Design Specifications for the Alignment Laser System

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Brief Summary
This document describes the specifications for the Alignment Laser system, which will establish and verify electron beam alignment down the electron beamline of the injector.

Change History Log

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An alignment laser will be used to establish a reference line for view screens along the downstream injector beamline.

Figure 1: Layout of the Gun Region with the Alignment Laser shown (not in scale)

The alignment laser should operate cw (continuous wave) in the visible wavelength range with the output power high enough to be visible on the screens with CCD camera and with a naked eye (2mW).

The beam diameter on the screens should not exceed 2mm. Taking into consideration that the length of the beam line is about 20m, special measures should be taken to keep the beam divergence low. It requires the use of the beam expander. The beam expander will be attached to the laser output. The beam expander should provide the beam, which has a Rayleigh range of approximately 9 meters and produce a beam waist half way between the mirror AM01 and the last screen (YAGS1). The beam waist should be less than 2 mm.
The laser beam on the screens should be moved with the accuracy 100 microns. It means that the angular resolution of the mirror mounts should be better than 1.1 arcsec. The mounts with this resolution are available commercially.

The alignment laser system will contain the steering optics, which will be located outside the vacuum beamline. Two of the steering mirrors will be controlled remotely.

The last steering mirror (AM01), which will guide the laser beam along the electron beam path, will be located inside the vacuum tube. This mirror will be removable, and the mirror mount will have the capability to be inserted remotely.