LIGO NCAL Quick Summary

See Poster for Additional Information

Jeff Kissel, Richard McCarthy, Daniel Sigg

LIGO Hanford Observatory

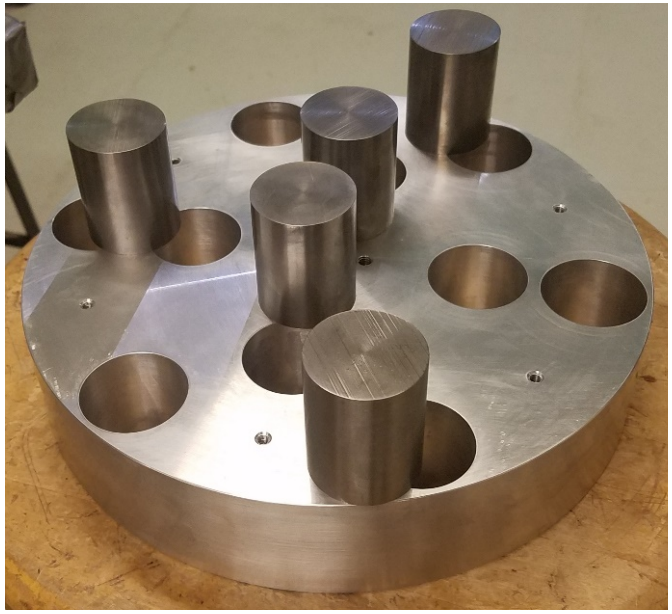
Robert Schofield

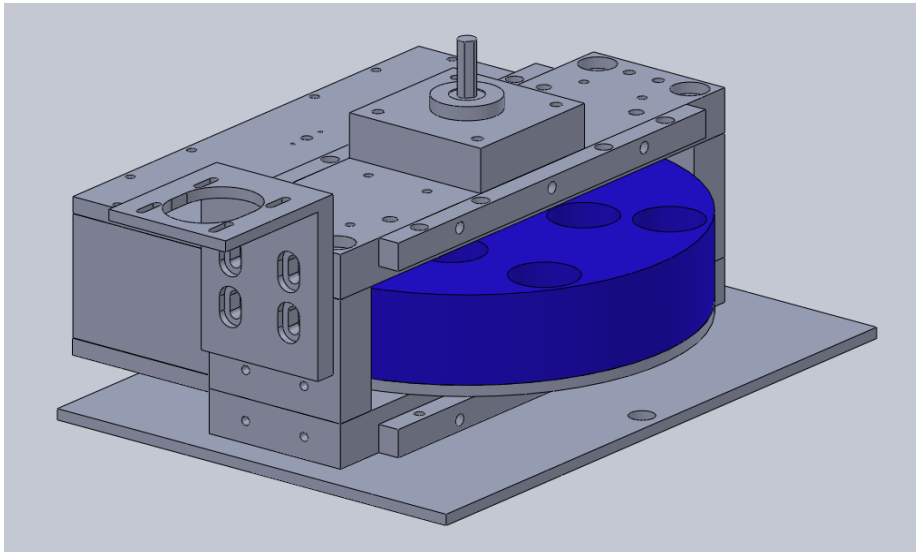
University of Oregon

Kavic Raman Kumar, Michael Ross, Jens Gundlach, Krishna Venkateswara

University of Washington

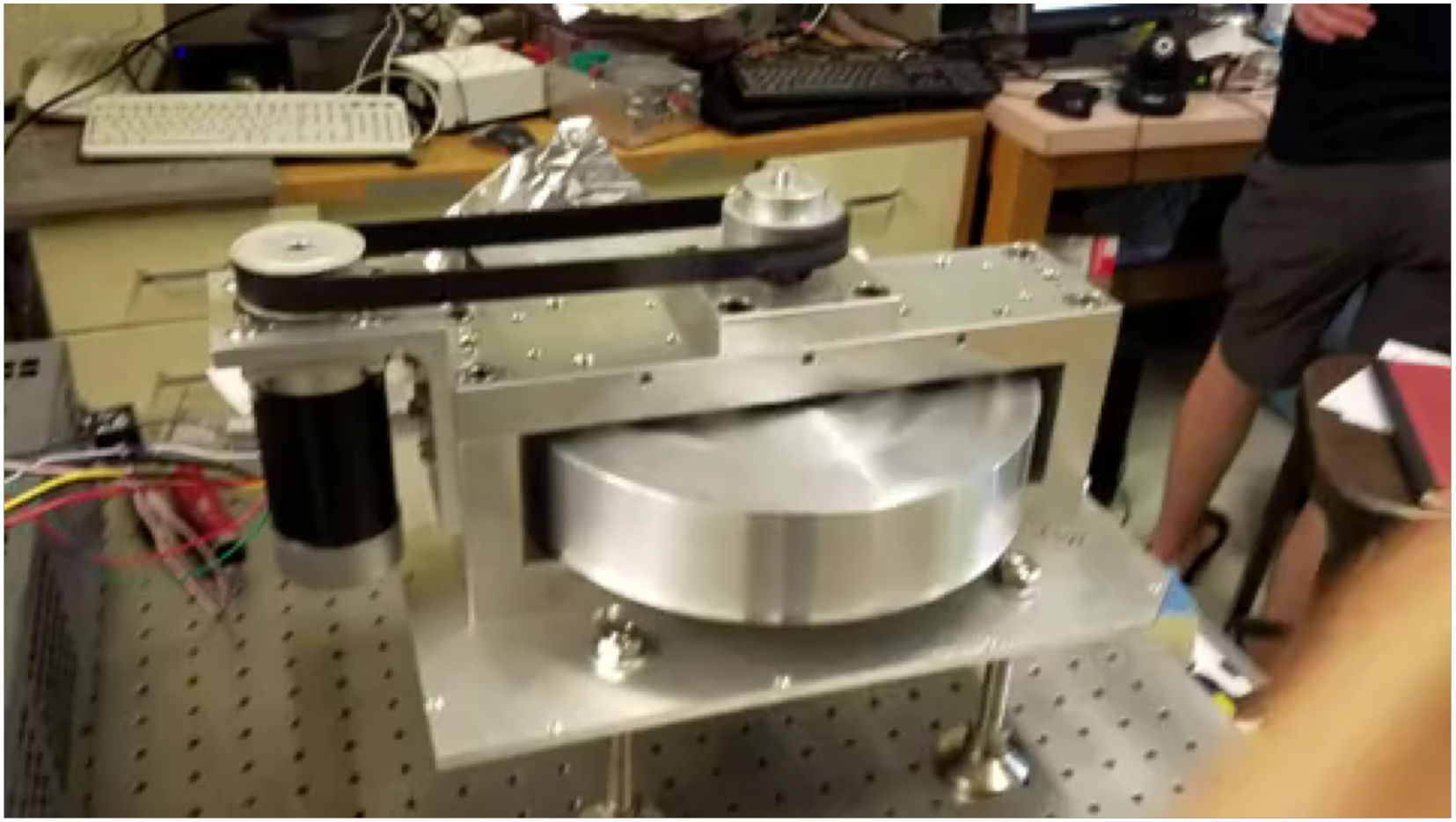
Quick Facts





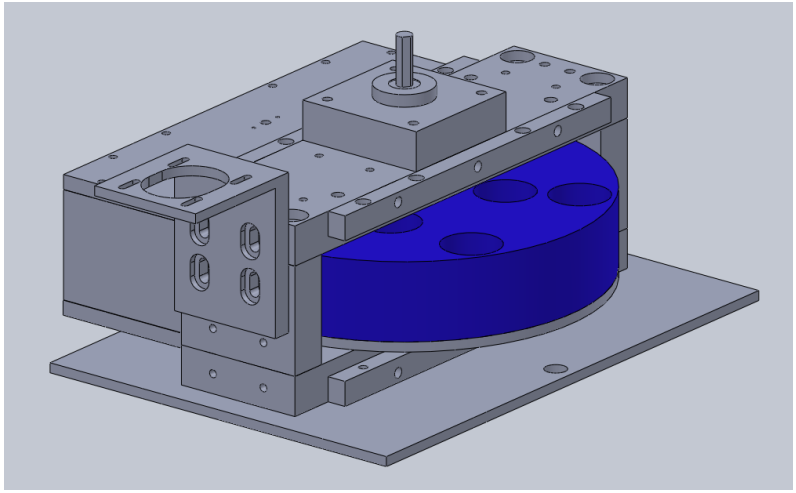
- Total Disk weight ~ 11.5 kg
- Disk outer diameter 10” = 25.4 cm
- Moment of Inertia ~ 0.093 kg.m^2
- Planned operational speeds < 100 Hz
- Stored Energy at 30 Hz = 1.7 kJ
  - Lots of carefully designed protective measures
- Current power consumption is ~38 Watts at a rotor speed of ~30 Hz.
- Never intended for running during LIGO “observation mode.”

The thing everyone likes seeing…



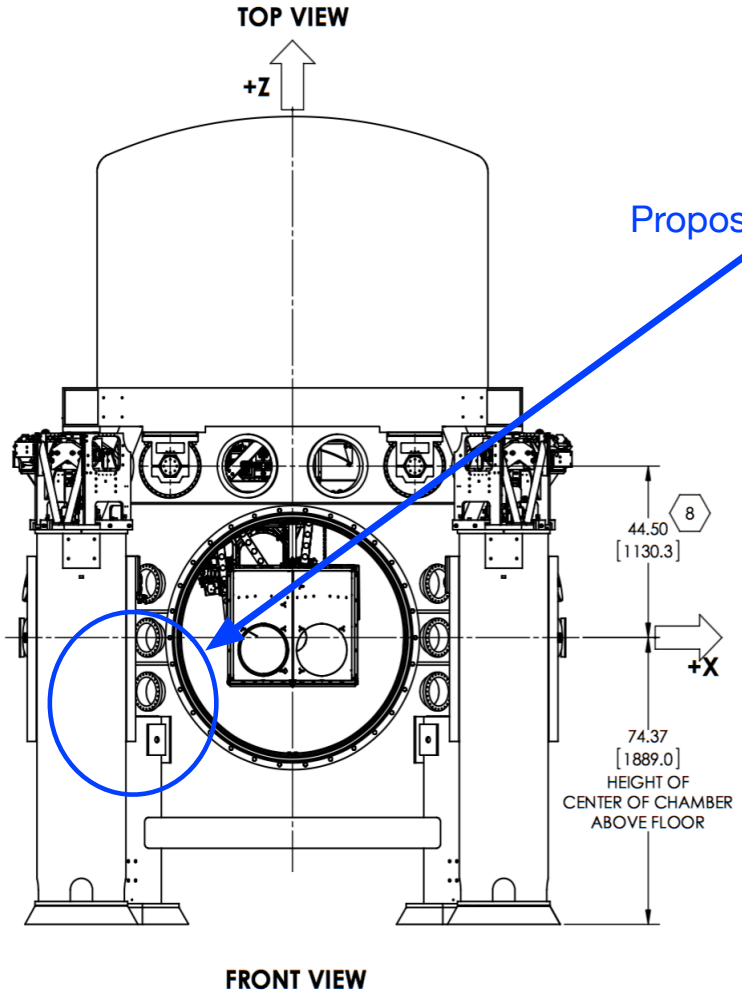
Other Details

- Frame = ~ 30 X 38 X 35(h) cm.
- Two separated bearings support the rotor shaft, driven by a brushless dc motor and a timing belt ⇒ allows the motor frequency to be offset from the rotor.
- Commercial rotary encoder (with 1440 pulses per cycle) attached on other side of shaft
- Vibration/acoustic noise are relatively small (less than most roughing pumps).

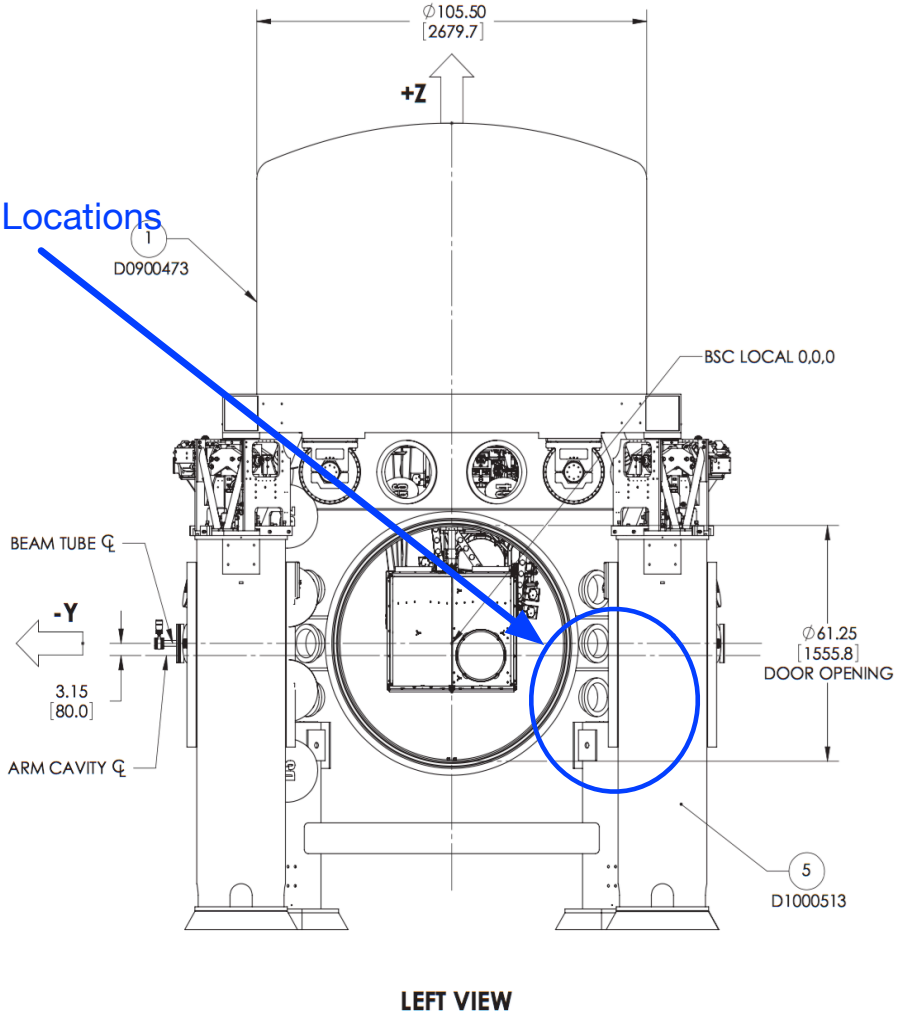


- Rotor was machined by Wire-Electrode Discharge Machining.
  - CMM confirms that the hole positions are accurate to ~ +/- 5 μmeters.
- Rods are made of Tungsten alloy (ASTM B777) with density = 16.96 g/cc. They weigh 1.0558 +/- 0.0003 kg (matched to < 0.1%)
  - Press fit into disk (by heating disk)
- The rods are slightly magnetic and will be demagnetized prior to use.

Location



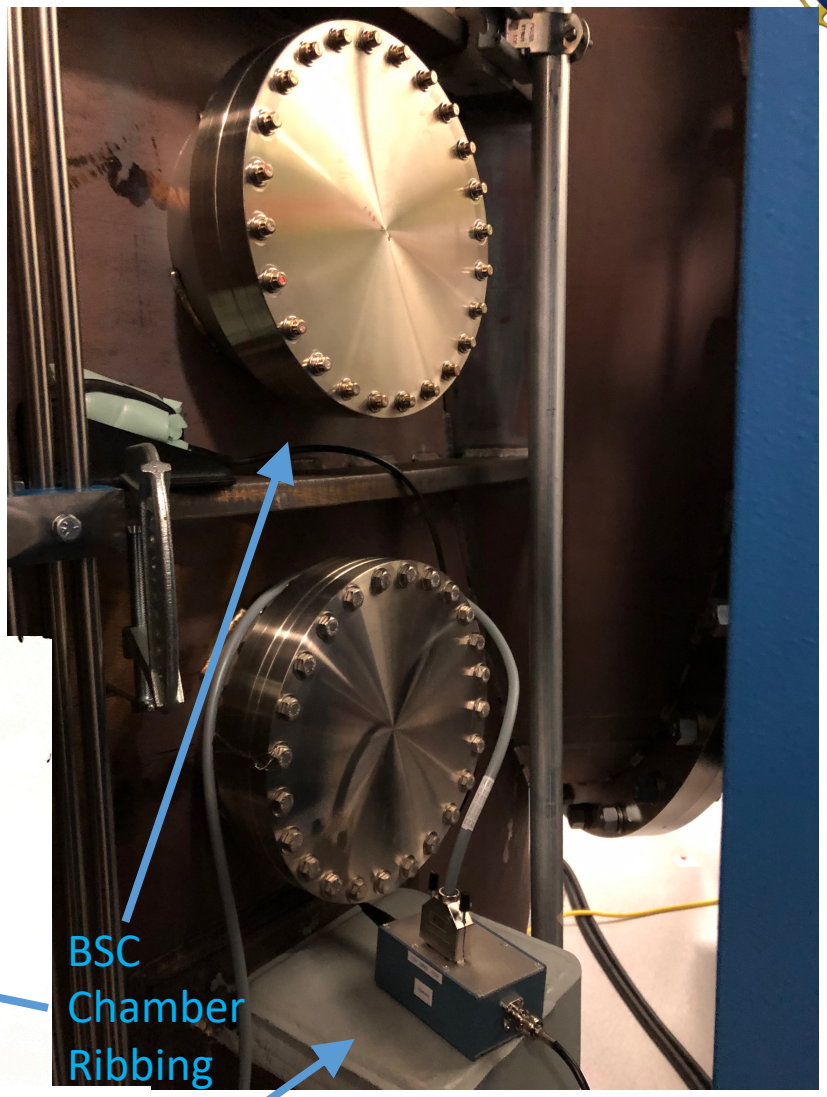
Proposed Locations

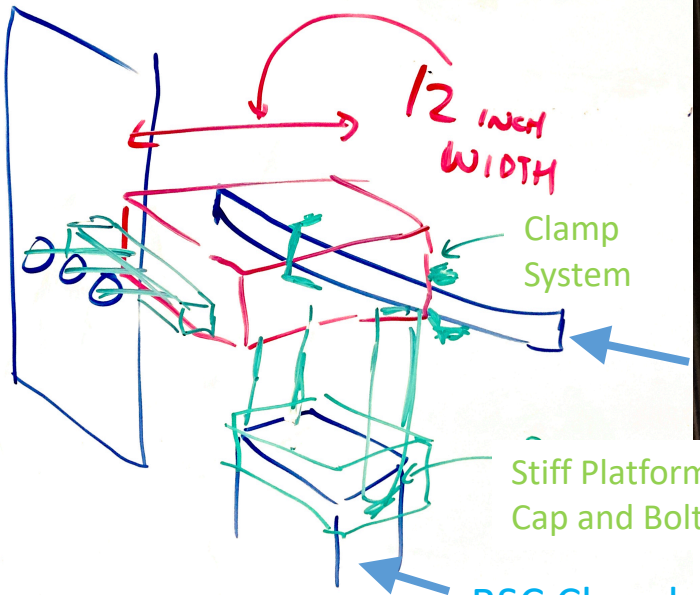


WBSC10 — H1 ETMY
(D0901154-v1)

WBSC9 — H1 ETMX
(D0901150-v6)

Location

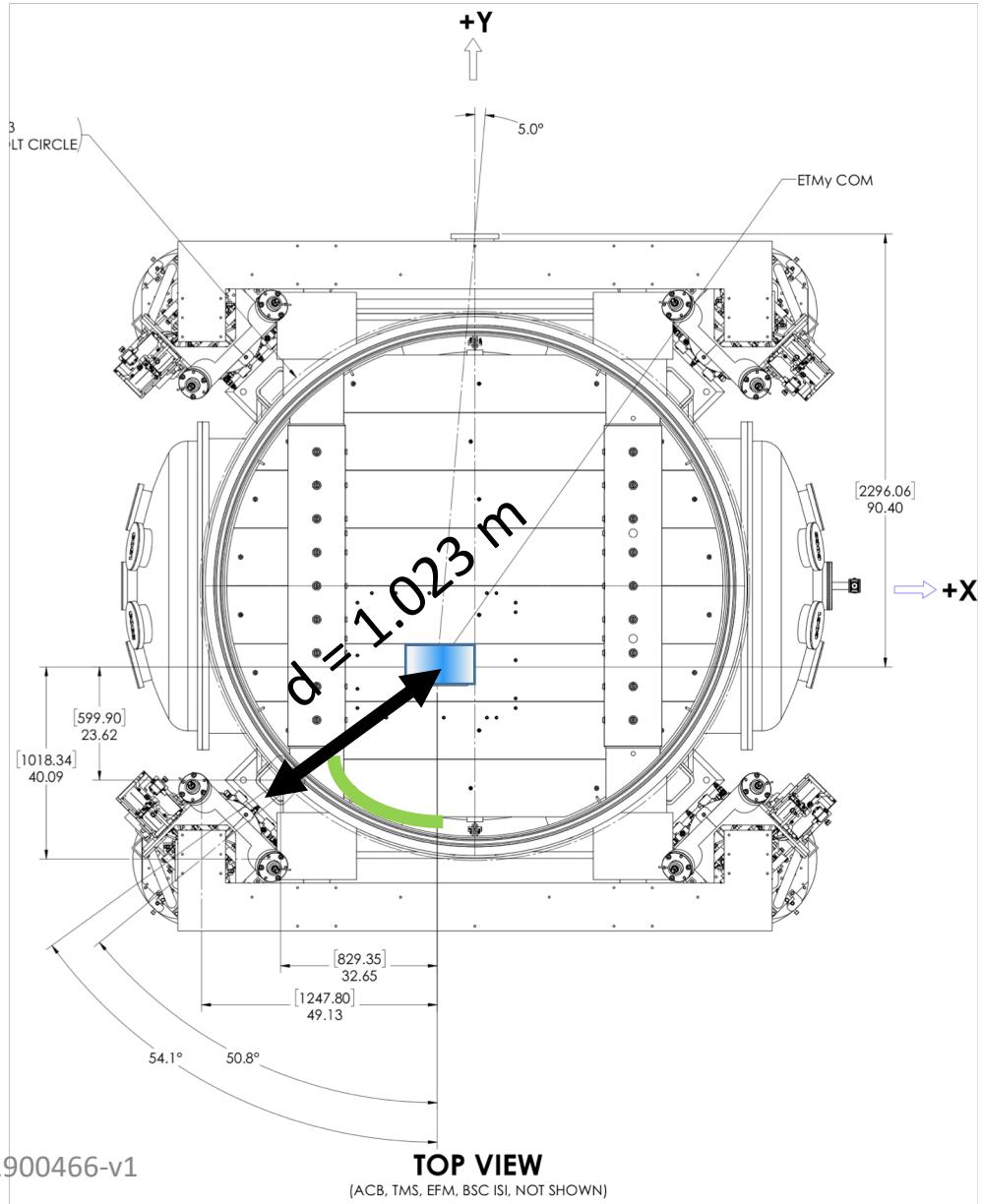




BSC Chamber Ribbing

HEPI Pier

Location, Location, Location

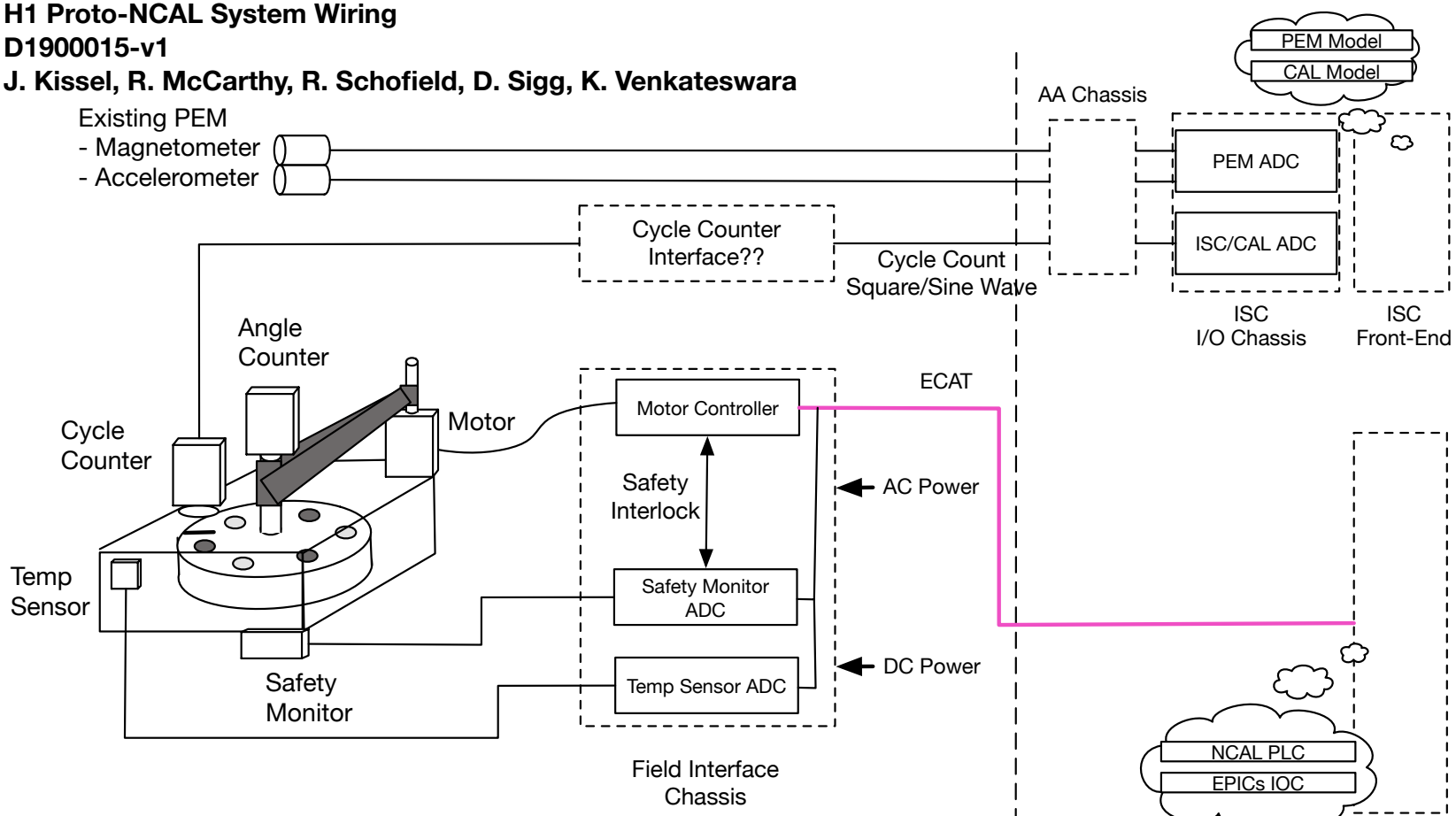


TOP VIEW
(ACB, TMS, EFM, BSC ISI, NOT SHOWN)

- Take rotation speed at 30 Hz
- 3f (hexapole) signal goes as $1/d^5$
- rough estimate for d = 1.2 m
  = 6 e -18 m @ 90 Hz
  (along beam direction)
- atand(829.35/599.9) = **54 deg**
  - Forces in desired beam direction (Y, in this case)
    - AND the transverse (X) direction
    - AND in Pitch and Yaw

Readout Integration Design
(Thus Far)

H1 Proto-NCAL System Wiring
D1900015-v1
J. Kissel, R. McCarthy, R. Schofield, D. Sigg, K. Venkateswara



Speed	Sensor	Permanence
Fast ADC	Cycle Counter	Permanent (New)
Fast ADC	Magnetometer	Temporary (preexisting)
Fast ADC	Accelerometer	Permanent (preexisting)
Beckhoff	Temperature	Permanent (new)
Analog	Safety Sensor	Permanent (new)
Beckhoff	Safety Trigger Status	Permanent (new)

Rough Schedule

- R&D First article built and spinning at UWash
- LIGO Observing Run starts ~April 1st (no kidding!)
- NCAL is not the highest priority, treating as an R&D project, installed during maintenance periods, commissioned during “targets of opportunity.”
- Controller computers will arrive on site soon
- Working with engineering team to design mounting system
- On site integration begins over the next ~2 months

Goal: “We will inject gravity into H1 during O3”