

# **Proton Driver Prototype Beam Operation at Meson Detector Building**

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This note is to specify operating parameters of the Proton Driver prototype in the Meson Detector Building (MDB) for the purpose of establishing radiation shielding requirements for acceleration of proton (or H-) beam in MDB. Shielding for x-rays from RF cavities will also be a concern, but this note is not intended to address that issue. Clearly, the facility will need to be constructed to satisfy both.

Since beam operations of the Proton Driver prototype will likely advance in stages, parameters for four stages are specified as discussion points. It remains a decision whether the enclosure/shielding as used at Stage 1 is constructed for Stage 4 operation. Stage 1 involves only the ion source and the 3 MeV RF Quadrupole section. Stage 2 adds the room temperature linac that takes the beam energy to 16 MeV. Stage 3 adds the first section of superconducting accelerating cavities taking the beam to 33 MeV. Finally, Stage 4 includes the second type of superconducting cavities that will accelerate the beam to 110 MeV. Stage 4 is broken into versions a, b and c. Stage 4a is determined by a RF power limitation in the scenario that only one klystron is available and includes a reduced pulse repetition rate adequate to make desired performance measurements. Stages 4b and 4c respectively represent the conditions of full repetition rate with one klystron and then with addition of a second klystron. The shielding requirements for Stages 4b and c are the most demanding.

Note: Stage 4a separately specifies average and limited-duration peak beam pulse rate. Also, although operation with a 1 millisecond pulse at 10Hz is specified, a 3 millisecond pulse at 2.5 Hz (slightly less average beam) is also a desired operating point at each stage.

## **Stage 1: Beam from RFQ (full rate) (28mA, 1ms, 10Hz)**

Beam Energy	- 3 MeV
Pulse Current	- 28 milliamp
Pulse Length	- 1 millisec
Pulse Rate	- 10 Hz
Protons/hour	- 6.3 E18
Peak beam power	- 84 KW
Ave. beam power	- 0.8 KW

## **Stage 2: Beam from room temp linac (full rate) (28mA, 1ms, 10Hz)**

Beam Energy	- 16 MeV
Pulse Current	- 28 milliamp
Pulse Length	- 1 millisec
Pulse Rate	- 10 Hz
Protons/hour	- 6.3 E18
Peak beam power	- 450 KW
Ave. beam power	- 4.5 KW

**Stage 3: Beam from single spoke SCRF section (full rate) (28mA, 1ms, 10Hz)**

Beam Energy	- 33 MeV
Pulse Current	- 28 milliamp
Pulse Length	- 1 millisec
Pulse Rate	- 10 Hz
Protons/hour	- 6.3 E18
Peak beam power	- 925 KW
Ave. beam power	- 9.2 KW

**Stage 4a: Beam from double spoke SCRF section (reduced pulse current due to single klystron limit, reduced average pulse rate) (9mA, 1ms, 10Hz)**

Beam Energy	- 110 MeV
Pulse Current	- 9 milliamp
Pulse Length	- 1 millisec
Peak Pulse Rate	- 10 Hz for 5 seconds
Average Pulse Rate	- 2 Hz over one hour
Protons/hour	- 0.4 E18
Peak beam power	- 990 KW for 5 seconds
Ave. beam power	- 2.0 KW

**Stage 4b: Beam from double-spoke SCRF section (reduced pulse current, single klystron limit) (9mA, 1ms, 10Hz)**

Beam Energy	- 110 MeV
Pulse Current	- 9 milliamp
Pulse Length	- 1 millisec
Pulse Rate	- 10 Hz
Protons/hour	- 2.0 E18
Peak beam power	- 990 KW
Ave. beam power	- 9.9 KW

**Stage 4c: Beam from double-spoke SCRF section (2 klystrons, full rate, and probably unrealistic) (28mA, 1ms, 10Hz)**

Beam Energy	- 110 MeV
Pulse Current	- 28 milliamp
Pulse Length	- 1 millisec
Pulse Rate	- 10 Hz
Protons/hour	- 6.3 E18
Peak beam power	- 3.1 MW
Ave. beam power	- 31 KW