

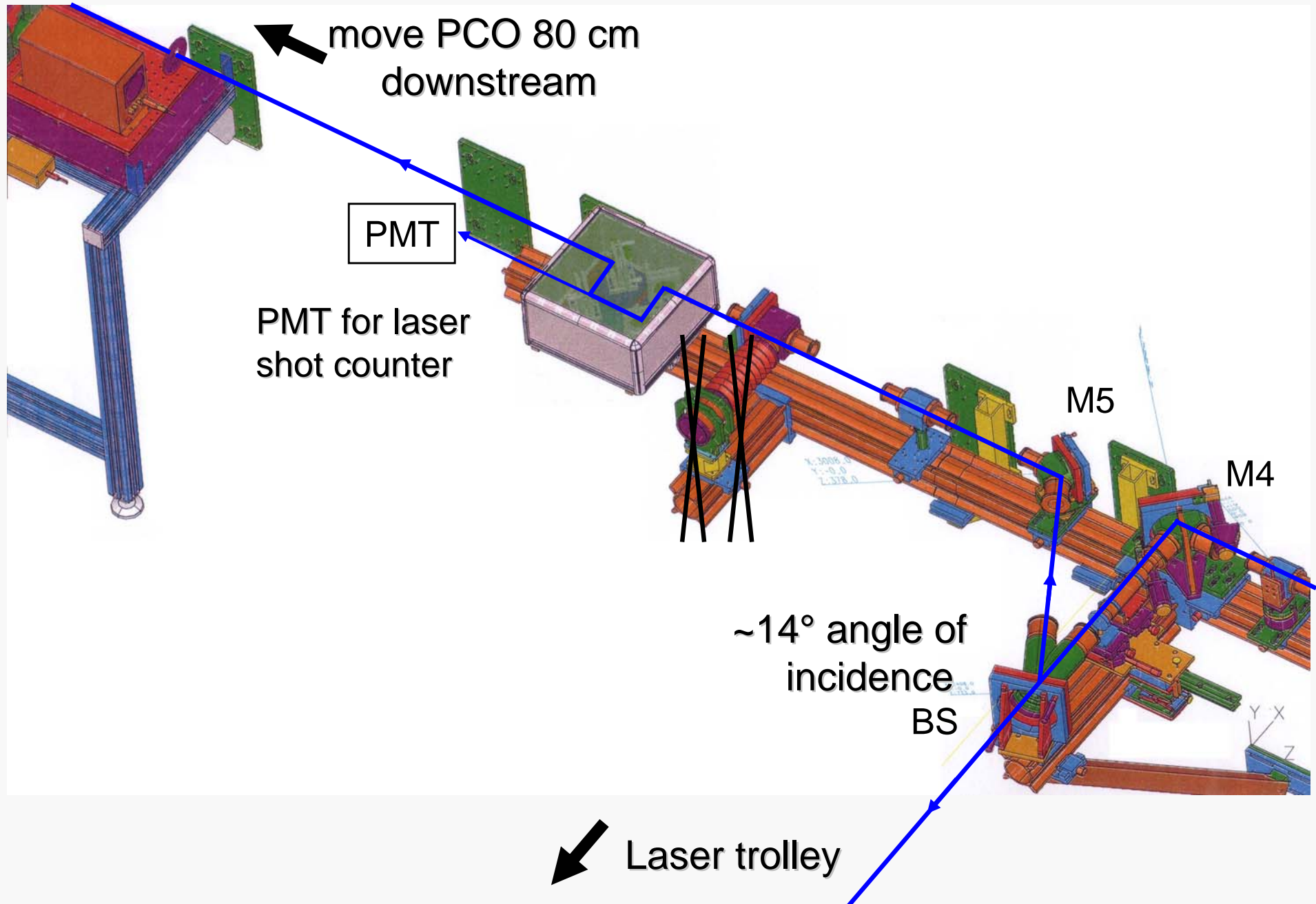
Diagnosics for the laser beamline in the PITZ tunnel



**Guido Klemz
2.2 & 9.2.2010**

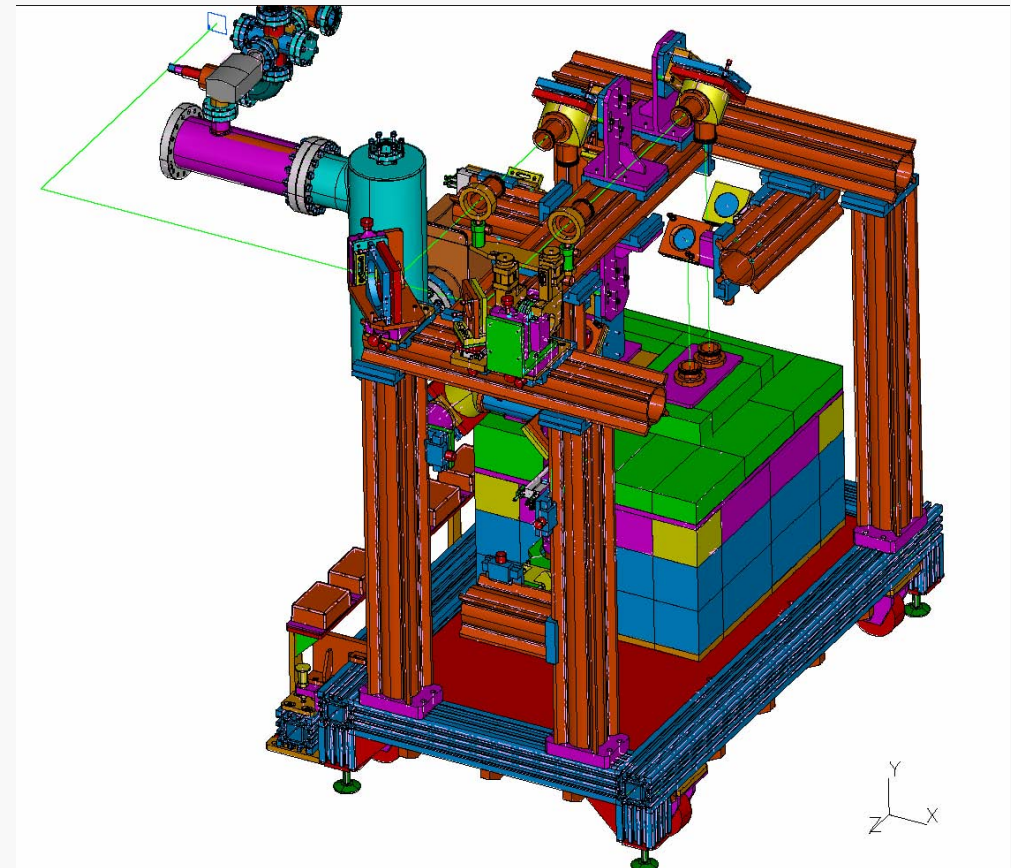
PITZ Physics Seminar

Diagnostics for the laser beamline in the PITZ tunnel



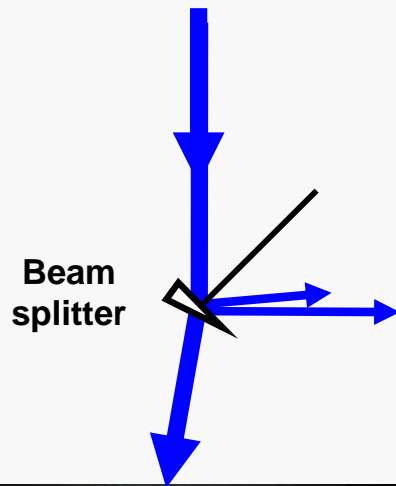
Reasons for redesign of the laser trolley

- A vacuum pump has been moved into the region of the laser trolley
- Laser beam profile transmitted to the cathode is distorted by unsuitable arrangement of beamsplitter wedge plates
- foreseen addition of a laserpulse counter

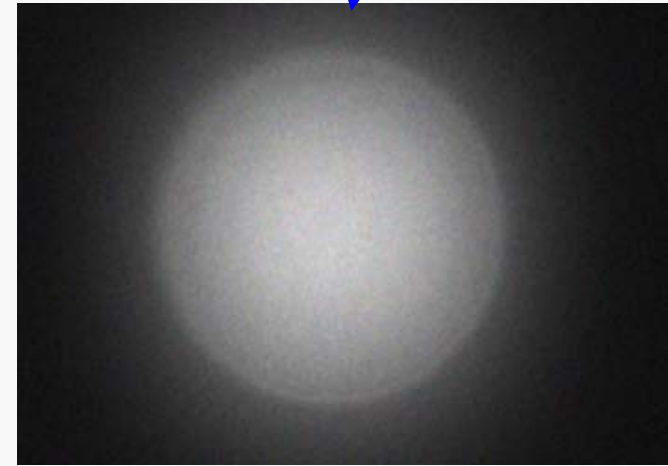
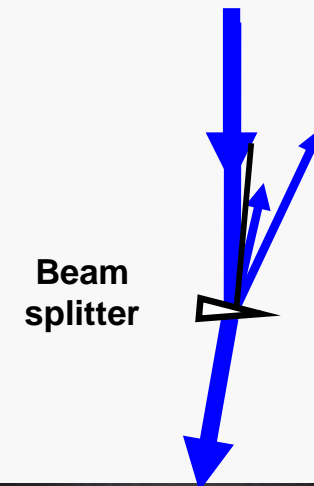


Present design of the trolley containing various detectors for laser beam diagnostic

Transmitted beam profile degrades when using wedges under $\sim 45^\circ$ angle of incidence



$\sim 45^\circ$ angle of incidence



$\sim 5^\circ$ angle of incidence

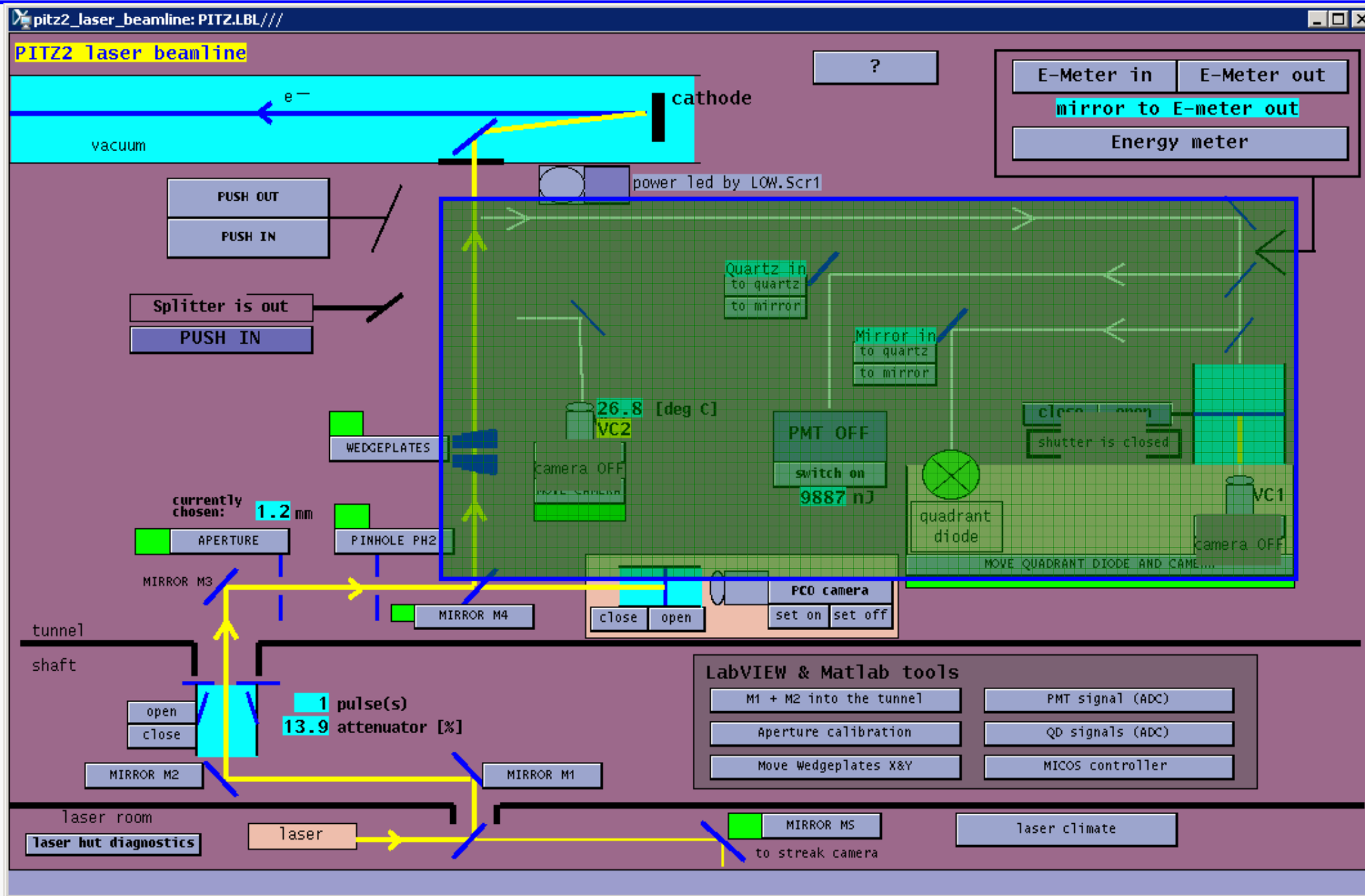
Intrinsic spatial resolution of the various detectors used in the trolley



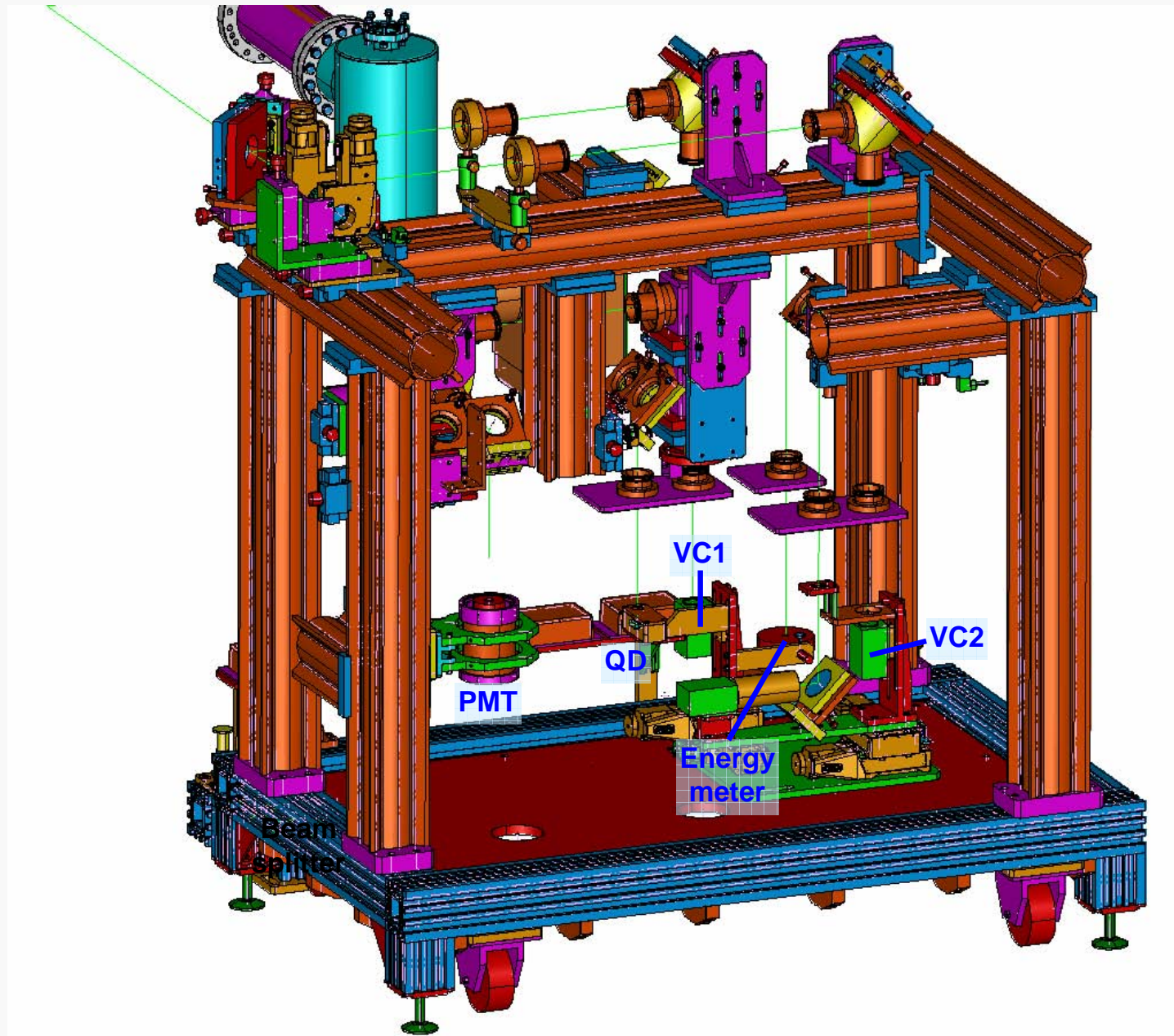
Type of detector	Resolution	Sensitive to...
CCD Camera	High	transverse features of the order of $10 \mu\text{m}^2$
Quadrant Diode	Moderate	center of gravity of the transverse profile in x and y; Beampointing direction
PMT	None	spatially integrated pulse intensity
Pulse Energy Meter	None	spatially integrated pulse energy

- **PMT, Pulse energy meter and also Quadrant Diode may be put in the transmitted beam of optics under arbitrary angle of incidence.**

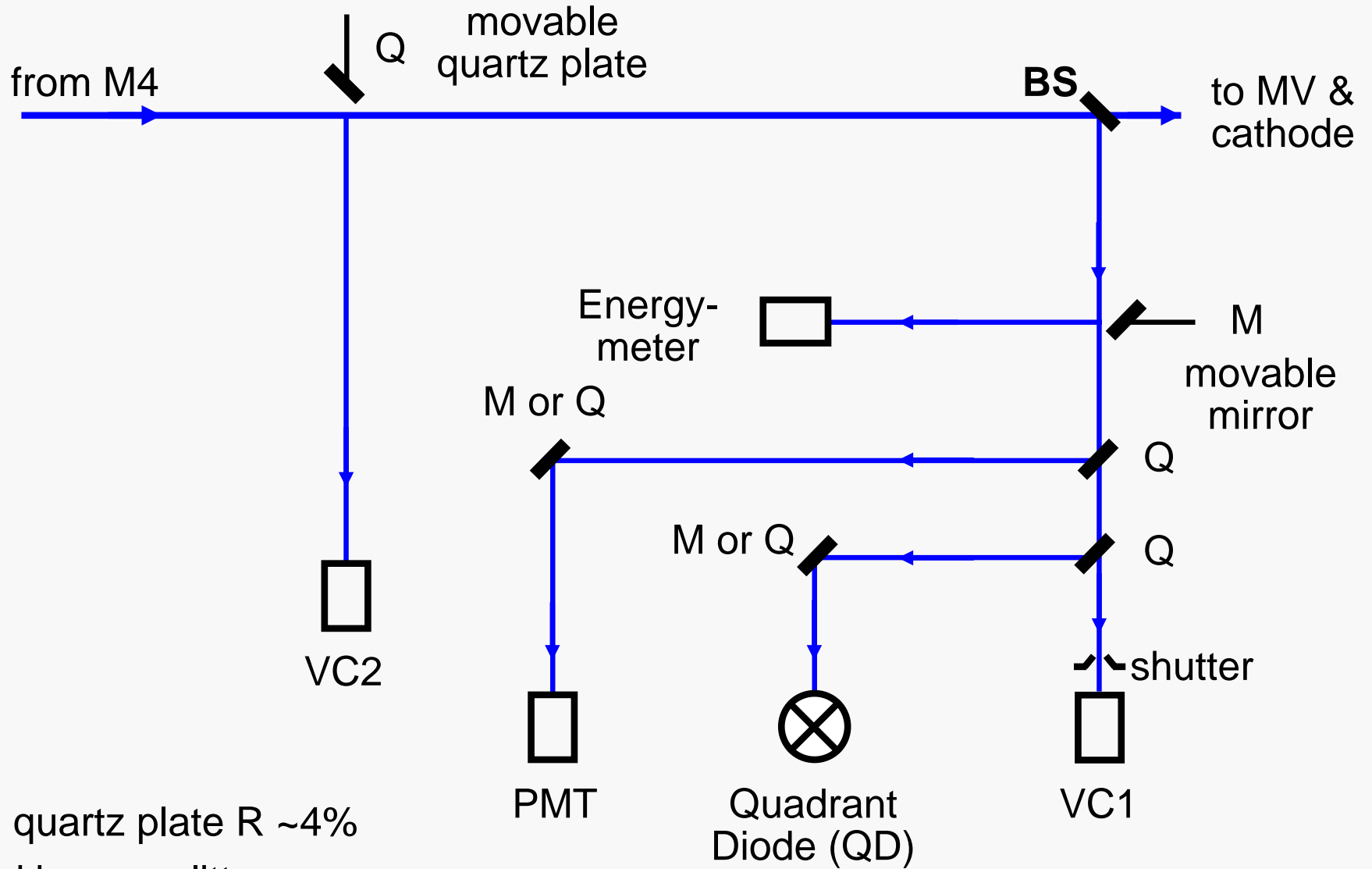
Present scheme of the laser beamline



Front view of the present laser trolley



Optical scheme of the present laser trolley



M: Mirror

Q: uncoated quartz plate R ~4%

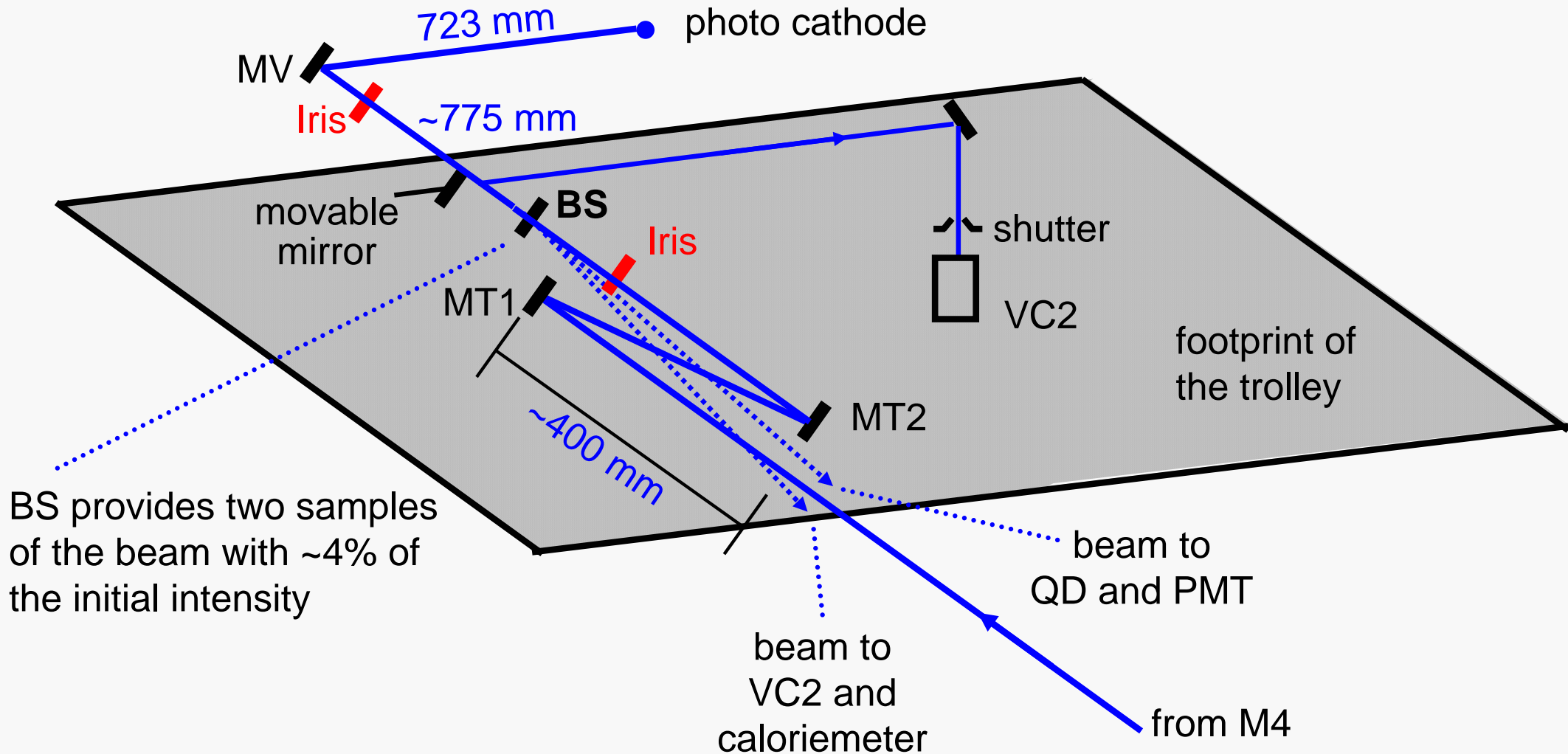
BS: uncoated beam splitter



Requirements to available signals

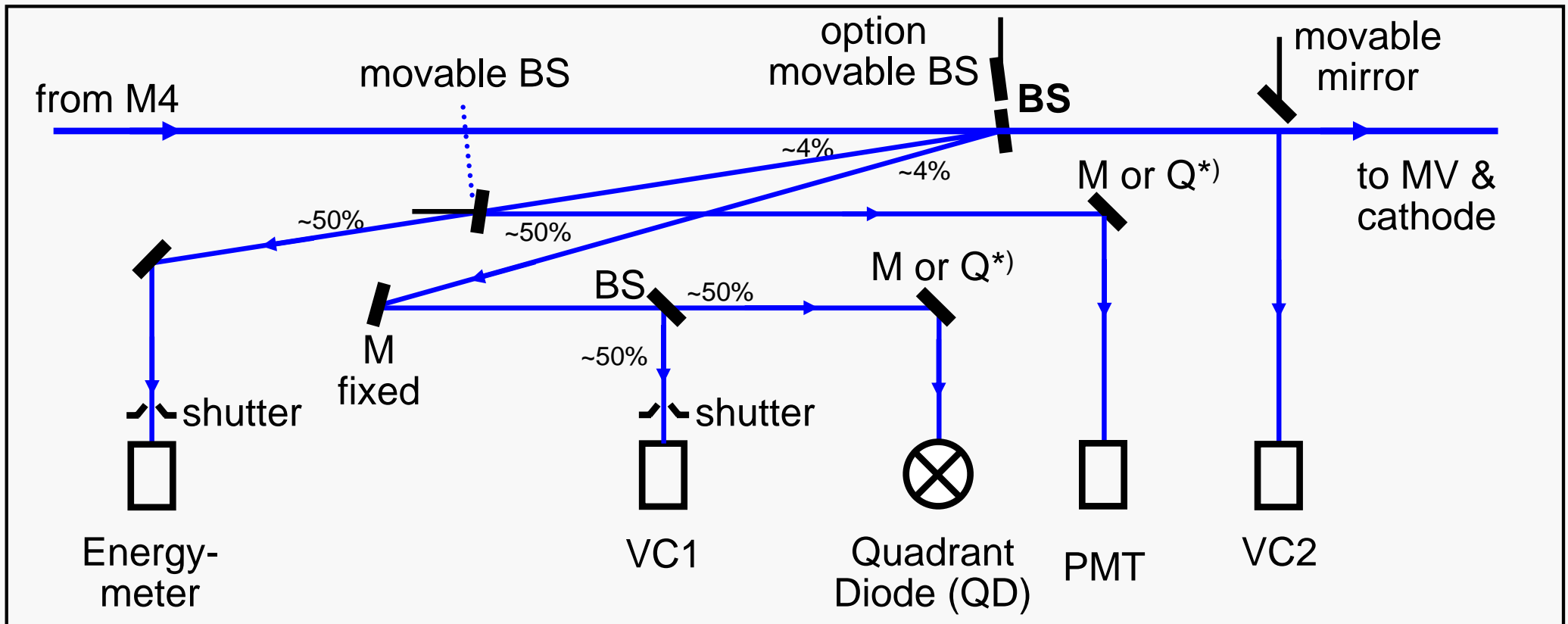
- **Which signals should in the future be available simultaneously ?**
- **signals from quadrant diode, energy meter, virtual cathodes ?**
 1. **QD and one of the VC need beam in parallel.**
 2. **QD is permanently in the beam. It doesn't need protection.**
 3. **PMT and energy (in the range 0.1 – 100 nJ) also need beam in parallel, but energy meter is protected by a shutter.**
 4. **PMT should be in the beam permanently.**
 5. **VC1 (with shutter) should be in the beam permanently.**
 6. **Dynamic range of PMT and QD shall adapted to pulse energy by choosing either a mirror or a beamsplitter for illumination.**

Proposed new design for the laser trolley



- The location of the virtual cathodes is ~1500 mm away from beamsplitter BS. CCD Cameras and Quadrant diode have to put there.

Side-view of new design for the laser trolley



*) : interchangeable optics (remote controlled)

M: Mirror

BS: uncoated beam splitter

Q: uncoated quartz-plate R ~4%

BS 50%: coated beam splitter R~50%

■ This is the view below the upper surface of the laser trolley



Conclusion

- **The proposed design has the capability to feature the signals from quadrant diode (QD), energy meter, photomultiplier (PMT) as well as virtual cathode VC1 simultaneously and in parallel to the beam on the photo cathode.**
- **Spatial sensitive detectors receive their light only from reflective surfaces. This should minimize image distortions.**
- **The new design is fully compatible to laser trolley as it was used before.**
- **A signal path for the laser shot counter has been added in the beamline outside of the trolley.**