

Status of the ELETTRA RF System Upgrade Activities

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On behalf of the ELETTRA RF group

- **Introduction**
- **Components**
- **Next Activities**
- **Conclusions**



➤ **TARGET OF THE RF UPGRADE PROJECT:**

- Provide the RF system with the necessary **operating margins**, when all IDs are operational (with a slight improvement also in beam lifetime).
- Increase available RF power in view of possible increase of beam current and energy.

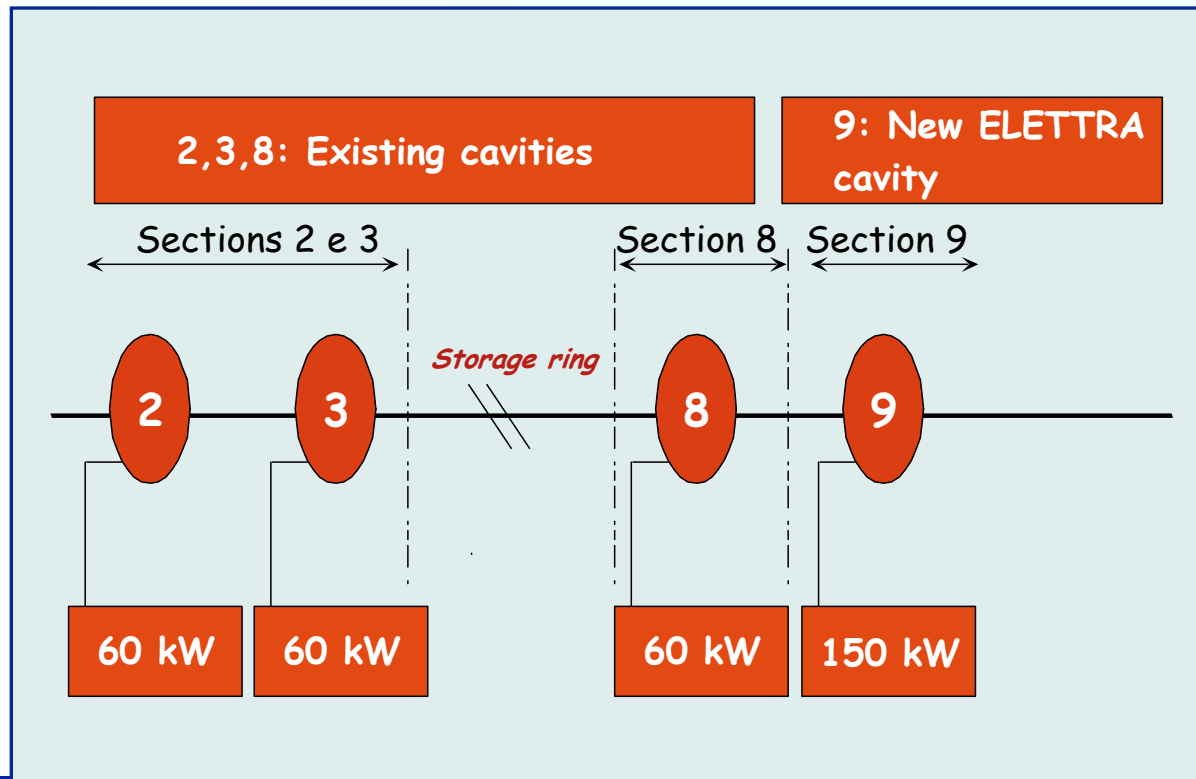
➤ **PROJECT WAS RE-STARTED IN MAY 2005 FOLLOWING THE AVAILABILITY OF FUNDS.**

➤ **DESIGN STRATEGY:**

- **Minimum interference** with machine operation.
 - Gradual approach.
 - No increase of the space for RF components in the machine.
 - Same number of cavities.
 - No sc cavities.
- **Consistency** with other upgrades of the facility.
- **Take benefit of working in the UHF band.**
 - Use as much as possible solutions adopted in broadcast applications.

➤ MULTI-STAGE APPROACH

- **PHASE A:** upgrade one 60 kW plant to 150 kW.
- **PHASE B:** repeat phase A on another plant.
- **PHASE C:** upgrade the two remaining plants in the same way.
- At the end of phase C, the available RF power will be **600 kW**.



PHASE A IS NOW IN THE CONSTRUCTION PHASE

Components : Amplifier / Power Transmission / Installations

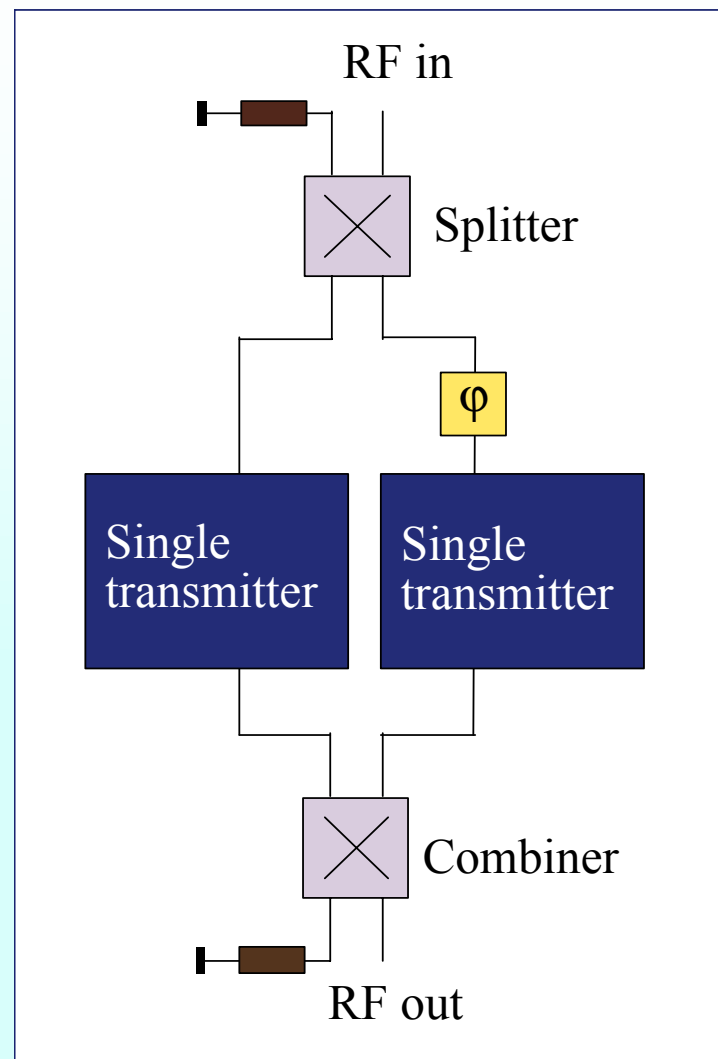
➤The Power Amplifier is made **combining two 80 kW** transmitters providing 150 kW at the amplifier output.

➤It has been acquired as a **turn-key system from industry (ELECTROSYS, Orvieto Italy)**.

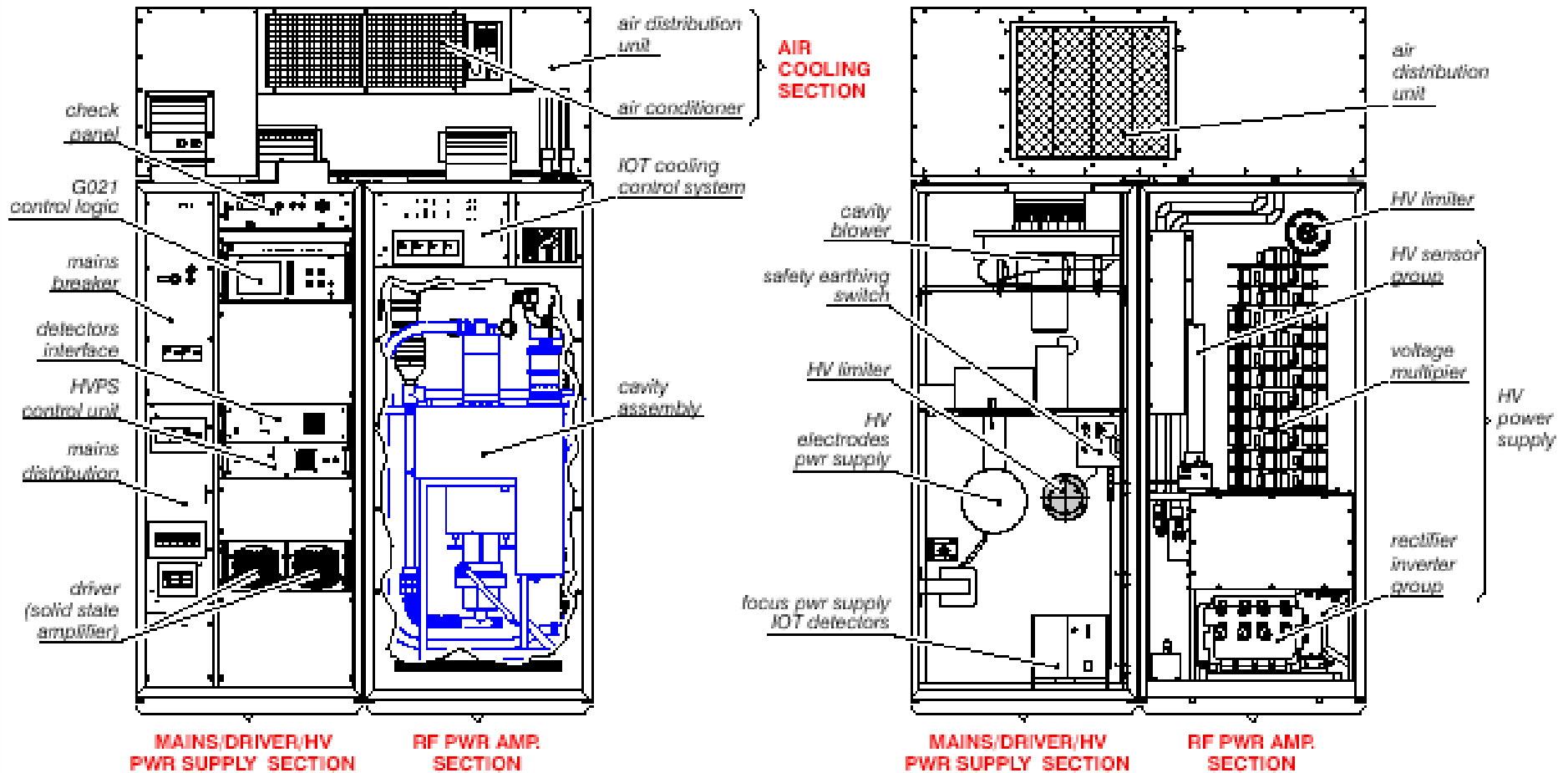
➤The final stage of each transmitter is a 80 kW IOT (TH793 from THALES). The use of other tubes assemblies could eventually be possible by use of a replacement kit.

➤The outputs of the two transmitters are combined by means of a **switchless combiner**.

➤**Each transmitter can work standalone, thus increasing operational flexibility.** The fault or the maintenance of one transmitter does not imply the interruption of the operation of the plant, since the other transmitter continues to operate.

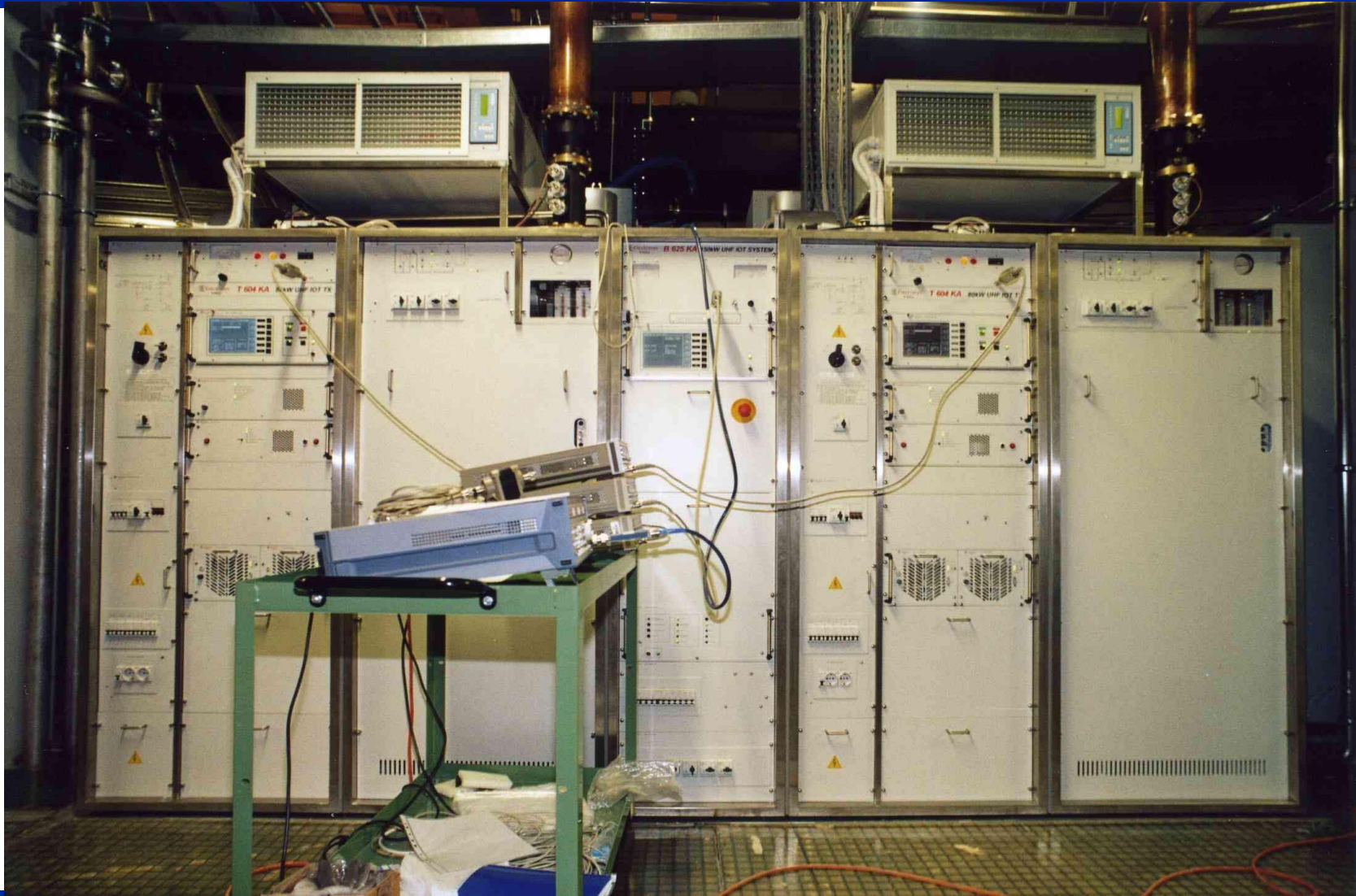


Components : Amplifier / Power Transmission / Installations



Courtesy of Electrosys

Components : **Amplifier** / Power Transmission / Installations



Components : **Amplifier** / Power Transmission / Installations



Components : **Amplifier** / Power Transmission / Installations

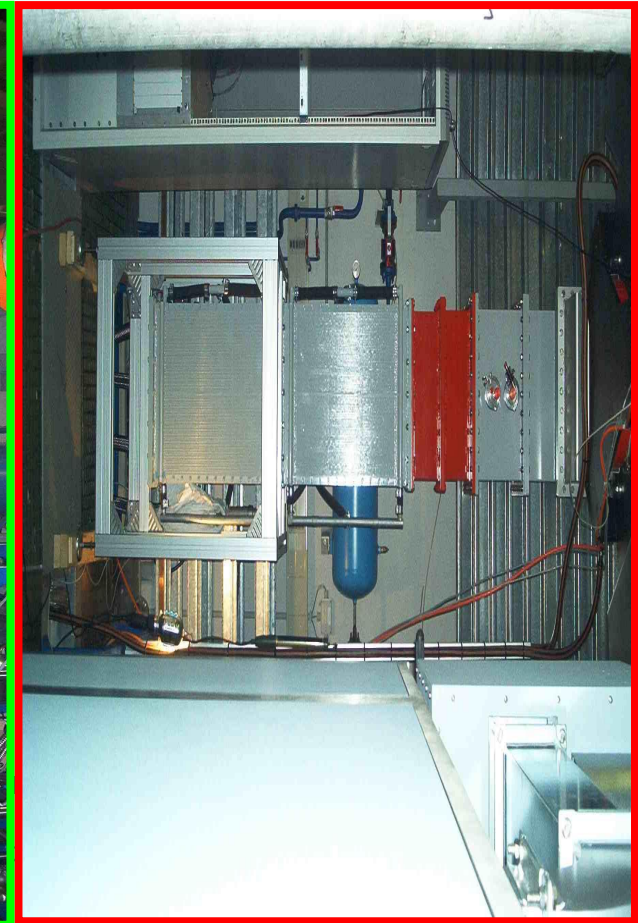
›The HV power supply of each IOT is a **switched mode power supply**.

- ›The structure is **more compact**.
- ›Lower residual ripple.
- ›Beam voltage is stabilised independently of:
 - ›Output power variations.
 - ›Mains input variations.
- ›If needed, **switching frequency can be adjusted** in the range 16 to 21 kHz.
- ›No oil capacitors or transformers are used.
- ›No crowbar tube.

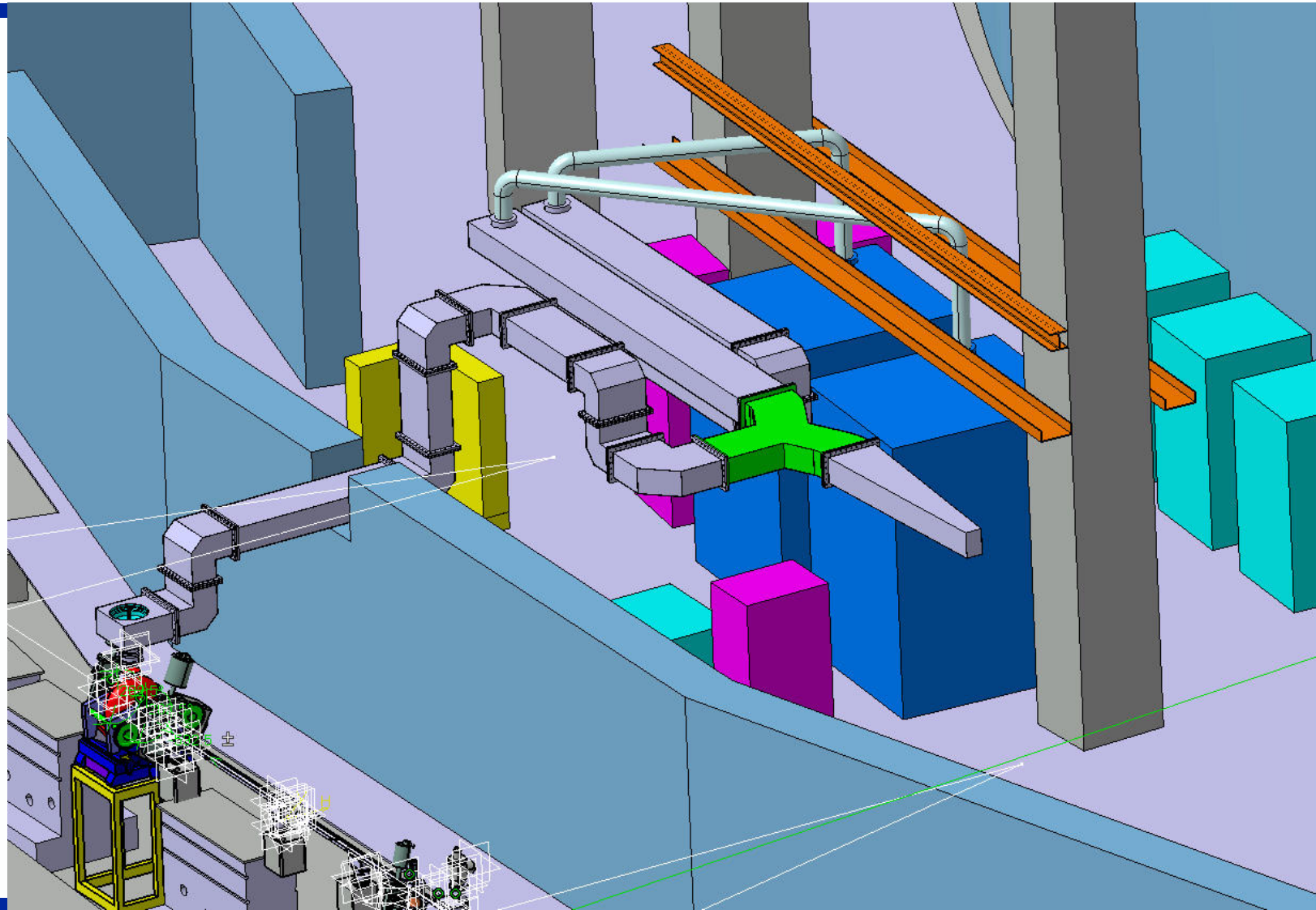


Components : Amplifier / Power Transmission / Installations

- The power amplifier is protected by a **200 kW 500 MHz circulator** ordered to AFT (Germany).
- Power transmission is done with **WR1800 waveguides**. The waveguide components have been ordered to MEGA Industries (USA).
- **Dummy loads** have been ordered to FERRITE (Russia).



Components : Amplifier / Power Transmission / **Installations**



Components : Amplifier / Power Transmission / Installations

- Installations have to fit in the planned shutdown.
- 2006 operation calendar has been planned taking care of planned deliveries.
- Program of concluded activities:
 - February and April shutdowns: preparatory activities.
 - Summer shutdown (June- half July 2006): amplifier and circulator installation.
 - August shutdown: completion of installations and tests.
 - From August: plant commissioning on dummy load.

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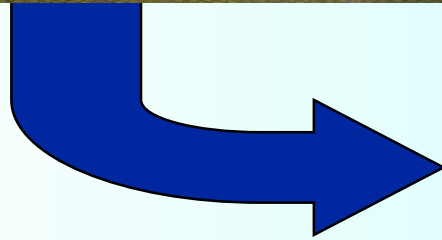
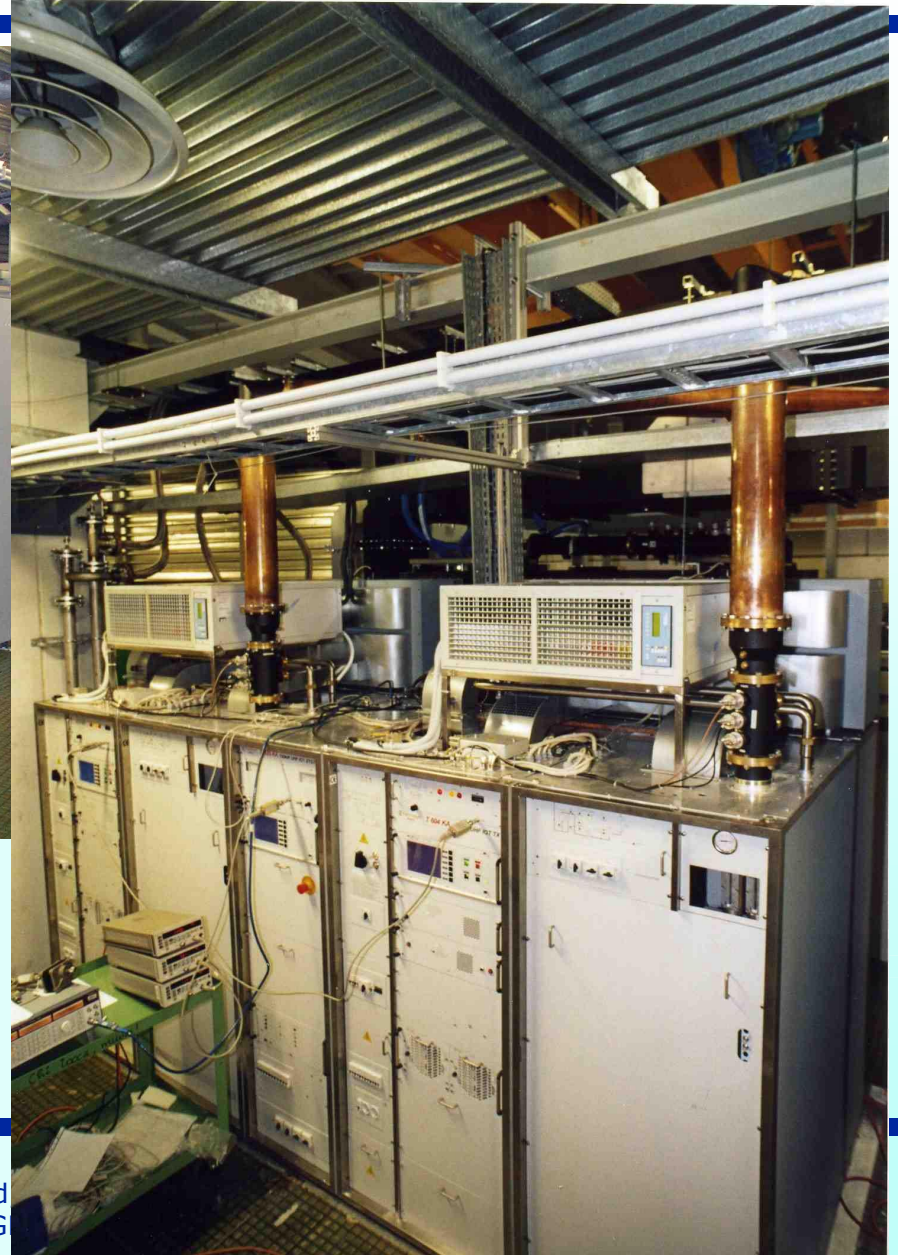
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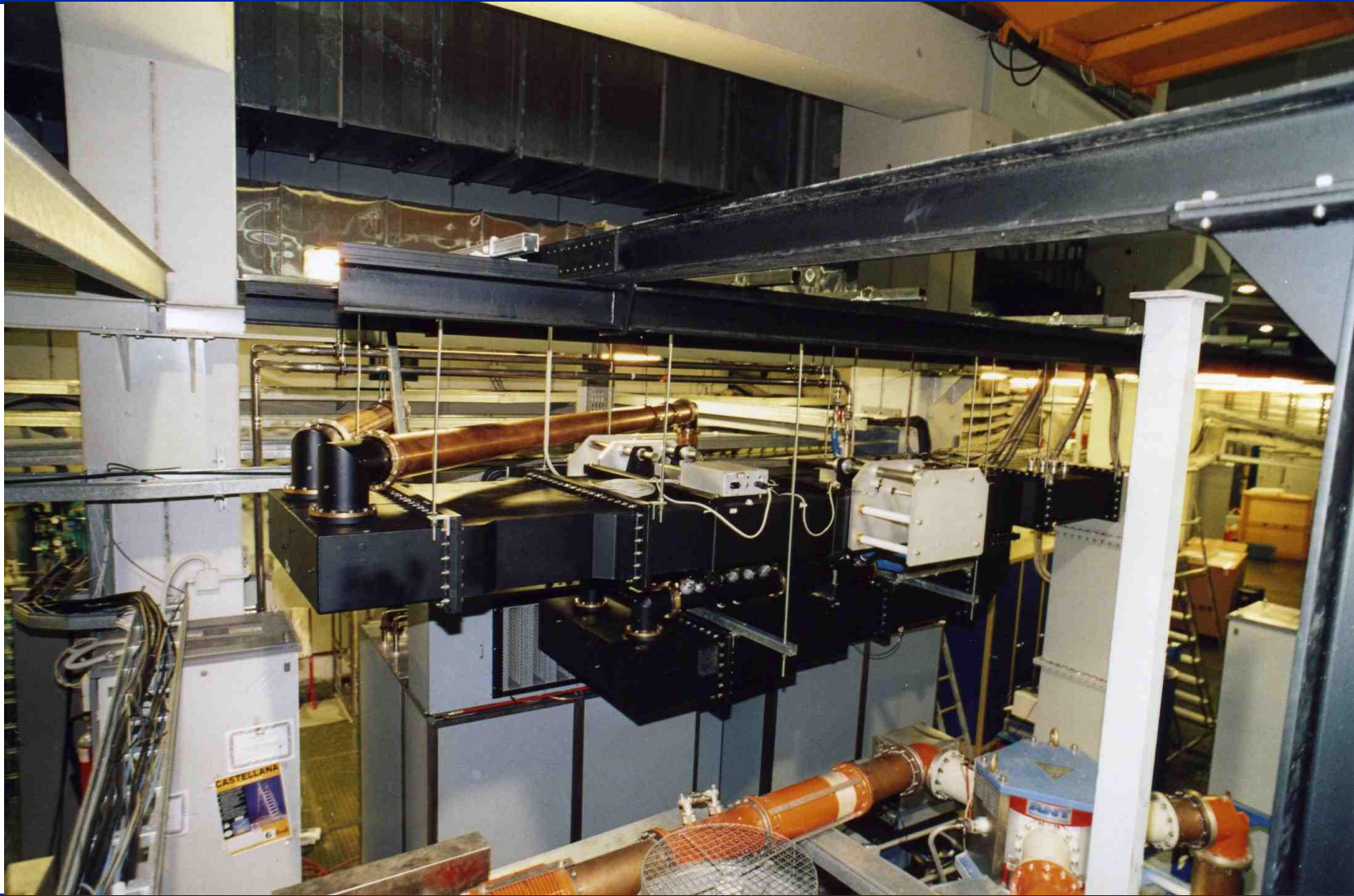
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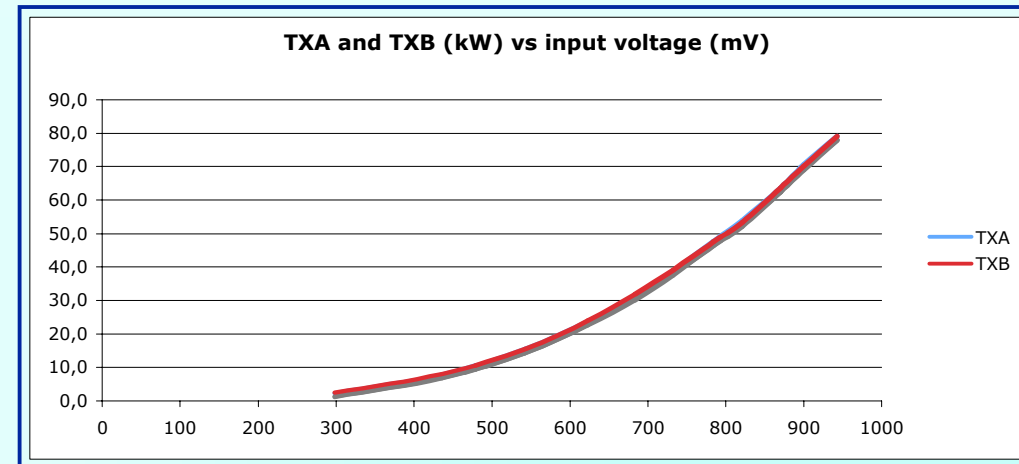
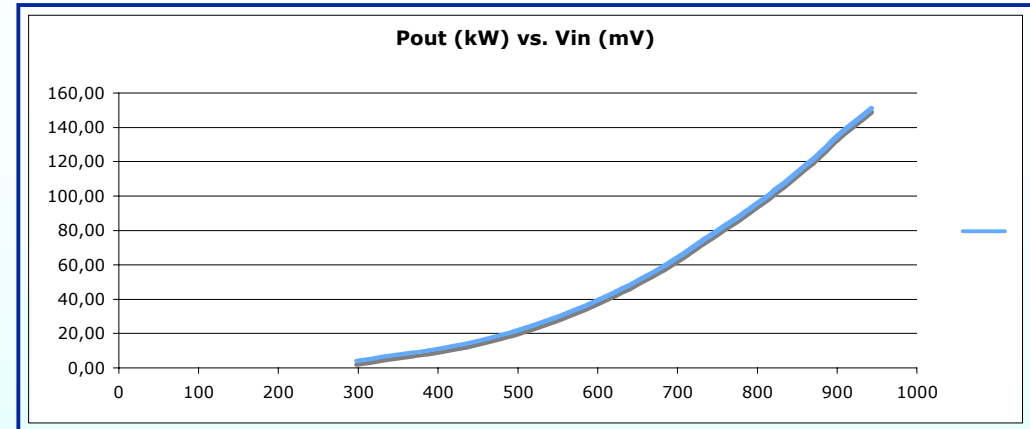
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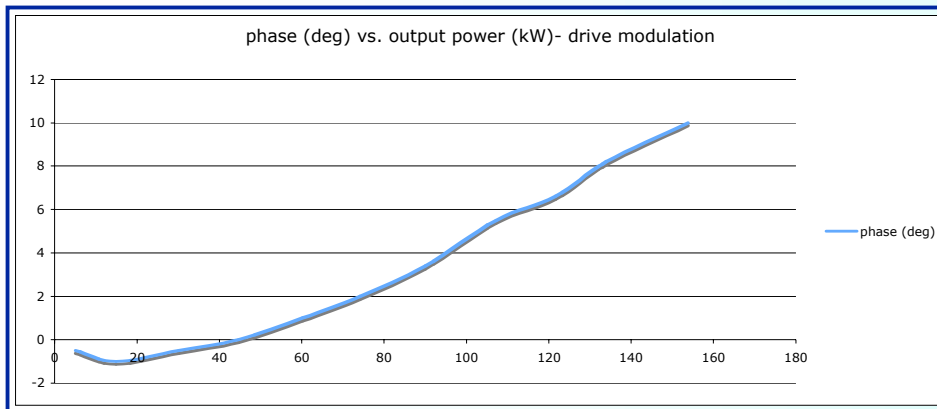
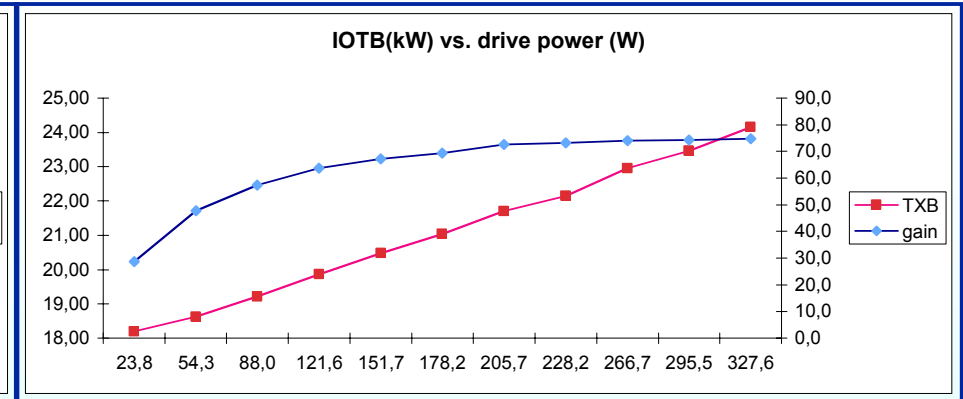
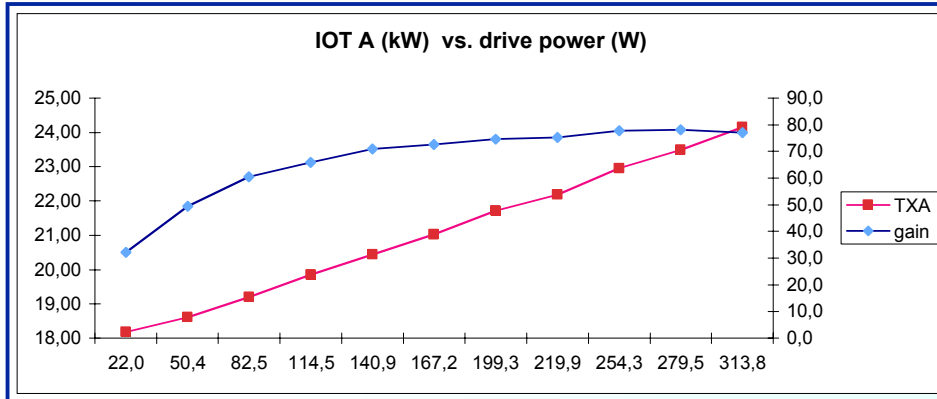
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AMPLIFIER MEASUREMENTS

Output power	150 kW
Gain	69.3 dB
Gain IOT A	24.0 dB
Gain IOT B	23.8 dB
Efficiency IOT A	65 %
Efficiency IOT B	68 %
Bandwidth (± 0.5 dB)	$> \pm 2$ MHz
I.L. combining system	<0.1 dB



Components : Amplifier / Power Transmission / Installations



► **Circulator** has been tested both at low and high power (with a variable high power short circuit). All remaining **power components** have been also tested.

► **From August 30, the amplifier is in operation** connected to the circulator and two dummy loads **24 hours/day** at different power levels from 100 to 150 kW.

► The long term test should allow to discover and clear child defects of the new plant, if any.

› **Next steps:**

› **October shutdown:**

- › Completion of installations of the power plants services.
- › Final check of waveguide run.
- › Construction of waveguide-hole final radiation shielding.
- › Optimization of components, if necessary.

› **January 2007 shutdown:**

- › Connection to the cavity.
- › Regulation of LLRF.
- › In parallel: construction and test of the optimised **door knob type coaxial to WG transition** for the input power coupler.

› **First run of 2007:**

- › **New plant commissioning.**

- **The first phase (phase A) of the ELETTRA RF Upgrade is in an advanced state.**
- Power plant components have been installed and are under test.
- The new plant will start providing power to beam at beginning of next year.
- Most of the components take benefit of existing products in UHF broadcast market and have been supplied by industries.
- This phase will provide a certain amount of safety margin to the system and provide the booster power plant (to be installed in 2007).
- Based on the results and on the development activities of the lab, a decision on the timing of the remaining phases will be taken.