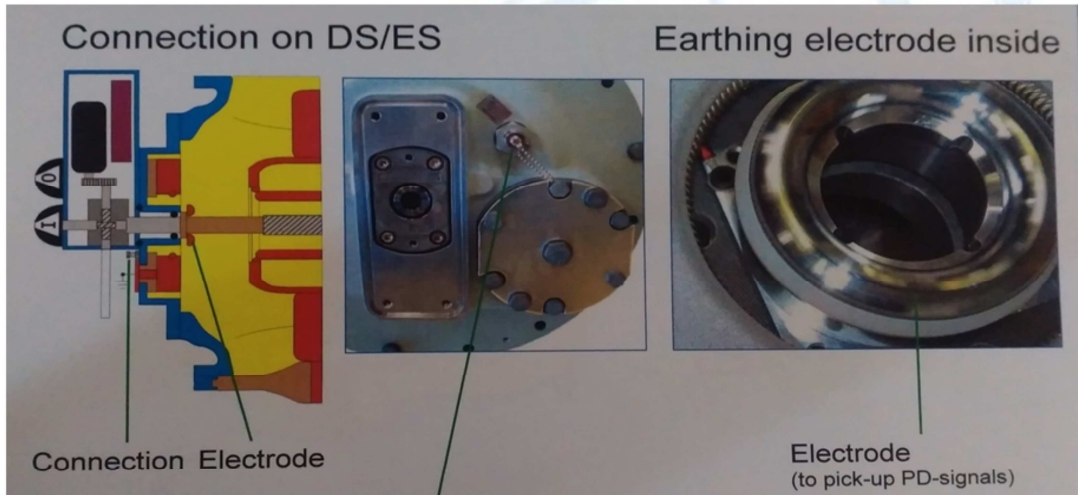
\*\*\*\*\*

But PD signal is attenuated 5 to 9dB per angle and T-junction



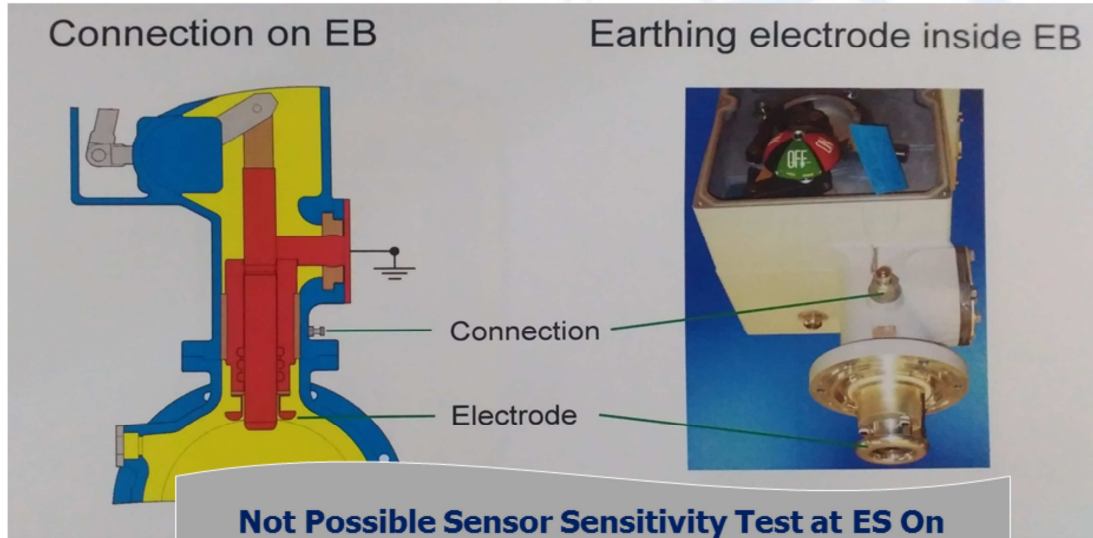
## ▣ Sensor Sensitivity Test Fail : ABB GIS

- Type : 220kV, 400kV
- PD sensor is located in earthing switch





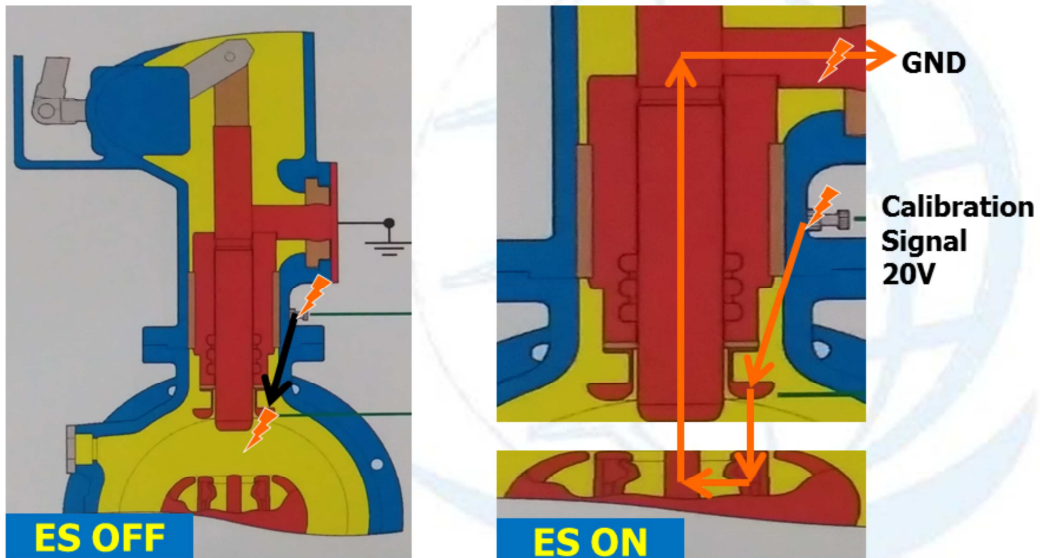
- Earthing Switch and PD sensor
- Spare & CB Off bay ES condition : On



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ABB feeder side PD sensor is located fast earthing switch.  
Spare and CB off bay's ES condition is On.. That time not possible  
sensor sensitivity test

• Reason : Electrode is connect to GND at ES on condition



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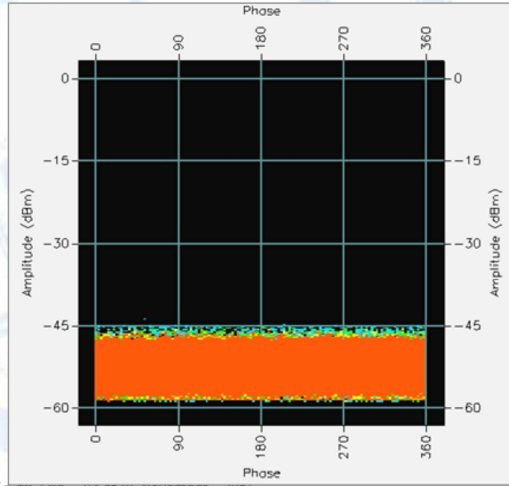
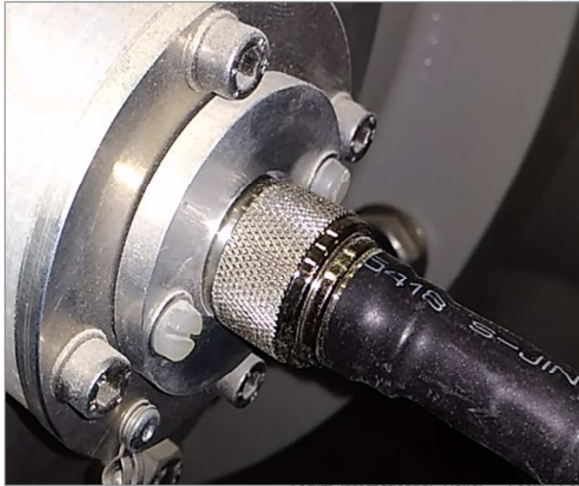
Because of PD sensor is connect to ground while ES on

\*\*\*\*\*

Compare ES condition on and off

## ▣ Sensor Sensitivity Test Fail : AREVA 66kV

- Location : Doha Super
- Consider : Sensor connection and heavy noise

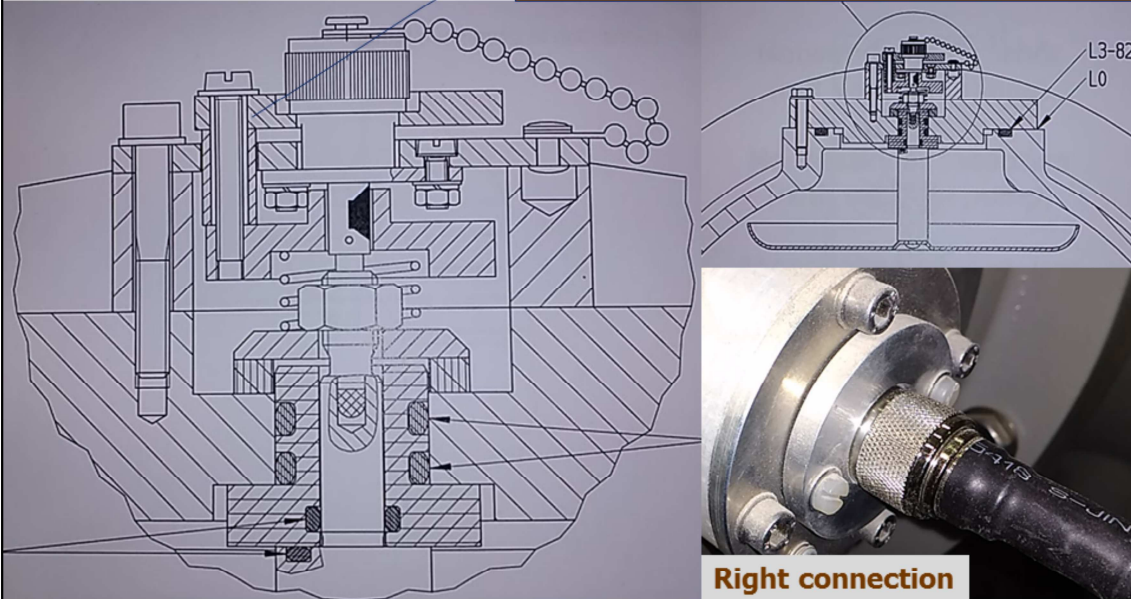


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● **Sensor connection**

**Automatic earthing device**  
When cable or shorting cap are removed

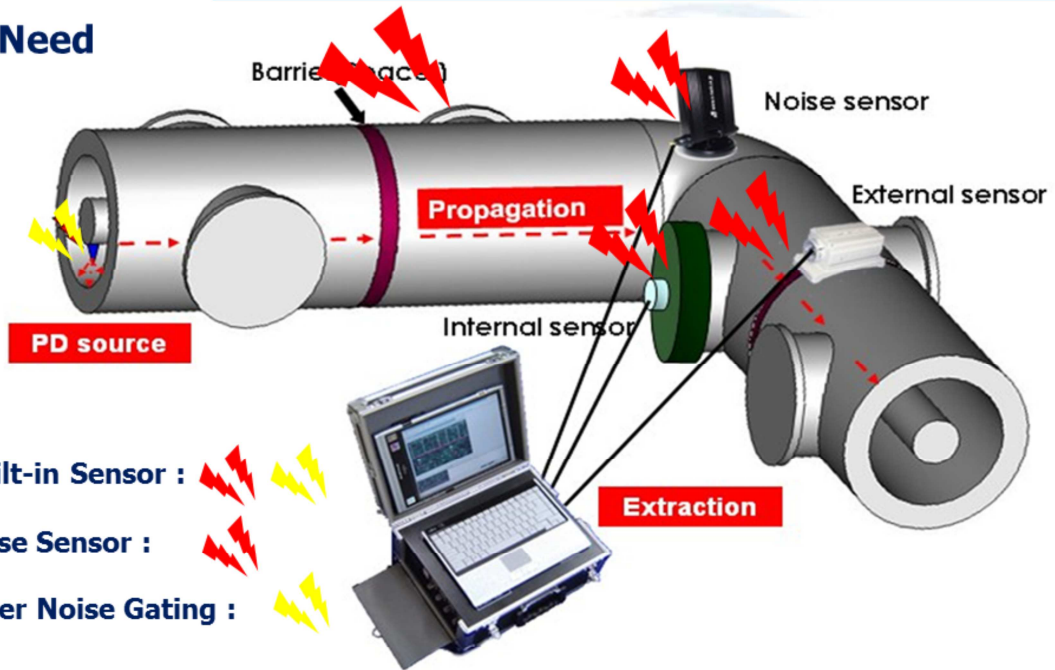




# Noise Gating

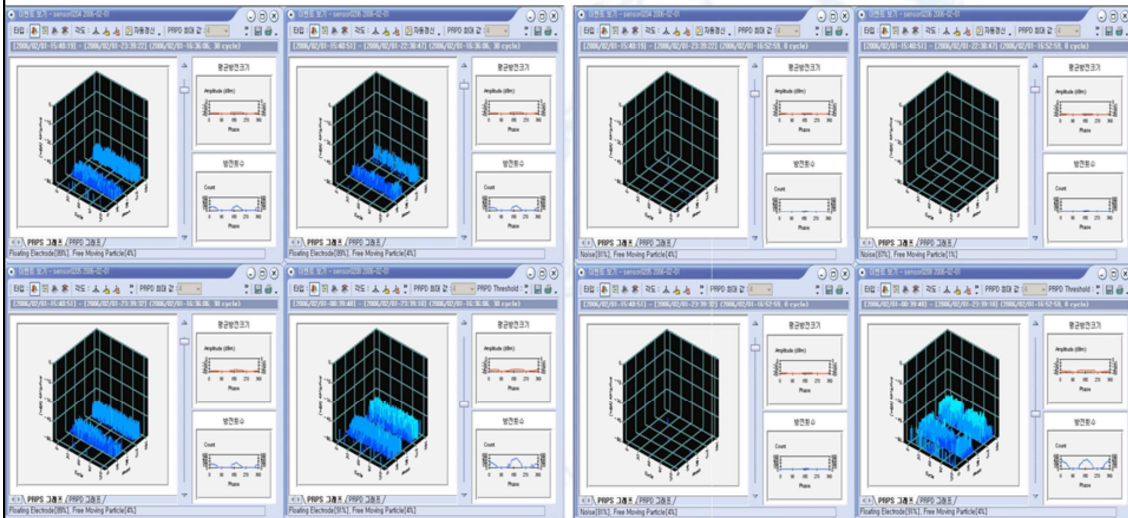
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▣ **Need**





## Before/After Noise Gating



[Before Noise Gating]

[After Noise Gating]

**• Noise gating method is very effective for noise reduction**

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## Case Study

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▣ **CASE 1**

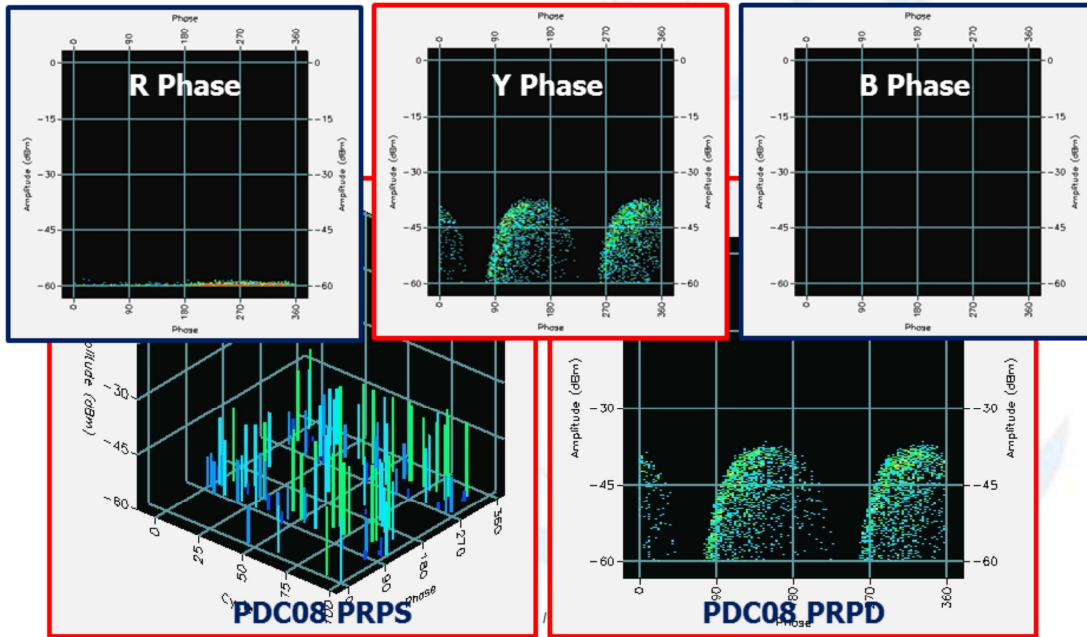


- **Maker : AREVA**
- **Voltage : 220kV**
- **Sensor Type : Built-in**

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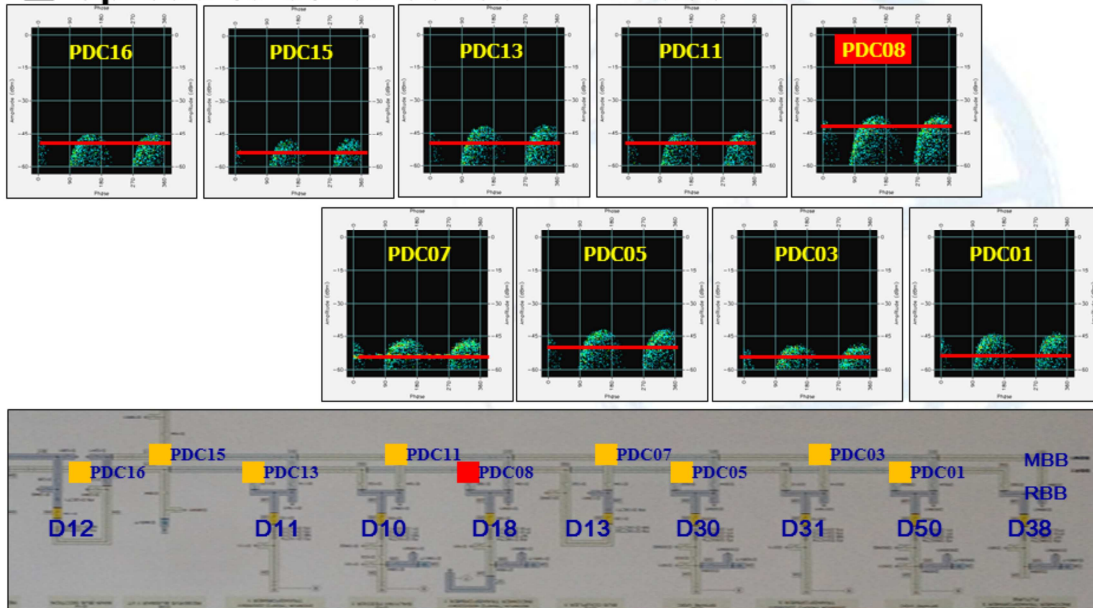
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### ■ D18 RBB : Sensor No.PDC08



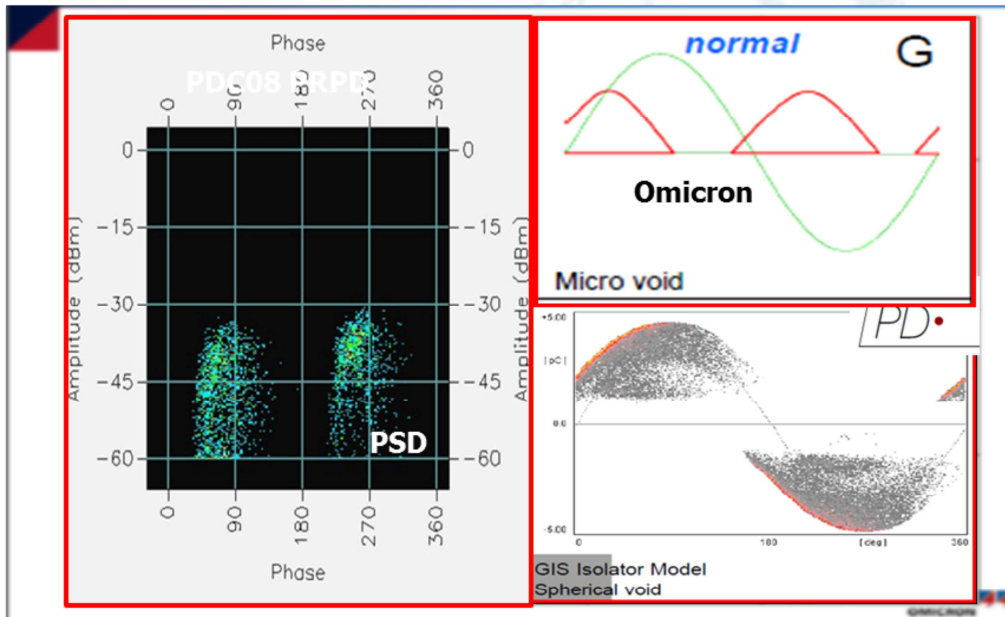
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■ Spread to other sensor Y Phase



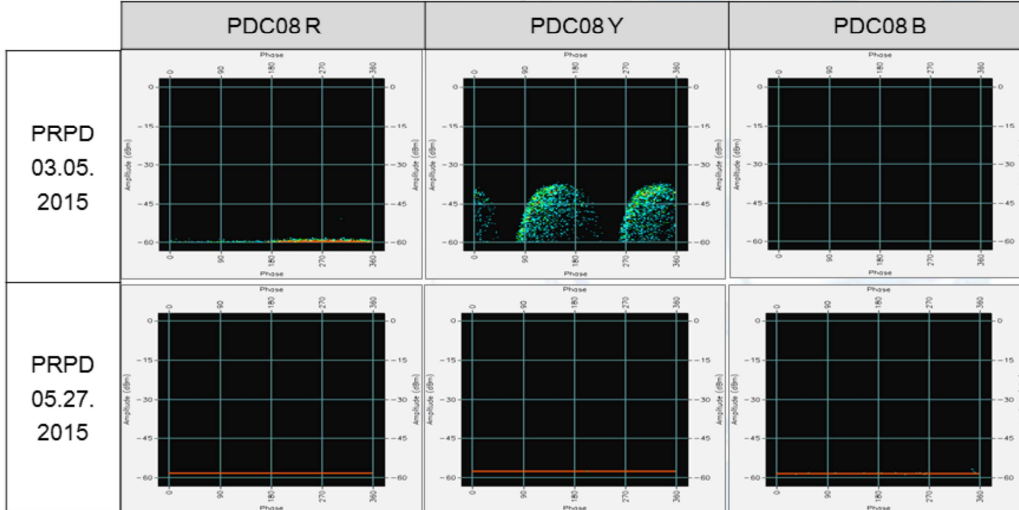
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## ■ Analysis



■ **After Transformer overhauling**

● **After CB On : PD signal is not detected**



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▣ **CASE 2**



- **Maker : SIEMENS**
- **Voltage : 220kV**
- **Sensor Type : Built-in**

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## ▣ D502 R Phase



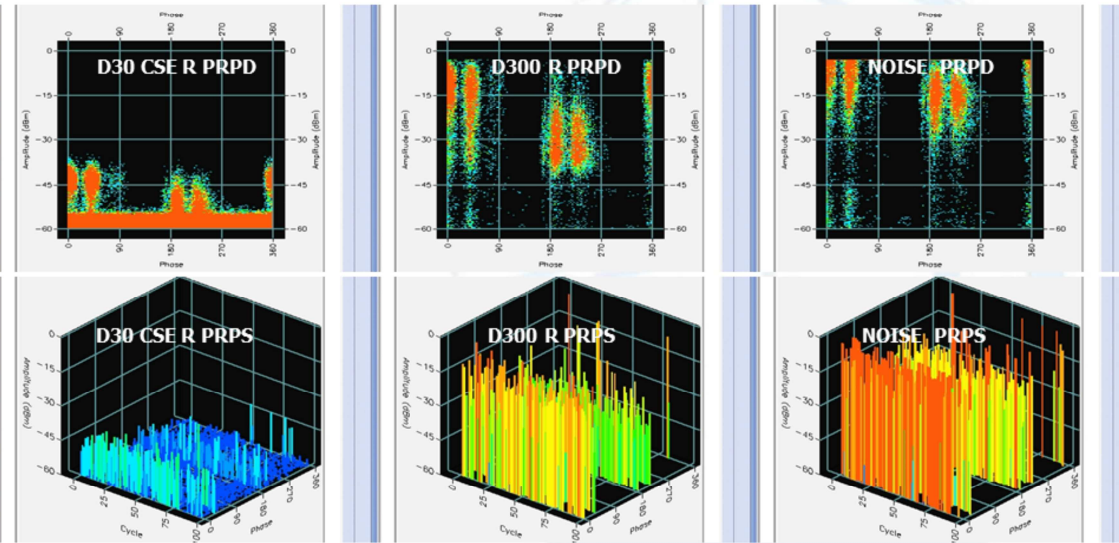
- **D502 R Phase sensor broken**
- **When closed sensor, center pin is connect guide.**
- **This arcing signal spread to near other sensor**

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## ■ PRPS & PRPD : Noise Gating Off



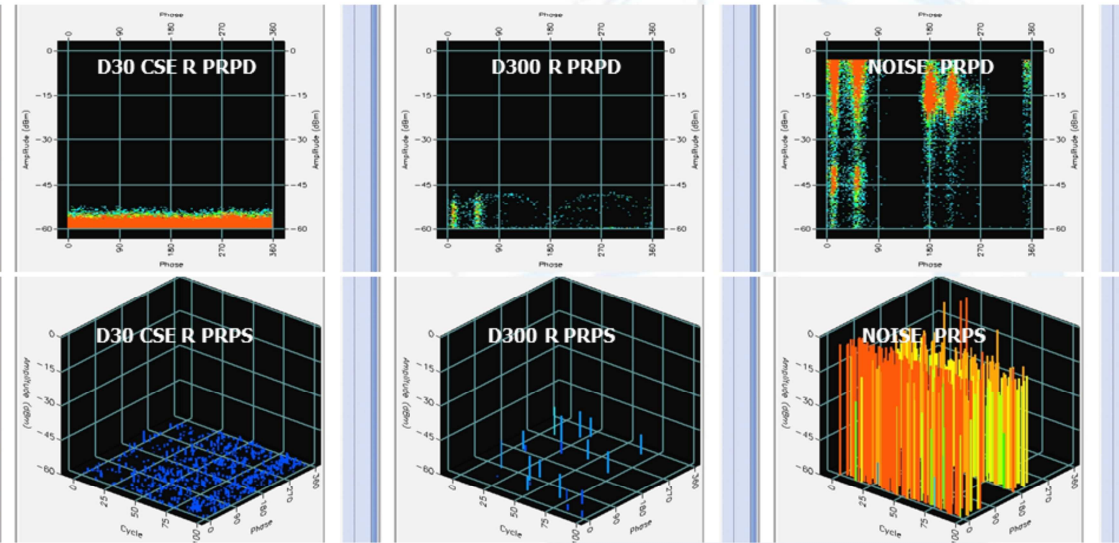
- D300 R : Similar PD + Arcing
- D30 CSE R : Arcing

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## ■ PRPS & PRPD : Noise Gating On

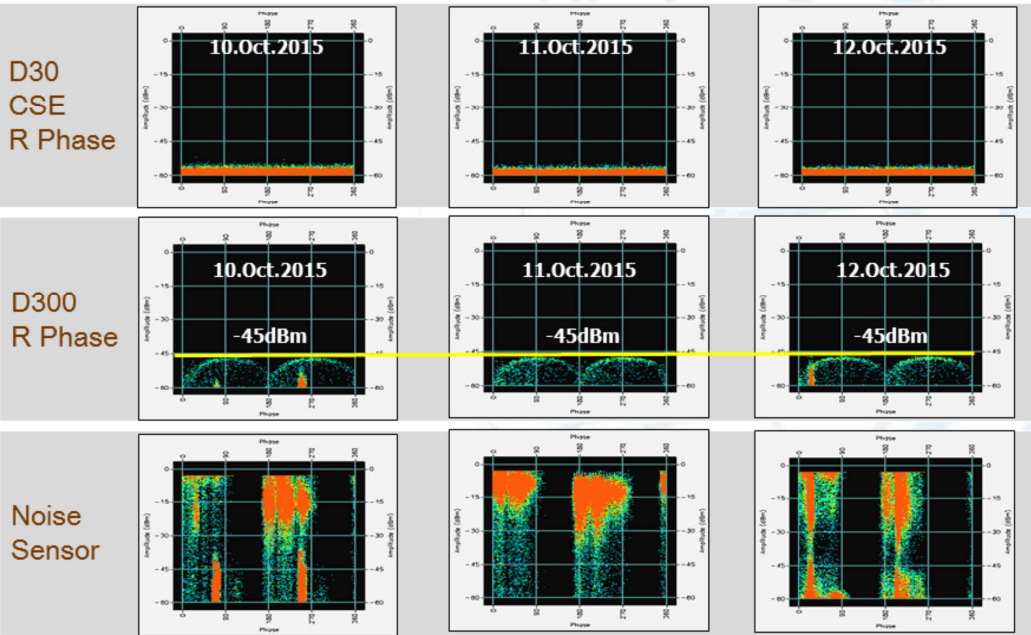


- D300 R : Similar PD + Arcing
- D30 CSE R : Arcing

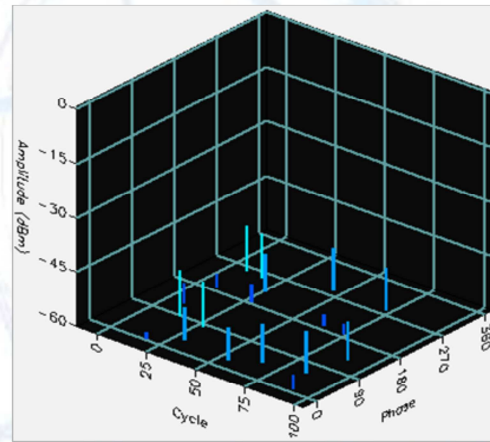
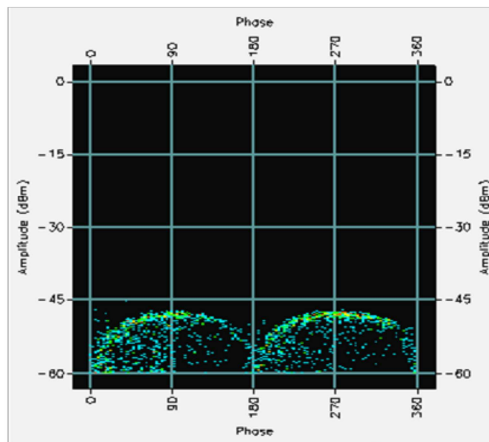
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## ■ PRPD : 1<sup>st</sup> Day, Noise Gating On



## ■ Test Result



- **D502 R phase sensor broken and occur arcing**
- **Remove arcing signal and only remain PD signal**
- **Test Result : Particle**



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A large, light blue, semi-transparent globe graphic with a grid of latitude and longitude lines, positioned behind the "Thank You!" text.

# Thank You !

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Do you have any question?

Ok.. Thank you very much