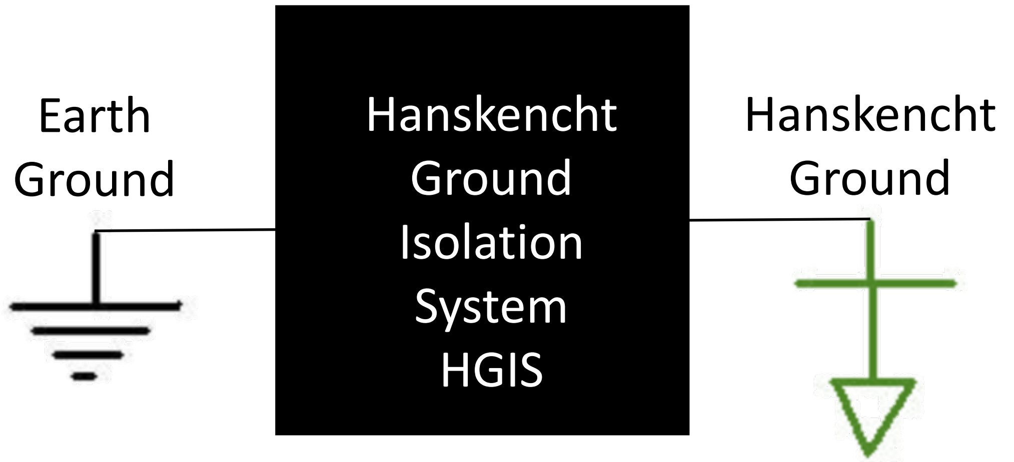
Injector Setup - 2021

6/29/2021

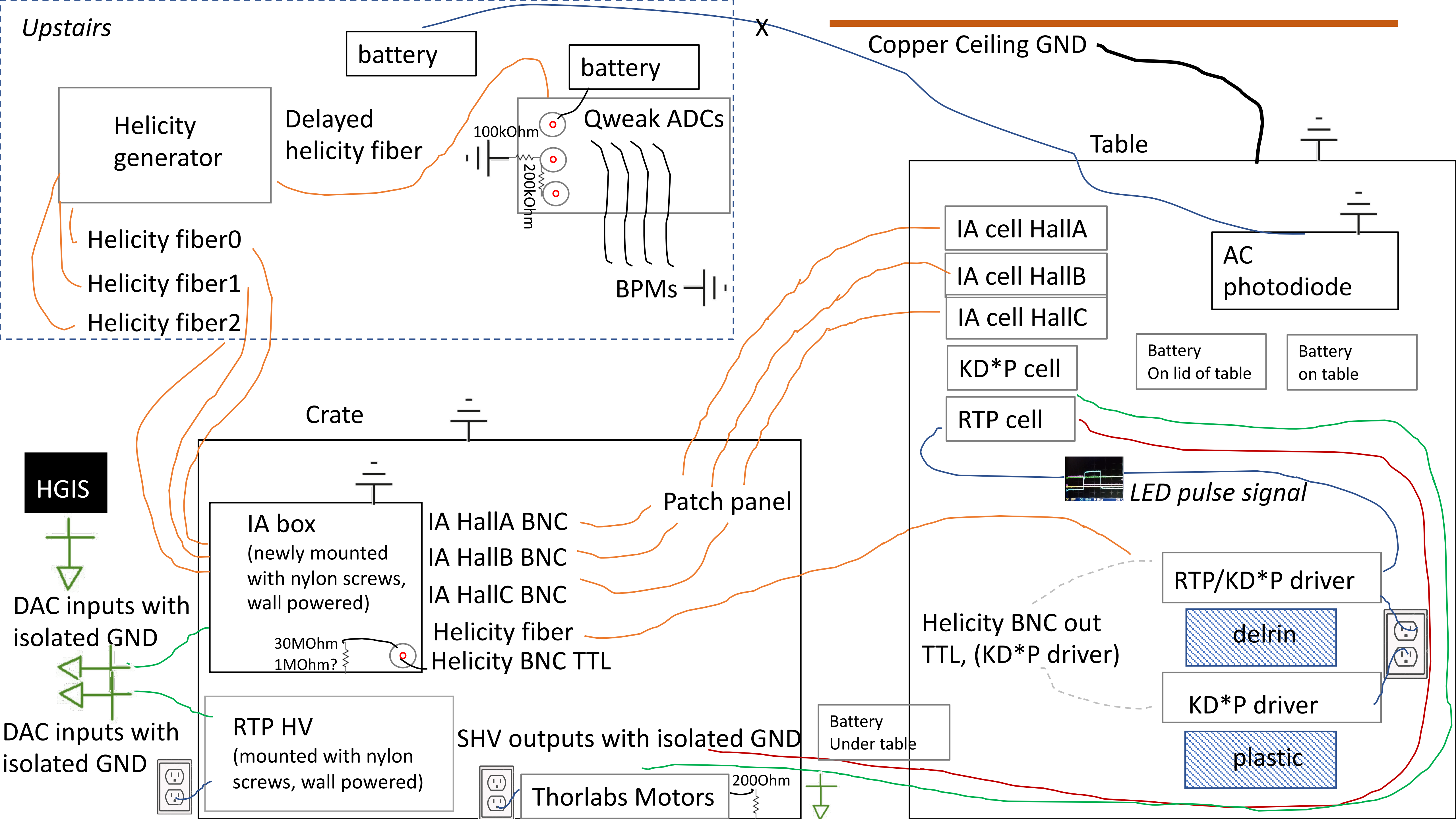
John Hansknecht's Ground Isolation System

- Function: Holds a ground floating within ~10mV of earth ground

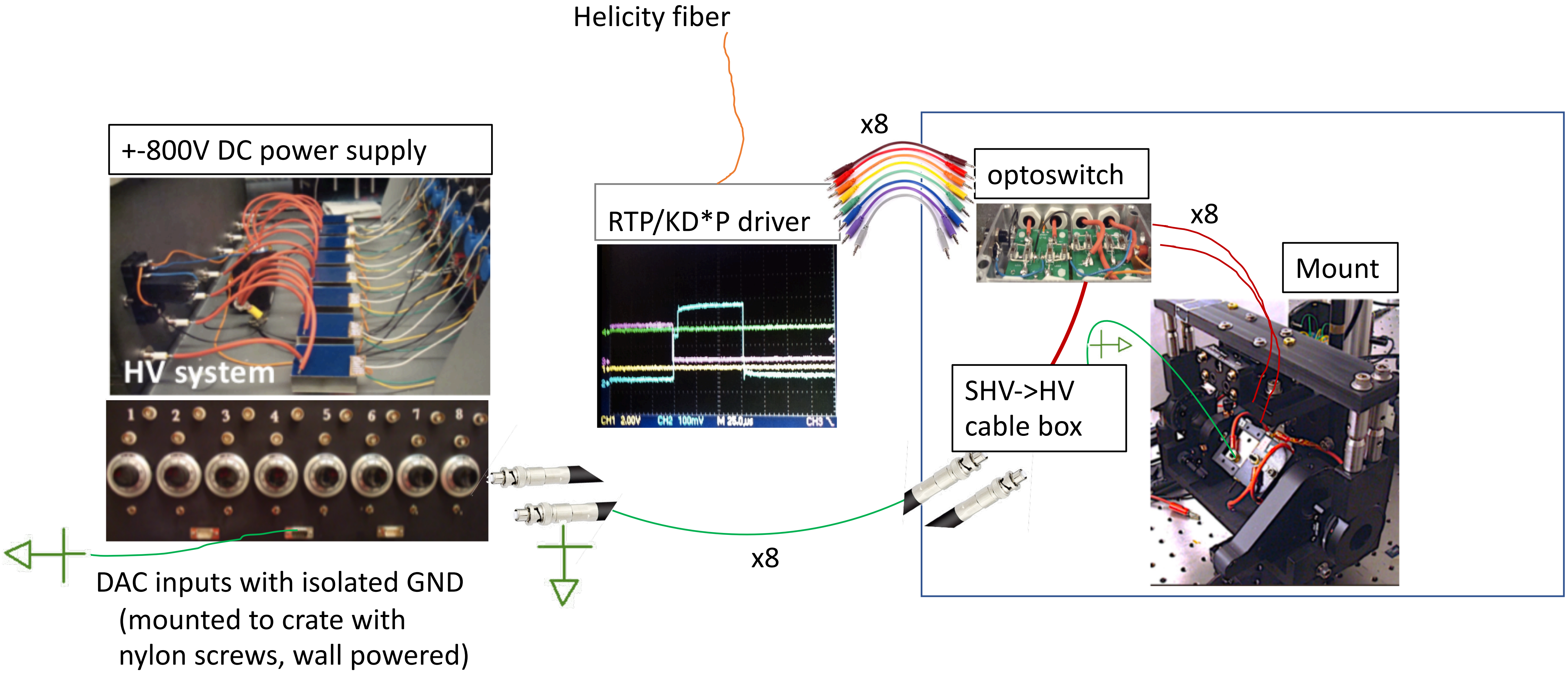
(i.e. measure voltage between Hansknecht-Ground and earth-ground, voltmeter reads a fluctuating value at the mV level



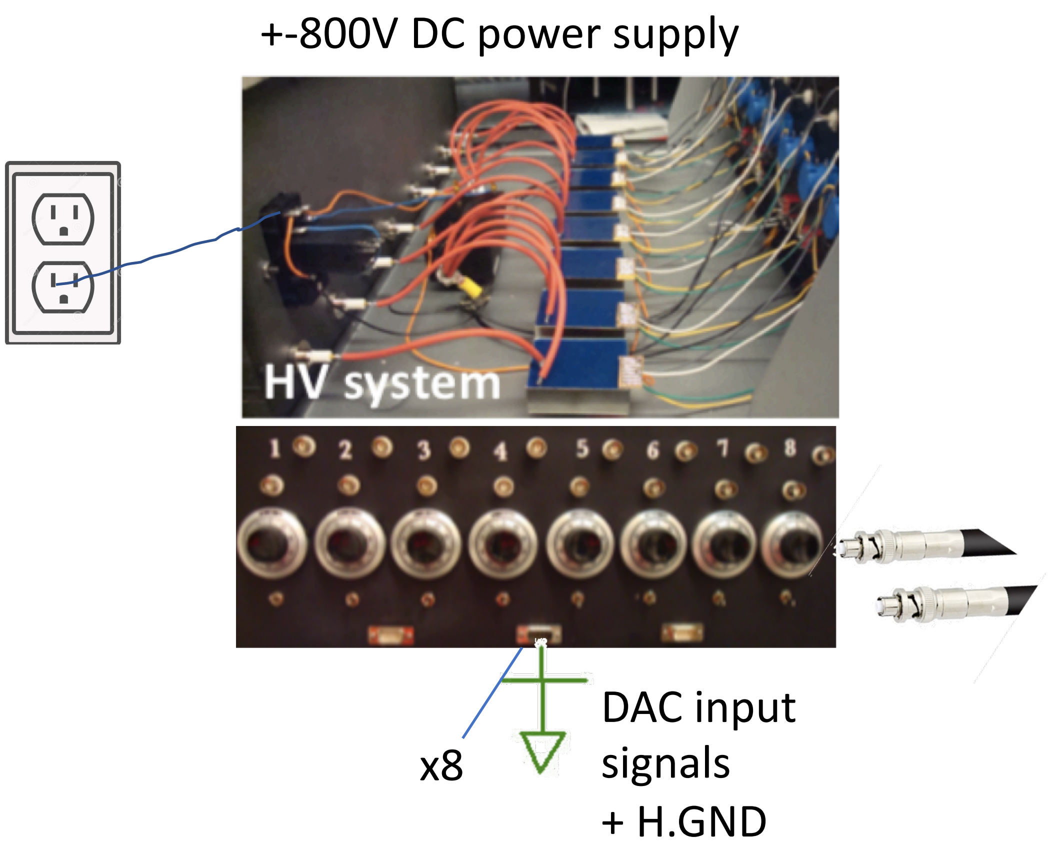
- Goal Downstream: **Keep** Hansknecht ground isolated


Upstairs
battery
battery
X
Copper Ceiling GND
Helicity generator
Delayed helicity fiber
100kOhm
Qweak ADCs
200kOhm
Table
Helicity fiber0
Helicity fiber1
Helicity fiber2
BPMs
IA cell HallA
IA cell HallB
IA cell HallC
AC photodiode
KD*P cell
Battery On lid of table
Battery on table
RTP cell
Crate
HGIS
LED pulse signal
Patch panel
IA box (newly mounted with nylon screws, wall powered)
IA HallA BNC
IA HallB BNC
IA HallC BNC
Helicity fiber
Helicity BNC TTL
30MOhm
1MOhm?
DAC inputs with isolated GND
DAC inputs with isolated GND
RTP/KD*P driver
delrin
Helicity BNC out TTL, (KD*P driver)
KD*P driver
plastic
RTP HV (mounted with nylon screws, wall powered)
SHV outputs with isolated GND
Battery Under table
Thorlabs Motors
200Ohm

RTP system



Helicity fiber
x8
+-800V DC power supply
HV system
RTP/KD*P driver
optoswitch
x8
Mount
SHV->HV
cable box
x8
DAC inputs with isolated GND
(mounted to crate with
nylon screws, wall powered)



- Wall powered: live/neutral -> AC-DC converter -> 12V DC -> IGES 2kV DC power supplies
- DAC control inputs with isolated GND – 9pin input -> IGES 2kV DC power supplies
- Mounted to crate with nylon screws (isolate chassis ground from earth)
- Cable outputs Kapton isolated from chassis (isolate Hansknecht ground from chassis ground)

SHV cable ground ISOLATED. DAC has input floating ground (Hansknecht ground). HVPS box isolated from crate.

IGES 4W, 0.0005% ripple, 2kV, 5V control,2mA

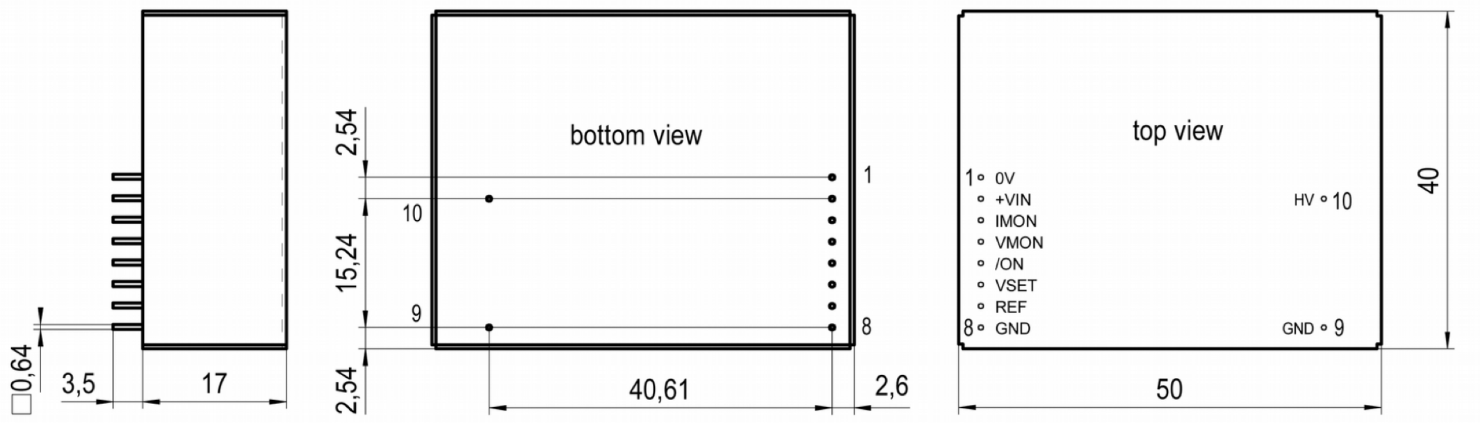


Figure 2: dimensional drawing BPS 4W

4.2 BPS 4W

PIN	NAME	DESCRIPTION	VALUE
1	**0V** (*	Supply ground	
2	**+VIN**	V_{in} Supply voltage	+12 V DC
3	**IMON**	I_{mon} Monitor voltage of output current	0 .. 5 V
4	**VMON**	V_{mon} Monitor voltage	0 .. 5 V
5	**/ON**	Signal ON	TTL-level, LOW or n.c. => HV ON HIGH => HV OFF
6	**VSET**	V_{set} Set value of output voltage	0 .. 5 V
7	**REF**	V_{ref} Internal reference voltage	5 V
8	**GND** (*	Signal ground	
9	**GND** (*	HV ground	
10	**HV**	V_{out} High voltage output	
Note: Case is connected to GND *) internally connected			

Table 5: PIN Assignment BPS 4W

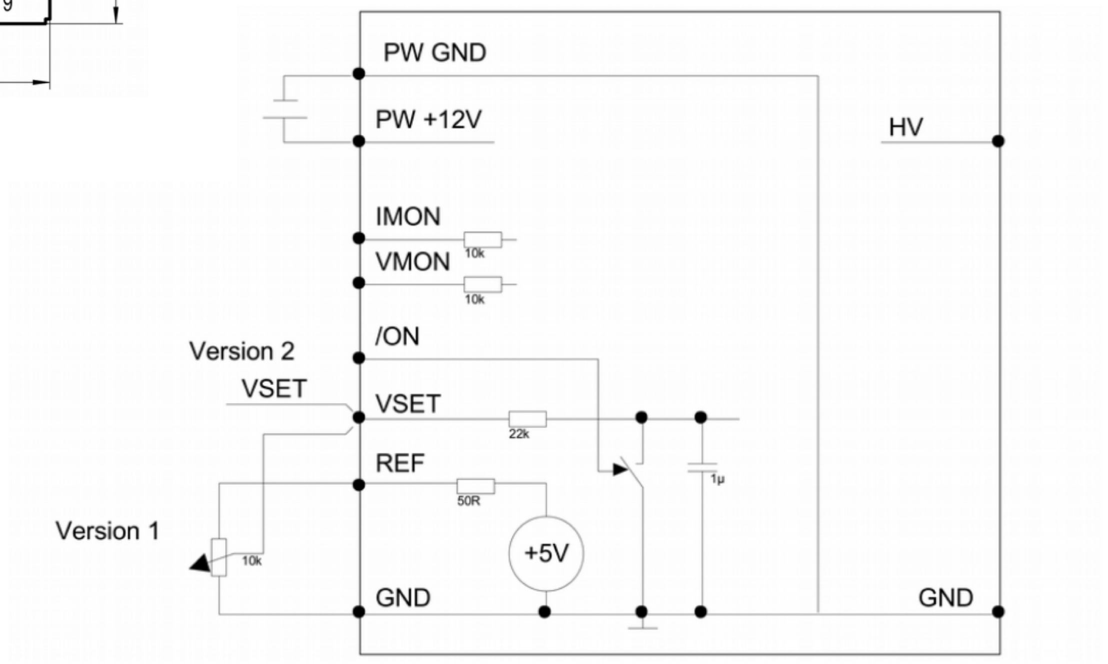
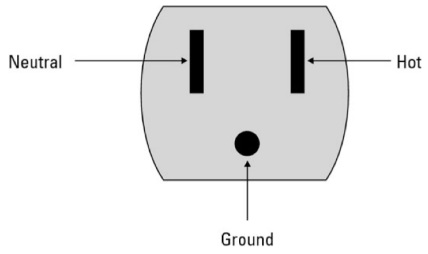
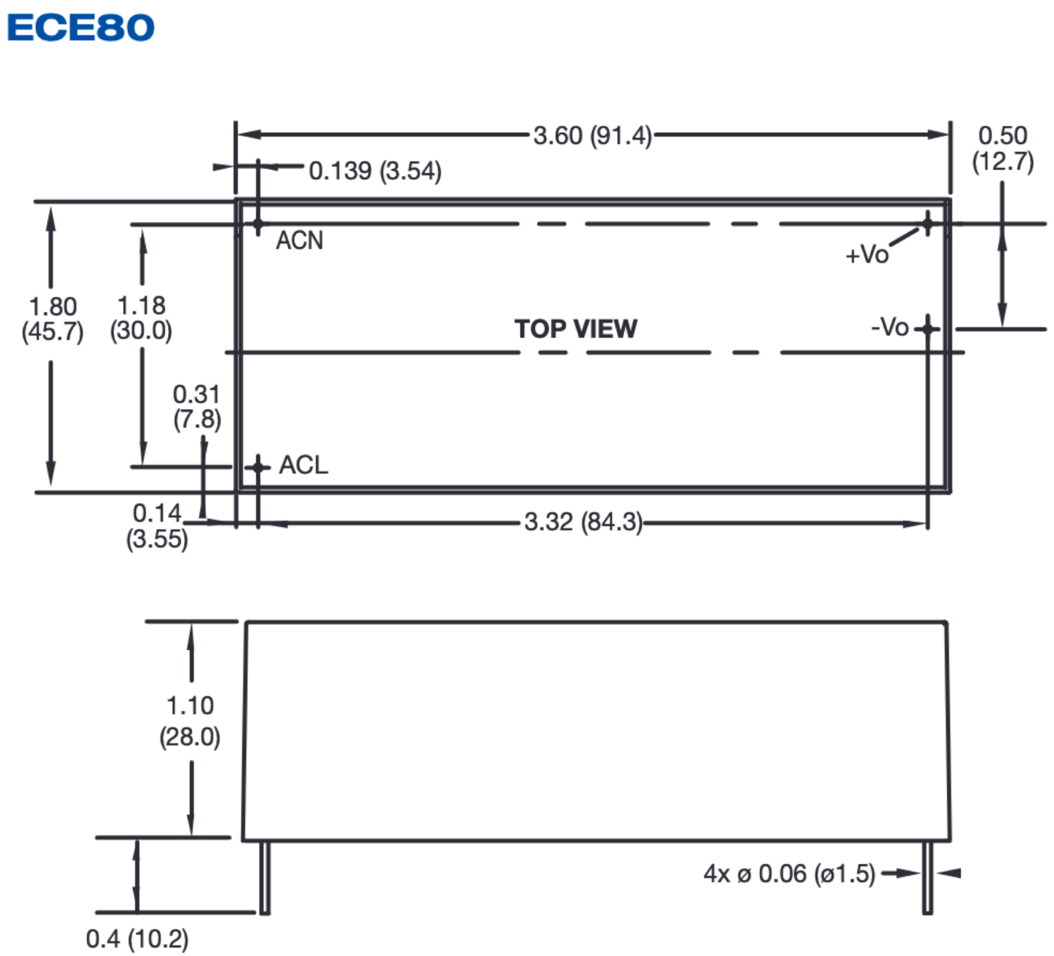


Figure 5: Control principle BPS 4W

AC/DC CONVERTER 12V 80W

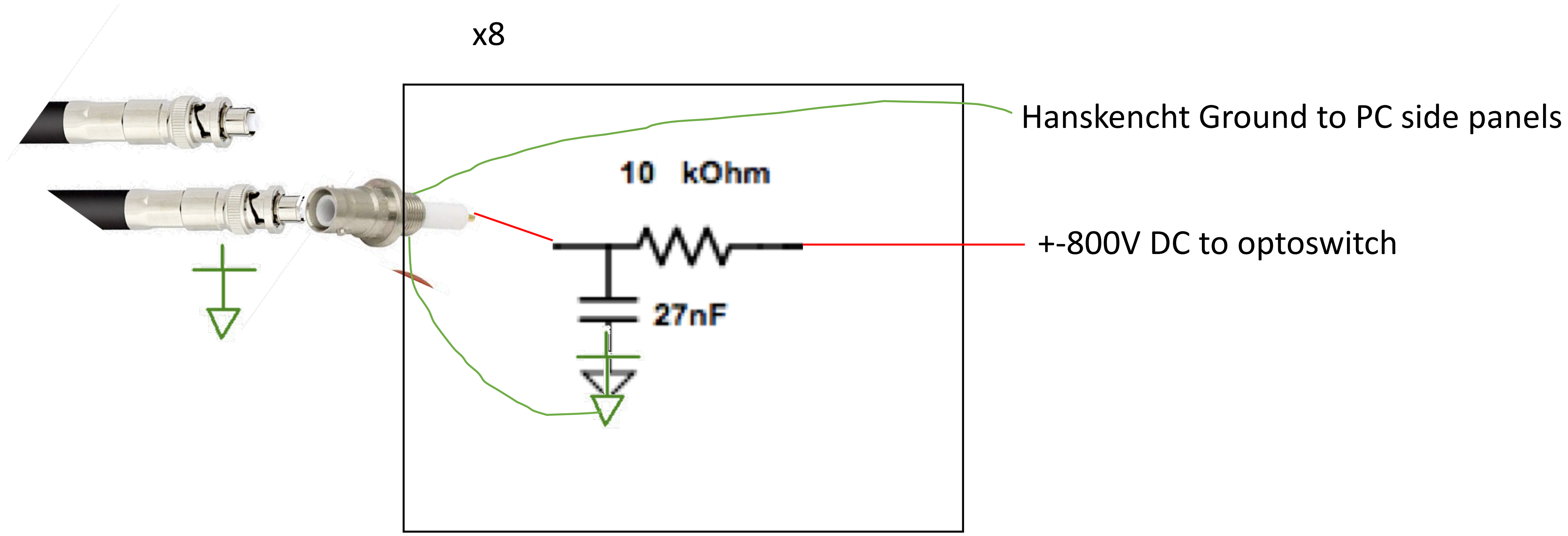


Input: ACL (line), ACN (neutral)
Output: +Vo, -Vo (at 12V DC)

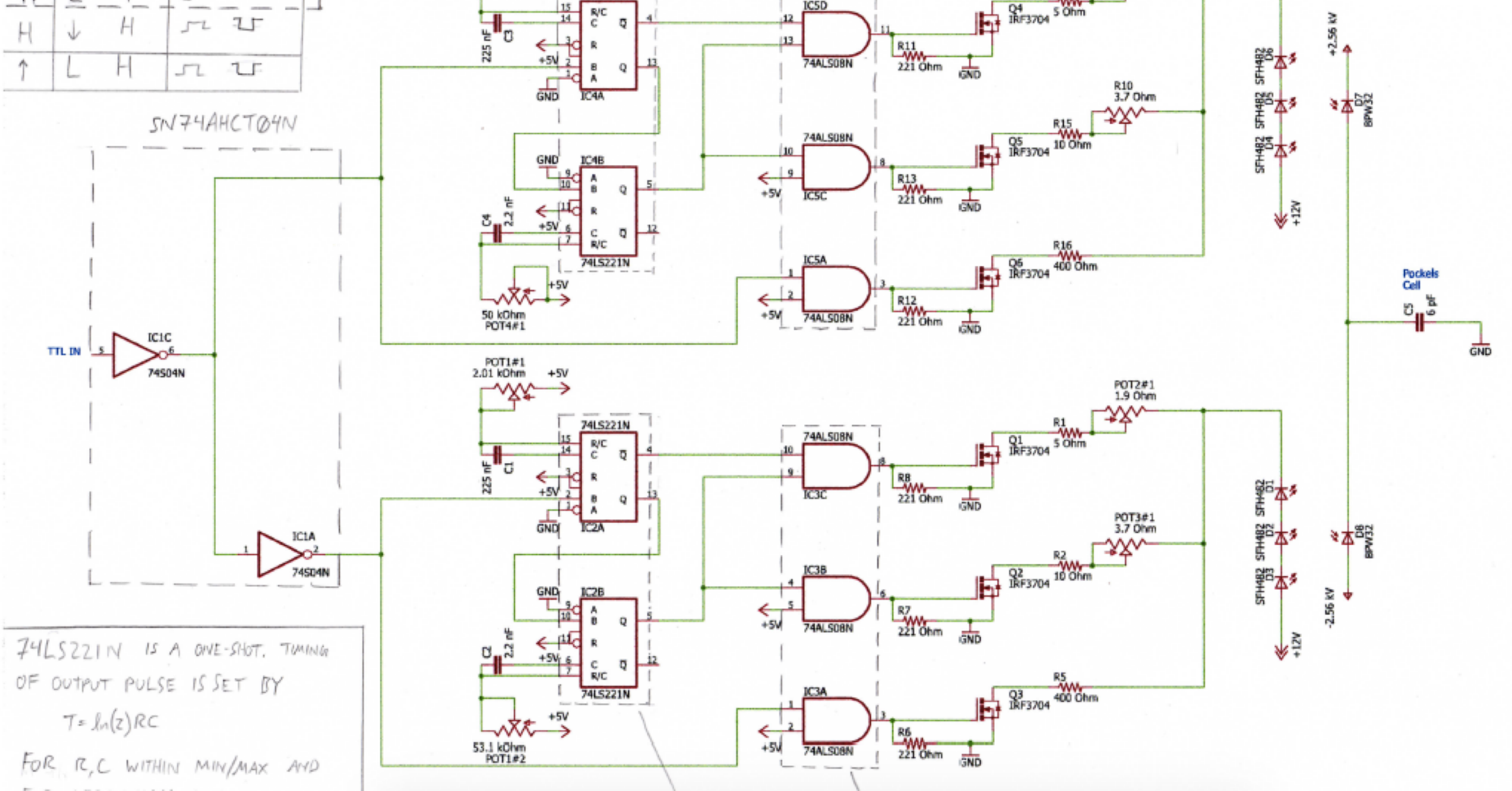


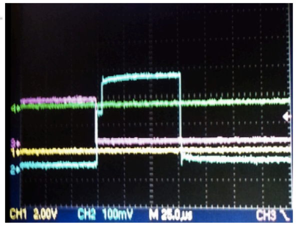
https://www.xppower.com/portals/0/pdfs/SF_ECE80.pdf

SHV->HV cable box

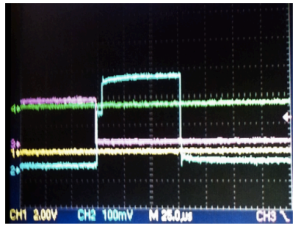


DRIVER – **fiber optic helicity signal input** (converted to TTL) – outputs short pulse

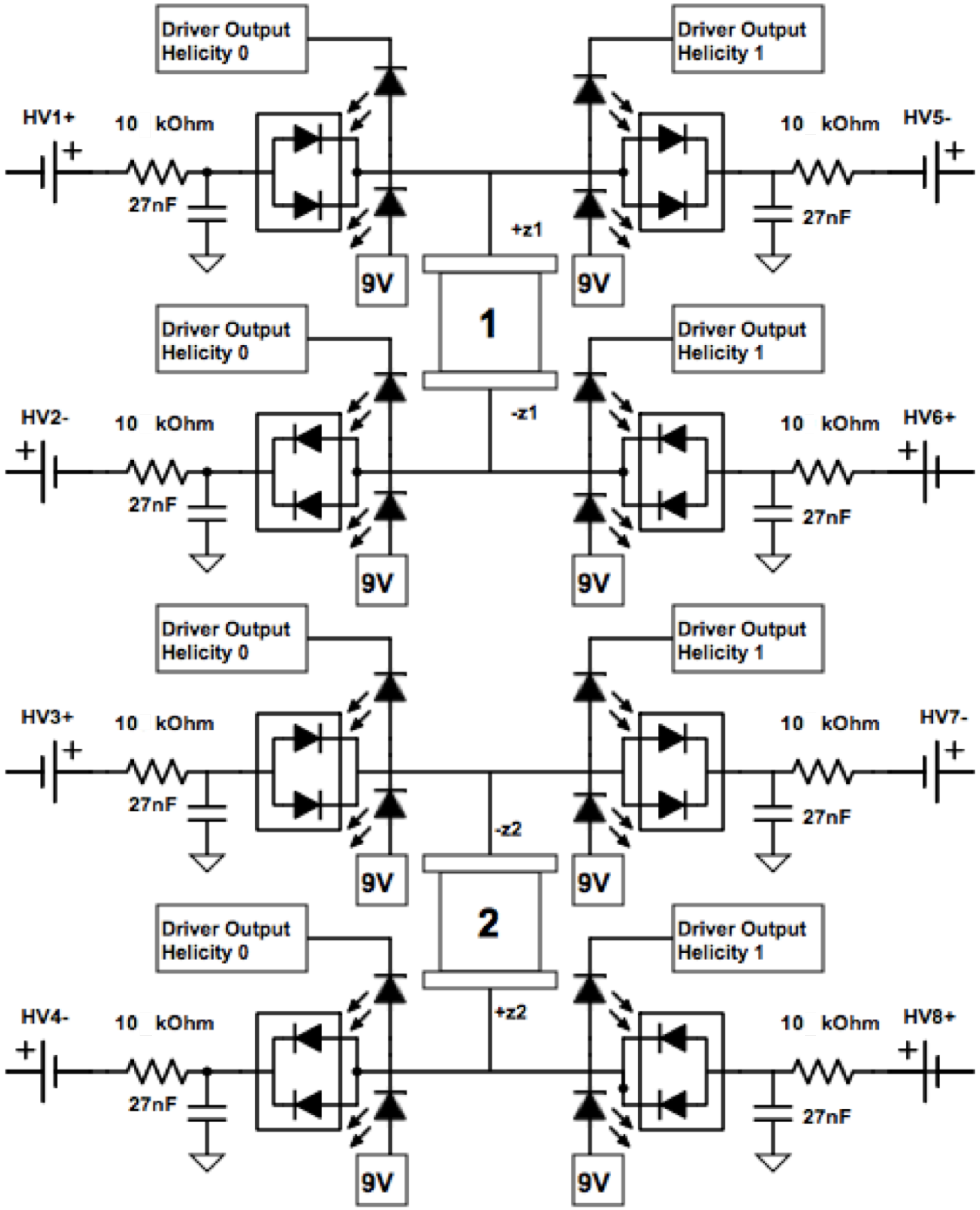




LED optoswitch

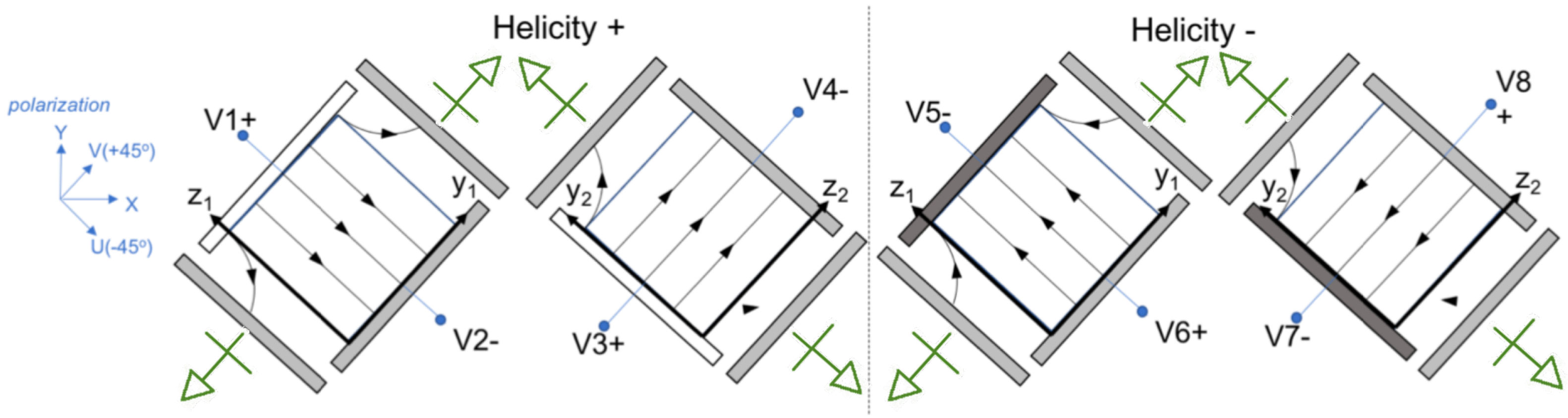


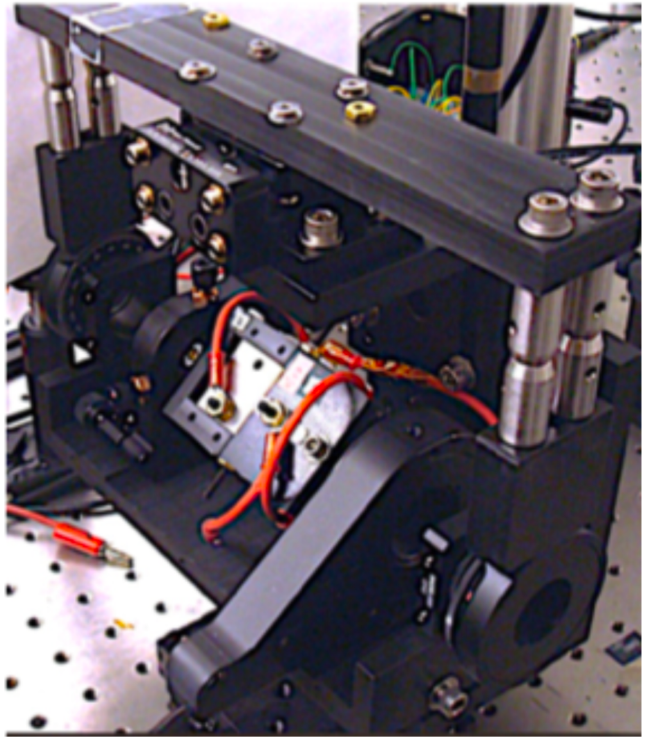
- Inputs: DC +-800V’s, pulse signal
- Input pulse runs through LED’s
- Optocouplers detect light allowing HV signal to pass to crystals (~10uF OOM)



RTP Mount

- 2 crystals – top plate and bottom plate ~+-800V
- Grounded side panels – Connected to Hansknecht Ground





No-no's

- Don't plug helicity straight into DAQ
- Don't ground signals in the injector hut (to table, crate, wall) and send them upstairs
- Don't transport true helicity through BNC cables if you can help it
- (Don't transport true helicity next to other cables - bleedthrough)

EXTRAS

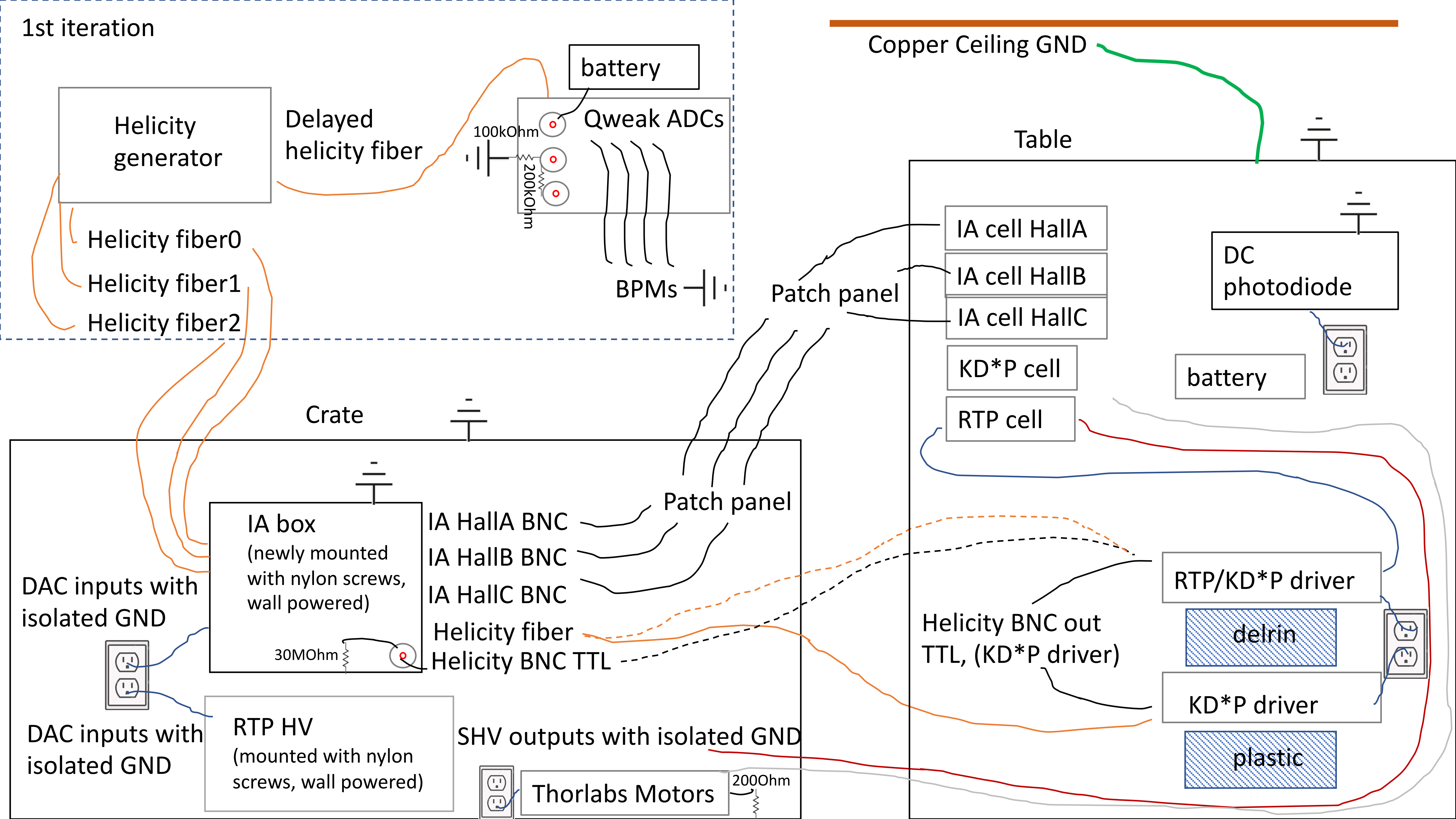
[Jim:
https://www.jlab.org/ehs/ehsmanual/6210.htm](https://www.jlab.org/ehs/ehsmanual/6210.htm)

Anything >=50V is Class 2, as is <50V and >50A.

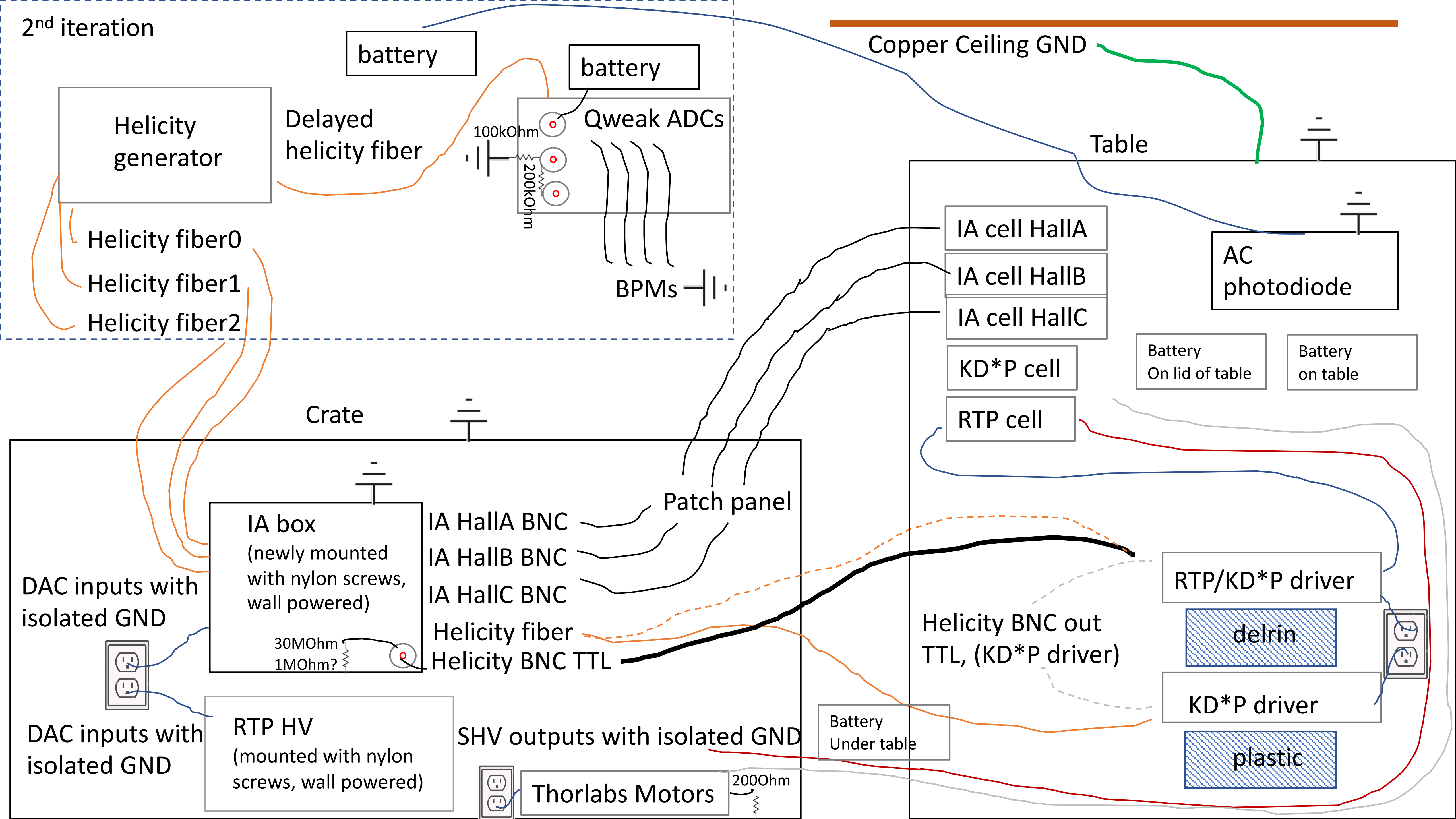
Actually there is a limit of 5 mA below which a supply is Class 1. But that needs to be the maximum current rating of the supply AT ANY VOLTAGE. So you will need to check the current rating of the supply.

And it is specifically <=5 mA for class 1 so 5 mA is sitill OK.

with 800 V there is a two person rule to work on this live beyond troubleshooting and diagnostic measurements.



1st iteration
Helicity generator
Delayed helicity fiber
battery
100kOhm
200kOhm
Qweak ADCs
Helicity fiber0
Helicity fiber1
Helicity fiber2
BPMs
Copper Ceiling GND
Table
IA cell HallA
IA cell HallB
IA cell HallC
Patch panel
DC photodiode
KD*P cell
battery
RTP cell
Crate
IA box
(newly mounted with nylon screws, wall powered)
IA HallA BNC
IA HallB BNC
IA HallC BNC
Helicity fiber
Helicity BNC TTL
Patch panel
30MOhm
DAC inputs with isolated GND
DAC inputs with isolated GND
RTP HV
(mounted with nylon screws, wall powered)
SHV outputs with isolated GND
Thorlabs Motors
200Ohm
Helicity BNC out TTL, (KD*P driver)
RTP/KD*P driver
delrin
KD*P driver
plastic



2nd iteration
battery
battery
Helicity generator
Delayed helicity fiber
100kOhm
200kOhm
Qweak ADCs
BPMs
Helicity fiber0
Helicity fiber1
Helicity fiber2
Copper Ceiling GND
Table
IA cell HallA
IA cell HallB
IA cell HallC
KD*P cell
RTP cell
AC photodiode
Battery On lid of table
Battery on table
Crate
Patch panel
IA box (newly mounted with nylon screws, wall powered)
IA HallA BNC
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SHV outputs with isolated GND
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200Ohm
Battery Under table
Helicity BNC out TTL, (KD*P driver)
RTP/KD*P driver
delrin
KD*P driver
plastic

Battery locations (for past tests)

- 3V battery signals
- Battery #1 – under laser table. BNC signal cable (#1). Kapton taped so not grounded. -> vqwk0_6
- Battery #2 – on laser table by qpd. BNC signal cable (#2) passes through table by SHV cables. Kaptop taped so not grounded. -> vqwk0_5
- Battery #3 – upstairs in ISB -> vqwk0_7
- Battery #4 – upstairs in ISB -> vqwk11_6

Note: Moved battery DAQ channels

Battery locations (NOW)

- Move injector hut batteries from vqwk's to scalar channels (want to keep all the bpms)
- Battery #1 – under laser table. BNC signal cable (#1). Kapton taped so not grounded. -> ~~vqwk0_6~~ inj scalar #10
- Battery #2 – on laser table by qpd. BNC signal cable (#2) passes through table by SHV cables. Kaptop taped so not grounded. -> ~~vqwk0_5~~ vqwk11_5
- Battery #3 – upstairs in ISB -> ~~vqwk0_7~~ inj scalar #12
- Battery #4 – upstairs in ISB -> vqwk11_6

Expected values

- Batteries in the injector hut: <3-6uV (if ~15-30uV, some signal cable is probably grounded downstairs or true helicity is being sent upstairs)
- Batteries upstairs in the ISB: <15nV (if see 120nV, helicity is plugged straight into DAQ in adjacent channel)
- Contributions from various things
  - 110nV from PC on (to injector hut battery on the table)
  - ~1-3uV from IA system (to injector hut battery on the table/under table)
  - 120nV from plugging helicity directly into DAQ (in ISB battery channel next to helicity)
  - 15-30uV from sending true helicity upstairs next to signal cables (in injector hut battery signals)
  - 90+-45ppb from plugging delayed helicity into DAQ (in ISB battery channel next to delayed helicity, when analyzed with no delay)

Expected values (ppm units for ~3V)

- Batteries in the injector hut: <1-2ppm (if ~5-10ppm, some signal cable is probably grounded downstairs or true helicity is being sent upstairs)
- Batteries upstairs in the ISB: <5ppb (if see 40ppb, helicity is plugged straight into DAQ in adjacent channel)
- Contributions from various things
  - 35ppb from PC on (to injector hut battery on the table)
  - ~0.5-1ppm from IA system (to injector hut battery on the table/under table)
  - 40ppb from plugging helicity directly into DAQ (in ISB battery channel next to helicity)
  - 5-10ppm from sending true helicity upstairs next to signal cables (in injector hut battery signals)
  - 30+-15ppb from plugging delayed helicity into DAQ (in ISB battery channel next to delayed helicity, when analyzed with no delay)

Summary Table

		nV	nV	nV	nV	uV	uV	uV	uV
	Run	ISB Aq (batt0_7 inj)	error	ISB Aq (batt11_6 inj)	error	Hut Aq batt vqwk0_6 under table	error	Hut Aq batt0_5 on table	error
PC on, IA off	2241	**4.8**	8.32			**-0.0096**	0.051	**0.11**	0.026
PC off, IA on	2245	**-35.2**	35.2			**-4.93**	0.23	**-2.05**	0.12
all on	2297	**2.56**	7.68	**-0.5**	2.3	**1.22**	0.019	**-1.1**	0.016
#2 cable gnd'd	2270	**-7.04**	11.84	**22.4**	11.2	**4.77**	0.067	**-47.4**	0.035
real helicity + grounding	2316	**-51.2**	22.4	**128**	19	**-41.22**	0.19	**-11.2**	0.16
delayed helicity + grounding (analyze with delay=0)	2311	***-39***	*48*	***-96***	*42*	*-0.15*	*0.15*	*-0.03*	*0.12*

New Goals

- Measure Nominal Pickup in Hall batteries and injector batteries for everything on
- Do something bad (like plug in delayed helicity into DAQ and either run with delay=0 or analyze later with delay=0) and observe suppression factor going to Hall batteries
- ….keep watch for changes in the level of pickup…

RTP system ver 1.0

Caryn Palatchi

2/12/2019

Platinum Dragon	$6.32	16	Mouser	http://www.mouser.com/ProductDetail/OSRAM-Opto-Semiconductors/SFH-4235-Z/?qs=vyVHuICG23uDj%252bpvRifQnw%3D%3D
Optocoupler VMI OZ100SG	$32.85	16	VMI	
IGES 4W, 0.0005% ripple, 2kV, 5V control,2mA probably	$185	8	ISEG	http://iseg-hv.com/files/media/iseg_datasheet_BPS_en_20.pdf
0.027µF ±10% 5000V (5kV) Ceramic Capacitor X7R Radial	$36	6	Digikey	https://www.digikey.com/product-detail/en/SV17KC273KAR/478-6833-ND/2699099

Features

- Variable Vled : 7-9V (remote control of this?)
- 2 LED's in series and two optodiodes in parallel on PCB
- Variable t_{end},R_1 for each of 8HV's (pots)
- 2 steps instead of 3, but possibly share between 2 mosfets/R's operating at the same time – be mindful of <I> tolerance of mosfets and R's for 2kHz flip rates
- SHV output from HVPS → box housing RC buffers & LEDs/optodiodes → ---cable---*connector(terminal,plug)*---cable---PC
- 16-bit DAC 10V range setting OUT -> IGES 5V range IN (may want either DAC set to 5V range, or buy PS with 10V to take advantage of full bit resolution)