# 6 - 25 Development of A 2.45 GHz Intense Proton Source and LEBT for CPHS

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The 50 keV, 60 mA ECR ion source and low energy beam transport system for Tstinghua University was developed successfully by IMP in September 2012. In 2009 Tstinghua University approved a project of compact pulsed hadron source (CPHS). The ion source and LEBT design parameters and requirements are listed in Table 1.

**Table 1 Source and LEBT requirements and status**

| Parameters | Required | Status |
|---|---|---|
| Species | Proton | Proton |
| Energy(keV) | 50 | 50 |
| Peak current(mA) | 60 (RFQ entrance) | 62 |
| Pulse width(ms) | 0.5 | 0.5 |
| Transport efficiency(%) | >85 (LEBT) | 95 |
| Rising edge($\mu$s) | <80 | 80 |
| Falling edge($\mu$s) | <80 | 40 |
| Reliability(h) | 120 | 150 |
| Beam emittance | <0.2 $\pi$ • mm • mrad | 0.18 |
| Spark intervals | <20 (120 h) | 7 |

A continuous 150 hours' reliability test has been done with the beam energy of 50 keV and 60 mA at the exit of LEBT and result is shown in Fig. 1. After a few hours' conditioning, the source plus the LEBT has been operated for 150 h with 7 spark intervals. The whole system can almost automatically recover its operation condition after spark except for microwave generator failure. About 60 mA proton beam was measured at test chamber-2 under vacuum of the order of $10^{-3}$ Pa in the beam line and the measured phase space distribution is shown in Fig. 2. Test results have shown that the ion source routinely produce 75~80 mA multi-component beams including $H^+$, $H_2^+$ and $H_3^+$ at test chamber-1. $H_2^+$ and $H_3^+$, which have greater momentum and are less focused than the protons, are lost in the LEBT.

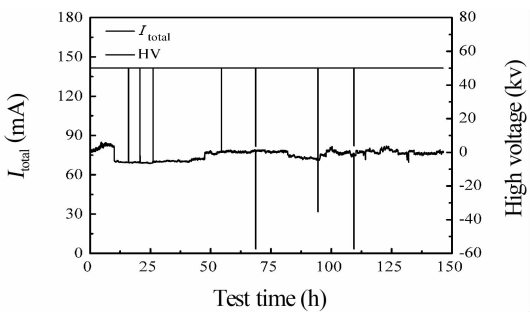


Fig. 1 Spark test for the extracted beam 50 keV, 62 mA from LEBT downstream.

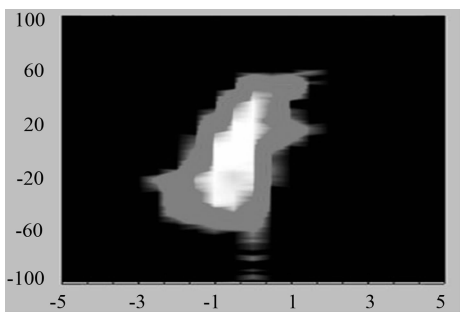


Fig. 2 Measured phase space distribution at beam energy of 50 keV, proton current of 60 mA.