1 MW AGS proton driver

Parameters and layout

1.3 GeV Superconducting Linac

2.5 Hz AGS: parameters and beam loss considerations

Bunch compressor ring

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AGS proton driver parameters

• Total beam power	1 MW
• Beam energy	24 GeV
• Average current	42 μA
• Cycle time	400 ms
• Number of protons per fill	1×10^{14}
• Average circulating current	5.3 A
• Number of bunches per fill	6 (1.7×10^{13} protons per bunch)
• Time between extracted bunches	20 ms
• rms bunch length	3 ns
• Peak bunch current	400 A
• Total bunch area	10 eVs (rms emittance 0.8 eVs)
• rms momentum spread	270 MeV / 24 GeV = 1.1 %

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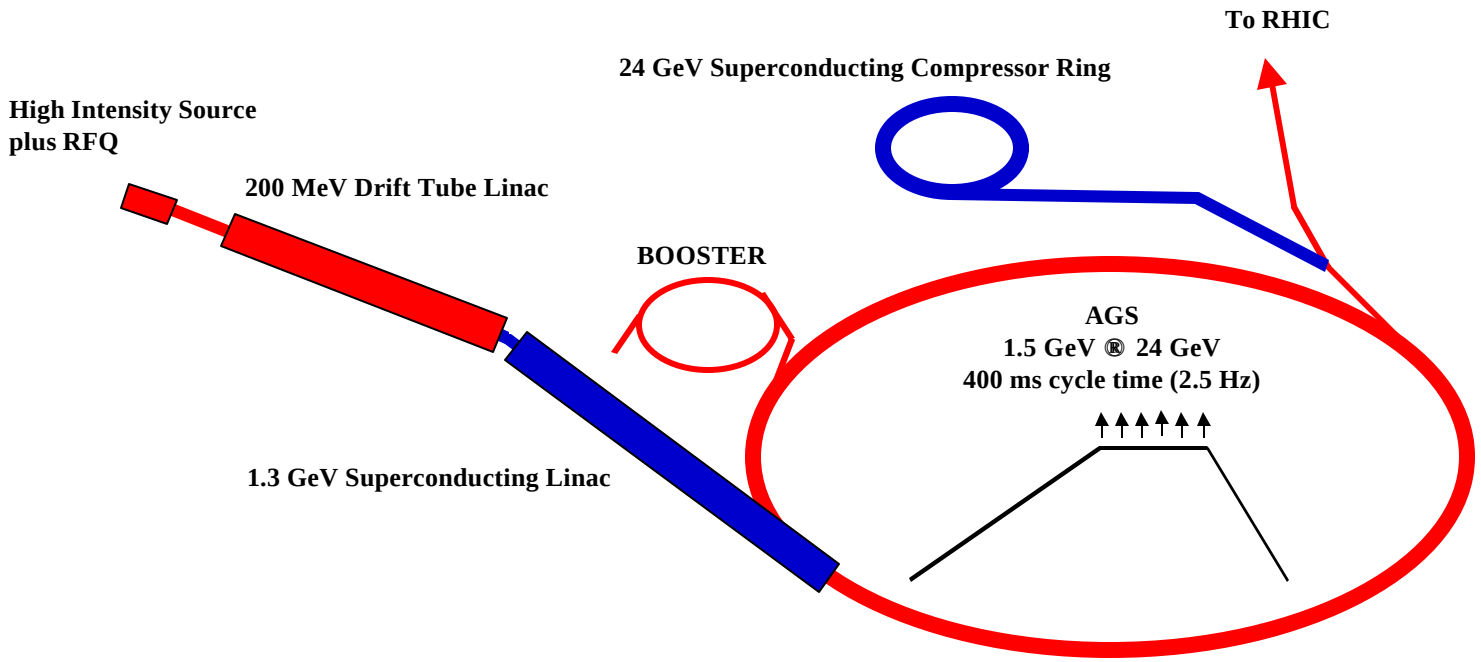
AGS proton driver layout



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Superconducting Linac

1.3 GeV (0.2 → 1.5 GeV) Linac modeled after SNS superconducting linac:

Beam energy	0.2 → 0.7 GeV	0.7 → 1.5 GeV
Rf frequency	805 MHz	805 MHz
Eff. average gradient	9 MeV/m	9 MeV/m
Length	55 m	88 m
Average beam power	29 kW	63 kW

If this average gradient can not be achieved the present 200 MeV DTL will have to be upgraded to 400 MeV (à la Fermilab).

AGS upgrades

New 1.5 GeV H- injection channel:

- Modeled after SNS but lower repetition rate and less foil traversals.
- 1.0 % controlled losses, 0.1 % uncontrolled losses.

New power supply for 2.5 Hz repetition rate:		presently:
• Peak power	100 MW	50 MW
• Average power	≈ 3 MW	4 MW
• Peak current	5 kA	5 kA
• Peak total voltage	+ 15 kV / - 25 kV	7.5 kV
• Number of power converters / feeds	6 - 8	2

More AGS rf power:

- Need about 900 kV with 30 degrees synchronous phase (now: 400 kV)
- High gradient cavities with about 30 kV/m [Finemet,…]

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Beam losses in AGS

Major loss points	Present AGS		1 MW AGS	
	% particles	Power	% particles	Power
Injection and early accel.:				
Controlled			1.0 %	0.6 kW
Uncontrolled	30 %	1.9 kW	0.1 %	0.1 kW
Transition	2.0 %	0.4 kW	1.0 %	2.9 kW
Total:		2.3 kW		3.6 kW

- Injection losses are assumed to be 10 times SNS values scaling approx. with machine aperture.
- Transition losses are presently dominated by beam momentum spread required for AGS injection stacking. Direct injection should eliminate chromatic transition losses.
- 3.6 kW should be acceptable for hand maintenance.

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Compressor ring

Small superconducting ring to compress a single 24 GeV, 10 eVs bunch to 3 ns rms length. Small size reduces space charge tune shift and gap volt requirements.

- Circumference 200 m
- Energy 24 GeV
- Dipole field 4 Tesla
- Packing factor 60 %
- Transition gamma 40
- Momentum acceptance $\pm$ 5 %
- Rf frequency 6 MHz (h = 4)
- Rf Voltage per turn > 200 kV
- Bunch length compression (rms) 20 ns $\rightarrow$ 3 ns

Need to develop a low dispersion lattice similar to FFAG lattices.

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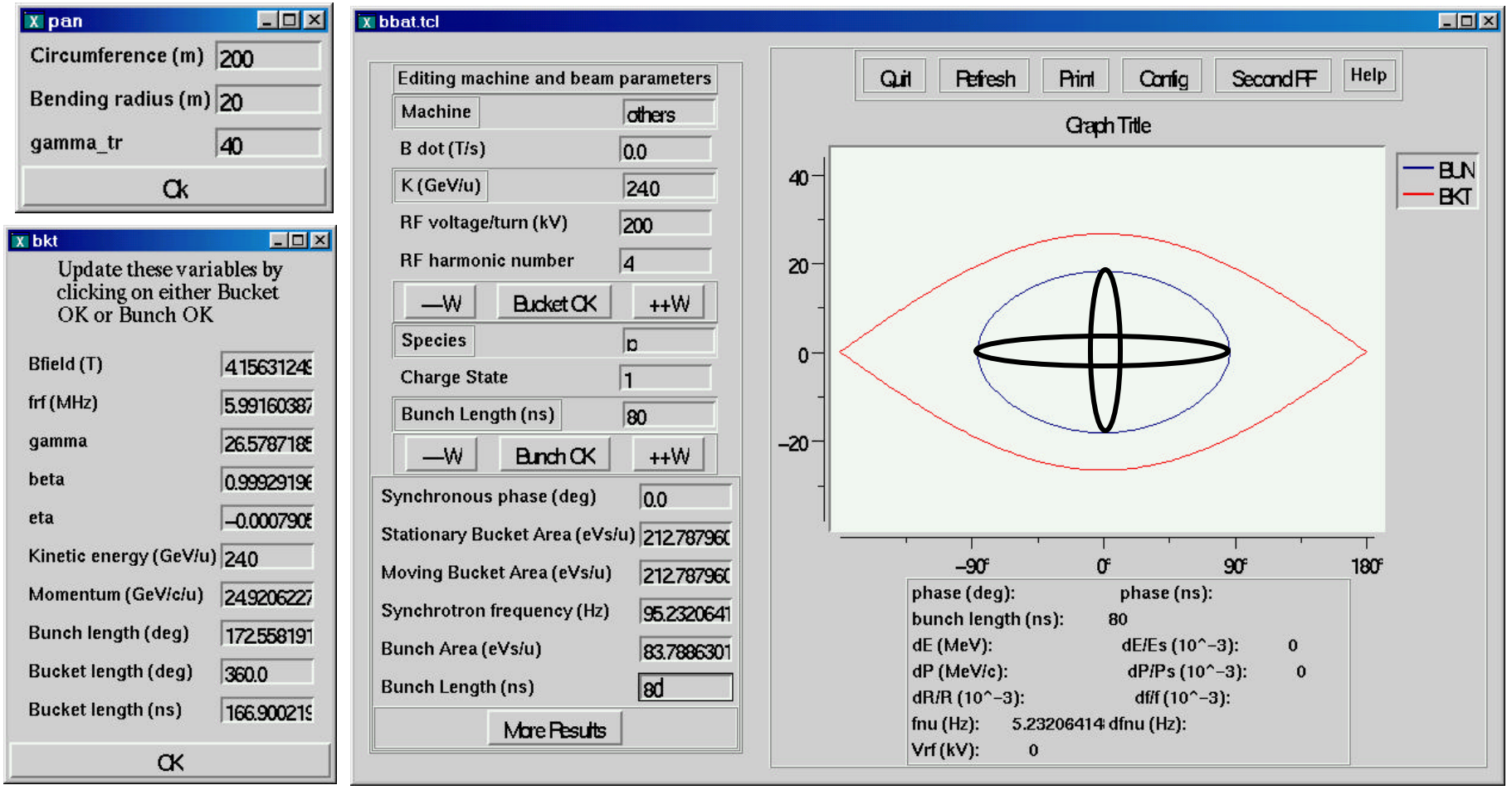
Bunch compression



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