



Fermilab

Beams Division Headquarters

June 17, 2002

TO: Mike Witherell
FROM: John Marriner
SUBJECT: Megawatt Proton Source

I wanted to formally bring to your attention an idea I had for creating a megawatt proton source by fully utilizing the potential of the existing accelerators. In some sense, the concept is an alternative to a proton driver, but it is certainly consistent with the implementation of a proton driver at a later time to achieve even higher beam power.

The concept is to make full use of the 15 Hz capability of the Booster at the existing intensity. If this beam could be brought to 120 GeV, the resulting average beam power would exceed 1 MW. The idea is that the Booster would run continuously injecting 6 pulses of beam into the Recycler Ring. The loading scheme in the Recycler would be identical to the present Main Injector scheme. At the conclusion of the 6 Booster pulses, the Recycler beam would be transferred to the Main Injector and Recycler filling would resume. The beam in the Main Injector would be accelerated and extracted in a 6/15 sec cycle, *i.e.*, the time that it takes to fill the Recycler.

What modifications would be required?

- The Main Injector magnet ramp would have to be sped up by a factor of 3. While some optimization of the existing ramp might be possible, the power supply voltage would have to be increased by a factor between 2 and 3. More power supplies would have to be installed to provide this voltage, and it is likely that some new service buildings would be required.
- The a.c. power distribution would need to be expanded, and some sort of filtering of the reactive load might be required.
- The Main Injector r.f. voltage gain per turn would have to be increased by a factor of about 3. One could tap the existing headroom in the currently installed r.f., but one would probably have to at least double the number of installed r.f. cavities, probably by using the straight-section at MI-30.
- The 8 GeV Injection into the Main Injector would have to be re-routed to the Recycler.

- The Booster pulsed devices would have to be modified to run at 15 Hz.

This mode of operation precludes operation in collider mode. However, speeding up the Main Injector ramp at factor of 3 (without using the Recycler) provides a factor of two increase in proton intensity (bringing the beam power into the 600 kW range). In this scenario, slip stacking is not required, nor is it useful.

This plan is a very brute force approach, but has little technical risk. My guess is that it would be possible to implement for 10's of M\$. Some things that would need to be considered further are:

- The existing Booster losses might prohibit flat-out running at 15 Hz.
- The eddy current effects in the Main Injector would be increased and might have adverse effects.
- The Main Injector magnets might have a higher failure rate when subjected to rapid cycling.
- There might be geometry problems (space conflicts) in the regions of injection and where the new r.f. cavities would be installed.

Distribution:

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