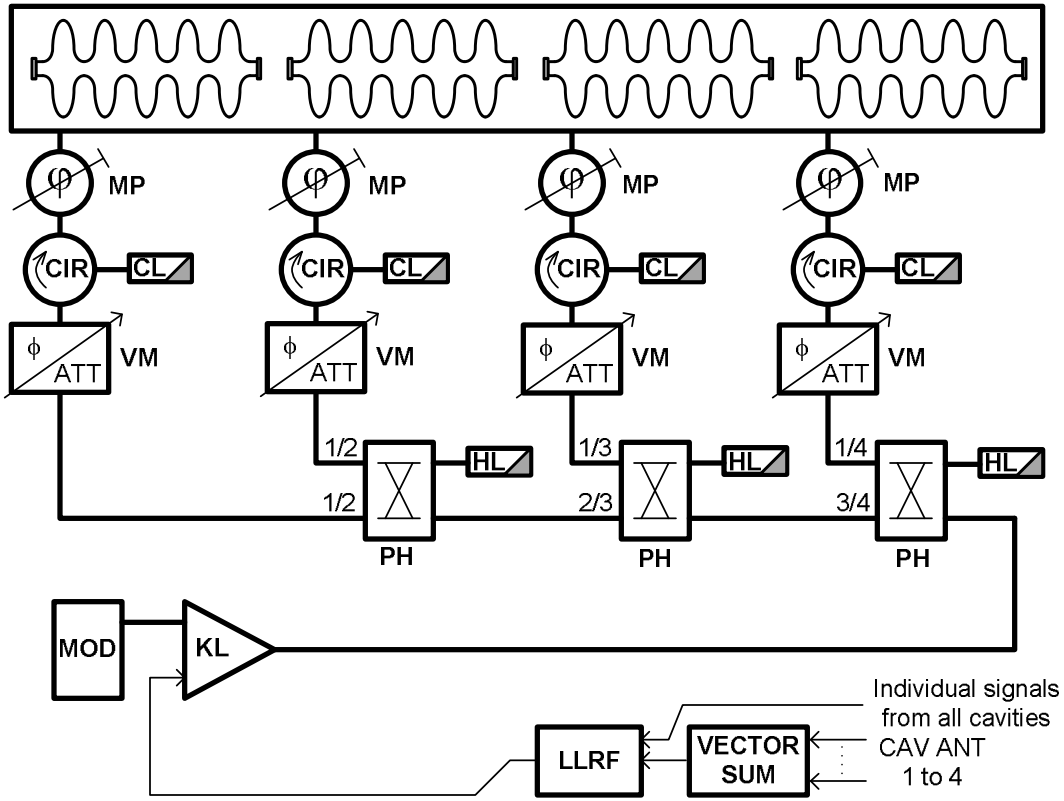
Working Group 1

Session 1

Review of RF Distribution Layouts and Power Requirements

RF Layouts - Reminder

Comparison of RF Power schemes for SPL – Option 1: 1 Klystron/4 Cavities



KL 5MW$_{PK}$ klystron
CIR 1MW$_{PK}$ circulator
CL 100kW$_{RMS}$ circ. Load
PH hybrid (e.g. planar 90°)
HL hybrid load
VM 1MW$_{PK}$ vector modulator
MP Mech. phase-shifter/switch
MOD Klystron modualtor

- Linear distribution, using compact "planar" hybrids with individually adjusted coupling.
- Vector modulators for fast phase/amplitude field control
- Mech. phase shifters for cavity phasing or isolation

SPL RF Power Distribution – Costing

Costing of Major Components

Item	Cost/item kCHF
6 MW Klystron	700
3 MW Klystron	600
1.5 MW Klystron	500
700 kW Klystron	400
1MW Circulator	50
500kW Circulator	35
Circulator load 100kW	40
Circulator load 50kW	25
Hybrid	20
Hybrid load 100kW	40
Hybrid load 50kW	25
Waveguides - per cavity 30m	60
Phase shifter (mechanical)	30
Vector Modulator 1MWp	75
Klystron Modulator 6 MW pk	600
Klystron Modulator 3 MW pk	300
Klystron Modulator 1.5 MW pk	175

Item	Cost/item kCHF
IOT 700 kW	400
IOT 350 kW	250
Local Water Distribution - Klystrons & modulator	30
Driver for klystron	20
Driver for IOT	60
LLRF for 1 klystron, VME, incl. signal treatments	45
LLRF per cavity, incl. signal distribution & treatment	30
Controls - per klystron	20
Controls - per cavity	20
Cabling - Klystron HV, RF, Controls - per klystron	70
Cabling - Cavity RF, HV, Controls - per cavity	70
Installation - per klystron	60
Installation - per cavity	60

SPL RF Power Distribution – Costing

Comparison of RF Power schemes for LPSPL

Configuration	Revised Cost per Cavity (kCHF)	For	Against
Option 1) Four cavities per 3 MW Klystron	780	Fewest power sources	Complexity, bulk, power overhead, fault tolerance…
Option 2) One ~700 kW Klystron per Cavity	1150	Reduced hardware inventory, minimum R&D, fully independent control, minimum RF power overhead, best fault tolerance, easy upgrade to HPSPL	Number of power sources
Option 2a) One 700kW (?) IOT per cavity	1130	As above, perhaps cheaper & more compact	HPSPL would need doubling of IOTs, or larger rating IOTs
Option 2a LB0) One 300 kW IOT per cavity in LB section	712	Cheaper & more compact	300kW per IOT
Option 3) Two cavities per Klystron	935	Half the number of klystrons	Need full hardware set, associated R&D, Power overhead, Reduced flexibility wrt option 2
Option 3a) Two cavities per Klystron Without VMs	900	Half the number of klystrons, more economical than Option 3	Risk for higher intensity?

Is option 3a the preferred one ?

Key Issues for WG1 - 1

IMMEDIATE

- Confirm baseline layout for Low/High B sections
  - Performance of the different layout options
  - Stability attainable in presence of microphonics, Lorenz detuning, detuned cavities, reflections due to RF distribution component imperfections
  - Difficulties with long waveguides (e.g. for RF Feedbacks)?
- Power Margins needed – identify & quantify definitively
- Klystron Modulator specs and design options – HPSPL needs, including space & integration !
- Power Coupler options – existing design & experience, overall review, requirements to get to high power – studies needed, protoyping requirements
- Integration studies, get first version of Klystron Gallery layout / Integration
- Investigate cost-cutting solutions in the RF Power and LLRF systems

Key Issues for WG1 - 2

LONGER TERM

- Power Sources
  - Magnetrons - future development programs
  - IOTs – follow up with manufacturers
- Preparation for hardware tests CERN / Outside on RF components
- Identify further studies needed

For the above agree on collaboration partner responsibilities, milestones and planning