Some activities status on New Final Doublets for ATF2 Test Facility

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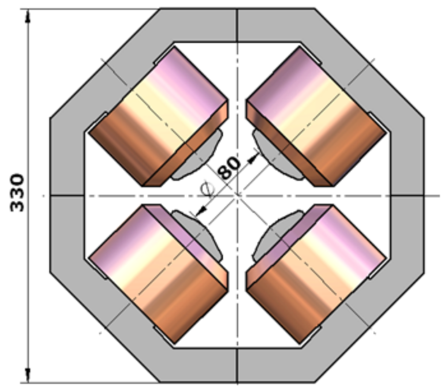
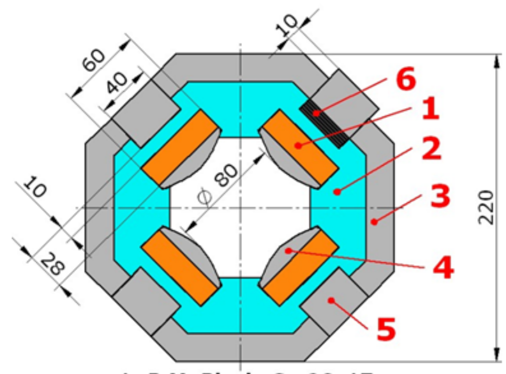
...from FJPPL-FKPPL WS on ATDF2 in March 2012:

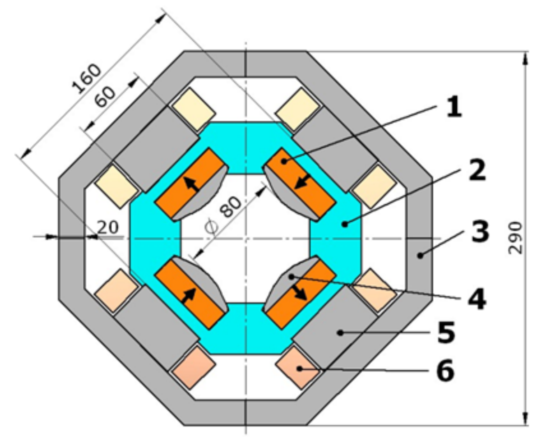
Magnet design

1) EM quadrupole: | 2) PMQ | 3) Hybrid(based on PMQ)





1- P.M. Block, Sm2Co17
2- Aluminium core
3- Return Yoke, AISI 1010
4- Pole Tip, AISI 1010
5- Tuning block, AISI 1010
6- Spacers, Stainless steel



<u>The PMQ solution looks more preferable over than the EMQ and the hybrid magnet due to the following reasons:</u>

- Compactness of the PMQ structure
- No vibration of the magnet induced by an active water cooling system which is required for EMQ option.
- No failures in the power supplies, which increases the reliability of the magnet.
- Maintenance of coils, cables and power supplies is not required.
- Set to zero operational costs related to electrical energy and cooling systems.
- PMQ can be assembled from one or two pieces, while for the EMQ option only four pieces yoke structure is possible.
- The proposed PMQ design has an ability to suppress the possible higher order multipole errors performed by the tuning blocks, while for the EMQ and the hybrid cases an additional trim coils and four independent power supplies are needed.

…from FJPPL-FKPPL WS on ATDF2 in March 2012:

Magnet stability (Temperature dependence)

Temperature at FD section T=26 ^{0}C, Temperature variation : $\Delta T = 0.3\ ^0C$

RECOMA® 30S
Magnets based on Sm_2Co_{17}

Permanent magnet material :Sm2Co17

- Reversible temperature coefficient of Br = -0.035%/^{0}C
- Br=1.12 [Tesla] @ 20^{0}C

=> $\Delta Br \approx 1.2\times10^{-4}$ [Tesla]

Magnetic properties at room temperature

			RECOMA 30S	
			Typ.	Min.
Remanence	Br	(T) (kG)	1.12 11.2	1.09 10.9
Coercive force	HcB	(kA/m) (kOe)	844 10.6	820 10.3
Intrinsic coercive force	HcJ	(kA/m) (kOe)	2150 27	1750 22
Max. specific energy product	(BH)max	(kJ/m3) (MGOe)	235 29.5	225 28

The values given in this table may deviate depending on the size and shape of the magnets.

Saturation field strength (inner field)		(kA/m) (kOe)	4000 50
Rev. temp. coefficient of Br (20 to 150° C)		%/°C	ca. -0.035
Max. operating temperature		°C	350 *)
Processing method			Pressed in transverse field or isostatically

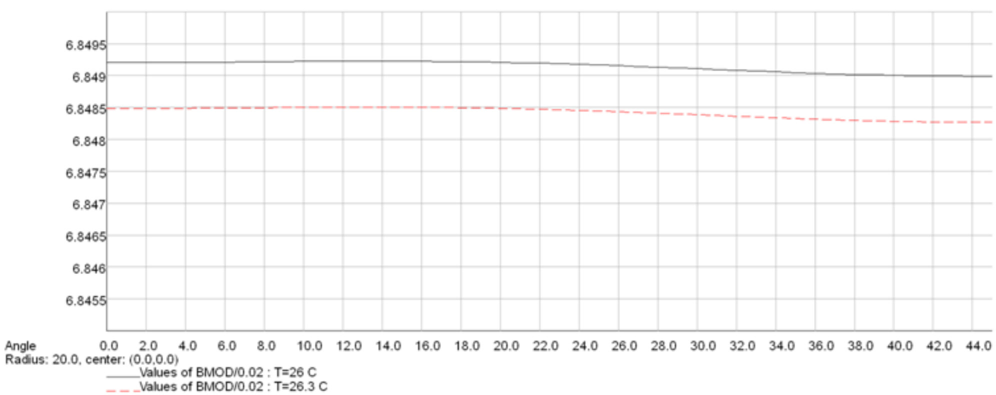
*) In the presence of strong demagnetizing fields, or if the magnets operate on a low load line, the max. temperature may be lower.

Characteristic properties at room temperature (indicative values)

Density	g/cm³	8.3
Compressive strength	N/mm²	800
Flexural strength	N/mm²	120
Young's modulus	kN/mm²	140
Vickers hardness (HV 5)		600
Electric resistivity	$10^{-6}\ \Omega\cdot m$	0.9
Linear expansion coefficient (20 to 200°C)	10^{-6}/K	ll c: 11 ⊥c: 13
Thermal conductivity	W/(m•K)	10
Specific heat	J/(kg•K)	350

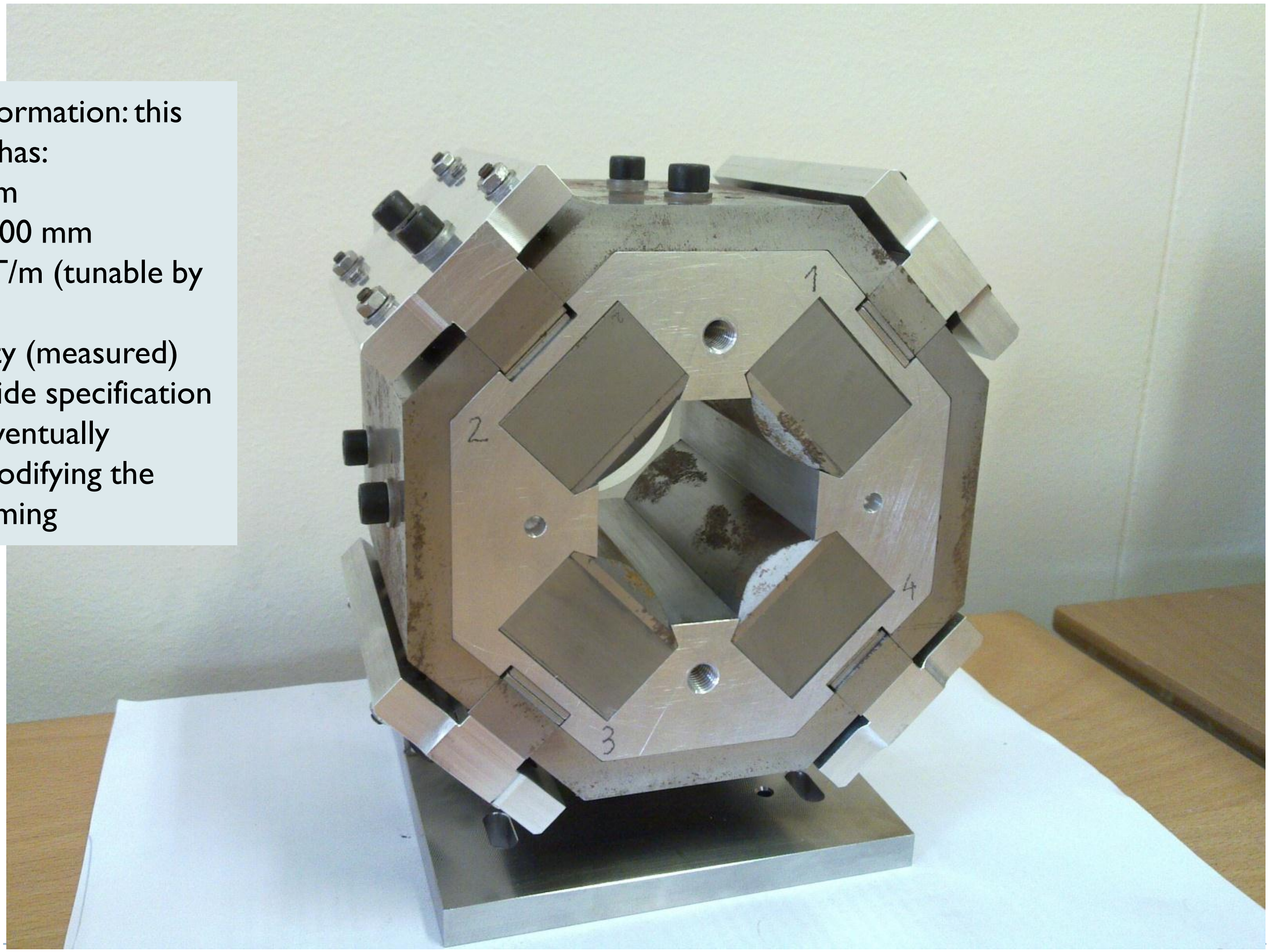
Field gradient QF1 for two simulation cases:

1) T=26 ^{0}C
2) T=26.3 ^{0}C



We plan to perform a: “magnetic behavior versus temperature” test to be done at CERN MM Lab on the LINAC4 PM prototype that has a very similar design to what we propose as baseline for possible new ATF2 doublets.

For your Information: this quadrupole has:
- -ID of 45 mm
- -Length of 100 mm
- -Max G: 16 T/m (tunable by shims)
- - Field quality (measured) was well inside specification and could eventually improved modifying the blocks shimming



Scope of the test is to check how precisely the dependence of the magnet (the predicted Sm_2Co_{17} dependence AND the magnet structure itself) from the temperature is measurable with a MM rotating coil system.

The ΔT scan will be relatively small (we propose max 10 °C) but the measurement is "delicate" in the sense that we have to take precautions :

- to uniformize the magnet temperature as much as possible
- to shield the MM probe as better as possible from warming-up
- to monitor the room temperature drift.

In case of a positive results, we could confirm the possibility to correct (via the coils present in the ATF2 design proposal) an eventual temperature drift.

We have procured the main components and measurements should start in the next days.