VACUUM TESTS IN THE BOOSTER WITH

SUBLIMATION PUMPS

1-INTRODUCTION

In view of the probable upgrading of the vacuum in the Booster for heavy ions acceleration, some tests have been performed during the last Shut-down (Jan-88). We tried the most efficent and economical proposal, as described in Technical Note PS. / Note Tech. 88-8. by installing in Sector 5 four additional Vacuum Sublimation Pumps (VPS) borrowed from SPS, with their power supplies.

Sector 5 was choosen for the following reasons :

-It is a short sector having a relatively heavy gas load due to the Septum Magnet BE/SMH (SS 15 L1).

– It is possible to estimate the future pressure distribution around the ring from the pressure measurements at the end of Sect. 5, which is similar to 80% of the Booster chamber (gas load only).

The Pumps were connected to the Vacuum Manifolds in SS L1 and L5 in such way that the titanium sublimates mainly into the manifolds thus increasing the pumping speed. Pump filaments were fired for 30 secondes every 90 minutes. Sublimation and interval times may be adjusted depending pressure conditions, these figures are optimised for the Septum tank in which the final pressure is 7×10^{-9} torr.

2 - STARTING SITUATION (before sublimation)

As the pumping speed of ion-pumps (VPI) is well known, thanks to F.L.Hoekmeijer who measured all our new and overhauled pumps for years, one can estimate 300 l/s a conservative figure for partialy saturated VARIAN 400 l/s. Total pressures were accurately measured by means of 4 added ion-gauges (VGI) close to the vacuum manifolds. Effective pumping speed to be S_{eff} =150 l/s near the beam orbite have been calculated.

With total pressure and effective pumping speed, gas load has been calculated (see Fig. 1).

3- EXPERIMENT WITH SUBLIMATION PUMPS .

VPS were started according to SPS procedure , from $2 \times 10^{-7}\,$ down to $7 \times 10^{-9}\,$ torr .

As gas load is unchanged between the two measurements (with and without additional pumps), VPS pumping speed has been evaluated to be 1600 l/s .

As gas load and vacuum chamber surface are well known , one can calculate specific outgasing to be 4×10^{-12} torr 1/s cm⁻².

4- RESULTS .

Experimental measurements were compared with the pressure distribution and mean pressure in a serie of vacuum segments as computed by a simulation program .

As the gauge readings and computed pressures are well in accordance (see Fig. 2), this program has then been run to evaluate by extrapolation pressure distribution and mean pressure, in the case of an extensive use of VPS around the Booster vacuum chamber.

For this simulation , we used the following parameters :

-Pumping speeds.

Existing VPI's	on manifolds	150 I/s
Existing VPI's	on tanks	300 l/s
Added VPS's		1600 l/s

- Gas loads. (Estimated after VPI 's pump current.

BI-SMH (1L1)	1 x10 ⁻⁵ torr 1/s
TARGET TANK (9L1)	4 x 10 ⁻⁶ torr 1/s
KFA (14L1)	3 x10 ⁻⁵ _torr 1/s
BE-SMH (15L1)	1.5 x10 ⁻⁵ torr 1/s

-Pump distribution (see Fig. 3)

29 VPS connected on existing manifolds . 7VPS connected on manifolds to be built .

3 VPS connected on Tank BI-SMH

1 VPS connected on Target tank

3 VPS connected on Tank BE-KFA

2 VPS connected on Tank BE-SMH

- Specific outgasing : 4×10^{-12} torr 1/s cm²

5- CONCLUSION

According to the simulation program (see Fig.4 A to E) the mean pressure in tanks BI-SMH, BE-KFA and BE-SMH is 4×10^{-9} torr their total length represents 4% of the total circumference therefore the equivalent distributed pressure around the ring will be 1.6×10^{-10} torr. For the rest of the machine (96%) the mean pressure is about 5×10^{-10} torr, hence the MEAN PRESSURE in the "BR" ring will be, with the help of 45 sublimation pumps 6.6×10^{-10} torr

At such pressure the gas composition will probably be 80 % Hydrogen and 20 % nitrogen + carbon monoxyde.

THE TRUE MEAN PRESSURE IN THE "BR" VACUUM CHAMBER WILL BE ROUGHLY 1.45 x 10^{-9} torr (1.9 x 10^{-9} mbar)

M. BROUET 29 - 03 - 88



YUN LAMPS ONLY

BR. SECTOR 6

BAG - BAYARD ALPERT GAUGE

F10, 1



BR. SECT. SØ. PRESSURE DISTRIBUTION. (PROGRAM)

= Gauge readings (EXPERIMENT)

Fig. 2

	_		h			(TT) (M)				
SCIION NO	LI	Faisceau BOL x 1 BHZ x 1	L2		L3		L4	QFO.Z	L5	BHZ x 2
1		Amont (betwee permise) Channes & vice permises Channes of the semi- DR VCD=11_2	فظلم	SE3.49.1198.1 DR.VCQ11 -	- Type 1 A	U-(51.3 40 1037 0)- S1.3.49 194 .2 BR.VEQ-1	1	St 3 49 1195.2	TELES T	BR V/R BR V/R BR VPR BR V/R BR VPR SI J 49 1215 1 L 10 22.6
2	B (0177 (1513 & 7020 0) B (0177 (1513 & 00050) B (01	BRVPI BRVPR	Carveso	B352 51.3.49.1193.2 BR.VCQ.21	Type 1.A	U-(51.3 40 11200)- 51.3 49 1656 2 BRVC0 2	51 349 1653 2 (BR: DHZ) (BR: DHZ) (BR: ASK (BR: ASK)	51 3 49 1657 2 BRVCQ 22	R Hor	
	(3) 3 40 1092 0) ■RVCS 311 5ymu E Type TB 0 R 4 VCS 113 ■RVCS 313 00 VCS 113 7 ■RVCS 313 00 VCS 113 7 ■RVCS 113 00 00 00 00 00 00 00 00 00 00 00 00 00	SI. 40. 1215.1 (51. 3. 40. 1043.0) BRVPR BRVPR BRVPR	n N	639.2 51.3.48 1193 2 _c	508	1004 . 51.3.49.1196.2 ₀ D	522 (5) 140 10390) (5) 140 10390)	636.2		51.3 49 (213.1 L = 1922,6 Gil.3.40 1055 0)-
3	BRILDES 508 C 508	BR VCB 3L 51 3 46 1215 1 		639,2	BANUES 508	2172,2 51.2 491196 2 D	51 3 40 1039 0)			BR.VCB-32 5/ 3 49 1215.1 L=1822.6 (\$1 3 40 1055 0)
4	Im. 200 Im. 200 Im. 200 <	BRVVF] BRVCB 41 SI 2 46 1215 1 L= 1622,6 (SI 2 40 1045 0)		639,2	BA: ONO DOMOTIS DALINGTS BAL UES	<u>BR VC0 4</u>	BRIDHZ BRIOVT Type 1			
5		BRYCEI BRYCEI SI 349 1205.1 L=1822,6	а вя volu 57	51.3 49 1193 2 BRYCO 51	MA CORKING MA CORKING MA DIGINA MA UES	U 51.3 49 1196 20 BR.VCO 5	BR: DHZ BR: DHZ DR: 9V1 Type 1			BRVP] BRVPT BRVPR BRVPT BRVPT SR VCB 52 [51 3 40 1215 1 L = 1022,6
6	BR VCS 811 PASSAGE DE SECOURS	BRYPI BRYPI BR VCB - 61,	Kerves	51.3.40.1193.2 _c BR VCQ 61	Type 1. A	Usi.3 49.1656.2	(51.340 1120.0) 51.349 1653.2 56. DHZ 56. DYT 56. ZXX 87. OBK	51.3 49.1657 2 DR VCO-62		(\$1.1.40 1054 0) BRYP] BRYCB -62 (\$1.3.48 1215)
7	522(\$1) 40 1086 0)	(\$134010470) BRVVR BRVPT BRVPR BRVPT BRVPR		639,2 SI 3 49,1193 2, BR VCO 71	- Type 1.A	1004 (51 3 40 1124 0) 51 3 49 1194 2 BR VCQ 7	522 51 3 49 1623 2 11 BR 085H	636.2 51 34911952 BRVCQ 72-		(51.3.40 1055 0 BR VP]
	Import Import<	ERVPI 51.3.49.1215.1 L=1122.6 (51.3.40,1044.0)		639.2 51 3 49 1193 2c	508 Type I A	1004. 51 3 49 1856 2 D	522 51 3 49 1653 2	BR.MBL.5J7L5 636.2 51.349 1657 2		513 49 1215 1 L= 1822,8 (\$13 40 1056 0
8	Barcoso Tope over 11 One tower 11 Barcoso Barcososo Barcososo Barcososo	BR.VC B 81 51 3 49 1215 1 La 1822.6 (51 ¹ 3 40 1048 0) BRVVR		639.2 51.3.49 1193 2	BR DRONG BR JUCHES 508 Type 1.A	BR VCO 8	51 3 49 1653 2	6362		OR.VCB 62
9	BP 2/2 BR TME Image: Construction of the constru	BR VP1 BR VP1 BR VP7 DR VE B-91 - - SI 3 49 1215 L = 1822,6 - -		BR.VCO 91 -	BR. CONKING BR. CONCINE BR. UES BR. UES	1004 	0R, D05H 0R-005W 1770+1 522	BRVCQ 92 636.2		BR.VCB 92 51 3 49 125 1 La 1622,6 (\$1 3 40 1055 0
10	BRVCS 1011 PASSAGE DE	BR VP1 BR VC5 101 S1 3 49 1215.1 L # 1122.6	201 <u>13</u>	51.3 49.1193 2 BRVCQ101	Type I A BR ONOLE BR ONOLE BR XNOLE BR UES	U 51.3.49 1196 2 _D	BRIDSLH DRIDVT Type 1		ख्याका	BRVCB -102
11	(\$1 3 40 1091 0) Type II.8 P\$5.0012 05.001 BRVCS III 05.001 BVVCS III 05.001 BV	(51) 40 1045 0) (51) 40 1045 0) (51) 40 1045 0) (51) 40 1045 0) (51) 40 1045 0 (51) 40 1045 0 (5		SI 3 49 1193.2 BRVCQ 111	Type I A Bin centrel Bin centrel Bin Xinond	ST 3 4 1656 2 D	51.3.491653.2 Bitu DH2 Bitu DH2	SJ.3 49 16672 BRVC0 112		(S) 3 40 1055 [BR VP] BR VCB 112
12	1095 633 1095 633 1097 VC5 1211 88 VC5 1212 88 VC5 1213 1107 1107 1107 1107 1107 1107 1107 1107	S. 142.2,6 (SI 3.40.1049.0)	Terrs to G SE	639,2 51.3 48 183 2	Type I A	1004 	522 51.3 48 MED 2 51.0 HZ 10 51.0	636,2 SI J 49.16572		SI 3 49 1715 1 L. 1822,6 SI 3 40 105 SI 3 40 105 BR VP] BR VP] BR VP] BR VP] BR VP]
12		SI 3 49 1275 3 L= 1422,4 (S1.3 40 1043 0)	L L	639,2 5134911932	BA XNOHP	1004 (51.3.49 mms 20 Ust.3.49 mms 20	ан. <u>зак</u> ан. оак 522	636.2		BR VCB 122 [SI 3 49 1216 1 Ls 1822,6 [SI 3 40 1054 BR VR] [BR VR]
13	BR. C	BR.VCB 131 \$1.3.46.1215.1 1 L=1022,6 (51.3.40.1046.0)		639,2	BE DEDUT	BR.VCO 13 2172.2 (SI 3 40 1038 0)	SI 3 40.10400			BR VCB 132 51 3 49 1215 1 L+ 1922.6 [51 3 40 1054]
14		- DR. VCB - 141 51.3 49.1217.1 L+1915.4 (51.3 40.1092 0)	Ň	51.3.49 1193 2 _c BRVC0141 639.2	Type 1 A BALOSK BEDWORD PLANS PLAN BALUES 508	051.1.49 1199.1 0R.VCO-14 1001	BE BSW	SL349.1404.2 OR YCO142 1048,2		BRVP1 BRVP1 BRVPR BRVP1 BRVP1 BRVPR BRVP1 BRVP1 BRVPR BRVP1 BRVP1 BRVPR
15	Вт. Гол. Туре 2 Туре 2 10 0 0 0 0 10 0 0 0 0 0 10 0 0 0 0 0 0 10 0	American and a second s	23	51.3.49 1193.2 _c BRYCQ 151		SI 3 49 1196 20 D	C51.3.40 1041 0)- BE BSW Type 5			BR VCD - 152
16	(51 3 40 1091 0) hps II B (51 3 40 1096 0) (51 000 0) (51 000 0) (51 0) (51 000 0) (51 0) (51 000 0) (51 000 0) (51 000 0) (51 000 0) (51 000 0) (51 000 0) (51 000 0) (51 000 0)	BR-VCB-161	Tavrse I	0.79,2 51 3 49 1193 7 _c BRYCO 161	Jype II A BR. OHO BR. DHO BR. XHOHO	<u>2172.2</u> 51 3 49 1194 2 BR VCO 16 ?	(51 3 4010420)	SI 3 49 1195.2 BRVCQ 102		BR VVR) Annual States
	1733	SI 3 49 1215 1 L= 1822,6 SI 3 40 1042 0)	0	639.2	508	1004	522	636,2		51 3 49 1219 0 Country is can entry in 13 mm 85 (51 3 40 101

Fig_3











Distribution :

M. BOURGEOIS A. BURLET B. GAY M. GIRARDINI H. HASEROTH C.E. HILL P. KHOU C. LACROIX H.F. MALTHOUSE A. PONCET L. PETTY P. RIBONI K. SCHINDL H. SCHONAUER M. VAN ROOY