

# *MICE RF Amplifier Status*



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*ASTeC*

*Collaboration meeting, RAL,  
10<sup>th</sup> – 13<sup>th</sup> February 2008*

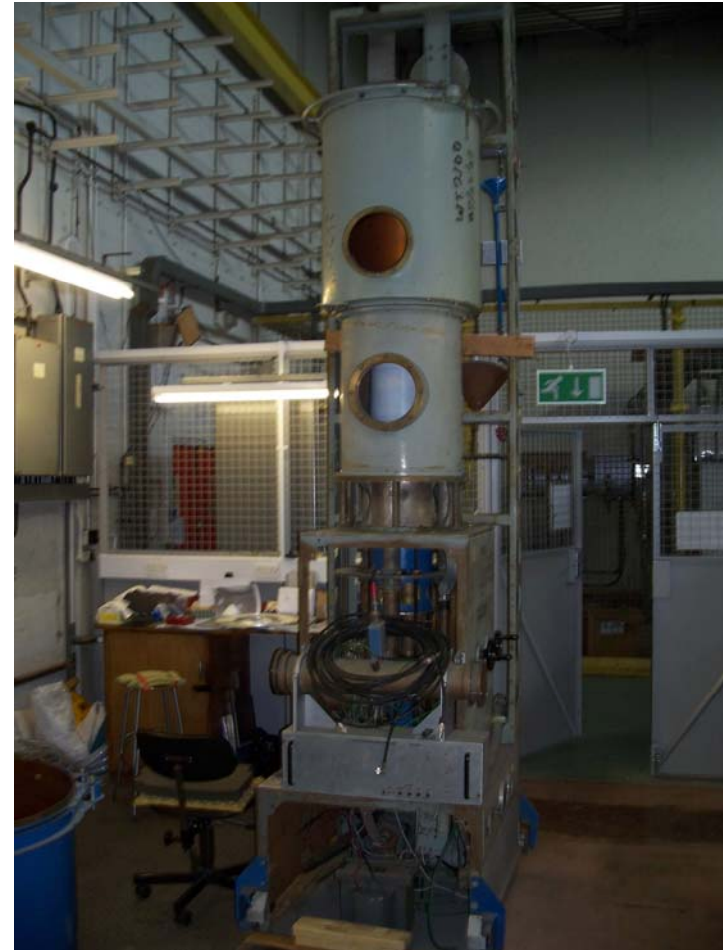


## *Outline*

- Large amplifier rebuild
- Test stand developments
- Issues for the MICE hall
- Conclusion

## *Large amplifier rebuild*

- First large amplifier is totally stripped down
- Refurbishing components is complete
- Process of rebuilding is underway



## *Refurbishment*

- Amplifier top can being 'adjusted' back into position using a 1 Ton jack and heat treatment



## *refurbishment*

- Base of amplifier under rebuild
- Adjustable parts of the amplifier will be motorised and remotely operable



## *Ready for assembly*

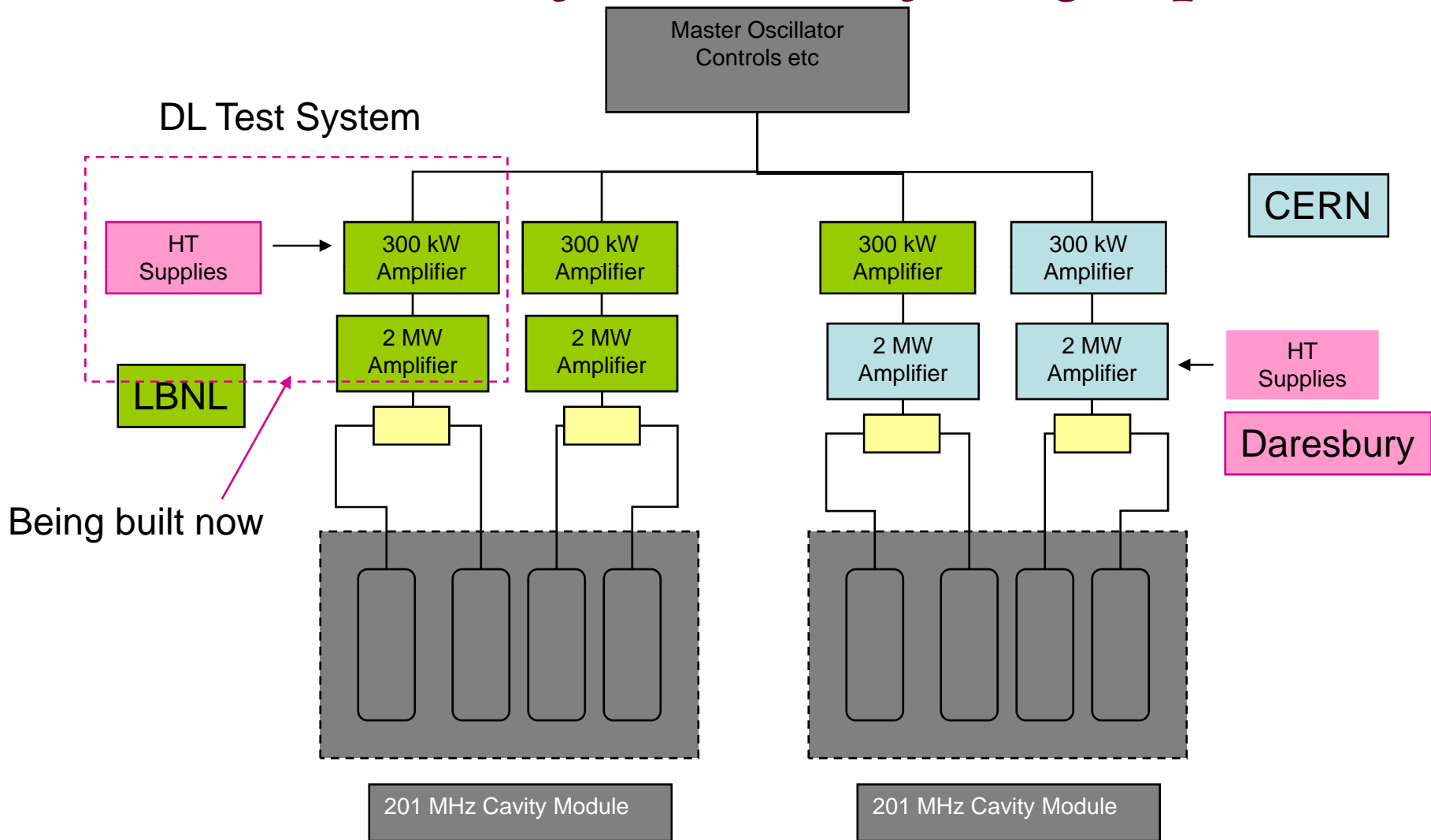


Parts ready to be assembled back on to amplifier stand

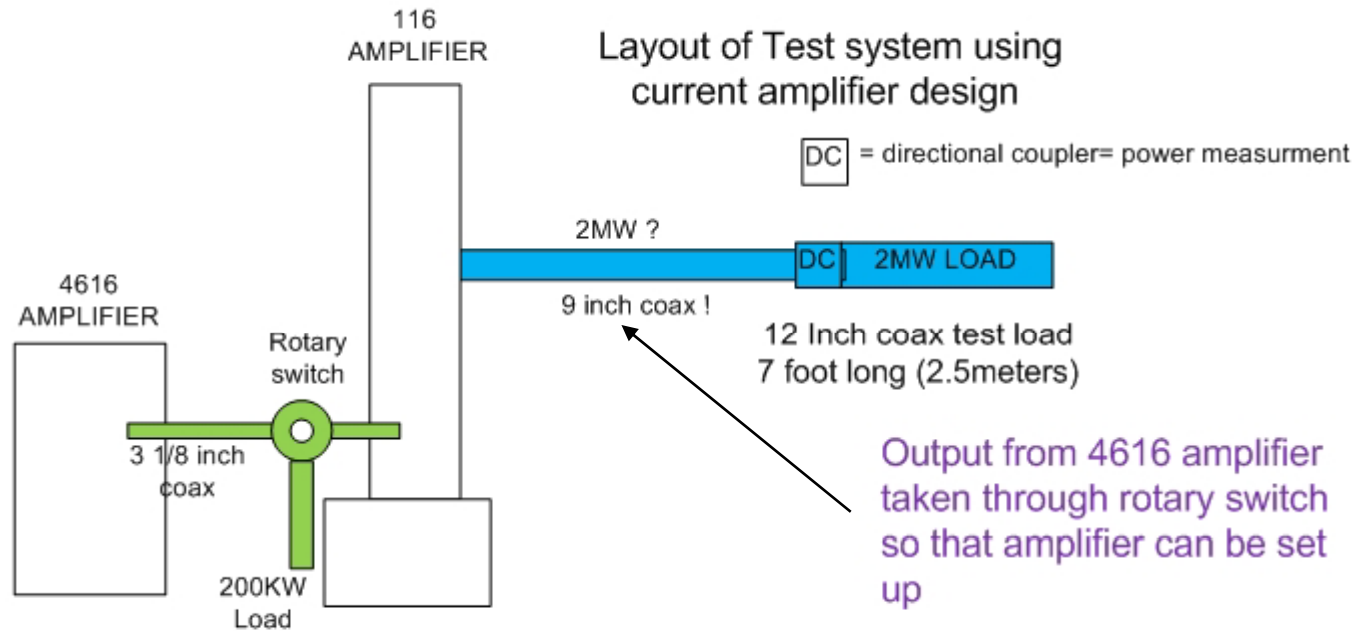
*Collaboration meeting, RAL, 7<sup>th</sup> – 10<sup>th</sup> October 2007*

*Andrew Moss*

# The Task for Daresbury RF group



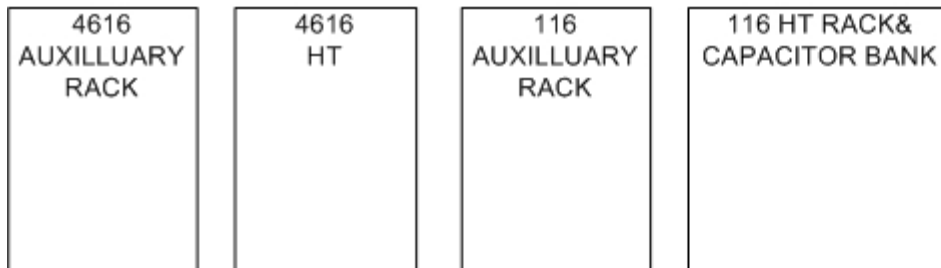
# Daresbury Test system



Output from 4616 amplifier taken through rotary switch so that amplifier can be set up

1 single 9 inch coax output from large amplifier

Concerns over voltage stand off in coax sections ~ gas pressurised systems may be needed



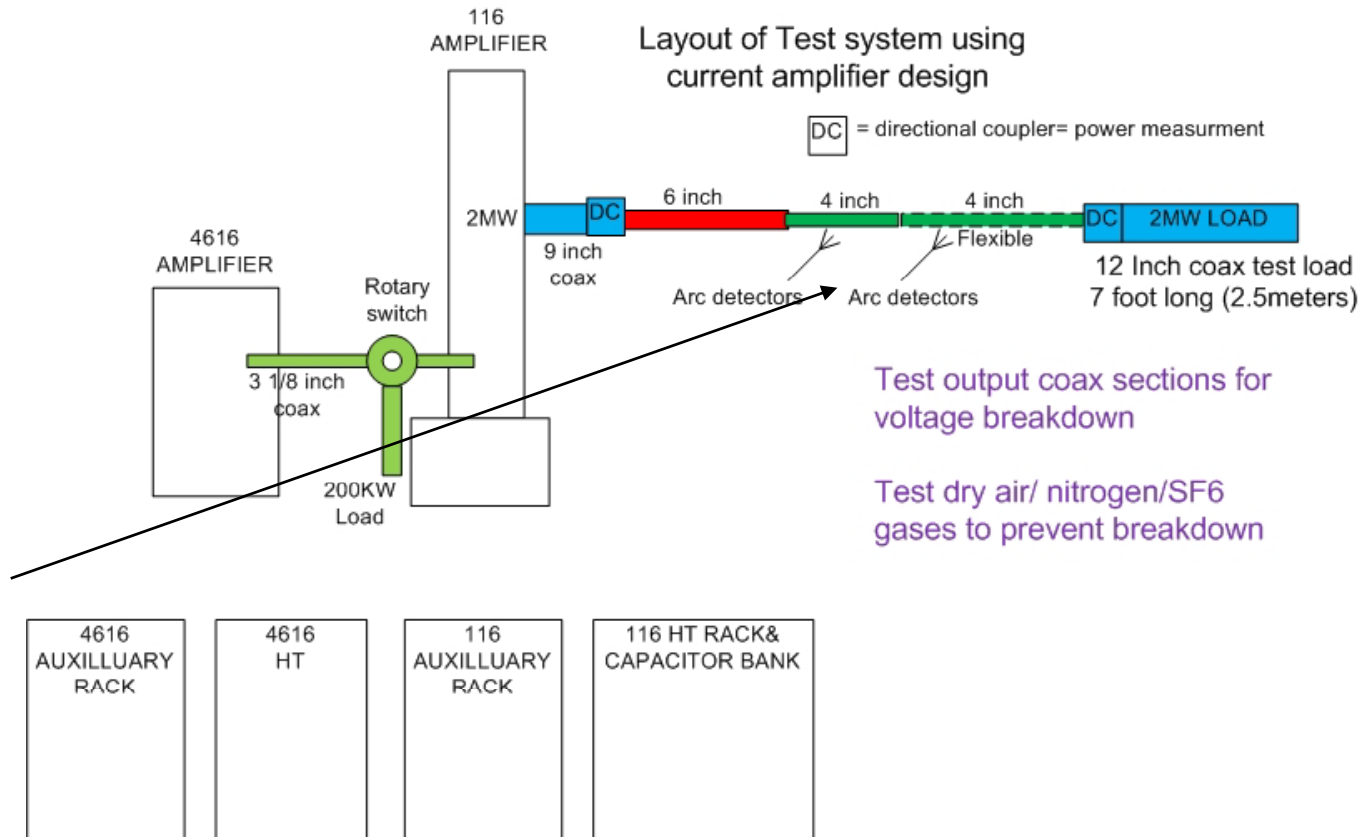


## *RF Coax*

- It is clear that space in the MICE experiment hall is at a premium
- 200MHz RF coax is big equipment
- Coax experts tell us that the voltage stand off to 2 Megawatt peak power level requires 12 inch coax components **minimum** !
- Smaller coax can be used if pressurised with insulating gas – nitrogen/ SF<sub>6</sub>
- MICE Cavity couplers are 4 inch coax – **have to be pressurised** !
- Smaller Coax = more power loss along length

## Coax system tests

- Use test system to understand coax limitations



## *Mucool Test Area*

- MTA system consists of long 9inch Coax from drive amplifier to cavity test area
- Size of the Coax is reduced near the cavity, split to feed both sides of the cavity and the system pressurised with SF6 insulating gas
- The MTA system has already ran at design fields
- It is clear that the MICE RF system will follow a similar design

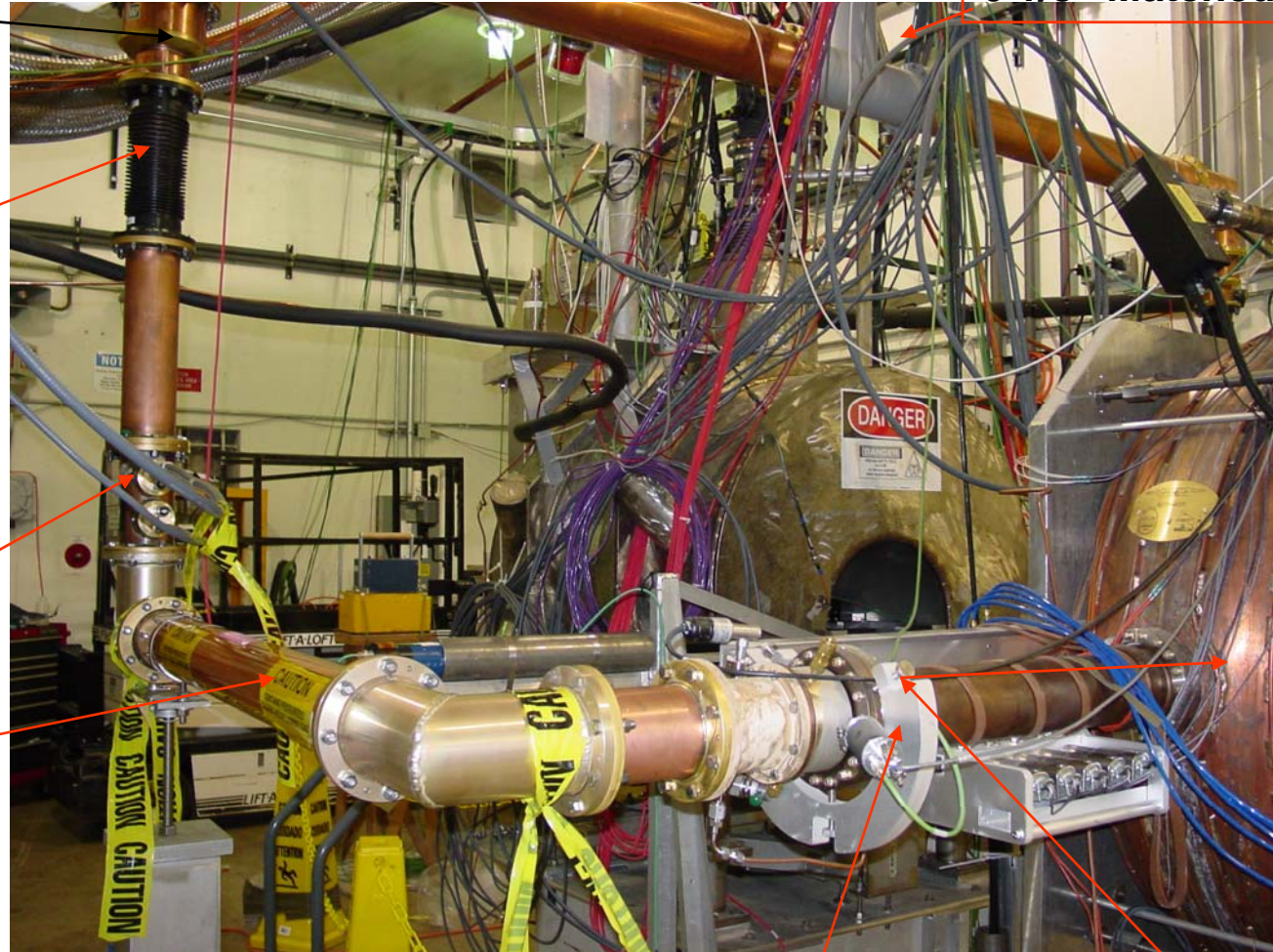
6 1/8" to 4 1/16" Coax Transition

6 1/8" Matched Tee

Flexible line section

Dual Directional Coupler

4 1/16" Coax Section

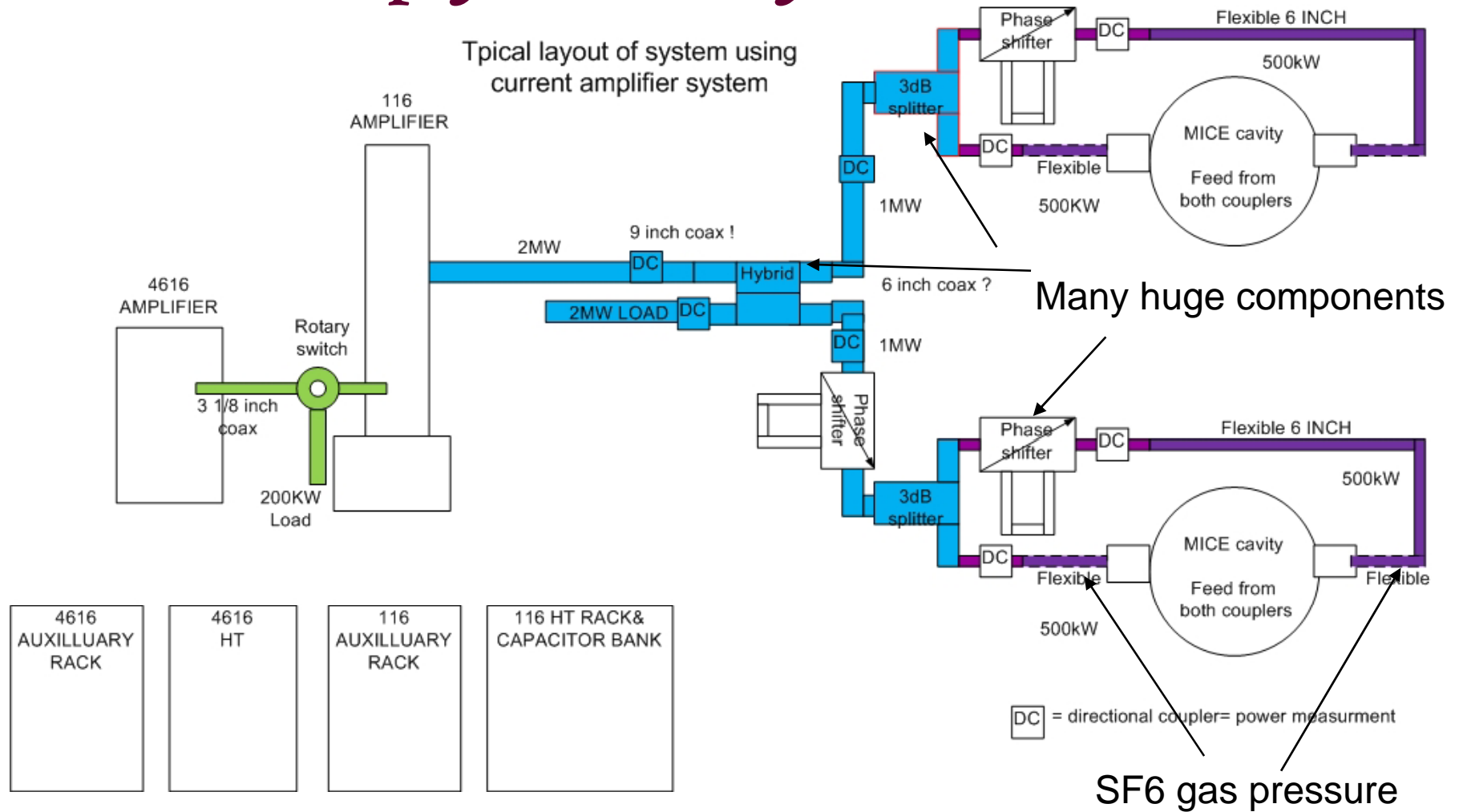


**MTA with 200MHz cavity on test**  
Slide courtesy of Al Moretti, Fermilab

Photo-Multiplier

Vacuum RF Coupler Loop

# Amplifier to cavity installation 1



## *Coax decisions*

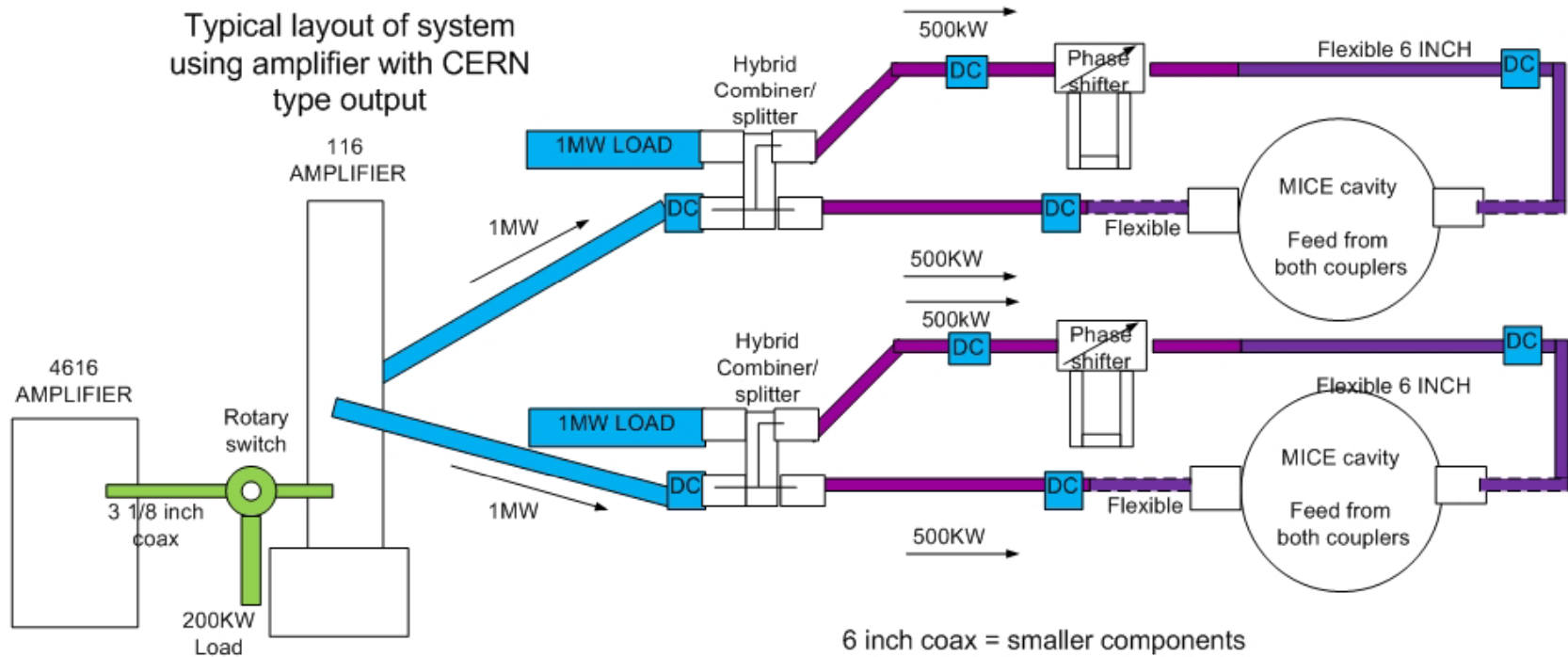
- DL amplifiers have a single capacitive 9 Inch coax output
- System will be tested to understand its capabilities' and limitations  
= can this style of output achieve 2MW reliably ?
- CERN operate their systems with 2 output taps via 6 Inch coax, this may be an advantage as it produces' a 'power split' directly at the amplifier
- DL systems could be converted to the CERN style once we have produced power from them, but this may mean pressurising more of the coax system with SF6
- Again, can the CERN style output on the amplifier produce 2MW reliably ? this needs to be investigated

## *Hall installation*

- Currently we favour using two outputs from the amplifier in 6 inch coax – ‘smaller’ components, still large pieces of kit !
- Still need a hybrid power splitter with a 1MW reject load for each cavity
- Phase shifters needed to used to offset phase error at coupler, large motor driven line stretchers
- Gas barriers needed inside coax to hold SF6 pressure
- Design of hall installation underway still lots of questions

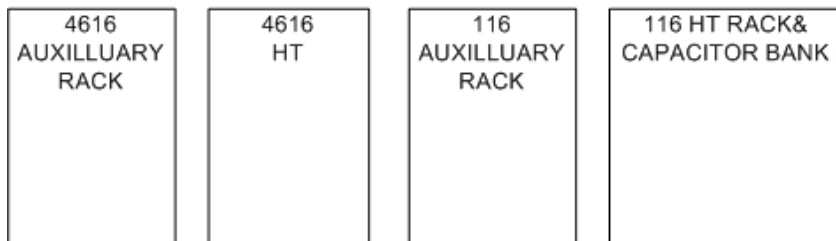
# Amplifier to cavity installation 2

Typical layout of system using amplifier with CERN type output



6 inch coax = smaller components  
 Amplifier provides 1 split already  
 Likely that the entire coax line will need to be pressurised

DC = directional coupler= power measurement





## *Plan*

- Make design of hall using both types of output configuration over the next few months
- RF meeting at CERN ? Try to set date for May
- Continue rebuild of first large amplifier
- Test amplifier ~ July/August 08
- Test output coax sections of differing sizes with and without gas pressurisation

## *Low level RF control*

- Production run of Larry Doolittle's LLRF control board in progress now, will arrive this month
- A version of this board is used on the SNS
- High speed and flexible



## *Conclusion*

- Large amplifier rebuild continuing
- HT power supply components are arriving but this will not be ready until June/July 08
- Amplifier needs testing to prove 2MW possible with single 9 inch output
- Likely modify amplifier to two 6 inch outputs ready for MICE experiment
- SF6 insulating gas will be needed in coax's