

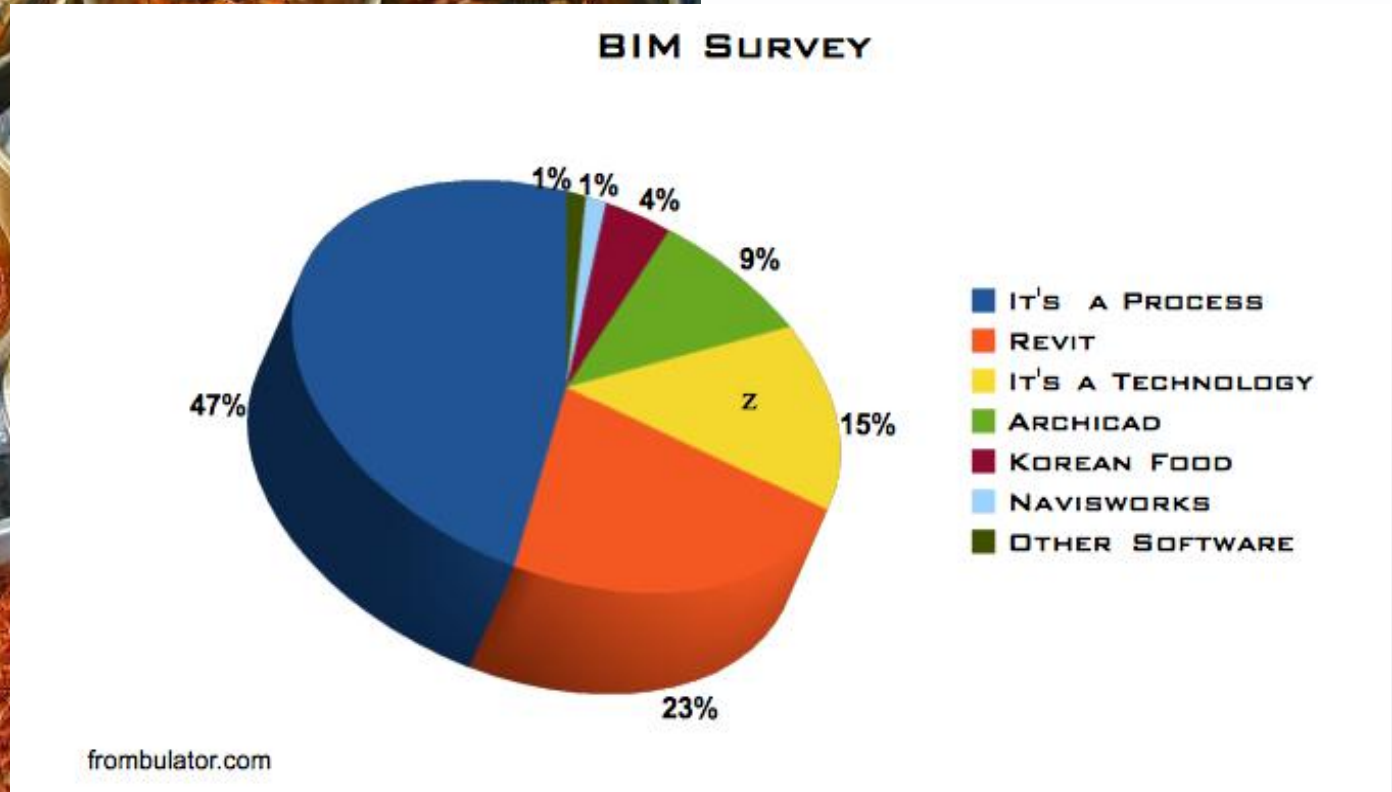
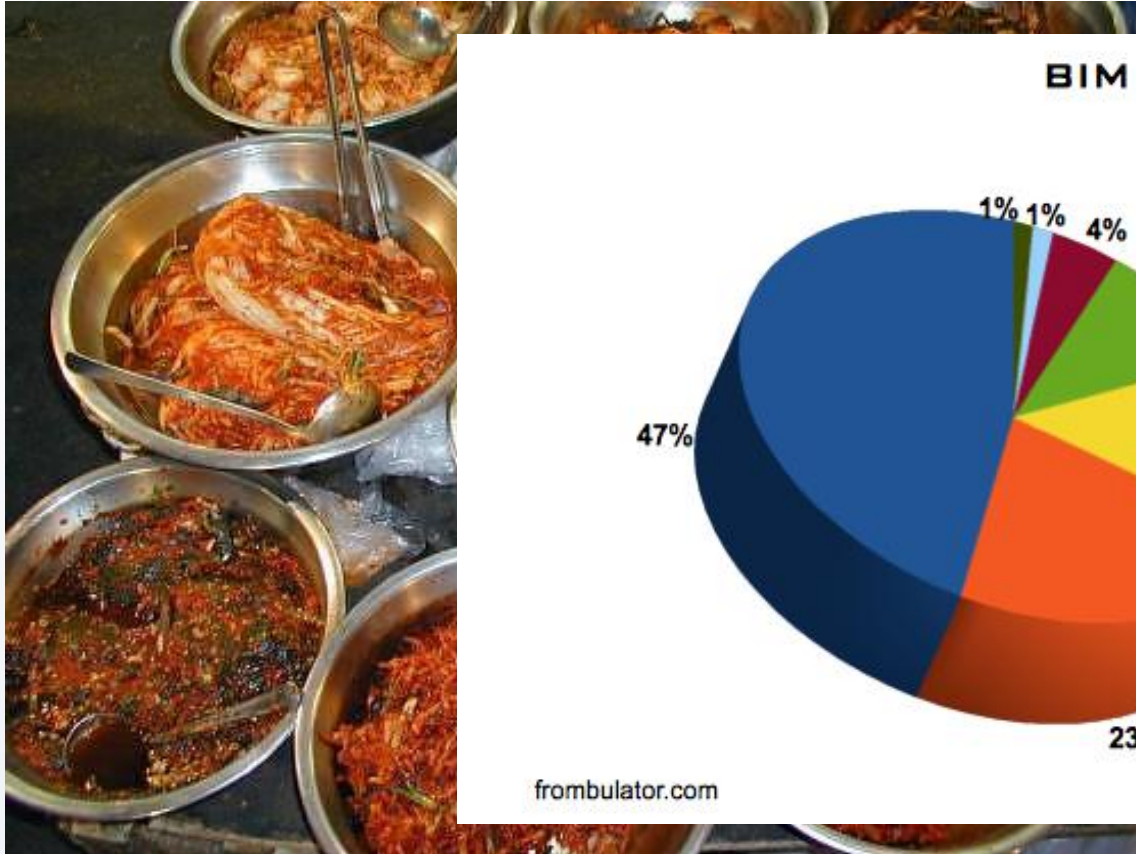
Delivering the value of BIM to Smart Mobile Devices

Capturing 3D Geometry for BIM (Scan2BIM)

Dietmar Backes, Charles Thomson, Stuart McLeod,
Prof Stuart Robson, Dr Jan Boehm, Dr David Chapman et.al.

or vice versa:
Delivering the value of Smart Mobile Devices to BIM ?!

What is BIM?



Content:

- Introduction
- BIM as we understand it
 - The magic melting pod
 - BIM Lifecycle
- Geometry capture
- Modelling for BIM
- Deploying BIM in the field
- Will BIM deliver?

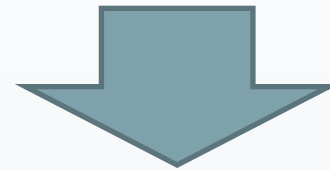
Introduction:

- BIM at UCL CEGE Department:
Civil Environmental and Geomatic Engineering



A multidisciplinary
Department within the
Faculty offering an

Four focus groups to
explore the integration of
BIM have been created.



Geometry
Informatics (CS)
Databases
Technology

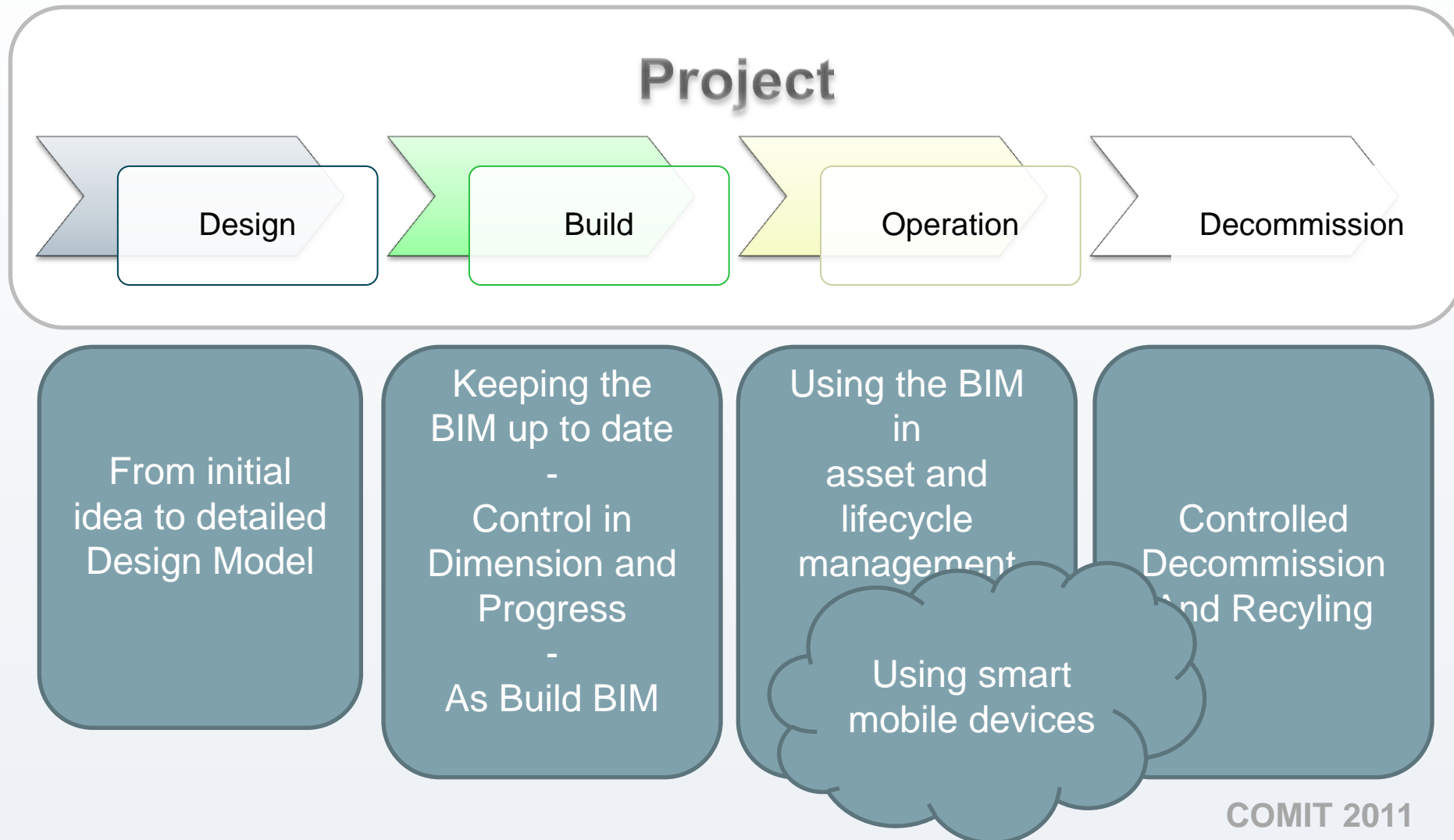
P3DIM group

Case study presented are produced under Partnership with:

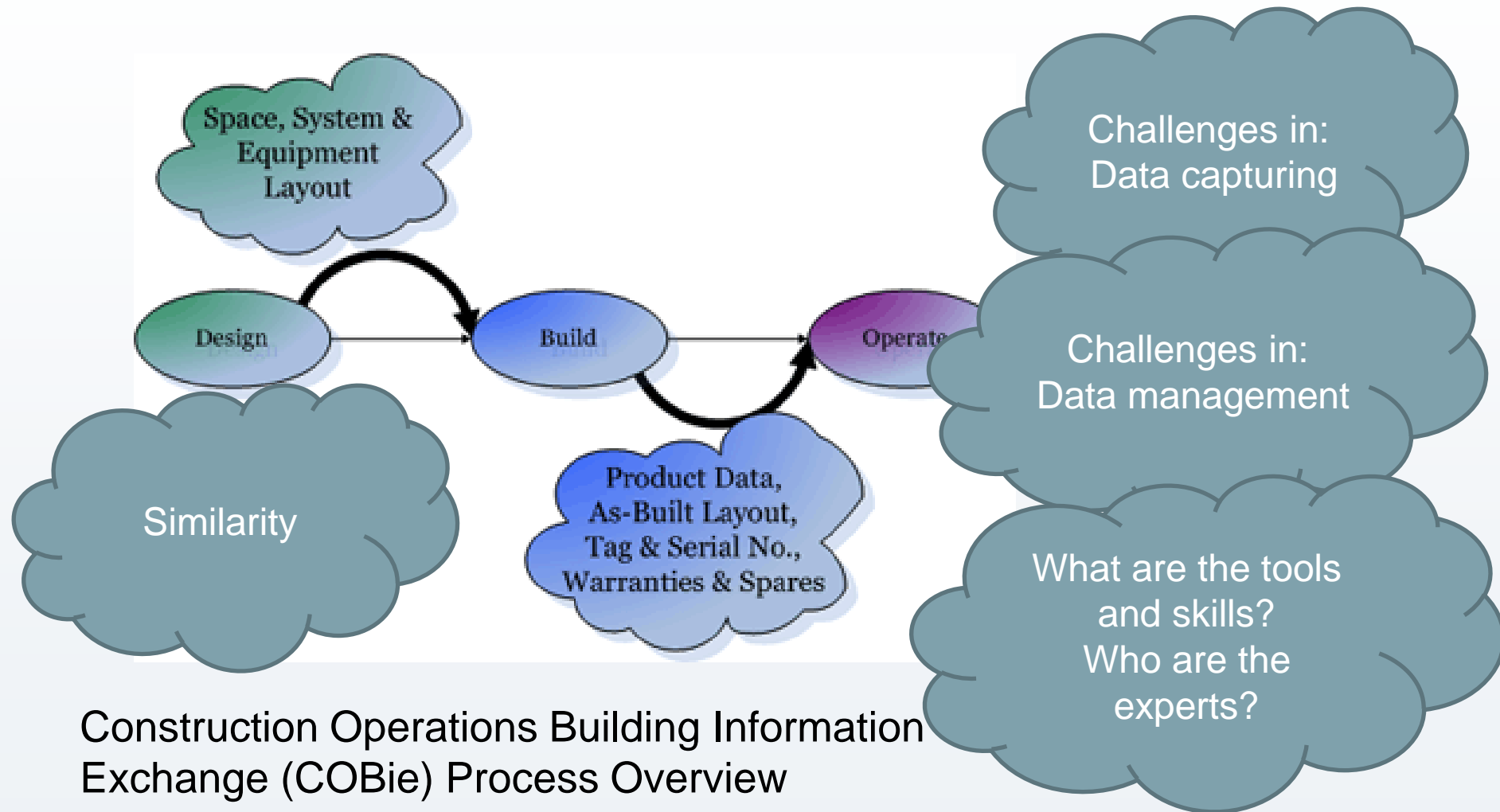


- FARO - UCL cooperation
- Gleeds - UCL advances HELO project

BIM lifecycle as we understand it



BIM lifecycle as we understand it

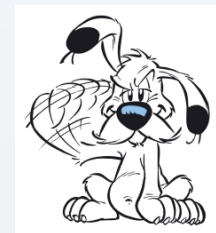


A good day in the office?!



BIM the magic melting Pot?

Who is this druid?



3D Geometry Capture & Modelling

- Why is there need for rapid and 3D reality capture:
 - For retrofit: (Very) Poor documentation for existing buildings
 - Control in many Dimensions
 - 3D dimension, Progress, As Built model after project completion, legal and safety
 - Keeping the BIM/Asset management system up to date



Tools for 3D Data Capturing: Main stream technologies

- Low cost survey:
Laser Disto



- Surveying:
Robotic total station



- 3D Imaging,
Laserscanning:



Tools for 3D Data Capturing: niche and future upcoming technologies

- Photogrammetry
 - Dense image matching
- Vision SLAM
 - via smart mobile device or UAV helicopter
- Range Cameras
 - E.g. PrimeSense, Microsoft



Capturing 3D geometry using Laserscanner: Scan2BIM

- Preferred method to collect 3D data
- Major Software vendors do integrate “Point Cloud Engines” in there Software packages



Autodesk®



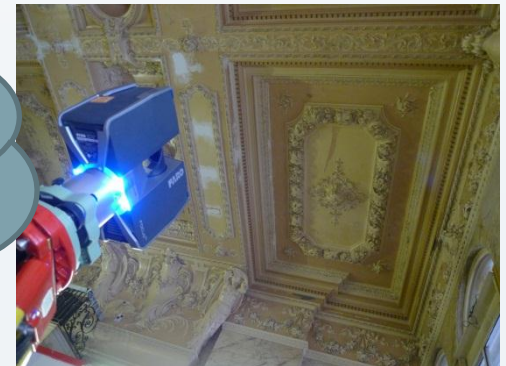
Handling Point Clouds requires powerful Hardware and clever Algorithms,
especially working with mobile devices!

3D Imaging - Laserscanner

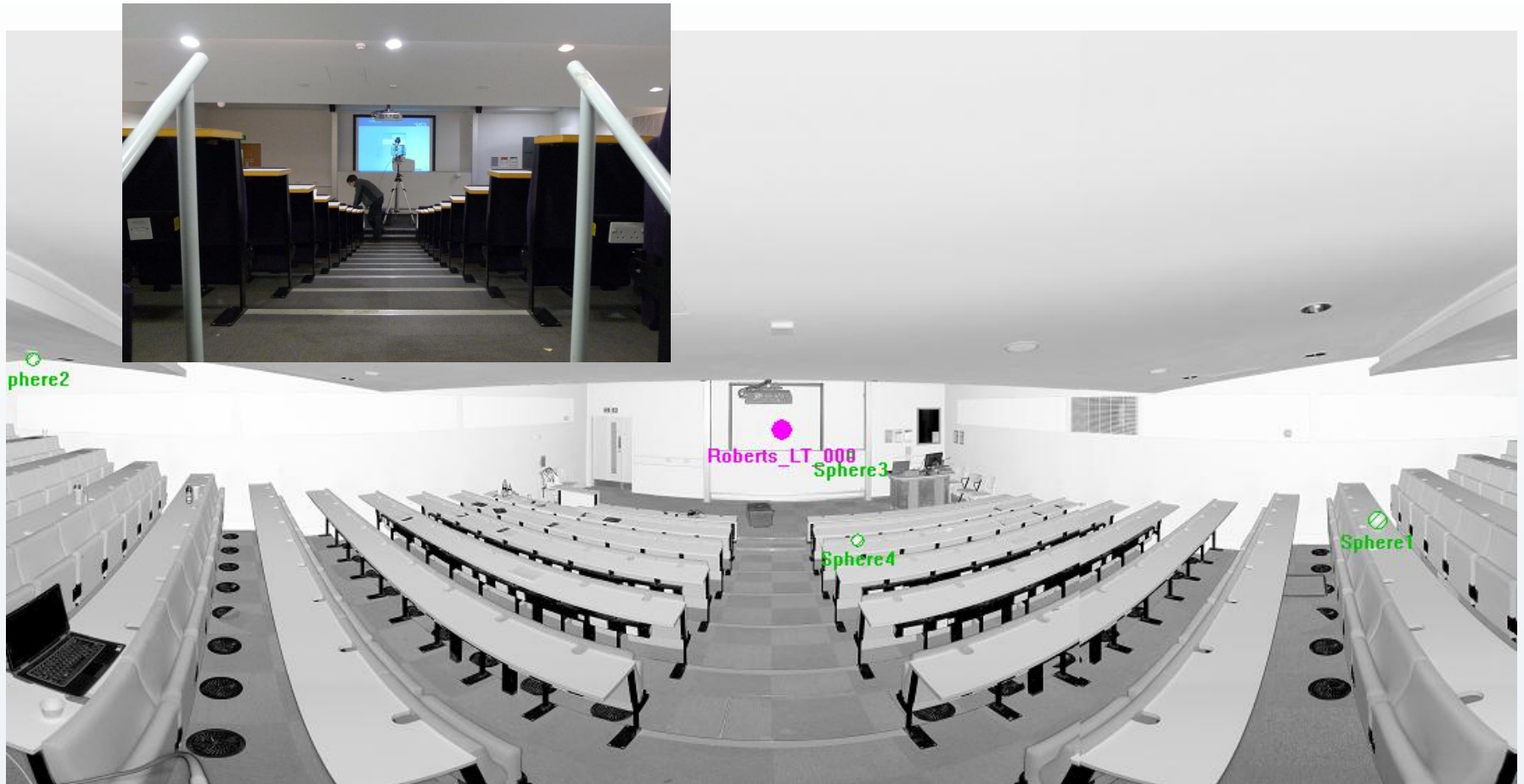
- Requirements:
 - Compact and light
 - Sensor in DSLR format
 - Fast and easy to use
 - These Scanners produce vast amounts of data.



Step change in 2010:
Scanner became
smaller

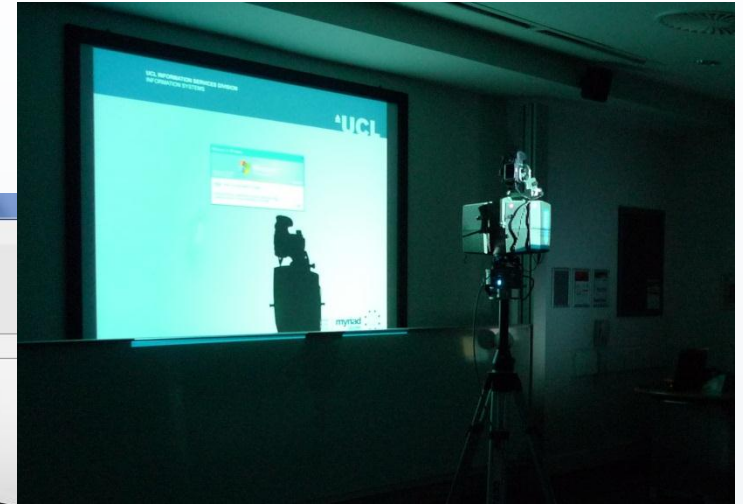
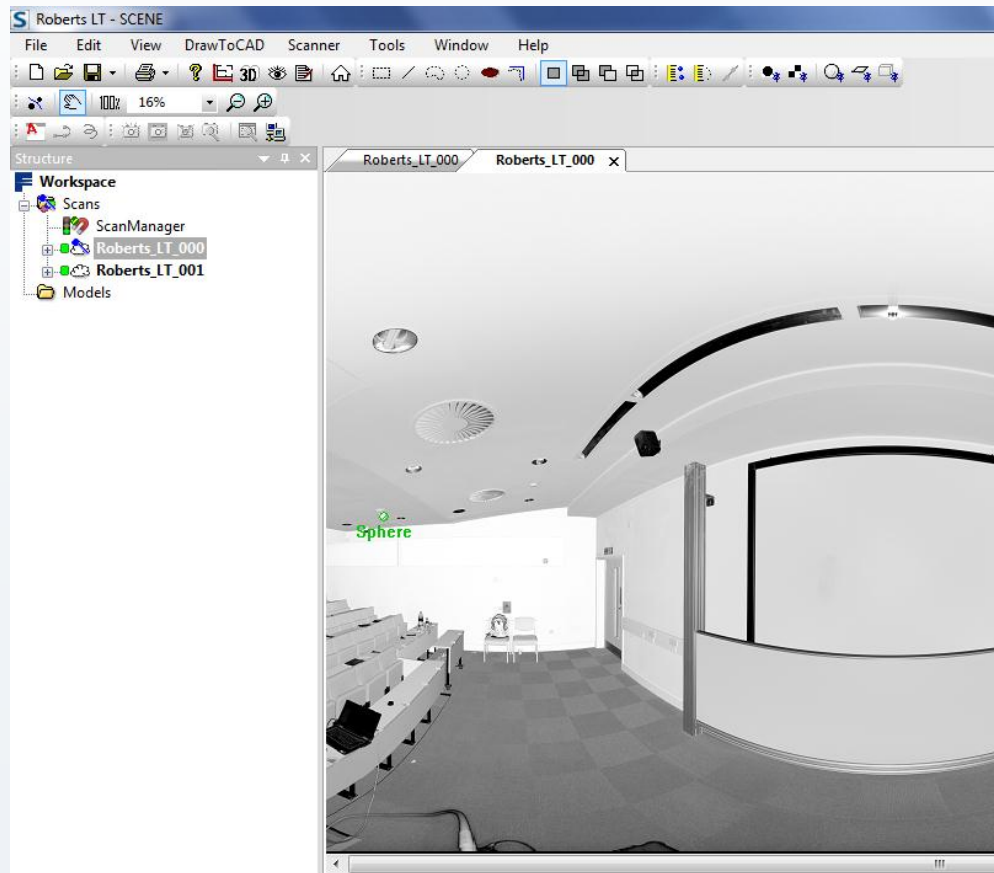


Laserscan of the Lecture Theatre: (DEMO)



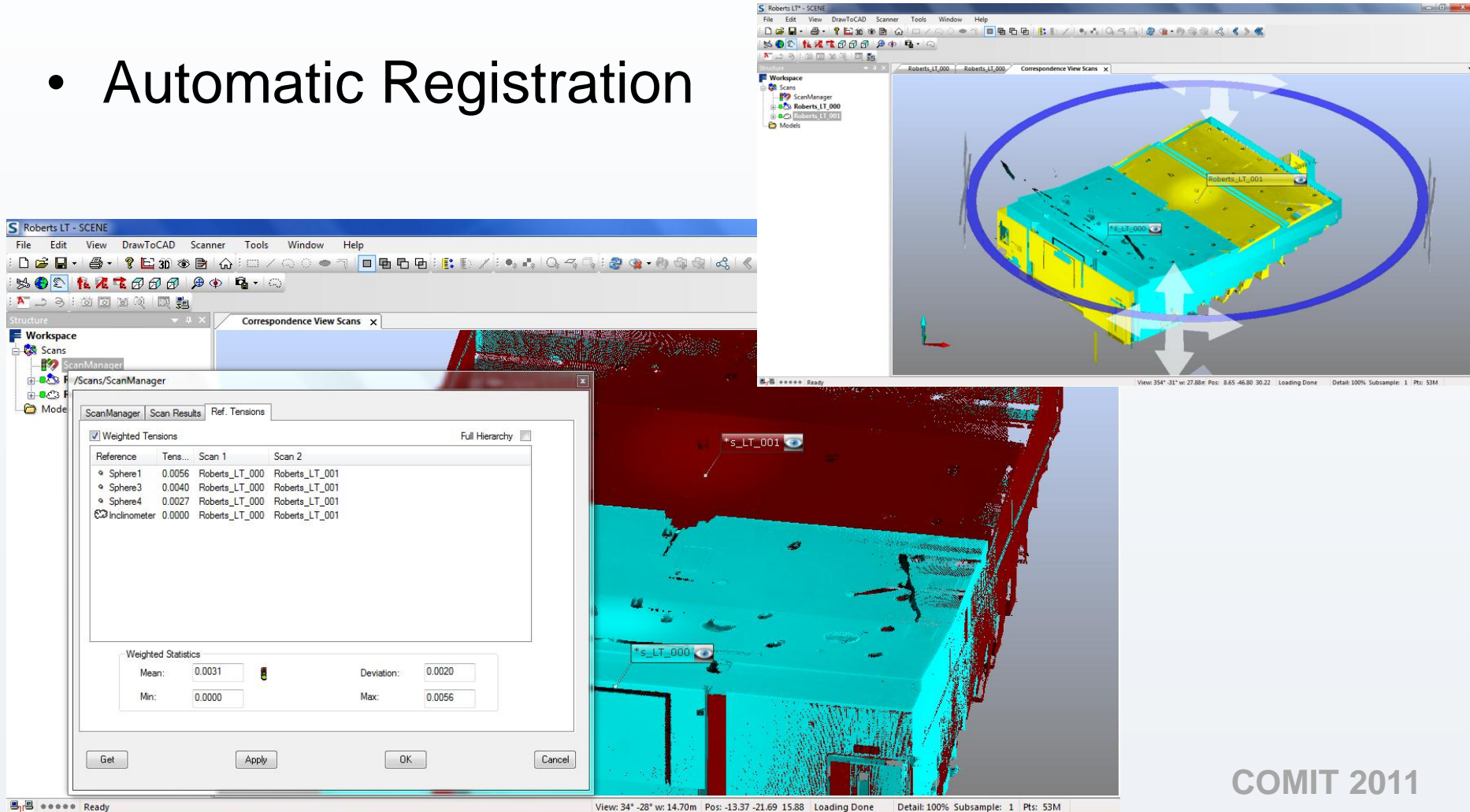
Laserscan of the Lecture Theatre: (DEMO)

- 2 Scans with a Photon 120
- 27 Mill points each
- Automatic Processing



Laserscan of the Lecture Theatre: (DEMO)

- Automatic Registration



The screenshot shows the Autodesk ScanWorks interface. The main window displays a 3D model of a lecture theatre with two scans, Roberts_LT_000 (cyan) and Roberts_LT_001 (yellow), aligned. A blue circle highlights the registration area. A 'ScanManager' dialog box is open, showing a table of reference points and weighted statistics.

Reference	Tens...	Scan 1	Scan 2
◦ Sphere1	0.0056	Roberts_LT_000	Roberts_LT_001
◦ Sphere3	0.0040	Roberts_LT_000	Roberts_LT_001
◦ Sphere4	0.0027	Roberts_LT_000	Roberts_LT_001
◦ Inclinometer	0.0000	Roberts_LT_000	Roberts_LT_001

Weighted Statistics

Mean: 0.0031 Deviation: 0.0020

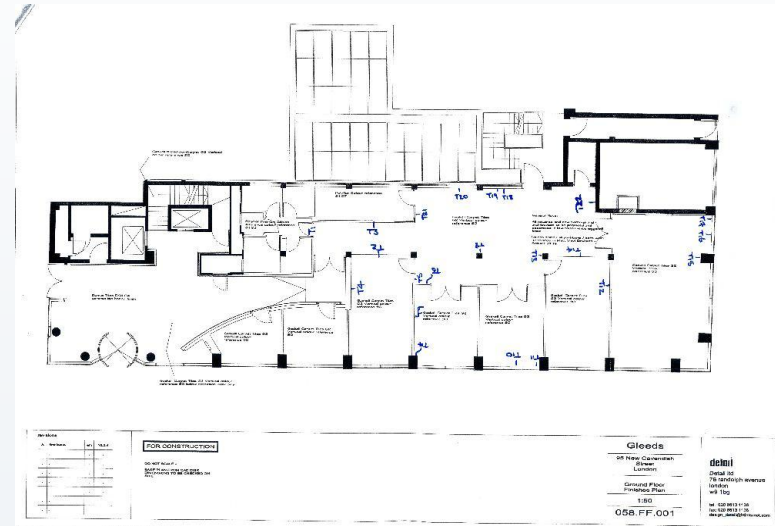
Min: 0.0000 Max: 0.0056

Buttons: Get, Apply, OK, Cancel

BIM case study @ Gleeds

Aim:

- Produce an “as built” BIM model of a known location using Laserscanning
- Case study to investigate the integration of BIM into a productive environment
- Compare existing plans with as built survey qualitatively and quantitatively



BIM case study @ Gleeds

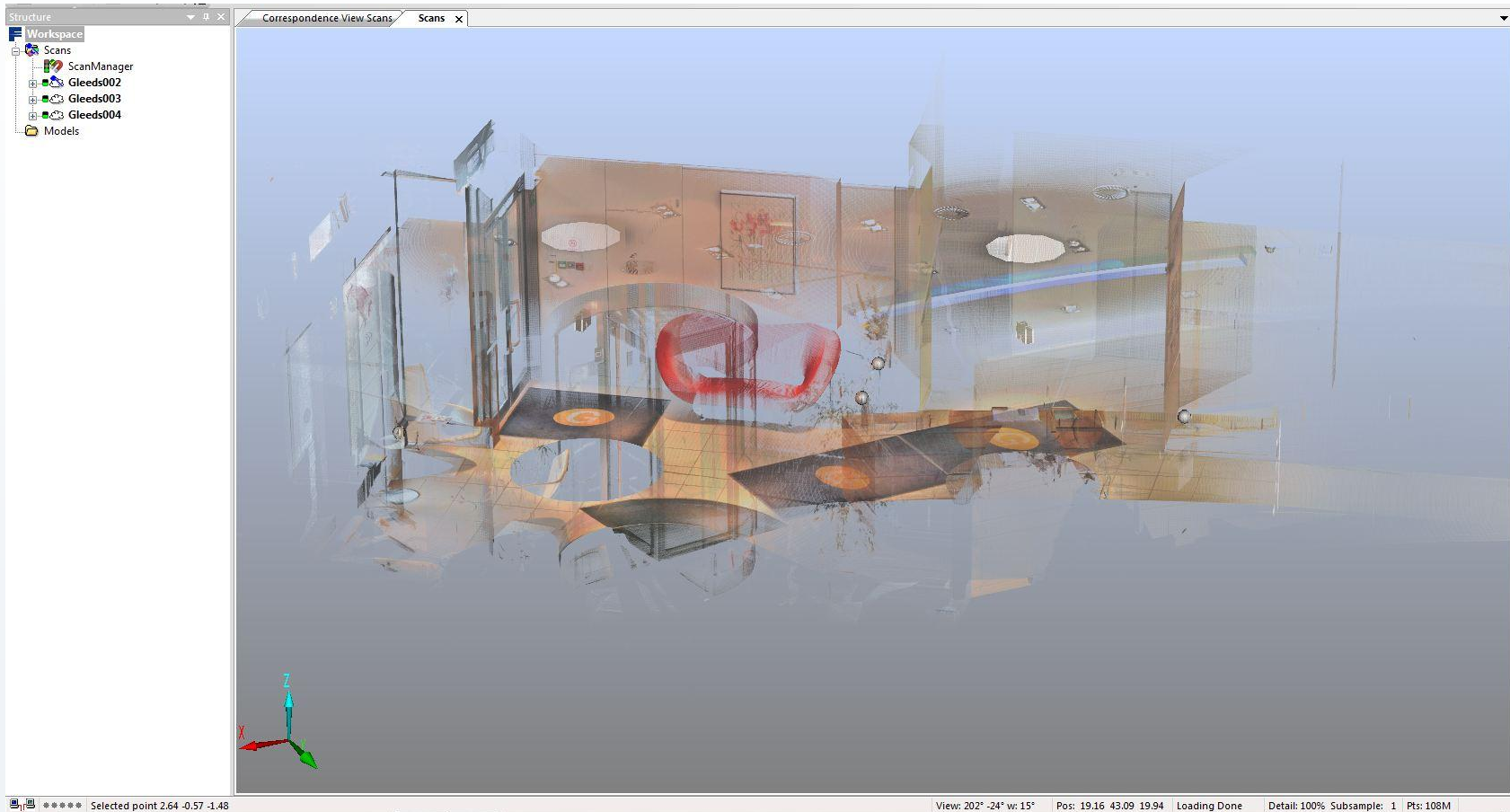
3D Laserscanning concept:

- 15 Laserscans over all



BIM case study @ Gleeds

3D Laserscanning concept:



BIM case study @ Gleeds

3D Laserscanning concept:

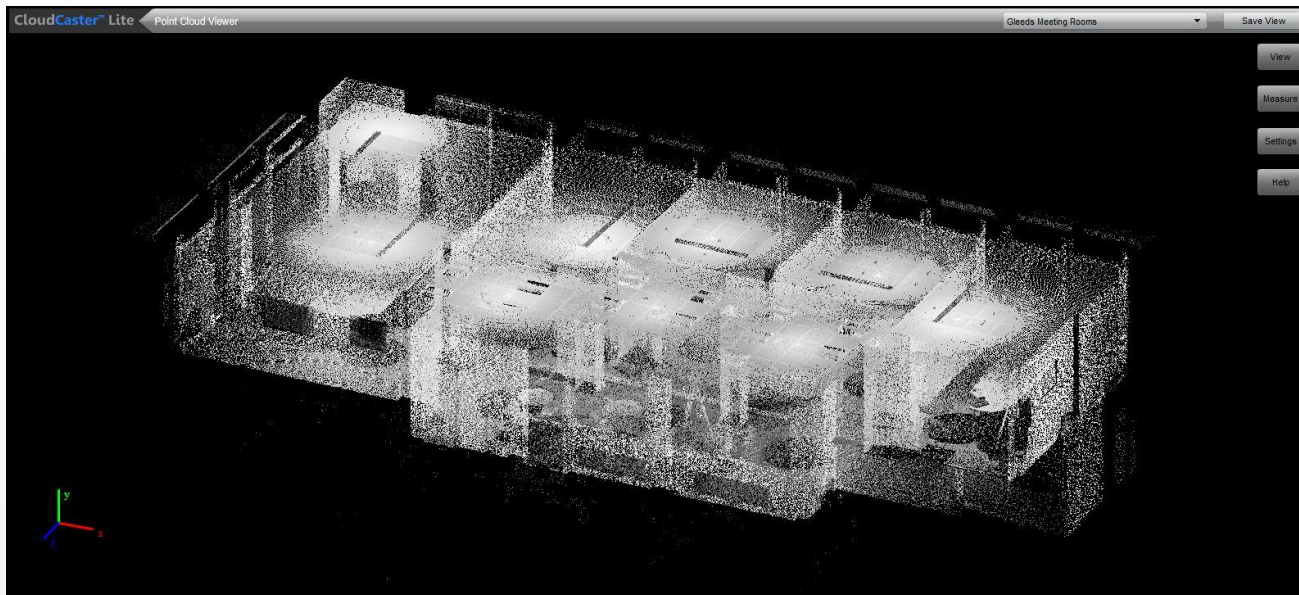
- Registered using a traditional survey network



BIM case study @ Gleeds

3D Laserscanning concept:

- Pre-Processing co-registration of Scans



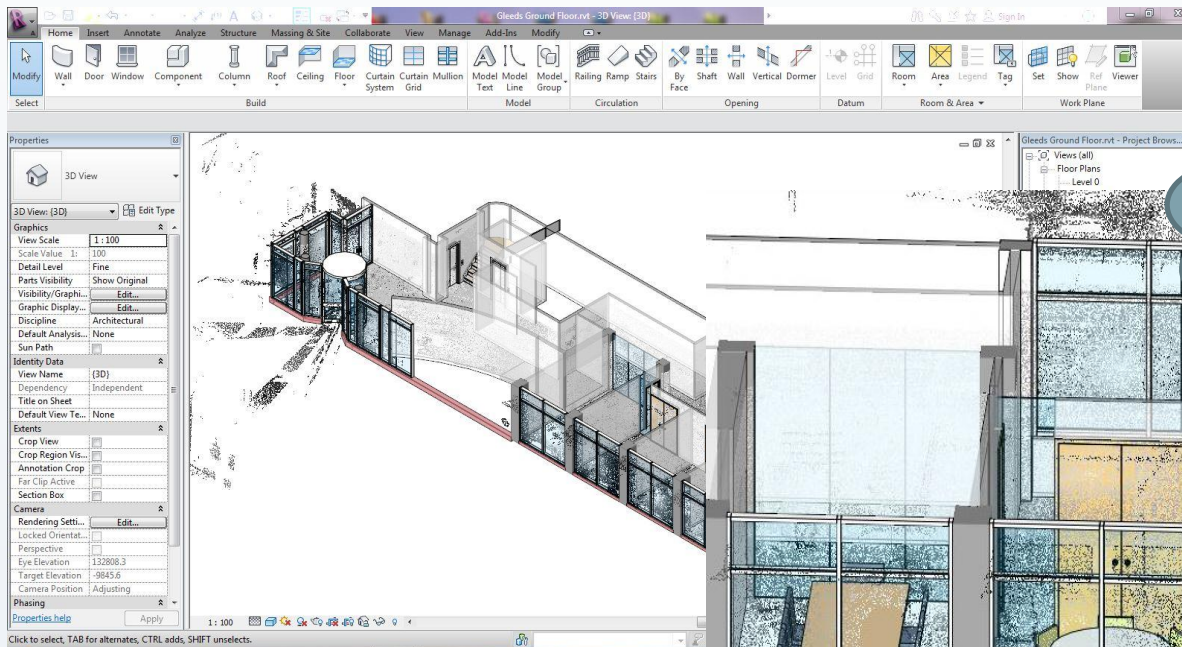
- The registered Pointclouds are accessible via our online platform: <http://casestudies.pointclouds.org.uk/gOff/>

BIM case study @ Gleeds walk through the point cloud

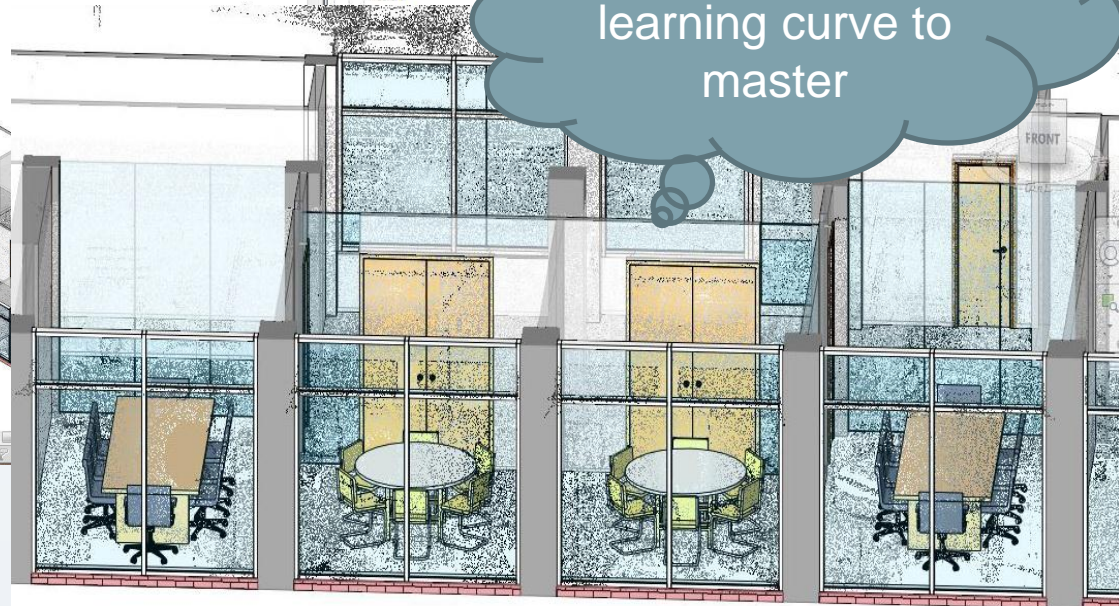


BIM case study @ Gleeds modelling in Revit

- Revit 2012 includes a pointcloud engine, thus allow direct import of the registered cloud
- The model is being build based on the registered pointclouds



There is a steep learning curve to master

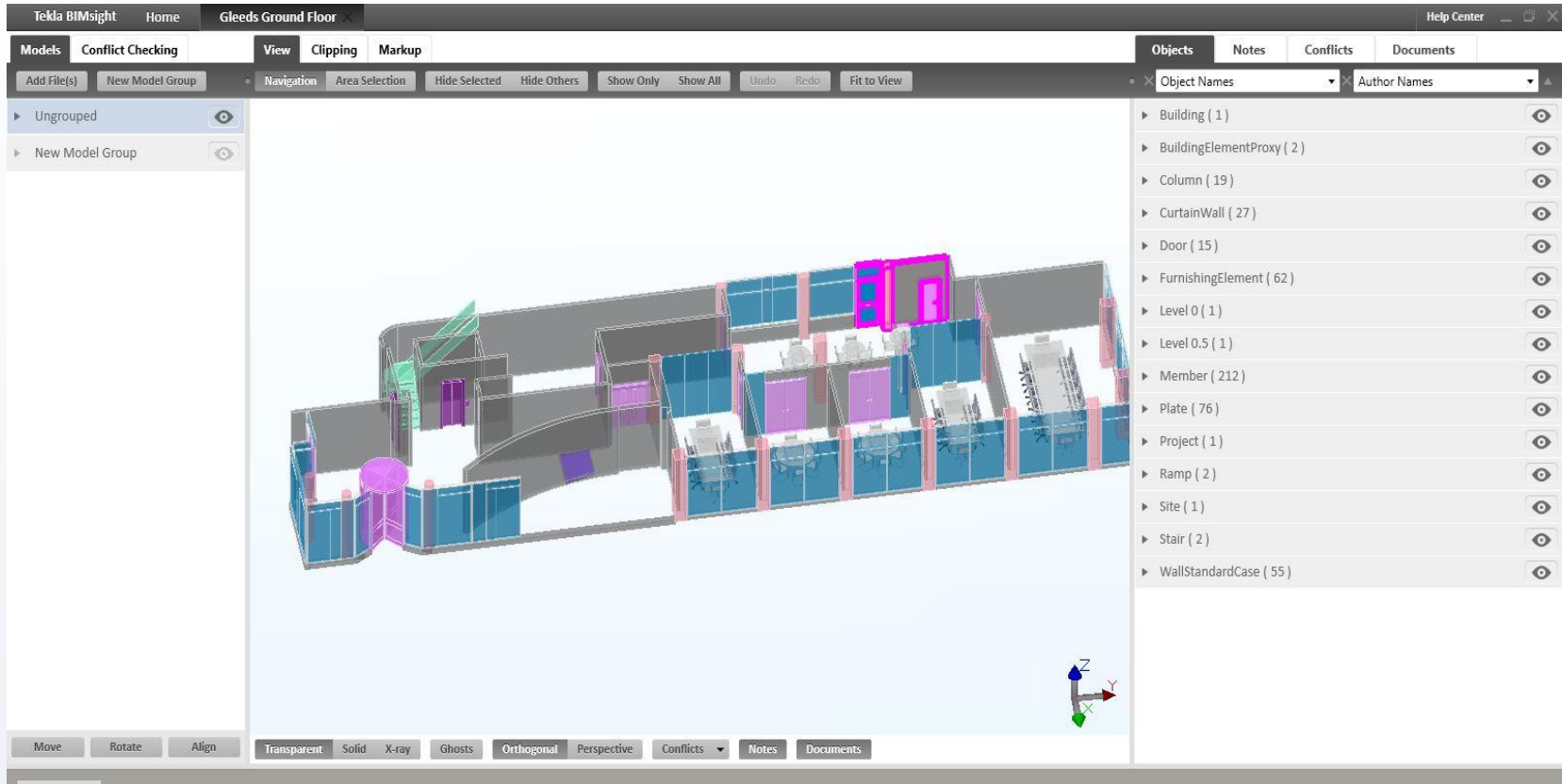


BIM case study @ Gleeds walk through



BIM case study @ Gleeds

Results imported in Tekla via ifc



BIM case study @ Berners Hotel

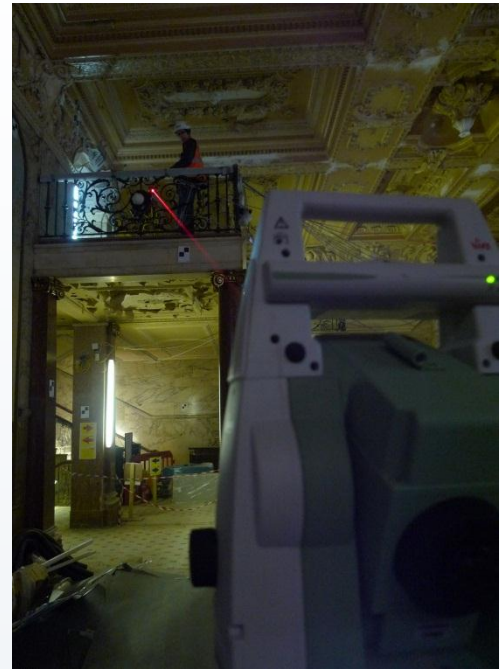
Retrofit case study

Background:

- The derelict Berners Hotel is currently undergoing a comprehensive refurbishment
- Period architectural features shall be preserved

Aims:

- Conducting a realistic case study on a live project based on the investigations of the initial study.
- Aspects of traditional methodology and BIM should be carried out parallel to allow direct comparison



BIM case study @ Berners Hotel

3D Laserscanning concept:

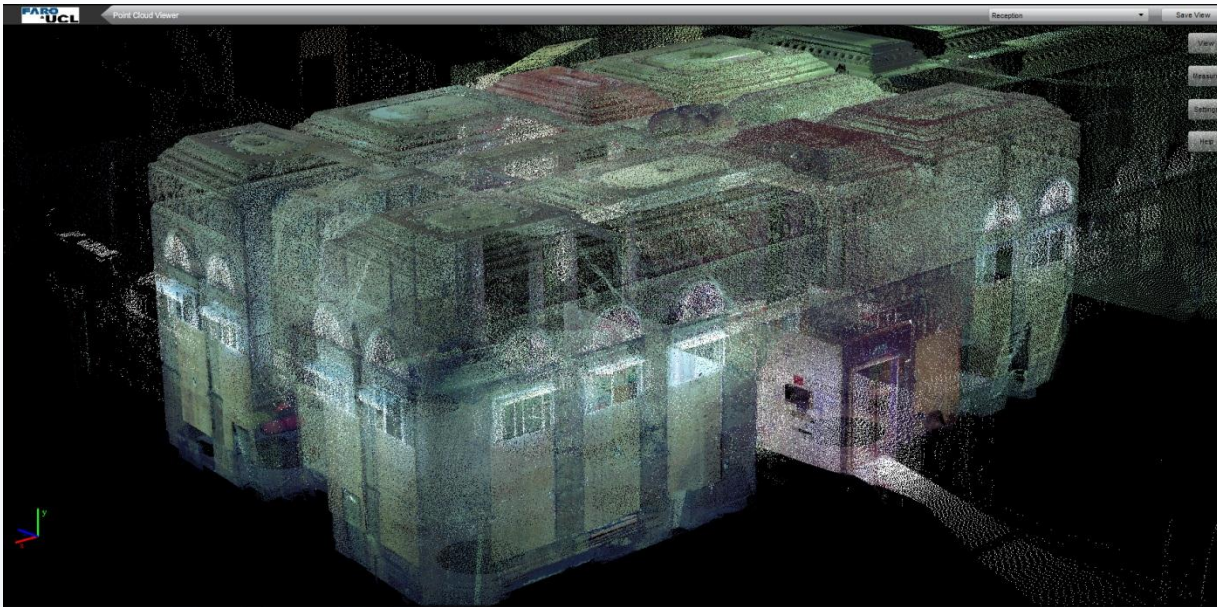
- 22 Scans using the Faro Focus Scanner
- Surveyed reference system to guarantee geometric fidelity



BIM case study @ Berners Hotel

3D Laserscanning concept:

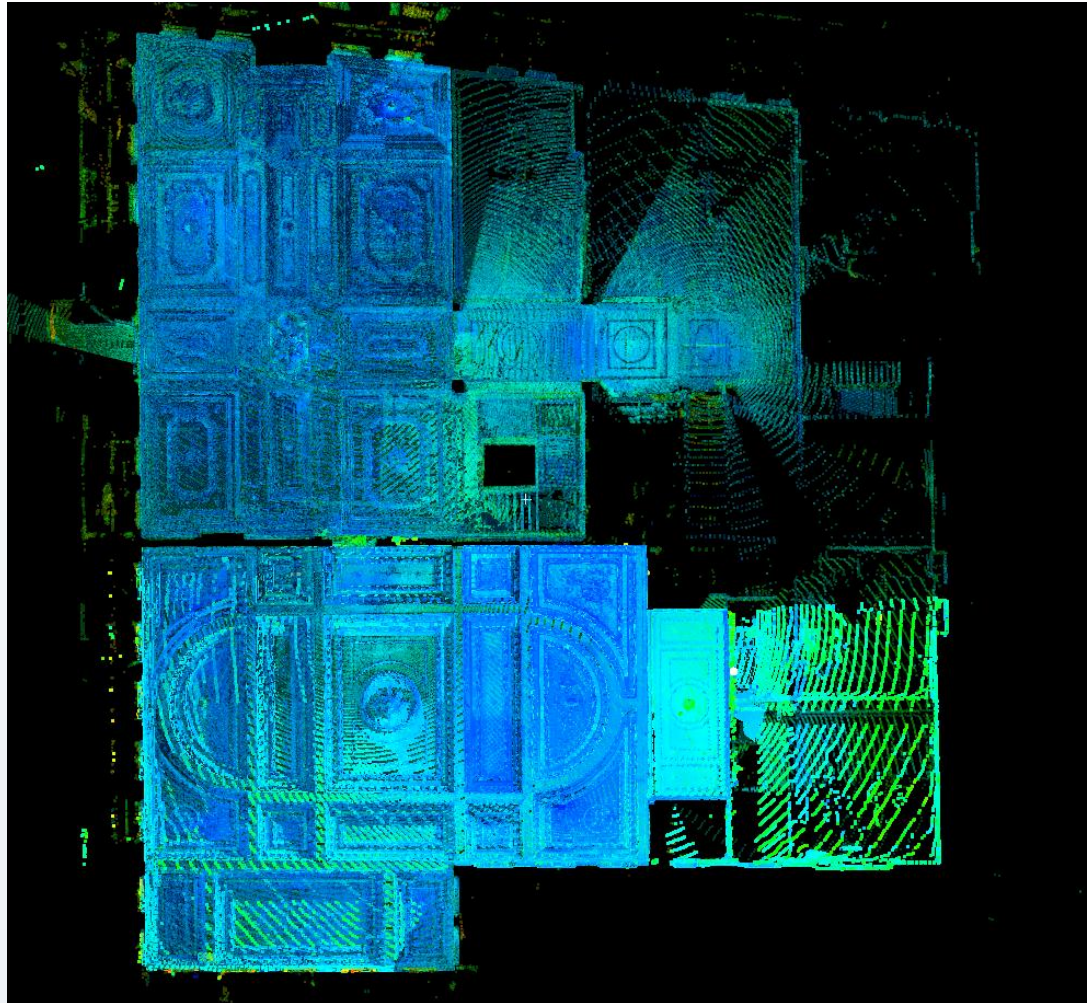
- Pre-Processing co-registration of Scans



- The registered Pointclouds are accessible via our online platform: <http://casestudies.pointclouds.org.uk/gBerners/>

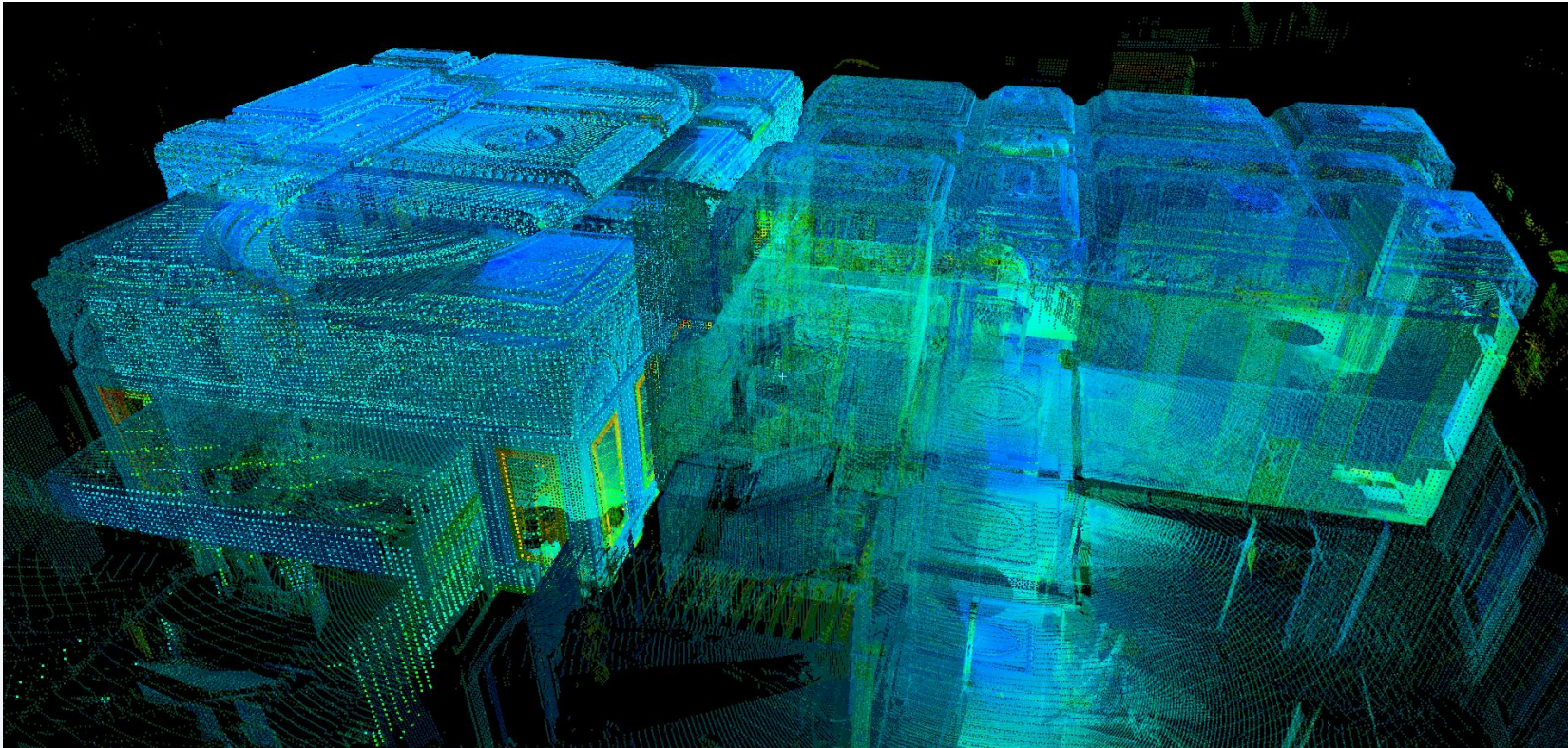
BIM case study @ Berners Hotel

3D Laserscanning concept:



BIM case study @ Berners Hotel

Retrofit case study



BIM case study @ Berners Hotel

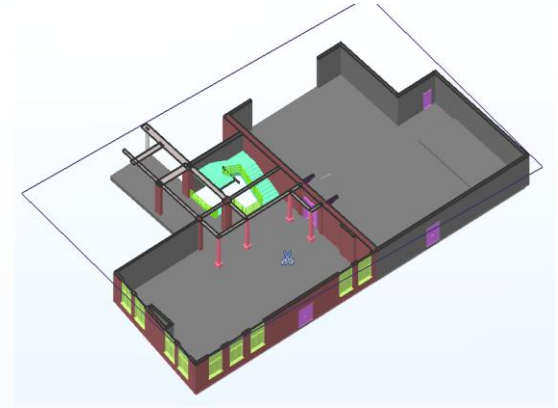
3D Models

- Screenshots of simplified model overlaid point clouds
- Model as much as necessary



BIM case study @ Berners Hotel

Results imported in Tekla via ifc



Tekla BIMsight Home New Project Logged in as: Backes Dietmar ONLINE Settings Help Center

Models Conflict Checking View Clipping Markup Objects Column

Add File(s) New Model Group Add Clip Plane Clear All

Imported on 10/11/2011

Berners Hotel scaled ifc.ifc

Column

Color :	
GUID:	2hxPgDcdD02uthP6b9K0I3
File Format:	ifc
Common Type:	Column
Geometric Classification:	Geometry
Layer:	A-COLS
Coarse Scale Fill Color:	0
Base Width:	502 mm
Diameter:	200 mm
Width:	400 mm
db:	194 mm
dt:	162 mm
Keynote:	G
Assembly Code:	C3010300
Assembly Description:	Column Finishes
OmniClass Number:	
OmniClass Title:	
Phase Created:	Existing
Base Level:	Level 0
Base Offset:	0 mm
Top Level:	Level Mezz Ceiling
Top Offset:	0 mm
Moves With Grids:	True
Room Bounding:	True
Height:	3335 mm

Move Rotate Align Transparent Solid X-ray Ghosts Orthogonal Perspective Conflicts Notes Documents

BIM case study @ Berners Hotel

Retrofit case study

- Current stage
 - Abstract parametric model with basic building information completed
 - Consultations about next steps with Architects, Designers and Project managers
- Conclusions:
 - Complexity of modelling steeply increases:
 - in none standard environments i.e. old buildings
 - higher level of detail is required
 - Capture all, model if and when necessary

Using the BIM on smart mobile devices:



© John Tocci

Augmented reality on mobile devices a lifestyle choice

Professional Systems

- Robust
- Mainly for Labs



BYOD

Consumer Grade Products

- Fast moving development, e.g. Intel just announced a new Ultrabook standard
- Interesting form factors



Augmented reality on mobile devices quick approaches

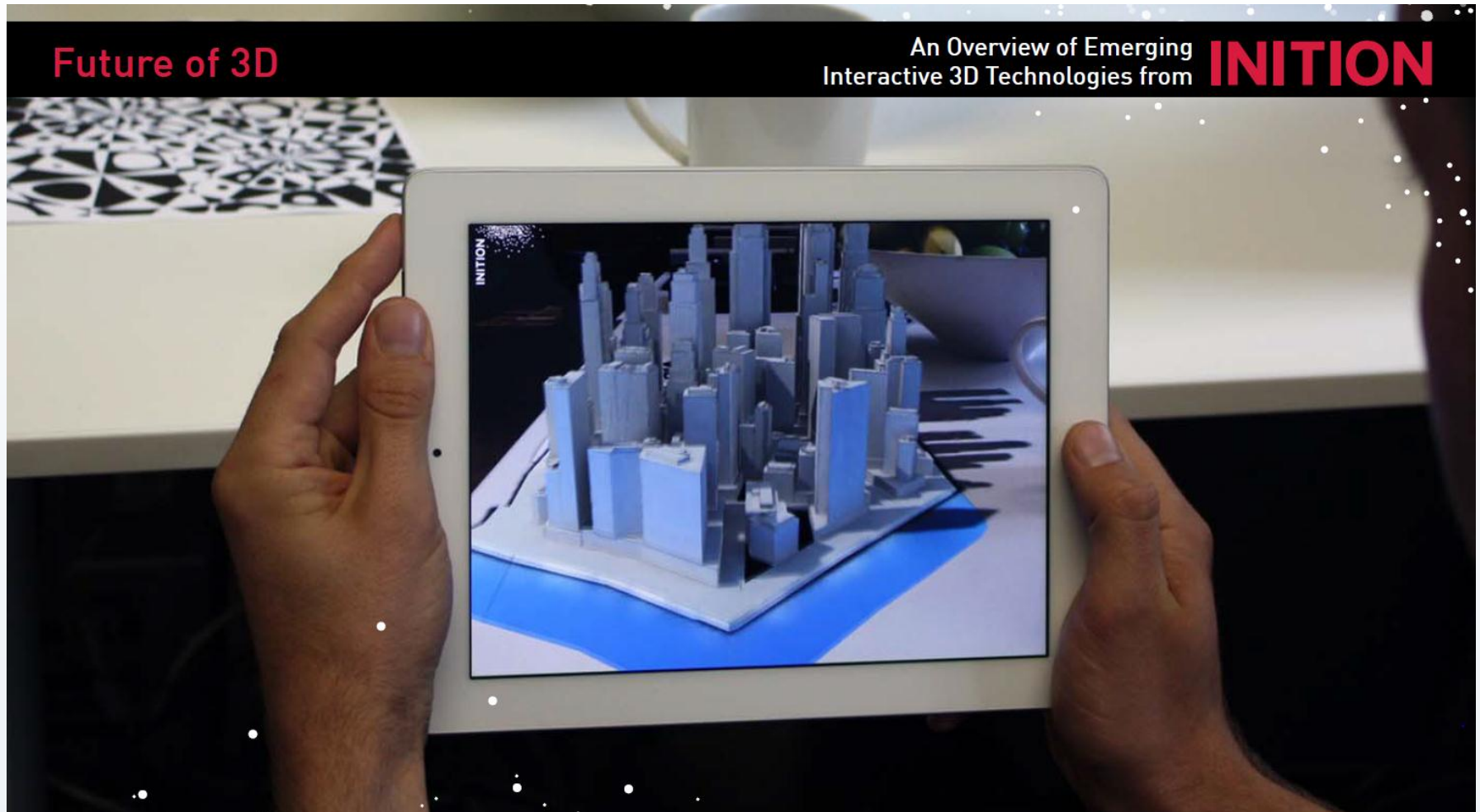
- Qualcomm Augmented Reality on Android
 - Qualcomm AR Extension for Unity:
<http://www.youtube.com/watch?v=CgnixC1-Bzs>
 - We tried this:
<http://www.ucl.ac.uk/3dim/indoor>
 - Sony Smart AR system
<http://www.youtube.com/watch?v=U4KTIjBQovk>

Indoor Modelling & Augmented Reality



Very impressive

Augmented reality on mobile devices



Augmented reality on mobile devices guided reality – a new perspective

- Prof Steven Feiner, University Columbia
<http://graphics.cs.columbia.edu/top.html>



Augmented Reality for Maintenance and Repair (ARMAR)

Will BIM deliver “The happy Family”?



So who is he?

