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1112* COLLIDING BEAM BYPASS

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This is a report on a study of a bypass for colliding beams which takes less than 1/6 of the main ring circumference. It starts at the downstream end of one straight section and ends at the beginning of the next. It contains two colliding beam areas, one of 87 meters and one of 55 meters.

*1112 rf wavelengths

1112 COLLIDING-BEAM BYPASS

This is a short report on a bypass for colliding beams. The bypass takes < 1/6 of the main ring from the end of straight section A to the beginning of straight section B. This particular design is for 2 colliding beam areas within this sector, one of 87 meters and one of 55 meters. It is proposed that the beams cross each other at each region. The above configuration is chosen to give maximum flexibility. If sufficient money is not available to develop 2 regions, only 1 could be developed at first leaving the second for the future. Figure 1 illustrates the sector. In Figure 2, the distance between the main ring beam line and the bypass beam line is shown. The maximum separation is 10.4 meters. The bypass beam goes between the service buildings and the main ring. The stairway will interfere at each of the service buildings. The minor vehicle access at B0 will also interfere. These are minor interferences and can be taken into account.

It is proposed that operation be fixed for periods of months, then no fast switching of beams from one tunnel to the other would be necessary. This way, magnets would be physically moved for operation in one tunnel or the other. For example, approximately the first 208 meters of beam is common to the bypass and the main ring. The main ring and Doubler magnets can be built on a structure similar to a railroad switch so that the magnets can be switched from the main ring to the bypass beam. All cryogenics and vacuum would be connected to the main ring end and all electrical connections would have to be disconnected on the bypass- main ring end and reconnected after the switch, since the bypass magnets run at approximately 14% higher current. The utilities of service buildings A1, A2, A3, and A4 can be used to serve whichever beam line is being used, thus avoiding additional power supplies and cryogenics. The bypass has 1112 rf wavelengths, whereas the main ring has 1113.

The necessary civil construction for the bypass would be a 65-meter "transfer hall" covering both main ring and bypass, then ~ 104 meters of new bypass tunnel, 87 meters of colliding-beam area, ~ 163 meters of new bypass tunnel, 55 meters of colliding-beam area, ~ 119 meters of new bypass tunnel, and 65 meters of "transfer hall."

The main ring lattice has 130 dipoles in a sector; it is possible to put ~ 108 dipoles in the bypass. Fifty two of these dipoles are common to both beams, therefore approximately 56 additional Doubler dipoles are required for the bypass Doubler beam. I would propose that 56 additional main ring magnets be added in the bypass for main ring beam, for the eventuality that electrons are put in the main ring. Approximately 14 quadrupoles are needed in each beam.

Table I lists advantages and disadvantages of the bypass. Table II lists a possible operating mode for the bypass. Table III gives a very rough cost estimate.

TABLE I

Advantages	Disadvantages
1. Independent fixed target and colliding beams.	1. Costs more - ~ $5 M.
2. Simpler areas.	2. May give less energy - 0 - 14%.
3. Fixed target can be run in either mode.	3. Six-fold symmetry of lattice is lost.
4. Gives 2 long areas - 87m - 55m dedicated.	
5. All accelerator functions serve both modes.	
6. All areas close together - saves on services.	
7. More hours/year of both colliding beams and fixed target.	

TABLE II - POSSIBLE OPERATION

≧ 1200 hours	3 months	pp 250 x 900
≧ 1200 hours	3 months	fixed target 1000 GeV
≧ 1200 hours ≧ 1200 hours	3 months	$p\bar{p}$ 900 x 900 fixed target 400 GeV

TABLE III - COST ESTIMATE

Civil Construction - Plant

2 - 65-meter transfer halls 4K/m	520K
387 meters of small tunnel 1.5/m	580K
109 meters of large tunnel 2.0/m	220K
1 - 20-meter colliding area	400K
1 - 15-meter colliding area	250K
Conventional utilities	800K
Contingency	230K
	3000K

Equipment

56 Doubler dipoles 30K	1680K
14 Doubler quads 15K	210K
56 main ring dipoles 15K	840K
14 main ring quads 5K	70K
Switch structure and stands, etc.	500K
Crossing and kissing magnets	750K
Controls	100K
Contingency	350K
	4500K

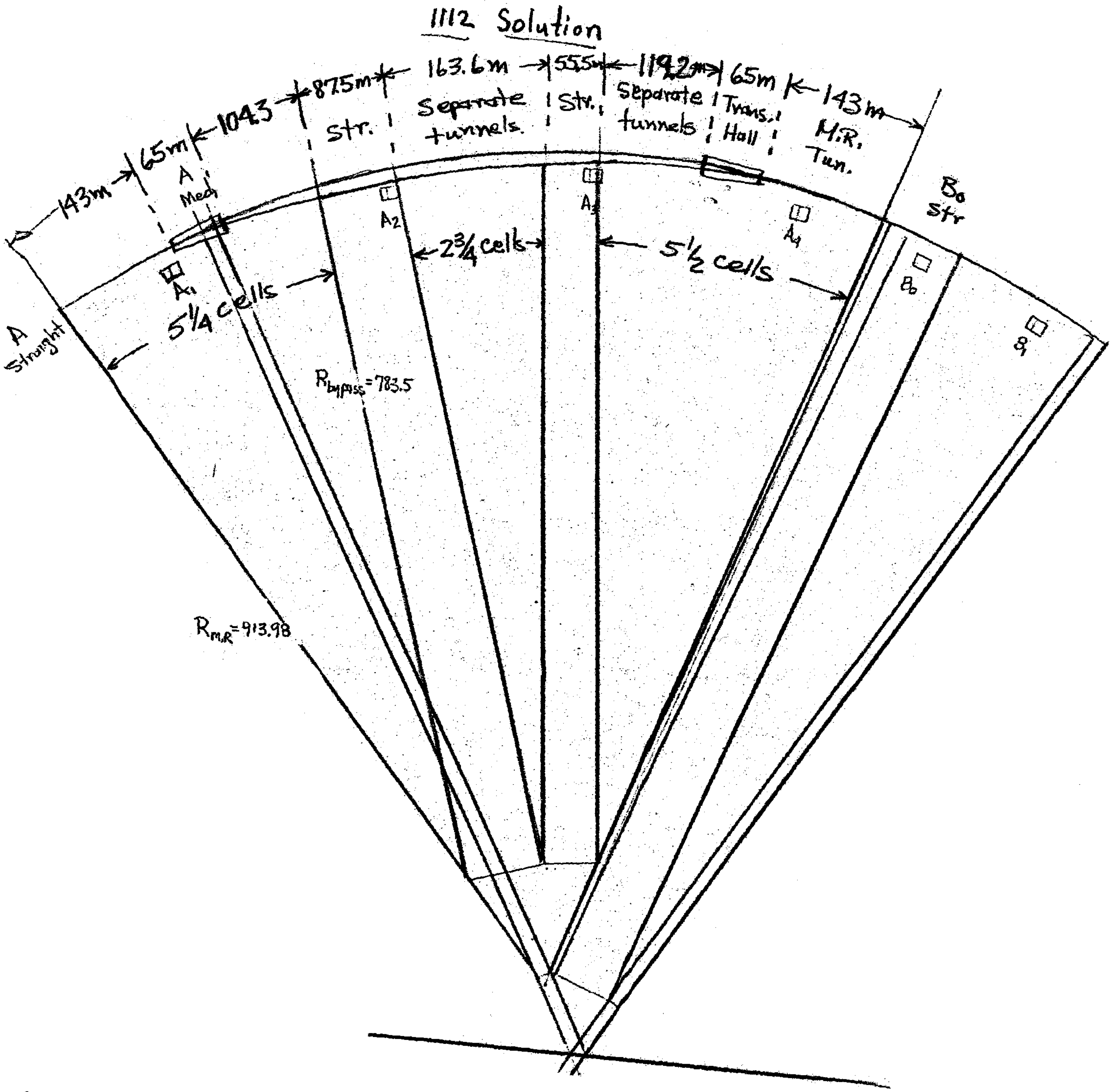
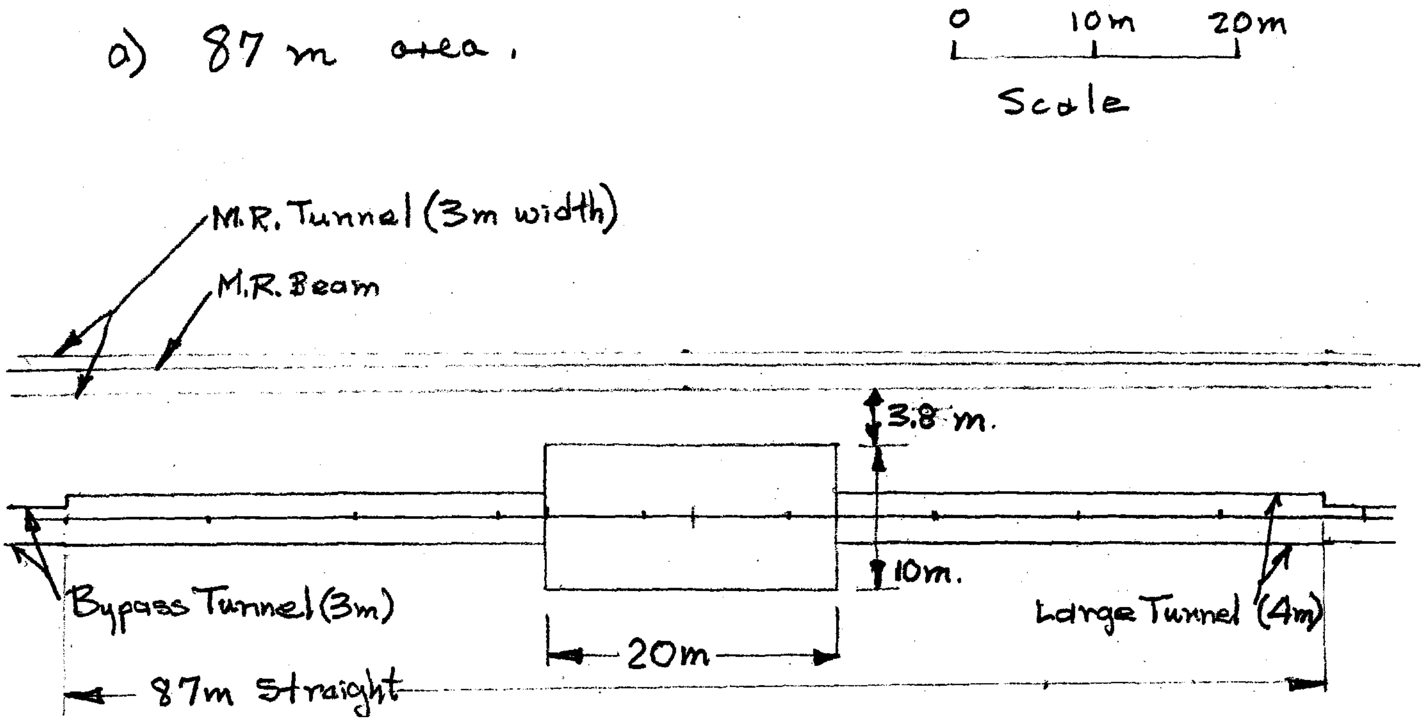


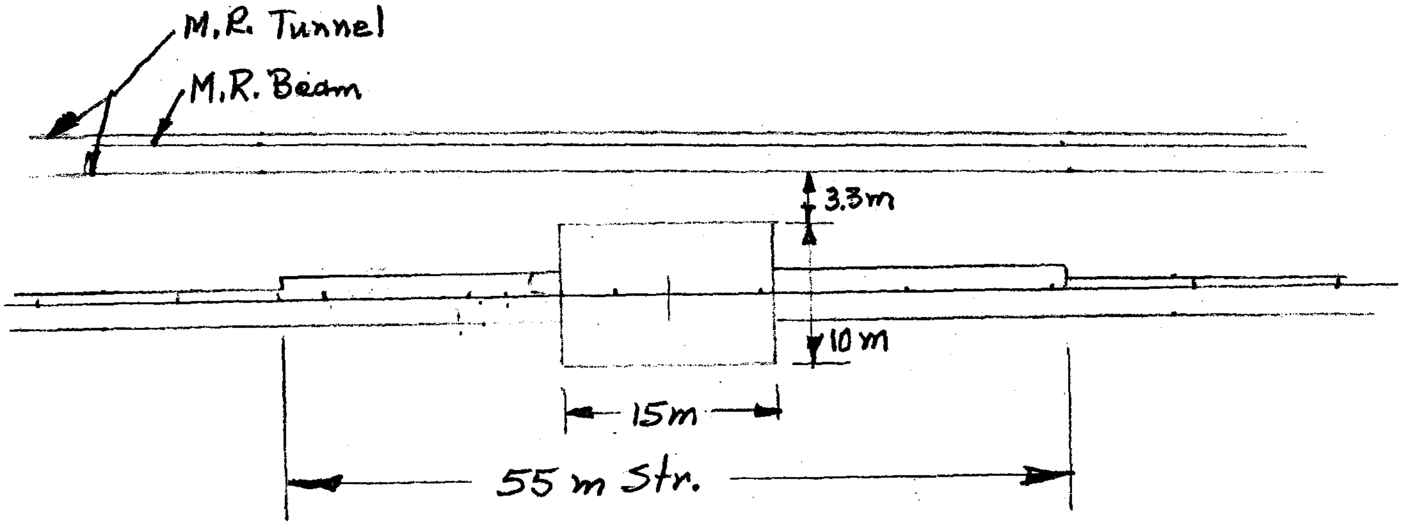
Figure 1. Bypass in A sector.

Figure 2. Separation of Main Ring and Bypass.

a) 87 m area.



b) 55 m area.



1112 Solution

$y = R - \sqrt{R^2 - x^2}$

x	y_{MR}	y_B	$\Delta y(1 - \frac{y_{MR}}{R})$
120	7.91	9.24	1.32
160	14.11	16.51	2.36
150	12.39	14.49	2.07
170	15.95	18.67	2.67
180	17.90	20.96	3.00
190	19.97	23.39	3.35
200	22.15	25.96	3.72
327	60.50	71.50	10.3

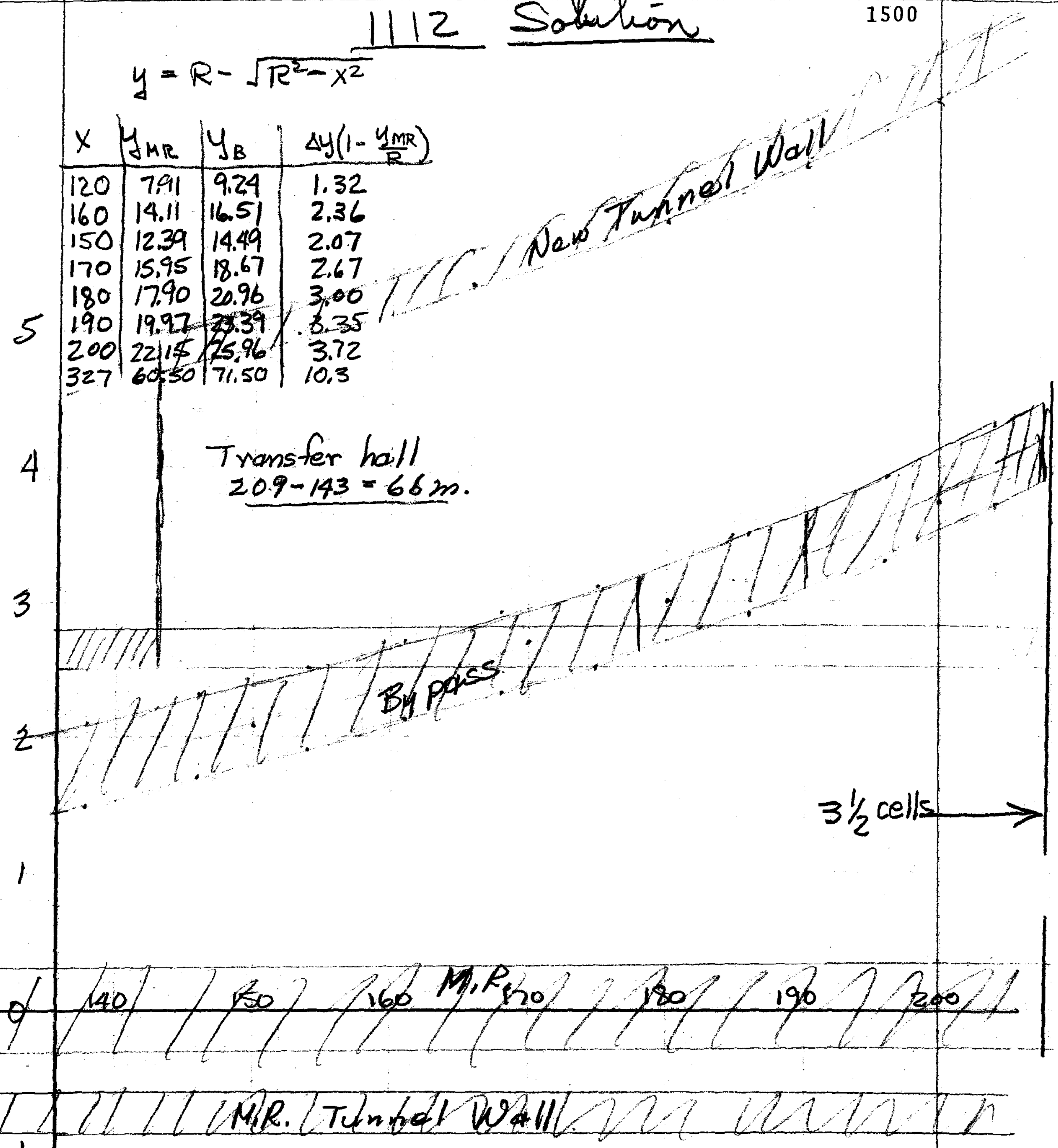


Figure 2c. Separation of M.R. and Bypass at "Transfer hall."