

IV.B. BEAM RAYTRACING LAYOUT

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Assumptions

1.
 - Power of beam impinging onto recycling mirror: 3W.
 - Test mass coating transmission: 3.3%.
 - Recycling mirror transmission: 3.3%
 - Mach-Zender reflectivity (power): 1%.
 - Power reflectivity of AR coatings: 0.1%.
2. Beams carrying less than $0.1\mu\text{W}$ have been disregarded
3. Beams carrying between $0.1\mu\text{W}$ and about $10\mu\text{W}$ now end up on flat, black surfaces¹, which are not seismically isolated.
4. Beams carrying more than about $10\mu\text{W}$ are either photodetected or dumped.
5. The nominal diameter of the beams is, usually, 6".
6. Wherever it was necessary, the nominal diameter for low power beams was trimmed, such as to satisfy the criterion of Point 2.
7. Nominal beam dump sizes are 8" diameter, 16" long. The beam dumps are not seismically isolated.
8. Wherever it was necessary, the size of the beam dump was trimmed down, in tune with Point 6.
9. The nominal diameter of the photodiodes is 7". It has yet to be determined what degree of seismic isolation needs to be provided for the photodiodes.

¹ The residual scattered light should not exceed 0.3%-1% of the incident light

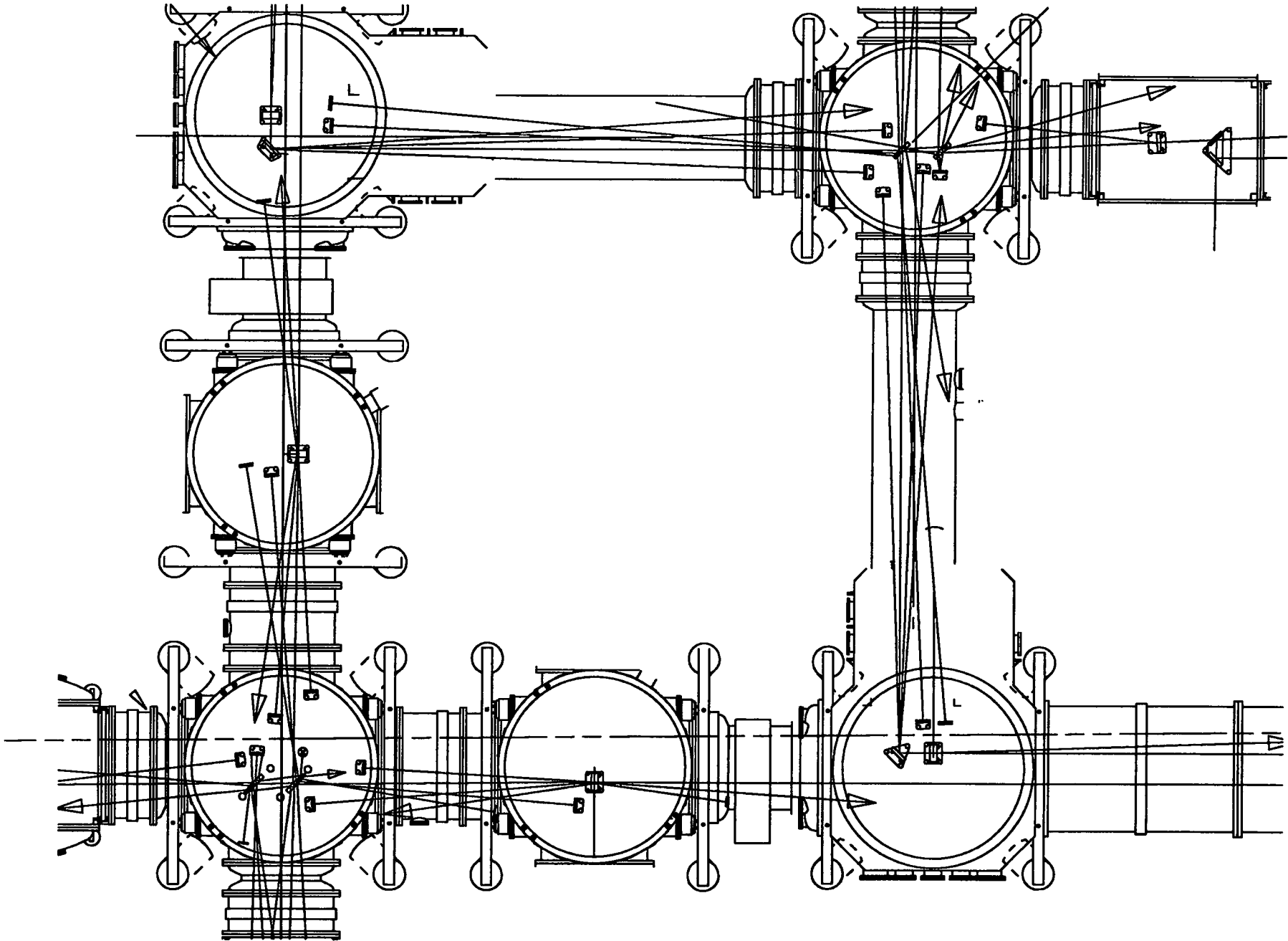
Features of the Layouts

- 1. Either horizontal or vertical stray beam spread-out could be accommodated by the vacuum system.**
- 2. Some stray beams had to be deflected downwards with a mirror, then caught with a vertical beam dump.**
- 3. Some beams, deflected at large angles, were dumped either by placing a baffle at the appropriate location, or by placing a conical beam dump inside a spool. In the latter case, one will have to provide a 8" ID port at the spool.**
- 4. The initial green directional monitoring beam for the diagonal interferometer was extracted by using a retroreflector, rather than a forward reflecting periscope.**
- 5. Optics wedges had to be customized to the various locations, with tolerances TBD.**
- 6. Baffled shrouds around the test masses are provided for catching $\sim 30\%$ of the scattered light, which emerges at large angles. The cross section of the shroud fits inside the test mass cage outline as seen along the light beam.**

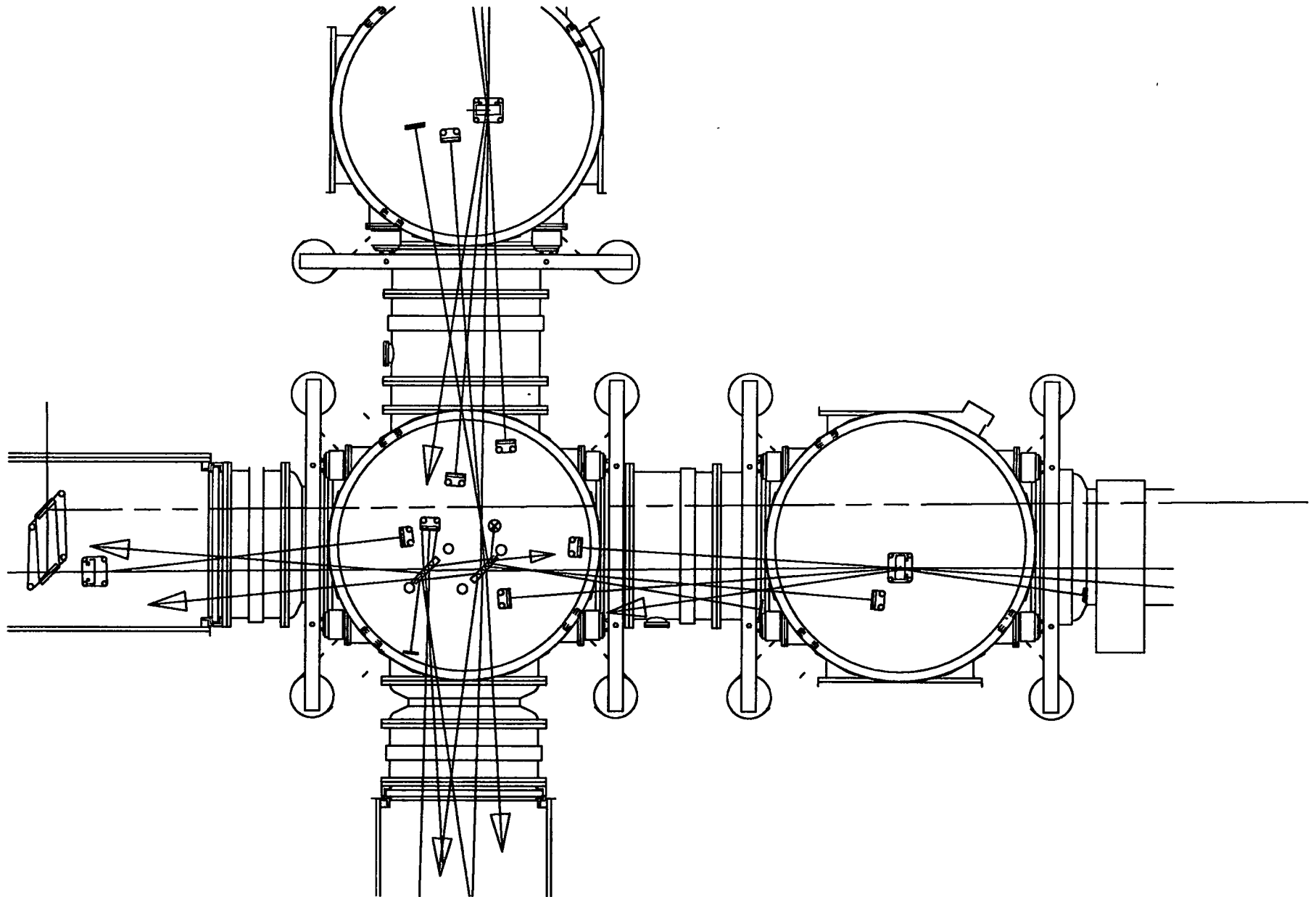
Required Vacuum System Features

1. The beam splitter chambers were placed at fixed heights. This is important for beam clearances in the right arm, and makes it possible to remove the 48" necks between the vertex chamber and the TMC2 chambers, leaving 60" apertures.
2. The 60" apertures between the vertex chamber and the HAMS have been necked down to 48", in order to allow for height adjustment.
3. The offset of the 60" ports of the beam splitter chambers was removed, as it has no apparent advantage. This change makes it possible to use a single design for both the beam splitter chambers and the TMC-2s.
4. Baffles were placed at several locations, inside of connecting spools.
5. 8" ID ports were provided at several locations, on the connecting spools, in order to allow placement of some beam dumps.

WASHINGTON SITE

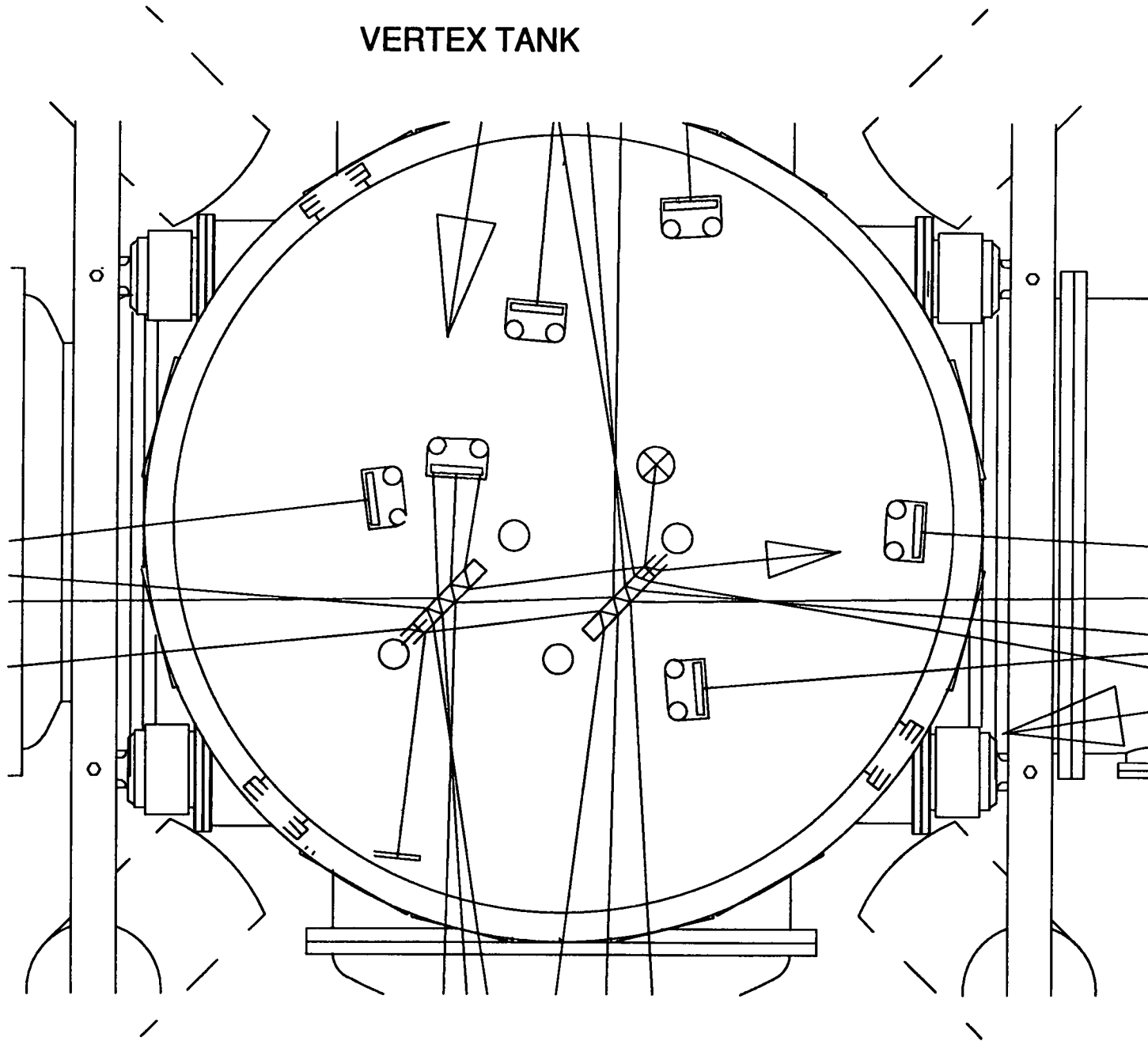


WASHINGTON SITE: VERTEX AREA

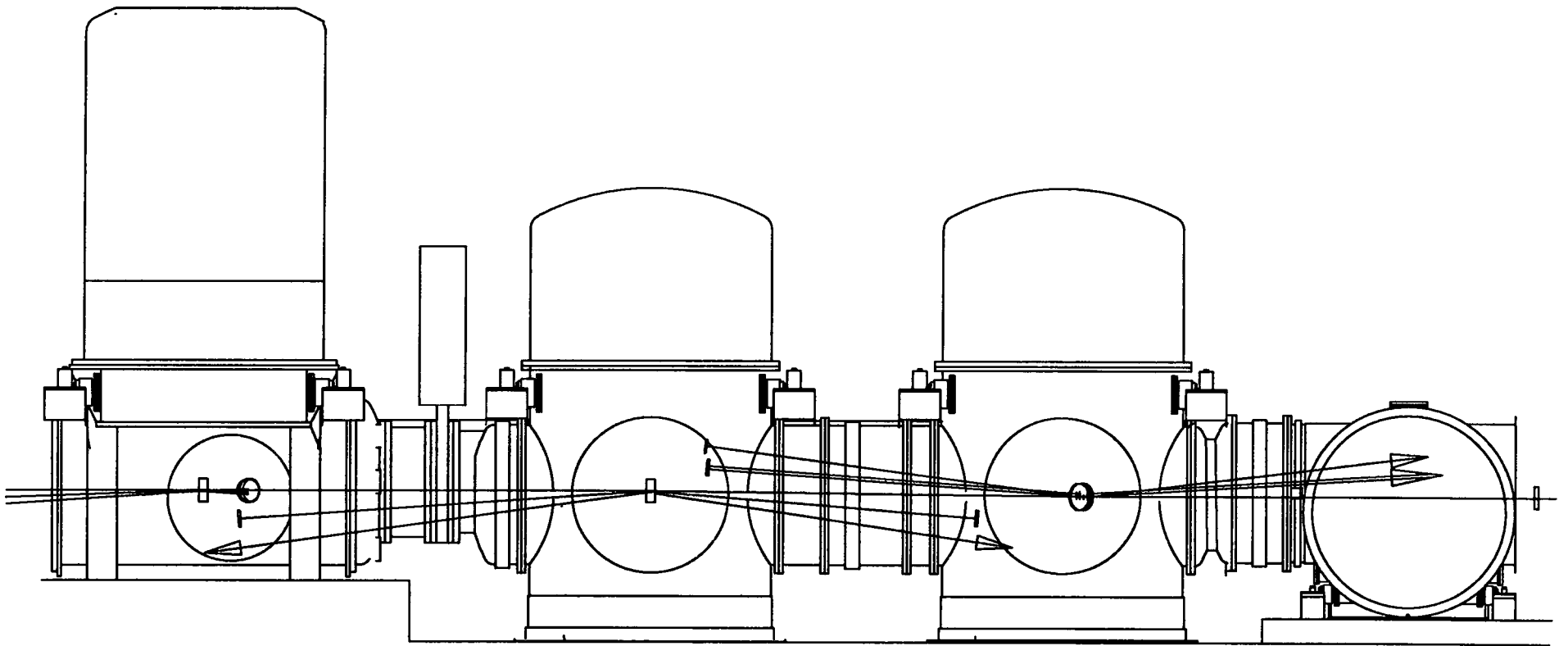


HORIZONTAL BEAM SPREAD:

VERTEX TANK

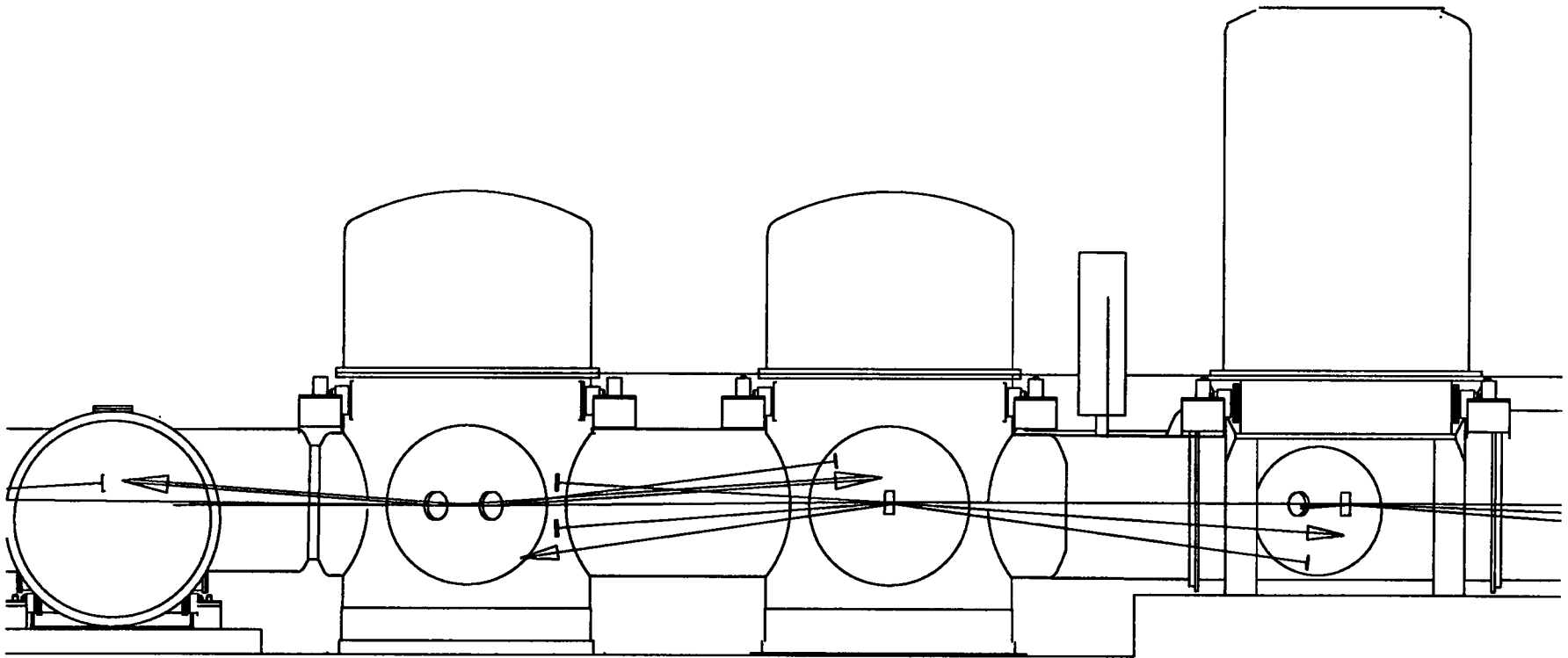


EXAMPLE OF LAY-OUT WITH VERTICAL BEAM SPREAD



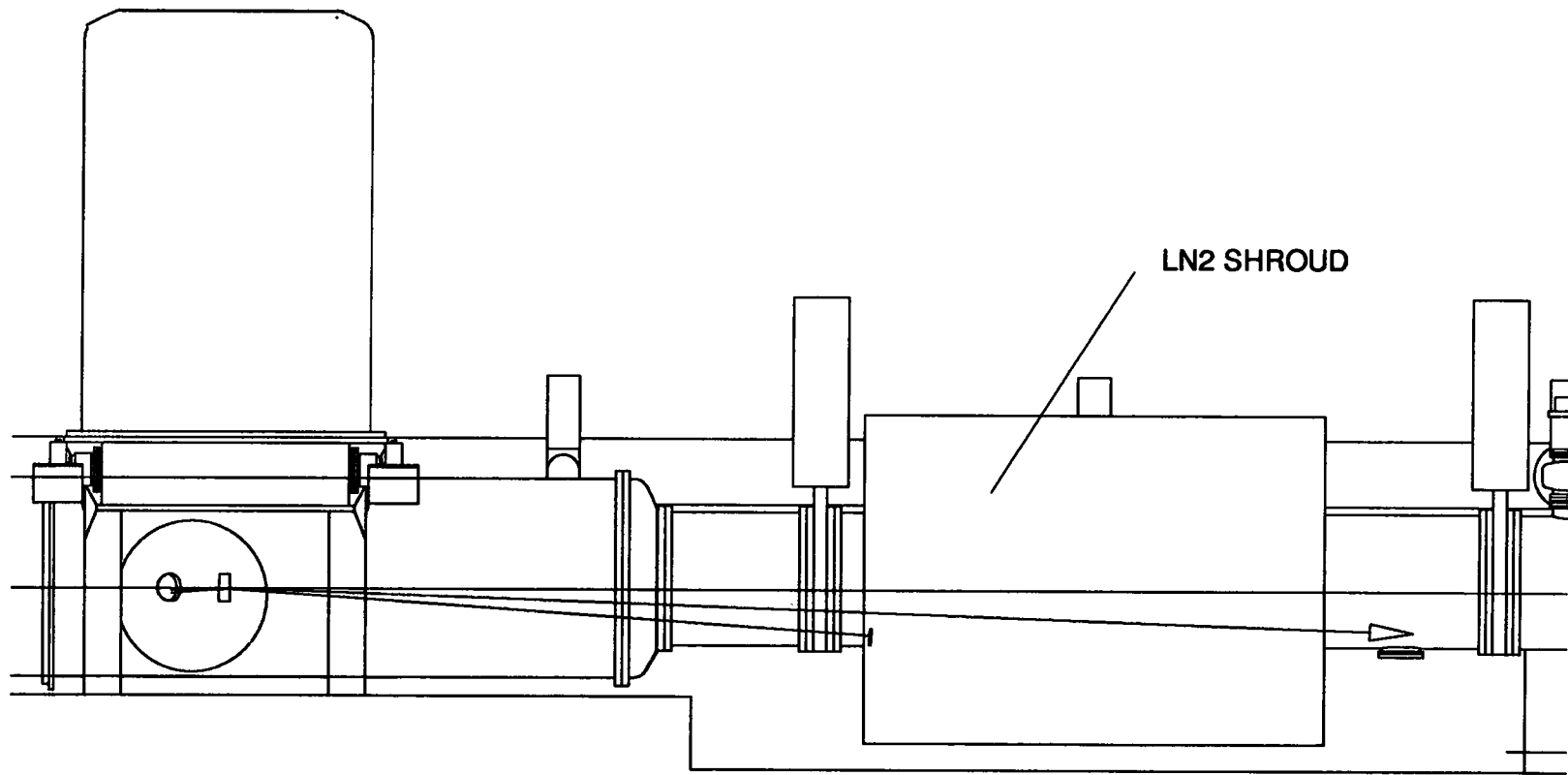
ELEVATION VIEW, LEFT ARM

EXAMPLE OF LAY-OUT WITH VERTICAL BEAM SPREAD



ELEVATION VIEW, RIGHT ARM

VERTICAL BEAM SPREAD FOR THE 6TH INTERFEROMETER



ELEVATION, RIGHT ARM

ARRANGEMENT FOR LARGE ANGLE SCATTERING CONTROL,
FROM TEST MASS REFLECTIVE COATING

AA, 9 February 1993

AXIAL SECTION

FRONTAL VIEW

