

DESIGN CRITERIA REPORT  
FOR THE  
KLYSTRON GALLERY

REPORT TO STANFORD LINEAR ACCELERATOR CENTER - NO. ABA-48  
STANFORD UNIVERSITY - ABA SUBCONTRACT S-128  
UNDER AEC CONTRACT AT(04-3)-400

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\* indicates change from original issue.

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I INTRODUCTION

This report contains the design criteria necessary for performing the Title I design of the Klystron Gallery and associated facilities and equipment. Included are criteria for the following items of work:

1. The 10,000 foot long Klystron Gallery Structure.
2. Conventional electrical and mechanical utilities both inside and outside the Gallery structure.
3. Fencing, access roads and parking necessary for operation.

Design criteria and Title I reports have previously been issued on the following related projects:

1. Design criteria report for foundation grading and cross drainage, ABA-42, dated March 26, 1962.
2. Design criteria report for the Accelerator Housing, ABA-45, dated May 21, 1962.
3. Title I report for foundation grading and cross drainage Station - (2+25) to Station 30 + 50, ABA-46, dated June 7, 1962.

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## II DESIGN CRITERIA

### 1.0 GENERAL

- 1.1 The Klystron Gallery will consist of a single story, metal frame building to house the Klystrons, modulators and auxiliary electrical and mechanical equipment required for operation of the Accelerator. This Gallery will be located on top of the Accelerator shielding fill. Alcoves, contiguous with the Gallery, will house the facility instrumentation and control equipment. Figures 1 and 2 indicate the site location and the relationship between the Klystron Gallery, the Accelerator Housing and the shielding fill.
- 1.2 All design work will conform to U. S. Atomic Energy Commission Manual, Chapter 6000 and the codes and standards listed therein. In addition, standards developed for this project by SLAC will be used wherever appropriate.
- 1.3 Maximum reliability, accessibility and compatibility will be incorporated into the design of all systems and equipment within budgetary limitations. Studies will be made of alternate designs in order to achieve minimum construction, operating and maintenance costs.
- 1.4 It is desirable, in order to expedite the installation of Gallery equipment by SLAC, that beneficial occupancy of the Gallery take place as soon as possible. Starting with a scheduled occupancy of 1000 feet of Gallery on December 6, 1963, construction completion will proceed eastward with final completion scheduled for September 25, 1964. Design of the Gallery and related utilities will take this goal into consideration.

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1.5 The Junipero Serra Freeway will cross the Gallery as shown in Figure 1. The construction schedules of the Division of Highways and ABA will be coordinated so that the false work for the freeway bridge can be erected after completion of the shielding fill and before construction of the Gallery in that area. Approximately 8' clearance will be provided between the Gallery roof and the freeway overpass.

## 2.0 ARCHITECTURAL - STRUCTURAL

### 2.1 Gallery Structure

\* 2.1.1 Building - The Klystron Gallery will be a 10,060 foot long prefabricated structural frame building, a portion of which is shown in Figure 3. The structure design will be based on arrangement of accelerator electrical and mechanical equipment within the Gallery. The interior faces of columns will be vertical in order to provide surfaces for mounting SLAC equipment. The 10,060 foot length will be divided into thirty sectors, each 333' 4" long. Arrangement of equipment within a typical sector is shown in Figure 4.

Wall and roof panels will be ribbed metal. Wall panels will be removable.

2.1.2 Floors - The floor will be reinforced concrete and will slope 0.5% from west to east. A surface hardener will be applied to the floor. The floor slab will be isolated from each waveguide penetration with joint material so that the slab and penetration will be free to move independently.

Reinforcing steel in the slab will be welded into an electrical network and will be bonded to the Gallery structural steel and to each waveguide penetration by a single pigtail.

The design floor loading will be an average 200 lbs/sq. ft. or a concentrated wheel load of 1000 lbs.

\* 2.1.3 Openings - Windows are not required. Skylights will be used if they are compatible with heating and ventilation requirements. Two sliding equipment access doors and at least three personnel doors will be provided in each sector. A minimum diameter of 34-inch clear space will be provided over each waveguide penetration for the installation of waveguide penetration packages.

\* 2.1.4 Supports - A design live load of 40 lbs/sq. ft. of floor area will be used for piping and equipment which are supported by the steel building frame. A 10' maximum longitudinal spacing will be used for supporting piping and conduit.

2.1.5 Alcoves - Alcoves for instrumentation and control equipment will be provided on the north side of the Gallery at the approximate midpoint of each sector. Each alcove will be separated from the Gallery by an expanded metal screen.

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2.1.6 Preliminary Dimensions

<u>GALLERY</u>		<u>CONTROL ALCOVES</u>	
Length .....	10,060 ft.	Length .....	45 ft.
Width (exterior)...	30 ft.	Width .....	10 ft.
Area .....	302,000 sq. ft.	Area ...	13,000 sq. ft.
	Side wall height		14 ft.
	Gross area		315,000 sq. ft.

2.1.7 Fire Protection - A "rate-of-rise" fire detection system will be installed in the Gallery. Firewalls will be installed in alternate sectors (666' 8" intervals) at the drift sections. Chemical and CO<sub>2</sub> fire extinguishers will be installed (by SLAC) but water protective devices will not be used in the Gallery. Fire hydrants will be located external to the building as required by fire codes.

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2.1.8 Occupancy - Approximately 50 personnel will be engaged in installation of modulator, Klystron, and instrumentation-communication equipment within a 5 sector area. Starting with the west end, installation will proceed to the east with the construction completion of each sector. During testing and operation no personnel will be assigned to the Gallery on a permanent occupancy basis; however, it is anticipated that a maximum of 10 operators will be in any one sector at a time.

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2.2 Contiguous Structures and Equipment

- \* 2.2.1 Heat exchange equipment for the low conductivity water system will be located adjacent to the Gallery on the south side of each sector. The equipment and piping will be provided by SLAC. No housing will be provided for this equipment.
- 2.2.2 Substations will be located adjacent to the Gallery on the south side of alternate sectors. Economics will determine whether the switch gear will be weatherproof type or sheltered in a structure.

3.0 MECHANICAL

3.1 Heating and Ventilation

- 3.1.1 No space heating or air conditioning will be provided. Heat losses from operating equipment will be removed by a combination of louvers located in exterior walls and gravity ventilators located in the roof. Design of roof ventilators will take Stage II requirements into consideration and will permit a maximum temperature rise in the Gallery of 15° above ambient. Removable ventilator sections may serve as access openings for waveguide penetration packages. Alcoves will be ventilate separately from the Gallery.

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3.1.2 Equipment heat losses to Gallery atmosphere (based on 90°F ambient).

	<u>PER SECTOR</u>	
	<u>Stage I</u>	<u>Stage II</u>
1. Modulators - 2.74 kw each		
8 modulators/sector	21.9 kw	
32 modulators/sector		87.7 kw
2. Klystrons - 2.80 kw each		
8 Klystrons/sector	22.4	
32 Klystrons/sector		89.6
3. Vacuum pumps - 1/2 hp		
16 pumps	6.0	6.0
4. Piping		
3" and 4" Low Conductivity		
Water	16.9	16.9
5. Electrical		
Lighting and Receptacles	34.0	34.0
	<hr/>	<hr/>
	101.2 kw	234.2 kw

3.1.3 Equipment heat losses to alcove atmosphere (based on 90°F ambient).

	<u>PER ALCOVE</u>	
	<u>Stage I</u>	<u>Stage II</u>
DC Power, control panels, monitoring and lighting	7 kw	8 kw

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3.2 Instrument Air - 5 cfm of instrument air will be provided to each Gallery sector for low conductivity water temperature control valves.

\* 3.3 Domestic Water - A buried water line for irrigation, fire and domestic use will run along the north side of the Gallery. Laterals into the Gallery will be provided at each sector for lavatories and drinking fountains.

3.4 Sanitary Sewer - A sanitary sewer will be provided on the north side of the Gallery to service lavatories and floor drains.

\* 3.5 Gallery and Alcove Equipment (SLAC design)

	<u>Size</u>	<u>Weight</u>
1. Modulators	4' x 8' x 7' high	4,000 lbs.
2. Klystrons	20" DIA x 5' high	500 lbs.
3. Waveguides		
a. Vertical -Builtup Assembly	27" DIA x 30' long	1,000 lbs.
b. Horizontal Assembly	25'-6" long x 9'-6" high - x 5' wide incl. wheeled fixture	
4. Vacuum Pumps	2' x 2' x 2' 3-5 CFM	150 lbs.
5. Control Panels (12 per alcove)	24" x 34" x 7' 6" high on 10" wire rack base	-
6. DC Power Supply Rack (alcove)	22" x 34" x 7' 6" high	-
7. Battery Rack (alcove)	18" x 6' x 4' high	

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3.6 Equipment Handling - No monorails or hoists will be installed in the Gallery. All handling of equipment or materials during installation, operation, or maintenance will be accomplished by wheeled vehicles which will be provided by SLAC. Provision will be made for a special waveguide package design in the freeway overpass area of the Gallery.

4.0 COOLING WATER SYSTEM

4.1 General - A cooling tower water system will be designed to provide cooling water for the Gallery low conductivity water heat exchangers. The cooling towers will be located on the south side of the Gallery adjacent to the road.

\* 4.2 Towers - Cooling towers for Stage I only will be installed at the first and third quarter points of the Gallery. Provision will be made for water treatment, make-up and blowdown.

DESIGN CONDITIONS

	<u>Each Tower</u>
Duty	10 megawatts
Wet bulb design temperature	68°F
Design approach	7°F
Range	20°F
Cooling water flow	5000 gpm.

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4.3 Distribution - Pumps will take suction from the cooling tower basin and deliver the water to supply and return headers which run the length of the Gallery. Provision will be made for three one-half capacity pumps with one on automatic standby. 8" diameter laterals at the midpoint of each sector will extend to the low conductivity heat exchange equipment.

## 5.0 ELECTRICAL

- 5.1 General - This section describes the design criteria for all conventional electrical facilities inside and outside the Klystron Gallery including the 12 kv distribution system to the Gallery and cooling tower substations.
- 5.2 12 kv Distribution System - A 12 kv, 3 phase, 3 wire, 60 cycle system will be installed in an underground duct system along the south side of the Gallery to serve the unit substations.
- 5.3 Substations - Each pair of sectors will be served by a 750 KVA, 480 volt unit substation. Sectors one and two, which include the west end injector station, will have a dual 750 KVA substation with secondary automatic transfer to provide continuity of service to the injector station should failure of either transformer occur. A visual and audible alarm will be furnished at this substation to indicate transformer failure.

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5.4 Gallery

\*

5.4.1 Distribution - Service from substations into the Gallery will be at 480 volts, 3 phase, 3 wire, 60 cycle. The sector service duct will be grounded steel conduit to minimize electrical noise. Ducts will be sized to accommodate future loading of each substation up to the full forced-air-cooled rating.

A. C. power duct runs will be located adjacent to the south wall. Exposed conduit runs will be perpendicular to or parallel with the longitudinal axis of the Gallery. Parallel runs between conduits and instrumentation cables will be minimized. Wherever practicable, conduit runs (parallel or perpendicular) will be a minimum of 3' from instrumentation cables.

5.4.2 Equipment Location - All distribution panels, motor control centers, lighting panels and transformers will be located along the south wall of the Gallery in order to minimize electrical noise interference with instrumentation and control system equipment along the north wall. Access for modulator replacement will be considered in the location and arrangement of this electrical equipment.

120 volt convenience outlets will be located at 20' intervals on columns along the inside of the south wall. No convenience outlets will be provided along the north wall or in the alcoves. 480 volt, 3 phase power receptacles will be located along the south wall at approximately 110' spacing with one at the center of each sector.

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- \* 5.4.3 Lighting - All lighting within the Gallery will be incandescent and will be controlled by panel switching. Alcoves will have local switches. Inside night lights will be on continuously and battery powered emergency lights will be located at each night light. Lighting will be provided for outside personnel and vehicular traffic.

DESIGN INTENSITY

Klystron Gallery	15 fc
Control Alcoves	20 fc
Inside Night Light	minimum

- \* 5.4.4 Grounding - In addition to normal equipment grounding requirements, special consideration will be given to the problems of radiofrequency noise suppression and instrumentation grounding both in the Gallery and in the alcoves. Welded wire mesh will be used for the Gallery floor reinforcing. The extent of RF grounding will be similar to the requirements for the Test Laboratory. Substation grounding will be separate from Gallery grounding.

- 5.4.5 Electrical Load - The average Stage I connected load for a single sector is approximately 450 kva with an estimated maximum demand of 225 kva. These loads are exclusive of the high voltage D. C. supplied to the Klystron modulators. It is anticipated that these load values will increase to 550 kva and 350 kva respectively for Stage II.

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\* 6.0 ACCESS ROADS, PARKING AND FENCING

Access roads will be provided for the full length of the Gallery. There will be a single lane on the north side and a double lane on the south side to handle Accelerator equipment installation as well as operation and maintenance traffic. Roads will be asphaltic concrete surfacing on a rock base. Paved parking, storage and drainage areas will be provided wherever necessary or practicable. A chain link fence will be provided around the shielding fill to control personnel access. Guard rails will be provided, if required.

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\* III COST ESTIMATE

<u>Account Number</u>	<u>Description</u>	<u>Amount</u>
502	Gallery Structure	\$2,585,000
502	Mechanical	598,000
502	Electrical	
	Lighting and convenience	365,000
	Power distribution	310,000
	Grounding	95,000
502	Fire Monitoring	<u>80,000</u>
	Total 502	\$4,033,000
440	Roads and Parking	\$ 125,000
450	Fencing	<u>65,000</u>
	Total 400 Series	190,000
613	Unit Substations	345,000
614	12 kv Distribution	638,000
651	Sewers	40,000
671	Fire and Domestic Water	60,000
674	Cooling Towers	224,000
675	Cooling Water Distribution	<u>217,000</u>
	Total 600 Series	1,524,000
	TOTAL CONSTRUCTION	\$5,747,000

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DESIGN AND CONSTRUCTION SCHEDULE

The following schedule for design and construction of the Klystron Gallery is based on the most recent CPM network information.

	Time	Completion Date
ABA Design Criteria Report		7-13-62
Review and Approval by SLAC	1 week	7-20-62
Title I	15 weeks	11-2-62
Title I Review by SLAC	1 week	11-12-62
Title II (90% Submittal)	29 weeks	5-31-63
Title II Review & Approval	2 weeks	6-17-63
Title II Revised	1 week	6-24-63
Title II Final Review	} concurrent	7-26-63
Bidding Period		4 weeks
Notice to Proceed		9-19-63
Beneficial Occupancy - 1000 ft. of Gallery		12-6-63
Construction Completion	12 months	9-25-64

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V SKETCHES

Figure

1. Klystron Gallery - general site plan - SKA 07022-A
2. Klystron Gallery - sections - SKA 07062-A
3. Klystron Gallery - elevations - SKA 07052-A
4. Klystron Gallery - typical sector plan - SK 502-103

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