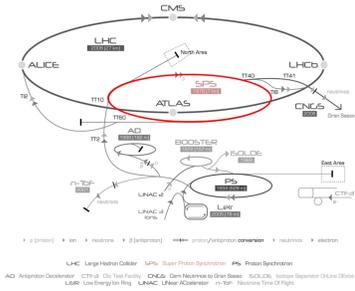


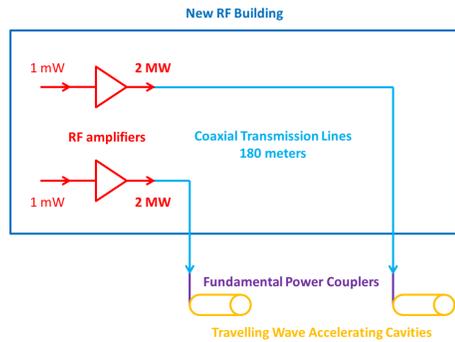
LIU-SPS RF Upgrade Project

For stability of future high intensity LHC beams in the SPS larger longitudinal emittance and therefore bucket and voltage amplitude will be necessary. The present SPS RF system composed of 4 x 0.75 MW RF power plants will be upgraded to **4 x 1 MW + 2 x 2 MW** additional RF power plants



The new RF power plants:

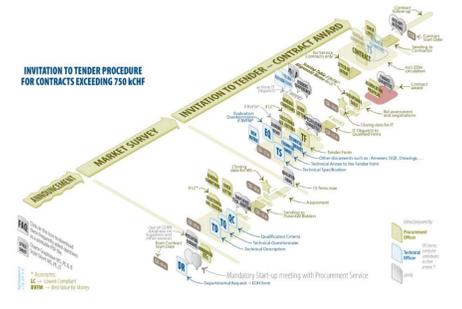
- A new RF building
- Two 2 MW RF amplifiers:
 - Drivers** (SSA)
 - Finals** (SSA or Tetrode or Diacode or IOT or klystron)
- Coaxial transmission lines
- Fundamental Power Couplers
- Travelling Wave cavities



Purchasing process

Long purchasing process due to specific technical requirements as it should be compatible with any Finals amplifier option

2011, 71 member state companies have been contacted



2012, 20 companies have shown interest to our request

2013, 10 companies have answered the Invitation to Tender

2014, the lowest bidder has been granted the contract

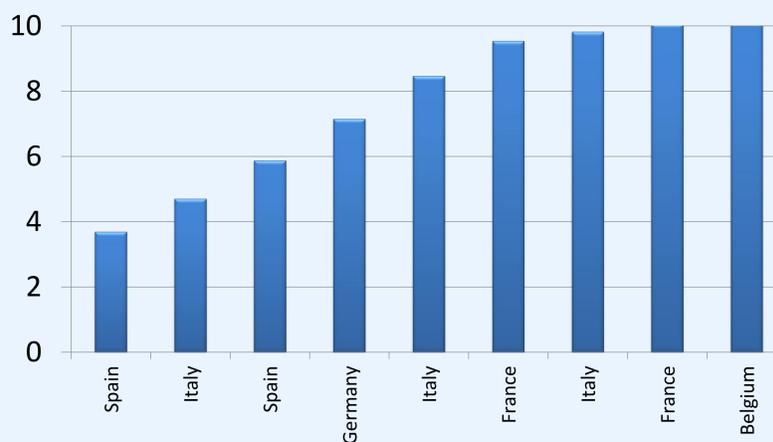
Offers analysis

The SSA requested were bricks of RF power operating at 200 MHz, without any control system

It is to produce a RF unit delivering CW to 1 MHz AM 100 % with respect to 1250 W peak power and 700 W average power, and with a wall plug efficiency greater than 60 %, whatever the operating point

This power unit shall sustain any reflected power, at any phase as well as at any amplitude

Cost per Watt in €
for a 1250 W SSA unit operating @ 200 MHz



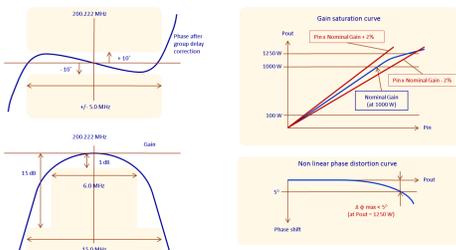
We are far from some values heard in conferences of less than 1 € per Watt

In Europe, for a 'brick of power' operating at 200 MHz, with no control, no high power combining, no infrastructure (racks nor cooling), at the kW range the cost is

4 € to 10 € per Watt

To go to 10 kW or 100 kW level, non negligible costs have to be added to these values; combining, cooling, infrastructure

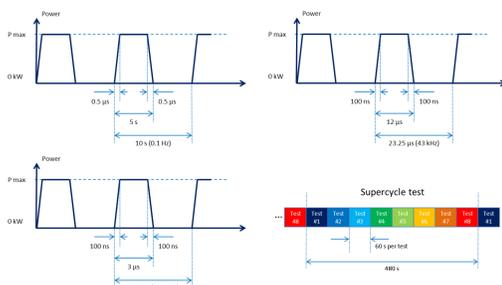
Qualification tests



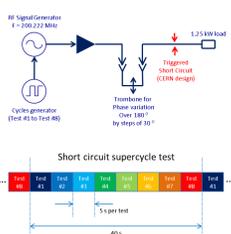
Specific bandwidth, gain saturation and phase distortion are required in order to guarantee a correct low level feedback operation

To simulate SPS operation, several tests have been defined

They will be repeated with a Supercycle test over hours



To be as close as possible to SPS during conditioning of Fundamental Power Couplers, a Supercycle with a triggered short circuit applying all phases will be repeated over hours



Variable quantity of Drivers regarding Final stage option

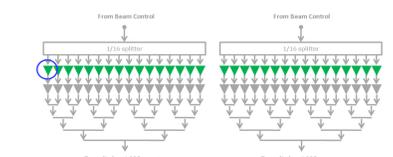
Contract adjudicated without knowing the selected technology for Final stage

Drivers unit cost will weight the Finals contract cost for a fair global option

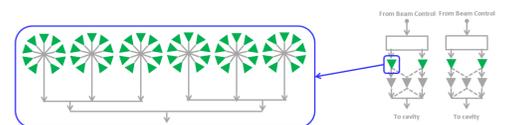
12 pre-series ordered for qualification

Total quantity will be defined once the Finals contract will be awarded end 2014

Final stage with SSA solution: 32 SSA Drivers



Final stage with Diacode solution: 216 SSA Drivers



Final Stage with Tetrode solution: 288 SSA Drivers

