

Cryogenic System for Superconducting Final Focus Magnets* at ATF-2

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*SCFFM: <u>Superconducting Final Focus Magnets</u>



- Proposed cooling scheme for SCFFM for 4K Connection Box
 - $\checkmark Vibration \ control$
 - \checkmark Heat load estimation
- Set up plan for the cryostat in the ATF-2
- Proposed schedule for construction plan
- Summary



 Infrastructures at ATF2 LHe supply Very limited (supplied only by dewar, from Cryogenics Science Center) - It could be supplied for pre-cooling and re-cover for quench. Cryogenics facility None Space for Liquefier around ATF ?? GHe recovery line Yes Human resource for cryogenics operation None We would like to propose our plan which can be operated under limited infrastructures at ATF2!! and can be consistent with BNL's magnet cooling design.

Proposed the cryogenics system at KEK

- Cooling scheme @ ATF2
 - "A re-condensation cooling type" with low vibration Cryo-coolers
 - –Vibration Control -> <u>Mixture of LCGT</u> <u>scheme & SCGR scheme</u>

A R&D work of low vibration cryogenics system have just started in Cryogenics Science Center as a basic.



Cooling scheme for 4K connection box at ATF2





Example of Connection Box with Cryocooler and C. Leads at SKS



Cryogenics Science Center/KEK

(Nobuhiro KIMURA -16/Dec./2009 at ATF2 TB meeting)



/URA –16/Dec./2009 at ATF2 TB meeting)

Example of Superconducting Gravimeter



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Estimated heat loads at 4K connection box

			1							
		Heat Loads (W)								
		300K->77K	77K->20K	20K(77K)->4.2K						
	Element									
Puls Tube No.1	Current Leads	50.0	4.70	1.04						
	Radiation	3.2	0.00	0.11						
Puls Tube No.2 &3	GFRP Support	5.0	0.00	0.10						
	Electrical leads	5.0	0.00	0.10						
		13.2	0.00	1.35						
Puls Tube No.1		57.6	15.0	$ \rightarrow $						
One 1.3W/4.2K Plus tube type cryocooler as 20K cooler				o 1.3W/4.2K Plus plers use for re-co plers	tube type on the type of type of the type of the type of the type of type of the type of t	ryo-				
Puls Tube No2+N	o.3	72.0		2.4	1 5 W					
Enough o	cooling power fo	58.8 or		(1.1) F	rom magn	ets				
		Co	Cooling performance for magnet cryostat							



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Proposed set up plan in the tunnel at ATF2





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Proposed Schedule (Construction & Installation)

		2009	2009 Jan.		2010		Jan.	20	11	Dec. J	Jan.	20	12	Dec.	Jan.	2013		Dec.
	Man Power	4/4	1/4	2/4	3/4	4/4	1/4	2/4	3/4	4/4	1/4	2/4	3/4	4/4	1/4	' 2/4	3/4	' ' 4/4
4K Box								1	 	 		1 1 1	1	1 1 1		 	 	
Design work	3 ' 0	9.10					\rightarrow	'11.3	 	1		1		1		 	1	
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K Box construction	1		. <u></u>					'11.6		 		'12.3		;		::::::: 	::::::: 	
Performance Test	2							 	1	1			'12.5					
hipping to BNL	0.2							 !				'12.6		1				
Commisioning vith Magnets	3				::::::	enen A		Co	mmiso	oning a	it 2K ?	- 1999 	V 12.7 -		13			i:::::
Shipping to KEK	0.2														>	'13.3	1	'
nstallation	3 3						::::::	• • • •	Ship	oping to	o BNL	2) 	'1	3.6 🗲	+ '13.	9
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- Re-condensation cooling system @ ATF2 are proposed by KEK.
- For reducing vibration level lower than 50 nm, we may contribute to the low vibration cryocooler system design to be adaptable to the BNL magnet design in cooperation to the design.
- R&D work for low vibration cryogenics have been accepted in Cryogenics Science Center as a basic research.
- Final goal for the ready to operation in ATF-2 is the end of October 2013.



- R&D?
- Other part for Contributions?
- Support system?
- Vibration?
- Etc?



Appendix

Superconducting Magnet for Solar Axion Search @ ICEPP U-Tokyo

