INTT Ideal Geometry

Joseph Bertaux
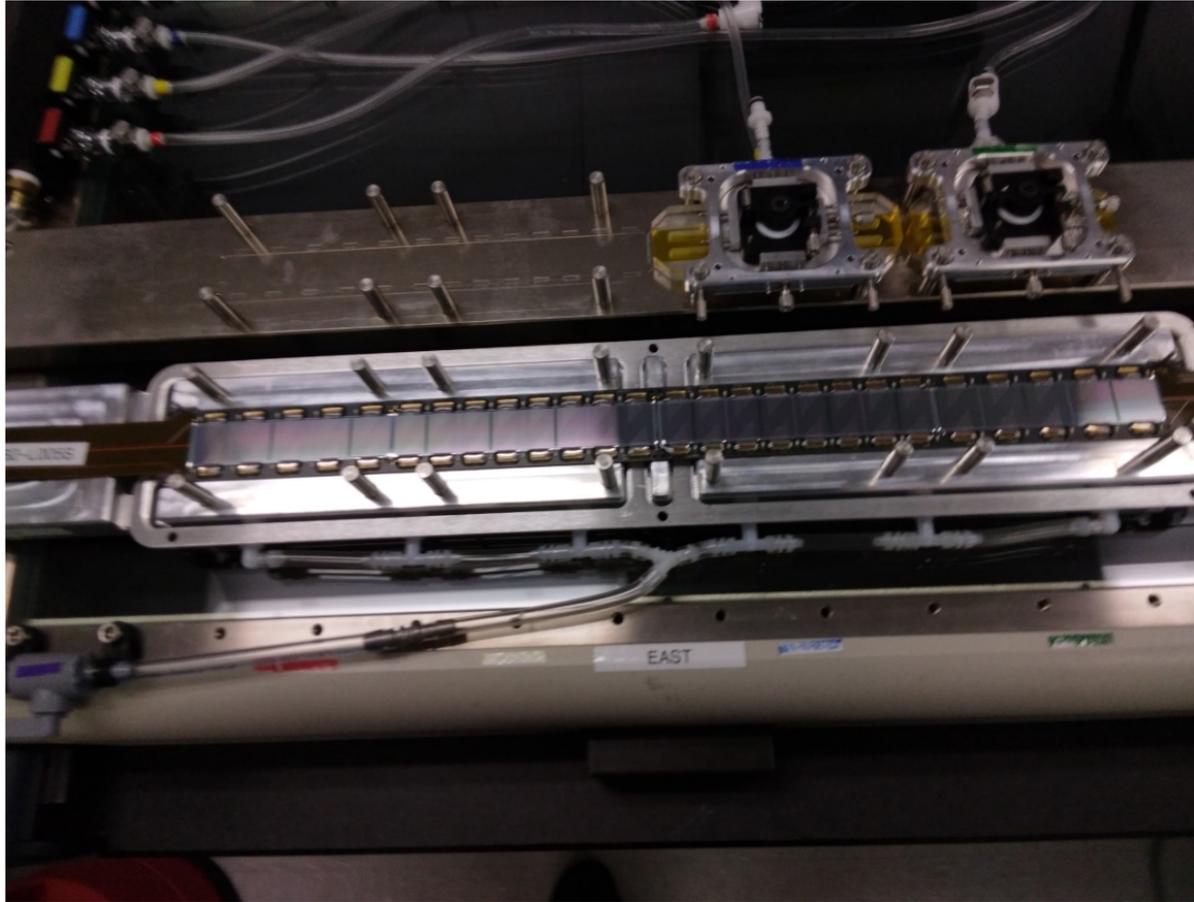Rachid Noucier

Outline

- Measure and catalog the positions of key points
  - Total of 20 positions to be noted:
    - 2 holes at the north and south ends of the ladder
      - (4 positions)
    - 4 marks at the corners of each of the 4 sensors
      - (16 positions)
- Measurements were taken by survey group using the OGP machine

Motivation

- This data will be useful in the tracking reconstruction
  - Each track allows fitting parameters for the offset of ladder, sensor, or pixel positions from nominal
  - These extra fitting parameters are
    - dx, dy, dz (global cartesian shift)
    - alpha, beta, gamma (Tait-Bryan ZYX Euler angle rotation)
  - There are sets of these parameters for each "index"
    - During reconstruction, parts of the detector can be assigned an index
    - Parts with a common index share a transformation
      - e.g., each sensor has its own index, and its pixels share a transform
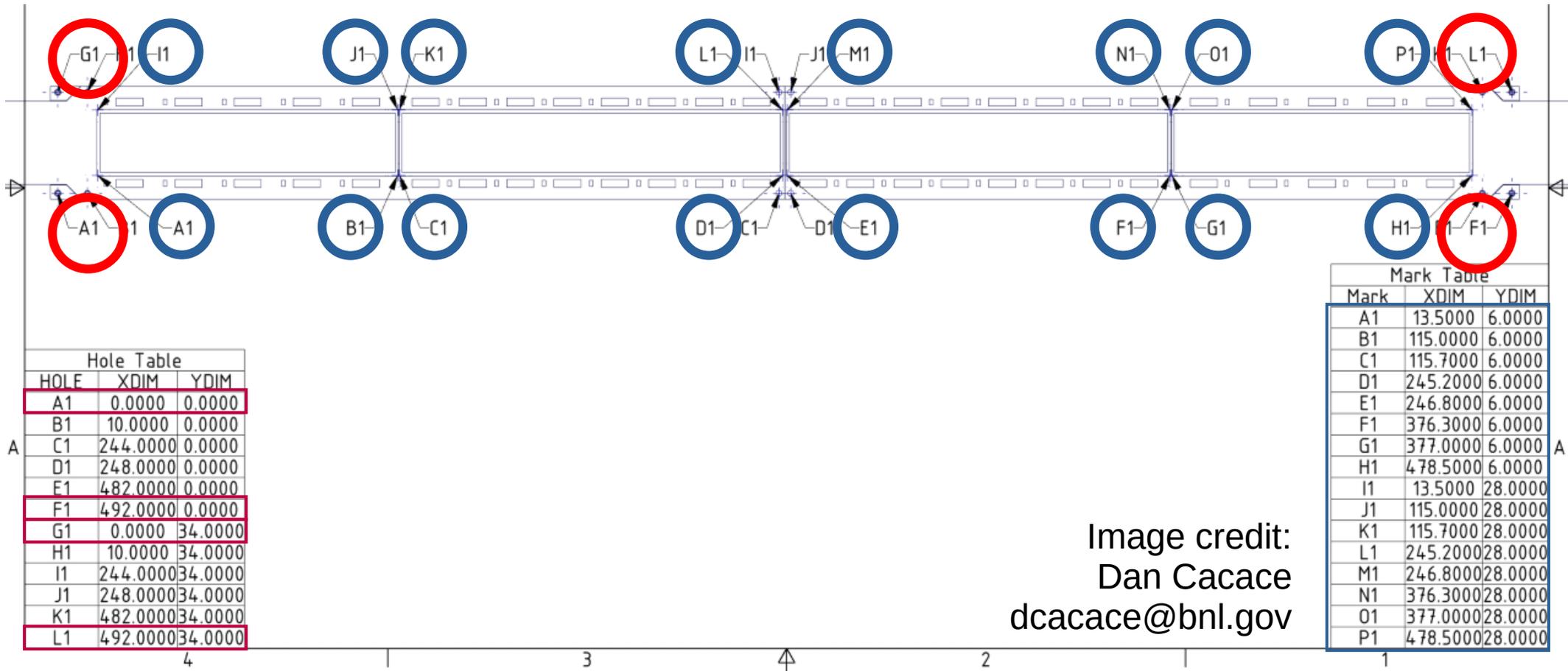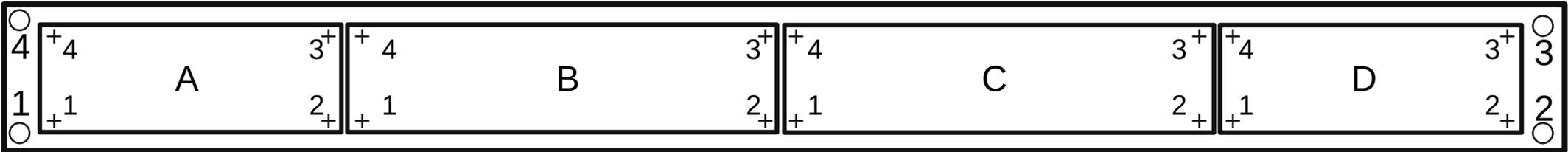
OGP Process

Nominal Ladder Marks

Image credit:
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Hole Table		
HOLE	XDIM	YDIM
A1	0.0000	0.0000
B1	10.0000	0.0000
C1	244.0000	0.0000
D1	248.0000	0.0000
E1	482.0000	0.0000
F1	492.0000	0.0000
G1	0.0000	34.0000
H1	10.0000	34.0000
I1	244.0000	34.0000
J1	248.0000	34.0000
K1	482.0000	34.0000
L1	492.0000	34.0000

Mark Table		
Mark	XDIM	YDIM
A1	13.5000	6.0000
B1	115.0000	6.0000
C1	115.7000	6.0000
D1	245.2000	6.0000
E1	246.8000	6.0000
F1	376.3000	6.0000
G1	377.0000	6.0000
H1	478.5000	6.0000
I1	13.5000	28.0000
J1	115.0000	28.0000
K1	115.7000	28.0000
L1	245.2000	28.0000
M1	246.8000	28.0000
N1	376.3000	28.0000
O1	377.0000	28.0000
P1	478.5000	28.0000

Nominal Ladder Positions

OGP File Example

```
Machine Serial Number: SVL6252331                                        Page:    1
================================================================================
Routine Name                                    Run #        Date & Time
================================================================================
INTT-Ladder-Survey-East.RTN                       10 Tue Oct 12 10:01:47 2021
================================================================================

================================================================================
Feature          Unit   Nominal      Actual       Tolerances      Deviation    Exceeded
================================================================================

Step 10 - Sensor A - Cross 1
X Location       mm +013.56485 +013.48306                          -000.08179
Y Location       mm +005.99526 +005.98173                          -000.01353
Z Location       mm +000.15466 +000.11972                          -000.03494

Step 12 - Sensor A - Cross 2
X Location       mm +115.06485 +115.00606                          -000.05879
Y Location       mm +005.99526 +005.97168                          -000.02358
Z Location       mm +000.15466 +000.27978                          +000.12512

Step 14 - Sensor A - Cross 3
X Location       mm +115.06485 +115.01265                          -000.05220
Y Location       mm +027.99526 +027.96840                          -000.02686
```

Procedure

- The OGP machine data has already been taken
- Data was stored in .txt files
- Wrote a macro to extract the data from from these files and store it in a root TTree
  - Branches for measured x,y,z coordinates (mm)
  - Branches for nominal nx, ny, nz coordinates (mm)
  - Branches for deviations dx, dy, dz (mm)

Procedure

- Created an additional branch to store a unique reference string
    - e.g., "B1L010_snsr_A_crss_1"
    - e.g., "B0L103_ndcp_2"
  - "..._snsr_%s_crss_%i" are for the 4 marks (labeled 1, 2, 3, 4) on each sensor (labeled A, B, C, D)
  - "..._ndcp_%i" are for the 4 holes (labeled 1, 2, 3, 4) on the ladder
- Difficult to work with strings directly in a root session
- Can use in macros just fine
  - Wrote a custom DrawComponent function to visualize components
  - Uses std::find(…) to determine if an entry is for a specific subcomponent
    - e.g., DrawComponent("B1L010", ...) draws all the points for that ladder:

ROOT Position Reproduction
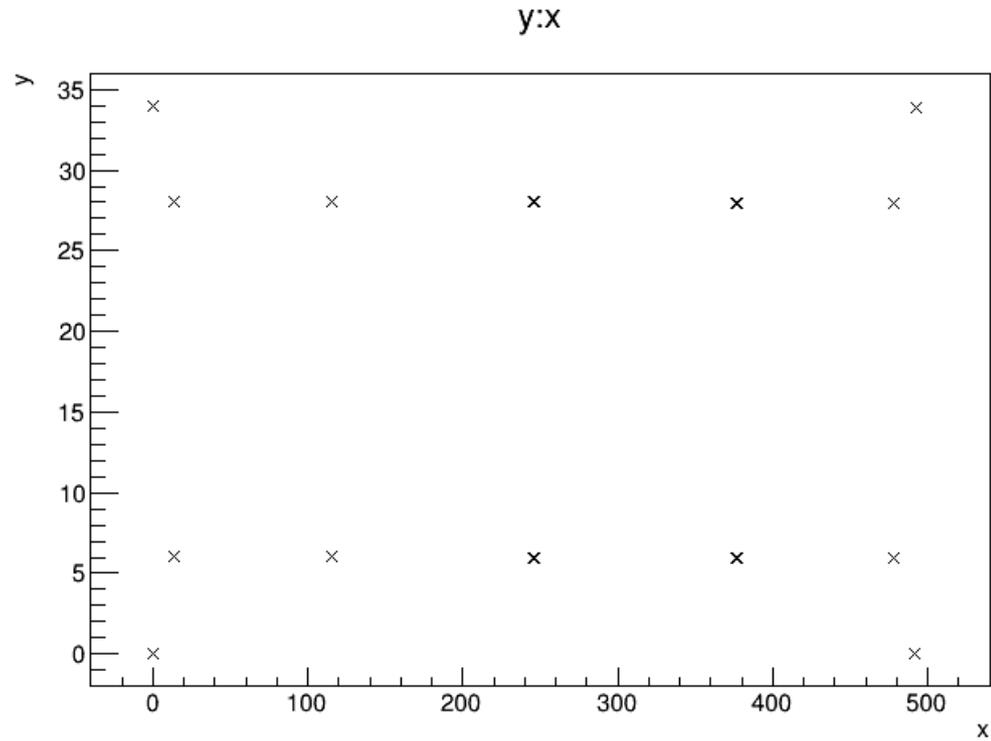
To Do:

- Now that the position data has been transferred to a .root file, it will be easier to work with
- This might already contain the local dx, dy, dz deviations we are looking for
    - (The "Deviation" column in the OGP file)
    - However, it does not contain these values for the holes
    - Only for the marks 1-4 for each sensor
- Now need to transform these to the global frame based on which ladder it was in
- Need to compute alpha, beta, gamma (Tait-Bryan Euler angles) for each sensor