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ATLAS Internal Note INDET-NO-014 - B

# **The ATLAS Silicon Inner Tracker and Vertex Detector: Design Considerations and Related Technologies**

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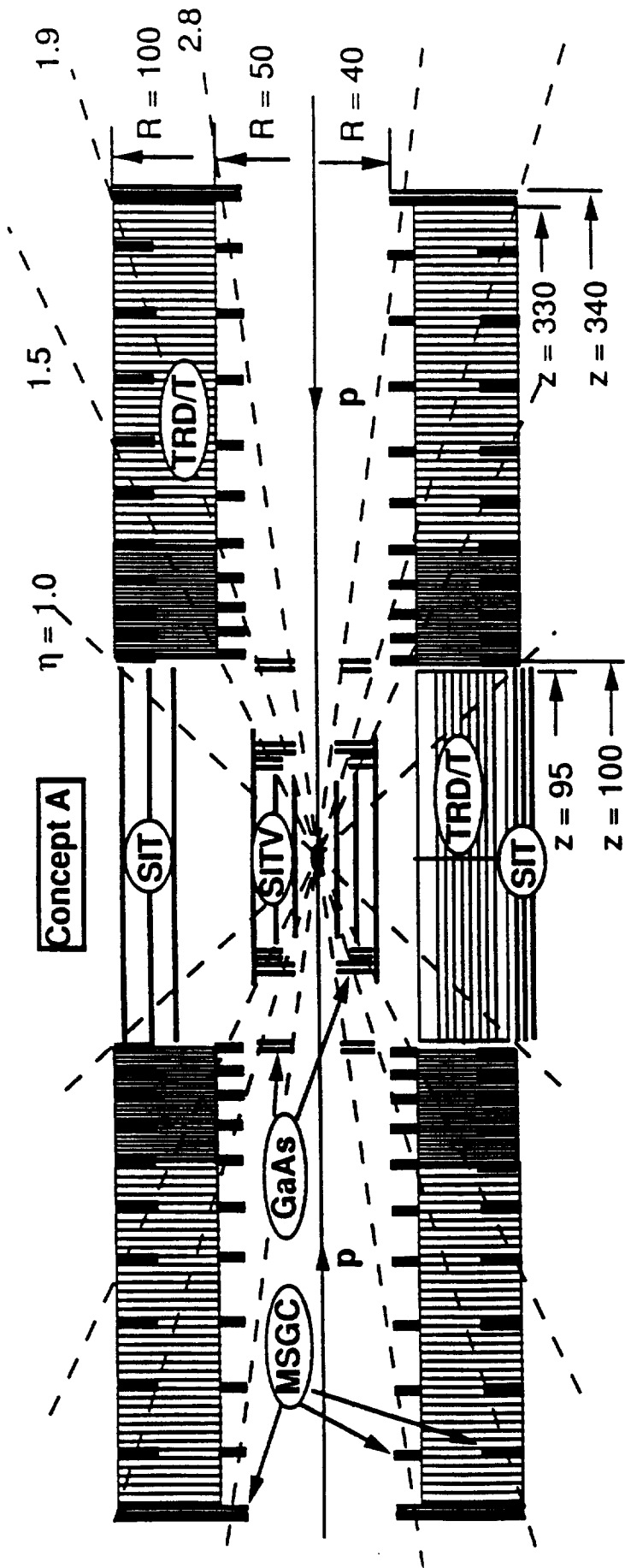
**RAL**

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This report describes the status of the Silicon Inner Tracker and Vertex Detector of the October 1 1992 ATLAS letter of intent. In this report, we review the detector and related technologies.



Concept A

Concept B

Fig (1)

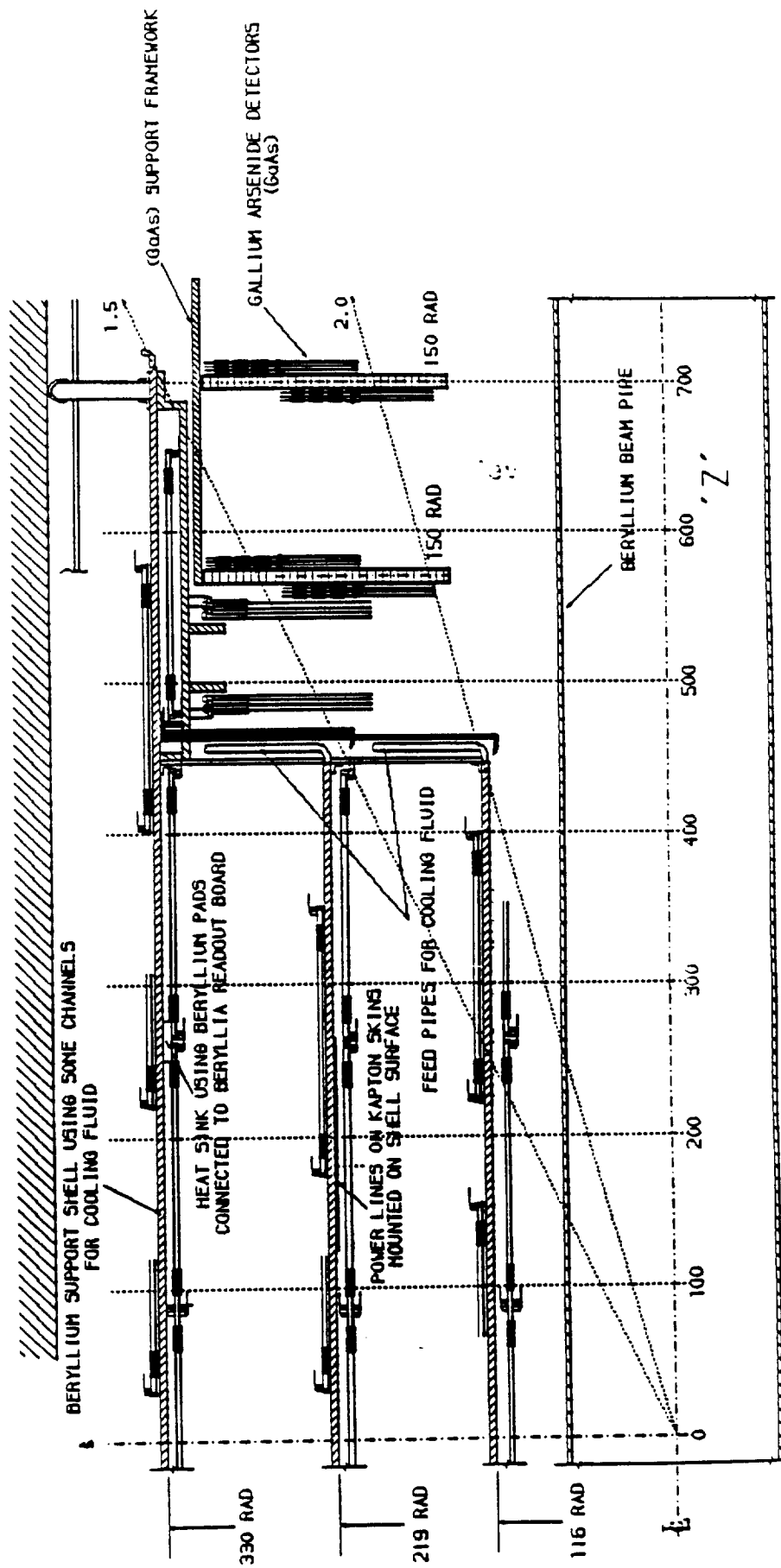
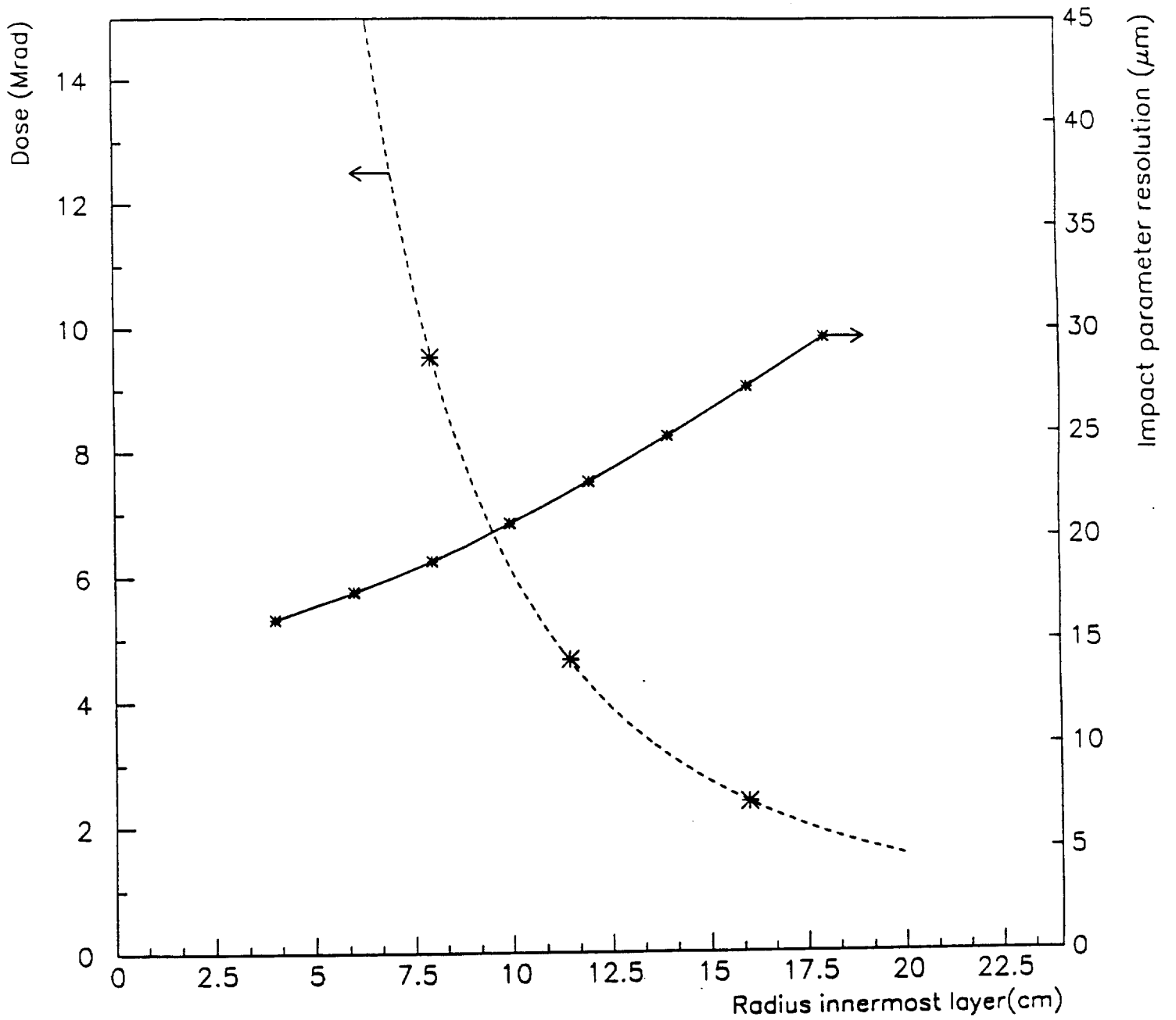
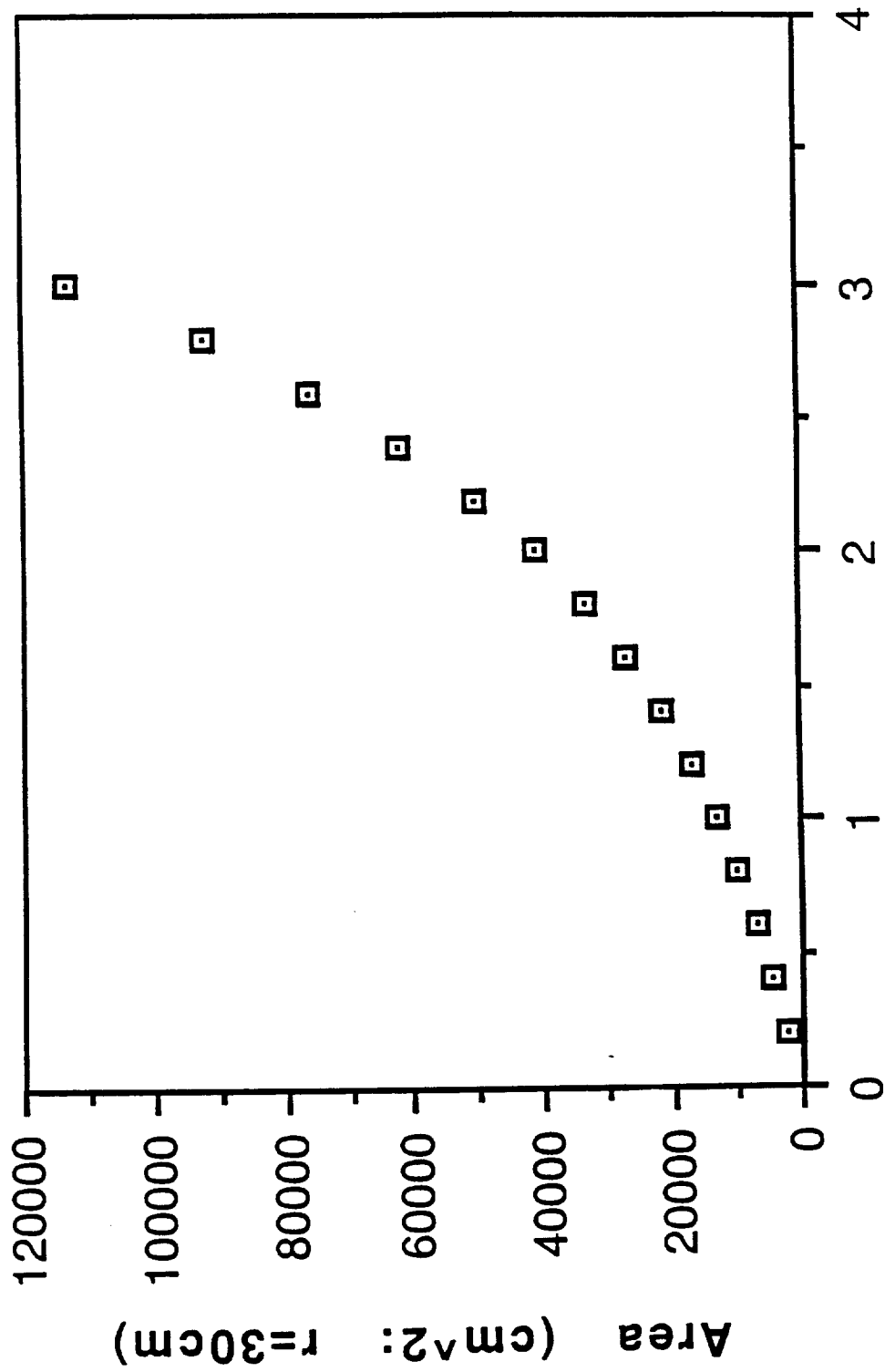


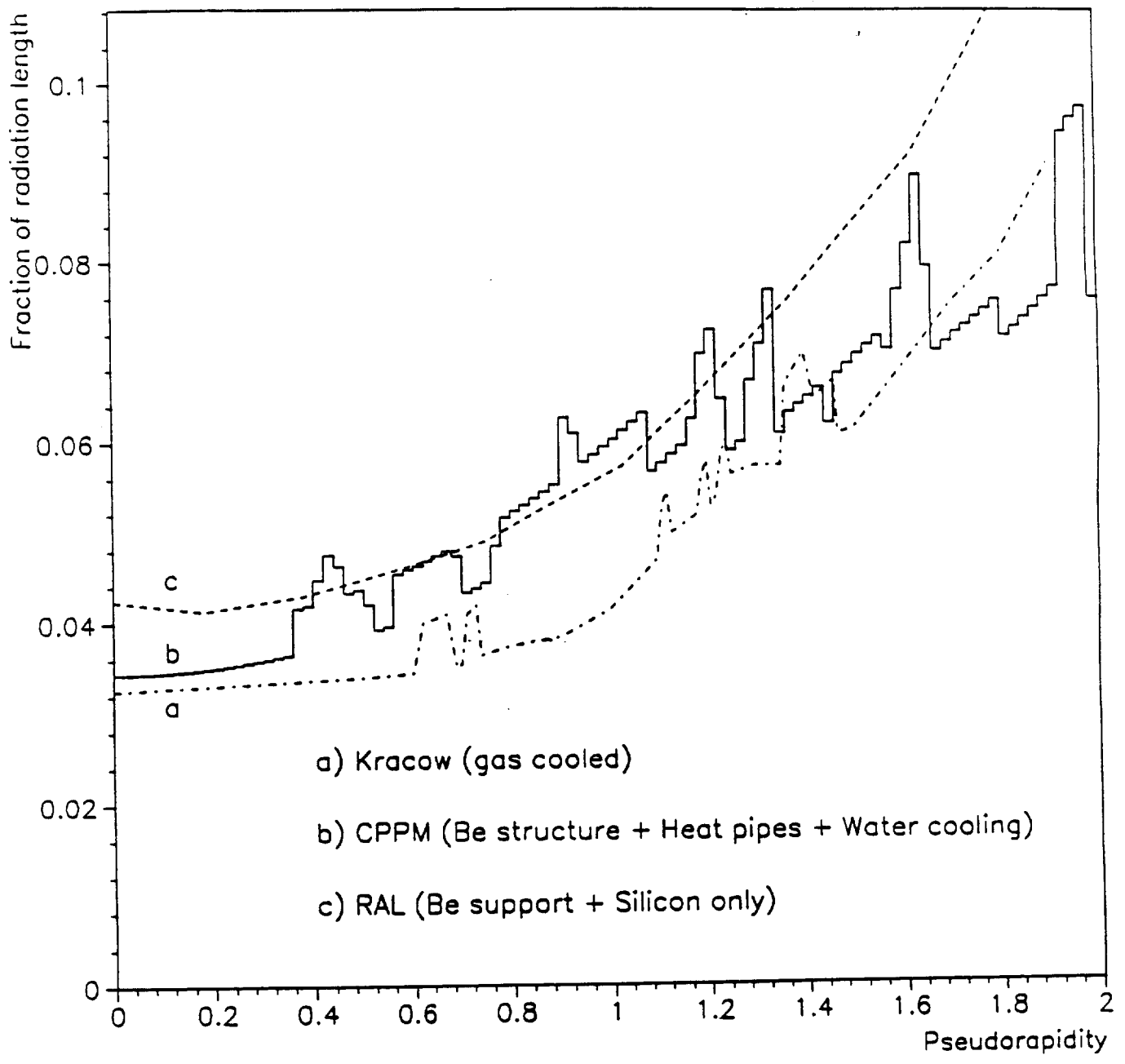
Fig (2)



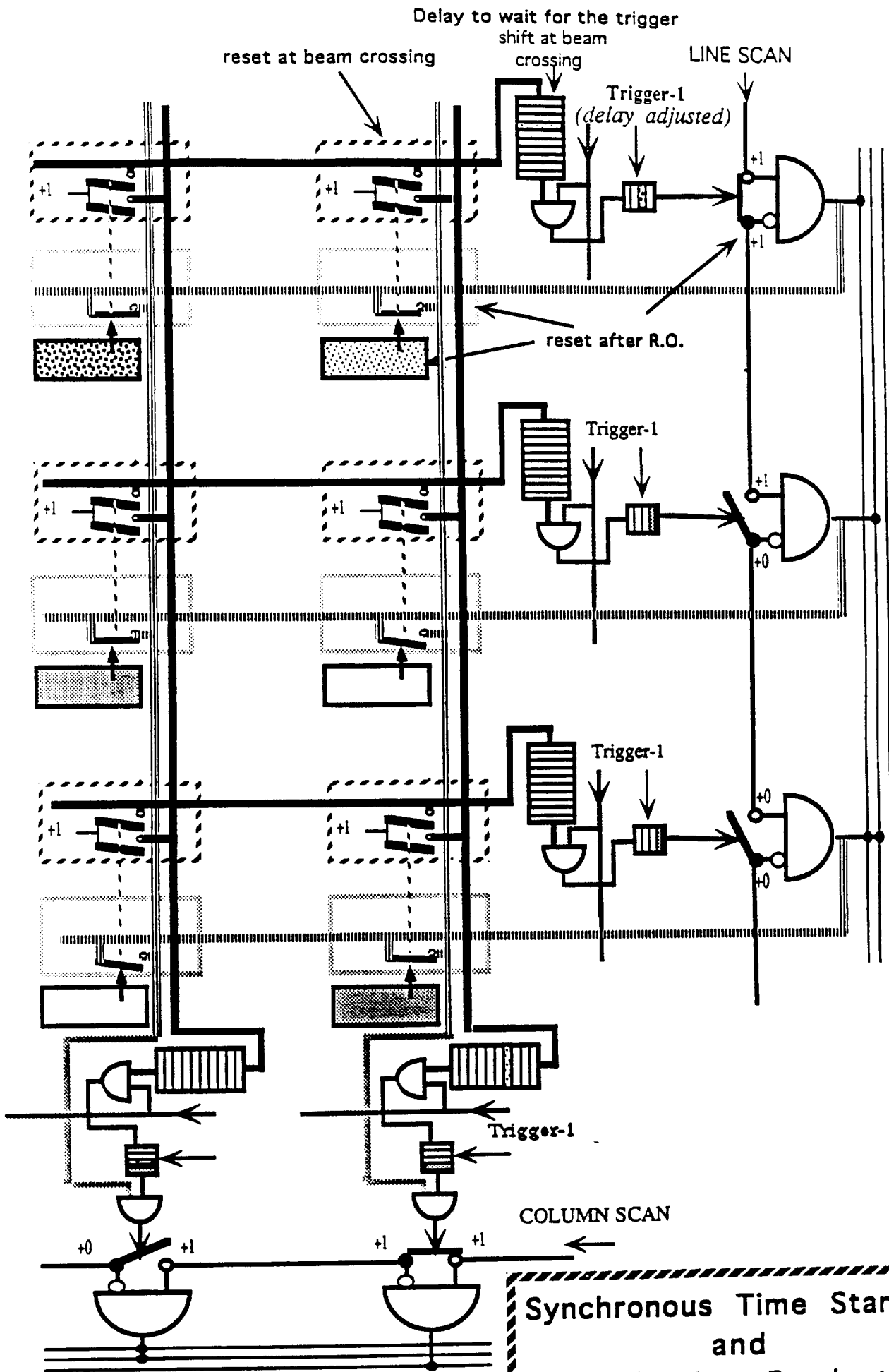
**Fig (3)**

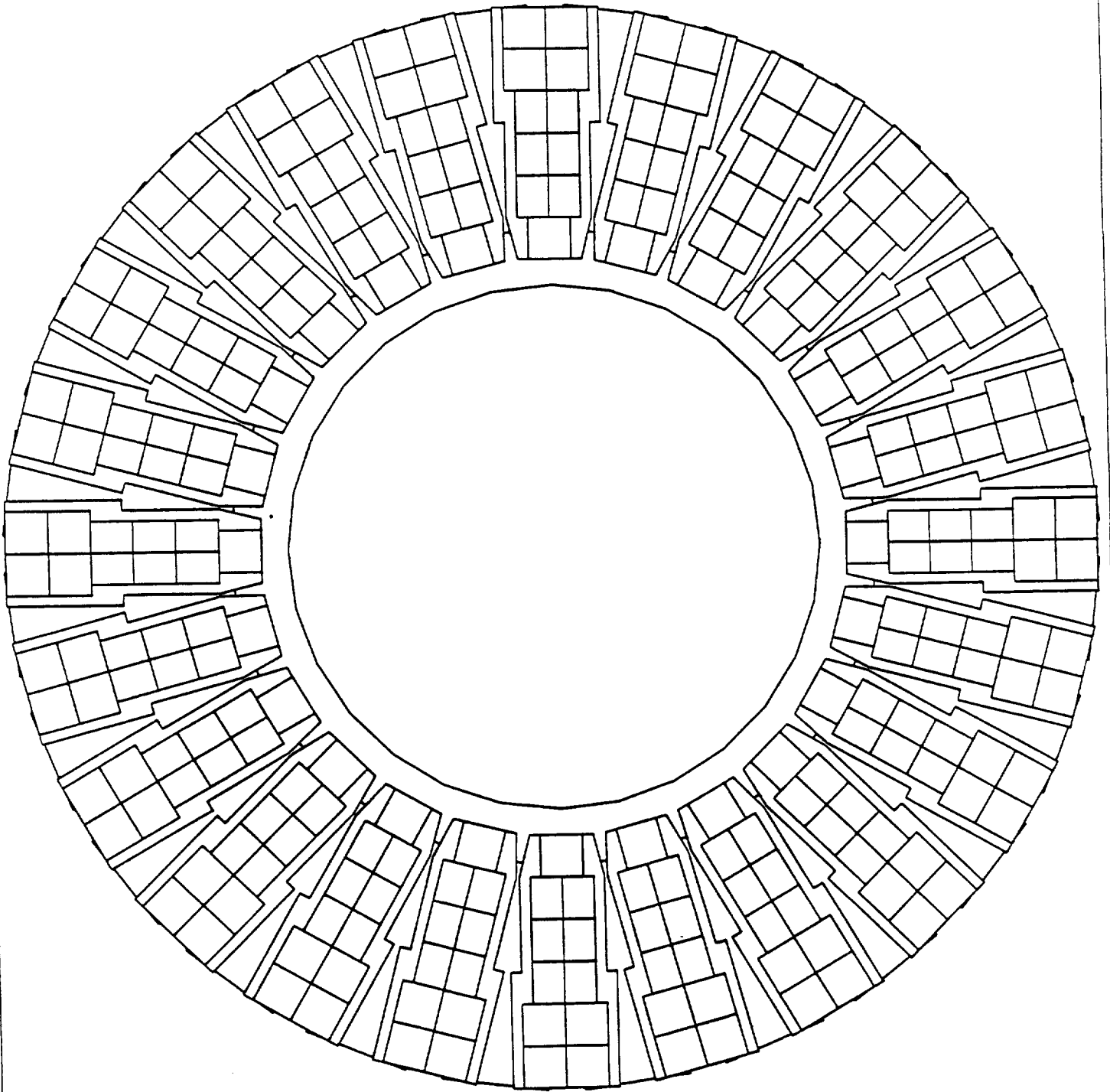


**Fig (4)**



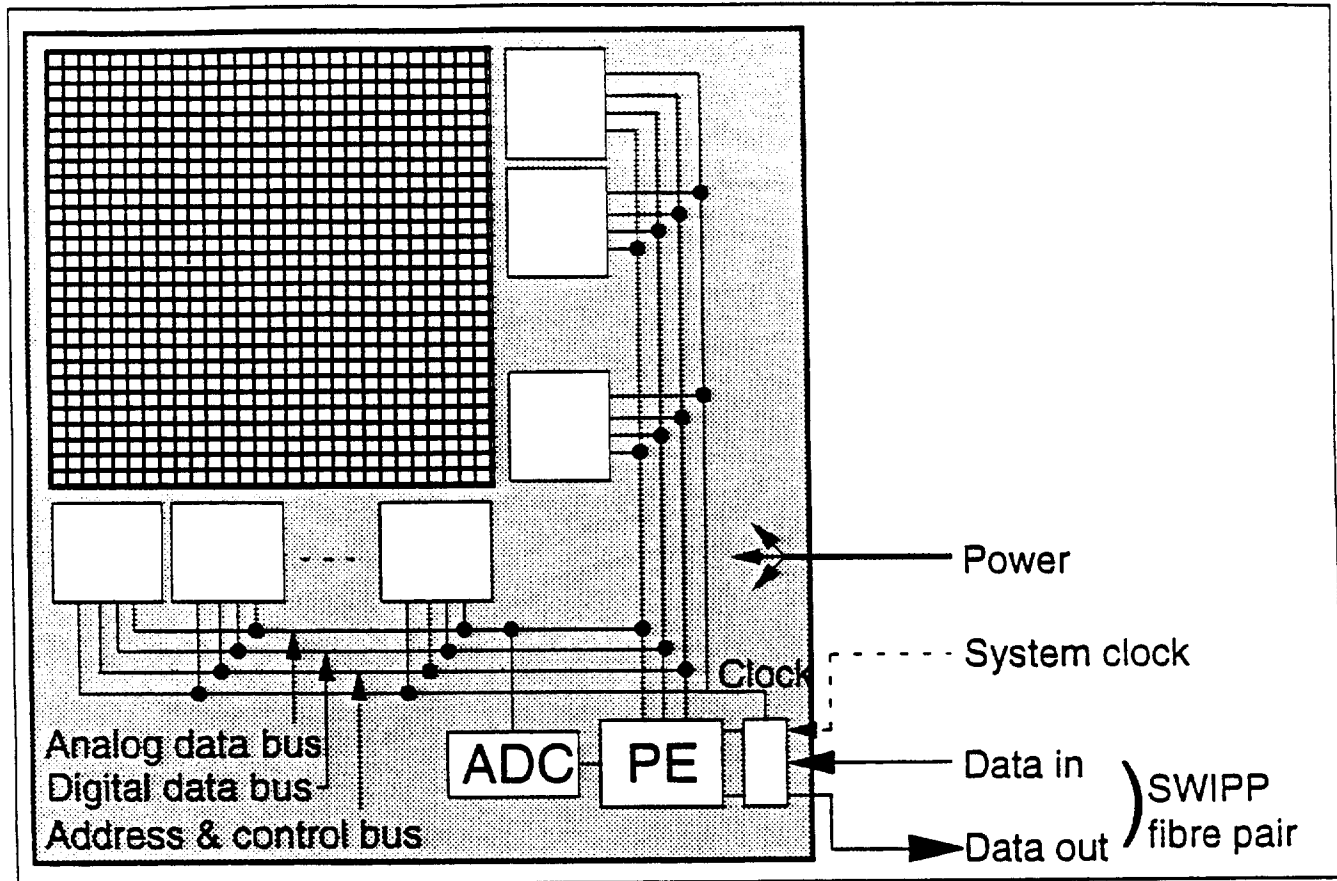
**Fig (5)**





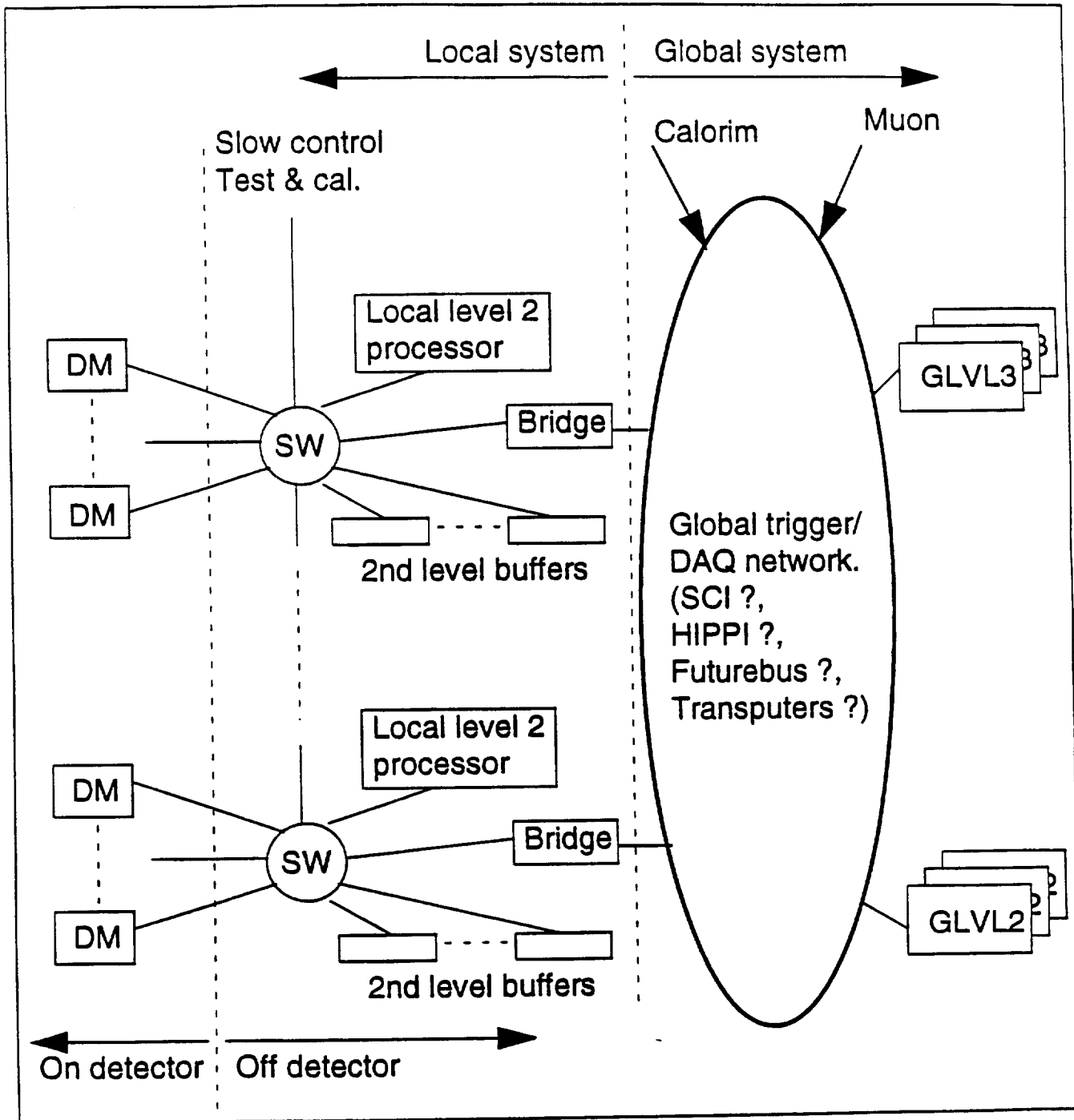
**Fig (7)**





- A minimum PE version included
- Simple protocol:
  - a flexible and unified frame for all kinds of messages in both directions
- Approx. 12 Mbyte/s event data readout rate
- Analog to digital conversion

**Fig (8)**



**Fig (9)**

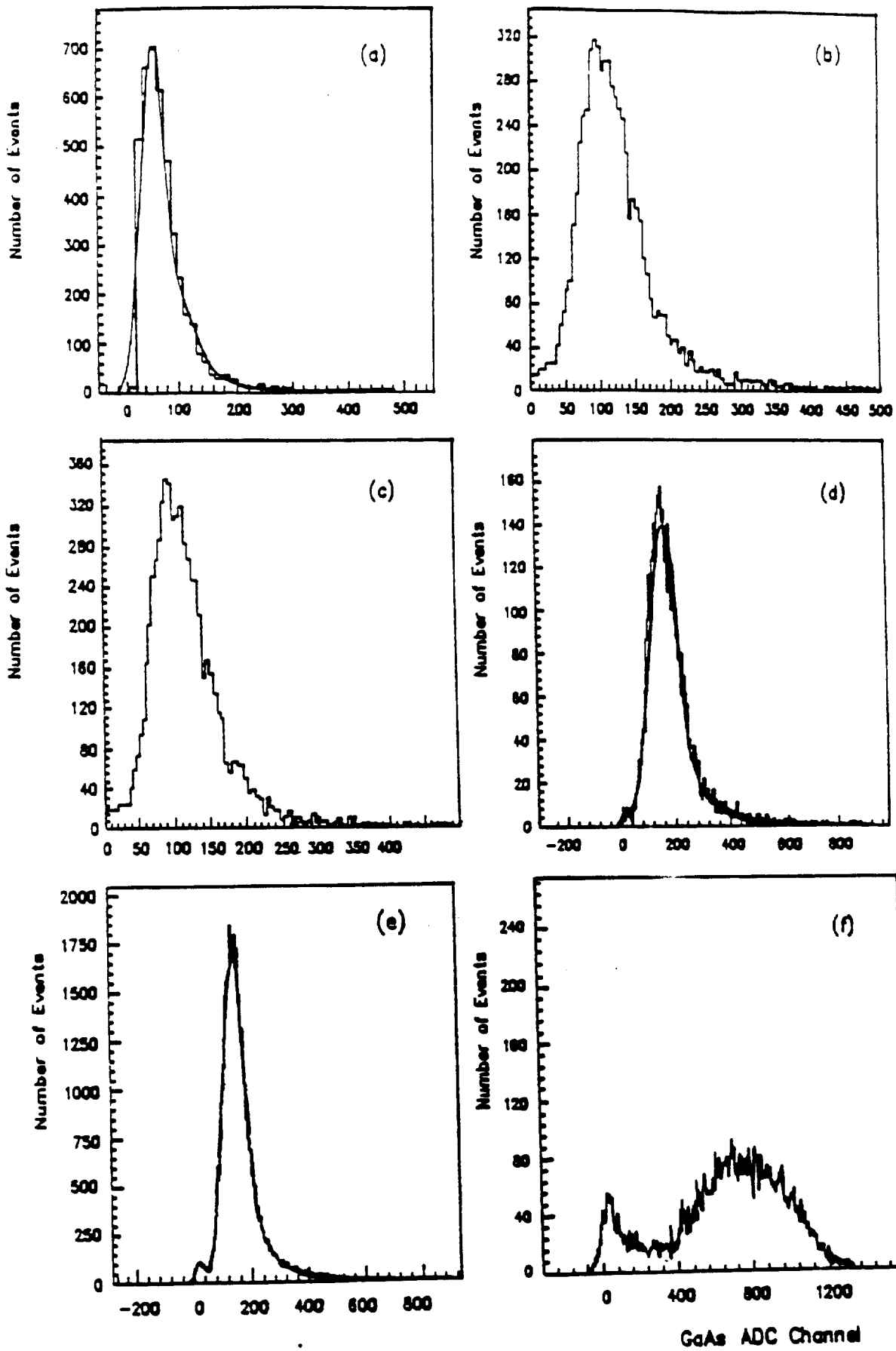
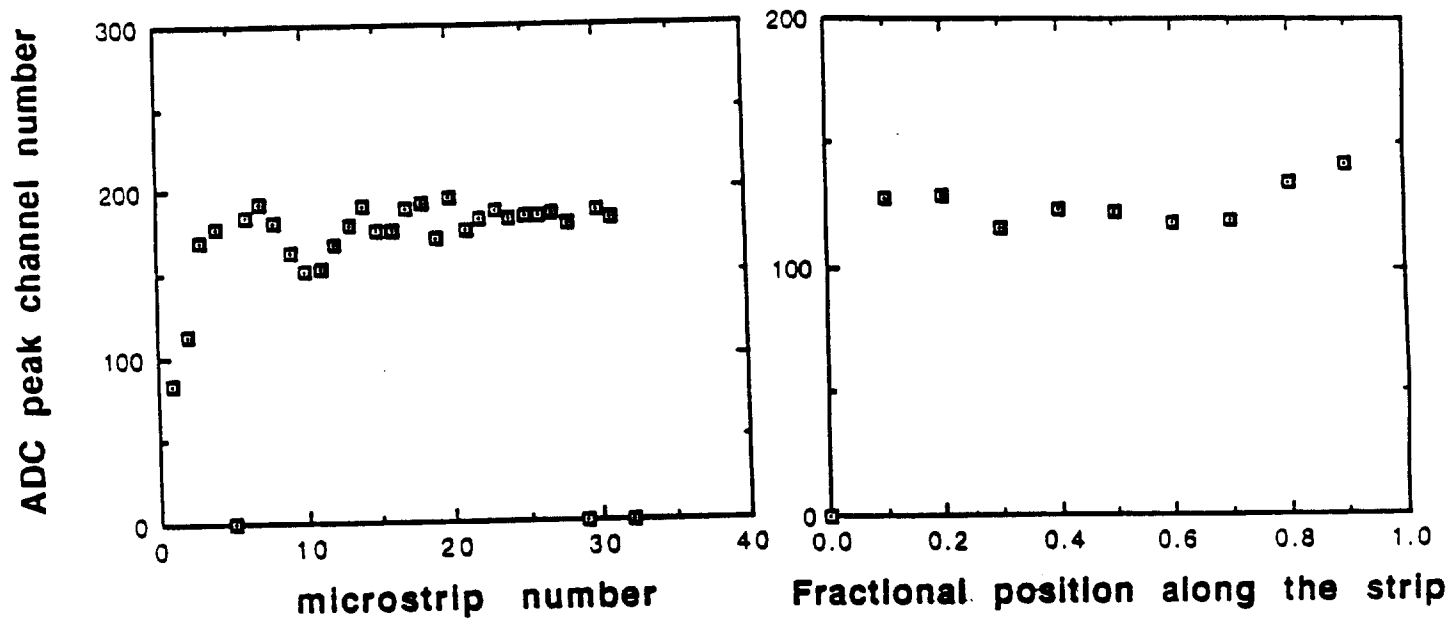
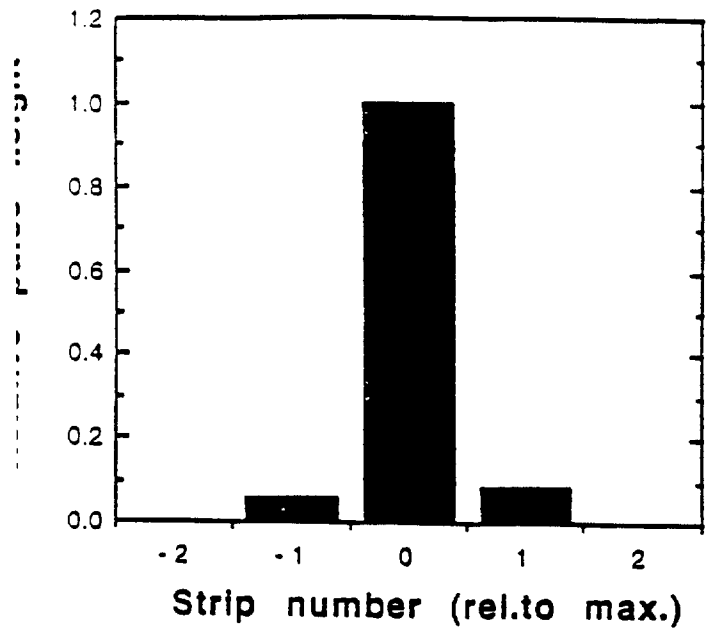


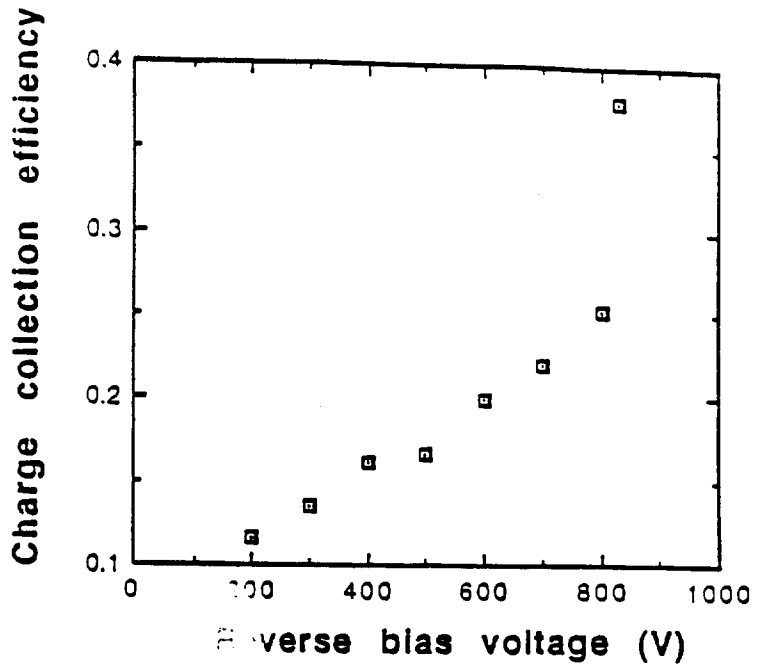
Fig (10)



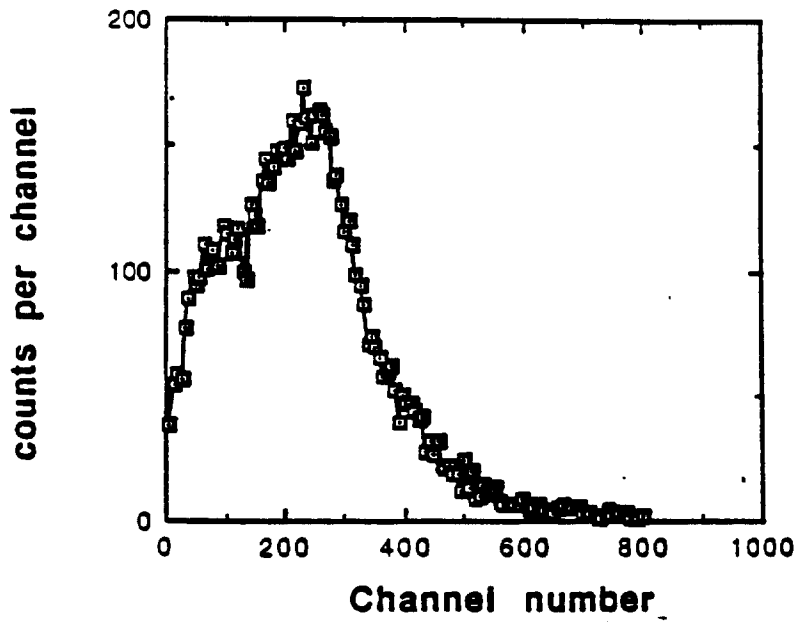
**Fig (11)**



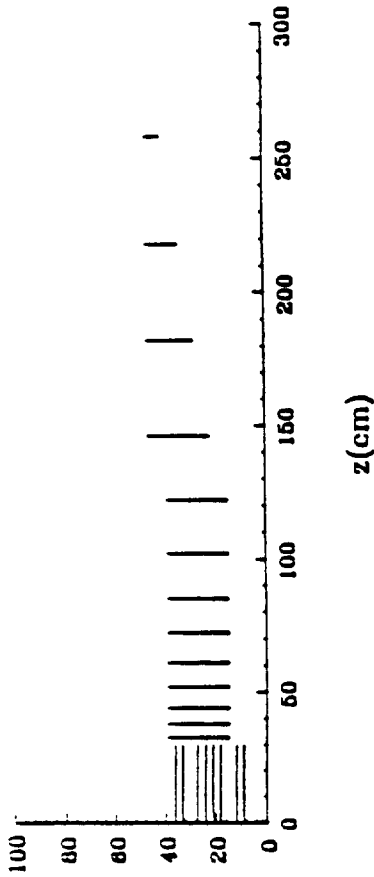
**Fig (12)**



**Fig (13)**



**Fig (14)**



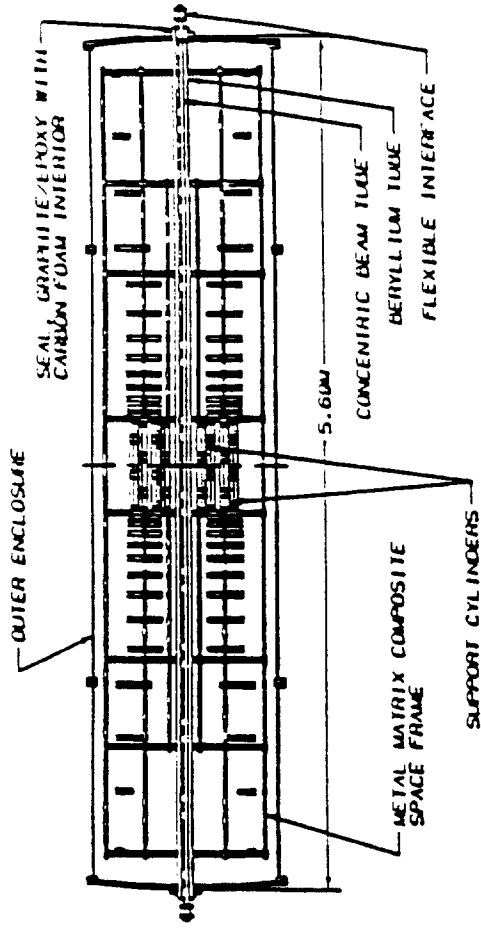
Silicon tracker design.

Dimensions for tracker

Barrel	r	z	Foot	z
(1)	0 cm	30 cm	39 cm	33 cm
(2)	12 cm	30 cm	39 cm	38 cm
(3)	18 cm	30 cm	39 cm	44 cm
(4)	21 cm	30 cm	39 cm	52 cm
(5)	24 cm	30 cm	39 cm	61 cm
(6)	27 cm	30 cm	39 cm	72 cm
(7)	33 cm	30 cm	39 cm	85 cm
(8)	36 cm	30 cm	39 cm	102 cm
(9)			39 cm	122 cm
(10)			46.5 cm	146 cm
(11)			46.5 cm	182 cm
(12)			46.5 cm	218 cm
(13)			46.5 cm	258 cm
				Total Area = 16.94 m <sup>2</sup>

6.78 m<sup>2</sup> for Barrel.

10.16 m<sup>2</sup> for Disks  
(both sides)



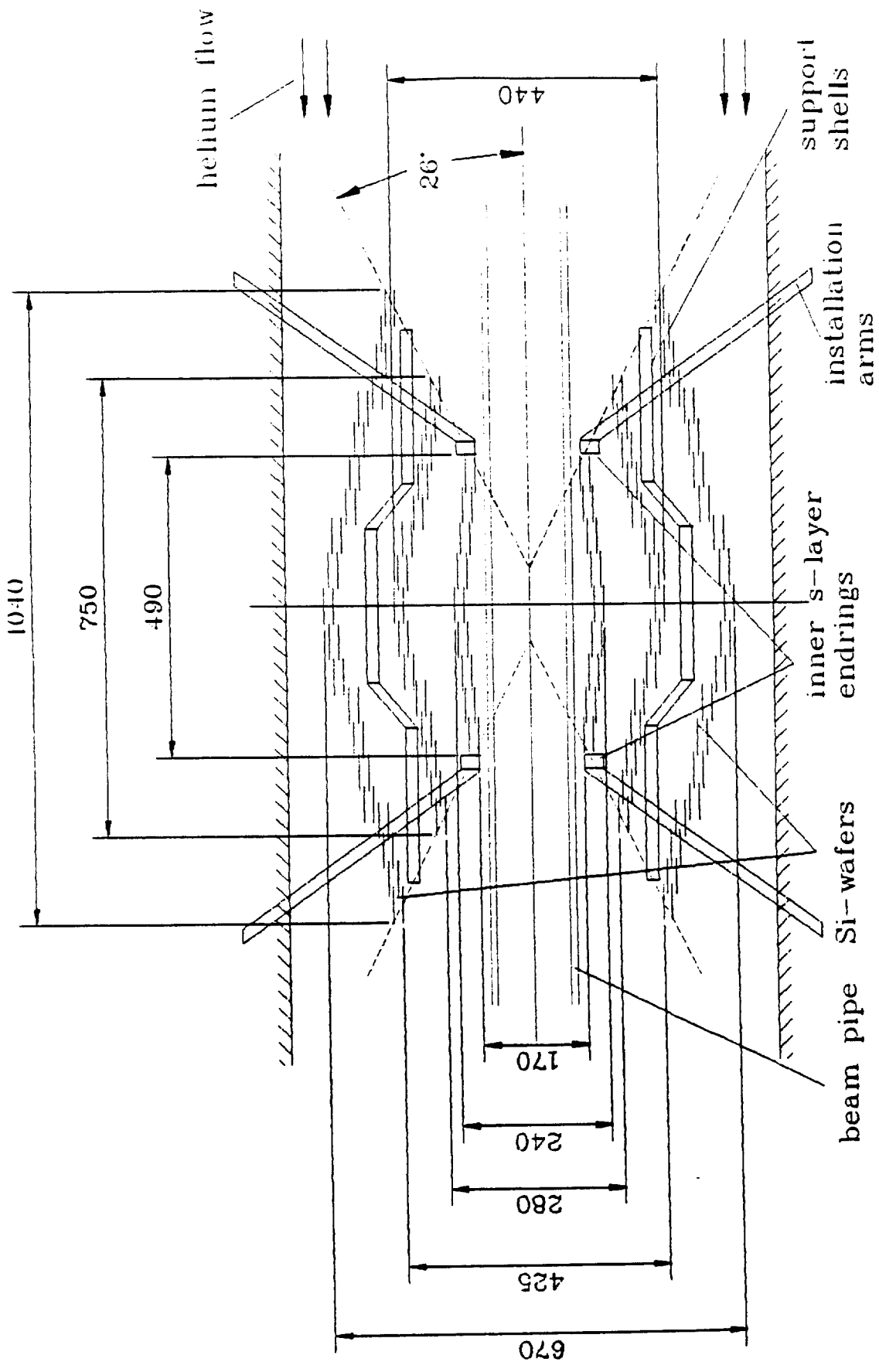
Baseline silicon tracking system arrangement layout.

Baseline Design Requirements

Detector Characteristics	Silicon, longstrip technology 50 μm pitch, double-sided
Detector Assembly	Maximum module length, 24 cm Maximum readout unit length, 12 cm Individual wafer edge bonded, 300 μm thickness, Maximum wafer length, 6 cm. Mounting precision: R, Rφ, Z - 80, 25, 250 μm Angular, 1 milliradian Positional stability: R, Rφ, Z - 80, 5, 250 μm Angular, 0.2 milliradian Detector cant angle, 7.4° Operational temperature, 0°C
Detector heat load	Heat flux, 1.33 W/cm <sup>2</sup> 12 kW Total, providing safety factor of 2 over expected value.
Radiation exposure	10 Mrads over 10 year service life No measurable stability effects > 5 μm
Material radiation length budget	Structure and related service connections 3% (except in limited regions e.g., transition from central to forward)

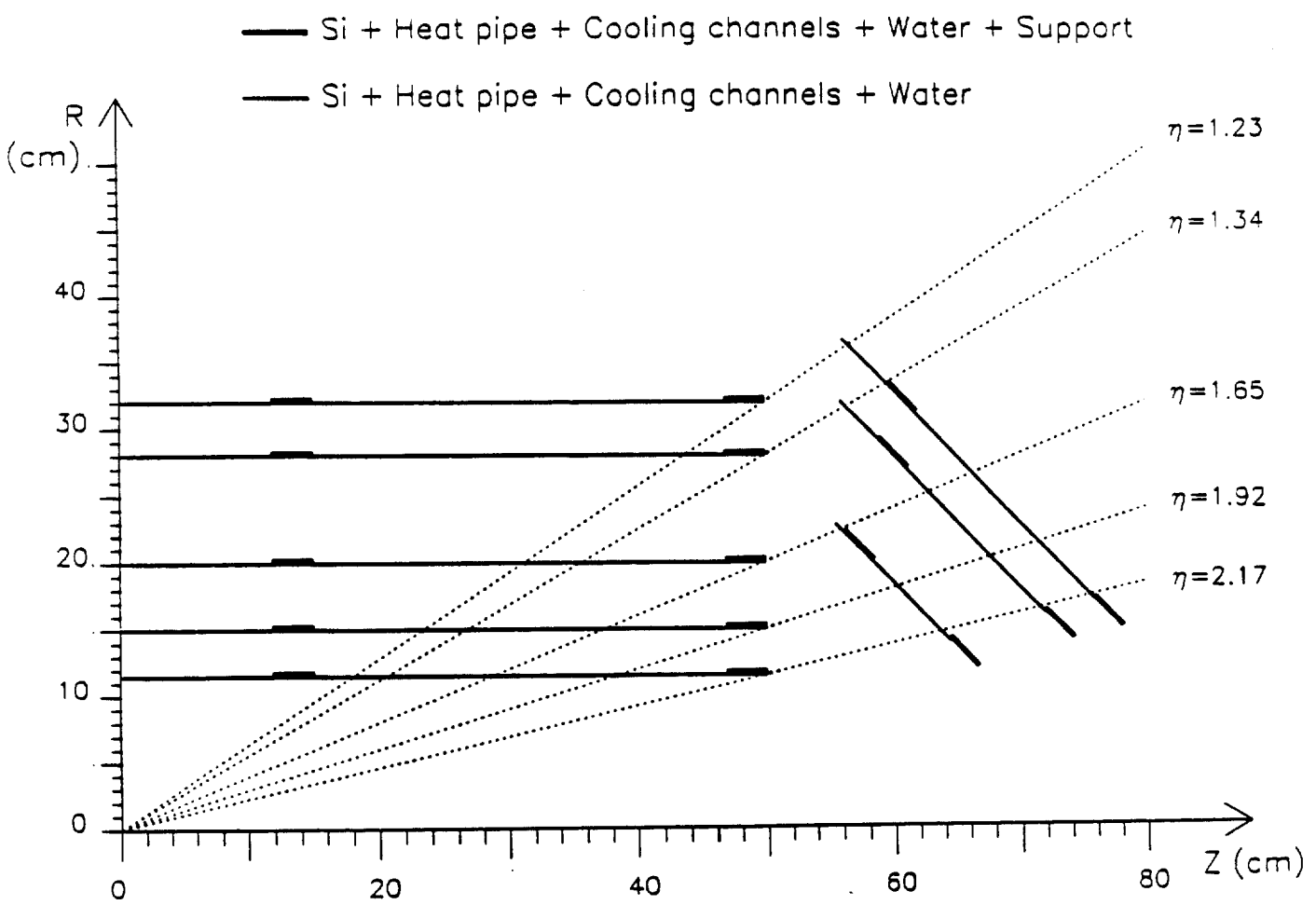
Fig (15)

Fig (16)



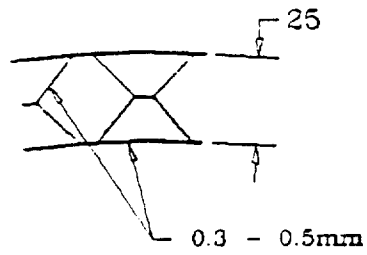
Conceptual Design of Helium Cooled STTV

Fig (17)

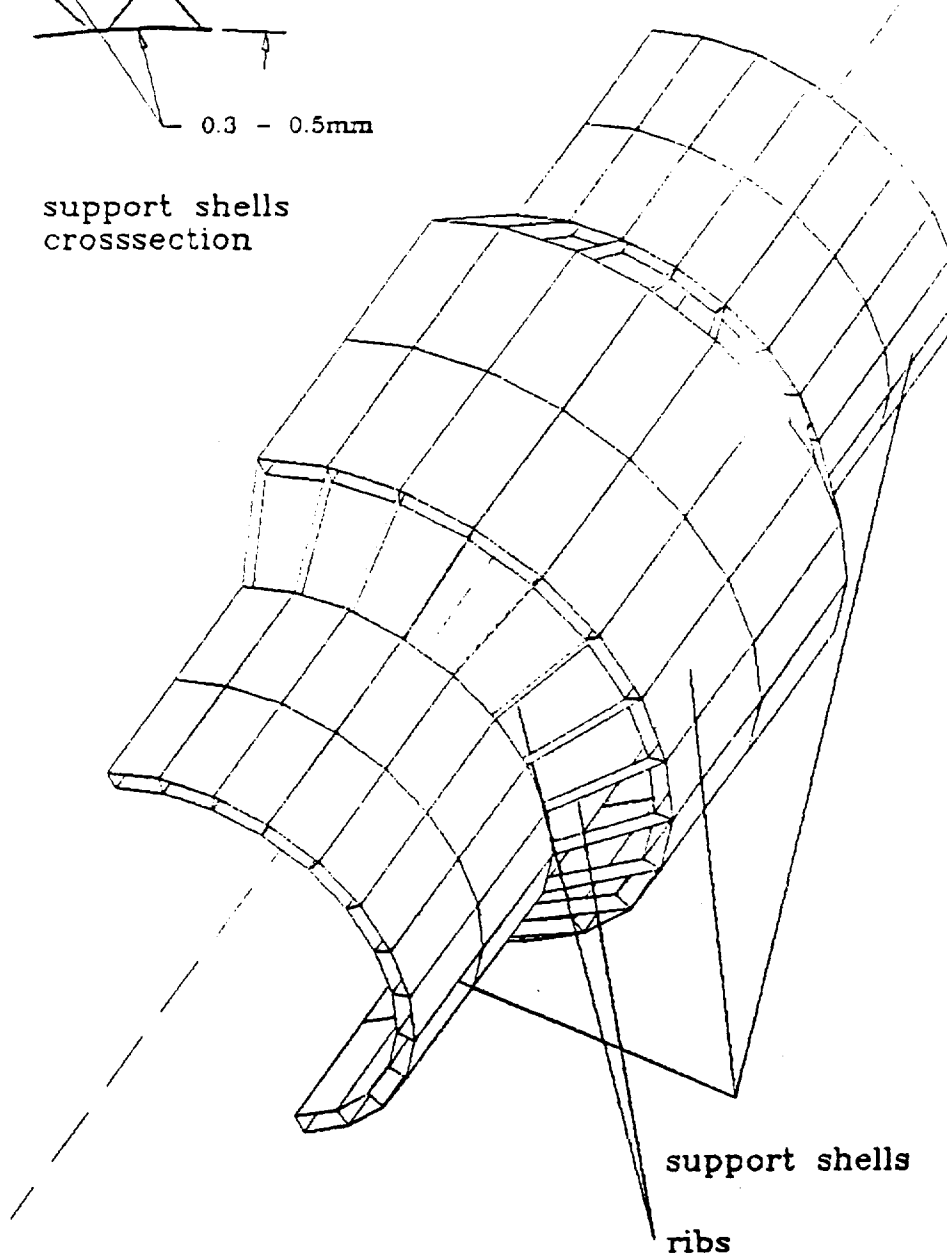


**Fig (18)**





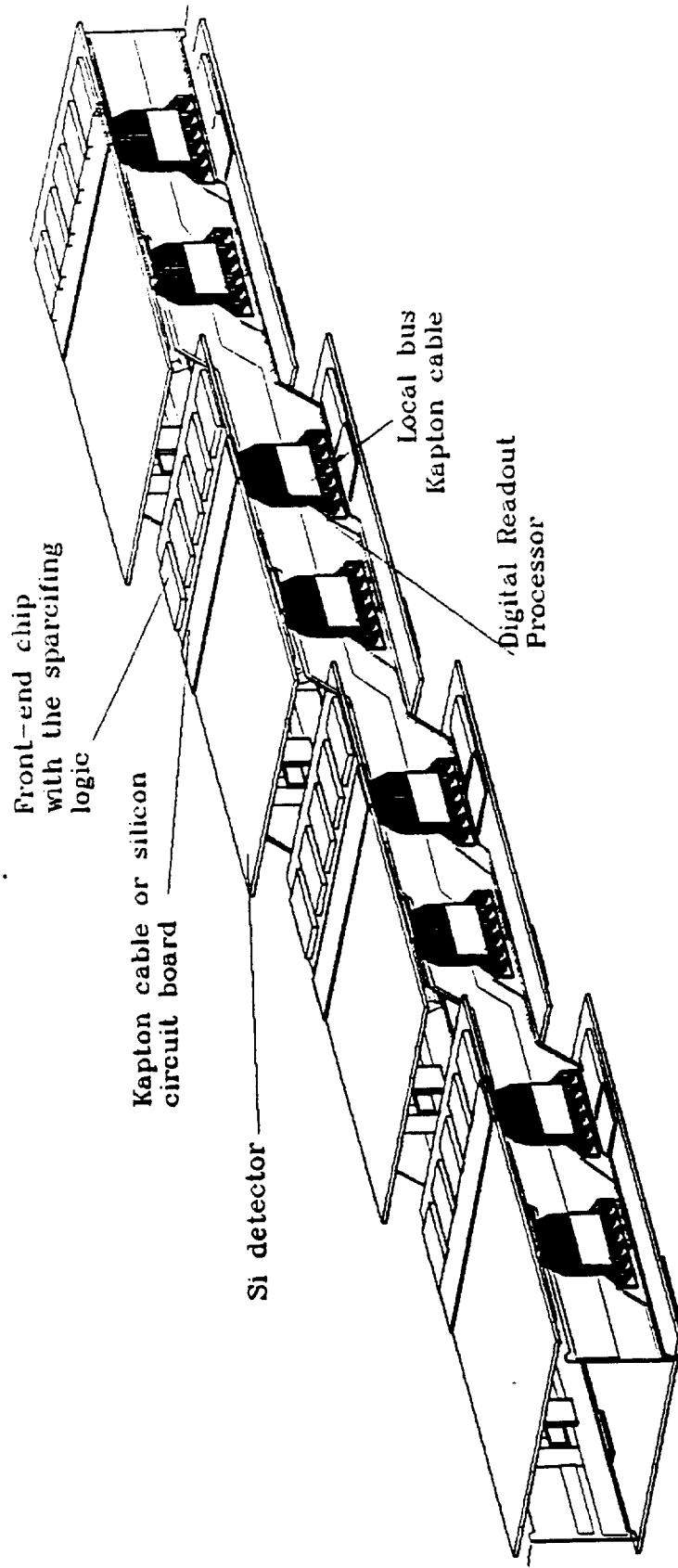
support shells  
crosssection



Set of carbon composite cylinders  
to support the outer & middle  
'superlayers' of SITV.

**Fig (19)**

SEPT '92

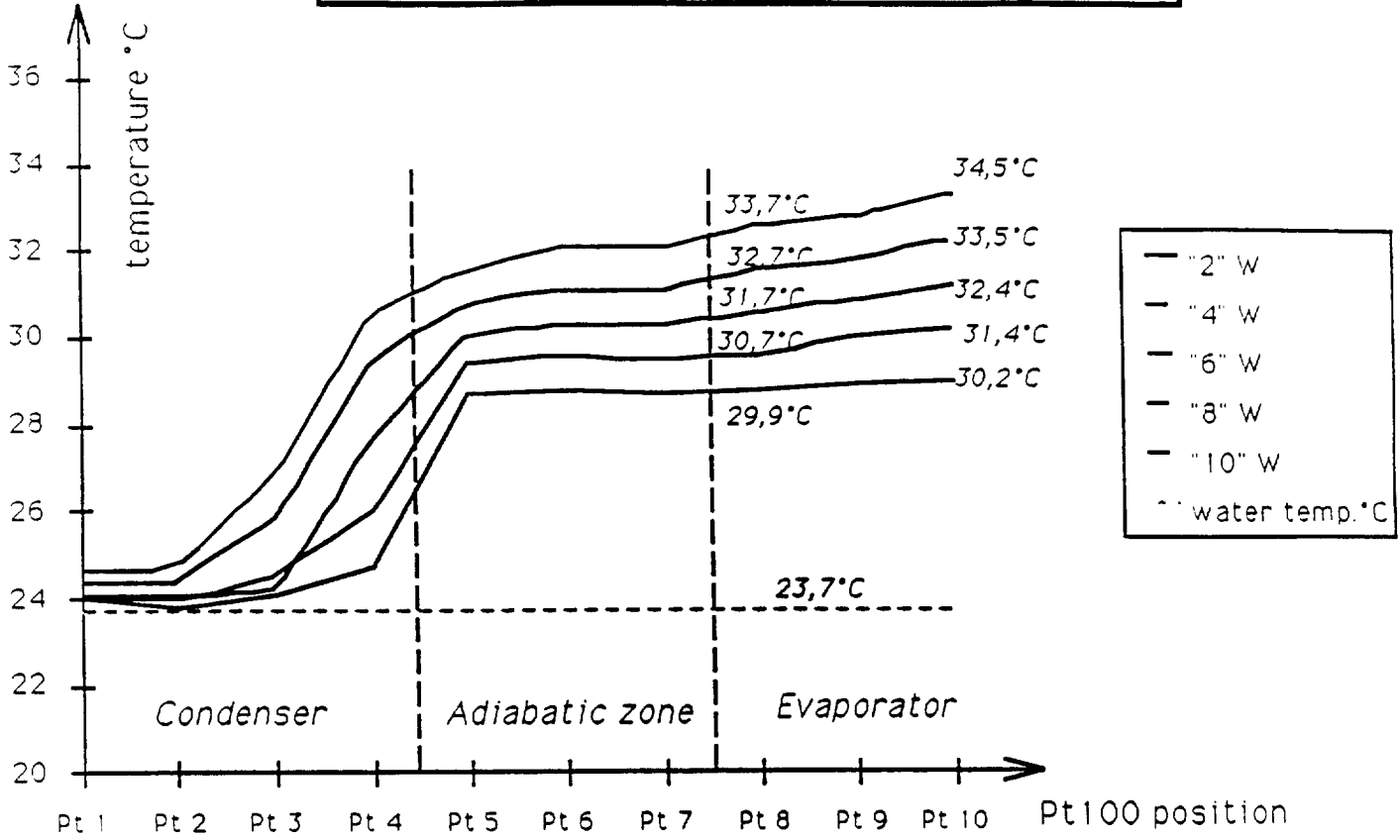


Si-module

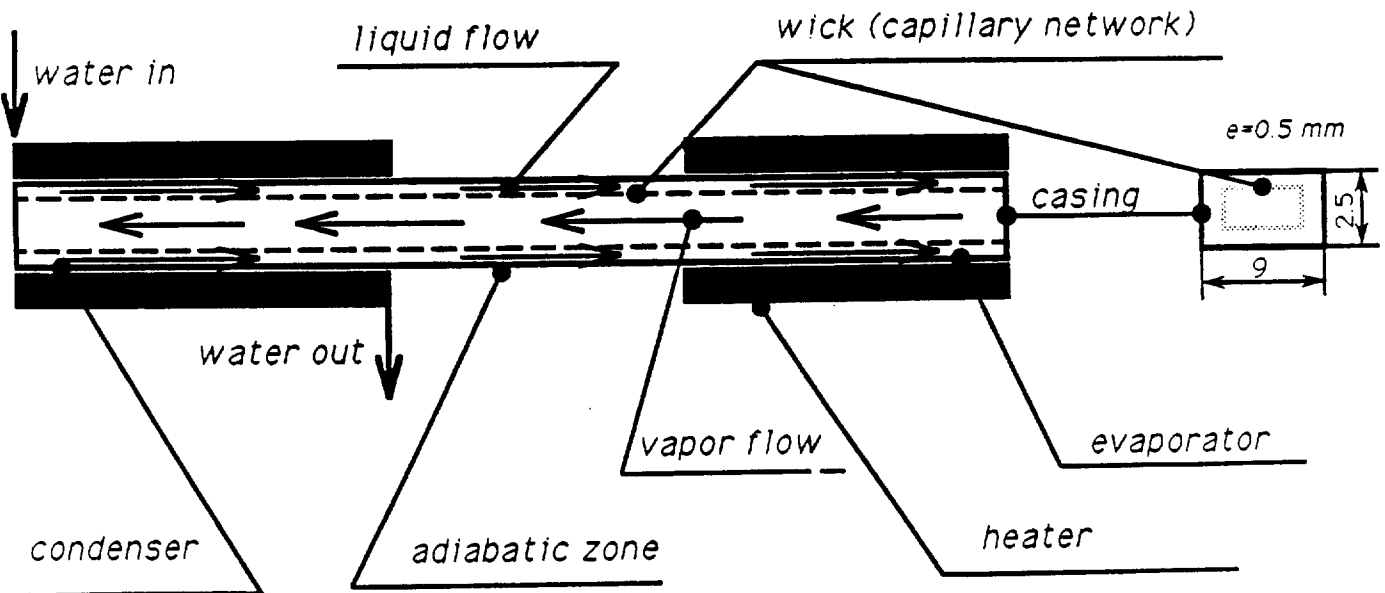
Fig (20)

# Heat-pipe Performance Test

cpdm Marseille, 4 Sept. 1992



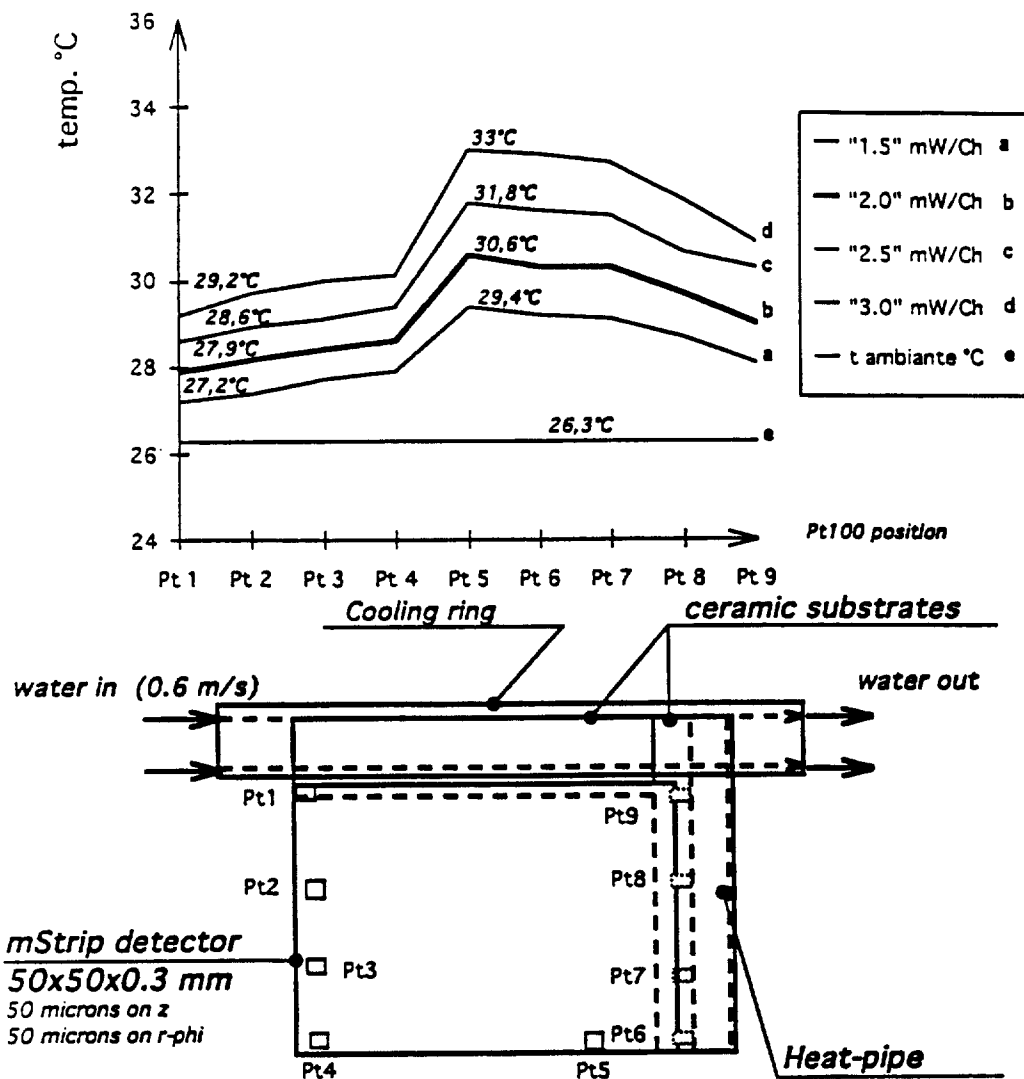
Temperature profiles along the heat-pipe



Heat-pipe performance test rig

# Heat-pipe Cooling Device Silicon micro-strip detector

cppm Marseille, 2 Sept. 1992



Remarks :

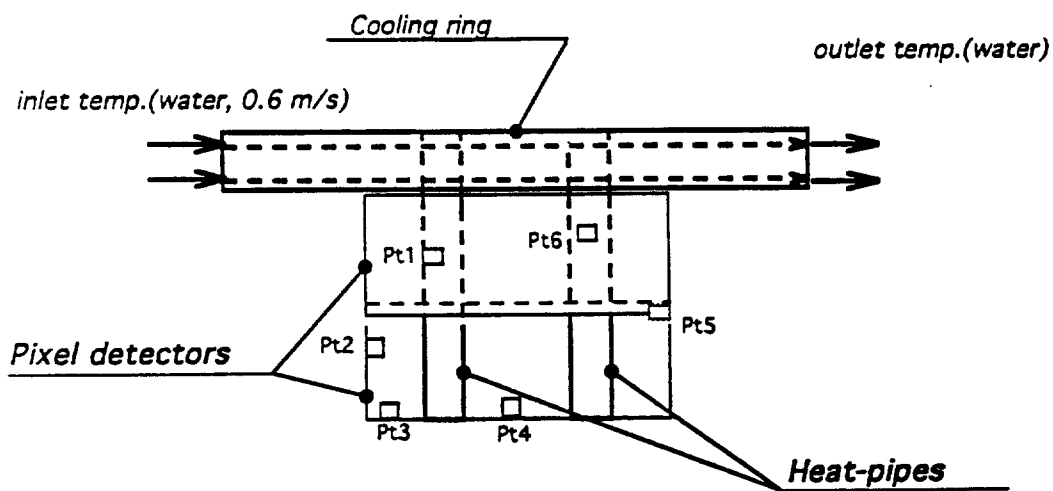
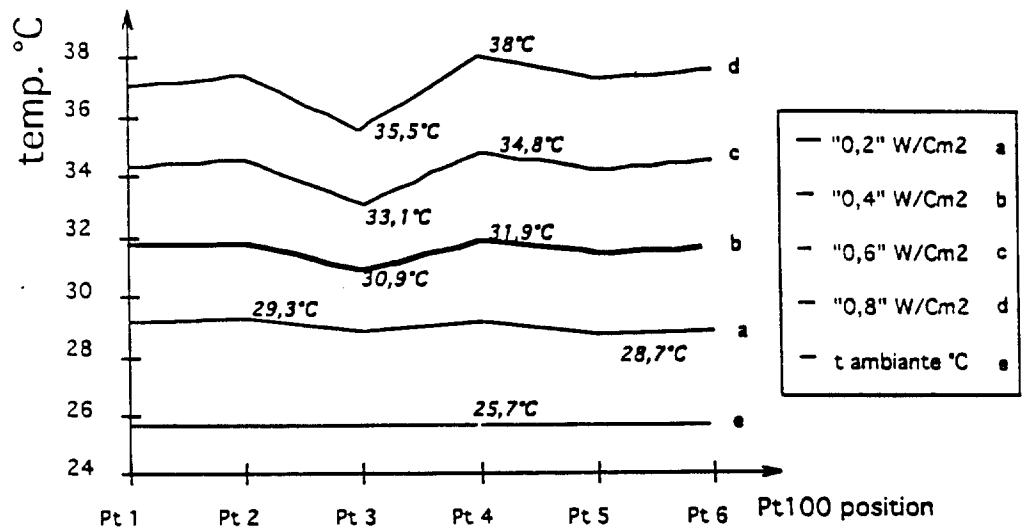
1-The maximum variation of temperature measured over r-phi electronics is 2.0°C. For 2mW/Ch, it is equal to 1.3°C (2.7°C over all detector and electronics).

2- No special work was made to optimise thermal resistance of detector and cooling ring interfaces.

**Fig (22)**

# Heat-pipe Cooling Device Silicon Pixel detector

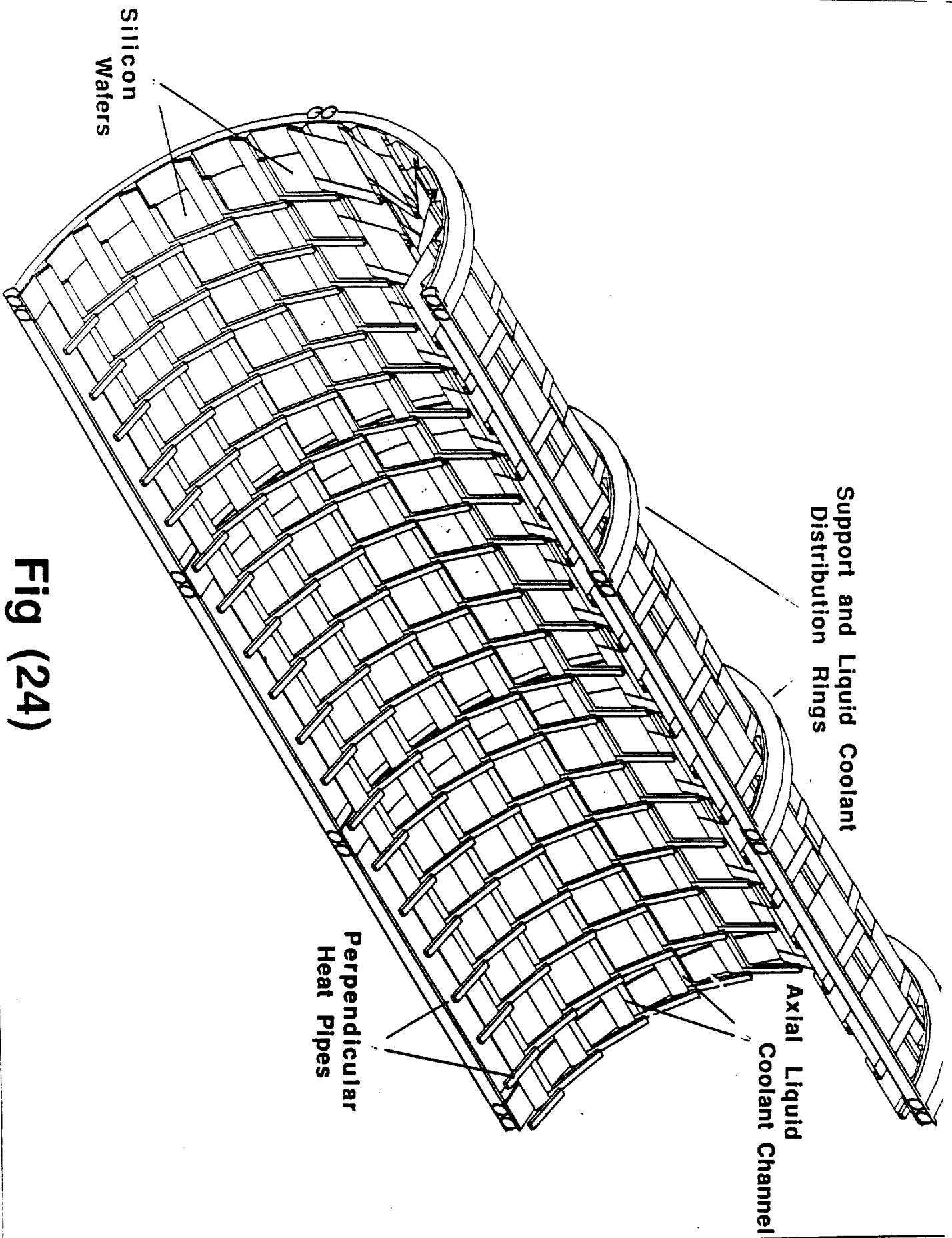
com Marseille, 2 Sept. 1992



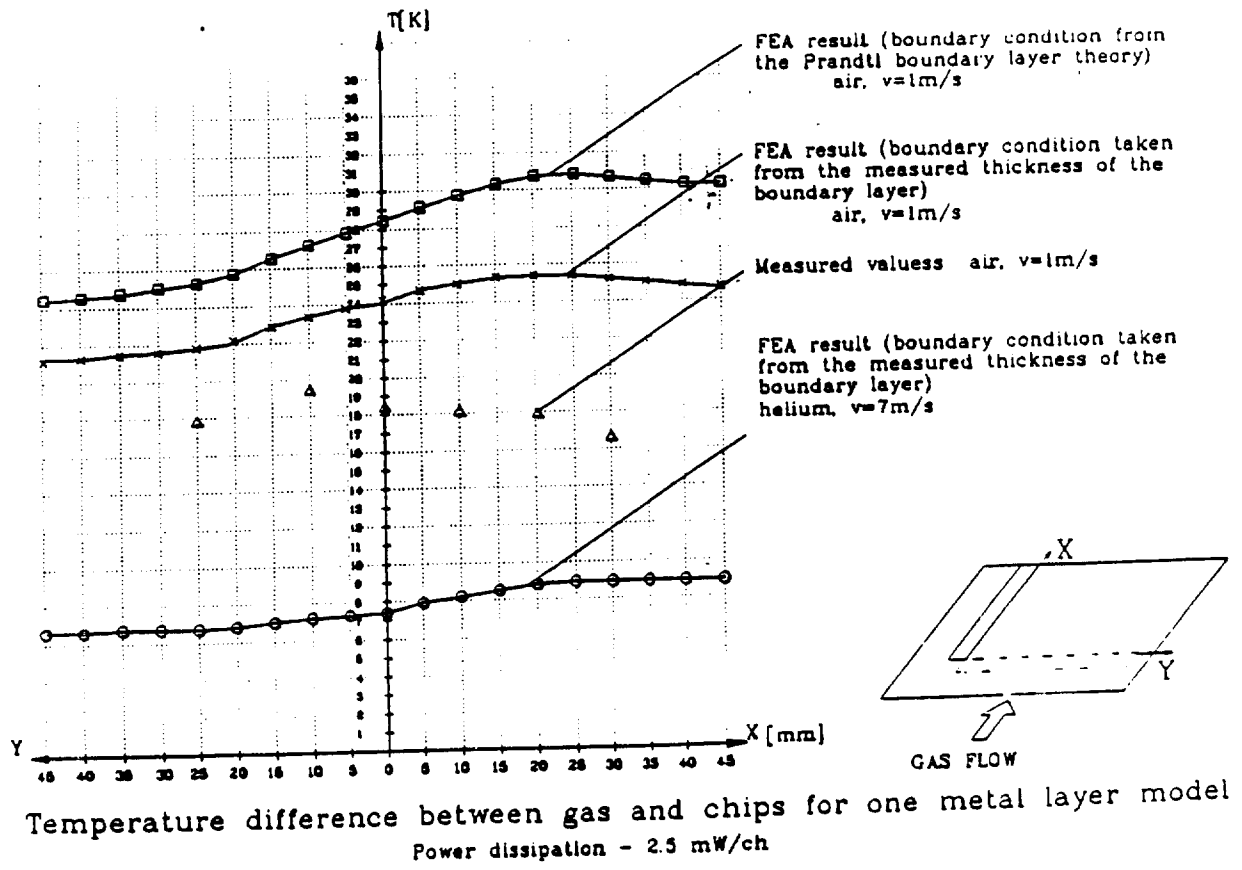
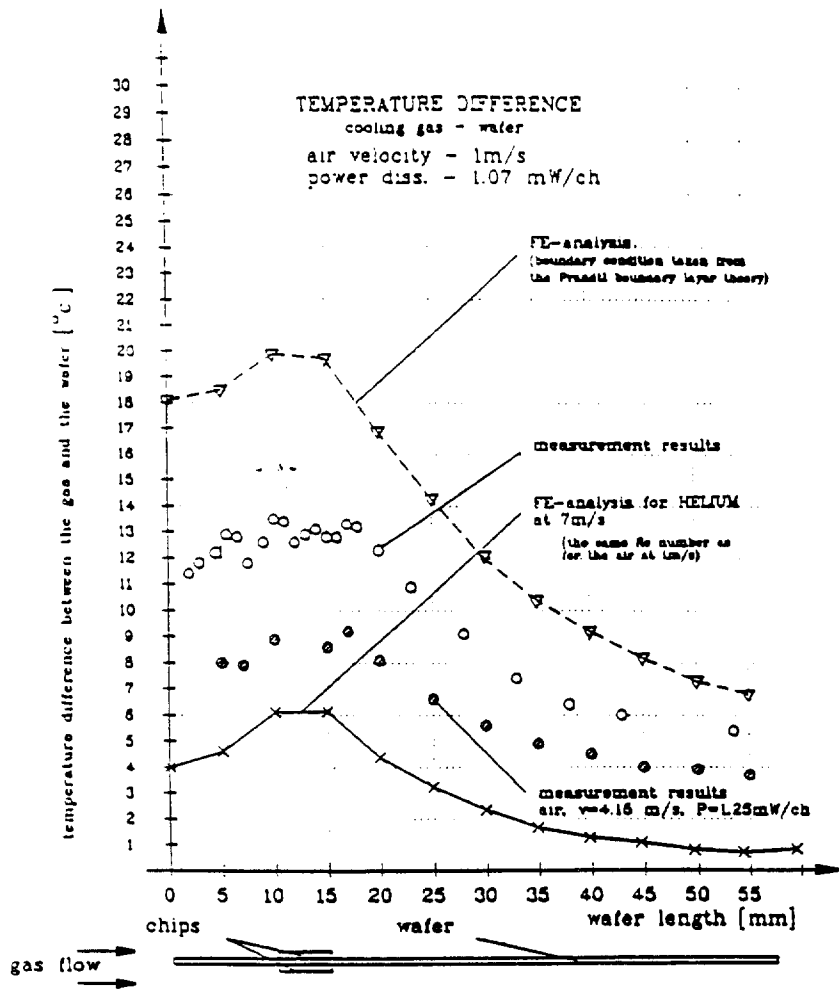
### Remarks:

- 1- The maximum variation of temperature measured over 2 pixel detectors is 1.0°C for 0.4 W/cm<sup>2</sup> nominal power dissipation.
- 2- No special work was made to optimise thermal resistance of detectors and cooling ring interfaces.

**Fig (23)**



**Fig (24)**



**Fig (25)**