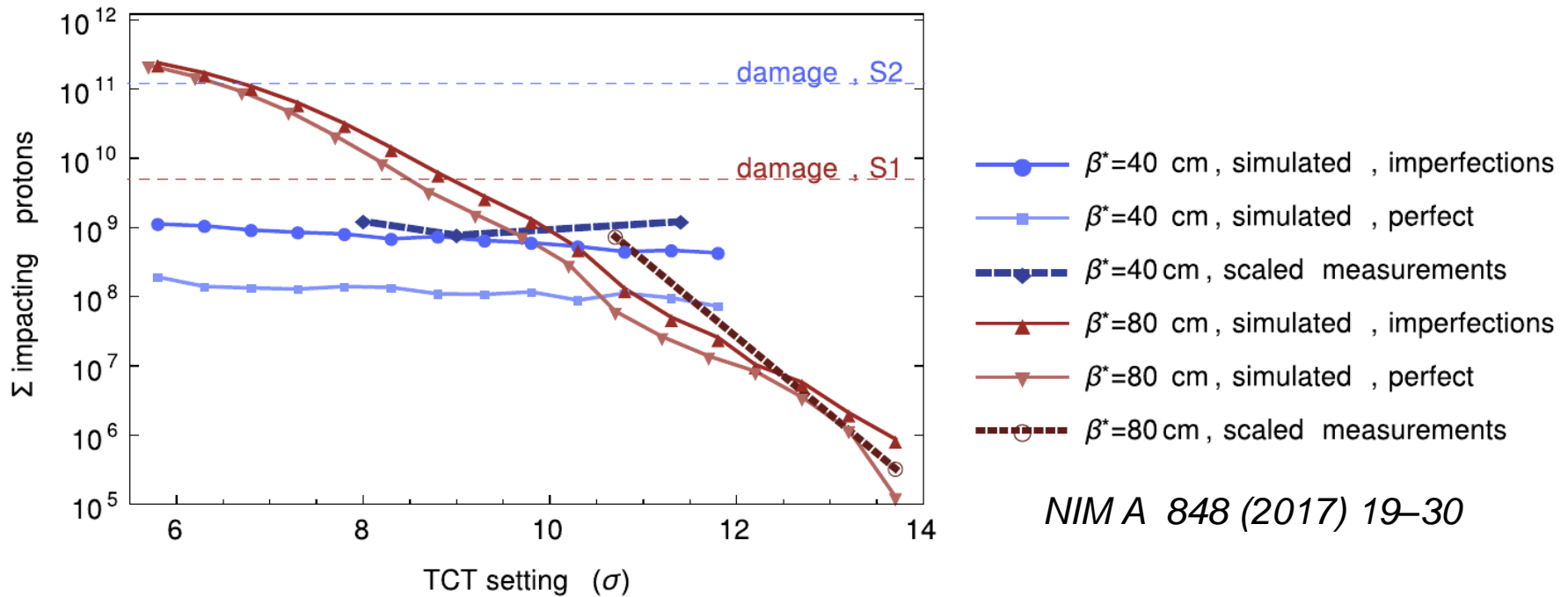


Analysis of TCT losses during 2017 asynch dump tests (*work in progress*)

R. Bruce

Many thanks to C. Bracco

- In 2016, operated at $\beta^*=40$ cm
 - Prerequisite: improved MKD-TCT phase advance, so that TCTs can be operated at smaller retraction from TCDO
 - Did series of asynch dump test to verify assumptions
 - Conclusion (measurements and simulations): TCT losses do not depend strongly on TCT setting with good phase, while they do with bad phase



- Switched to ATS optics
- Phase advance not as good as in 2016, but still acceptable for tight TCT settings (based on simulations)
- Starting nevertheless at 40 cm, and tighter IR6/7 => 1σ more margin TCDQ/TCT than in 2016
- Proposed BPM and PC interlocks (see previous talks)
- To check dependence of TCT losses on setting: as in 2016, did asynch dump tests with standard TCT settings as well as tighter TCTs

- Standard asynch dump test carried out in commissioning
- Checked TCT losses in the following tests:

– Collision : 22/05/17 22:16:07.411

Data good

– End of squeeze : 23/05/17 03:48:28.524

– End of squeeze, tighter TCTs 7.5σ : 23/05/17 06:22:37.945.

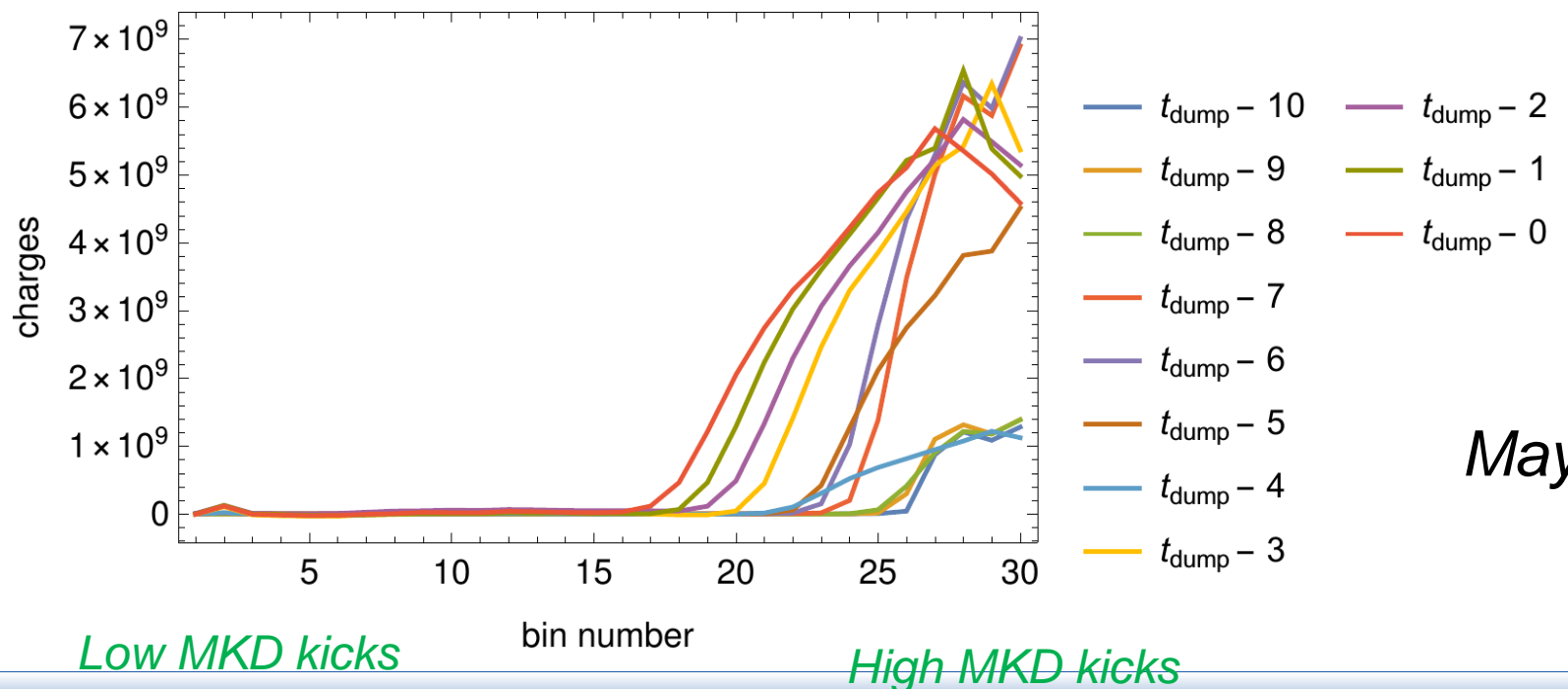
Data not good –
dumped too early

– End of squeeze, tighter TCTs 7.5σ : 02/06/17 02:05:18.946

– Collision, tighter TCTs 7.5σ : 03/06/17 22:49:12.753

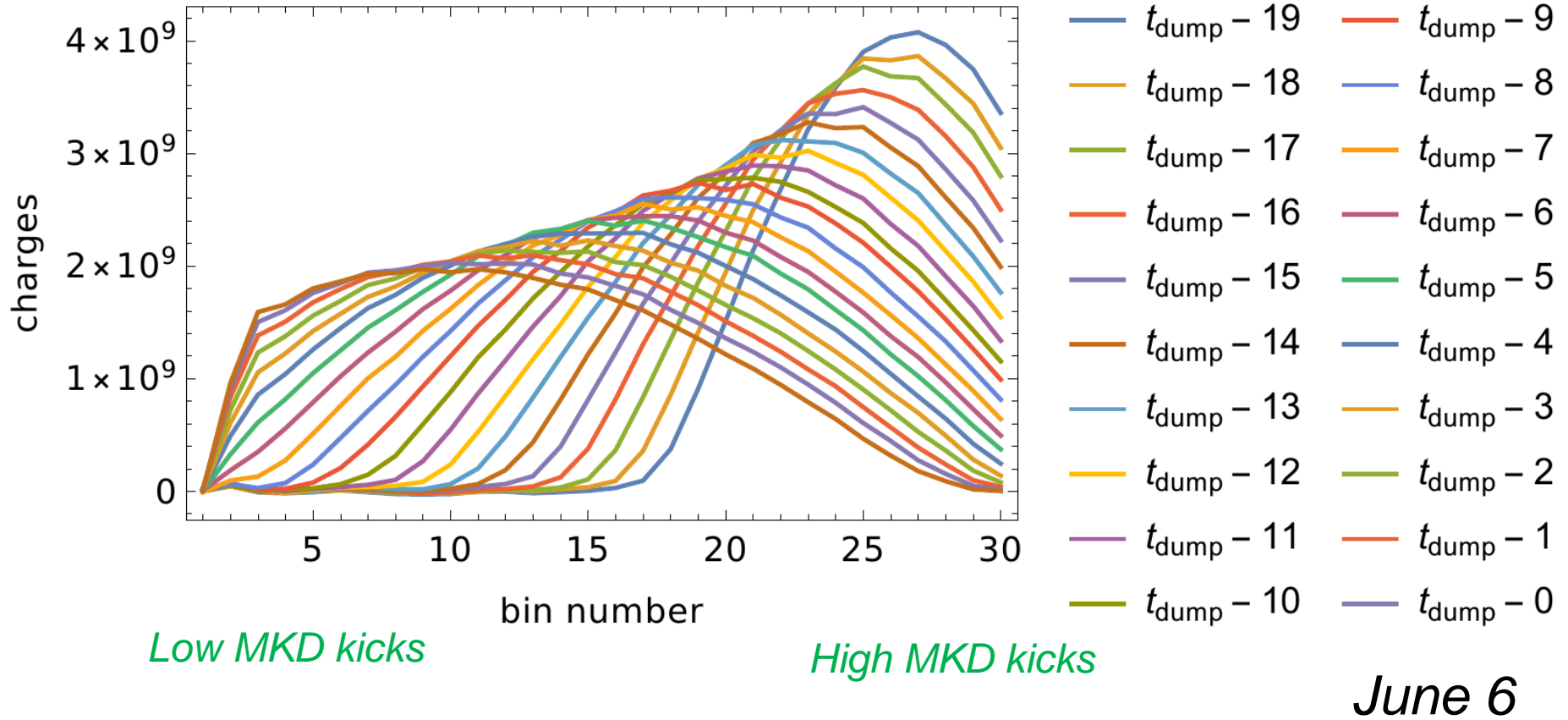
Data good

- Beam enters abort gap on side with high MKD kicks
- If dump is triggered too early, not enough beam has propagated to the side of the abort gap with low MKD kicks
 - Only particles at this side of the abort gap can potentially make it to the TCTs

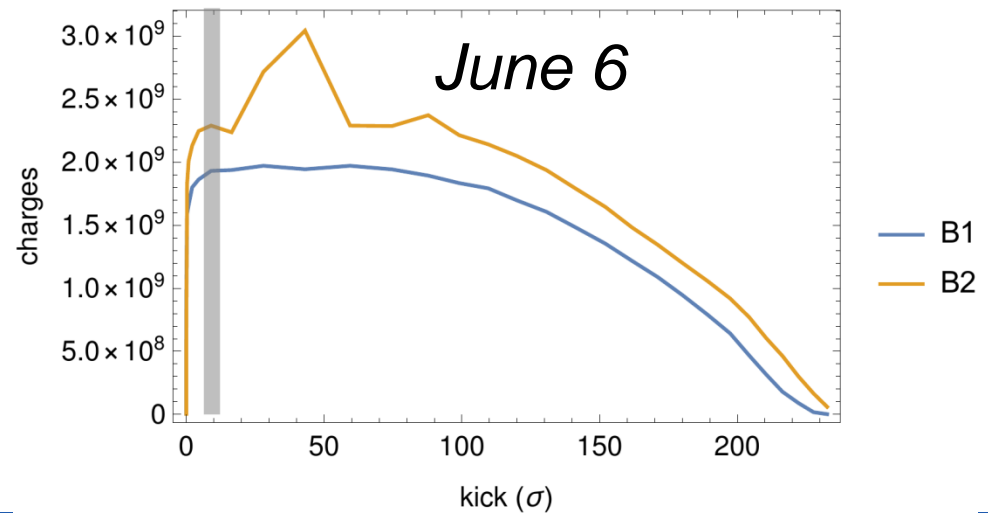
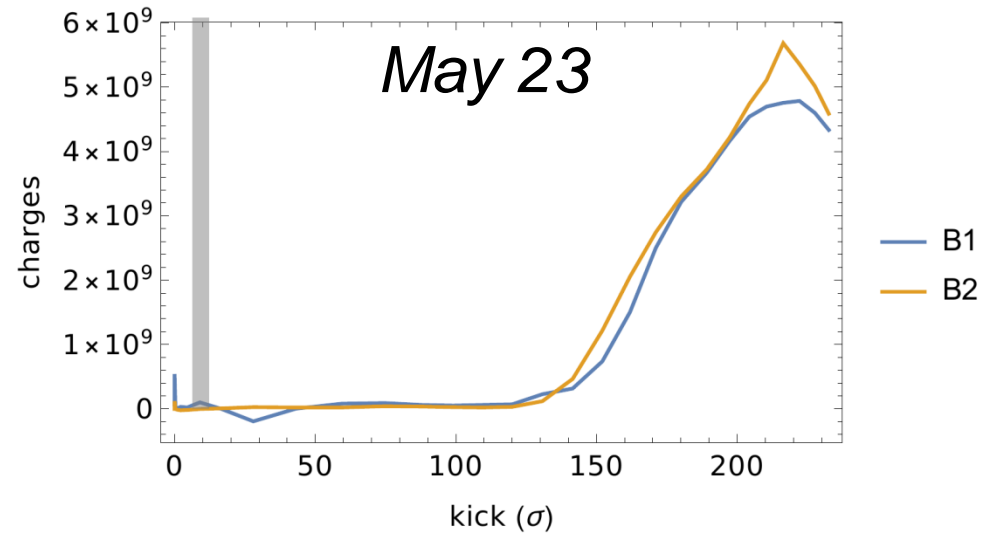


May 23

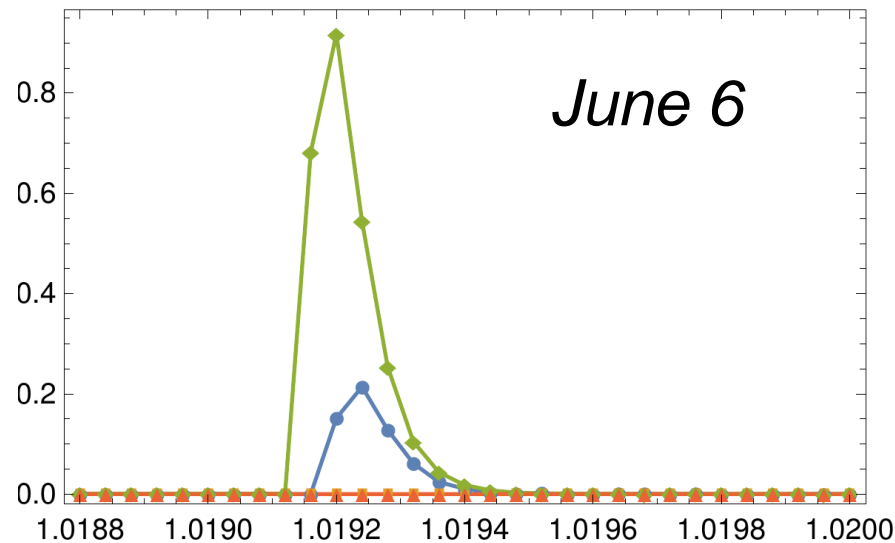
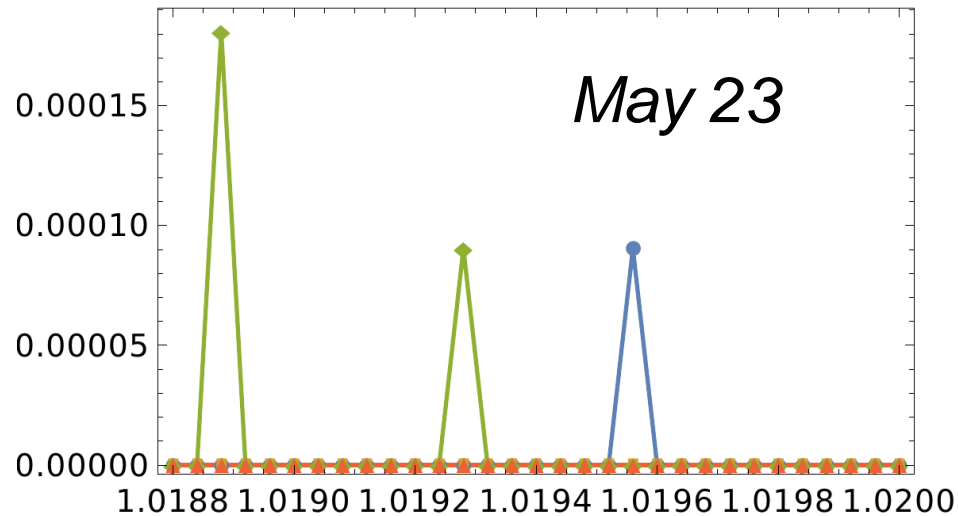
- Example: B1 during latest test on 3/6



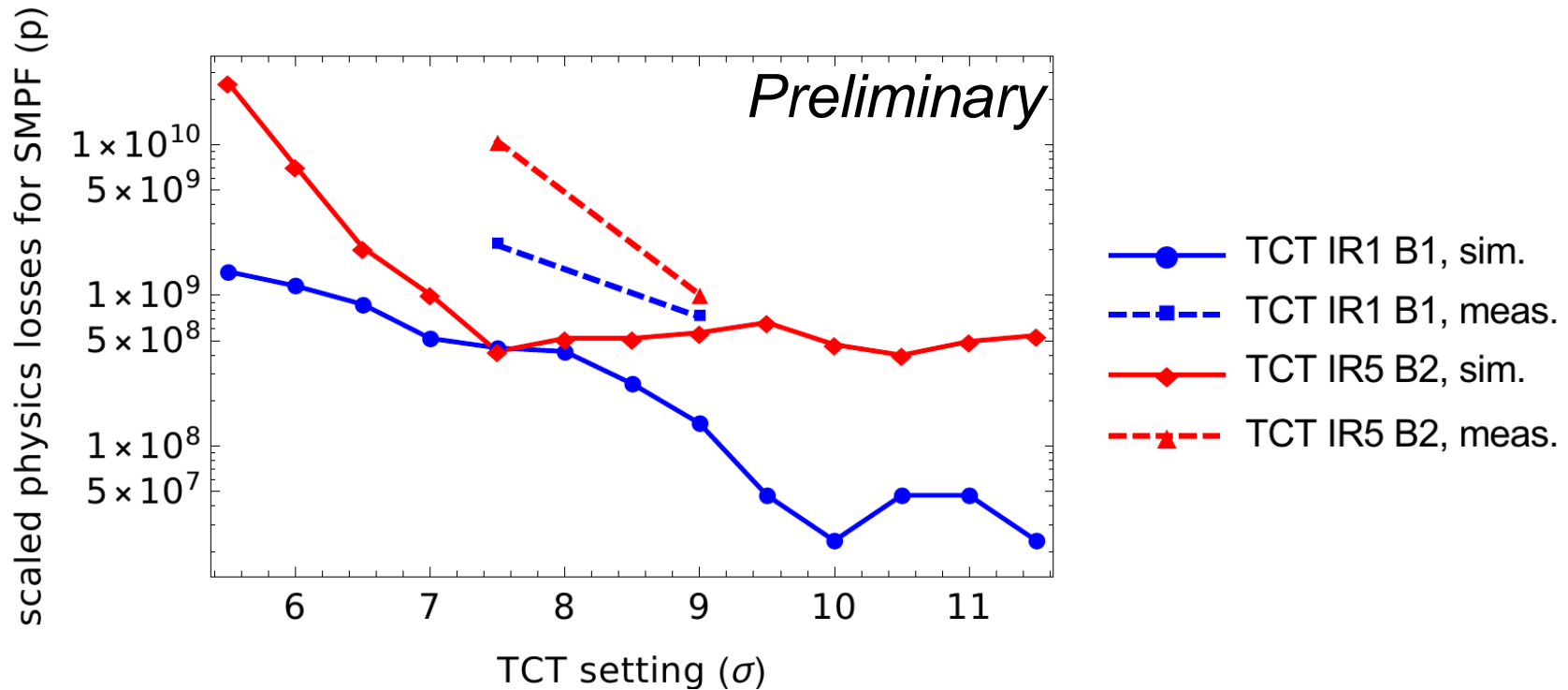
- Showing the abort gap population at time of dump, as function of kick in σ



- Showing BLM signals as function of time around the time of dump
- If dump is triggered early, no real losses seen on TCTs as expected



- Focusing now on the two “useful” tests (May 22 and June 6)
- Showing the two highest TCTs: IR1 B1 and IR5 B2
- First results: measurements and SixTrack simulations (perfect machine)
 - 1.2 mm IR6 bump on in both cases
 - Scaled to full physics beam, type 2 single module pre-fire (kick data from M. Fraser)

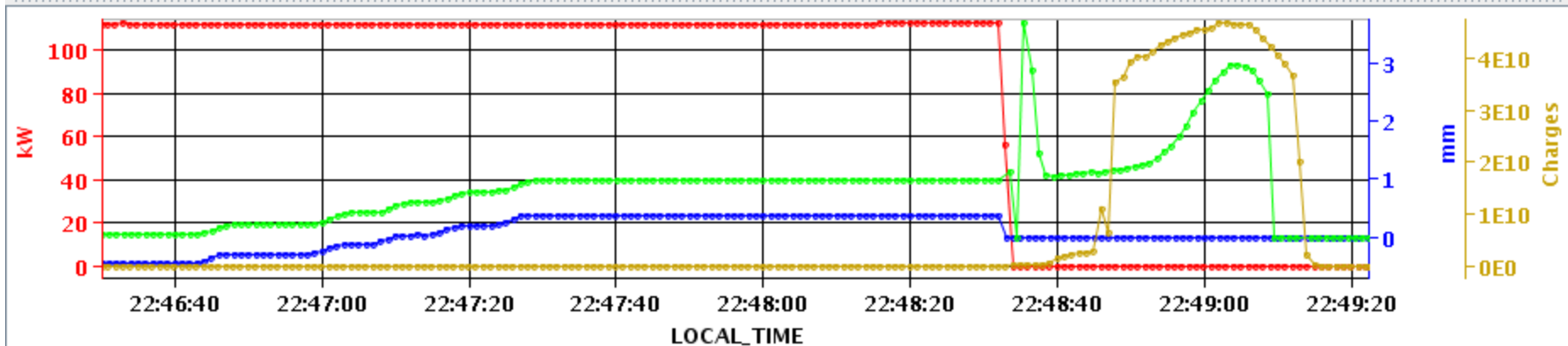


- 1 order of magnitude difference between IR₅ TCT losses at 9 σ and 7.5 σ
 - From simulations, losses not expected to rise at 7.5 σ but at smaller settings
 - Explained by imperfections? Further simulations to be done
- Still, should be no issue for operation – the effective loss in margin from 40 cm OP configuration is around 4 σ
 - But we should understand this for 30 cm
- Asynch dump test done with RF off after 30 -40 s – beam is effectively off-momentum at time of dump.
 - Momentum offset to be checked

- Standard BPMs seem to give zero readings after RF off
- Collimator BPMs (linear positions) show significant excursion. How reliable are these data? Any ideas?
- Do we have effectively a larger loss in margin due to additional orbit offsets? Would still be consistent with 2016 tests.

Timeseries Chart between 2017-06-03 22:40:45.000 and 2017-06-03 22:50:15.000 (LOCAL_TIME)

—●— ACSCA.UX45.L1B1:RF_CAV_FWD
 —●— LHC.BPMSX.A4R6.B2_ITLK:ORBIT_H
 —●— LHC.BPTDH.A4L6.B2:CALIBLINEARPOS
 —●— LHC.BSRA.US45.B1:ABORT_GAP_INTENSITY



- **Work in progress** – still some features to be understood
- Several asynch dump tests performed during 2017 commissioning
- Unfortunately, only two were triggered late enough to give useful data on TCT losses
- TCT losses seem to rise more sharply at smaller settings than expected from simulations in IR5
 - To be understood for 30 cm, but no worry for 40 cm operation
 - Repeat simulations with imperfections
 - Repeat simulations off-momentum
- Could one think of an “on-momentum” asynch dump test in the future?
Cogging to get some pilots to the left part of the abort gap? MD on closed bump from IR6?

Timeseries Chart between 2017-06-03 22:40:45.000 and 2017-06-03 22:50:15.000 (LOCAL_TIME)

ACSCA.UX45.L1.B1.RF_CAV_FWD LHC.BCTFR.A6R4.B1.BEAM_INTENSITY LHC.BPTDH.A4L6.B2.CALIBLINEARPOS LHC.BPTDH.A4R1.B2.CALIBLINEARPOS LHC.BPTDH.A4R5.B2.CALIBLINEARPOS LHC.BPTDH.A4R6.B1.CALIBLINEARPOS LHC.BSRA.US45.B1.ABORT_GAP_INTENSITY

