SuperFRS Magnet Testing Strategy Update

Pierre Schnizer

MAC7 2 – 3 April 2012 @ FZJ

Outline

Magnets Number

	single magnets		cryomodules
SIS100	dipoles	109	cryodipole
	quadrupoles	169	doublet
	others	144	
total		422	
SuperFRS	dipoles	24	cryodipole
	quadrupoles	66	multiplet
	others	89	
total		179	

Magnets main parameters

	dip.	quad.	sex.	corr.	
bore	warm				
design	superferric			air coil embedded	
yoke	warm		cold		
pole field	1.6	2.5	2.2	0.2	T
current	≈230	≈300	≈170	≈300	A
energy	450	1600	25.9	1.3	kJ
quench voltage		< 3000			kV
mass	50	multiplet: 60			T
string	single supply				

Magnets Units

	dipol	multiplett	
N	24	31	
height	2	4	m
width	2	2.5	m
length	2.4	2.5	m
weight	60	55	ton
	splittable		
iron	warm	cold	
bore	warm		
cooling	bath cooled		

Boundary Conditions

- Superconducting magnets: dipoles and multiplets
- Dipoles ← contributed by InKind, still open
- Multipletts ← German inkind
- first dipole expected 2014
- pre-series multiplet ready for test Q2/ 2014
- extended test for a year
- all magnets for preseparator branch on site Q4 / 2016 (3 Dipole, 11 Multipletts)
- all magnets for SuperFRS on site Q3 / 2018

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Production rates

- Dipole: $\approx$ 1.5 month per dipole
- Multiplet: $\approx$ 1 per month
- full units $\rightarrow$ ready for test after production

Outline

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SuperFRS Targets

Test	Limit	Accuracy
high voltage test	> 4 KV	above threshold, defined by measurement equipment accuracy
sensor test		
vacuum leak	$< 10^{-8}\ mbar \times l \times s$	
cryogenic loss	< 10 W static $< 10\%$ variation	< 3 W
power test	defined by magnet	above threshold, defined by measurement equipment accuracy
	$> 1.2 I_{nom}$	0.1% SuperFRS Magnets
magnetic field	0.2 %	$2.5 \cdot 10^{-4}$ for main field 20 ppm for field quality
axis	$\pm$ 0.2 mm	$< 0.1\ mm$

Outline

SuperFRS: Test Sequence I/VI

1. reception
2. preparation
3. cool down
4. testing @ 4.2 K
5. warming up
6. removal
7. fiducialisation

SuperFRS: Test Sequence II/VI

reception

1. reception (administrative at CERN)
2. unloading to temporary storage
3. visual check of magnet
    1. readout of the shock sensors; acceptance of the transportation
    2. half yokes have to be correctly fixed on the magnet (upper and lower half) so that these do not neeed to be turned. nitrogen in vacuum space
4. high voltage tests @ RT
5. testing of instrumentation
6. opening of the vacuum space

SuperFRS: Test Sequence III/VI

preparation

1. opening of cryostat vacuum
   1. remove transport restraint
   2. check of the geometry
   3. closing vacuum space
2. leak test
3. transport to the test bench
4. cryo connection (always the same layout, connections to be made)
5. electrical connections
   1. power (screwing warm connections)
   2. instrumentation
6. vacuum test
7. pre testing: pressure test, vacuum (magnet, interconnection as a vacuum barrier is in the device)
8. electrical tests: instrumentation all alive, insulation test

SuperFRS: Test Sequence IIII/VI

cool down

1. cool down
2. purging cold volumes
3. pumping insulation vacuum
4. during cool down: temperature measured, He flow, vacuum
5. resistance measurements of the electrical connections
6. cool down procedure (optimisation, dewar for storing liquid helium, test object on separate test cycle, split in cool down with Nitrogen/Helium)
7. end of filling

SuperFRS: Test Sequence V/VI

testing at 4.2 K

1. HV
2. Sensor test / insulation test
3. Quench detection: UPS / power converter
4. Power converter: normal situation only one system connected
5. Corrector magnets: individually powered
6. Before first test: disconnect one of the tabs and make the power converter trip: dump resistor in the power converter
7. Power tests
8. Magnetic measurement
9. Insulation tests

SuperFRS: Test Sequence VI/VI

warming up

1. empty liquid helium volume
2. warm-up with circulation

removal

1. electrical tests
2. N_2 gas filling
3. prepare disconnection, cryogenic piping disconnection (welding)
4. insulation test
5. removal from bench

finalisation

1. opening of the vacuum system; installation of the transport restrains
2. loading on the truck / disposal of the reception

Outline

SuperFRS Testing I/II

- (Informal) meeting with CERN contact person J. Bremer 25 of January
- Discussion on magnets and parameters to test

SuperFRS Testing: Status II/II

Von: **Johan Bremer** Ausblenden
Betreff: Re: Testing SuperFRS Magnets @ CERN
Datum: 23. März 2012 17:59:12 MEZ
An: Pierre Schnizer
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Dear Pierre,

The collaboration agreement between GSI and CERN has indeed be signed very recently. I'll be off next week for Fermi Lab for a review. I've however informed the groupleaders which could eventually be involved in this project That I'll contact them in the weeks before and after Easter. Once I've met them I would like to start to create real workpackages, make a schedule and have a look at the budget needs over time, and a manpower plan.
I'll contact you when back from Fermi (next week). Have a nice weekend, I'll pass most of my time in airports/ plaines.

Johan

CERN
CH-1211 Geneve 23
Suisse
Tel: 00 41 22 7678752

Mehr anzeigen von „Pierre SCHNIZER“

Outline

Conclusion

1. Not too small number of magnets tested
2. Tests @ CERN
3. Interaction started