Calibrating an Optical See-Through Rig with Two Non-Overlapping Cameras: the Virtual Camera Framework
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Context: Optical See-Through Augmented Reality

**Immersive**
games, marketing, maintenance...

**Secure**
driving assistance, surgery...

Most generic and challenging setup: moving viewer and scene
Prototype: screen, two cameras.

Calibration process

We know:
- Viewer pose: Head Tracking
- Scene pose: SLAM

We still need:
- Scene camera pose
- Viewer camera pose

Two rotations involved: hard, non convex problem...
**What if we could get back to a classical problem?**

Introducing our new framework: virtual cameras to the rescue

User inputs

= Reprojection of object points into a virtual camera

Huge simplification of the problem by allowing the use of proven techniques.

Classical resectioning of virtual cameras as an initial calibration

Object points are known in the scene camera coordinates.
**Direct Linear Transform** [1] is used to estimate the pose of the scene camera. The other camera can be estimated by symmetry or ICP. A bundle adjustment step refines these estimates.

Result: unnoticeable 3mm reprojection error (with object and viewer one meter from the screen)

15x better than mirror-based state-of-the-art[2]

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