Pbar Note #688
Moving DRF3 to Improve Debuncher Apertures

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Introduction

This note details a plan to move DRF3 to the D20 – D30 straight section in order to improve Debuncher apertures.

Motivation

Measurements using a BICRON analyser show significantly increased levels of activation on DRF3.

On November 6th, 2001, as-found surveys were done on both DRF2 & DRF3. They were both found to be out of alignment by significant amounts. See table below. The skew positioning of DRF2 appears to indicate the cavity stand was probably hit at some point causing the misalignment. Positions given are with respect to the centerline of the cavities' upstream & downstream quads.

	Horz U/S	Horz D/S	Vert U/S	Vert D/S
DRF2	N/A	+270 mil	-46 mil	-175 mil
DRF3	-180 mil	-160 mil	N/A	N/A

Both cavities were moved to square them up with their respective U/S & D/S quad centers.

Unfortunately, horizontal & vertical admittance measurements were not done immediately before and after these moves, so no definitive judgement can be made as to any improvements in apertures. However, the average measured apertures before the moves were **H = 22.2 pi-mm-mr, V = 18.7 pi-mm-mr**, and after they were **H = 26.3 pi-mm-mr, V = 19.65 pi-mm-mr**. We can say these moves did not hurt our apertures. Since the moves, activation levels on both cavities dropped, especially on DRF2.

Why Move DRF3 ?

AP2 scraper studies with D:LJ719 & D:RJ719 (AP2 momentum scraper) show that our Debuncher momentum aperture at present is defined by AP2, not the Debuncher. Activation levels on DRF3 therefore cannot be attributed to a momentum aperture.

Semi-periodic activation surveys of the Debuncher have been performed now for a couple of years. DRF3 has always been one of the 'hotspots' when measured with a BICRON analyst meter.

Looking at the beam parameters at this point in the lattice, we have:

System	Cavity Type	ID	β_H	β_V	$Disp_H$
DRF3	Studies	3.50" (88.90mm)	10.161m	10.175m	1.631m

Assuming a dp/p of 4%, we get a horizontal beam size due to dispersion of:

$$x_D = (0.04)*(1631mm) = 65.24mm$$

And the beam size due only to the emittance, assuming a 26.3 π beam:

$$x_e = \sqrt{(26.3*10.16mm)} = 16.34mm$$

So the beam size is 81.6mm – a pretty good percentage of the 88.9mm aperture. Any steering error will make matters worse.

Where to Put DRF3

There are at present 3 places in the D20 – D30 straight to place DRF3. They are:

1) Between D2Q7 & D2Q6. This will require D:VT206 to be moved upstream ~ 2 ft.
2) Between D2Q6 & D2Q5. This will require an ion pump & pumpout port be moved upstream towards D2Q6.
3) Between D3Q2 & D3Q3. This will require an ion pump & beam valve to be moved upstream towards D3Q2.

All these locations are in zero-dispersion regions. Using measured admittances of **H = 26.3 pi-mm-mr, V = 19.65 pi-mm-mr** and β's averaged between quads, beam sizes are:

- For D2Q7 & D2Q6: $\beta_h = 9.998m$, $\beta_v = 9.653m$: H = 16.22mm, V = 13.77mm
- For D2Q6 & D2Q5: $\beta_h = 11.51m$, $\beta_v = 8.510m$: H = 17.40mm, V = 12.93mm
- For D3Q2 & D3Q3: $\beta_h = 8.200m$, $\beta_v = 9.890m$: H = 14.68mm, V = 13.94mm

So the recommendation would be in D30 between D3Q2 & D3Q3.

As for the electronics, at present rack A33R06 is empty. All we need is 110 VAC for the frequency synthesizer and an ethernet connection. Pbar crate $33 has room for the CAMAC control cards.

We will need to pull a piece of helix to the cavity, and we will need to pull a cable back to AP10 for the fanback signal.