Summary of 1st session

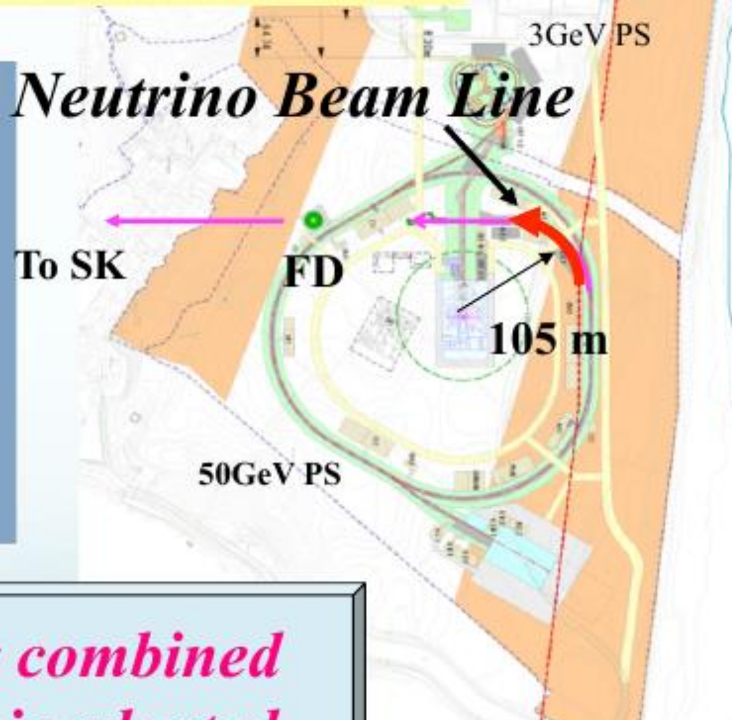
Talks:

1. Ken-ichi Sasaki, J-PARC: two beam-induced quenches in superconducting transfer line.
2. Belen, LHC: losses through the machine cycle.
3. Mariusz, HERA and Tevatron: statistics and reasons for beam-induced quenches.
4. Mei: Beam losses and quenches at RHIC.

T2K project and neutrino beam line

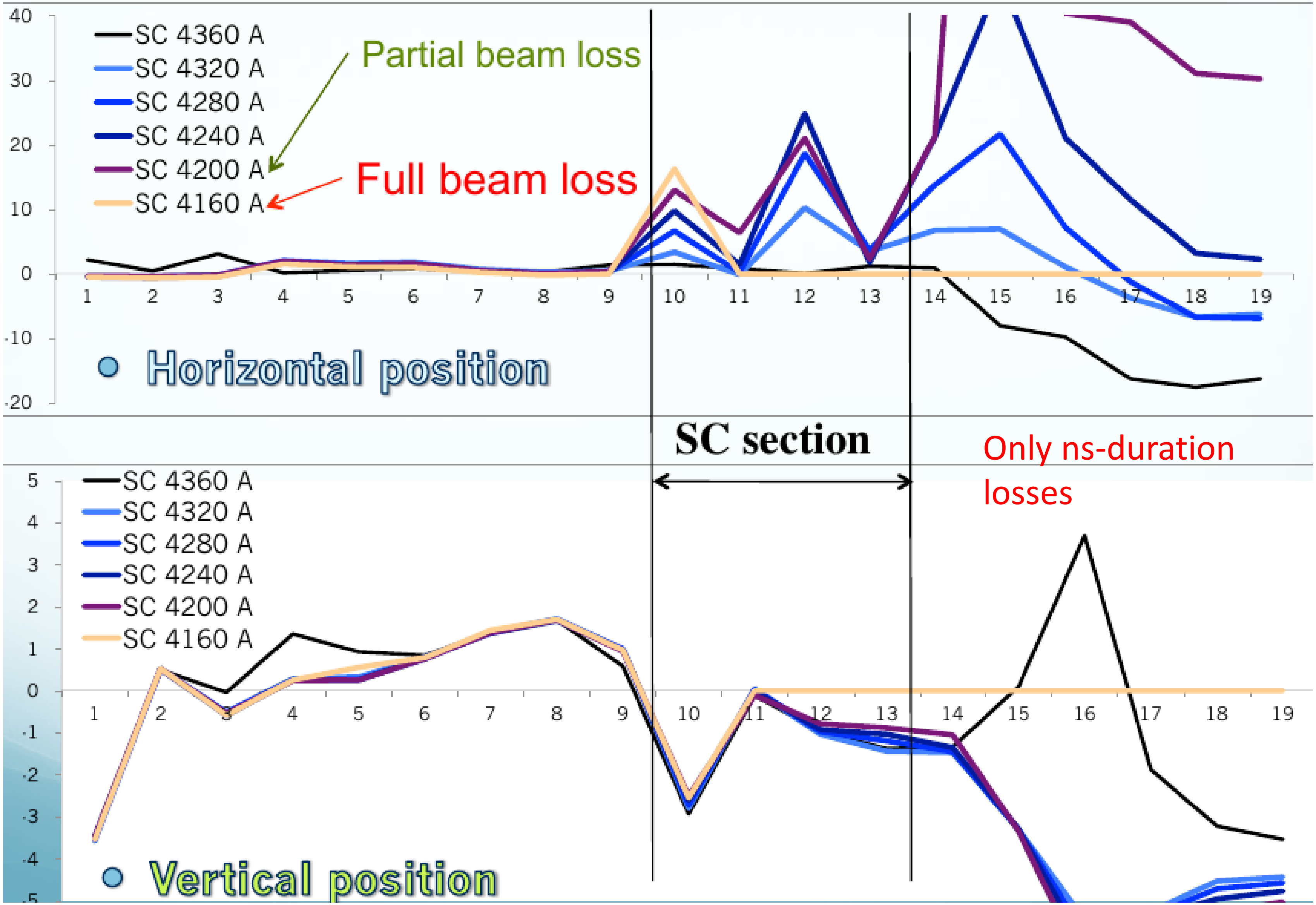
- *SC magnet system for Neutrino experiment at the J-PARC*
  - *constructed since 2004*
  - *completed in 2009*
  - *no serious damage : the East Japan Great Earthquake*
  - *restart physics run in this October*

@Tokai village



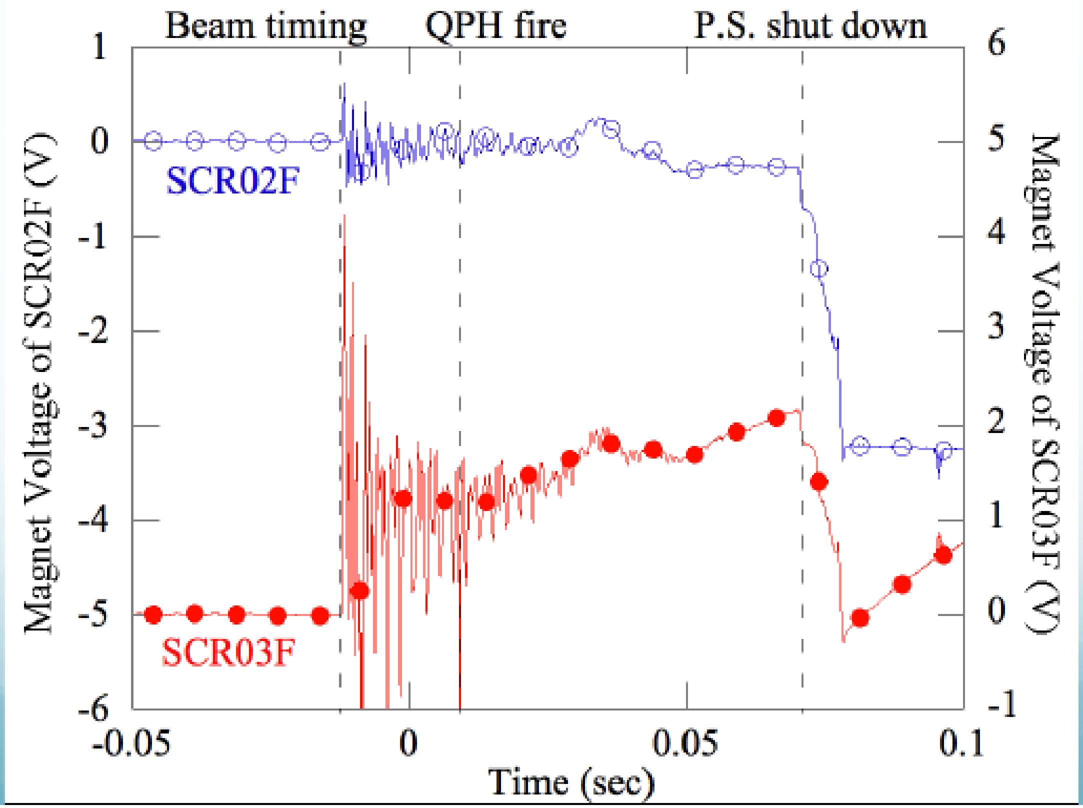
Superconducting combined function magnet is adopted

Beam Position at different currents



Voltage signals in the 1st BIQ

- Voltage fluctuation
  - SCR02F and SCR03F <- Noise caused by particle shower
- Voltage shift
  - SCR03F -> Quench started

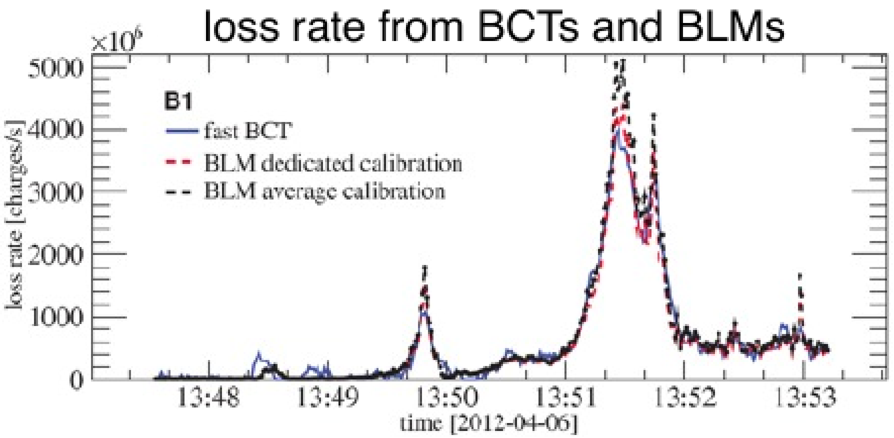


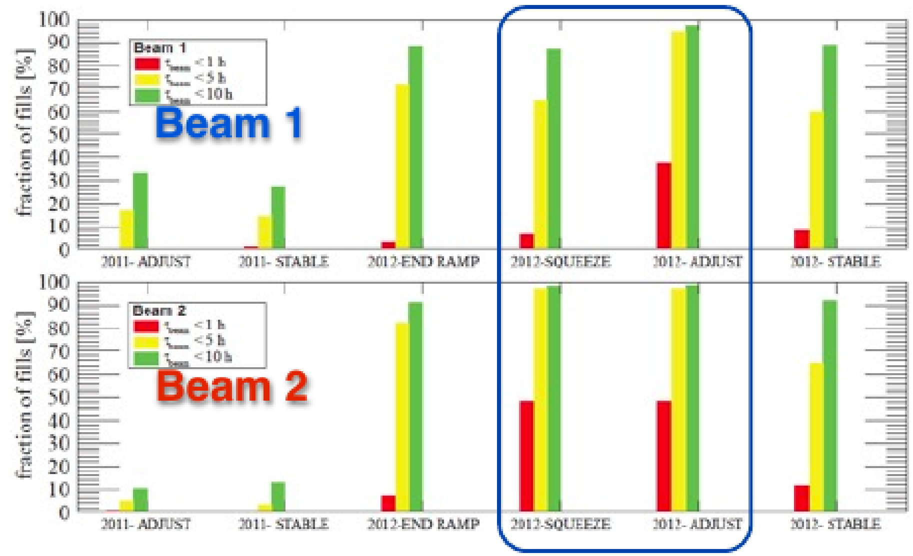
Belen - LHC

- Extensive review of beam losses in LHC
- Particularly interesting: losses at squeeze
- Increase of losses in 2012

Minimum Beam Lifetime

- Beam lifetime: decay time of the beam intensities
- Beam dumped with lifetimes of 0.2h
- Bottleneck for beam losses in 2012 was:
  - Squeeze
  - Adjust
- In **2012, 90%** of the fills had lifetime **below 10h**, while in 2011 only 30%.
- In **2012, 50%** of the fills with **lifetime < 1h** during **ADJUST**
- In **2012, 50%** of the fills with **lifetime < 1h** during **SQUEEZE** for **Beam 2** and 10% for Beam 1





Mariusz-Tevatron and HERA

- BIQs during squeeze at Tevatron
- <5ms losses in HERA

Tevatron

FERMILAB-CONF-11-129-APC

TEVATRON ACCELERATOR PHYSICS AND OPERATION HIGHLIGHTS

A. Valishev for the Tevatron group, FNAL, Batavia, IL 60510, U.S.A.

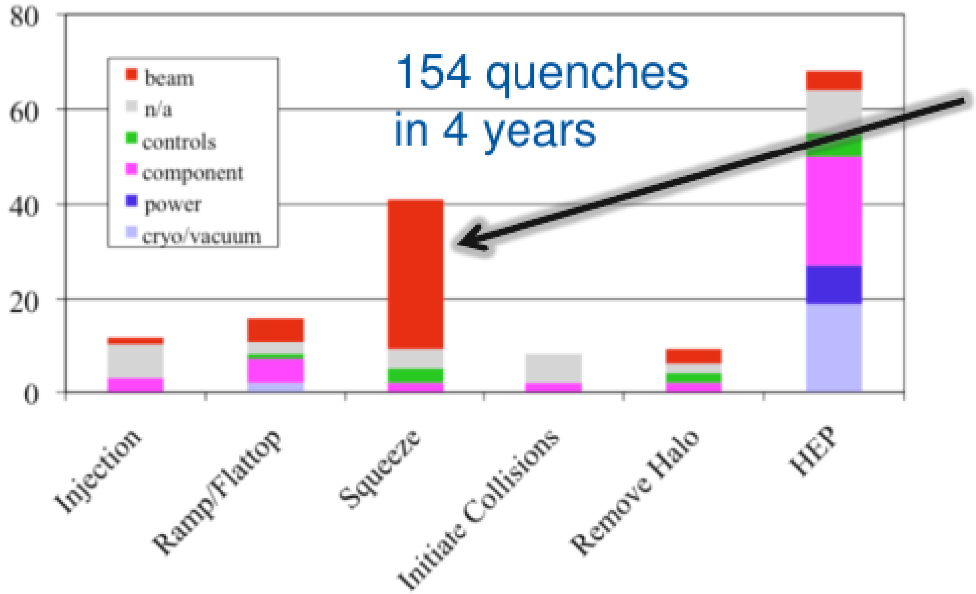
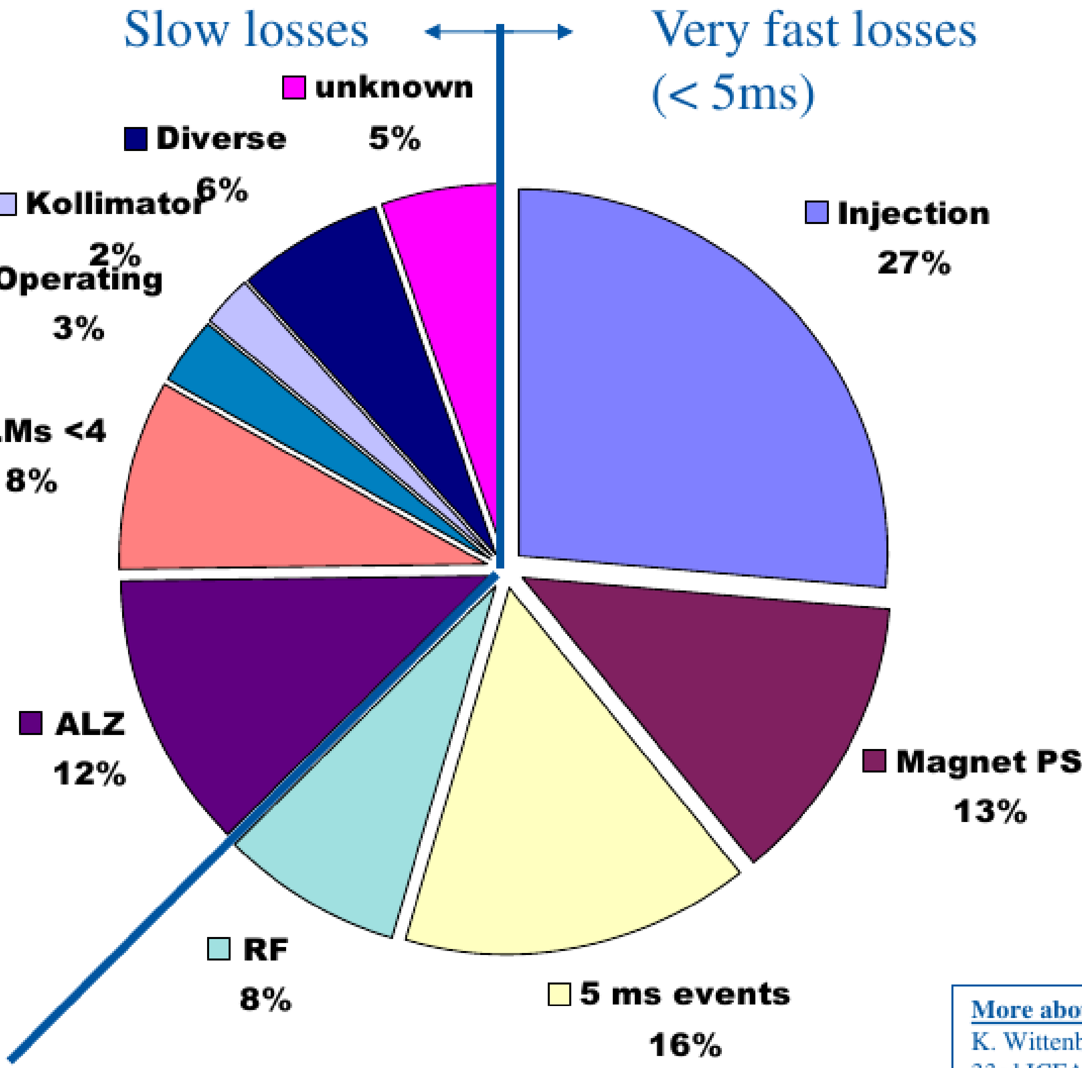


Figure 4: Categorization of Tevatron magnet quenches. Data between October 2007 and March 2011.

- 32 quenches during 120s step during β* squeeze from 1.5 m to 0.28 m and change of helical orbits shape – reduction of beams separation from 6 to 2σ
- Loss of antiprotons requires lengthy replenishment – significant loss of lumi
- 2010 – introduction of collimation at top energy (in IRs), reduction of losses to experiments and beam-induced quenches

Beam loss induced Quenches 1994 - 2004



$\Sigma = 200$ Quenches

More about failures:
K. Wittenburg (DESY): Beam loss & machine protection
33rd ICFA ADVANCED BEAM DYNAMICS WORKSHOP on
HIGH INTENSITY & HIGH BRIGHTNESS HADRON BEAMS

Mei - RHIC

- Lack of good time-resolution for BLM measurements
- Decrease of number of quenches over years
- Many BLMs observe both beams at the same time
- Empirical thresholds – cannot damage magnets
- Quenches due to filling of abort gap or dump kicker mis-firing

Beam Losses and Beam Induced Quenches at RHIC

M. Bai, K. Brown, P. Oddo
D. Bruno, G. Heppner, C. Mi
C-A Dept., Brookhaven National Lab., Upton, NY, USA

BROOKHAVEN NATIONAL LABORATORY
a passion for discovery
U.S. DEPARTMENT OF ENERGY | Office of Science

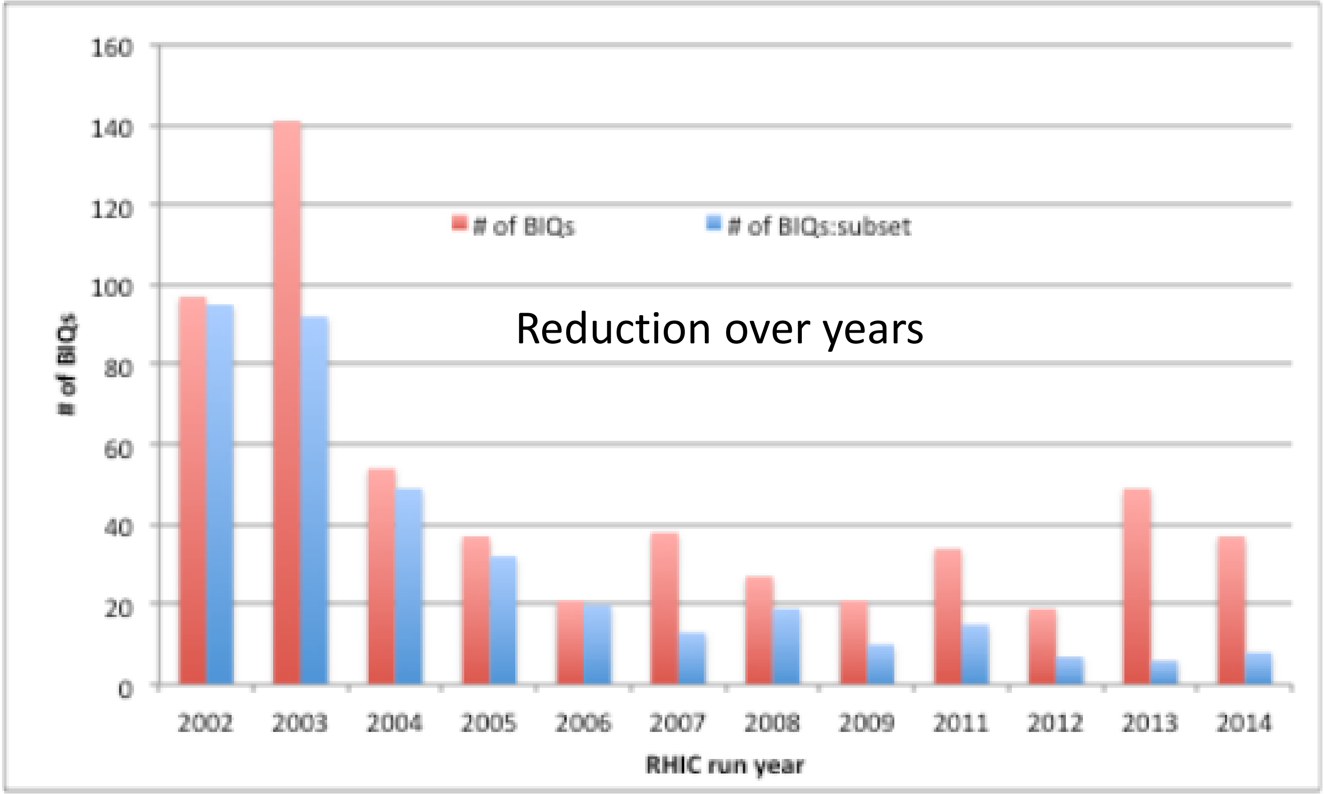
RHIC Beam Induced Magnet Quenches

- Remaining beam induced magnet quenches are
  - Beam abort kicker dis-function
  - Significant de-bunched beam

    dominant
  - Blms thresholds are not enabled in the beam permit
    - at injection and low energy
    - At the end of the store. BLMs are removed from permit to minimize the false permit pull due to the spread of beam losses downstream of dump area
  - Blm's blind spot due to localized losses that only a few beam loss monitors see excessive beam losses (fill 10488, 10496, etc)
    - Enabling or lowering these BLM thresholds can help to reduce the risk but at a price of making false beam aborts due to large losses from beam halo instead of beam core
  - Inappropriate setting of threshold settings
    - Threshold set value is too high than the actual radiation that caused BIQ
  - Losses that are too fast for SlowThreshold yet too slow for FastThreshold
  - Blind spot of accumuLoss threshold system since its setting is fixed for all energies

RHIC Beam Induced Magnet Quenches

- Excluding the un-preventable BIQs, the # of BIQs



Summing up

- It is very useful for BIQ understanding to have BLM system with good temporal resolution (HERA, RHIC).
- LHC and Tevatron: both significant losses at squeeze.
- QPS system initial spike: seen also in case of KEK transfer line quench.
- LHC is the only machine without operational quenches (yet), but it operates with 200x more energy stored in the beams, so beam losses are potentially more destructive.
- In future LHC cannot afford number of quenches experienced in other machines.