Status of the Tail Catcher/Muon Tracker

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for NICADD NIU

CALICE DECEMBER 7- 8 2004

Outline

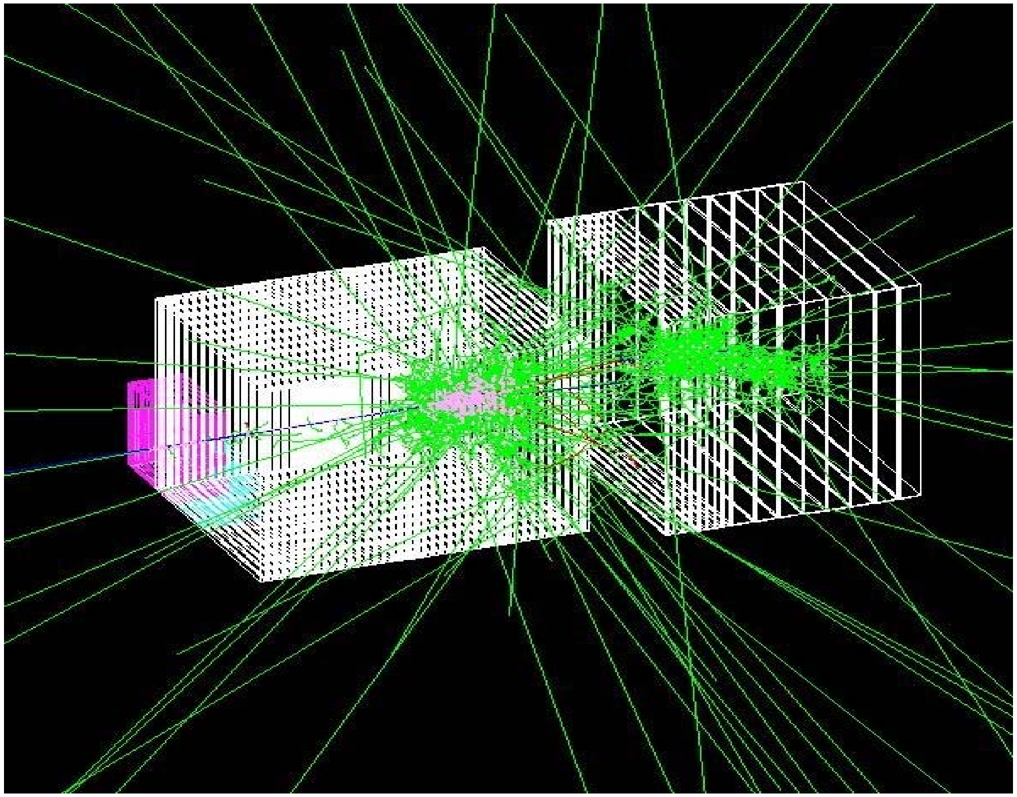
- **Current status.**
- **Plans.**

Current status

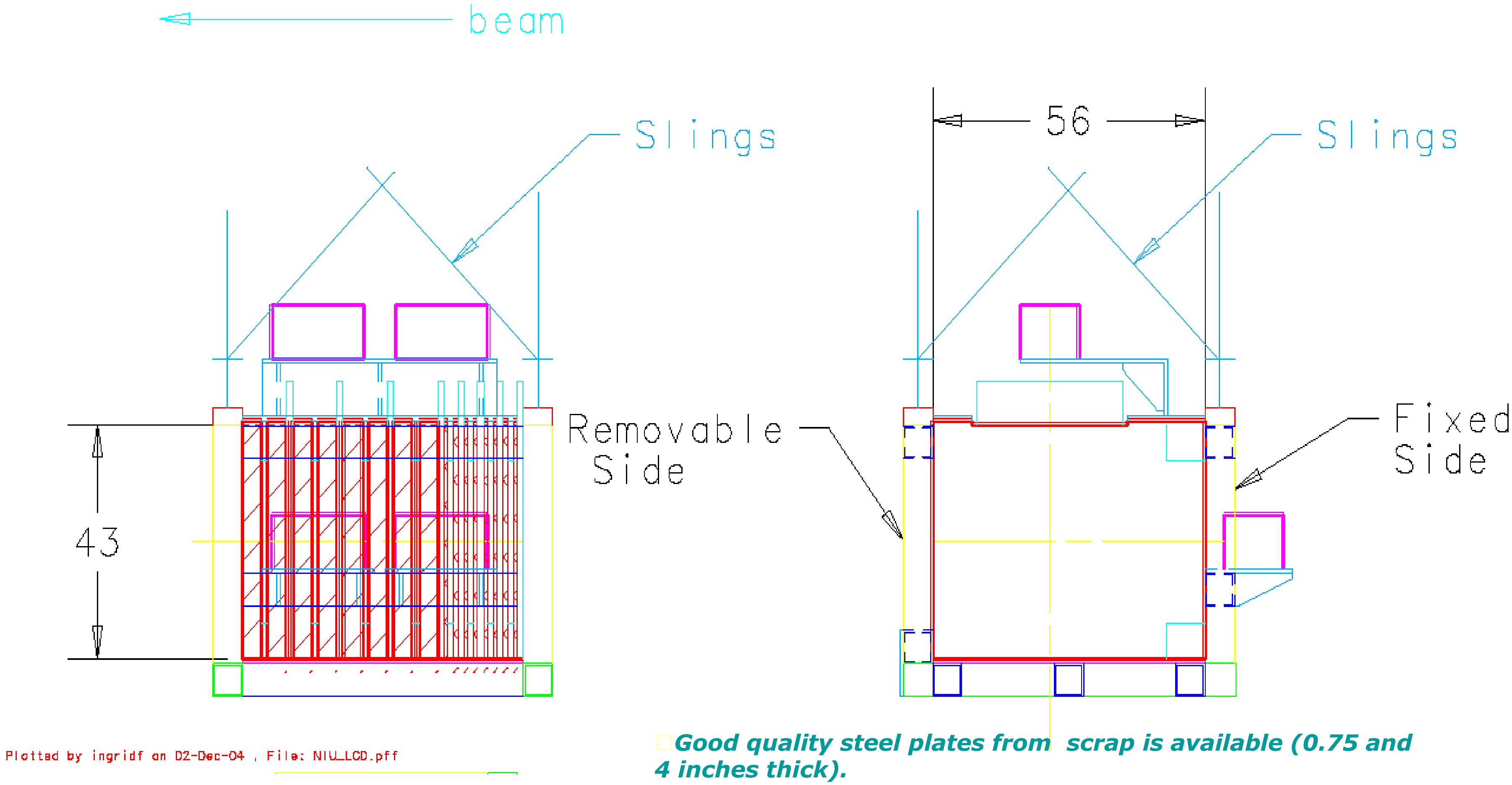
- **Status of the TCMT**
  - a) **TCMT design** (TCMT for the test beam)
  - b) **Calibration and monitoring**
  - c) **Scintillator strips**
  - d) **Detectors (SiPM) and electronics**
  - e) **On-Site tests**

TCMT design

- Fine" section (8 layers)
  2 cm thick steel
- "Coarse" section (8 layers)
  10 cm thick steel
- 5mm thick, 5cm wide strips
- Tyvek/VM2000 wrapping
- Alternating x-y orientation
- Si-PM photo detection
- Common readout with Hcal
- Along the beam - 142 cm
- Height - 109 cm
- Weight ~10 tons

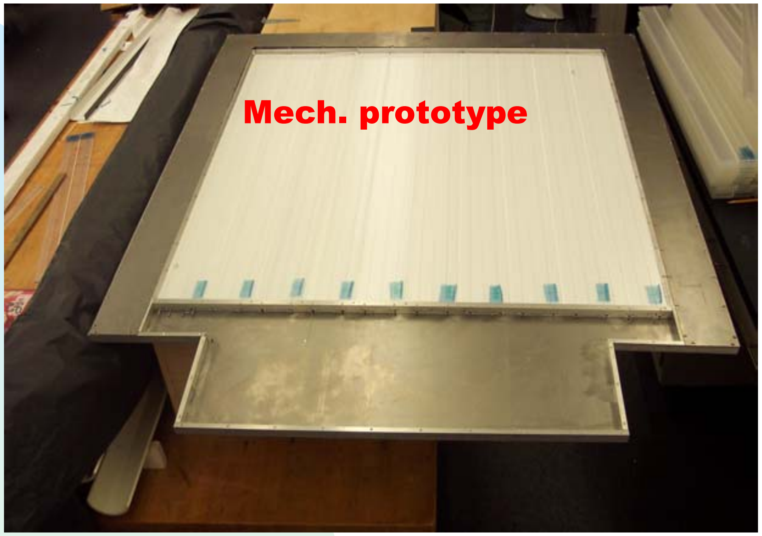


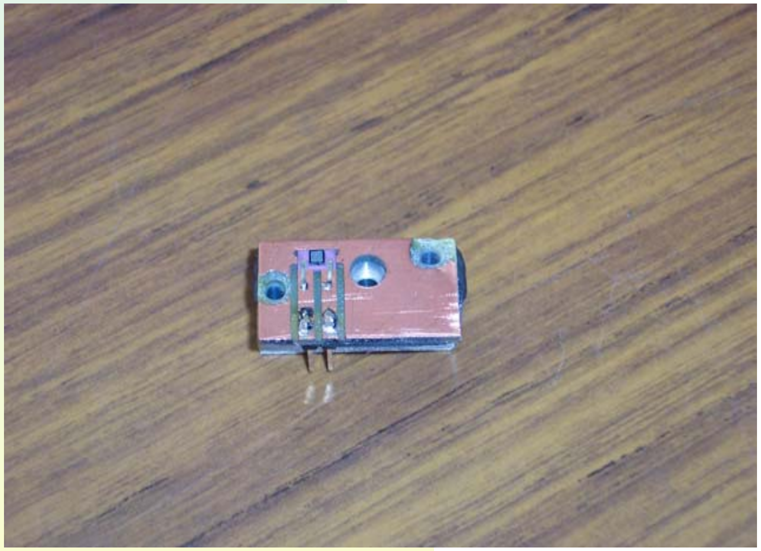
Very preliminary mechanical support drawing.

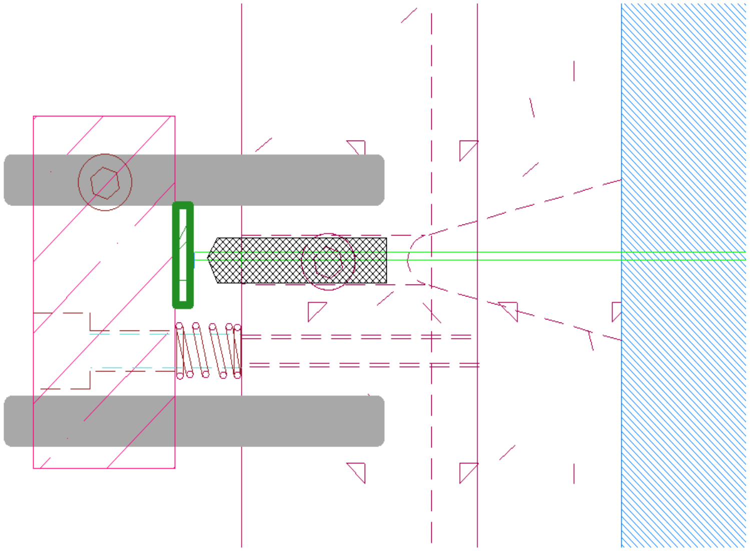


- Good quality steel plates from scrap is available (0.75 and 4 inches thick).
- Maximum size for the thicker plates is 1.066m x 1.2m.
- Cart being designed with about 10 ton load capacity.
- Will have the capability for forward-backward and left-right motion.

Tail Catcher one cassette view



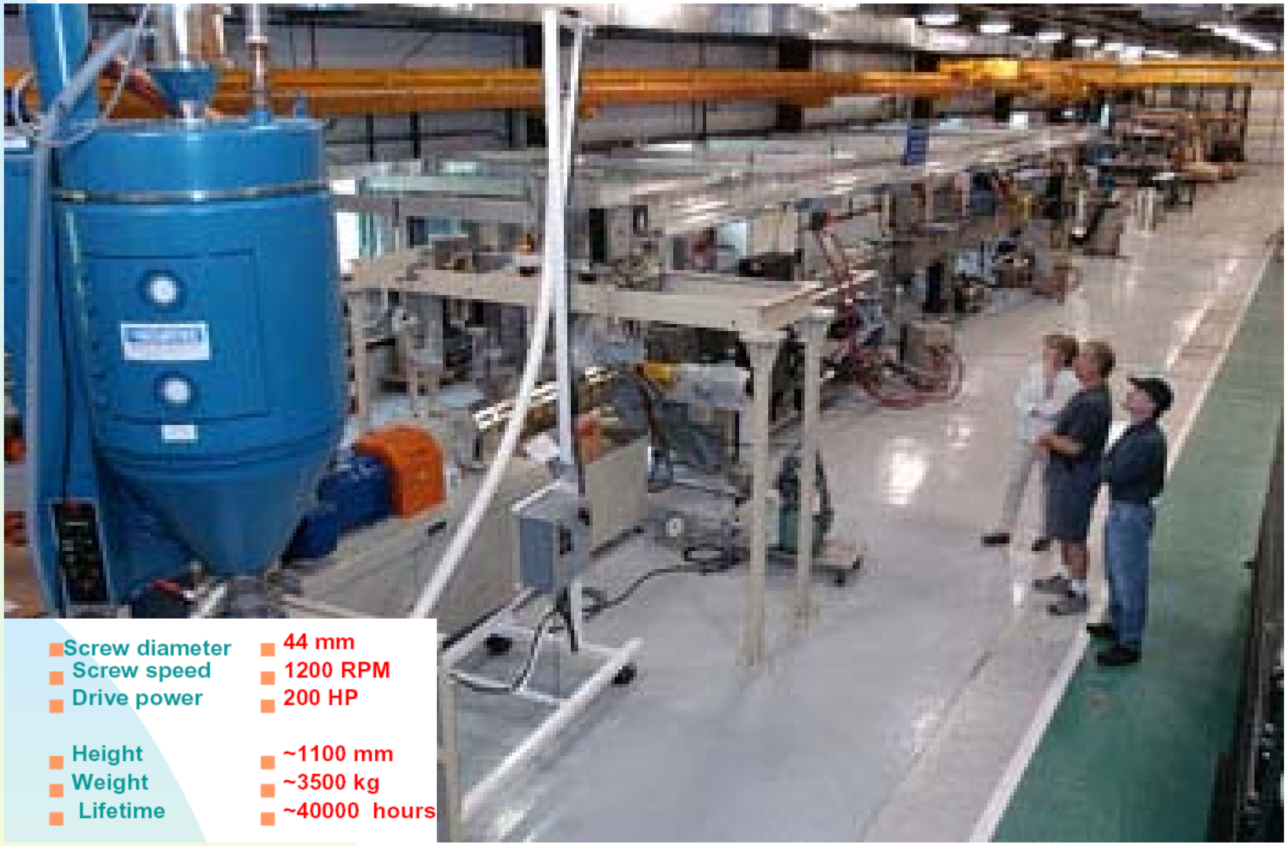




Brief summary of the FNAL-NICADD extruded scintillator characteristics.

Thickness:	σ ~ 0.6 %	(Over 300 m)
Width :	σ ~ 0.2 %	(Over 300 m)
LY non-uniformity	σ ~ 4 %	(across 10 cm)
LY non-uniformity	σ ~ 2.2 %	($10*10\ cm^2$)
LY non-uniformity	~ 3 %	(Hexagonal cell 9 cm^2)
Light Yield	66 % of BC408	
	~100% of Kuraray SCSN-81	
Rad. Hardness	< 5 % LY degradation after 1 Mrad (gamma)	

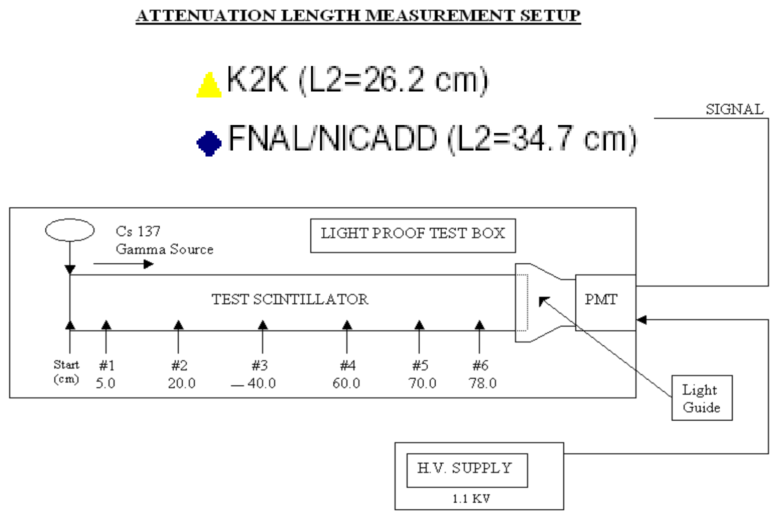
FNAL-NICADD extruder line



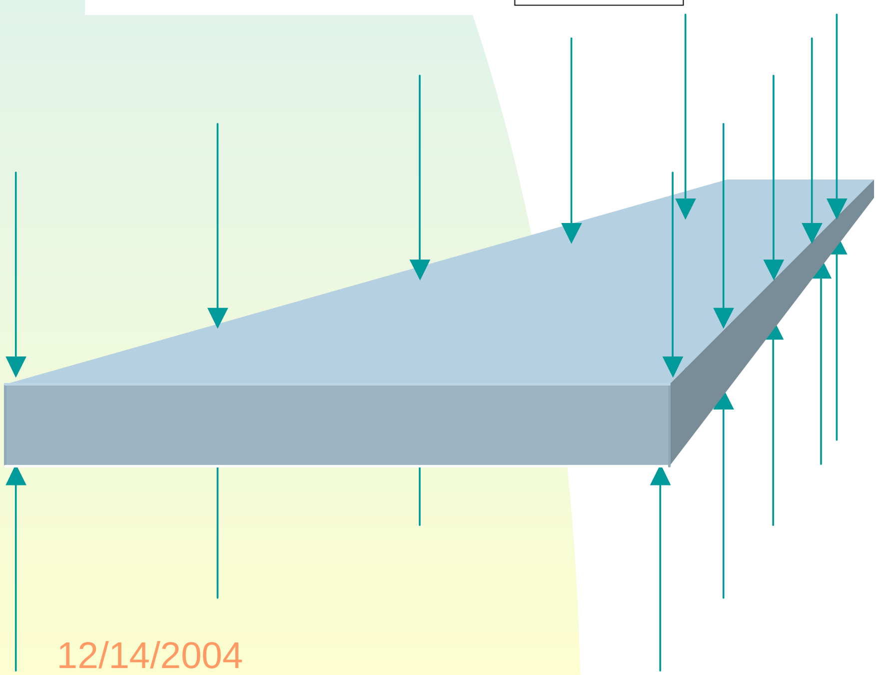
Screw diameter	44 mm
Screw speed	1200 RPM
Drive power	200 HP
Height	~1100 mm
Weight	~3500 kg
Lifetime	~40000 hours

Output range 30-200kg/h

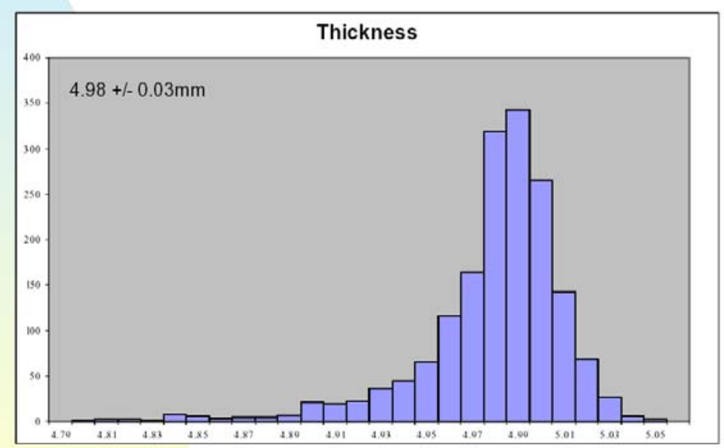
QC on scintillator strips



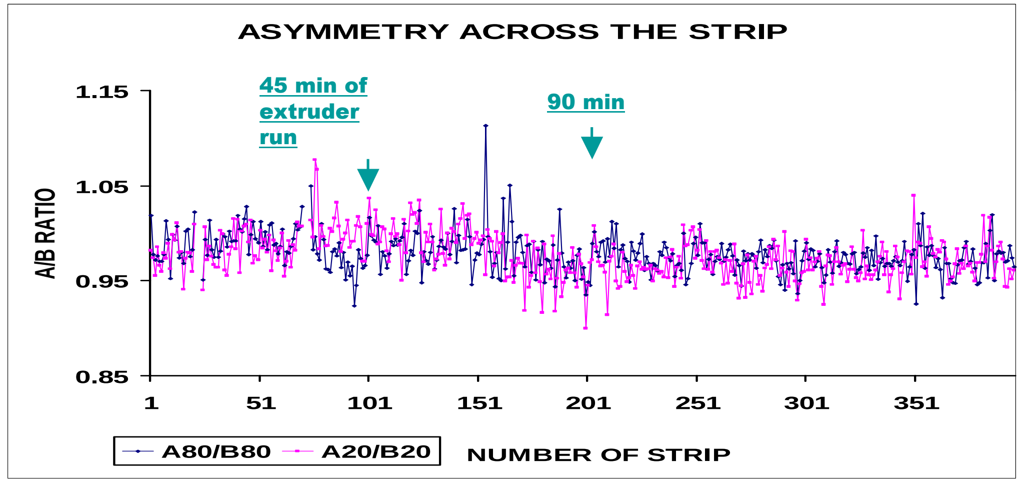
Number:	Batch:	L1 (Long)	L2 (Short)
1	1	41.3 cm	38.0 cm
101	6	59.9 cm	48.8 cm
121	7	69.0 cm	49.3 cm
161	9	64.1 cm	51.4 cm
182	10	31.3 cm	24.1 cm
Ref	-	43.7 cm	24.1 cm



Thickness 4.98±0.03 mm

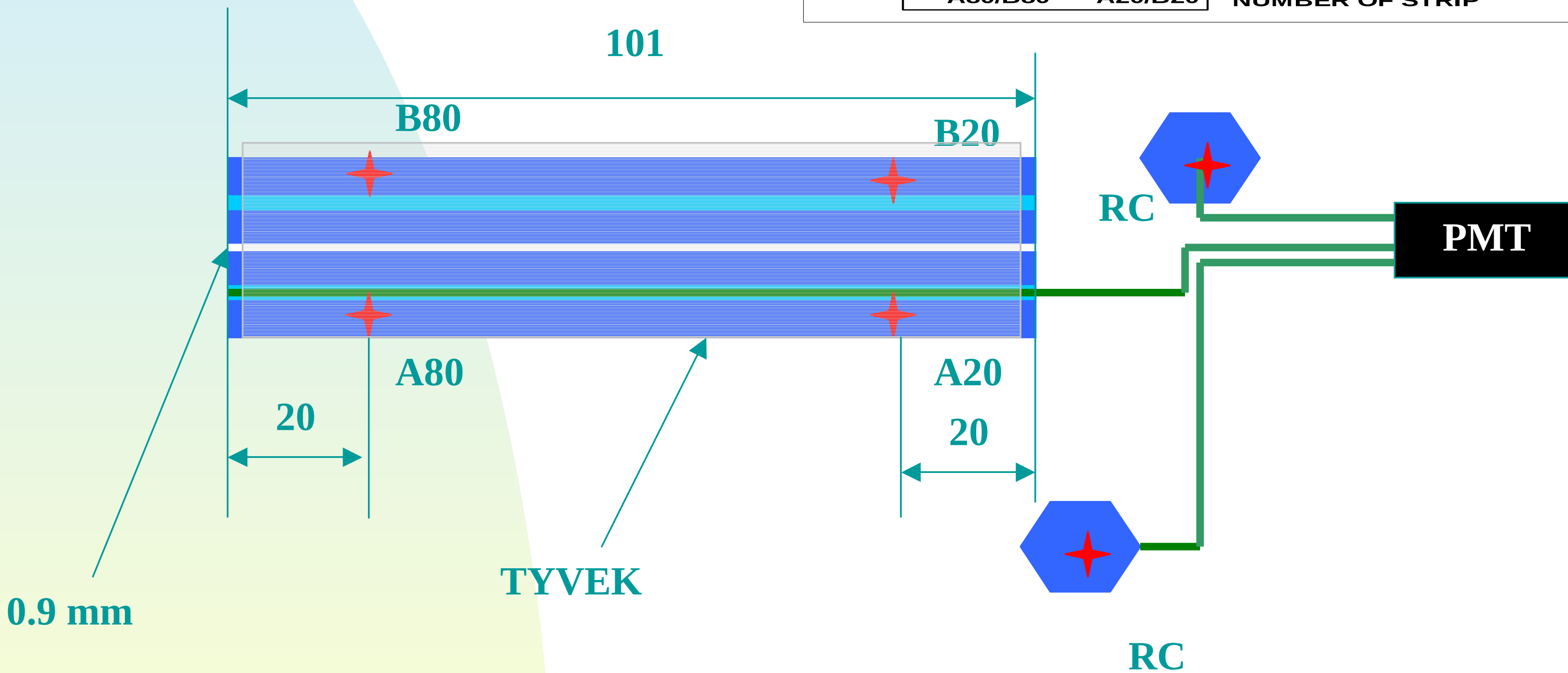


QC on scintillator strips



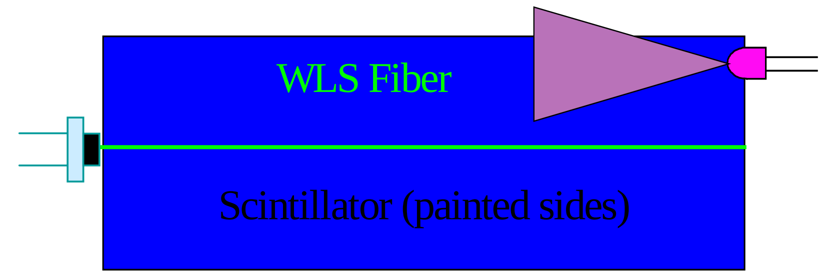
A/B(80) ratio=0.98±0.02

~2%

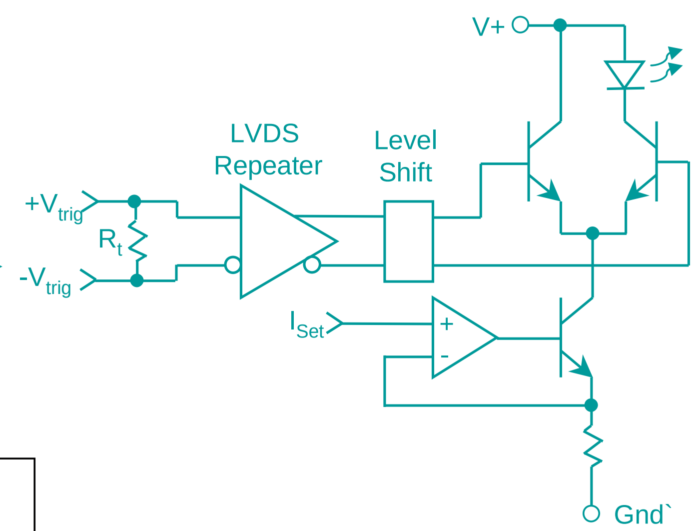


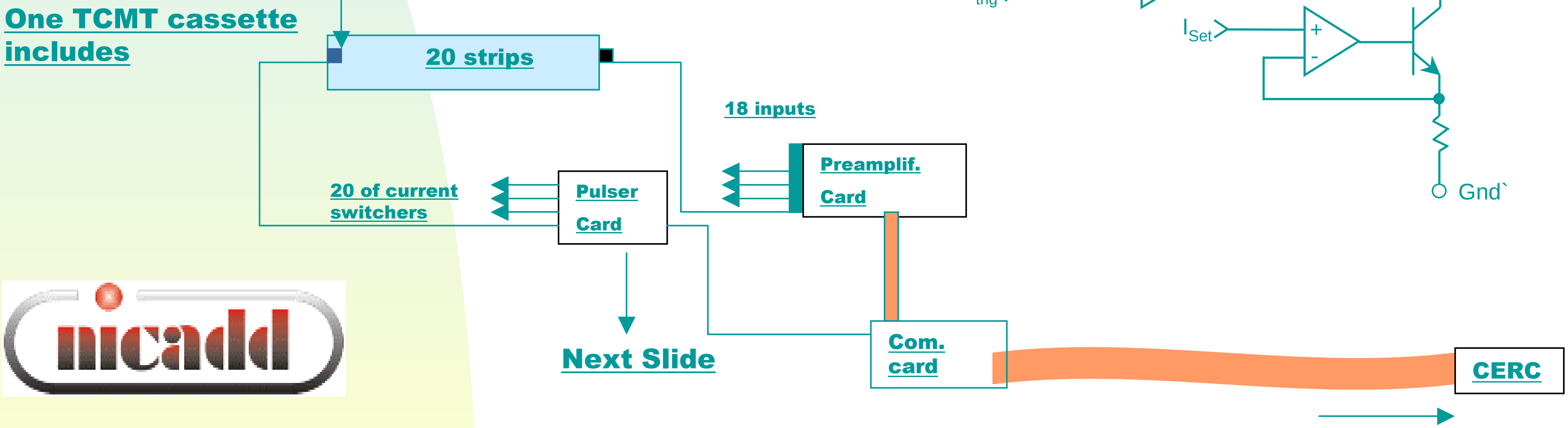
Calibration and monitoring

- Individual LED driver for the each strip
- Preliminary driver design has been proposed
- Read-out schema is under discussion

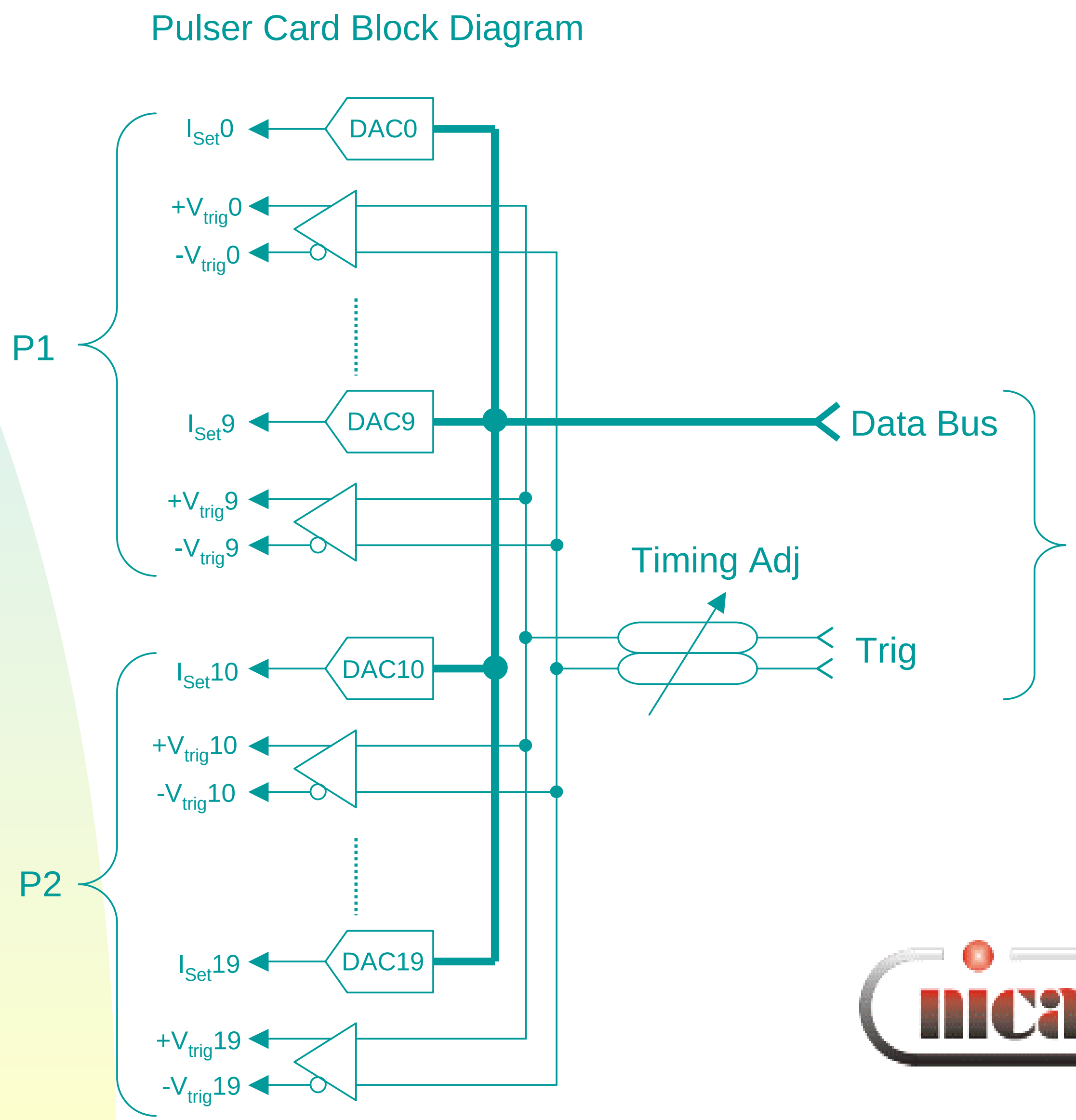


Block diagram of current switch at LED





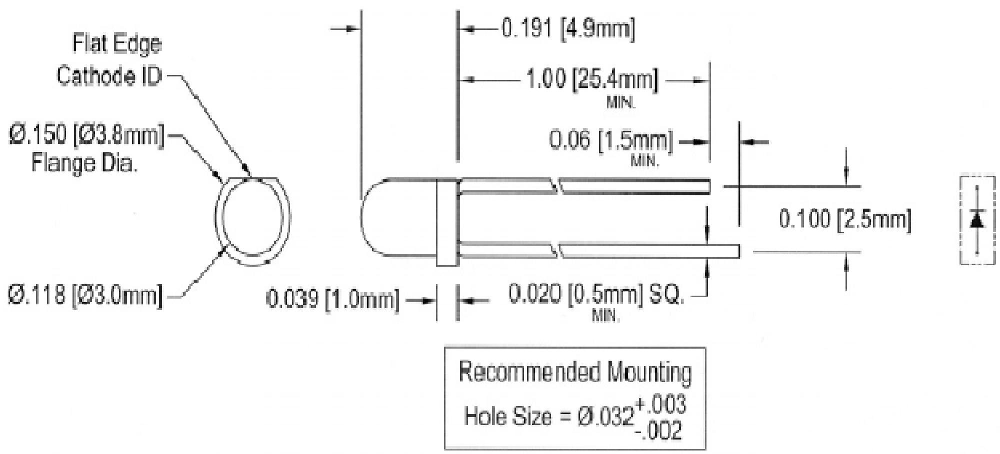
Calibration(Proposed by Sten Hansen, FERMILAB)



LED information

LED3-UV-XXX-30 Series | 3mm Ultraviolet LED

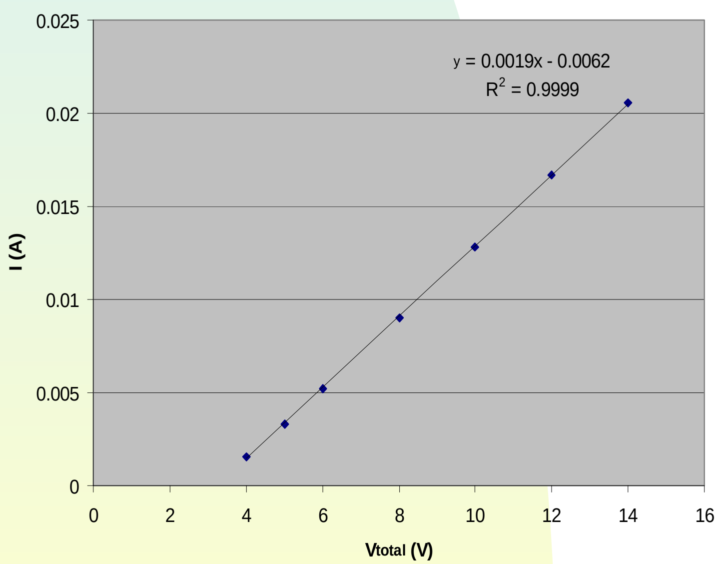
LED Part No.	Chip			Lens Appearance	Absolute Max. Ratings				Electro-Optical Data @20mA			Viewing Angle 2 θ 1/2 (deg)
	Material	Peak Wave Length λp(nm)	Emitted Color		Δ λ (nm)	Pd (mW)	If (mA)	Peak If (mA)	Vf (V) TYP	Vf (V) MAX	Iv (mcd) TYP	
LED3-UV-395-30	InGaN	395	BLUE UV	WATER CLEAR	60	100	30	100	3.7	4.0	11.0	30
LED3-UV-400-30	InGaN	400	BLUE UV	WATER CLEAR	60	100	30	100	3.7	4.0	12.0	30
LED3-UV-405-30	InGaN	405	BLUE UV	WATER CLEAR	60	100	30	100	3.7	4.0	12.0	30

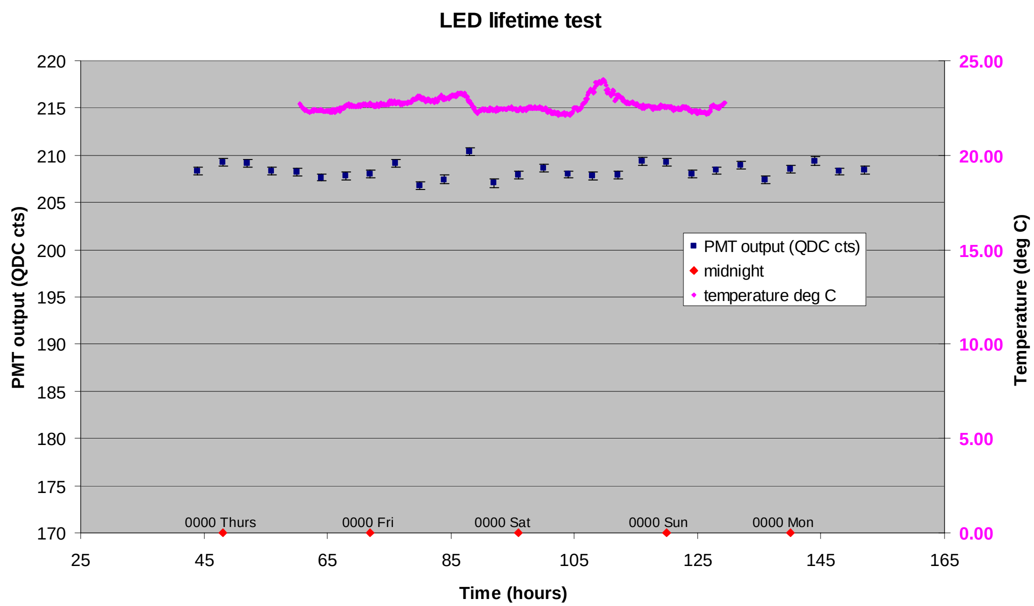


UV LED R&D

1. All LEDs show good reproducibility in the characteristic behavior
2. ~$1 UV LED is a promising candidate for the calibration of each scintillator strip+SiPM.
3. R&D is under way

	LED 1	LED 2	LED 3	LED 4	LED 5	LED 6	LED 7	LED 8	LED 9	LED 10
4.14V										
slope	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019
intercept	0.0062	0.0062	0.0061	0.0062	0.0062	0.0062	0.0062	0.0062	0.0062	0.0063
R^2	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
5-14V										
slope	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019
intercept	0.0063	0.0063	0.0062	0.0063	0.0063	0.0063	0.0063	0.0063	0.0063	0.0064
R^2	1	1	1	1	1	1	0.9999	0.9999	1	1





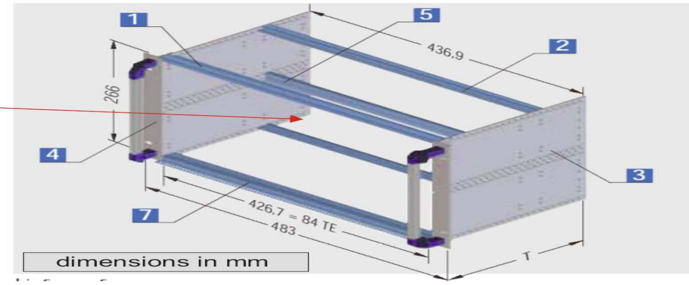
Detectors and electronics

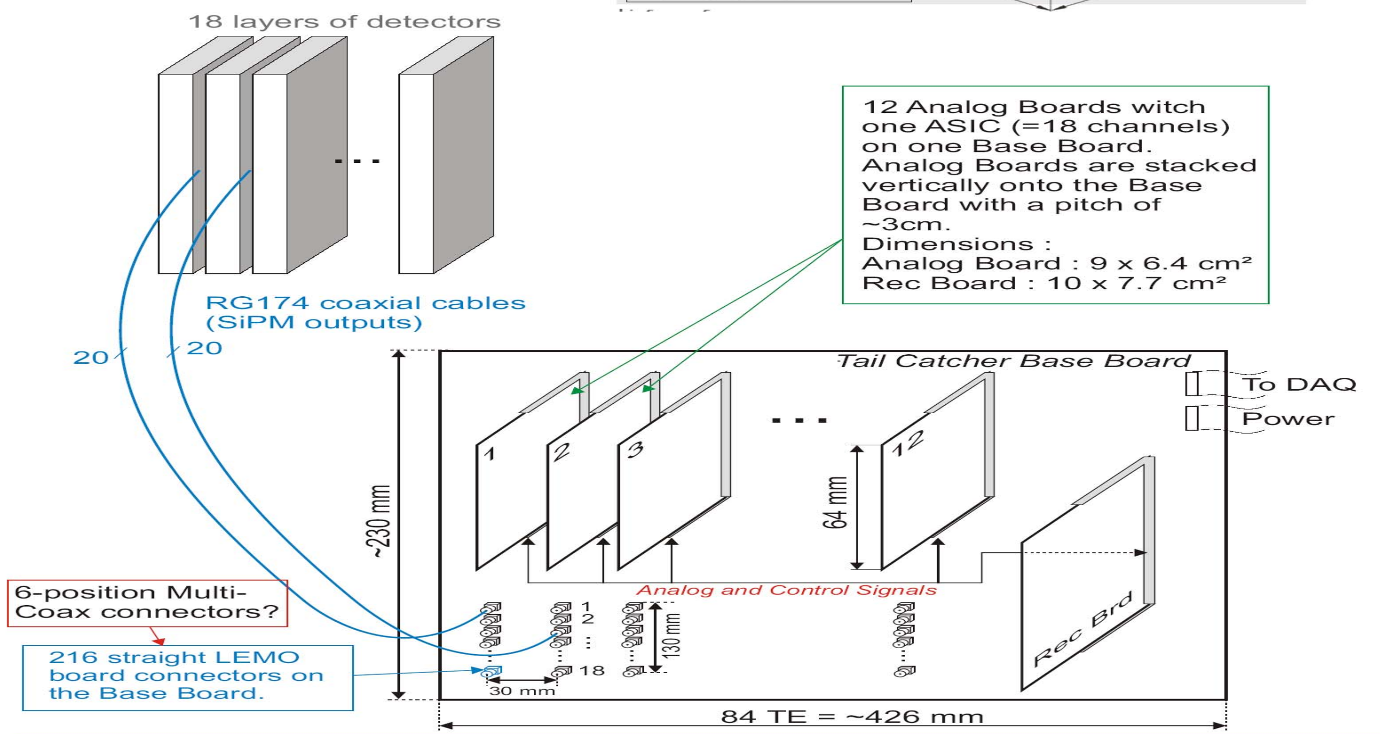
- Layout of electronics
- New setup for the SiPM commissioning was prepared
- Encapsulation test of the SiPM bonds was performed
- The measurements before and after encapsulation were carried out

Layout of electronics

Tail Catcher Base Board is placed in a standard 19" Crate (Backplane).
2 Crates are needed for the
analog channels

16*20=320



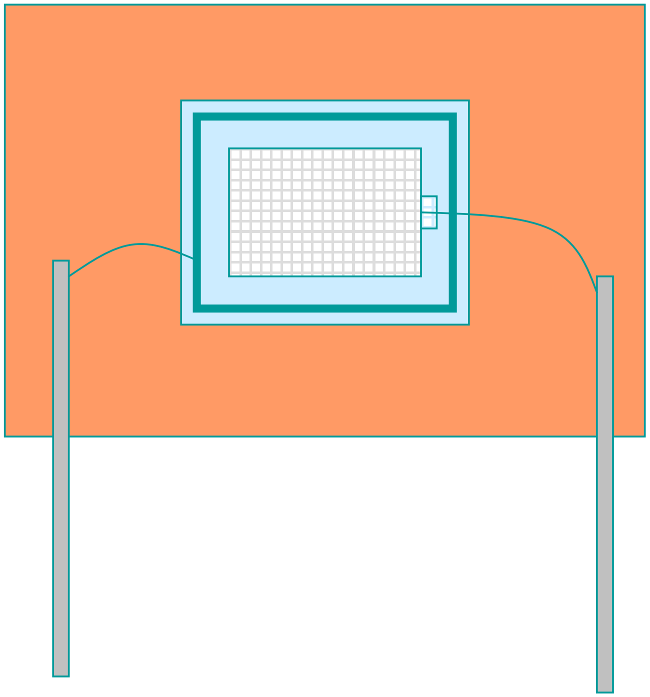


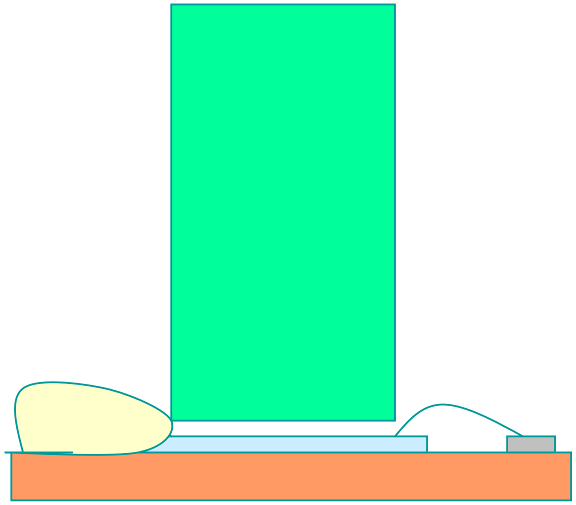
Encapsulation of the wire bonds

* Easy to damage

* Experience of the D0 SiMT

* Availability of the equipment at FNAL Si Det. lab.

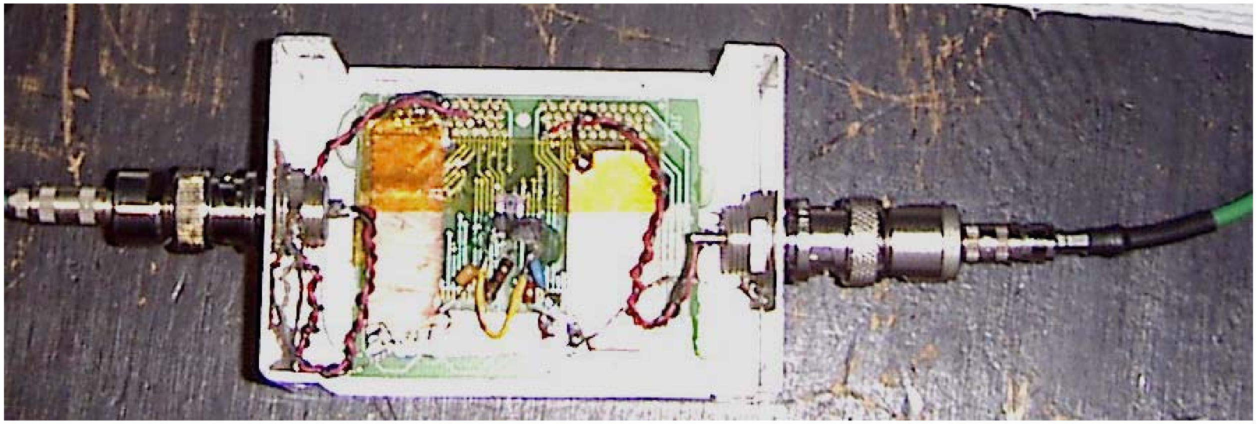


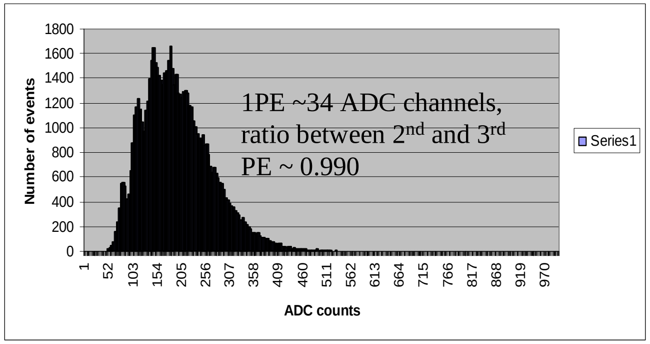


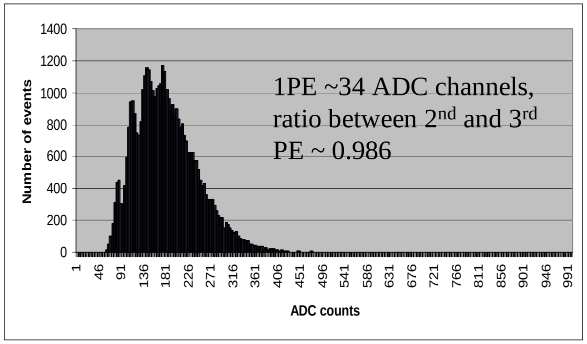
Encapsulation setup

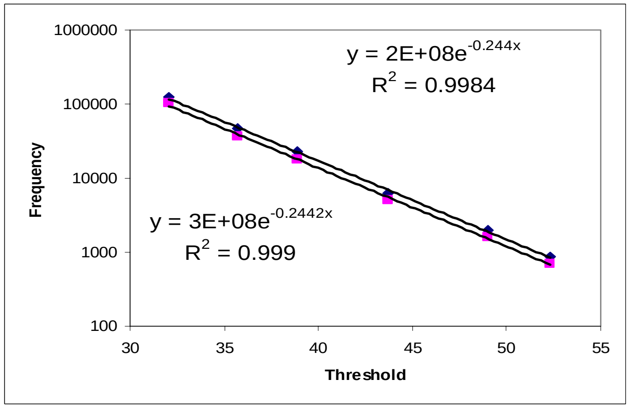
New setup and tests results .

1. **Allows to have reproducible light flux during the tests**
2. **Meets mechanical problems(bent legs, different distance between them)**
3. **Simple and robust**
4. **We are going to evaluate each sensor (working point)**



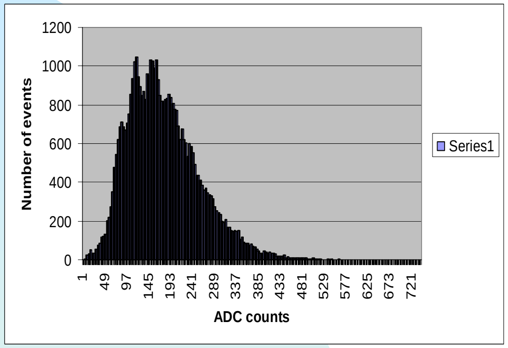




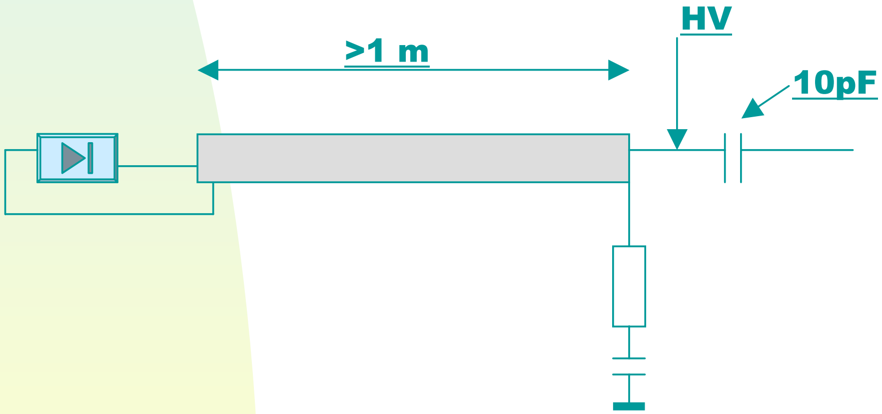


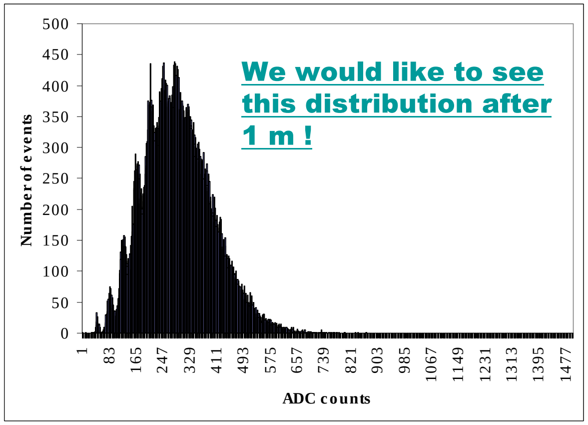
Data was taken: before at 25.3C, after at 24.9C, thus small difference in absolute value of counts, but the slope is the same and the behavior or noise is the same

On-Site test and results



- Different lengths of the cable were tested.
- Currently we are comfortable with length of 30 cm with electronics we have.
- The real electronics(FLC_PHY3) tests are necessary with longer cables.
- Some assistance from electronics experts will be requested during current visit to DESY.





Plans

- LED calibration system: to test a single prototype of the current driver.
- LED: to perform a long time stability tests with temperature tracking.
- Electronics:To perform a test with real electronics for one cassette prototype. We expect to test one board at NICADD.
- SiPM sensors: to find a working point for each sensor.
- Mechanics: To make an over all design.

Schedule

Strips : Done

SiPM : 25 ok!, will need more starting Feb.

Cassette: Mech. Prototype done, 1st ready Feb.05

LED System: design ready this year, prototype ready in Jan. 05

Stack & Cart:Construction starts Feb. 05