

11/14/88 (R.Drever)

Notes on Baffle and Beam Parameters Relevant for Scattering Estimates

The scattering calculations are reaching a stage where realistic numerical estimates may be helpful, and may assist comparison of various practical baffle arrangements with one another. For the purposes of initial conceptual design of the LIGO it was necessary to assume a value for the clear aperture defined by the baffles, and to pick initial locations for the several interferometer beams. In view of the engineering design which is in progress with these assumed parameters it would be useful to take these particular values for estimates of scattering and baffle efficiency made at the present stage.

The parameters used are as follows:

1. The baffles are assumed to leave a clear circular aperture of radius 20 inches from one end of the pipe to the other.

Note (i):

The vacuum pipe diameter is not necessarily defined - and may remain to be determined by scattering requirements related to the baffle design and this 20 inch radius defined clear aperture.

The value of 20 inches taken here for the clear aperture was based on an initial assumption that the pipe inside diameter is 48 inches plus or minus 1 inch, and the pipe is laid with a maximum deviation of the center of the pipe from a true straight line of plus or minus 1 inch over the 4 km length. In this case each individual baffle has a circular aperture of radius 21.25

inches and an outside radius of 23.5 inches so that it will fit into the narrowest sections of pipe, but with alignment errors up to the maximum tolerance specified will still leave a 20 inch radius clear cylinder from end to end of the 4 km arm. These dimensions are initial assumptions only, and the scattering calculations should give more accurate data on which to base the actual pipe inside diameter.

2. Scattering from baffles and pipe walls is expected to be more important for interferometer beams near the walls than those near the center, so the beams nearest the edge of the baffles are probably the most important ones to be considered in assessing scattering dangers. The positions of the beams in the current design satisfy the following specifications:

(a) All full-length beams have their centers within a radius of 17.0 inches from the center of the clear aperture;

(b) All half-length beams have their centers within a radius of 17.5 inches from the center of the clear aperture.

Note (2):

The closest beams to the walls in the current layout have their centers at radii of 16.8 inches and 17.4 inches respectively.

3. It is assumed that the baffles are located at places where there are pipe supports, so motions of the baffles are minimized. The spacing of the baffles remains to be determined.

Note (3):

It may be noted that the fluctuations in pipe alignment allowed by the specification above is likely to lead to some natural randomness in actual baffle centering. It may be desirable to introduce further deliberate randomness in scattering from the baffle edges by making the edges serrated or jagged in a suitable way. In this case the radial and circumferential scales of the serrations may be determined more by the beams near the pipe walls than by those near the center.

It is hoped that the above data on baffle and beam parameters assumed for initial design purposes may be help to make calculations on scattering and baffle design more realistic, and relevant for the current conceptual design work.

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