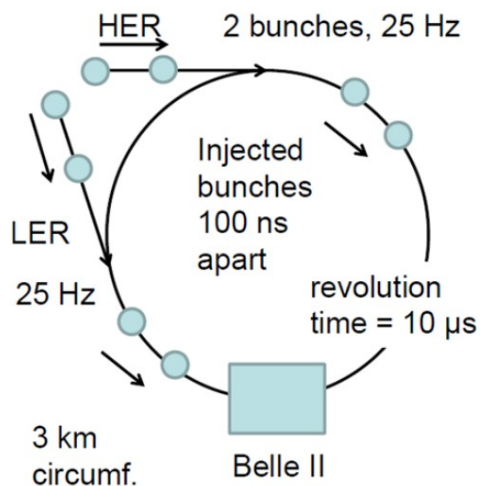
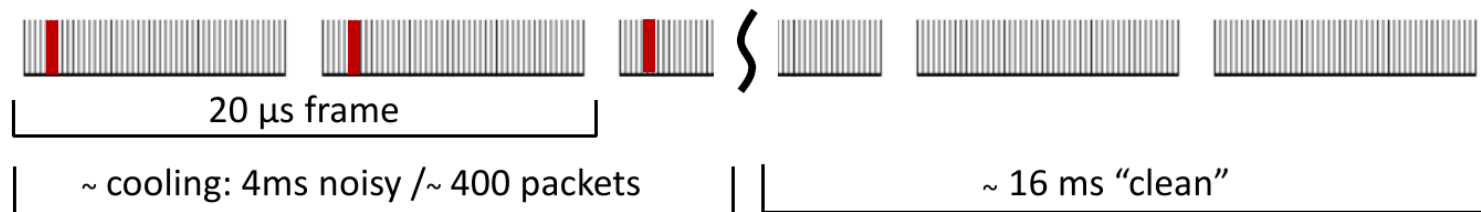


# Summary on Gated Mode Studies During 2019c run

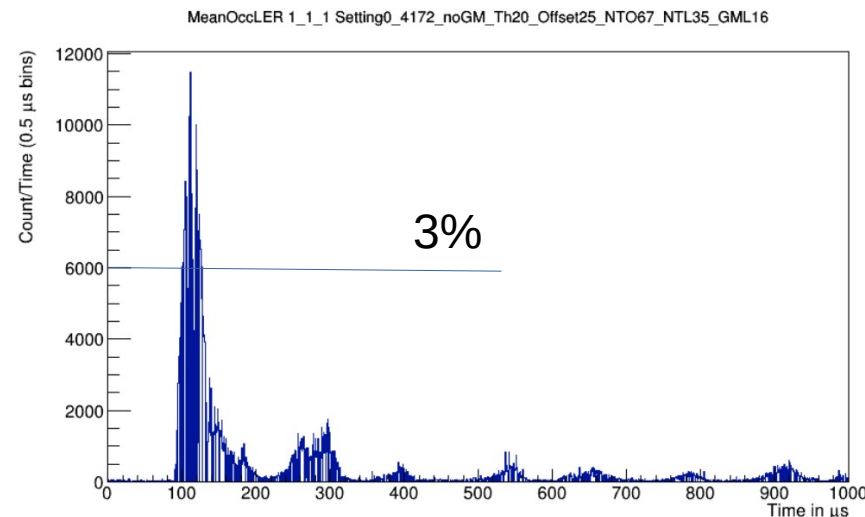
- Three gated mode sessions with beam in 2019c (exp 10)
  - 2019.11.6:  
3557 (LER inj), 3558 with (HER inj)
  - 2019.11.16:  
Runs 4172, 4174 (LER inj), 4175 (HER inj)
  - 2019.11.23:  
Runs 4666 (HER inj, no LER beam), 4668 (LER inj)
- Preliminary analysis:
  - <https://pxd.belle2.org/USER/Bjoern/gatedmode/>
  - <https://agira.desy.de/browse/BIIPXDH-381>
  - Preprocessed files for different setting in /group/belle2/users/bspruck/gm/ (basf2 master!)



SuperKEKB bunch pattern (second abort gap not included)



- After injection, go n-times into GM (every 10  $\mu$ s, cycle) for  $n \cdot 10 \mu$ s
- This is independent from Belle II trigger veto
  - (complete veto +  $n \cdot$  the bunch)



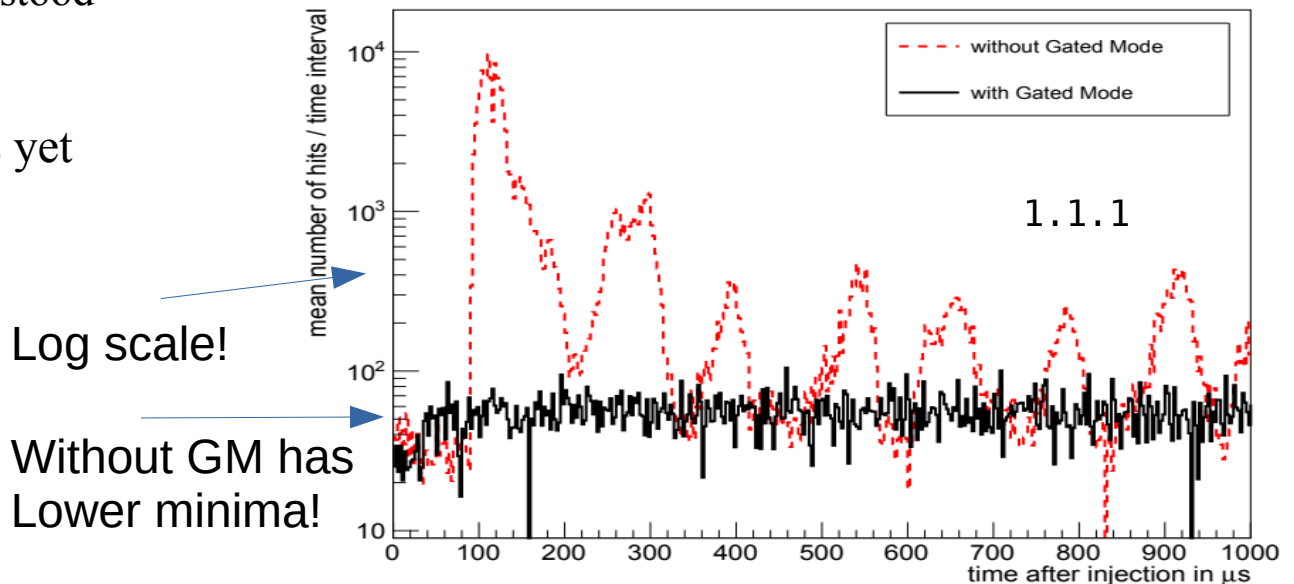
- Single LER/HER single beam injection with 1 Hz or 5 Hz
  - That is why the current is not stable (careful about absolute hit numbers!)
- No injection veto (because this is the time we want to see)
- 2<sup>nd</sup> test: all 19 modules
- 3<sup>rd</sup> test: only (the best) 11 modules were on
- 1<sup>st</sup>, 2<sup>nd</sup> test, Poisson 5kHz
- 3<sup>rd</sup> test: **Pulse 45 kHz** → quasi continuous readout (we read out >192 gates)!
  - → long and stable running with 45 kHz!!! ~ 2TB of data!
- Scanning Offset, No-Trigger-Offset, No-Trigger-Length, Gated-Mode-Length, Threshold, and Offset between LER/HER settings **within** one run
  - Threshold in most cases much larger than in physics runs! (20 vs 7 ADU)
- Each setting for only few minutes, limited statistics (in terms of number of injections)

# Occupancy after Injection LER, HER

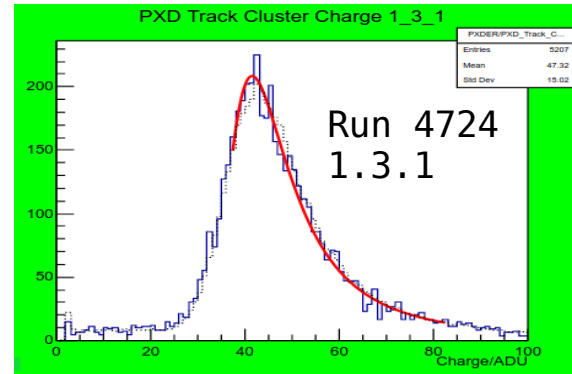
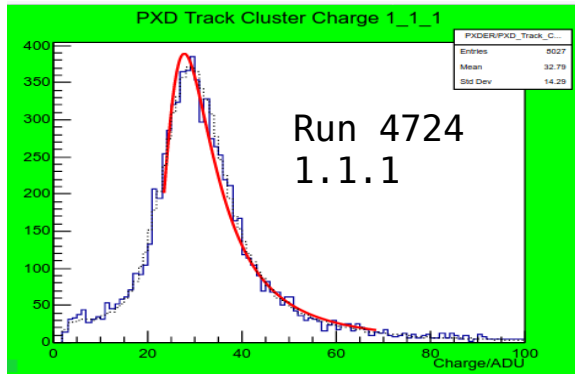
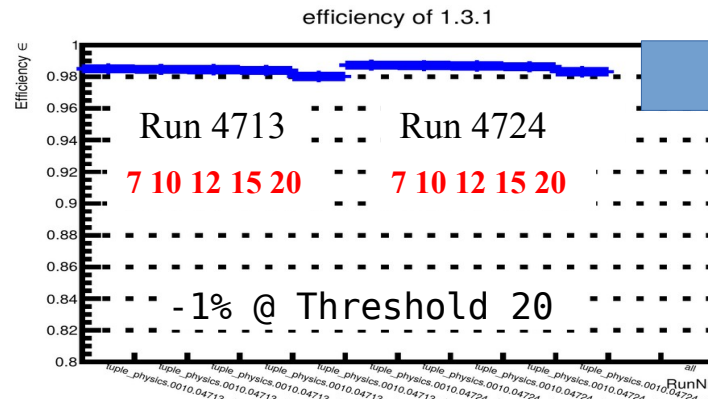
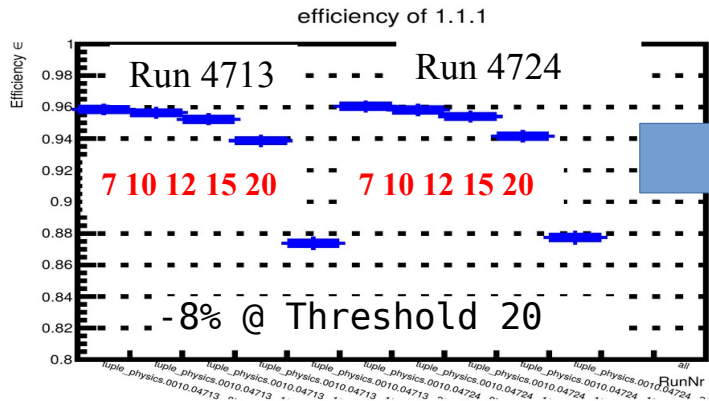
We look for  
settings where  
the peak is  
suppressed



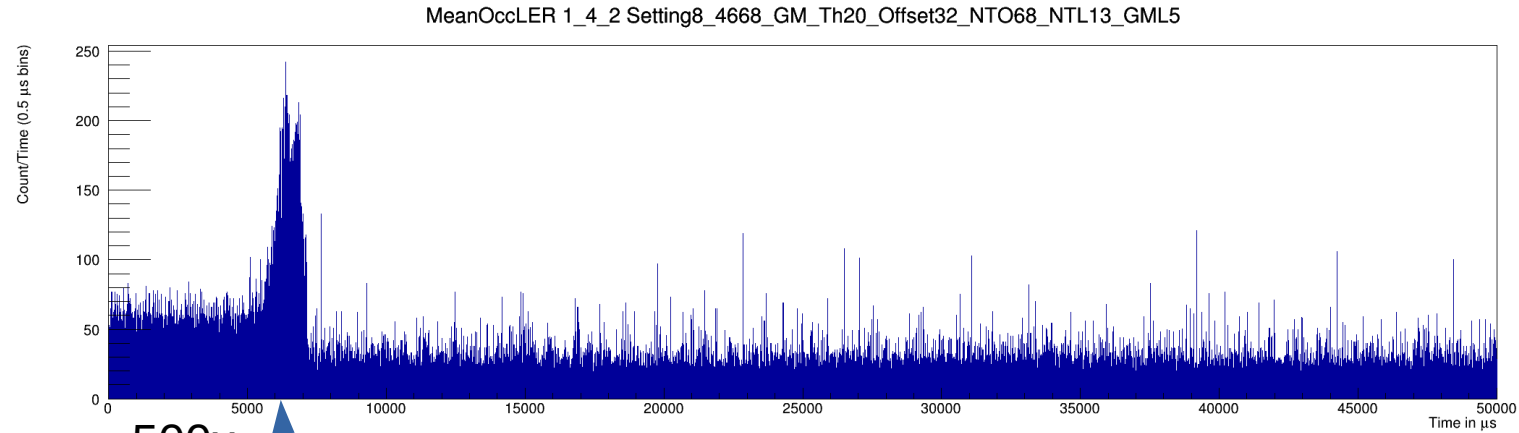
- We can suppress the injection noise!
- But:
  - Large threshold (15, 20 instead of 7)
  - Long no-trigger-length (to suppress noise)
  - Different module performing different
  - Some 'structures' not understood
- Technically working
- Not ready for use in physics runs yet



- Gated Mode might need increased threshold, what is the impact?
  - Effect depends on module!
  - Cut dependent on module; noise depend on module parameters?

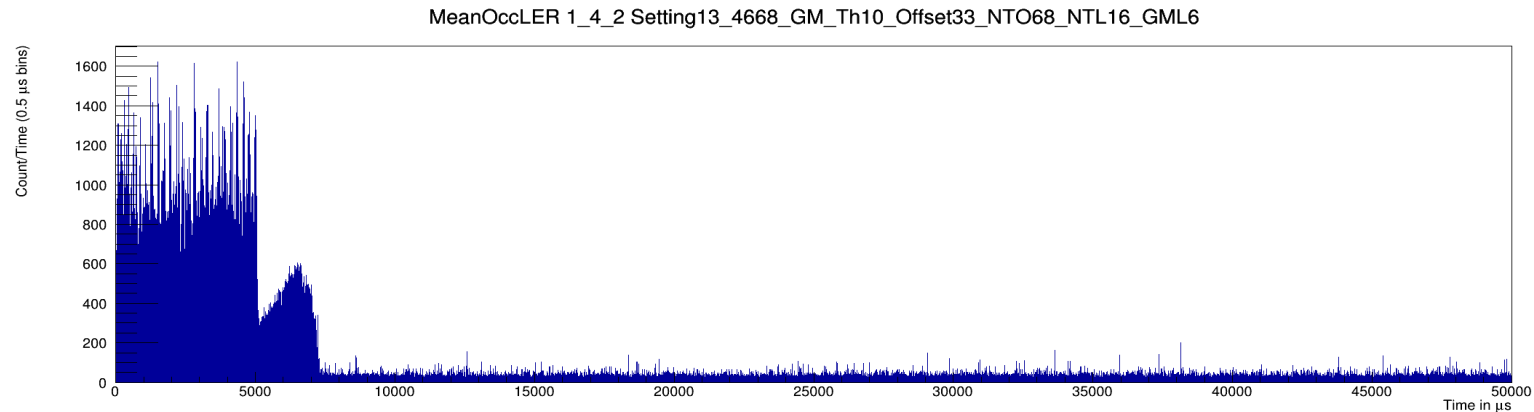


Remark:  
This is not what we cut on!  
Just to show the difference in  
Peak position



500x  
GM

Peak after GM is not used anymore?  
Charge-up effects?





- 3<sup>rd</sup> test with optimized conditions
- Peak suppressed for several settings, could go down to GML 5 and 6
- Modules behave slightly different!
  - Might be that we have to use different parameters (offset +/- 1, longer no-trigger-length, higher threshold, etc) for some modules
- → **More studies and optimization in the lab**
- Structures when starting/stopping gating (charge up effects? Firmware issues?)
- Some features not understood like GML 5 looks better than GML 6 etc ...



- 1<sup>st</sup> test partly unusable because of firmware issues (optimize on firmware condition)
  - Mostly useless for analysis, need careful selections if at all
- 2<sup>nd</sup> test o.k. but we did not find the best parameters
- 3<sup>rd</sup> test with optimized conditions, but fewer settings
- Attention: slight changes between 2 and 3 (number of revos with GM 1000 → 500)

# Threshold Scan (offline emulation in two random normal runs)

