A Supernova “Calibration” Source

4th year thesis project

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Idea:

- Use a programmable pulse generator, a laser diode, and the laserball to create a semi-realistic simulation of a SN signal in the detector.
- Compensate for lack of power of a Laser Diode by stretching pulse out to 100-200 ns if necessary (should not affect trigger; don't care about reconstruction)

Motivation:

- SN Trigger is embedded in snostream and sees only "dispatched" data
- dispatcher efficiency known to be a function of data volume (rate x <NHIT>)
- Laser system has rep rates up to 50 Hz and adjustable occupancy, so is not a good test for DAQ chain performance during a SN
- point out weaknesses / opportunities for tuning in DAQ chain
- be ready for a near SN

Some Facts:

- SNO front-end electronics can buffer ~10^6 events (4MB/MB)
- read-out is at 10Mbps (ethernet) – takes many minutes
- chain: detector, FECs, eCPUs, DPM, builder, builder2, dispatcher, snostream
    - opportunities for overflow, buffering losses / mismatches, network congestion

- what we know:
    - under sustained calibration – data throughput 300-400 kbps; then data losses

- How close could a SN be before have data loss? (weakness of S-K)
- whole system performance?
- possibility to tune throughput? Change buffer sizes, etc.

- with NCDs adding a second builder; new dedicated UG and AG dispatchers
- SN trigger is at the end of a long chain with several possible weak links

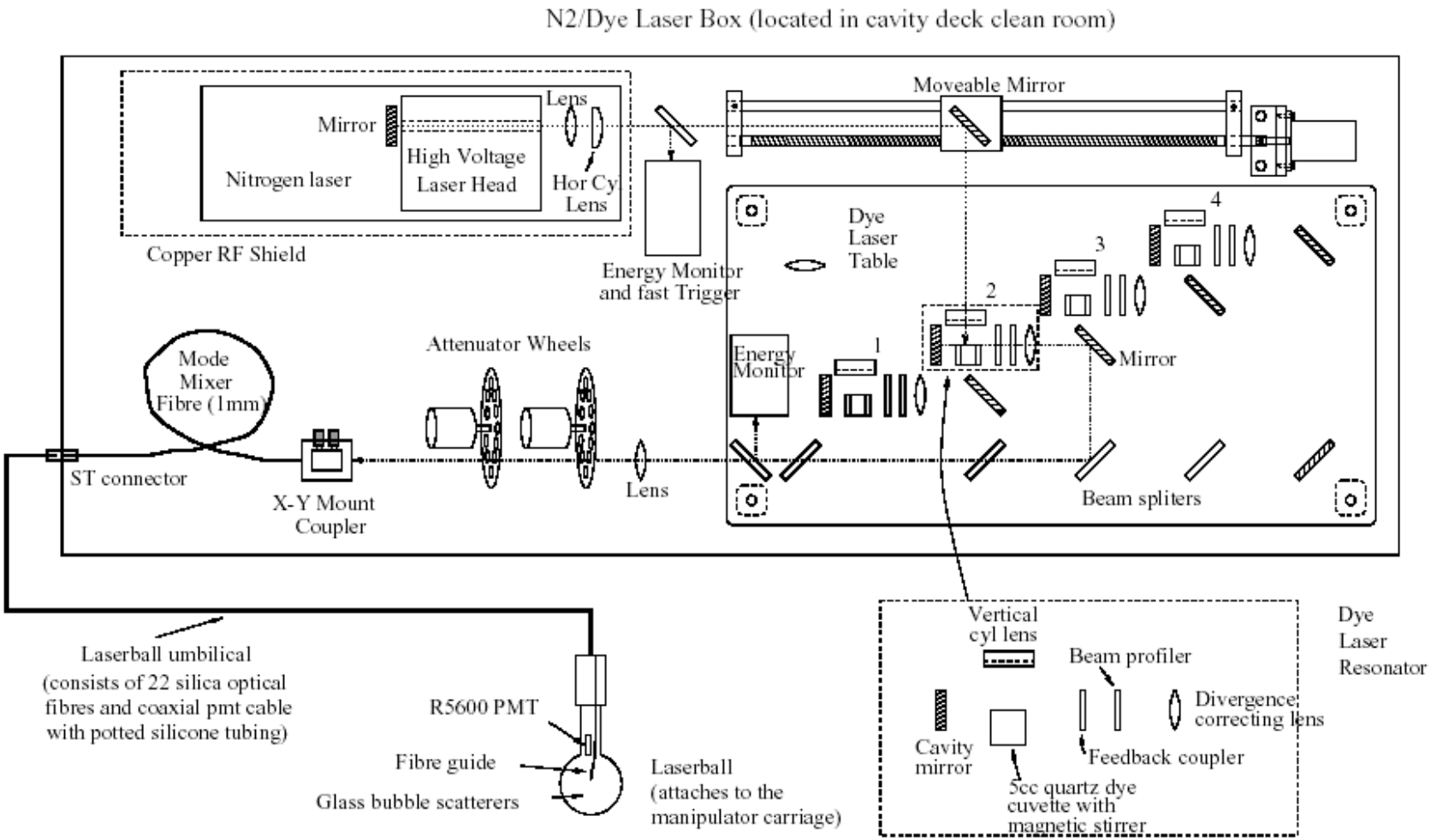


Figure 5.1: *N_2/dye laser system overview [11].*

from Bryce Moffat's thesis

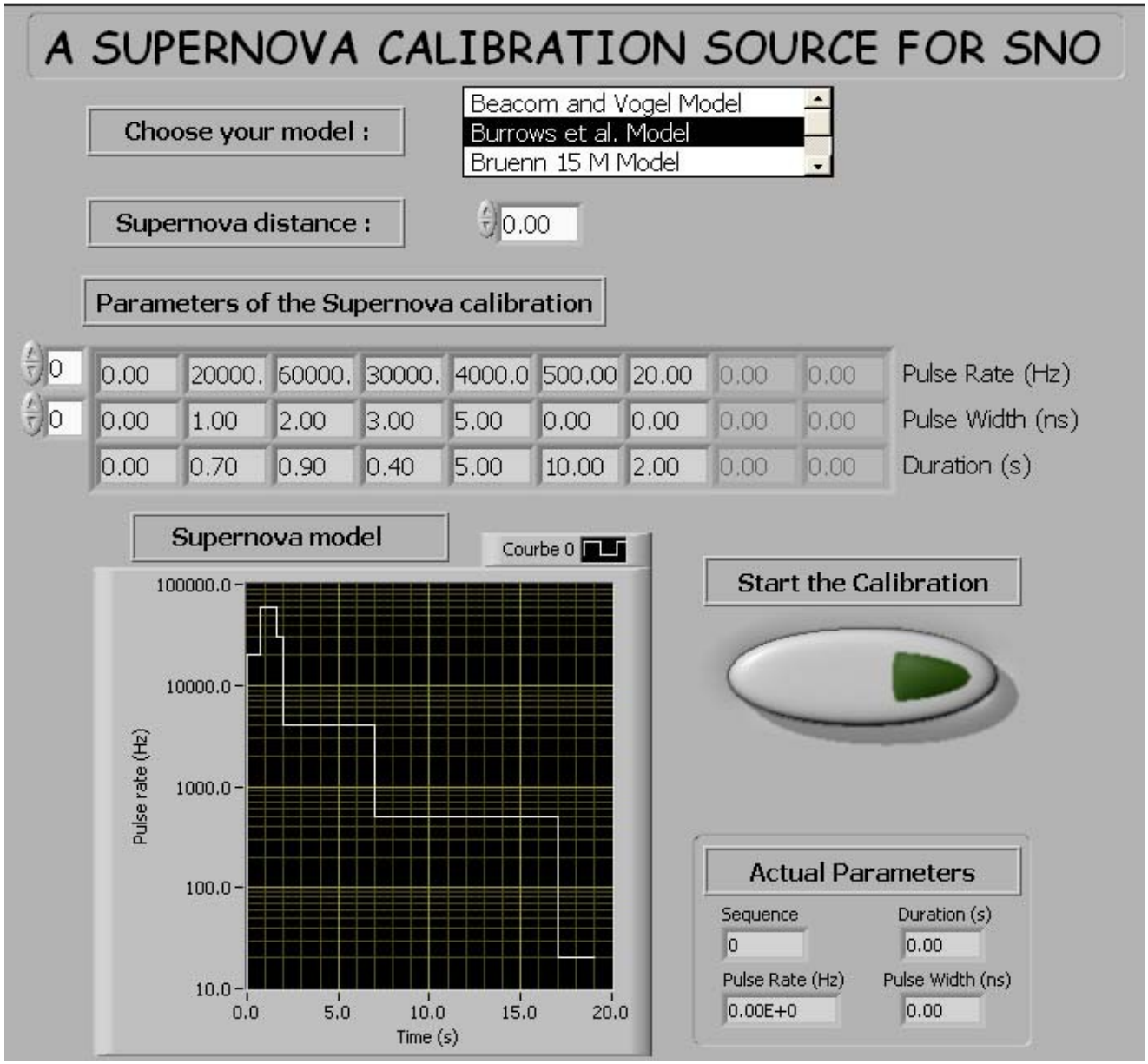
Photon budget:

- Assume 100kW, 600ps for laser --> 10^{14} photons per pulse
- Assume laserball transmission ~5% **
- Assume 10^5 attenuation at 400nm gives occupancy ~100 **

- Best guesses at attenuation through complete system ~10^{11}
- Possibility to insert Laser diode at point where attenuation is $2x10^3$
- For NHIT 300, 20ns pulse, need only 0.13mW Laser Diode power

- satisfied that this is feasible, pending confirmation of assumptions

** Richard Ford's estimates



- done in LabView
- GPIB interface to pulser

Still to do…

- optical design
- mechanical design
- finish labview interfacing
- laser driver design
- trigger interface