



# ILC EDR Kick-off Meeting

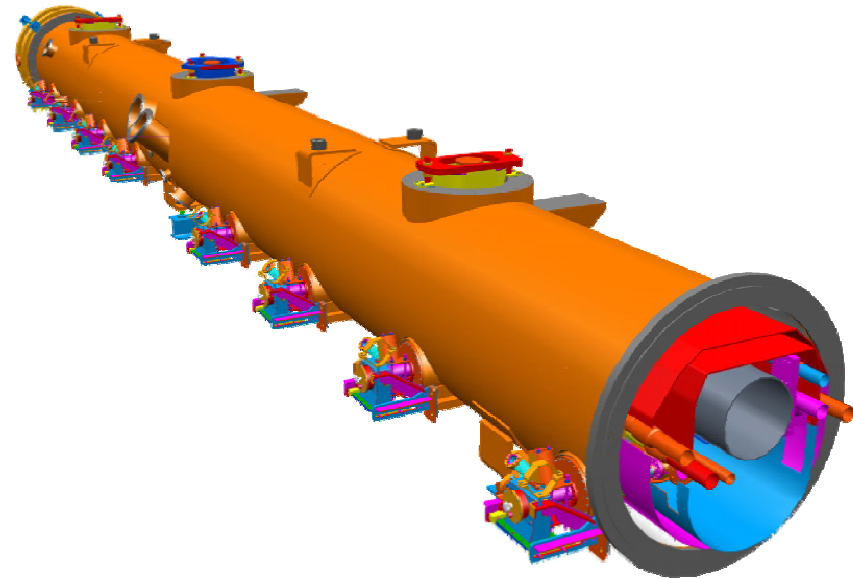
DESY, 19-21 September 2007

## ILC and XFEL Cryomodules

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University of Milano  
INFN Milano-LASA & GDE



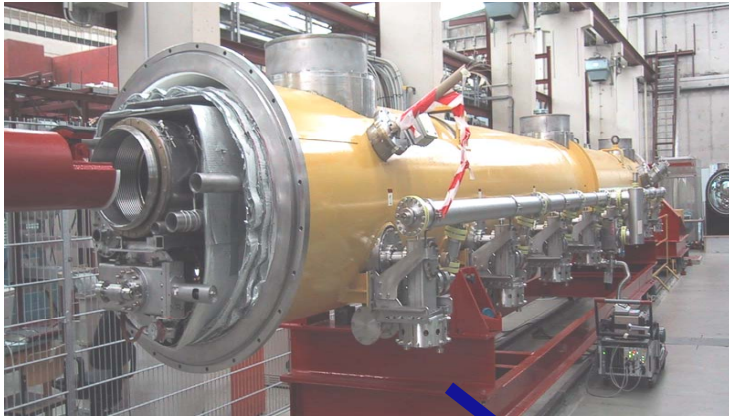
TESLA cryomodule



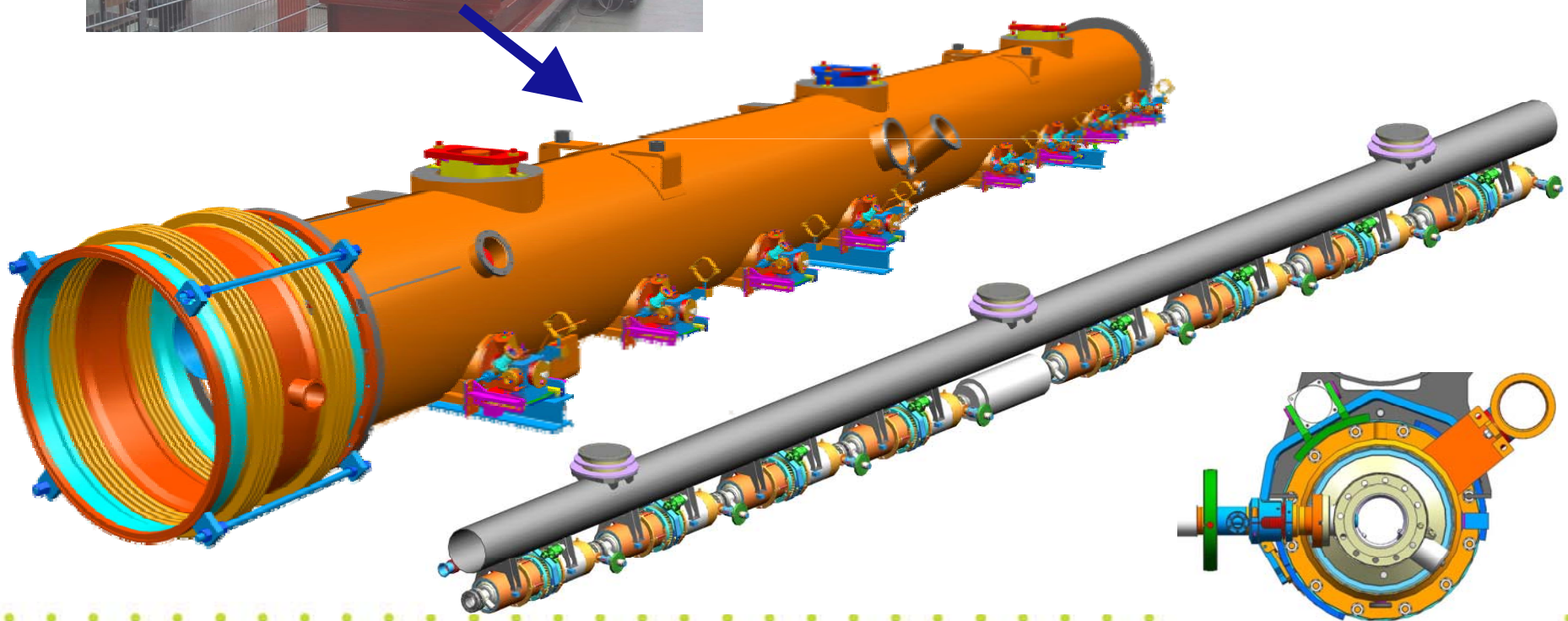
4<sup>th</sup> generation  
prototype ILC  
cryomodule



# From Type 3 to the ILC Cryomodule



- International collaborative Effort in the three regions
- Design changes are towards nailing down slot length of components
  - Costing should be straight-forward from TTF (and possibly XFEL) experience





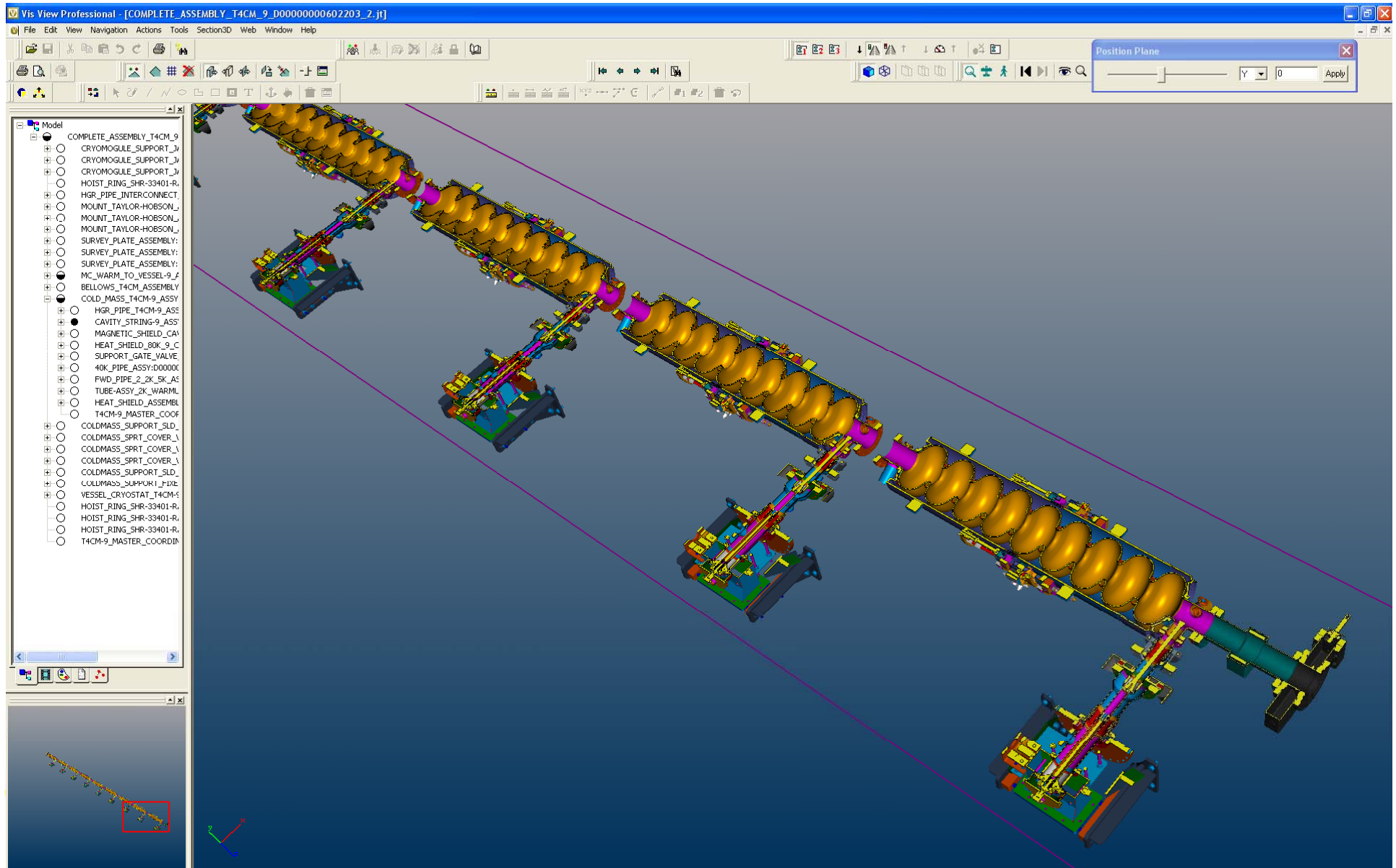
# The Main Linac

Subdivision	Length (m)	Number
Cavities (9 cells + ends)	1.326	14,560
Cryomodule (9 cavities or 8 cavities + quad)	12.652	1,680
RF unit (3 cryomodules)	37.956	560
Cryo-string of 4 RF units (3 RF units)	154.3 (116.4)	71 (6)
Cryogenic unit with 10 to 16 strings	1,546 to 2,472	10
Electron (positron) linac	10,917 (10,770)	1 (1)

- Costs have been estimated regionally and can be compared.
  - Understanding differences require detail comparisons - industrial experience, differences in design or technical specifications, labor rates, assumptions regarding quantity discounts, etc.

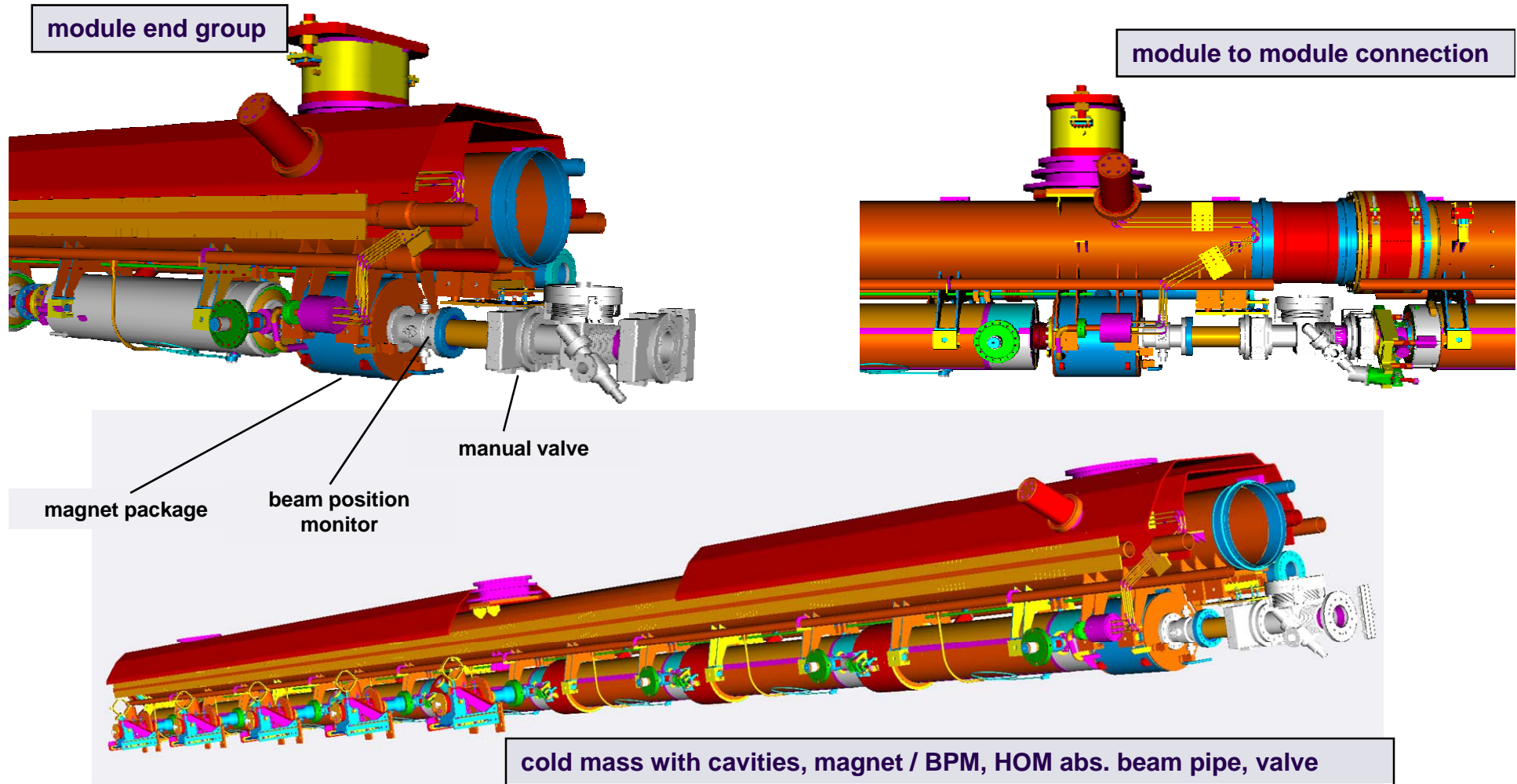


# From the ILC Cryomodule drawings





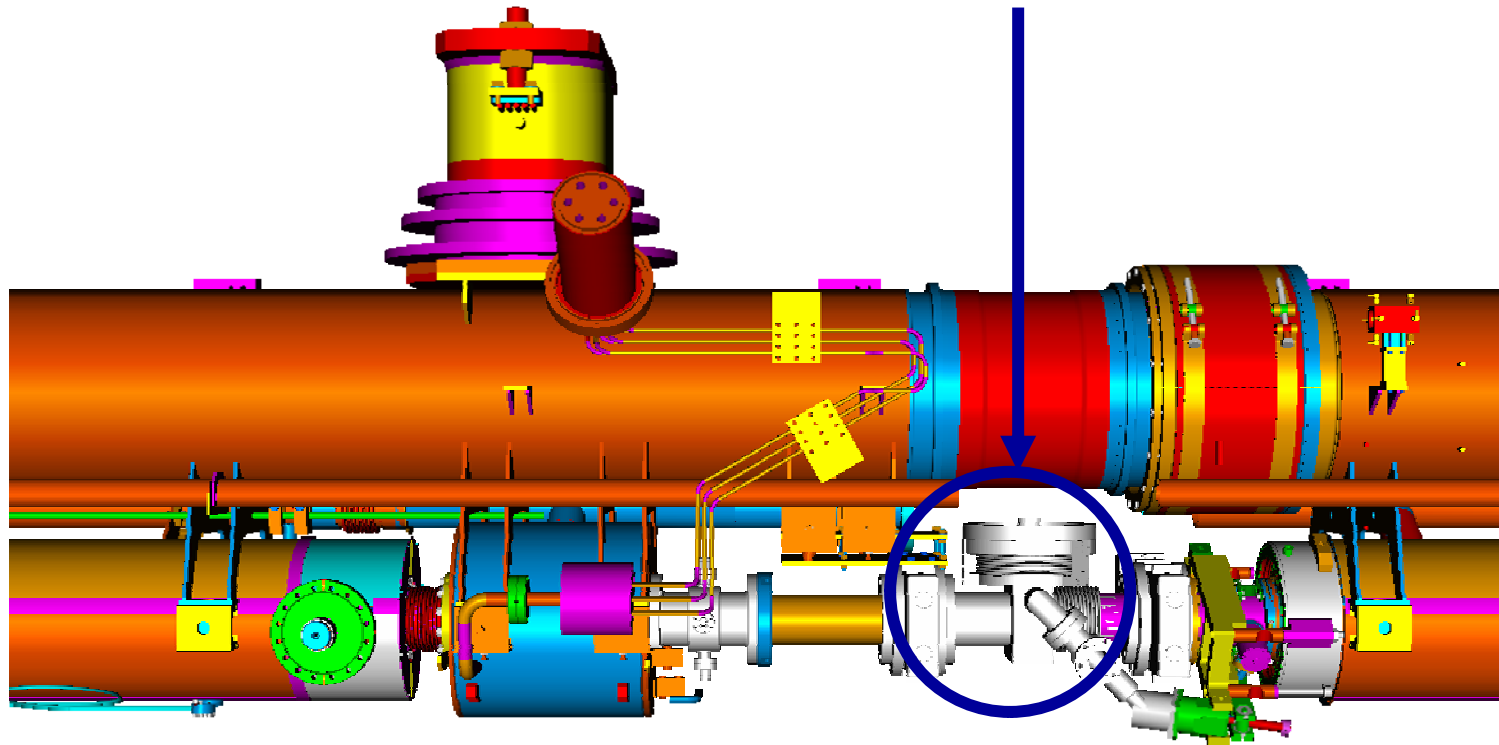
# XFEL Accelerator Cryomodule





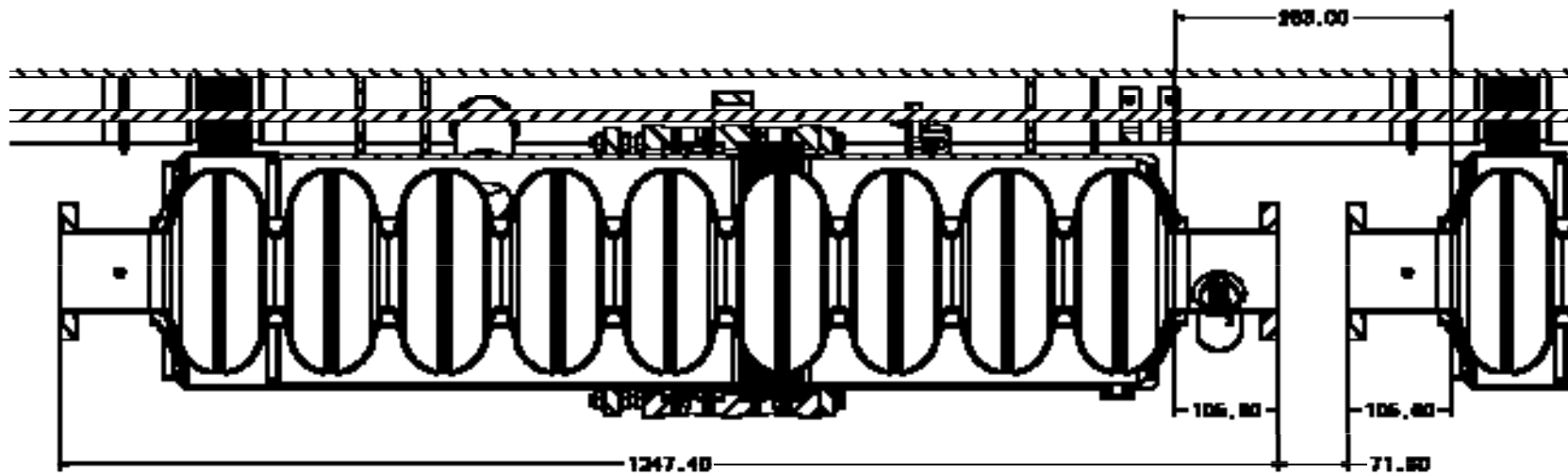
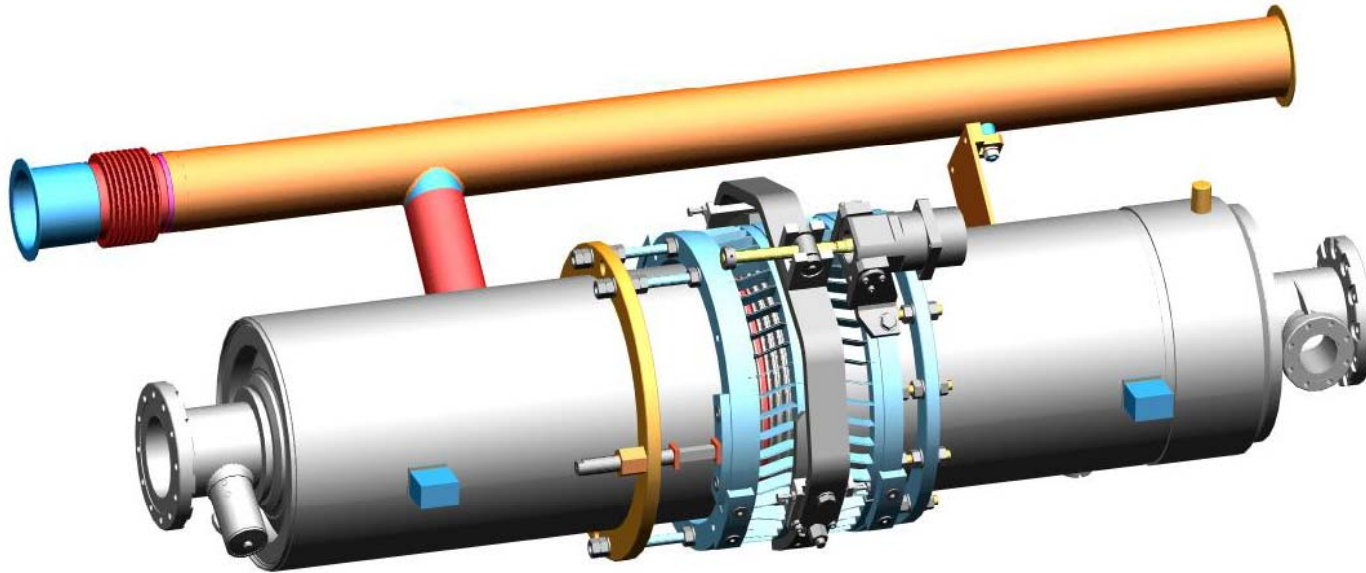
## HF HOM Coupler for the XFEL

In the XFEL the HOM Couplers for frequencies above cut-off are placed at each module interconnection. The power extracted from the beam is dissipated at the 40-70 K level.





# Actual ILC Baseline Cavity







## Present XFEL/ILC Differences

- Cavity distance and Quadrupole length:
  - Just "2 parameters" in the 3 D model
- Quadrupole position:
  - In the XFEL is maintained because of the required effort.
- Number of cavities per module:
  - XFEL maintains 8, ILC has 9+8+9 in one cryounit
  - ILC numbers could be reviewed if beneficial ?
- Cavity ancillaries:
  - Couplers: same baseline
  - Tuner: 2 alternatives on baseline. It could easily converge
  - Magnetic shield: tuner dependent
- Module ancillaries:
  - vacuum, beam pipe HOM, BPM, diagnostics: they could converge easily at least in term of interfaces.



## General Comments

- The study is complete and well done. **But, year 2000 costs**
- **Costs are consistent with the logarithmic extrapolation law.**
- **Minor (few per cent) cost reduction is expected using long modules.**
  - **Less cryo-supports and pipes.**
  - **Higher machining cost because of size.**
  - **Equal pre-assembling cost.**
- A small margin exists through a further production optimization.
- Cost distribution is homogeneous: **no expensive components.**

### **ILC extrapolation to 2007 cost has been confirmed**

- Material cost increase from the market prices
- Labor cost increase from official tables

### **XFEL extrapolation valid but penalized by the smaller quantity**



# Cryomodule Assembly Studies - 1



## ACCEL Cryomodule Assembly Study I

**S. Bauer, B. Griep, M. Pekeler, H. Vogel, J. Zeutschel**  
**ACCEL Instruments GmbH**  
**Friedrich-Ebert-Str. 1**  
**51429 Bergisch Gladbach**

**TTC meeting at FNAL, April 23-26, 2007**

TTC meeting at FNAL, April 23-26, 2007



# Cryomodule Assembly Studies - 1



## Industry Study on the Series Production of XFEL Cryomodules

C.Boffo, W. Gärtner, S. Sattler, G. Sikler, U.-M. Tai





## Cryomodule Transportation Study

- Very complete and detailed study performed by Babcock Noell / DESY on Complete Module transportation issues
- Critical points have been detected
- Reasonable cures have been proposed that look sufficient for a safe transportation
- Next steps are:
  - careful reviewing of the document delivered
  - definition of a set of tests required for qualification
  - final qualification tests on a module prototype



# Final Considerations - 1

- The present XFEL cryomodule is very close to the present ILC baseline design. Both are derived by the TTF Type III.
- A part from few parametric details (cavity distance and quadrupole length), the 2 modules could be set almost identical, or at least compatible (consistent interfaces)
- A possible joint effort to reinforce convergence, if agreed upon by the two Project Managements, would have a number of unequivocal benefits, mainly for the ILC:
  - **Maintain a strong links between the two projects**
  - **Have XFEL as a large size ILC prototype**
  - **ILC cost saving by sharing the XFEL invaluable experience on**
    - industrialization and consequent cost saving
    - managing QA and QC with industry
    - effective cavity gradient and yield
    - reliability issues of major components
    - .....



## About the XFEL Status

- External contributions for the Phase I formally promised
- The project, as European Project, started on June 5<sup>th</sup> 2007
- The XFEL ISC is acting as XFEL Council
- New major Countries are still subscribing and Phase II from the beginning looks possible.
- As the substantial part of the in-kind contributions from Italy and France, INFN and CEA look interested to jointly support DESY on the SC linac construction
- LAL Orsay confirmed its interest on Couplers
- Next Monday at the "XFEL In-Kind Review Board" a preliminary document, jointly prepared, will be presented by DESY with a possible distribution of tasks and responsibilities on the major machine components
- All agreement are expected to be signed, and shares distributed by the end of 2007.