# *Sector-by-sector beam loss observations*

D. Mirarchi, S. Redaelli

for the LHC Collimation team

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# Introduction

- Follow up of studies presented at e-cloud meeting #25.
- Main aim:
  - ✓ try to find **correlations** between **loss pattern** and **heat load** along the machine
- Main analysis performed:
  - ✓ **Integrated losses in each sector** during the cycle
  - ✓ For “interesting” sector: **integrated losses in each CELL** during the cycle
  - ✓ **Integrated losses** in stable beams **normalized w.r.t. background** level
- Only **IC BLMs** on **MQ** and **MB** are considered, with **1.3s** integration time
- Set of **12 fills** taken into account: all fills with stable beams >12h from 13/6 to 10/7

# Integrated losses in each sector

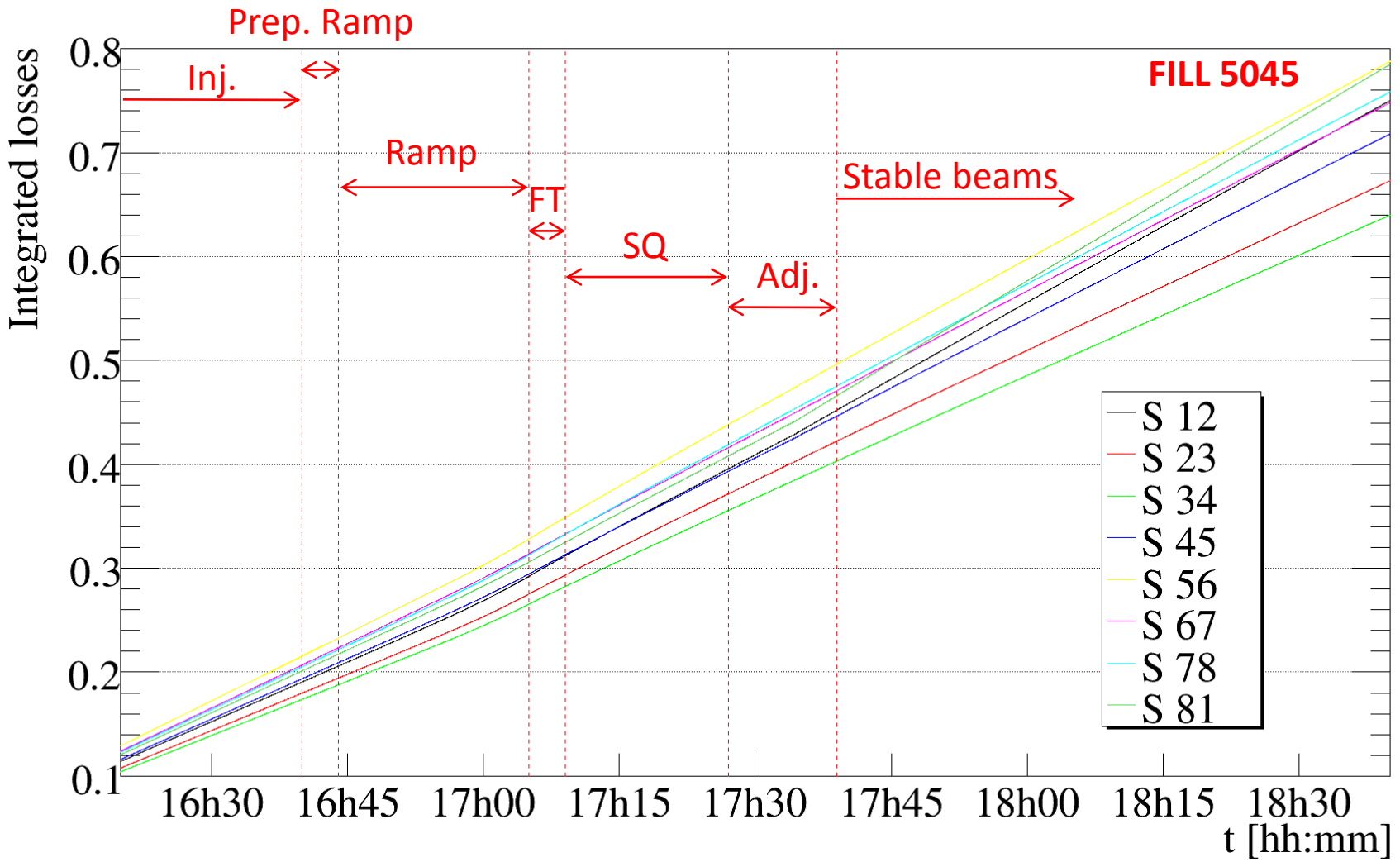
- Sector defined as: ***from C14.R# to C14.L#+1***

- Losses on MQ and/or MB integrated **from injection until few hours in stable beams**
  - **Decoupled losses on MQ and MB**

- **Changes of loss rate observed in all fills**
  - Reported here only the **5045 as example**

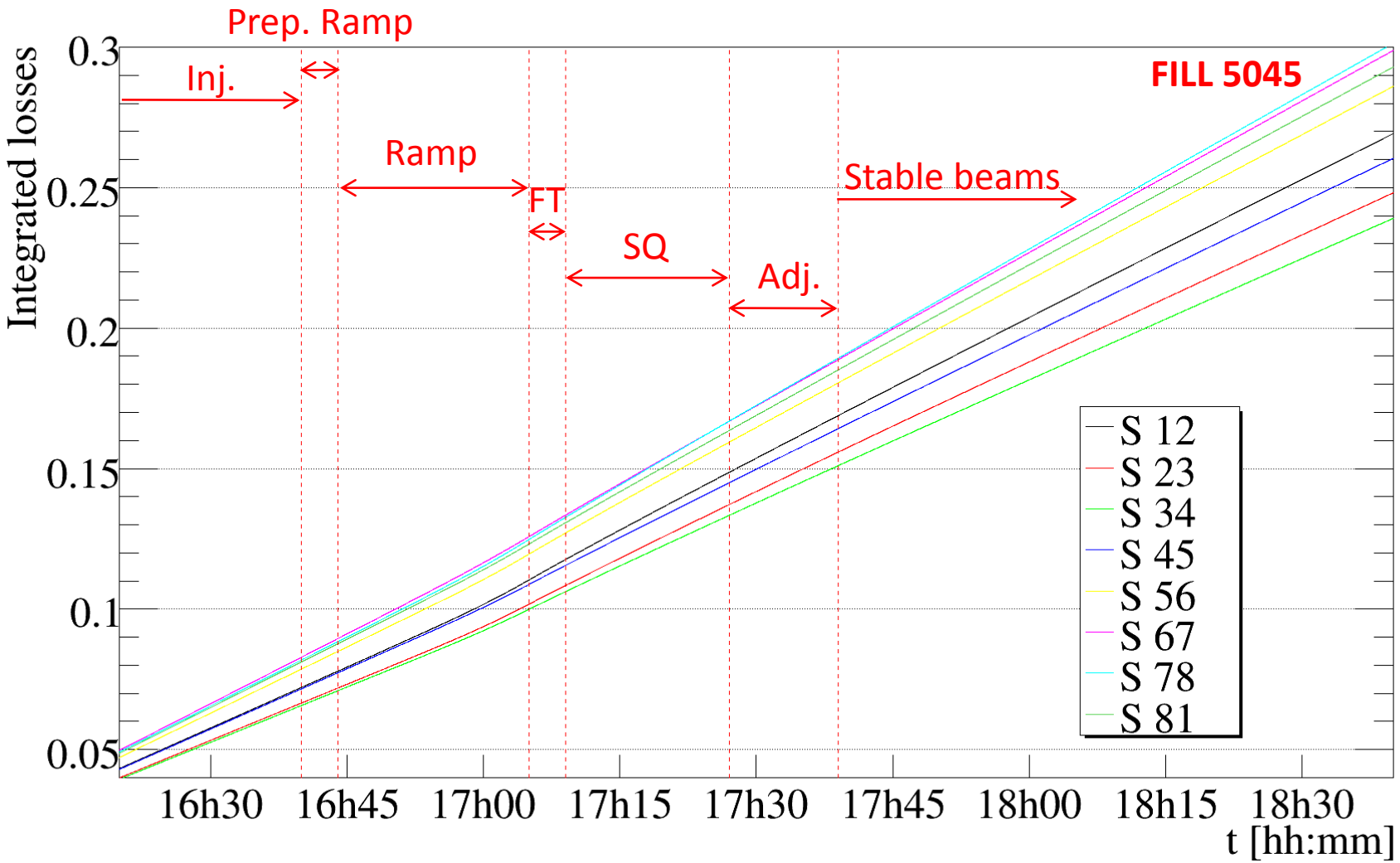
- For interesting sector performed **same analysis but cell by cell**
  - Reported here only the **cells where change on loss rate is present**
  - **Decoupled also B1 and B2**

# Integrated losses SECTOR (MQ & MB)



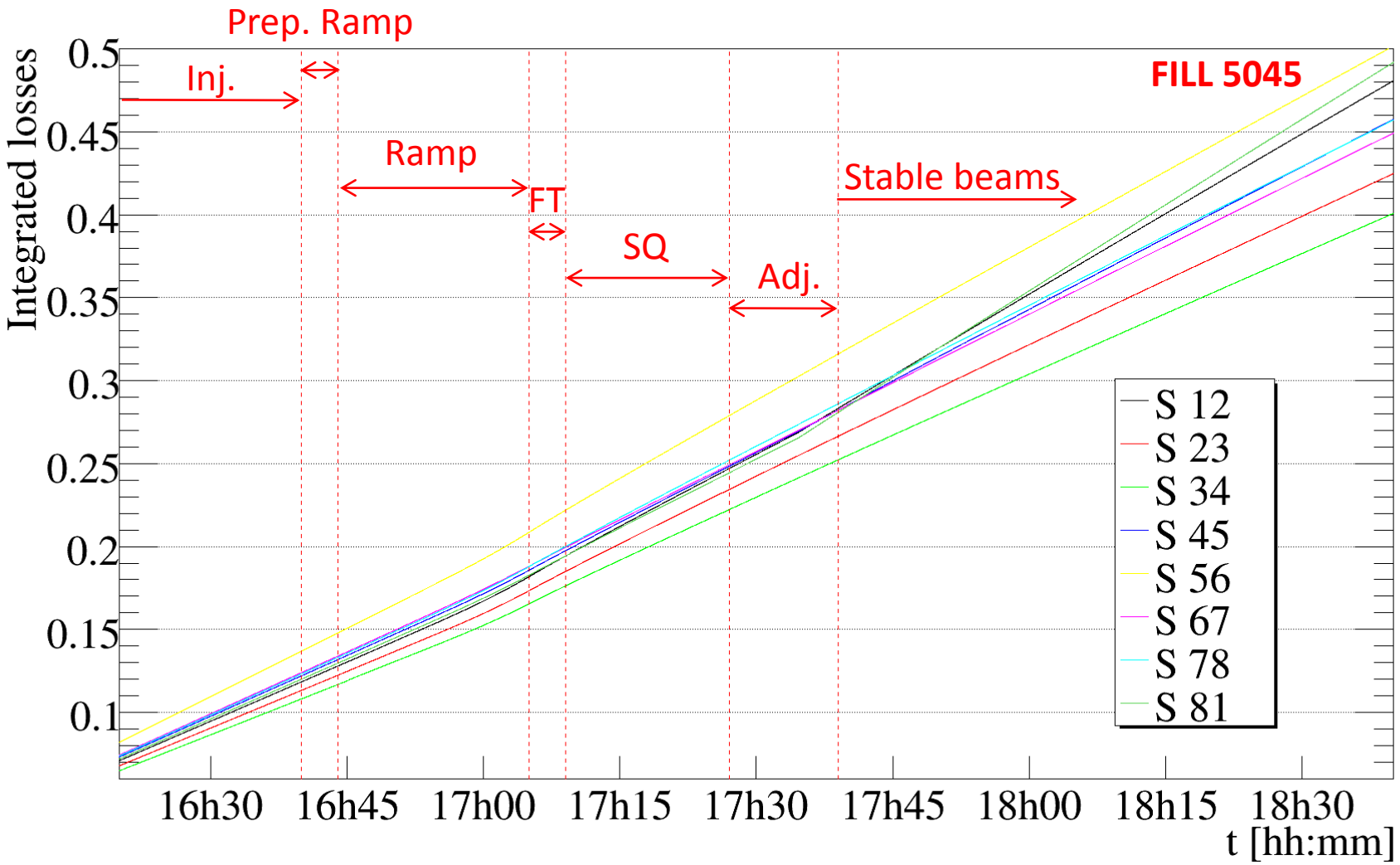

- ✓ *Change of loss rate at end of ramp in about all S: S 12 most significant increase (as in 2015)*
- ✓ *Change of loss rate in Adj. in S 12 & 81: S 81 most significant increase (new feature)*

# Integrated losses SECTOR (only MB)




- ✓ *Change of loss rate at end of ramp in about all S: S 12 most significant increase*
- ✓ *Stable loss rate in Adj.*

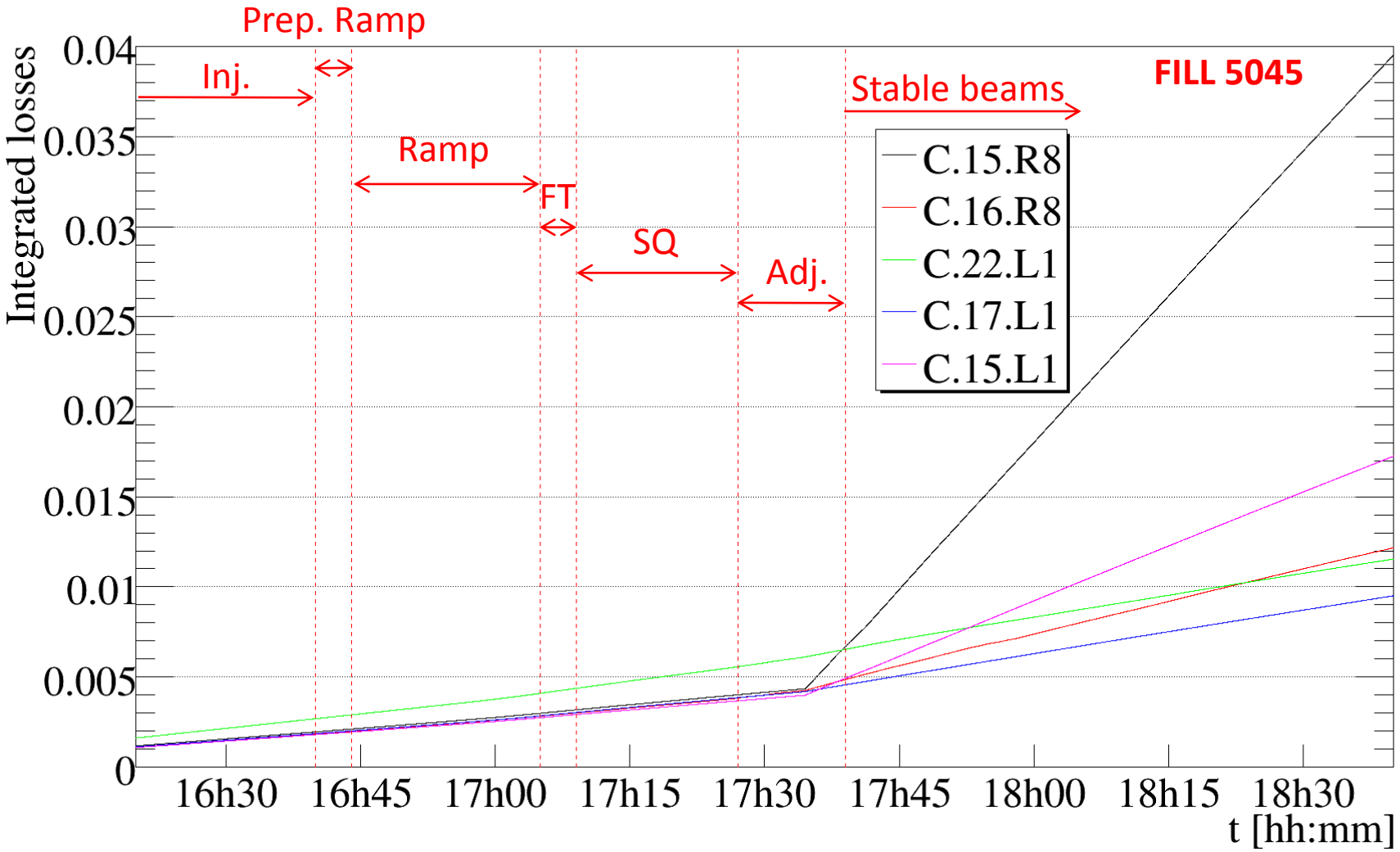
# Integrated losses SECTOR (only MQ)




- ✓ *Still visible change of slope at end of ramp*
- ✓ *Significant change of loss rate in S 81 when going in collision*

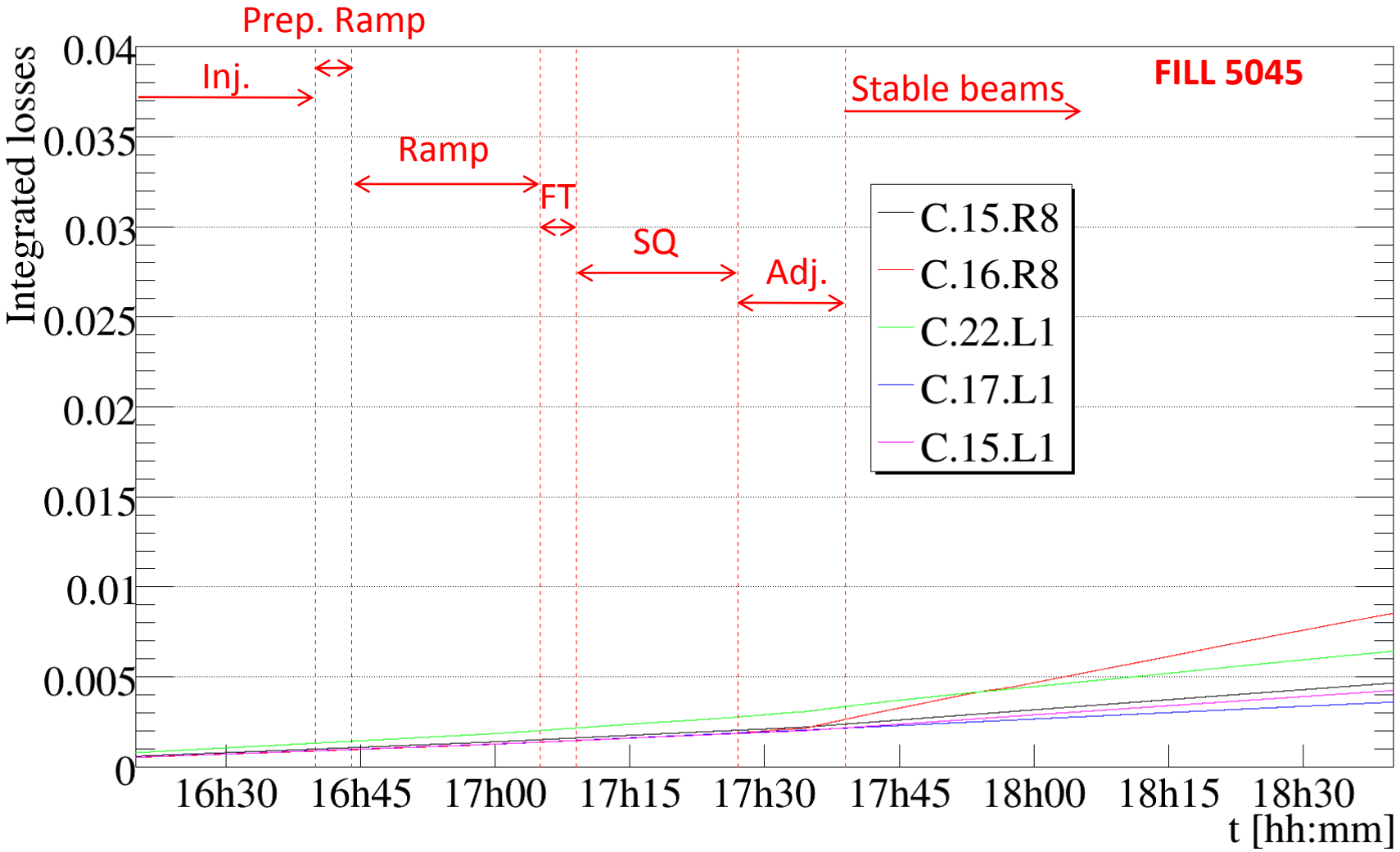
# Integrated losses CELL (only MQ)

- *Change of loss rate in S 81 due to losses on MQ, cell by cell analysis show such change in cells:*



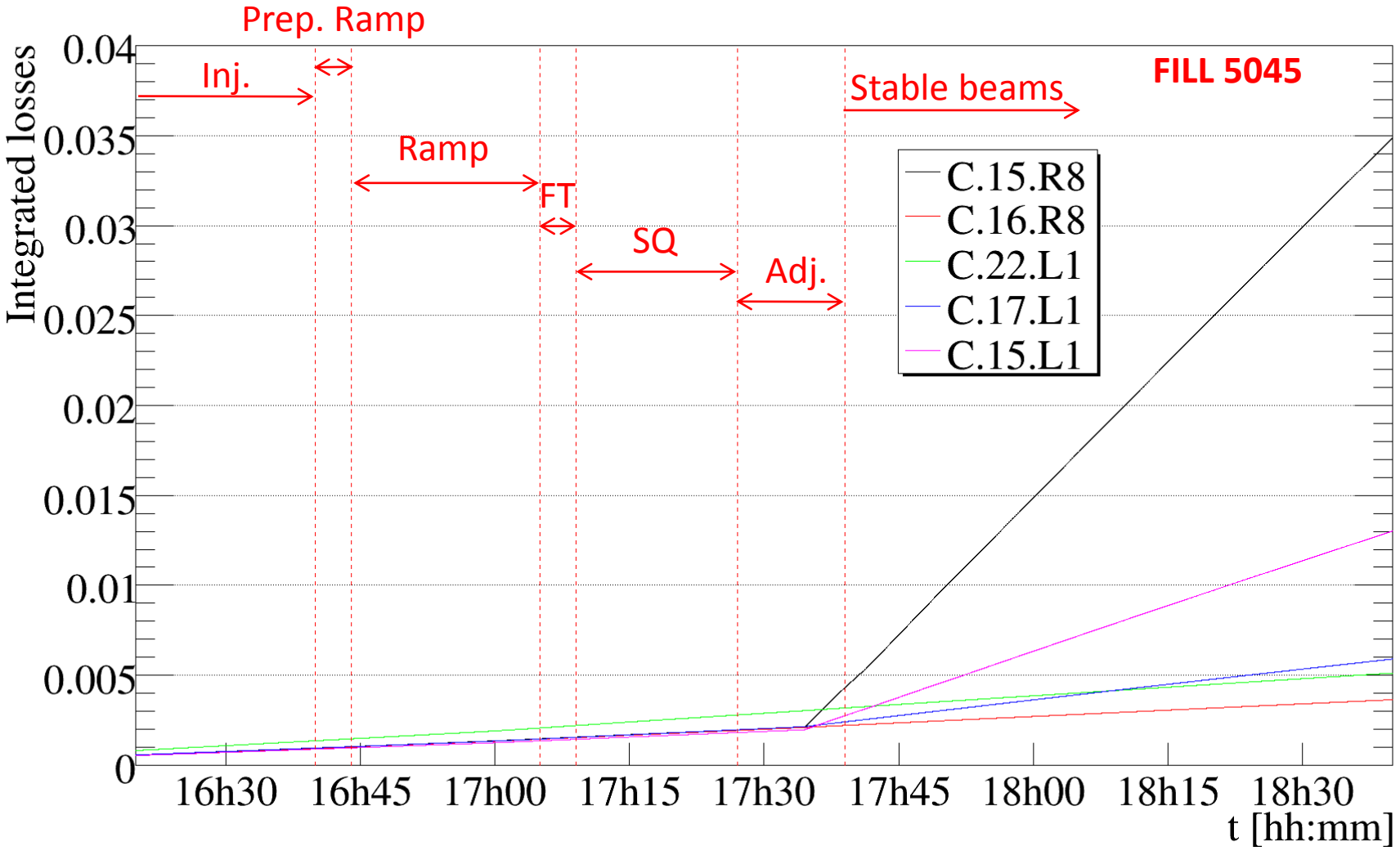
# Integrated losses CELL (only MQ.B1)

✓ Change of loss rate on Q16R8 and Q22L1 comes from Beam 1 losses



# Integrated losses CELL (only MQ.B2)

✓ Change of loss rate on Q15R8 (ULO), Q15L1 and Q17L1 comes from Beam 2 losses



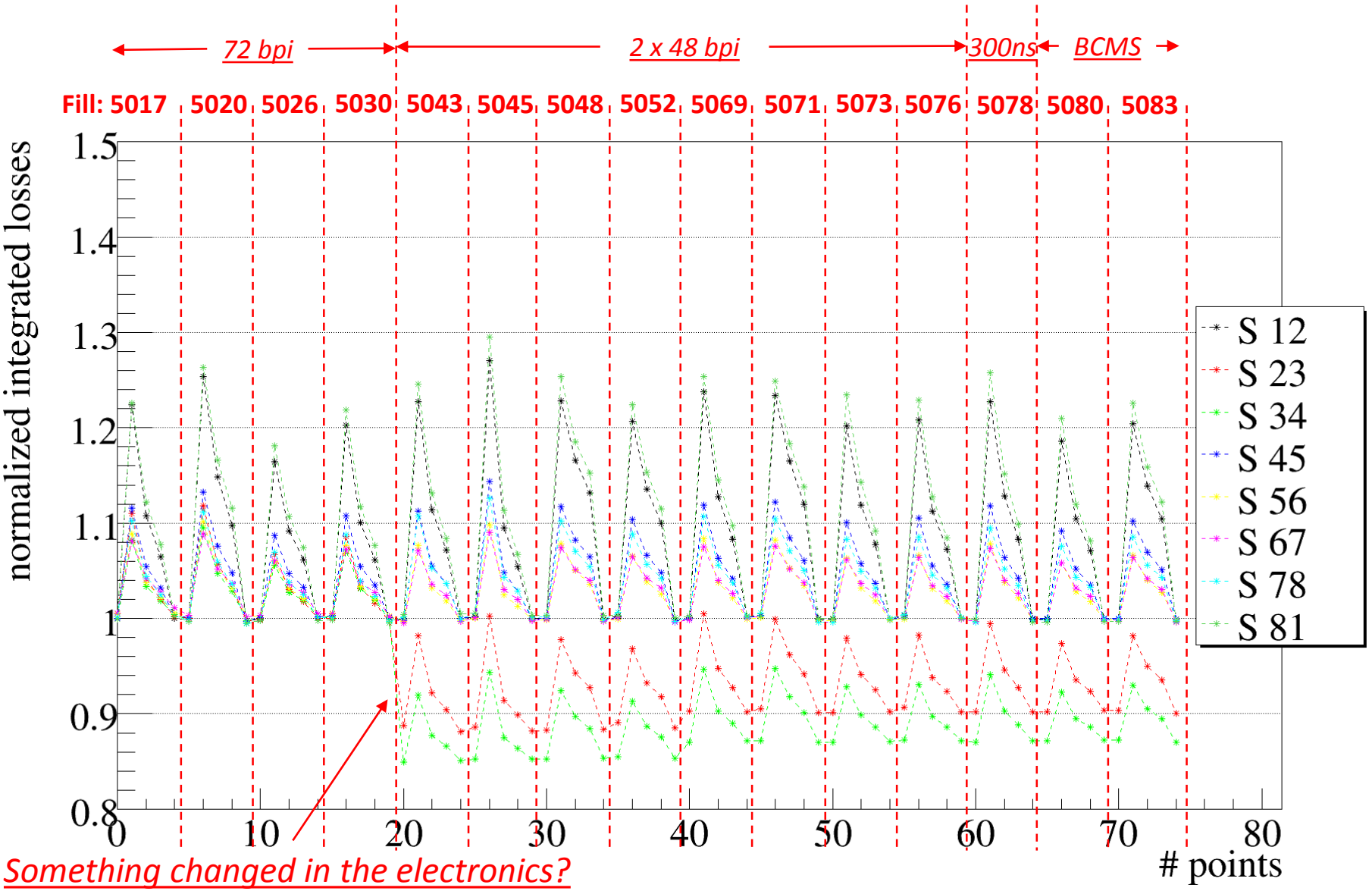
# Normalized losses

- **Losses** in each sector **integrated over 1h in 5 points** of each fill:
  - ✓ 1 right **before/after** the **Inj./dump** → *Background level*
  - ✓ 1 starting **after ~30min in Stable Beams**
  - ✓ 1 in the **middle of Stable Beams** duration
  - ✓ 1 ending **~10min before dump**

- All points **normalized to average background** in each sector
  - → Plot that can be compared directly w.r.t. heat loads from Gianni

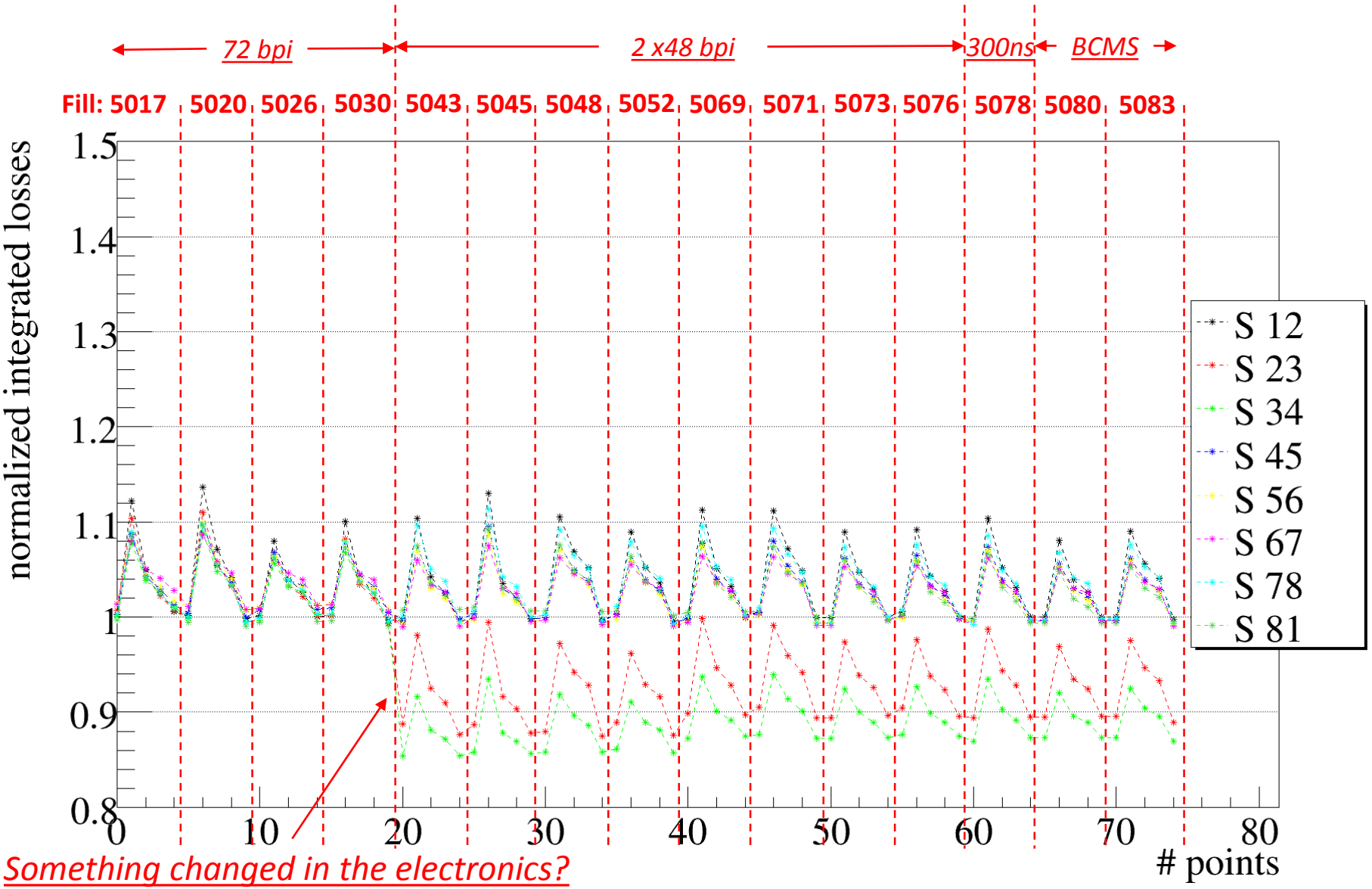
# Normalized losses (MQ & MB)

*First and last points refer to bkg without beam, and the other three are in stable beams*



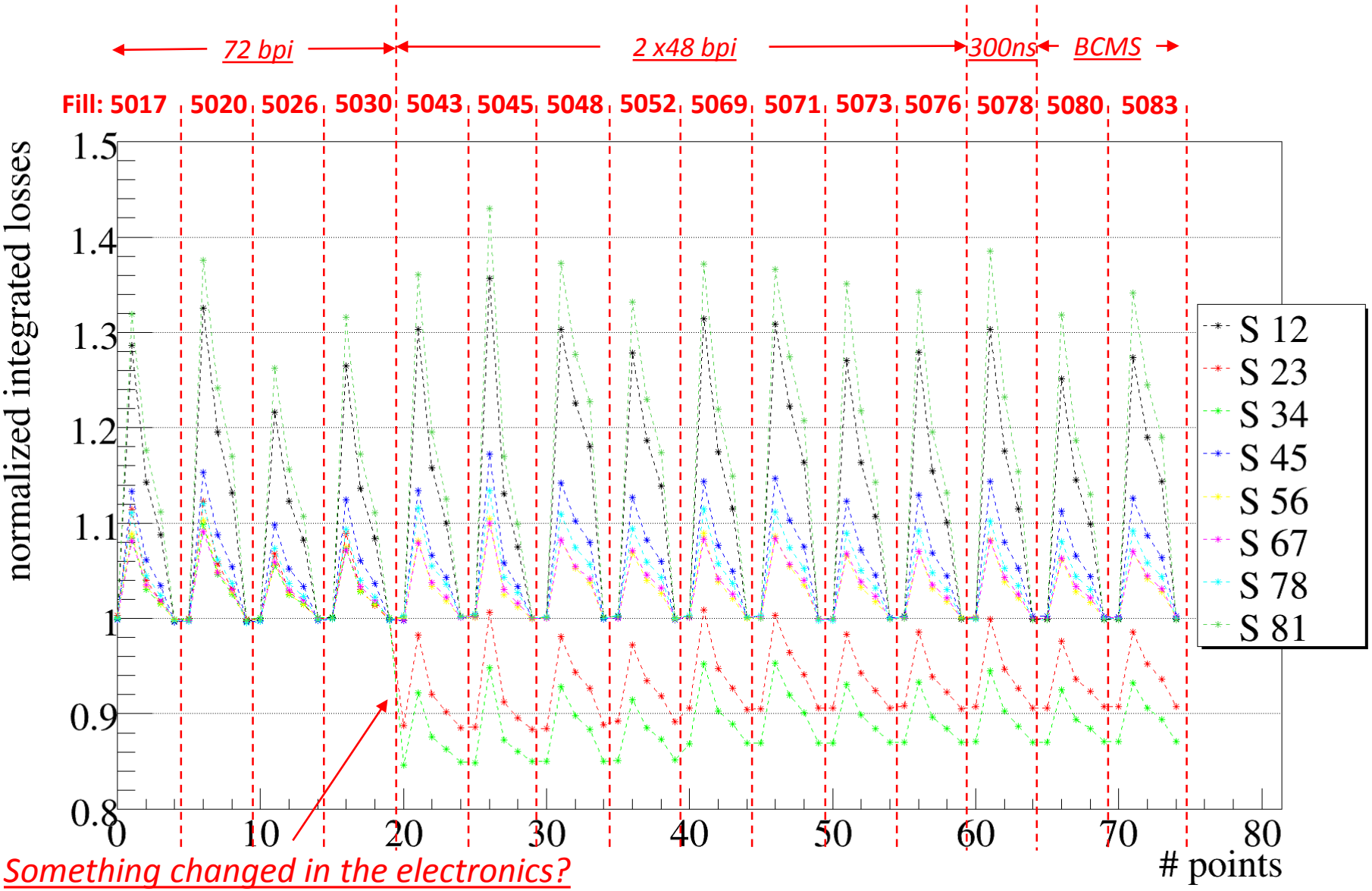
# Normalized losses (only MB)

*First and last points refer to bkg without beam, and the other three are in stable beams*



# Normalized losses (only MQ)

*First and last points refer to bkg without beam, and the other three are in stable beams*



# Conclusions

- **Changes of loss rate** in all the 12 fills analysed (with different filling scheme) observed:
  - ✓ *At end of ramp in about all S: S 12 most significant increase (as in 2015)*
  - ✓ *In Adj. in S 12 & 81 : S 81 most significant increase (new feature)* → Due to losses on MQ

- **Cell by Cell analysis in S 81** show that change of loss rate in Adj. is only visible on:
  - ✓ Q16R8 and Q22L1 coming from Beam 1 losses
  - ✓ Q15R8 (ULO), Q15L1 and Q17L1 coming from Beam 2 losses

- Normalized losses show a **"hierarchy" of losses** in each sector during stable beam:

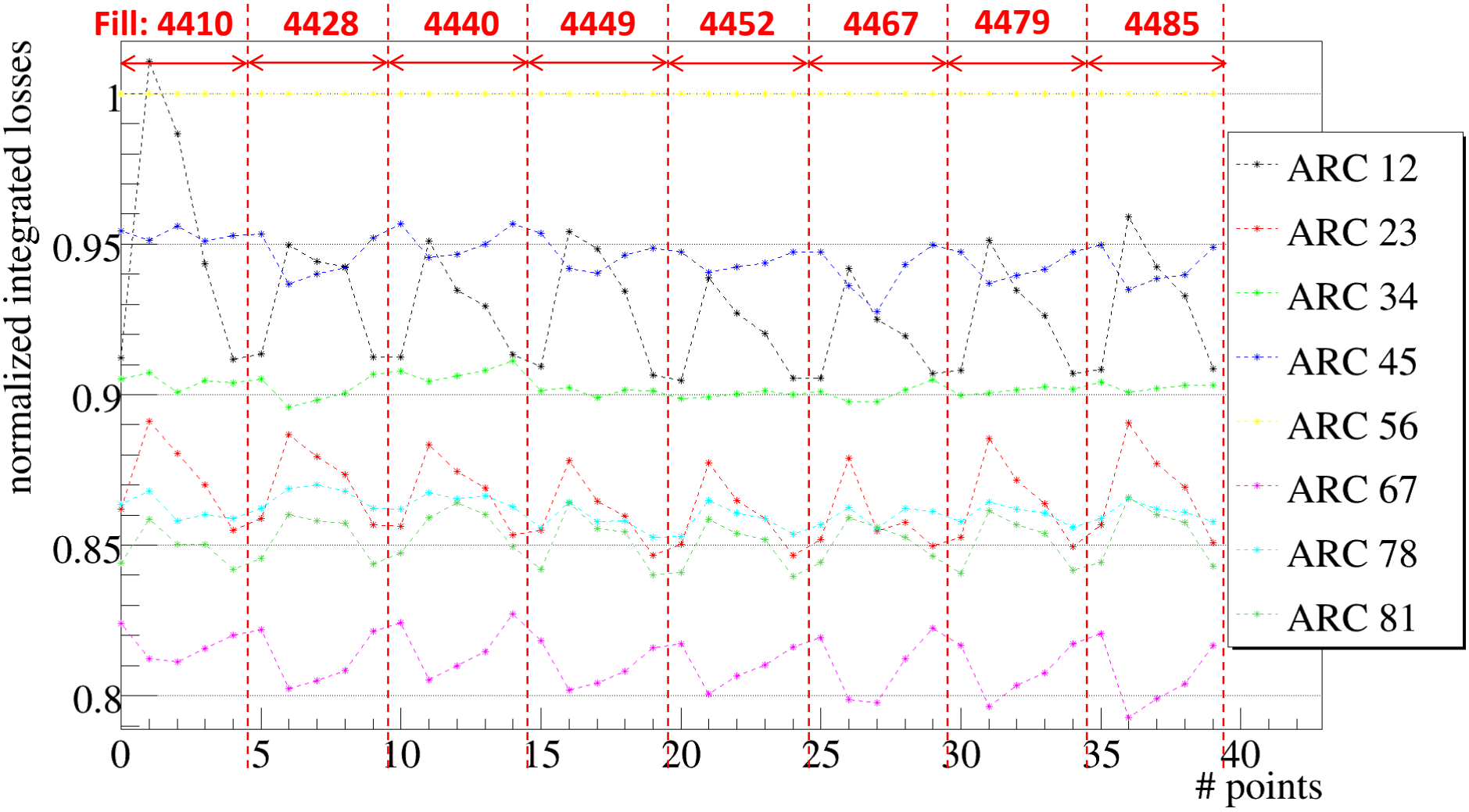
| Using both MQ & MB | Using only MB | From heat loads |
|---|---|---|
| S 81 | S 12 | S 81 |
| S 12 | S 23 | S 12 |
| S 45 | S 45 ~ S 56 ~ S 78 ~ S 81 | S 23 |
| S 23 | S 34 ~ S 67 | S 78 |
| S 78 | | S 56 ~ S 67 |
| S 56 ~ S 67 | | S 45 |
| S 34 | | S 34 |

# *BACKUP*

# Normalized integrated losses (ARCs)

Beam loss integrated over 1h in five points and normalized w.r.t. S56 (smooth loss along cycle)

*First and last points refer to bkg without beam, and the other three are in stable beam*

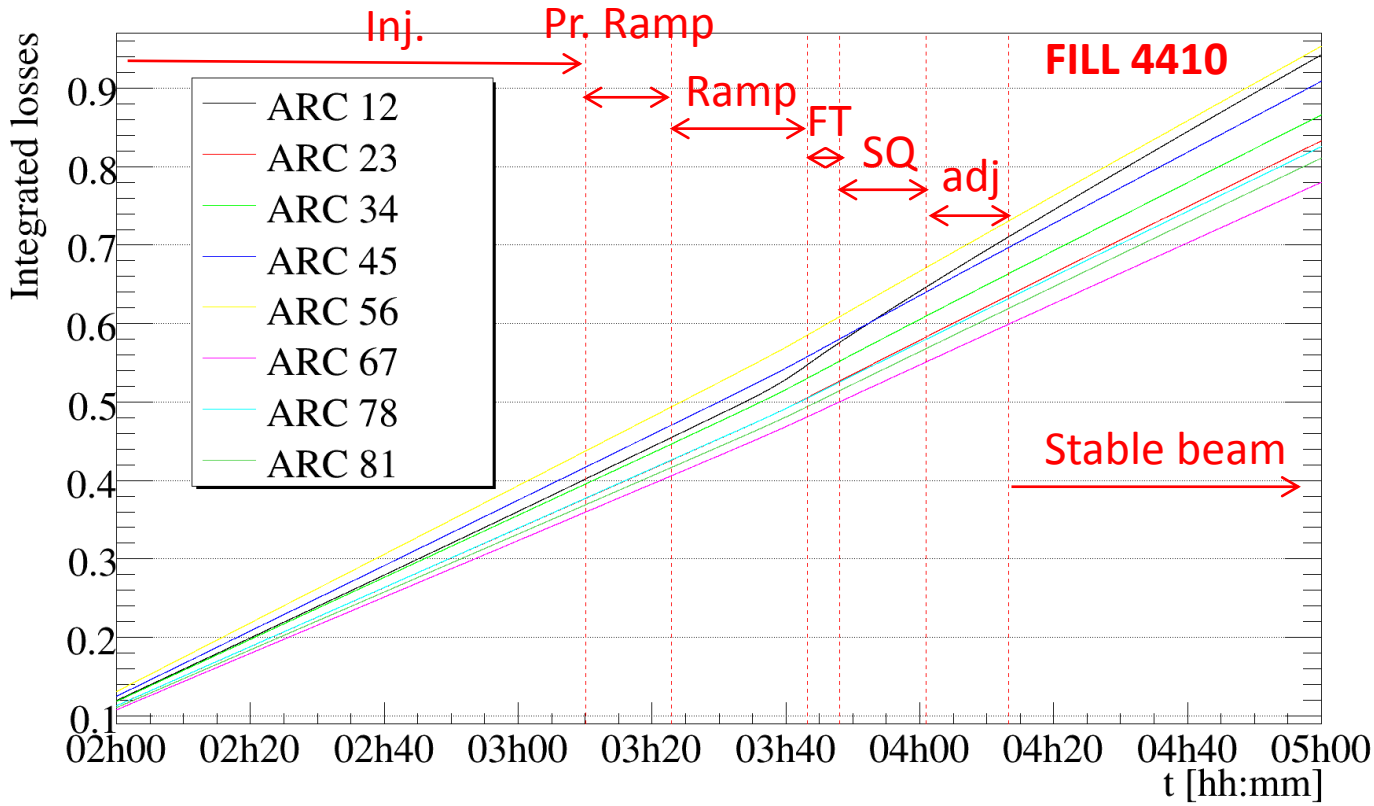


# Integrated losses in the ARCs

All the long fills (>8h) from 24th September checked

Shown here only the most representative fill and for the interesting time range

***Integrated losses in the ARCs (from C14.R# to C14.L#+1)***




*Increase of loss rate observed systematically in S12 from the end of ramp*