New shashlik prototype pre-test and ERS as fiber end reflector

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Shashlik module pre-test

New SDU module description

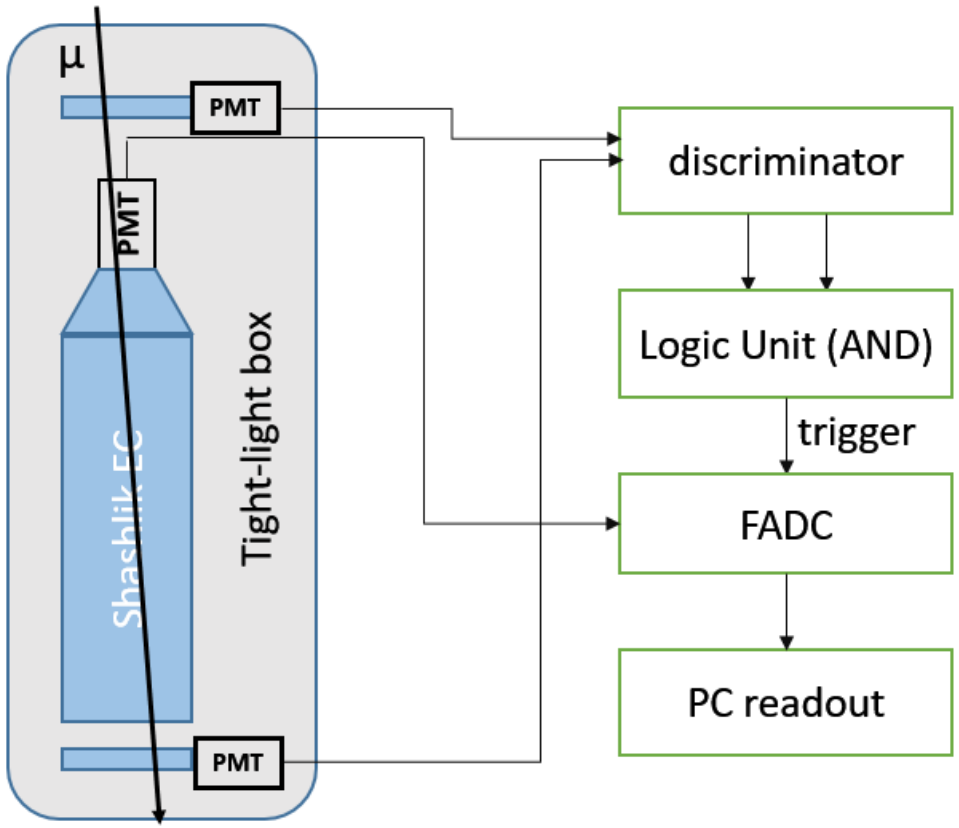
prototype	Scintillator	lead	Reflective Material between layers	fiber	Fiber end reflector	Side painting
SDU#4	Kedi(improved)	ordinary	Powder painting	BCF91A		
SDU#5	Kedi(improved)	US Kolgashield (metal plating surface)	Tyvek(about 0.145mm thickness)	BCF91A		

For fiber end reflector, the fiber end is outside of module, we try to glue reflector to the fiber end.
For side painting, titanium dioxide+glue is a good choice, and applied in SDU#3. (EJ-510?)

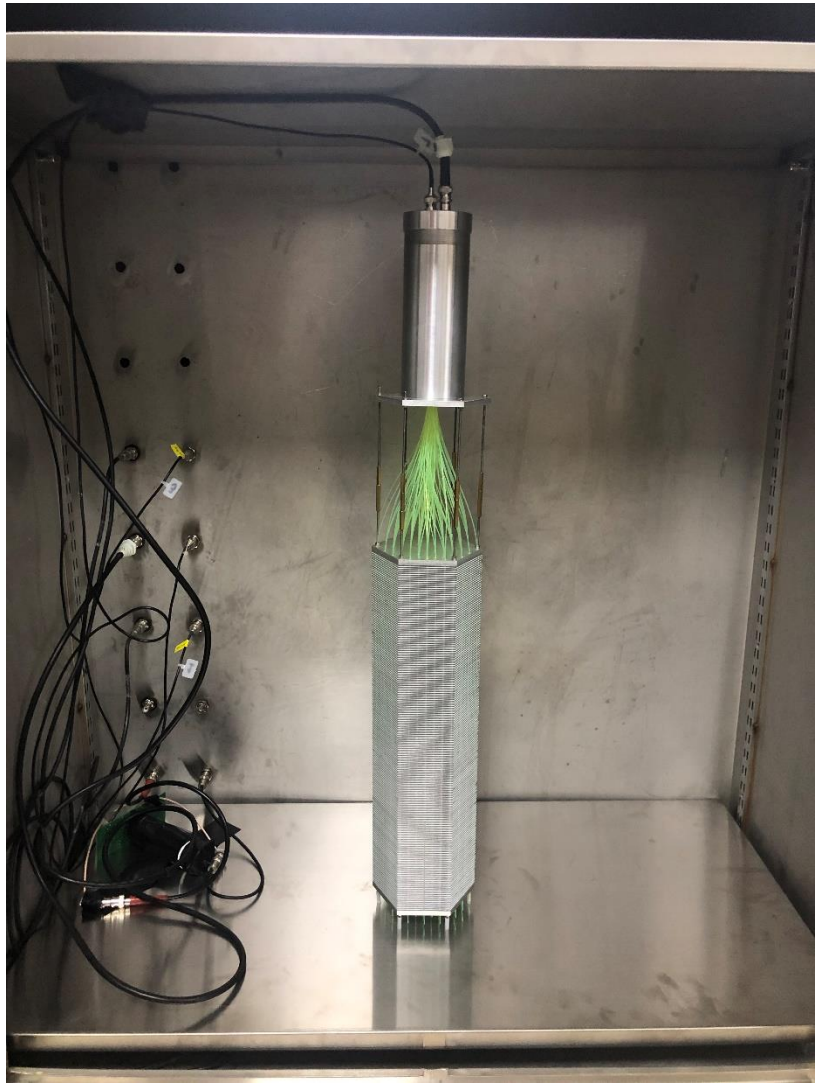
EJ-510 Reflective Paint for Plastic Scintillators

This is a bright white paint consisting of titanium dioxide pigment and a water soluble paint base selected for excellent resistance to yellowing and good adhesion. While primarily intended for coating of blue-emitting plastic scintillators, EJ-510 employs a blend of pigments selected also for enhanced reflectivity for longer wavelength scintillators with green emissions. This is a diffuse reflector for use on scintillators where the length is not greater than twice the width. It should not be used on long, narrow, optical elements. In addition to plastic scintillators, EJ-510 has been successfully applied to acrylic light guides and a variety of metals.

Vertical cosmic ray test setup



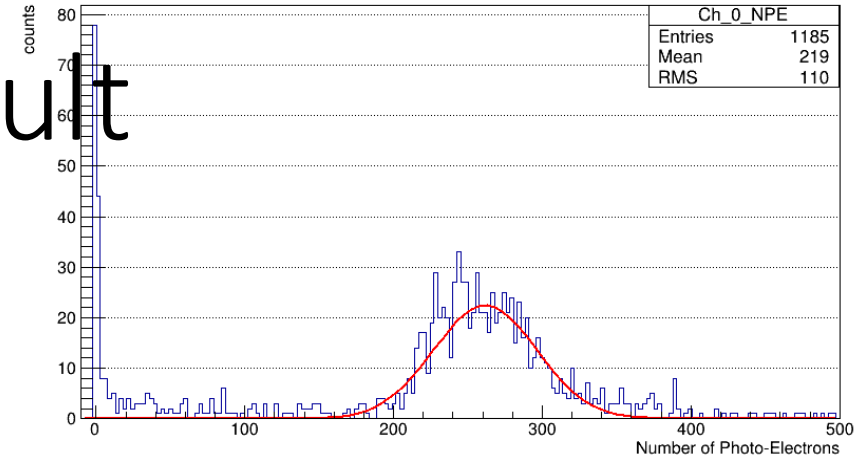
All three tests use same PMT with same HV.
PMT HV:1500, Gain: 5.09*10^6

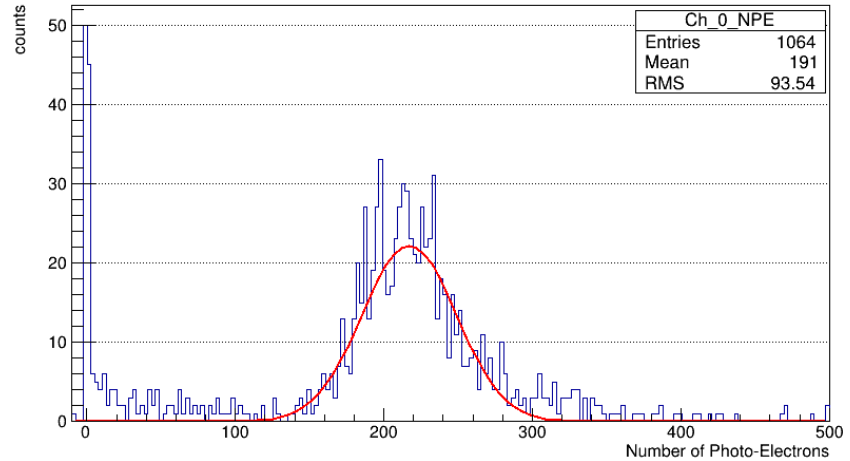


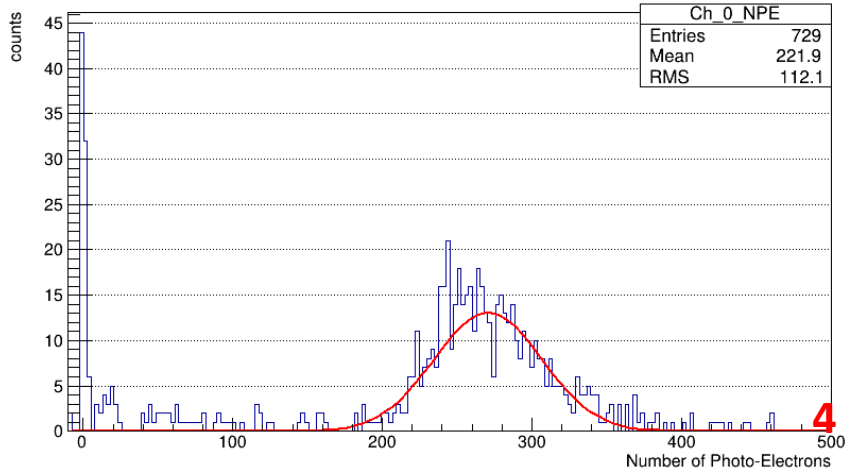
SDU #4

Shashlik module pre-test result

Prototype	Side wrapping	NPE (number of photo electrons) Fitting by gaus(actually gaus+landau)
SDU#4	No side wrapping	261
SDU#5	No side wrapping	217
	Loose tyvek	270
Previous:		
SDU#1	Loose tyvek	224 difference comparing SUD#5(270): worse scintillator, different layer reflector(paper)



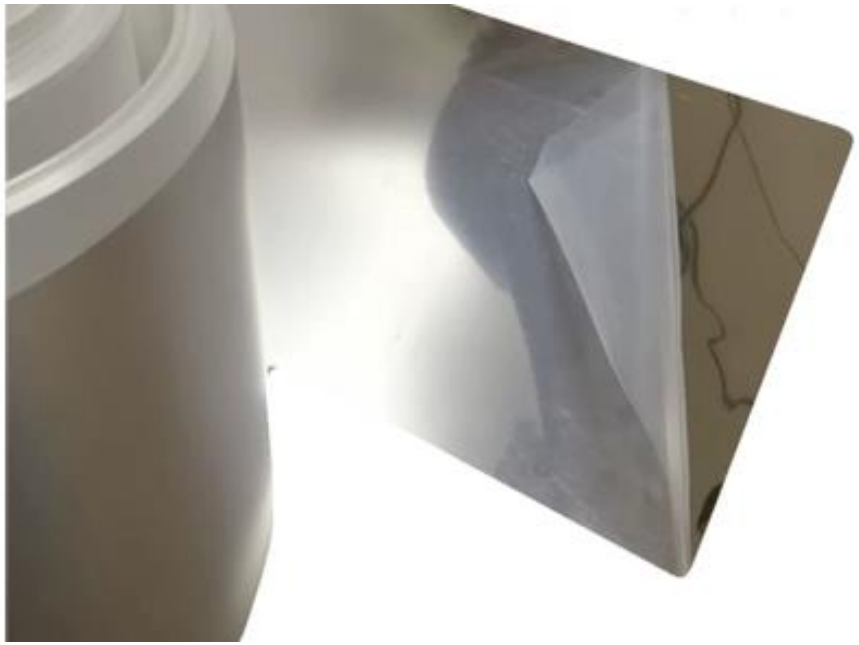




- Powder painting is about 20% better than tyvek(0.145mm).
- Considering improved scintillator has 30% light yield, the property of tyvek and paper is similar(224*1.3=291.2)(or tyvek even worse).

3M™ Enhanced Specular Reflector (3M ESR)

new choice for fiber end reflector



产品特点:
可见光波段98%以上高反射率
蓝光波段反射率高于一般反射片
无卤素
无金属

Details

- Improves light recycling efficiency across the visible spectrum
- Variations include thinner films
- Available with a rough surface for reduced wet-out

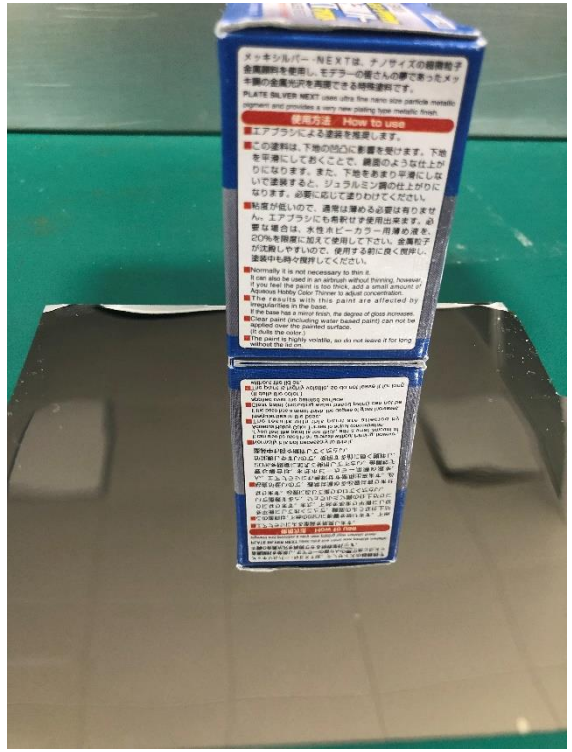
3M™ Enhanced Specular Reflector (3M ESR) is a non-metallic mirror film family, which reflects more than 98% of light and improves the recycling efficiency of a backlight across the visible spectrum.

3M™ Enhanced Specular Reflector (3M ESR) is a high-performance, non-metallic, color-neutral reflector which works synergistically with prisms and reflective polarizers to optimize light recycling in the backlight of an LCD display.

Other details of 3M ESR

- Retail price: ¥220/m^2(taobao)
- Material: polyester(聚酯)
- Both sides have similar very good reflectivity

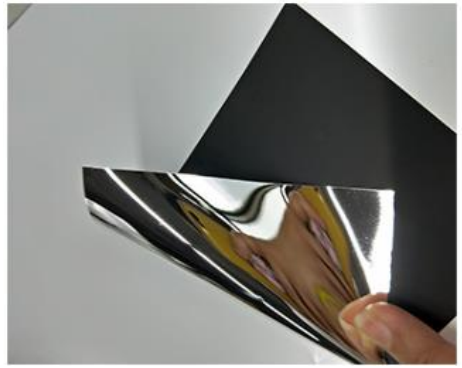
Very good reflectivity



Slightly light leak

Other choice with black layer

型号	厚度
ESR双银	0.065mm
ESR黑银	0.09mm



Add additional black layer

Fiber end reflector test

- Data readout from oscilloscope, same setup as before
- For silver mirror, New batch from Yantai could reach 80% reflectivity.
- Tired of silver mirror test, previous fiber end mirror from Shanghai company get worse to about 80%, confused at caused by aging or damage in test.

Tape and 3M ESR test result

- Each fiber is tested firstly without reflector, then add tape and replace tape with ESR.
- Use optical silicon grease to 'glue' ESR to fiber temporary. (use optical cement to glue to module)
- Test shows ESR has really good reflectivity, which better than 95% improvement.

Fiber No. (all fibers are new)	No reflector (charge, nC)	With silver polyester tape	Improvement(%)	3M ESR	Improvement(%)
1	4.45	7.835	76%	8.852	98.9%
2	4.295	7.301	69.9%	8.43	96.2%
3	4.77	8.5	78.2%	9.42	97.5%
4	4.562	8.168	79%	8.81	93.1%

Previous test result is only 60%

Conclusions

- SDU#4 and SDU#5 is building in process

- Price from Shanghai company with good silver mirror is ¥13/each
- 3M ESR show very good reflectivity than all other material
- Will add ESR to one module with optical cement.
- Good choice for front plate design with holes.
- Build standard fiber reflector test setup……