

ReCap Pro – What's New and Advanced Topics AS125538-L

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ReCap & Reality Capture at Autodesk

Overview

- ReCap 1.0 Launched in 2013
- Current Release: 4.2.1.7
- Hardware agnostic laser scan and point cloud processing
- Photogrammetry

The ReCap Portfolio

- ReCap Pro for desktop
- ReCap Pro for mobile
- ReCap Photo
- Web Publishing, Viewing, and Sharing at recap.autodesk.com
- Portfolio Point Cloud Support (AutoCAD, Revit, Inventor ...)
- Reality Capture Forge API

ReCap Enables User to Leverage Captured Reality for Design and Creation

About Me



- Marc Zinck
- Software Development Manager, Reality Solutions Group
- Lead development of ReCap Pro for desktop
- Based in Pittsburgh, PA, United States
- Joined Autodesk through the acquisition of a startup focused on automated point cloud processing and commercializing robotic perception algorithms in 2012.

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Workshop Datasets

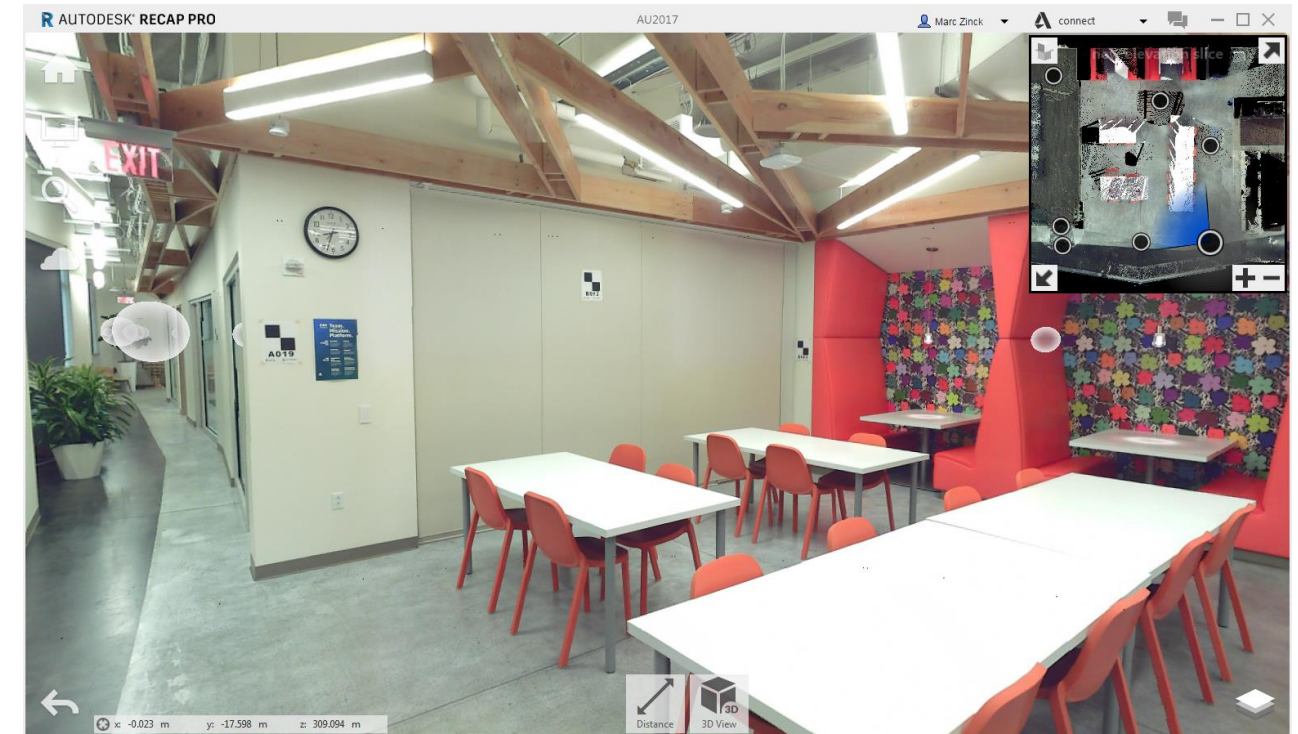
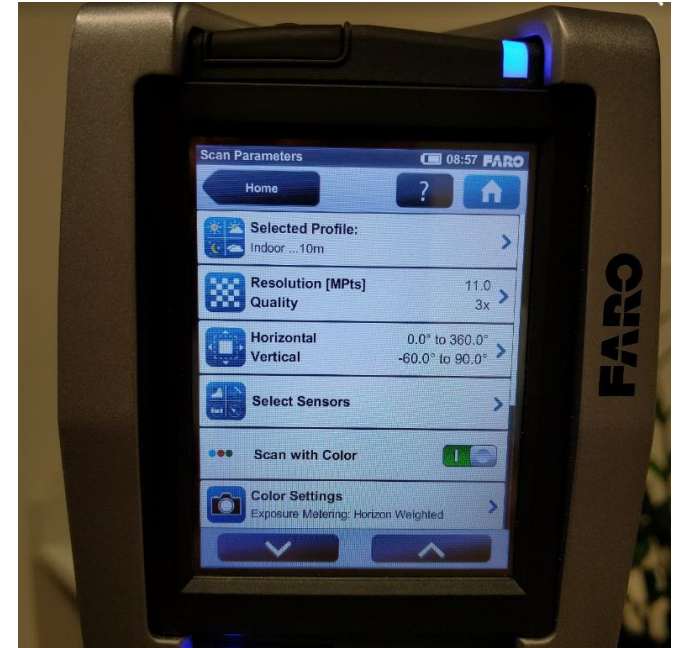
Download Datasets

The datasets for this class can be downloaded from the following URL

<https://autodesk.box.com/v/AU2017-AS12558-L>

Dataset

- Interior Terrestrial Scans with Color
- Faro Focus 120
- Medium Resolution (~11 Mpts / Scan) at 3x quality
- Color Exposure: Horizon Weighted
- Office Environment











Dataset used today will be made available for download

Dataset Folder Structure

- Scans
 - AU2017000.flr ... AU2017016.flr
 - Preview
- ReCap
 - AU2017.rcp, AU2017 A.rcp, AU2017 C.rcp, AU2017 D.rcp (no B)
Support Folders
 - AU2017 Unified
 - au2017Unified.rcs
- Models
 - Table, Chair, Car (nwd, dwg, ...)
- Mesh
 - AU2017 D Booth.rcm, obj.zip
- Targets
- Docs



Name	Date modified	Type
 AU2017000.flr	11/6/2017 6:30 AM	File folder
 AU2017001.flr	11/6/2017 6:30 AM	File folder
 AU2017002.flr	11/6/2017 6:30 AM	File folder
 AU2017003.flr	11/6/2017 6:30 AM	File folder
 AU2017004.flr	11/6/2017 6:30 AM	File folder
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 AU2017007.flr	11/6/2017 6:30 AM	File folder



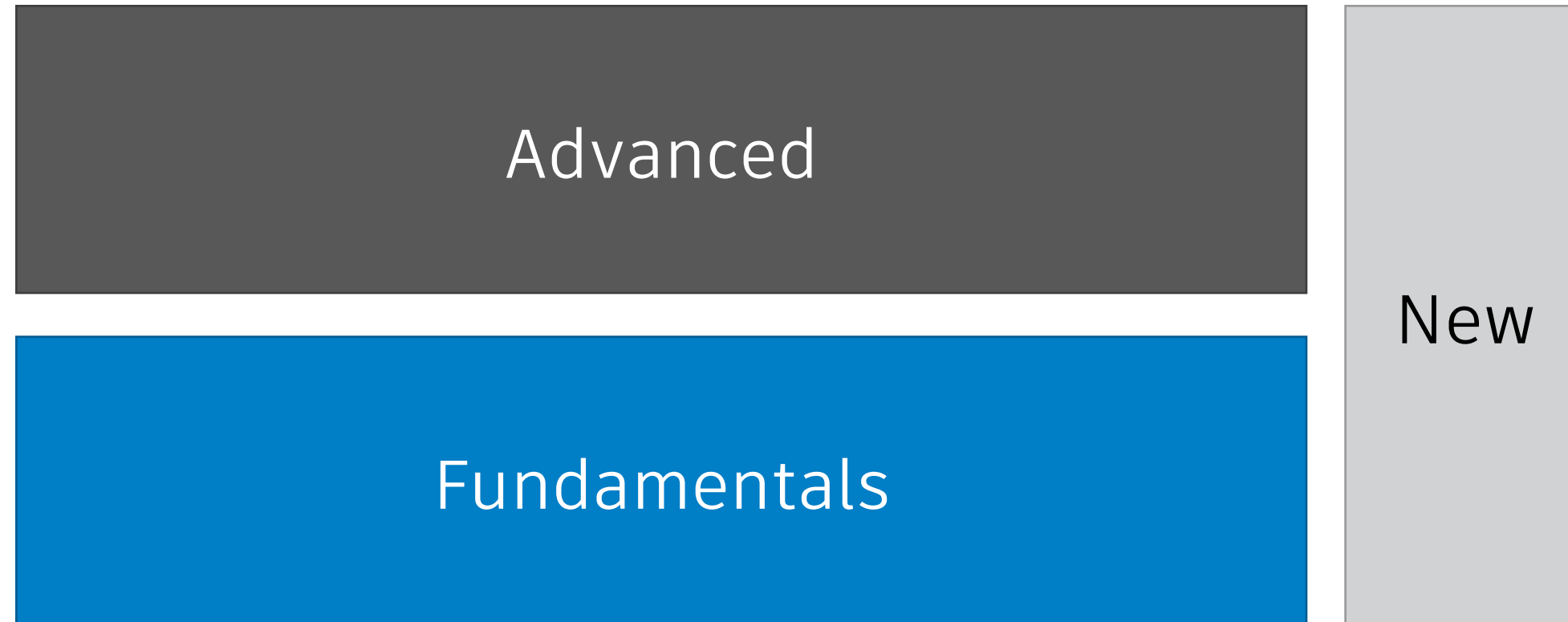
Exercise #0: Review Data & Backup RCP Files



Themes & Outline

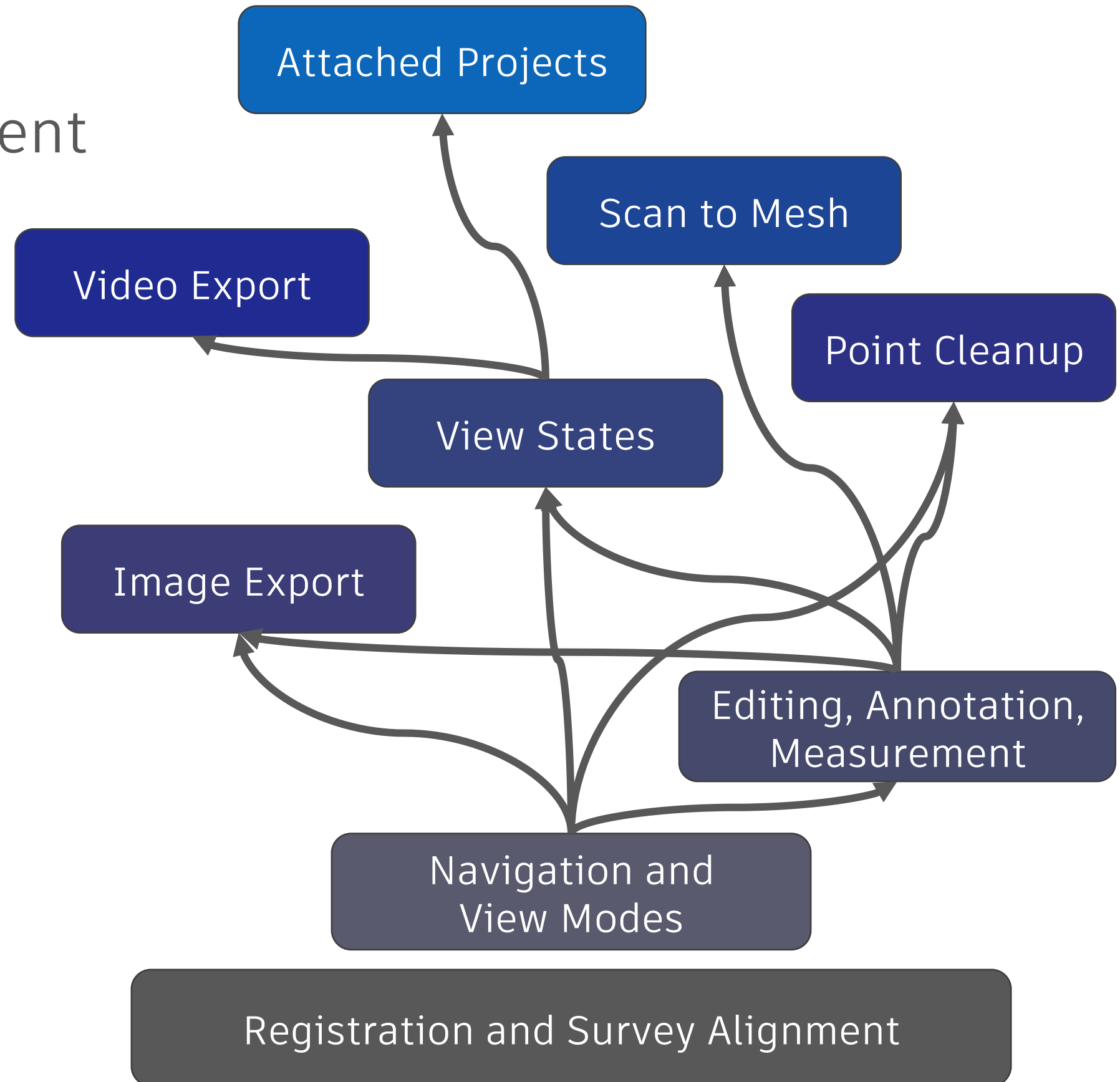
Themes

- Fundamentals, New, and Advanced



Outline

- Registration & Survey Alignment
- Navigation & View Modes
- Editing, Annotation & Measurement
- Image Export
- View States
- Video Export
- Scan to Mesh
- Attached Projects
- Point Cleanup
- Unification with RealViews



Registration

Registration and Survey Alignment

- Registration Metrics
 - Overlap, Balance, Quality
- Developing Confidence in Cloud To Cloud Registration
 - Understanding the Registration Report
 - Validating Registration with Targets
- Resuming Registration after Suspend
- Survey Alignment with Targets



Exercise #1: Understanding Registration Metrics

Understanding Registration Metrics (intuitive)

- **Overlap:** **Amount** used in registration.
- **Balance:** **Constraint** on placement of the scan given the features in the region of overlap.
- **Quality** (%<6mm): **Consistency** of data with regards to other scans in the region of overlap.

Understanding Registration Metrics (technical)

- **Overlap:** Percentage of the suitable data in the scan use in registration.
- **Balance:** Normalized ratio of the *smallest* eigen value to the sum of all three eigen values of feature-normals in the region of overlap.
- **Quality (%<6mm):** Percentage of points, in the region of overlap, which are within six millimeters of points in other scans.

Understanding Registration Metrics (practical)

- **Overlap:** Low values deserve a second look. – Is the scan station density appropriate for the environment?
- **Balance:** Value should reflect scene geometry. Low for corridors and exteriors, high for well defined rooms.
- **Quality** (%<6mm): Scene does not contain sufficiently strong features. Possible hardware issue. Increased likelihood of poor registration. Scene may contain noisy features (grass, trees).

Understanding Registration Metrics (causes)

- **Overlap:** Scan Station Density
- **Balance:** Scene Geometry & Scan Station Placement
- **Quality** (%<6mm): Scene Materials, Sensor Stability, Sensor Issues

Understanding Registration Metrics (thresholds)

- Overlap: 100%-15% 15%-5% 5%-0%



- Balance: 100-25% 25%-5% 5%-0%

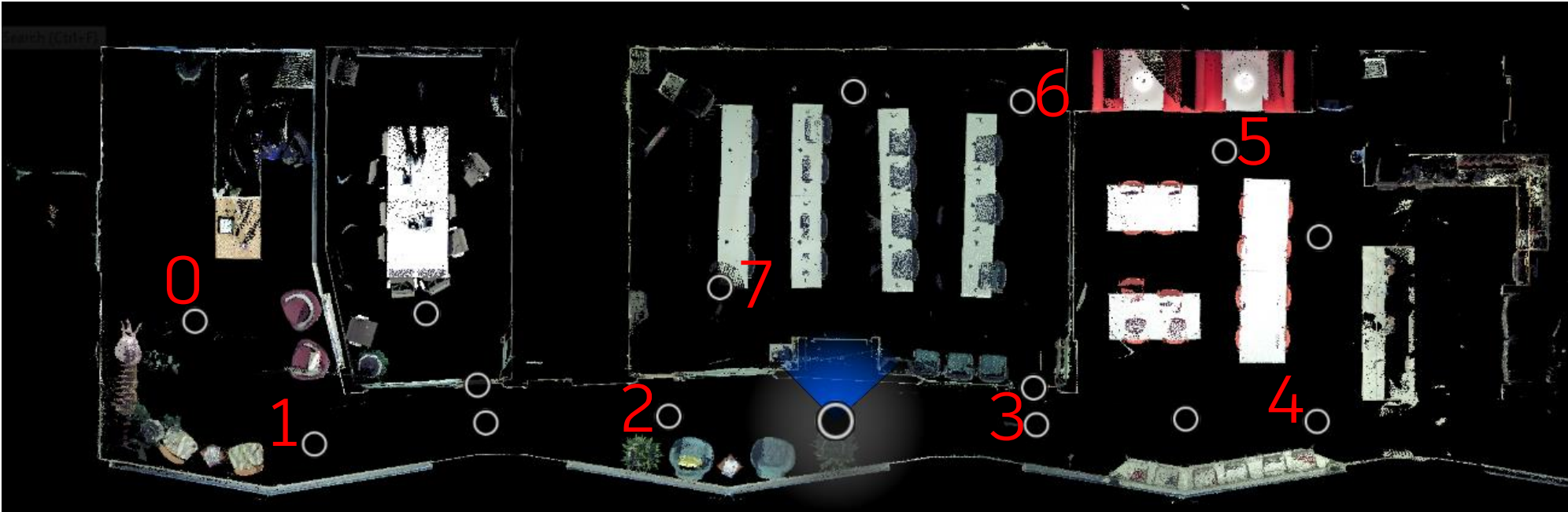


- Quality (%<6mm): 100%-92% 92%-85% 85%-0%

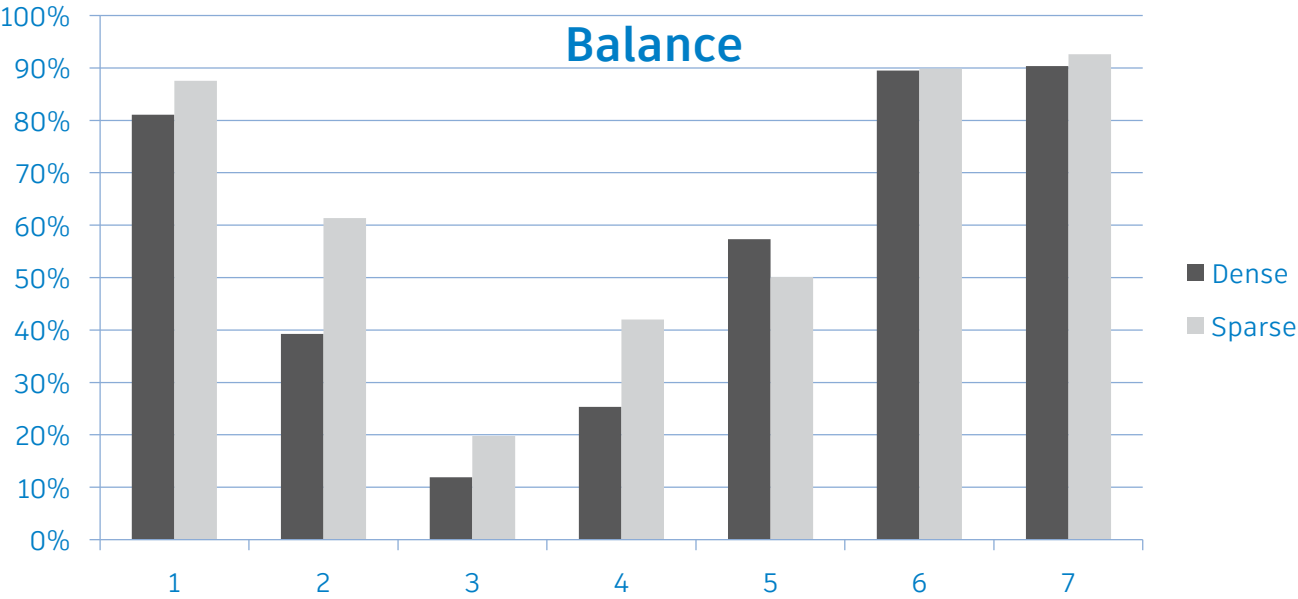
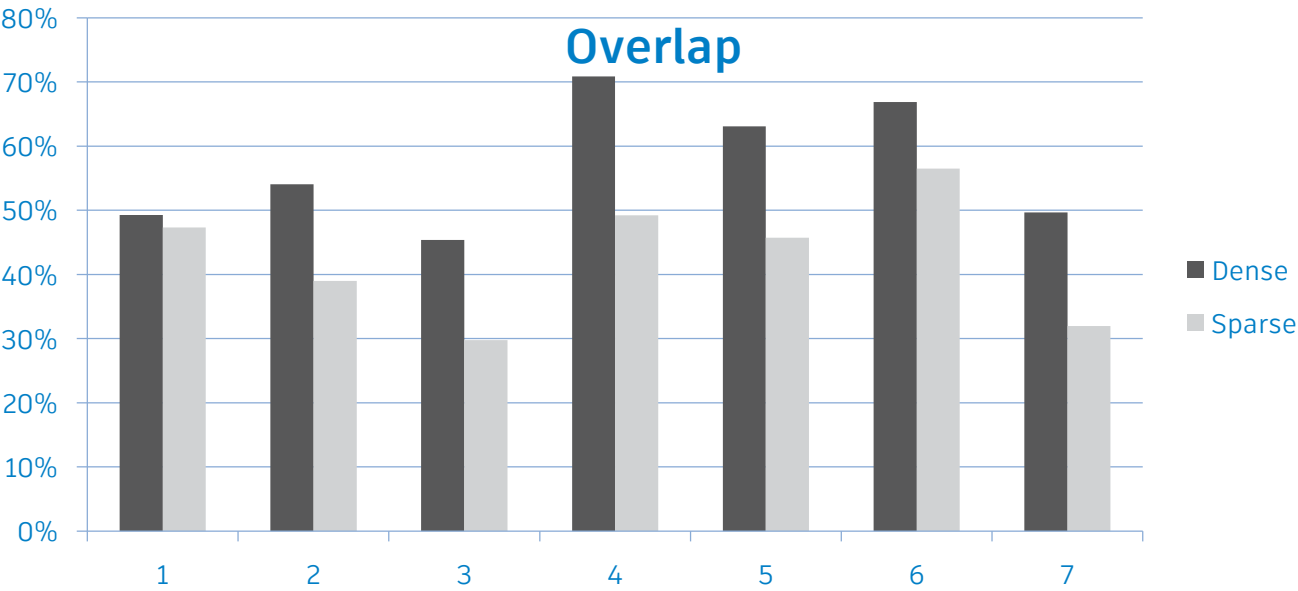
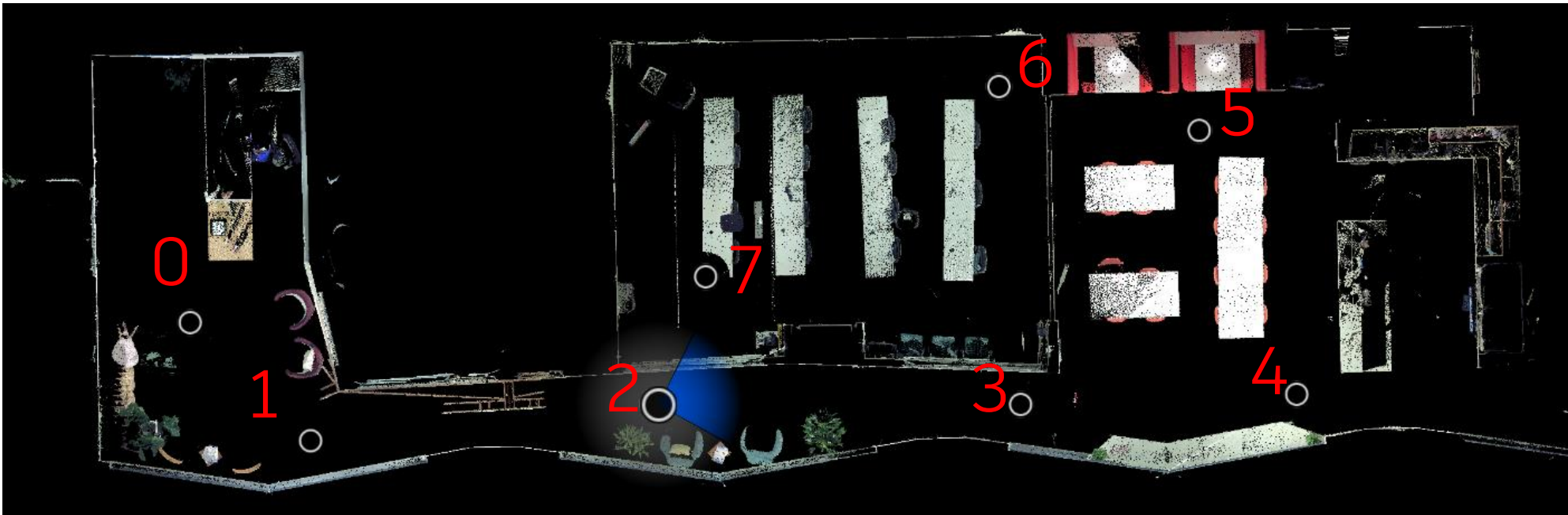


Dense vs. Sparse: Overlap & Balance

Dense



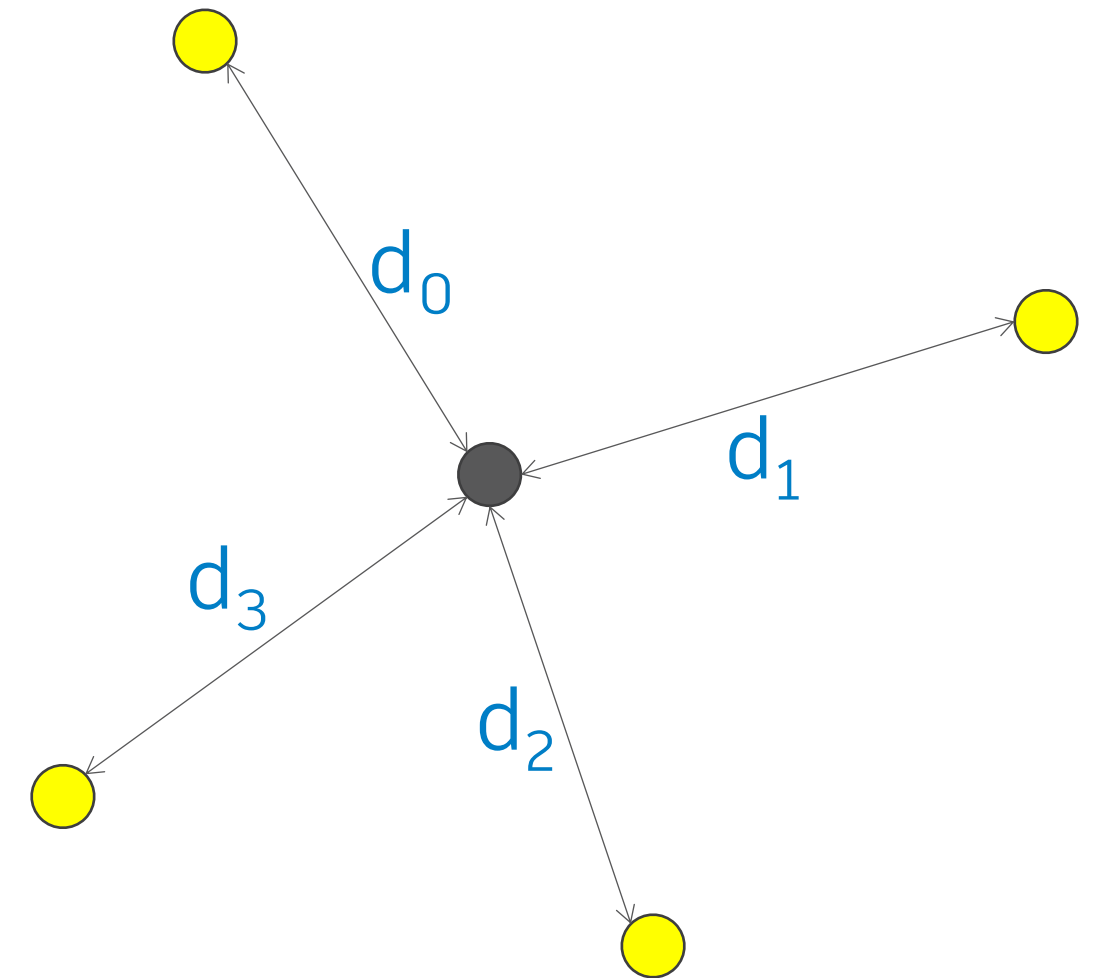
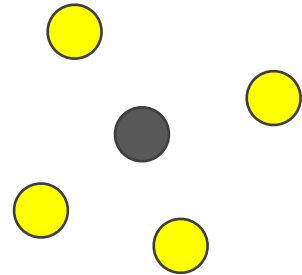
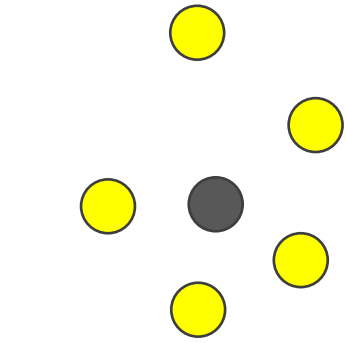
Sparse



The background of the slide features a complex, abstract pattern of thin, grey lines forming a mesh or wireframe structure. This pattern is overlaid on a solid blue horizontal band that spans the width of the slide. The mesh pattern appears to be a distorted grid, with lines curving and intersecting to create a sense of depth and movement. The blue band is a medium blue color and contains the title text in white.

Exercise #2: Confidence in Registration

Understanding the Registration Report (Target RMS)



$$\text{RMS} = (d_0^2 + d_1^2 + d_2^2 + d_3^2)^{1/2}$$

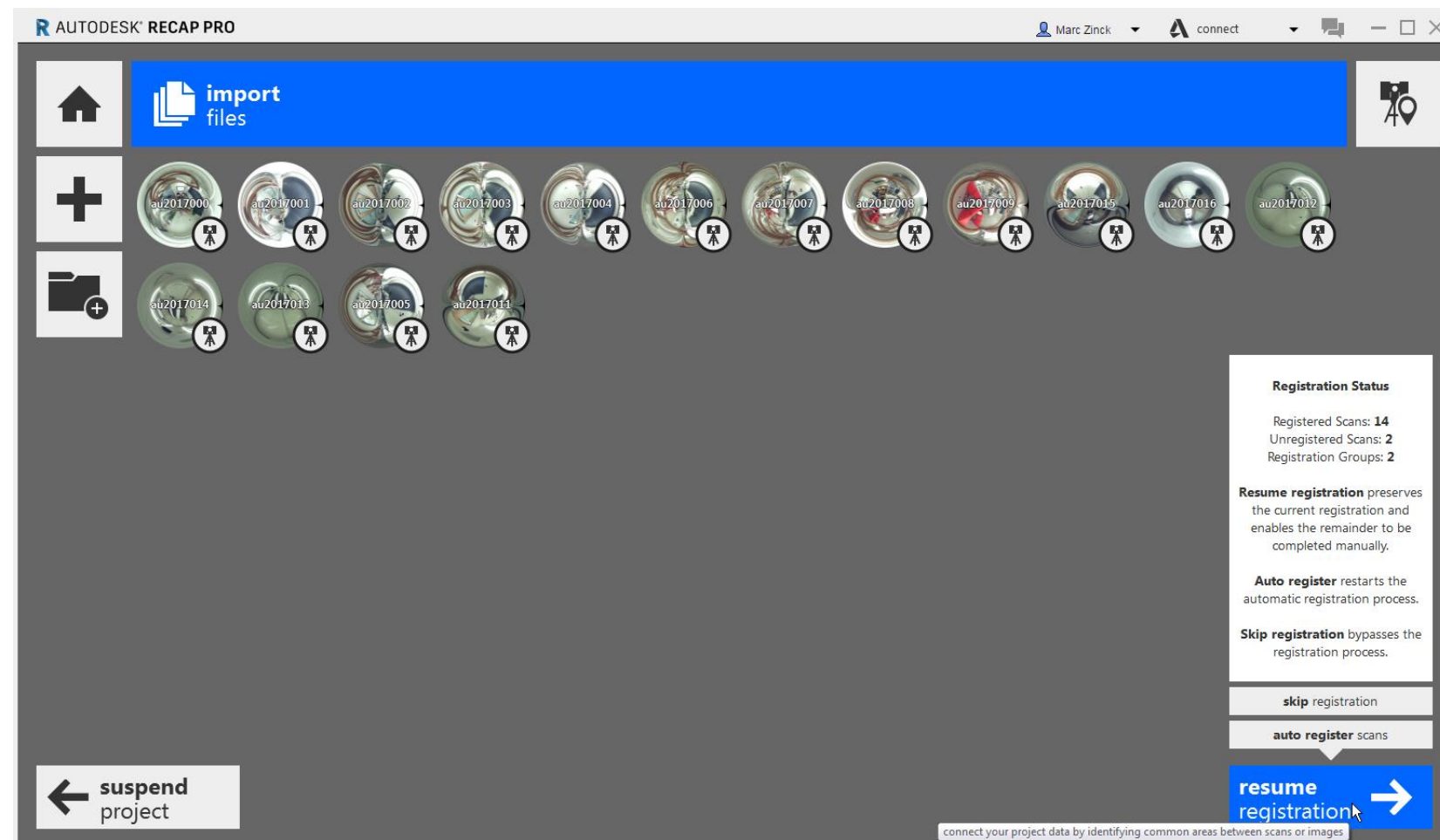
Exaggerated Scale

The background of the slide features a complex, abstract pattern of thin, grey lines forming a mesh or wireframe structure. This pattern is overlaid on a solid blue horizontal band that spans the width of the slide. The mesh pattern appears to be a distorted grid, with lines curving and intersecting to create a sense of depth and movement. The blue band is a medium blue color and serves as a backdrop for the white text.

Exercise #3: Resume Registration after Suspend

Registration Status

- Quickly Assess Current Status
- Help Determine Next Step (auto / manual)



Registration Status

Registered Scans: **14**

Unregistered Scans: **2**

Registration Groups: **2**

Resume registration preserves the current registration and enables the remainder to be completed manually.

Auto register restarts the automatic registration process.

Skip registration bypasses the registration process.

skip registration

auto register scans

resume
registration

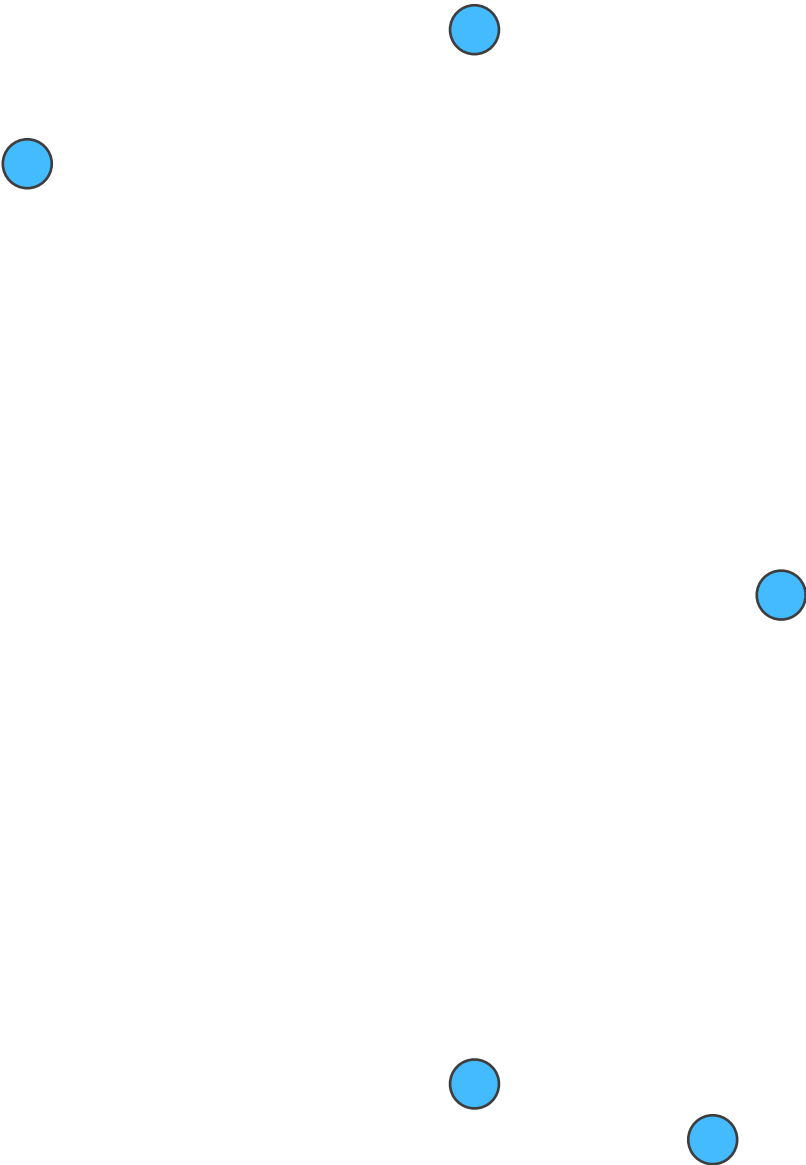


as between scans or images

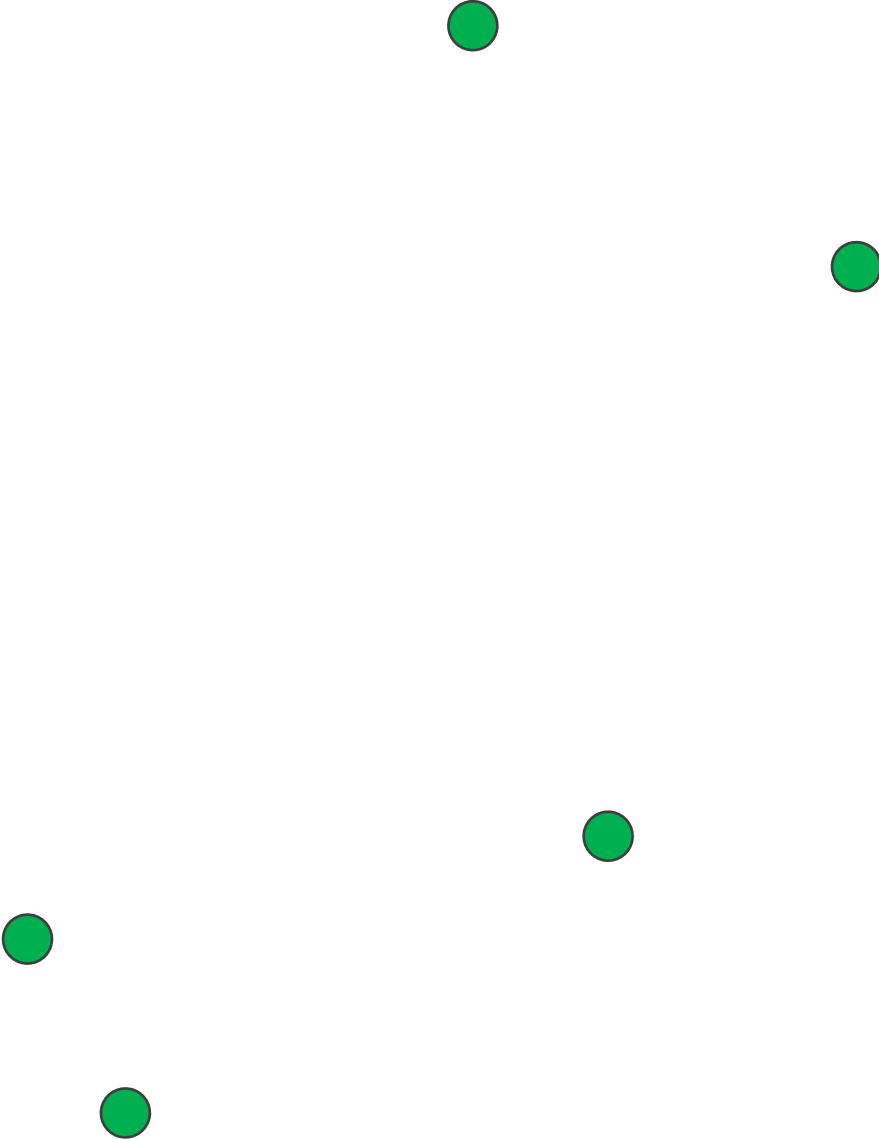


Exercise #4: Survey Alignment With Targets

Understanding Survey Alignment

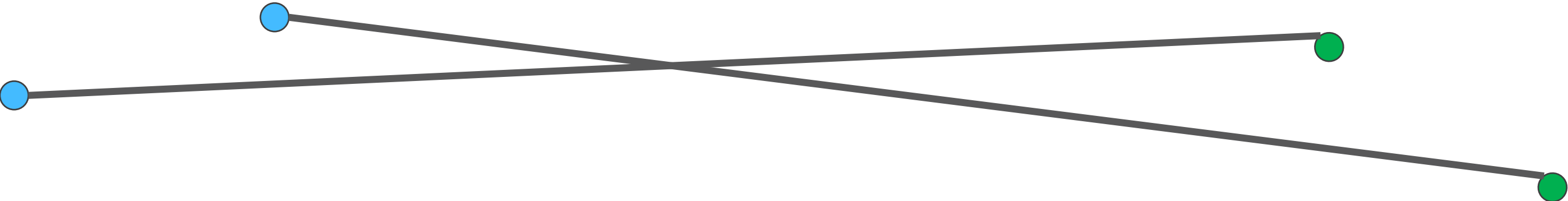


Extracted Targets

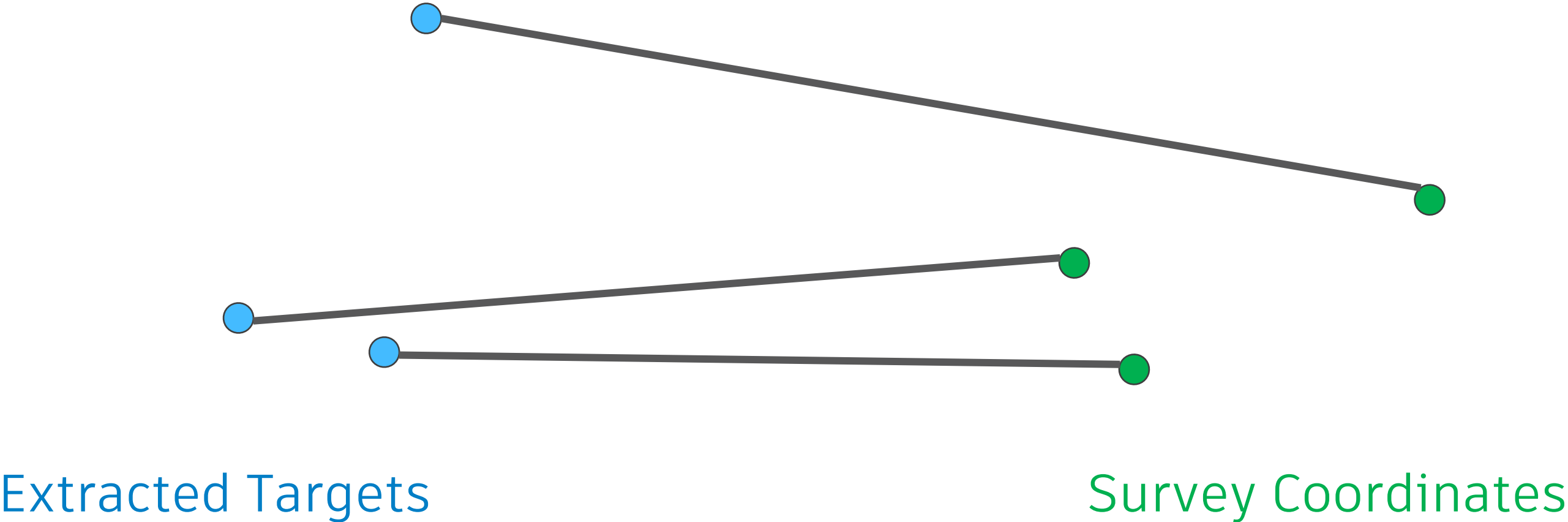


Survey Coordinates

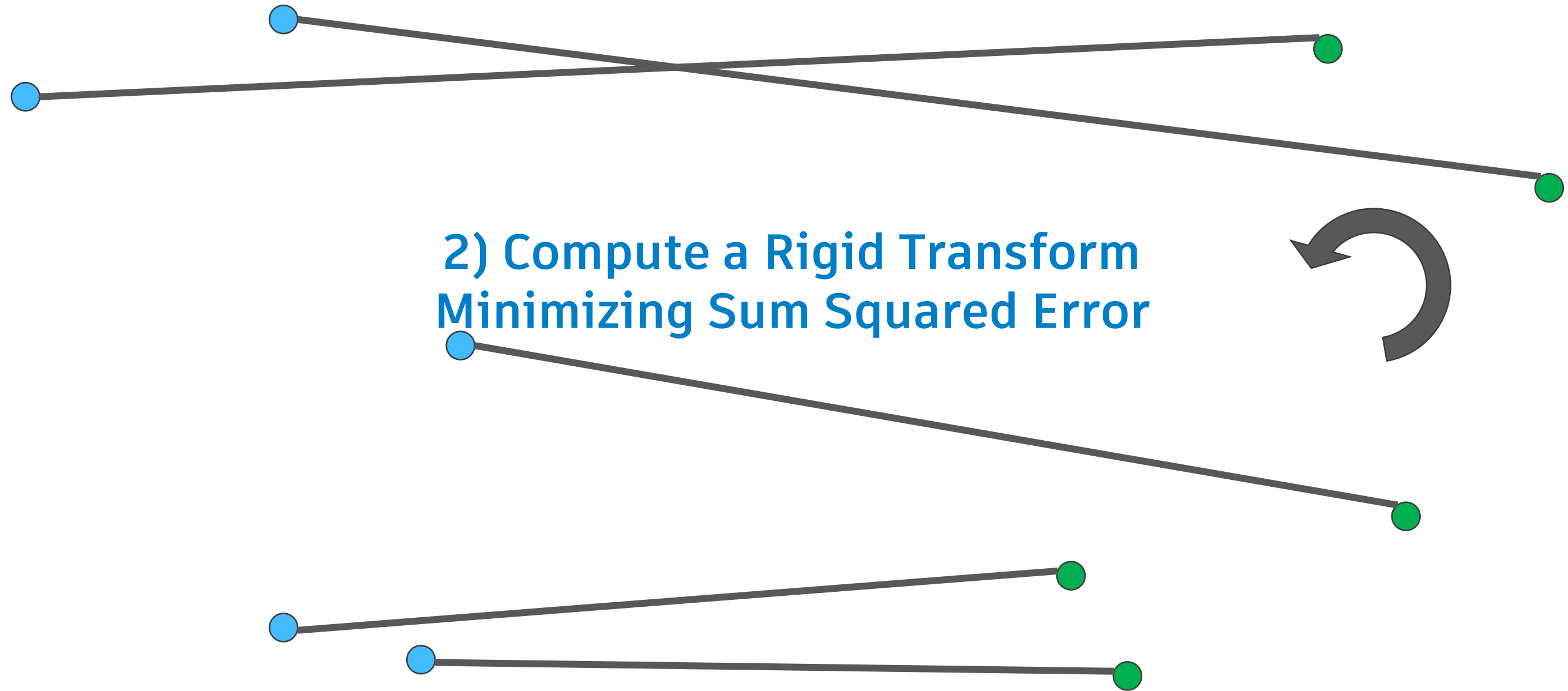
Understanding Survey Alignment



1) Establish a Correspondence



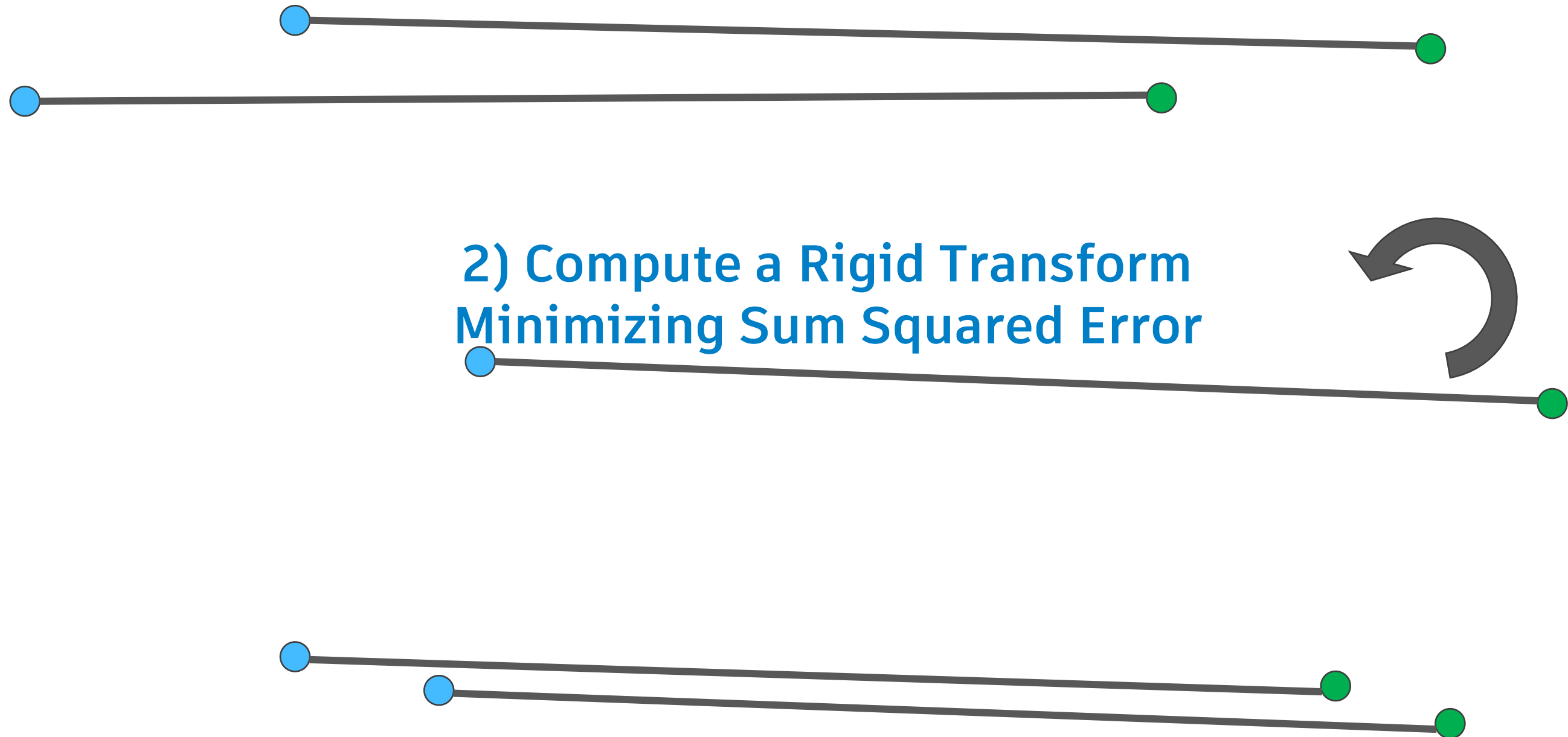
Understanding Survey Alignment



Extracted Targets

Survey Coordinates

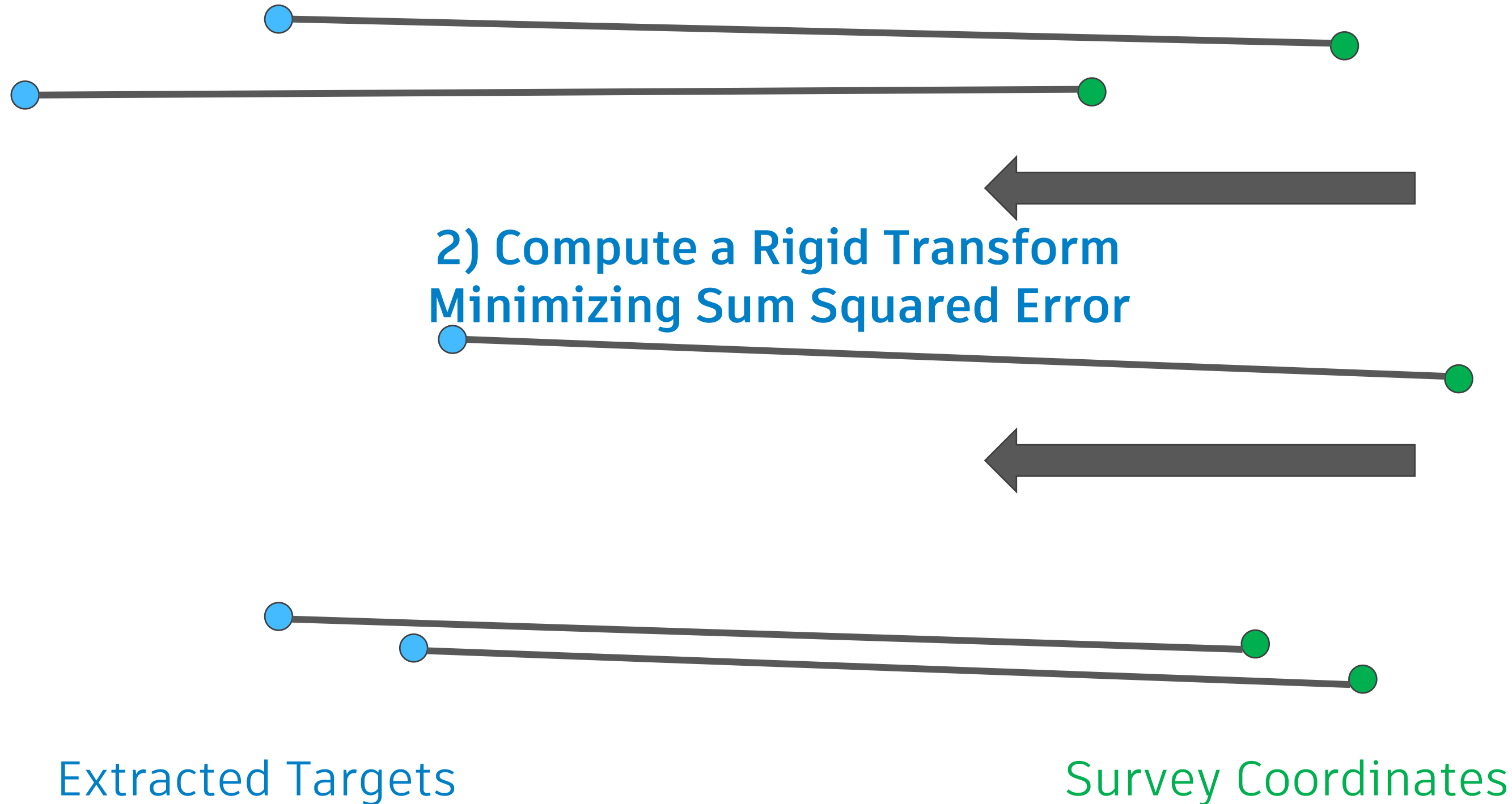
Understanding Survey Alignment



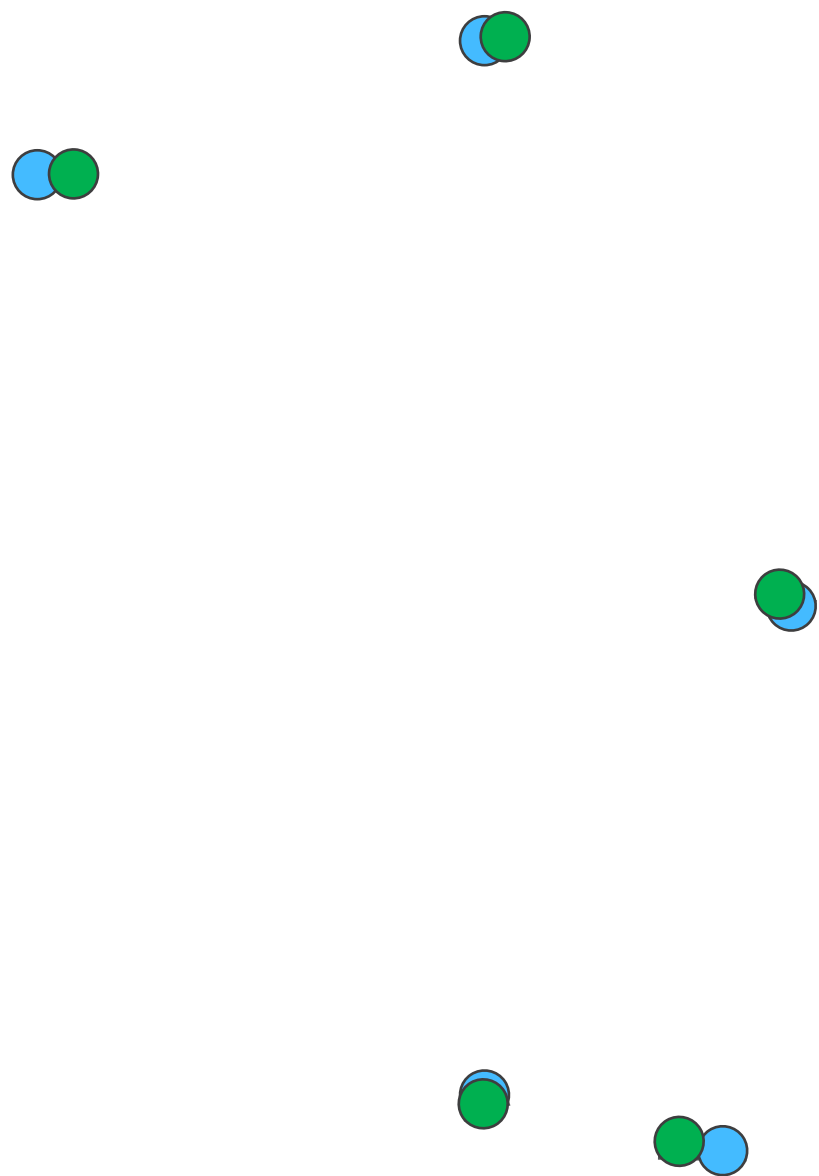
Extracted Targets

Survey Coordinates

Understanding Survey Alignment



Understanding Survey Alignment



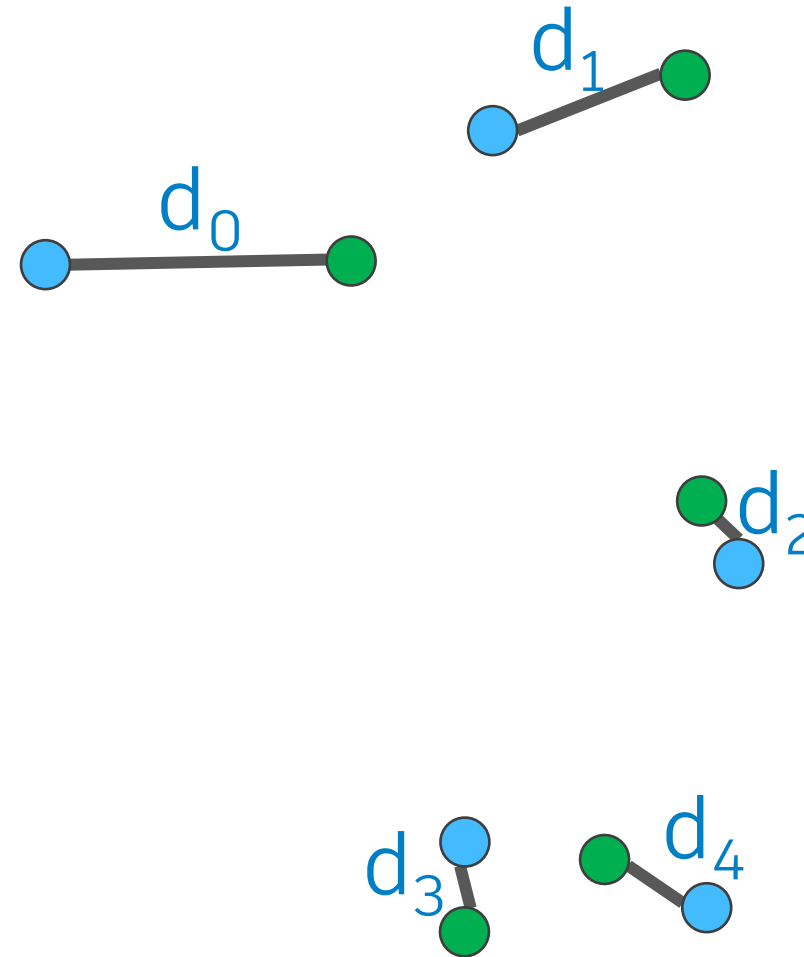
3) Compute Residuals

Extracted Targets
Survey Coordinates

Understanding Survey Alignment

Extracted Targets

Survey Coordinates



$$\text{Overall RMS} = (d_0^2 + d_1^2 + d_2^2 + d_3^2 + d_4^2)^{1/2}$$

$$\text{Alignment Confidence} = \{d_0, d_1, d_2, d_3, d_4\}$$

Exaggerated Scale

View | Navigate | Edit



Exercise #5: Navigation Fundamentals



Exercise #6: Tools

The background of the slide is a complex, abstract wireframe mesh. The mesh is composed of numerous interconnected lines forming a series of organic, flowing shapes that resemble a stylized, interconnected network or a series of overlapping, curved planes. The lines are thin and light gray, set against a white background. A solid blue horizontal bar spans the bottom portion of the image, providing a contrasting background for the white text.

Exercise #7: Image Export

The background of the slide features a complex, abstract pattern of thin, grey lines forming a mesh or wireframe structure. This pattern is overlaid on a solid blue horizontal band that spans the width of the slide. The mesh pattern appears to be a distorted grid, with lines curving and intersecting to create a sense of depth and movement. The blue band is a medium blue color and serves as a backdrop for the white text.

Exercise #8: View States

Video Export

The background of the slide is a complex, abstract wireframe mesh. The mesh is composed of numerous interconnected lines forming a series of organic, flowing shapes that resemble a stylized, interconnected network or a series of overlapping, curved planes. The lines are thin and grey, set against a white background. A solid blue horizontal bar spans the bottom third of the image, providing a contrasting background for the white text.

Exercise #9: Basic 3D Flythrough



Exercise #10: Story Telling



Exercise #11: Smooth Transitions

Design in Context

The background of the slide is a complex, abstract wireframe mesh. It consists of a dense network of thin, grey lines that form a series of interconnected, flowing, and undulating shapes. These shapes resemble organic, cellular structures or perhaps a stylized representation of a complex surface like a topographical map or a molecular model. The mesh is more densely packed in some areas, creating a sense of depth and volume, while other areas are more sparse. The overall effect is one of dynamic, organic complexity.

Exercise #12: Render CAD in Photo Real Context

The background of the slide is a complex, abstract wireframe mesh. It consists of a dense network of interconnected lines forming a series of organic, flowing shapes that resemble a stylized, multi-lobed structure or a series of interconnected tubes. The mesh is rendered in a light gray color against a white background. A solid blue horizontal band is positioned across the lower third of the image, serving as a backdrop for the title text.

Exercise #13: Create a Textured Mesh From Scans

Managing Scale

The background of the slide is a complex, abstract wireframe mesh. It consists of a dense network of thin, light gray lines that form a series of interconnected, flowing, and somewhat chaotic shapes. These shapes resemble organic, branching structures or perhaps a highly detailed, stylized representation of a natural phenomenon like a coral reef or a complex geological formation. The mesh is set against a plain white background, which makes the gray lines stand out. The overall effect is one of intricate detail and dynamic movement.

Exercise #14: Unified Point Cloud with RealViews

The background of the slide is an abstract, light gray wireframe mesh. The mesh is composed of many small, irregular polygons that form a complex, flowing, and somewhat organic shape. It resembles a stylized, interconnected network or a series of overlapping, curved planes. The overall effect is one of dynamic, non-linear geometry.

Demo #15: Automatic Noise Removal

Topics for another time ...

- Photogrammetry
- Forge Reality Capture API
- Unstructured Scans (Mobile Lidar, Aerial, Handheld)
- Point Clouds in Design Tools (AutoCAD, Revit, Inventor, ...)
- Transfer from Mobile
- Region Import
- Annotation Import
- Import Parameters (Format, Filters & Coordinate Systems)
- ... and more

ReCap at Autodesk University 2017

- Reality Capture Forge API Launch Event
~~Monday at 2pm~~
- ReCap to the Max! How to Edit, Document, and Coordinate - [ES125302-L](#)
Wednesday 8am
- Hands On with ReCap Pro from the Field to the Office - [CS125189-L](#)
Wednesday at 10am
- ReCap and UAVs to Deliver 2D, 2.5D, and 3D Data for Your AEC and Infrastructure Projects - [CS124614-L](#)
Thursday at 10am
- User Research
- Idea Exchange
- Answer Bar

Additional ReCap Resources

- Product Page : www.autodesk.com/recap
- Youtube : <https://www.youtube.com/user/autodeskreap>
- User Forums

