

# Bunch Frequency Multiplication in the CLIC Test Facility CTF 3



**R. Corsini, L. Rinolfi, F. Tecker** – CERN, Switzerland

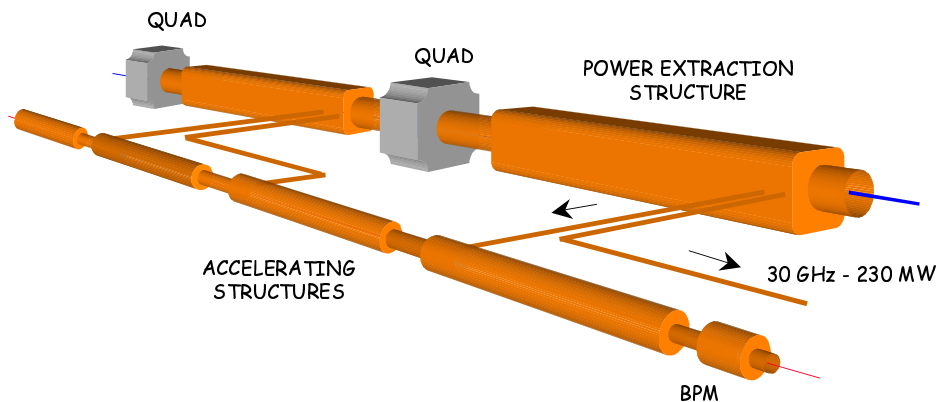
**C. Biscari, A. Ghigo, M. Preger** – INFN, Italy

**P. Royer** – Lausanne University, Switzerland

**A. Ferrari** – Uppsala University, Sweden

- Introduction to **CTF 3**
- Bunch **Frequency Multiplication**
- Bunch Combination **Results**
- **Conclusions**

## CLIC: Compact Linear Collider (0.5–5 TeV)



- **two beam** acceleration scheme:

- high charge, low energy **drive beam** (2 GeV)
- produce RF power at **high frequency – 30 GHz**
- high **gradient – 150 MV/m**
- low charge, **high energy main beam** (1.5 TeV)

- **CLIC Test Facility 3** addresses **feasibility** issues:

- test of **drive beam generation**

● **combination** of bunches by **RF deflectors**  
 ⇒ bunch frequency multiplication

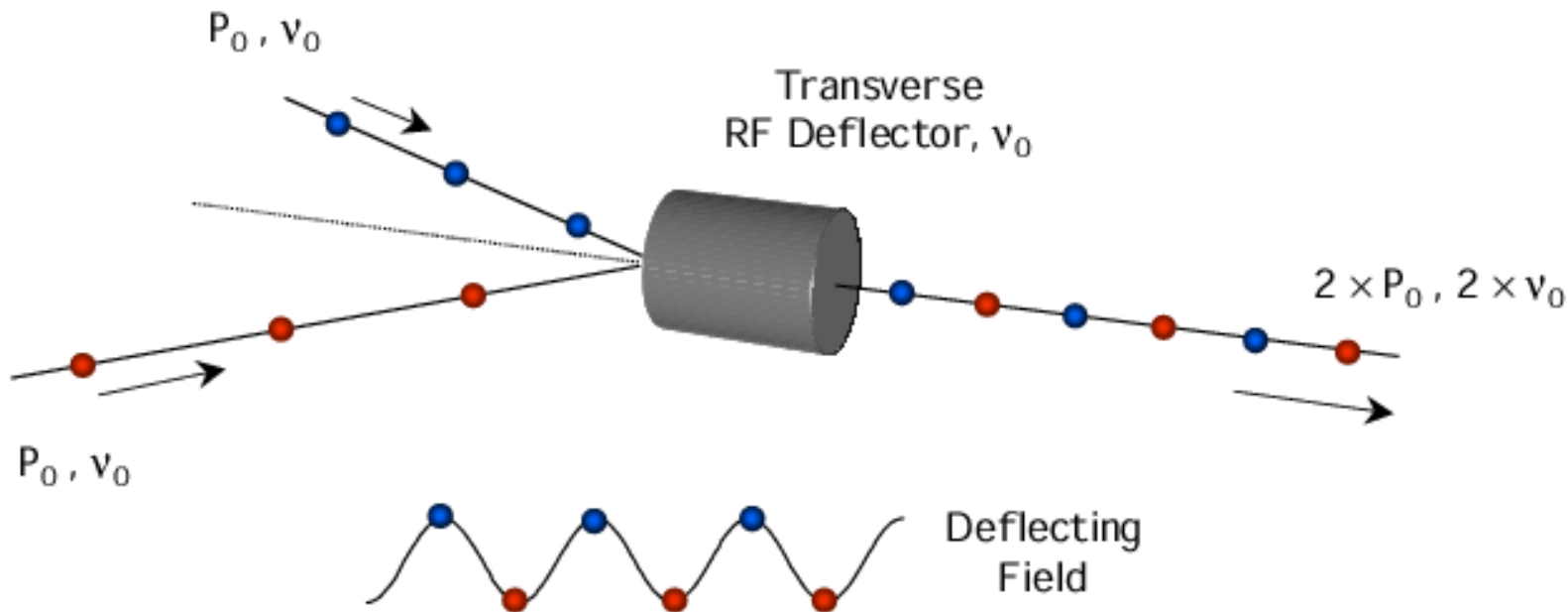
- **RF power production** at 30 GHz
- test CLIC components



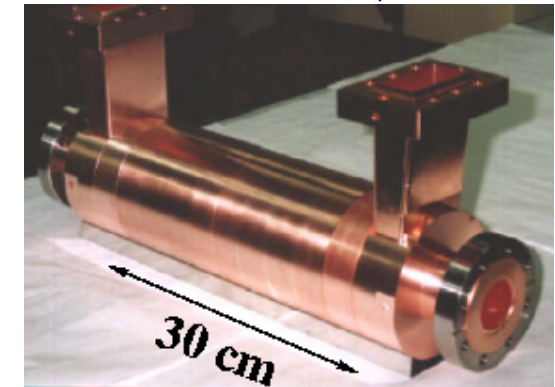
# Frequency multiplication



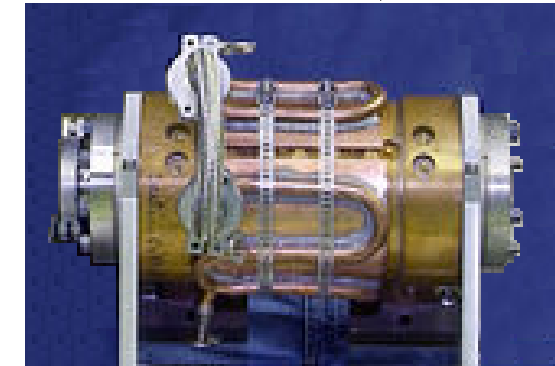
- basic principle of **drive beam generation**
- transform very long pulses into many short pulses with **higher power** and **higher frequency**
- use **RF deflectors** to **interleave** bunches
  - $\Rightarrow$  double beam power
  - $\Rightarrow$  double beam frequency



CTF3 deflector, INFN

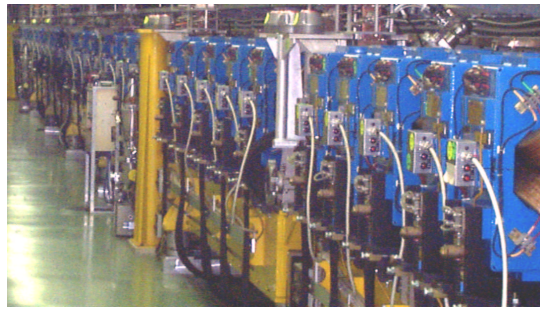
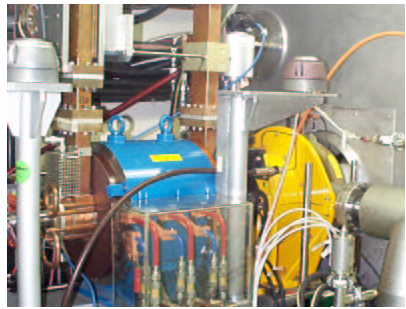


CTF3 deflector, CERN





# Preliminary phase of CTF 3 (2001–2002)



Linac ( 8 structures )

streak camera measurement

RF deflectors

isochronous injection line

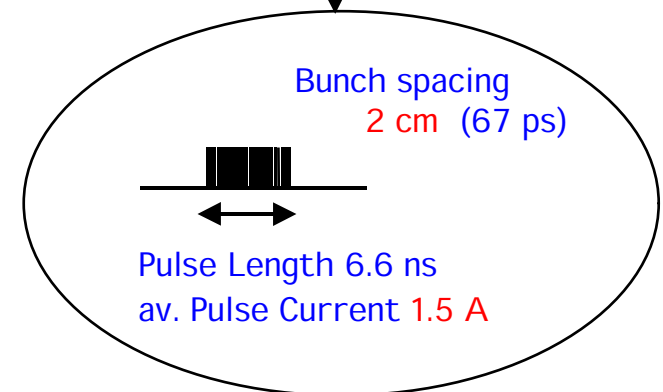
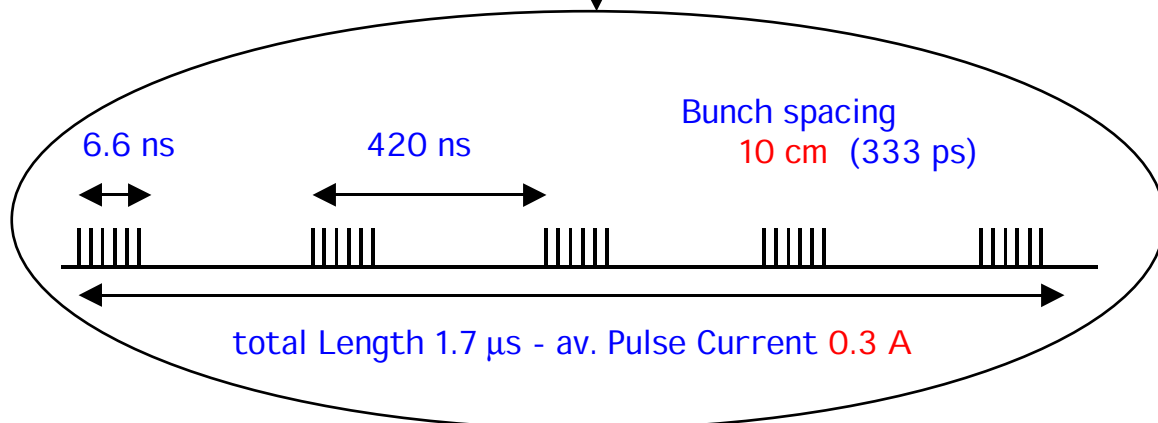
matching section

isochronous ring

gun & bunching system

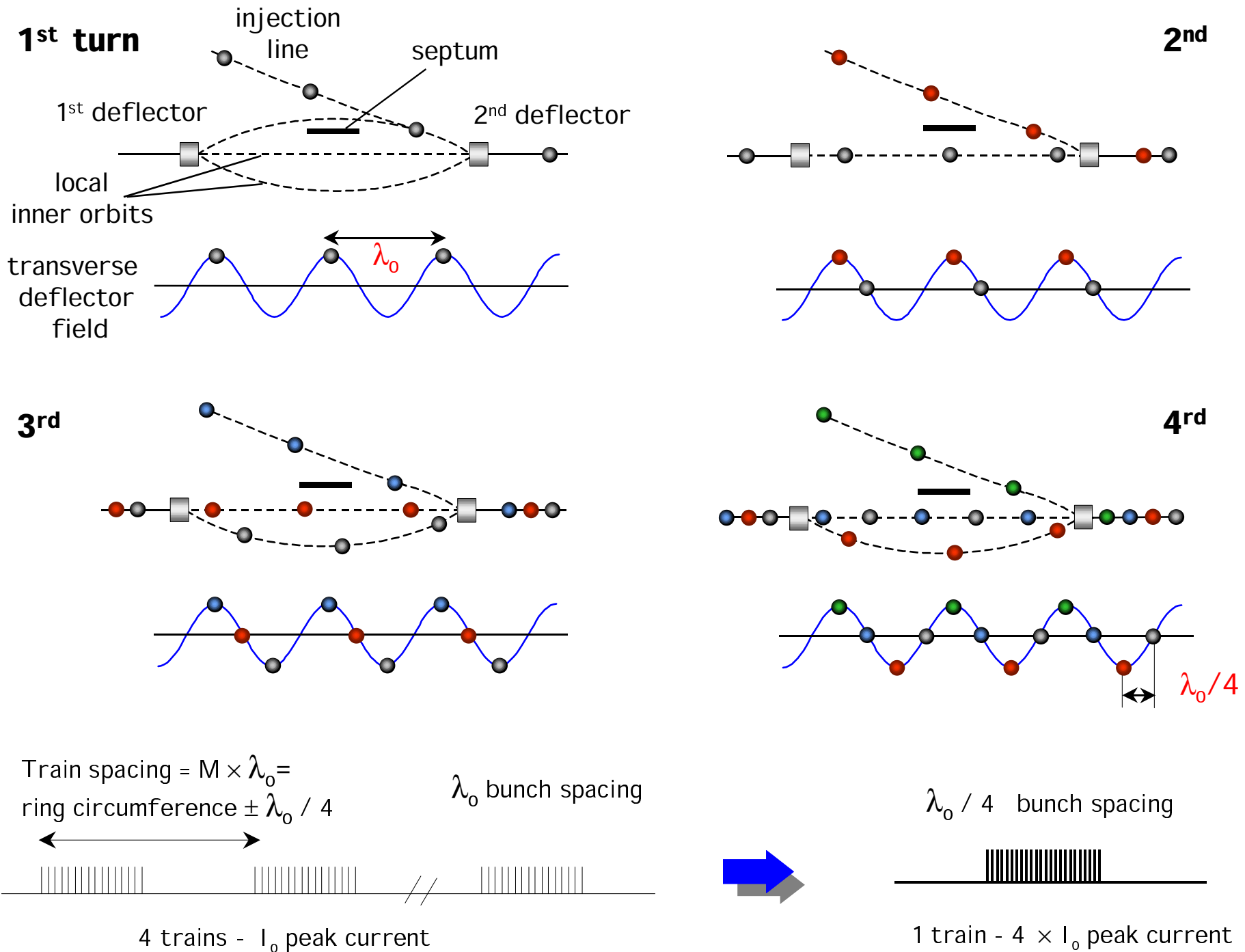
Beam structure in linac (up to 100 Hz)

Beam structure after combination



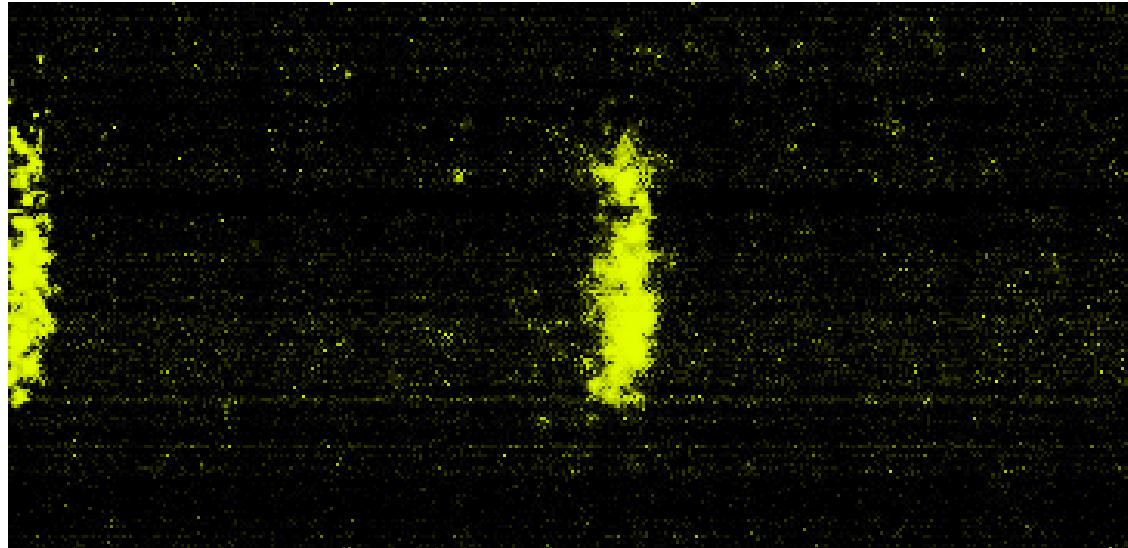


# Combination by RF deflectors in a ring

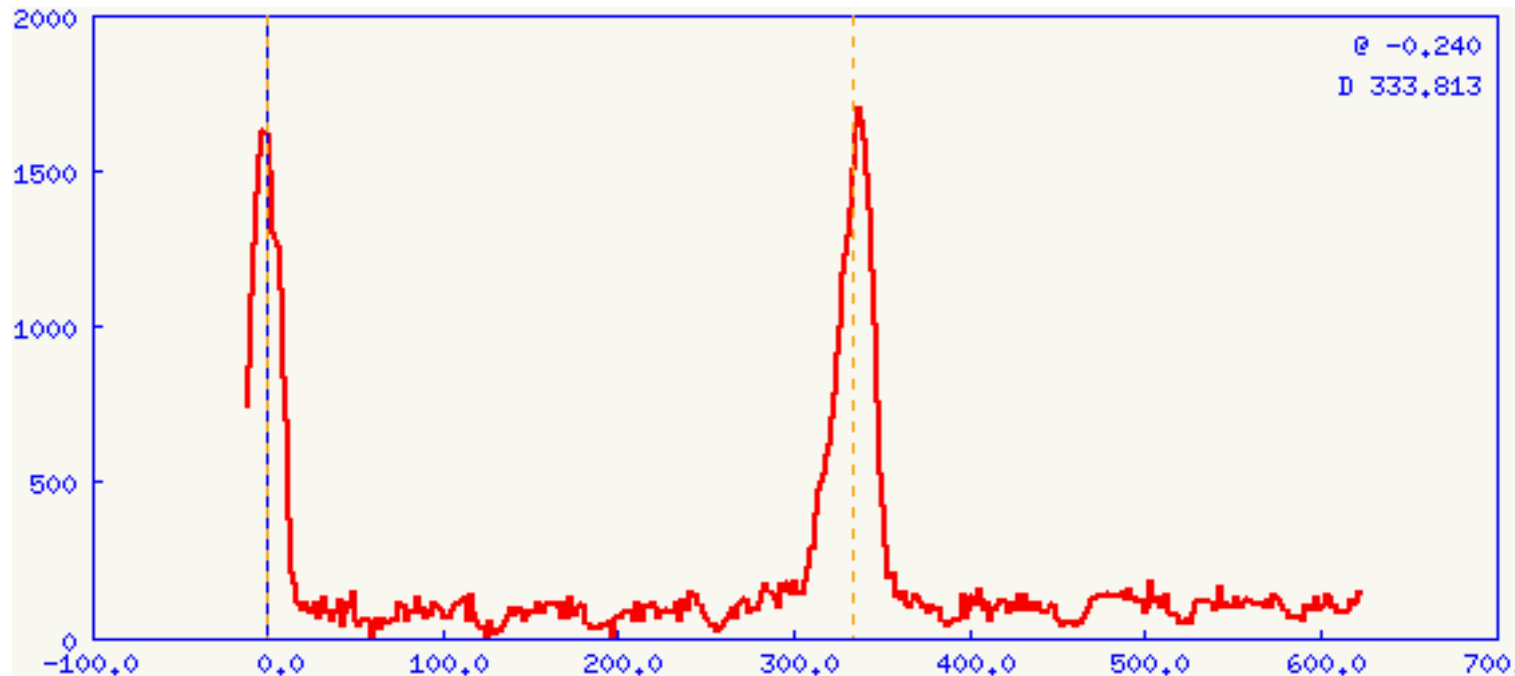




# CTF3 recombination factor 4 - 1 pulse

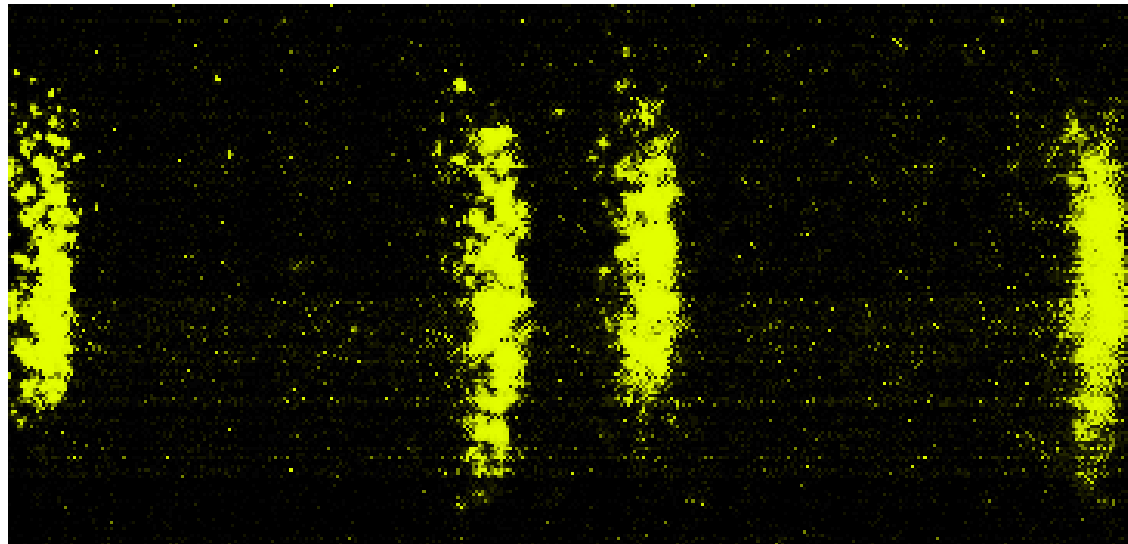


—————→ time

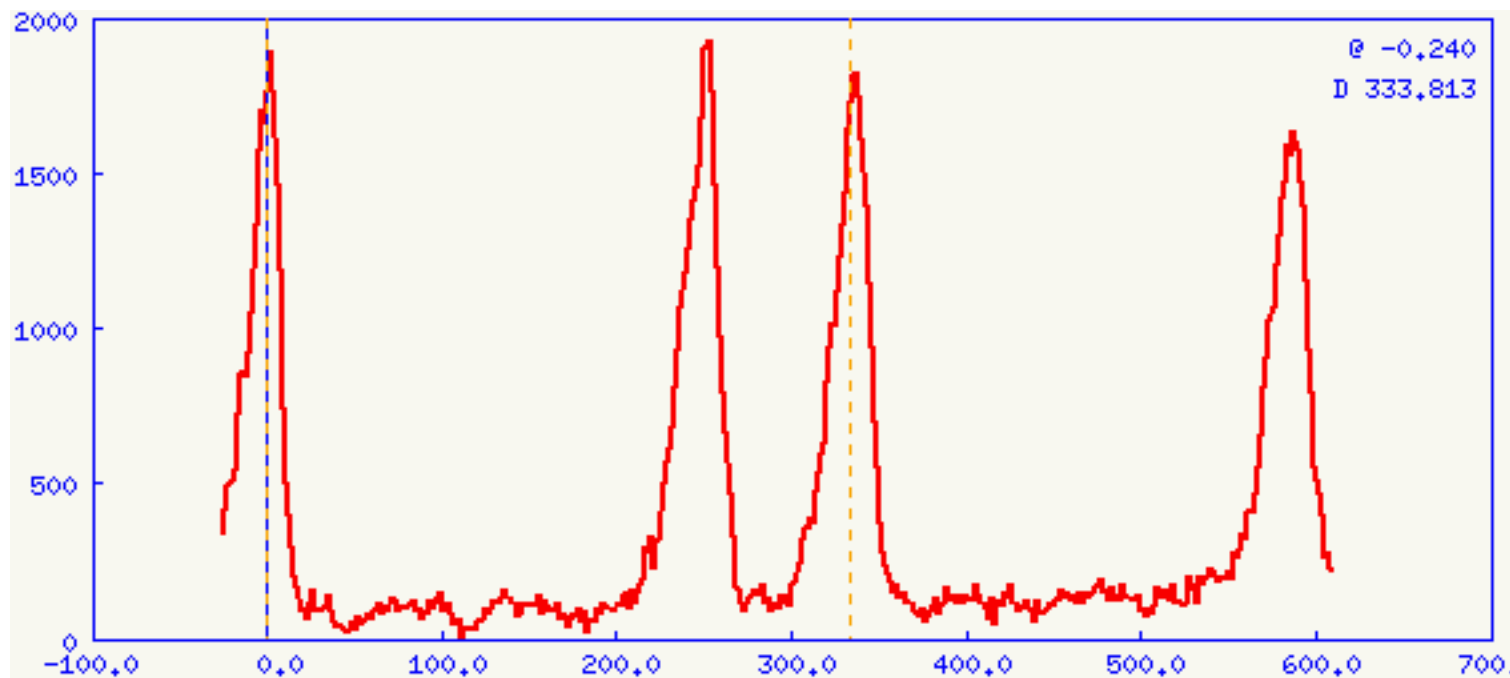




# CTF3 recombination factor 4 - 2 pulses

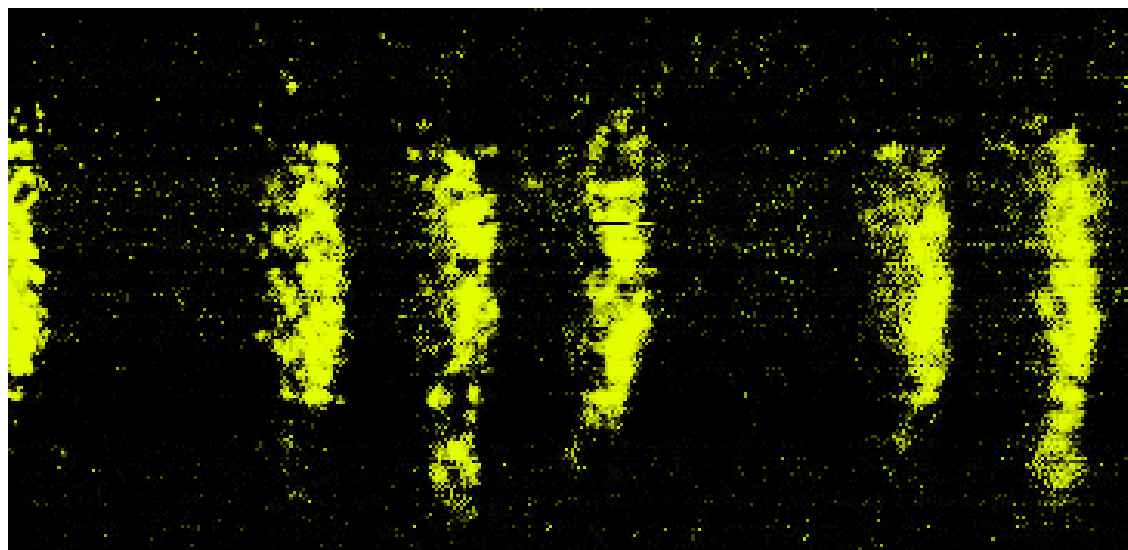


—————→ time

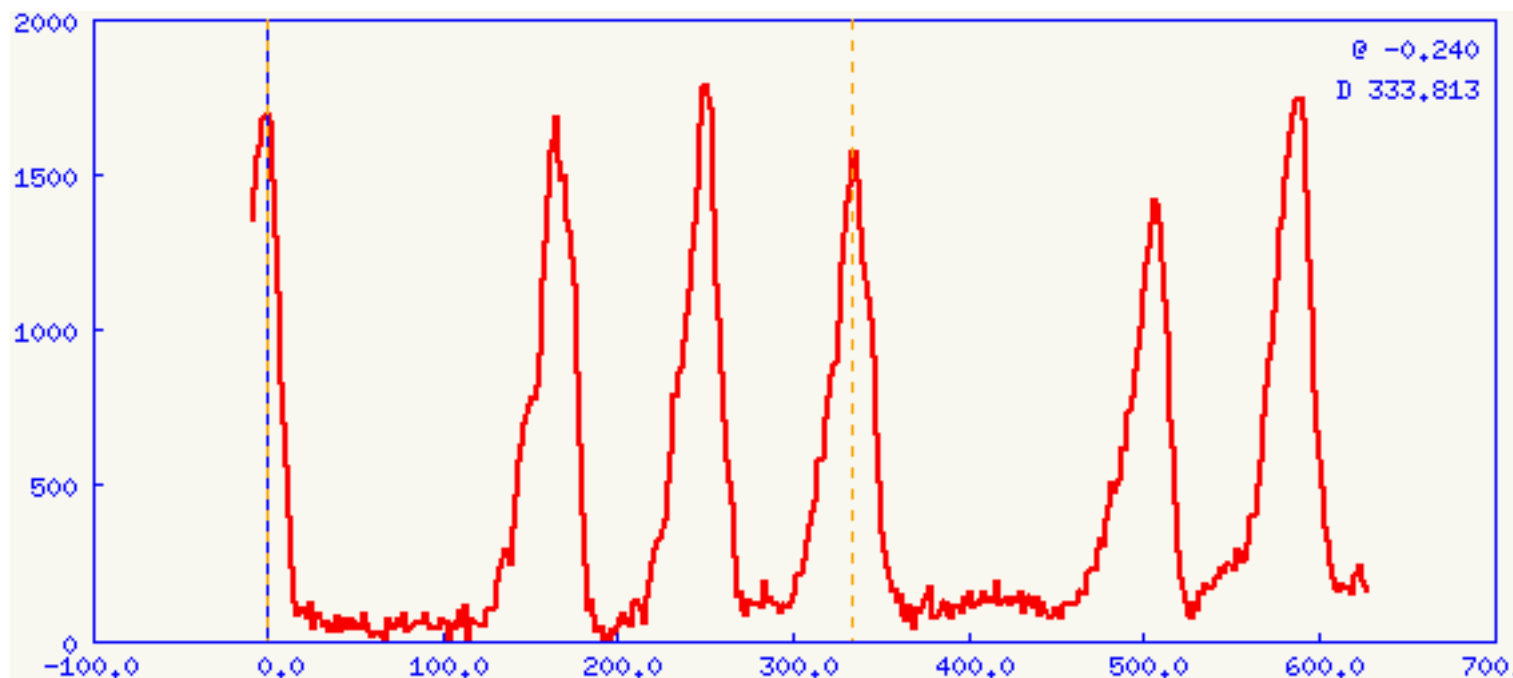




# CTF3 recombination factor 4 - 3 pulses



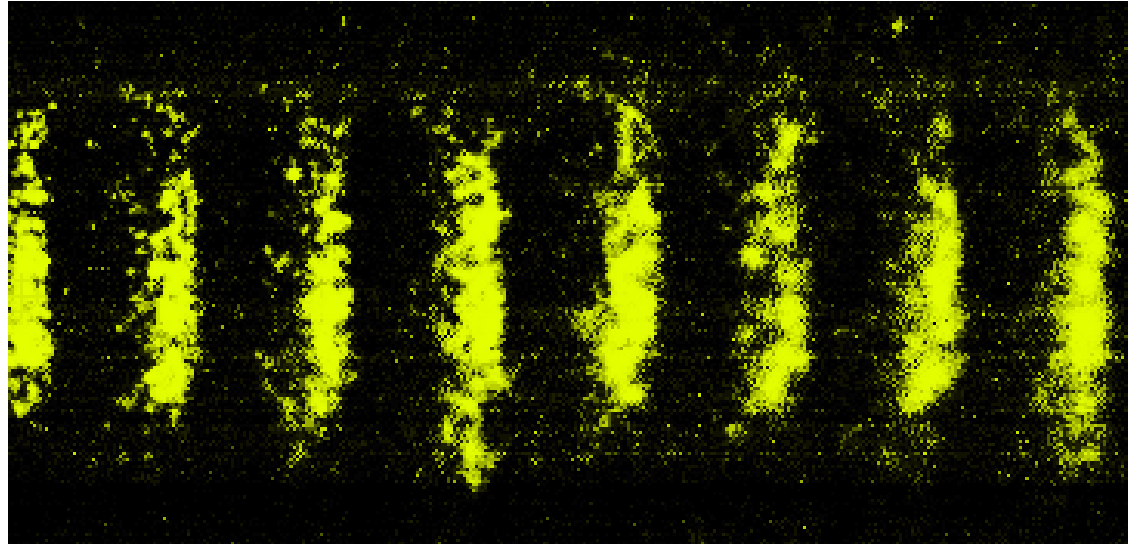
time



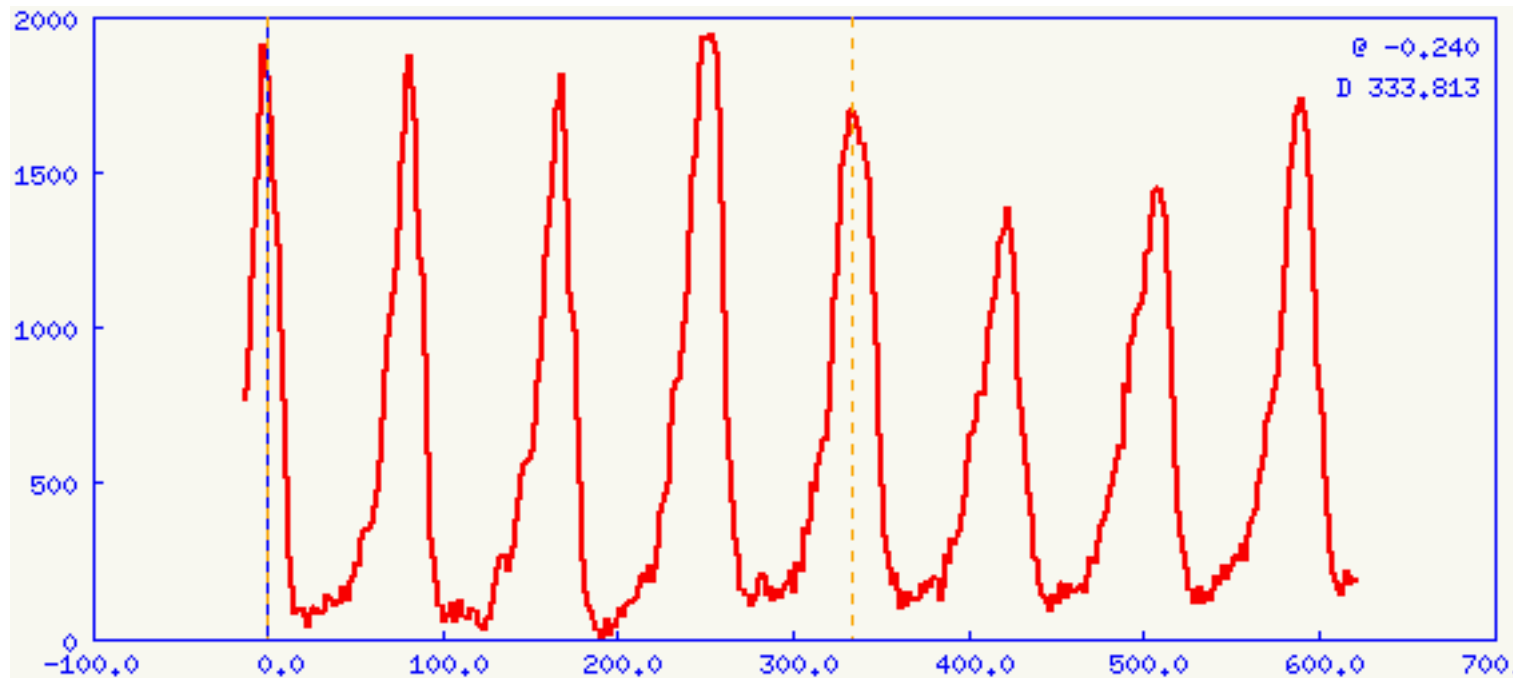




# CTF3 recombination factor 4 - 4 pulses

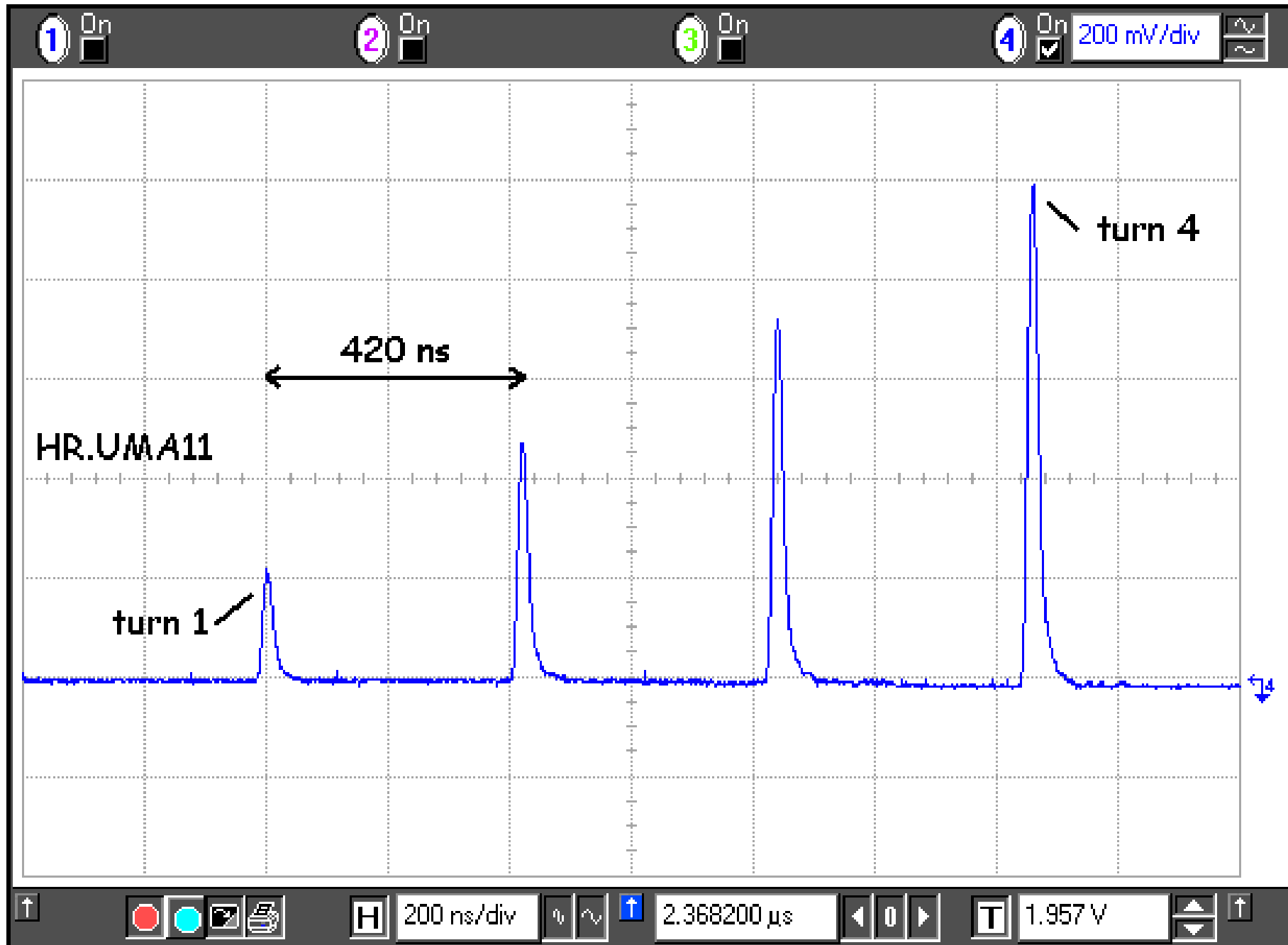


—————→ time



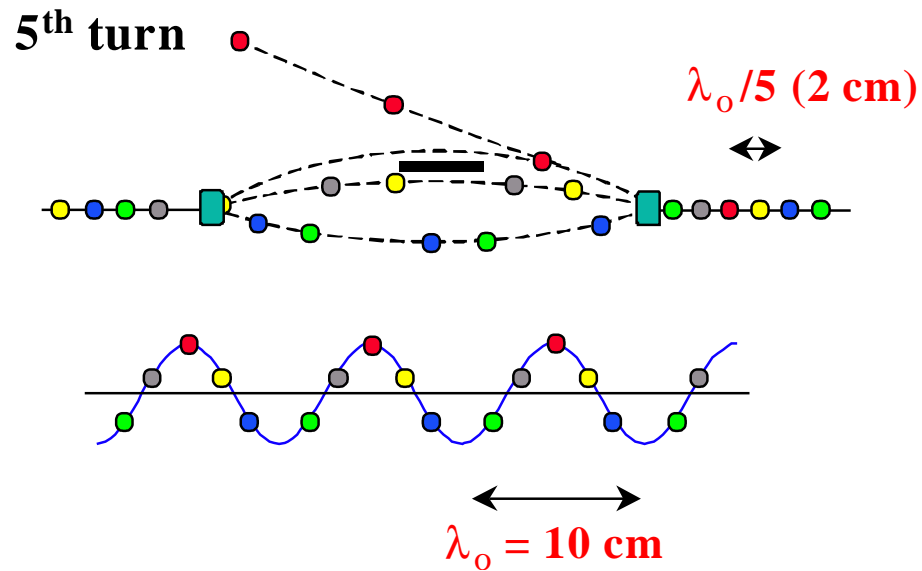


# Recombination factor 4 - beam current

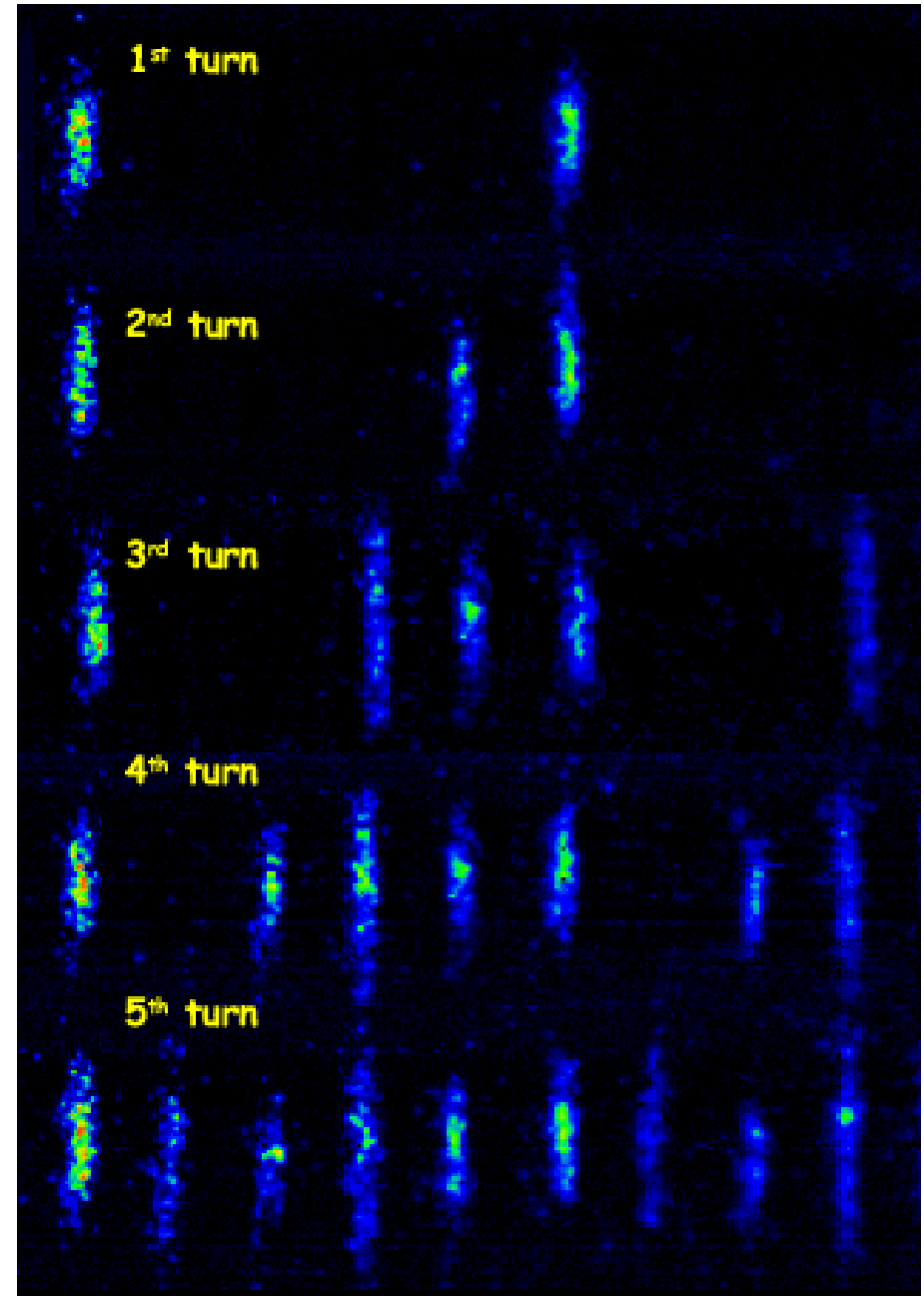
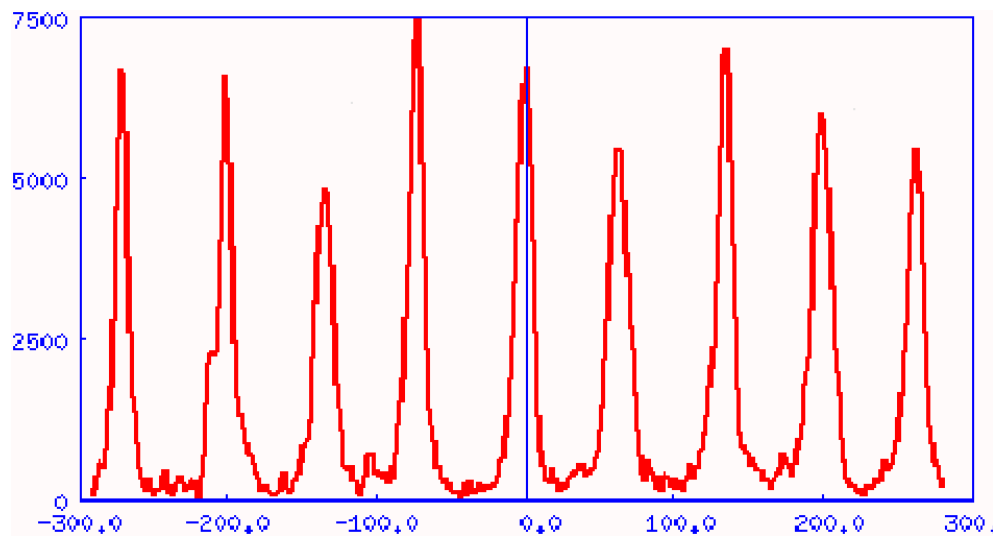




# CTF3 recombination factor 5



- bunch distance 333 ps  $\rightarrow$  67 ps
- frequency 3 GHz  $\rightarrow$  15 GHz





- **CTF 3 preliminary phase**
  - bunch **frequency multiplication** by RF deflectors **demonstrated** for factors 2 – 5 at low charge
  - crucial step for the CLIC study
- **CTF 3 initial phase**
  - drive beam linac is being installed now (higher charge)
  - commissioning starts this month
- **Acknowledgements:**
  - R. Corsini, A. Ferrari, L. Rinolfi, P. Royer
  - various CERN divisions and groups
  - **Collaborations:**
    - INFN, Frascati, Italy – SLAC, USA – RAL, UK –
    - IN2P3-LAL, France – Uppsala University, Sweden