

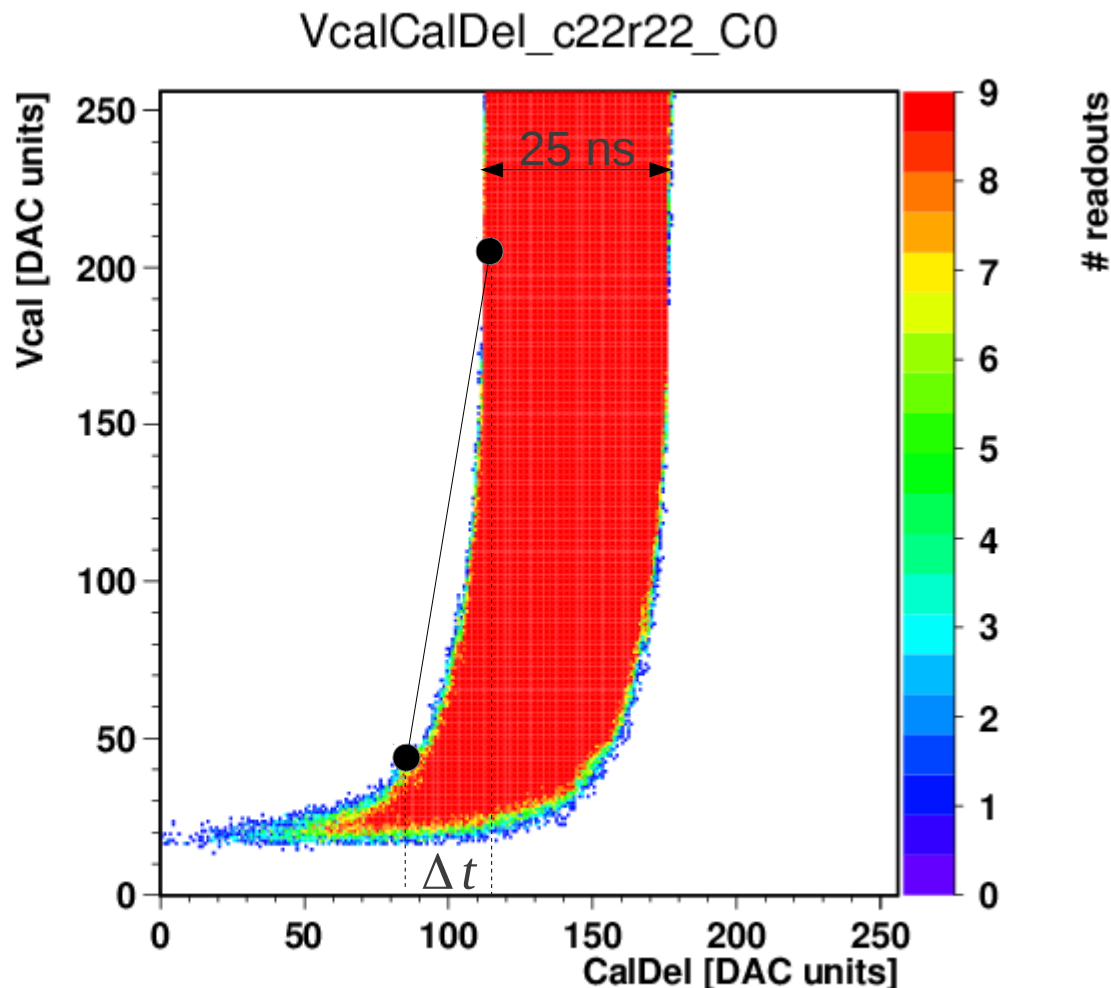
Timewalk studies

G. Dolinska, I.Korol, D. Pitzl

CMS phase 1 pixel upgrade, 16.11.2012

- new time walk test
- time walks for different chips
- comparisons

Tornado plot (chip214)

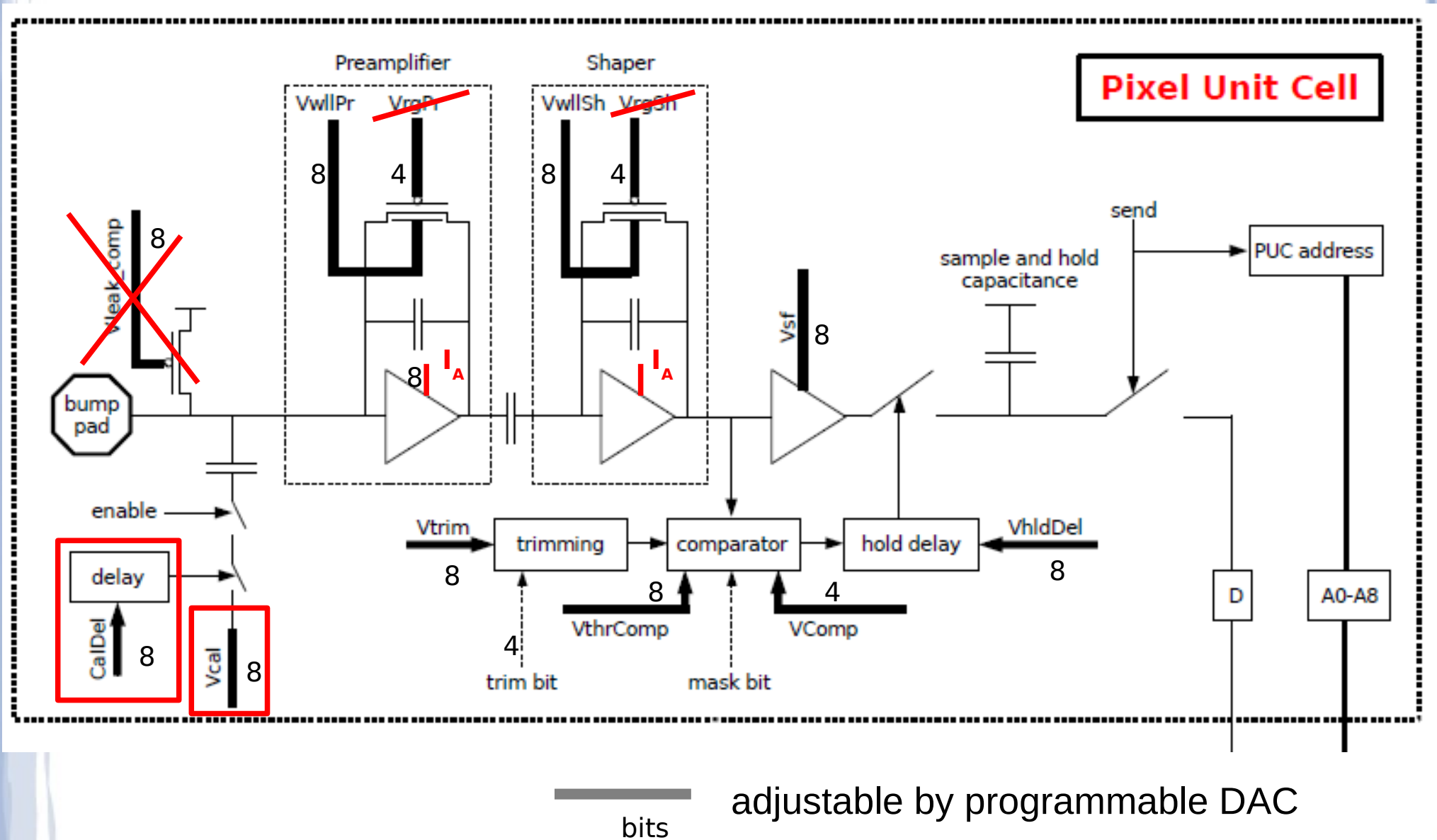


- ◆ Readout test vs Vcal and CalDel for chip214, c22 r22
- ◆ Width of active region = 25 ns (one clock cycle)
- ◆ Lower edge: threshold – 30 Vcal
- ◆ Small pulses need less delay: timewalk
- ◆ Goal: timewalk < 1 bunch crossing

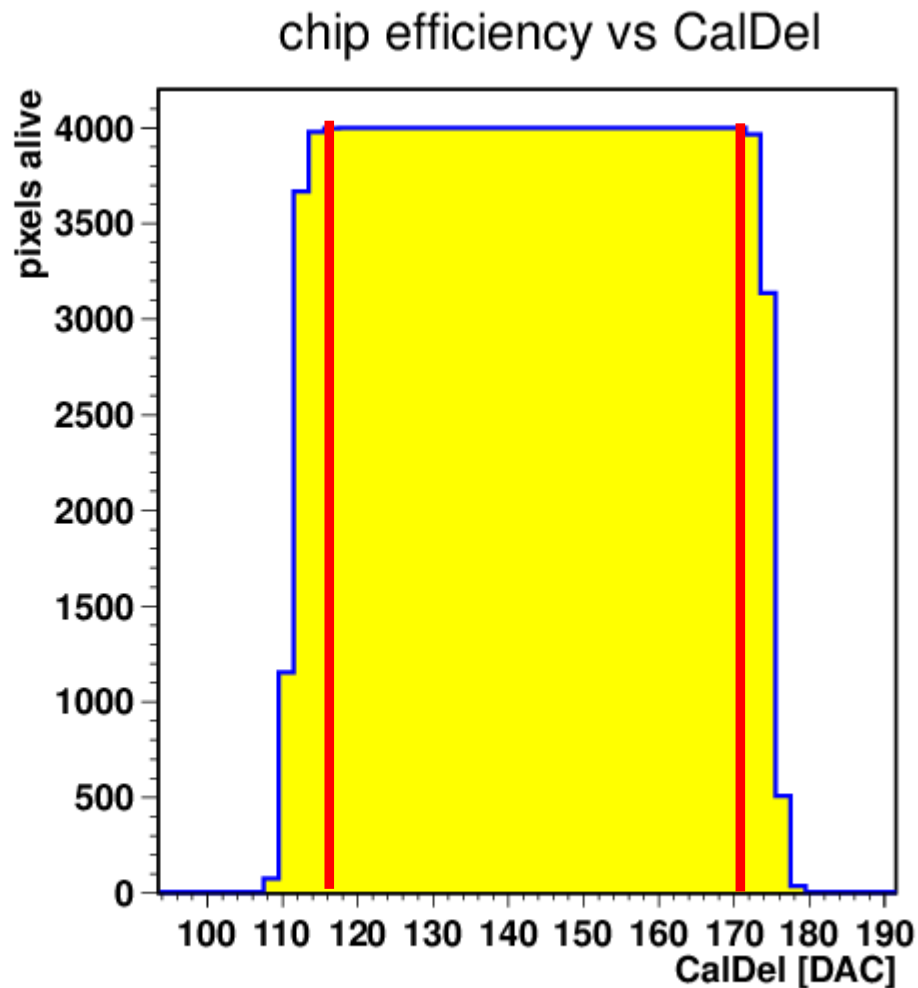
Mon Nov 5 14:31:17 2012

Our definition:
timewalk = left edge (Vcal 200) - left edge (Vcal 40)

psi46dig pixel unit cell



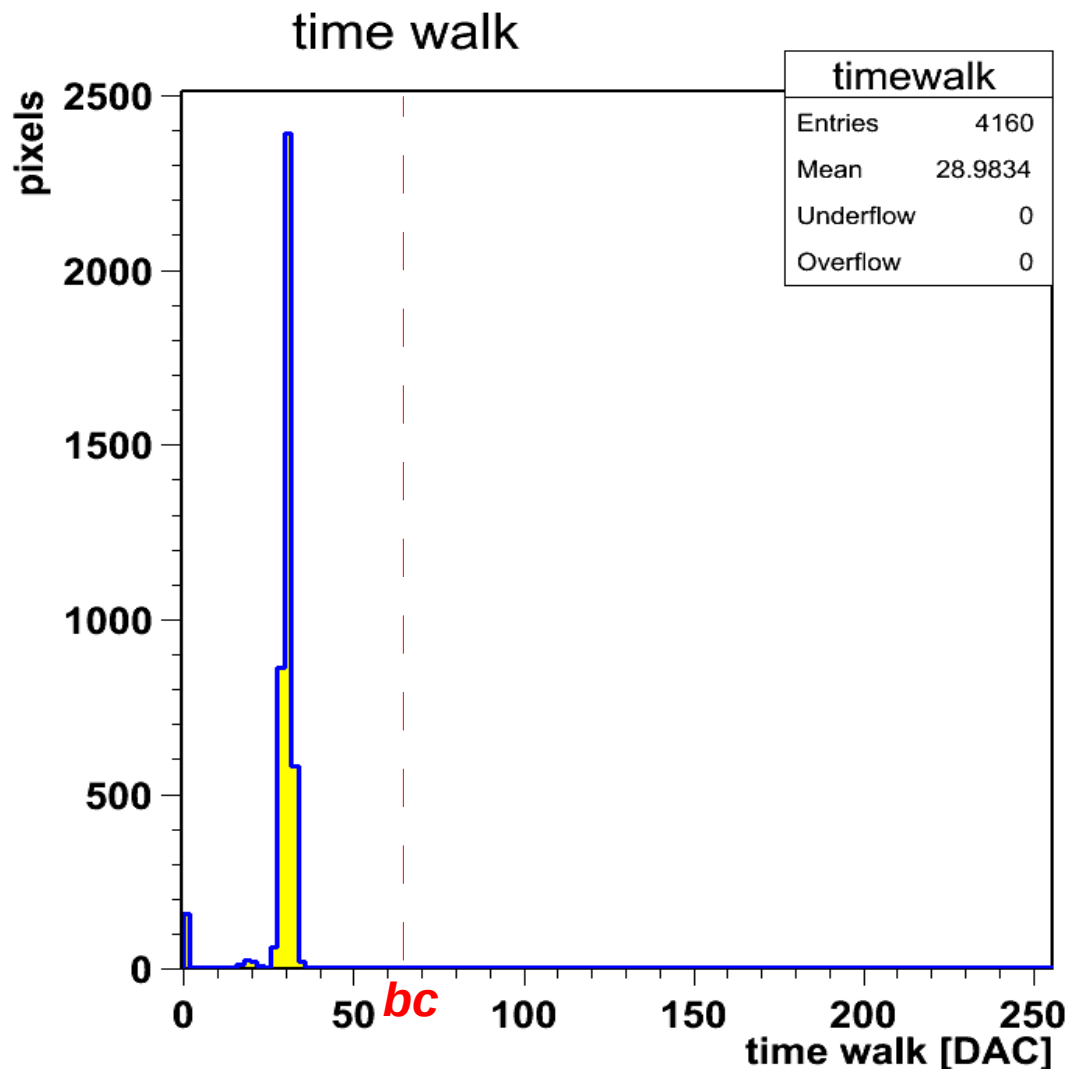
Chip efficiency vs CalDel (chip214)



Mon Nov 5 16:10:32 2012

- ♦ Chip214 (without sensor, 4000 good pixels)
- ♦ $V_{cal} = 200$ test pulse given to each pixel
- ♦ Vary test pulse delay:
66 DAC = 1 bunch crossing
- ♦ Efficiency = number of responding pixels
- ♦ New test: `effvscalDEL`
- ♦ Width of fully efficient region = 54 DAC = 0.8 bc
- ♦ Timing is uniform on this chip

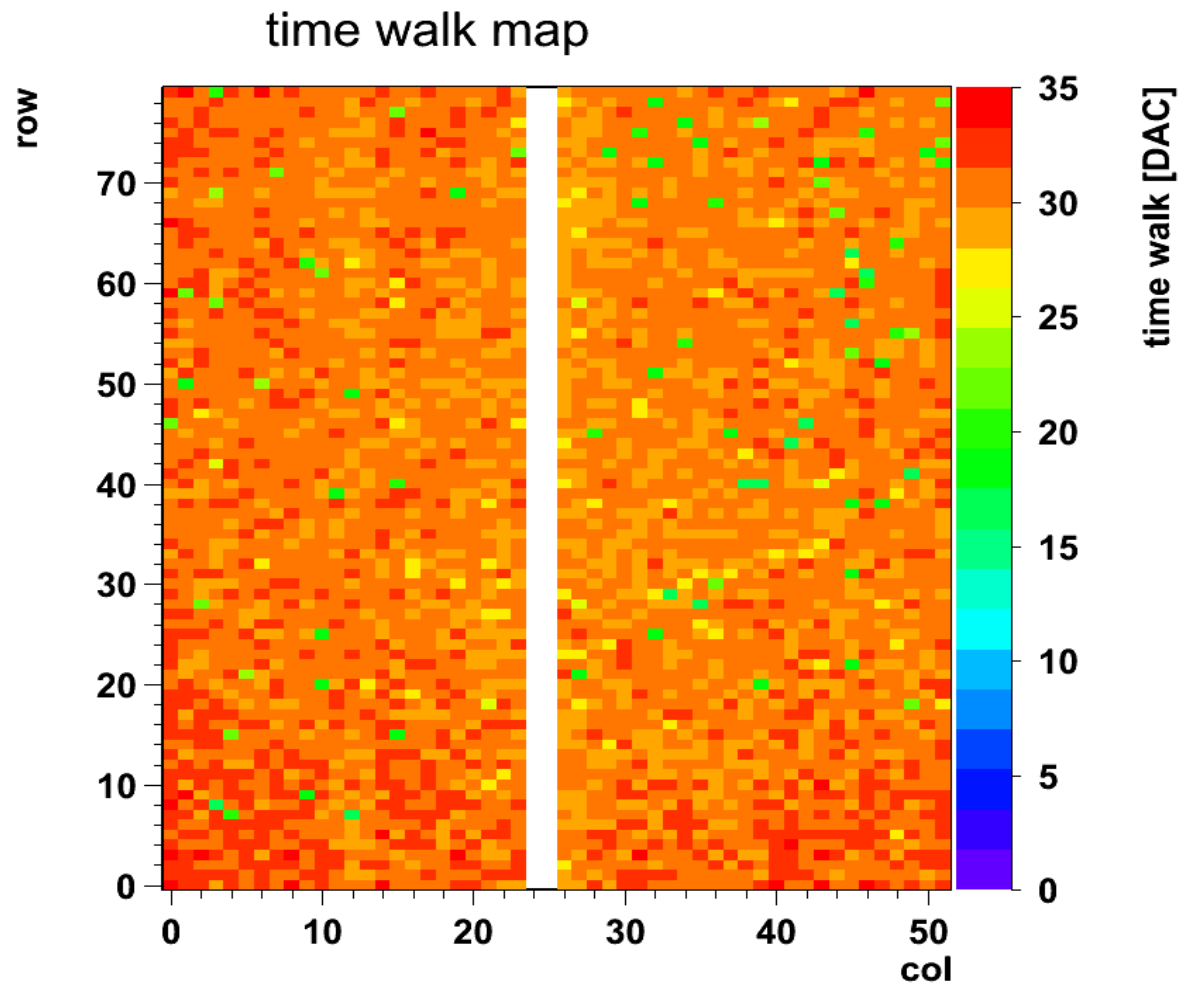
Time walk distribution (chip214)



- ♦ New test in psi46expert: timewalks
- ♦ 66 DAC units = 1 bc
- ♦ Chip214:
 - ♦ one dead double column (160 pixels)
 - ♦ **without sensor**
 - ♦ **old comparator design**
- ♦ Time walk distribution is sharp ~ 0.5 bc

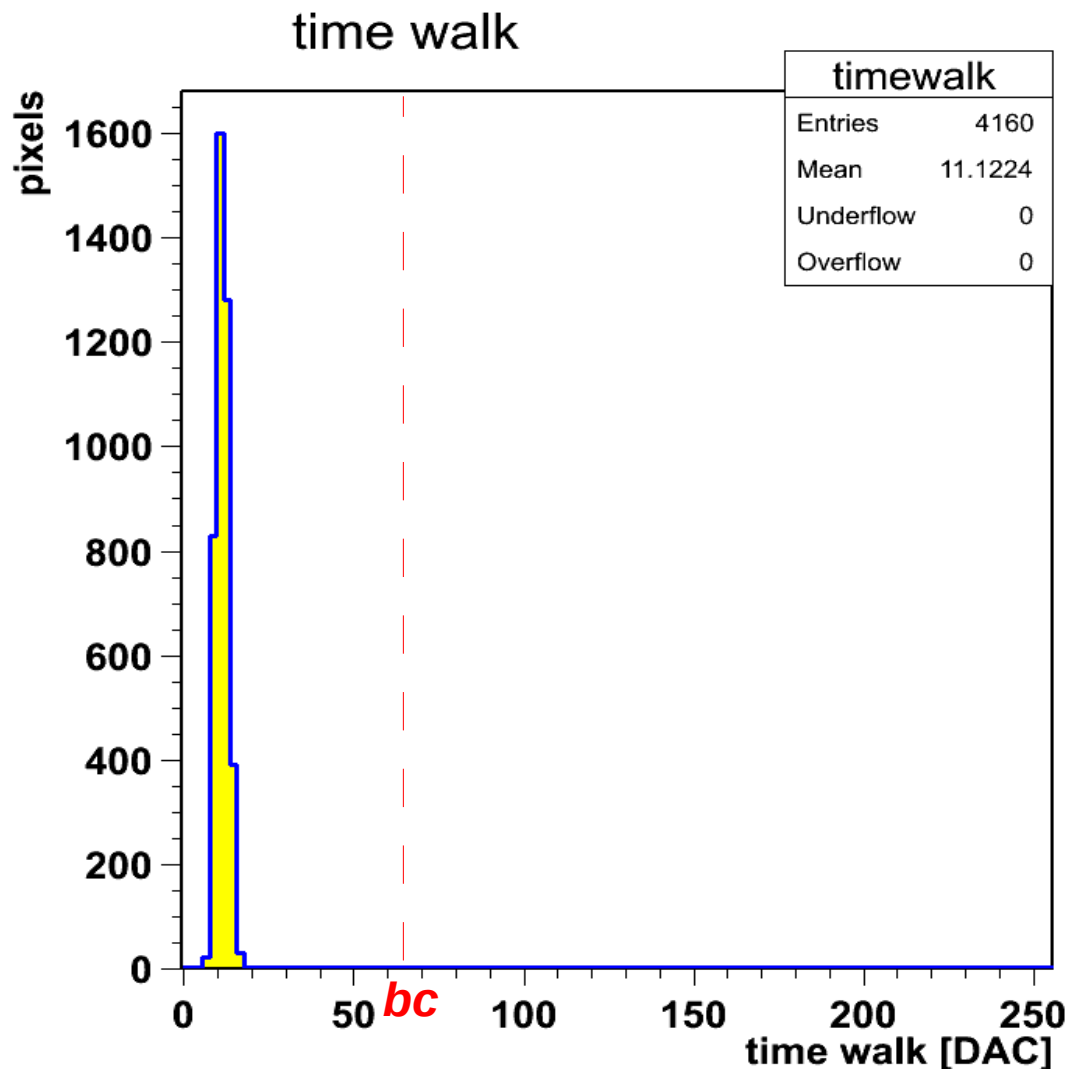
Fri Nov 9 11:33:19 2012

Time walk map (chip214)



Fri Nov 9 10:40:53 2012

Time walk distribution (chip204)

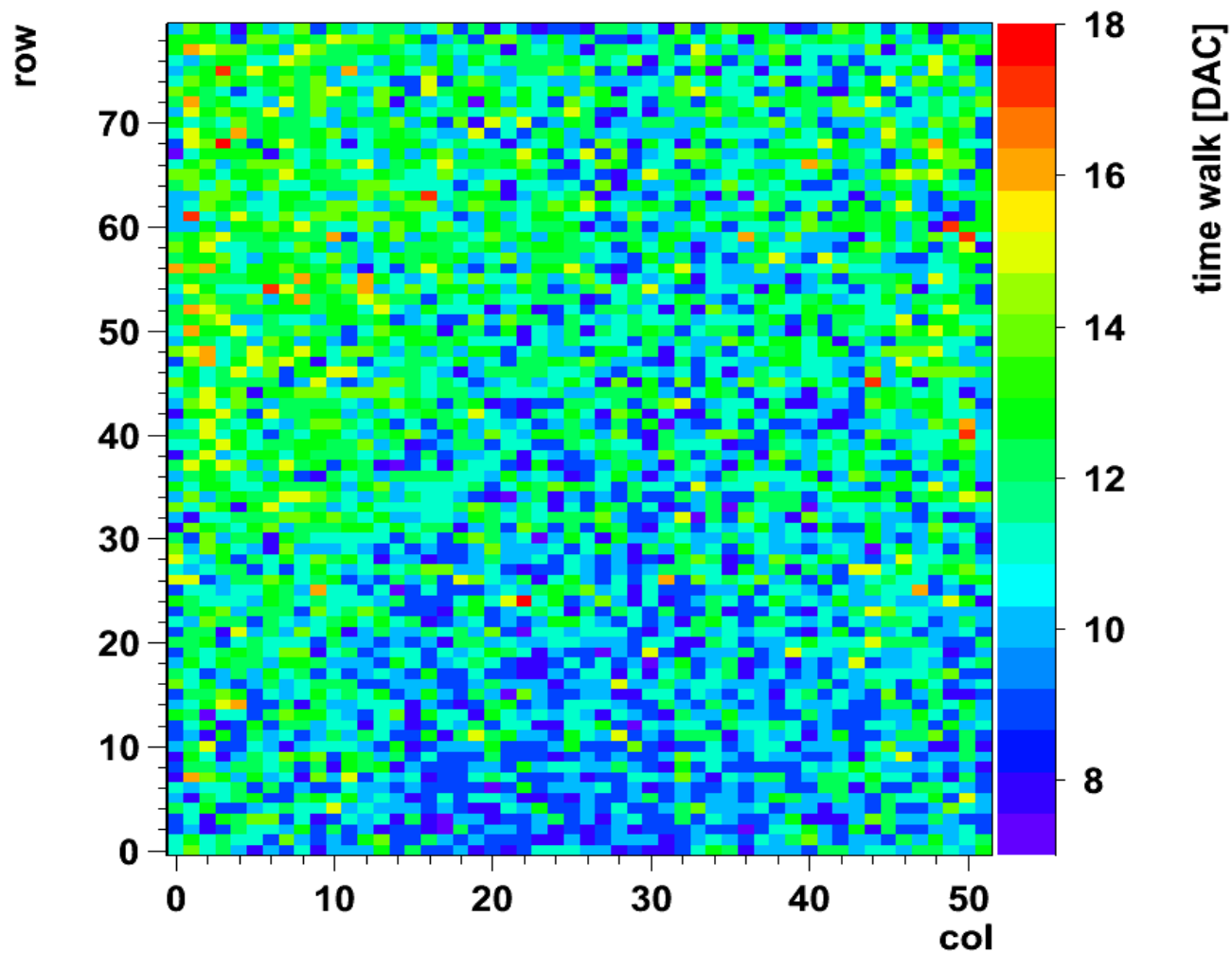


- ♦ Chip204:
 - ♦ no sensor
 - ♦ new comparator design
- ♦ Time walk distribution is sharp at 0.16 BC
- ♦
- ♦ New comparator design has factor 3 less time walk (without sensor)

Tue Nov 13 18:16:30 2012

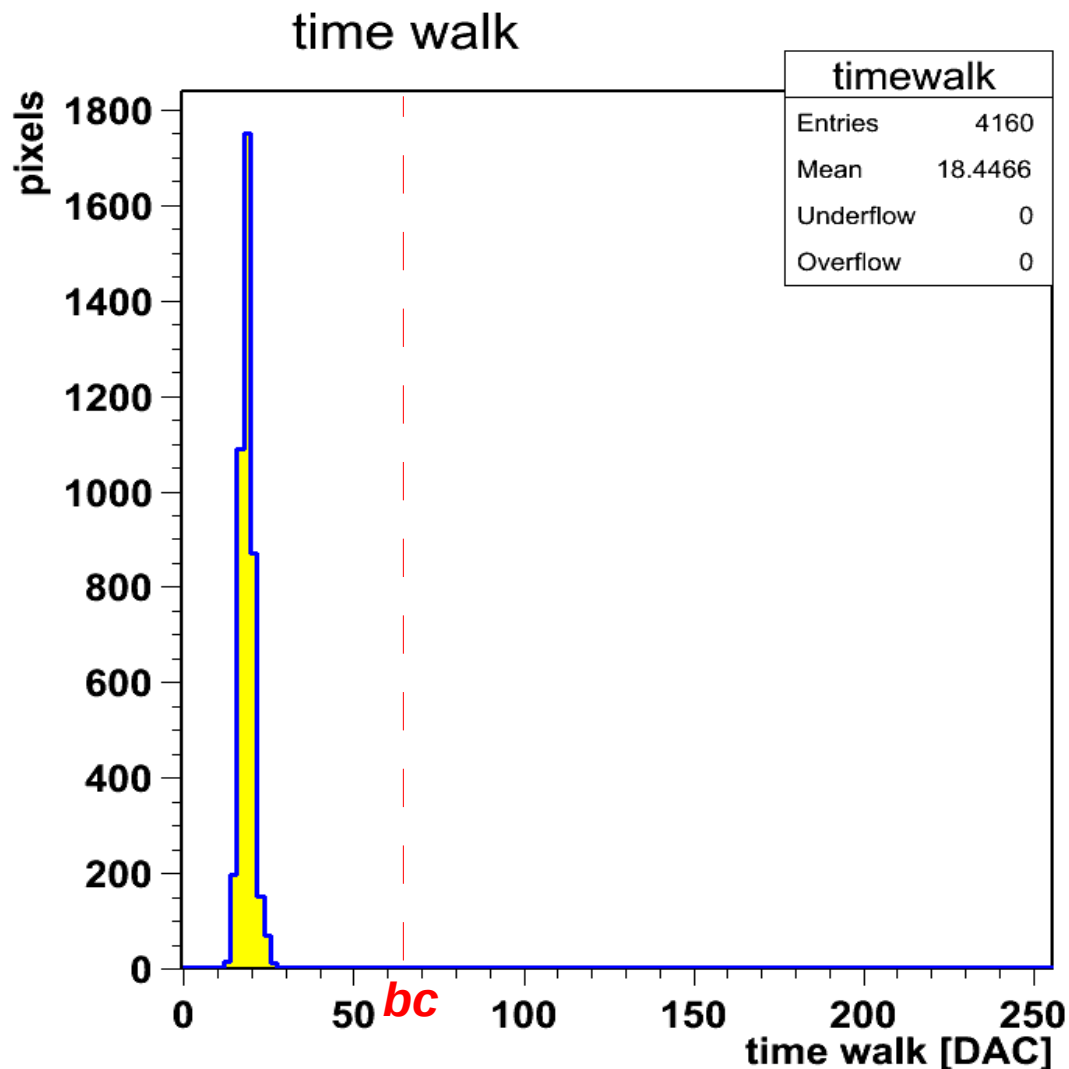
Time walk map (chip204)

time walk map



Tue Nov 13 18:13:45 2012

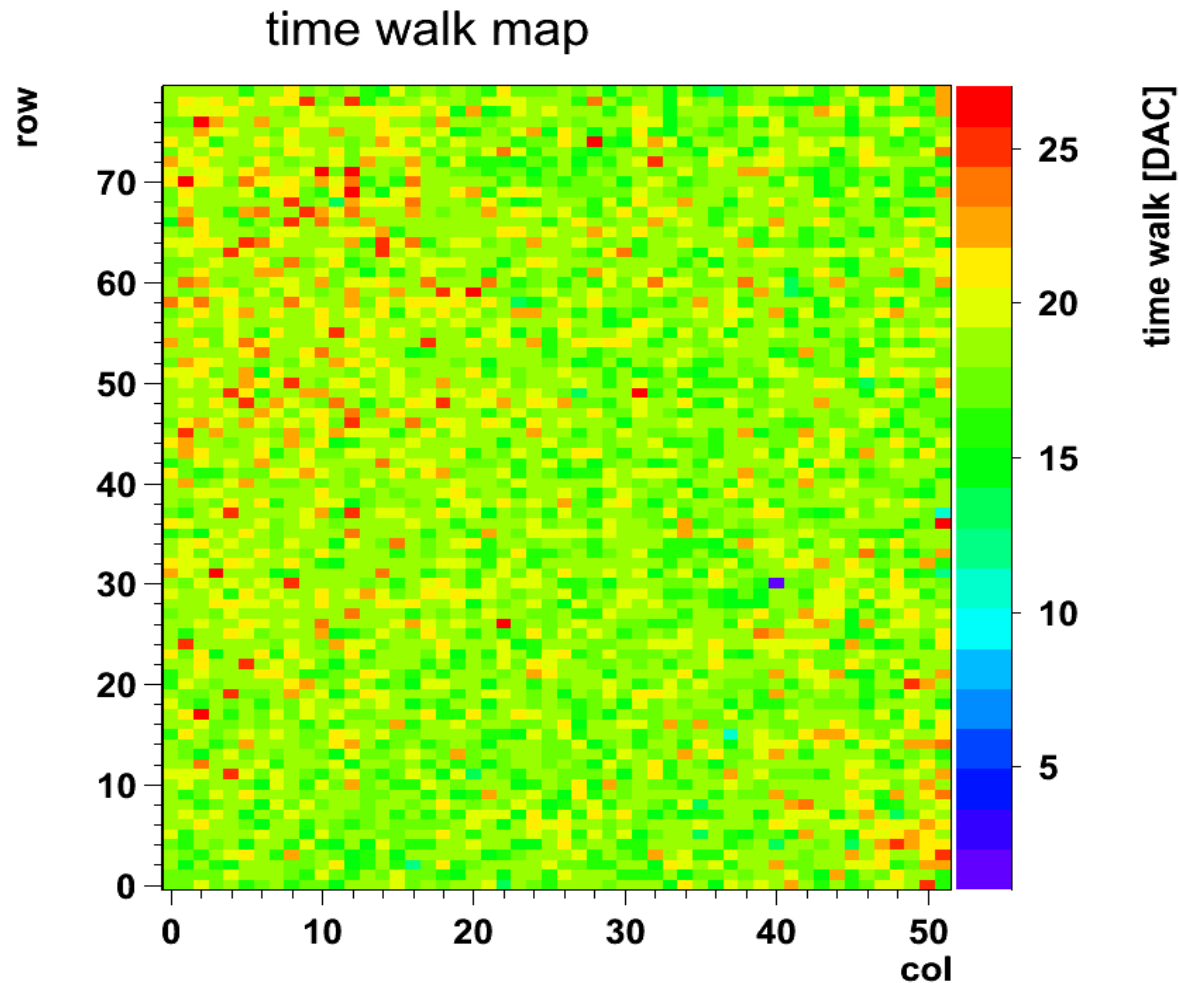
Time walk distribution (chip39)



- ♦ Chip39:
 - ♦ **with sensor**
 - ♦ **new comparator design**
- ♦ Medium $I_a = 35$ mA
- ♦ Time walk distribution is sharp at 0.3 BC
- ♦ Time walk with sensor is larger

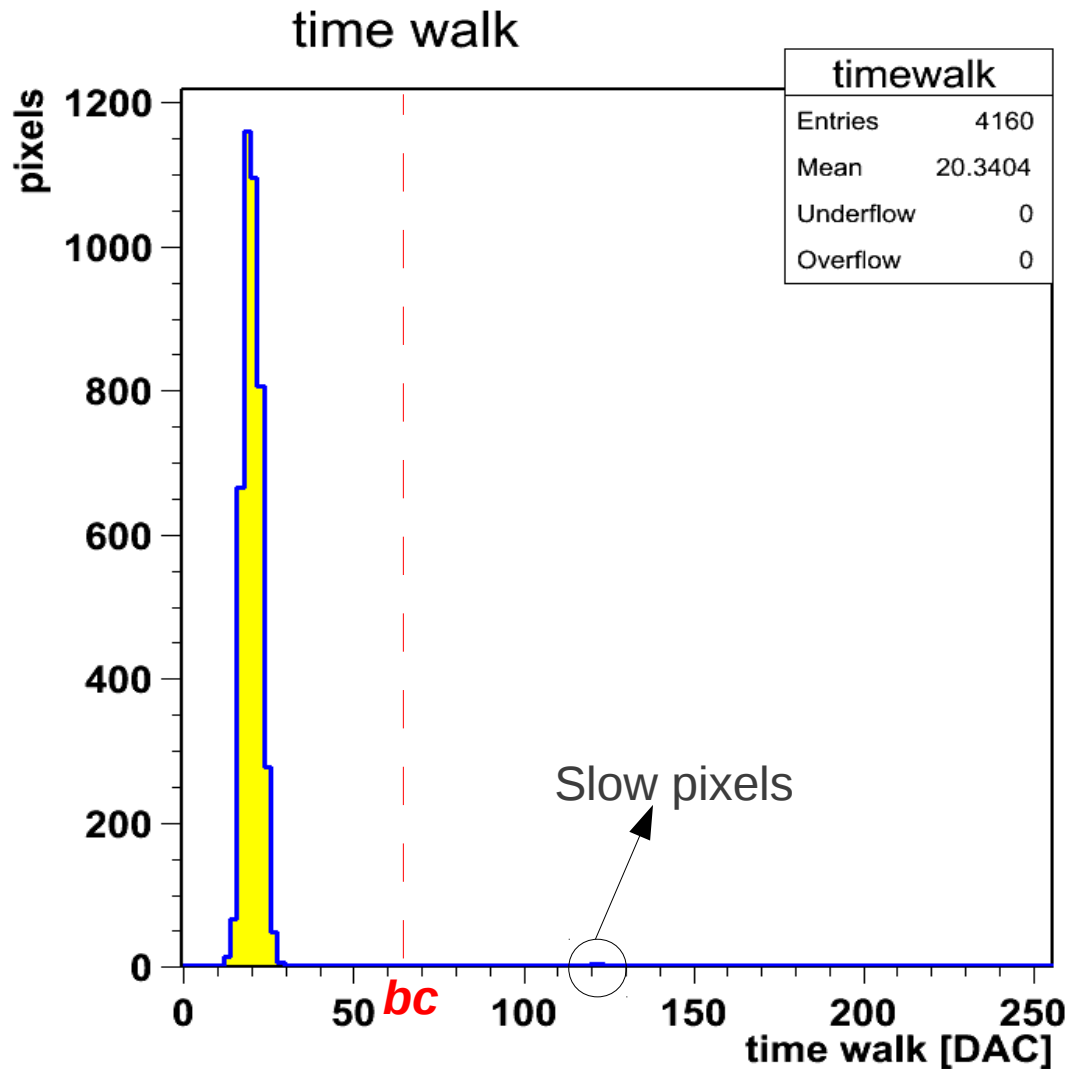
Tue Nov 13 17:36:38 2012

Time walk map (chip39)



Tue Nov 13 17:37:19 2012

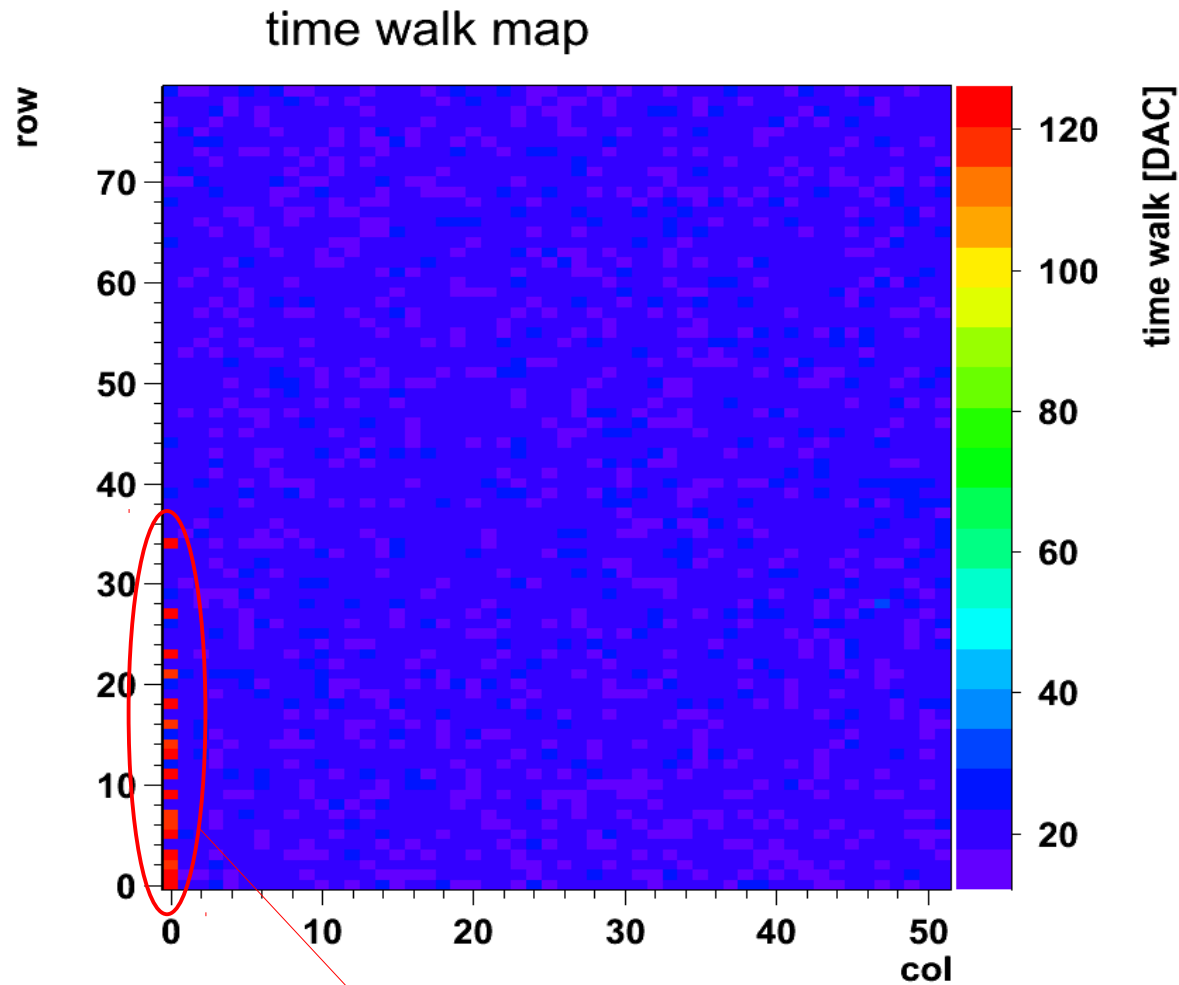
Time walk distribution (chip39)



- ♦ Chip39:
 - ♦ with sensor
 - ♦ New comparator design
- ♦ Higher $I_a = 40$ mA
- ♦ Time walk distribution is sharp at 0.31 BC
- ♦ A few slow pixels appear...
- ♦ Changing analog current has at most small influence on time walk.

Tue Nov 13 17:44:27 2012

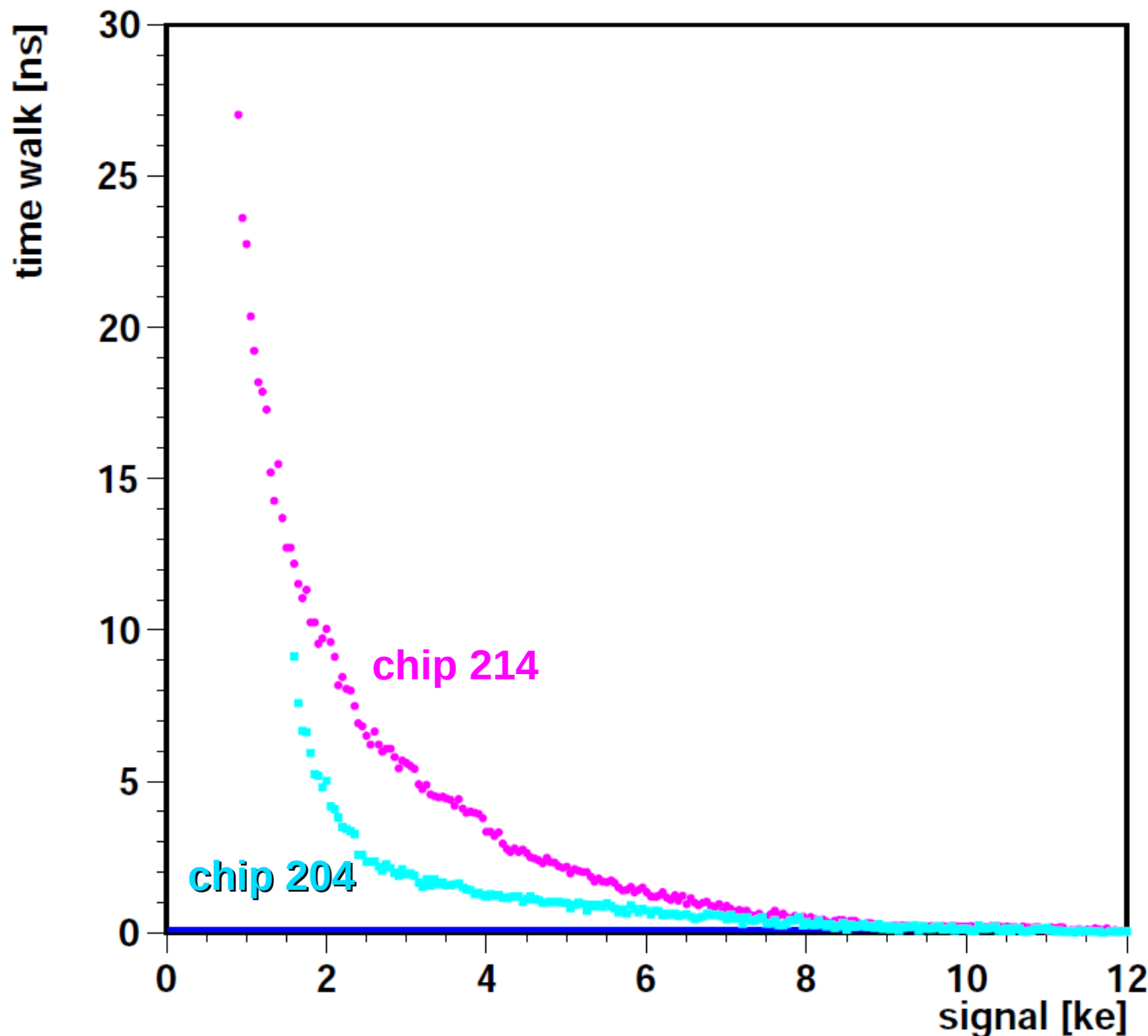
Time walk map (chip39)



Tue Nov 13 17:45:01 2012

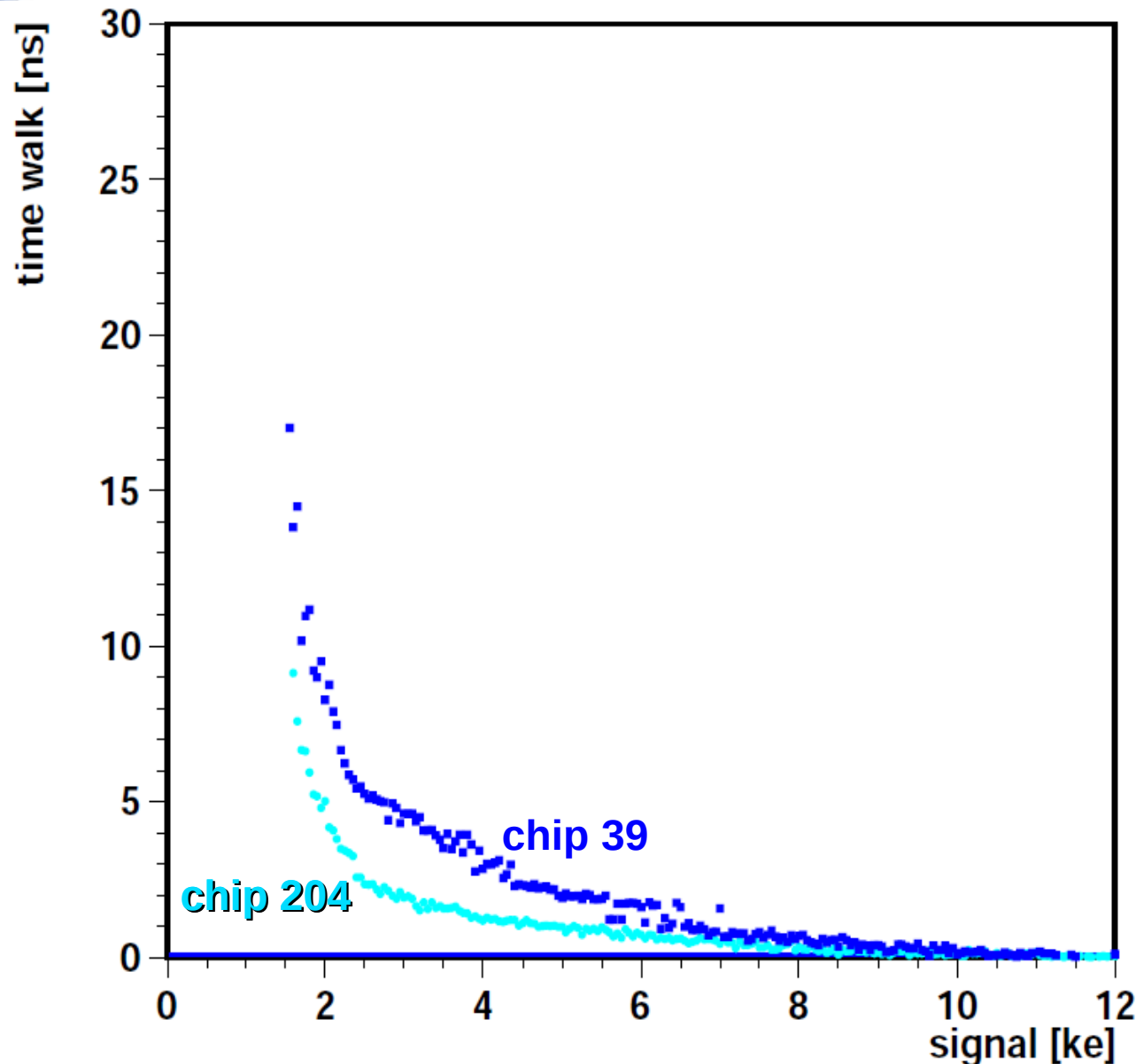
Slow pixels

Compare time walk



- psi46dig chip 214
 - no sensor
 - old comparator design
 - pixel (11, 23)
 - trim 30
 - time walk reaches 1 BC for smallest pulses.
- psi46dig chip 204
 - ▶ no sensor
 - ▶ new comparator design
 - ▶ pixel (22, 22)
 - ▶ trim 30
 - ▶ time walk less than 1 BC even at smallest pulses.

Compare time walk



- psi46dig chip 39:
 - **with sensor**
 - new comparator design
 - pixel (22, 22)
 - trim 30
 - time walk less then 1 BC
- psi46dig chip 204
 - ▶ **no sensor**
 - ▶ new comparator design
 - ▶ pixel (22, 22)
 - ▶ trim 30
 - ▶ time walk less than 1 BC

Summary

- New time walk test was applied to three different chips:
 - ▶ chip214 (old comparator design) shows the largest time walk (reaches more than one BC)
 - ▶ chips with new comparator design do not reach one BC
 - ▶ chip with sensor has a larger time walk than chip without sensor
- Plan:
 - ▶ re-measure after irradiation (soon)
 - ▶ measure with DESY bump bonding (next year)

Back up