GEM TN-93-271

Muon, Magnet and Calorimeter Interface Meeting - SSCL

January 7, 1993

Abstract:

Agenda, attendees, minutes and presentations of the GEM Muon, Magnet and Calorimeter Interface Meeting held at the SSC Laboratory on January 7, 1993.

Muon, Magnet and Calorimeter Interface Agenda
January 7, 1993
Directorate #1
1:30 - 4:00

1.	Muon structure design	F. Nimblett
2.	FFS support design	J. Bowers
4.	Baseline design for TDR	B. Barish
5.	Facilities for muon construction	J. Pier-Amory, Z. Chen

MINUTES OF THE MUON, MAGNET, AND CALORIMETER INTERFACE MEETING

M. Harris Presiding

January 7, 1993

M. Harris Remarks: The magnet requires definition of the FFS parameters to advance the design. The FFS bore may change because of beam pipe / access requirements.

F. Nimblett: The large end rings on the muon system barrel have increased to 1m in depth on the FFS end. The CDS side end ring is problematic because of the lack of space for structure. There is not enough space for the high bending stiffness structure needed. Prealignment may be destroyed or not even practical unless a strong back for the assembly is incorporated. The load is too great to use a totally radially-loaded ring. A former L* design using a cage with various supports to insert the module inside. The inner radius is now 18.1m. The former rail structure in the magnet is no longer viable for linear insertion of a sector. A new, larger section rail system is now envisioned at approximately 45°. For assembly, crane insertion is only possible for those modules at the horizontal midplane and above.

12 Sectors will be fixed together to compose a monolith then the monolith will be inserted into magnet on a short track. The monolith will be pushed into the magnet. J. Pier-Amory took issue with this plan, claiming pulling assures a more even force distribution because it can be rigged to be self centering and pulling produces less compressive stress on the support structure's slender beams.

R. Strynowski questioned the stress on the magnet vessel during this introduction. An analysis memo by A. House to J. Bowers, dated 2 December 1992, GEM-LLNL-92-066, indicating acceptable preliminary stresses was indicated. A smaller footprint is now planned for the introduction pads , hence a higher stress level will be experienced by the FFS end of the magnet vessel and must be evaluated. J. Bowers suggests that the monolith may be required to attach to the floor and vessel during introduction.

M Harris questioned the capability of the assembly to sustain torsional loading associated with introduction. F. Nimblett admitted this is yet to be studied. The use of a side roller is planned to reduce skew axial loading upon introduction.

Shielding emerged as an issue especially with respect to the FFS. 100mm of Boron-Polyethylene (B-P) was mentioned. A firm number was never presented. B. Barish claimed that the iron FFS must have some low Z absorber on it. He questioned whether B-P could be deployed on the outer radius of the FFS bore? He asked if a large forward calorimeter would be sufficiently "self-shielding" to obviate the need for additional shielding? M. Marx responded that such things would known within 2 weeks.

F. Nimblett used 150 mm of B-P plus 50 mm of lead as his baseline, per C. Wuest. This may eventually entail a muon system endcap redesign. Muon resolution is already diminished by forward calorimeter shielding. G. Deis expressed concern regarding cantilevering this mass off of the FFS. F. Taylor suggested that M. Marx and his task force investigate this. M. Marx responded that such things would be known within 2 weeks.

M. Gamble

The current shielding arrangement and beam pipe configurations render detector access through the FFS intractable. The muon endcap design also precludes human access through the endcap structure. G. Chapman is to study beam pipe profiles and optimize diameter and efficiency.

The FFS is currently at z=16.5m and its inner thickness profile is straight up, towards the vertical. The barrel region end ring currently interferes with the endcap at z=16.5m.

G. Mitselmakher asked how much the muon system would move as a result of energizing the magnet. F. Nimblett responded that the muon system is almost completely detached from the magnet. Further, that its attachment points were the most stable the magnet has to offer. G. Mitselmacher appeared dissatisfied and stated that an individual chamber could not have its pointing accuracy disturbed by more than 1mm or 2mm, whereas L3 required 50μm for this number. The group consensus was that this will not be a problem.

M. Harris asked if the global muon system alignment must be done with the magnet closed and the FFS in place.

G. Deis expressed concern over eddy current effects in the muon system. B. Barish dispelled this saying that only large areas were substantially affected by such currents. The sparse muon system and its truss structure do not apply.

J. Bowers: Presented a recap of FFS support history. Initially 1000MT of support structure was used to support the 1000MT FFS. The support was trimmed to 600MT with ~2.5mm (0.1 in) of vertical and ~6mm (0.25in) of axial deflection while sustaining ~55MPa (8ksi) of stress. All nonaxisymmetric regions of the support are stainless steel (SS) representing 400MT out of both the 1000MT original design and the new 600MT design.

B. Barish asked how much is paid for the FFS cantilever region (cone) in comparison to the overall FFS structure. Clear access for the crane and floor space preclude the use of a cheap concrete counter balance on the outside of the detector to equalize the weight of the FFS cone.

J. Bowers should add B-P and lead to the FFS and recalculate the stress distribution and provide this information to F. Nimblett as a design parameter. Adding 100mm to the cone, however, will certainly not be accommodated by the current endcap design, according to F. Nimblett. J. Bowers moved the FFS cone mount back to accommodate a 1m thick muon system end ring and 0.5 m shielding. The conservative design of his structure absorbed this change without the need for modifications. This precipitated questions of overdesign.

Filling the far end (largest z) of the FFS with iron will improve the resolution at large pseudo rapidity by ~0.8%! This is roughly equivalent to an additional layer of endcap muon chambers per G. Mitselmakher. B. Barish considered this a boon and recommended study proceed.

M. Marx claimed 2 sources of neutrons are important, 1. Collimator down stream (could be reduced by a reentrant coffin) and 2. Forward calorimeter back end (steel could be used to reduce this). He claimed that there is no reason to shield the FFS cone, there may be a need to shield secondary gammas with ~1cm of lead on the FFS disk. This is in contrast to the claims of C. Wuest, but is motivated by the FFS bore size. M. Marx again assured that the answers to these issues would be well known within 2 weeks.

G. Chapman: Two beam pipe options were shown. Option #2 featured a flared then tapered pipe while Option #4 showed a flare only with a 794mm OD, maximum thickness of 6.3mm, and a safety factor of 2 regarding stress. Option #4 is the current design and allows no access through the FFS bore. M. Marx promoted moving the entire FFS assembly back each time any access is required to the far end of the detector. This requires removal of the large pumps outside the FFS on the back as well as the mechanical difficulty associated with movement of this massive FFS hardware. M. Harris moved that the large FFS bore decision be reviewed vis a vis the new beam pipe design information. G. Chapman was asked to determine the minimum FFS bore feasible for use with his current configuration.

R. Strynowski inquired about **B** field requirements for the muon system. 1/2% for field integral and stability of monitoring at the same level was suggested by F. Taylor who later agreed to publish a memo on field requirements.

B. Barish: Confirmed the fact that the distance between the flat surface of the FFS disk and cryostat has been increased by 1.5m (previously 15m, now 16.5m), such that the FFS disk now ends at 21m. The fact that the quadrupole may not be able to be captured, as previously envisioned, was mentioned.

Confirmed the fact that the introduction scheme of the muon system into the magnet vessel is reasonable.

By 21 January 1993 all interface dimensions must be defined. M. Marx claimed that all shielding parameters would not be defined by that date.

M. Harris elected J. Pier-Amory, F. Nimblett et al. to study the facilities issues off line because of the meeting room time constraints.

ACTION ITEMS

J. Bowers will provide an official OK on the rail system envisioned for system introduction bearing higher point loading than previously calculated.

J. Bowers is to use 10mm (0.4in) as his maximum deflection constraint when performing the analysis of filling the last 1.5m (largest z) of the FFS with iron. The financial ramifications of this assignment are of keen interest.

G. Chapman will reduce the 1.2m FFS bore to a minimum through his creative genius.

S. Shapiro will report on the progress of the **B** field mapping procedure on 21 January.

M. Marx will report the results of his shielding studies within 2 weeks.

F. Taylor will publish a memo regarding **B** field requirements.

Muon, Magnet, and Calorimeter Interface Meeting

January 7, 1993

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GERRY CHAPMAN	SSCL	GCHAPMAN @ SSCVX1
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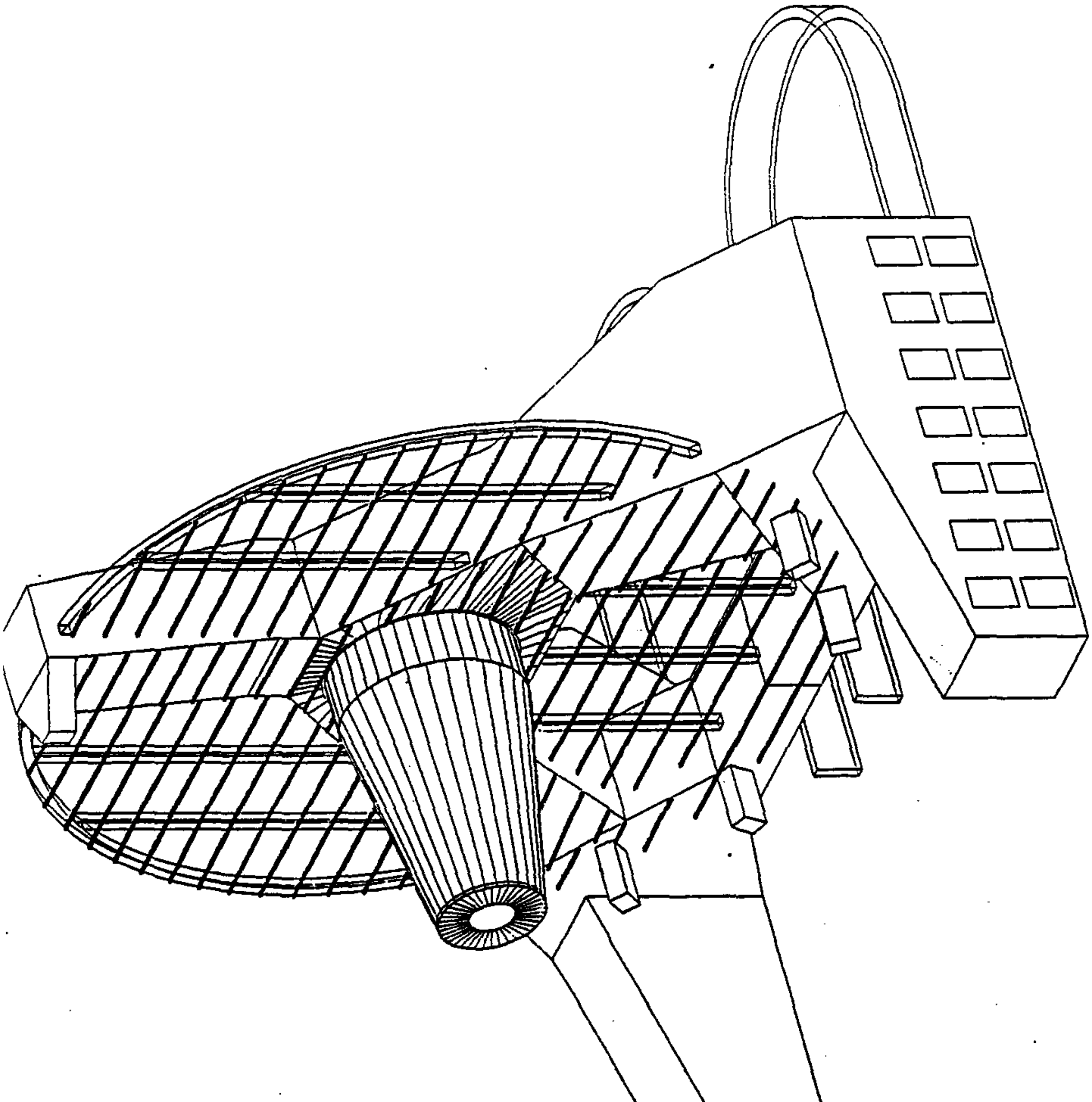
Barry Barish	Caltech	BARISH@SSCVX1
Sol Shapiro	SSCL	

Muon, Magnet and Calorimeter Interface Mtg.
Presented By

Joel Bowers
LLNL



gem

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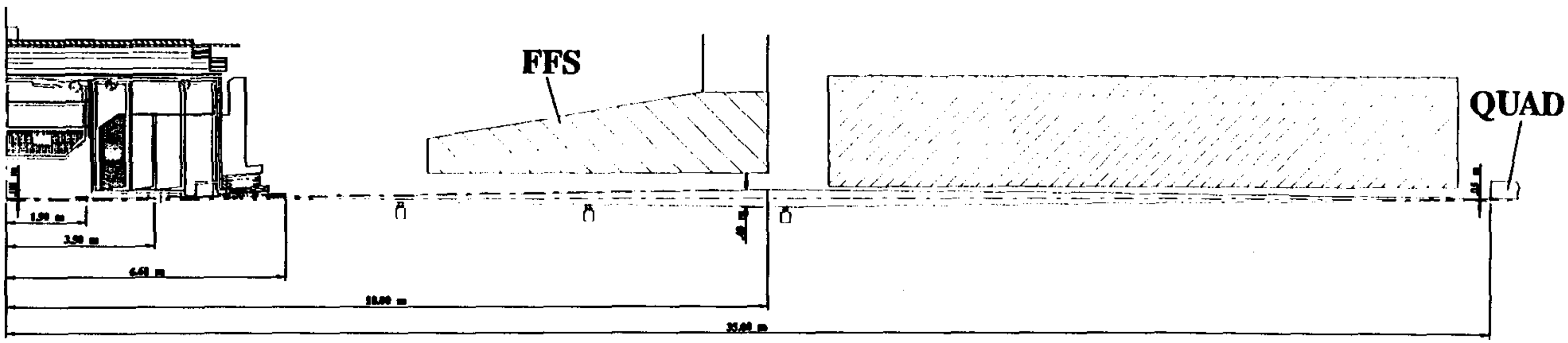
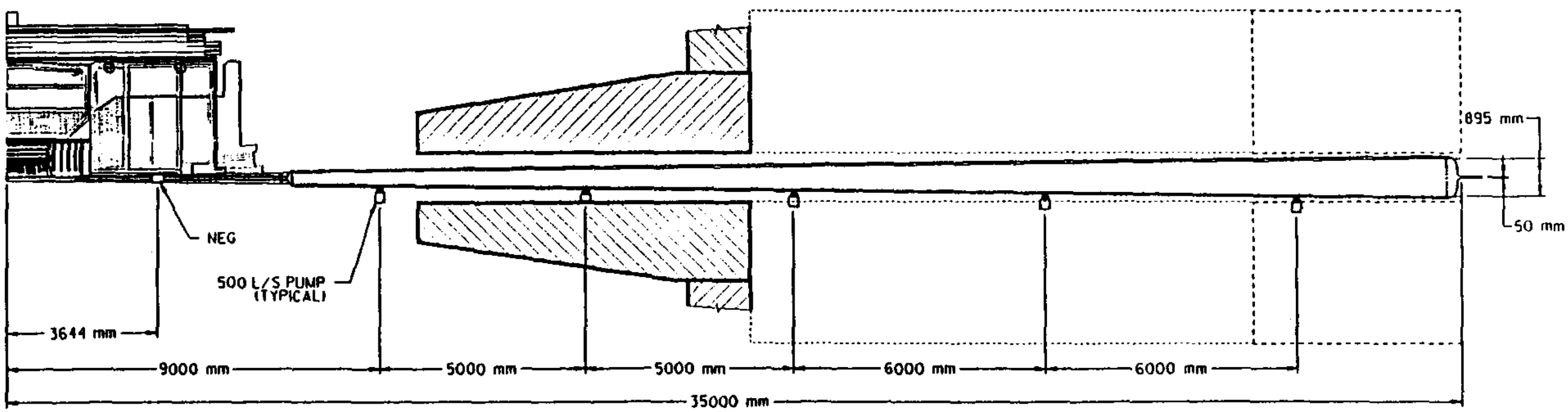
Muon, Magnet and Calorimeter Interface Mtg.
Presented By

Gerry Chapman
SSCL

BEAMLINE LAYOUT

OPTION 3

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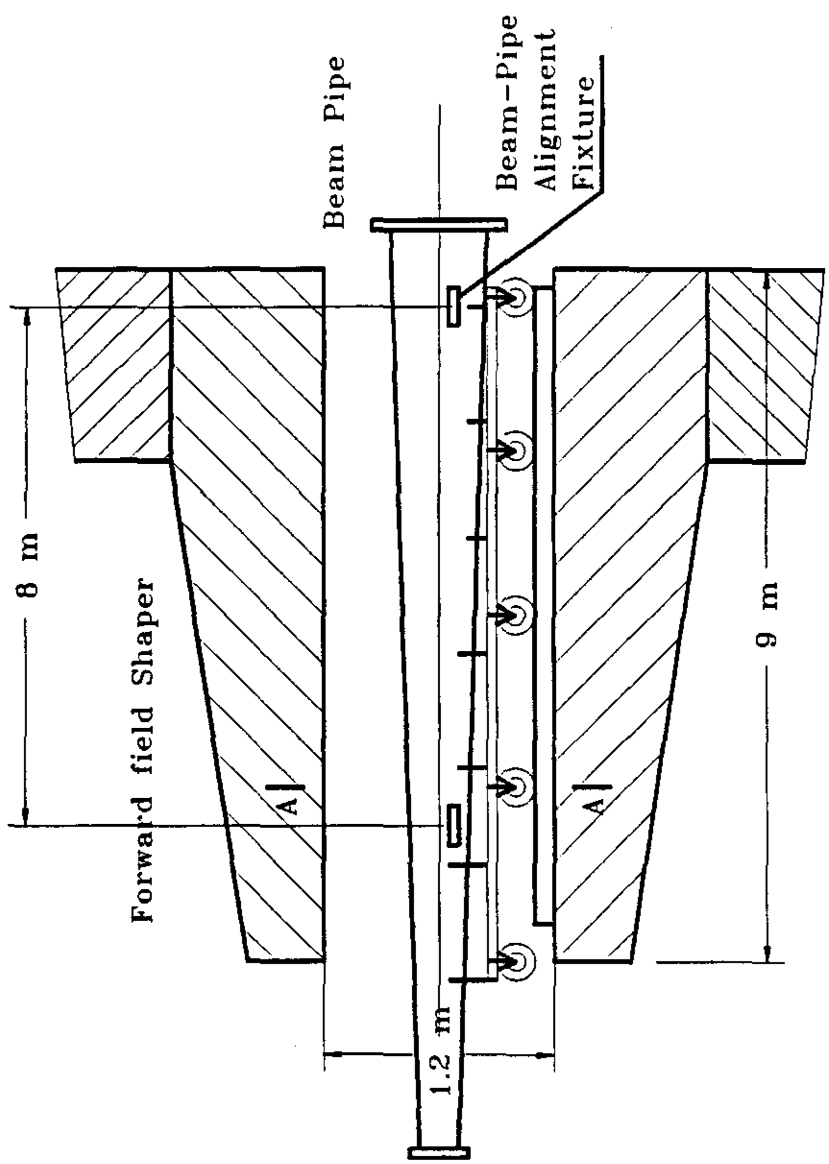
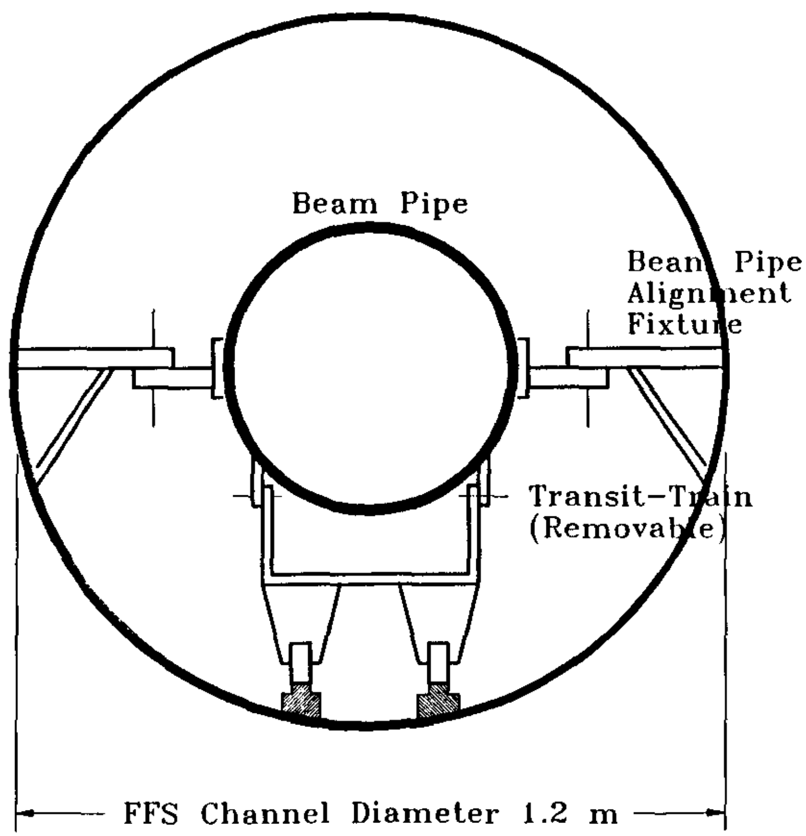
NEG
500 L/S PUMP (TYPICAL)
3644 mm
9000 mm
5000 mm
5000 mm
6000 mm
6000 mm
35000 mm

OPTION 4



FFS Beam Pipe Support: Train Mode


Beam Pipe
Beam Pipe
Alignment
Fixture
Transit-Train
(Removable)
FFS Channel Diameter 1.2 m

A-A Section

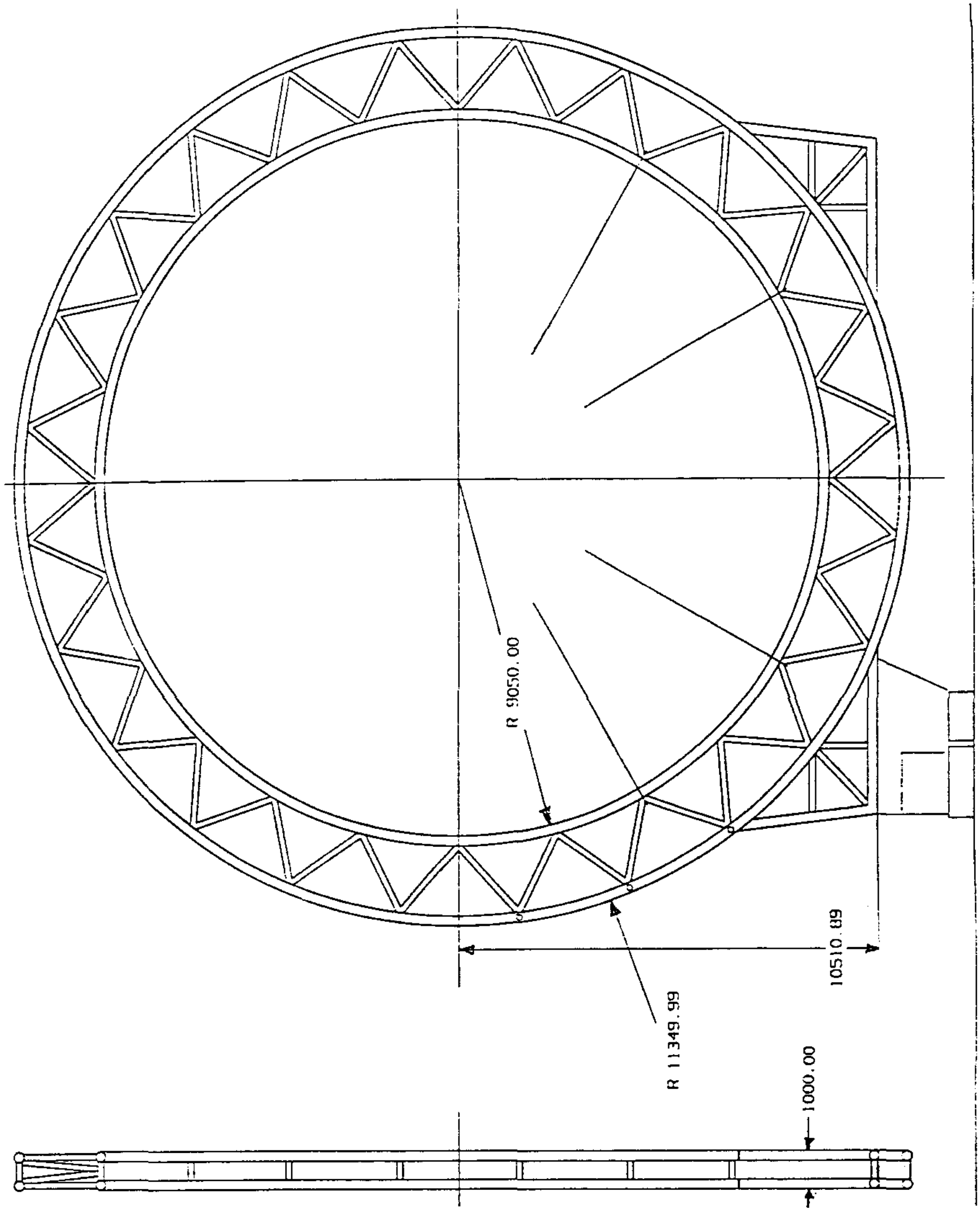
Muon, Magnet and Calorimeter Interface Mtg.
Presented By

Frank Nimblett
Draper Laboratory

GEM MUON SYSTEM
AND
MAGNET / FFS INTERFACES

PRESENTED AT SSCL

FRANK NIMBLETT
DRAPER LAB.
08 JANUARY 1993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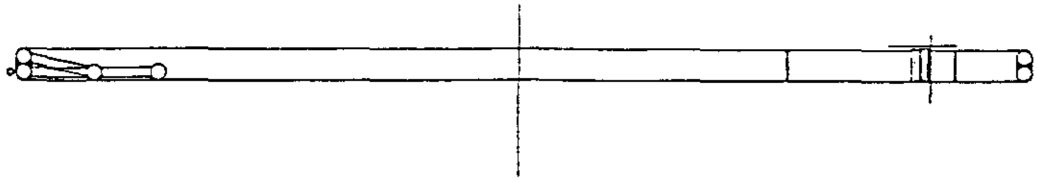

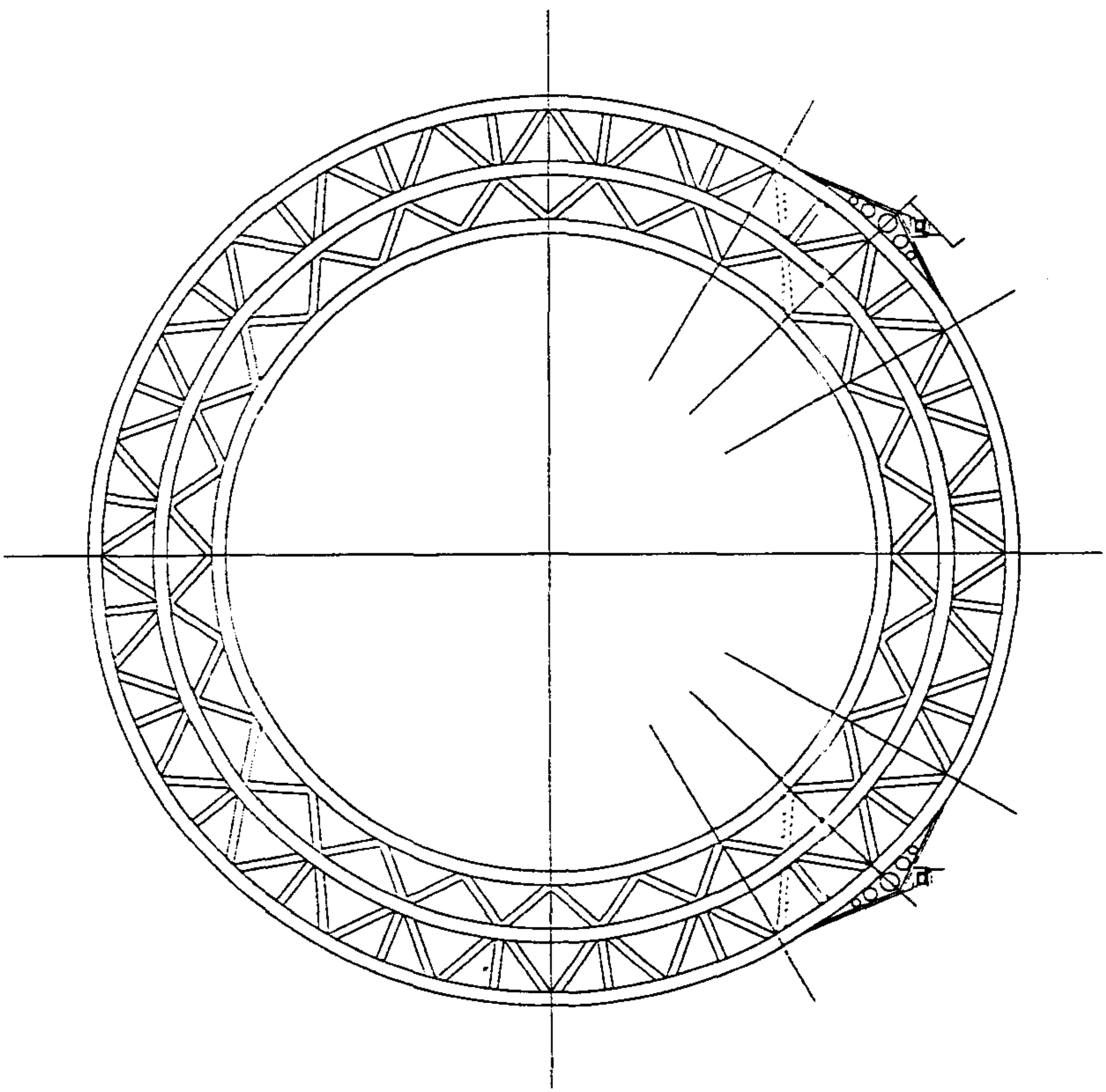

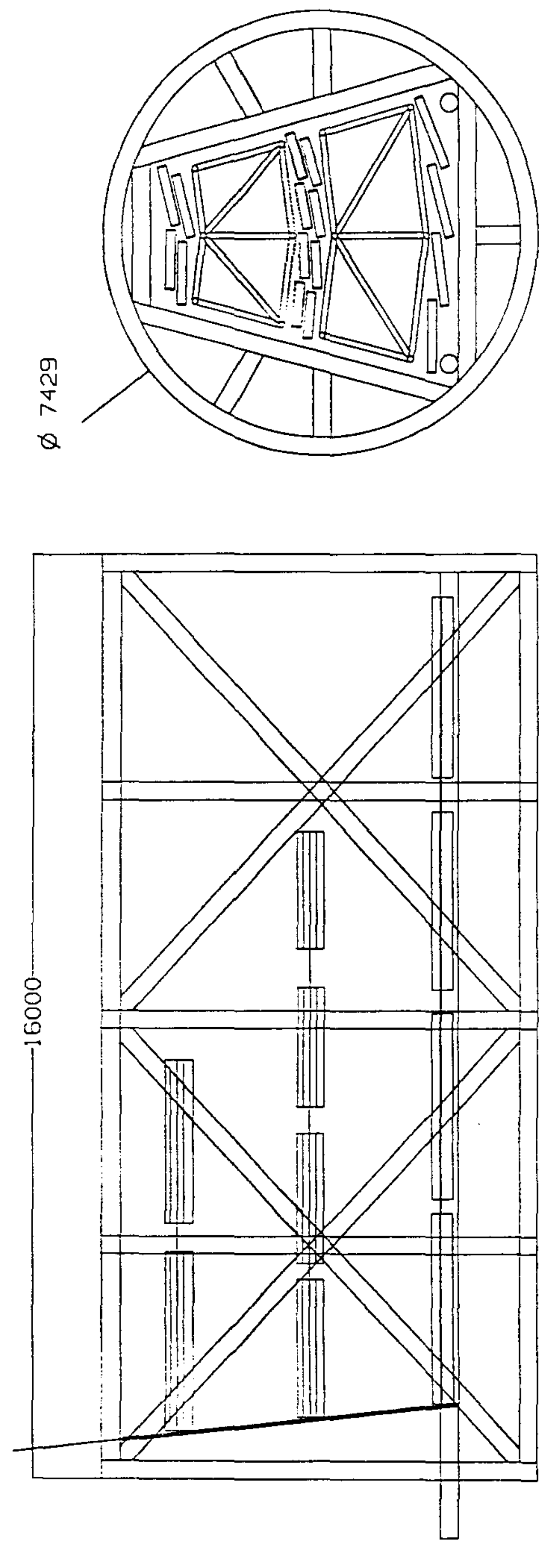
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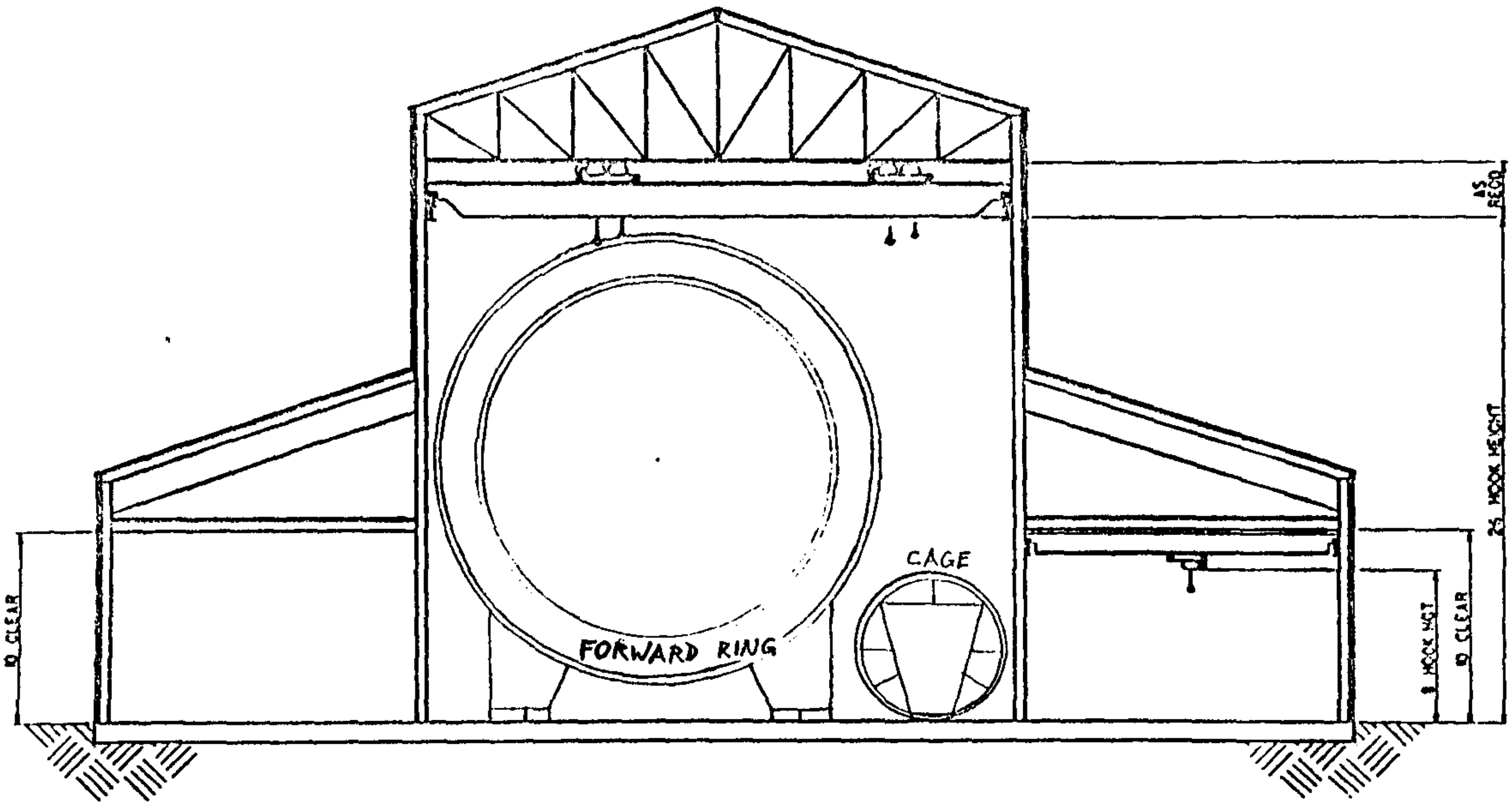
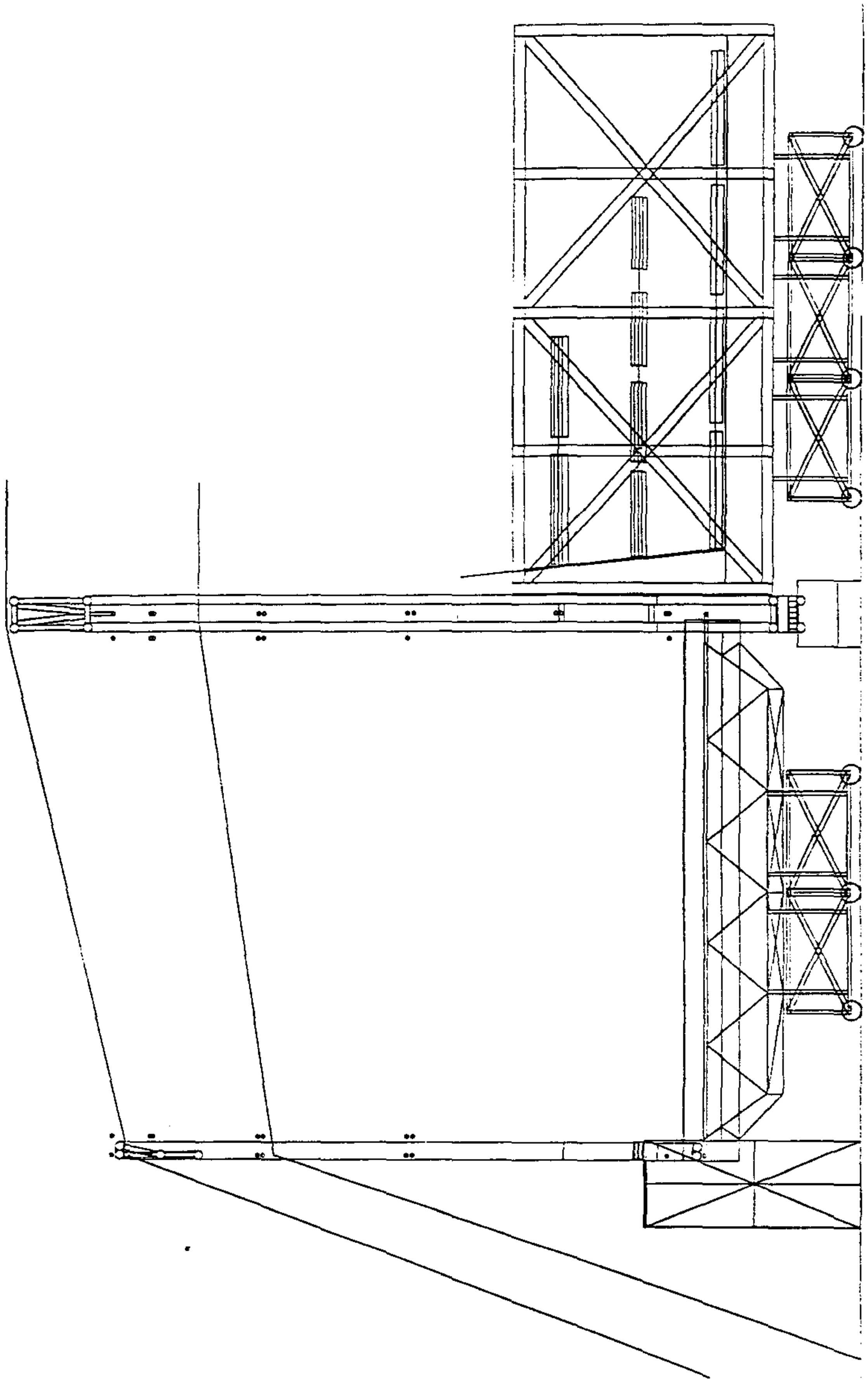
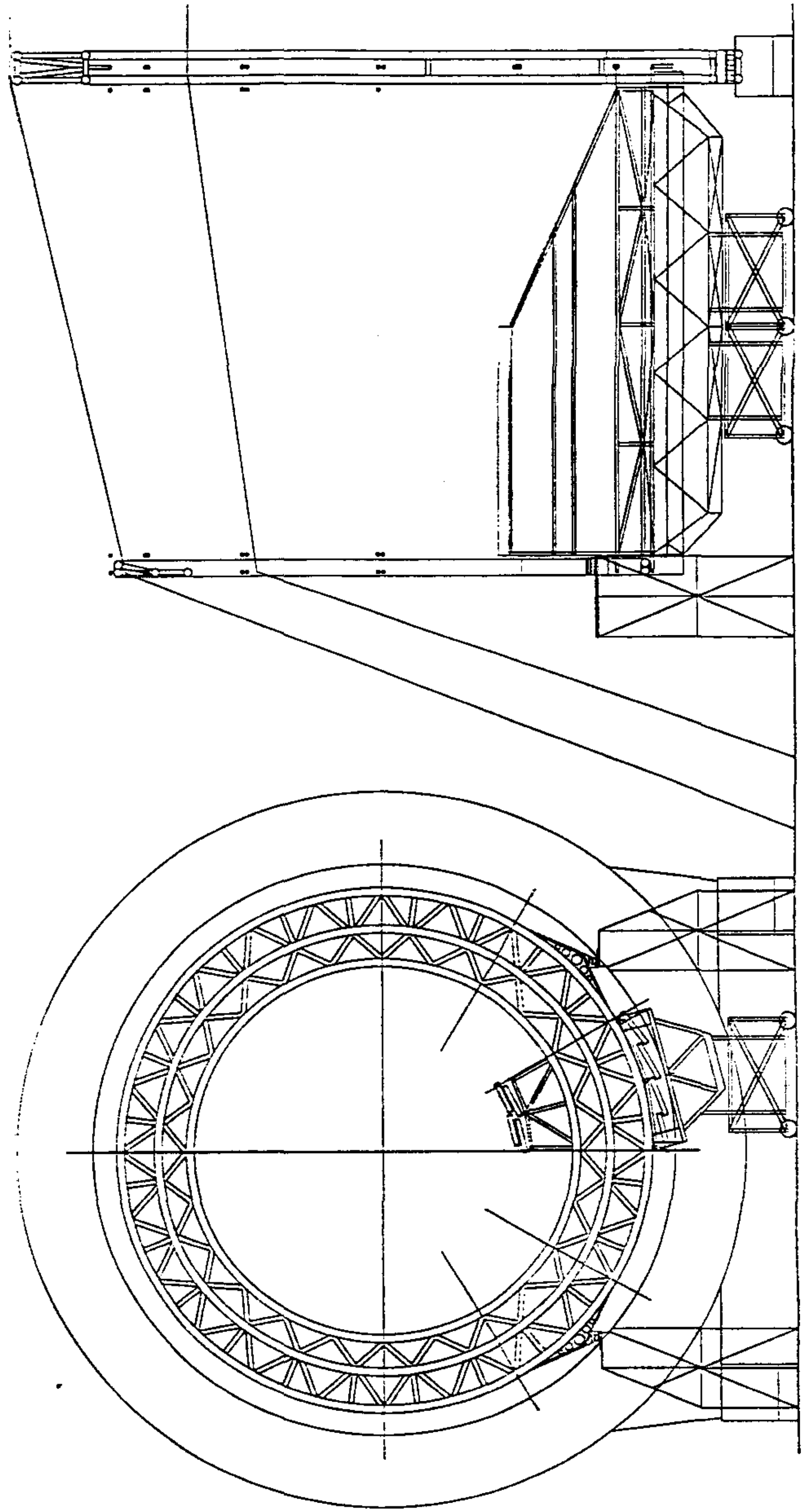


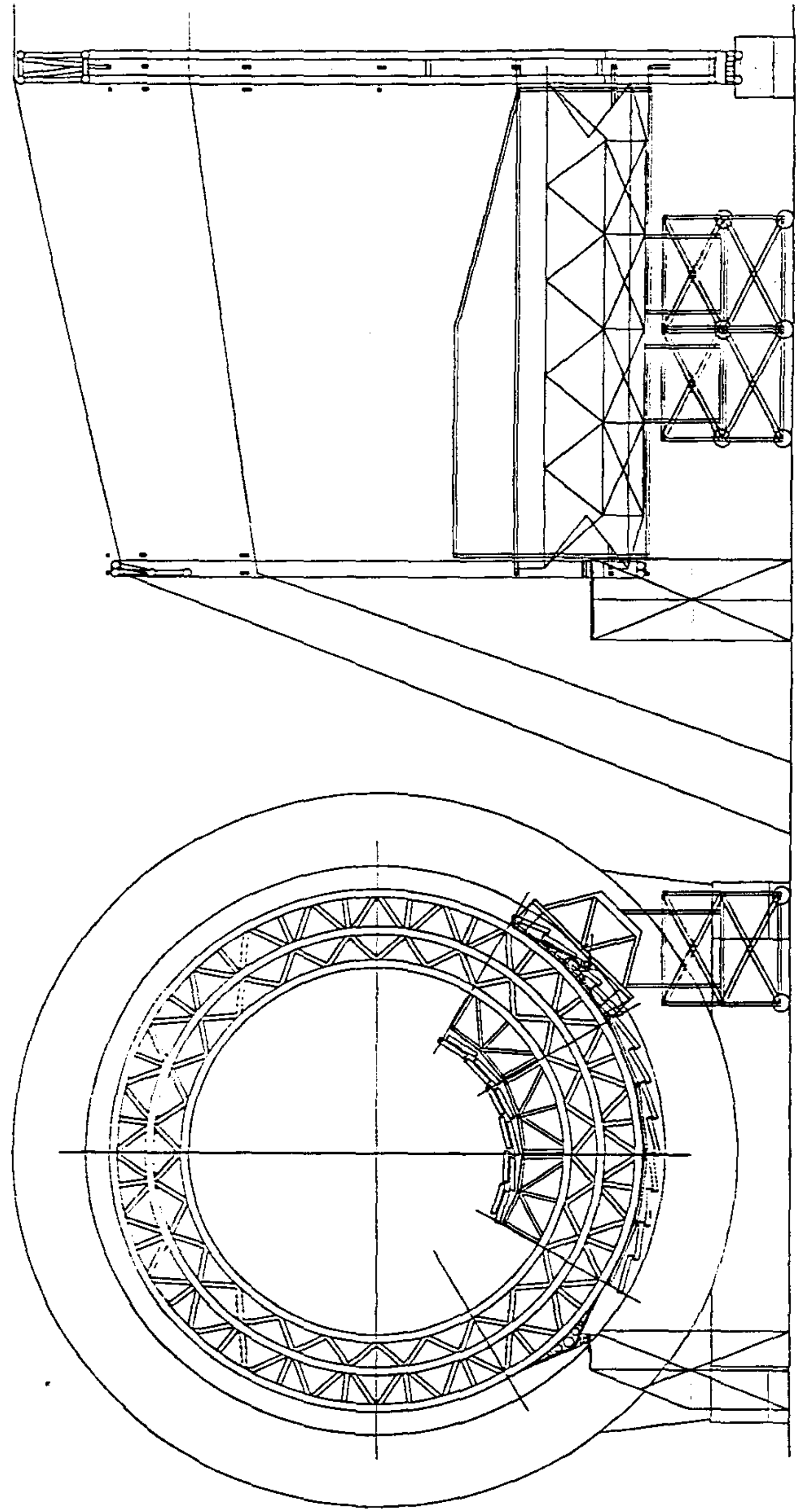
SECTION A-A

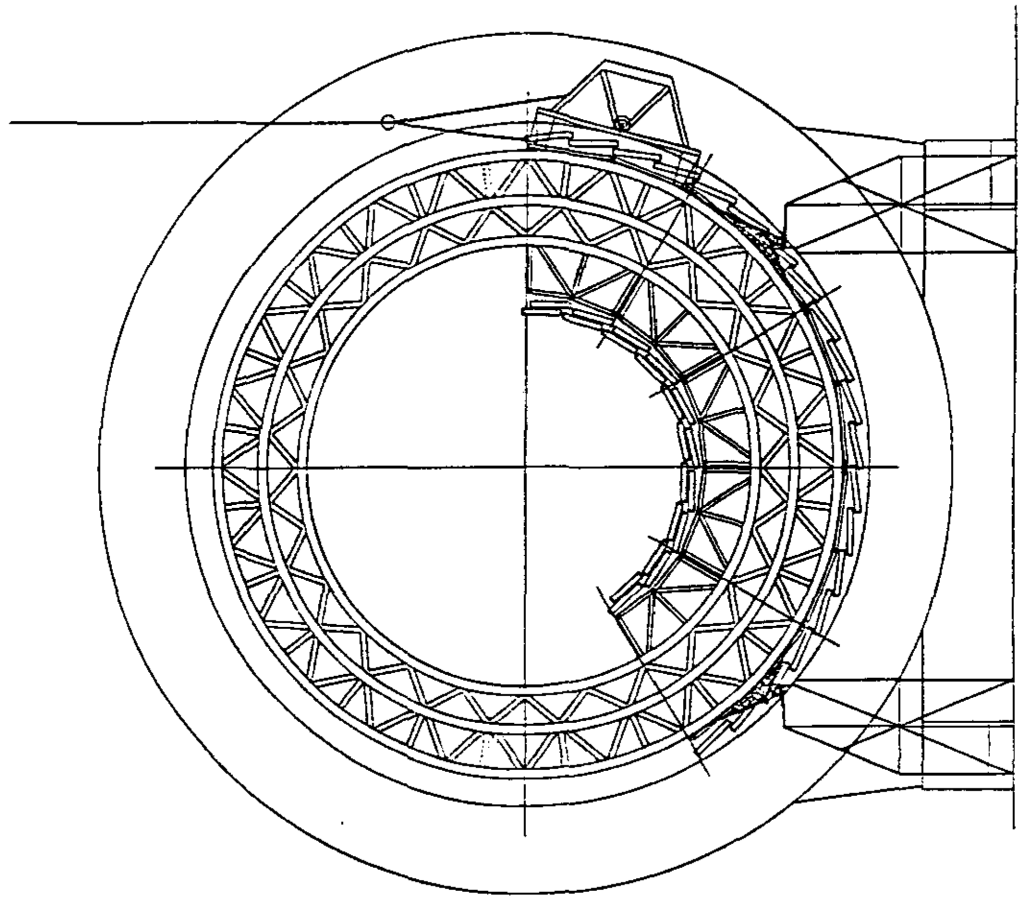
gcd000134b
REF: gcd000241
11-12-92
H HAZLETT

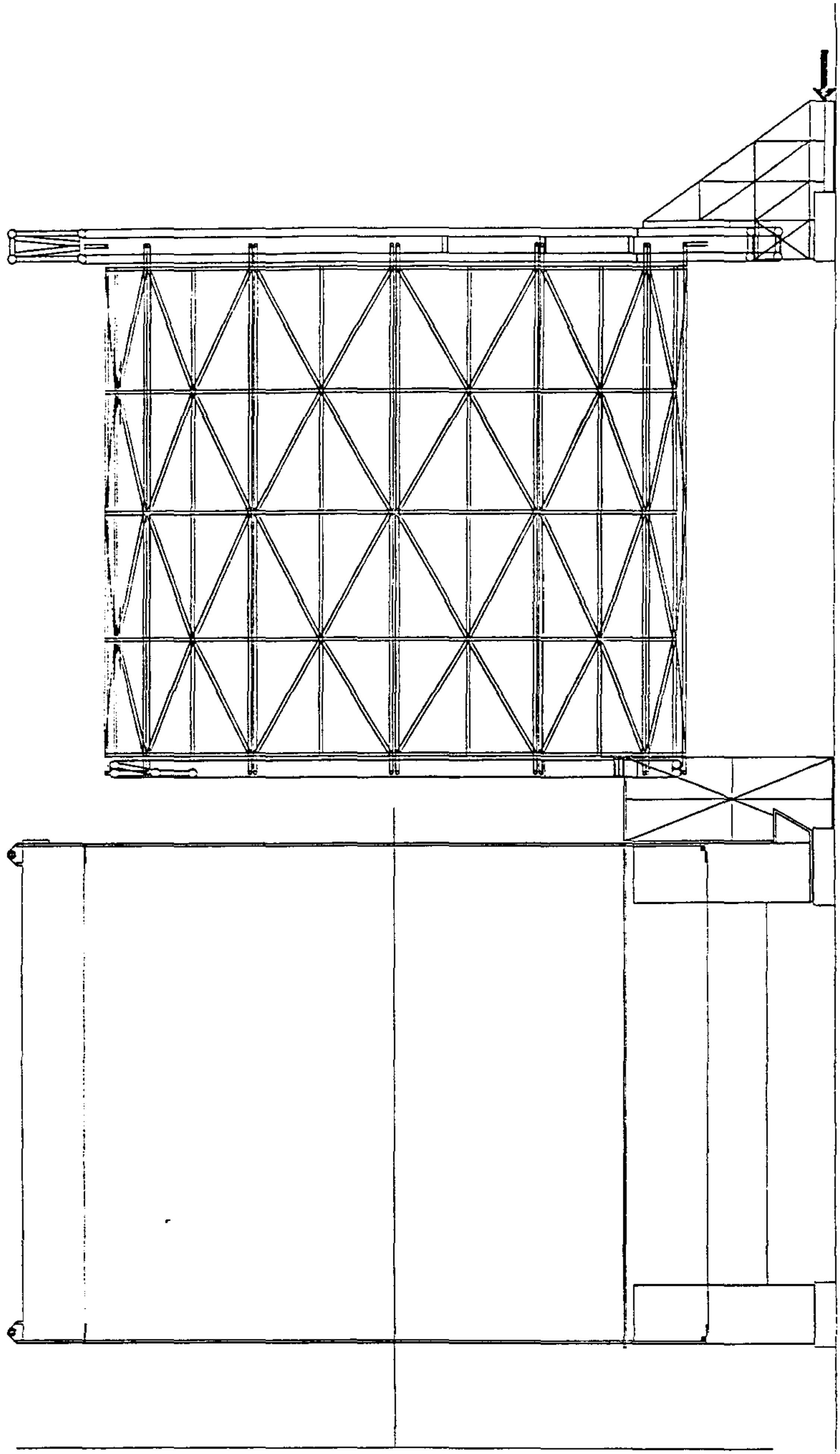
North Assembly Building Section

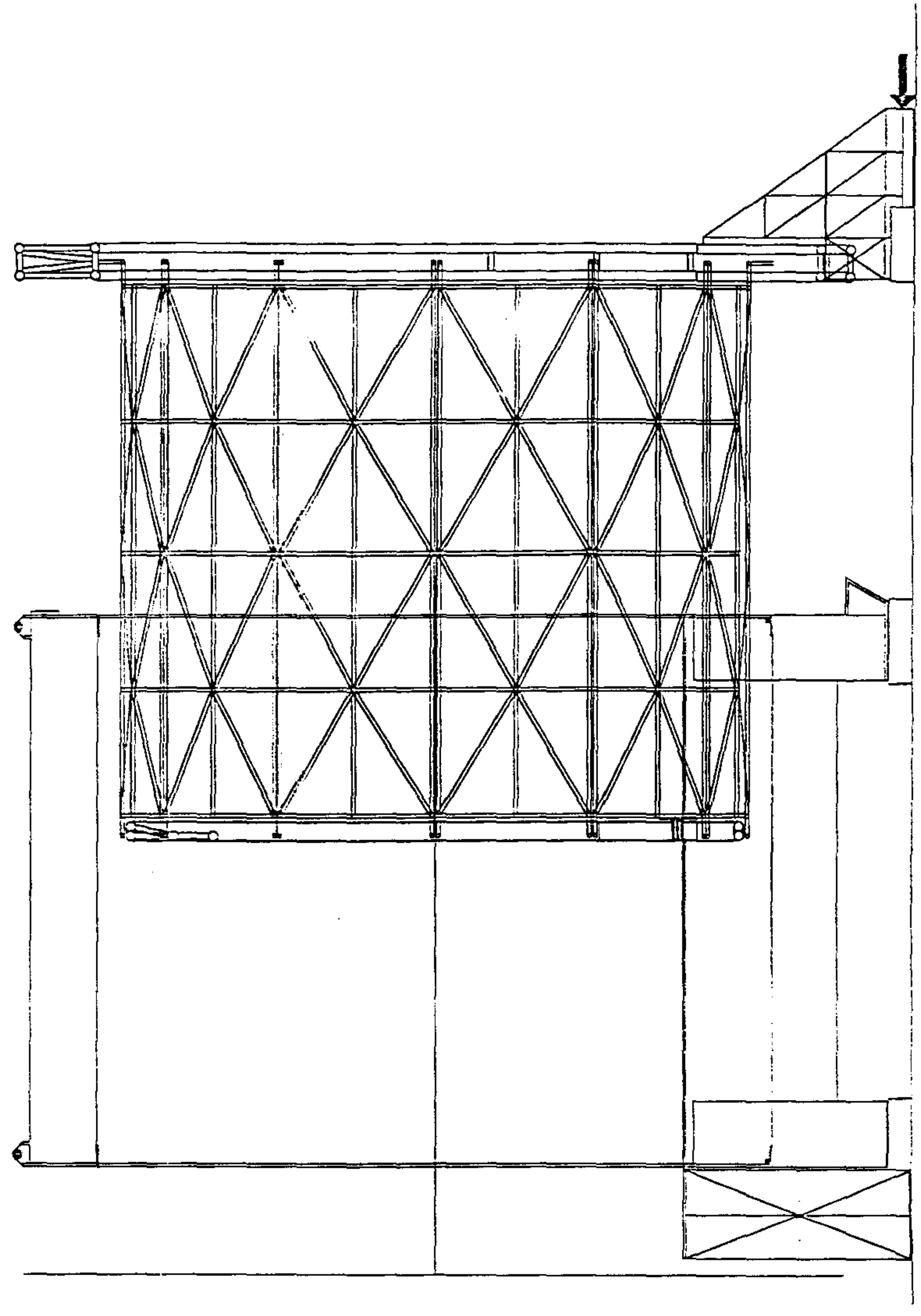


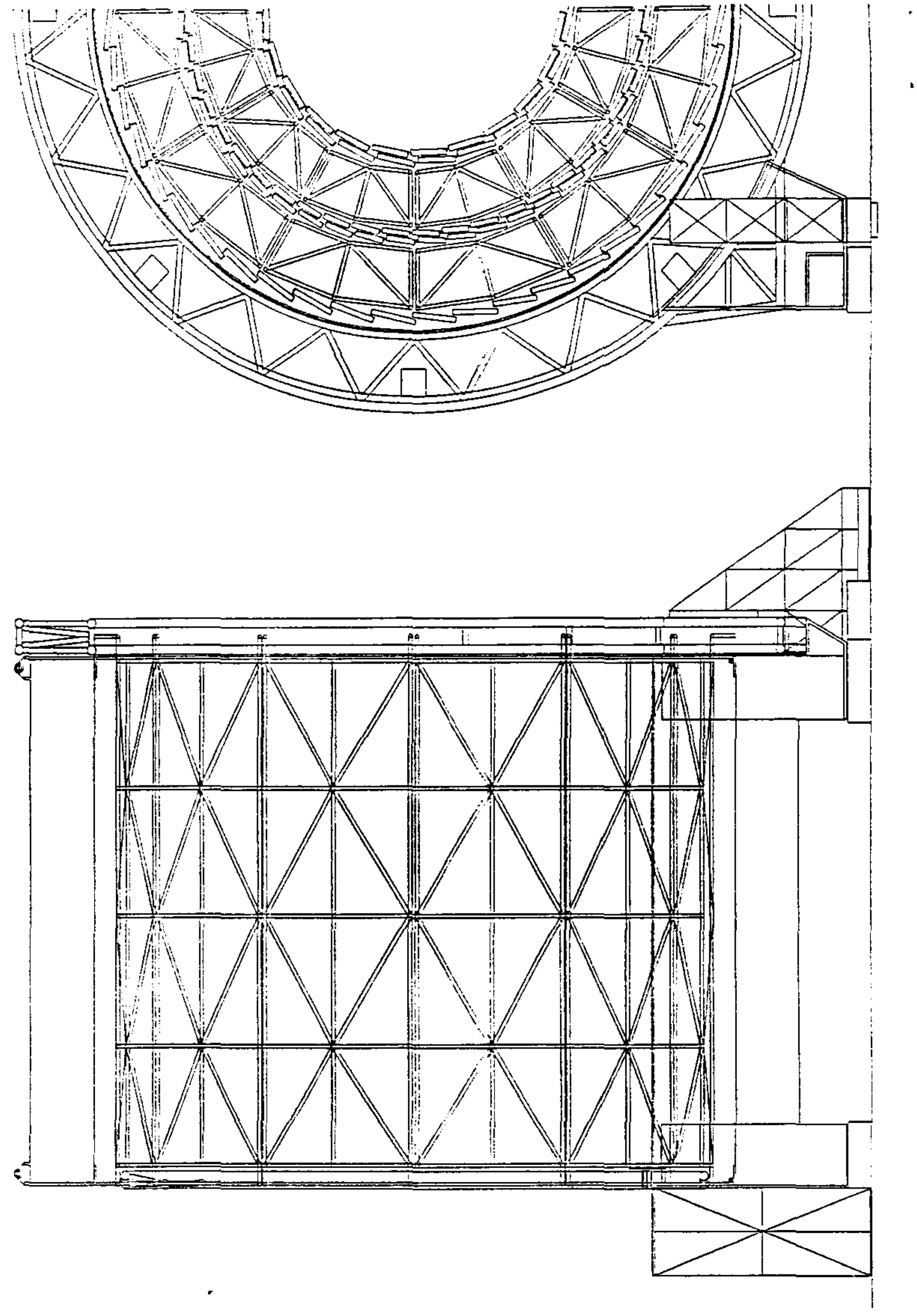


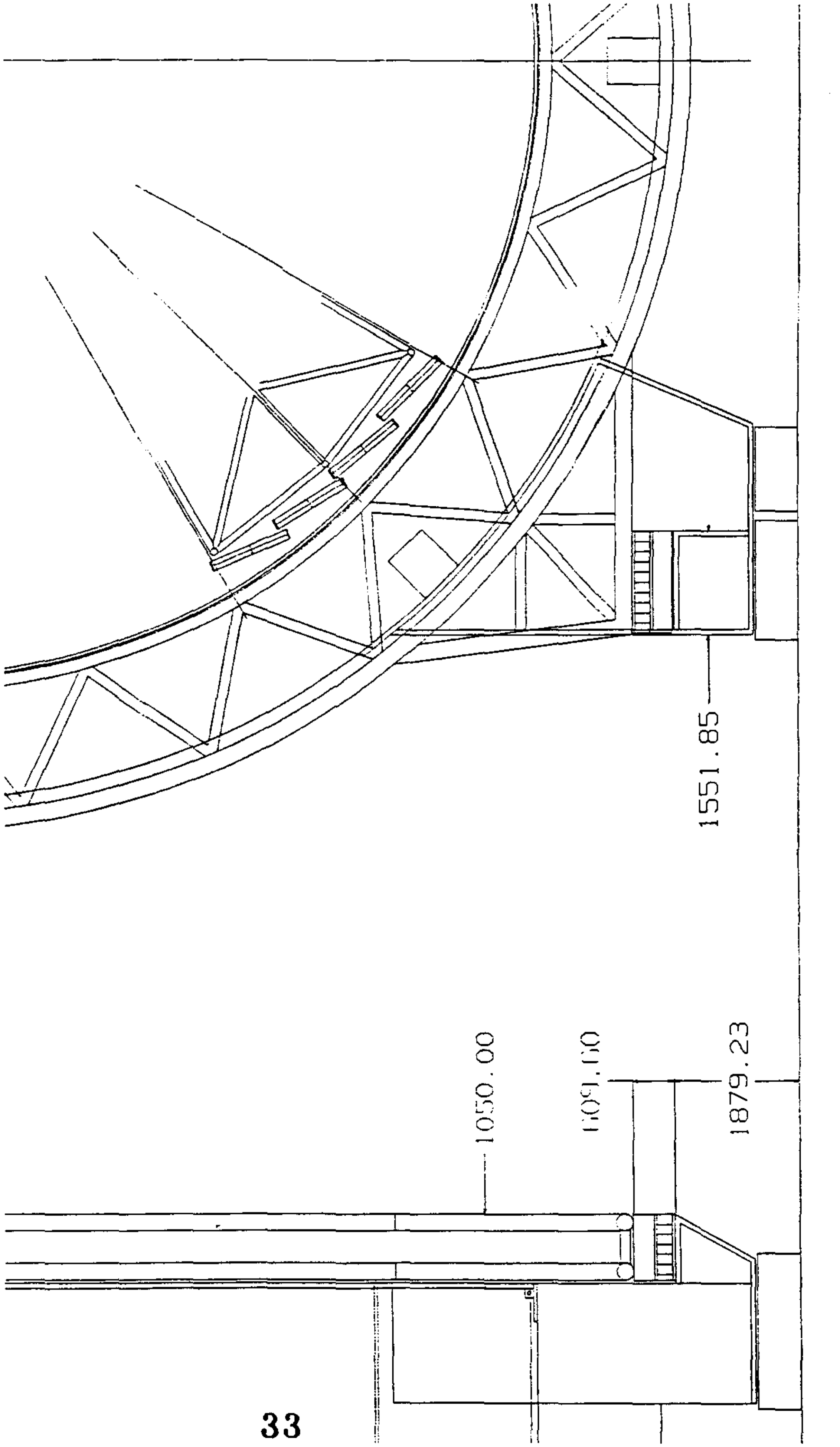








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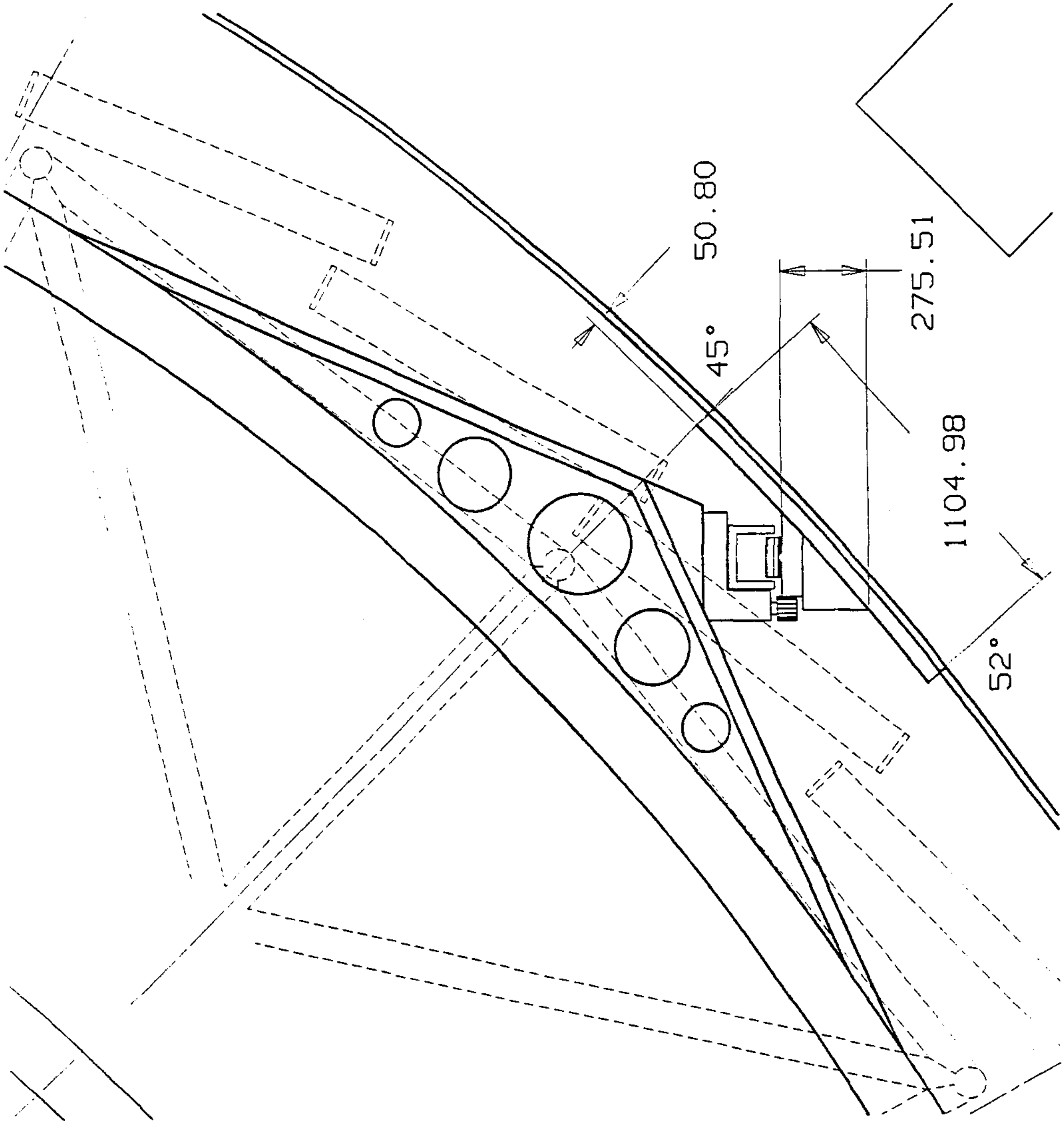

50.80
275.51
45°
1104.98
52°

BARREL SUPPORT RING ANALYSIS

CSC CHAMBER WEIGHTS

G.E.M. 07 Jan. 1993

- Total weight for twelve (12) modules ≈ 2.00E5 lbs. (8.86E5 N)
- Chamber configuration 4,4,2
  - single layer outer chambers
  - double layer mid and inner chambers
- Chamber weights determined from characteristics given by C. Johnson
  - panel depth ≈ 1.0 in (25.4 mm)
  - edge thickness ≈ 0.5 in (12.7 mm)
  - edge area density ≈ 2.87 gm/cm^2
  - G-10 area density ≈ 0.297 gm/cm^2

CDS & FFS END RING DESIGNS

G.E.M. 07 Jan. 1993

- Barrel structure revised from 16 modules to 12 modules
  - modules rotated 15° from vertical
  - separation of 76 mm between sectors
  - for support ring design purposes only the 2,3,3 chambers/layer configuration used
    - total chamber weight 2.11E5 lbs.
- FFS support ring design
  - ring dimensions are 18.1 m ID and 22.6 m OD
  - clearance of 100 mm minimum between compression pad and ring OD
  - support reactions centered on midplane of ring ID
  - total ring weight 4.98E4 lbs.
  - maximum deflection 7.4 mm

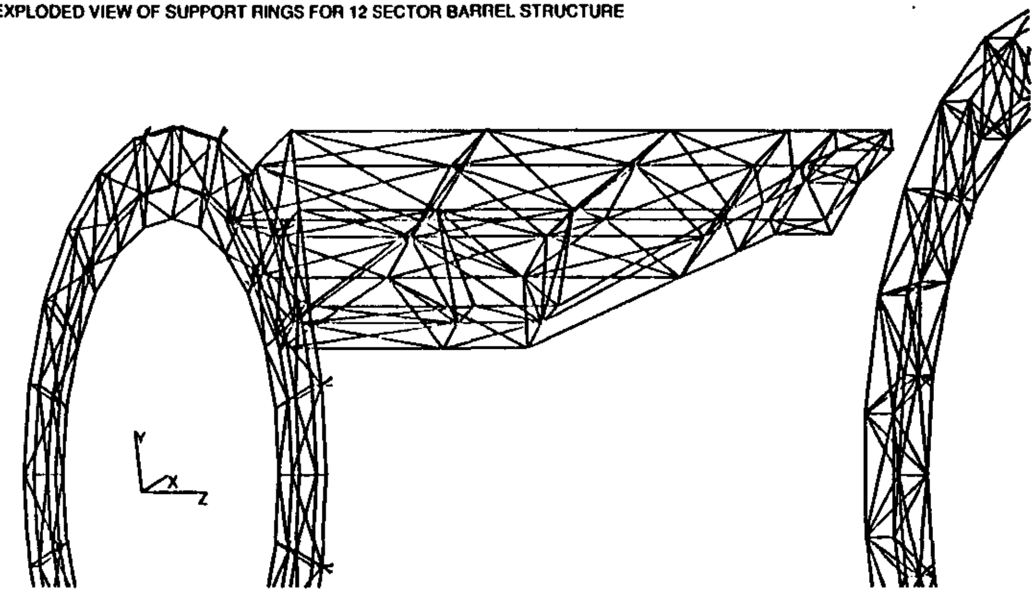
CDS & FFS END RING DESIGNS (CONT.)

- CDS support ring design
  - planar ring design requires added stiffness
    - barrel assembly loads applied eccentrically
    - lateral loading during insertion of assembly into magnet
    - option: additonal support ring within barrel modules
    - option: revise design with stiffened ID and OD
  - several attachment points to each barrel module for added stiffness
  - current ring design:
    - revised design with stiffened ID and OD
    - total ring weight 2.79E4 lbs.
    - ring buckling safety factor of 2.3 for vertical loading
    - improved design presently being implemented

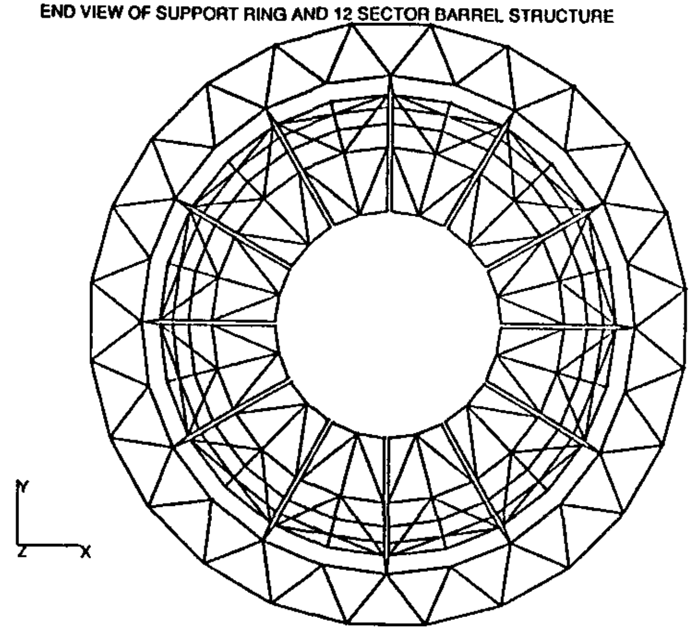
CURRENT RING DESIGN

G.E.M. 07 Jan. 1993

EXPLODED VIEW OF SUPPORT RINGS FOR 12 SECTOR BARREL STRUCTURE



END VIEW OF SUPPORT RING AND 12 SECTOR BARREL STRUCTURE



DRAPER LABORATORY

NEAR TERM TASKS

G.E.M. 07 Jan. 1993

- Complete design of CDS support ring
- Redesign barrel sector structure
  - new 4,4,2 chamber layout
  - 12 sector configuration
  - revised chamber weights