

HV filter pot re-design

Saba Parsa

University of Bern

5 April 2024

Motivation for HV filter re-design

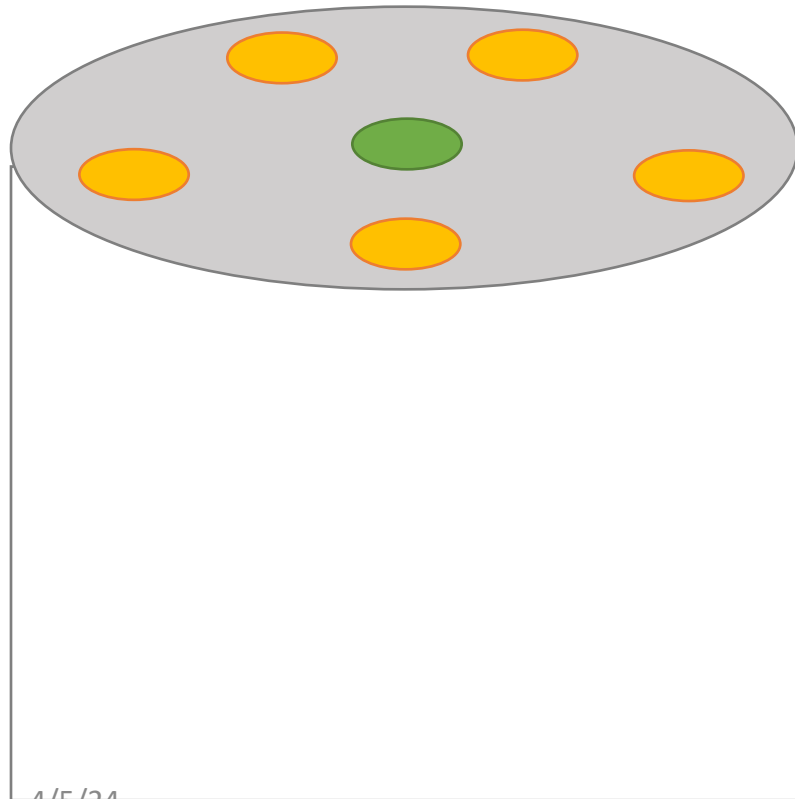
Bern Single Module tests	PFD5 (loaded output)	Eshell, kV/cm	Rshell, MOhm	P shell, W	Spellman HVPS, V, kV	Spellman HVPS, I, mA	P in PFD5, W
Module-0	15.100	0.500	71.193	3.203	20.5	0.296	2.865
Module-1	15.105	0.500	82.582	2.763	17.446	0.270	1.948
Module-2	15.102	0.500	71.285	3.199	17.75	0.307	2.250
Module-3	15.115	0.500	61.791	3.697	18.095	0.340	2.455

During the cosmic test runs of the single modules at Bern the electrical performance of the HV distribution system and the modules field structure was studied. This table summarizes the required voltage value of the Spellman power supply for operating at nominal E-field of 0.5 kV/cm for each module. The corresponding current draw and the calculated dissipated power in FPD-5 is listed for reference.

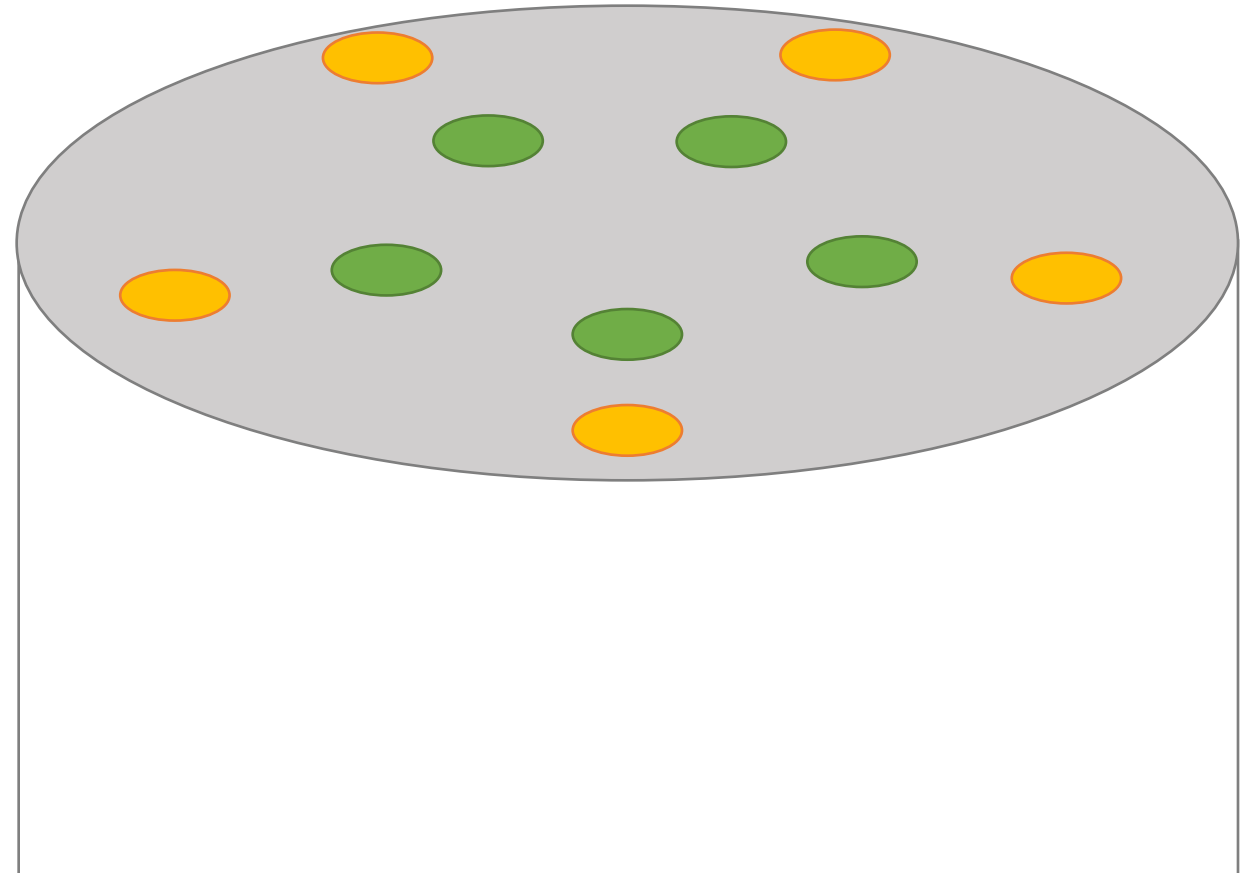
Each module has a different shell resistance, and this is going to be the case for ND-LAr modules as well!

PFD-5x5 filter pot re-design

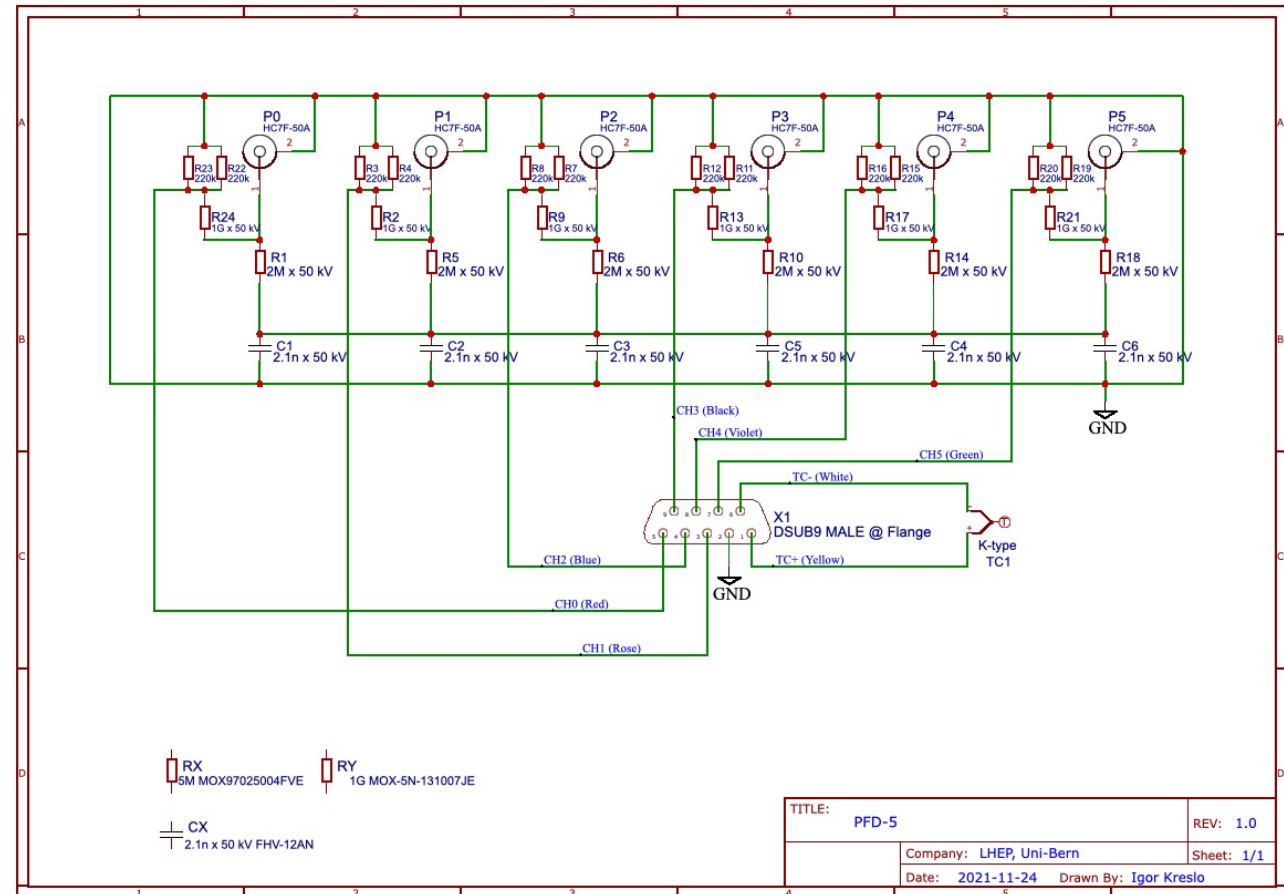
PFD-5



Modified PFD-5x5



PFD-5 used in Bern module runs



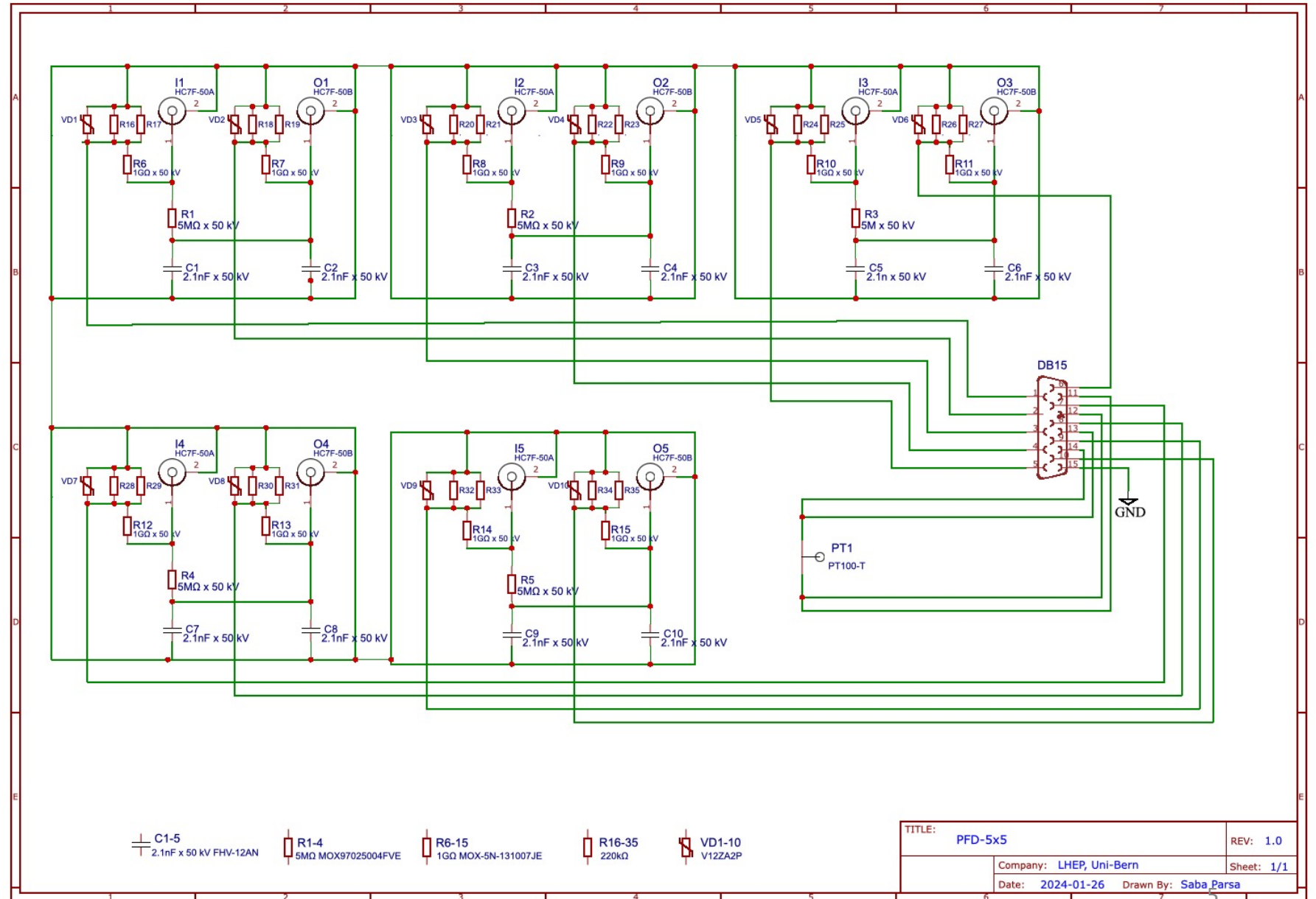
PFD 5x5 Schematics

PFD-5x5

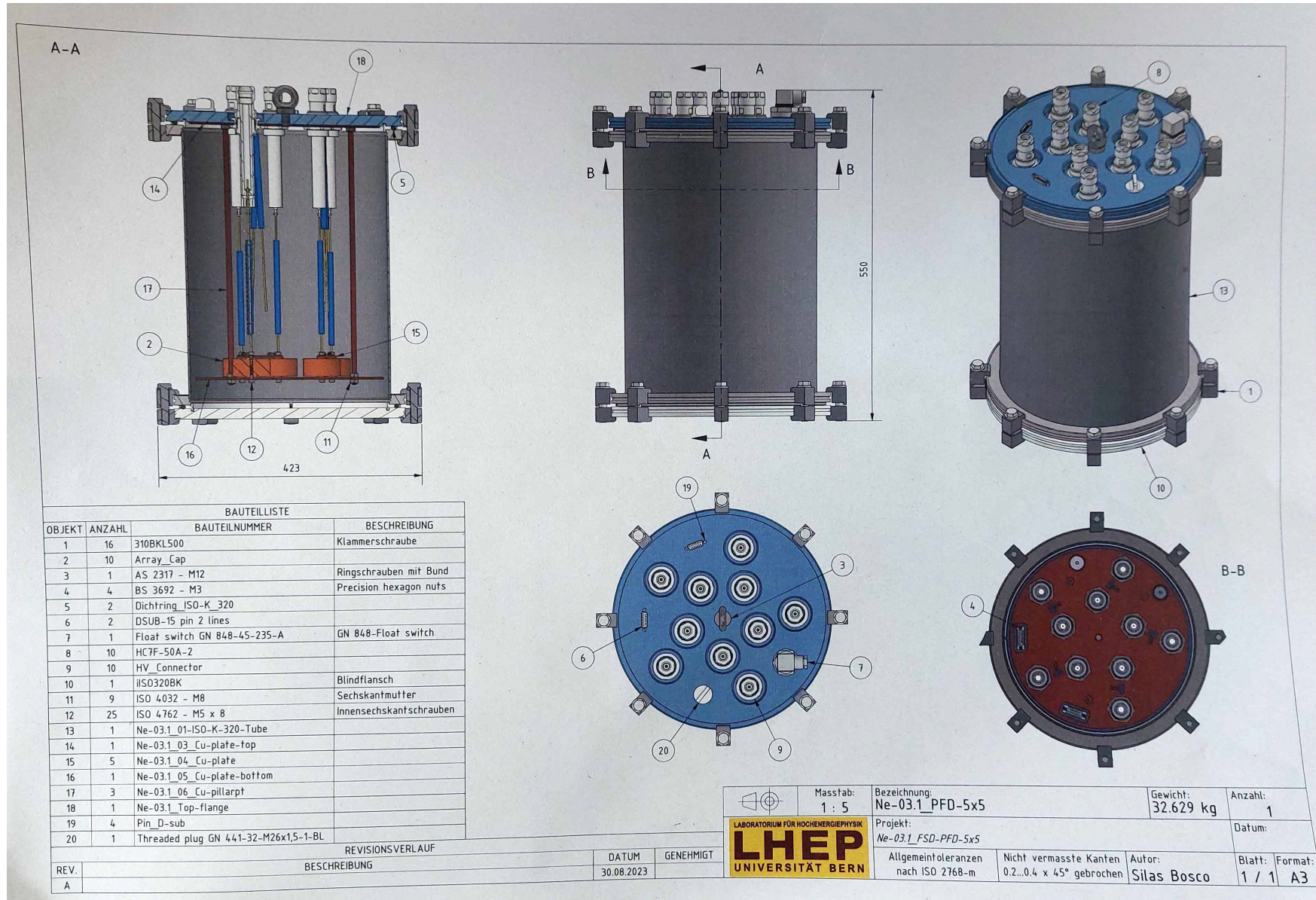
- 5 inputs
- 5 outputs
- 10 monitoring channels
- 1 temperature sensor
- DSUB-15 connector

Low pass Filter calculation

- PFD-5 Cut off frequency 6-7 Hz
- $C = 12.6 \text{ nF}$, $R = 2\text{M}\Omega$,
 $f = 1/2\pi RC = 6.3 \text{ Hz}$
- Redesign and keep $RC = 25 \text{ e-3}$
- $C = 4.2 \text{ nF}$, $R = 5 \text{ M}\Omega \rightarrow f = 7.5 \text{ Hz}$



PFD-5x5 design



Components

Item	Value	number	Part number	Manufacturer
Capacitor	2.1 nF	10	TDK FHV-12AN	https://octopart.com/fhv-12an-tdk-194027?gclid=EAIaIQobChMIxrzUge7XgwMV01tBAh1u-Q36EAAAYASAAEgKW4vD_BwE
Resistor	5 M Ω	10		
Resistor	1 G Ω	10		
Resistor	210 k Ω	10		
Varistor	> 5 V	10		
HV connector female output		5	HC7 -F -50B -O	Hivolt.de
HV connector female input		5	HC7 -F -50A -O	Hivolt.de
HV connector male for dummy module cable filter end		5	HC7 -M -50B	Hivolt.de
HV cable		1 (Spellman to filter ~ 2 m)	2124	Hivolt.de
Oil		20 lit		Nitro transformer oil

Production is ongoing

