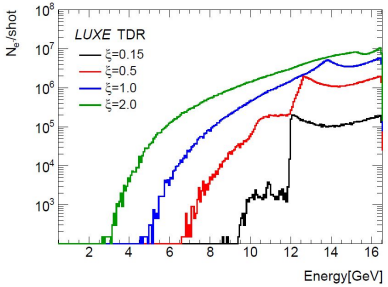
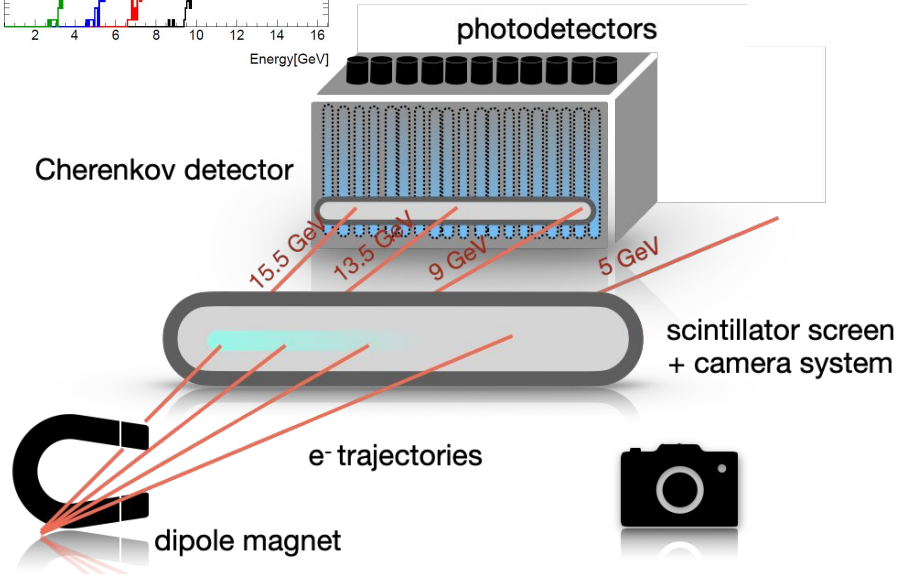
aCSPMA12
PCB design

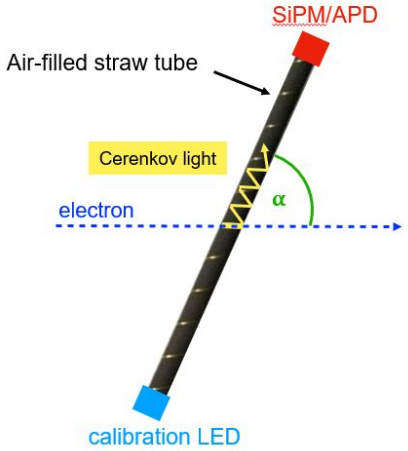
(assembly/)a Cherenkov Silicon PhotoMultiplier Array
Printed Circuit Board design review

Daniel Klein
DESY, FH-FTX-SLB-LUXE meeting
14th December 2023

Cherenkov detector







High e^- rate from Compton scattering- Sig/Bkg ~100

Goal: Measure non-linear Compton spectrum- Compton edges shift as function of the Laser intensity.

Dipole spectrometer + combined detector: Scintillator screens and segmented gaseous Cherenkov detector.

Straw tube light guides: Cherenkov light in air reflected towards photodetector.

Topics encountered

Why do we do this? Cherenkov detectors

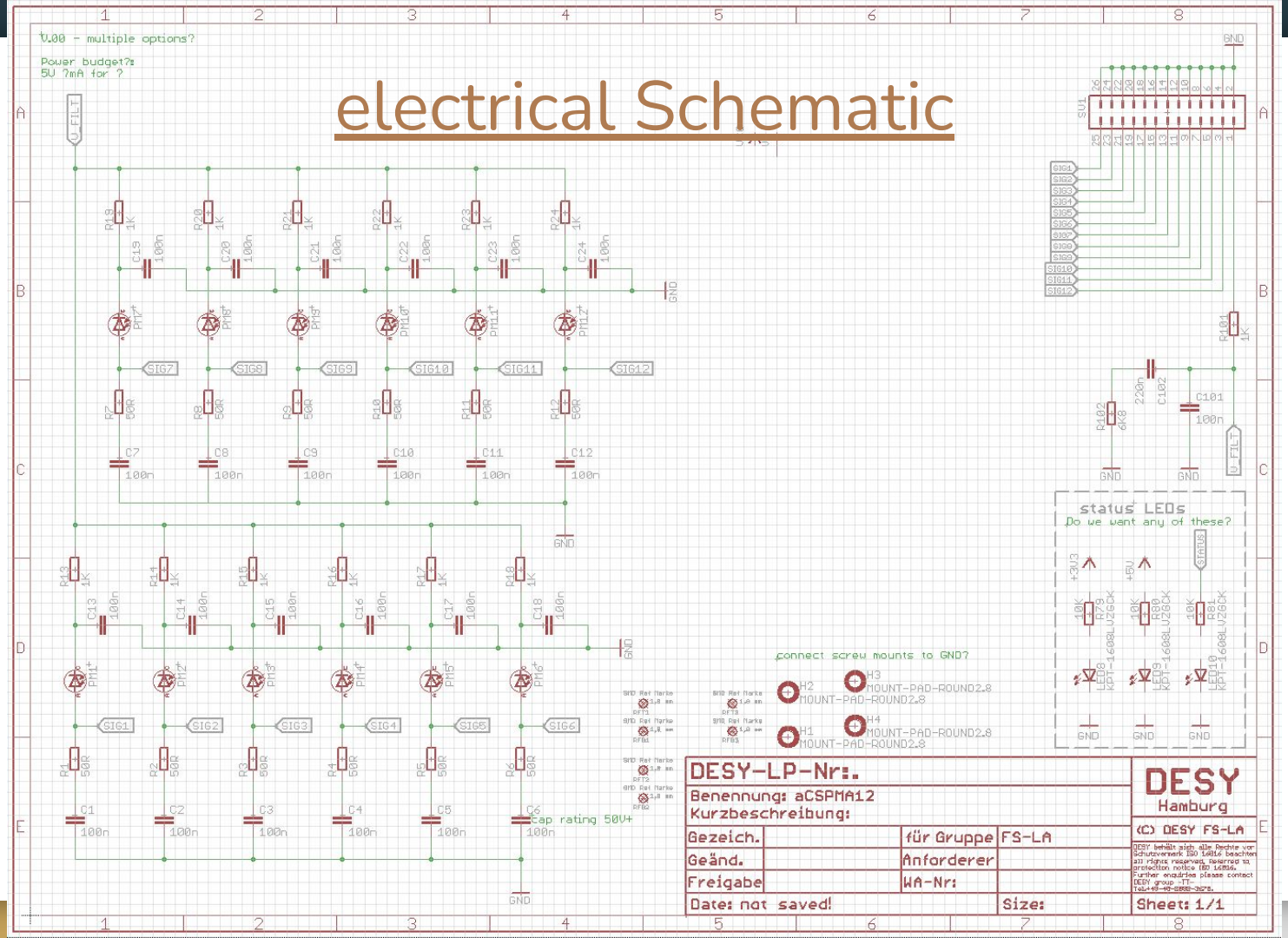
Geometry choices

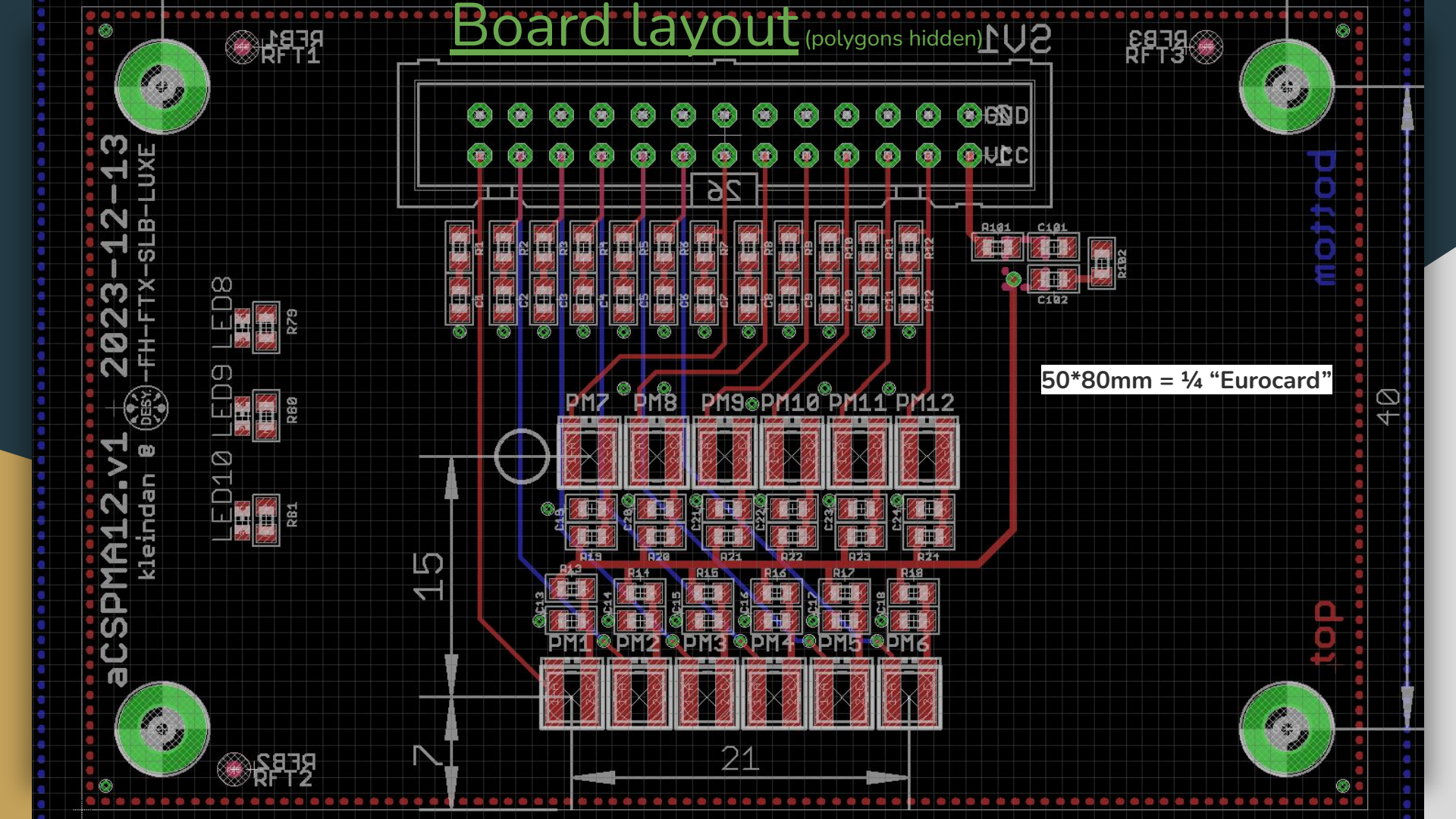
The importance of scientific communication

Noise filtering - in series or parallel? Measurements / Experimenting with filters

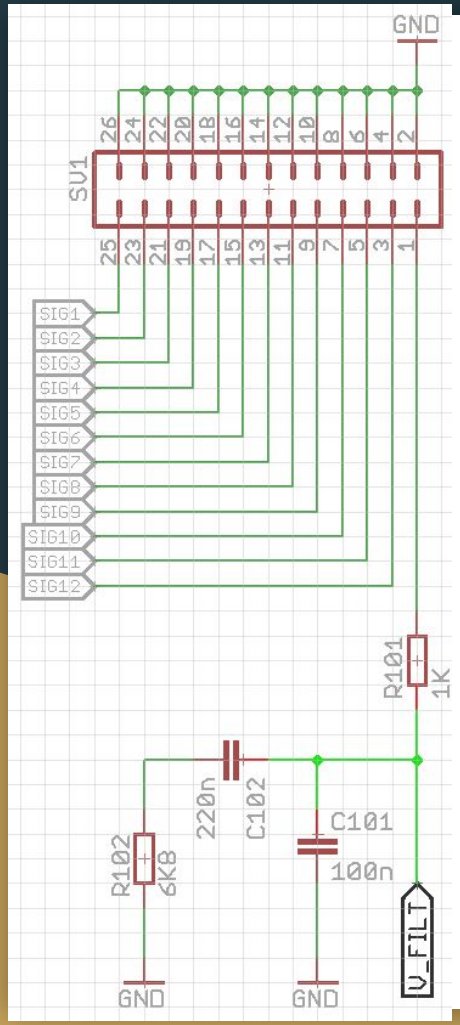
Impedance matching & Readout line biasing

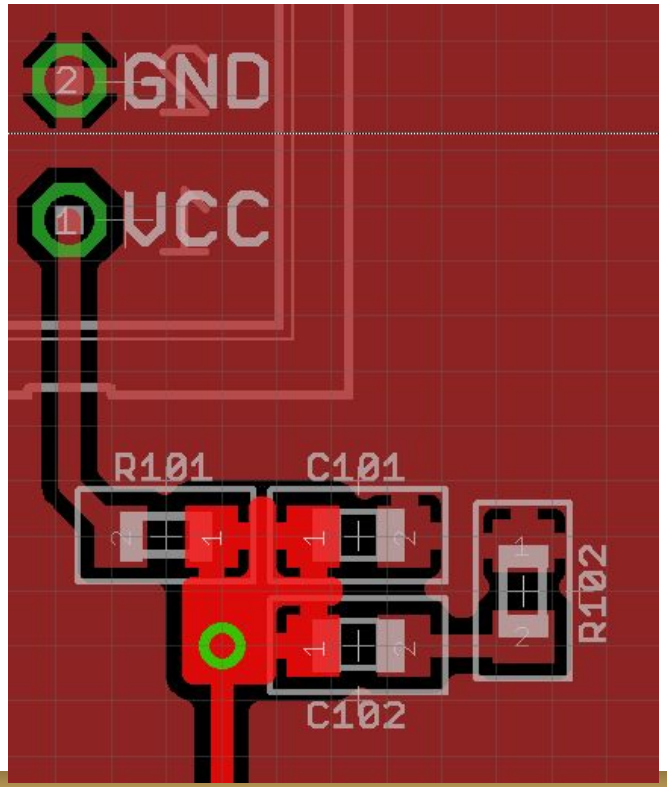
electrical Schematic




Board layout (polygons hidden)
aCSPMA12.v1 2023-12-13
kleindan @ DESY
FH-FTX-SLB-LUXE
LED10 LED9 LED8
R79
R80
R81
RFT1
RFT2
RFT3
RFT4
SV1
GND
VCC
R101
C101
C102
R102
PM7 PM8 PM9 PM10 PM11 PM12
PM1 PM2 PM3 PM4 PM5 PM6
15
7
21
40
mottod
top
50*80mm = ¼ "Eurocard"

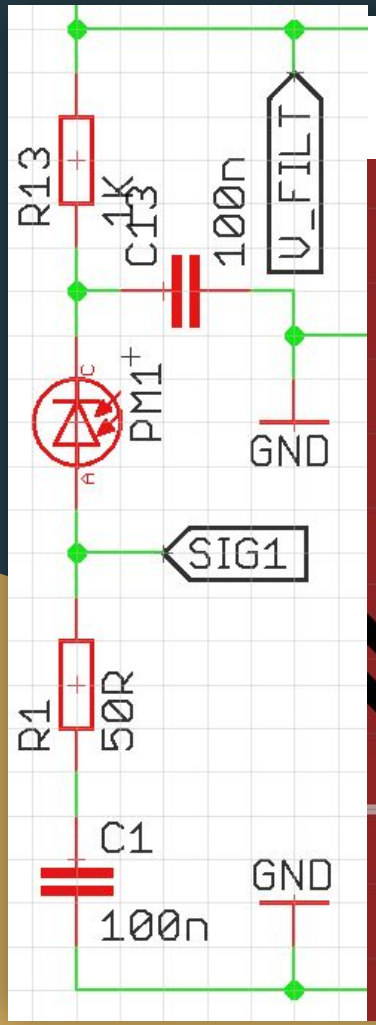
Power in- connector and filter

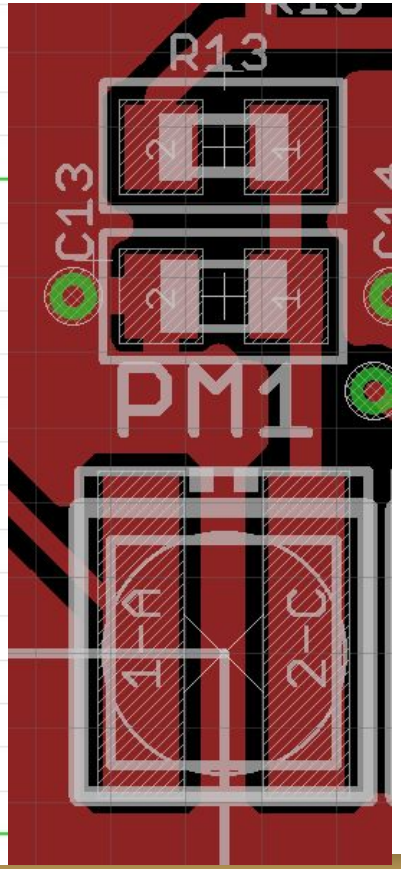


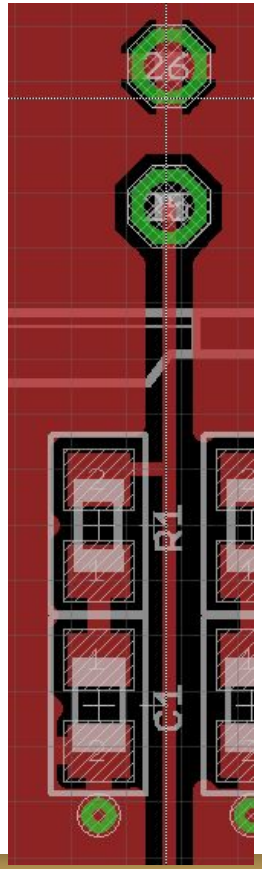


Filtering the input voltage ~40V

SiPM unit



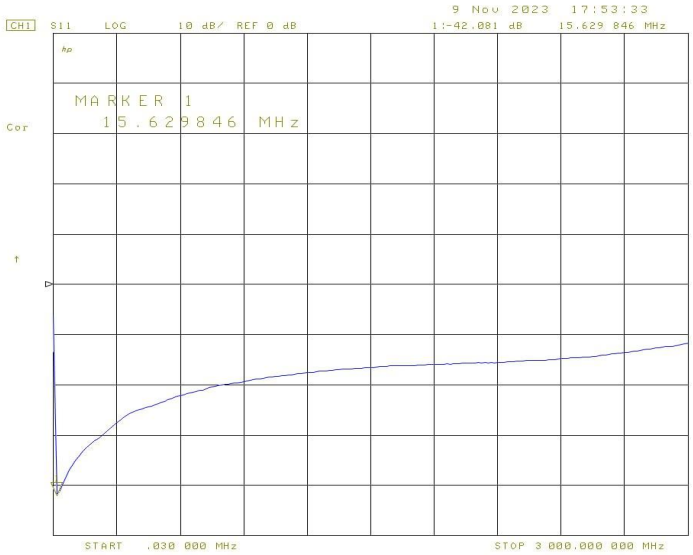




- Schematic, signals
- PM unit, input V
- Output, impedance matching and DC bias blocking

The impedance matching issue

We deliberated for a while how to correctly dress the output lines leading from the SiPMs to the ADC readout pins.



S11

Outlook - near future / planned research

Polishing and ordering v1 PCBs (from multi-cb)

mid-January: Experimental measurements - lock down component values - order components if necessary.

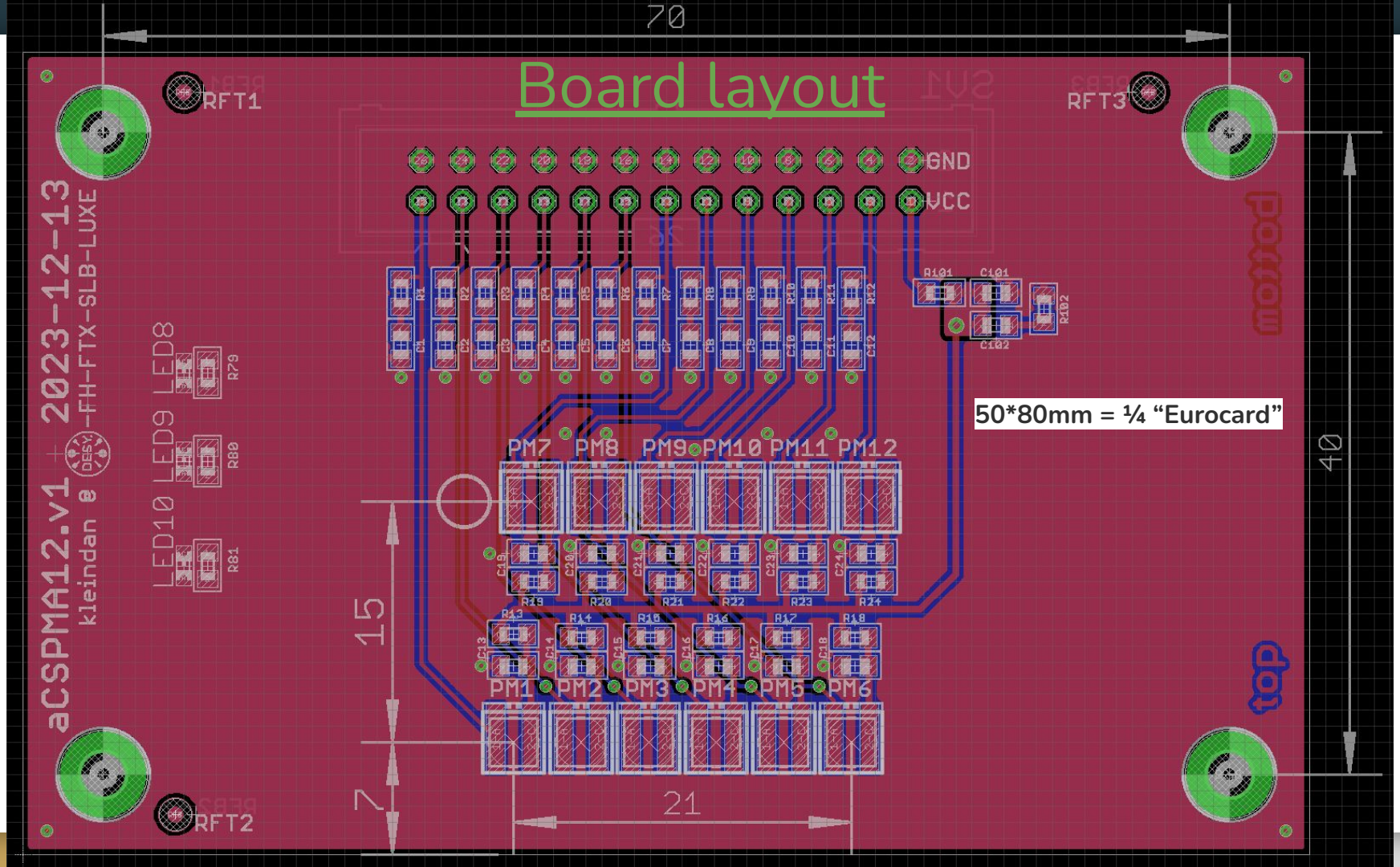
late-Jan / early-February: Printing and in-house assembly :-)

Tackle another part of detector?

Write first thesis chapter?

END

Board layout



Prelim takeaway

~~A little text on each slide - this is the takeaway~~

~~What is the cherenkov detector~~

~~Graph and illus from p4 in CDT presentation~~

~~Illus from p6~~

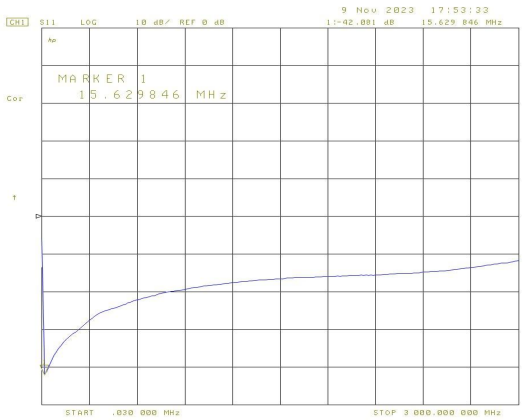
~~Zoomed cutouts of relevant circuit/board sections while highlighting certain topics~~

~~Outlook slide - future planned research - measurements/experiments in Jan - Printing and assembly in Feb, hopefully~~

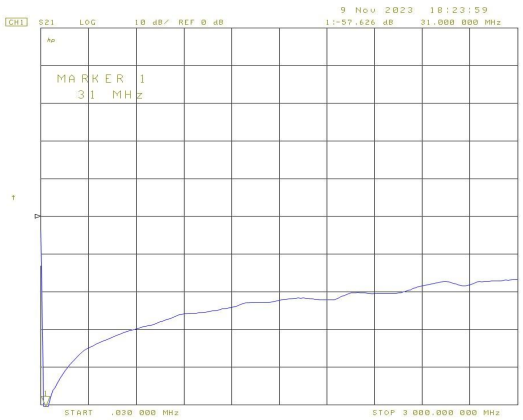
Send slides to Antonios to discuss order of story telling

Send slides to Gudrid in advance

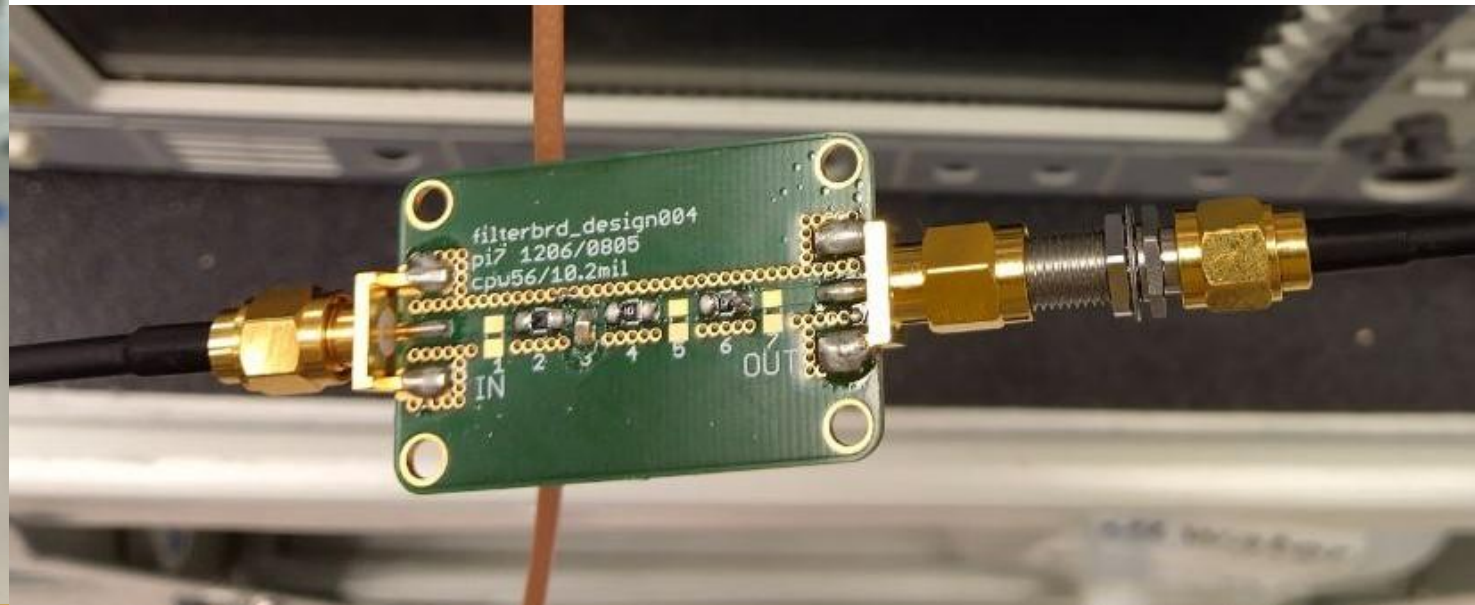

filterbrd_design004
pi7 1206/0805
cpw56/10.2mil
IN
OUT
1
2
3
4
5
6
7


9 Nov 2023 17:53:33
CH1 S11 LOG 10 dB/ REF 0 dB
1:-42.081 dB 15.629 846 MHz
MARKER 1
15.629846 MHz
START .030 000 MHz
STOP 3 000.000 000 MHz

S11


9 Nov 2023 18:23:59
CH1 S21 LOG 10 dB/ REF 0 dB
1:-57.626 dB 31.000 000 MHz
MARKER 1
31 MHz
START .030 000 MHz
STOP 3 000.000 000 MHz

S21


filterbrd_design004
pi7 1206/0805
cpw56/10.2mil
IN
OUT
1
2
3
4
5
6
7