

# TTF3 Power Coupler for the ILC

## Fabrication, Tests and Performance

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# Fabrication of TTF 3 Couplers

number of couplers	machining & welding	ceramic TiN coating	copper plating	final e-beam welding
10 prototypes	Desy	Fermi Lab	Industry	Industry
12 first series	Industry	Desy	Industry	Industry
40 second series	Industry	Desy	Industry	Industry

62 TTF 3 couplers are fabricated so far  
52 at industry

# Processing times of Couplers

- In the past:
  - coupler test stand: 70 - 125 h
    - two at a time, baked in situ
  - Horizontal Cryostat: 20 - 120 h
    - one at a time, baked in situ
- Now:
  - Test stand & horizontal cryostat after handling & assembling improvement 20 – 50 h

# Better Handling of Couplers

- all parts are stored under dry Nitrogen
- warm side of cold window is now always under dry Nitrogen
- time on air during assembly is minimized

sealing cap for  
cold window



# Tests and Performance

- 44 TTF 3 couplers are successfully tested on a coupler test stand at 1 MW, 1.3 ms, 2Hz, traveling wave, baked in situ, two at a time
- TTF 3 couplers are operated at the VUV-FEL for 100,000 hours x coupler up to 400 kW, 2-10 Hz, 1.3 ms
- All couplers in the VUV FEL linac could be processed and operated up to the cavity performance limits

# Tests at 35 MV/m

- Long run test of EP cavities in the horizontal cryostat
  - o This test includes all auxiliaries like power coupler, HOM coupler, tuner, piezo...
  - o Gradient: 35 MV/m
  - o Max forward power: 600 kW
  - o RF on time 2400 hs, at 600 kW 1100 hs
  - o No breakdowns in the coupler
- High gradient test with beam (in module ACC1)
  - o Gradient: 35 MV/m
  - o Gradient calibration with beam

# Recent High Gradient Test at Module 5

- All couplers at module 5 are TTF 3 type
- due to the VUV-FEL needs: long time operating at low power (10 kW)
- for the test the power could be raised up to 370 kW (the cavity limits) without any sign of processing

# Conclusion

- All TTF3 couplers in the VUV-FEL Linac are operated for 100,000 hour x coupler
- TTF3 couplers are successfully tested together with cavities up to 35 MV/m (600kW)
- TTF 3 coupler design was chosen for the X-FEL
- The processing time could be improved and will be investigated further
- Industrial studies for mass production and price reduction are started



# TTF3 Coupler on Module 5

