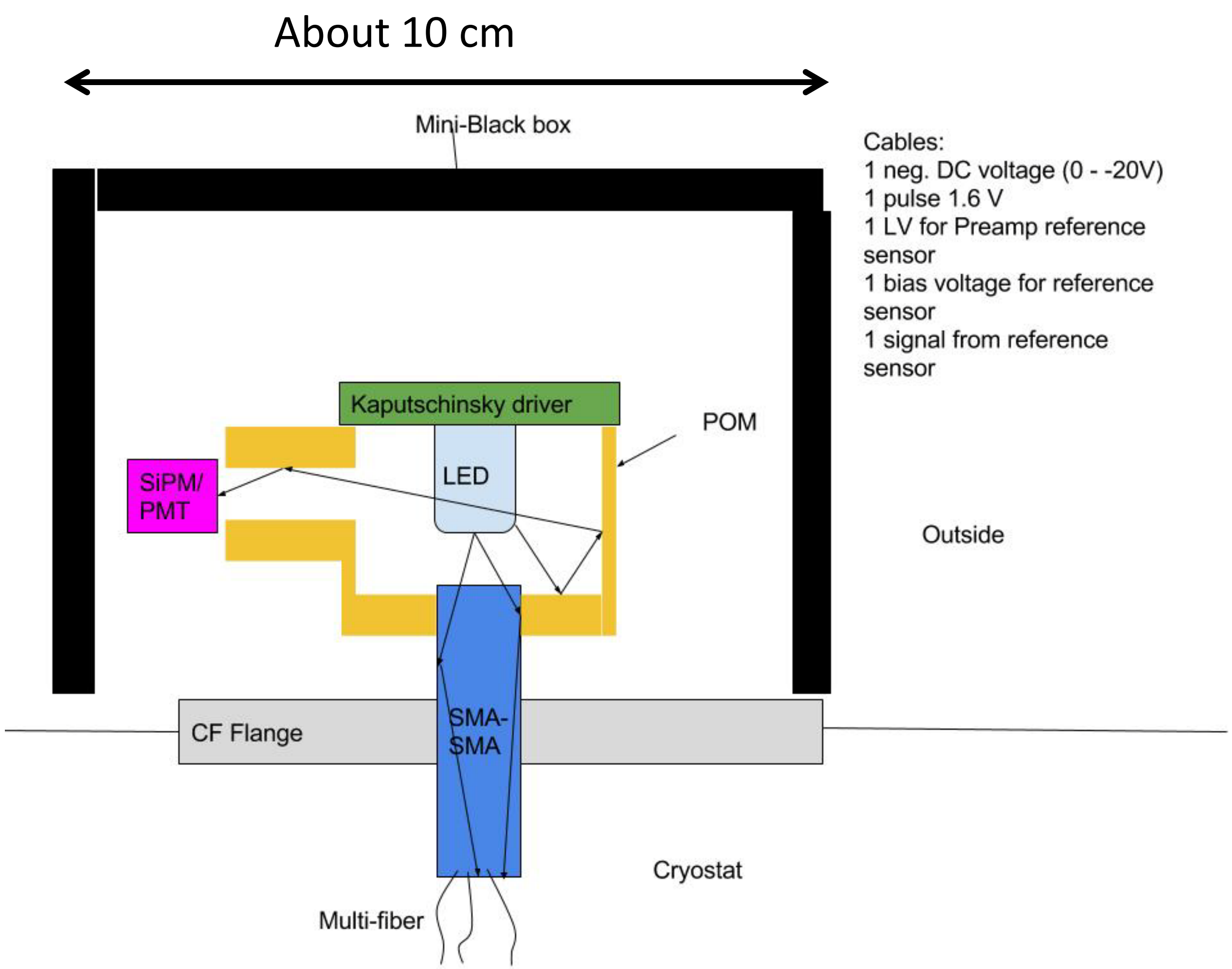
Plans for this week

- ~~MWPC: wire stretching today~~
- Analysis of DNA setup data
- ~~Measurement of light at end of 30 m fiber~~
- Look into charge readout options of gas detectors (AGET/DREAM chips)
- ~~Clarify if workshop available to contribute to ND T2K upgrade~~
- ~~Finish Master course on Monday~~

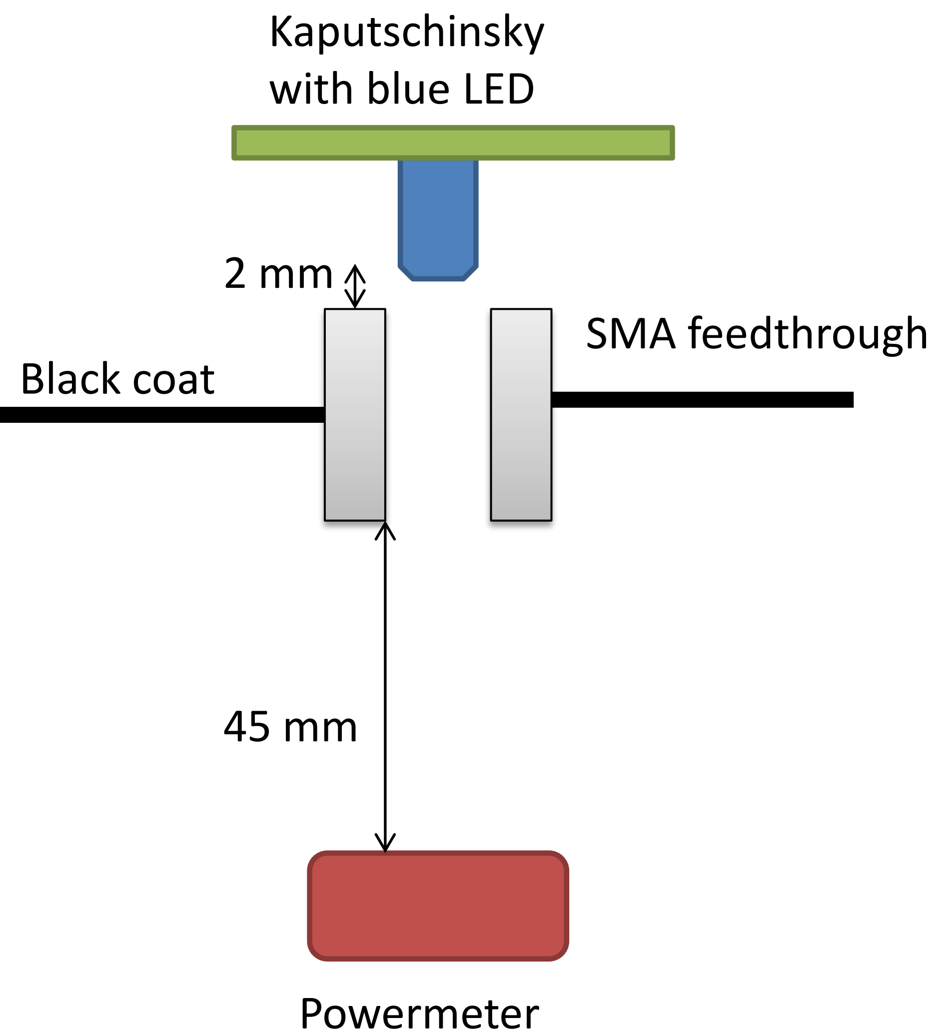
Alternative Idea

Put LED with Kaputschinsky driver directly in front of SMA feedthrough to shine on fibers inside the cryostat



Cables:
1 neg. DC voltage (0 - -20V)
1 pulse 1.6 V
1 LV for Preamp reference sensor
1 bias voltage for reference sensor
1 signal from reference sensor

First Tests without Fiber

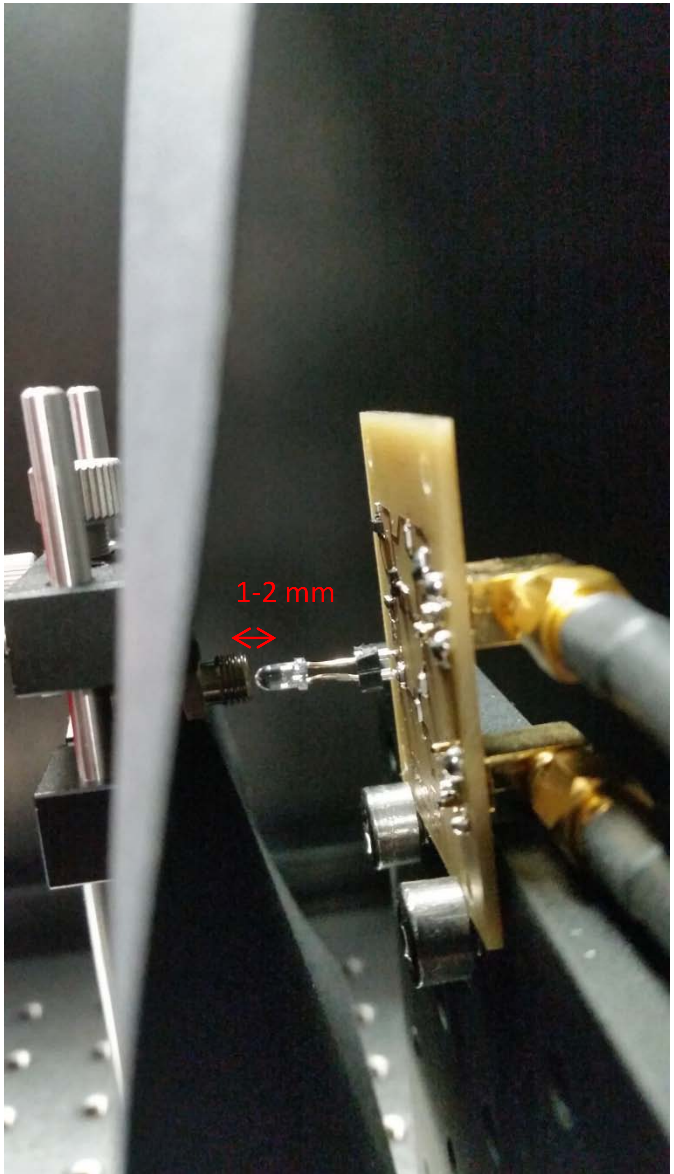


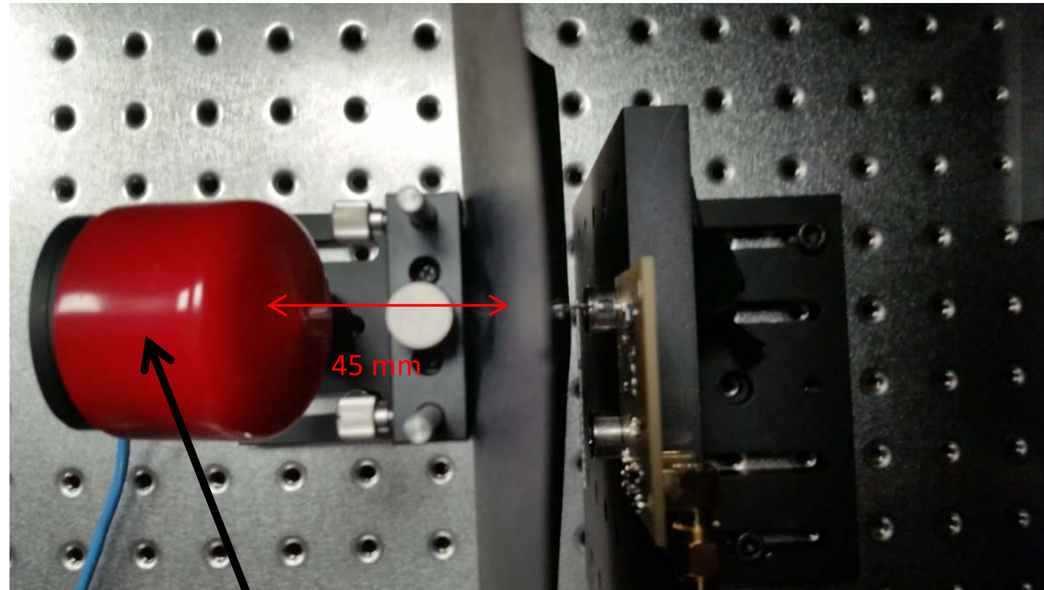
- Measured power released with Kaputschinsky
- Result: 11.5 nW
- Amazing result: E(465 nm)=430*10**-21 J => 11.5 nW correspond to 27 billion photons
- 1 kHz pulsing => each pulse 27 million photons which will directly go to fiber bundle
- next step measure no of photons at end of 30 m fiber

Advantages of this approach:

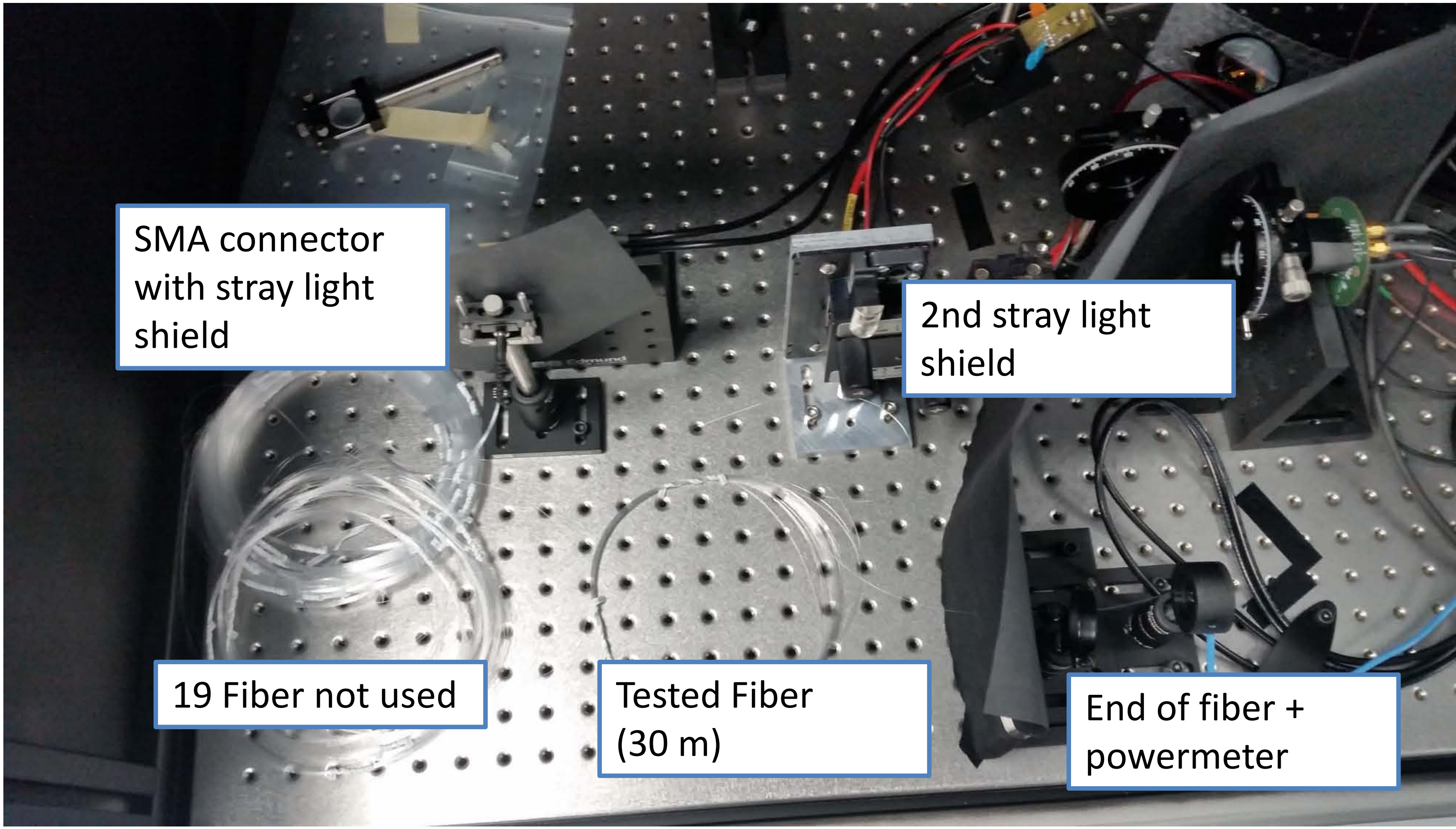
- much cheaper than laser approach
- no safety issues at CERN

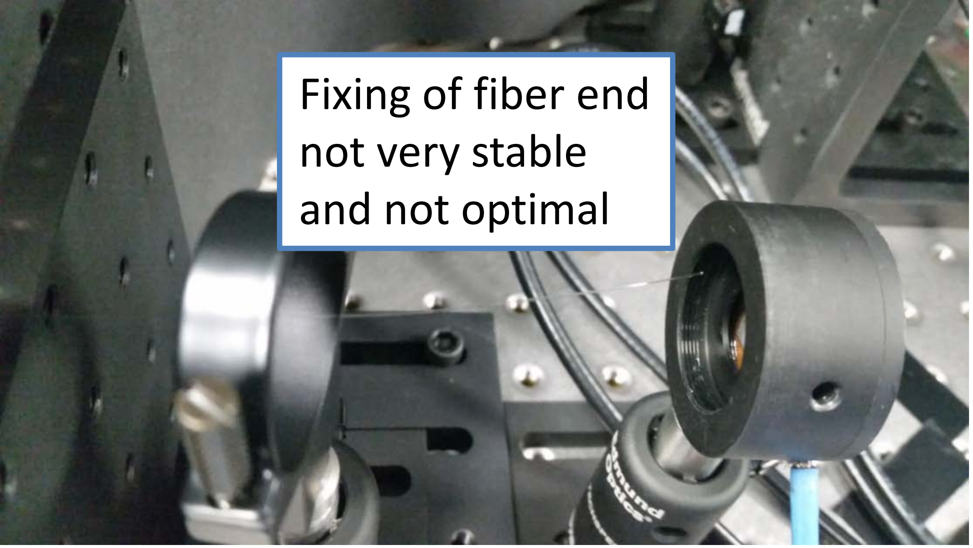
Question: Do we really need a reference sensor?


1-2 mm

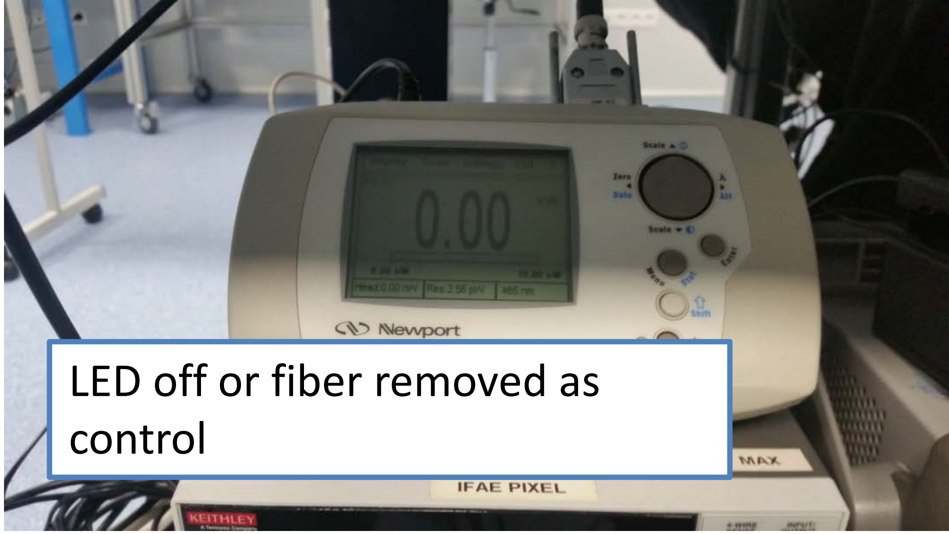

45 mm
Photodiode with protection

Tests with Fiber and Powermeter

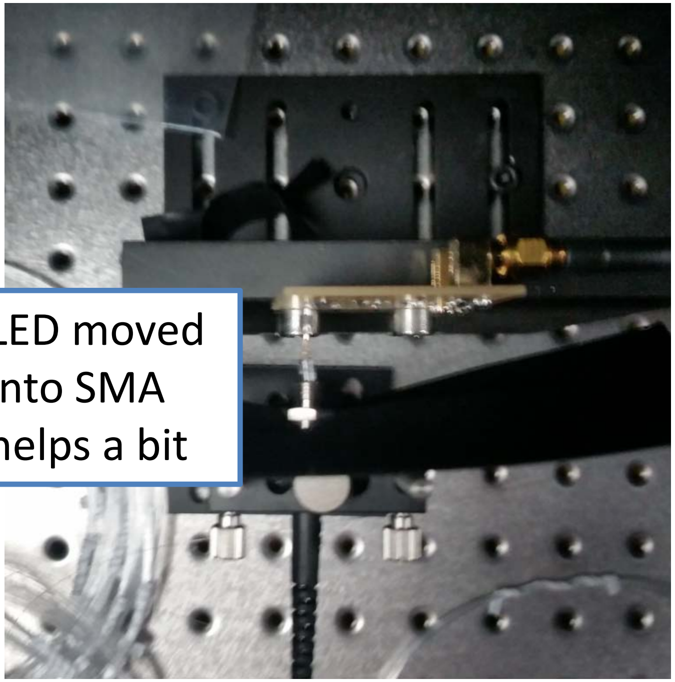




Fixing of fiber end not very stable and not optimal



LED off or fiber removed as control

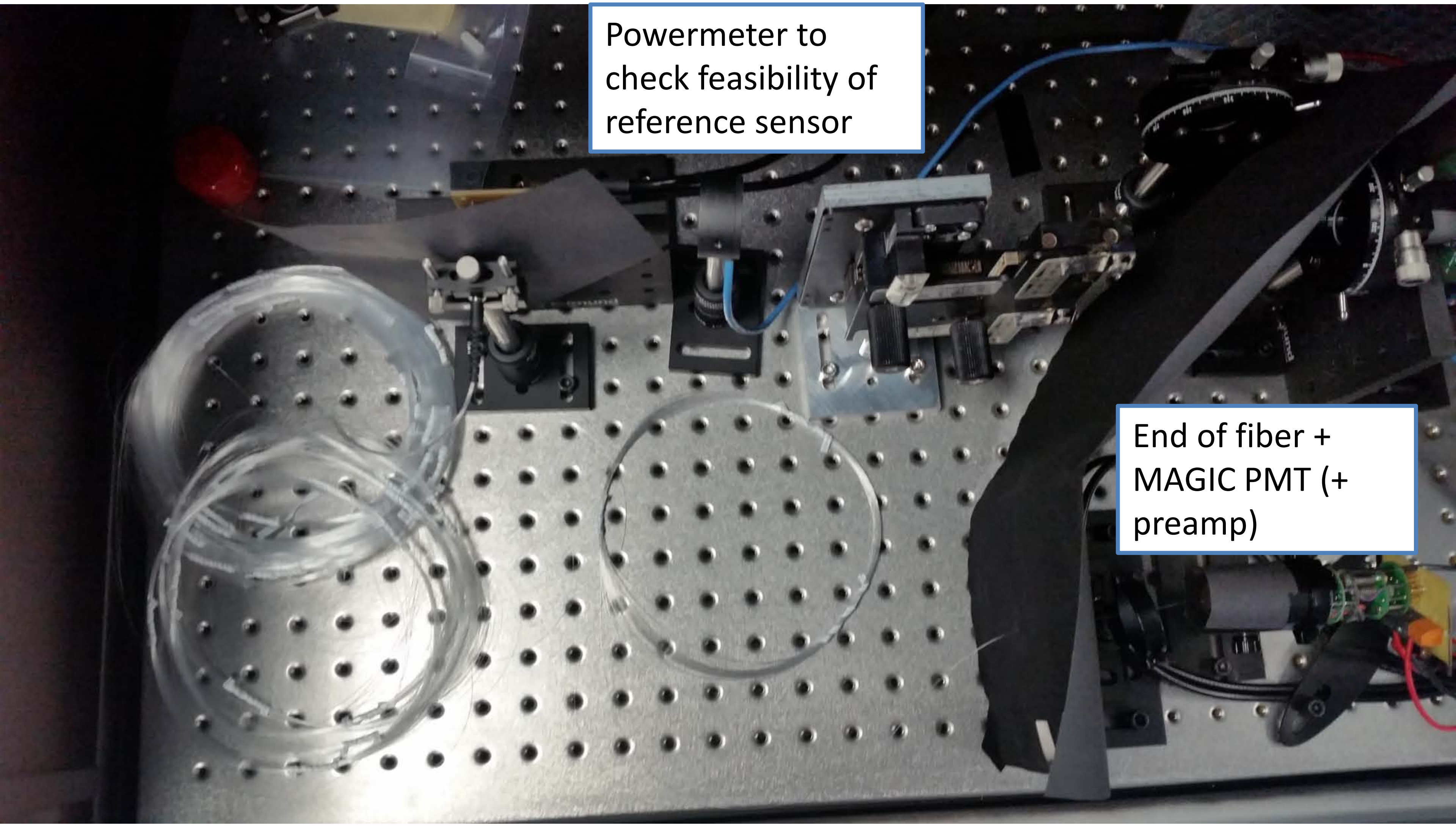


LED moved into SMA helps a bit

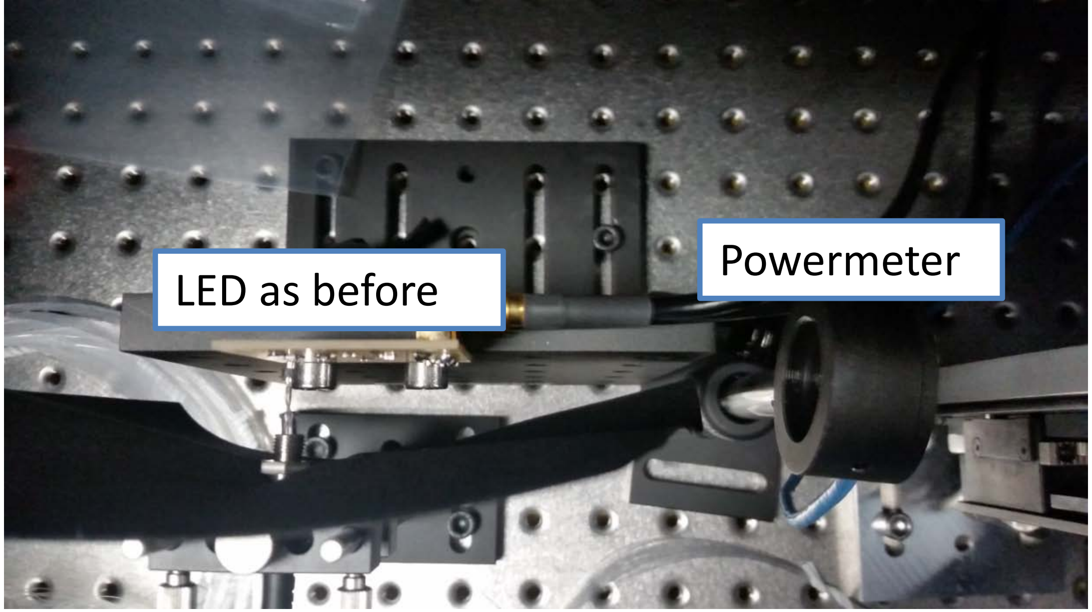
- Measured power should correspond to about 30.000 photons per pulse (10 ns) assuming 0.01 nW
- reduction by factor 1000 compared to direct pulsing without fiber
- Seems Still a factor 100 reduction possible and needed to get photon range of 0 to about 250 photons per pulse

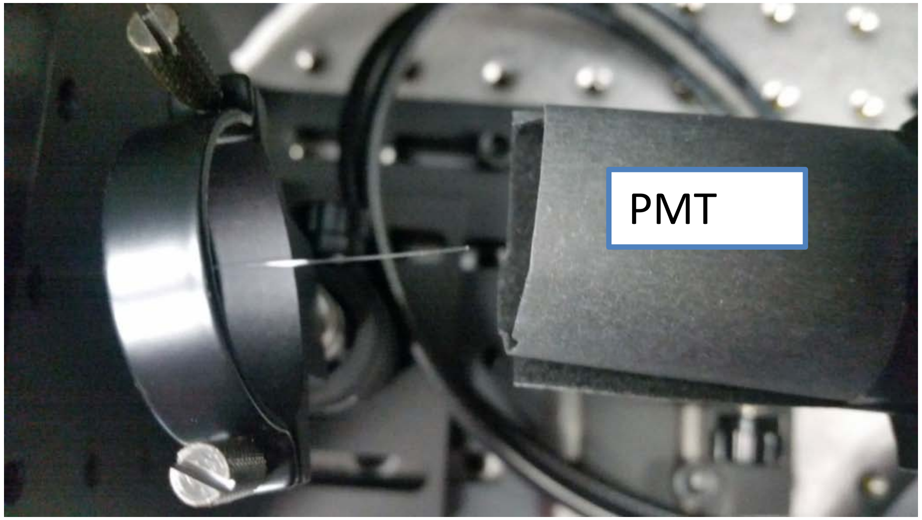
LED pulsed with 1 kHz

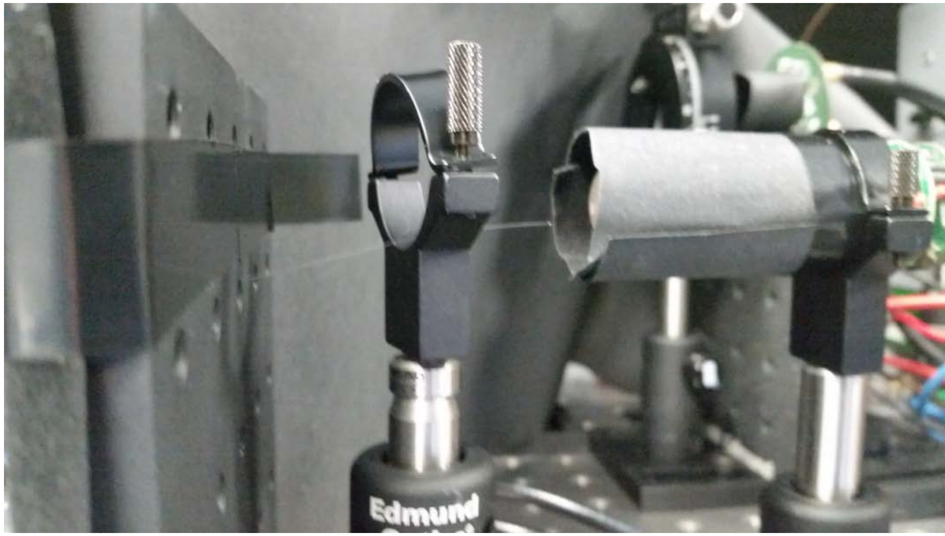
Tests with Fiber and PMT

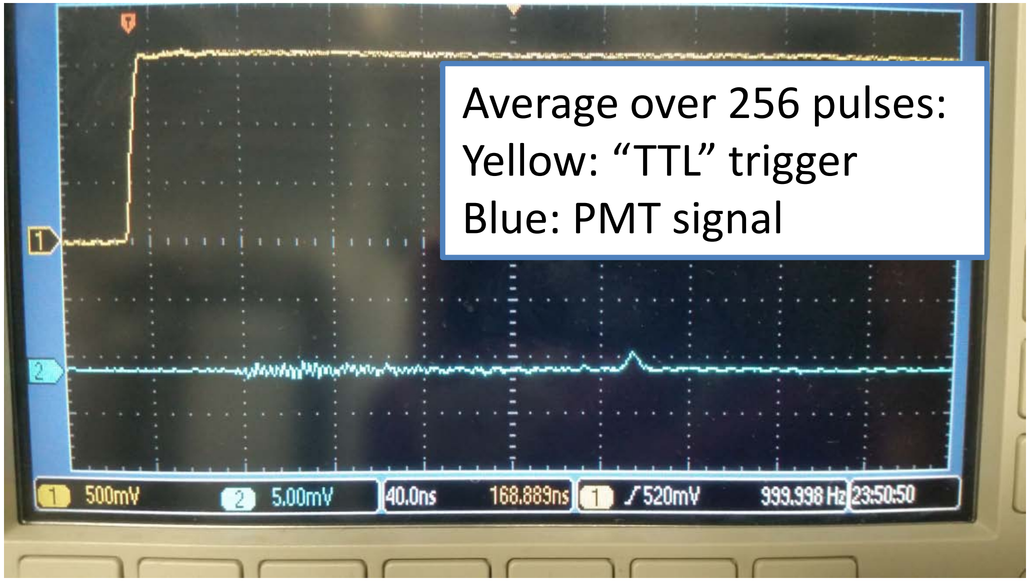


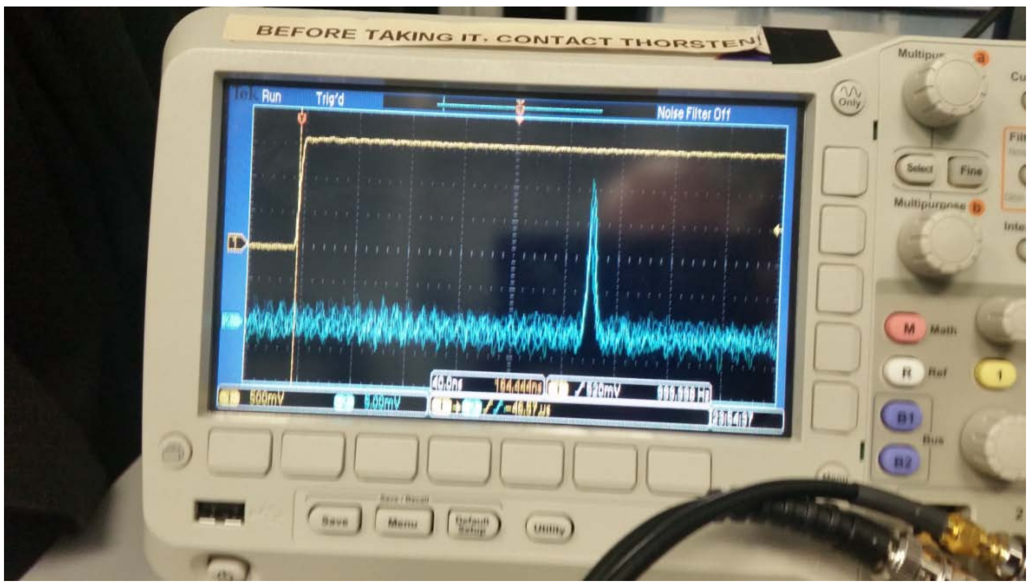
- powermeter detects light, about 0.03 pW
- geometry obvious not optimal
- reference sensor in alternative approach should be feasible if desired











- PMT sees clearly the light from the end of the fiber
- Single photons at around 6.9 V bias voltage on the LED
- With powermeter was necessary to go to 18 V to get a signal
- Signal at 18 V smaller than expected, probably of the order of 1000 pe
    - electronic effect?
    - difference in Qeff powermeter and PMT?
    - mistake and photon estimation?
    - mis-calibration of powermeter?
- delay of 220 ns between trigger and PMT pulse expected (60-80 ns delay without 30 m fiber and fiber should add roughly “100 ns * n” from the refractive index of the fiber
- pulse width at end of fiber around 12 ns

ESKA[TM] High-performance Plastic Optical Fiber: SK-10

Manufactured by Mitsubishi Rayon Co., Ltd.

Marketed and sold by Mitsubishi International Corporation

May, 2001

Structure		
Core Material	Polymethyl-Methacrylate Resin (PMMA)	
Cladding Material	Fluorinated Polymer	
Core Refractive Index	1.49	
Numerical Aperture	0.5	
Refractive Index Profile	(Step Index)	
Attenuation (db/m)	0.3	
Approximate Weight (g/m)	0.06	
	Unit	Typical
Core Diameter	µm	240
Overall Diameter	µm	250
Fiber Diameter Tolerance	+/- 9.2%	

Packaging	
Spool Length (m)	12,000
N weight on spool (kg)	1.4
Spool Weight (kg)	0.68
Carton Size	286 X 286 X 130
Carton G Weight (kg)	1.6
Fiber Code	SK
Cable Code	SH1001
Master Carton	12 Spools

Applications: Sensing

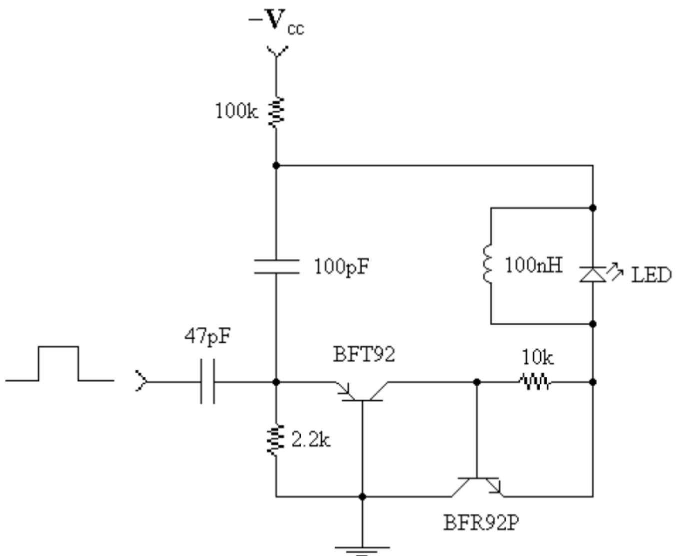
SK grade fibers are typically used for sensing temperatures, speed, liquidity levels and positioning. In addition, medical and general illumination are popular applications

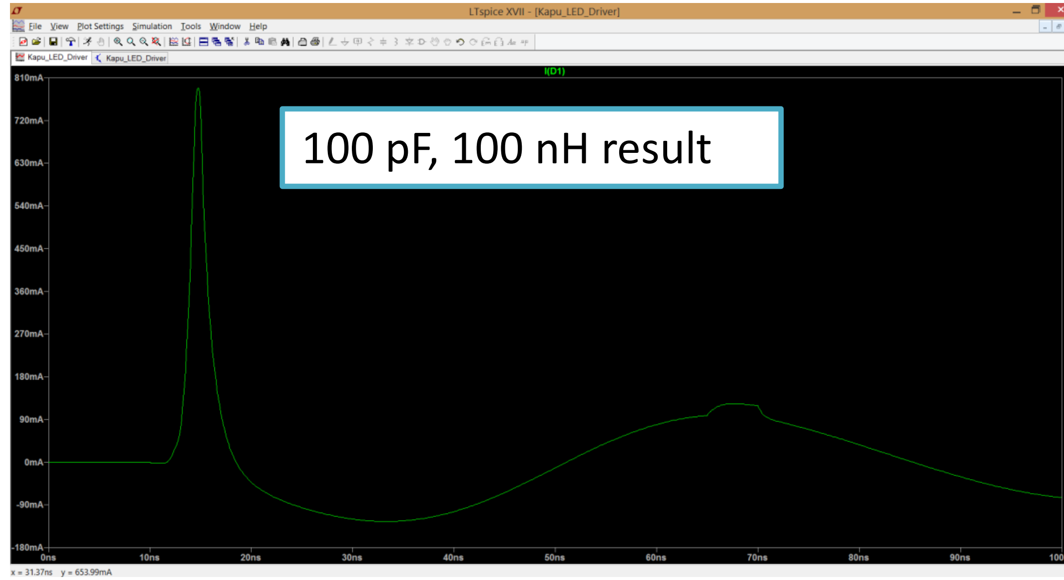
Performance		Criteria for Acceptance and/or Test Conditions	Unit	Values
Temperature Range		No deterioration in optical properties *	°C	-55 -- 70
Operating Temperature Under Conditions of High Humidity		No deterioration in optical properties [95% RH] **	°C	=<60
Optical Properties	Transmission Loss	650nm collimated light (standard conditions) [10 – 1m cutback]	dB/km	=<300
Mechanical Character-istics	Minimum Bend Radius	Loss increment =< 0.5dB [Quarter bend]	mm	[illegible]
	Tensile Strength	Tensile force at yield point [JIS C 6861]	N	=>3

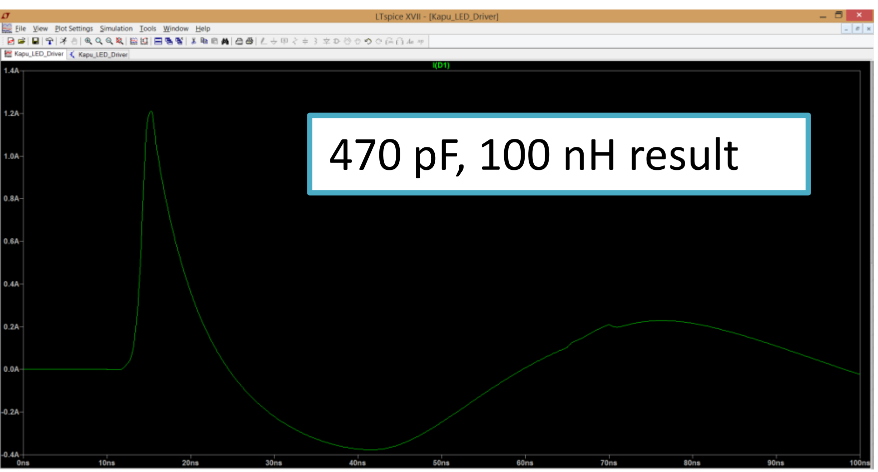
Notes: Performance tested in conditions cooler than 25°C unless otherwise indicated
* Attenuation change <10% after 1000 hours
** Attenuation change <10% after 1000 hours, except when due to absorbed water

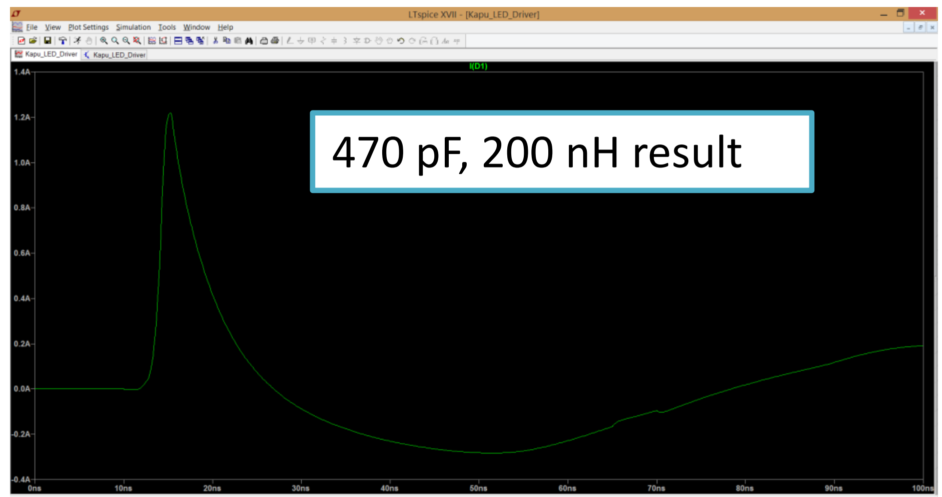
Possible improvements discussed with CIEMAT:

- current fiber has 0.3 dB/m (650 nm) => 9 dB over 30 m => at least 90% loss of the light inside the fiber
- Other fibers used by Miniboone has 10 times less attenuation and that at 470 nm => only 20% loss
- current fibers 200 um diameter => using 400 or 600 um fiber could increase coupling efficiency by factor 4 to 9
- or use 15 m optical fiber from top to bottom (with low attenuation) and <10 m long multi-fibers on the bottom => also advantage from construction point of view
- modify Kaputschinsky to provide more light from LED or use green LED with 8 times more luminosity





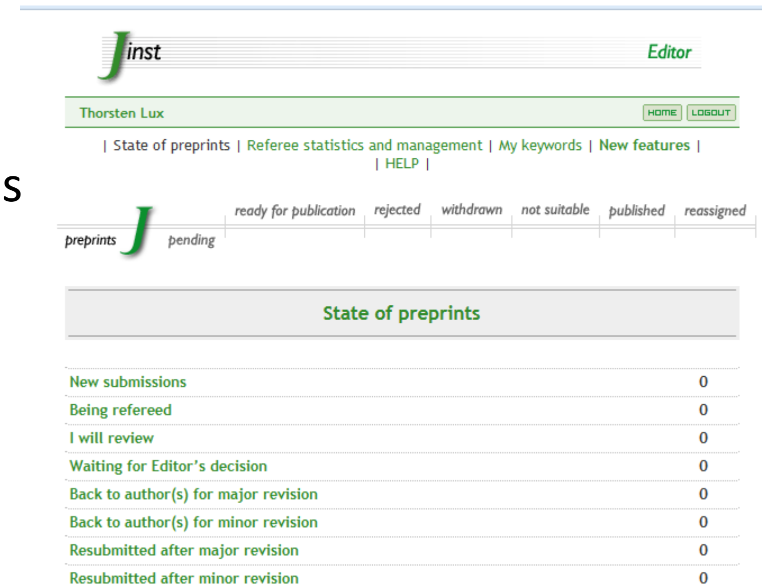




- larger capacity => more current and longer pulses
- larger inductivity => longer oscillation and with smaller amplitude
- new Kaputschinsky ordered from workshop to test these ideas

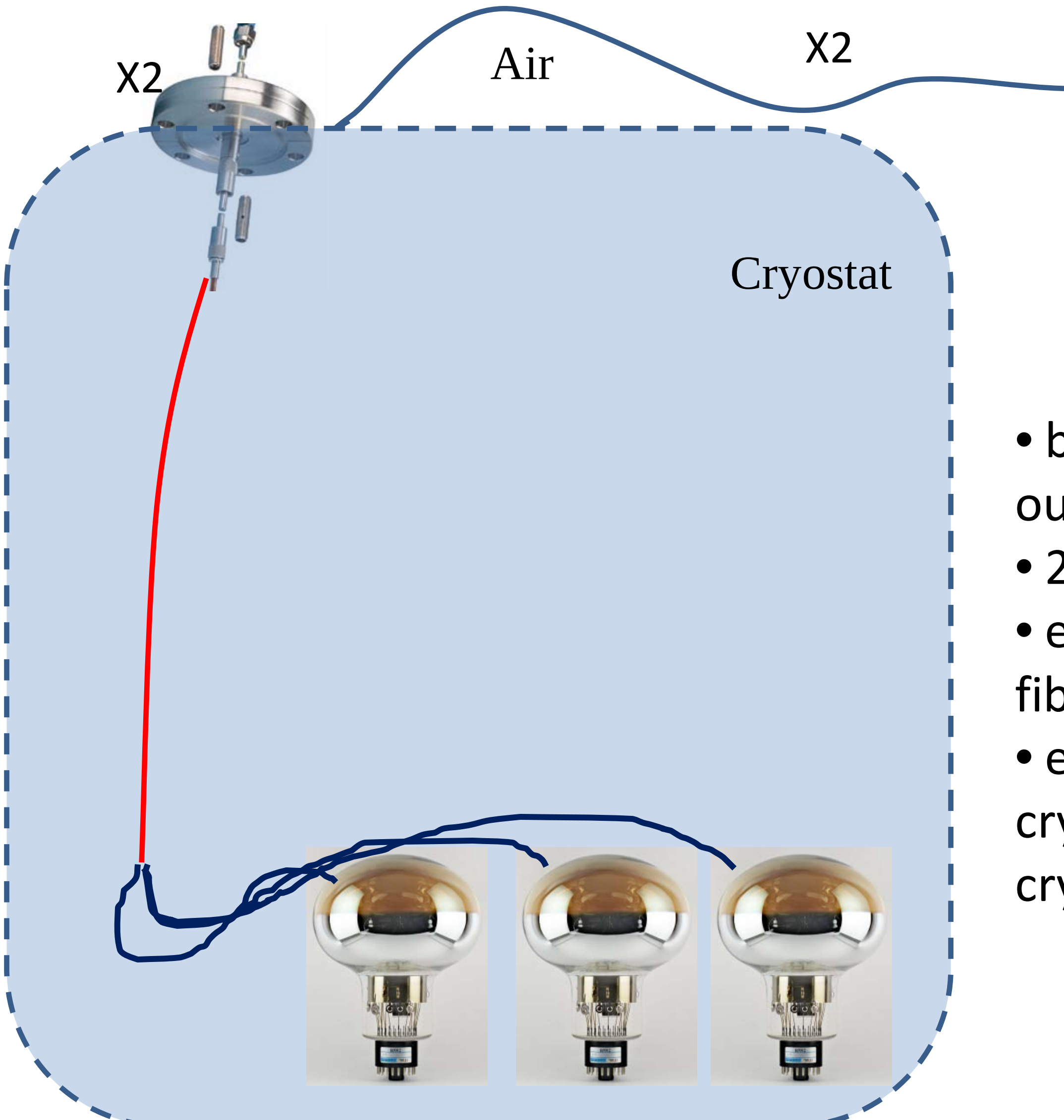
Other Stuff

- WA105: Compromise found for delay of construction of 666 => if confirmed this Friday might give other 3 months to take final decision
- WA105/DUNE: Meeting tomorrow at CIEMAT to discuss plans for DUNE
- MWPC: Sebastian/Alicia (PR) stretched 40 wires during one afternoon => gives hope that it is not too much work to do full detector
- T2K ND Upgrade: Meeting with Juli this morning to discuss possibility to participate in prototype construction:
  - Juli available for Design second half of 2017
  - Worskhop still free for first half of 2018
- Lab: Linde installs N2, air, vacuum and tubes for our gas system today
- Done with IWORID proceedings



Plans for next weeks

- Analysis of DNA setup data + improvements of setup
- Look into charge readout options of gas detectors (AGET/DREAM chips)
- Test new Kaputschinsky + modify it
- Put laser in RF mode and repeat fiber tests with laser (since Andrea is on vacation next week)
- Prepare talk about light readout of WA105 for protoDUNE DP review (24/25th of April at CERN)



- black box with light source outside of cryostat
- 2 fibers going to cryostat
- each splitting into 20 micro fibers (~200 μm thick)
- either directly on top of cryostat or at bottom of cryostat