

PHIN

Two 3 GHz RF Guns Construction

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Abstract

A detailed report about the work done at LAL until February 2008 is available in the 2007 PHIN yearly report. Two different guns have been realised in LAL to be operative on CTF3 and the LAL future accelerator PHIL. We report on the problems encountered, the final realisation of an RF gun that will be sent to CERN and the solution adopted for the other problems.

A detailed report about the work done at LAL until February 2008 is available in the 2007 PHIN yearly report [1].

The RF gun for the drive beam linac of CTF3 at CERN was brazed at CERN just before Christmas 2007 (see Figure 1). However big leaks were detected and the CERN brazing workshop had several attempts to fix the problem. Then, in March 18th 2008 the gun was sent to LAL where more thorough investigations about the leaks have been performed. Results of the measurements showed a leak rate of $\sim 4.5 \text{ mbar.l.s}^{-1}$, which prevents to reach UHV in the gun. Moreover the leak between the cooling tubes and the inside of the gun leads to introduce water which is a poison for the photo-cathode and the NEG coating. Therefore the conclusion is that this gun is unusable for whatever beam production.

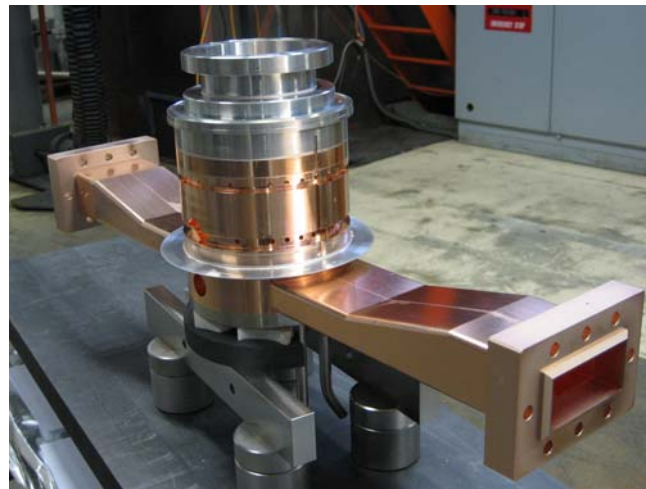


Figure 1: Picture of the photo-injector made by LAL and previously aimed to be installed in CTF3.

According to the PHIN/WP4 objectives, a twin RF gun was under construction to be installed in a test facility at LAL. So an agreement was found between LAL and CERN to give this second RF gun to CERN. The brazing of the latter was successfully finished at LAL in mid-April, and then the NEG chamber was welded in the end of April (see Figure 2). Finally the gun was tested for RF parameters and vacuum, no leak has been detected. So the gun and all its components (vacuum chamber, gauges, pumps, valves, RF windows etc) will be sent to CERN in May the 19th.

An agreement has already been established for the mounting planning and LAL experts will follow this operation by visiting CERN during the critical operations. The know-how transfer on how to mount the gun has already been worked out.

So the deliverable of the construction of two guns was fulfilled also if, unfortunately, only one should be utilised under high RF power regime.



Figure 2: Picture of the photo-injector made by LAL and previously aimed to be installed at LAL. Now, it is given to CERN to be installed in CTF3.

Regarding the others deliverables, e.g. the operation of a twin photo-injector at LAL, it is obviously much delayed. Nevertheless LAL takes into account the construction of a third gun that will start in June 2008 and it will roughly last one year.

Besides the upgrade of the NEPAL test hall is almost finished, major part of the infrastructures are completed as it is illustrated in Figure 3. All the components are provided except the RF gun. Since the installation could be ready to produce an electron beam in the beginning of July 2008 if we could get a gun, we decided to use one which has been realised at LAL.



Figure 3: Nepal test room.

This RF gun was built by LAL in the framework of a contract between LAL and the University of Strathclyde in Scotland (UK). This contract foresees one prototype for Strathclyde, and another one for LAL. A picture of this gun is showed in Figure 4. It is called alphaX because the one for the University of Strathclyde is installed in the alphaX beamline to produce fs electron bunches which will be accelerated in a laser-plasma cell up to 1 GeV.



Figure 4: AlphaX RF gun which will be installed in the NEPAL test beamline.

This gun has been slightly modified to be compatible with the LAL installation. It is a 2.5 cells at 3 GHz with a critical coupling and field well balanced in between cells. The main difference is in the way to couple the gun to the RF network: in the PHIN gun there are 2 holes in the diameter of one cell while it is a coaxial antenna introduced along the cut-off of the alphaX gun.

In conclusion, the deliverable “RF gun for the CERN” is fulfilled. As far as the gun to be tested in LAL a spare solution has been found for the immediate activity. Nevertheless LAL has engaged itself to realise another “PHIN photoinjector” to be delivered and tested during 2009. So the deliverable which consists in a report about the operation at LAL will be fulfilled in the second half of the year 2009.

References

[1] A. Ghigo, R. Losito, L. Rinolfi, "CARE Annual Report 2007", CARE-report-08-003-PHIN

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