INSTALLATION AND COMMISSIONING OF THE E+/E- INJECTOR FOR DAΦNE AT FRASCATI

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I. INTRODUCTION

The electron-positron injector[1, 2] for the DA NE[3] project at INFN-LFN is being installed and will begin commissioning this summer at Frascati. This is a S-band rf linac system utilizing four 45 MW SLEDed[4] klystrons and 15, 3 m traveling-wave accelerating sections. It is designed to deliver a 250 MeV, 4 ampere electron beam to the positron converter, followed by an accelerator that captures and accelerates the resulting positrons to the ring injection voltage of 510 MeV. All major subsystems are in place. This system is undergoing final installation, alignment and subsystem testing. Also, system integration is beginning. Beam testing and positron generation will begin this summer. Commissioning and final acceptance are expected to be complete by the end of the year.

II. SYSTEM DESCRIPTION

Figure 1 shows one of the four RF units, consisting of a pulsed modulator, klystron and SLED cavities.

The Linac System consists of (see Table 1):

1. A high current linac designed to produce 250 MeV, 4 ampere beam with a 1 mm radius spot at the position converter. This section includes the electron gun and high current linac, which are useable in both positron and electron ring filling modes.

Table 1: DAΦNE Linac Design Parameters

General

RF Frequency	2856 MHz
Klystron Power	45 MW each
No. of Klystrons	4
No. of SLED Cavities	4
No. of Accelerator Sections	15 + Bun & Prebun
Beam Repetition Rate	50 Hz
Beam Pulse Width (FWHM)	10 ns

High Current Electron Linac

No. of Accelerating Sections	5 + Bun & Prebun
Gun Current	10 Amps
Nominal Gun Voltage	120 KV
Current at Positron Converter	>4.0 Amps
Energy at Positron Converter	250 MeV
Emittance at Pos Conv (geo RMS)	< = 1 mm mrad
Energy Spread (FWHM)	± 5%
Focused Beam Spot (FWHM)	˜2 mm

Positron Converter

Type	SLAC SLC
Target	Tungsten
Target Thickness	6, 7, 8 mm (selectable)
Tapered Flux Compressor	4.3 T pulsed
Tapered Solenoid	1.2 T
Solenoidal Field over Capture Section	.5 T
Electron Separation	Chicane Magnet

Positron Linac

No. of Accelerating Sections	10
Final Energy	>510 MeV
Useful Output Positron Current	>36 mA
Emittance at 510 MeV (geometric RMS)	< = 5 mm mrad
Energy Spread (FWHM)	± 1%

High Energy Electron Linac Mode

Final Beam Energy	>510 MeV
Useful Output Current	> 150 ma
Emittance at 510 MeV (geometric RMS)	<= 1 mm mrad
Energy Spread (FWHM)	± 0.5%

Figure 1: Modulator, Klystron and SLED Cavities

2. An electron to position converter based on the SLAC SLC positron converter design.

   Figure 2 shows the "High Current" portion of the accelerator.

Figure 2: High Current Linac

3. A low current accelerator designed to produce up to 550 MeV, unloaded, for accelerating either positrons or electrons at low current to match the 510 MeV ring energy. There is a chicane magnet after the first two accelerating sections to remove the electrons from the beam.

   Figure 3 shows the final focusing triple, positron converter, the solenoid magnets over the capture section and the rest of the "Low Current" portion of the accelerator.

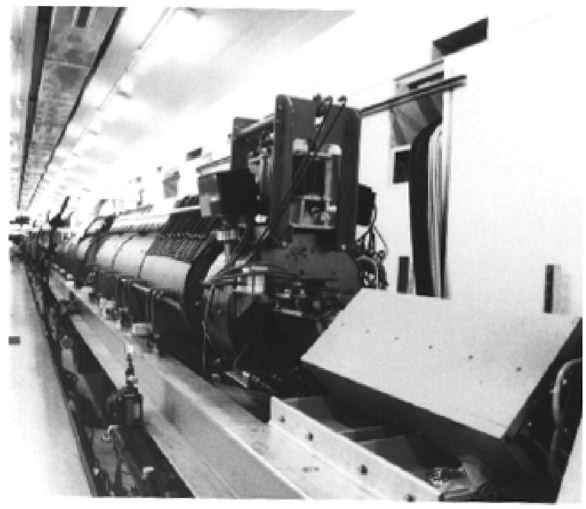

Figure 3: Triple Position Converter and Low Current Linac

4. A control and data acquisition system giving remote control and beam data acquisition and analysis to the main control room operators. The control system runs on an Apple Macintosh under Labview interfaced through CAMAC to the hardware. The data acquisition system similarly runs on an Apple Macintosh under Labview interfaced to two Tektronix TDS644 digital oscilloscopes used as remote transit digitizers. This is an inexpensive but powerful control and data acquisition system.

   Figure 4 shows the entire accelerator from the output end.

Figure 4: Entire Injector From Output End

III. INSTALLATION STATUS

All subassemblies are in place, wired and plumbed. All the klystrons have been installed and being tested with the modulators. The evacuated rf waveguide is complete on the first two rf subsystems. Installation of the remaining rf waveguide and beamline vacuum components is nearing completion. Alignment of the rf accelerator sections is complete. Alignment of all the magnets is also nearing completion.

IV. COMMISSIONING START

The first two rf subsystems, including the first 7 sections, are about to be rf conditioned. Beam testing is expected to begin within a couple of months.

Verification/repetition of factory testing of the "High Current" portion of the accelerator will be done first[1]. The factory test achieved 4 amps at the positron converter position focused to a .94 x 1.56 mm FWHM spot. The energy was measured at 240 MeV, a bit less than the design value of 250 MeV, but within acceptable limits. No attempt was made at the factory to produce positrons because of radiation problems.

Positron production will begin about a month later. Optimizing positron yield and transport with the required beam parameters is expected to take the most time. Final acceptance testing and availability to inject into the damping ring is expected by the end of the year.

V. REFERENCES

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