# High Voltage power supply system for High-Granularity Timing Detector

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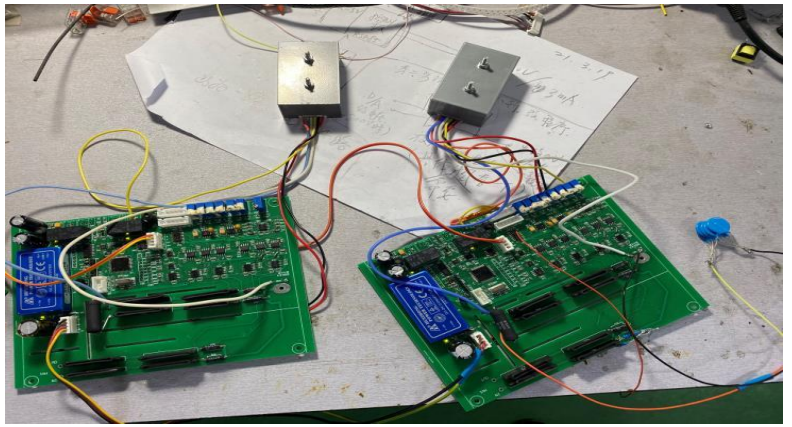
# Introduction of High Voltage(HV) system for HGTD

Each of the LGAD sensor modules of the detector require an individual bias voltage in a range up to 800 V. Such a high voltage is needed to power the sensors after being exposed to the high radiation conditions of the HL-LHC.
Since sensor modules close in radius are expected to require the same voltage, the baseline choice is that two modules share a bias supply. High voltage supplies capable of delivering 6 mA current per channel will be used.
This choice, which requires a commercial supply with multi-channel rack-mounted units. Systems with high channels density (~ 400-500 per crate) allow to minimize space but also reduce cost. A schematic layout of the high voltage system is shown in Figure


HGTD schematic High Voltage layout

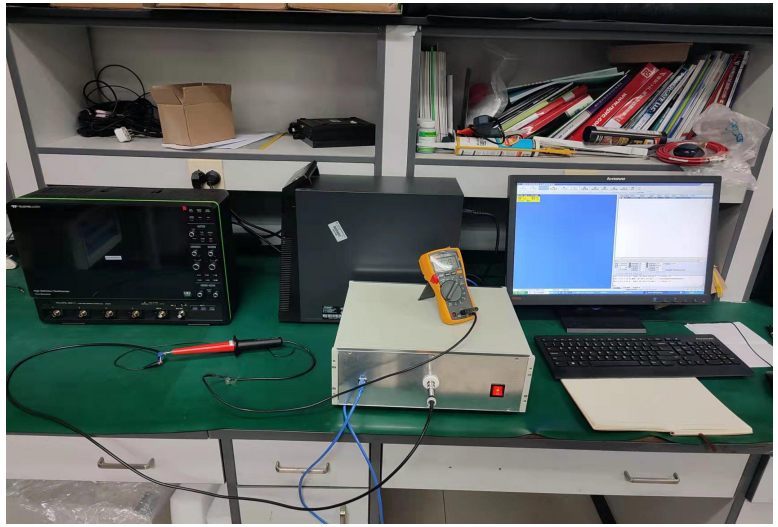
# Status of the HV prototype

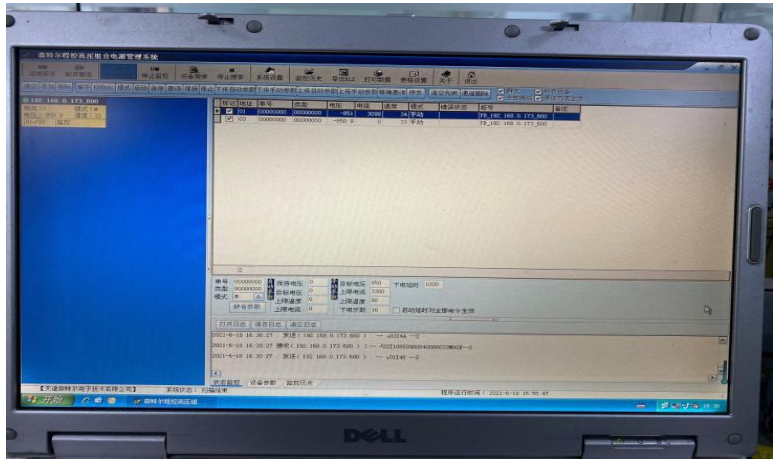
A HV power supply prototype from “Tianjin Centre Advanced Tech Magnet Co.,Ltd” is in test now. Most of the parameters are designed based on requirements of HGTD.



| Item | parameters | |
|---|---|---|
| Channel | 4 channels, | It is enough to test and evaluate the performance of the power supply |
| Connector | SHV | Easy to use. It may change due to the large number of channels and limited number of racks |
| Software | control and monitoring power supply through the network. | It is not suitable for ATLAS DCS, but DCS will be incorporated in the future |
| Box & size | 2U or 3U | It is the box of other products in Centre. It needs to be designed in the future. |
| HV cable | SYV-75-3-4 | It is used for testing in IHEP. |

# Status of the HV prototype

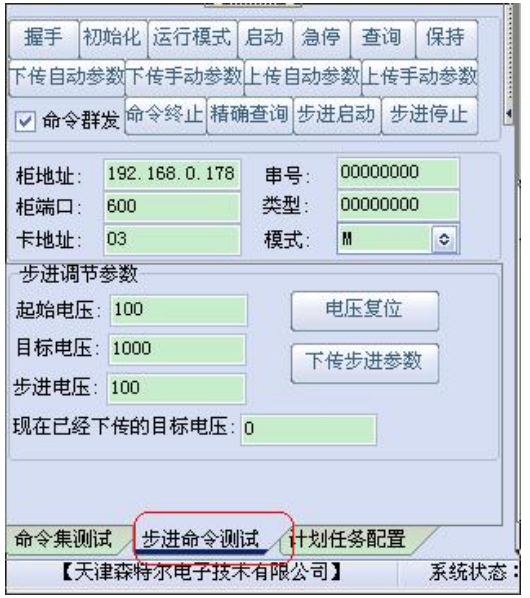




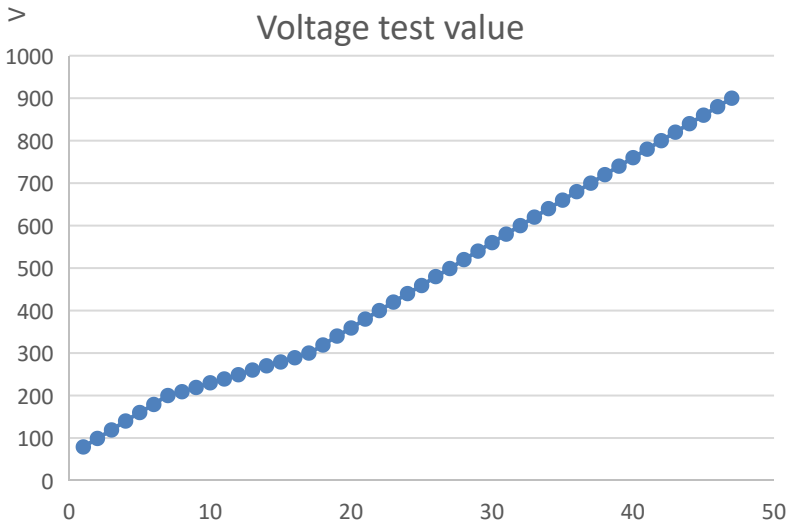
The purpose of this prototype is to evaluate Centre's technology. To judge whether it has the ability to produce HV for HGTD.

The proprietary software can realize the function of step-by-step test and monitor the real-time temperature, voltage, and current.

You can also set the ramp up/down speed and generate an e-log to record all the parameters change.



# Preliminary results




The y axis is the monitored value and the x axis is the measured value after tenfold decay.

Here shows the result of the Voltage test. We compared the measured value after tenfold decay and monitored values. This plot shows that after 100V the prototype has good accuracy and stability.

Electrical Performance of test cable：

| | Withstanding voltage | Impedance | Attenuation (20℃,200MHz) |
|---|---|---|---|
| SYV-75-3-4 | 4kV | 75Ω | ≤0.22dB/m |

# Test Schedule

- Voltage stability test
  - The test range is from 0 to -900 V (active range 0 to -800 V with -100 V margin) and Precision of voltage setting and monitoring should be 1V.
- Current test
  - Range from 0 to 6 mA, resolution of current limit setting and monitoring should be 0.1 µA or better.
- Ramp up/down speed test
  - Ramp up/down speed will be tested from 1V/s steps up to 10 V/s & 1V/s steps up to 50 V/s.
- Output ripple voltage analysis
  - Need to check the ripple waveform of the output voltage.

After finishing these preliminary tests, will try to connect the LGAD sensor

# Thanks for your attention!