Efficiencies for L1 DT primiteves
UPDATED SLIDE

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MBTF Working Meeting,
CERN, 6 March 2014

IMPORTANT!

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During the MBTF Working Meeting, CERN, 6 March 2014, I presented some results on the L1 primitive efficiencies. Meeting on INDICO

After the meeting, and following the discussion, I've re-check my code, and realized that I was treating in a silly way the case when more than a L1 Primitive was present in a chamber, simply taking the last one. following the order in which they were stored in the ProuductContainer.

I've changed the code in order to get the one with highest quality instead, and I found that this makes quite a lot of difference.

In particular, the efficiency drop I saw before is not there anymore, instead I do see a **increase** of efficiency of few %

In the following, I've redone the plots I've presented at the meeting with this issue fixed, changing the comments accordingly (marked by **NEW**)

Intro

- Look at efficiency for L1DTTrigger;
- Look only at bending primitives: ϕ superlayers (1 and 3);
- Efficiecny definition: $\epsilon = \frac{N}{D}$
  - Numerator:
    - ★ A primitive is present;
    - ★ If more than one priitives, take the highest quality one **NEW**
    - ★ Consider only correct BX (=0), any code;
    - ★ for legacy and new L1 primitives.
  - Denominator:
    - ★ Some DTDigi are present;
    - ★ Any number of DTDigi
    - ★ Separately for number of Layers and SuperLayers which have at least one Digi;
    - ★ For local position in chamber use centroid of wires with Digis, normalized to chamber width ($x \in [-1., 1.]$);
    - ★ For x (bending) and y (orthogonal to x).

Details on code

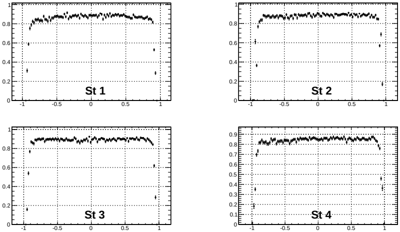
- `CMSSW_5_3_14`
- latest code from `GIT` repository
  `battibass/L1IntegratedMuonTrigger.git`
- datasample
  - 100k
  - SingleMu
  - flat pT Gun, $3 < p_T < 140$ GeV
  - charge=+1
  - $|\eta| < 0.85$
  - $-30^\circ < \phi < 30^\circ$
  - No PU, No noise

Eff vs chamber position

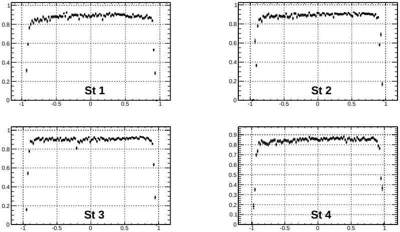
- Showing ϵ for legacy and new primitives as well as ratio New/Legacy
  - grouped by station (by wheel in backup);
  - per chamber granularity is available, but too much stuff to show here.
- only if BX is correct (BX=0)
- Inclusive in term of quality code, and number of Layers or SuperLayers with DTDigis;
  - Exclusive efficiency later;

Efficiency vs Chamber position X by Station

Legacy



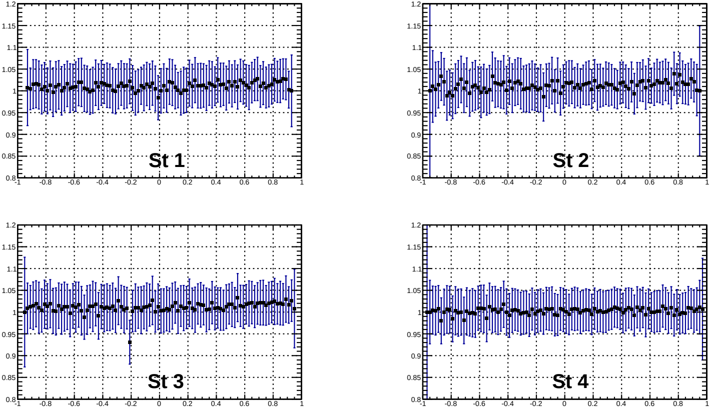
New



Drop at border of chamber (acceptance) Ratio New/Legacy next slide

Efficiency vs Chamber position X by Station

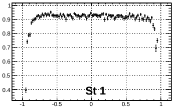
New/Legacy **NEW** Some % of better ϵ from Legacy to New

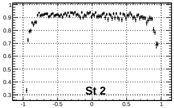


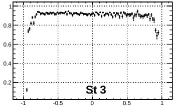
NEW funny drop at $x = -0.2$ for St3

Efficiency vs Chamber position Y by Station

Legacy

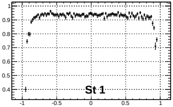


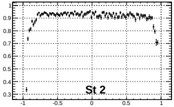


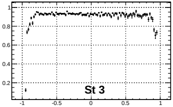


St 4

New





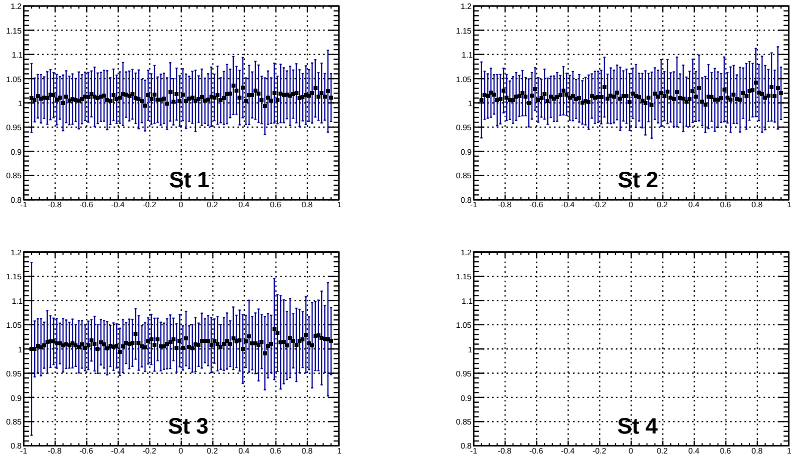


St 4

NB: local-Y (non bending) coordinate, no ST4

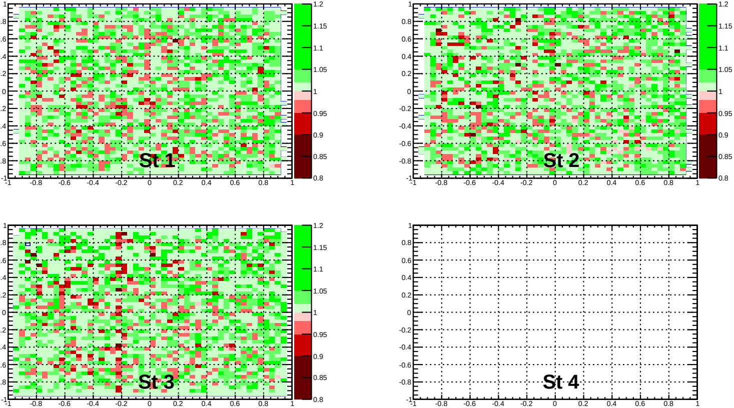
Efficiency vs Chamber position Y by Station

New/Legacy



Efficiency vs Chamber position Y vs X by Station

New/Legacy **NEW** funny drop at $x = -0.2$ for St3 not localized in Y

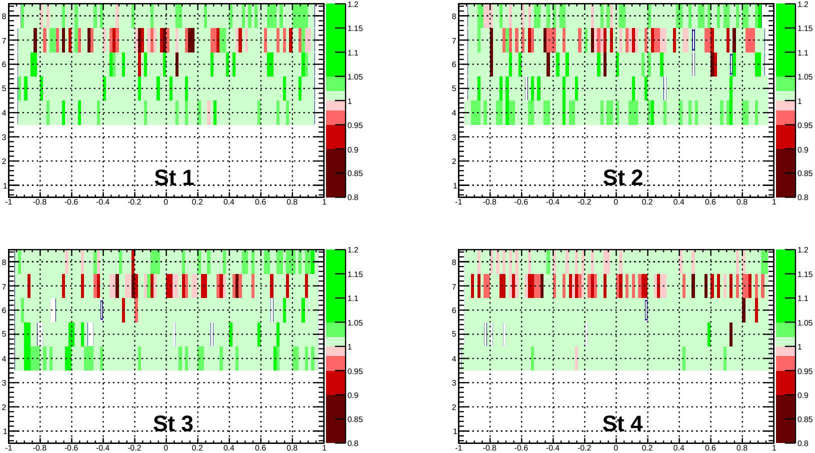


Eff vs chamber position vs n Layers

- only if BX is correct (BX=0)
- Inclusive in term of quality code
- **As a function of Num of Layers with at least one DTDigi**
- **As a function of Num of SuperLayers with at least one DTDigi**
  - NB: considering only ϕ Layers (SL=1,3, max N layers=8)

Efficiency vs Chamber pos vs N. Layers by Station

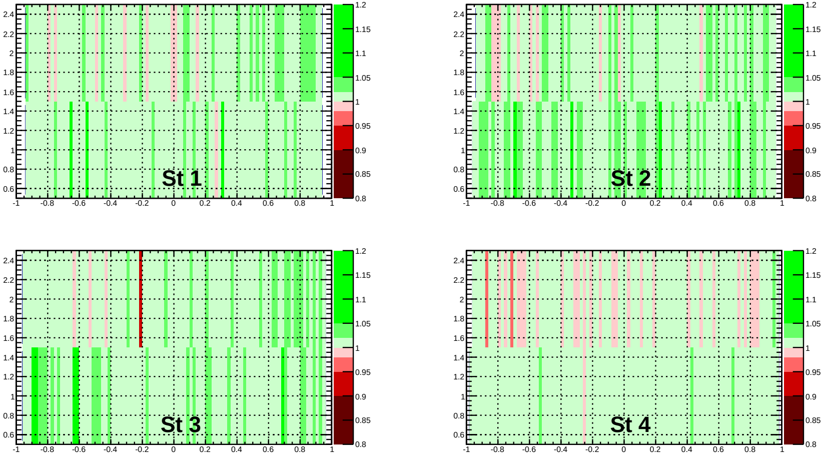
New/Legacy **NEW**some small ϵ drop is for nLayer=7



NEW funny drop at $x = -0.2$ for St3 for nLayer=7 or 8

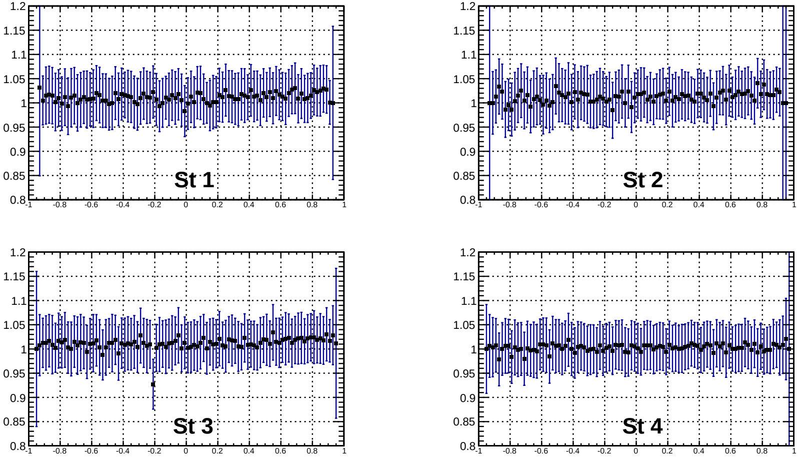
Efficiency vs Chamber pos vs N. SL by Station

New/Legacy some small ϵ drop is for nSL=7



Efficiency vs Chamber pos N SL==2 by Station

New/Legacyϵ drop not at chamber border, less for St4



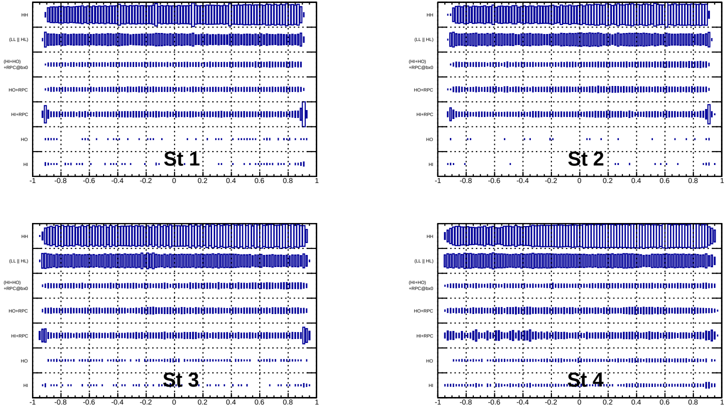
Primitives vs Code

- Study the Primitive distribution as a function of chamber position
- **Subdivided for different Quality Code;**
- In case Digis in both SL, or in just in one;

Code	New
1	HI
2	HO
3	HI+RPC
4	HO+RPC
5	(HI+HO)+ RPC@bx0
6	(LL || HL)
7	HH

N primitives vs Chamber pos vs Code
by Station vs nSL

New n SL=2

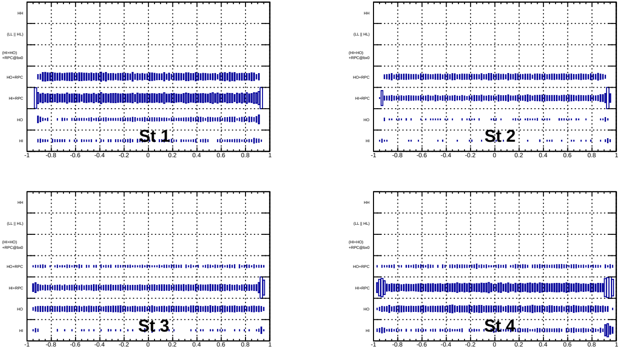


At chamber border `HI+RPC`

N primitives vs Chamber pos vs Code

by Station vs nSL

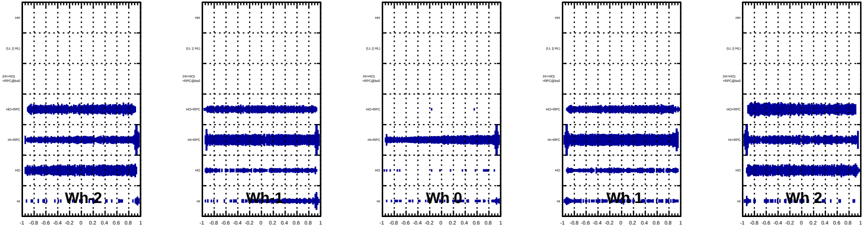
New n SL=1



- At chamber border `HI+RPC`
- **ST1,2**: `HI+RPC` or `HO+RPC`
- **ST3,4**: `HO` or `HI+RPC`

N primitives vs Chamber pos vs Code
by Station vs nSL

New n SL=1



HO w/o RPC in wheel±2

Why no HO+RPC in Wheel0?

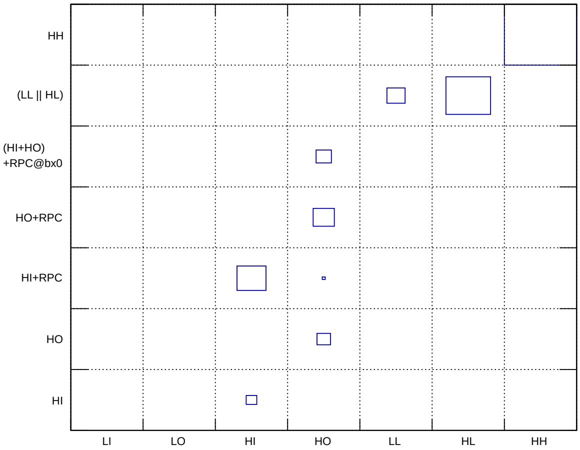
Primitives vs Code

Study the primitives quality code legacy vs new;

- In case Digis in both SL, or in just in one;

Code	Legacy	New
1	LI	HI
2	LO	HO
3	HI	HI+RPC
4	HO	HO+RPC
5	LL	(HI+HO)+ RPC@bx0
6	HL	(LL || HL)
7	HH	HH

Quality code New vs Legacy

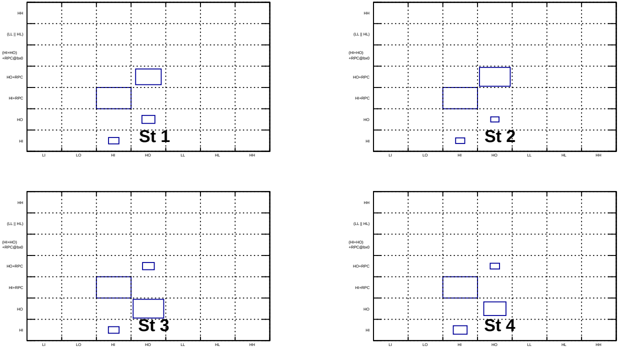


- Similar for all station/wheel;
- HO sometimes (seldom) becomes HI+RPC
- (HI+HO)+RPC@bx0 come only from legacy HO, and not from HI

NEW with the proper choice of primitive when more than one is present in a chamber, migration of legacy to new codes are fine

Quality code New vs Legacy by Station if num SL=1

When only one SL has digis;



ST1,2

- HI/HO mostly becomes HI/O+RPC;

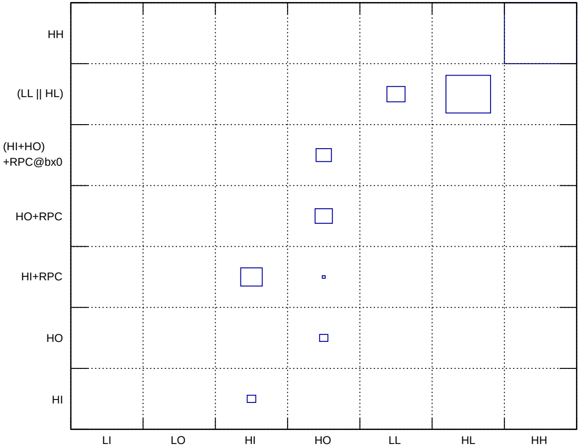
ST3,4

- HI mostly becomes HI+RPC
- HO mostly remains the same;

as expected

Quality code New vs Legacy by Station if num SL=2

When both one SL has digis;



- The strange cases described before comes all from chambers with Digis in both SL
- maybe legacy finds `HO` in one SL and new finds `HI+RPC` in the other
- why not viceversa?

Summary

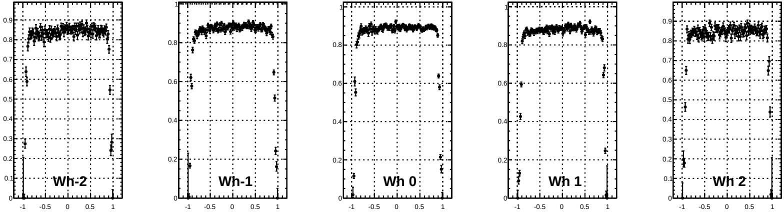
- Infrastructure for detailed efficiency study is in place
- **NEW** Choosing the best Primitives when more than one is present in a chamber makes a lot of difference
- Overall, the New Primitives behaves as expected;
- ~~There is a drop of efficiency at the level of few %;~~
  NEW There is an **INCREASE** of efficiency at the level of few %;
- Something odd in Wheel=0 for nSL=1;
- **RPC usage**:
  - good for HI for all station and for HO only for station 1 and 2
  - at chamber edge many new superprimitives are HI+RPC, almost none HO+RPC
- ~~Some strange migration of quality code from Legacy to New Primitives~~ **NEW** All is fine

Backup

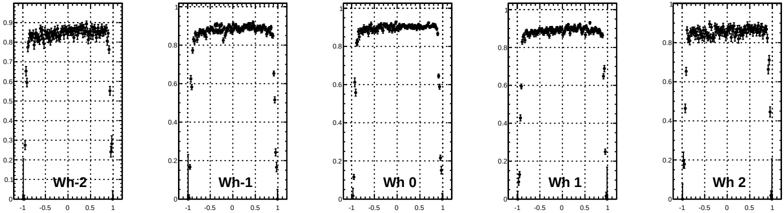
Backup slides follows

Efficiency vs Chamber position by Wheel

Legacy

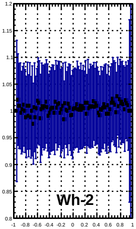


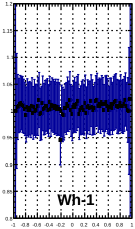
New

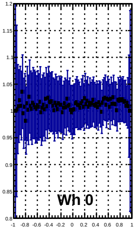


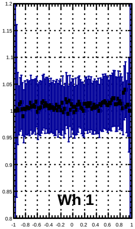
Efficiency vs Chamber position by Wheel

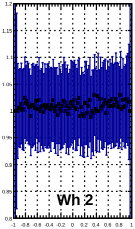
New/Legacy





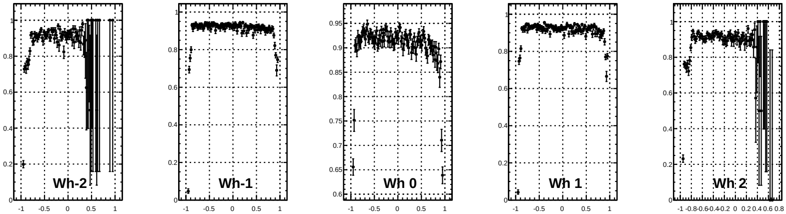




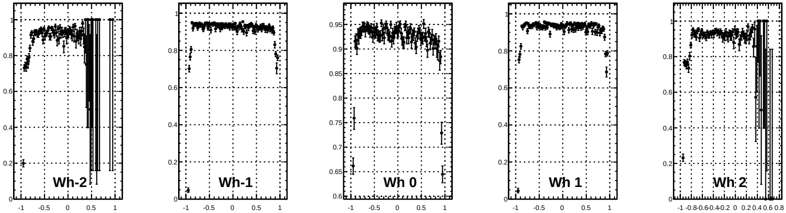


Efficiency vs Chamber position Y by Wheel

Legacy

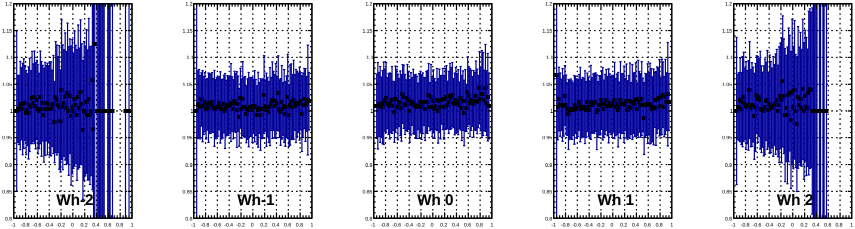


New



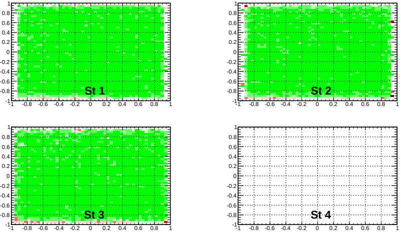
Efficiency vs Chamber position Y by Wheel

New/Legacy

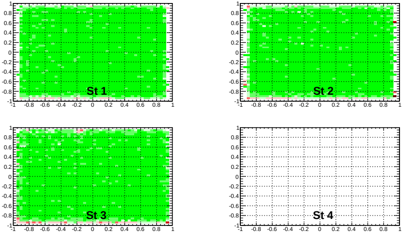


Efficiency vs Chamber position Y vs X by Station

Legacy

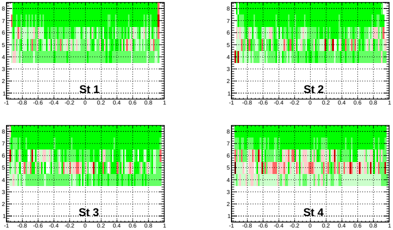


New



Efficiency vs Chamber position vs #Layers by Station

Legacy



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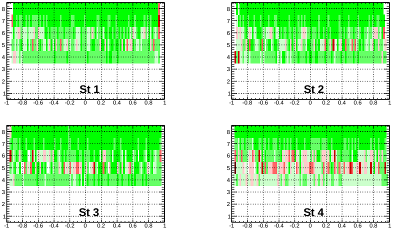
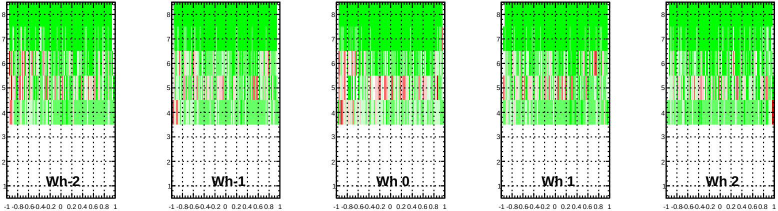


Efficiency vs Chamber position vs #Layers by Wheel

Legacy



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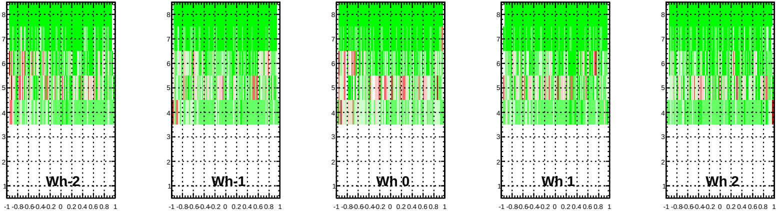
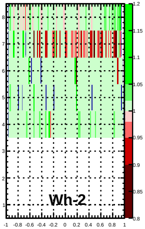
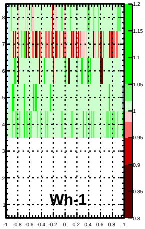
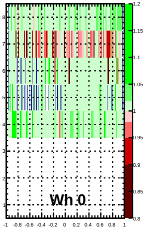


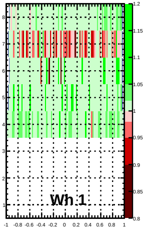
Efficiency vs Chamber position vs #Layers by Wheel

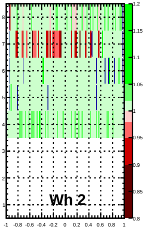
New/Legacy





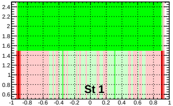


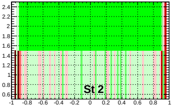


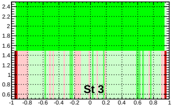


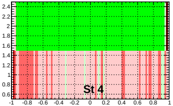
Efficiency vs Chamber position vs #SL by Station

Legacy

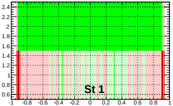


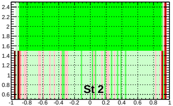


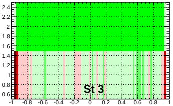


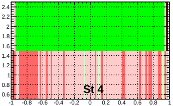


New



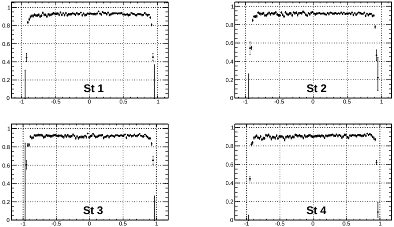






Efficiency vs Chamber position #SL==2 by Station

Legacy



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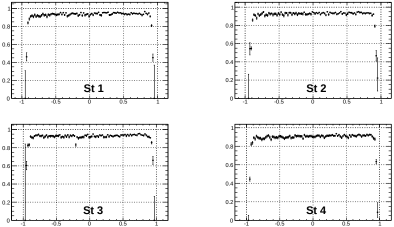
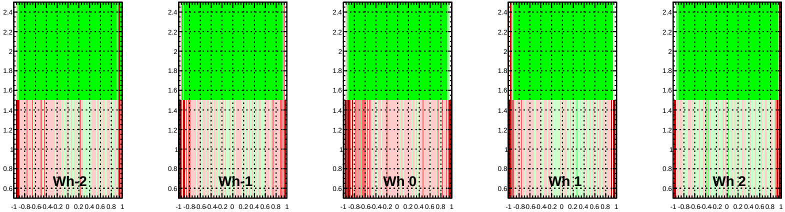


Efficiency vs Chamber position vs #SL by Wheel

Legacy



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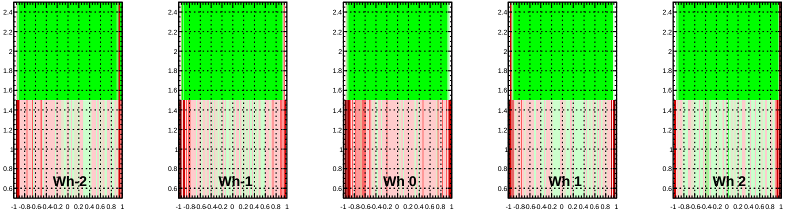
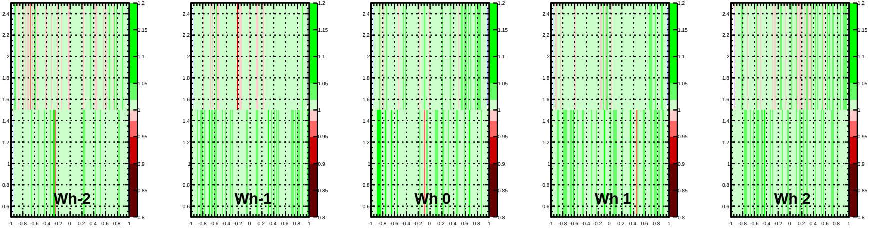


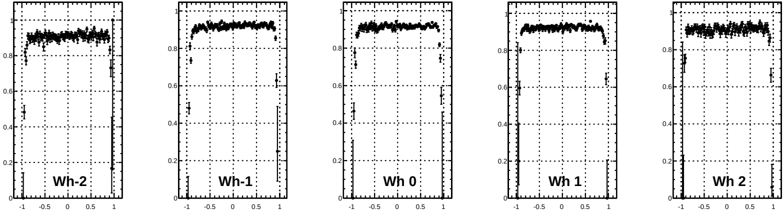
Efficiency vs Chamber position vs #SL by Wheel

New/Legacy

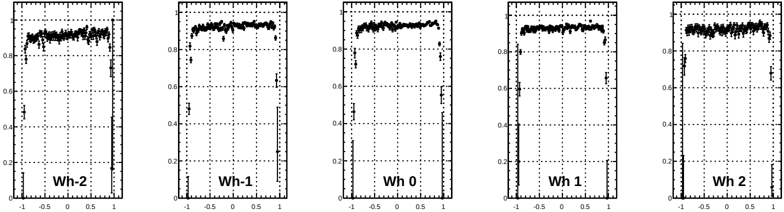


Efficiency vs Chamber position #SL==2 by Wheel

Legacy

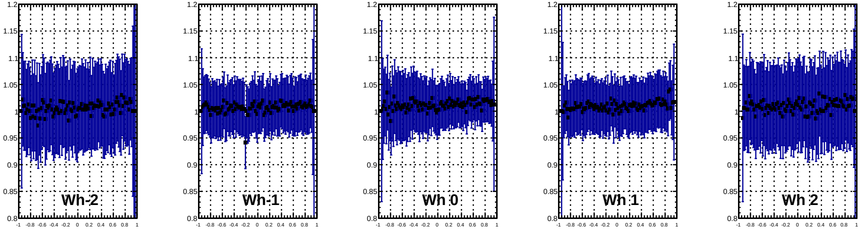


New



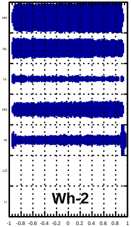
Efficiency vs Chamber position #SL==2 by Wheel

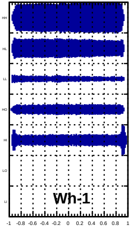
New/Legacy

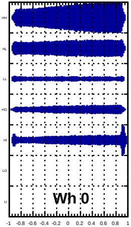


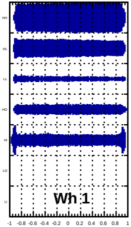
N primitives vs Chamber position vs Code by Wheel

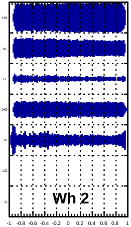
Legacy





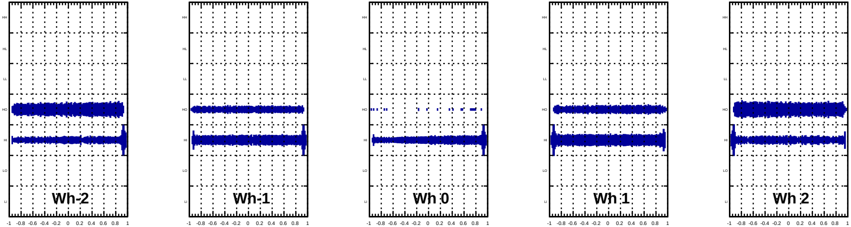






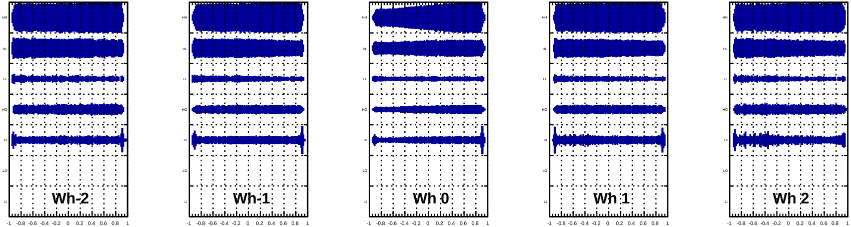
N primitives vs Chamber position vs Code by Wheel vs nSL

Legacy n SL=1



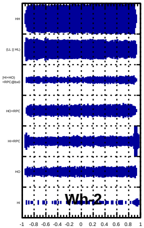
N primitives vs Chamber position vs Code by Wheel vs nSL

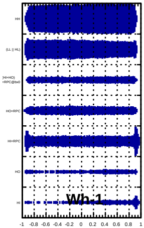
Legacy n SL=2

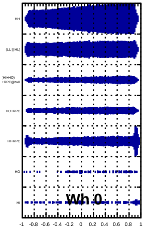


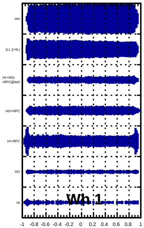
N primitives vs Chamber position vs Code by Wheel

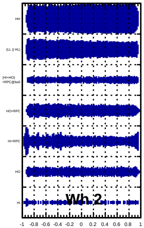
New





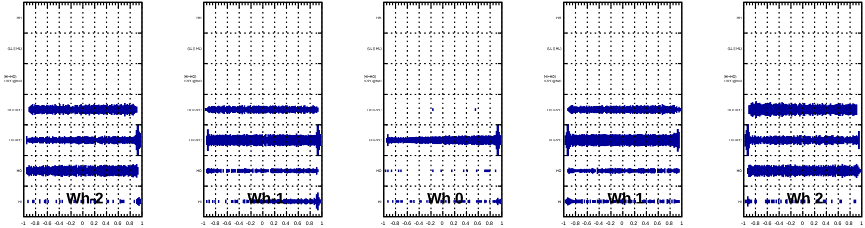






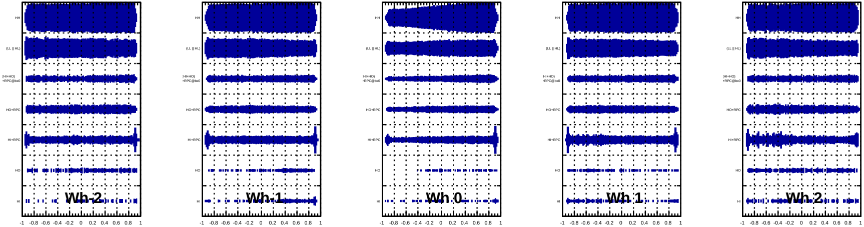
N primitives vs Chamber position vs Code by Wheel vs nSL

New n SL=1



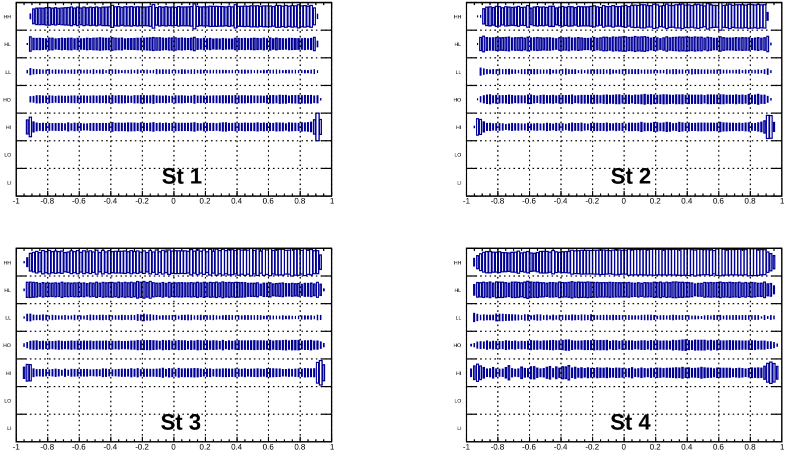
N primitives vs Chamber position vs Code by Wheel vs nSL

New n SL=2



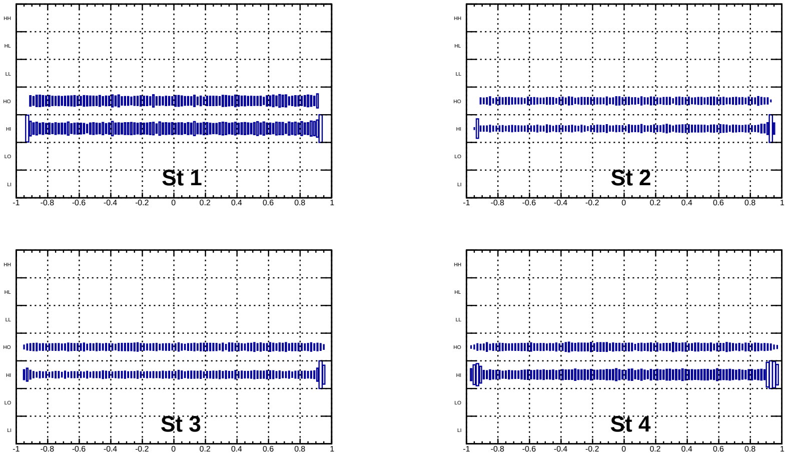
N primitives vs Chamber position vs Code by Station

Legacy



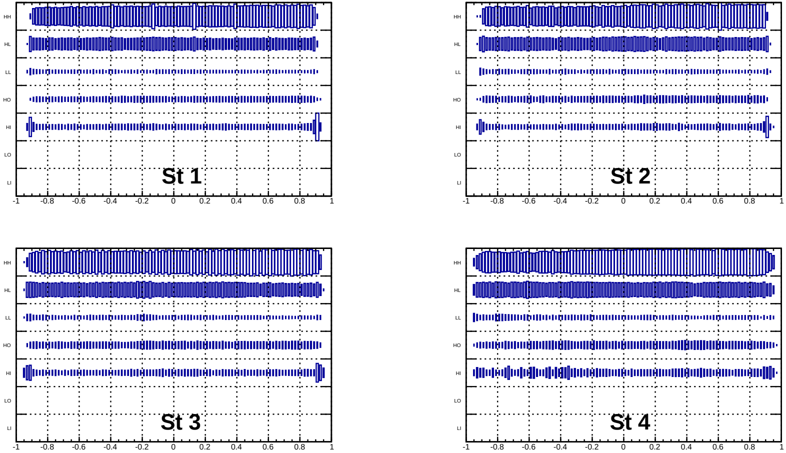
N primitives vs Chamber pos vs Code by Station vs nSL

Legacy n SL=1



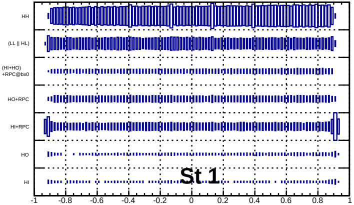
N primitives vs Chamber pos vs Code by Station vs nSL

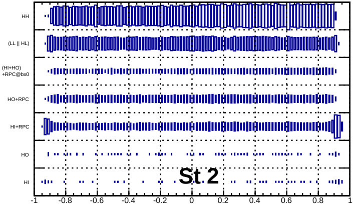
Legacy n SL=2

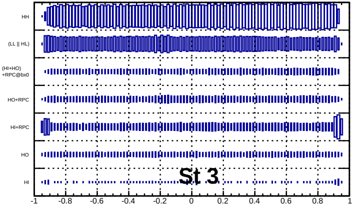


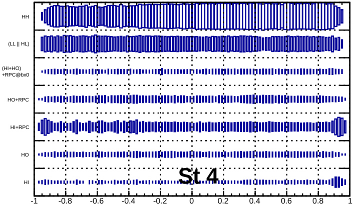
N primitives vs Chamber position vs Code by Station

New

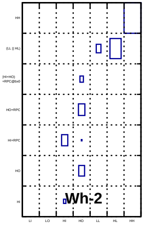


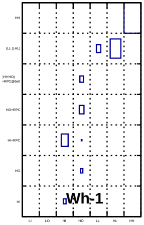


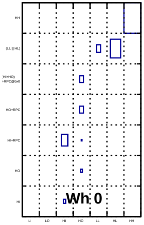


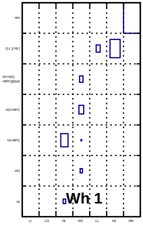


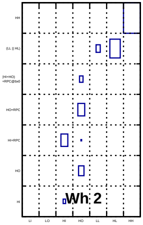
Quality code New vs Legacy by Wheel


HH
(LL || HL)
(HI+HO)
+RPC@bx0
HO+RPC
HI+RPC
HO
HI
LI
LO
HI
HO
LL
HL
HH
Wh-2


HH
(LL || HL)
(HI+HO)
+RPC@bx0
HO+RPC
HI+RPC
HO
HI
LI
LO
HI
HO
LL
HL
HH
Wh-1


HH
(LL || HL)
(HI+HO)
+RPC@bx0
HO+RPC
HI+RPC
HO
HI
LI
LO
HI
HO
LL
HL
HH
Wh 0


HH
(LL || HL)
(HI+HO)
+RPC@bx0
HO+RPC
HI+RPC
HO
HI
LI
LO
HI
HO
LL
HL
HH
Wh 1


HH
(LL || HL)
(HI+HO)
+RPC@bx0
HO+RPC
HI+RPC
HO
HI
LI
LO
HI
HO
LL
HL
HH
Wh 2