High Voltage Power Module

pluggable to
NAT RTM Power Supply Carrier

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Outline

- Motivation
- Hardware
- Firmware
- Software
- Results
- Possible applications
Motivation

DESY introduced an RF-Backplane for MicroTCA.4 Crates

- The RF-Backplane is located behind the AMC backplane of the MicroTCA.4 Crate.
- Three types of RTMs used: µRTMs with only a Zone-3 connection to the front AMCs, µRTMs with a connector to the RF-Backplane and optionally a Zone-3 connection to the front AMCs and extended RTMs

eRTMs are not covered by MicroTCA.4 Specification, a standard Power Modules does not provide power to them

µRTMs used together with the RF-Backplane might be powered from the RF-Backplane instead of corresponding to a given AMC board

In many cased sensitive analog signal conditioning elements are installed on RTMs and there is a need to provide clean power supply to these RTMs

For specific applications there is a need to deliver high voltage, high current power supply which is not covered by MicroTCA.4 Specification
Hardware (RF-Backplane)

<table>
<thead>
<tr>
<th>PM</th>
<th>PM</th>
<th>MCH</th>
<th>AMC</th>
<th>AMC</th>
<th>AMC</th>
<th>AMC</th>
<th>AMC</th>
<th>AMC</th>
<th>AMC</th>
<th>AMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>eRTM#15</td>
<td>eRTM#14</td>
<td>eRTM#13</td>
<td>µRTM</td>
<td>µRTM</td>
<td>µRTM</td>
<td>µRTM</td>
<td>µRTM</td>
<td>µRTM</td>
<td>µRTM</td>
<td>µRTM</td>
</tr>
</tbody>
</table>

Rear PM

Courtesy by H. Lauftkoetter
Hardware (Example Setup)

Example Configuration

Courtesy by H. Lauftkoetter
Hardware (NAT RTM Power Supply Carrier)

- High quality ±VV for μRTMs, adjustable 5-12V
- +12V PP, +3.3V MP for eRTMs
- Contention protection against standard PMs
- Modular design
- Optional ±100V output at front panel
- AC frontend

EMI/PFC Frontend 600W
DC/DC Converter for 48V Output

Courtesy by H. Lauftkoetter
Hardware (High Voltage Power Module)

- Accept low voltage input (up to +48 VDC) and deliver stable, high voltage (up to ±100 VDC – bipolar or unipolar) and high current (up to 500 mA) outputs
- PMBus standard communication bus
- Temperature, output voltage, current and power sensors
- Allow supplying up to 4x RTM cards
- High voltage output indicated by front panel LEDs
- Built in: short circuit protection, input filter
- Inputs/outputs isolated with possible line, load regulation
- Closed inside housing (Nickel Plated Copper),
- Cooled using free air convection (no additional heat sink needed)
Firmware (ATXMEGA128A1U)

>` hvpm.c

- void HVPM_DriverInit(); void HVPM_ActivateHVPos(); void HVPM_DeactivateHVPos();
- void HVPM_ActivateHVNeg(); void HVPM_DeActivateHVNeg();
- void HVPM_ActivateHVPosNeg(); void HVPM_DeActivateHVPosNeg();
- void HVPM_TemperatureSenseHVPos(); void HVPM_TemperatureSenseHVNeg();
- void HVPM_VoltageSenseHVPos(); void HVPM_CurrentSenseHVPos();
- void HVPM_PowerSenseHVPos(); void HVPM_VoltageSenseHVNeg();
- void HVPM_CurrentSenseHVNeg(); void HVPM_PowerSenseHVNeg();

>` hvpm.h

- #define MAX6626A_ADDR (0x48)
- #define MAX6626B_ADDR (0x49)
- #define LTC2945A_ADDR (0xD8>>1)
- #define LTC2945B_ADDR (0xDE>>1)
- ...

Konrad Przygoda | Seite 8
Software

NAT RTM PSC menu

HVPM submenu
## Results

<table>
<thead>
<tr>
<th>Load</th>
<th>Ripples [Vrms]</th>
<th>Waveform</th>
</tr>
</thead>
<tbody>
<tr>
<td>0V@none</td>
<td>0.051</td>
<td><img src="image" alt="Waveform 0V@none" /></td>
</tr>
<tr>
<td>100V@200 Ohm</td>
<td>0.036</td>
<td><img src="image" alt="Waveform 100V@200 Ohm" /></td>
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<tr>
<td>-100V@200 Ohm</td>
<td>0.043</td>
<td><img src="image" alt="Waveform -100V@200 Ohm" /></td>
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</table>
Possible Applications (XFEL RF Station – 32 cavities)

2x12 Slot Crate

8x RF in (probe)

8x RF in (forward)

8x RF in (reflected)

1x KLY

FPGA

FPGA

FPGA

FPGA

1x KLY

32x cavities = 64x piezos

Cavity tuner control – pulse or cw modes

EMI/PFC Frontend 600W

DC/DC Converter for 48V Output

Hot Swap Handle

USB Console

48V Bus

Cage/Isolation barrier

On/Off Switch

AC Connector

Control Logic

Backplane Connector

MP

13

MP

14

MP

15

PP

13

PP

14

Power Switches and U/I Monitors

Regulator 12 V to 3.3 V

Regulator 12 V to 5 V

SMP

PP

15

PP

-1

MGMT  OUT

N.C. N.C. N.C.
Possible Applications (XFEL link stabilization)

1x12 Slot Crate

4x OXC

6x

DAMC-FMC25

1x FPGA

2x DAMC-FMC25/20/TCK7

4x V_piezo

1x FPGA

SFP

24x links = 24x piezo fiber stretchers

Link Stabilization

1x12 Slot Crate

4x OXC

6x

DAMC-FMC25

1x FPGA

2x DAMC-FMC25/20/TCK7

4x V_piezo

1x FPGA

SFP

24x links = 24x piezo fiber stretchers

Courtesy by C. Sydlo
**Possible Applications (XFEL Master Laser Oscillator Sync)**

Laser Synchronization

![Diagram of laser synchronization system](image)

**1x12 Slot Crate**

- **PZD**
- **FPGA**

Redundant solution

- **2x RF in**
- **RTM-DWC10**
- **DAMC-FMC25**
- **DAMC-SIS8300**

Before connecting your AMCs with serial links over the AMC backplane study its show_fruinfo 253
Possible Applications (many more)

- bERLinPro at HZB
- TARLA in Ankara
- ESS?

Courtesy by P. Echeverria