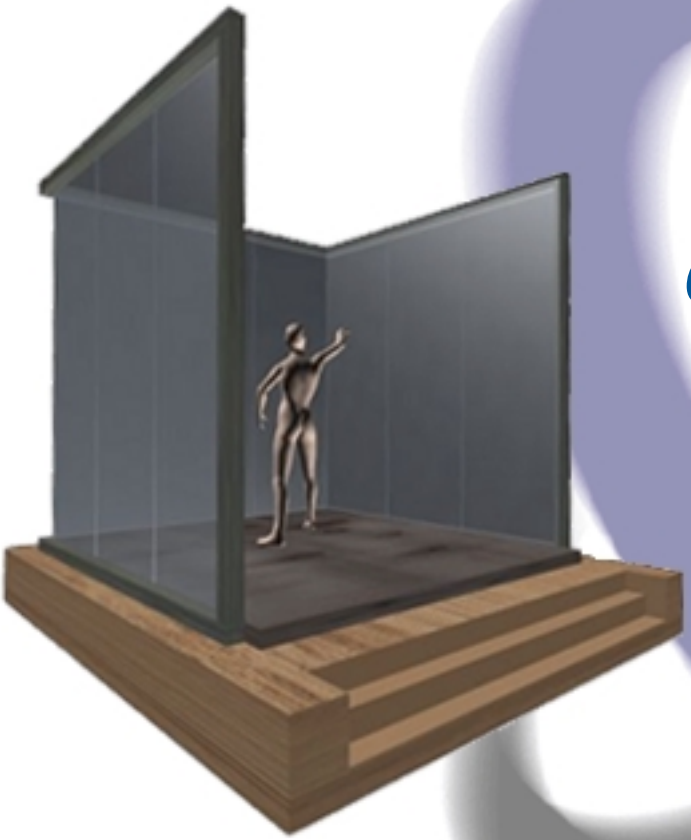

blue-c

# The blue-c

## Industry Meeting
## 06. June 2002

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

http://blue-c.ethz.ch



# Collaborative Virtual Reality

# Industry meeting

## Program

| | | |
|---|---|---|
| 14:00-14:15 | Welcome (Prof. M. Meier) | CLA J1 |
| 14:15-14:45 | Overview of the project (Stephan Würmlin) | CLA J1 |
| 14:45-15:15 | Coffee Break | IFW D42 |
| 15:15-17:45 | Demos in the first blue-c portal (Martin Näf, Christian Spagno) | RZ D09 |
| 17:45 | Wrap-Up (Prof. M. Meier) | IFW D42 |
| 18:15 | Discussion | IFW D42 |
| 18:30 | Dinner - Clausiusbar | CLA |

# Industry meeting

- *The "blue-c industry meeting" is an opportunity for the major players in the fields associated with this research to view, critique, and comment upon the blue-c project.*
- *The industry meeting sets up a dialogue between the academic research of blue-c and the commercial application and viability.*
- *The industry meeting brings together a multi-diciplinary group from the associated industries to complement the working group of the project.*
- *The industry meeting augments the research with real world knowledge, skills, and experience.*

# Mission

- *Build a prototype of a highly immersive projection and video acquisition environmentfor collaborative work*
- *Allow users to meet and collaborate in virtual worlds using advanced graphics, vision,computing, and networking techniques*
- *Development of advanced collaborative Virtual Reality applications*

# The blue-c

- *The blue-c is a project to develop both technologies and applications.*

- *The blue-c team is composed of groups from ETH Zurich working on hardware, software, interface design, interaction, visual recognition and program applications for the project.*

# The blue-c

## Key-features

- Immersive
- Distributed and connected
- Collaborative
- Photo-realistic three-dimensional acquisition and rendering of users
  - No avatars

## Applications

- Architectural and Engineering Design
- Digital Collaboration in Product Design and Development
- Medical Simulation
- Location-based Entertainment

# The blue-c Team

- **Computer Graphics Laboratory**
  *Department of Computer Science - ETHZ*
- **Center of Product Development**
  *Department of Mechanical and Process Engineering - ETHZ*
- **Computer Aided Architectural Design Group**
  *Department of Architecture - ETHZ*
- **Computer Vision Laboratory**
  *Department of Information Technology and Electrical Engineering - ETHZ*
- **MultiMedia Laboratory**
  *Department of Computer Science- University of Zurich*

# Project Team @ ETHZ

| | Computer Graphics Laboratory | Center for Product Development | Computer Aided Architectural Design | Computer Vision Laboratory |
|---|---|---|---|---|
| **Project Lead** | Prof. M. Gross | Prof. M. Meier | Prof. L. Hovestadt | Prof. L. Van Gool |
| **Team Members** | E. Lamboray | Dr. A. Kunz | S. Lang | Dr. E. Koller-Meier |
| | M. Näf | C. Spagno | K. Strehlke | Dr. T. Svoboda |
| | S. Würmlin | S. Müller | A. Vande Moere | P. Guha |
| | (Prof. O. Staadt) | Y. Parish | (K. Mieusset) (Prof. M. Engeli) | A. Hajra |

# Computer Graphics Laboratory

*Development Responsibilities:*

*SOFTWARE development and programming:*

- *Application Programming Interface*
- *Three-dimensional Human Acquisition and Rendering*
- *Multimedia Networking and Communication*

# Center of Product Development

*Development Responsibilities:*

## *HARDWARE development :*

- *Construction of the blue-c Portal*
- *Projection Screens*
- *Stereo Projection Hardware*
- *Synchronization of all Components (electronics)*
- *Applications*

# Computer Aided Architectural Design

*Development Responsibilities:*

*APPLICATION development and programming:*

- *Applications*
- *Interface Design*
- *Physical Design of blue-c and Integration*
- *Virtual Environments*
- *Webpage Design and Communications*
- *Public Relations*

# Computer Vision Laboratory

*Development Responsibilities:*

## *SOFTWARE development and programming:*

- *System Calibration (cameras, illumination)*
- *Fore- and Background Segmentation*
- *Silhouette Extraction*
- *3D Human Motion (gesture) Analysis*

# The blue-c

## A collaborative immersive virtual environment

### Design

# Project Goals

## Overview

- Build a prototype of a highly immersive projection and video acquisition environment
- Three-dimensional representation of the user
- Connect two such prototypes, allowing for collaborative work
- Allow users to meet, interact, and collaborate in a common virtual world
- Develop novel interaction metaphors for Virtual Reality
- Develop new applications for multiple users

# Project Goals

## Phase I - until Spring 2003

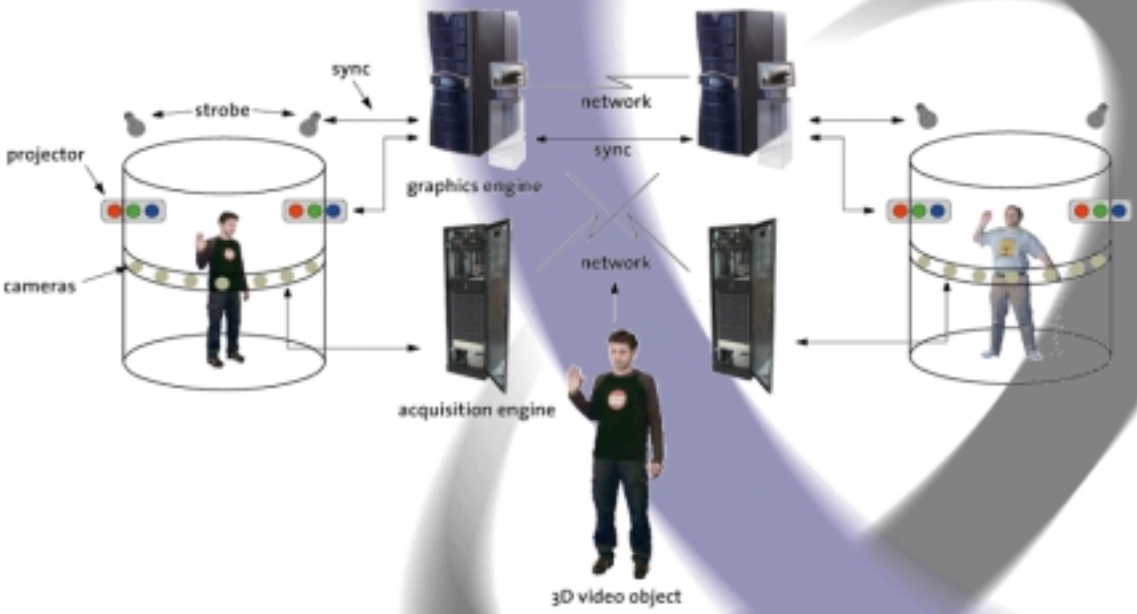
- Initial prototype design and construction of a three-sided, single-user collaborative virtual environment
- Build and connect two prototypes together (ETH-Zentrum, ETH-Hönggerberg)
- Real-time acquisition and display of three-dimensionally reconstructed users in virtual environments
- Navigation interface and protocols
- Communication interface and protocols (collaboration)
- Stereo projection and local (real-time) 3D rendering
- Video and audio transmission via network
- 3D head tracking and 3D interaction devices
- Selected applications: architecture, medicine, product design

## Milestones

- Summer 2002
  - First blue-c portal completed
  - Located at the RZ building at ETH Zentrum
  - Comprises most hardware components of the final system
  - Four patents filed
- Autumn 2002 (anticipated)
  - One Stand-alone blue-c system including all hardware and software components
- Spring 2003 (anticipated )
  - Link two blue-c systems
  - Located at ETH Zentrum and ETH Hönggerberg

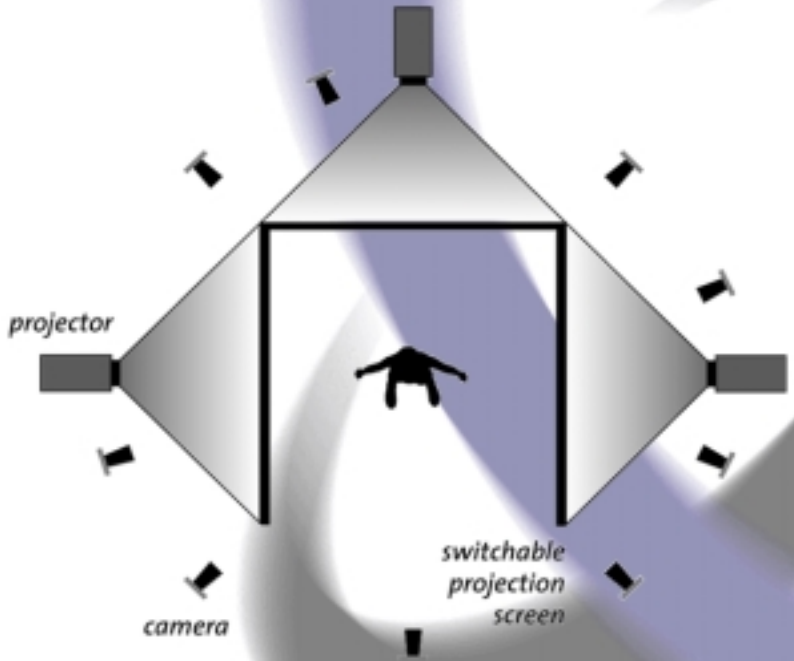
# The blue-c

## System Setup



# The blue-c

## Basic Idea



## First blue-c Portal

# Shuttered walls and synchronized cameras

*walls **opaque** –*
*no acquisition, projection*

*walls **transparent** –*
*acquisition, no projection*

# Components

## Hardware

- Multi-pipe projection (three passive stereo projection units)
- Multi-camera video acquisition (up to 16 cameras)
- Rendering Server (SGI Onyx 3200)
- Video stream processing (PC cluster)
- Active illumination
- "Active" projection screens
- Tracking (position and gestures)
- Spatial audio and transmission
- Video and audio transmission via ETH network

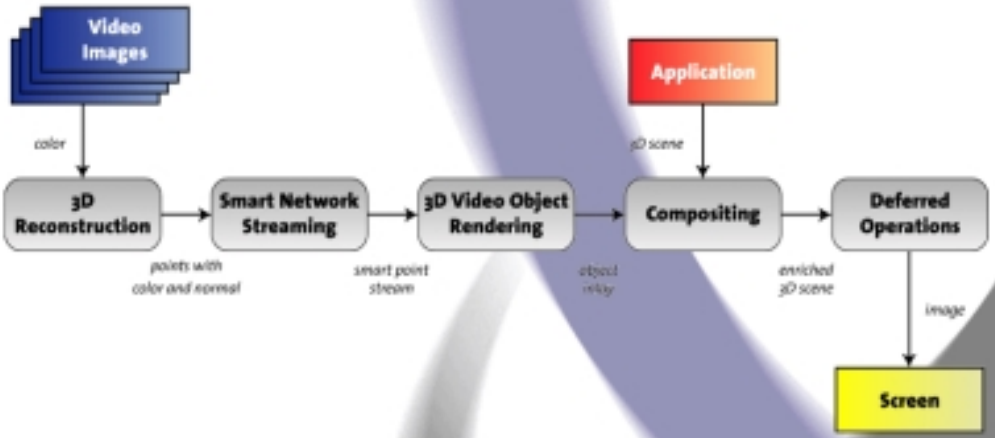
# Components

## Software

- Acquisition and 3D reconstruction
  - Silhouette extraction
  - Point-based representation
  - Composition and rendering
- Scene-graph API
  - Shared virtual environments
  - Point-based human integration
- Communication
  - RT-CORBA for event synchronization
  - Multimedia streaming

# Human 3D Acquisition

## Real-Time Pipeline



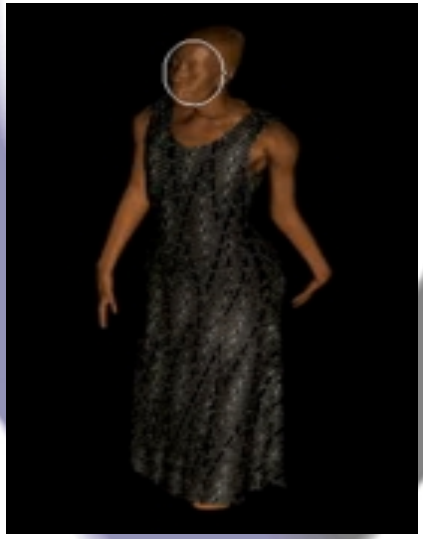
# Human 3D Acquisition

## Acquisition Setups

*acquisition setup 1*

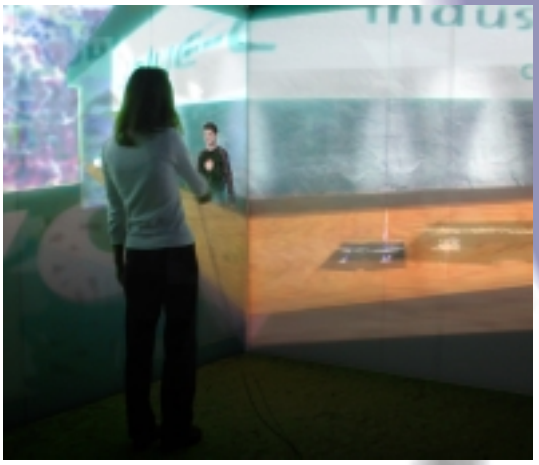
*acquisition setup 2*

# Silhouette Extraction

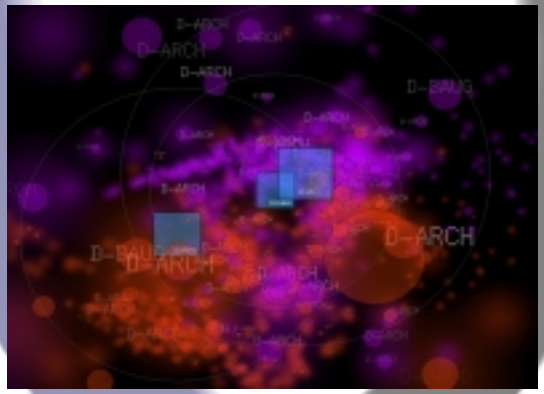


# Applications

## Fashion Show



## Infoticles

# Conclusions

- *Project start: Spring 2000*
- *First hardware setup: Summer 2001*
- *Stand-alone prototype (one-way operation): Autumn 2002*
- *Full bi-directional setup: Spring 2003*
- *Application development in progress*
- *Core algorithms and technology ready*

# Publications

## Paper and Poster

- Gross, Kunz, Meier, and Staadt. „**The Blue-C: Integrating Real Humans into a Networked Immersive Invironment.**“ Proceedings of ACM Collaborative Virtual Environments 2000
- Gross, M.; Kunz, A.; Meier, M.; Staadt, O.: “**The Blue-C: Integrating Real Humans into a Networked Immersive Invironment**”; CVE Conference 2000
- Lamboray, Naef, Wuermlin, Staadt, and Gross. “**A CORBA-Based Distributed Virtual Reality Platform.**” IEEE Middleware 2001, IEEE Distributed Systems Online, Vol. 2, No. 7, 2001
- Staadt, Naef, Lamboray, and Wuermlin. “**JAPE: A Prototyping System for Collaborative Virtual Environments.**” Proceedings of Eurographics 2001.
- Gross and Staadt. “**The blue-c Project.**” ERCIM News No. 44, 2001.
- Kunz, A.; Spagno, C.: “**Modified Shutter Glasses for Projection and Picture Acquisition in Virtual Environments**”; IEEE Virtual Reality 2001 Conference; March 13.-17. 2001; Yokohama, Japan
- Kunz, A.; Spagno, C.: “**Novel Shutter Glass Control for Simultaneous Projection and Picture Acquisition**” Immersive Projection Technology and Virtual Environments 2001, pp. 257-266; May, 16-18 2001; Stuttgart (Germany); Springer-Verlag Wien/New York

# Publications

## Paper and Poster

- *Kunz, A.; Spagno, C.: "**Simultaneous Projection and Picture Acquisition for a Distributed Collaborative Environment**"; IEEE Virtual Reality 2002 Conference, March 24.-28. 2002, Orlando, Florida, USA*

- *Kunz, A.; Spagno, Ch.: "**Technical System for Collaborative Work** "; Virtual Environments 2002 - Eurographics Workshop in cooperation with ACM Siggraph; Mai 30. - 31. 2002; Barcelona, Spain*

- *Andrew Vande Moere, "**Infoticles: Information Modeling in Immersive Environments**", IV02, 6th International Conference on Information Visualisation, London, England, July 2002*

- *Four patents filed*

# Contacts


## Prof. Dr. Markus Gross

*Computer Graphics Laboratory*
*Department of Computer Science*
*IFW C28*
*ETH Zentrum*
*CH-8092 Zürich*
*Switzerland*

*tel.: +41 1 632 71 14*
*mail: grossm@inf.ethz.ch*

## Prof. Dr. Markus Meier

*Center of Product Development*
*Department of Mechanical Engineering*
*CLA E32, ETH Zentrum*
*Tannenstrasse 3*
*CH-8092 Zürich*
*Switzerland*

*tel.: +41 1 632 23 58*
*mail: meier@imes.mavt.ethz.ch*

# Contacts


## Prof. Dr. Ludger Hovestadt

*Computer Aided Architectural Design*
*Department of Architecture*
*HIL D74.3*
*ETH Hönggerberg*
*CH-8093 Zürich*
*Switzerland*

*tel: +41 1 633 40 33*
*mail: hovestadt@arch.ethz.ch*

## Prof. Dr. Luc Van Gool

*Computer Vision Group*
*Department of Electrical Engineering*
*ETH Zentrum*
*Gloriastrasse 35*
*CH-8092 Zürich*
*Switzerland*

*tel.: +41 1 632 52 83*
*mail: vangool@vision.ee.ethz.ch*

# Contacts


*Dr. Claudia Fesch*

*Technology Transfer Manager*
*ETH Transfer*
*Rämistrasse 101*
*ETH Zentrum*
*CH-8092 Zürich*
*Switzerland*

*tel: +41 1 632 23 82*
*mail: fesch@sl.ethz.ch*

# links

- http://blue-c.ethz.ch
- http://graphics.ethz.ch
- http://www.zpe.ethz.ch
- http://www.caad.arch.ethz.ch
- http://www.vision.ee.ethz.ch
- http://www.ifi.unizh.ch/mml