G-line white beam diagnosis

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Purpose of the white beam test facility

1. With the A/G wiggler the counterrotation particle beams in CESR will be utilized to provide photons beam firing in both direction. The effect of the CHESS feedback on the G-line beam position are presently not understood. White beam monitoring at G-line will provide information on beam position and beam shape. The basic set-up is shown in Fig.1. Moreover, new monitor types as well as new white beam components such as coated Be window can be exposed to the white beam for testing purposes. In combination with the existing photoelectron monitor, also angular information can be obtained in the vertical plane.
2. Current ideas for monitoring projects:
    - White beam calorimeter to measure total power
    - Split-electrode ion chamber
    - Test of Be white beam monitor (photocurrent on thin Be or Gr foil)
    - White beam fluorescence monitors, imaged with optical CCD
        1. CVD diamond film
        2. phosphor screen (alumina or ZnO powder on Kapton support)
        3. chamber gas fluorescence (He or Ar)

    A sketch of the CVD diamond monitor can be found in Fig. 2. There is strong overlap with white beam monitoring efforts at CHESS and the G-line efforts will closely interact with current CHESS efforts (PR).
3. Goals of the monitor projects
    - Determining white beam monitor parameters and stability
    - Imaging of the white beam: shape and intensity distribution
    - Monitoring white beam position, understanding necessary constraints on CESR orbit, CHESS feedback
4. The CHESS staff is invited to perform other test experiments in the white beam, e.g. component testing or heatload measurements. Proposals for all white beam experiments have to be approved by the CHESS Safety Committee and G-line.
5. In phase II, the white beam box will be upgraded to house a multiplayer monochromator to provide first monochromatic beam to the G-line hutches.

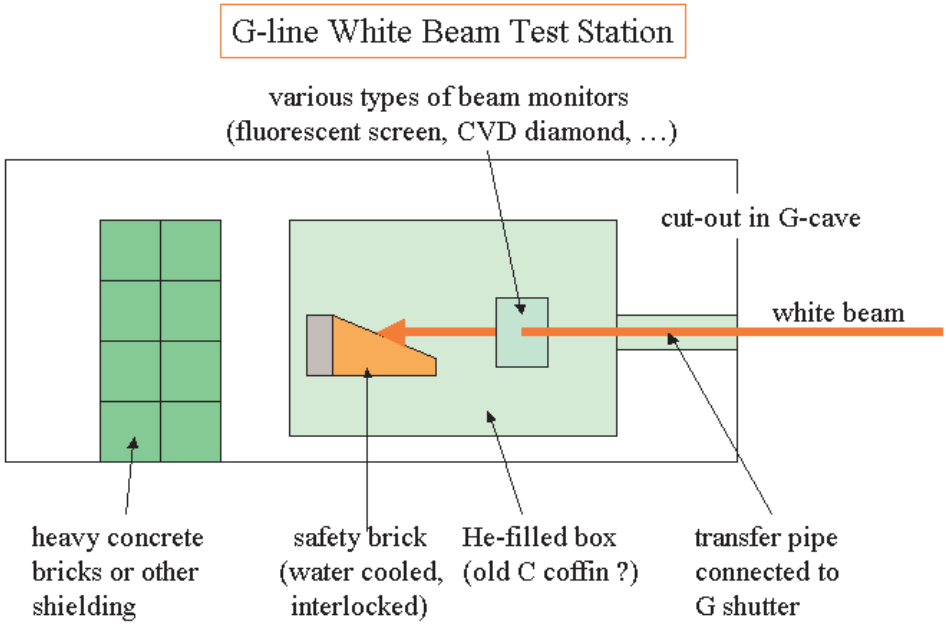


Fig. 1 proposed set-up for the G-line white beam test station.

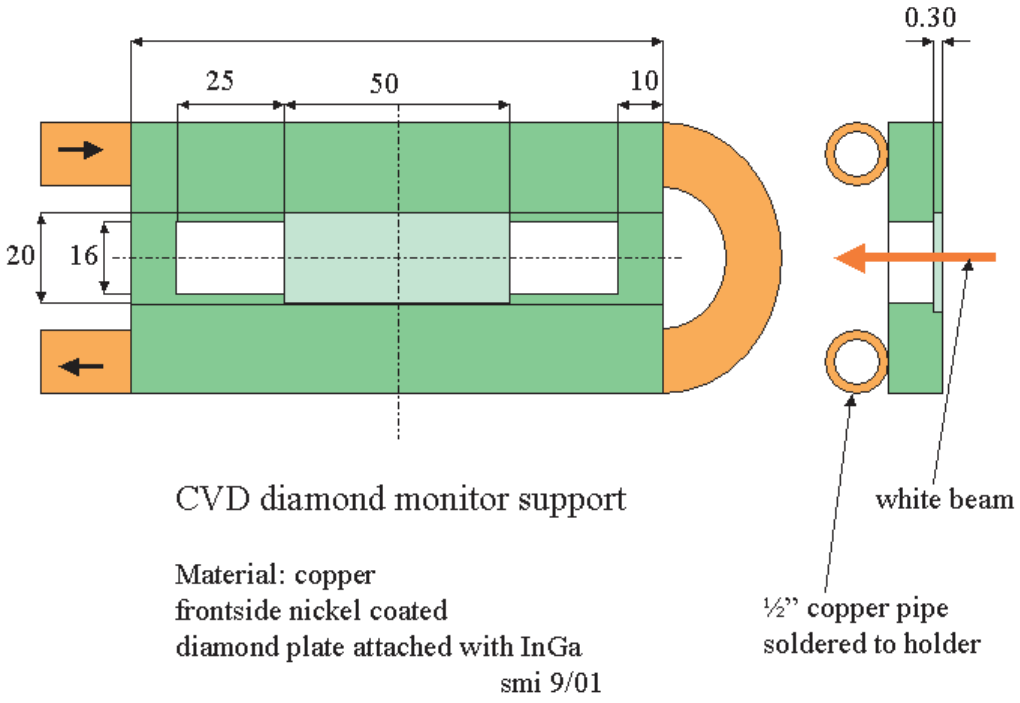


Fig. 2. CVD diamond monitor and water-cooled support.

Safety Considerations

A. White beam box and safety brick

1. The White Beam Test Station is equipped with a full-scale safety brick designed to take the full heat load from the A/G Wiggler up to 500 mA CESR current.
2. A water-cooled copper aperture positioned at the beam pipe through the vault/cave shielding will limit the beam size such that the passing beam will be safely stopped by the beam stop. The aperture became necessary because the temporary position of the beam stop is several meters further downstream than its final position.
3. The safety brick will be installed inside the coffin in a helium atmosphere.
4. The safety brick has a tungsten block of 6" length attached which will stop the hard radiation from the wiggler.
5. For alignment, the safety brick will be surveyed into place. Burns at the upstream and downstream walls of the G cave will indicate the exact beam path inside the cave.
6. The coffin is supported by a blue table which will be positioned at the end of the cut-out on the back wall. The table will be fixed to the ground with the screws of the kinematic mount. The screws will be red-tagged.
7. The precise beam height will be adjusted with the crank of the blue table. When the safety brick has reached its proper height the crank will be removed and the shaft will be red-tagged.
8. Final burns will ensure that the safety brick is positioned correctly.
9. Cooling water for the safety brick and the copper aperture will be provided from auxiliary outlets of the optics cooling water manifold.
10. Safety interlocks for proper cooling water flow (thermocouple, thermal switch, flow meter) will be installed.
11. Helium gas for the box and the transfer pipe will be provided from the CHESS helium system. A helium control panel controls the incoming flow (?). The helium atmosphere inside the box can be monitored with a flow sensor. If necessary, an oxygen sensor and/or a hygrometer can be installed.
12. The box and the transfer pipe can be evacuated with a roughing pump for quick backfilling of the system woth helium.

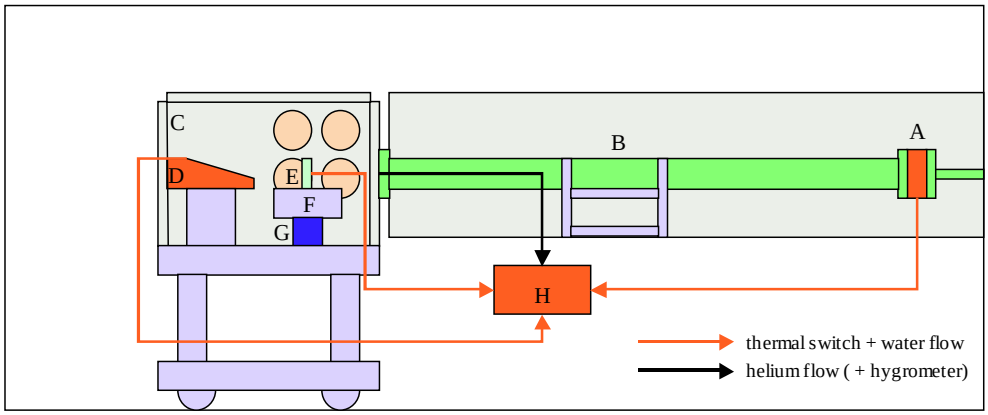
B. Cave shielding and radiation survey

1. Additional shielding will be installed at the cave door and at the window between cave and G1.
2. When the safety brick is in place, a thorough radiation survey of the outside of G cave will be preformed with particular emphasis of the cave door and the G1 hutch.

C. Scattering experiments

1. All scatterers exposed to the white beam will be inside the coffin in a helium atmosphere.
2. Scatterers may be positioned inside the coffin with a CHESS xz stage
3. Water feedthroughs are available so that scatterers can be water-cooled; a flowmeter and thermocouples will be provided.

The white beam project in a nutshell



A aperture: machined, needs cooling water, flow meter, thermal switch, thermocouple
B transfer pipe: to be made, needs ordering, flanges to be welded, Unistrat stand
C box (old C Coffin) on Blue Table: needs upstream plate with hole, O-ring groove for transfer pipe
needs flanges for cooling water, electrical feedthroughs, vacuum, He out
needs vacuum pump, He flow meter, hygrometer
D white beam safety brick: is machined, needs brazing
needs cooling water, flow meter, thermal switch, thermocouple
E monitor: CVD diamond purchased, water-cooled holder made and Ni plated for InGa mount
needs water cooling, flow meter, thermal switch, thermocouple
F CCD camera: mount+shielding, mirror, some parts still to be made
needs electrical feedthrough for power and signal
G xz stage: needs mounting plate, electrical feedthrough for power, spec control
H auxiliary equipment box: water flow and thermal switches for A,D,E, He flow for C