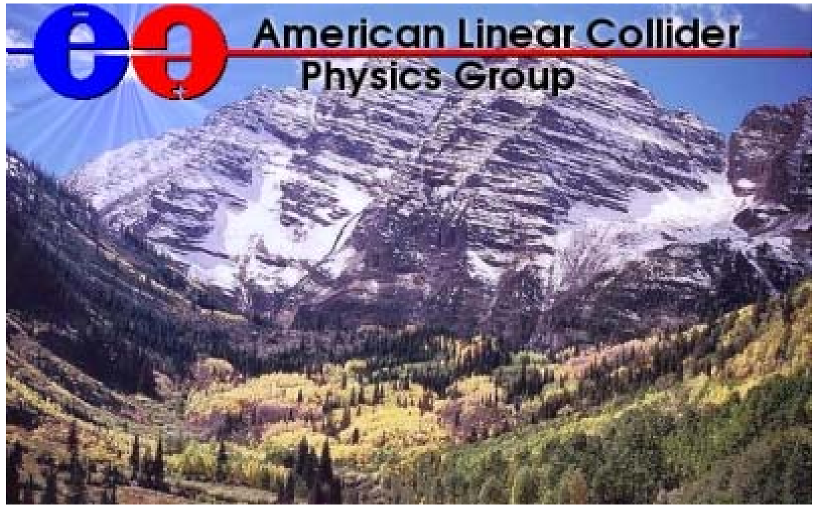

2005 International Linear Collider Physics and Detector Workshop
and Second ILC Accelerator Workshop
Snowmass, Colorado, August 14-27, 2005

Cryomodule Design:
Reference Configuration

Carlo Pagani

INFN Milano and DESY

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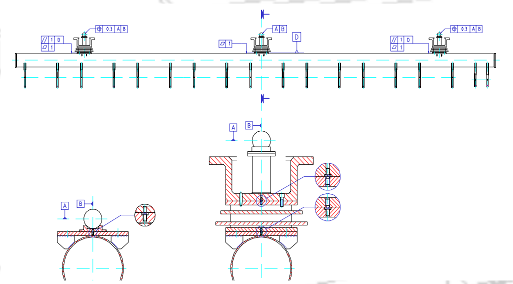
Consensus on TTF Type III

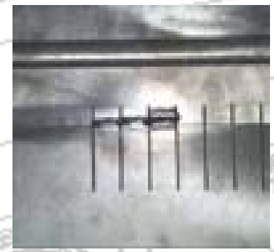
Three cryomodule generations to:

- **improve simplicity and performance**
- **minimize cost**

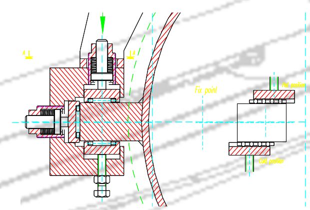
Reliable Alignment Strategy



"Finger Welded" Shields



Sliding Fixtures @ 2 K



Required plug power for static losses ~ 5-7 kW/(12 m module)

Large Operation Experience in TTF

	Type	Installation date	Cold time [months]
CryoCap		Oct 96	50
M1	1	Mar 97	5
M1 rep.	2	Jan 98	12
M2	2	Sep 98	44
M3	2	Jun 99	35
M1*	2	Jun 02	30
MSS	2		8
M3*	2	Apr 03	19
M4	3		19
M5	3		19
M2*	2	Feb 04	16

15 August 2005

Type III Cryomodule Main Features

- Very low static losses: dominated by warm to cold penetrations
- Very simple and effective thermal shields
- Moderate cost for production and assembly
- Relaxed tolerances for most of the components
- Main tolerances set to minimize internal forces while allowing a simple and effective alignment procedure at warm
- Warm to cold alignment maintained in within ± 300 μm
- Maximum filling factor, i.e. maximum real estate gradient. Filling factor determined by module independent items to be improved:
  - Cavity and quadrupole interconnections
  - Quadrupole/BPM package and beam line HOMs
  - Vacuum valves and pumps at the module interconnection, i.e. module length
  - Required cryogenic boxes to feed and extract He
  - Vacuum barriers
- Very few cold to warm transitions: both MTBF and MTTR affected

From Type III to ILC

- Take TTF Type III as reference conceptual design
- Introduce layout modifications required to fit ILC requirements:
  - Quadrupole/BPM package at the center (symmetry and stability)
  - Review pipe sizes/positions according to gradient and cryo-distribution
  - Consider/include movers (warm) at the center post for x,y quadrupole beam based alignment
  - Consider/include movers to optimize the module centering according to HOM data
  - Review suspension system (post, etc.) for stability and transport
- Review all the subcomponent design for production cost and MTBF
  - Materials, welds, subcomponent engineering, LMI blankets, feed-through, diagnostics and cables, etc.
  - Module assembly issues
- Reduce the waste space between cavities for real estate gradient
  - Flange interconnection, tuners, etc.
- Define all the QC and QA steps required to assure MTBF

Concluding remarks

- The cryomodule design, performance and cost are central for the ILC based on the cold technology
- Detail design must be driven by the active element requirements and the overall ILC optimization
- Interregional collaboration is crucial
- XFEL, SMTF and STF should move as much as possible in a parallel and synergic way