KAGRA Instrument Control System Requirements

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Systems to be controlled

Vacuum

Hardware: Pumps, Gauges, Gate Valves

Monitoring: Pressure, On/Off Status, Failure Status, etc

Control: Gate Valves (Open/Close)

Interlock: Close gate valves in an emergency

Laser

Monitoring: Temperature, LD Current, Light Power, etc

Control: Temperature Set point, LD Current, etc

Interlock: Emergency shut down
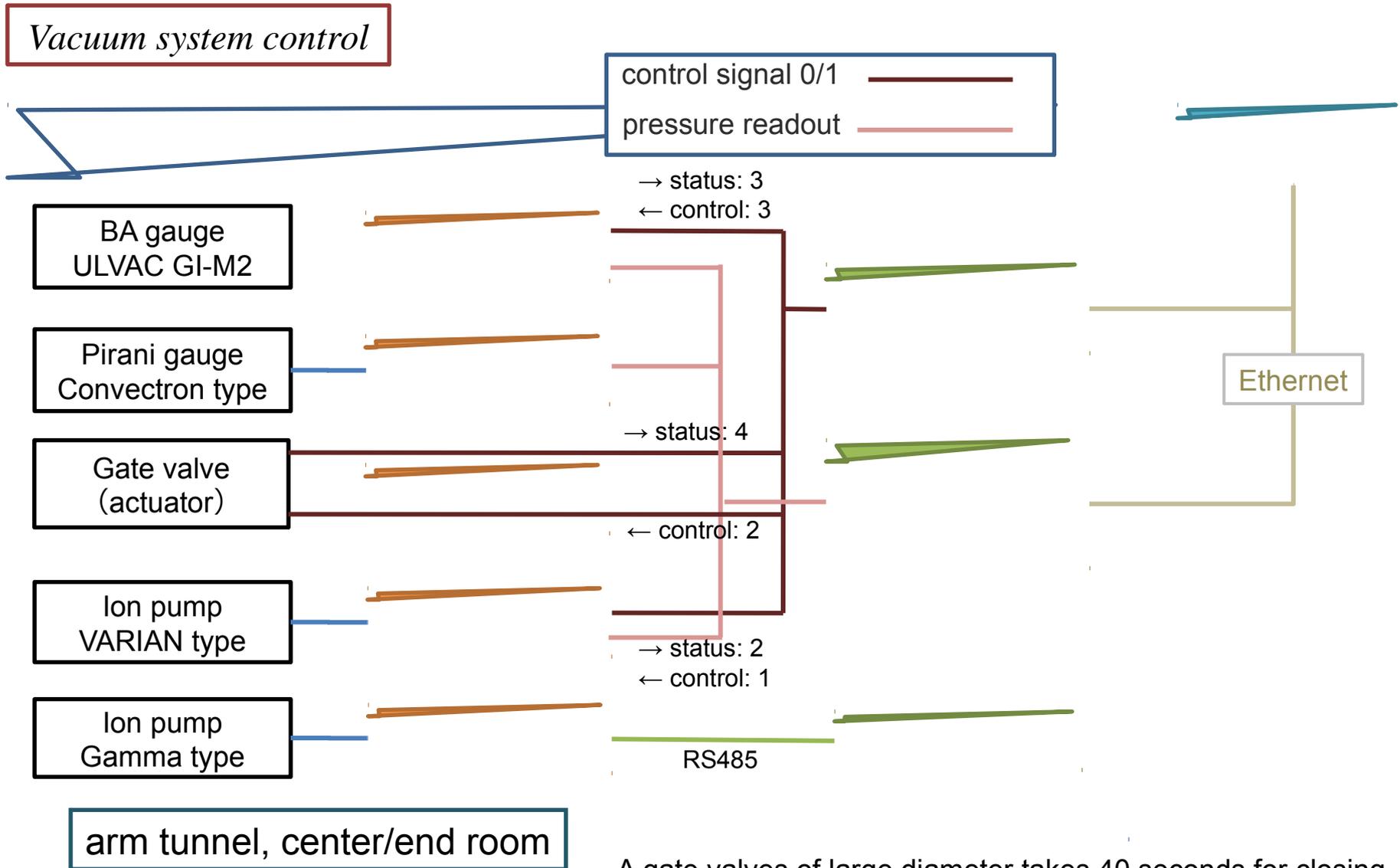
Cryogenic

Monitoring: Power Status, Temperature

Control: Power On/Off

Environmental Monitors

Monitoring: Temperature, Humidity, Pressure, Oxgen

Hardware Interface

Vacuum

Vacuum system control

control signal 0/1

pressure readout

→ status: 3
← control: 3

BA gauge
ULVAC GI-M2

Pirani gauge
Convectron type

→ status: 4

Gate valve
(actuator)

← control: 2

Ion pump
VARIAN type

→ status: 2
← control: 1

Ion pump
Gamma type

Ethernet

RS485

arm tunnel, center/end room

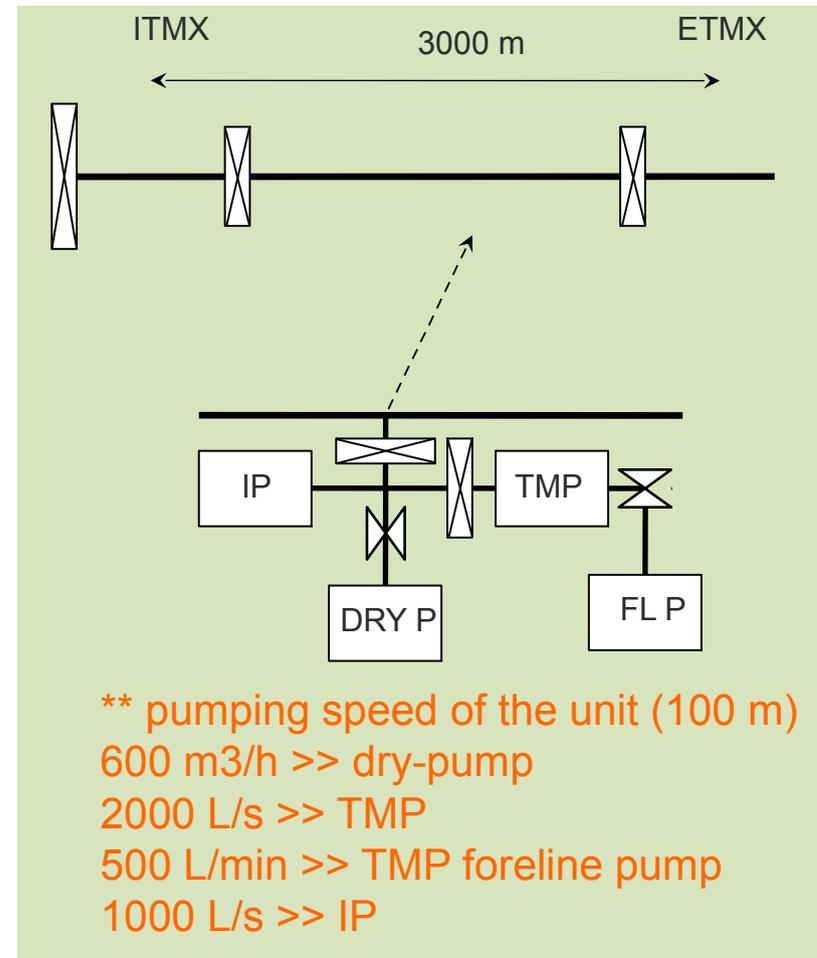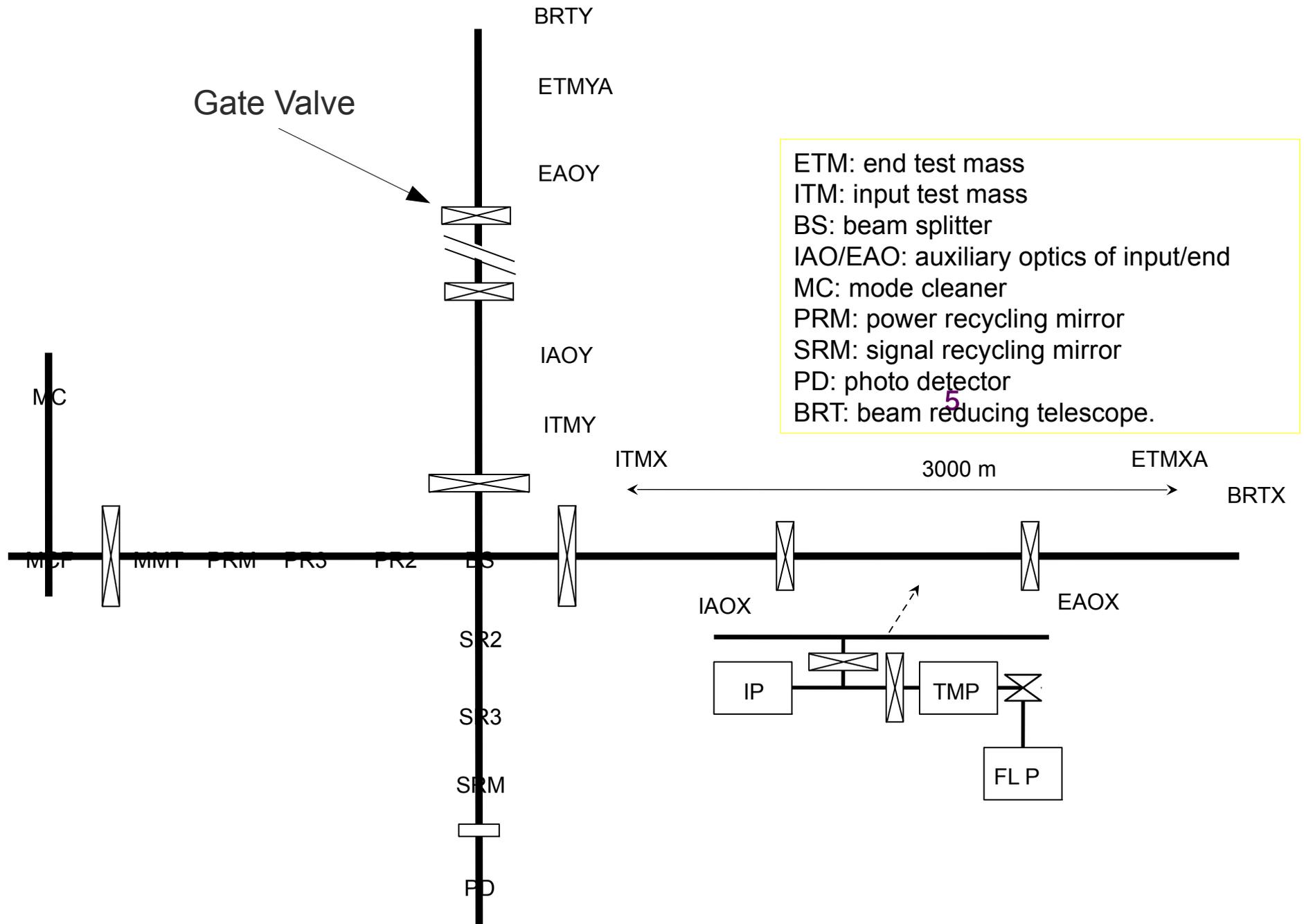A gate valves of large diameter takes 40 seconds for closing.

Vacuum Unit

Installed along the beam tube at every 100m, i.e. 60 units total.

Each vacuum unit also has environmental sensors.

Number of Channels per Unit

A/D: 15ch ?
D/A: 0ch ?
Binary I/O: 10 bits ?
RS485: 1 ?

** pumping speed of the unit (100 m)
600 m3/h >> dry-pump
2000 L/s >> TMP
500 L/min >> TMP foreline pump
1000 L/s >> IP

Gate Valve

BRTY

ETMYA

EAOY

ETM: end test mass
ITM: input test mass
BS: beam splitter
IAO/EAO: auxiliary optics of input/end
MC: mode cleaner
PRM: power recycling mirror
SRM: signal recycling mirror
PD: photo detector
BRT: beam reducing telescope.

5

IAOY

ITMY

MC

ITMX   3000 m   ETMXA

BRTX

MCF   MMT   PRM   PR3   PR2   BS

IAOX   EAOX

SR2

IP   TMP

SR3

SRM

FL P

PD

Laser

Number of Channels
A/D: 15 ch
D/A: 5ch
Binary I/O: 16bits

Connectors
D-SUB XX-pin

Cryogenic Unit

4 cryostats

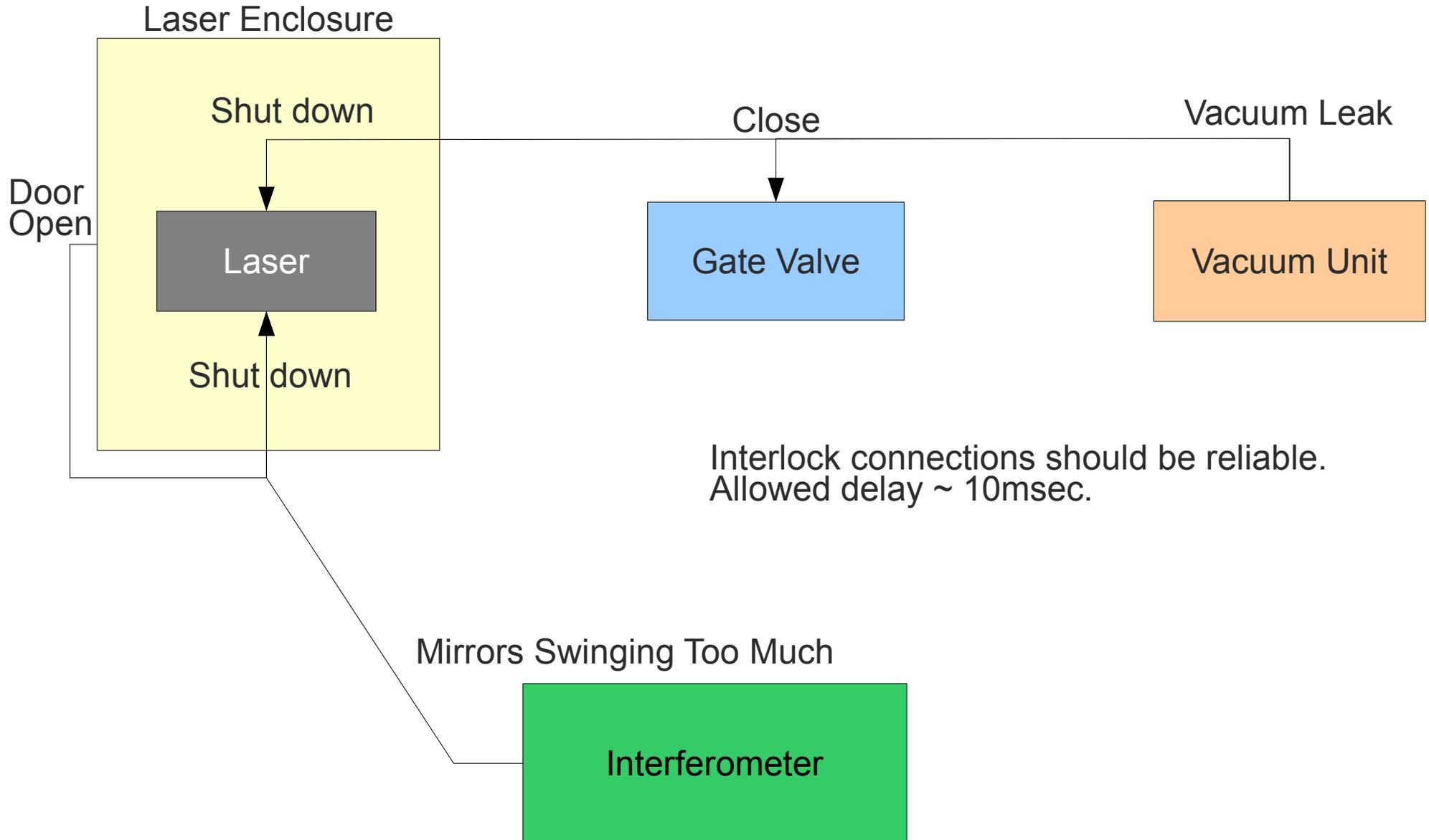## Number of Channels per Cryostat
A/D: 20ch
Binary I/O: 20bits

Interlock System

Laser Enclosure

Shut down

Laser

Door
Open

Shut down

Close

Gate Valve

Vacuum Leak

Vacuum Unit

Interlock connections should be reliable.
Allowed delay ~ 10msec.

Mirrors Swinging Too Much

Interferometer

External Interface

- Monitor channels have to be exposed as EPICS PVs to the internal TCP/IP network of the KAGRA site.

- Control channels have to be accessed as EPICS PVs.

- Interlock status has to be visible as EPICS PVs.