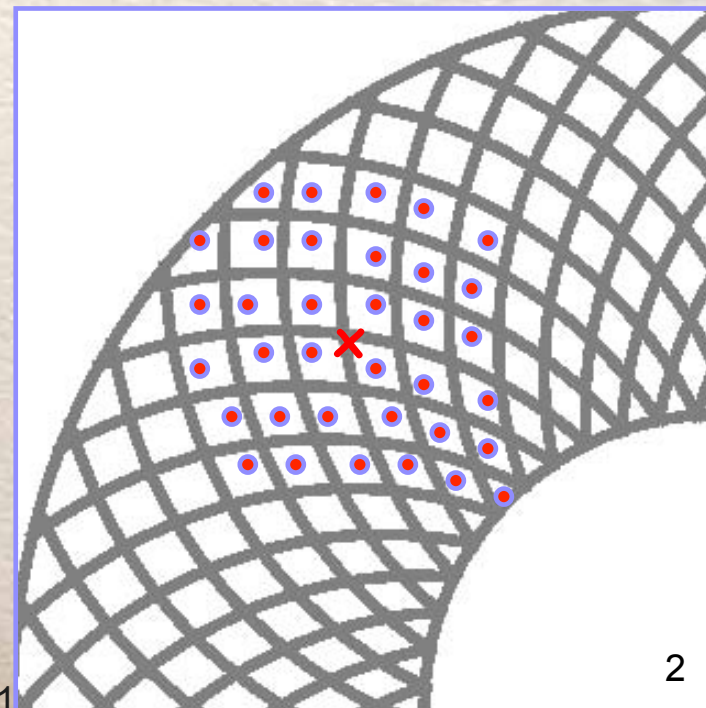


Backward EC EMC Update

Introduction



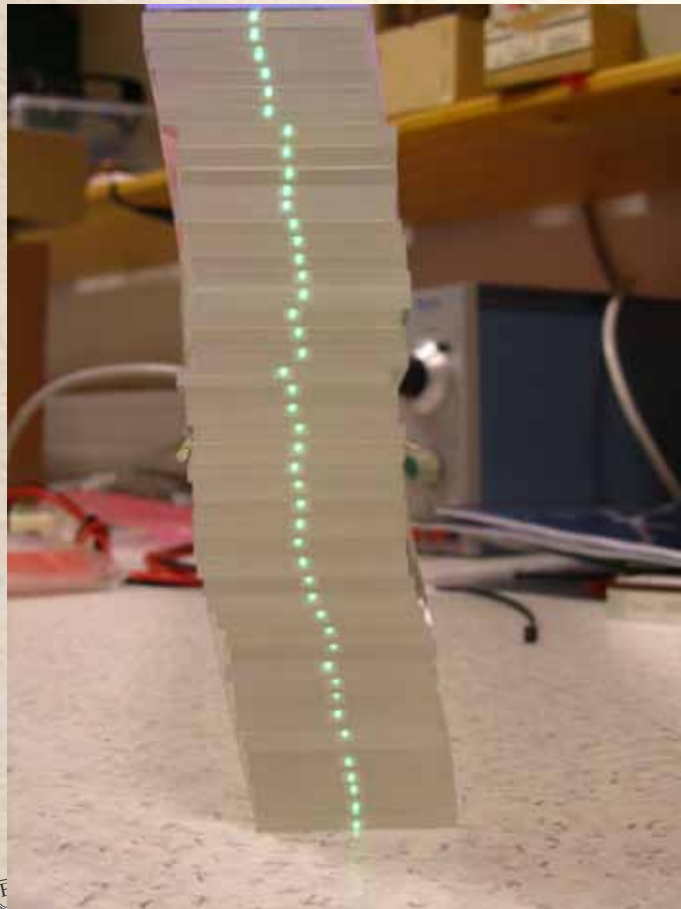
- The backward endcap EMC prototype consists of 24-layers of Pb plates and scintillator strips → full depth is $12 X_0$
- Pb plates are 2.8 mm thick ring segments
- Scintillator strips are 3 mm thick left-handed spirals, right-handed spirals radial segments that alternate eight times
- 6 strips per layer will be read out
strip sizes vary from 4.1 cm at the inner rim to 9.8 cm at the outer rim
→ total of 144 readout channels
- Each scintillator strip is read out with a Y11 WLS fiber positioned in a groove in the center of the strip and coupled to an MPPC at the outer rim



Status of Prototype Preparations



- All 48 sector strips have been completed in our workshop with the old milling machine



- I will try another approach to persuade the machinist to cut one spiral strip
- This may serve as a template for cutting the 96 spiral strips



Status of Spiral Strip Production



- The production of the 96 spiral is more complicated
- Felix Sefkow spoke with his mechanical engineer, Karsten Gardow whom I talked to
 - ➔ The issue is delicate since DESY joined Belle II, but Karsten would help me out
 - ➔ He needs professional drawings with all tolerances specified
The pro engineer drawing made by our engineer are useless
 - ➔ I would have to provide a fixture to hold the strips that costs about €3500
 - ➔ They would cut rectangles out of the plate first from which the spirals would be milled
 - ➔ The lab is refabricated and not available till March 2012
- I have applied for resources from the University to get the strips produced in Bergen ➔ got address on Monday from a space physics engineer whom I will contact next week (charge >€160/hour)

I will know in March if I get the money (€20k)



Manpower Issues



- My Chinese master student, Zhou Zhuo, is learning to make preamplifiers
- Concerning the postdoc hiring, the department would not make any commitments before the budget for next year is clarified
 - ➔ we are in a transition period to a new 4+4 year contract with NFR (application was sent Oct 16th, but we have not heard anything yet)
- Steinar Stapnes suggested to hire the postdoc via CERN, ➔ costs would be half, we would not need to advertise, I could pick postdoc
- Marcello suggested to find a qualified person in SuperB
- Hire technical PhD student jointly with CERN next year
 - ➔ Justas is excellent candidate but he is not finished before June
- New master students come in January, ➔ I will try to recruit at least one



Status of Remaining Items

- Transferred 9k CHF to CERN not to lose money → order from CERN
- Offer from Dupont on Tyvec ($r=.968$) roll of 90.2 cm × 50 m, 0.25mm thick is €12/m or for 75 cm × 75 cm (50 pieces) €16.9/m
 - one roll is sufficient (€600)
 - look into 3M reflector before ordering
- New Hamamatsu photodetectors (20 μ & 15 μ pixels) have to be produced, takes 3 months (no cost estimate)
- Got price for TiO_2
- Use a few thermocouples (cheap)
- Look for reflective mylar
- Machine shop has plastic sheets, preferentially use scintillator residues
- 30m Y11 fiber (need help from collaborators)



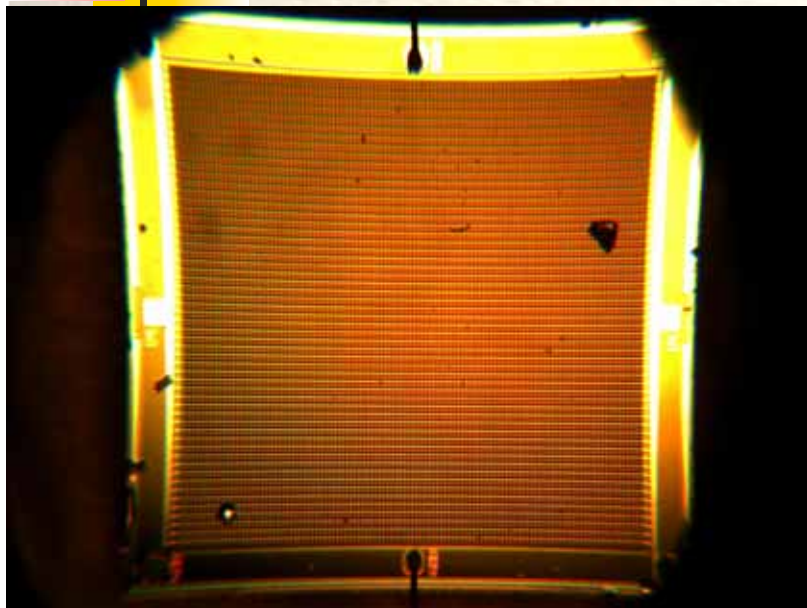
Light Uniformity



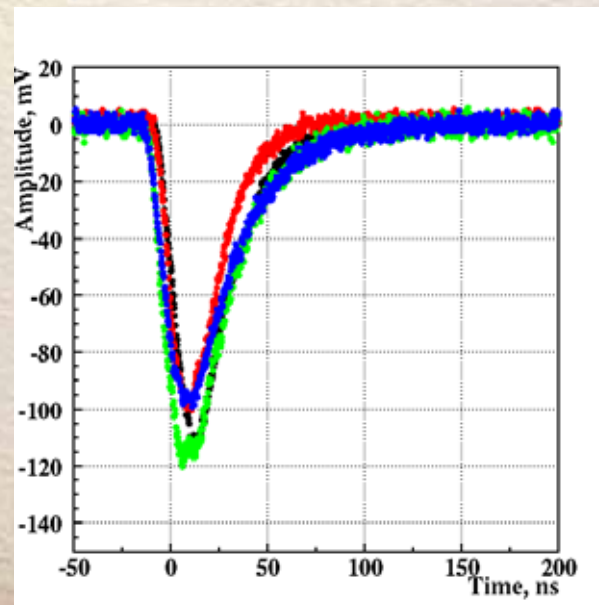
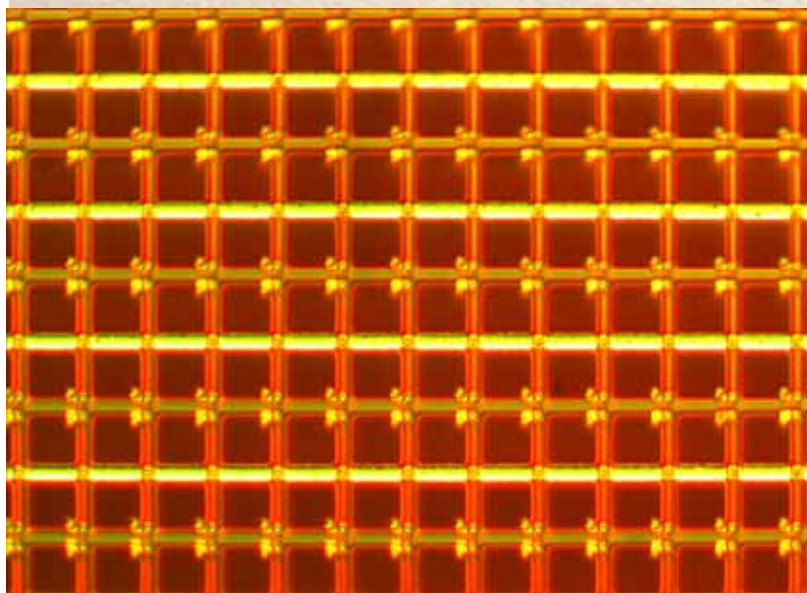
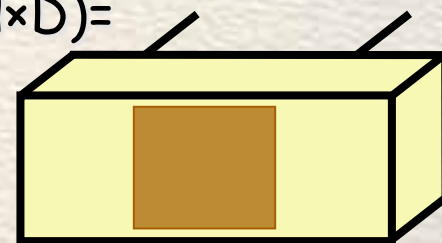
- For radial and spiral strips the light yield is not uniform
- For the radial strip we measured a 60% decrease from outer edge to inner edge
- To restore uniformity the idea is to print a dot pattern onto the white diffuse reflector
- The dot density decreases linearly with length from outer edge to inner edge
- To first order same pattern should also work for logarithmic spiral strips



New SiPM from KETEK

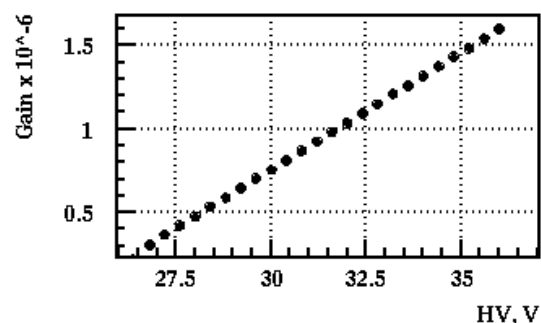


- Sensitive area - $2.25 \times 2.25 \text{ mm}^2$
- Pitch: 20μ → more than 12000 pixels
- Package size: (L×H×D)=
 $6.4 \times 2.9 \times 2.0 \text{ mm}^3$
- Response to LED flash w/o amplification

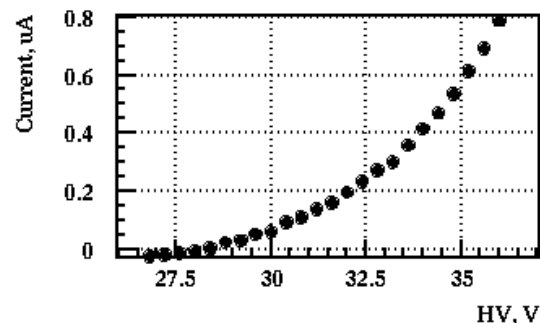


From M. Danilov

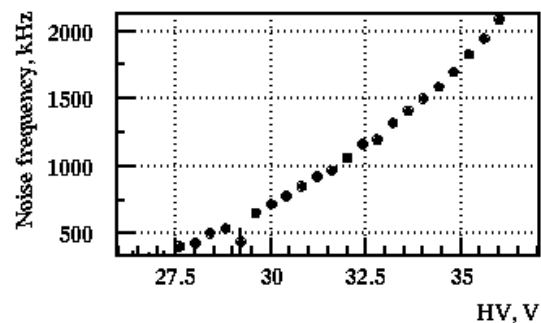
KETEK SiPM Parameters measured with blue LED



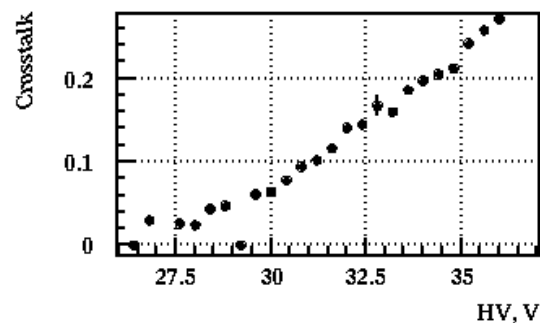
GAIN VS HV



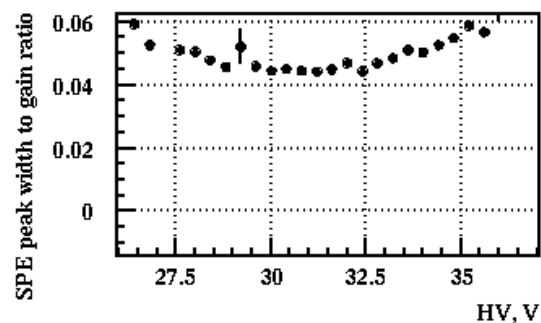
APD CURRENT VS HV



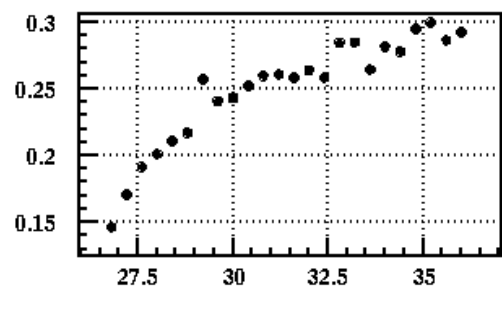
NOISE VS HV



CROSS TALK VS HV



PEAK WIDTH VS HV



EFFICIENCY PER PHOTON VS HV

● Breakdown
HV ~ 24.6 V

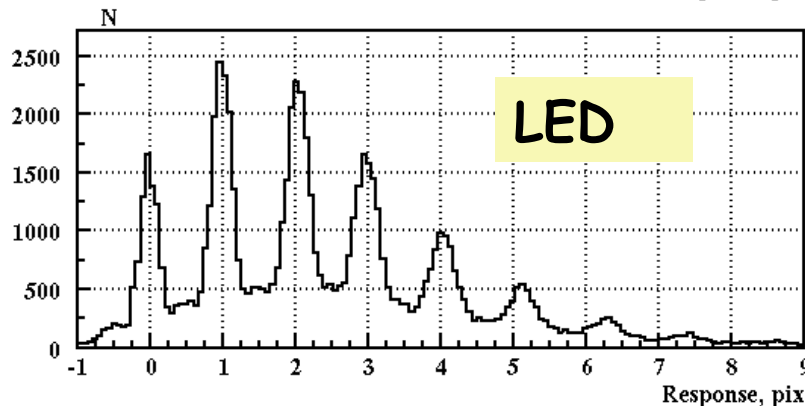
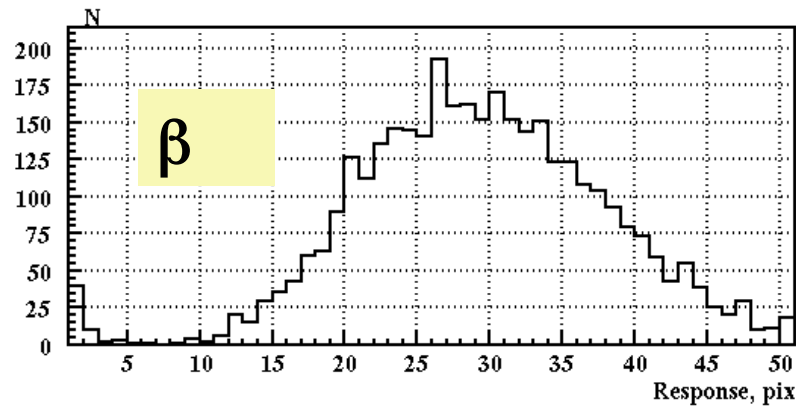
From M. Danilov



KETEK SiPM Performance from ^{90}Sr



- Mount KETEK SiPM on to tile and measure response to β -particles from ^{90}Sr



HV	response, pixel	cross talk	response, p.e.
33.2	26	0.18	22
30	22	0.07	20

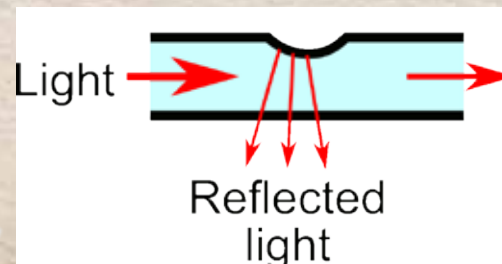
- Weak dependence on operating voltage
- Weak dependence on temperature!



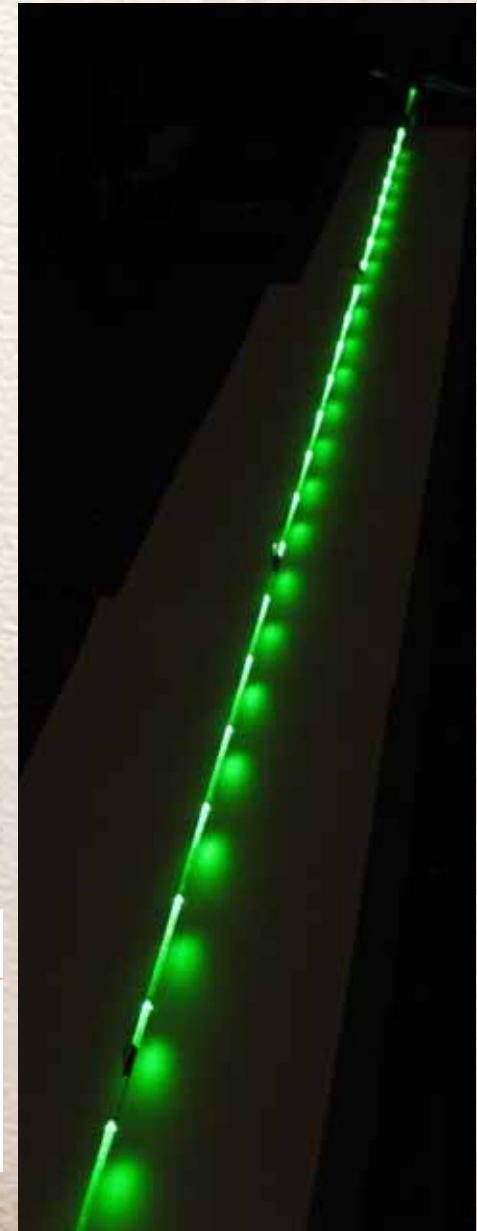
Notched Fibers



- # LEDs, PIN diodes and calibration boards can be reduced by using WLS fibers with notches
- This new technology is planned for the AHCAL
 - External company Safibra will make semiautomatic setup to produce precise notches in fibers
- Prototype fibers used 24 notches
 - observe systematic error in light distribution
- Need to see calibration results
- If this works and one fiber can illuminate 24 strips
 - need 48 fibers
 - need 4 LEDs for 12 fibers/LED
 - 1 calibration board
- Think about layout, 1 board would be ok for 12 notches, 16 fiber/LED & 6 LEDs



From I. Polak

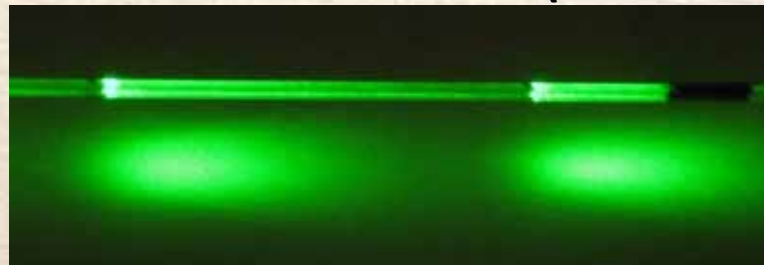


Notched Fibers



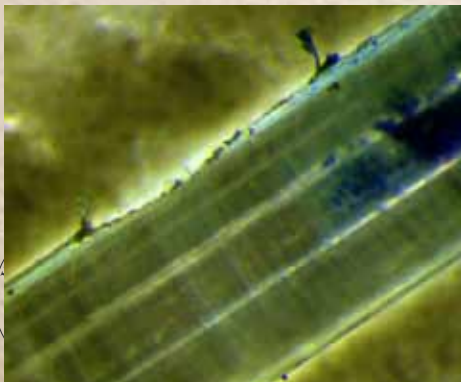
- Light is emitted from the **notches**
- The **notch** is a special scratch in the fiber that reflects light in opposite direction
- The size of the notch varies from first to last notch in the fiber to maintain homogeneity of the light emitted from the notches

Emission from the fiber (side view)

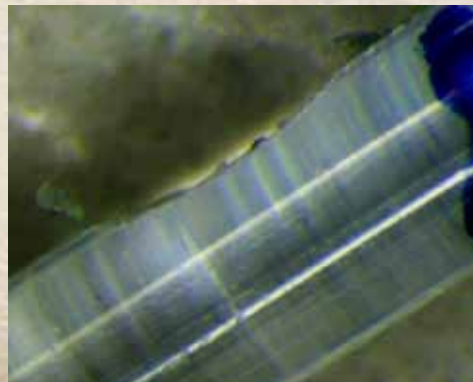


From I. Polak

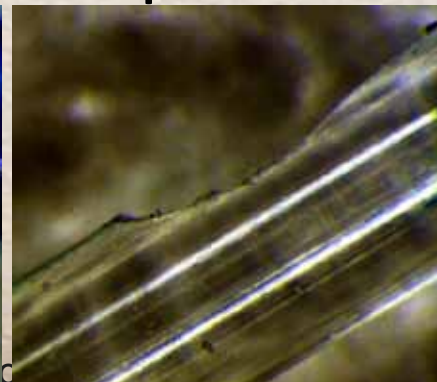
First notch



Middle notch

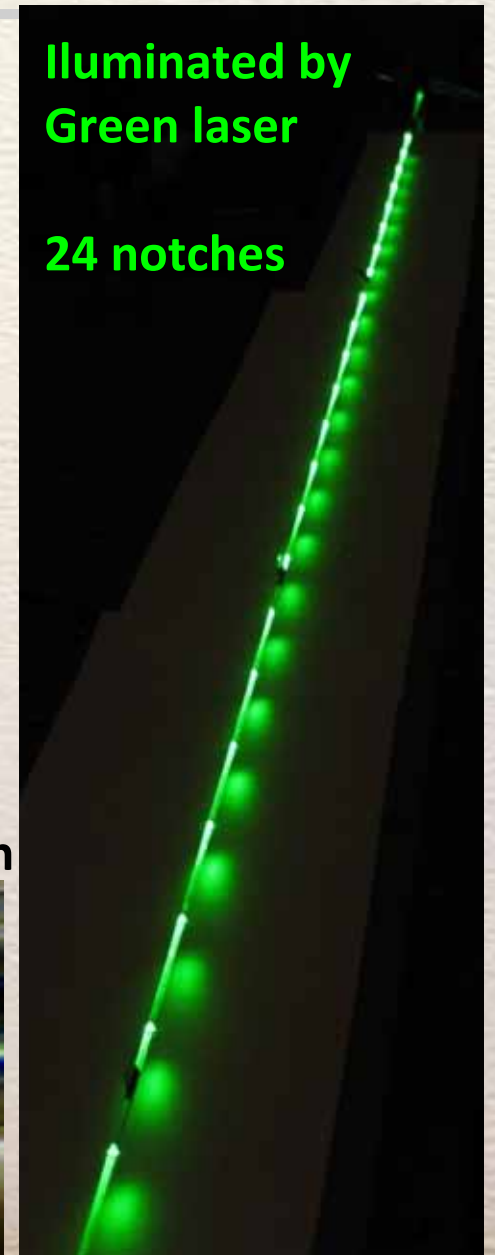


End position notch



Illuminated by
Green laser

24 notches



TDR Status



- The first draft of the TDR is >80% complete
- Missing parts are
 - Section: Solid angle, transition to barrel
 - Section: Calorimeter construction (exists in other sections)
 - Section: Supply and services
 - Section: Discussion of task force conclusions
 - Discussion of $B \rightarrow K \nu \bar{\nu}$
 - Missing figures referenced
 - Additional figures
- Need to organize sections to be coherent
- Try to complete the text and work on preliminary figures in next 2 days



Remaining Answers to Integration Form



- What is the number of cables to preamplifier?
 - 4 cables, 2 for voltage, signal in, signal out
- What is the number of cables to SPIROC ASIC
 - 36 flat ribbon input, 5 output + special connector for +5.5,-7.5 V, USB output
- What is the power consumption of a CMB?
 - (12 LED channels) 0.65A @ 12V (up to 15V) 9.8W maximum
- What is the number of cables for one CMB, (power, signal cables)?
 - 4 cables: 1: power subD9, 2: CANbus subD9, 3: PIN output multicoax, 4: flat cable at bottom- T-calib + V-calib + 5x Temp sensors
- What is the maximum bending radius for these cables?
 - minimum bending radius 10cm for PINoutput cable,
 - 5cm for PWR and CANbus cables,
 - 1cm for flat cable and 30cm at orthogonal direction



Conclusions



- The production of the radial strips is not solved yet
- Rest funds are secured to purchase remaining items
- The postdoc hiring is still up in the air (crucial for progress)
 - This has to be settled asap (complained to Vincent Boudry)
 - One master student is working
 - I am promised a technical PhD student jointly with CERN
- ➔ Urgently need new collaborators
- Danilov introduced new SiPM (MEPHI/KETEK) that looks superior
- Notched fibers may simplify calibration system
- First draft of TDR is >80% complete
 - New developments need to be integrated

