

Preliminary results of the MEPhI material selection latest tests for SPD BBC

Speaker: Zakharov Arseniy

Material selection

Basic criteria for selection:

- Light collection
- Mass production convenience
- Material cost
- Sanction independence
- Radiation resistance
- Aging, e.t.c...



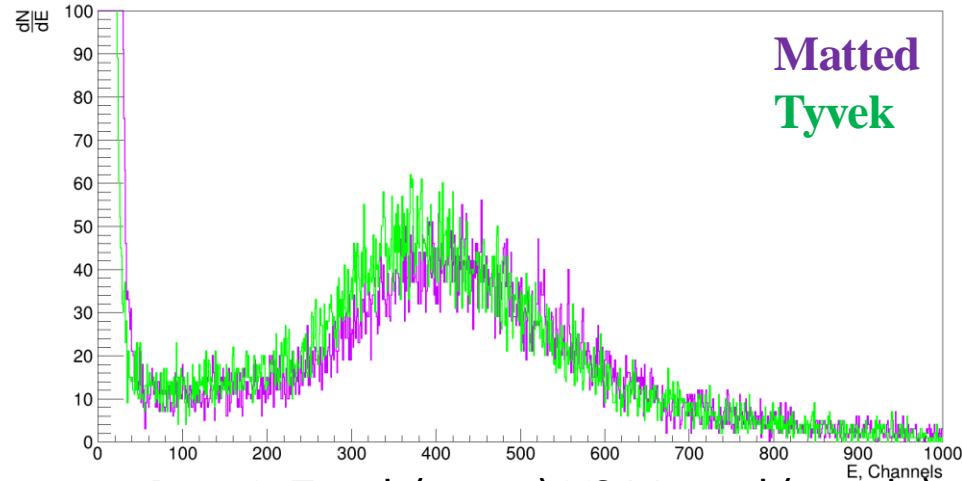
Leading Order

Next leading order

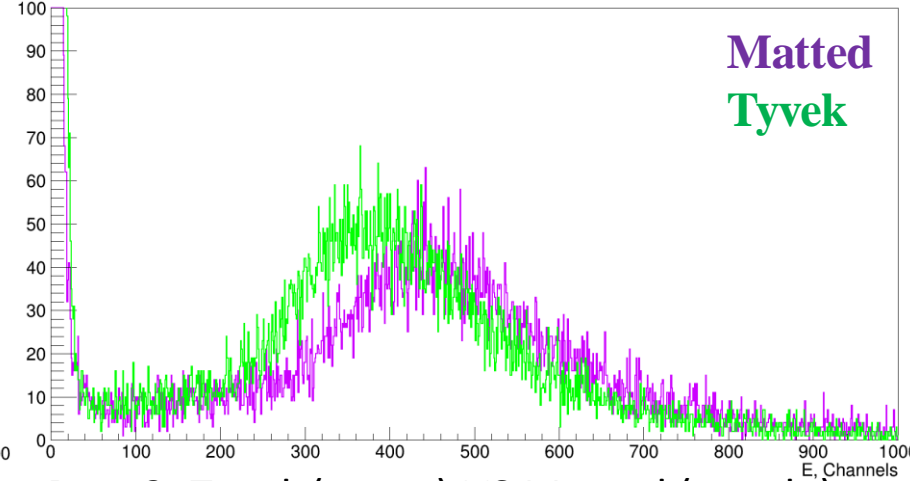
Material selection: Cover and WLS

Well known for today:

- Scintillator cover: **matted** vs Tyvek



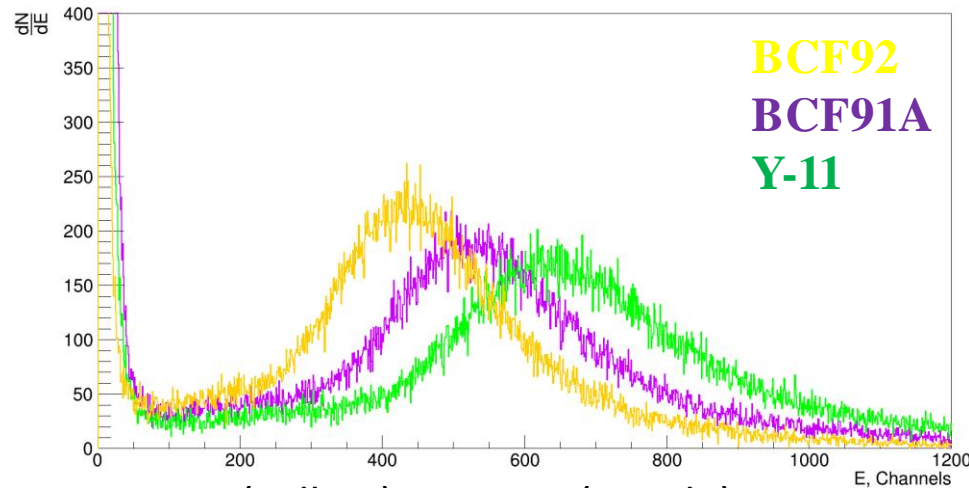
Row 1: Tyvek (green) VS Matted (purple)



Row 3: Tyvek (green) VS Matted (purple)

Due to the higher peak position (from 7% and up to 15%) as well as the comparative simplicity in the context of mass production, the option with matted ones is more appropriate.

- WLS fiber: **Kuraray Y-11** vs SGC BCF91A & BCF92



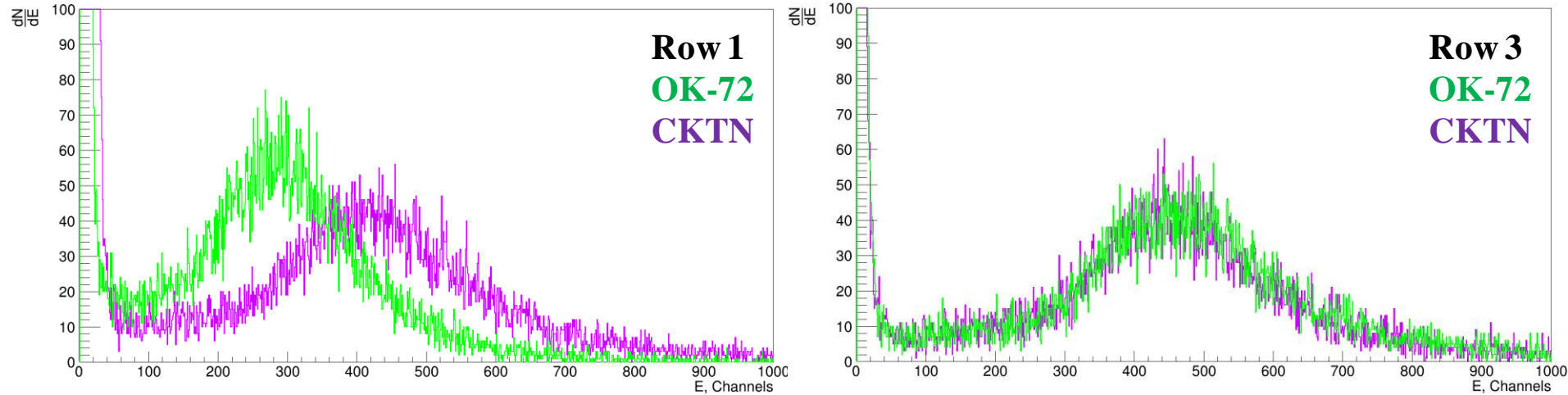
Row 3: SG BCF92 (Yellow), BCF91A (purple), Kuraray Y11 (green)

Due to the fact that Kuraray Y-11 fiber collects more light these fibers looks more appropriate for our detector

**Both chosen materials pass LO criteria
NLO tests are planned for the future**

Material selection: Optical cement

As for optical cement, tests tend to show different results.

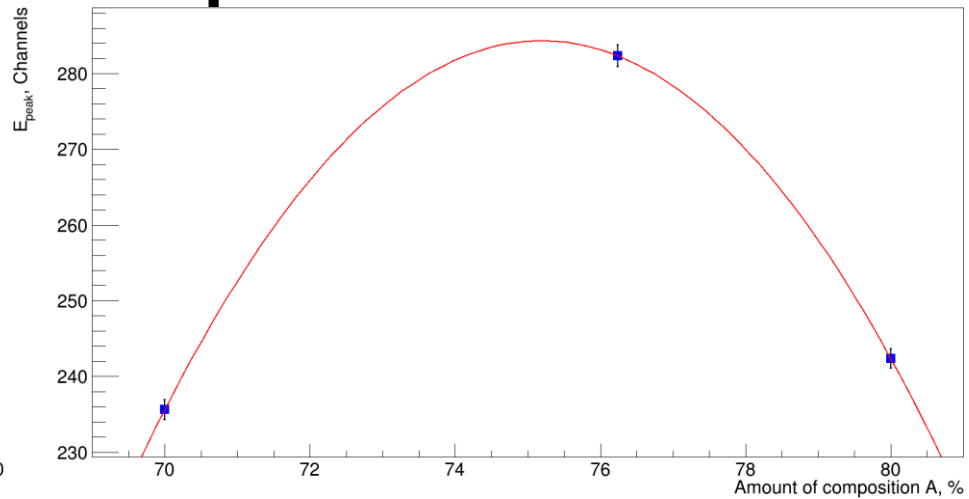
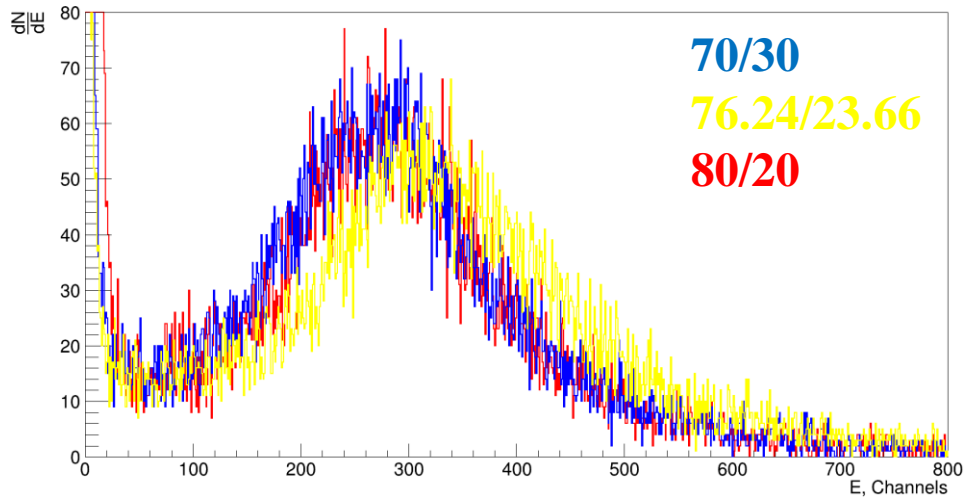


Purple – CKTN MED type E, green – OK-72, SGC BCF92 WLS fiber. Row 1 (left) and row 3 (right) tiles used for the tests.

Row 1 tiles filled with 76.24/23.66 OK-72 A to B composition (datasheet), row 3 tiles filled with 70/30 (by accident).

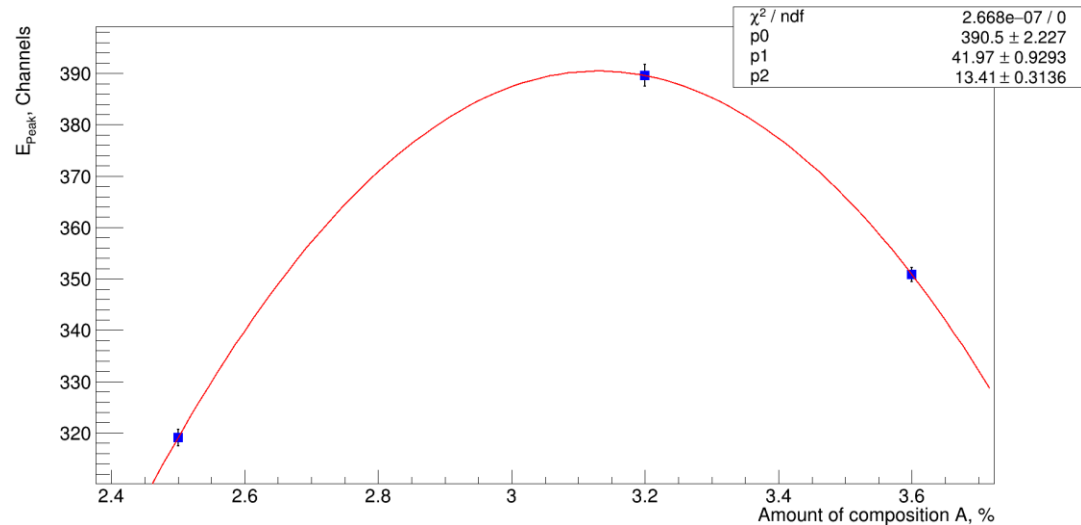
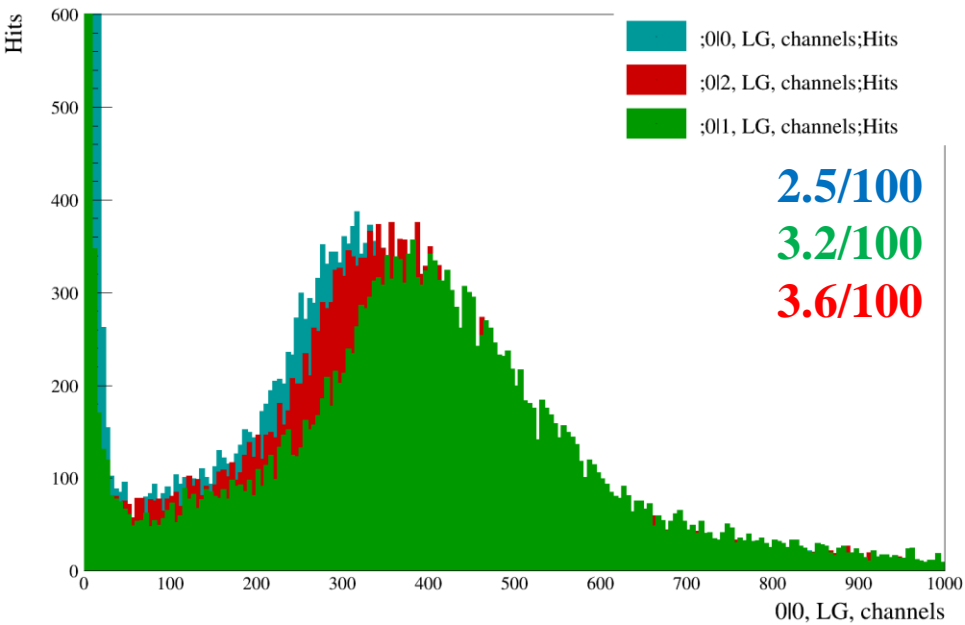
Hypothesis: A/B compositions of optical cements significantly affect light collection

Material selection: Optical cement



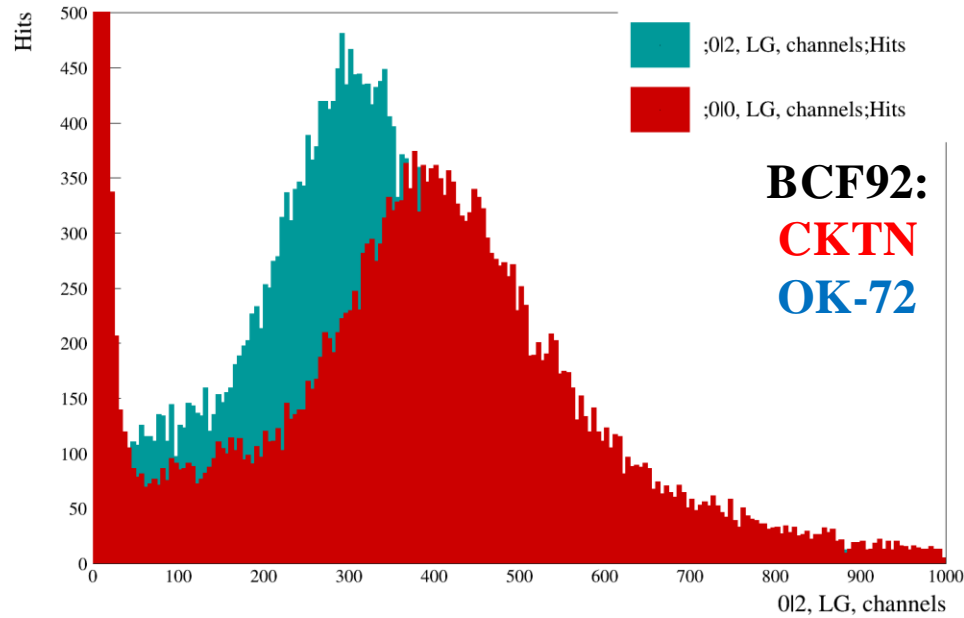
Study: OK-72 70/30 (blue), 76.24/23.66 (yellow) and 80/20 (red) compositions comparison

On the right: Light collection peak position in dependence of A component amount for optical cement. Same for CKTN, using 2.5 (blue), 3.2 (green), 3.6 (red) of A to 100 B.

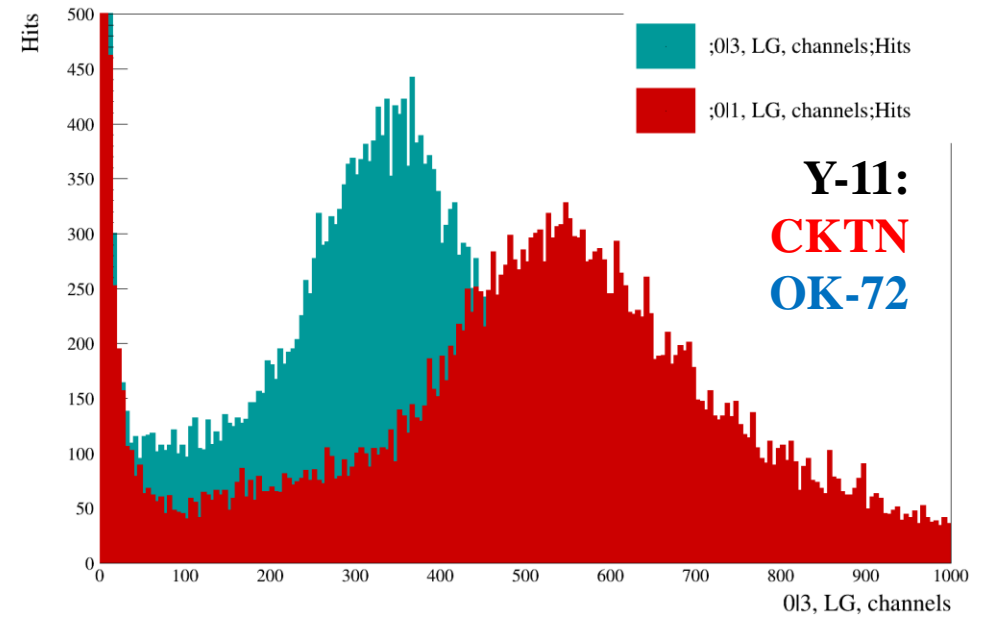


Study proved that A/B ratio affects the light collection, but not dramatically (questionable for CKTN). Also, datasheet ratio is the most effective we used so far.

Material selection: Optical cement



Comparison of row 2 tiles with SGC BCF92 and CKTN (red) VS OK-72 (blue) optical cement

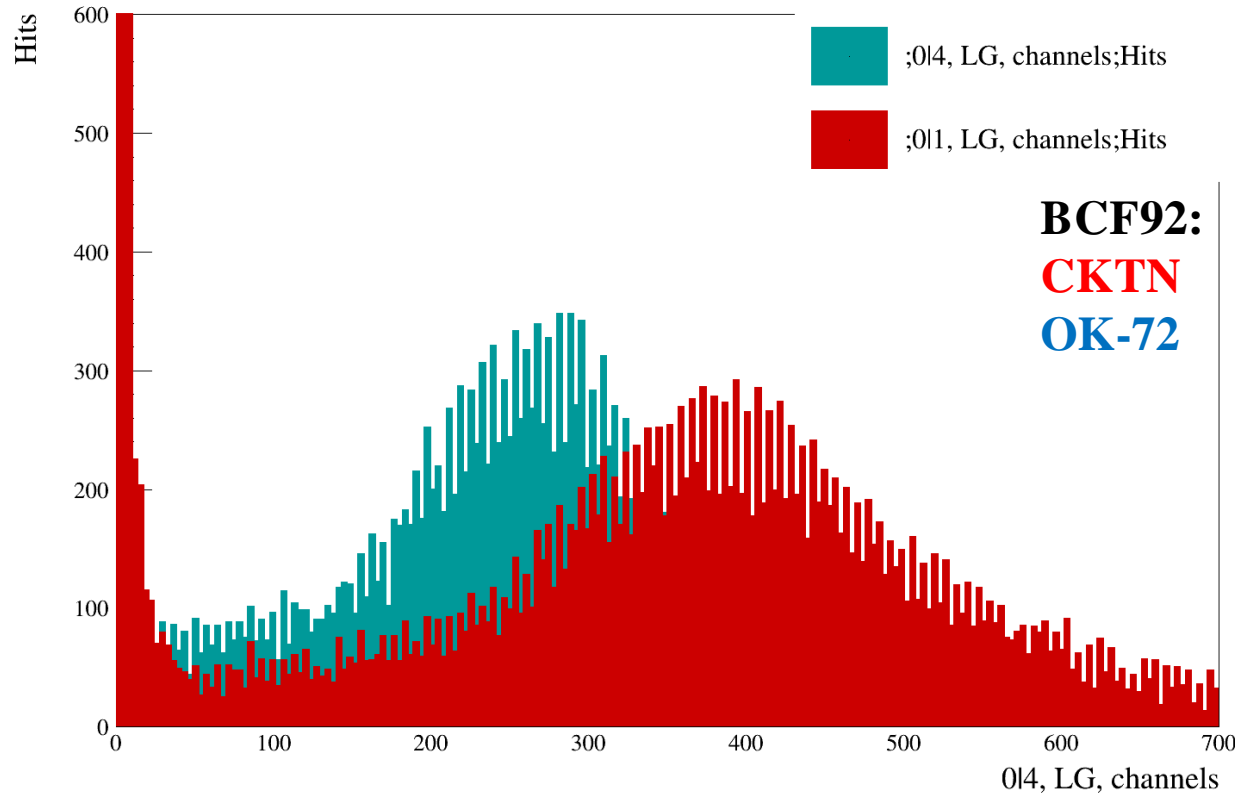


Comparison of row 2 tiles with Kuraray Y-11 and CKTN (red) VS OK-72 (blue) optical cement

Fit Param-s	SGC BCF92 CKTN	SGC BCF92 OK-72	Kuraray Y-11 CKTN	Kuraray Y-11 OK-72
Mean, Channels	394.6	303.6	535.6	339.8
Width, Channels	295.9	252.3	354.4	255.8

07.12.2023 Samples

Material selection: Optical cement



Fit Params	CKTN	OK-72
Mean, Channels	389.6	202.6

Reason, why we still looking for the answer:

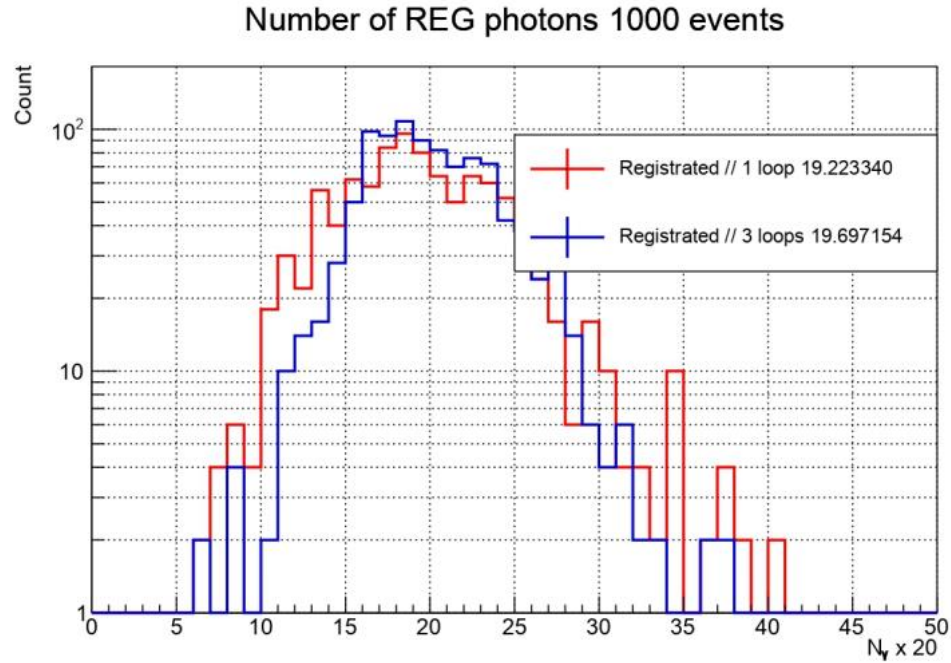
- | | |
|------------------------------------|---|
| CKTN MED type E - Light collection | ✓ |
| Convenience in mass production | ✗ |
| NLO studies | ? |
| OK-72 - Light collection | ✗ |
| Convenience in mass production | ✓ |
| NLO studies | ? |

28.01.2024 Samples:

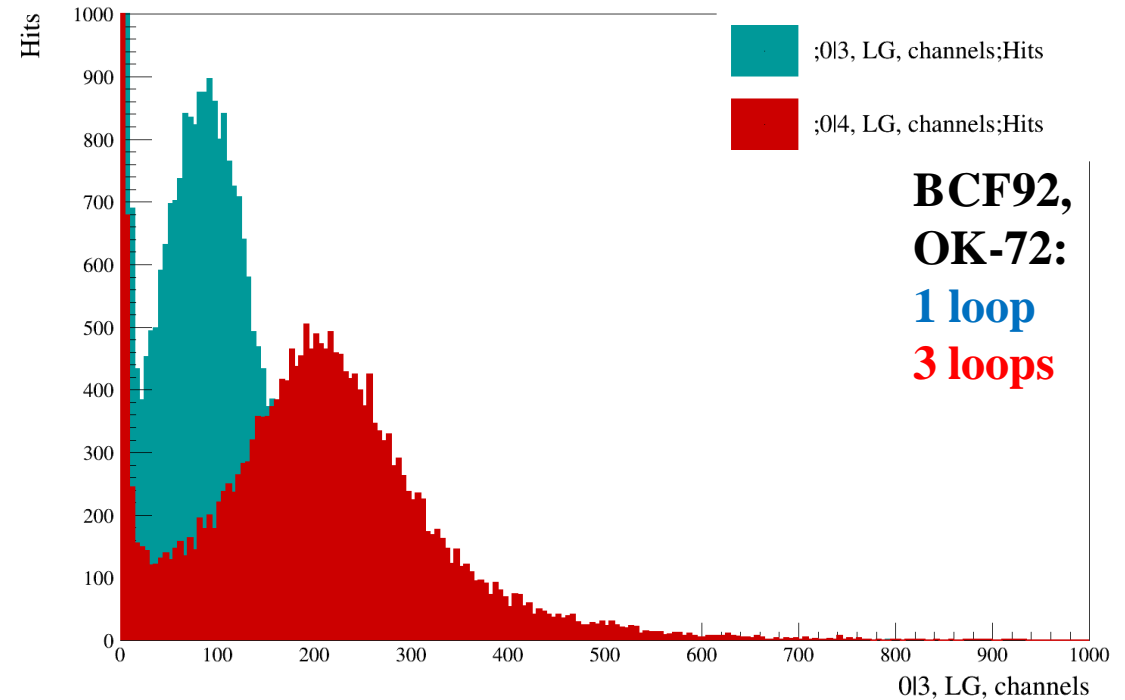
Comparison of row 2 tiles with SGC BCF92 and CKTN (red) VS OK-72 (blue)

There is a possibility that we will test a compromise variant – CKTN MED Type A - same light collection (as stated in the data sheet), but the viscosity is reduced by 10-100 times. Curing time might also increase

Material selection: Amount of fiber rows



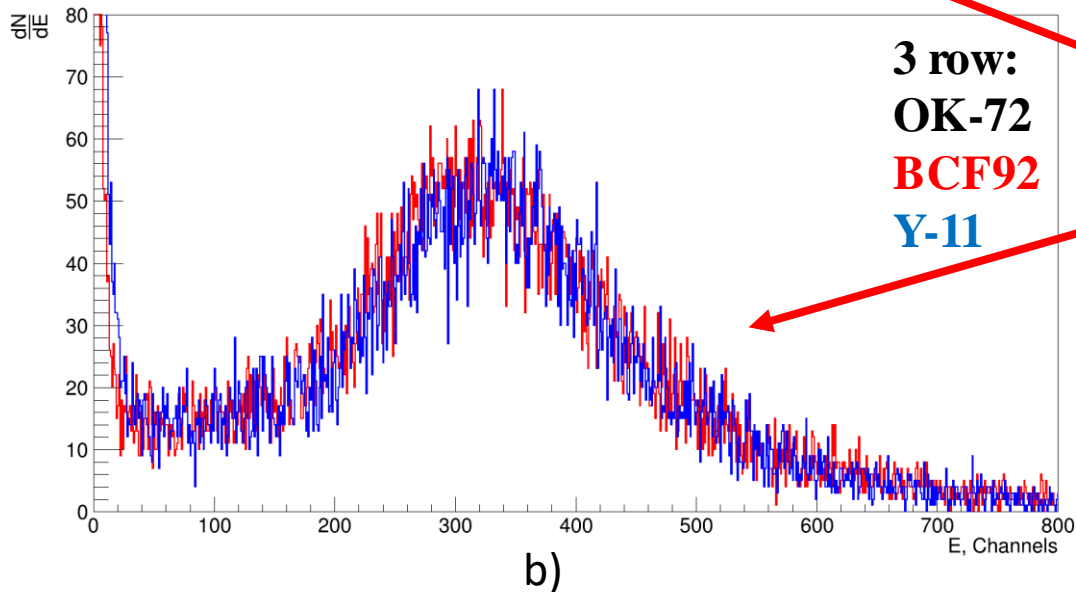
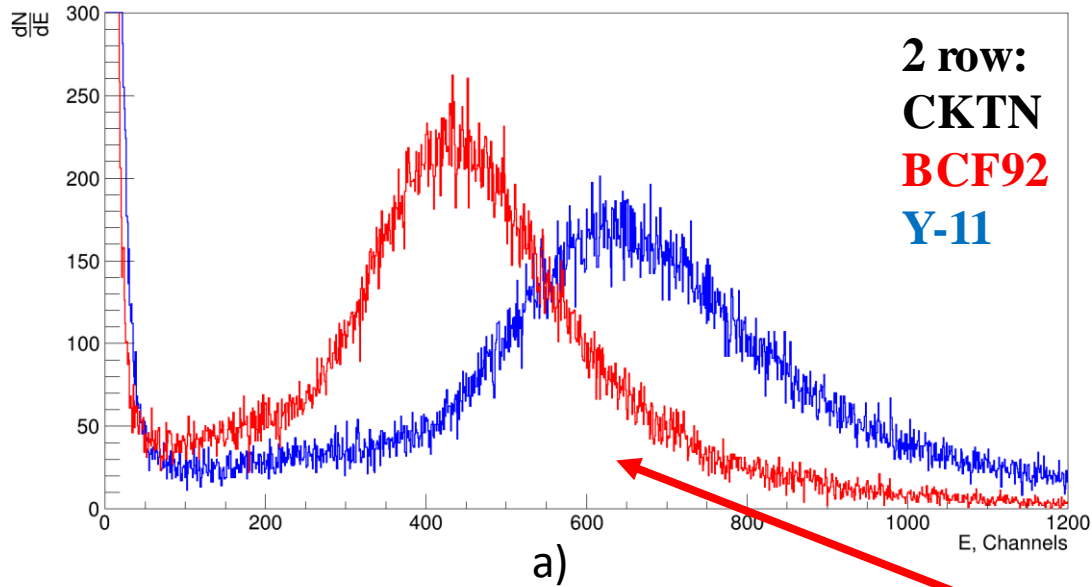
For more details, see
<https://indico.particle.mephi.ru/event/389/contributions/3829/attachments/2283/4212/-12--.pdf>



Experimental data: Light collection of second row tiles with SG BCF92 and OK-72, but: 1 (blue) and 3 (red) rows of WLS fiber, starting from the same depth

Fit Params	1 row	3 rows
Mean, Channels	86.7	202.6

An opened question and further discussion



Мы сравнили волокна SG BCF92 (красным) и Kuraray Y-11 (синим) с использованием тайлов 2 и 3 ряда, а также:
 а) СКТН МЕД марки Е 100/3.2;
 б) ОК-72 с составом 76.24/23.66 В.

Fit Param-s	BCF92 СКТН R3	Y-11 СКТН R3	BCF92 ОК-72 R2	Y-11 ОК-72 R2
Mean, Channels	402.3	596.7	284.4	293.0
Width, Channels	24.7	43.7	26.0	23.0

Why do we see this difference in WLS comparison?
 We cant collect photons with higher energy due to OK-72 optical throughput? (400-2700 nm OK-72, no information about CKTN)

Is it an additional indirect evidence that CKTN collects more light than OK-72, cause it at least let photons at higher energy through?

Thank you for attention!