

Applications of AR in broadcasting

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A range of “AR-like” applications in TV:

- Basic chroma-key (fixed camera); possibly augmented with some feedback for presenter
- Virtual studio (chroma-key background with graphics rendered live to match camera movement)
- Virtual foreground graphics overlaid on a real background (like a virtual studio but without keying)
- Virtual foreground graphics attached to a tracked object rather than fixed background
- Real objects modelled and inserted into a virtual world (“virtualised reality”)
- Graphics applied in post-production can be considered a separate area: no live feedback to presenter / crew / audience

Virtual studio

- Example: UK Election results programme 2005

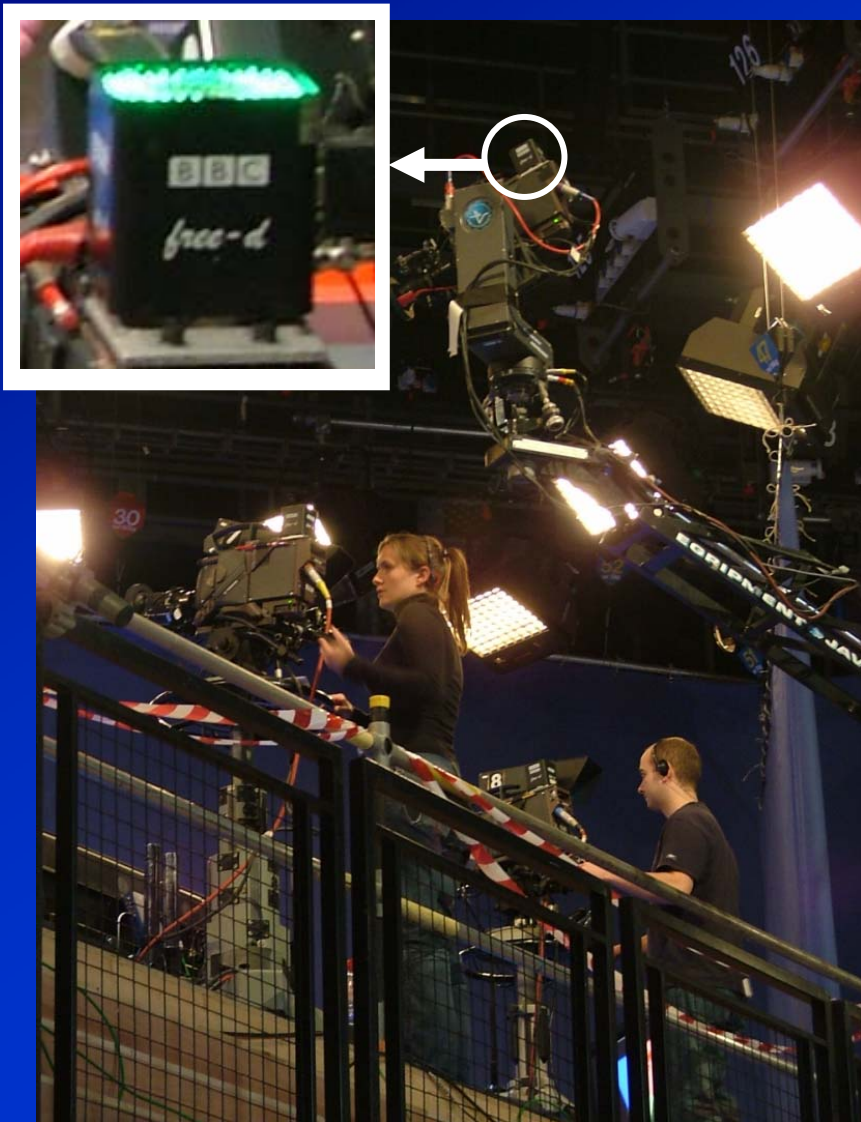


Projector feedback for presenter

- 100Hz projector showing black in alternate images
- TV cameras shuttered to $1/100^{\text{th}}$ s to cut out projected image
- Projected image keyed to black where presenter stands



Camera tracking (*free-d*)



Extracts from *Election 2005*

Virtual foreground objects in studio reference frame

- Example: *BAMZOOKi*



Behind the scenes....



Some clips from *BAMZOOKi*

An “extreme” example: *Fightbox*

Behind the scenes at *Fightbox*...

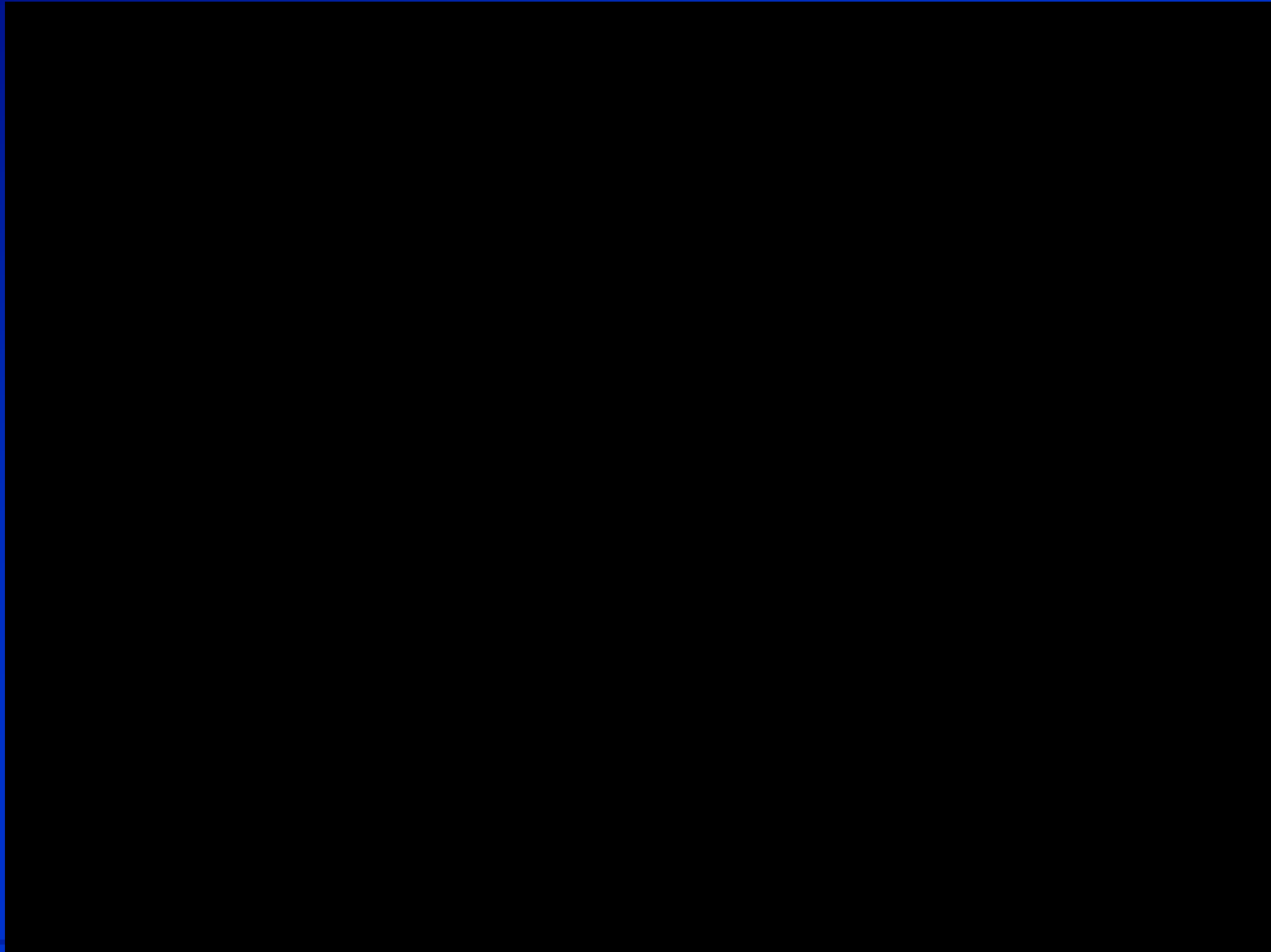
Virtual foreground objects attached to tracked object

- Example: Election 2005 rehearsals



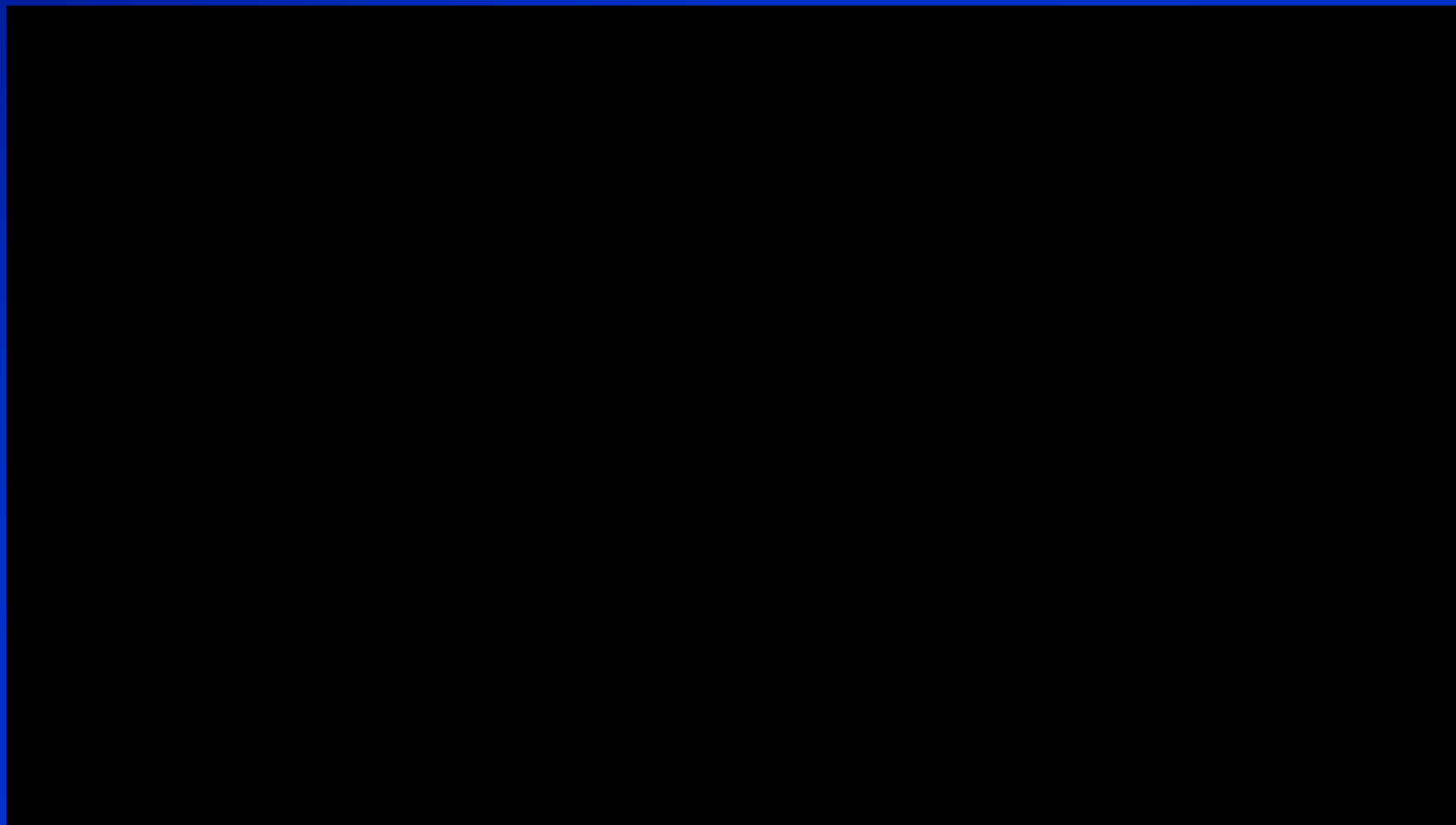
Tests during *Election 2005* rehearsal

Comments from director & presenter



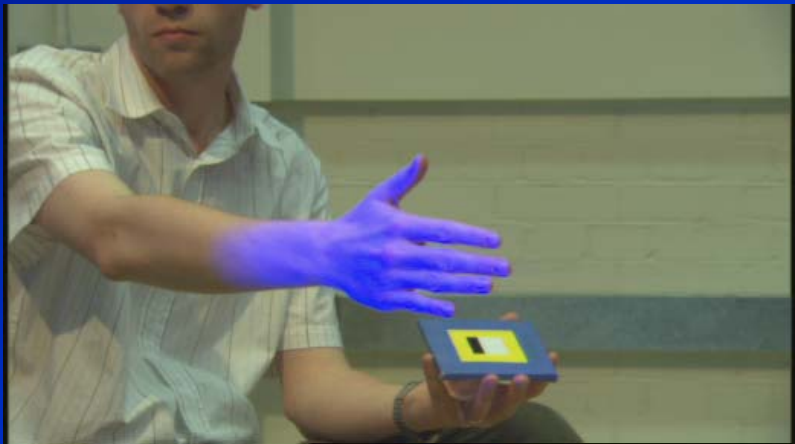
Virtual foreground graphic tracking a real object

- Example: Live tracking of a table-tennis ball in 3D (two fixed cameras for ball tracking; *free-d* for camera tracking)

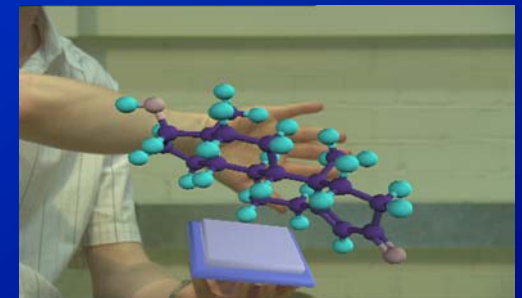
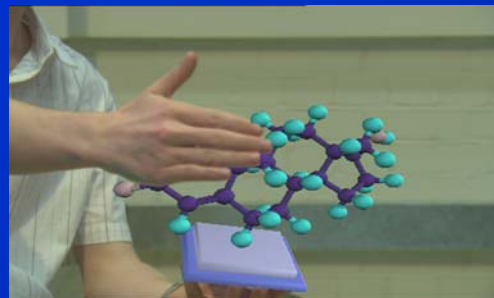


“Depth keying” for foreground virtual objects

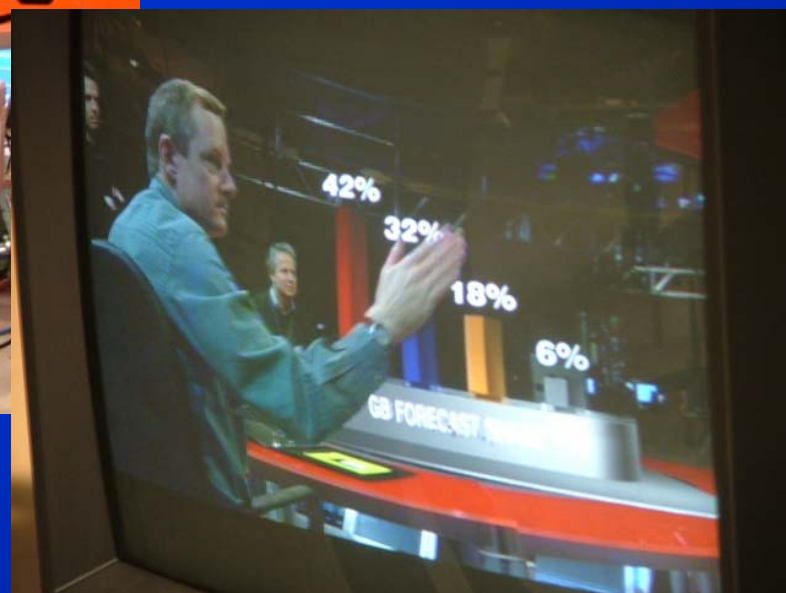
- For applications where there’s no chromakey background
- Illuminate the foreground with pulsating light, then detect & remove this light from the camera image



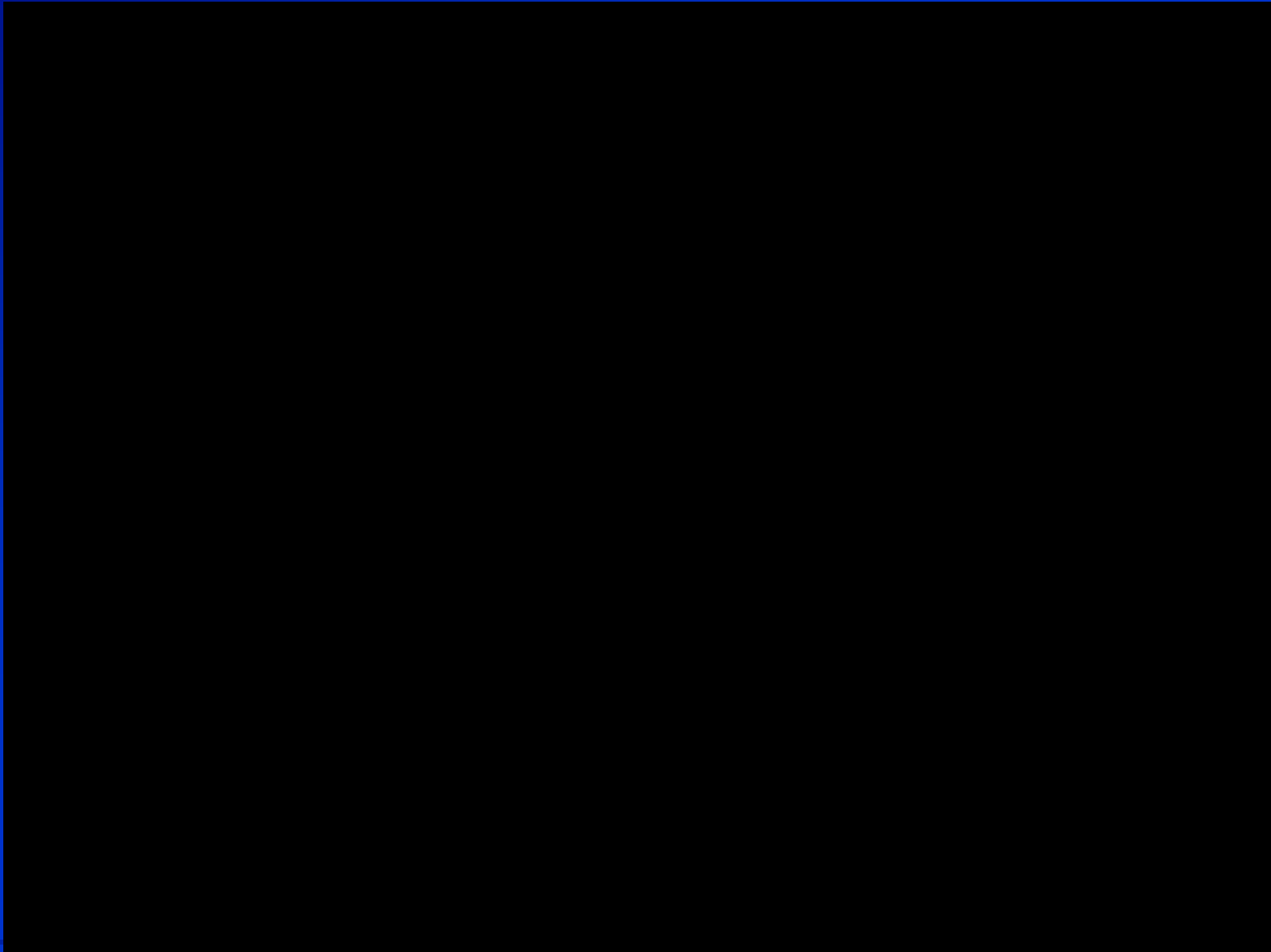
- Allows virtual object to appear between two real objects



“Depth key” studio tests

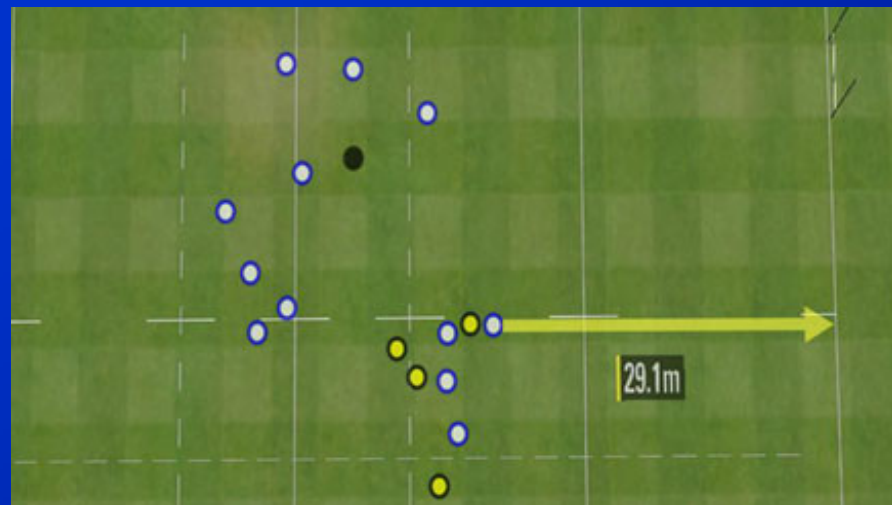
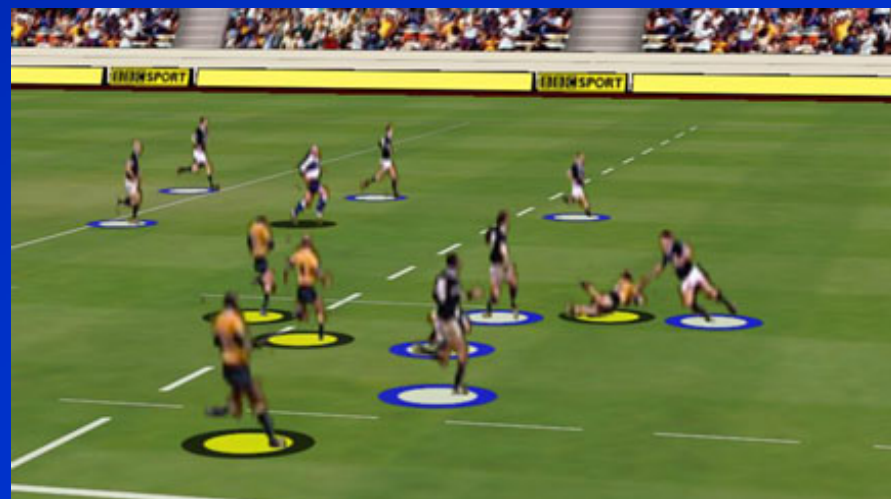


“Depth key” studio tests



Real objects moved to a virtual world

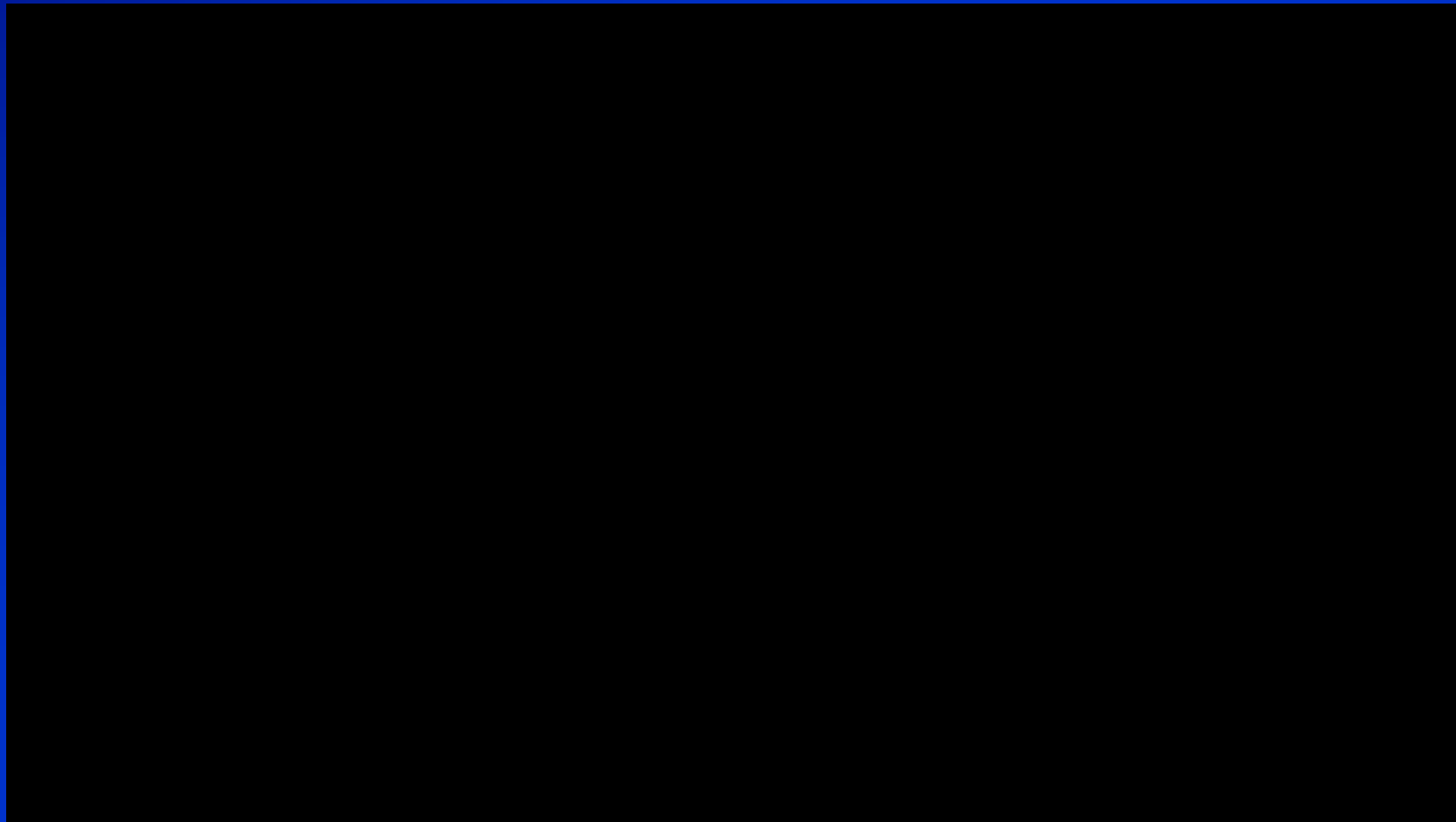
- Example: Virtual views for sports – the *Piero* system



Piero in use

Camera tracking for *Piero* sports graphics

- Camera tracked in real-time using image analysis developed by BBC R&D in the EU-funded MATRIS project



Conclusions

- AR/VR techniques have many applications in innovative programme production
- The technologies involved (tracking, compositing, rendering,) also have applications in many related areas
 - 3D modelling / virtual view generation from multiple images
 - Tracking people / objects for automatic camera control, statistics generation, etc
- For more details on BBC R&D projects in this area, see www.bbc.co.uk/rd/projects/virtual