Quality status

PANDA collaboration meeting, Jülich 7-11 June 2009

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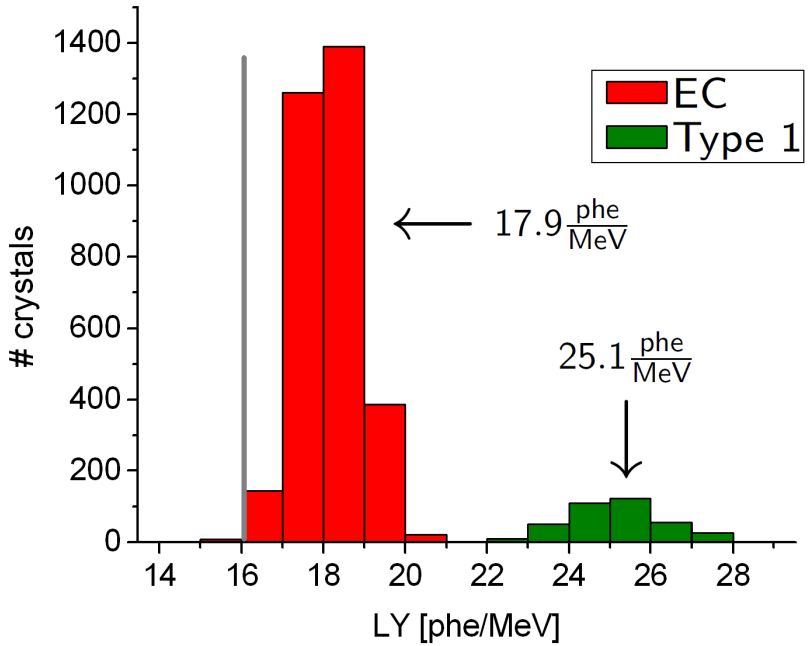
09.09.2009

Outline

Initial Motivation

- LY distribution of the first 4 lots measured at CERN
- 3575 EC and 375 Type 1 geometry



Ratio between mean values:

$$\frac{<LY_{Type\ 1}>}{<LY_{EC}>} = \frac{25.1}{17.9} = 1.40$$

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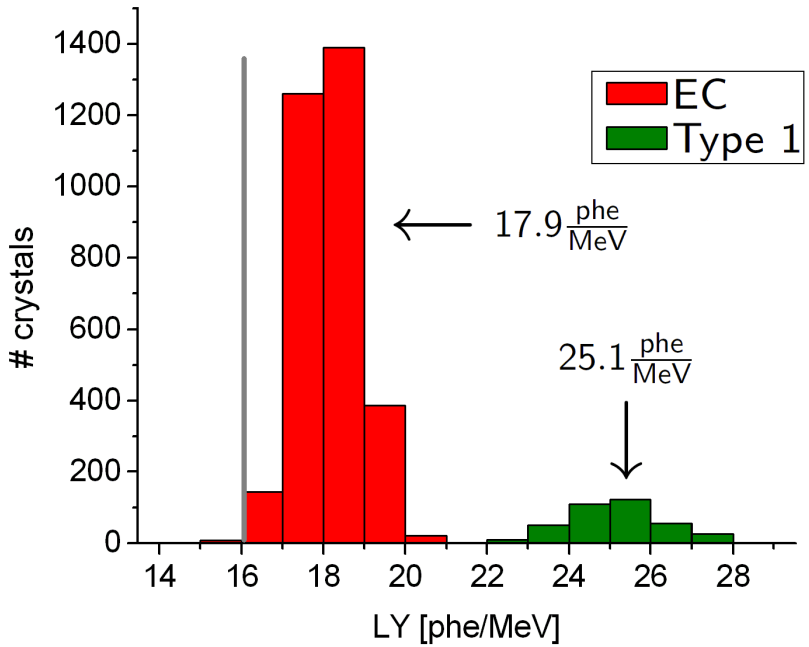
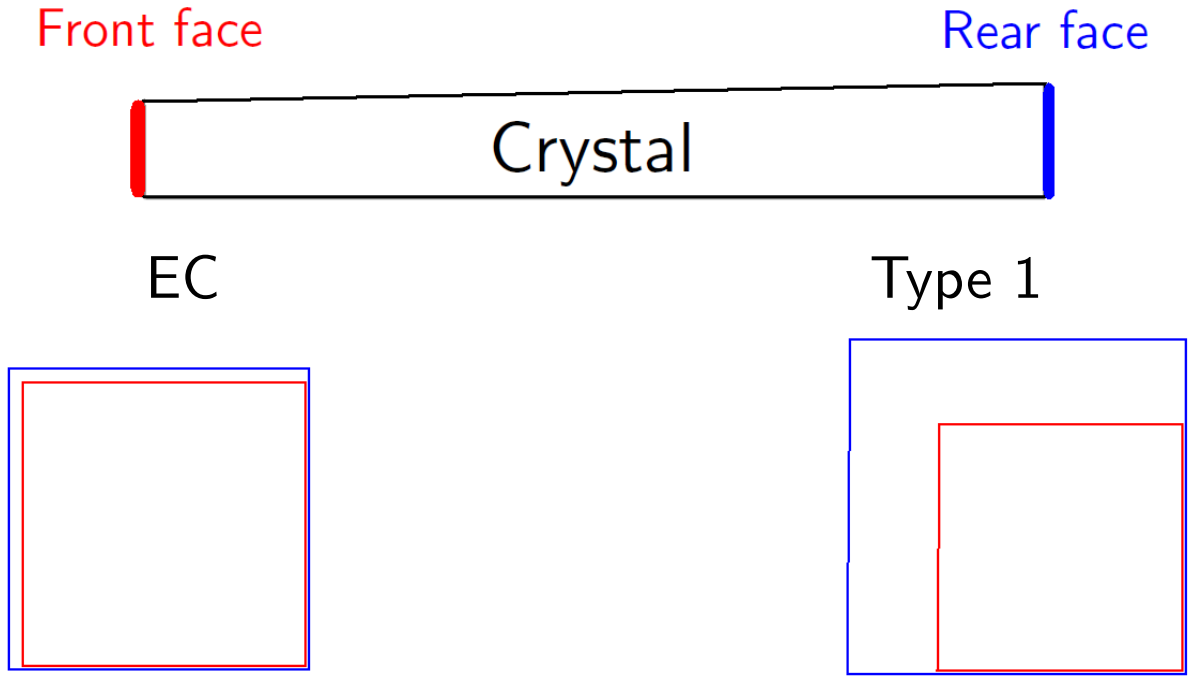


Ratio between mean values:

$$\frac{\langle LY_{Type\ 1} \rangle}{\langle LY_{EC} \rangle} = \frac{25.1}{17.9} = \underline{\underline{1.40}}$$

$\Rightarrow$ LY strongly depending on the geometry!

Comparison between EC and Type 1 Geometry



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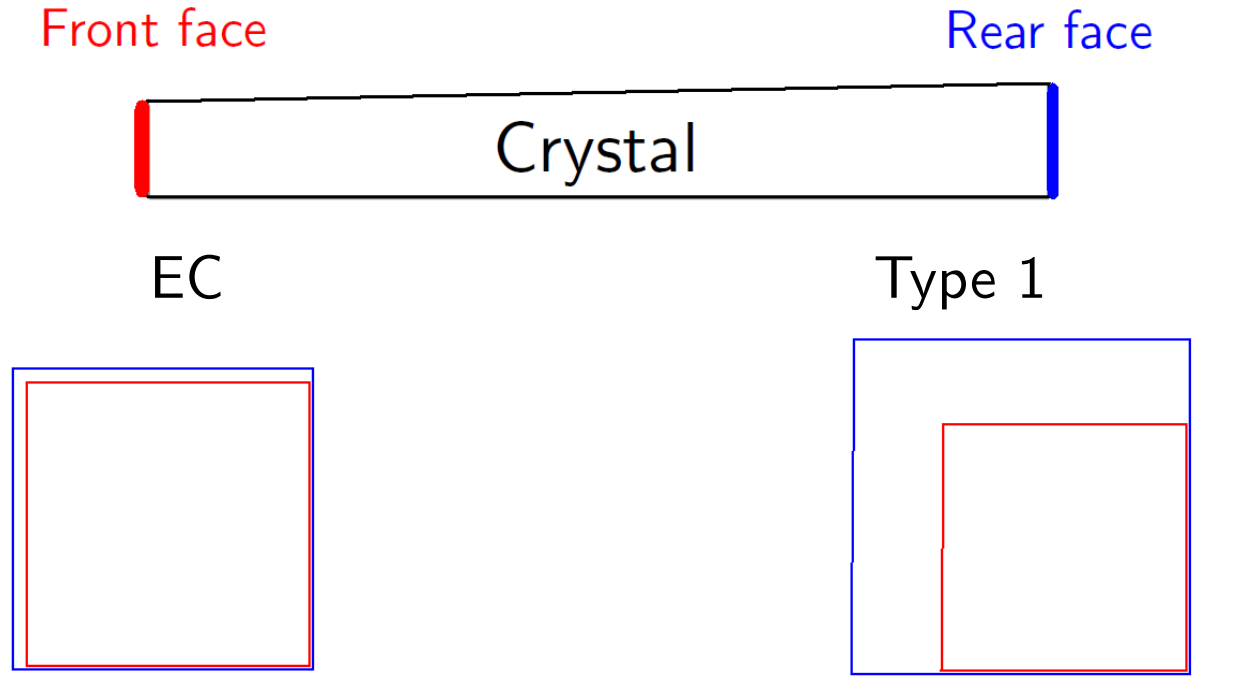
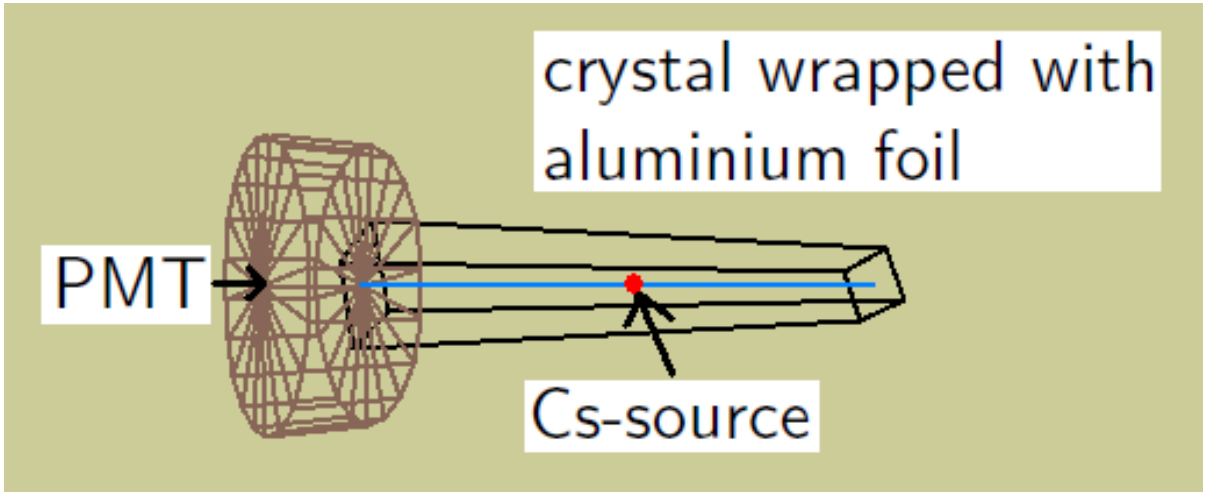


least tapered

most tapered

$\Rightarrow$ higher LY of Type 1 crystals obviously due to the stronger focusing

Inserted Setup



- PMT with real Quantum Efficiency: Hamamatsu R2059, QE(420 nm) $\approx$ 20%
- radioactive source: ^{137}Cs $\rightarrow$ 662 keV photons
- source will be shifted successively in steps of 2 cm

Input Parameters

- $PbWO_4$ as uniaxial negative birefringent
- cross sections for Photo effect and Compton scattering for $PbWO_4$ at 662 keV
- fluorescence component at 420 nm
- indices of refraction for $PbWO_4$, aluminimum coverage and entrance window of PMT

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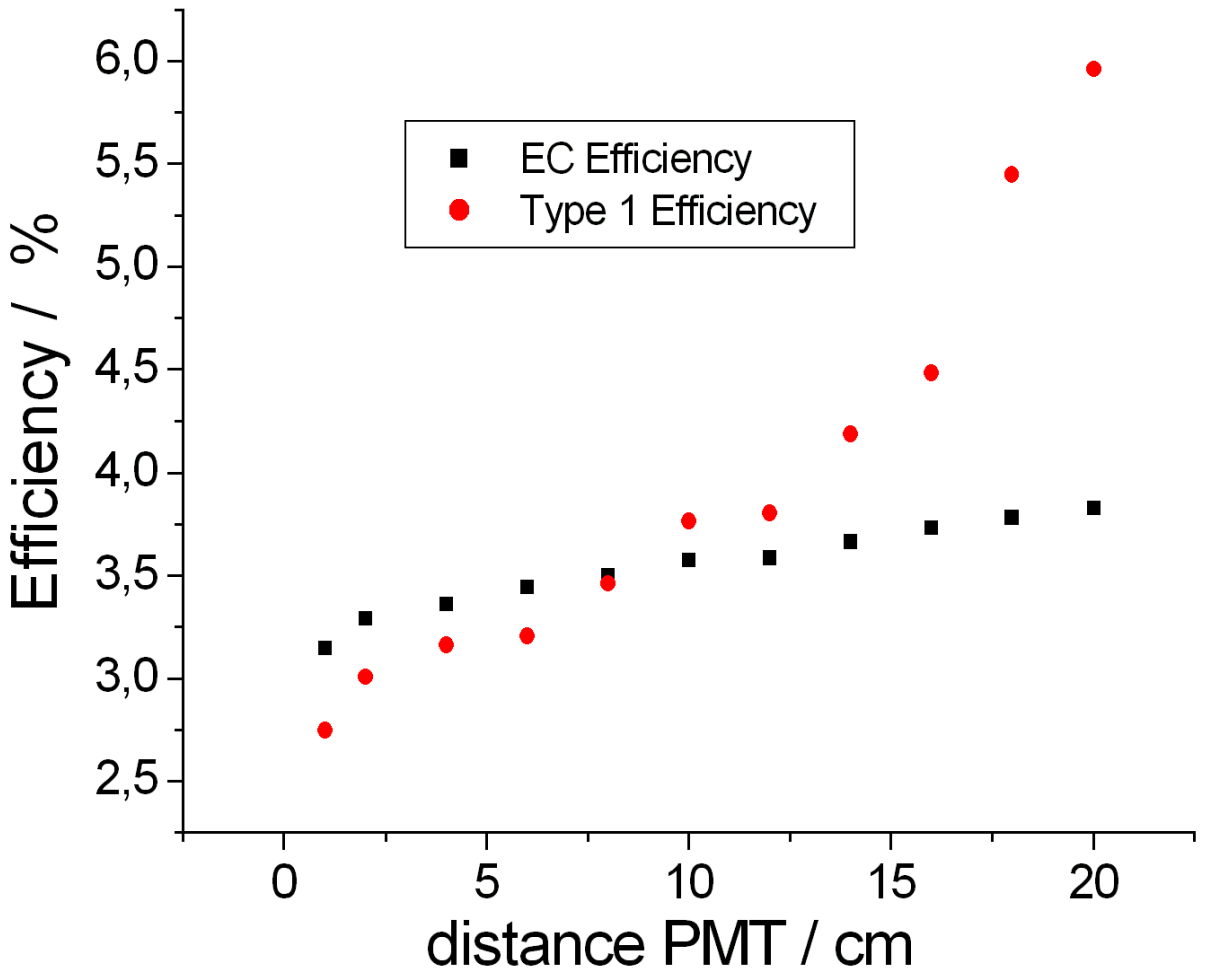
no optical coupling between crystal and PMT

Results



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How to normalize the simulation results to the obtained LY?

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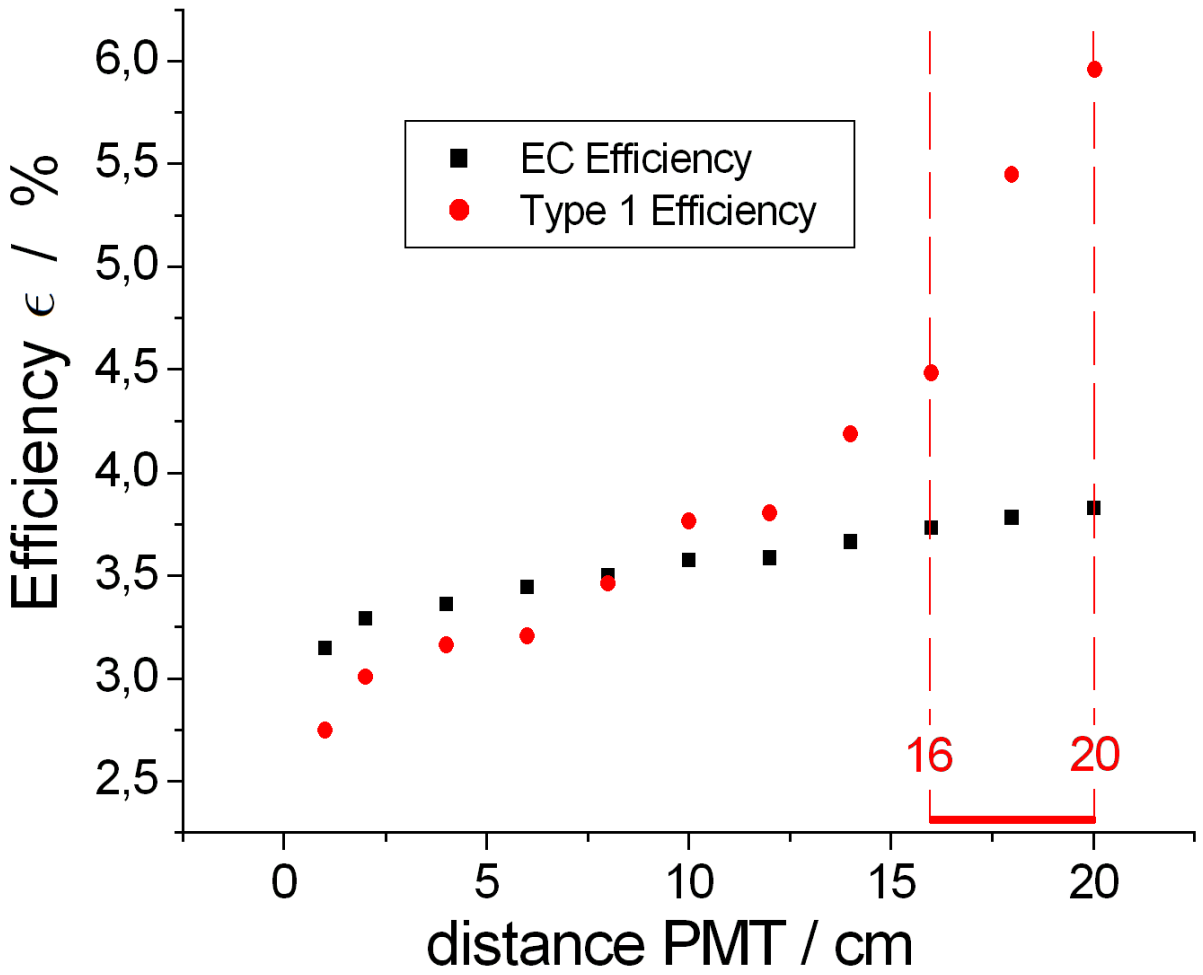

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$$\Rightarrow \underline{\text{LY values understandable}}$$

Delivery Status

Type		Lot B1 - B4	Lot B5	Lot B6	Lot B7	Lot B8	Lot B9
End Cap		4400					
Backward EC						70	630
Barrel	Type 1	375		270	695		
	Type 2					140	
	Type 9			330	325		
	Type 10					120	
Total		**4775**		**600**	**1020**	**330**	**630**
Delivered?		✓		✓	✓	✓	✓
Present station		Giessen		Giessen		CERN	Giessen

⇒ 3950 crystals (4 lots) pass all quality test stations and are completely analyzed

Longitudinal Transmission
4 Lots

Facility	Mean Values / %		
	360 nm	420 nm	620 nm
BTCP	50.41	71.83	76.07
CERN	50.96	71.22	75.25
Gießen	49.15	71.07	77.02
Specification limit	35	60	70

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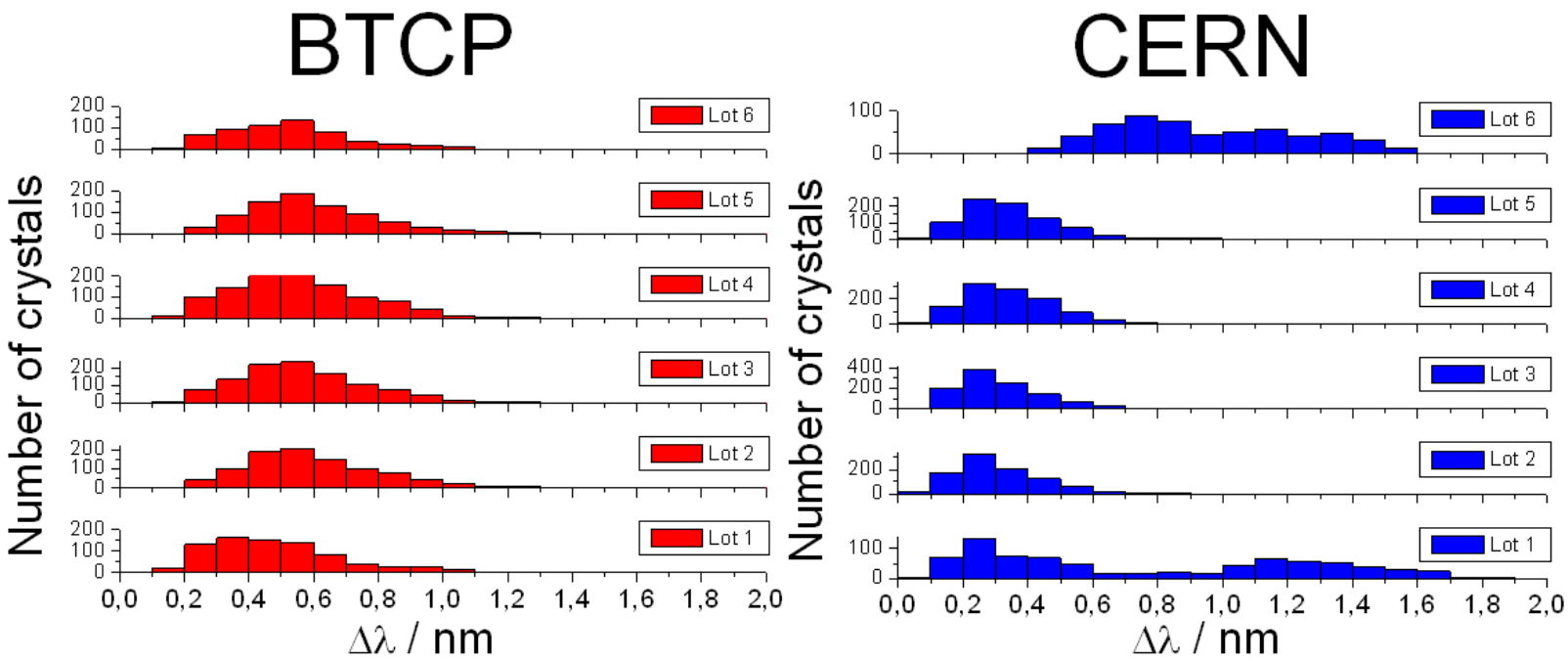
$\Rightarrow$ no crystal is below the threshold $\surd$

Transversal Transmission
BTCP and CERN - 6 Lots



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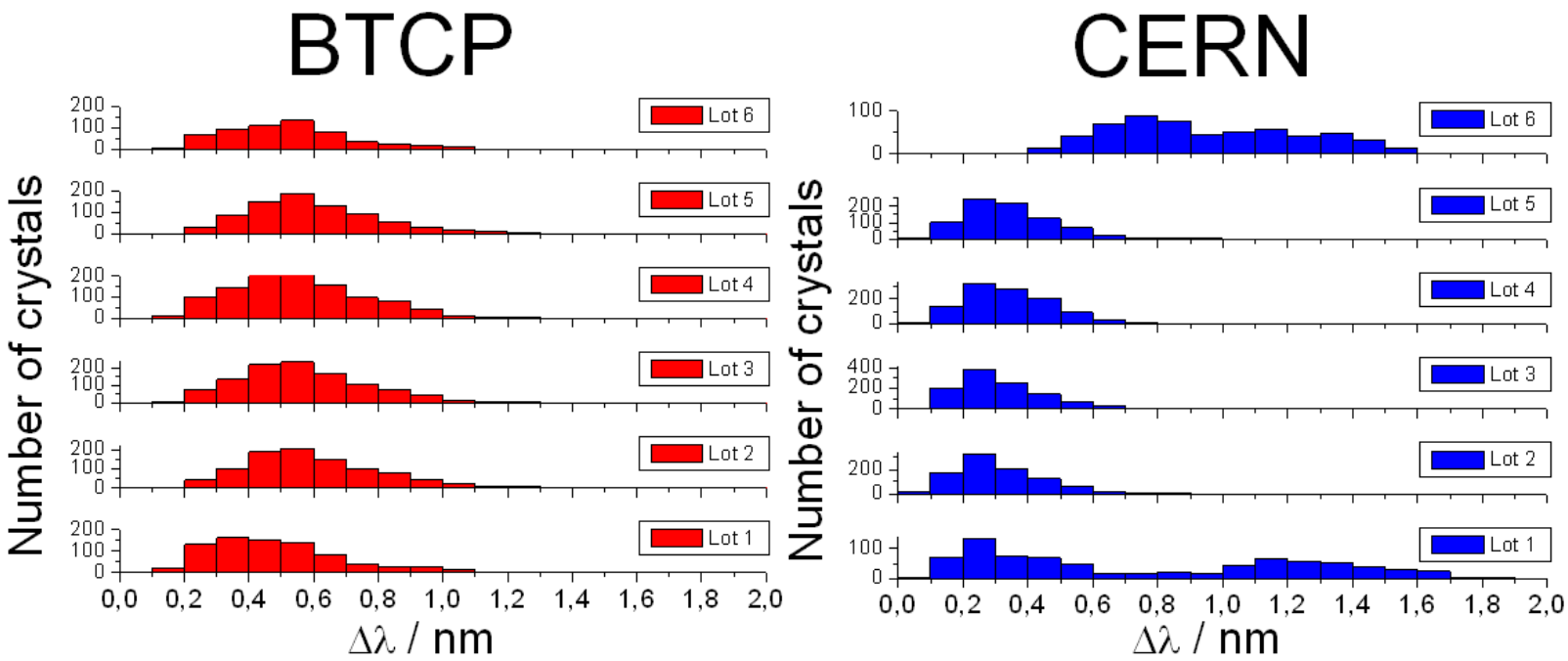

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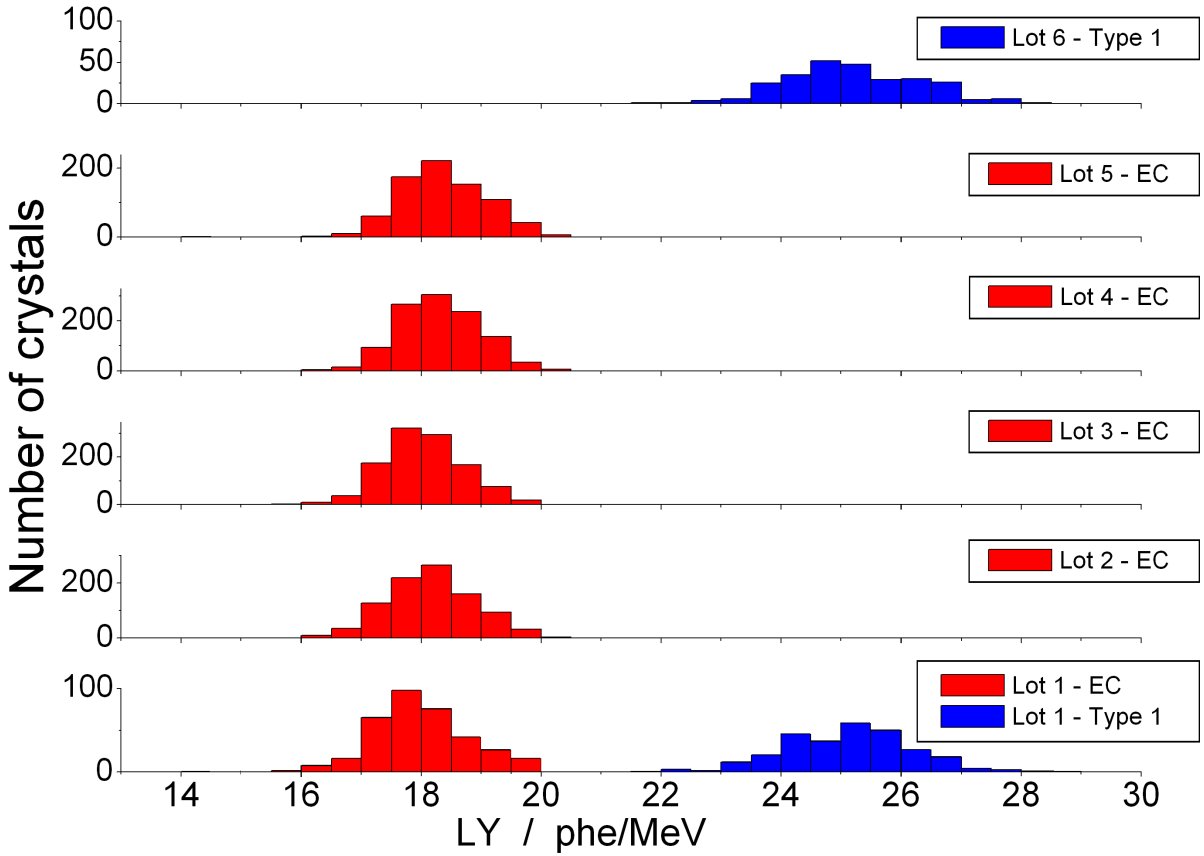
Light Yield
CERN - 6 Lots



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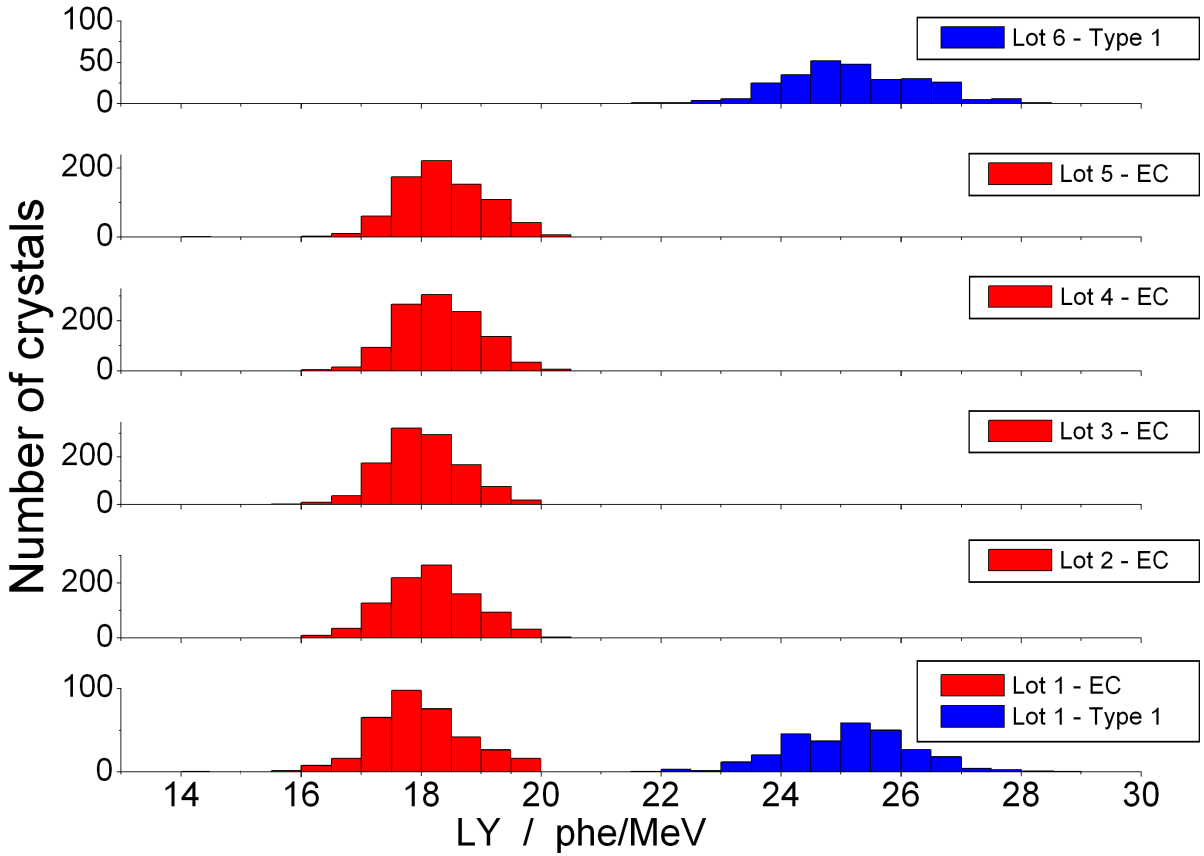
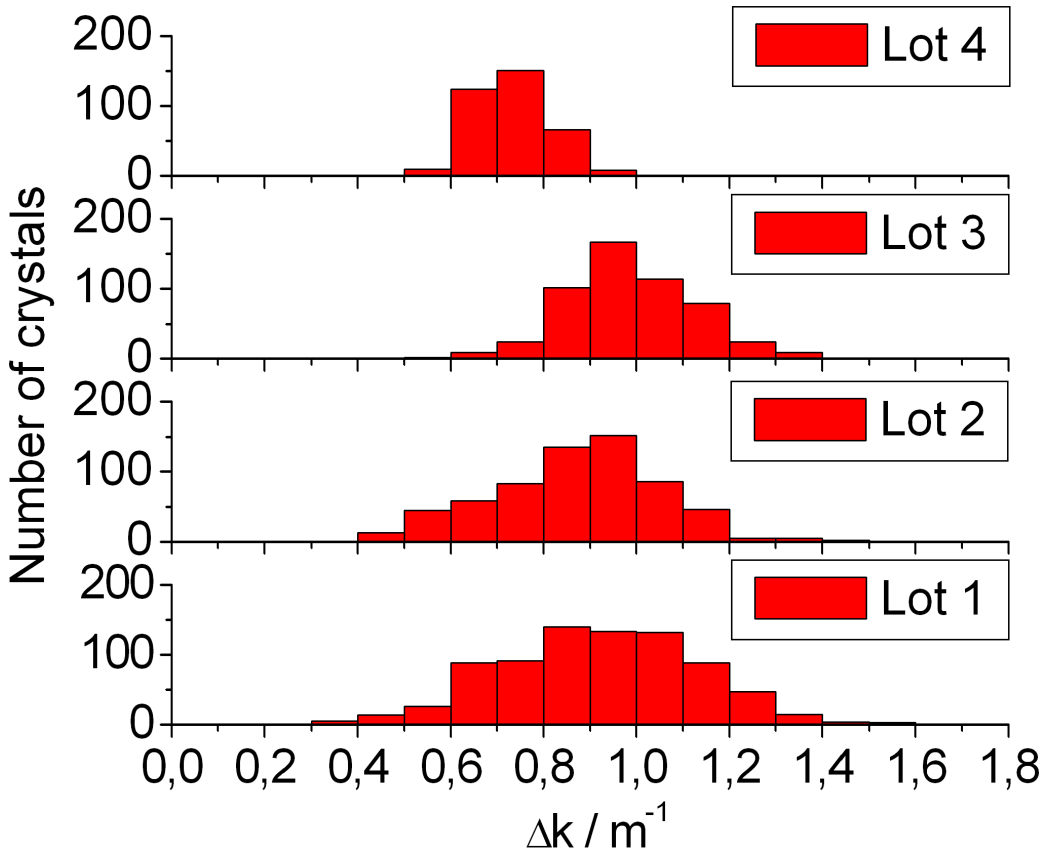


$\Rightarrow$ 7 crystals are out of specification

Radiation Hardness
Gießen - 4 Lots



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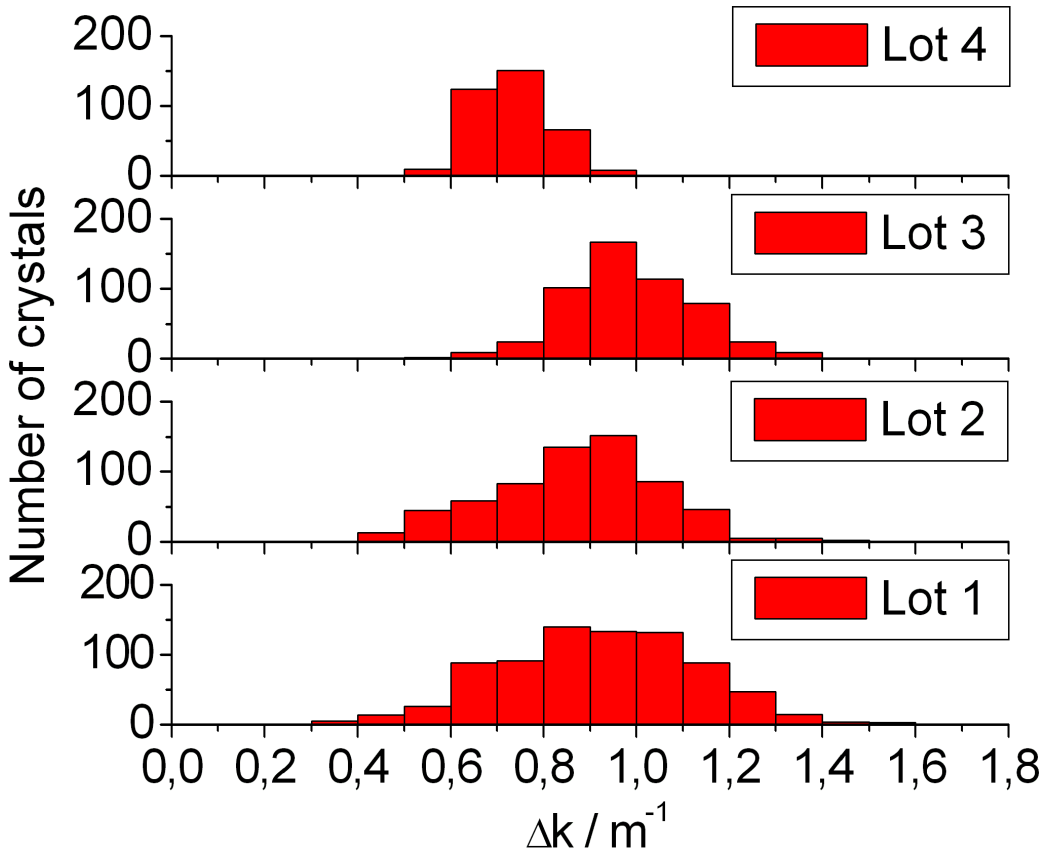

⇒ 391 crystals are out of specification

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  $\Rightarrow$ higher LY due to more pronounced focussing effect

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- The first four lots (3950 crystals) are completely analyzed
- Altogether: 391 crystals are out of specification
- Interesting: Δk development for the further lots

Thank you for attention!