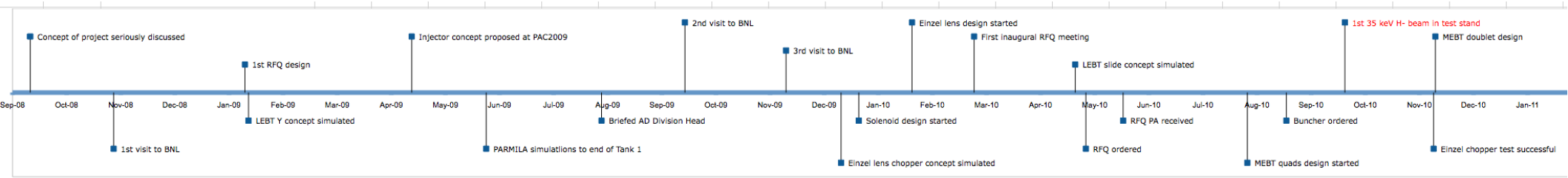
RFQ Injector Fixes and Performance/Reliability

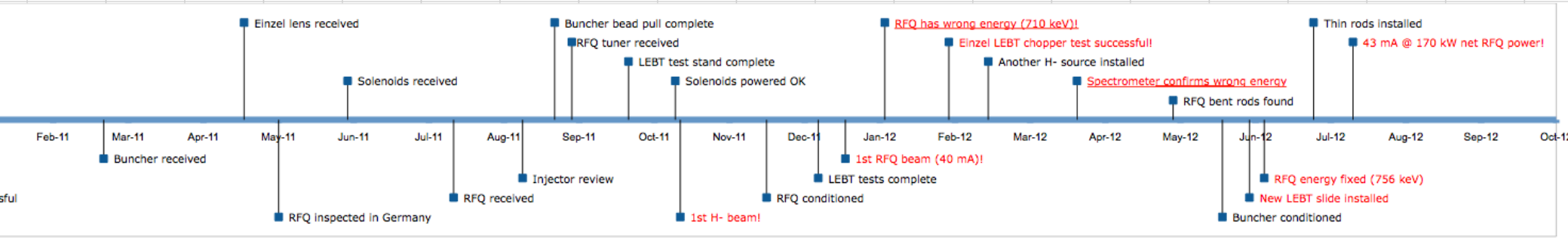
C.Y. Tan
15 Aug 2012

Agenda

- RFQ injector fixes
  - Relieved pressure on input power coupler.
  - Used gas focusing
  - Revealed that there was insufficient gas focusing when chopper is running.
- 4 days of continuous running (Friday to Tuesday morning)
  - Problems started on Tuesday when we started messing around with the source extractor.

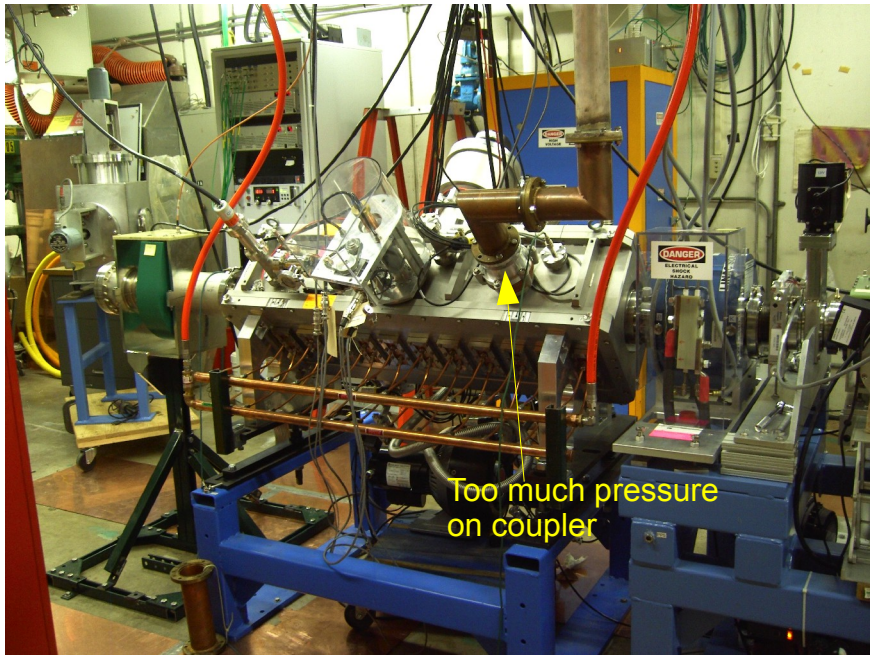
Project Time Line

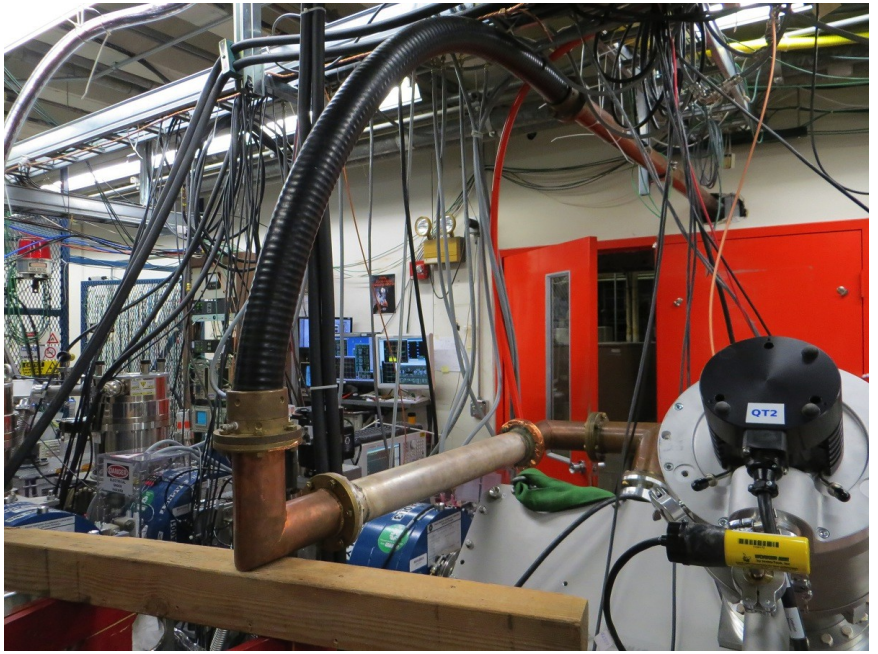




4 years and counting!

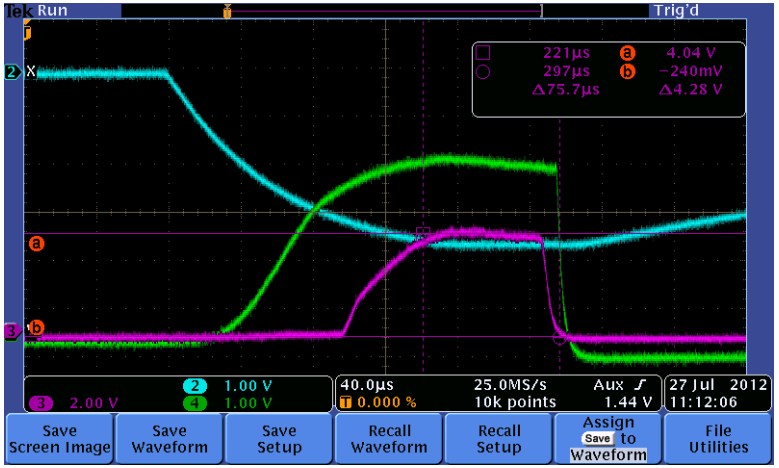
S11 of power coupler is poor

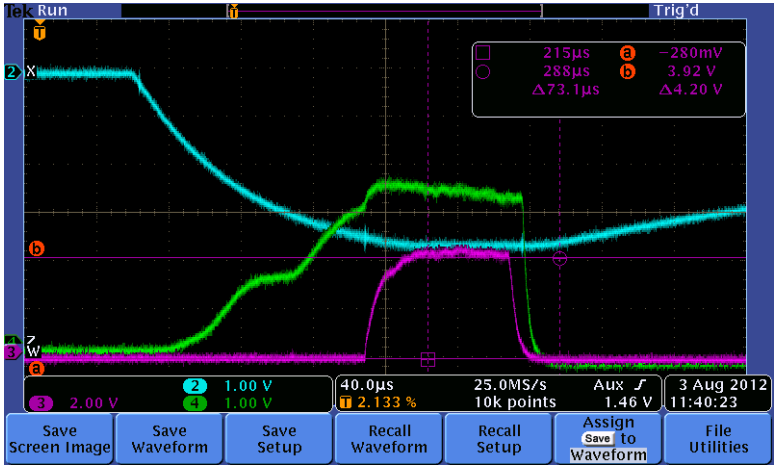


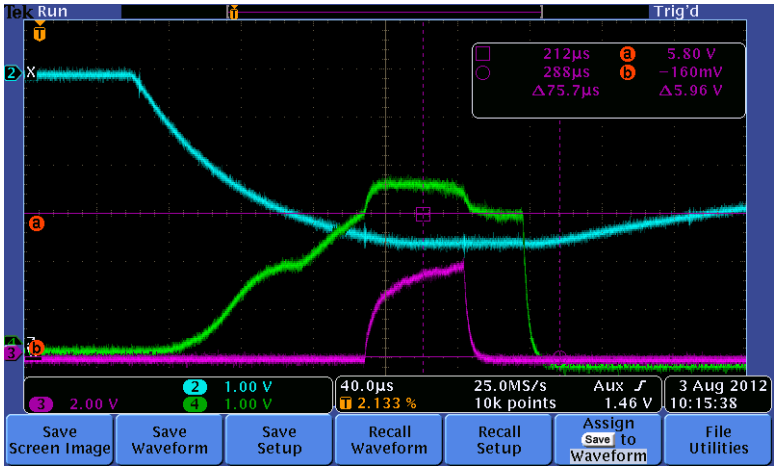


The new configuration with the piece of “magic” wood relieves pressure on the power port. The reflection without beam is now 1-3% compared to 10-15 % previously!

Addition of Chopper



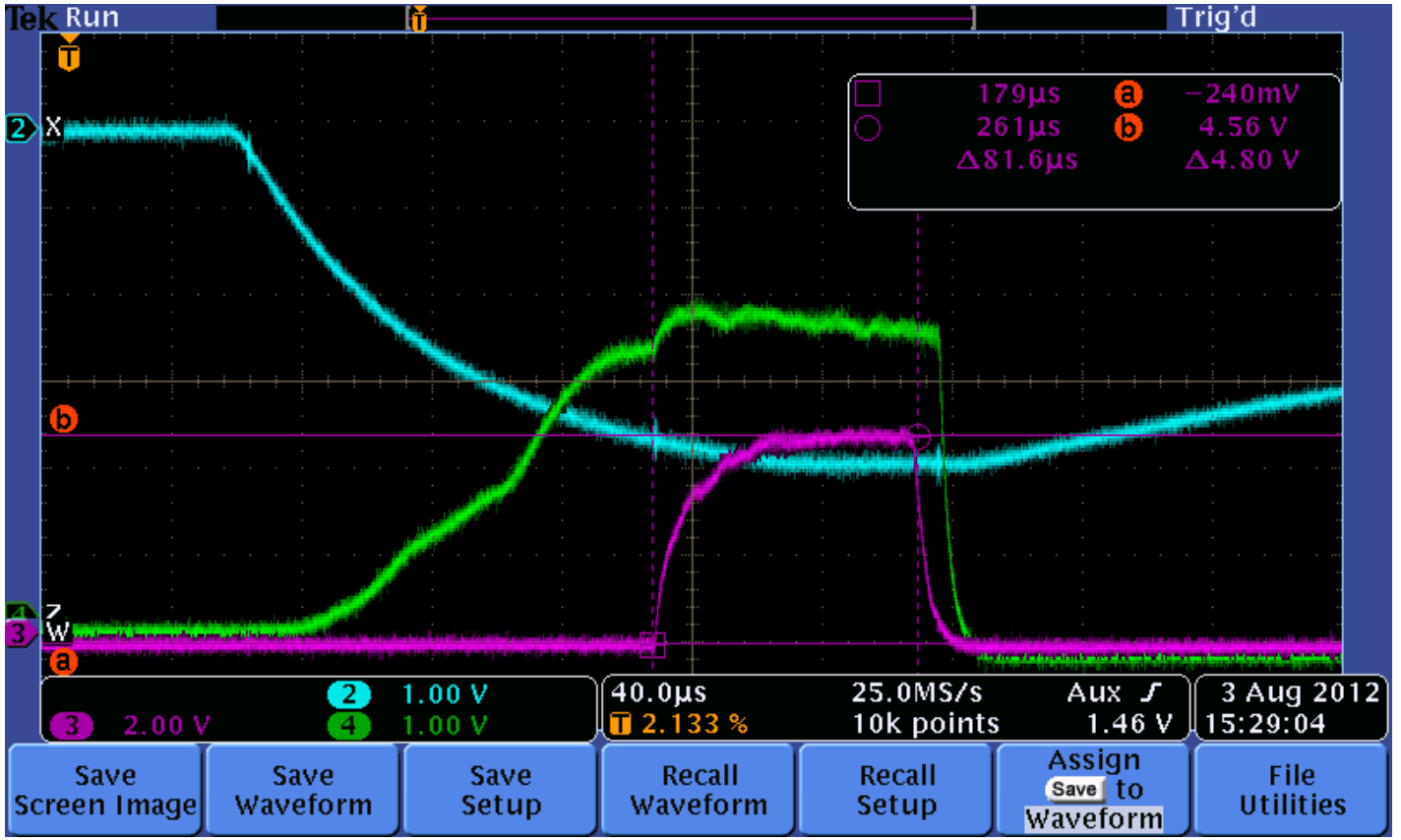




Spoil vacuum in LEBT from 1e-6 torr to 2e-6 torr, and beam becomes flat!

An important consequence, gas focusing increases transmission through RFQ to 42.5 mA @ 170 kW net!!!!

More tuning improves capture



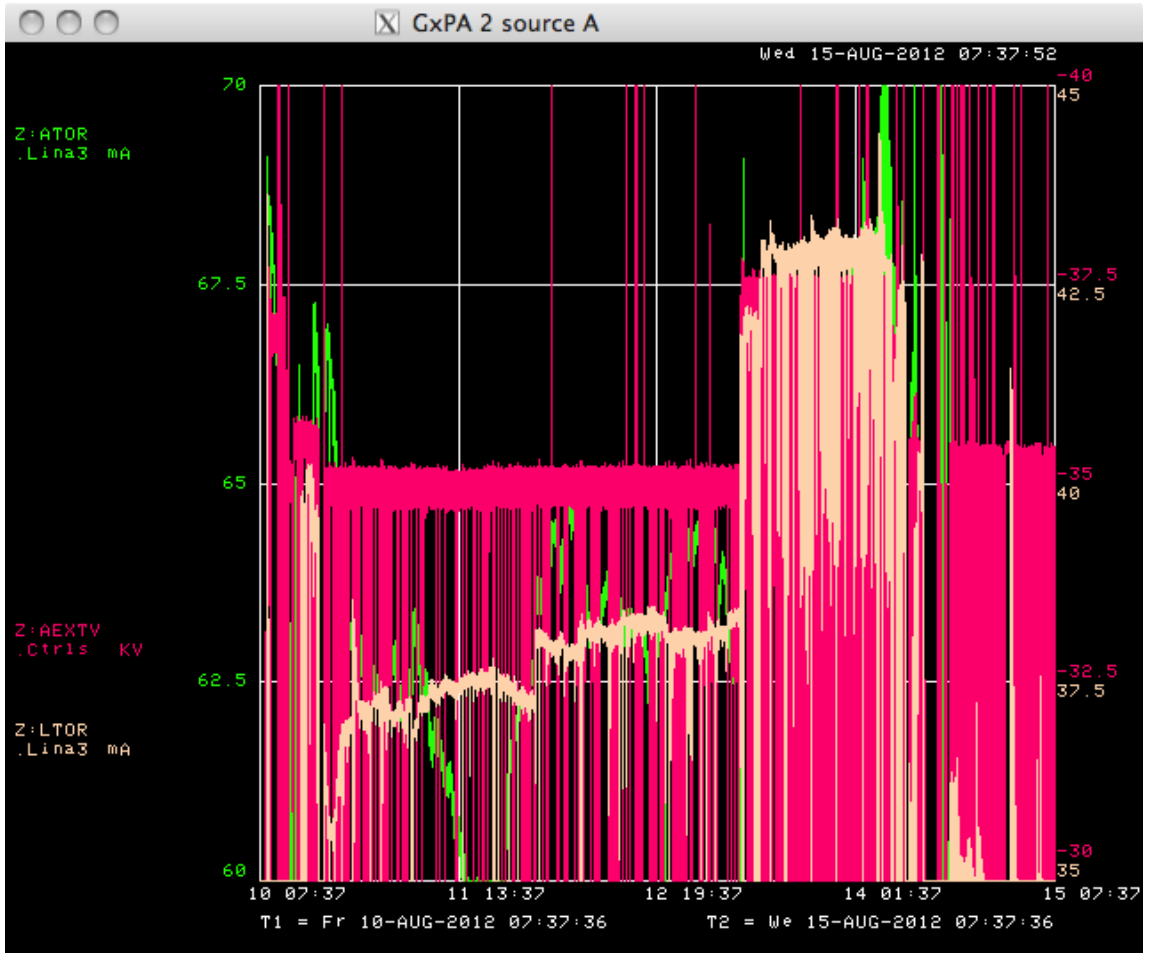
LTOR = 45 mA @166 kW from 67 mA in LEBT (67% efficient)

Scope says 48 mA!

Compare with BNL in 1990s which has approximately the same LEBT as we do. Output is 45 - 50 mA with 55 mA in LEBT (80-90% efficient)

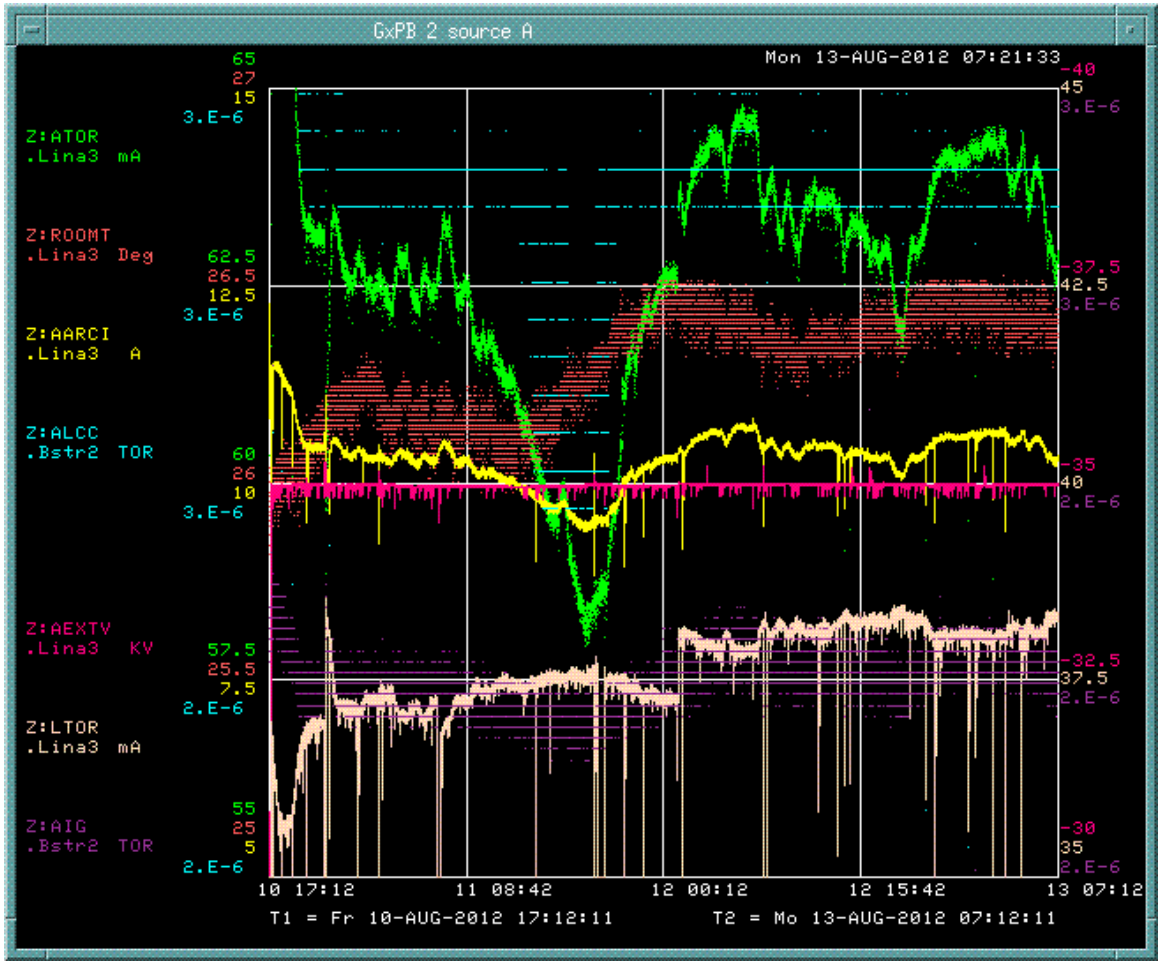
However, must run source extractor between 37 – 38 kV !

Source sparking



The source is sparking whether it is running at 35 kV or 38 kV, although the rate is higher at 37.5 kV compared to 35 kV.

Source Current Drifting



Gas valve opening/closing closely correlated to temperature in the room.

RFQ current anti-correlates with source beam output. Emittance?

Conclusion

- RFQ largely good enough to go.
- Source is presenting some problems
  - Current drift
  - Sparking
    - Extractor broke twice from sparking. Once at the start of the reliability studies. Second time, after extractor tube change out when voltage increased from 35 kV to 37.5 kV. (Don't let Tan touch the voltage!)
- Is the injector good enough to go. Hard to tell in 5 days!
  - That's why Bill is paid the big bucks to make hard decisions.
  - Tan would just do it.

Bill Makes a decision ...