

# Method for Monitoring the Electromagnetic Impacts due to High Voltage Overheads Lines in Aosta Valley



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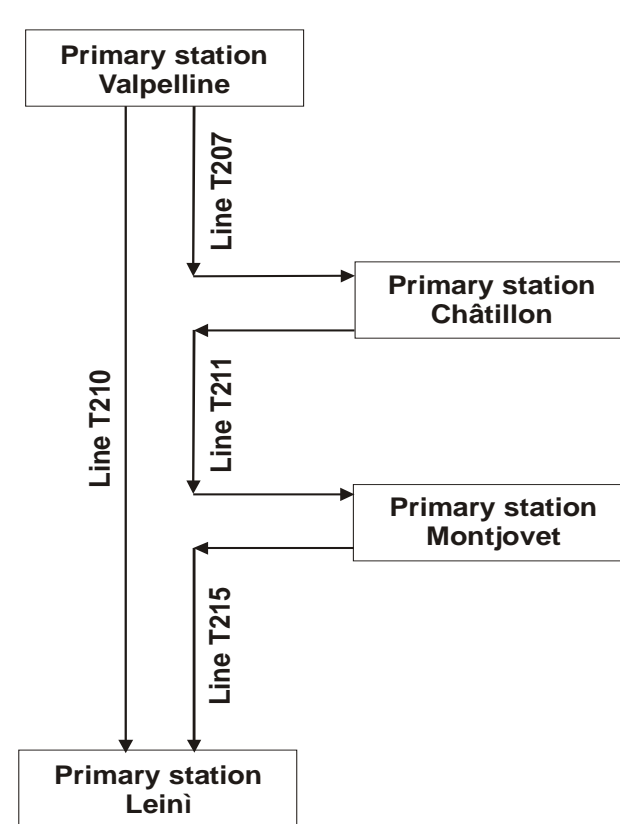
**Abstract**—The aim of this paper is to show the methodology used by the Environment Protection Agency (ARPA) of the Aosta Valley for evaluating the electromagnetic impact due to high voltage overhead lines which cross the region, with regards to public exposure. At first, by simulation and inspections, buildings potentially exposed to electromagnetic field due to their proximity to the lines were identified, then field measurements, performed for some day time, permitted to verify if exposure limits were exceeded and to set a method to evaluate the population exposure level at any time and on any time lapse provided current data are known. So far, two important line branches were examined with the purpose to extend the controls to all lines in Aosta Valley.

## Methodology

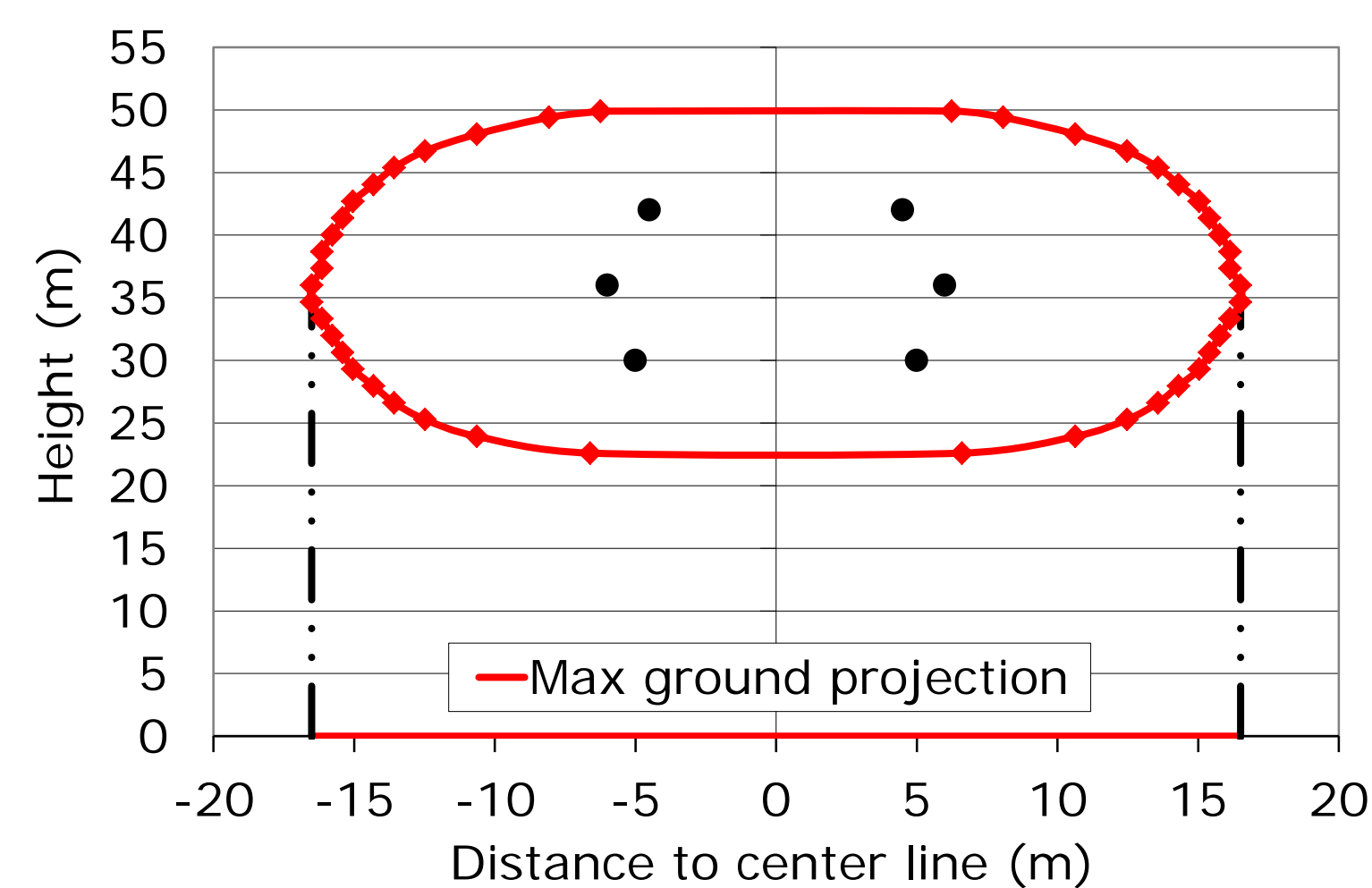
### A. Inspections and measurements

1. Line identification → Two 220 KV lines were chosen due to proximity to buildings

- Villeneuve – Chatillon (single line T209)
- Valpelline – Leini (composed line)



2. Preliminary EMF simulation along lines paths



Data required: shape and coordinates of the pylons, geometry of conductors and current rating in normal service

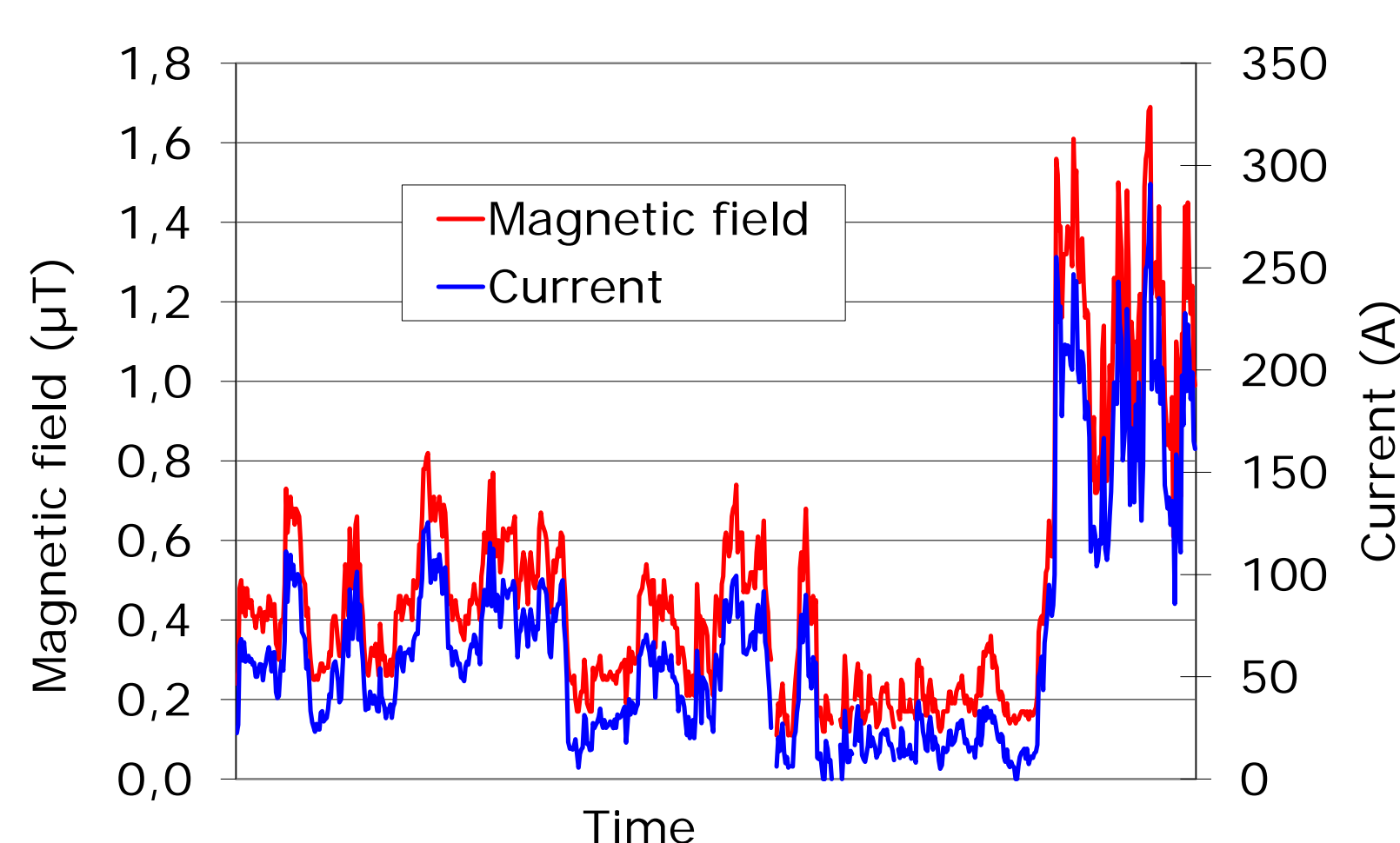
Aim: define restricted areas (buffer zone) on both sides of conductors where magnetic field can exceed an established value and identify the buildings within these areas

3. Inspections and screening → selection of buildings for thorough measurements

4. Measurements → electric field instantaneous outside the buildings and magnetic field instantaneous and long-term (acquisition every 30 seconds for one week).

### B. Indirect assessment to evaluate magnetic field from current data

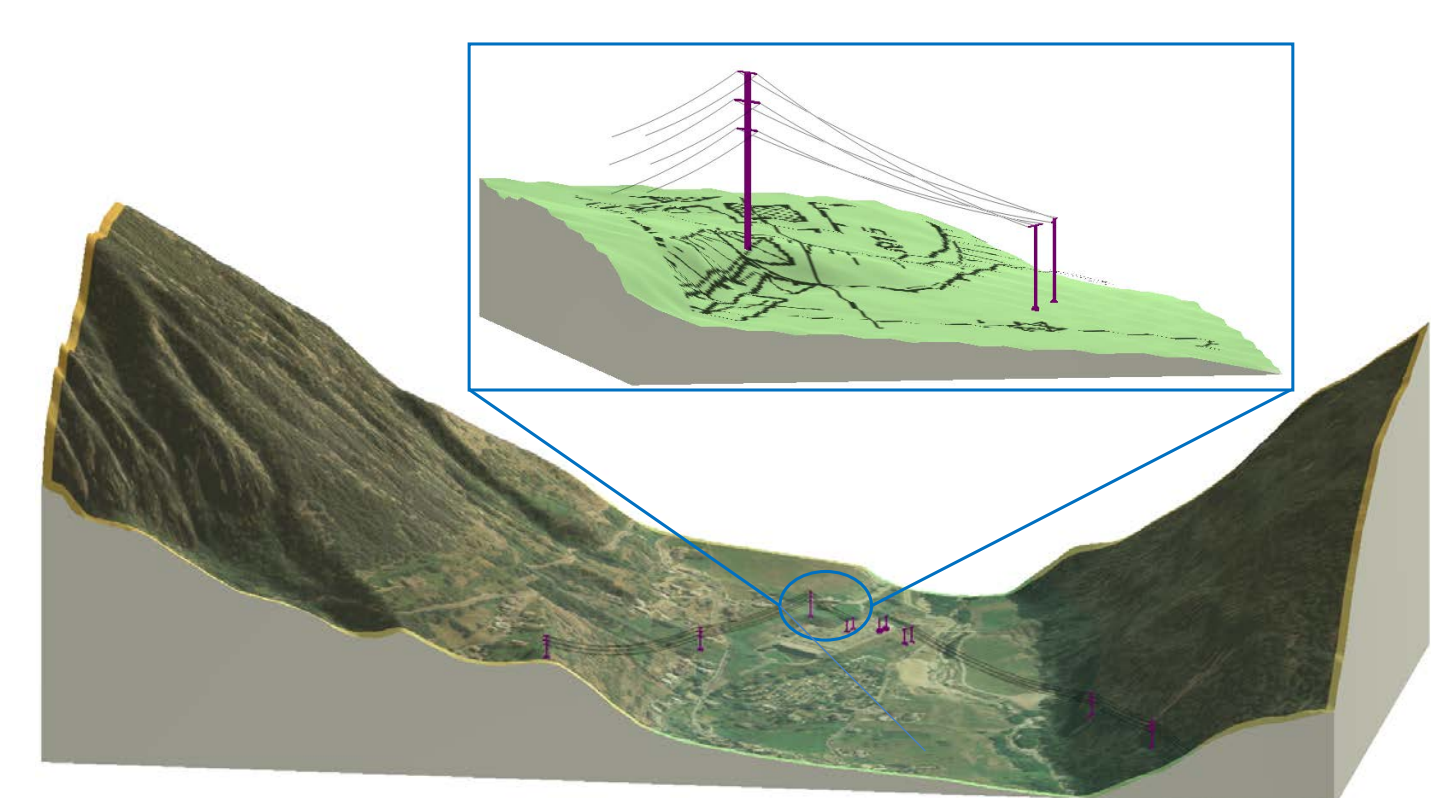
→ Single lines



Correlation (C) between magnetic field data series and current values was calculated.

If  $C > 0.9$  → average of the ratio between field measured values and current data in the same time was used as a multiplication factor to evaluate magnetic field in any time period in which current data were known

→ Composed line when line phases are known:

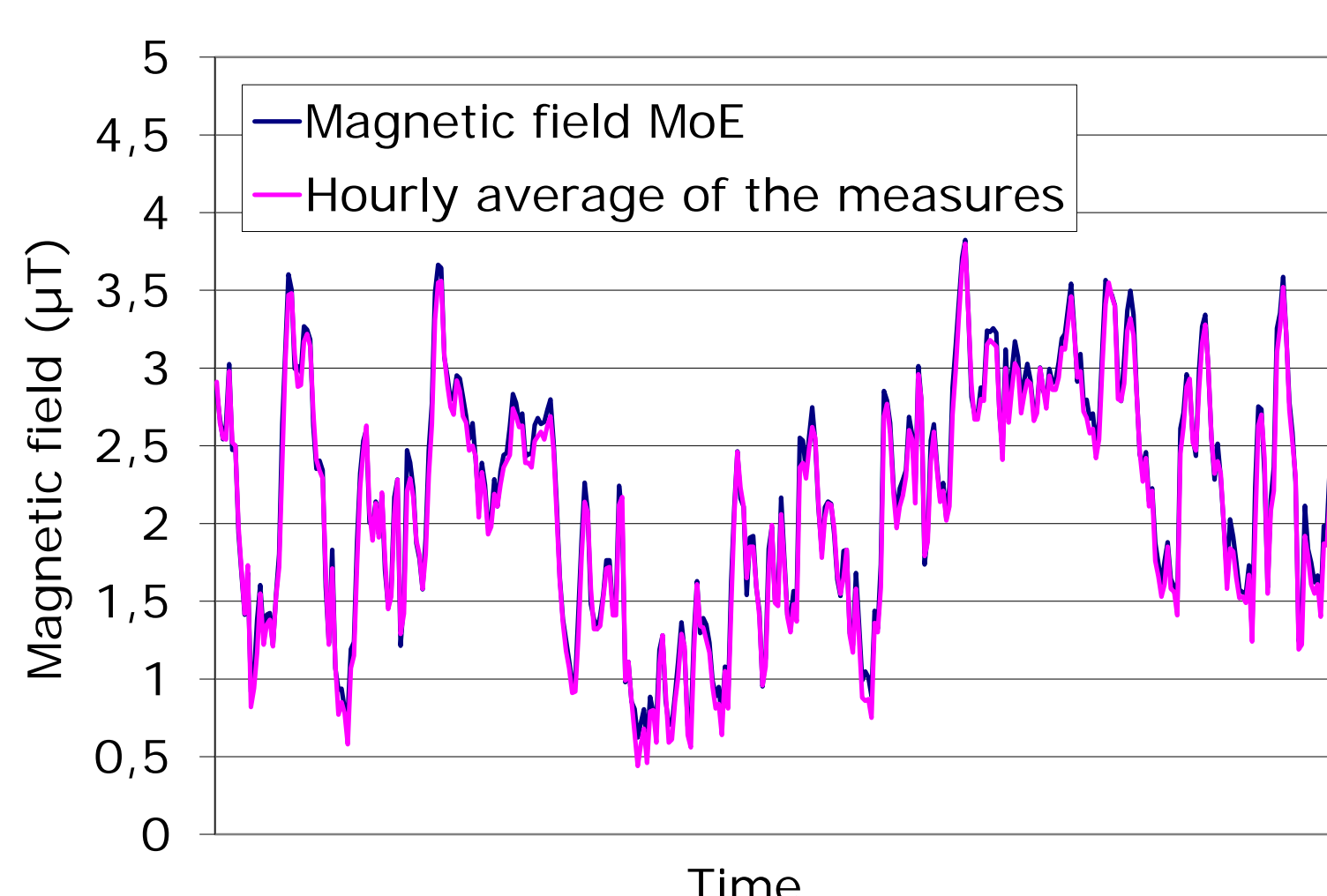


First step (WinELF software by Vector)

- Reconstruction of 3D geometrical configuration
- Identification of the exact point of long term measurement

Second step (MoE software by CESI)

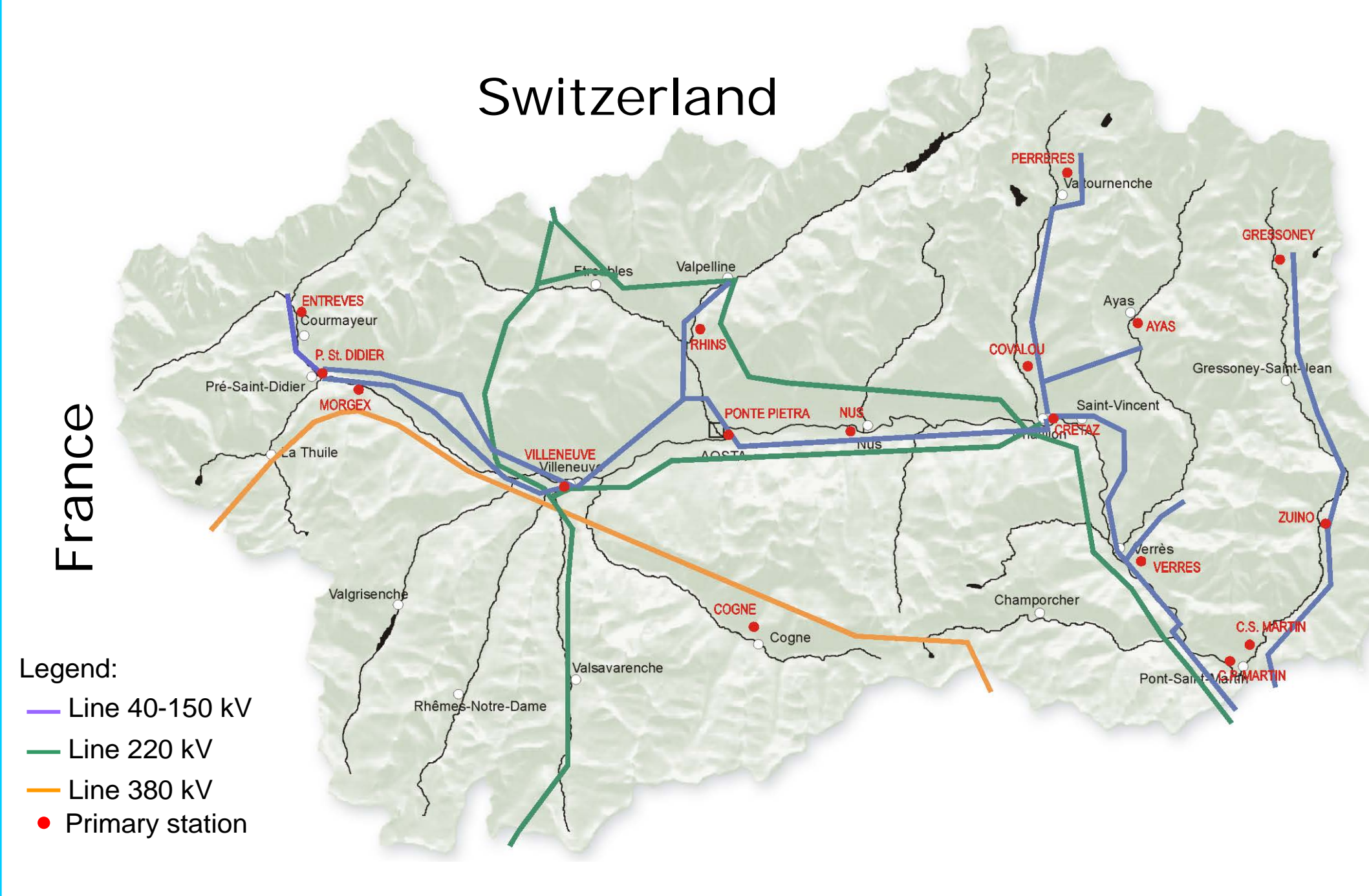
- Data required: output of previous step, magnetic field measurements, current data (amplitude and phase)
- Simulation of the magnetic field and comparison with measurements in time period were measured and calculated data are both available
- Simulation at any time provided that current data are available



→ Composed line when line phases are not known

Simulation algorithmis can't help, it is necessary to repeat measurements over time

## Framework

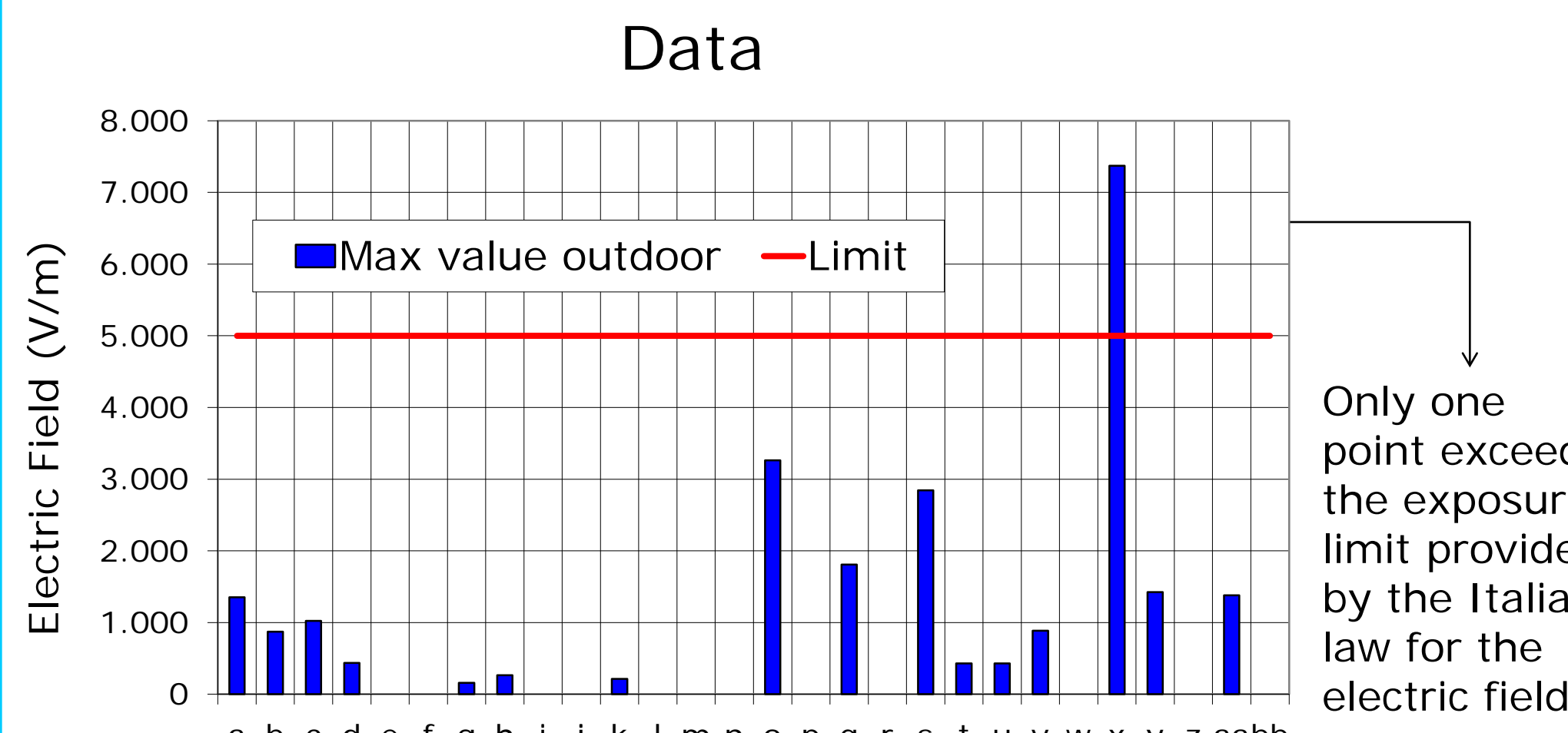


Aosta Valley is an Italian alpine region crossed by many high overhead voltage lines (220 kV or 380 kV) which transport electric power from France and Switzerland to Italy.

Moreover, due to orography and water supplies of the region, many local hydroelectric power plants produce and introduce energy into the national transmission network.

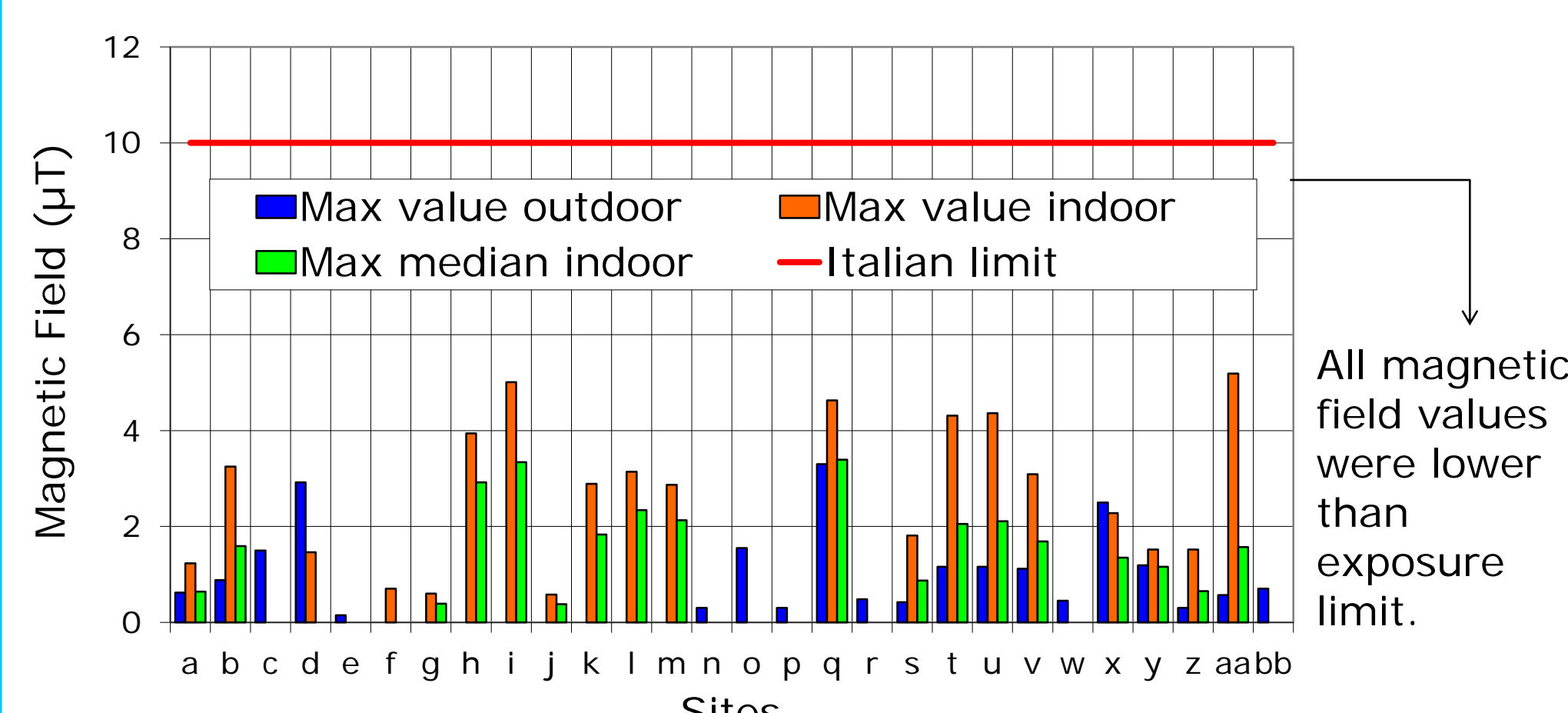
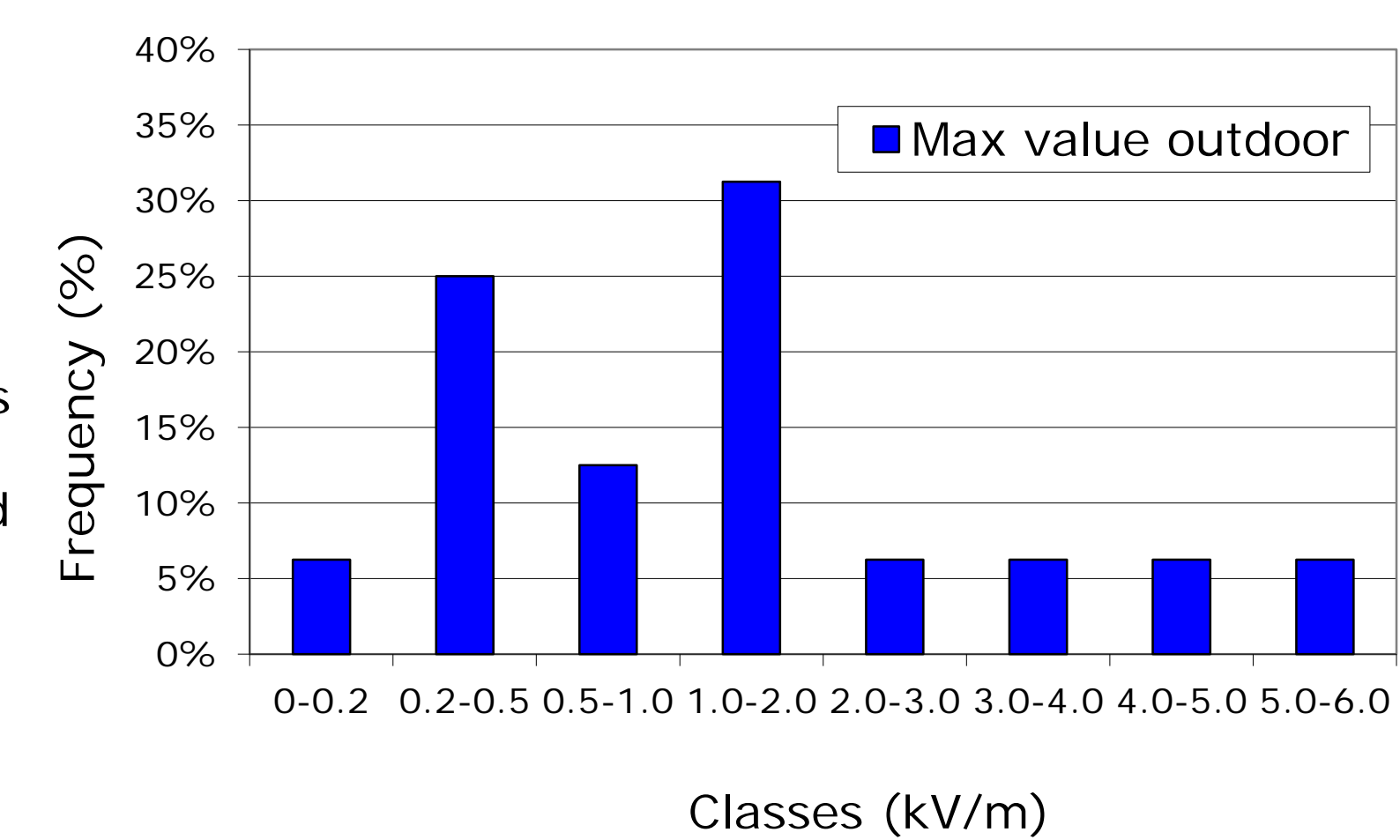
## Results

### A. Inspections and measurements

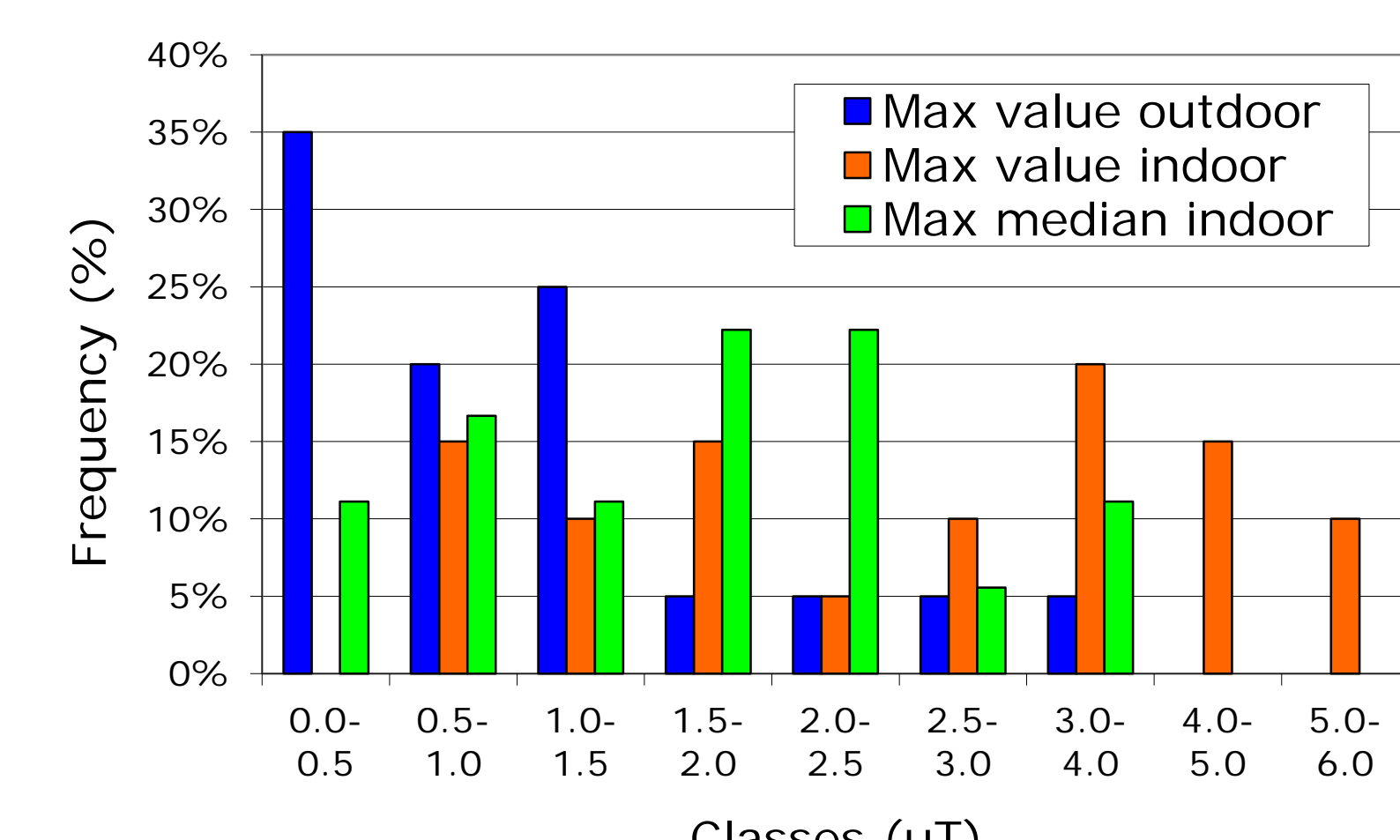


Only one point exceeds the exposure limit provided by the Italian law for the electric field.

### Statistical analysis



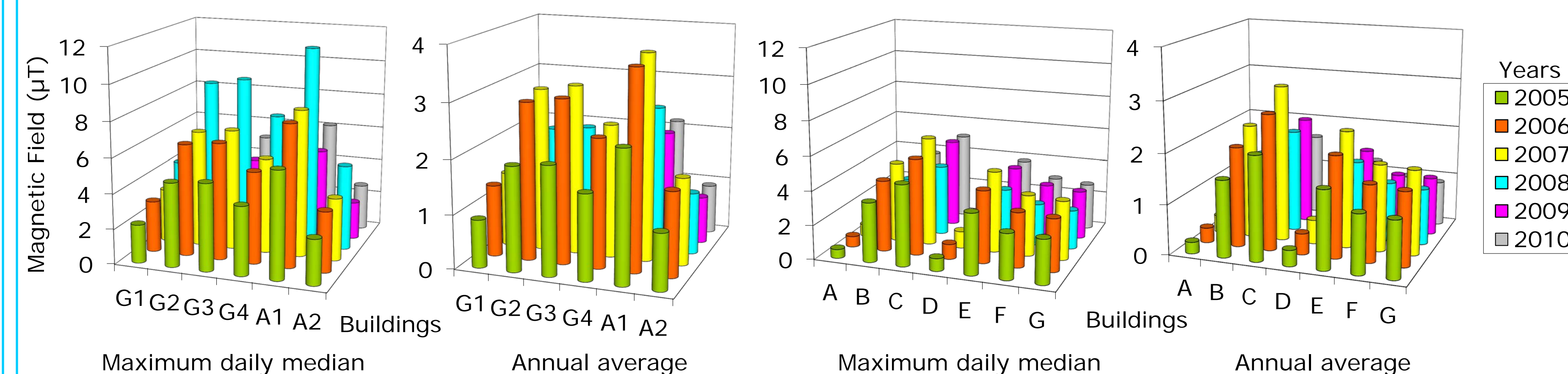
All magnetic field values were lower than exposure limit.



### B. Indirect assessment → Elaboration since 2005

→ Single lines

→ Composed line when line phases are known



## Conclusions

In this work an investigation method to assess the exposure to electric and magnetic field generated by power lines was described, based both on measurements and simulations.

- Knowing pylons position and shape and line electrical characteristics, a 2D buffer can be drawn on the map to locate buildings to be investigated in the aim of estimate population exposure to magnetic and electric field.
- Electric and magnetic field measurements are carried out. The first don't vary in time so the exposure can be immediately evaluated. The latter varies according to current flow: to evaluate exposure single measurement aren't comprehensive and some more analysis has to be accomplished.
- If values of current flowing in the lines during the field measurements and line phases are known, and correlation between current and field data is higher than 0.9, mathematical methods can be used, both for single or double lines, to evaluate magnetic field values from current data series at any time.
- If steps from 1 to 4 are verified, the method can be used to investigate exposure limit overrun and evaluate average exposure on a long period or field values on a specified time, provided that the current data are available.