

Optimization of laser corrections (ultralegacy tags production)

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May 22, 2019

Strategy of preparation of ultralegacy tag

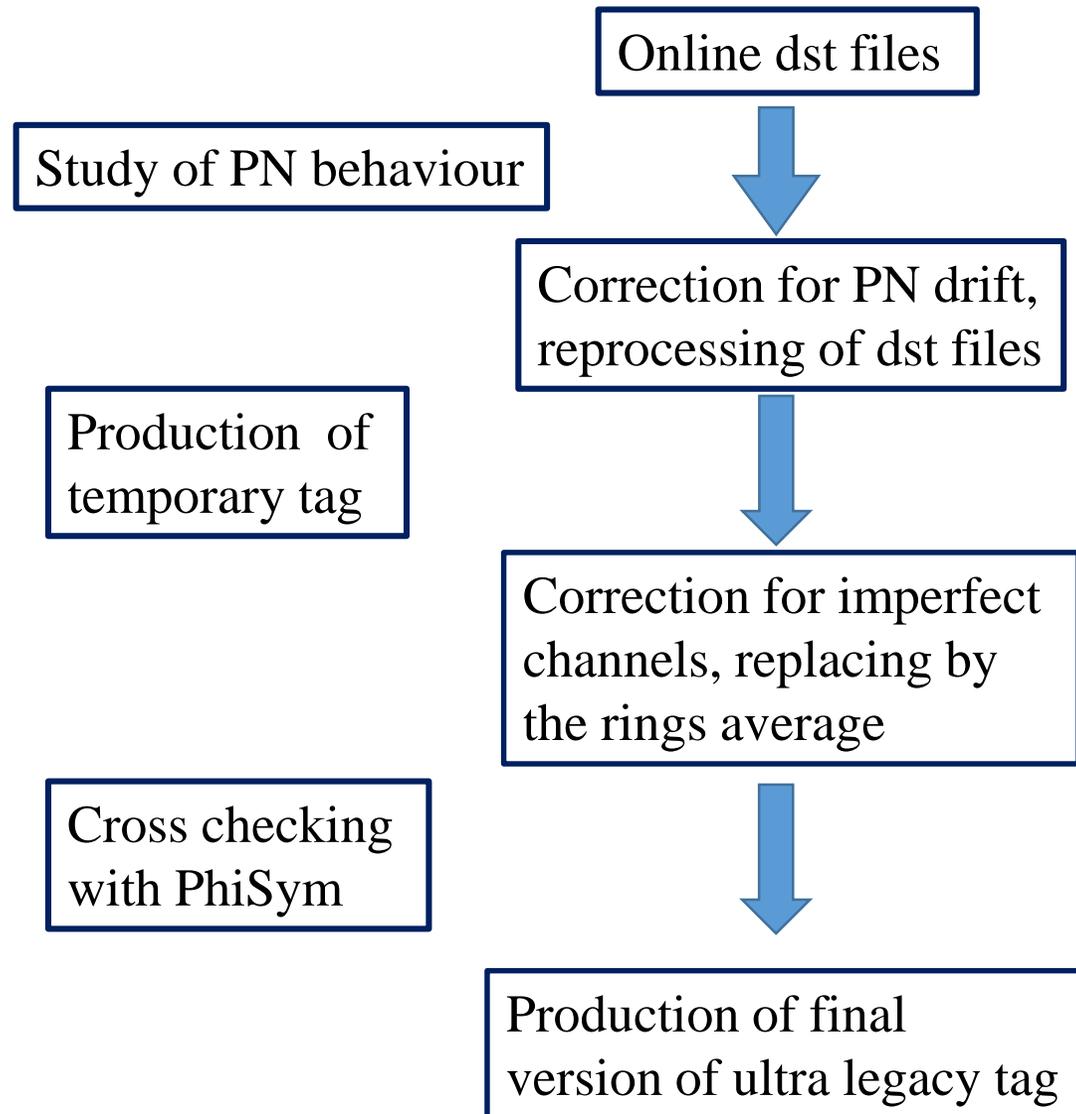
Due to imperfection of online data production of offline tag is inevitable

PNs : **prompt** is based on data of previous year
offline can be prepared using data of current year

Crystals: **offline** analyses based on whole year data can be done, so we can find and “cure”:

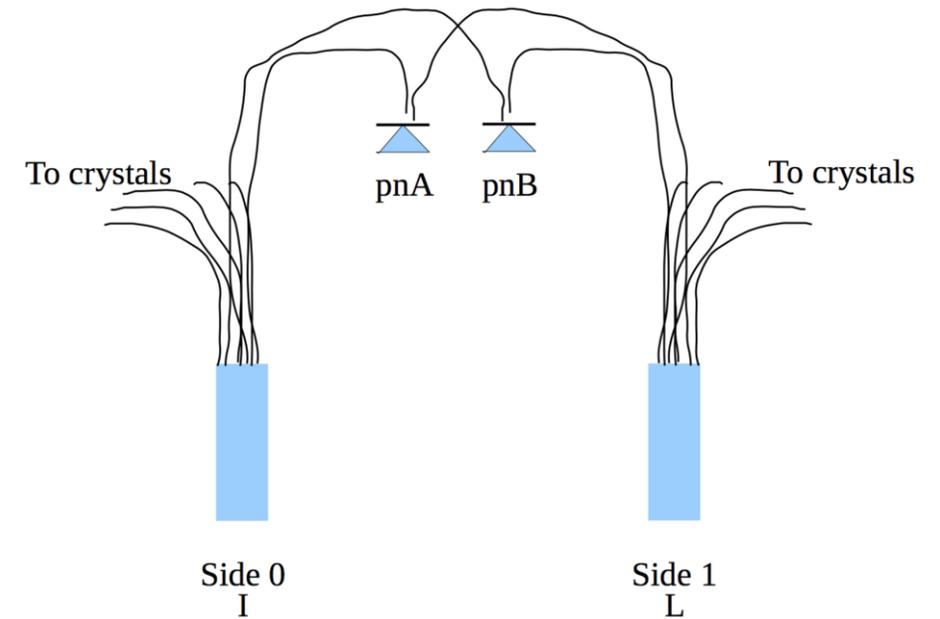
- crystals with non physical behavior
- sticking crystals
- crystals without LaserCorrection

Strategy of preparation of ultralegacy tag: workflow



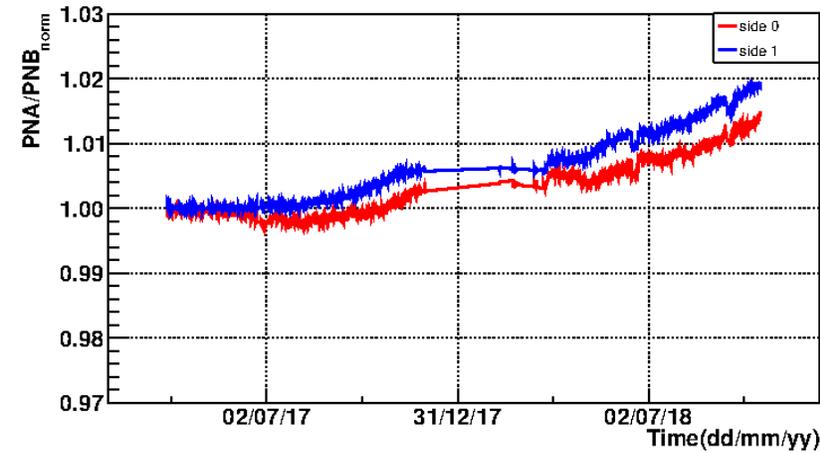
Preparation of ultralegacy tag: PN study(I)

- **PNs in LM system:**
 - each crystal is referenced by 2 PN diodes
 - each PN diode monitors 2 monitoring regions
- **pnA/pnB should be flat for both sides**
- **pnA/pnB drifts for both sides:**
 - one PN is drifting
 - Compare PN's response with other SM to define pathological one
 - remove it from computing for both sides
- **pnA/pnB drifts only on one side:**
 - one fiber is drifting
 - Compare PN's response with other SM to define pathological one
 - remove it from computing for one side



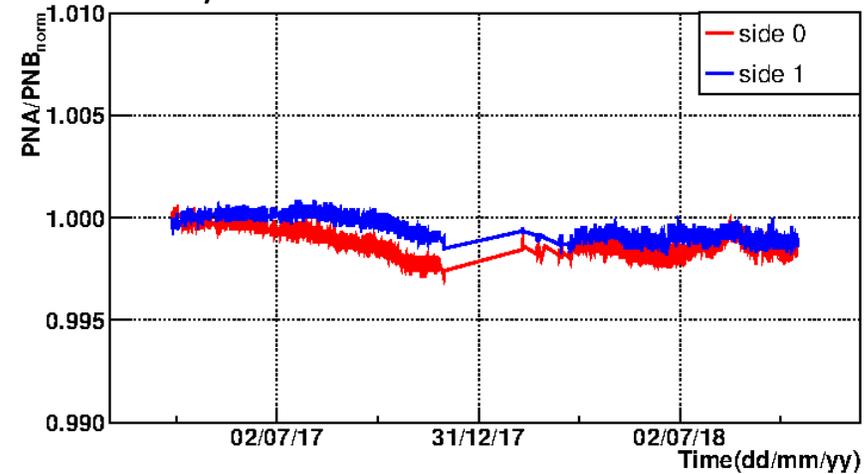
Preparation of ultralegacy tag: PN study(II)

PNA/PNB



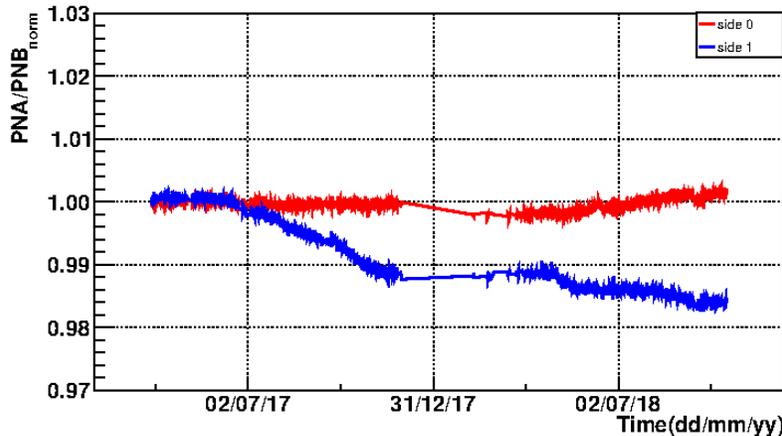
Drift for two sides:
PN problem

PNA/PNB



Stable PNs

PNA/PNB



Drift for one sides:
fiber problem

(in prompt – both sides are treated with 1 PN,
in offline – one side can be treated with 1
PN, other – with 2 PNs)

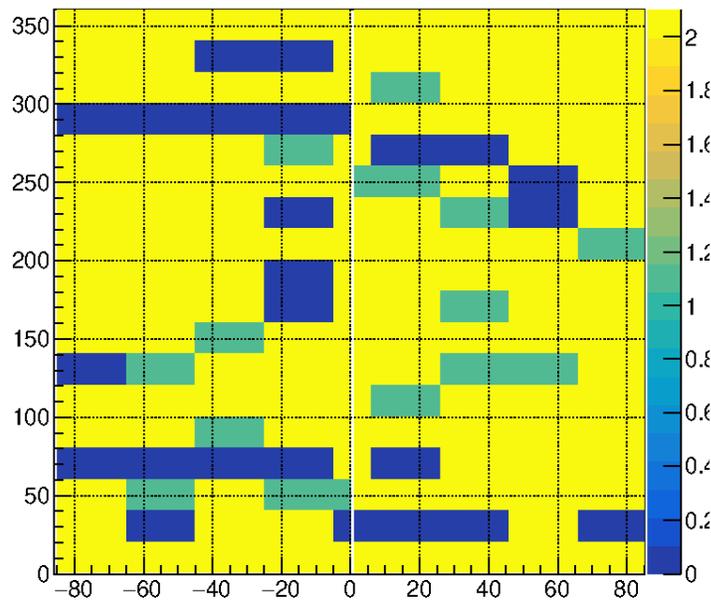
Preparation of ultralegacy tag: PN study(III)

For prompt map from previous year is used!

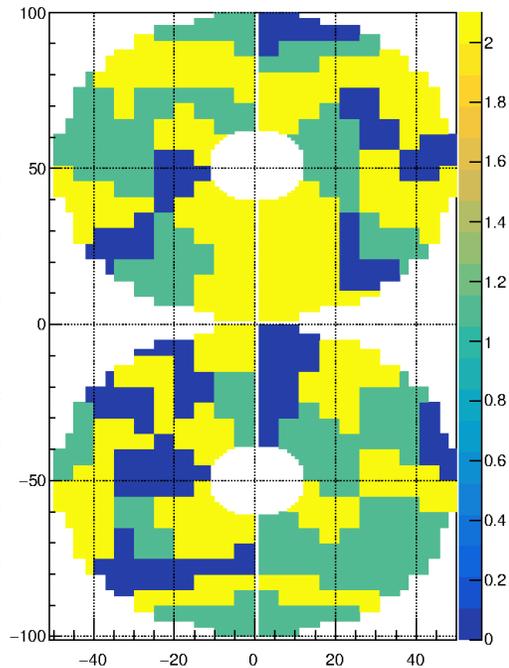
For ultralegacy tag map for current year is used!

2017 Map

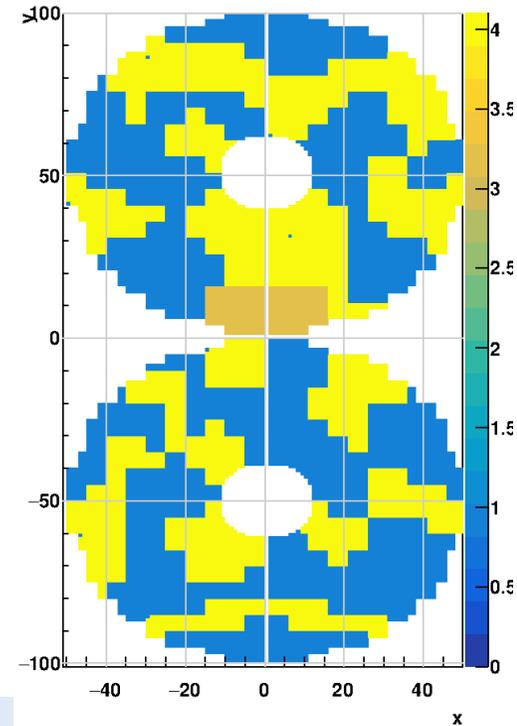
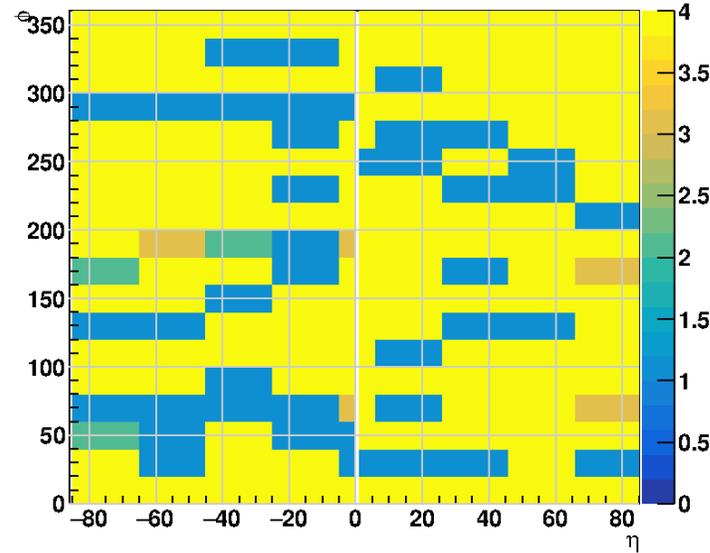
EB pn map



EE pn map



2018 Map



0 – pnA alone used
1 – pnB alone used
2 – pnA and pnB used

1 – know region with one PN
2 – PN problem
3 – fiber problem
4 – no drift

Preparation of ultralegacy tag : PN study (IV)

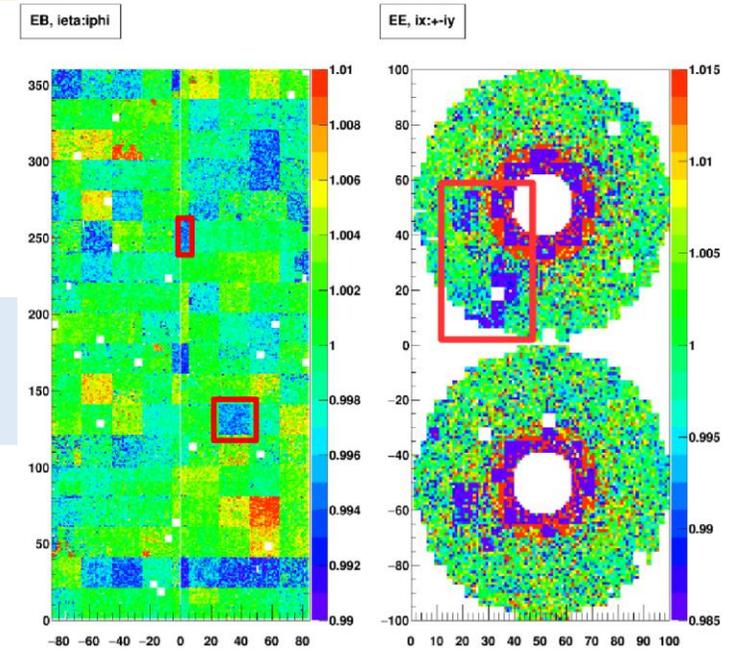
Searching for regions with 2 bad PNs:

- Drift in laser correction during the year using map for:
$$\frac{\text{Correction}/\text{RingAverage}(\text{July2018})}{\text{Correction}/\text{RingAverage}(\text{May2018})}$$
- Correlation with PN structure
- Only 1 PN is used

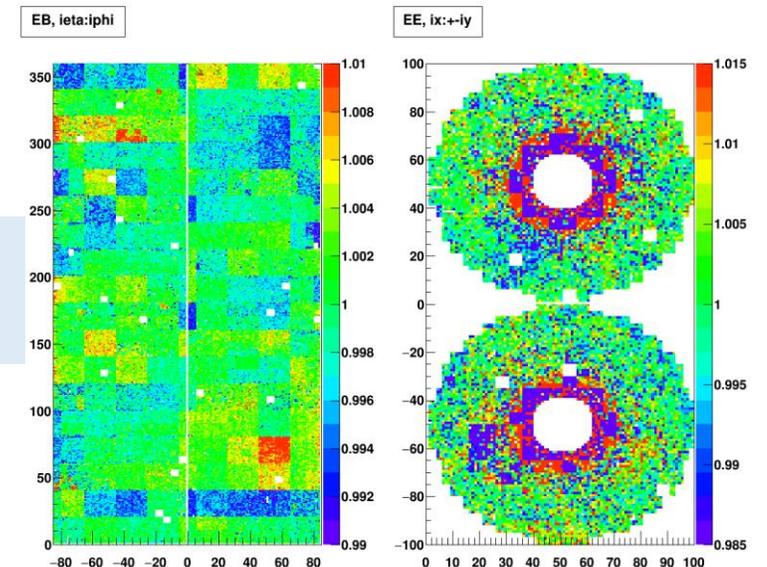
Swapping of PN data: looking for PNs with similar amplitude:

- in the neighboring LMR
- in symmetric LMR.

Before
correction



After
correction



Preparation of ultralegacy tag : PN study (V)

New PNs in 2016

FED	PNs
One PN drifting	
611	5
Two PNs are drifting	
602,603	5,10

New PNs in 2017

FED	PNs
One PN drifting	
630	1
632	6
601,609	2,17
604,605	27,32
647,648	46,51
One fiber is drifting	
613	0
646,654	40,55

New PNs in 2018

FED	PNs
One PN drifting	
612	9
618	9
619	2
One fiber is drifting	
619	5
619	3
631	4
636	4
653	49
Two PNs are drifting	
651,652	61,76

Bug connected with switching off of TP corrections was found and corrected for 2017 and 2018 data

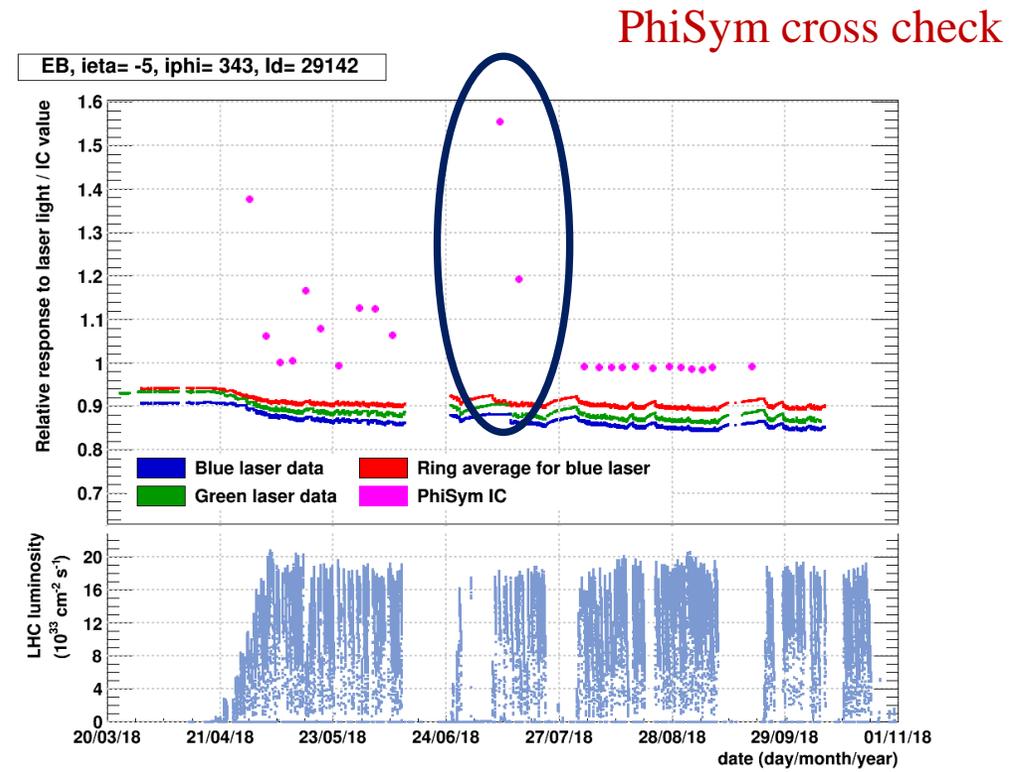
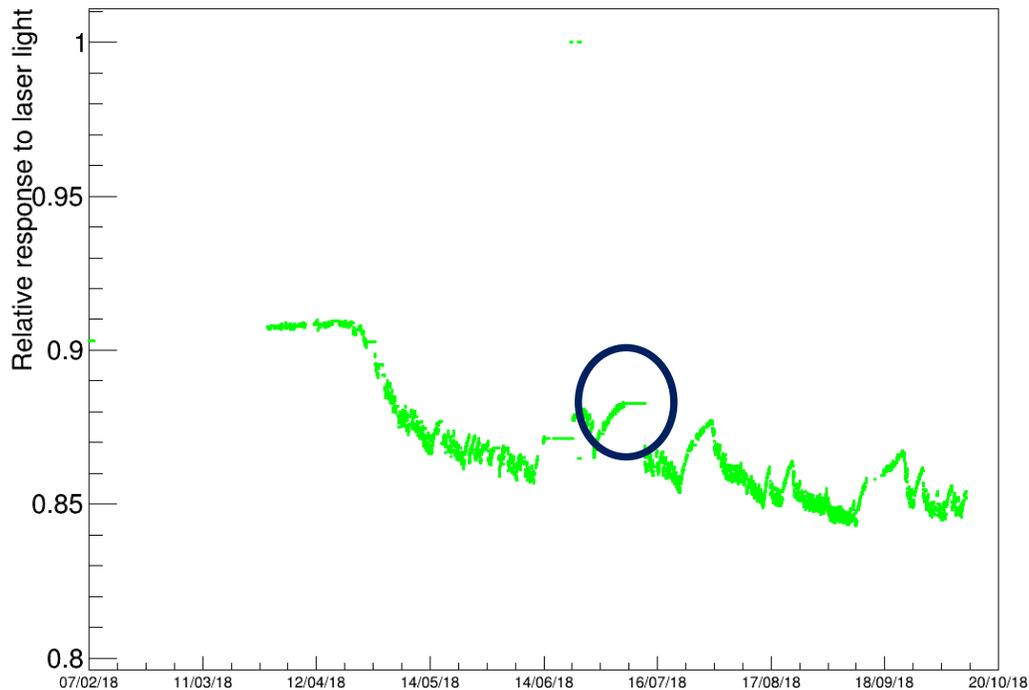


Preparation of ultralegacy tag: abnormal crystals(I)

2 methods of looking for abnormal crystals (crystal by crystal)

1. Sticking at the same value:
 - only JSON runs are used
 - stuck period is longer 4h (>5 iov)
 - More than once
 - PhiSym cross check

EB, ieta= -5, iphi= 343, N= 29142



Preparation of ultralegacy tag: abnormal crystals(II)

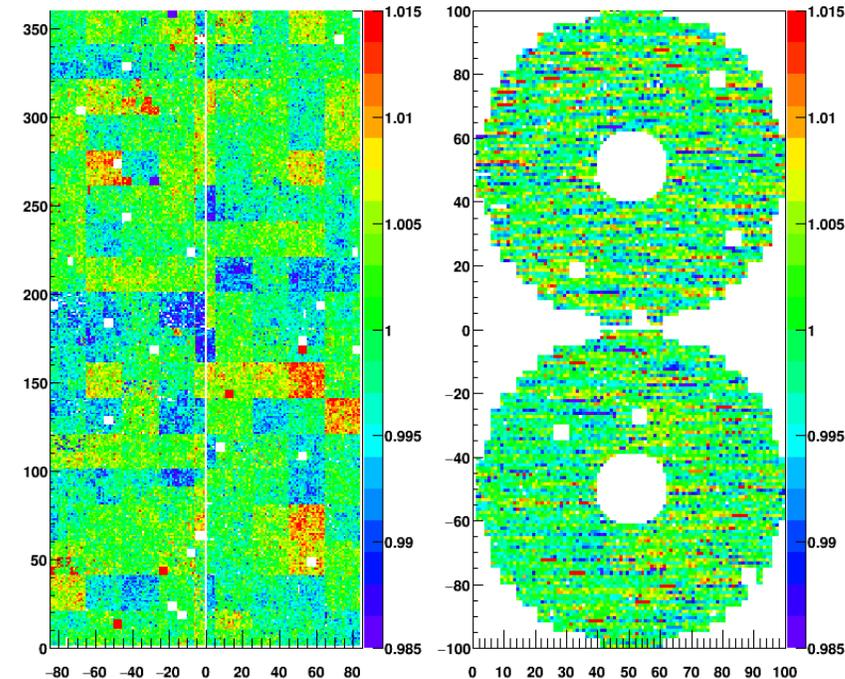
2 methods of looking for abnormal crystals (crystal by crystal)

2. Using PhiSym IC algorithm:

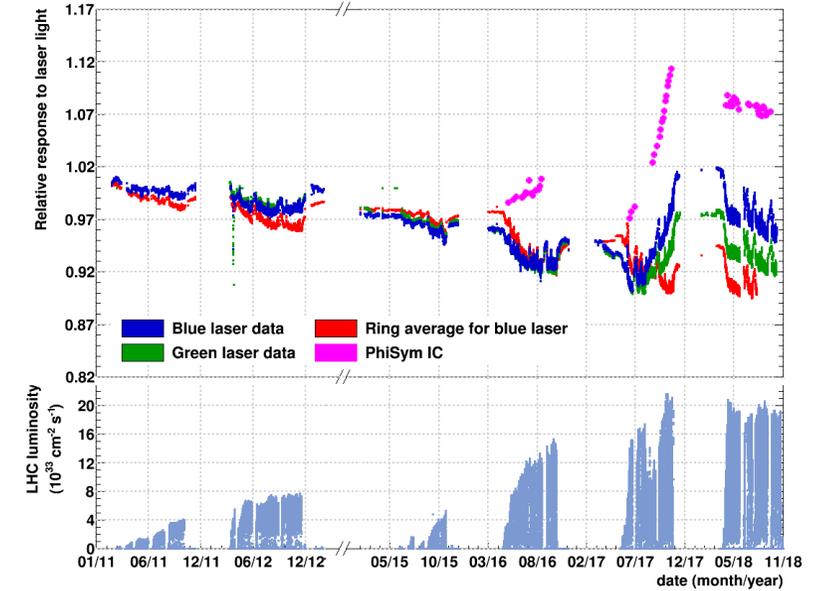
- Obtaining of map
- Looking for correlation between PhiSym IC and variation of laser correction

PhiSym IC map for 2018

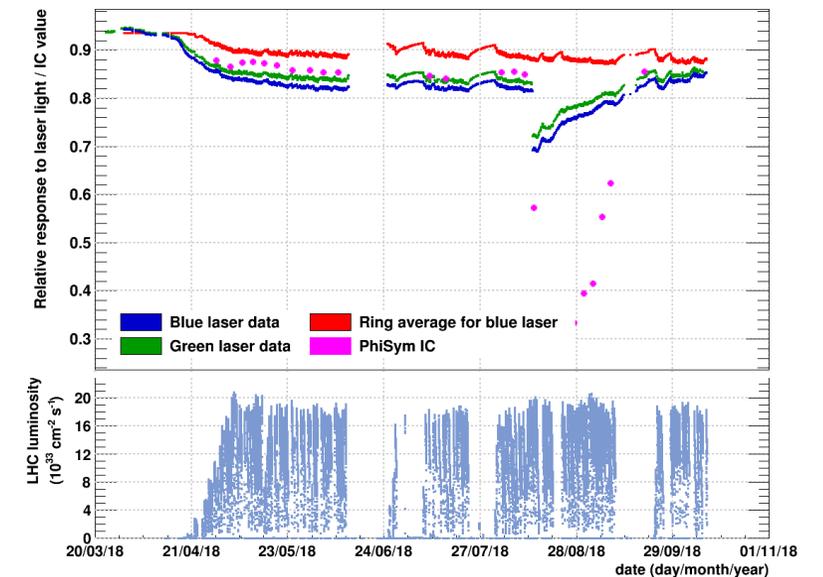
PhiSym, IC_n/IC₀



EB, ieta= -27, iphi= 139, N= 21018

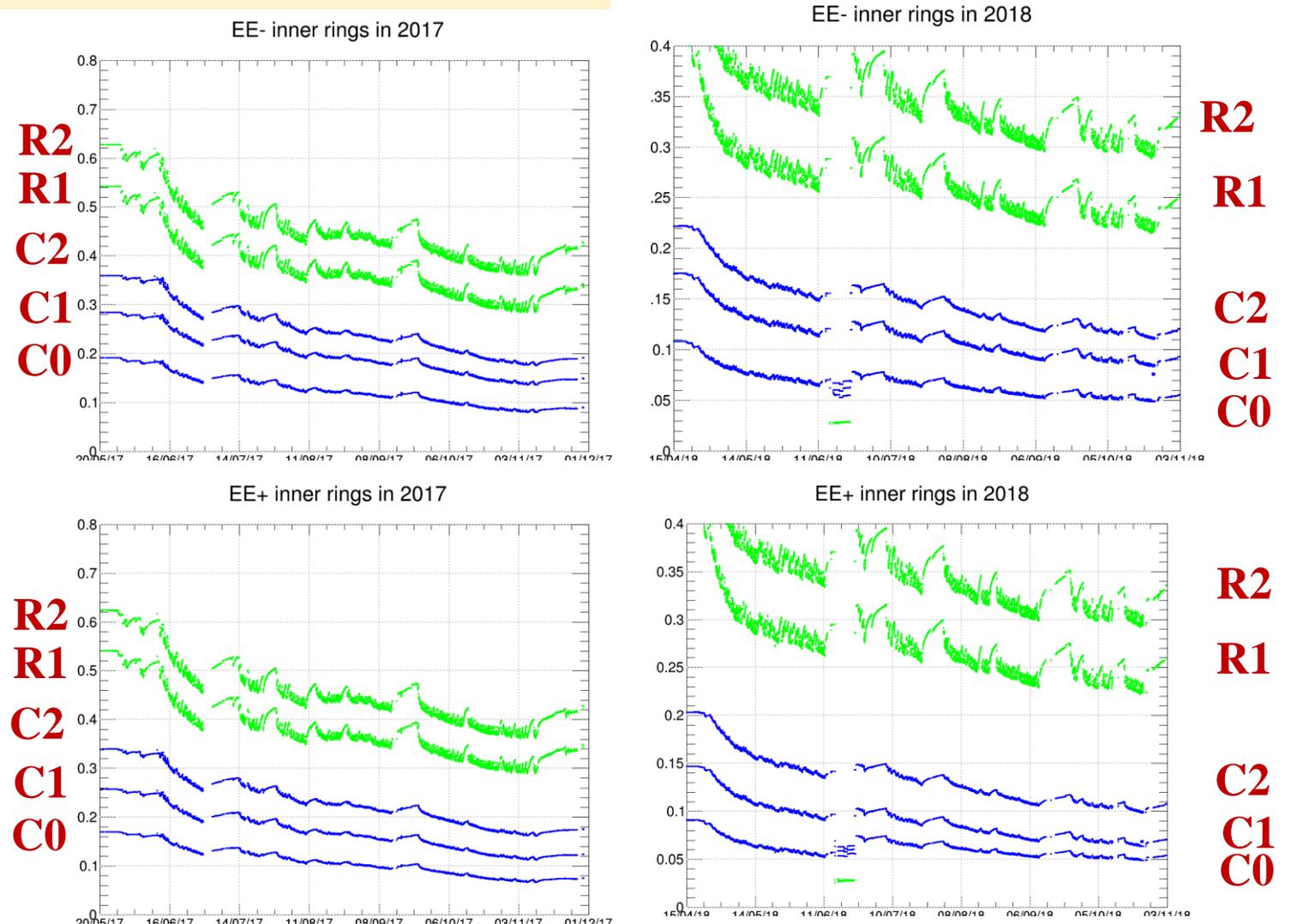


EB, ieta= -45, iphi= 21, Id= 14420



Preparation of ultralegacy tag: russian and chinese crystals in endcaps

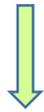
Difference in ring's average for russian and chinese crystals in **internal rings**: separate treatment for ring's average replacement



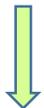
Preparation of ultralegacy tag: algorithm

Input tag

List of crystals

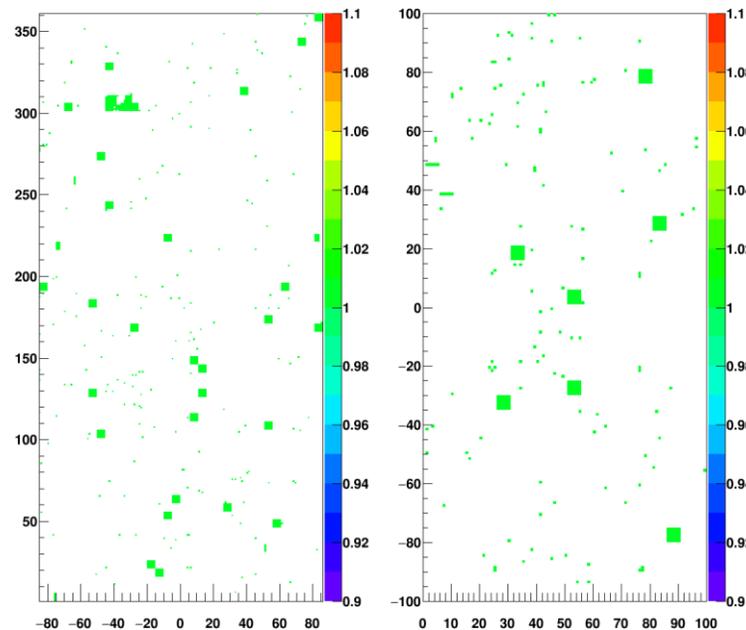


Calculating ring's average without taking into account crystals from the list. Ring's division:
11s ring in each endcap
170 ring in barral



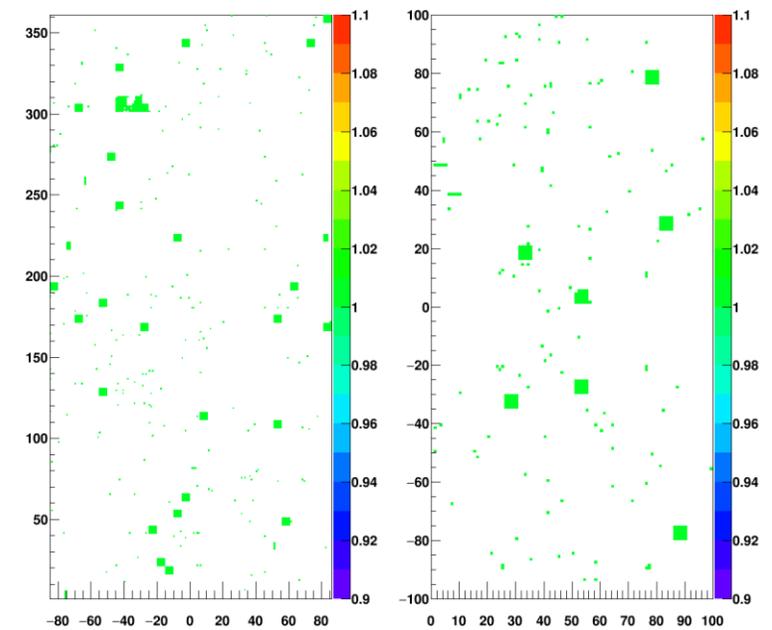
Production of new tag with where LC for crystals in list replaced by ring's average

Map of replaced crystals for 2017



Total: 1408
EB: 1097
EE- : 134; EE+: 177

Map of replaced crystals for 2018

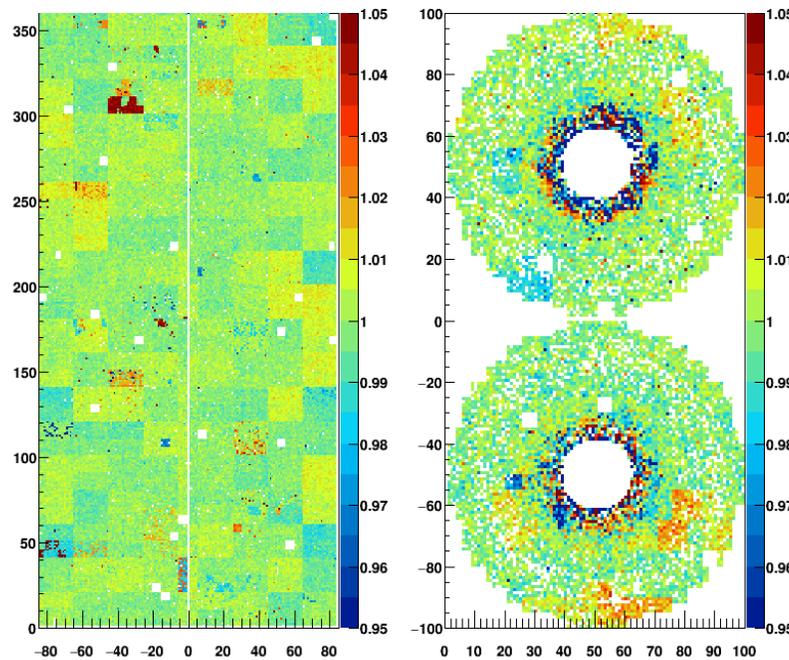


Total: 1377
EB: 1065
EE- : 128; EE+: 181

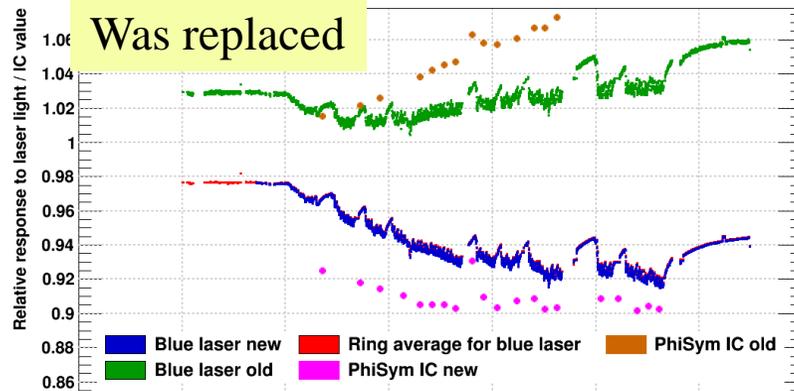
Cross checking of new tags

- Comparing PhiSym for prompt and new tags
- Checking crystal by crystal in all suspicious regions
- Correction of crystal list
- Production of final version of ultra rereco tag

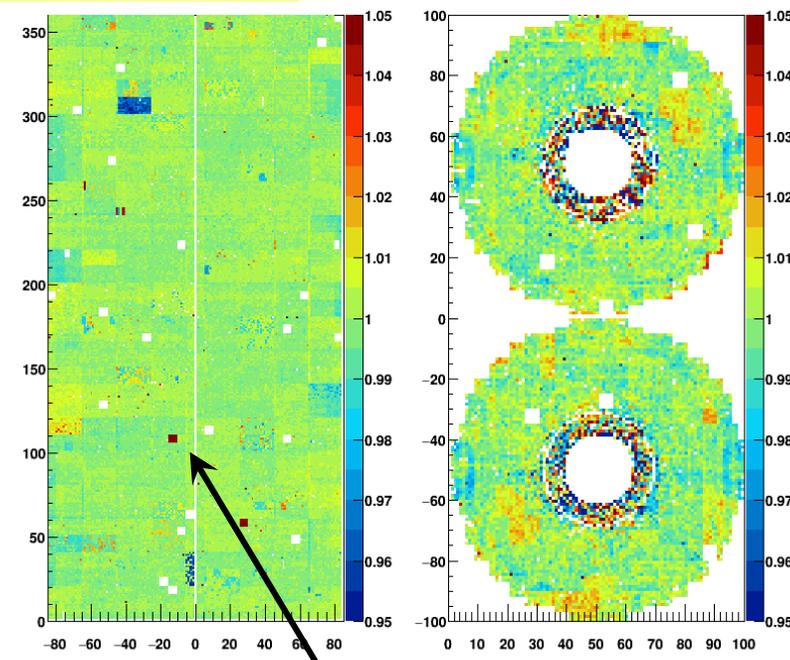
For prompt



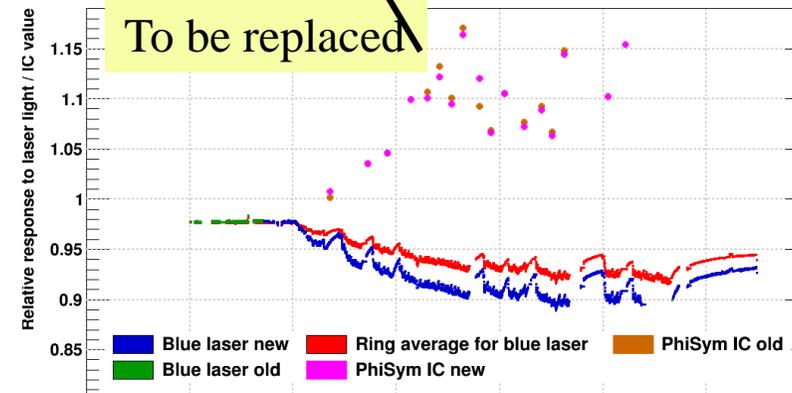
EB, ieta= -15, iphi= 180, Id= 25379, kfRMS=0.06, kfMean=2.5



For rereco

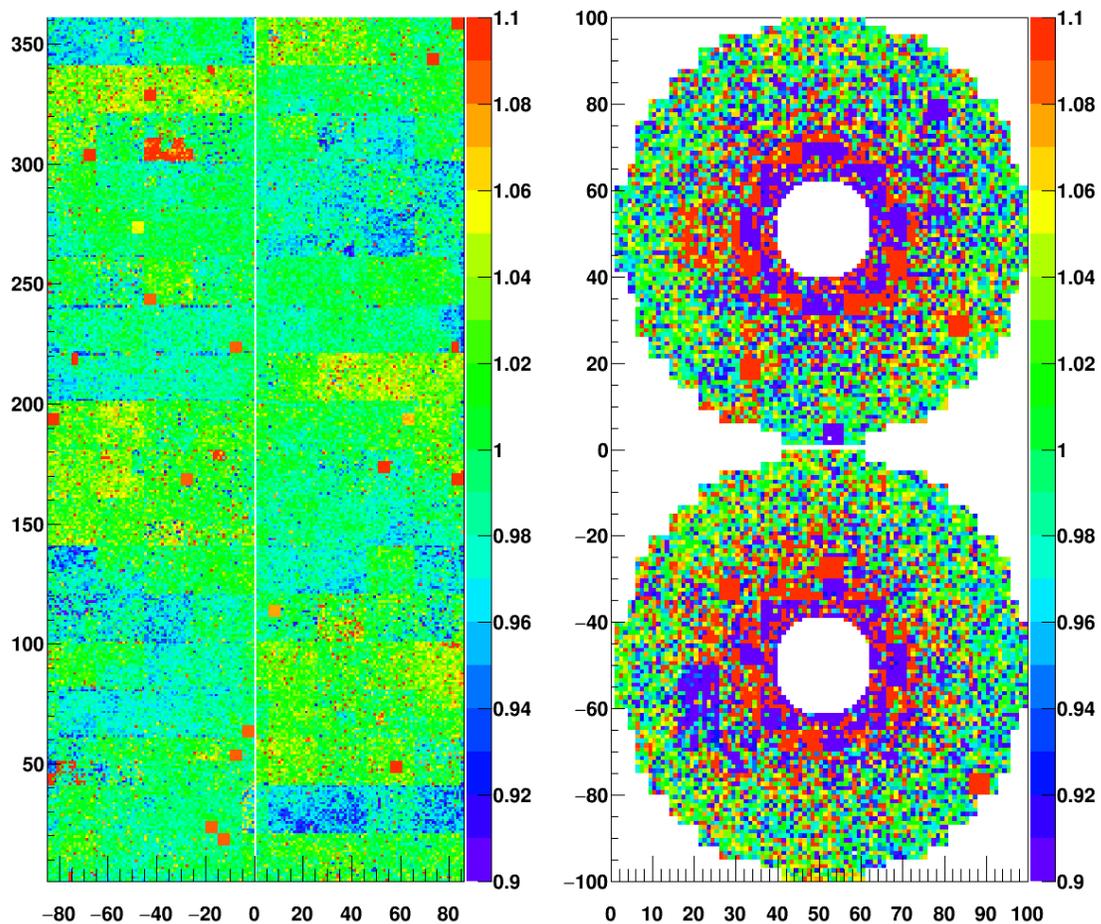


EB, ieta= -12, iphi= 110, Id= 26389, kfRMS=0.07, kfMean=2.7

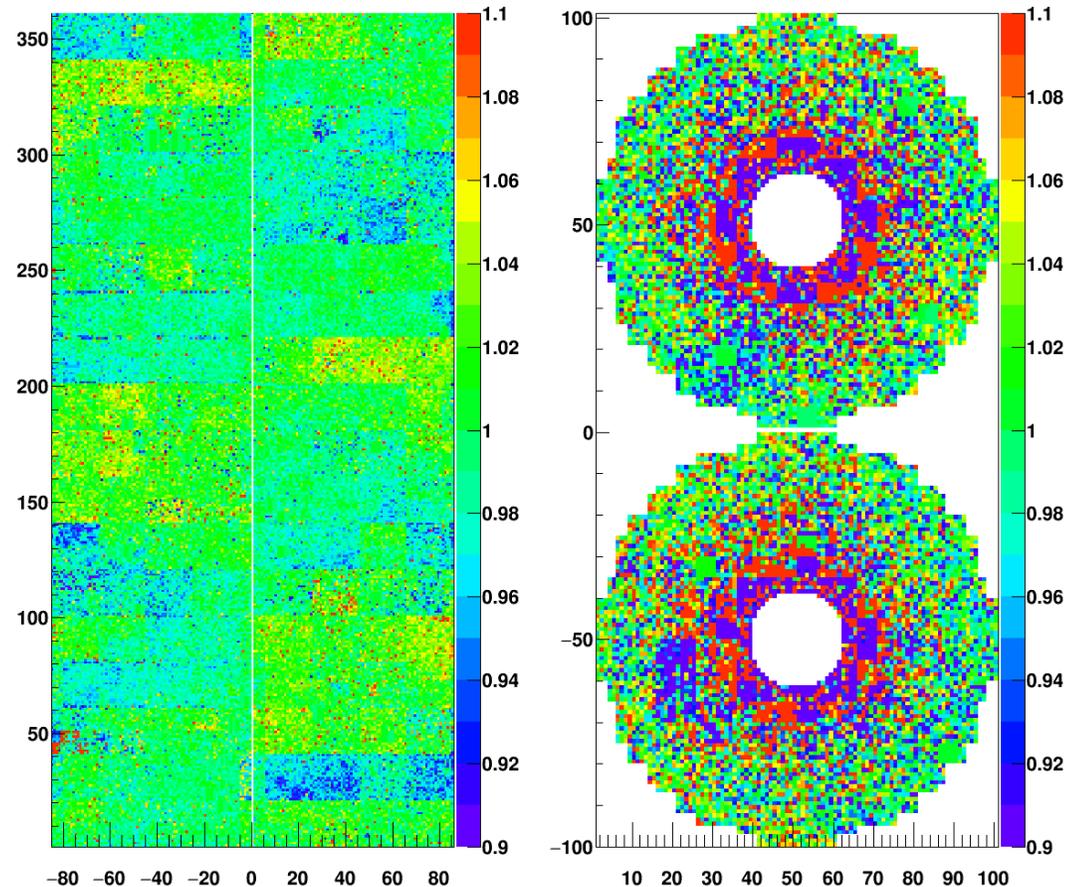


Preparation of ultralegacy tag: 2017 year

NoTP2

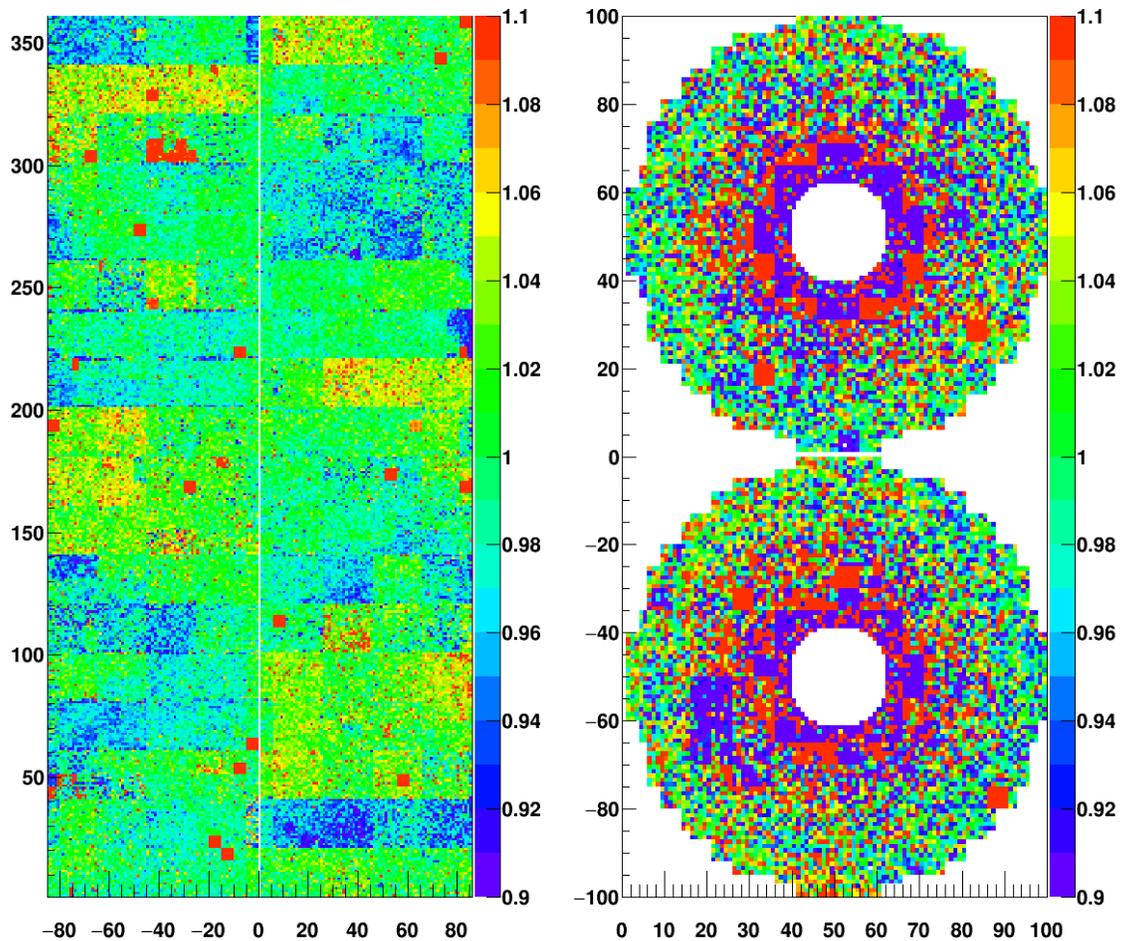


Rereco_v4

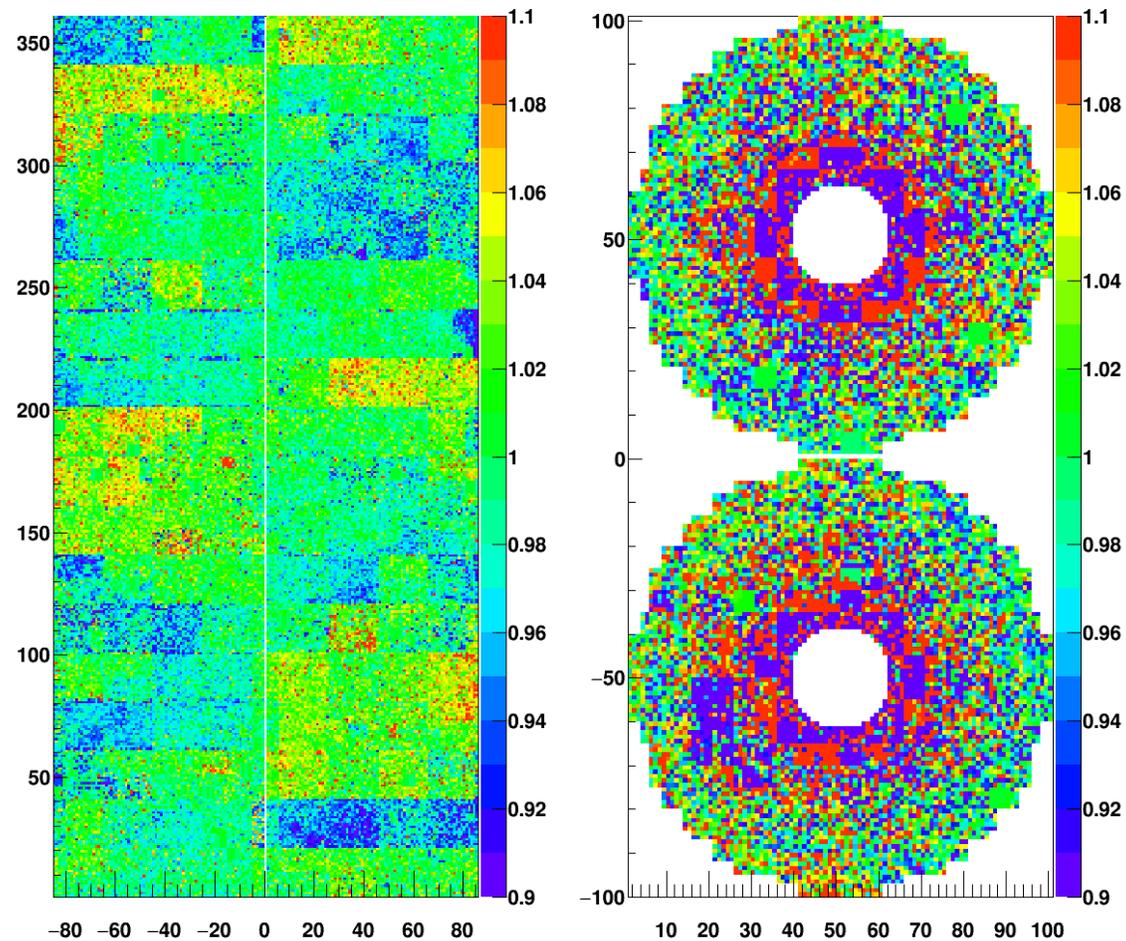


Preparation of ultralegacy tag: 2018 year

Prompt

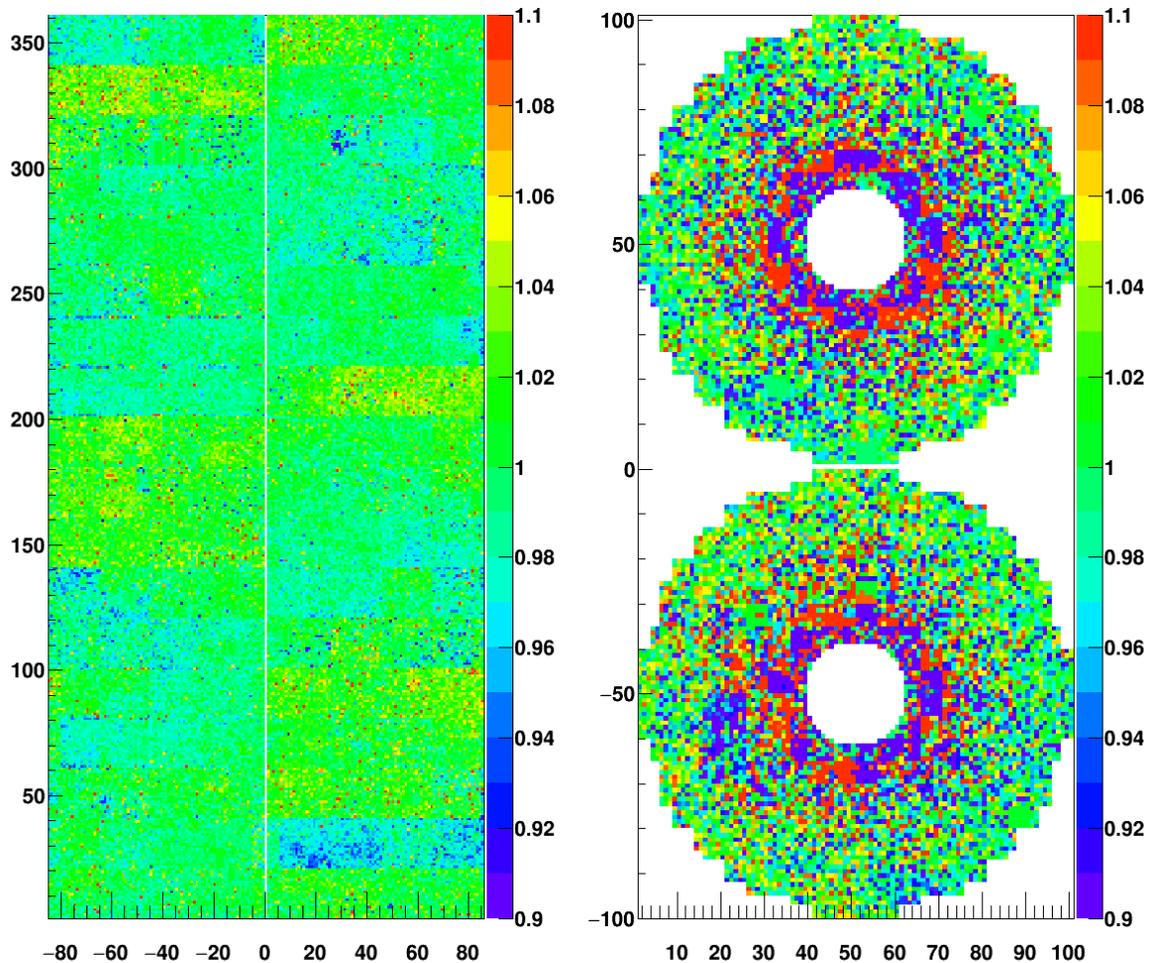


Rereco_v3

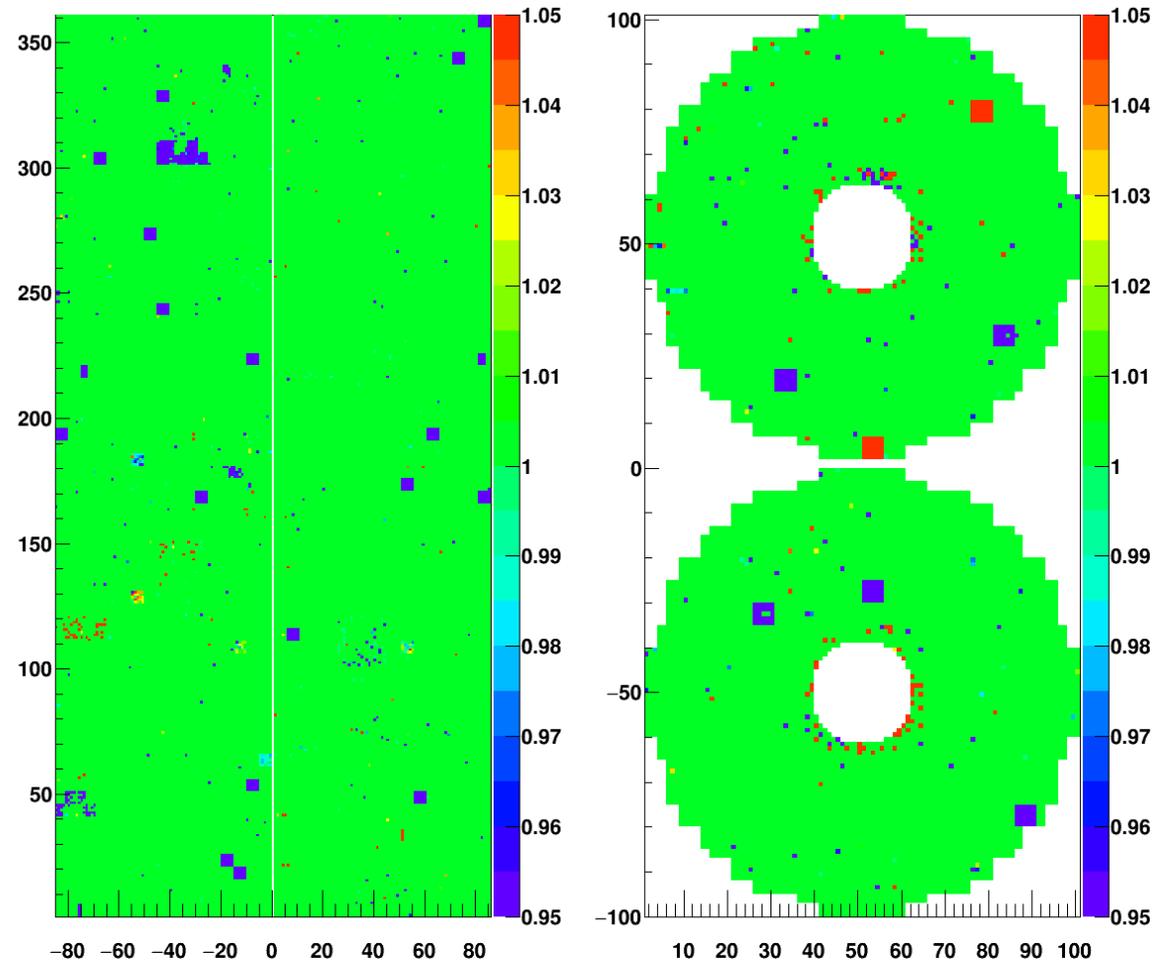


Preparation of ultralegacy tag: 2016 year

Rereco_v2



Ratio rereco/offline



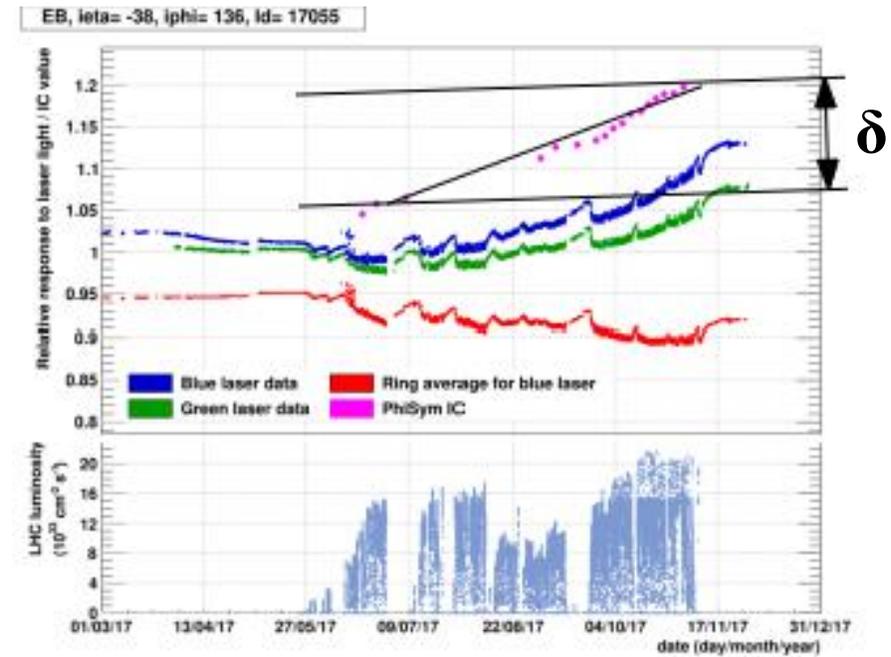
Conclusions

1. New approach for offline laser calibration has been developed and applied for ultralegacy tag production. This approach includes
 - PN drift corrections during corresponding year of operation
 - correction of the crystals with abnormal behavior
2. **Ultralegacy tag status:**
 - ❑ for 2017: EcalLaserAPDPNRatios_rereco2017_v4
 - ❑ for 2018 : EcalLaserAPDPNRatios_rereco2018_v3
 - ❑ for 2016: corrected version was generated, ready for uploading into db (EcalLaserAPDPNRatios_rereco2016_v2)

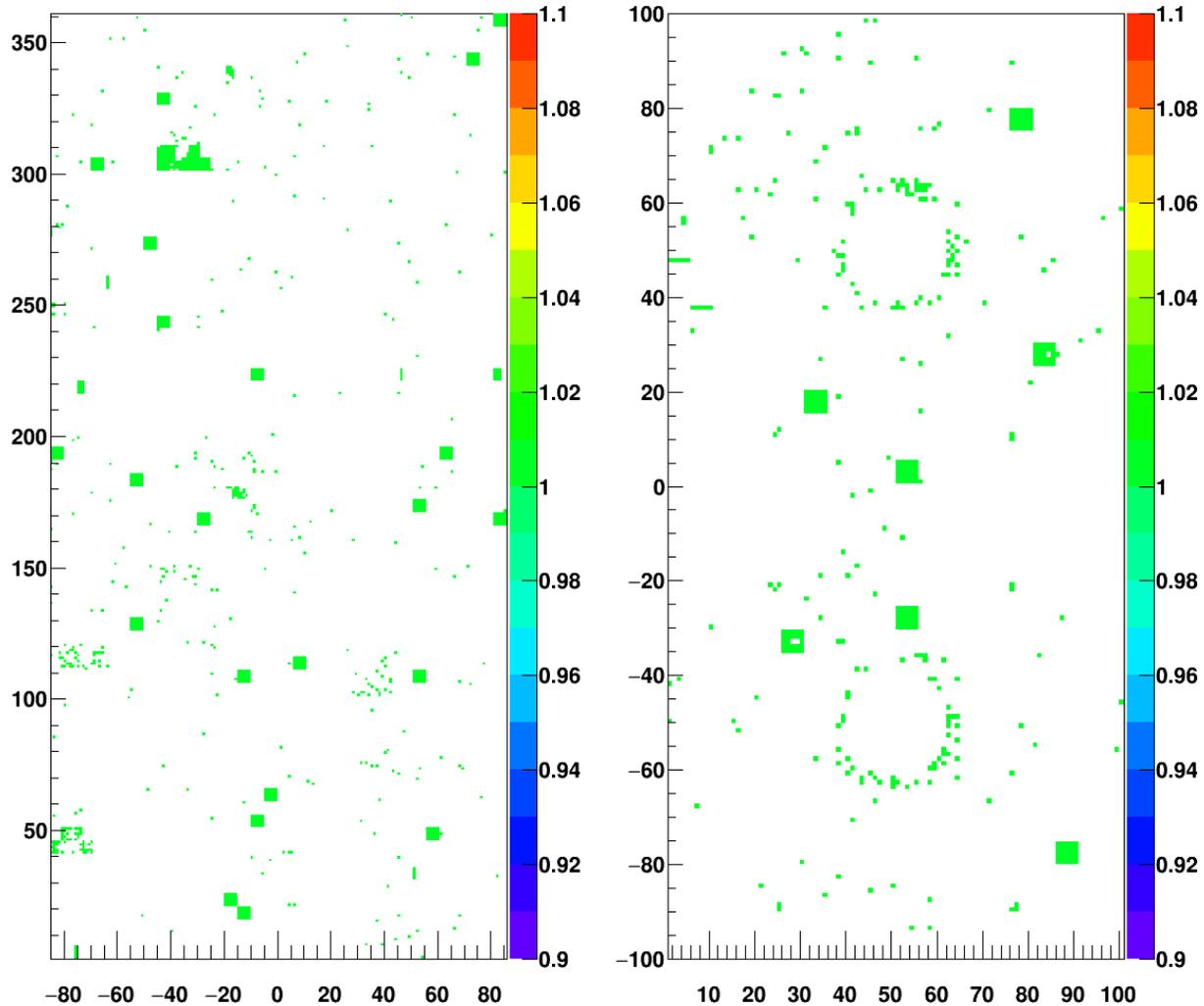
Backup slides

Explanation for PhiSym maps

- Fit IC by linear function
- Channels with bad status and unstable k factors are marked by white color



Map of replaced crystals for 2016



Total: 1565

EB: 1154

EE- : 177; EE+ : 243

Added for new version: 35