



⇐ Turbines and generators to produce 100,000 GWh of electricity from renewable energy sources for 100 m people



⇐ High voltage transmission plants supplying power to 400 m people



⇐ Plants to supply water for 200 m people, wastewater treatment for 130 m people



⇐ Support for our customers with infrastructure solutions to reduce the energy demand



⇐ Metallurgical plants to produce 150 m tons of steel - this corresponds to the yearly demand of the EU

VA TECH Transmission & Distribution

CENTRAL FUNCTIONS

VA TECH Schneider High Voltage(VAS):
Products, Projects & Services

Brazil



England



Italy



France



Austria



TRANSFORMER
+ COMPONENTS



AC&P



CB 's Manufacturer (high voltage)

➤ VATECH T&D, BD Products:

- Development of High Voltage Circuit Breakers (72 kV - 800 kV)
- 2 R&D centres (Grenoble-France, Battaglia-Italy)
 - In France: core activity for GIS
 - In Italy: core activity for AIS

Using the same interrupters for AIS and GIS

- VATECH T&D SA France: 717 employees* (*2002 figures)
- VATECH T&D SA Italy: 285 employees* (*2002 figures)

Constructeur matériel électrique HT

- Nouvelles chambres de coupure (performances, fiabilité, coût)
- Anticiper les évolutions (technologies, normes, lois)

Arc de coupure

- Arc dans le SF6
- Arc dans un autre gaz
- Arc dans le vide

Arc dans le SF6

- Développement de produits performants et optimisés
- Utilisation de logiciel de modélisation (interaction arc électrique / écoulements de gaz)
 - Analyse au 0 de courant
 - Critère ' thermique ' (défaut kilométrique)
 - Critère ' diélectrique ' (TTR, courant de court circuit)
- Confirmation par des essais (développement, certification)

Analysis around current 0: flow calculations

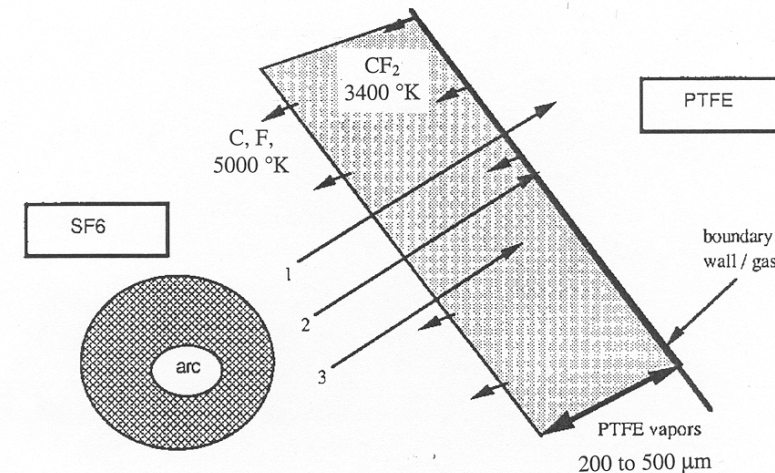
Main characteristics of the code:

- 2D axisymetrical simulation resolving the Navier-Stokes equations
- LTE, dissociation and ionisation through state laws
- Source terms taking into account Joule heating, lorentz force and radiation

Arc-nozzle interaction modelling:

Global treatment through a so-called transformation enthalpy, which account for the PTFE ablation and then the decomposition of the vapours in the boundary layer.

$$E_{\text{transf}} = 2.8 \cdot 10^7 \text{ J/Kg} \text{ and } T_{\text{vap}} = 5000 \text{ K}$$



Analysis of the voltage recovery after current 0:

- Coupling between flow and dielectric calculations after current 0
- T and ρ fields are obtained owing to arc/flow calculations
- E field is obtained owing to standard dielectric calculations

Both calculations are coupled in order to identify the weak regions and to improve the design of the chamber

- The chosen criteria E/ρ is obtained owing to the coupling between both models

Activités centrées sur l'arc électrique

Arc dans le SF6

Figure 1. SF₆ LTE composition versus gas temperature (p=0.5MPa).

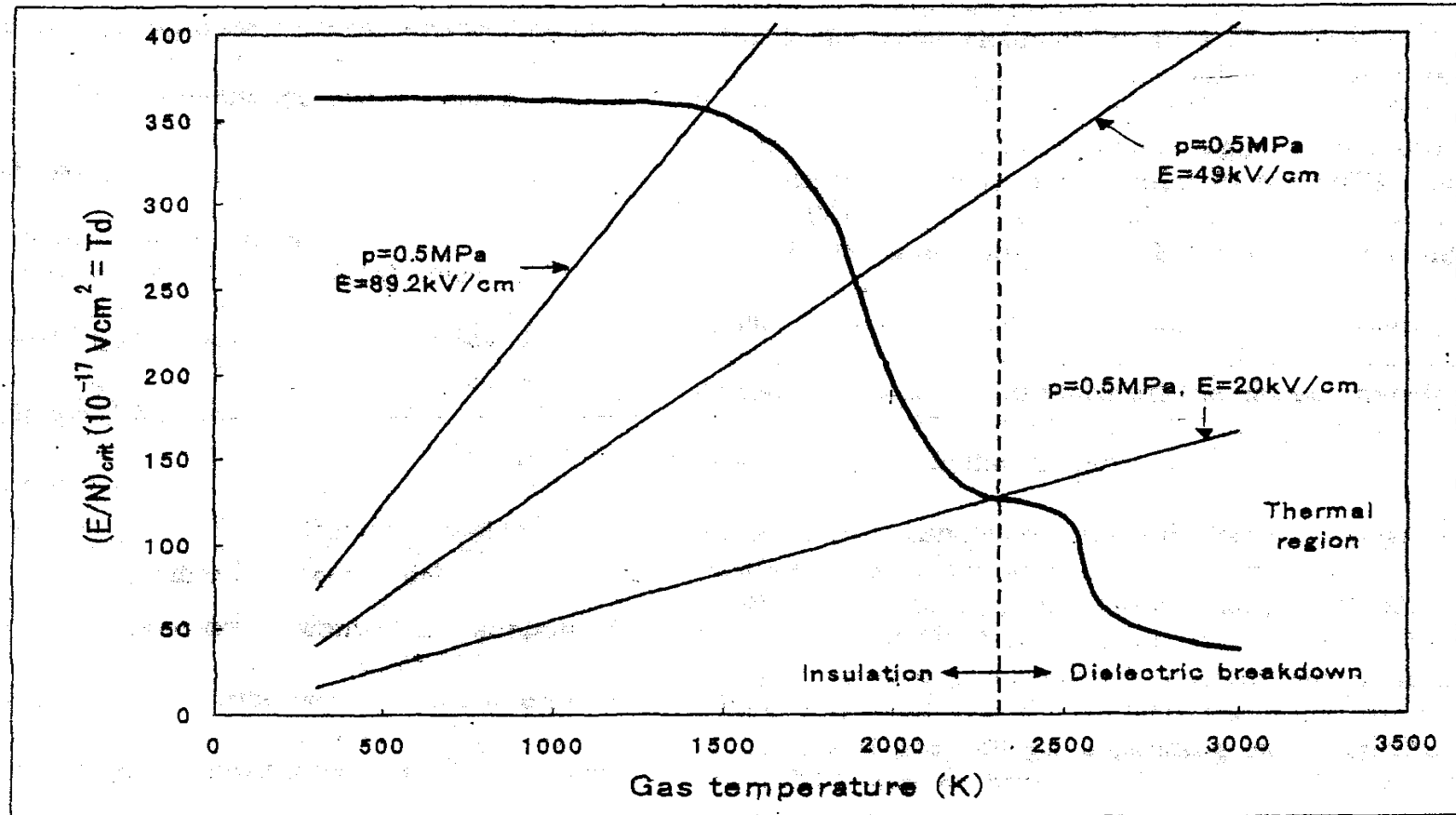


Figure 2 . $(E/N)_{crit}$ versus gas temperature.

Calculation of the Uniform Breakdown Field Strength of SF₆ Gas over the Temperature Range of 300K-3000K, G.J. Cliteur and al., IEEE Tr.on Dielectric and Elec. Insulation, Vol.5, N°6, p.843, Dec. 1998



- Temperature maps

In order to identify the regions where T is greater than 1300°K (SF6 dissociation)

- Density maps

In order to identify the low density regions:

- due to relatively high temperature area
- due to flow structure (shock wave, supersonic, ...)

- Coupling between dielectric and density

The meshes are not the same:

- Flows: simplified mesh, taking into account the contact motion
- Dielectric: detailed mesh (with contact position at TRV peak)

- Coupling between dielectric and density: **CRITERIA**

The chosen criteria are based on experimental electric field **limits for switching impulse (at 7 bars abs):**

- In SF6: $E_{\max} = 30 \text{ kV/mm}$
- In SF6, along PTFE: $E_{\max} = 15 \text{ kV/mm}$

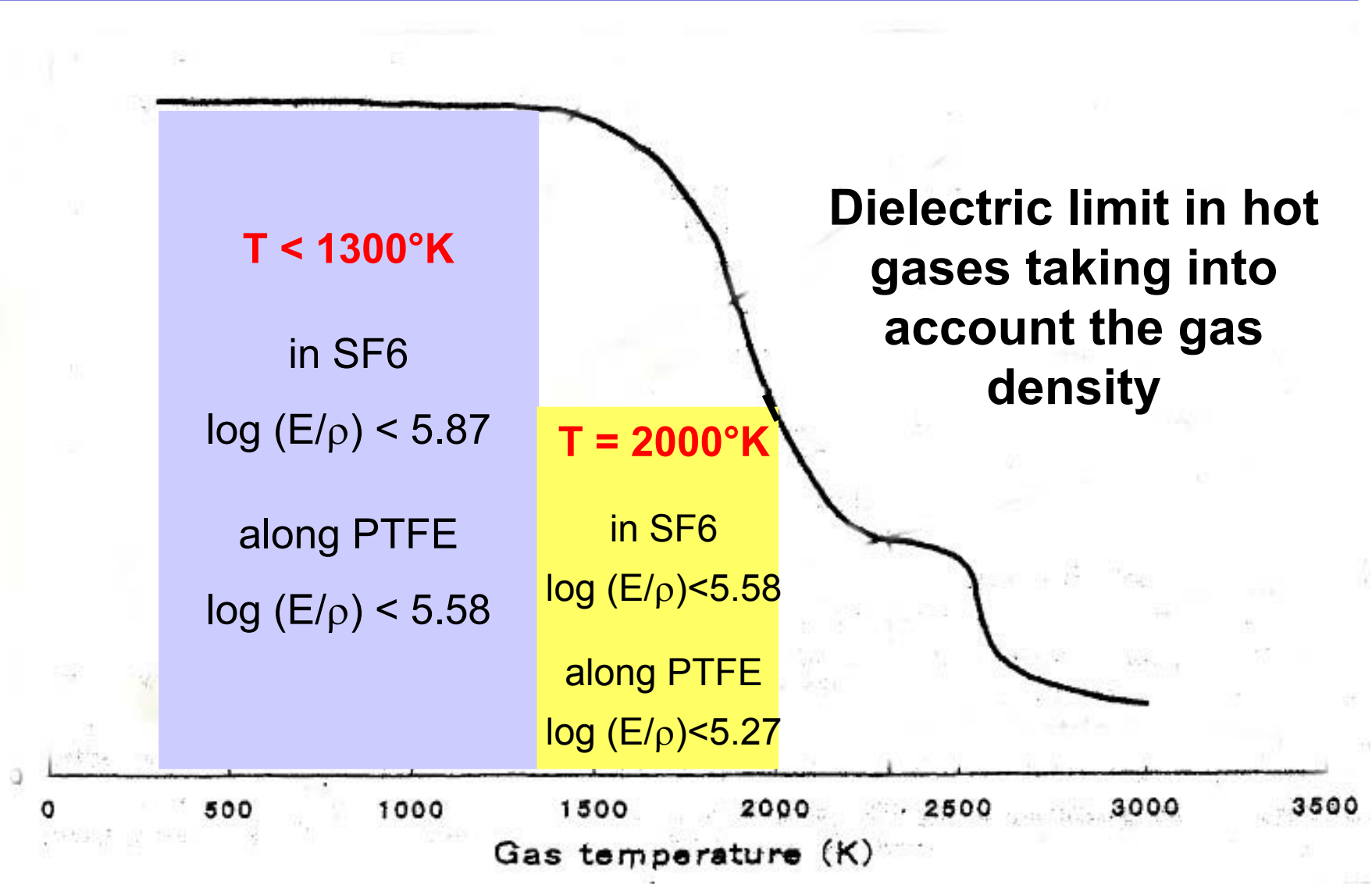
At 7 bars abs, the SF6 density is 41 kg/m^3 :

- In SF6: $(E/\rho)_{\max} = 7.5 \cdot 10^5 \text{ (V.m}^2\text{/kg)}$
- In SF6, along PTFE: $(E/\rho)_{\max} = 3.8 \cdot 10^5 \text{ (V.m}^2\text{/kg)}$

--> These are reference values and not absolute values

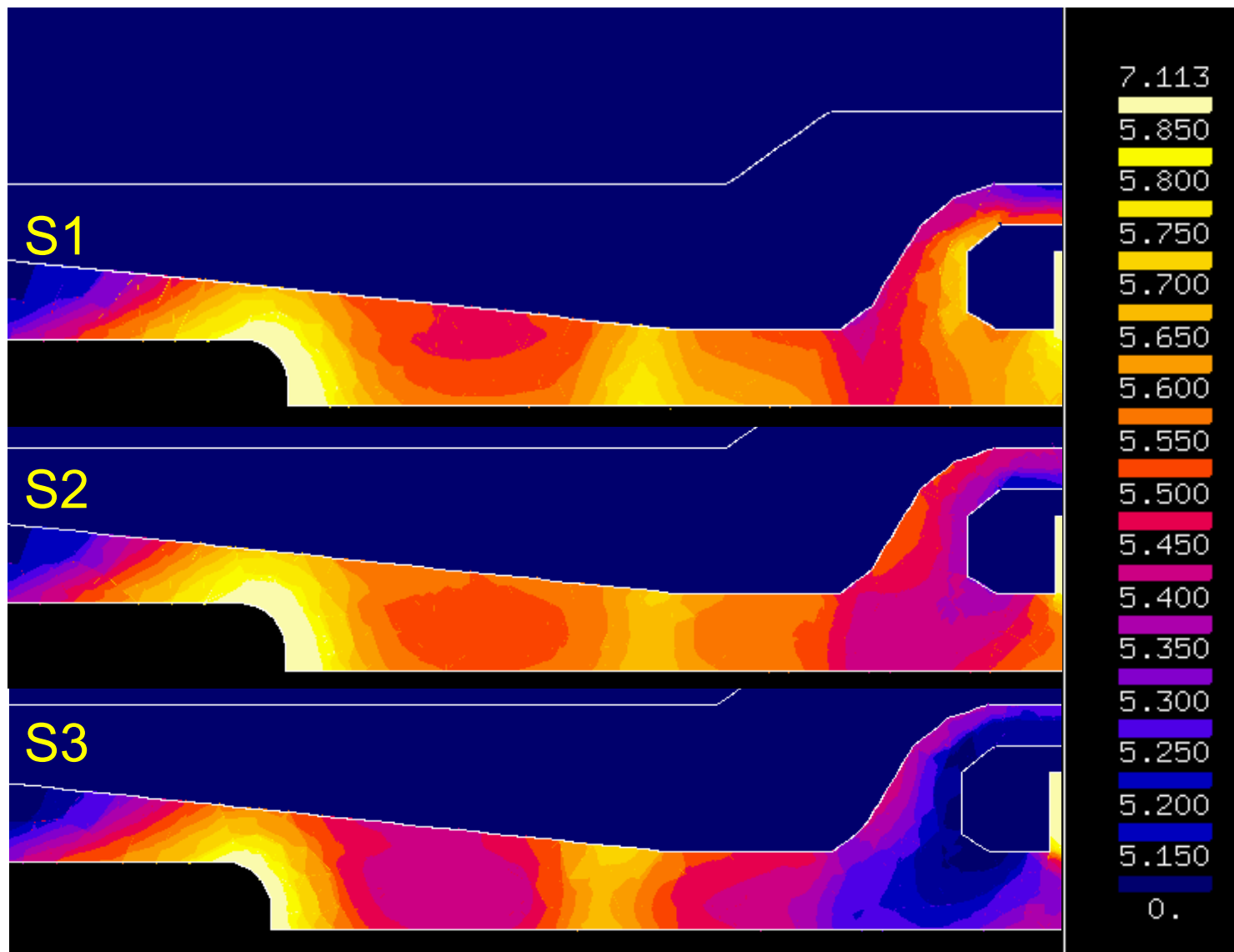
Activités centrées sur l'arc électrique

Arc dans le SF6



Activités centrées sur l'arc électrique

Arc dans le SF6



Arc dans un autre gaz

- Cadre: substitution du SF6
- Orientation: gaz légers
 - Adapter le modèle
 - Identifier les techniques de coupure les plus adaptées (puffer, self blast, matériaux, ...)
 - Optimiser les écoulements/géométries

En collaboration avec l'Université de Provence (Pr Zeitoun, Polytech' Marseille)

Arc dans le vide

- Ampoule 72 kV 31.5 kA