

RF power and distribution

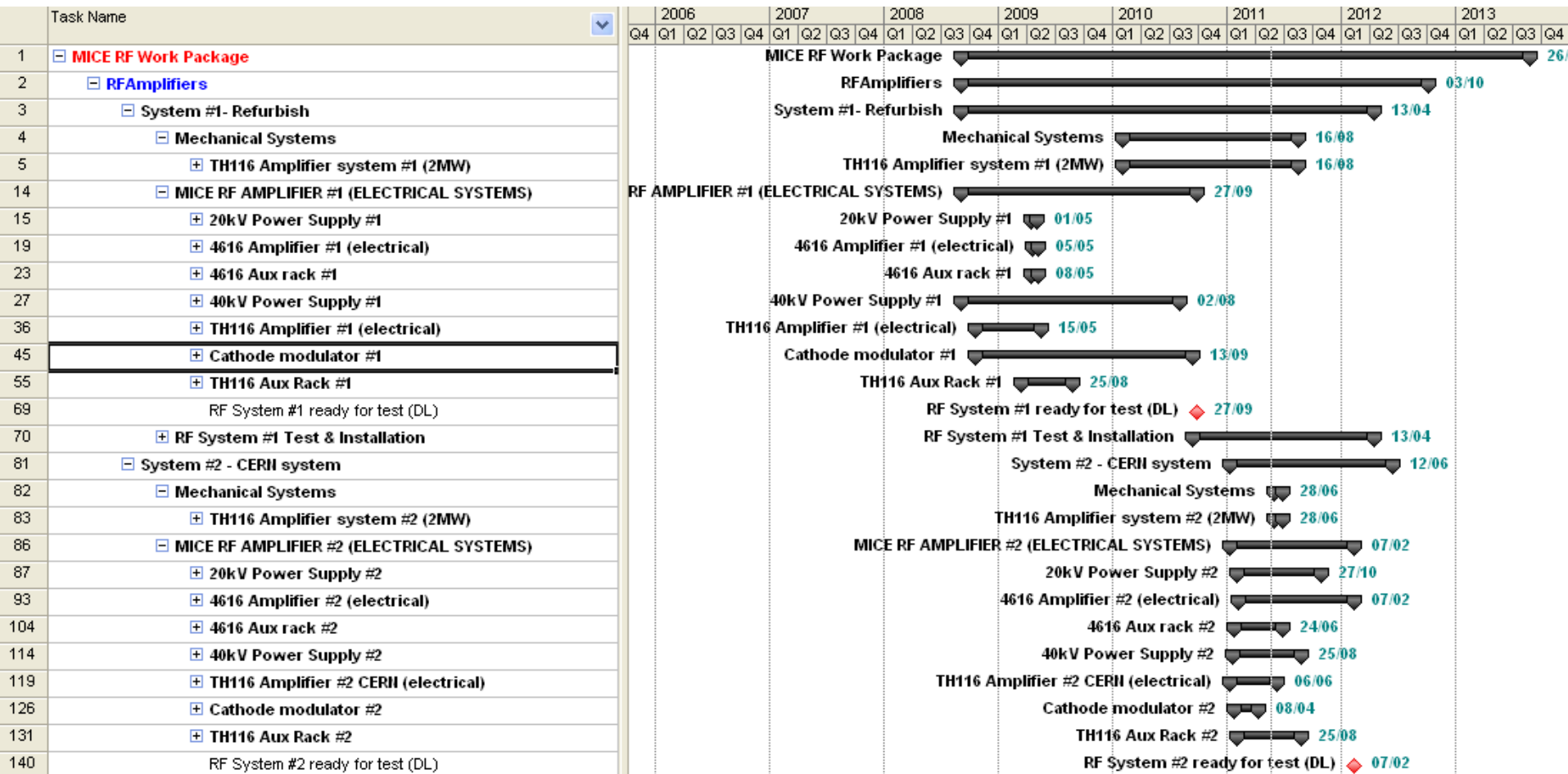
Andrew Moss
ASTeC
Daresbury Laboratory
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contents

- Current schedule
- Progress so far
- Plan for 2nd amplifier test
- Plan for second power supply build
- Hall layout developments
- Schedule for hall components

Current work package

- Refurbishment of Berkeley amplifiers
 - three 200kW driver amplifiers
 - two 2MW main amplifiers
- Build up of necessary power supplies to operate amplifier system in a test bay at DL
- Reconstruct two CERN 2MW amplifiers that have been refurbished, fit with modulators and adjust as necessary to suit power supplies - not been tested at CERN
- Build up power supply systems for all amplifiers for step 5 and 6



Success so far

- Amplifier 1 and electrical systems complete and on test
- Amplifier 1 began rf testing October 2010, recent problems with crowbar system and filament capacitor have been resolved but lost ~3 months
- 600kW output power reached, all electrical and rf calculations agree with expected results
- Continue to test to gain experience and understanding of system , interaction with LLRF control for example
- Expect this to finish by mid July 11

Schedule for first CERN amplifier

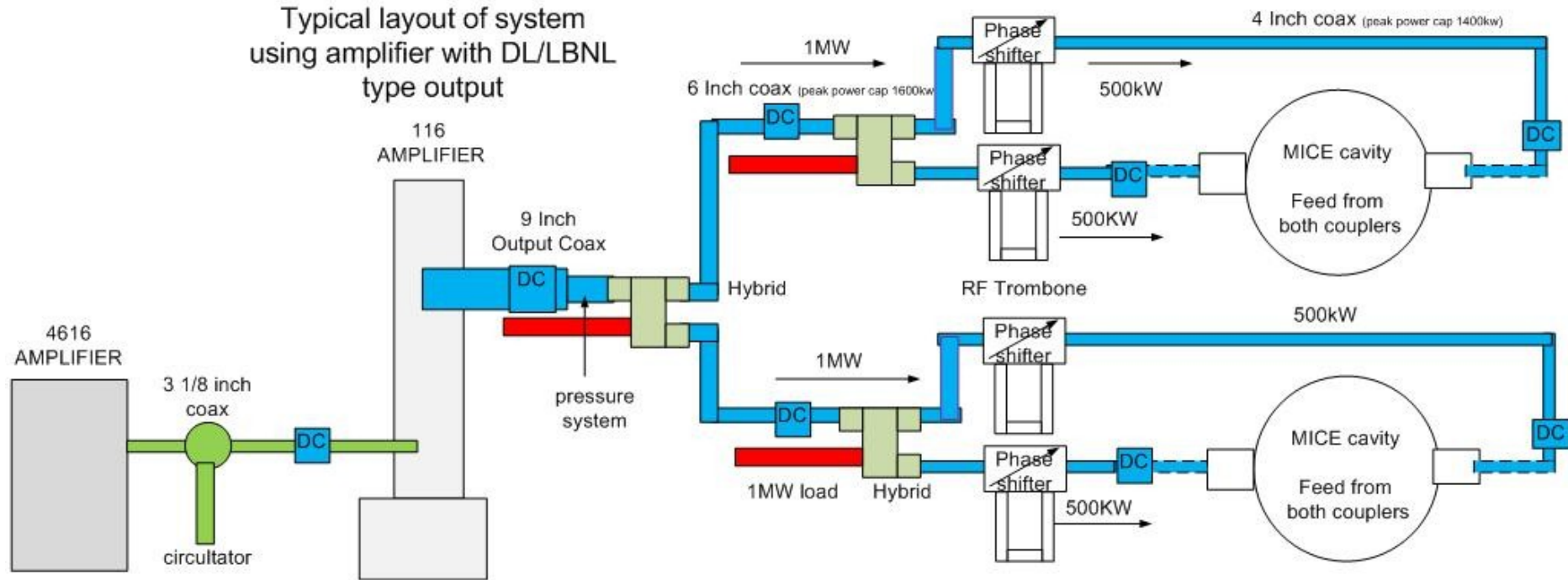
- Order Extra waveguide components needed to recombine power from amplifier outputs – 3 months delivery
- Build up cathode modulator – 6 weeks
- Remove 1st amplifier from test system
- With assistance from CERN, build up amplifier into test bay - 2 weeks
- Ready for testing September 2011

2nd power supply build

- Design of power supplies and auxiliary system is understood
- Some parts already purchased with first system
- HT for main amplifier system ~ 60k + 20k for Aux
- HT for driver amplifier ~45k + 20k for Aux
- 8 months to build up systems, not started at present , 2012
- Transfer in to test bay to commission on known amplifier system

General arrangement of RF system

Typical layout of system using amplifier with DL/LBNL type output



4616
AUXILLUARY
RACK

4616
HT

116
AUXILLUARY
RACK

116 HT RACK &
CAPACITOR BANK

DC = directional coupler = power measurement

Coax system

- MICE cavities fed from two couplers, rf phase needs to be identical so that power adds inside cavity
- 3D CAD layouts have been done that solve phase length issues
- Many iterations have been done with input from CERN, design is near complete
- Coax guide will have to be pressurised to prevent internal sparking, N₂ possible, but SF₆ is the best option, need to have systems in place to deal with transfer and storage of gas
- Costing for coax system will be known soon, some costs for components are known, 6 - 9 month lead time for coax

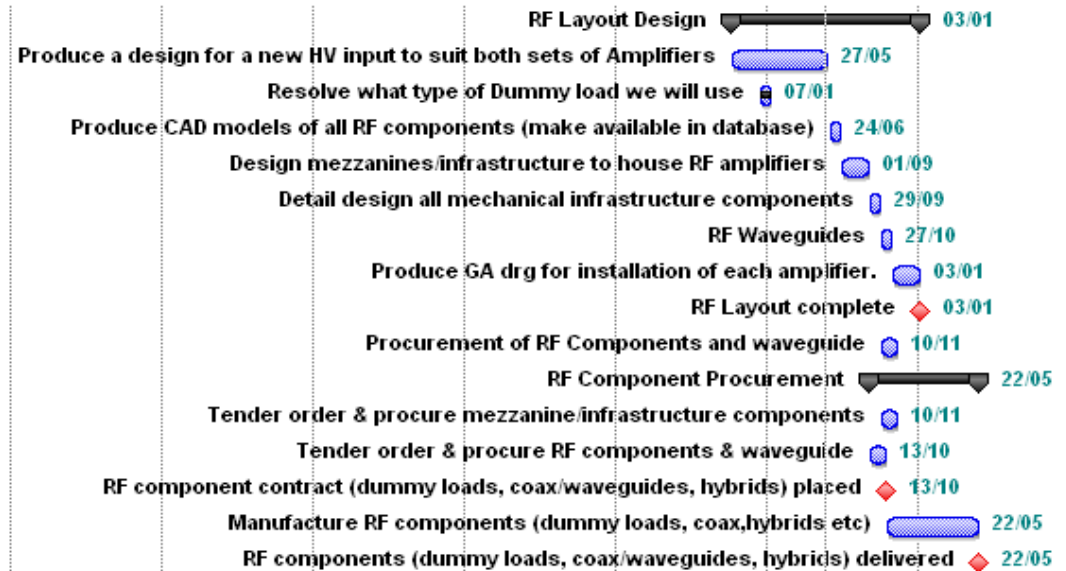
Hall coax schedule

RF Layout Design

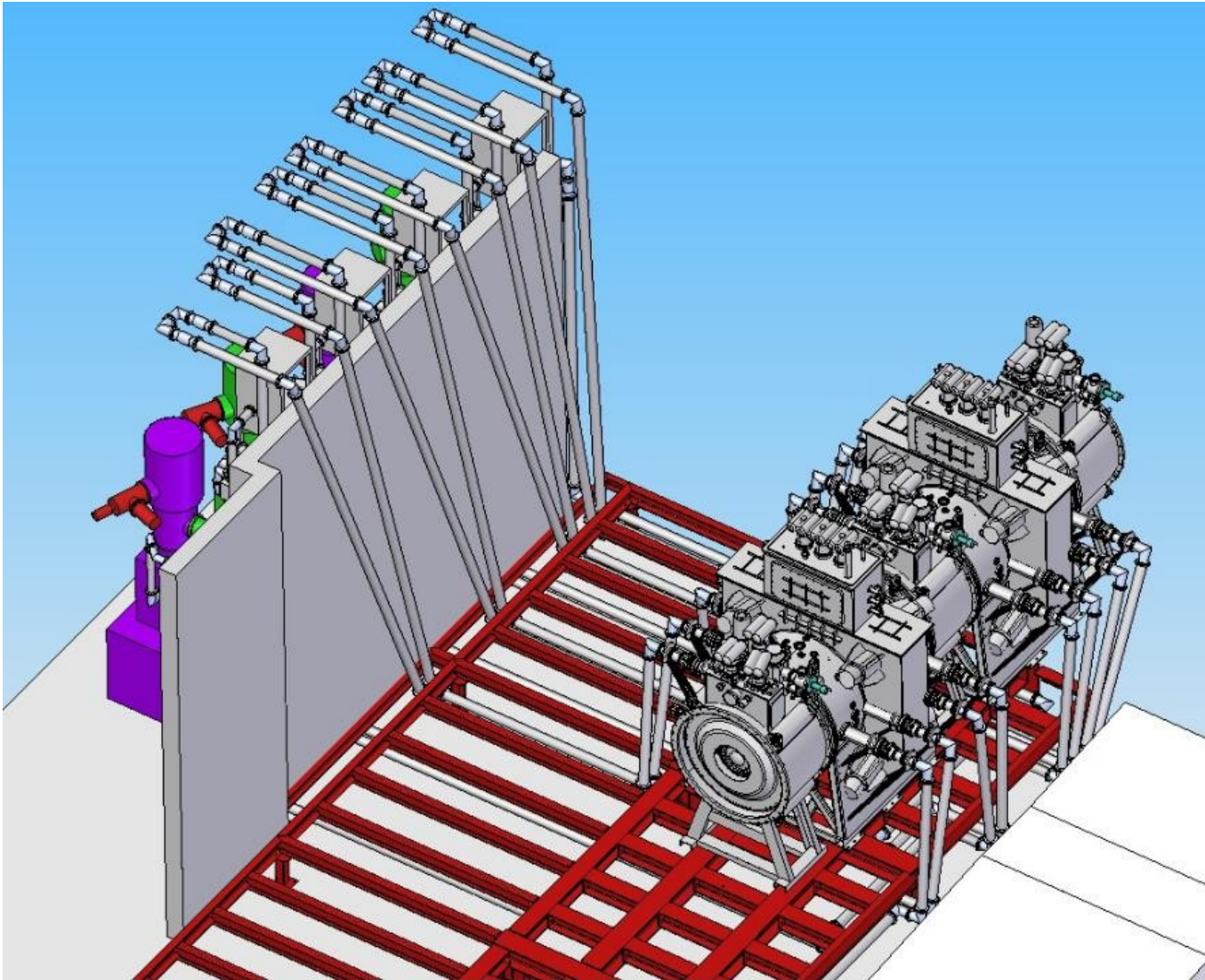
- Produce a design for a new HV input to suit both sets of Amplifiers
- Resolve what type of Dummy load we will use
- Produce CAD models of all RF components (make available in database)
- Design mezzanines/infrastructure to house RF amplifiers
- Detail design all mechanical infrastructure components
- RF Waveguides
- Produce GA drg for installation of each amplifier.
- RF Layout complete
- Procurement of RF Components and waveguide

RF Component Procurement

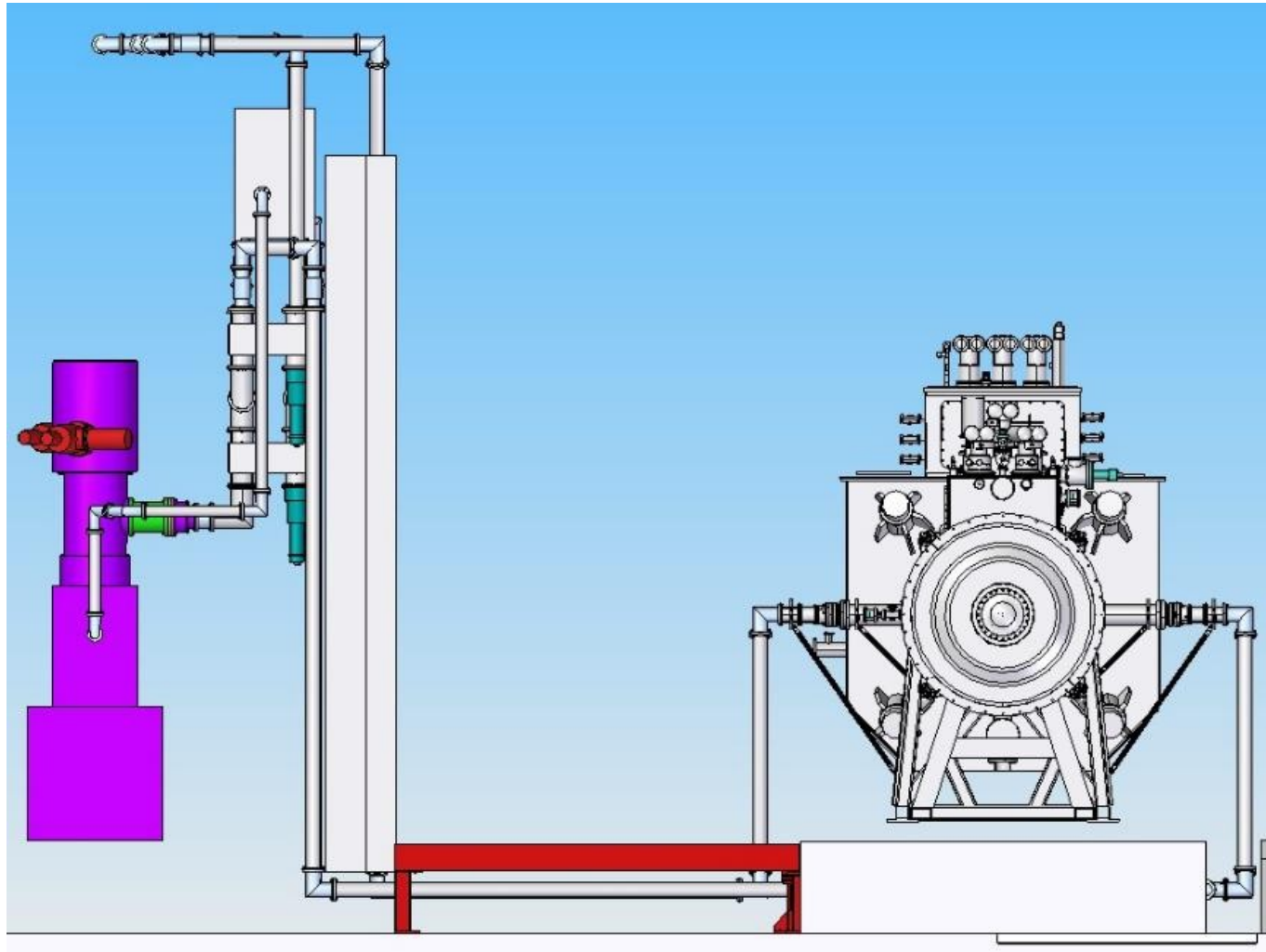
- Tender order & procure mezzanine/infrastructure components
- Tender order & procure RF components & waveguide
- RF component contract (dummy loads, coax/waveguides, hybrids) placed
- Manufacture RF components (dummy loads, coax, hybrids etc)
- RF components (dummy loads, coax/waveguides, hybrids) delivered



Coax distribution



Amplifier to cavity distribution

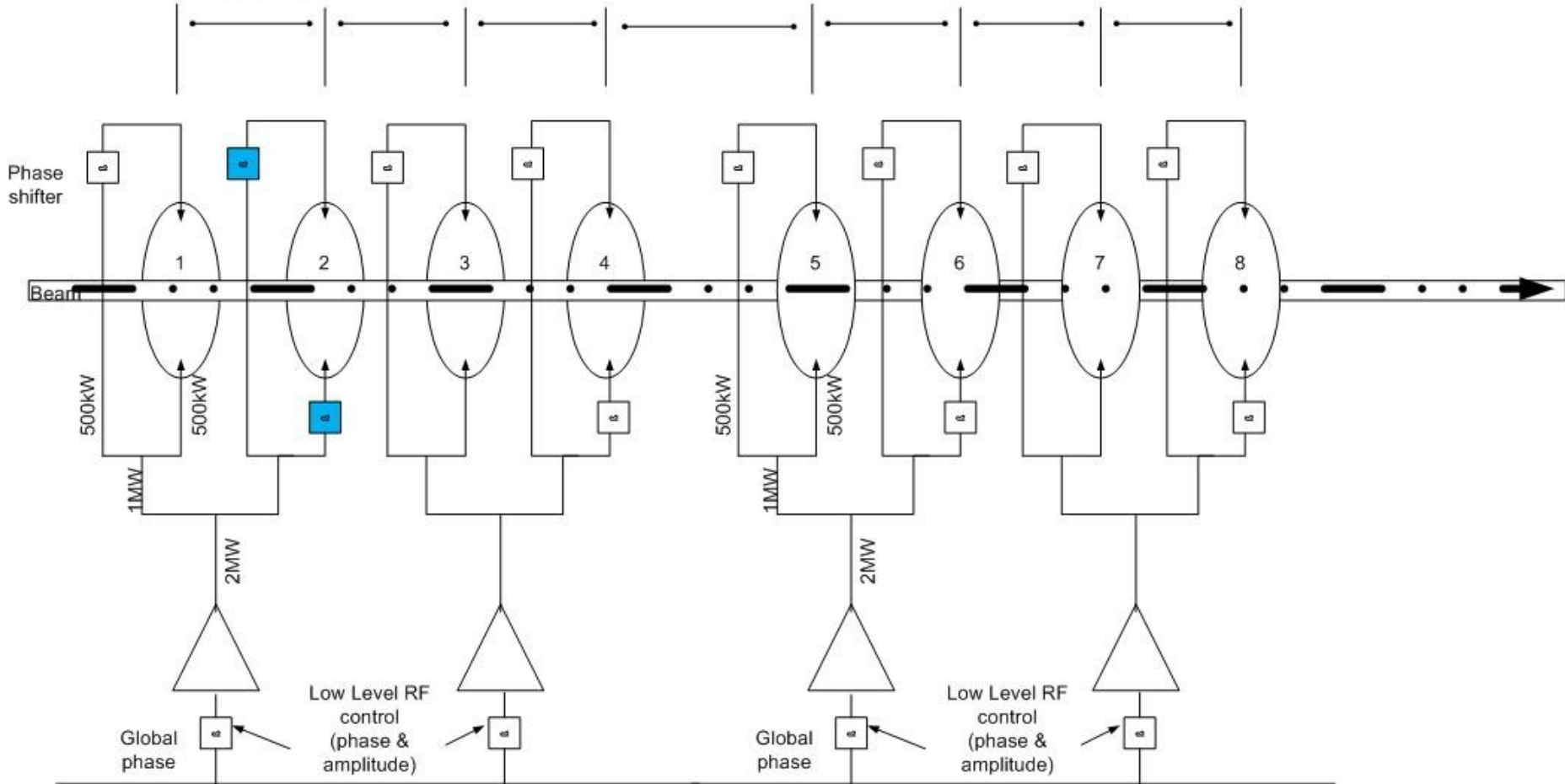


Inter cavity phase

- Simulations of time of flight through MICE cavity system for 140 – 240 MeV/C, cavity phase relationship needs to change to maintain acceleration
- Can be taken up in LLRF (on drive side of amplifier) however second cavity of each system will need phase shift in the high power coax
- Add length to the coax, or use phase shifter – bulky and expensive and may not be possible with pressurised system
- Solutions being sought

Mice cavity phasing

for 140 - 240 MeV/C
 $dt = 1.972 - 1.709 \text{ nS}$
 $= 19 \text{ degrees} = 7.7 \text{ cm}$



Inter cavity phase relationship for 140 – 240MeV/C requires phase adjustment of cavities