

1 Separator System and RF Cavity Parameters

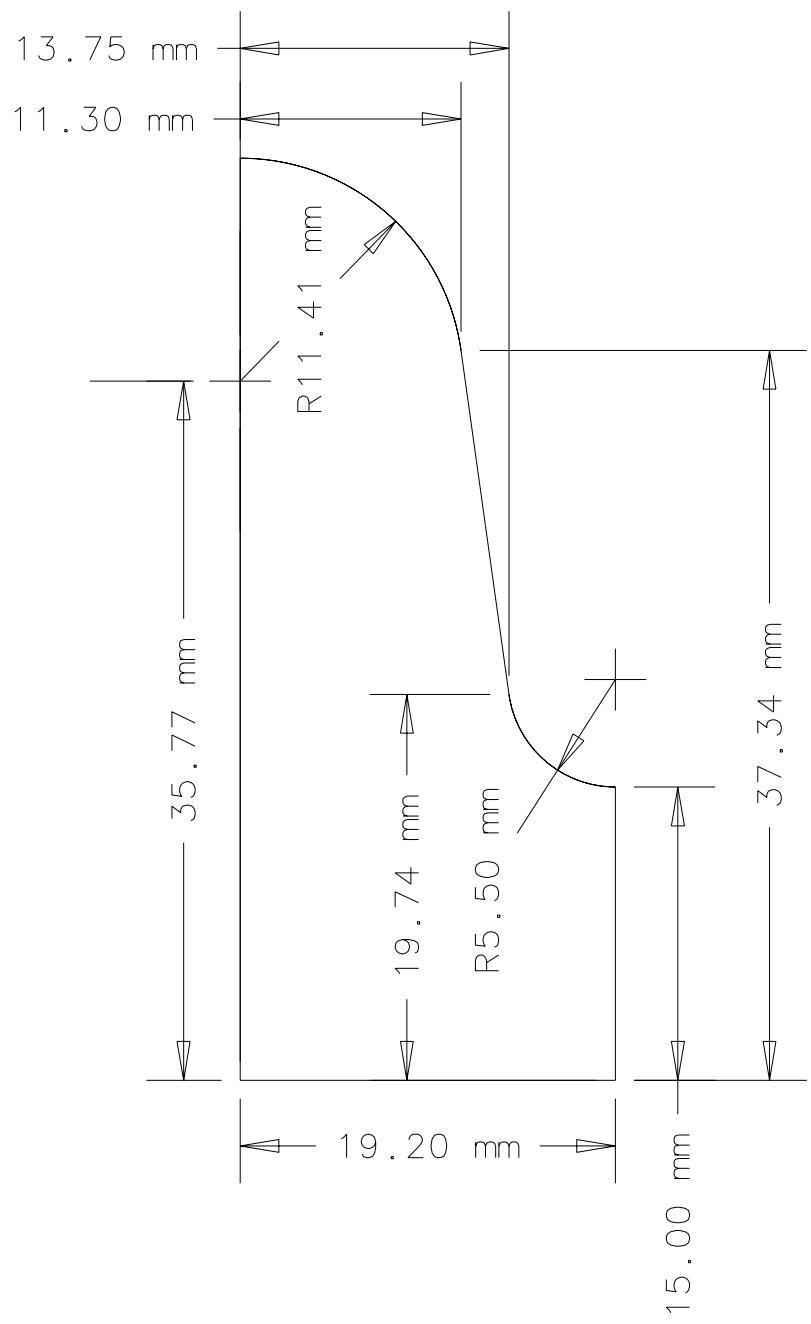
Table 1: Separator System Parameters

Beam momentum, pc	22	GeV
Main Injector cycle time	3	sec
Extracted beam duration per cycle	1	sec
Main Injector intensity used	5×10^{12}	proton
Secondary beam intensity	$\approx 1.4 \times 10^{10}$	
Secondary beam current	$\approx 2.2 \times 10^{-9}$	amp
Potential beam loss on cavities	≈ 2	%
Power in lost beam	11	W
RF Station Configuration	2	stations
Distance between stations	86.5	m
Station deflection angle	0.68	mrad
Deflection per station	15	MV
Total deflection	30	MV
Deflection gradient	5	MV/m
Total effective RF length	6	m
Station effective RF length	3	m
Total # cavities	12	
System requirements @30MV		
Cryo power @1.8K bath, 2K surface	8.5	W/m
Cryo power @2.0K bath	20	W/m
Total cryo power @2.0K*	120	W
Q_{ext}	6×10^7	
RF power @ 5MV/m	400	W/m
design margin	$\times 2$	
RF power/2m(4cav)	1600	W
RF power @ source supply	2.4	kW
# RF supplies/station	2	
Total # RF supplies	4	
Total RF power	10	kW

*contingency factor= duty factor

Table 2: Separator RF Cavity Parameters

Frequency mode	3.9 $\pi, \approx \text{TM110}$	GHz
Equator diameter body, (end)	94.36 (95.10)	mm
Iris diameter	30	mm
Cell length	38.4	mm
cells/cavity	13	
cells/m	26	
Effective RF length/cavity	499.2	mm
# cavities/m effective	2	
Overall length/cavity	660	mm
$(R/Q)'/\text{cavity}^*$	351	Ohm
$(R/Q)'/\text{m}$	702	Ohm
V_{trans}	5	MV/m
$E_{peak} @ 5 \text{ MV/m}$	18.5	MV/m
$B_{peak} @ 5 \text{ MV/m}$	0.077	T
Coupling factor $(f_0 - f_\pi)/f$	0.04	
$f_\pi - f_{\pi-1}$	1.2	MHz
polariz-tune-split.	10 ... 40	MHz
tuning range	± 1	MHz
Q_{copper}	1.4×10^4	
$Q_{nb} @ 273 \text{ K}$	$Q_{cu}/3$	
$f/2Q_{nb} @ 273 \text{ K}$	0.42	MHz
$G_1 = Q \times R_{sur}$	228	Ohm
$R_{sur} @ 2 \text{ K}, T_c/T=4.6$	1.1×10^{-7}	Ohm
$Q @ R_{sur}$	2.1×10^9	
Power dissipated@5MV, 2K	8.5	W/m
Q_{ext}	6×10^7	
full bandwidth f/Q_{ext}	65	Hz
U (stored energy)	0.73	Joules/m
Beam tube		
Mode	TE11	
Decay length	10.9	mm
Beam tube length	80.5	mm
$Freq_{cutoff}$	5.856	GHz
* $P = V^2 / 2(R/Q)' \times Q$		



ALTERNATE CELL PROFILE
(MCASHAN)

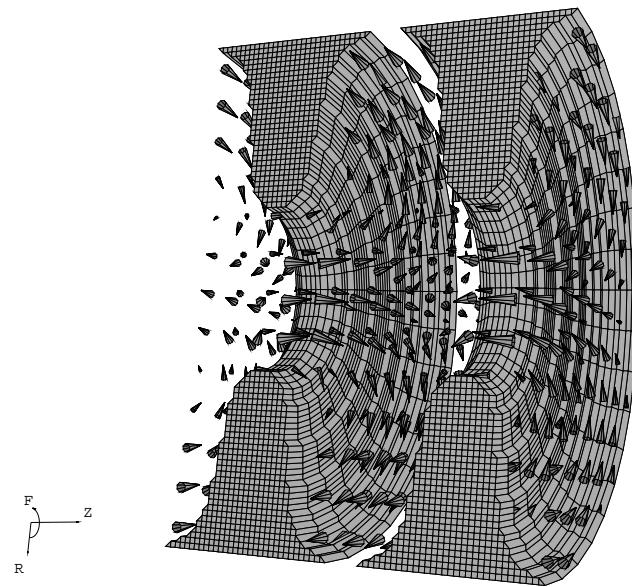


Figure 1: Magnetic field of dipole π -mode

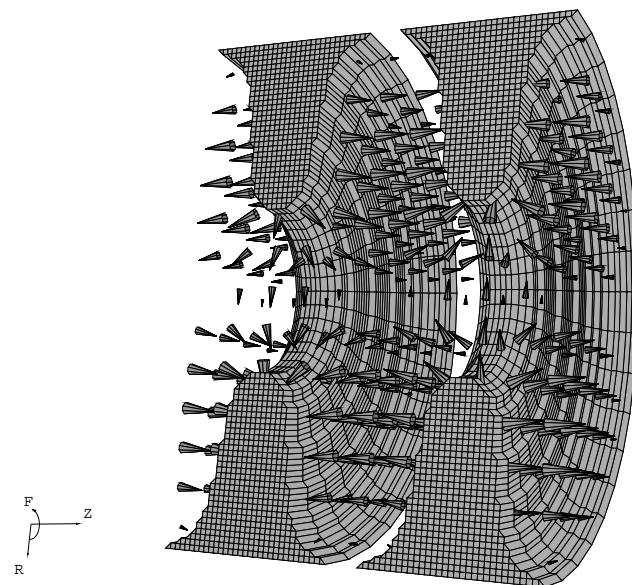


Figure 2: Electric field of dipole π -mode

