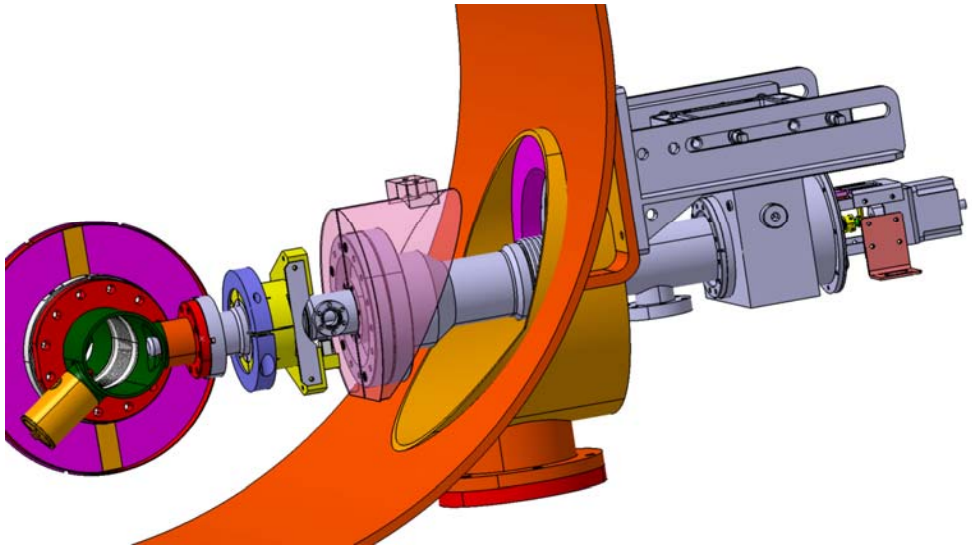
Interfaces

power couplers for XFEL

SCRF Meeting

Fermi Lab

21-25 April 2008



INTERFACES OF POWER COUPLER WITH OTHER WP's

WP 1 – Waveguide
1.1 Waveguide flange, bolts and nuts
1.2 Kapton window

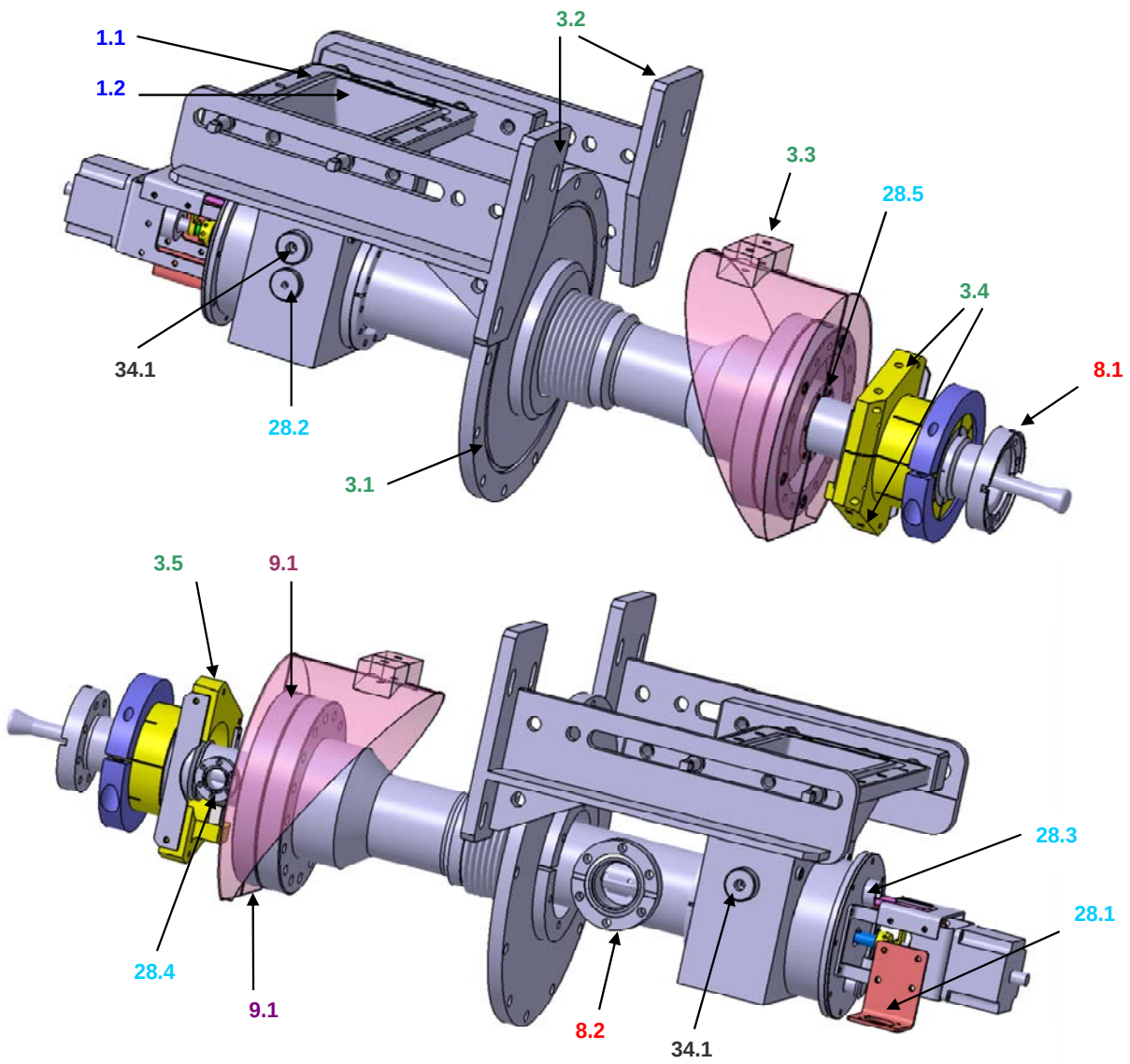
WP 3 – Cryomodule
3.1 Flange on vacuum vessel, gasket, bolts
3.2 Coupler supports (left & right), bolts
3.3 Connection of Cu braids from 80K thermal shield, bolts
3.4 Connection of Cu braids from 4K thermal shield, bolts
3.5 4 holes in 4K interface for assembly rods
3.6 Super insulation

WP 8 – Cavity & vacuum
8.1 Cavity flange, gasket, bolts & nuts
8.2 Coupler vacuum pumping port, gasket, bolts & nuts

WP 9 – Cavity string assembly
9.1 Two holes in big cold flange
9.2 Clamp for cold bellows

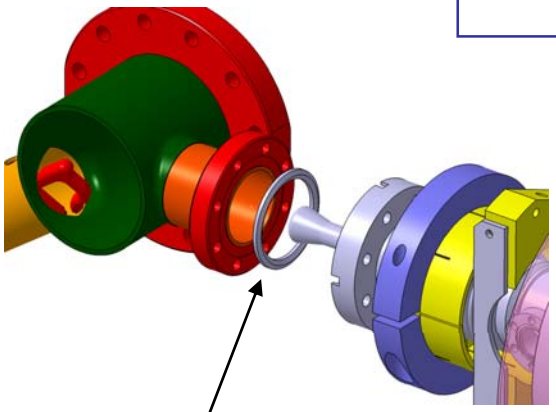
WP 28 – Control system
28.1 Connector for motor, end switches, PT100
28.2 Arc detector
28.3 HV connector
28.4 e- pickup
28.5 2 sensors PT100 in 80K zone

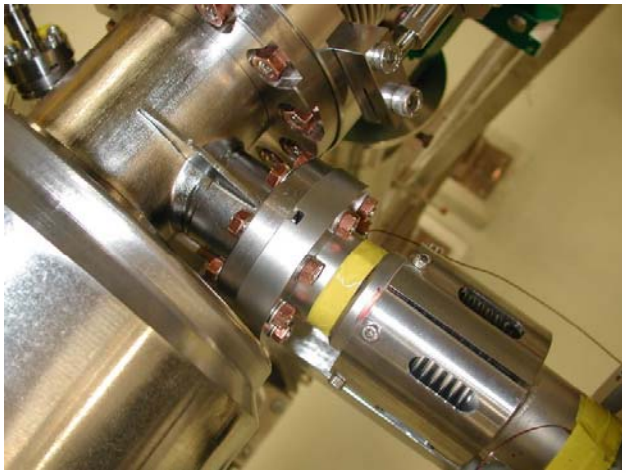
WP 34 – Utilities
34.1 Two N2 cooling ports
34.2 Environmental conditions: T, P, H, radiations

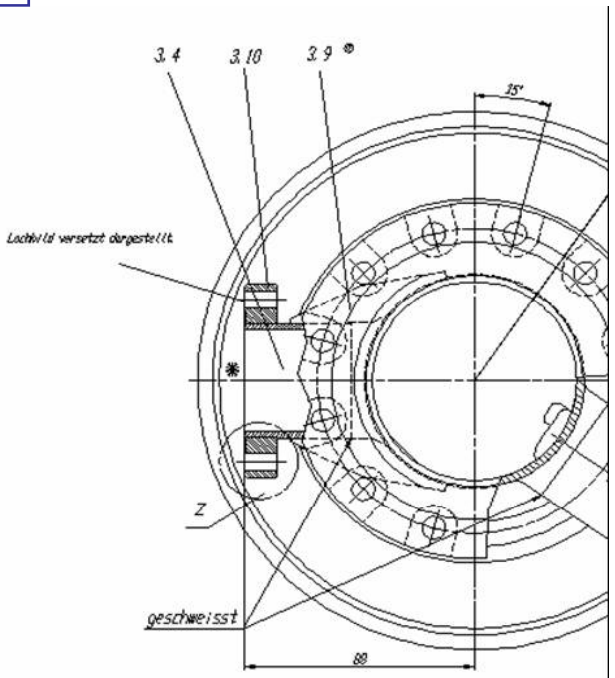


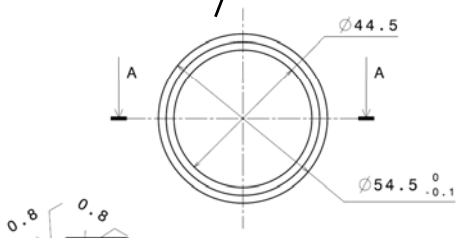
WP	Item	Drwg No	Part	Provided by	Comment
1	1.1	I65 0D 1301-3	Seal, Bolts & nuts for WG connection	WP1	Assembly procedure includes alignment control
	1.2		Kapton window	WP1	abandonned, use temporary protection cover
3	3.1	I65 2D 2116-1	O-ring seal NW200 with support ring	WP3	
			Bolts for flange on module	WP3	12 bolts only
	3.2	I65 1D 1611 & 1612	Bolts for fixation of support brackets	WP3	
	3.3	199 9173/0.000	70K shield shell	WP5	includes 4 threaded holes. Thermal P < 6 W
			Copper braids & bolts	WP3	quantity of 4, OFHC Cu braids with RRR > 100
	3.4	I65 1D 4407-3	4K shield connecting part	WP5	includes 4 threaded holes. Thermal P < 0.5 W
			Copper braids & bolts	WP3	quantity of 4, OFHC Cu braids with RRR > 100
	3.5	I65 1D 4407-3	4 holes in 4K shield		Interface with WP3 special tooling
	3.6		super insulation	WP3	interface with coupler to be clarified
5	5.1	I65 4D 2222-1	CF 100 seal	WP5	provide new seal for module assembly
	5.2		16 Screws CHC M8 x 35 and washer	WP5	provide new set for module assembly
	5.3	I65 3D 1425-2	CF 25 seal for pushrod	WP5	provide new seal for module assembly
8			He leak rate < 10^{-10} mbar.l/s	WP5	New requirement (before was 10^{-9})
	8.1	4 98 3710/A.003	cavity seal	WP9	Seal used for test stand provided by WP5
		3 96 4328/A.001	threaded rods, nuts	WP9	Threaded rods & nuts used for test stand provided by WP5
					Thermal P < 0.06 W
	8.2	I65 2D 1111-2	Pumping port	WP5	
			Blind flange assembled	WP5	Equipment tooling used for filling with N2 and storage
			CF seal, bolts & nuts	WP3	for final assembly on module
			Valve for intermediate coupler leak test	WP3	including Cu seal, bolts & nuts
9	9.1	I65 2D 1221-3	2 holes in big cold flange		Interface with WP9 special tooling
	9.2		Clamp for cold bellows	WP5	Equipment tooling used for storage and WP3 assembly
28	28.1	UTO 01619P21T	male socket connector	WP5	Radiation resistant > 1MGy
	28.2	I65 0D 1301-3	Arc detector port	WP5	Threaded hole 1/4" - 36 UNS-2B
			Arc detector	WP28	
	28.3		electrical short for HV connector	?	
	28.4	SMA-R ,L=34.7on CF16	e- feedthrough	WP5	including Cu seal, bolts & nuts
	28.5	I65 2D 1221-3	2 sensors PT100 at 70K point	WP5	includes cables
	28.6		1 sensor PT100 for warm window	WP5	wired to socket connector
34	34.1	I65 0D 1301-3	2 x N2 cooling ports	WP5	Threaded holes G 1/8"
	34.2		Environmental conditions	WP34	Tunnel environment:T, P, H, radiation dose 1 Mgy

Interface with cavity flange





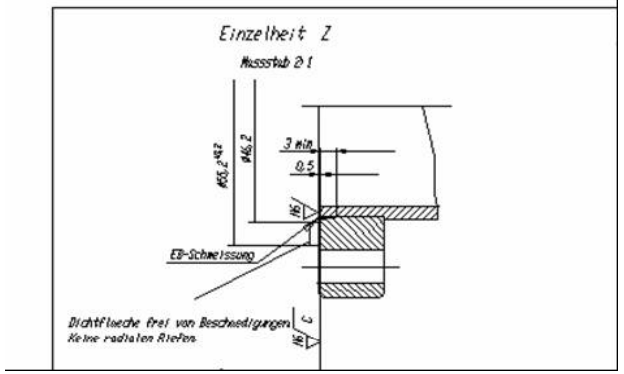




Al Mg Si0.5 F22

Cavity tuning motor

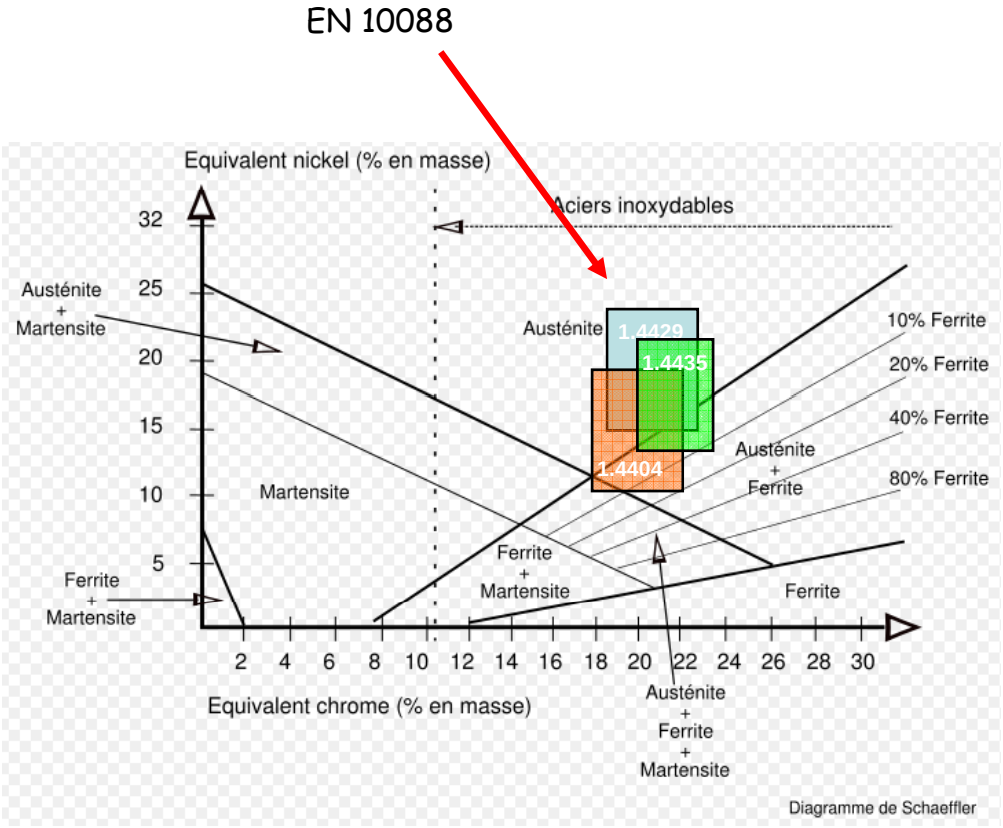
→ Restricted space for coupler



Stainless steels quality is essential

Verify the real chemical composition !
Standards have a wide range

EN 1.4404 X2 Cr Ni Mo 17-12-2 (316L) • ferrite number ~ 2 • easy to procure	Tubes, bellows, fixation parts
EN 1.4435 X2 Cr Ni Mo 18-14-3 (316L also) • ferrite number ~ 0 • μr < 1.01 • less easy to procure	Tubes in cold part
EN 1.4429 X2 Cr Ni Mo 17-13-3 (316LN) • μr < 1.005 • N2 enriched → Hardness 150 / 190 HB • refined by electroslag process • forged in bars • stands baking 2h at 950°C • difficult to procure	• CF flanges • cavity flange

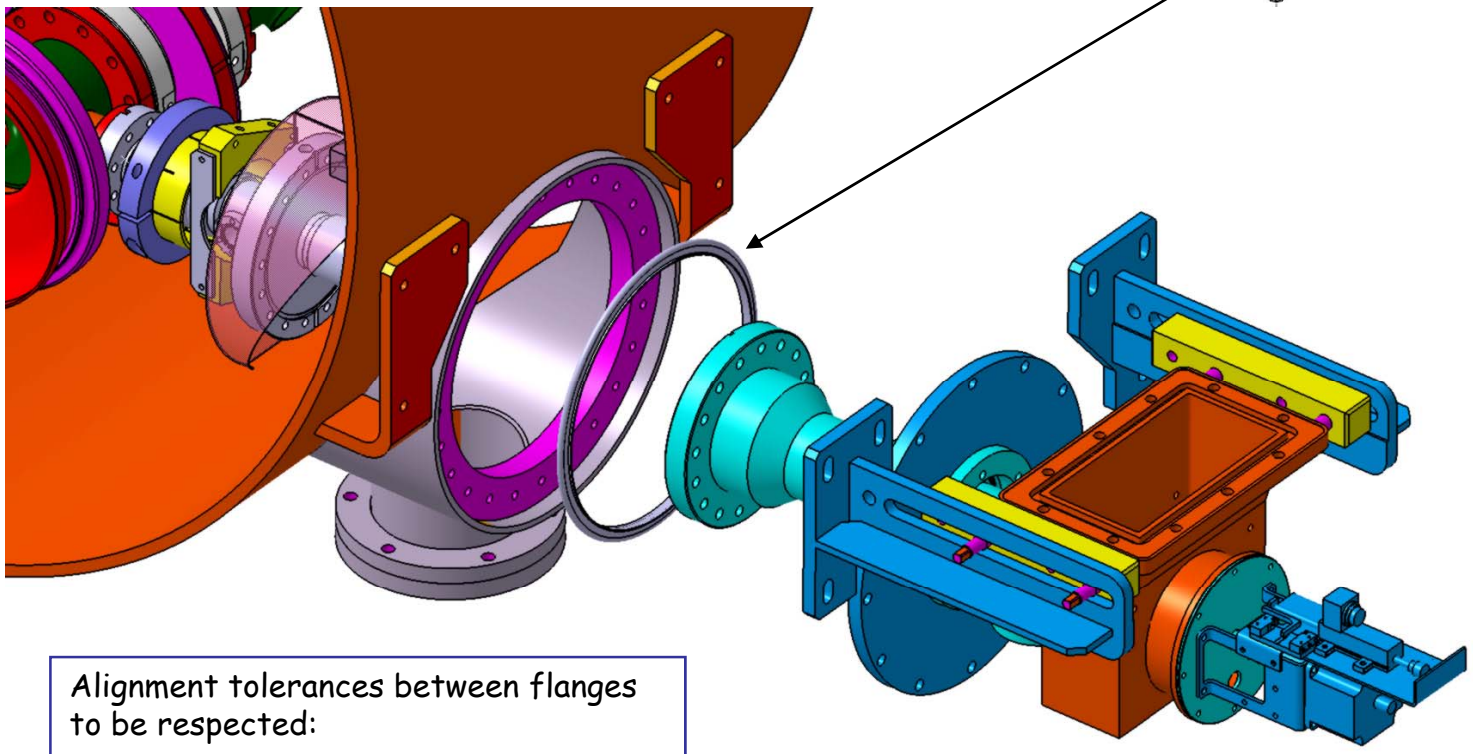


Delong model:

Equivalent Chrome : (Cr)eq= (%Cr) + 1,5(%Si) + (%Mo) + 0,5(%Nb)
Equivalent Nickel : (Ni)eq= (%Ni) + 0,5(%Mn) + 30(%C) + 30(%N)

Interface with vacuum vessel

EVAC seal NW200
Alu/viton



Alignment tolerances between flanges to be respected:

-at ambiant T

- when cold

ILC couplers:

→ Some interfaces could be fixed:

- cavity
- vacuum vessel
- waveguide
- environmental

→ Define interface in terms of:

- material and geometry
- heat load
- surface finish
- bolts and nuts
- seals
- which WP provides what

→ if these interfaces are respected, then couplers:

- are plug-compatible
- but may be different (≠ vendors, ≠ batches)

→ Big constraint on coupler structure (2 separate parts) due to module assembly principles:

- cold part assembled on cavity string in clean room
- warm part assembled on cryomodule outside clean room