



The 59th ICFA Advanced Beam Dynamics  
Workshop on Energy Recovery Linacs

# Summary, Working Group 4

## Superconducting RF

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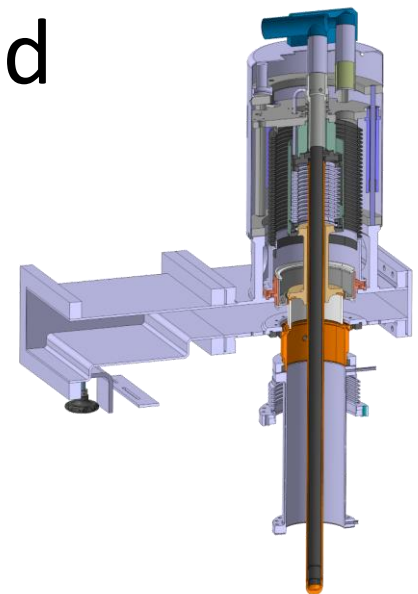
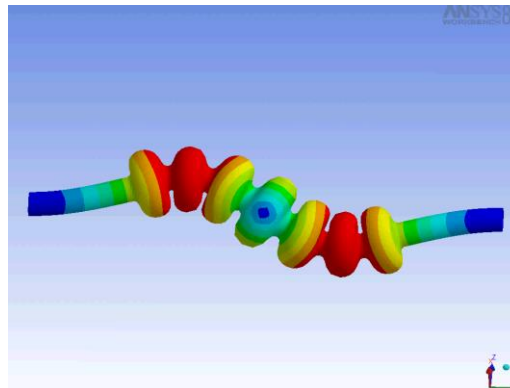
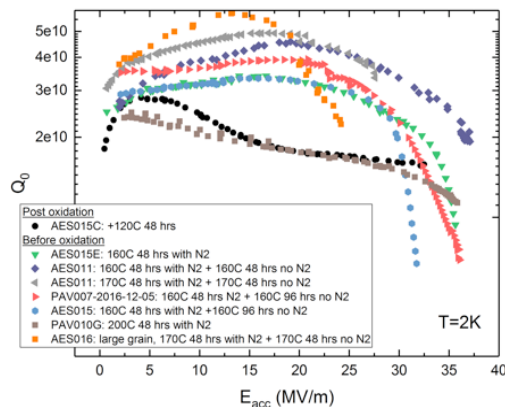
# Objectives of WG4 (SRF)

- A few guiding principles:
  - Cavity performance in ERLs, operating in a CW mode, is dominated by cryogenic loss.
  - RF power is dominated by stability and microphonics.
  - High current CW operation requires exceptionally good HOM damping.
  - Surprises are always possible...



# Themes set for WG4

- HOM damping and power coupling
- Advances in SRF surface performance
- Microphonics and resonance control
- Some additional cavity design and cryomodule performance.

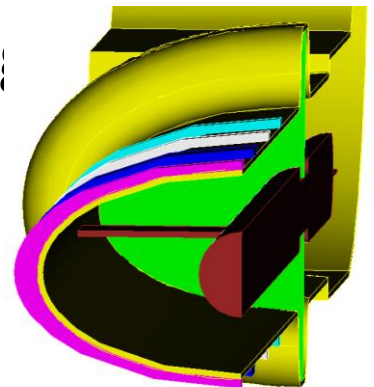


# Presentations in WG4

- Power couplers & HOM dampers at CERN, Eric Montesinos (CERN)
- Coaxial couplers, Qiong Wu (BNL)
- Resonant Frequency Control at the Compact ERL in KEK, Takako Miura (KEK)
- High-Q R&D at FNAL Mattia Checchin (FNAL)
- Twin-Axis Elliptical Cavity, Frank Marhauser (Jlab)
- Cornell ERL CM performance, Fumio Furuta (Cornell)
- The potential of Nb/Cu technology for high beam current applications, Sarah Aull (CERN)
- Resonance control of the PIP-II SC cavities, Warren Schappert (FNAL)
- Microphonics analysis of ERL cryomodule, Fumio Furuta (Cornell)
- Development of an ERL RF Control System, Sebastian Orth (TU Darmstadt)

# What we have heard (1)

- Power handling of 10's of kW is necessary
- The art of high-power couplers is well advanced, yet its practice is very demanding.
- Coaxial couplers are particularly effective for lower frequencies, favorable for ERL.
- High-pass filters in HOM suppressors are relatively new and require further development
- Surprise: TE11 coaxial coupler has some performance advantages.



## What we have heard (2)

- The science and technology of better performing SRF surfaces, in terms of peak surface fields, surface resistance and operating temperature made great strides in recent times through nitrogen treatments and thin-film technology.
- These developments are particularly critical for CW ERLs.

# What we have heard (3)

- Surprise:
  - Progress and renewed interest in separated trajectory energy recovery cavities.
  - Such a technique, once proven, holds enormous advantages in
    - Injection (straight trajectory of low energy beam!)
    - Beam dumping (No dispersion in waste beam, which allows dumping beams with high energy spread)
    - Possible added suppression of BBU.



Cavity #1

Cavity #2

# What we have heard (4)

- Issues of microphonics and cavity resonance stability continue to challenge new SRF facilities.
- These issues are being addressed by feedback, but advanced thinking in the design of components and systems (cavities, cryomodules, helium delivery systems, cryogenic plants) is highly desirable.



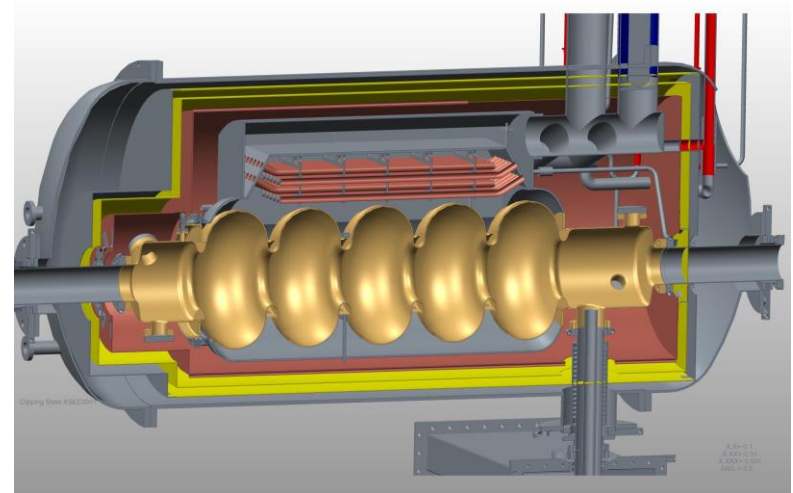
# What we recommend for future R&D

- Coaxial couplers, in particular high-pass, high-power HOM dampers and TE11 high-power fundamental power couplers.
- Nitrogen infusion and niobium sputtered on copper hold great promise.

# Future R&D (2)

- Vigorous R&D on separated axis energy recovery cavities.
- Development of cryomodules designed with the goal of increasing stability of cavities.

microphonics < 10 Hz p-to-p



We thank the participants and  
contributors!