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# Assessment of Voltage Sag in Medium Voltage Distribution System in PEA. By Using GIS Map



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Provincial Electricity Authority***



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## *Objective*

- To identify area of vulnerability in distribution system in GIS map that use to be data for maintenance and system improvement for PEA.***



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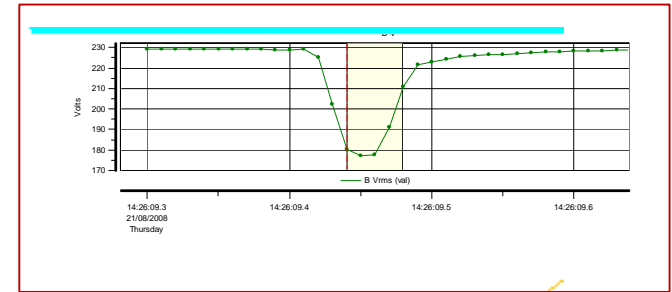
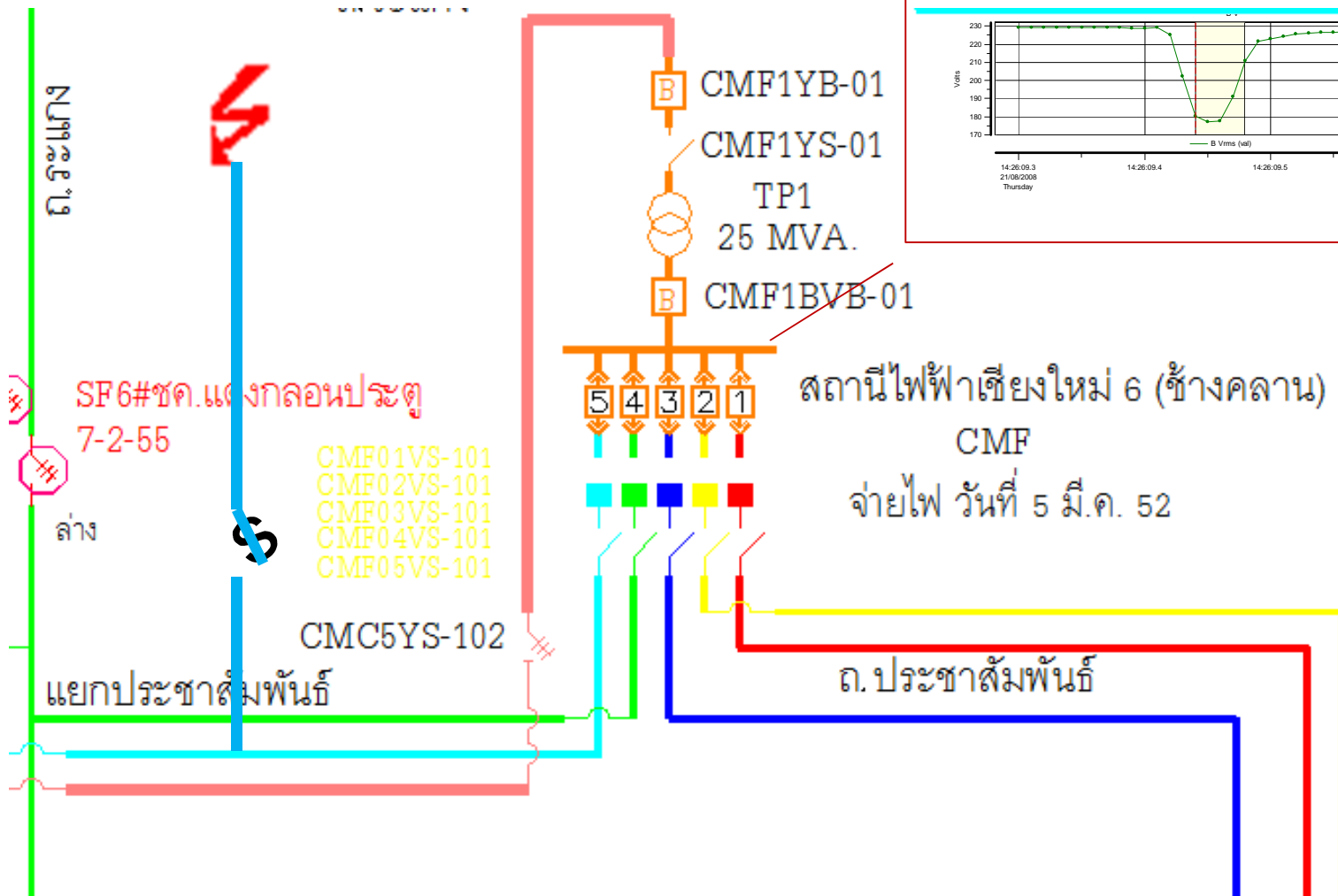
## Introduction

- ❑ *When load increase , PEA. construct new substation transmission line and improve existing distribution system*
- ❑ *improve main distribution line first*
- ❑ *improve branch line later*
- ❑ *In customer section , there is no improvement*



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# Introduction





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## *Scope of work*

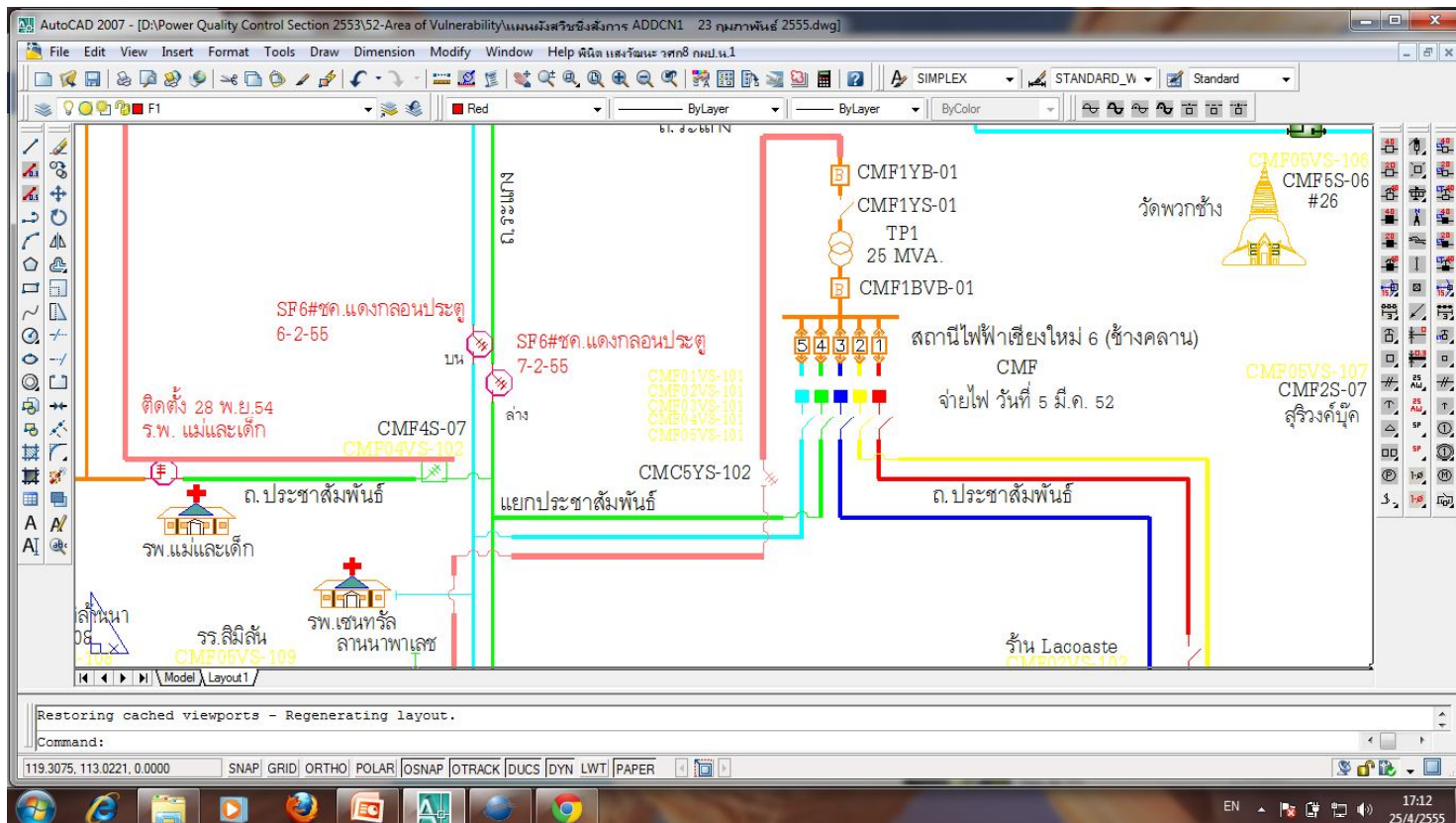
- study of voltage sag in medium voltage 22 kV PEA. Distribution system*
- consider Chiang Mai 6 Substation ( CMF )*
- Using GIS. data base by ARC GIS program*
- Calculate short circuit current by DIgSILENT*
- draw AOV. By using Single line to ground fault and Voltage sag 70%*



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# How to draw AOV.

## 1. Correct data both real distribution dispatch and GIS data

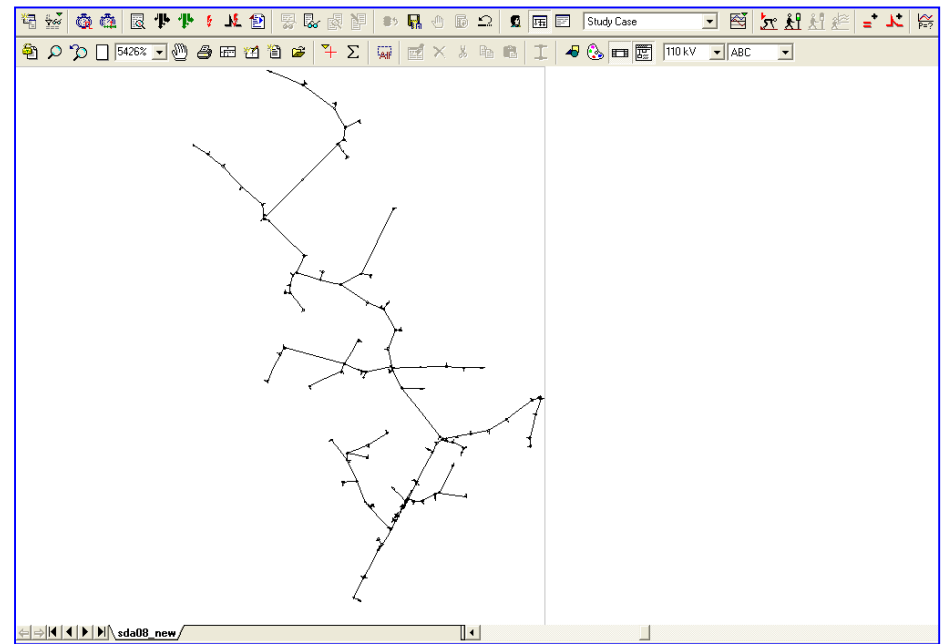
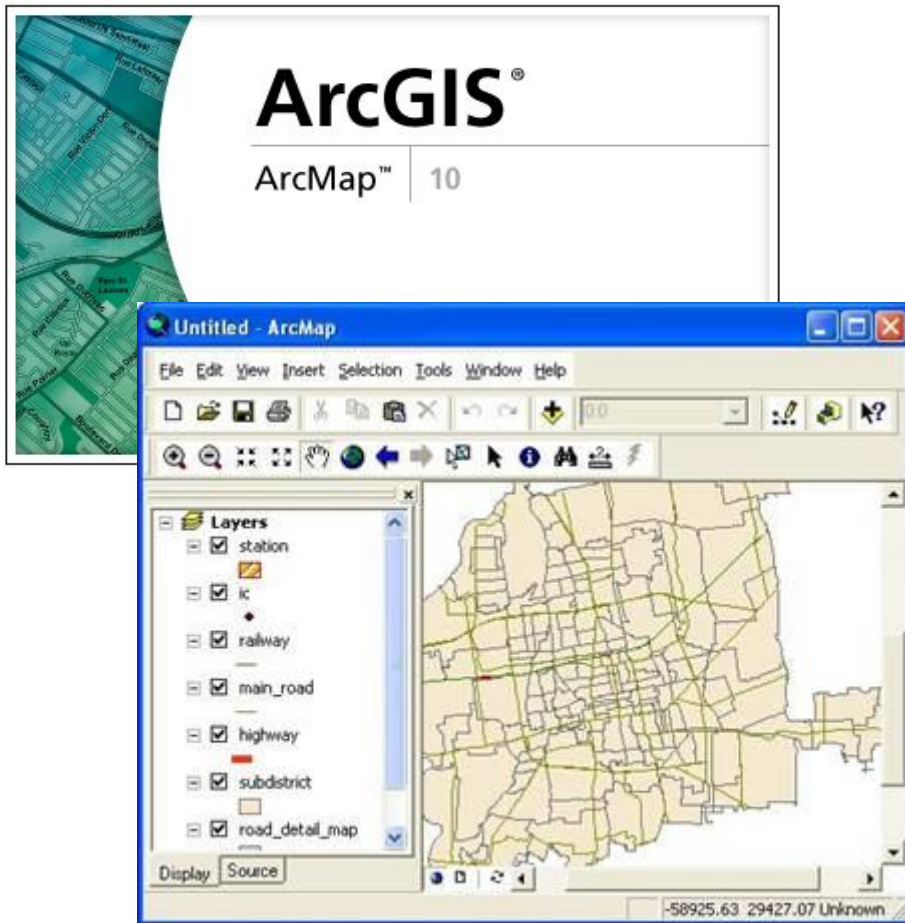




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# How to draw AOV.

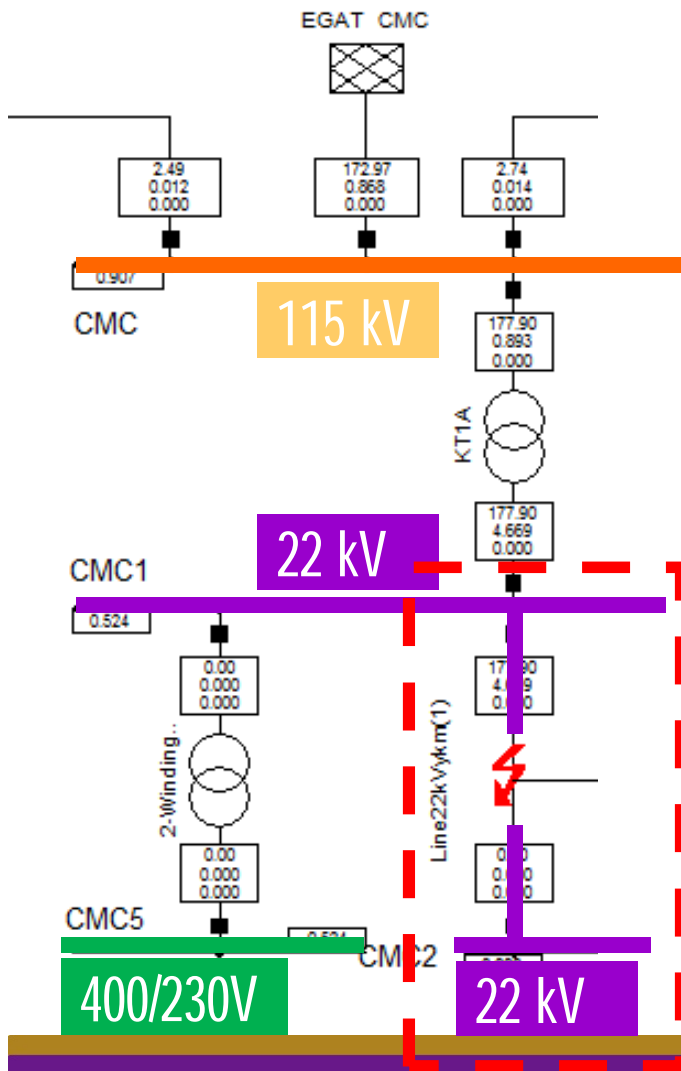
## 2.export data from GIS and import data to DlgSILENT





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# Fault Calculation



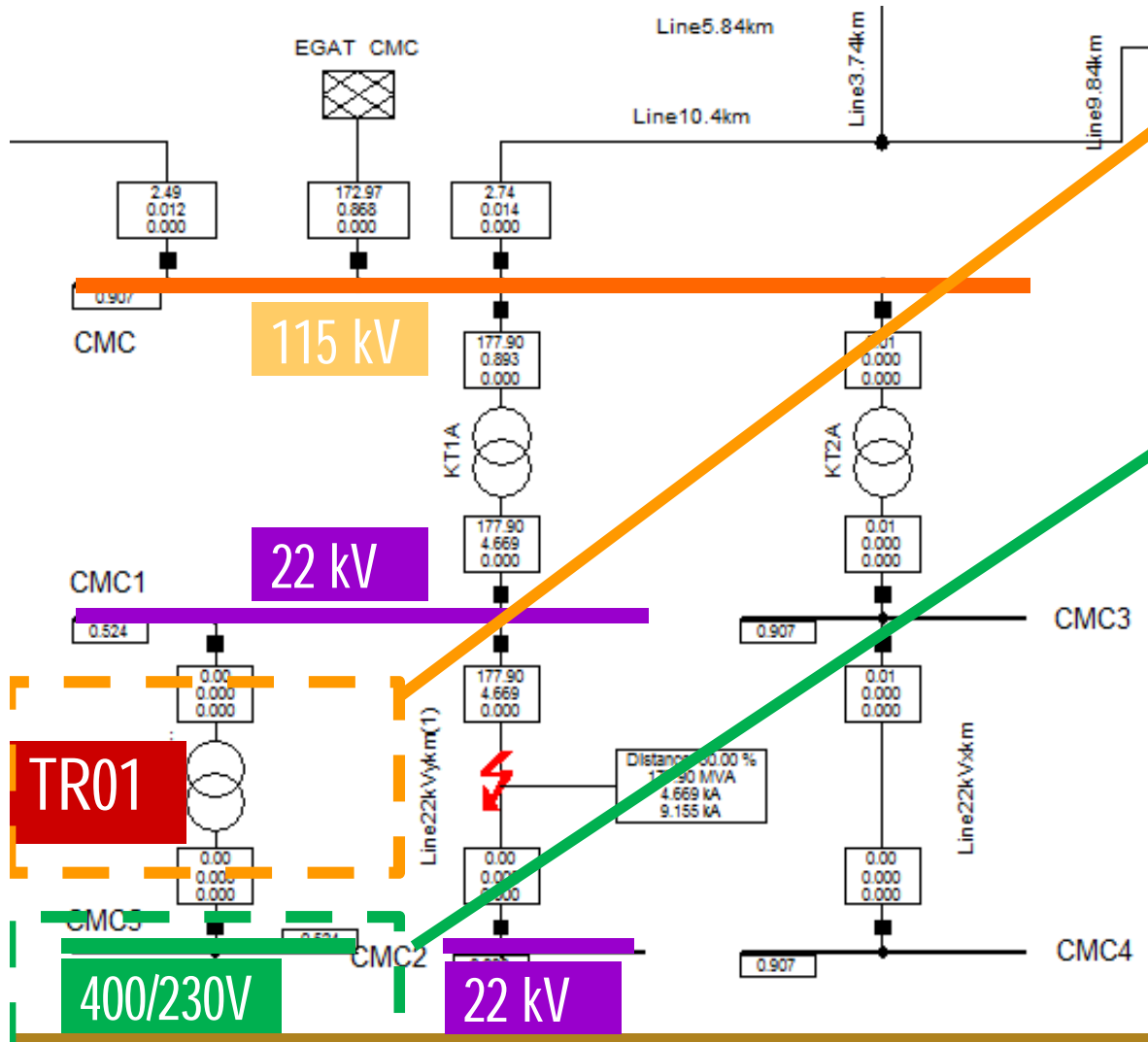
Simulate fault in  
distribution line 22 kV.





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# Determine AOV.



- Model **TR1** DYn11  
22kV/400V at substation to  
measure 230V side
- Voltage at this bus is voltage  
that all customer in  
substation will meet during  
short circuit.



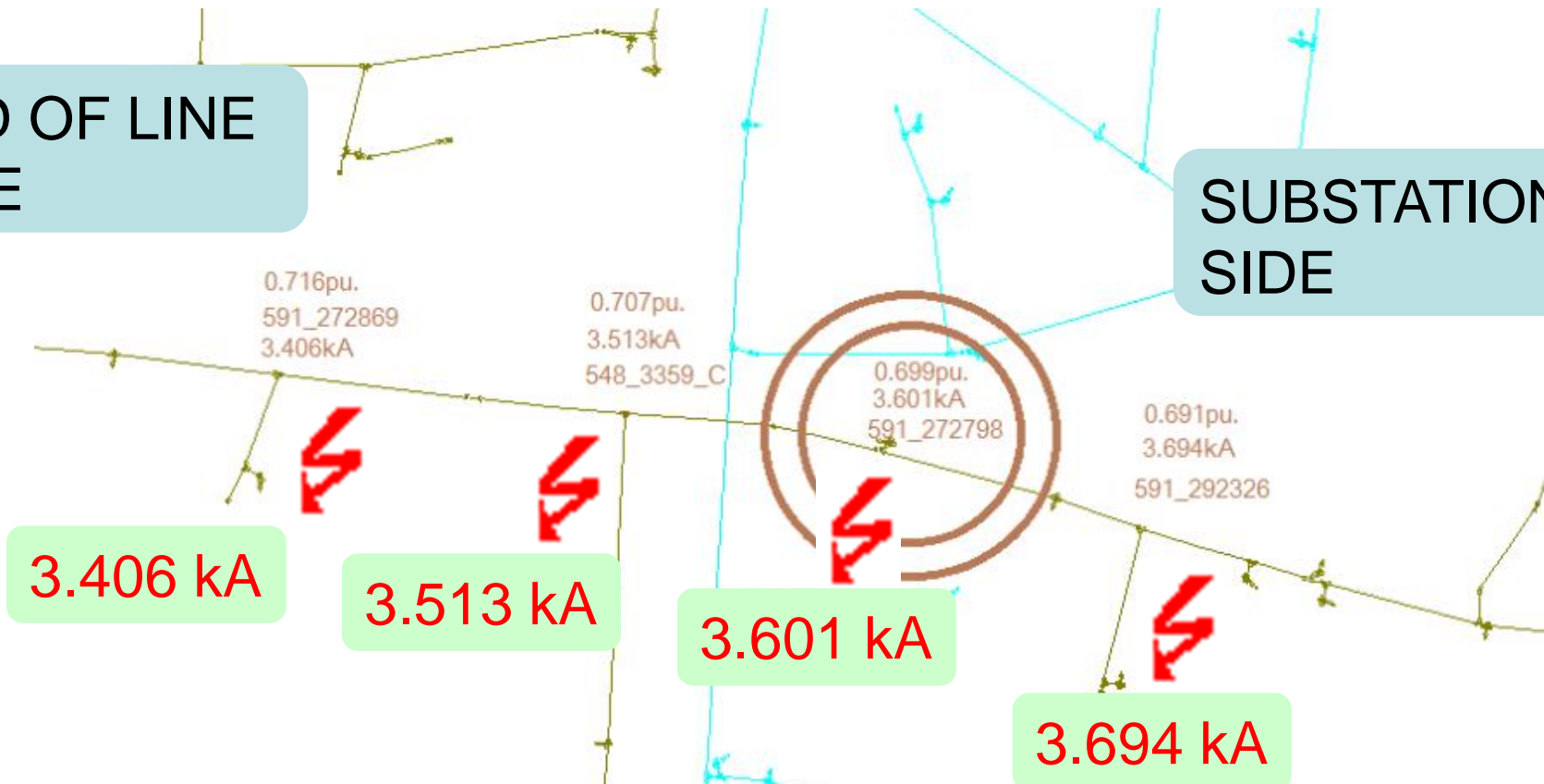


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## How to draw AOV.

END OF LINE  
SIDE

SUBSTATION  
SIDE



**3. Calculate Short circuit current (Single line to ground)  
each node refer to IEC60909 (2001)**

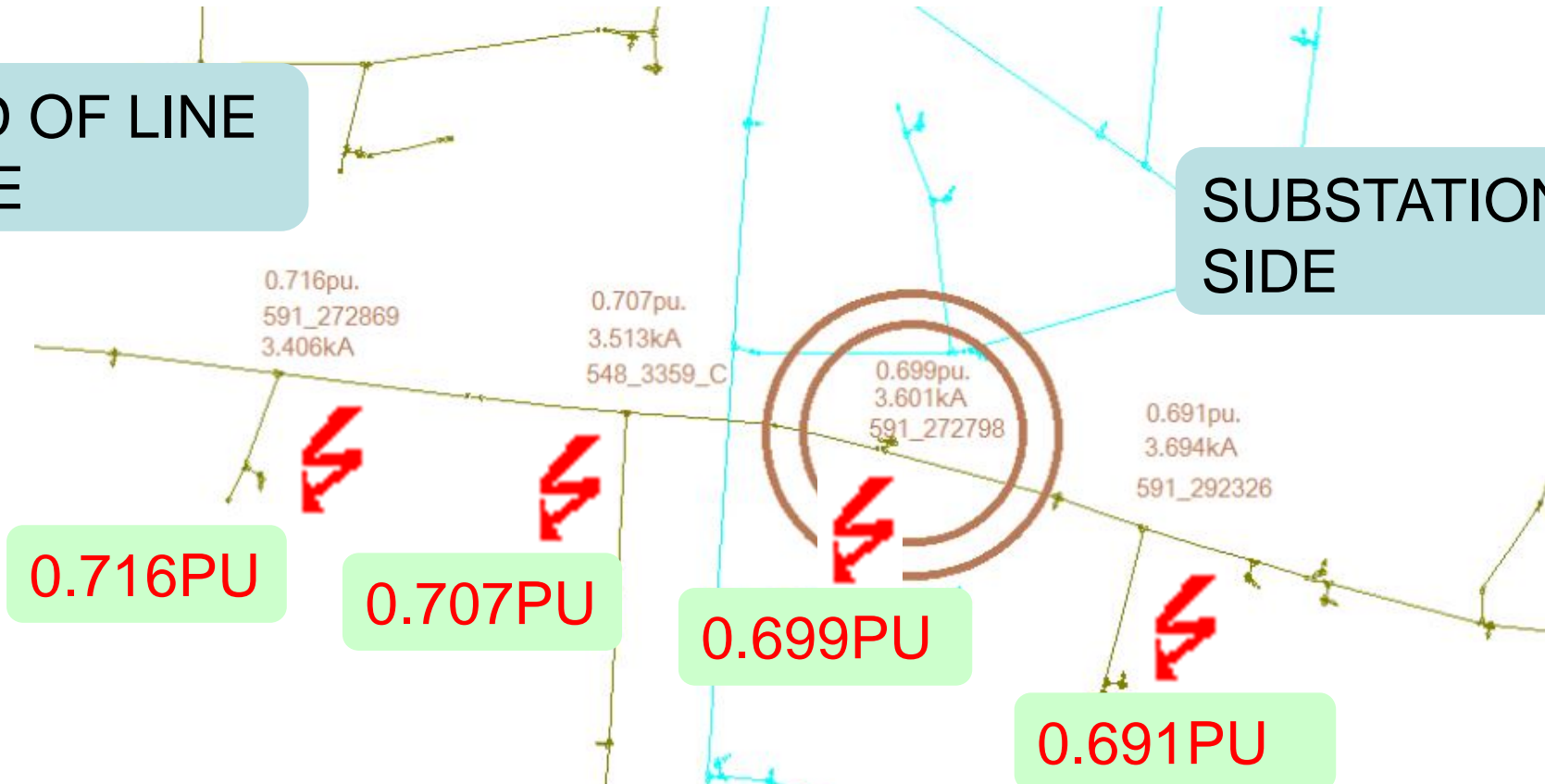


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## How to draw AOV.

END OF LINE  
SIDE

SUBSTATION  
SIDE



**4. Determine voltage sag at low voltage 400 V side when fault occur at medium voltage 22 kV. For each node.**



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# How to draw AOV.

## 5. FIND BOUNDARY OF AOV.

Sag above the curve

Normal operation

0.716PU

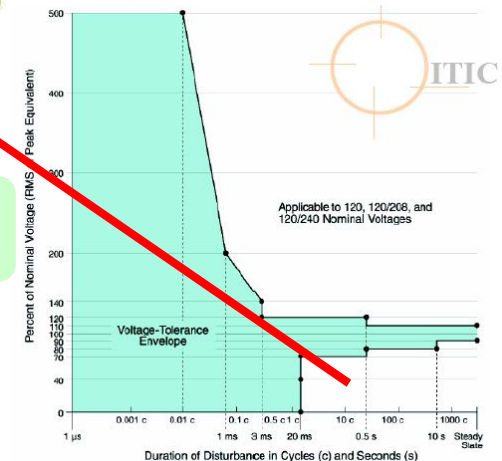
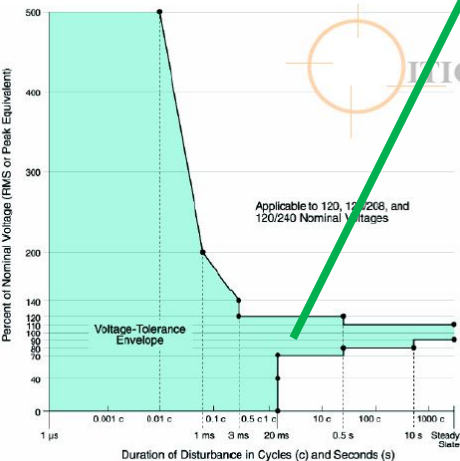
0.707PU

0.699PU

SUBSTATION  
SIDE

Sag below curve

Mul function or stop



0.691PU

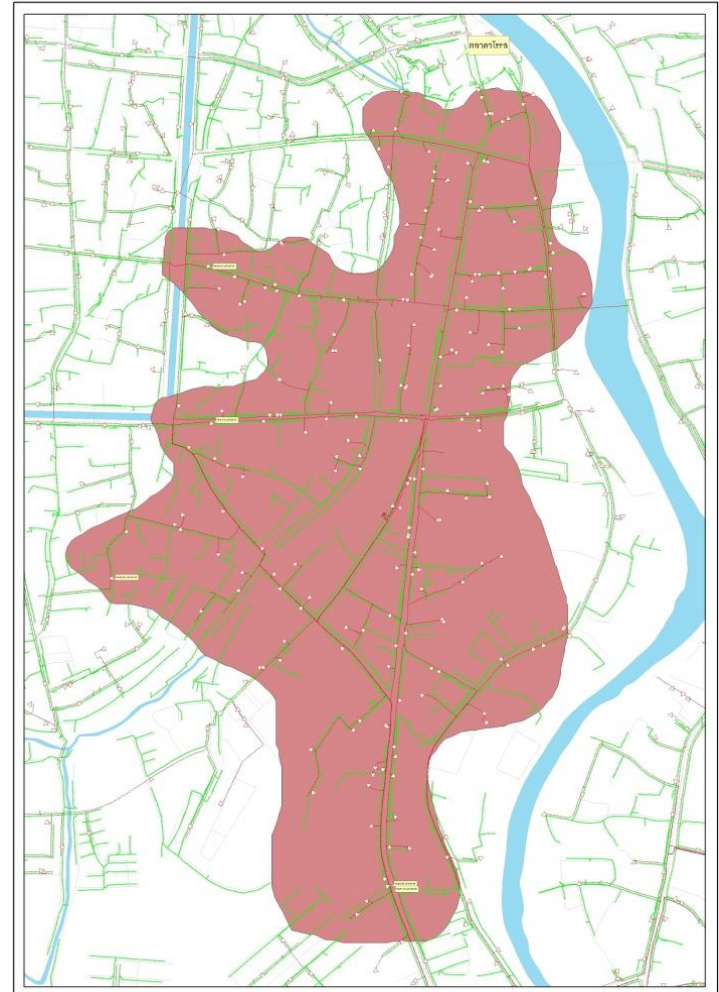
548\_3359\_C  
0.699pu.  
3.601kA  
591\_272798



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## *How to draw AOV.*

### *6.Draw AOV. In GIS. MAP*

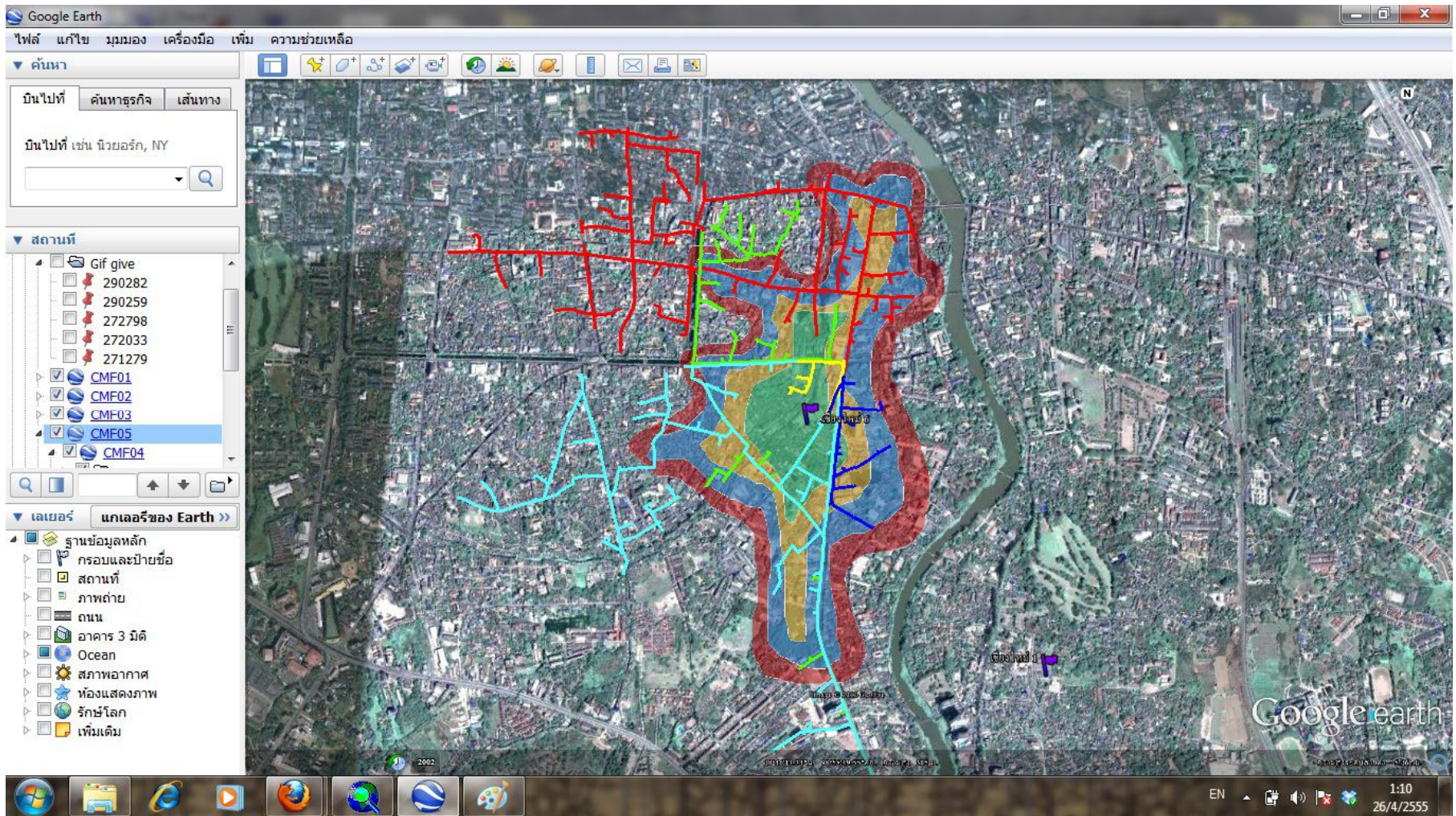






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# Result.





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## Result

|                 | In AOV. | total | %      |
|-----------------|---------|-------|--------|
| km-circuit      | 27.24   | 35.92 | 75.84% |
| Fuse and Switch | 36      | 52    | 69.23% |
| Transformer     | 205     | 310   | 66.13% |







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## Conclusion

- ❑ *This study show prediction of voltage sag and area of vulnerability in distribution system . The AOV. In GIS. Map is easy to identify position in real area.*
- ❑ *The study show number of equipment in distribution system (both PEA's and customer's equipment) that should take more action.*
- ❑ *GIS Data can be useful for maintenance and system improvement for PEA to reduce number of sag in network.*