

Collimator Design Meetings

Minutes of the meeting 56 (27/01/2005)

Present: Aberle, Assmann, Bertarelli, Calatroni, Losito, Kadi, Mayer, Perret

Minutes # 55: the chart presented by Manfred (Water connections item 4) is taken from "Compilation of Radiation damage test data". Part III, [pages 284-285](#))

PURCHASING PROCEDURE

1. In spite of previously announced agreements between AB/ATB and the Finance Department on a "fast-track" procedure devised to accelerate series material supply (see [CDM minutes 53](#)), problems have emerged for the critical orders, which are stopped as of 27/01/05.
2. A special meeting will be held on January 28th with relevant people from the Finance Dept. to find an arrangement for the issues.
3. Impact on deadlines is not yet clear and shall be studied

DECISIONS ON ELECTRONIC COMPONENTS

1. Roberto gave a short presentation on the following issues:
 - a. **Position sensors:** after a visit to a qualified possible supplier it emerged that, according to this supplier, the best accuracy of LVDTs at full scale after several years of service is in the range of $\pm 200\mu\text{m}$. This is a comprehensive full-scale figure: close to sensor zero accuracy is $\sim 40\mu\text{m}$; also reproducibility is better than this. The large error is mainly due to inherent electronics reliability.
 - b. **Resolvers:** since the electronics for the resolver is basically the same as for linear sensors, one might expect the same error band.
 - c. **Motors:** the motor proposed encompasses an integrated gearbox and coaxial "relative" resolver (i.e 1 motor revolution = 1 resolver revolution – no way to detect absolute linear position). Dimensions are those given in previous minutes. Number of steps per revolution is 200 or more.
2. As a possible electronic set-up, Roberto proposes to use 4 relative resolvers (plus one for the 5th motor) allowing the required accuracy ($\sim 10\mu\text{m}$) plus 6 LVDTs for the absolute position. Ralph remarks that in his mind this is not acceptable!
3. Roger is studying a table arrangement which would decouple the switch cams from the LVDT supports.
4. **Electrical feedthroughs:** Roberto stated that the feedthrough long parallel wires are not acceptable because of the antenna effect: the wires should be twisted. Alternative solutions will be tested on the 3rd prototype as soon as it is available.
5. Conclusions affecting mechanical design:
 - a. Given motor dimensions are compatible with the allowable space budget.
 - b. Roger's study on decoupled supports is continued, though it is not easy to find a solution in particular for the gap sensor.
 - c. No decision is taken on the type of resolver.
6. **Temperature probes:** Oliver is waiting for a answer/proposal from the supplier

RF CONTACT TEST BENCH

1. An update on the new tests carried on is given by Sergio. Results are very promising, showing a further reduction of the ohmic resistance after a $2\mu\text{m}$ Rhodium coating of the steel flanges. The contact resistance including the bulk 0.5mm-thick finger resistance is now $\sim 0.5\text{ m}\Omega$. For more details see [RFContactsTest2\(SC\).pdf](#).
2. In the coming week additional tests will be performed to evaluate under vacuum the wear of the finger Ag coating in contact with the Rh plated flange.

HIGH ORDER MODE (HOM) TESTS

1. Manfred proposed to carry out HOM tests on the RF test set-up, exploiting HF equipment already existing. The value of the frequency and current should be given by Ralph.

WATER COOLING (INSTALLATION APPROVAL)

1. No action with Ralph / SC/RP was undertaken by Rosario. Anyhow, Ralph confirmed what announced and decided at the [10th Collimation Project Meeting](#) on 12/03/04, i.e. the same demineralized water of IR3/IR7 general cooling circuits will be used.
2. In consideration of the concerns raised by Rosario on the treatment of the drained water, Ralph proposes that a general description of the cooling circuit be prepared by Rosario (**action** Rosario)

AOB

1. According to Sergio, D. Schulte questioned the real need for longitudinal RF contacts. The issue will be discussed at next Collimation Working Group. In the meanwhile the order of RF contact strip will be put on hold.
2. After latest Fluka simulation, it is agreed that the level of radiation dose to be specified for electrical components is 10 MGy.
3. Next week there will be a visit from CERCA.
4. LSS 5 motor torque measure: the mechanical equipment is ready and installed; upon Fabrice's return (next week), the electronics will be connected and the measure will start.

ACTION LIST to be followed up:

Play between motor spindle and jaw	#34	Roger
Non-symmetric heating of vacuum flanges	#34	Vasilis, Oliver, Miguel, Rathjen
Radiation issues – heat evacuation, air duct, space, shielding		Ralph
New Fluka simulation for 0.45/7TeV accident case (URGENT)	#47	Vasilis
Updated calculation on beam optics during transient	#49	Ralph
Acceptable RF design by RF people	#50	Ralph

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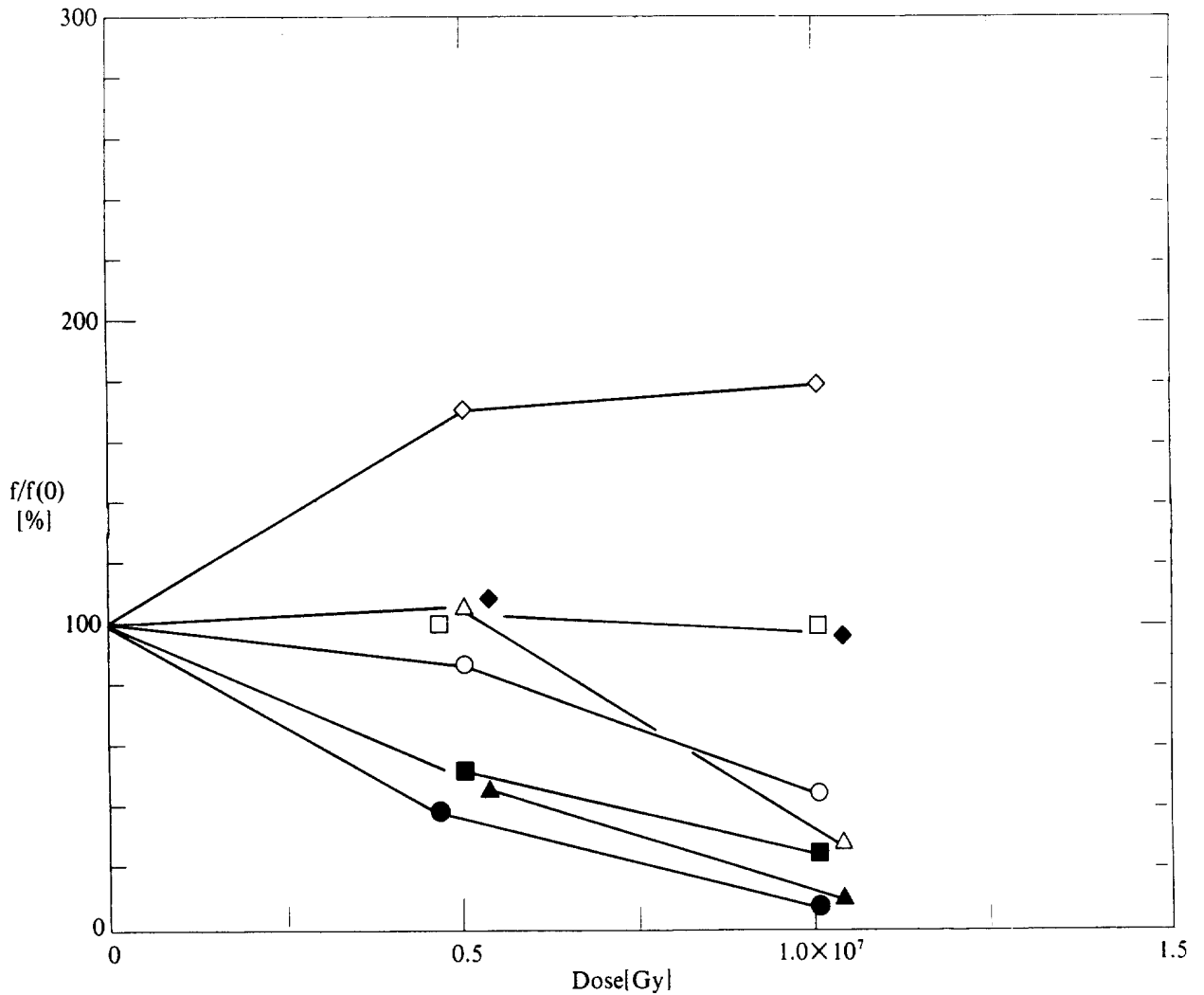
SEAL (O-ring)

BASE MATERIAL: Ethylene-propylene rubber (EPR)

TYPE: EP 851 ENA

SUPPLIER: Walther Präzision

IDENTIFICATION: 160-1975



SYMBOL	PROPERTY	INITIAL VALUES	TYPE
● } ■ } ▲ }	elongation at break	587%	a
		342%	b
		404%	c
○ } □ } △ }	tensile strength	4.5 MPa	a
		8.3 MPa	b
		8.5 MPa	c
◆ } ◇ }	hardness	25 Shore D	a
		14 Shore D	c

DIMENSIONS	TYPE a	TYPE b	TYPE c
Inner diameter (mm)	25	44	15
Outer diameter (mm)	37.5	50	25
Thickness (mm)	4	3	2
Section	Y-shaped	circle	square

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DESCRIPTION OF MATERIAL:

O-rings of different cross-sections (see types a, b, c, in the table on opposite page), all made from ethylene-propylene rubber

APPLICATION AT CERN:

IRRADIATION CONDITIONS:

Type: Reactor ASTRA, position 11 in water, dose rate approx. 400 Gy/s

Doses: 5×10^6 , 1×10^7 Gy

METHODS OF TESTING:

Elongation and tensile stress at break were measured with samples mounted on a silicone-lubricated fitting disk whose two halves were separated at a speed of 100 mm/min.

Hardness Shore test.

RESULTS:

Whereas the value of 100% for the elongation at break was situated between 0.7 and 0.9×10^7 Gy for all three types of cross-sections, at 1×10^7 Gy the circular type remained the best with 83%, with the other two at half this value.

The tensile stress at break remained nearly unchanged for the circular cross-section but decreased by a factor of 2.3 for type (a) and 3.5 for type (c).

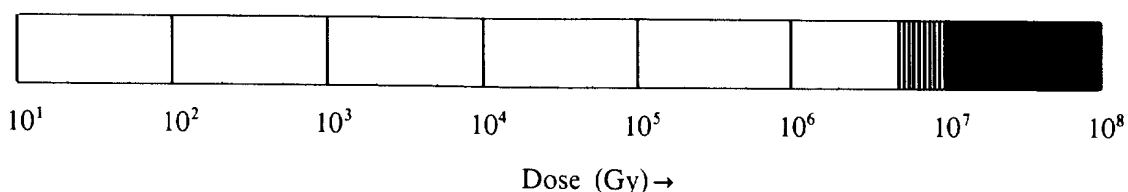
The hardness test also yielded different results, but was not applicable for type (b).

Remarks:

REFERENCES: 32

APPRECIATION: See Appendix 7

Degradation of mechanical properties:



- Required global contact resistance: 1 mΩ
- New test:
 - CuBe fingers 0.5 mm thick Ag plated (5 μm)
 - Inox rings Rh plated 2 μm
- Measurements in air
- Contact resistance < 0.5 mΩ after some cycling.
- Next: wear test foresee for the weekend.

