Sudden (and chronic) beam losses, new masks

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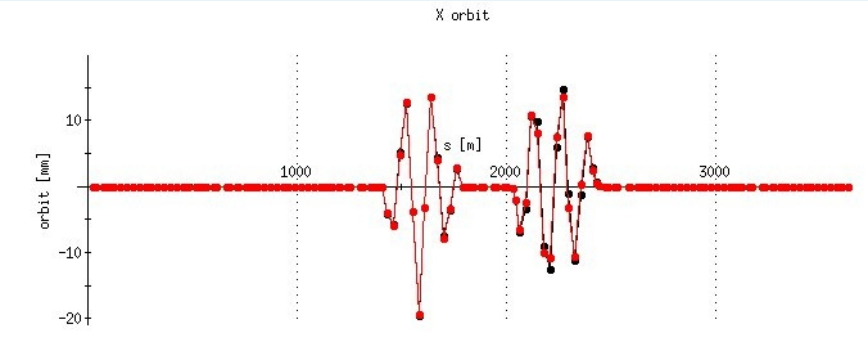
- History (previous runs)
- Run 14 statistics and summary
- Masks (tbi)

A brief reminder of the blue prefire – STAR history

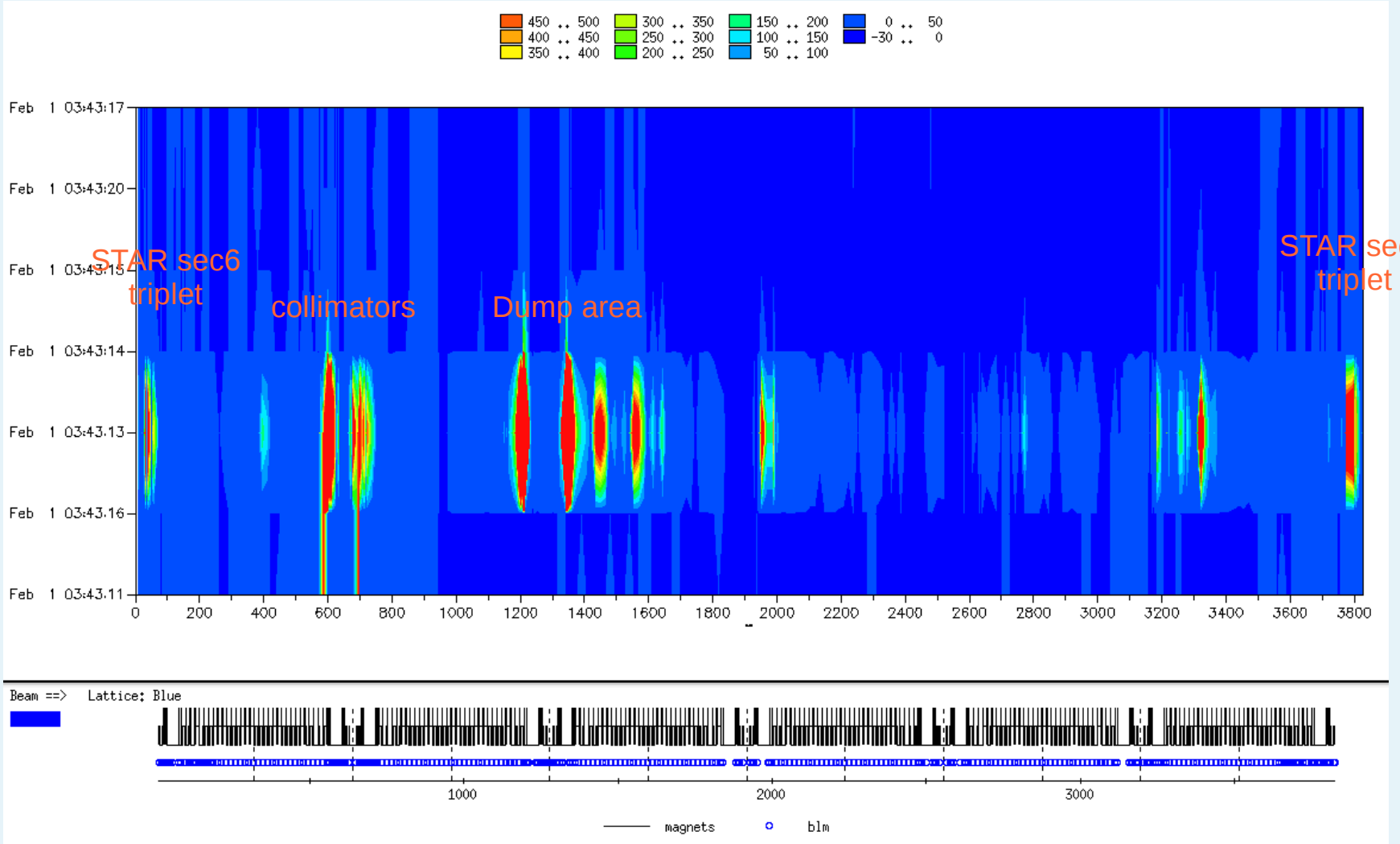
- 2010
  - Total of 11 blue prefires (5 in run 9)
  - 1st blue prefire of the run, STAR MTD electronics damage:
  - Au @ 100 GeV, Fill 11593, intensity 113e9
- 2013
  - Total of 5 blue prefires (run 11 had 3, run 12 only 2)
  - 1st blue prefire of the run, STAR MTD electronics damage:
  - pp @ 255 GeV, Fill 17347, intensity 102e11
- 2014
  - Au @ 100 GeV, He3-Au @100 GeV
  - Could we prevent damage to the STAR detector?

Protection Bump in Run 14

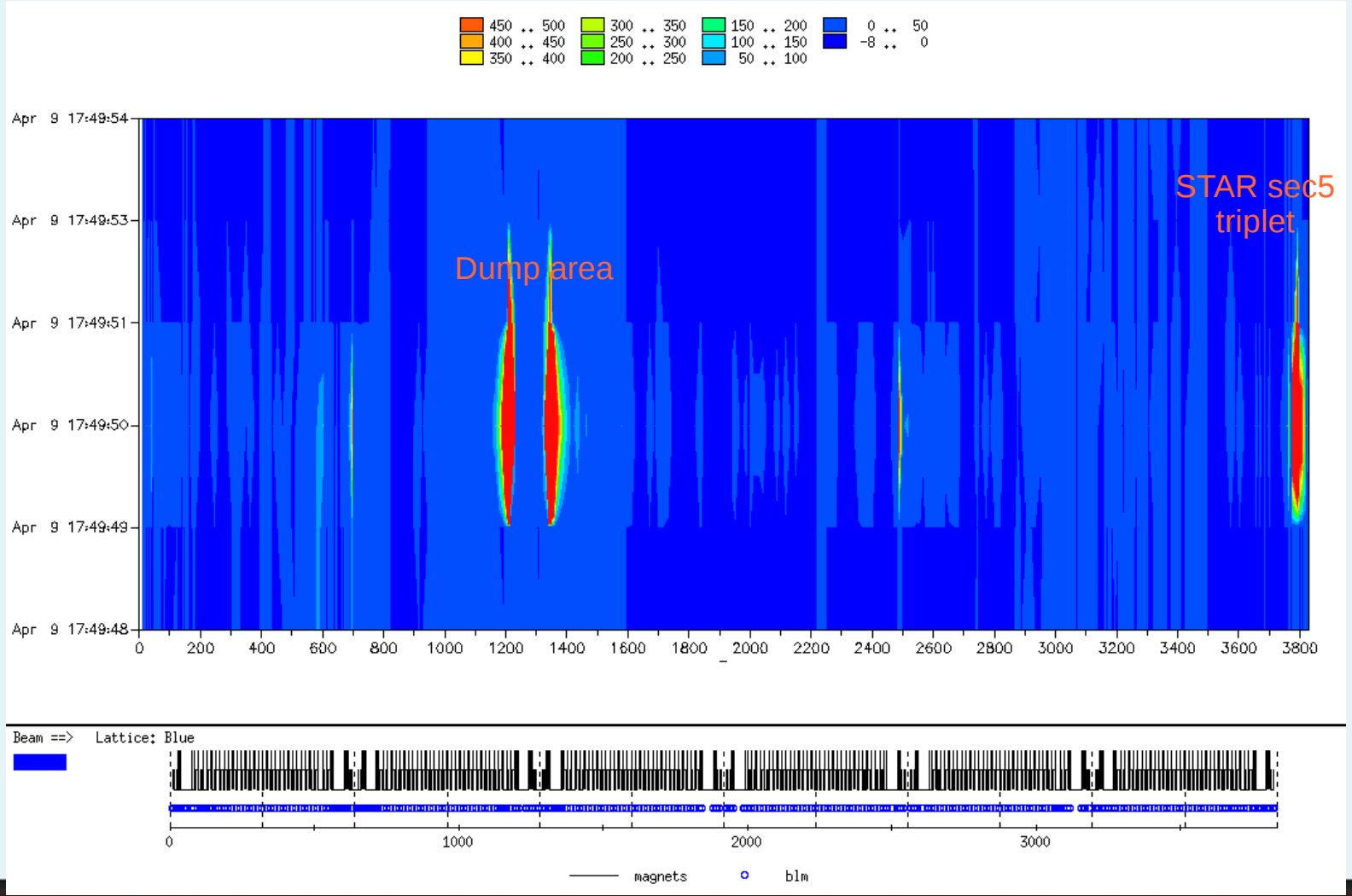
- Due to the lack of other protection a +20mm prefire protection bump was designed and installed in two arcs in each ring
- Bump is located in sec 10 and 11 (blue), sec 9 and 8 in yellow
- One or both arcs(/ring) quenched every time we had a prefire (=> indicates 'smearing' of bunches in bump area)



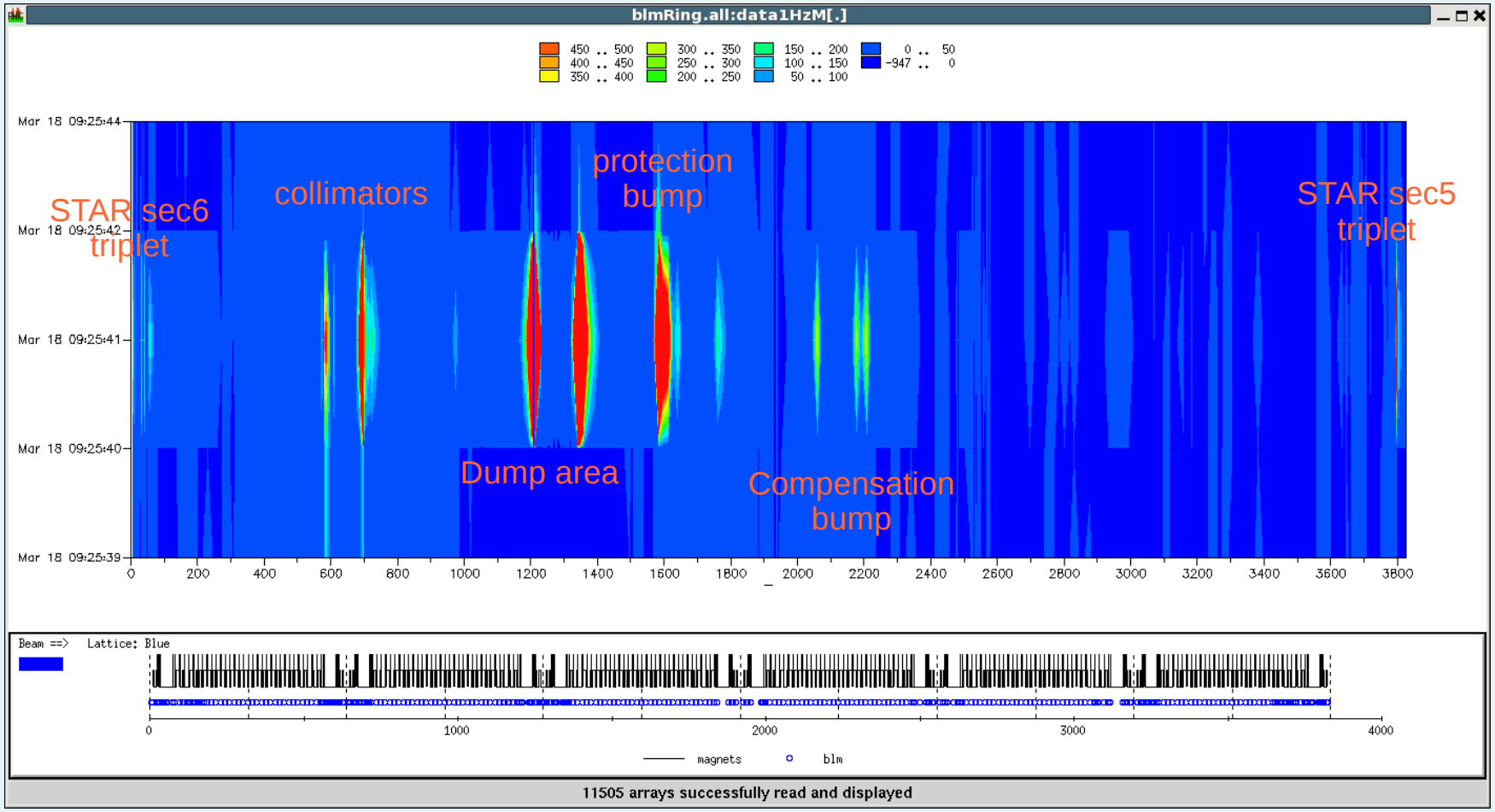
Loss Pattern #11593



Loss pattern #17347



Loss pattern #18066 (run14)



Run 14 statistics

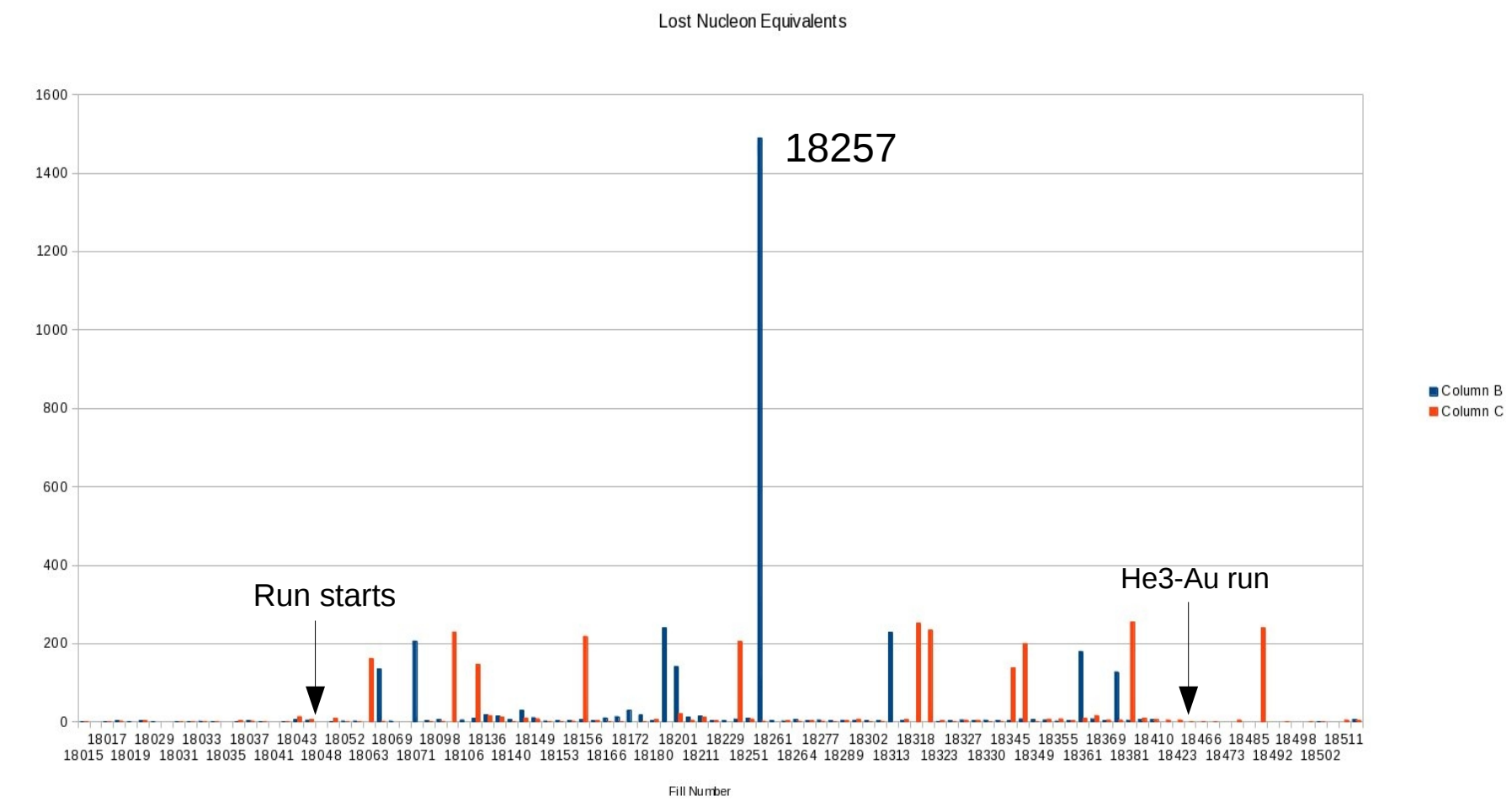
- **Blue**
- 7+3 prefires:
- 18066, 18071, 18199 (@13kV!), 18201 (async. Trigger), 18256 (trip), 18259 (trip), 18313, 18361, 18371
- 18257: beam abort with kickers @ injection!!!
- 2 events w/o losses in bump area

- **Yellow**
- 12+1 prefires:
- 18030 (6x6),18063, 18103, 18129, 18156, 18246, 18318, 18321, 18345, 18347, 18381, 18491, 18511 (voltage deviation permit pull)
- 2 events w/o losses in bump area

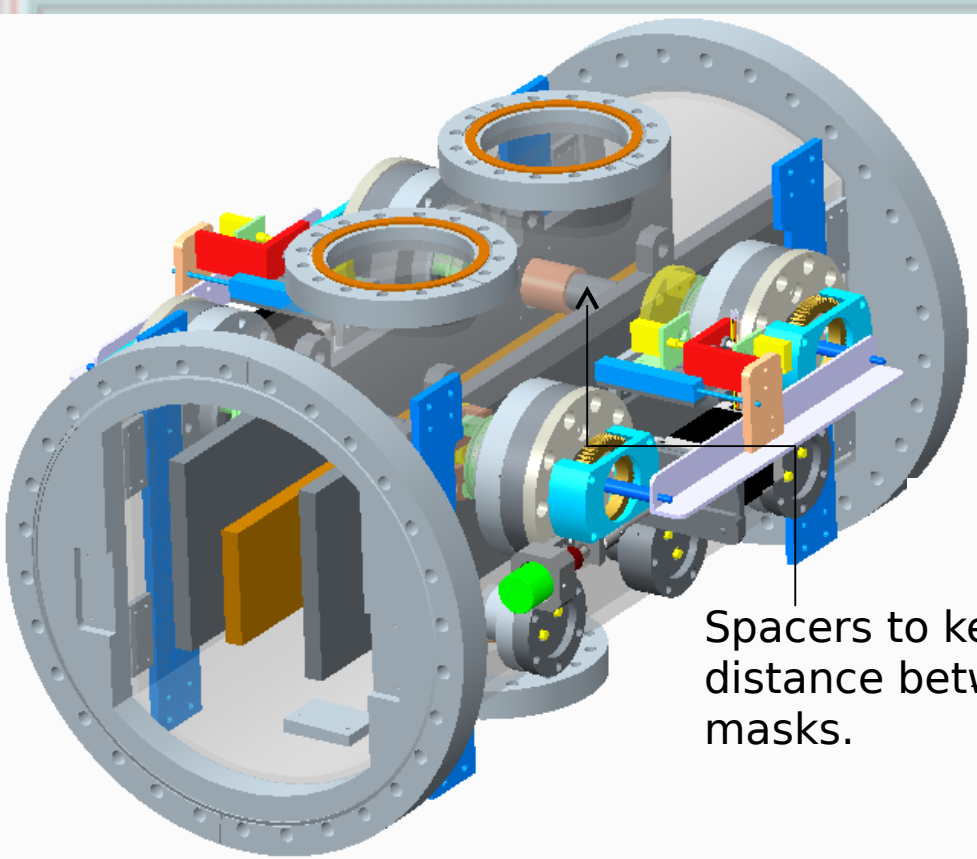
Summary

- All together we had 8 Blue and 11 yellow prefire-type events with beam losses
- In 10(11) yellow events both IR8 triplets quenched (in addition to the arc dipoles)
- Most blue events only the arc dipoles quenched and not the STAR triplets
- Lowest prefire voltage to date: 13 kV :(
- Over 25% of all fills end with beam aborts (107 of 467, with 467 = all numbers, not ramped fills with beam)

Run 14 statistics

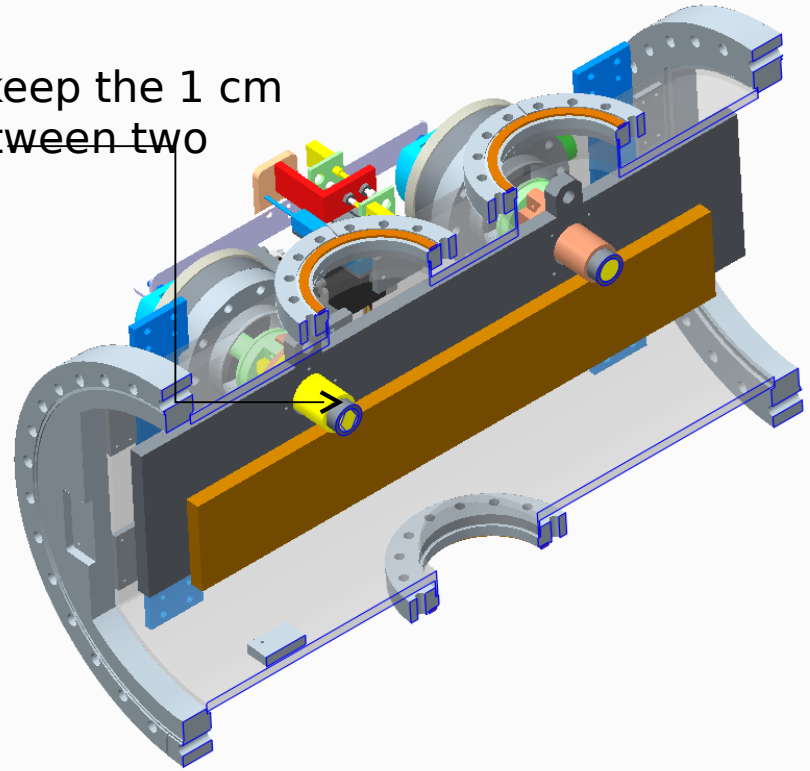


The masks ...
... to be installed



A Conceptual Design of the Mask Assembly
(With a pair of masks installed inside a Stochastic cooling tank.)

Spacers to keep the 1 cm distance between two masks.

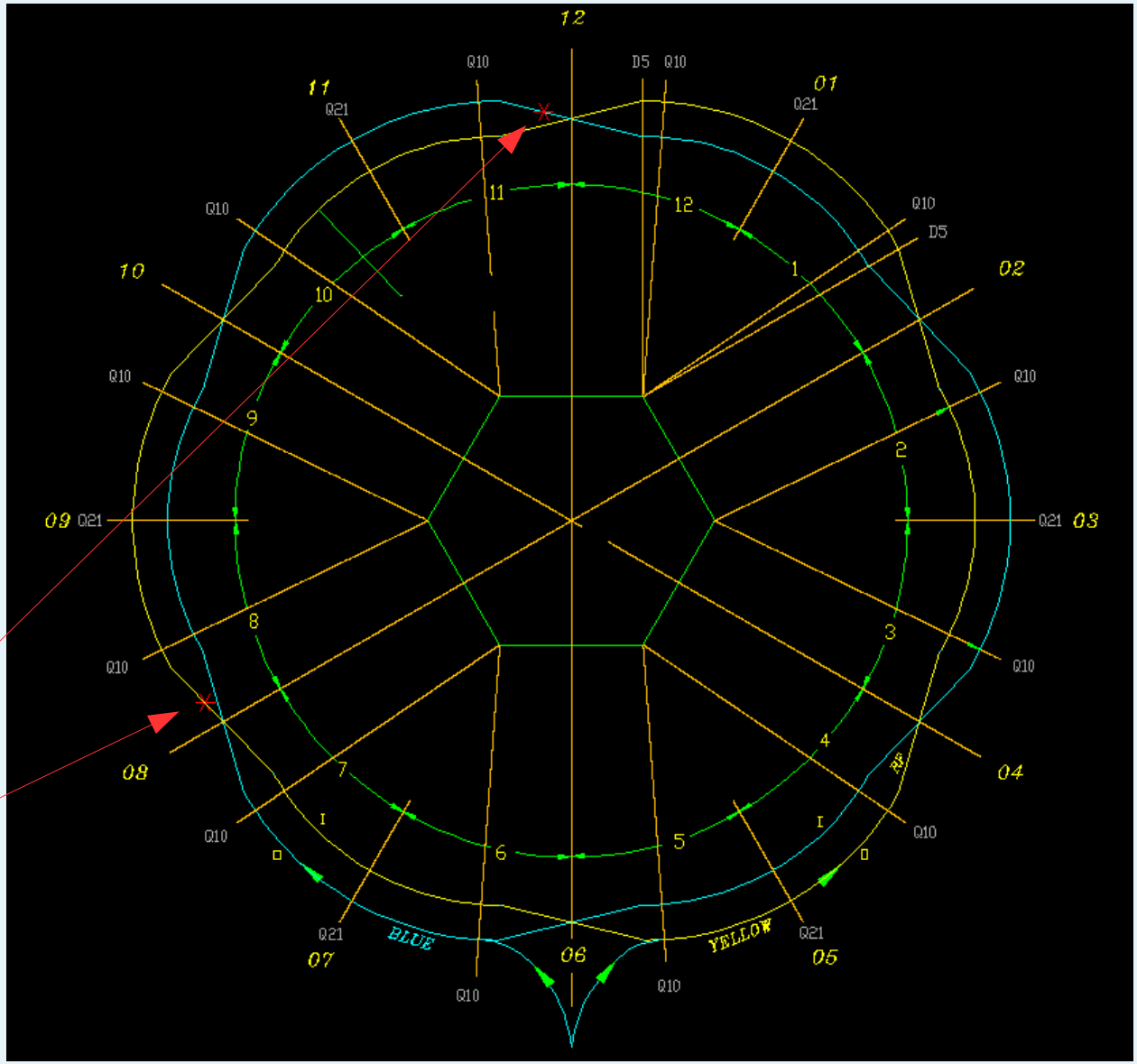


Mask size:
1 cm x 8 cm x 50 cm (LG)
Distance between two masks:
1 cm to 6.3 cm

Courtesy: CJ Liaw

Installation Plan for the New RHIC Mask Assemblies

Masks to be installed between Q3 and Q4 on the incoming sides at IP12 (blue) and IP8 (yellow). There is no room in IP10.



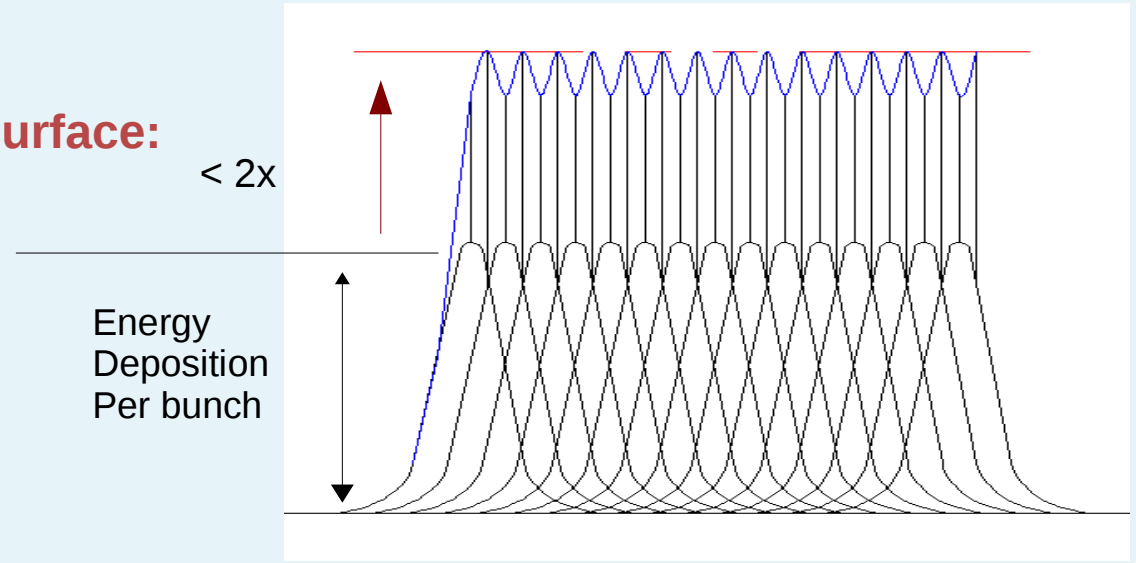
:Mask Assembly

Courtesy: CJ Liaw

Thermal analysis results based on adding 15 bunches of ion particles at the same location and instant.

- Max. temperature on SST Mask due to proton beam: 542 oC (< 1400 oC) Melting Temp.
- Max. temperature on SST Mask due to gold beam: 6415 oC (>> 1400 oC) Melting Temp.

Consider for HI:
"paint" bunches on mask surface:



Courtesy: CJ Liaw

Summary of Stress and Thermal Analysis

- SST for protons (15 x 4e11 bunches):
  - OK after thermal and stress analysis
- SST for HI (15 x 2e9 bunches):
  - Fails both (thermal and stress)
- Graphite for HI (15 x 2e9 bunches):
  - Fails both
- Consider “painted beam”, 2 x 2e9 HI:
  - SST fails stress analysis (OK thermally)
  - Graphite OK for 2 x 2e9 HI (thermal and stress)

Conclude:

- Total of 6 old “Fermilab” type stochastic cooling tanks available
- Use 4 of the available 6:
  - 2 with SST for protons
  - 2 with graphite for HI
- Mechanical alterations needed before installation!