



Brookhaven
National Laboratory

BNL-104081-2014-TECH

AGS.SN205;BNL-104081-2014-IR

Pressure Bump Effects on the High Intensity Beam

M. Tanaka

April 1986

Collider Accelerator Department
Brookhaven National Laboratory

U.S. Department of Energy

USDOE Office of Science (SC)

Notice: This technical note has been authored by employees of Brookhaven Science Associates, LLC under Contract No.DE-AC02-76CH00016 with the U.S. Department of Energy. The publisher by accepting the technical note for publication acknowledges that the United States Government retains a non-exclusive, paid-up, irrevocable, world-wide license to publish or reproduce the published form of this technical note, or allow others to do so, for United States Government purposes.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

 * AGS Studies Report *

Date: 24-April-86

Time: 15:30 - 16:30

Experimented and reported by :

M.(Sanki) Tanaka, E.G. Gill, J.W. Glenn and L. Ahrens

Subject : Pressure Bump Effects on the High Intensity Beam

**** AGS Studies ****

\$ Introduction

Whenever we experience a large beam loss at extraction or a so-called bunch tearing, we usually suspect the poor vacuum for it even if the VSCAN reveals no poor vacuum sectors. It is generally assumed that poor vacuum sector(s) (e.g., Press. > $5 \cdot 10^{-6}$ Torr) may cause an extra beam loss and/or lead to growth of the beam size or emittance (i.e. beam blowup) during the acceleration period due to beam-gas interactions.

This report presents results of a study of effects of a vacuum pressure bump on the high intensity circulating beam by utilizing the Ionization Profile Monitor Controlled Vacuum Leak (IPM_LK) at E-10.

\$ Experimental Procedure

@ The machine was set up for the normal FEB run.

@ The maximum pressure limit for the IPM was increased from $6 \cdot 10^{-6}$ Torr to $5 \cdot 10^{-5}$ Torr in order to make a stronger vacuum pressure bump around E-10.

@ The HOLD system for the E vacuum sector was replaced with one of three available start-supply systems.

@ The vertical flip target at J-19 was set up at 450 msec and was moved to close to the edge of the beam.

@ The beam current, timing of the flip target and radiation loss at J-19 were monitored on a scope.

After establishing an reasonable stable running condition, the data from VSCAN,RLRM and IPM were collected.

CBM = 1.2 to 1.4 *10**13 ppp
Transition Loss = 80 to 85 %
Average Ring Vacuum Press. <P> = 1.1 *10**-7 Torr
H-05_Loss = 0.4 to 0.5 %
H-10_Loss = 0.5 to 0.6 %

@ Then ion pumps around the E-10 box (E-8,9,11 &12) were disconnected to produce a broader pressure bump.

@ A pressure bump at E-10 was created by turning on IPMLK at 2500,

Pressure [10**-07 Torr]

Bump	E-10	E-06	E-05	E-04
-----	-----	-----	-----	-----
Off	1.0	1.3	0.5	0.4
ON	185.	20.	10.	4.0

Again the relevant data were collected without changing any machine parameters and were compared to the previous data.

§ Results and Conclusion

Results with and without the pressure bump are summarized in summarized in the attached figures.

Fig.1 (VSCAN) shows the vacuum pressure distributions around the ring, which were rather uniform. The bump created at E-10 is illustrated by the dotted lines. It should be noted that the pressure reading at the E vacuum sector with the bump ($7.5 * 10**-7$ Torr), was an average value for E-04,E-05 and E-06 pumps but not for the whole E sector.

Fig.2-a and 2-b (RLRM) show the radiation loss distributions around the ring.

Fig.3-H and 3-V (IPMPL) show the circulating beam size, emittance and centroid as a function of acceleration time in the horizontal and vertical planes, respectively. The circulating beam intensity (L20) is shown in Fig. 3-L.

Fig. 4 (IPMPL) shows a blow-up of Fig.3-L for the early acceleration period (< 200 msec).

Fig.5-a and 5-b show photos for the beam current,the flip target timing and the radiation loss at J-19 on scope.

Radiation levels at H-05 and H-10 at the extraction time remained the same at a level of 0.4 to 0.6 %.

- * - * - * - * -

Despite of our expectations, the pressure bump created at E-10 made no significant effects on beam conditions of the FEB run. However it appears that during the early acceleration period (< 100 msec);

@ the vertical beam size reduced more slowly while the vertical emittance increase more rapidly (Fig.3-V-(3) and (4)).

@ the beam intensity (L20) reduced more sharply (Fig.4).

@ there are some shifts (3 mm) in both horizontal and vertical beam centroids (Fig.4-H (2) and V (2)).

\$ Open Questions

-> Was the E-10 pressure bump too localized (narrow) to make effects on the beam conditions even if the pressure at E-10 was $> 1.8 \cdot 10^{-5}$ Torr ?

-> Do effects on beam conditions depend on the location of the pressure bump ?

-> Was the beam intensity of $1.4 \cdot 10^{13}$ ppp still too low to observe any clear effects ?

-> Can we take IPM measurements at face value?
or How are we sure that the observed differences by IPM are real , not due to apparatus effects ?

\$ Recommendation

In order to study vacuum-related effects on beam conditions quantitatively, a vacuum leak control facility which is independent of the IPM (measuring device) will be needed.

*** end ***

** VSCAN **

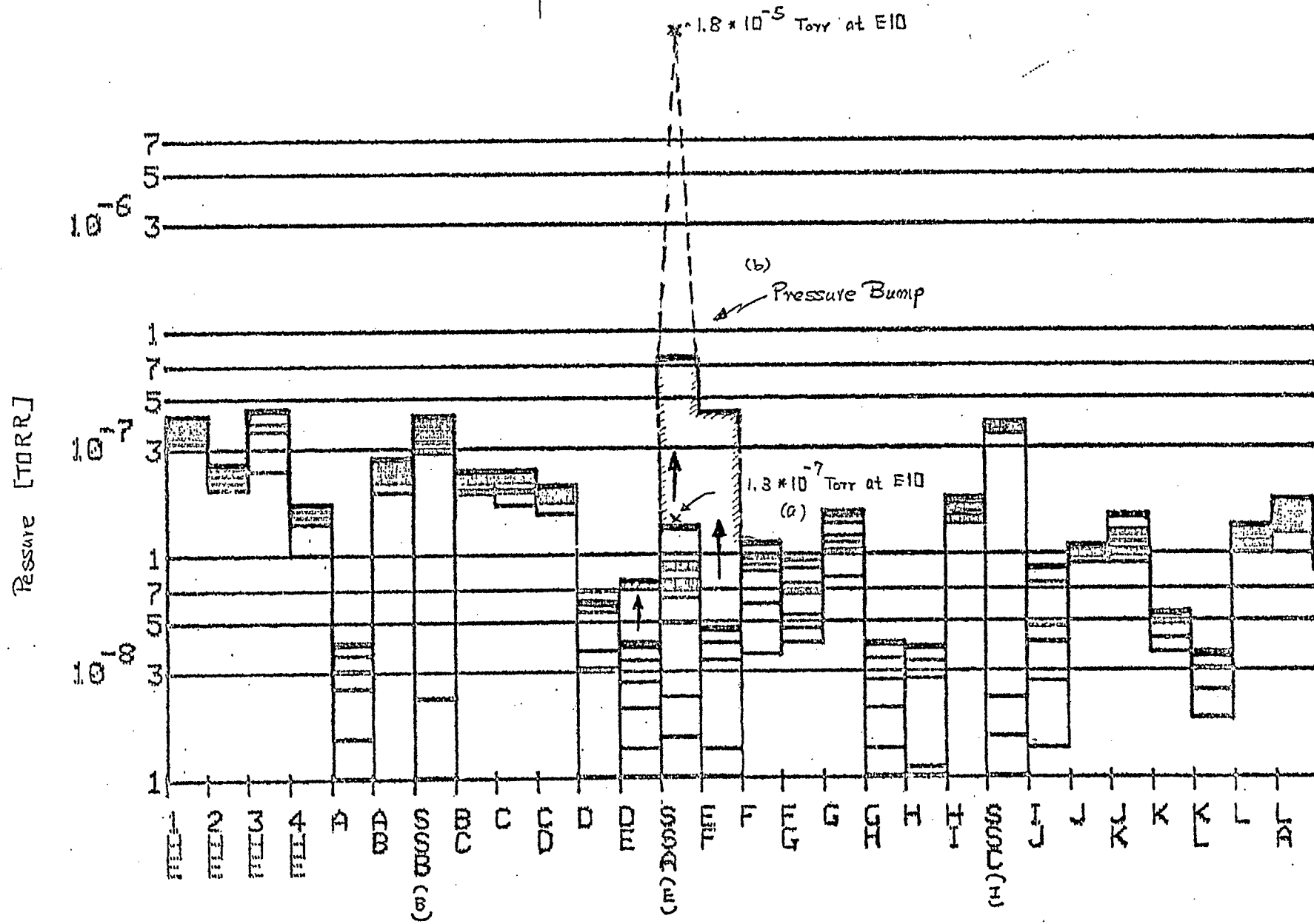


Fig.1 VSCAN

23-APR-86 TIME=16:03:21.4 ** RLRM **

U-P SET UP: MODE=1 TIME= 55 TO 750MS SCALE= 4
CBM= 00 55MS CBM= 00 750MS

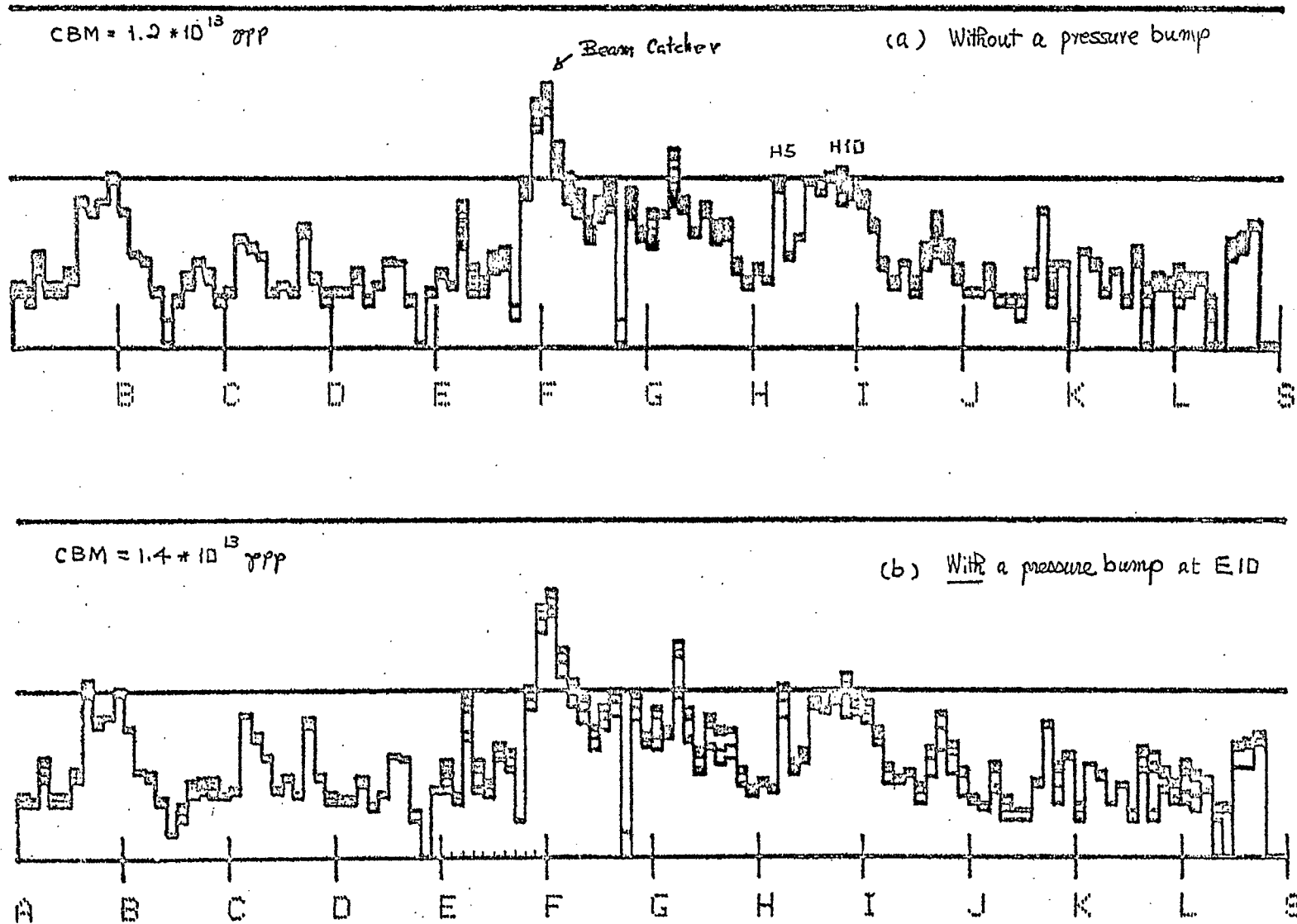
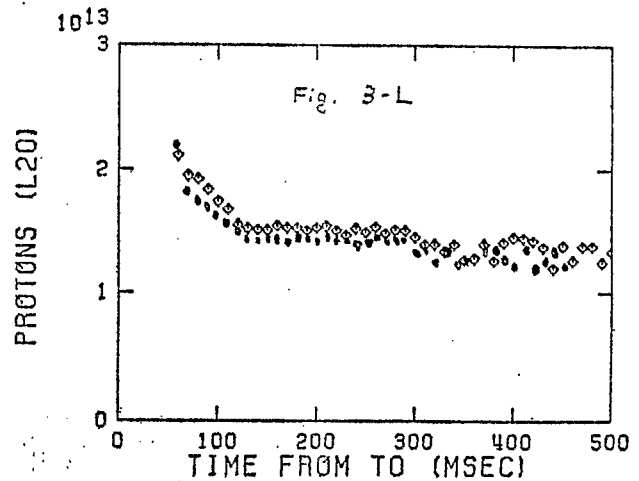
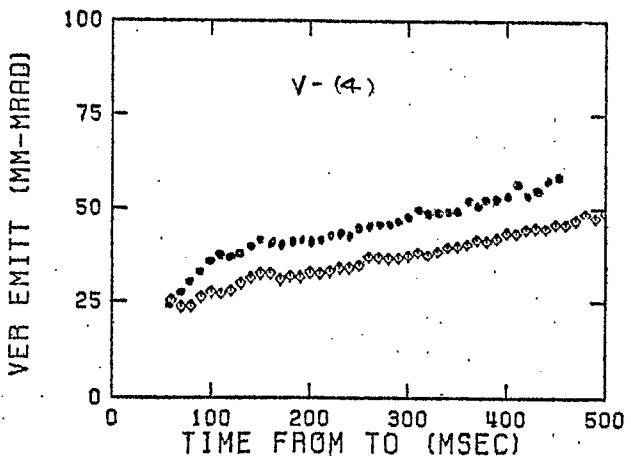
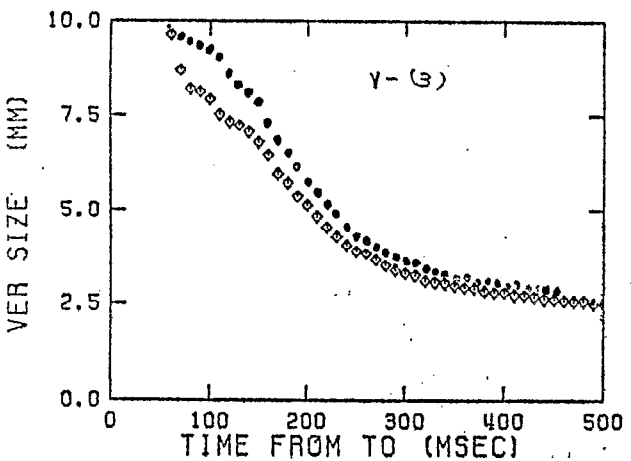
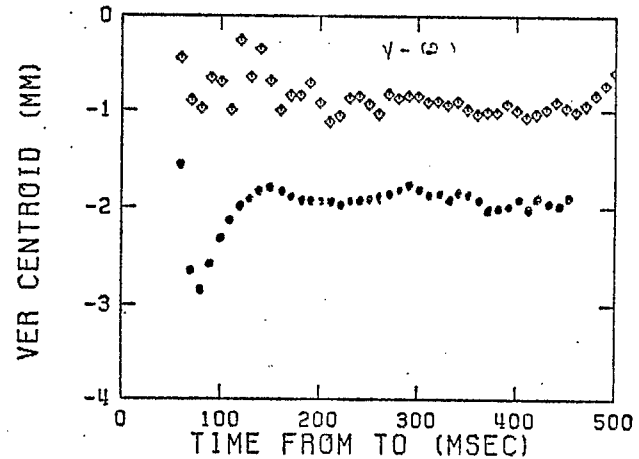
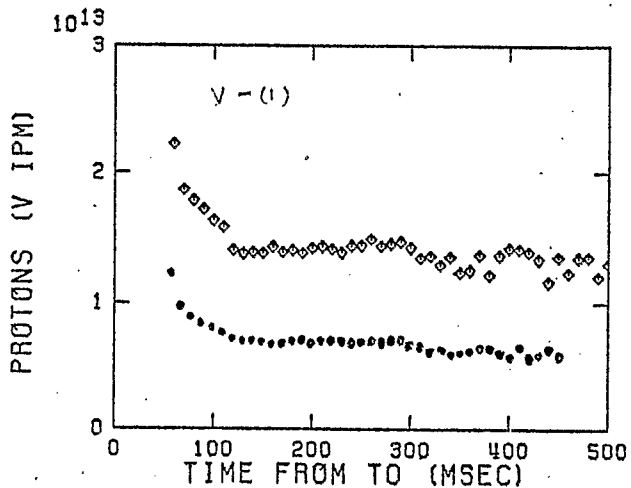
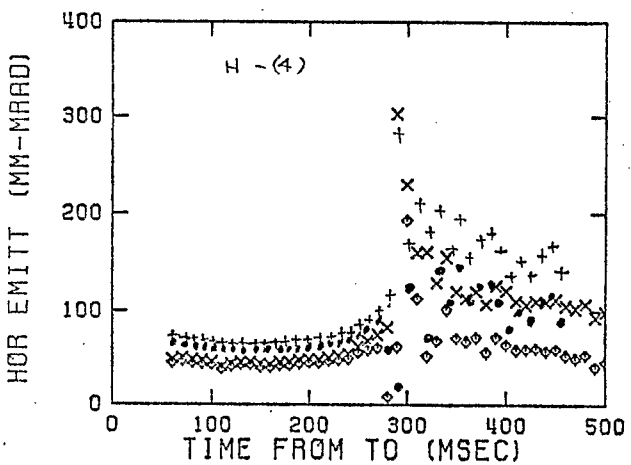
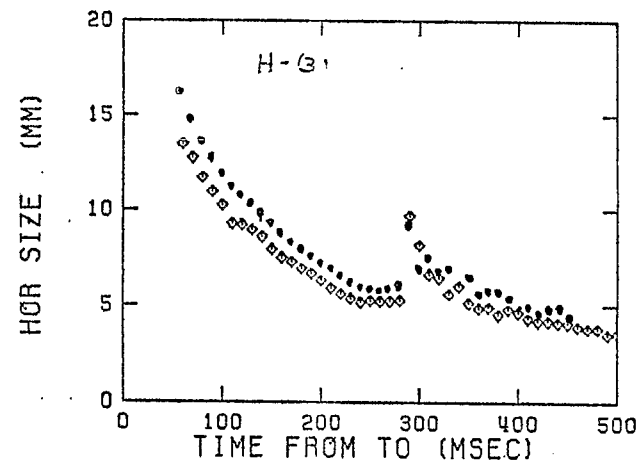
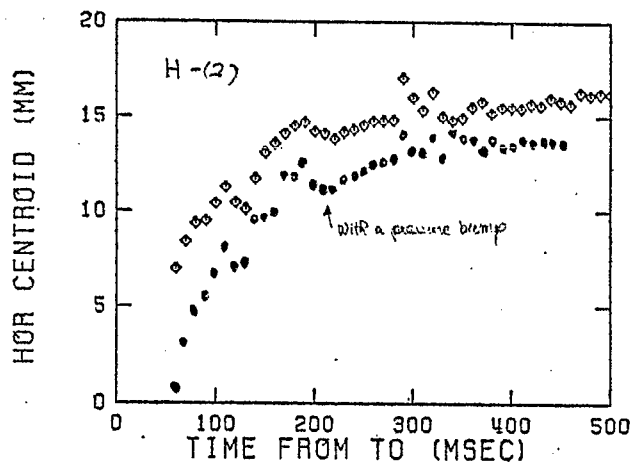
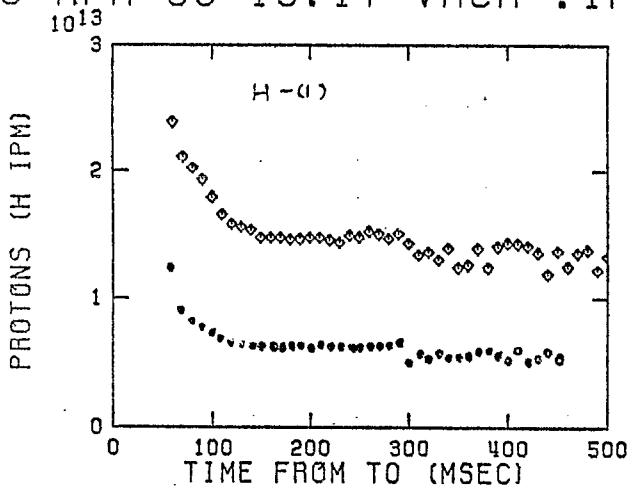


Fig.2 RLRM



23-APR-86 16:17 VACA .IPD

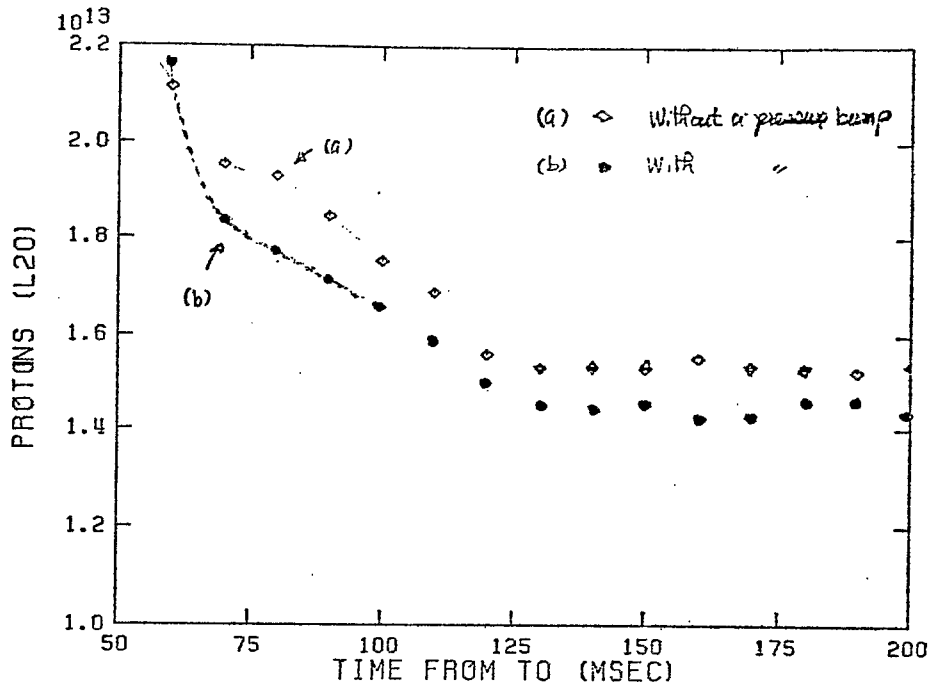
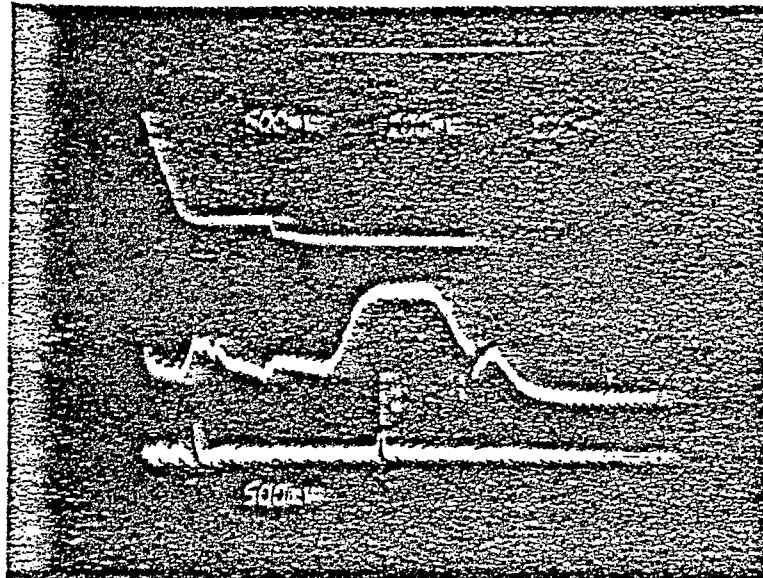


Fig.4 IPMPL (CBM)

16:05 without a pressure bump (a)

#1



Beam Current

Timing of the Flip Target

Loss at J-19

15:22 with a pressure bump (b)

#2

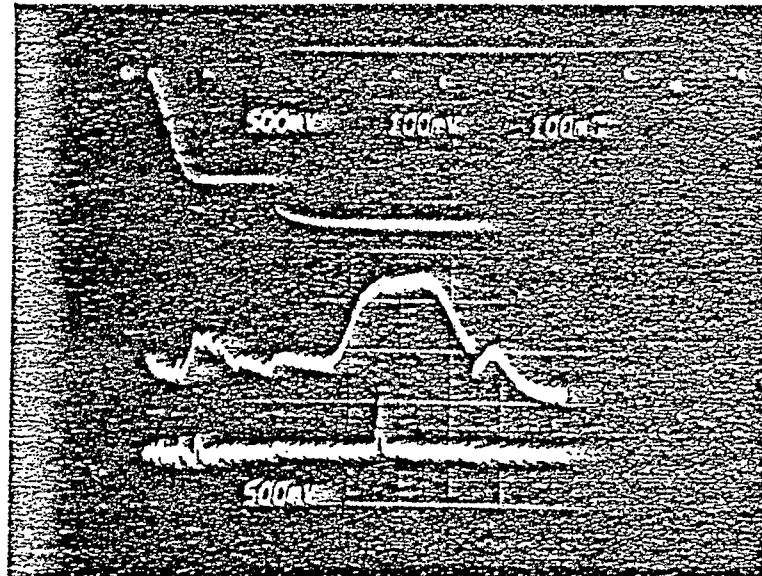


Fig.5 SCOPE (CBM, Timing, Loss)