

Abstract

Two accelerators facilities, China initiative Accelerator Driven Sub-critical System (CiADS) and High Intensity heavy-ion Accelerator Facility (HIAF), co-funded by the China central and local government, is being designed and constructed at Huizhou city, Guangdong Province. The Institute of Modern Physics(IMP), Chinese Academy of Science is responded for constructing and operating the facility. CiADS's mission is to demonstrate the principle and technical of employing high power protons to transit fission nuclear plant wastes. HIAF is defined as a nuclear structure research facility. The two linacs contains seven types , totally 233 superconducting cavities, will be constructed in recent three years. Stable production rate and reliable surface processing will be the main challenges. This paper reports the cavity design, prototype status and massive production plan and status.

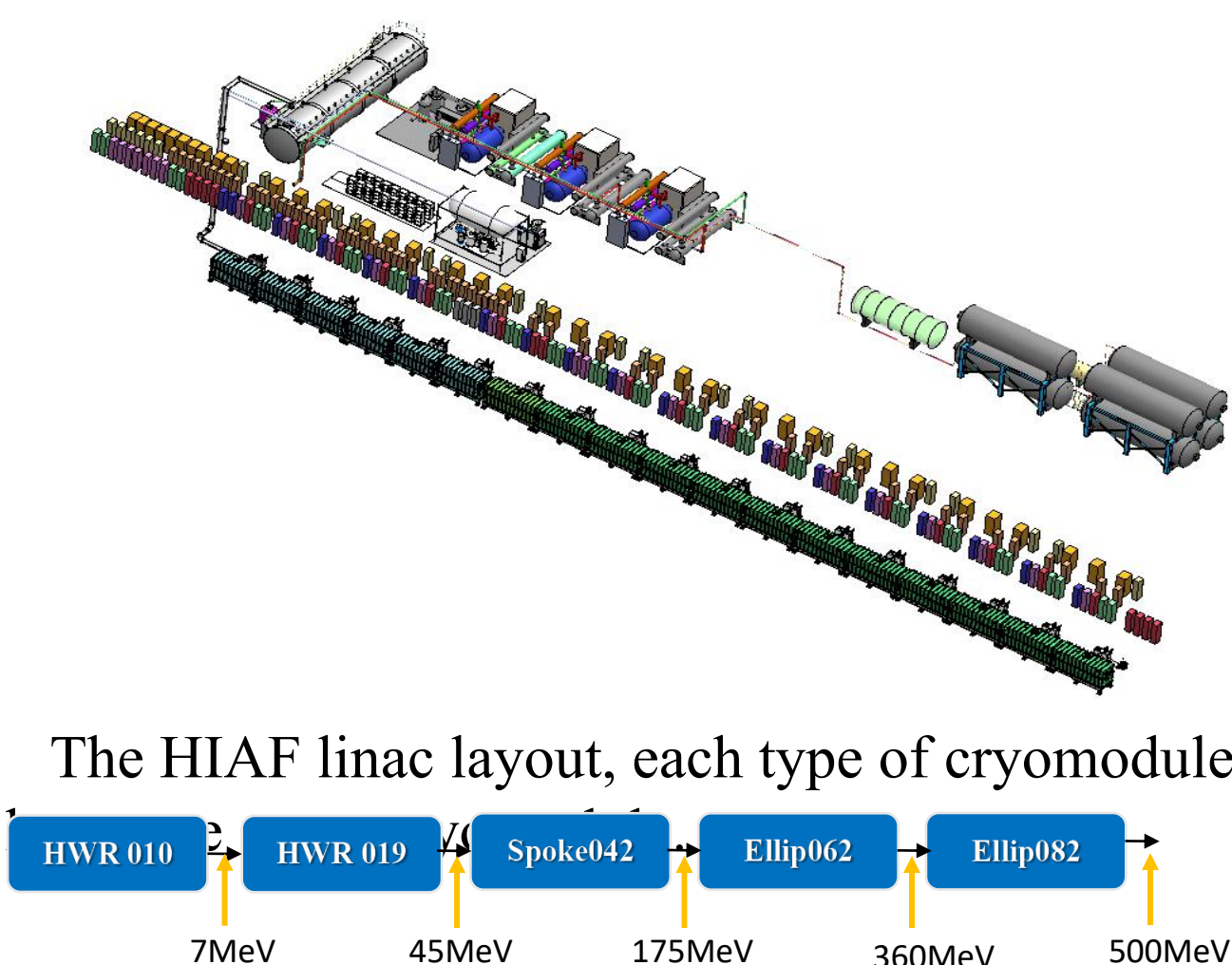
Introduction

The Project of HIAF started construction since 2018, the massive procurement of SC cavity system have been initiated this year. The total number of 96 cavities will be delivered in recent three years.

The CiADS got the budget from this year, the schedule of cavities production will be one year later. Five types of cavity will be fabricated in three years.

The SRF scope of project of HIAF and CiADS.

Project	Cavity Type	Frequency [MHz]	Cryomodule Quantity	Cavity Quantity
CiADS	HWR010	162.5	1	9
	HWR019	162.5	4	24
	SPOKE042	325.0	10	40
	Elliptical062	650.0	10	40
	Elliptical082	650.0	6	24
HIAF	QWR007	81.25	6	30
	HWR015	162.5	11	66



The CiADS linac layout, the output energy is 500 MeV.

Cavity Parameters

For the stability consideration, the CiADS and HIAF's cavity will be operating in 2K cryogenic system. The operating gradient of cavity will be setup about $E_p=28\text{MV/m}$, which is based on IMP CaFe cryomodule operation experiences. The RF system and coupler have enough margin for operating in higher gradients.

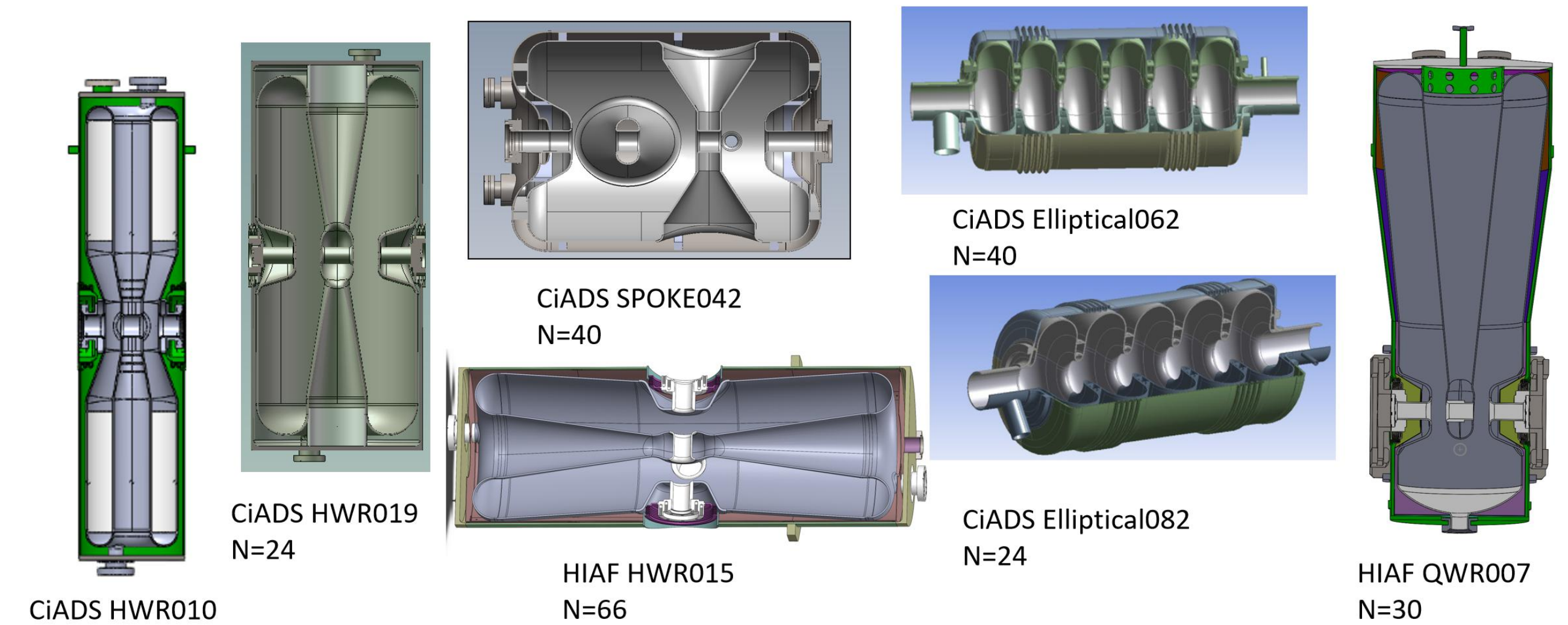
The design parameters of SC cavity of CiADS and HIAF.

Project	Unit	CiADS					HIAF	
		HWR010	HWR019	Spoke042	Elliptical062	Elliptical082	QWR007	HWR015
Beta		0.10	0.19	0.42	0.62	0.82	0.07	0.15
Frequency	[MHz]	162.5	162.5	325.0	650.0	650.0	81.25	162.5
Beam aperture	[mm]	40.0	40.0	50.0	100.0	100.0	40.0	40.0
Leff	[mm]	185.0	351.0	580.0	824.0	895.0	258.0	276.0
Ep/Eacc		5.71	4.24	3.79	2.80	2.10	4.69	4.89
Bp/Eacc	[mT/MV/m]	12.52	6.21	7.05	4.86	3.98	5.84	6.11
TTF		0.83	0.887	0.80	0.72	0.74	0.87	0.87
Veff	[MV]	1.17	2.73	5.06	9.72	14.07	1.54	1.58
G	[Ohm]	28.0	66.43	109.0	187.0	229.0	30.0	51.0
R/Q	[Ohm]	158.3	337.2	431.3	334.0	501.0	482.0	292.0
Rbcs[2K]	[nOhm]	0.17	0.17	0.68	2.73	2.73	0.04	0.17
Specific Q0		1.5×10^9	3.7×10^9	3.6×10^9	1.1×10^{10}	1.3×10^{10}	1.7×10^9	2.8×10^9

Production Status

All of the preproduction cavity are under constructing by different vendor in China. HWR010 and HWR015 use similar design as CaFe accelerator.

The 3D model of seven types of cavity is shown as follow.



The parts production of HWR010 and Elliptical062 cavity.

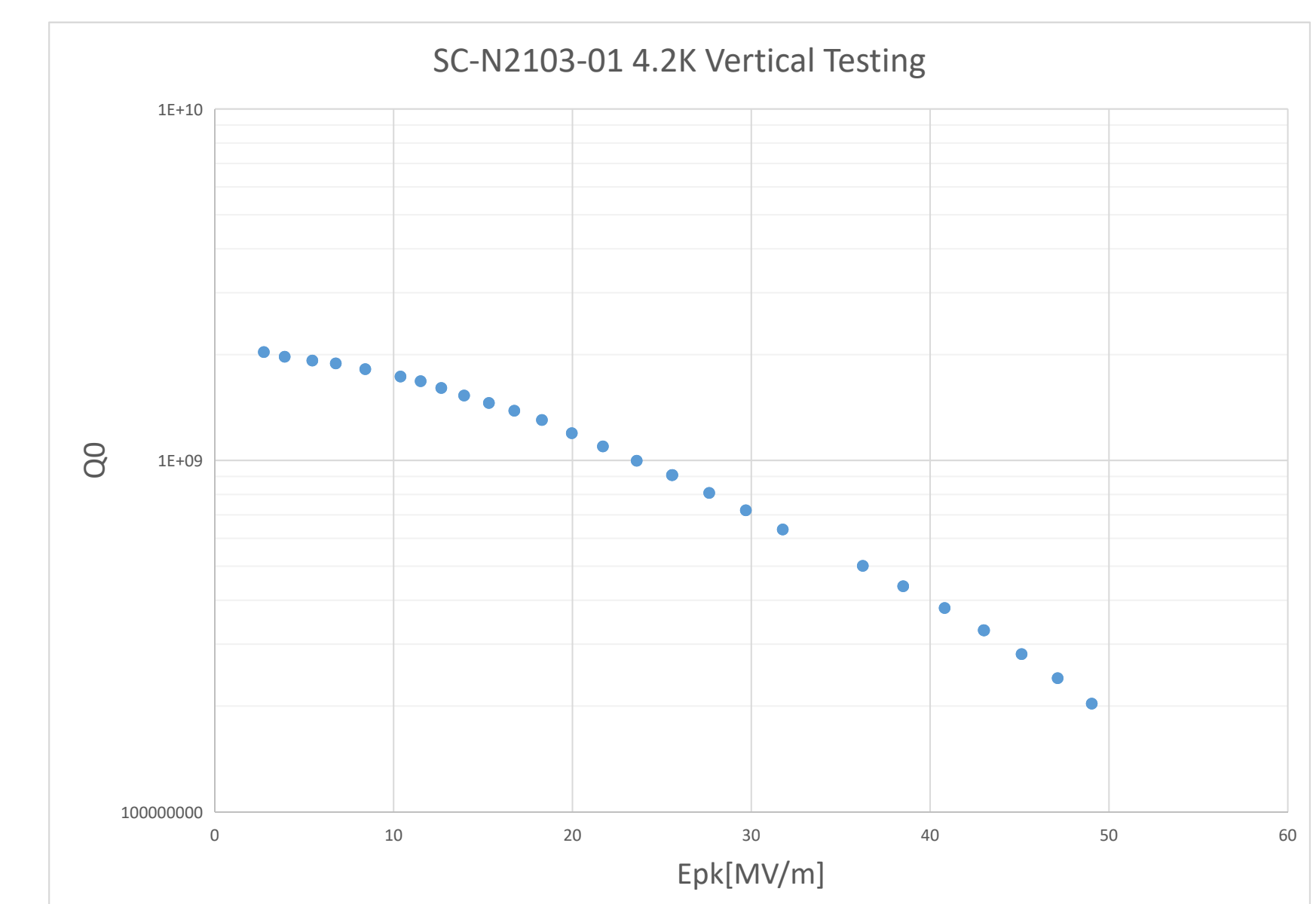
**Verification Test**

A few new vendor for niobium and cavity production have been involved in CiADS and HIAF. One HWR010 cavity performance have been validated in vertical testing, which were fabricated by NINGXIA's company. The gradient shows similar with previous cavity.

The cavity connection during vertical testing shows as follow.



The 4.2K testing of Q0 vs Eacc for HWR010.

**Summary**

1. The SC cavity design for CiADS and HIAF linac have been completed.
2. Preproduction of cavity is under way by different local company in China.
3. HWR010 cavity shows consistant results during vertical testing by one new cavity supplier.