
Crab Cavity Status & Plans

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CM11 Summary

Oct 28, 2008

Many Thanks to CC-Team

Afternoon Session

1:30 – 2:00 pm	Crab cavity status & FY09 plans – R. Calaga
2:00 – 2:30 pm	Cavity/Coupler R&D FY09 – A. Seryi (BNL / KEK / LBL / SLAC / UK)
2:30 – 3:30 pm	Discussion: Cavity/Coupler down selection
3:30 - 3:45 pm	Coffee
3:45 - 4:15 pm	Cryostat Evaluation (Flexibility for multiple designs) – N. Solyak
4:15 - 4:30 pm	Discussion: Cryostat R&D & Installation
4:30 – 4:45 pm	Coordination with KEK & UK activities – Y. Morita/P. McIntosh
4:45 - 5:15 pm	Discussion: SBIRs proposals
5:15 - 5:30 pm	Discussion: Simulations

[The session is organized to be discussion oriented](#)

Session Goals

- Outline the FY09 plan as a first step towards a comprehensive plan for a 5 yr program
- Coordination of a very large collaboration & manage various contributions w/o duplication
- Effective R&D measures to reach to a approx baseline design by Fall-2009

Critical Milestones, FY08

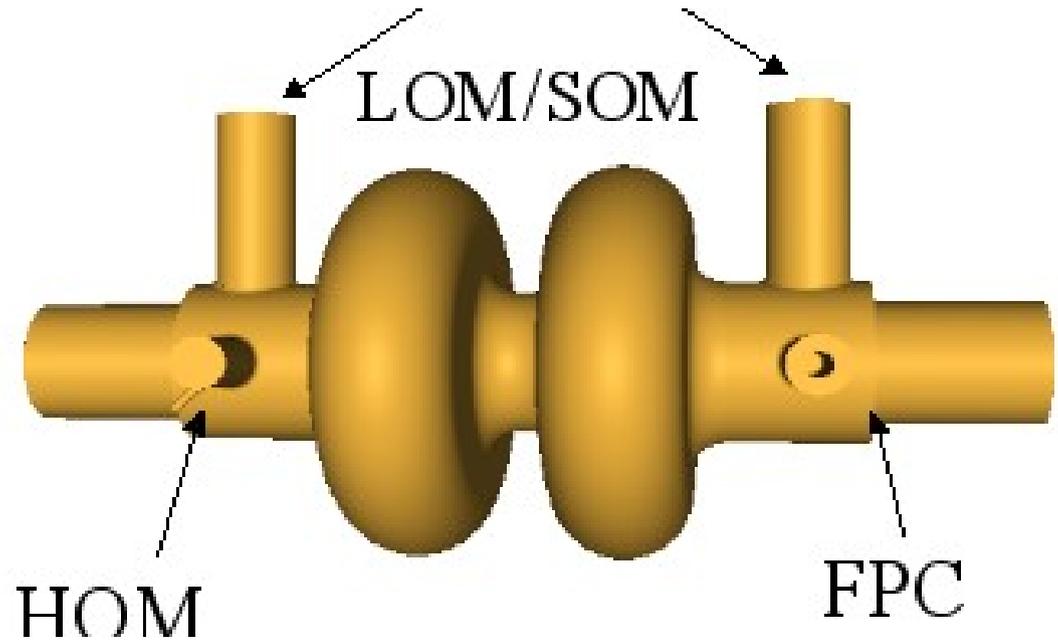
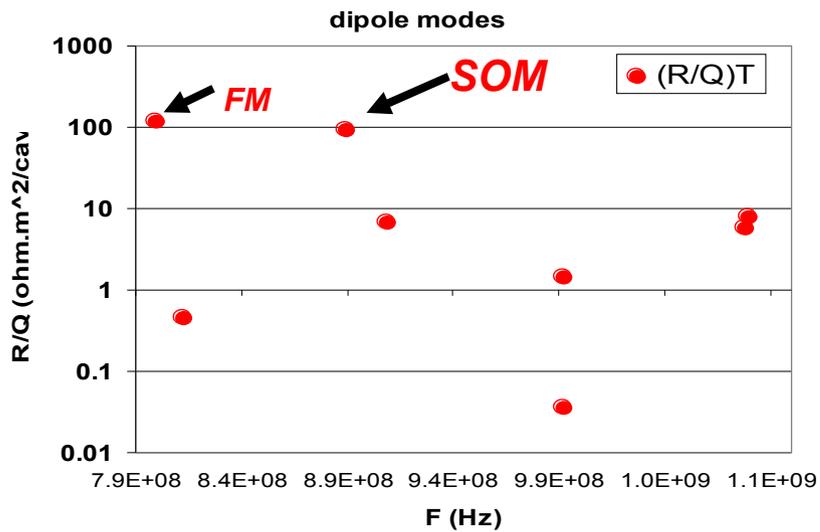
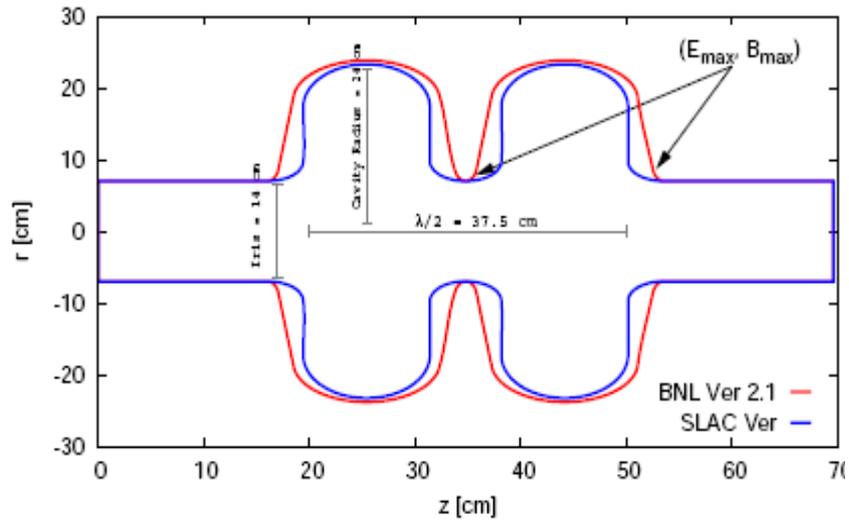
- 1st LHC-CC workshop – big step forward to start international collaboration
- CERN [consensus](#) & strong support for LHC-CC prototype & installation in phase I commissioning stage
- Significant progress in design achieved in short period ([7 months](#))
- [IR4 location](#) established by CERN-RF group for potential installation
- Preliminary beam simulations (beam-beam, collimation and impedance estimates) show promising results, need very detailed simulation campaign to satisfy all tolerances for “[Prototype Scenario](#)”
- Convergence to a [baseline](#) design within [1 year](#) and design review in [2 years](#)

Some Recommendations, CERN

- Hardware must be extensively tested before installation in the tunnel
- LHC performance shall **not be reduced**, even if hardware fails
- The time available to build hardware.... leaves no other possibility than **elliptical cavities** at 800 MHz
 - Moreover, the detailed layout of the insertions for Phase 2 and their integration in the tunnel is not yet known. For both of these reasons, I think unrealistic to state that the hardware developed for the validation test will be the one finally used in operation.
- A large enough **effect on luminosity** must be aimed at for the demonstration to be convincing. Setting the goal of at least +10%

A comprehensive list of requirements for the cryomodule ↔ installation and beam testing layout will be prepared by CERN in due time.

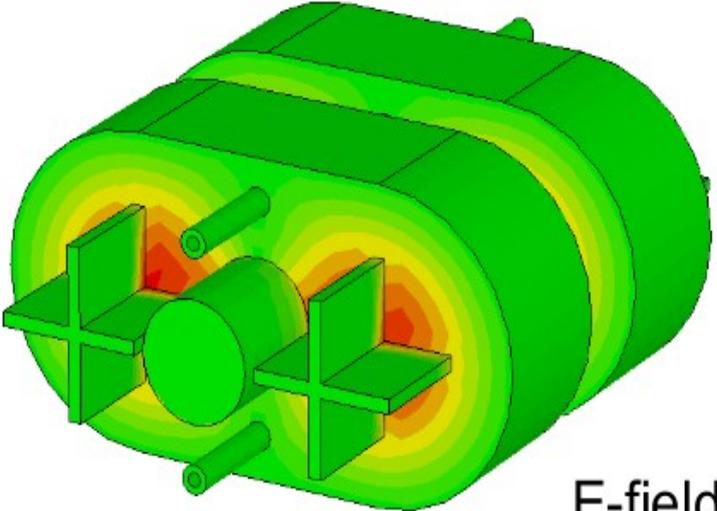
“Baseline Design”



Result of work from [L. Xiao](#) & several collaborators from the CC-Team

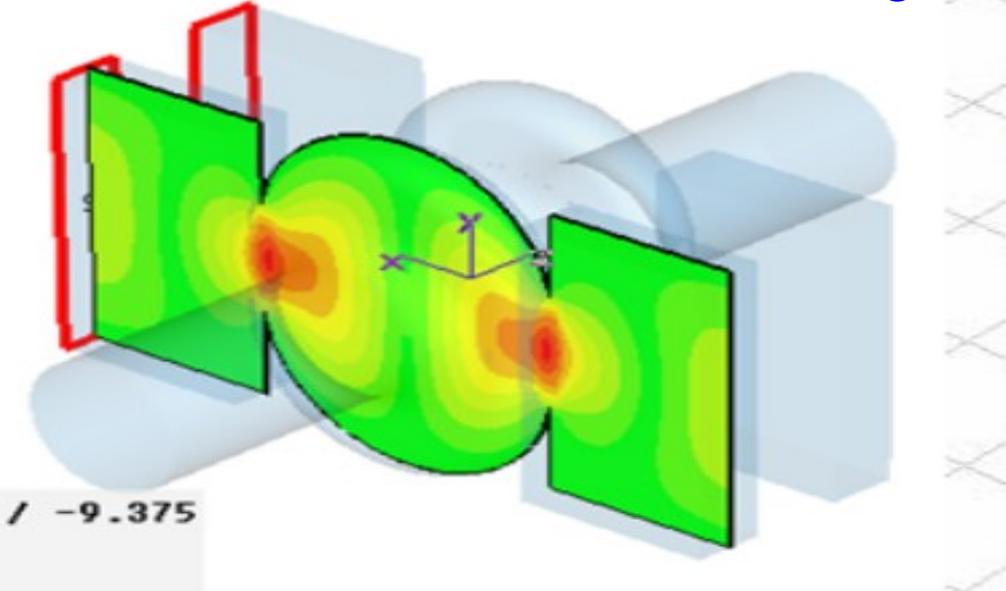
Two Alternatives

Super-KEKB type design



0 5.02e+006 V/m

UK/LBL/JLAB design



Merit Sheet, Under Construction...

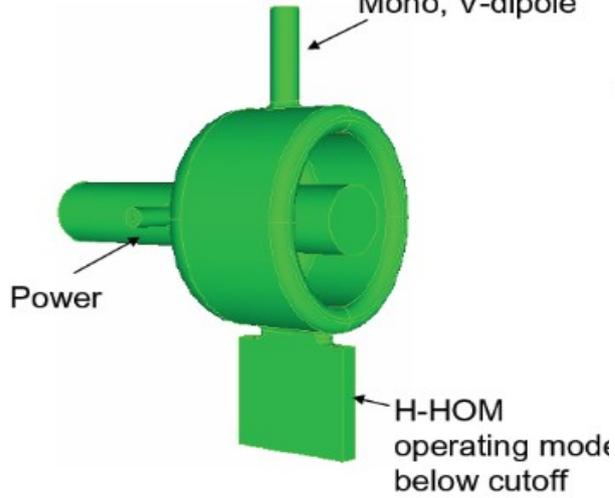
Gradient of 2.5 MV for 2-Cell Cavity

Parameter	BNL-SLAC		UK	KEK-B
	6 deg	0 deg		
Epk [MV/m]		25		
Bpk [mT/MV/m]		83		
R/Q [ohms]		117		120
cell-to-cell coupling				
Beam pipe radius [cm]		6		
Transverse size (Equator Radius)				
Loss factor (longitudinal)				
Transverse loss factor				

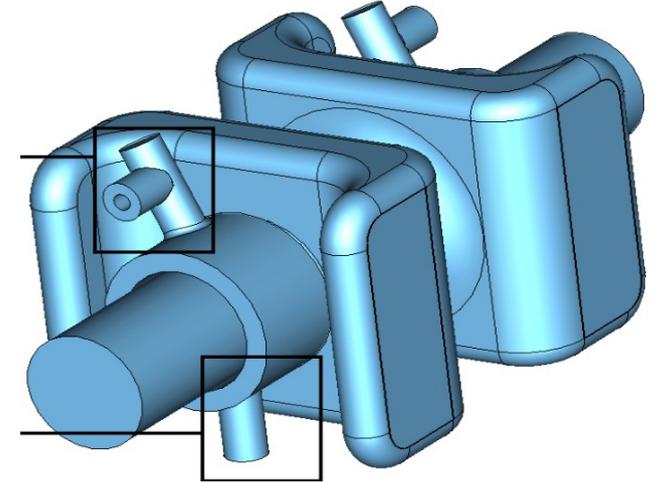
LOM, R/Q, Qext				
SOM: R/Q, Qext				
HOMs: R/Q, Qext				
Multipacting				
Fabrication				
Chemistry complexity				
Cryostat complexity				
Assembly & associated components				

Compact Cavities

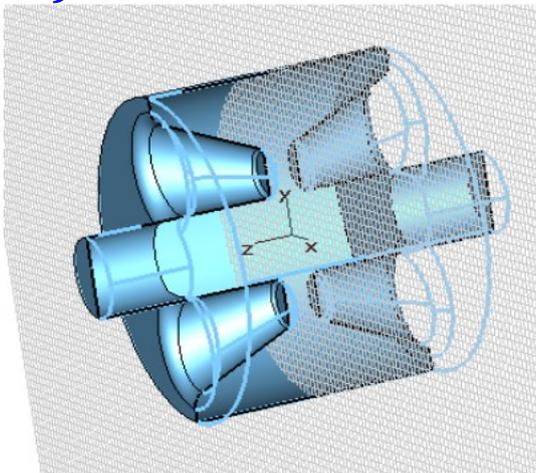
SLAC $\frac{1}{2}$ Wave & Spoke Structures



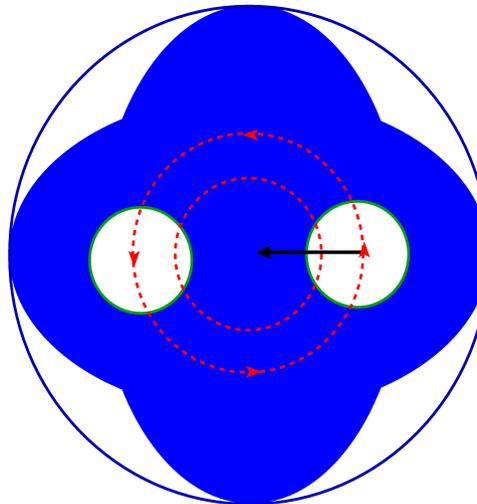
FNAL Mushroom Cavity



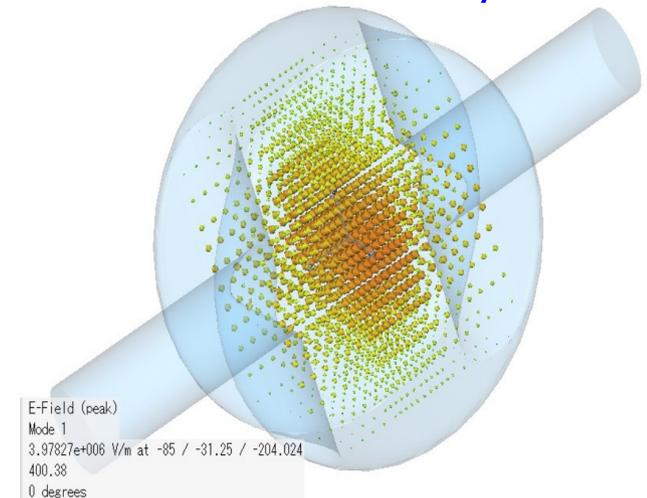
UK-JLAB Rod Structure



BNL TM010, BP Offset



KEK Kota Cavity



Cryostat

- CERN main RF cryostat was evaluated in a detailed fashion by FNAL
- Recommendation based on this assessment to start [new design](#) to adapt to LHC-CCs while using some common components from CERN cryostat
- We anticipate that this effort is supported within FNAL to some level for a conceptual design for Fall 2009 due to very limited funding on this topic
- Anticipate SBIRs to supplement the effort and help fabricate

Conclusions

- Strong potential of LHC-CCs (>50% luminosity), LARP is in the **lead role** and we need to maintain this momentum. Even the experiments are pushing crab cavities
- FY09 will use maximum effort using available resources and synergies. Need **stronger** support to sustain for the next fiscal years. Anticipate **SBIR support** for fabrication.
- Aim for **ONE** baseline design by Fall 2009 & critical design review by end of 2010 (this one year time can be used to identify merits and improve concepts – “robust & simple”)