HZB Helmholtz Zentrum Berlin

LINAC 16
28TH LINEAR ACCELERATOR CONFERENCE
East Lansing, MI USA
25-30 September

# A COLD BEAD-PULL TEST-STAND FOR SRF CAVITIES

**A.Velez**, A.Frahm, A.Neumann, J.Knobloch

FG-ISRF
Helmholtz-Zentrum Berlin, 12489 Berlin, Germany

HZB Helmholtz Zentrum Berlin

## Cold Test-Stand

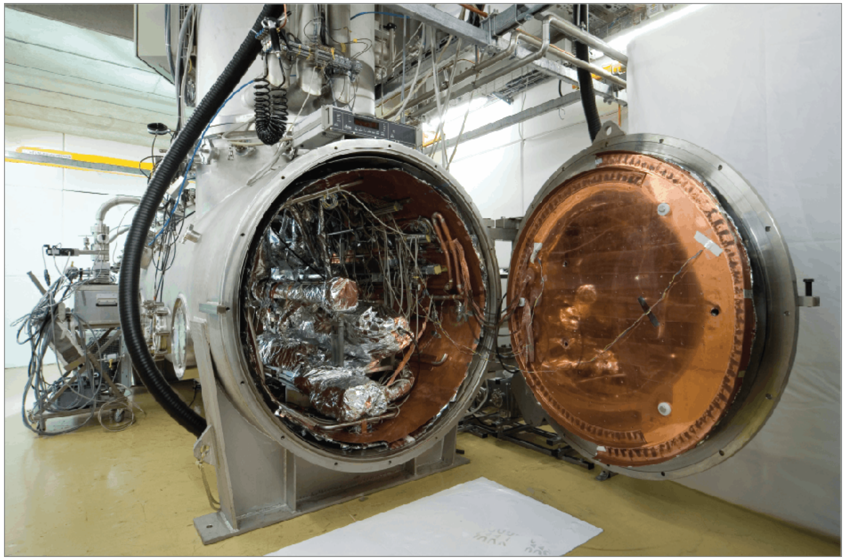
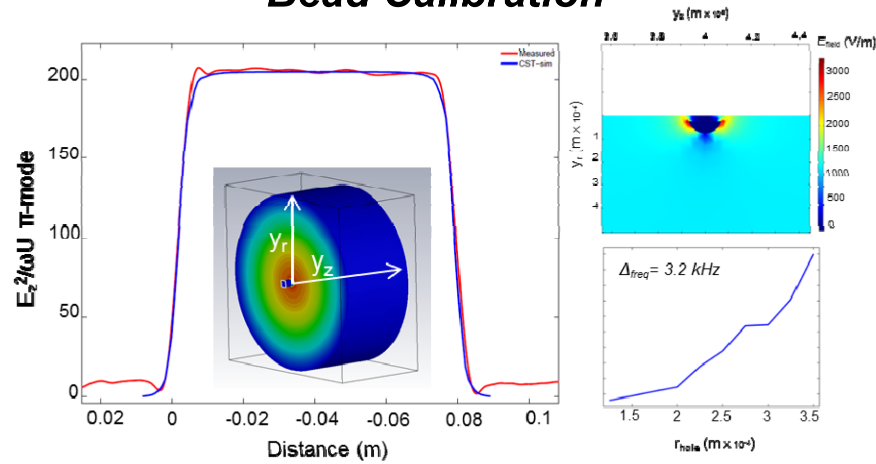


**Figure 1**: 9-cell Tesla cavity mounted on the test-stand before the installation of the pillbox (a). Pill-box cavity mounted with the wire system inside the HobiCat cryomodule (Niobium 9-cell cavity hidden behind) (b).

## Bead Calibration




$$f = \pi r^3 \varepsilon_0 \frac{(\varepsilon_r - 1)}{(\varepsilon_r + 1)} \qquad s = \frac{R/Q_{meas}}{R/Q_{sim}} \qquad f_c = f \cdot s \cdot s^*$$

$\Delta_{nohole/hole}$ = - 103 Hz  Phase corr. factor = - 0.012 °

$$f_c = \mathbf{5.083e\text{-}21}$$

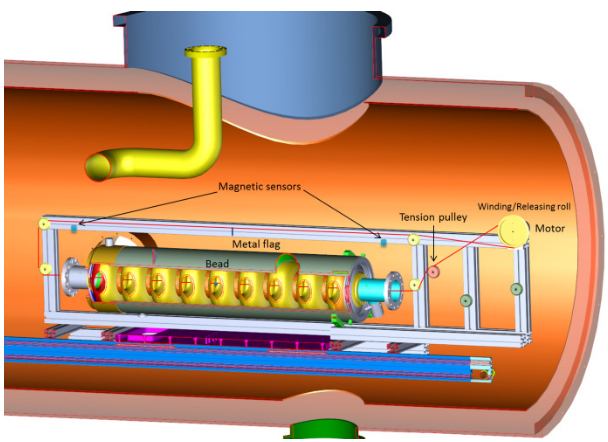
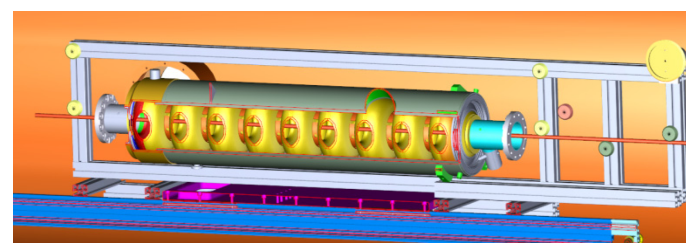



**Figure 2**: Layout of the 9-cell Tesla cavity mounted within HoBiCaT test cryomodule [1,2].




[1] A. Vélez, A. Frahm, J. Knobloch, A. Neumann "Developments on a cold-bead-pull test stand for SRF cavities". Proceedings of SRF2015, Whistler, BC, Canada. TUPB078.

[2] O. Kugeler, A. Neumann, W. Anders, and J. Knobloch, Review of Scientific Instruments 81, 074701 (2010).

# A COLD BEAD-PULL TEST-STAND FOR SRF CAVITIES

## *Cold Test-Stand*

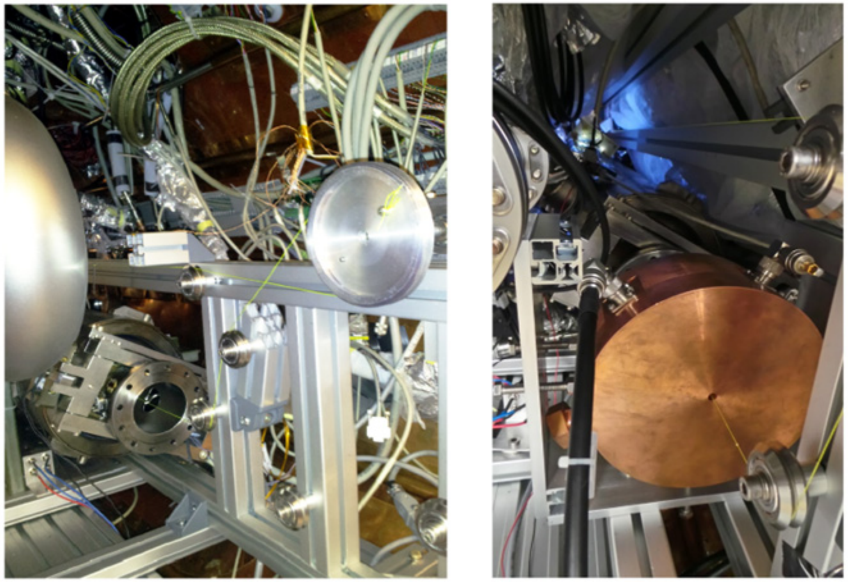
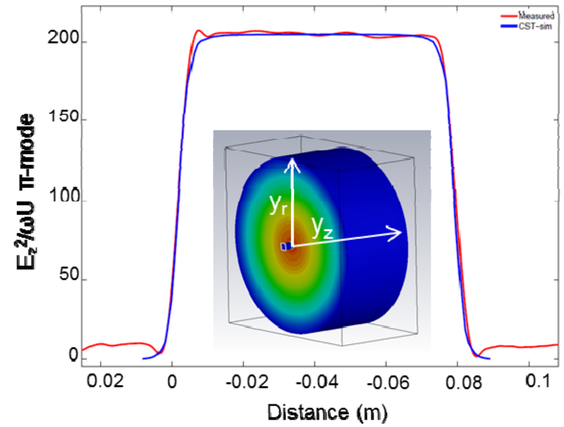
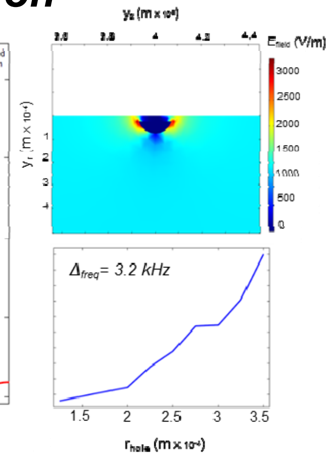


**Figure 1**: 9-cell Tesla cavity mounted on the test-stand before the installation of the pillbox (a). Pill-box cavity mounted with the wire system inside the HobiCat cryomodule (Niobium 9-cell cavity hidden behind) (b).

## *Bead Calibration*




$$f = \pi r^3 \varepsilon_0 \frac{(\varepsilon_r - 1)}{(\varepsilon_r + 1)} \qquad s = \frac{R/Q_{meas}}{R/Q_{sim}} \qquad f_c = f \cdot s \cdot s^*$$

$\Delta_{nohole/hole}$ = - 103 Hz    Phase corr. factor = - 0.012 °

$f_c$ = ***5.083e-21***

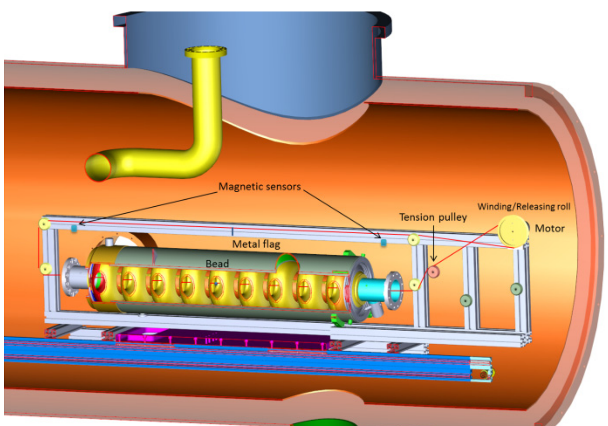
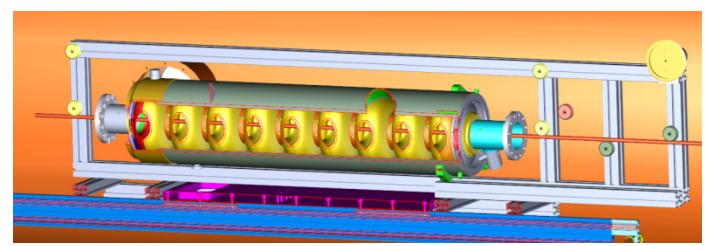



**Figure 2**: Layout of the 9-cell Tesla cavity mounted within HoBiCaT test cryomodule [1,2].

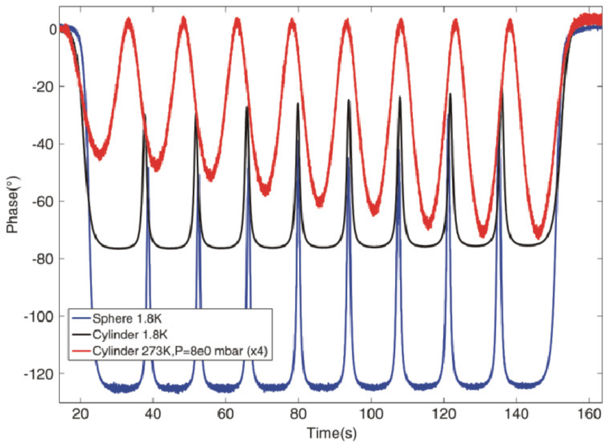



[1] A. Vélez, A. Frahm, J. Knobloch, A. Neumann “Developments on a cold-bead-pull test stand for SRF cavities”. Proceedings of SRF2015, Whistler, BC, Canada. TUPB078.

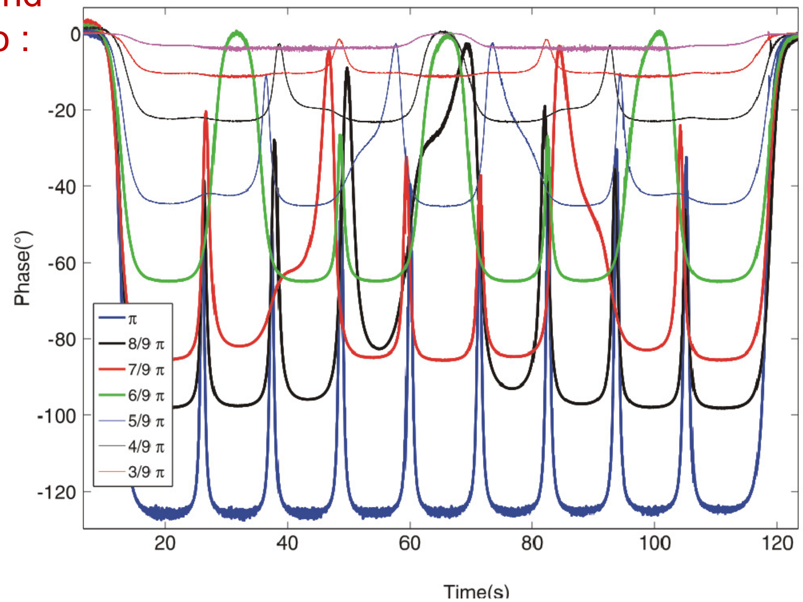
[2] O. Kugeler, A. Neumann, W. Anders, and J. Knobloch, Review of Scientific Instruments 81, 074701 (2010).

## Monopole Band 1, published in [1]

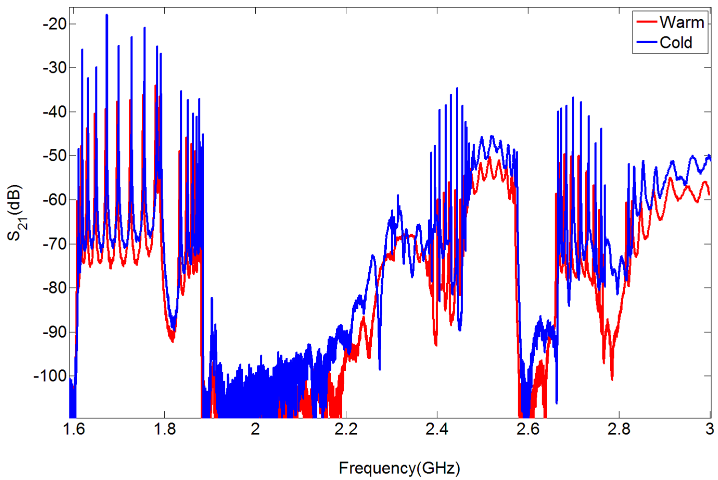
*π*




- Saturation in the band measurement due to :
  - Metal bead
  - Big size



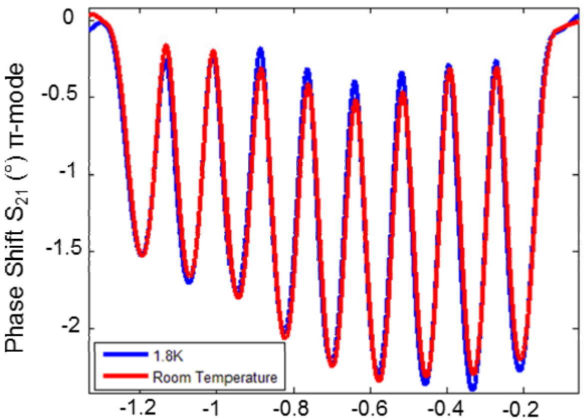

## HOMs




- Due to a LHe enviroment, the lossless surface material characteristics allow for the characterisation of many high order modes (HOMs)
- Extreme field sensitivity to bead perturbation
- Proper bead calibration is required.

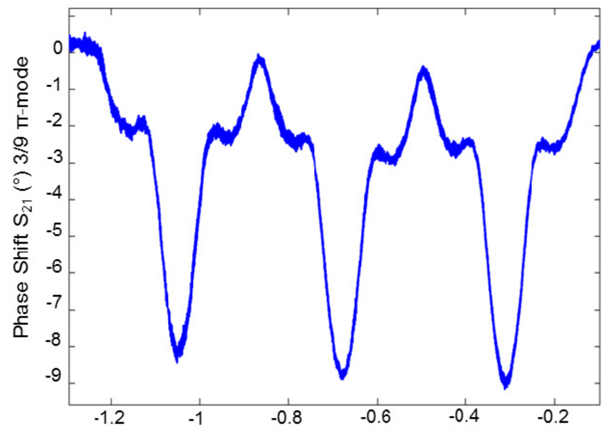
## Monopole Band 1

*π*



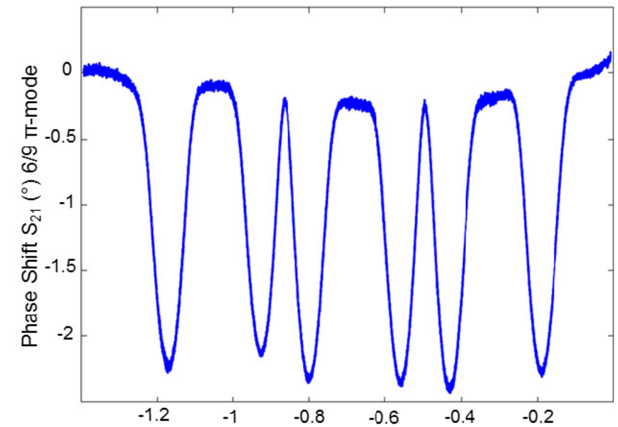

$R/Q$ $_{\text{Wanz}}$ = 1022
$R/Q$ $_{\text{meas}}$ = 1099
$Q_l$ =1e5

*3/9π*




$R/Q$ $_{\text{Wanz}}$ = 0.0013
$R/Q$ $_{\text{meas}}$ = 0.032
$Q_l$ =1.95e5

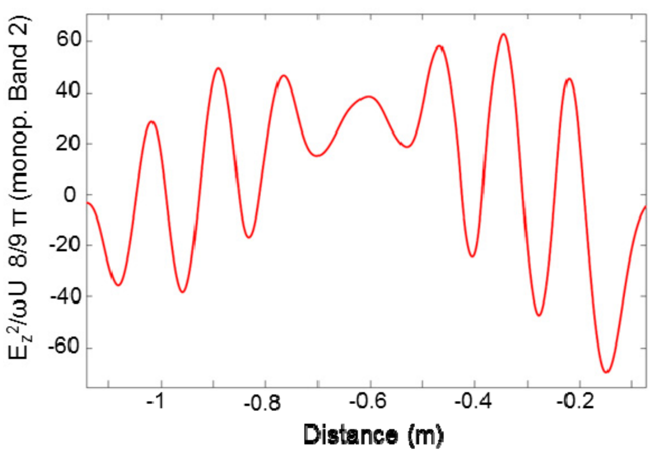
*6/9π*




$R/Q$ $_{\text{Wanz}}$ = 0.0019
$R/Q$ $_{\text{meas}}$ = 0.12
$Q_l$ =6.9e4

## Monopole Band 2 (HOMs)

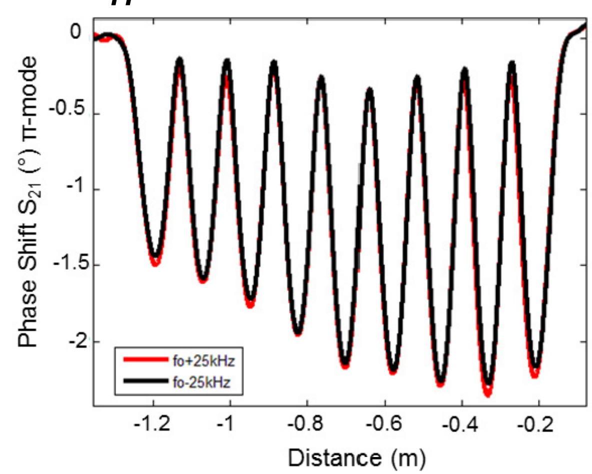
*8/9π*




$R/Q$ $_{\text{Wanz}}$ = 77.6
$R/Q$ $_{\text{meas}}$ = 89
$Q_l$ =4320

- Average deviation in the field flatness of 1.98%
- Small repetition error 0.31% (average)

*π*



# CONCLUSIONS:

- 1st Cold bead-pull test stand commisioned and in operation
- Form factor of the bead extracted by means of a copper pillbox at 1.8 K
- Experimental study of the effects created by cooldown process and tuner actuation on field profile
- Sucessfully commisioned a 1.3GHz 9-cell Tesla cavity for the fundamental passband. Characteristic parameters such as R/Q can be experimentally determined.
- Study of the field profile and R/Q for different HOM modes

**Questions? Please visit our poster on THPRC004**