EXPERIMENTATION PART

- **Presentation of the test case**
- Part I : Using the OLTC
- Part II :
  - Using reconfiguration
  - Using VVC

Presentation of the test case

- **Test case** : scenario 1 (G_4 at node 13) at the step time 13h.

	Load 1	Load 2	Generator 3	Generator 4
P	3.230 kW	3.230 kW	0.000 kW	- 4.680 kW
Q	0.460 kVAr	0.660 kVAr	0.000 kVAr	- 0.03 kVAr
S	3.260 kVA	3.300 kVA	0.000 kVA	4.68 kVA

→ Screenshot of the SCADA system (PCVue)

- Load 1 and 2 (industrial loads) → asynchronous machines.
  - ✓ The power factor is not equal to 0,4.
  - ✓ It is not constant and varies for small size asynchronous machines regarding the value of the active power and the quality of the voltage waveform.
- L_6, L_7, L_9 at 0,6 kW and L_{10} at 0,8 kW
  - ✓ The values of these loads are not remotely accessible to the SCADA system,
  - ✓ The steps of variation of these loads are discrete : for L_6, L_7, L_9, the step size is 0,2 kW and for L_{10} it is 0,4 kW. That is why we cannot put 0,6 kW for L_{10}.

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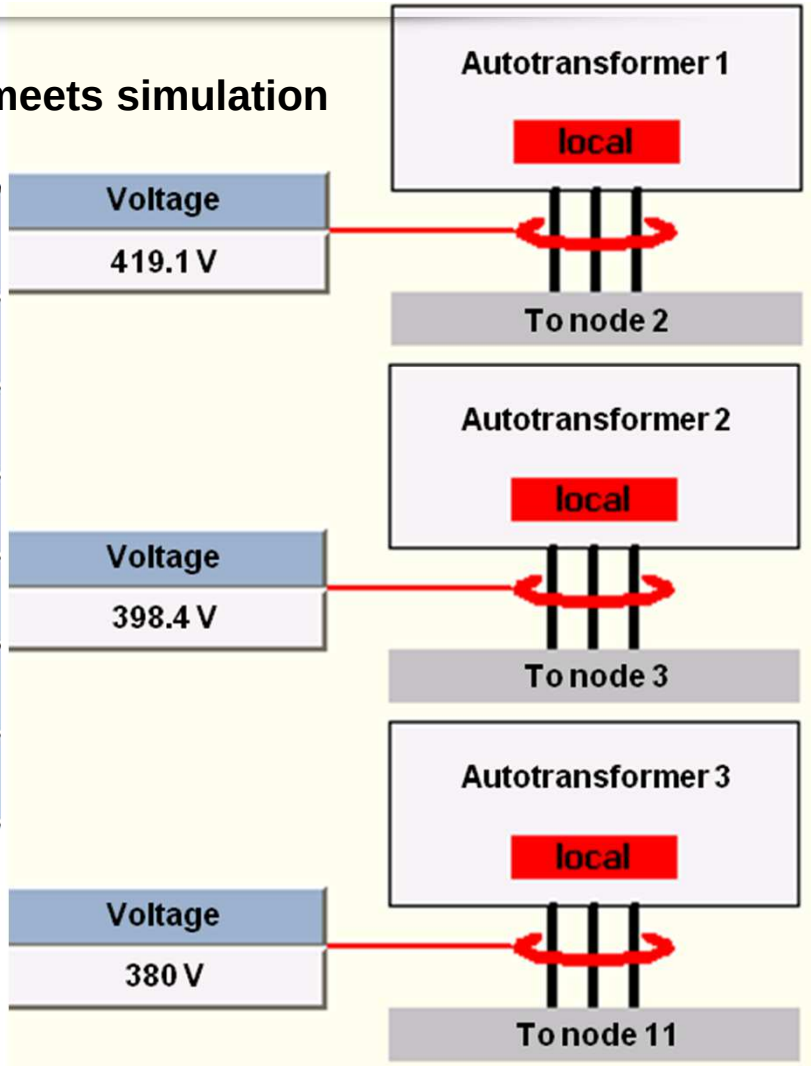
Using the OLTC

Using the classical control, check if experiment meets simulation

	Load 1	Load 2	Generator 3	Generator 4
P	3.230 kW	3.230 kW	0.000 kW	- 4.680 kW
Q	0.460 kVAr	0.660 kVAr	0.000 kVAr	- 0.03 kVAr
S	3.260 kVA	3.300 kVA	0.000 kVA	4.68 kVA
U12	387 V	409 V	416.59 V	427.59 V
U23	388 V	410 V	416.49 V	427.09 V
U13	388 V	411 V	417.79 V	427.69 V

L_6, L_7, L_9 at 0,6 kW
L_{10} at 0,8 kW
Measure of G_3 at node 10



Using the OLTC

Compute the error between measurement and simulation using the following formula

$$Error\ (\%) = \frac{U_S(N_i) - mean(U_{Ekl}(Ni))}{V_S(N_i)} \times 100, k \neq l$$

With:

- $U_S(N_i)$ = Voltage gotten with the simulation at node i
- $U_{Ekl}(N_i)$ = Voltage gotten with the experimentation at node i between phase k and l

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Using the reconfiguration

Using the reconfiguration pushbutton, find the optimal configuration for the following inputs

	Load 1	Load 2	Generator 3	Generator 4
P	3.230 kW	3.230 kW	0.000 kW	- 4.680 kW
Q	0.460 kVAr	0.660 kVAr	0.000 kVAr	- 0.03 kVAr
S	3.260 kVA	3.300 kVA	0.000 kVA	4.68 kVA

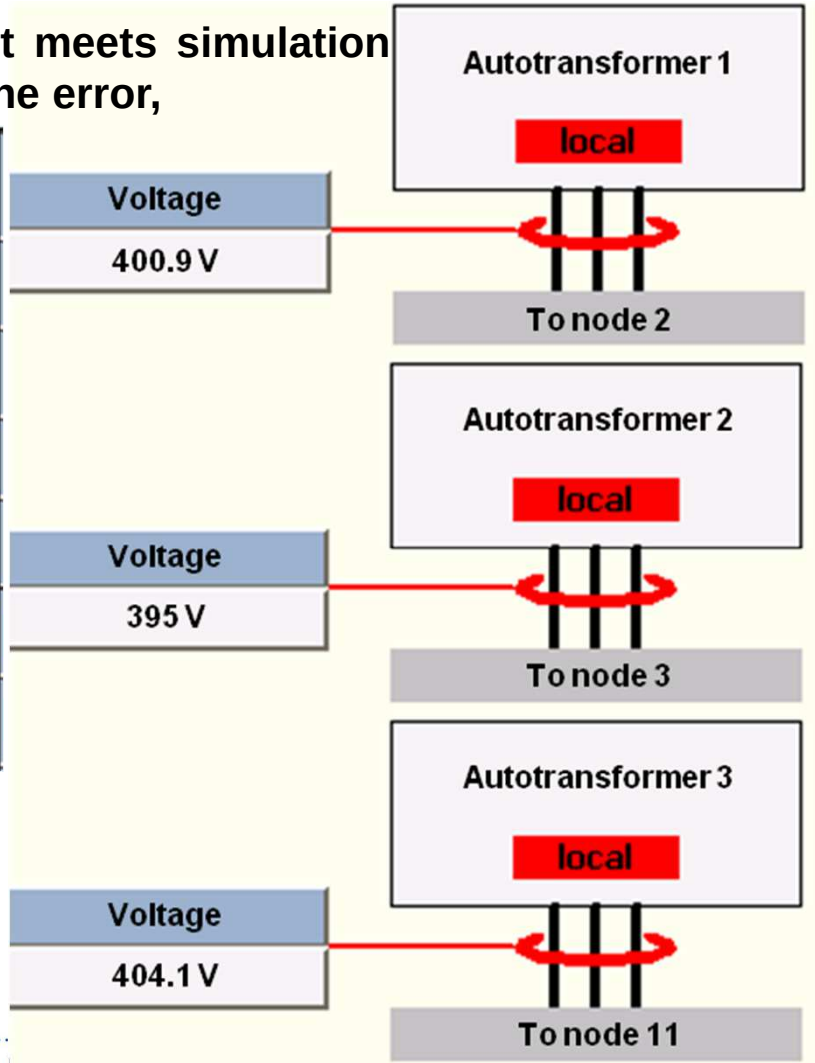
L_6, L_7, L_9 at 0,6 kW
L_{10} at 0,8 kW
Measure of G_3 at node 10

- Optimal configuration found : **4, 6, 7, 8, 15**
- It can be noticed that power losses decreases and the voltage profile is better even if there is a small over-voltage. This problem can be adjust using the OLTC.

Using the reconfiguration

Using the classical control, check if experiment meets simulation for the configuration 4, 6, 7, 8, 15 and compute the error,

	Load 1	Load 2	Generator 3	Generator 4
P	3.260 kW	3.230 kW	0.000 kW	- 4.660 kW
Q	0.560 kVAr	0.640 kVAr	0.000 kVAr	0.08 kVAr
S	3.310 kVA	3.260 kVA	0.000 kVA	4.66 kVA
U12	390 V	393 V	403,79 V	417.29 V
U23	391 V	394 V	402,79 V	418.19 V
U13	392 V	394 V	404,29 V	418.99 V



L_6, L_7, L_9 at 0,6 kW

L_{10} at 0,8 kW

Measure of G_3 at node 10

EXPERIMENTATION PART

- Presentation of the test case
- Part I : Using the OLTC
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Using the VVC

Using the VVC pushbutton, find the reactive power of G_4 for the following inputs

	Load 1	Load 2	Generator 3	Generator 4
P	3.230 kW	3.230 kW	0.000 kW	- 4.680 kW
Q	0.460 kVAr	0.660 kVAr	0.000 kVAr	- 0.03 kVAr
S	3.260 kVA	3.300 kVA	0.000 kVA	4.68 kVA

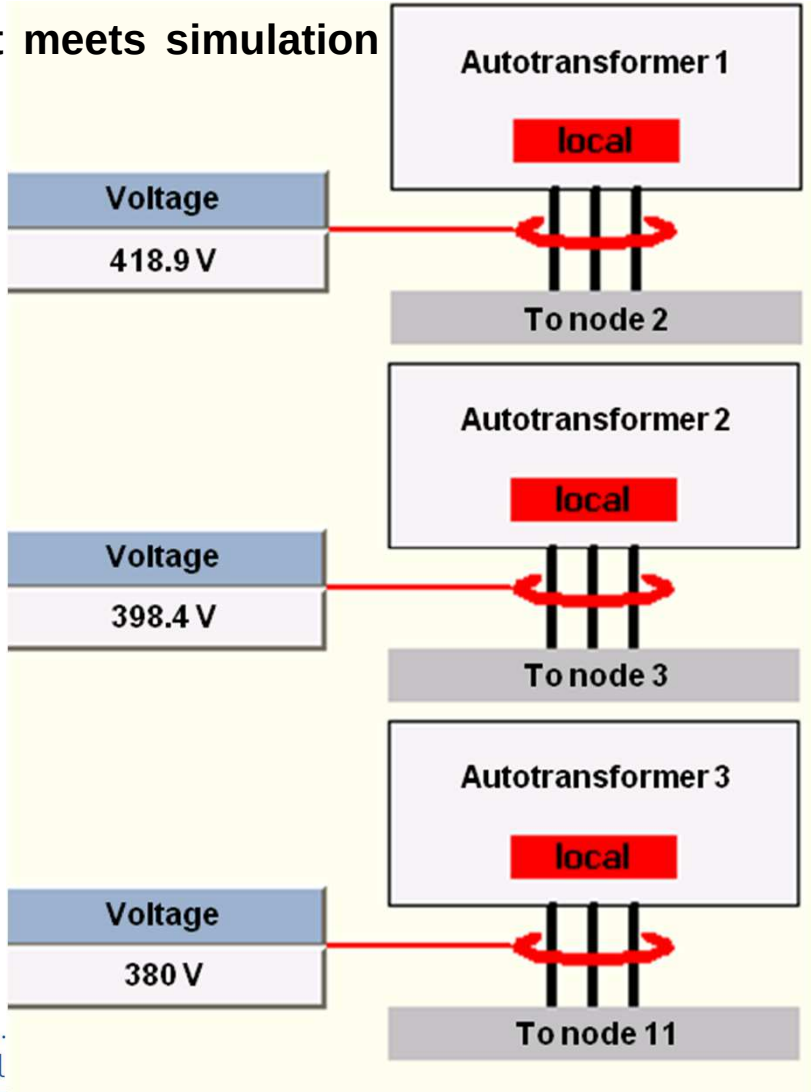
L_6, L_7, L_9 at 0,6 kW
L_{10} at 0,8 kW
Measure of G_3 at node 10

- Settings of transformers : 416 V, 400 V, 380 V
- Q_{G4} = -0,3734 kVAr

Using the VVC

Using the classical control, check if experiment meets simulation and compute the error,

	Load 1	Load 2	Generator 3	Generator 4
P	3.250 kW	3.220 kW	0.000 kW	- 4.670 kW
Q	0.500 kVAr	0.670 kVAr	0.000 kVAr	0.38 kVAr
S	3.290 kVA	3.290 kVA	0.000 kVA	4.68 kVA
U12	388 V	410 V	417.39 V	418.59 V
U23	388 V	410 V	416.69 V	417.99 V
U13	389 V	411 V	417.49 V	418.79 V



L_6, L_7, L_9 at 0,6 kW

L_{10} at 0,8 kW

Measure of G_3 at node 10