MOSS

MINER OPERATED SURVEY SYSTEM

NSS CANADA

NSS Canada

Leica Geosystems

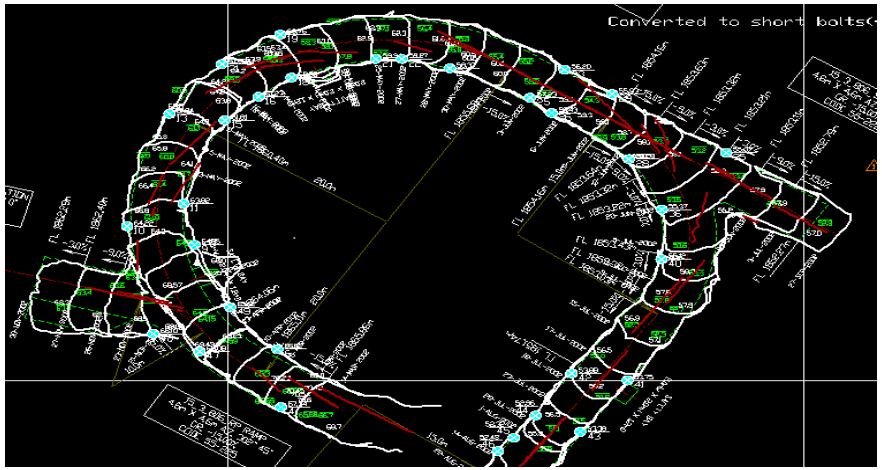
HEXAGON MINING

NSS CANADA

What Is The Miner Operated Survey System?

- Computerized survey system
- Used by miners and surveyors
- Simple and easy to use
- Tools for:
  - Operations
  - Surveying
  - Planning
  - Geology

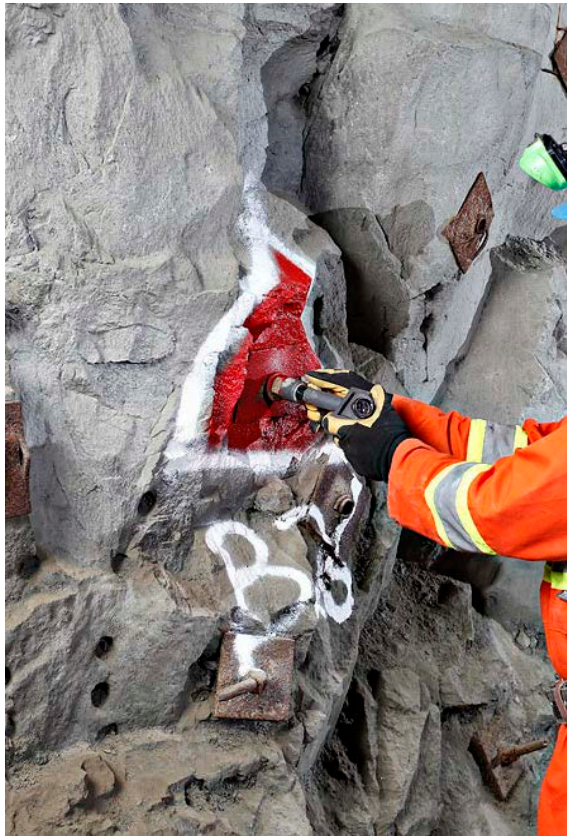
Increased Efficiency

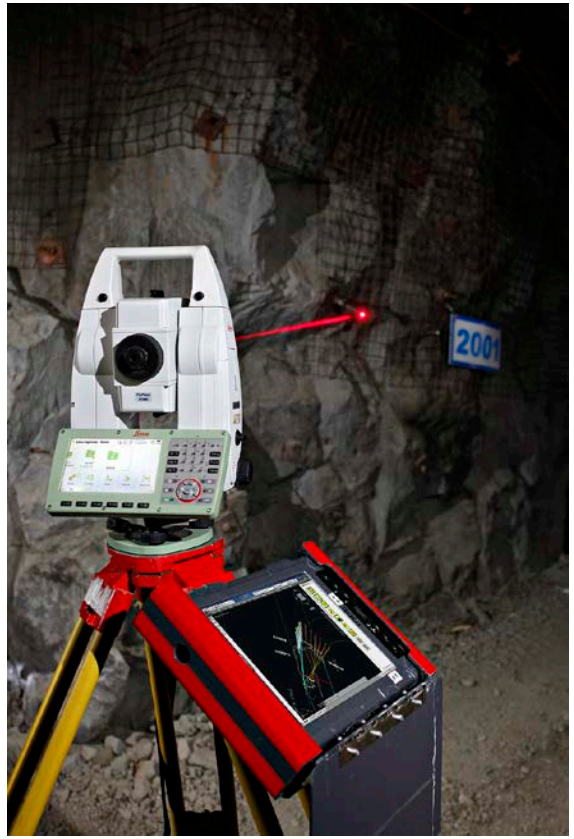


- Automated survey pickups for every round
- Mine to exact mine design specifications
- Share data in real-time
- Average markup time of 10 – 20 minutes

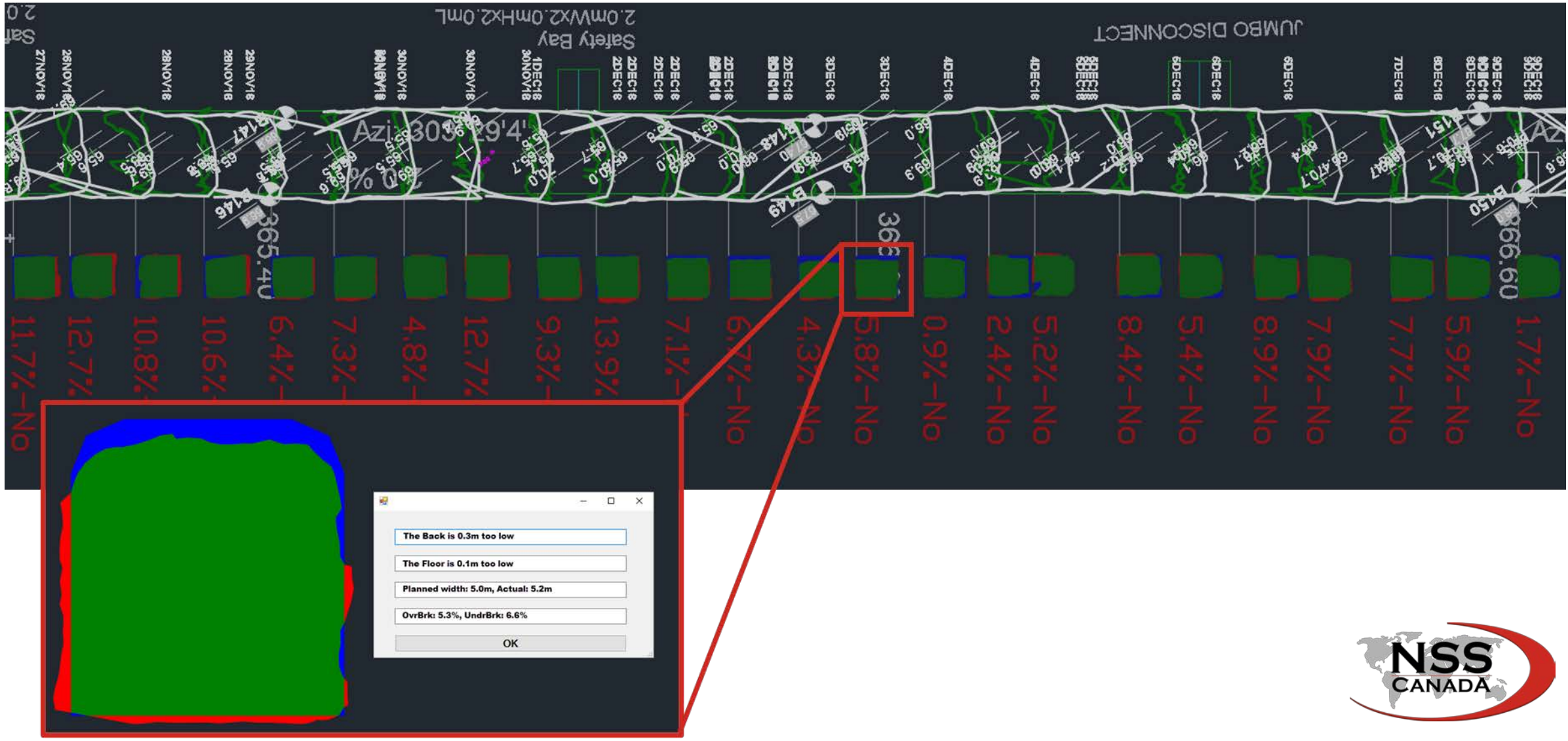
Increased Accuracy

- Utilize existing survey control network
- Focus on QA/QC
- Drive continuous improvement





Proven Reduction in Overbreak



Clients

Base Metals

VALE

GLENCORE

NORNICKEL

Gold & Precious Metals

Newmont

IMPLATS
Distinctly Platinum

NORTHERN STAR
RESOURCES LIMITED

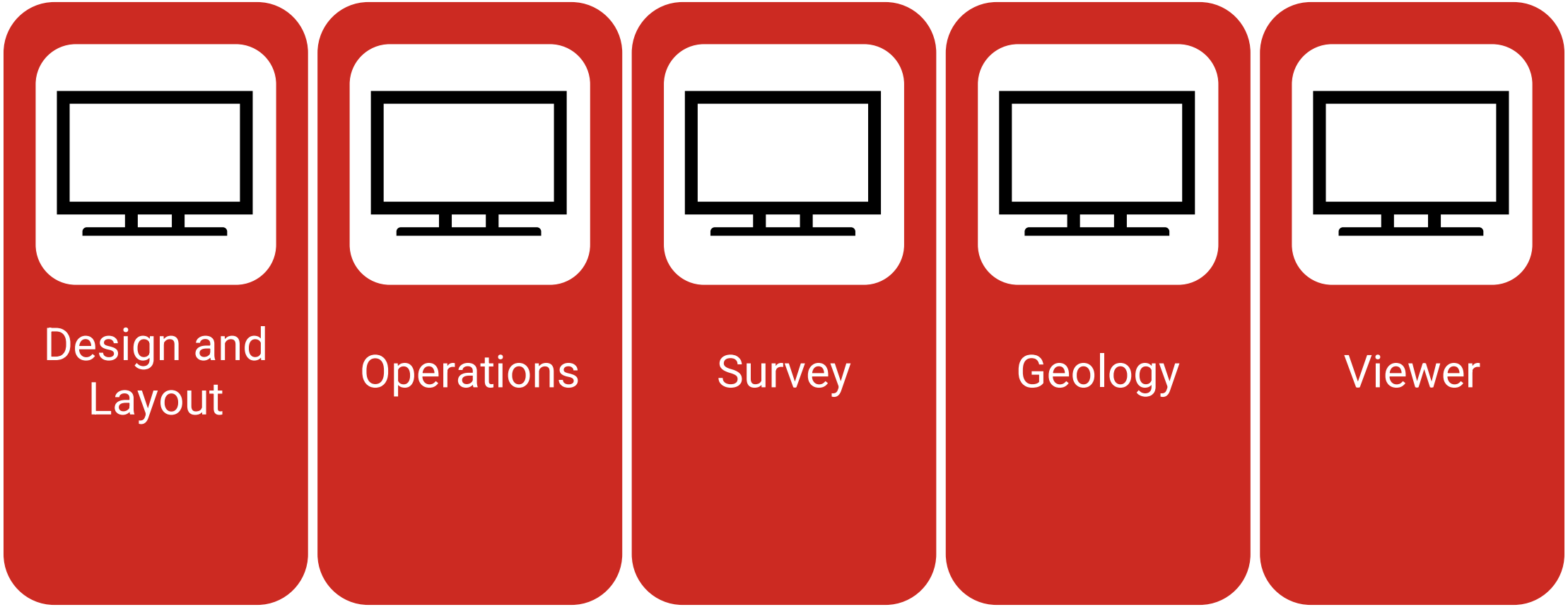
Gowest

ILION ONE
METALS

PAN AMERICAN
SILVER

NSS
CANADA

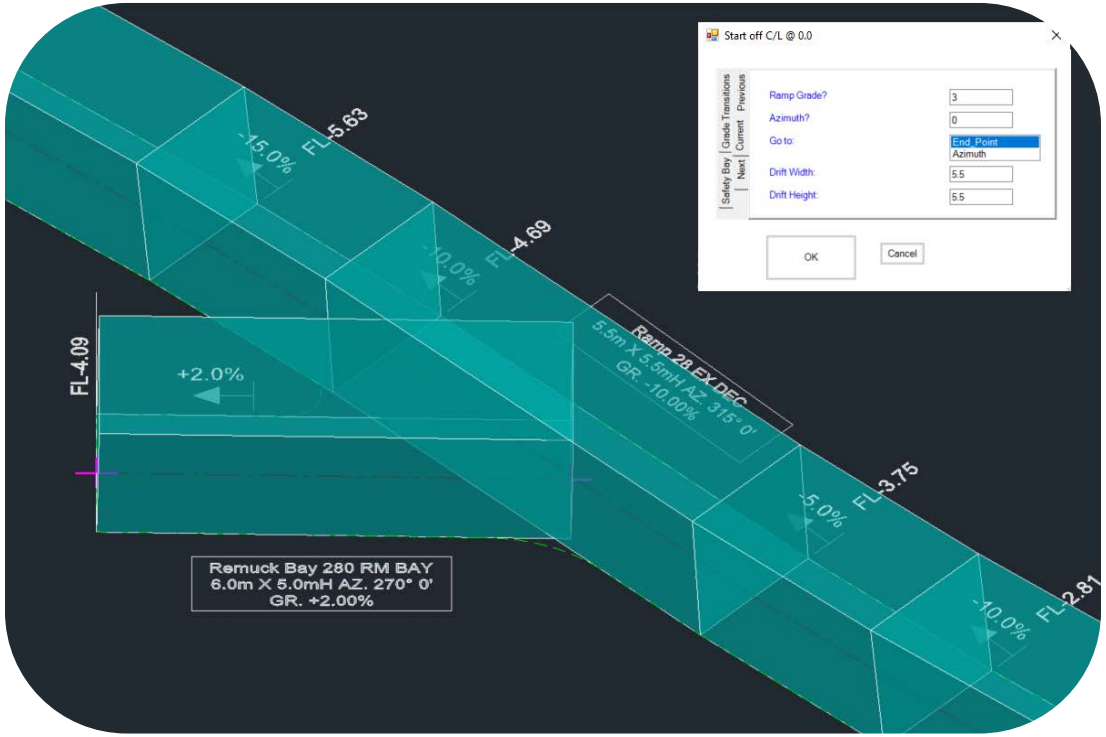
Miner Operated Survey System



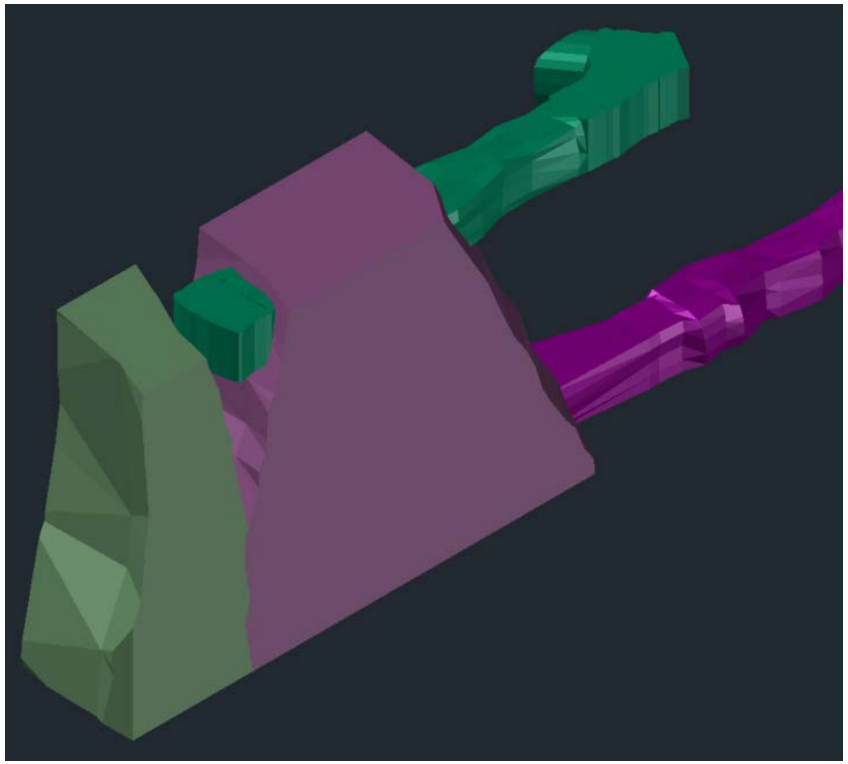
Design and Layout

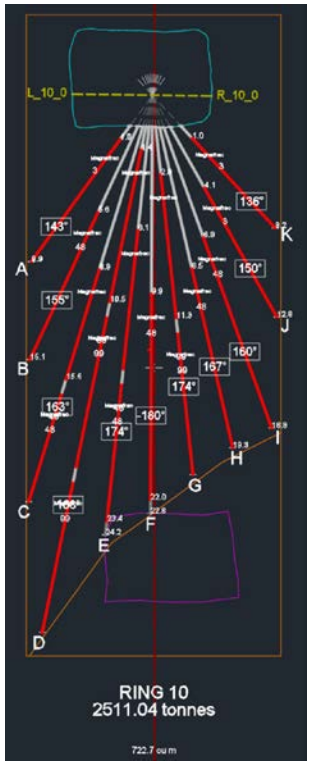
Short Term Planning, Long Hole Design

Short Term Planning



Long Hole Design





RING	HOLE	DUMP	ROTATION RING	OFFSET from reference line Pivot Pt		LENGTH THEOR	ACTUAL	
10	K	-13°S	137.0°N	W of REF	0.1m	8.2m		
	J	-13°S	151.0°N	W of REF	0.1m	12.8m		
	I	-13°S	160.0°N	W of REF	0.1m	18.8m		
	H	-13°S	167.0°N	W of REF	0.1m	19.3m		
	G	-13°S	174.0°N	W of REF	0.1m	20.6m		
	F	-13°S	-180.0°S	W of REF	0.1m	22.8m		BT
	E	-13°S	174.0°S	W of REF	0.1m	24.2m		BT
	D	-13°S	168.0°S	W of REF	0.1m	30.4m		
	C	-13°S	163.0°S	W of REF	0.1m	23.1m		
	B	-13°S	155.0°S	W of REF	0.1m	15.1m		
	A	-13°S	144.0°S	W of REF	0.1m	9.9m		

Sub Total: 205m

Nº	Rotn	Depth	Delay	BrkThru	Charge	Explosive	Units	Kg	
K	136°	8.2	3		[(2.1) 1.0 - 8.2]	Magnafrac	8.8	154.0	
J	150°	12.8	3		[(5.4) 4.1 - 12.8]	Magnafrac	8.2	186.6	
I	160°	18.8	48		[(8.7) 6.9 - 18.8]	Magnafrac	11.3	255.2	
H	167°	19.3	48		[(10.2) 8.5 - 19.3]	Magnafrac	10.2	231.8	
G	174°	20.6	99		[(4.1) 2.8 - 11.3]	Magnafrac	16.0	363.5	
F	-180°	22.8	48	BT	[(11.7) 9.9 - 22.0]	Magnafrac	11.4	259.6	
E	174°	24.2	48	BT	[(7.4) 6.1 - 14.4]	Magnafrac	15.5	351.9	
D	168°	30.4	99		[(2.8) 1.4 - 10.5]	Magnafrac	25.9	586.6	
C	163°	23.1	48		[(9.8) 8.8 - 15.6]	Magnafrac	12.7	288.8	
B	155°	15.1	48		[(7.0) 5.6 - 15.1]	Magnafrac	9.0	205.0	
A	143°	9.9	3		[(2.4) 1.0 - 9.9]	Magnafrac	8.4	190.2	
						Total	135.5	3073.2	
						Tonnes	2511		
						Explosives	3073		
						Powder Factor	1.224		
						Total Len	205		
						Tonnes/m	12		

Operations

Markup

Markup

MOSS OPS VIDEO

Survey

Cavity Monitoring Surveys, Check Surveys, Bore Hole Pickup & Markup

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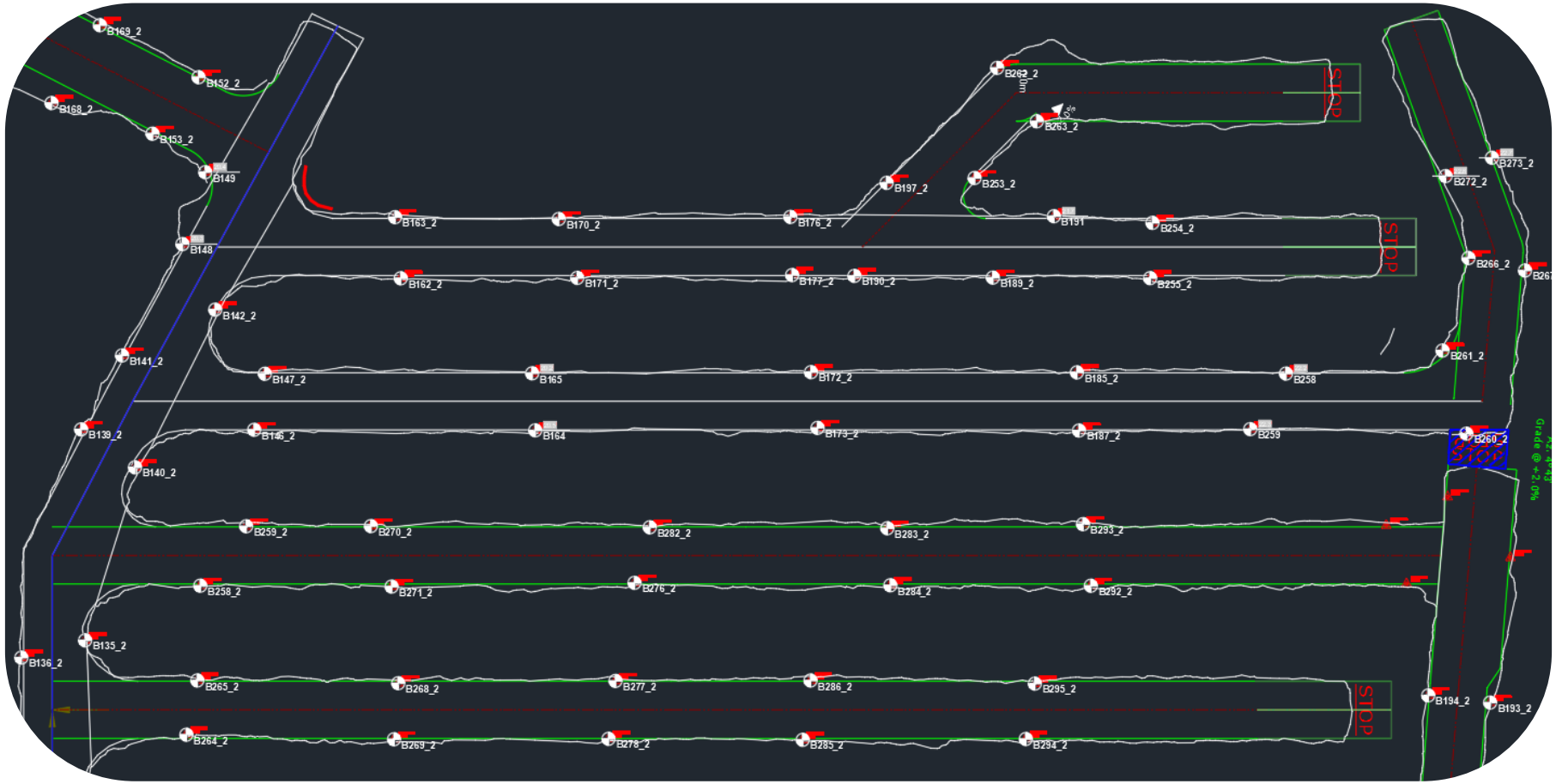
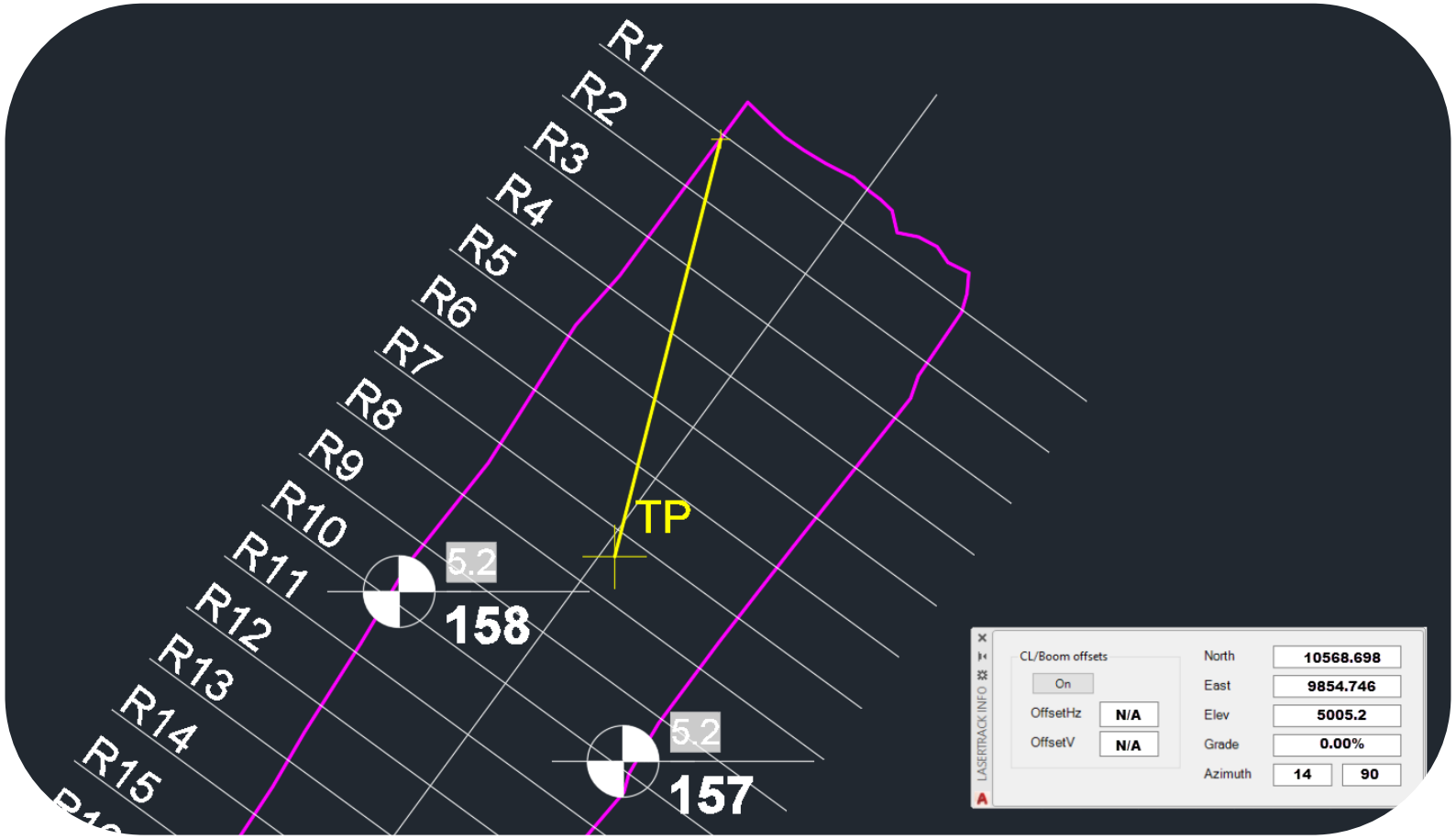
Cavity Monitoring Survey

- Convert Total Station to CMS instrument
- No Post Processing
- 20 minutes for Rings
- 6 minutes for Point Cloud

Check Survey



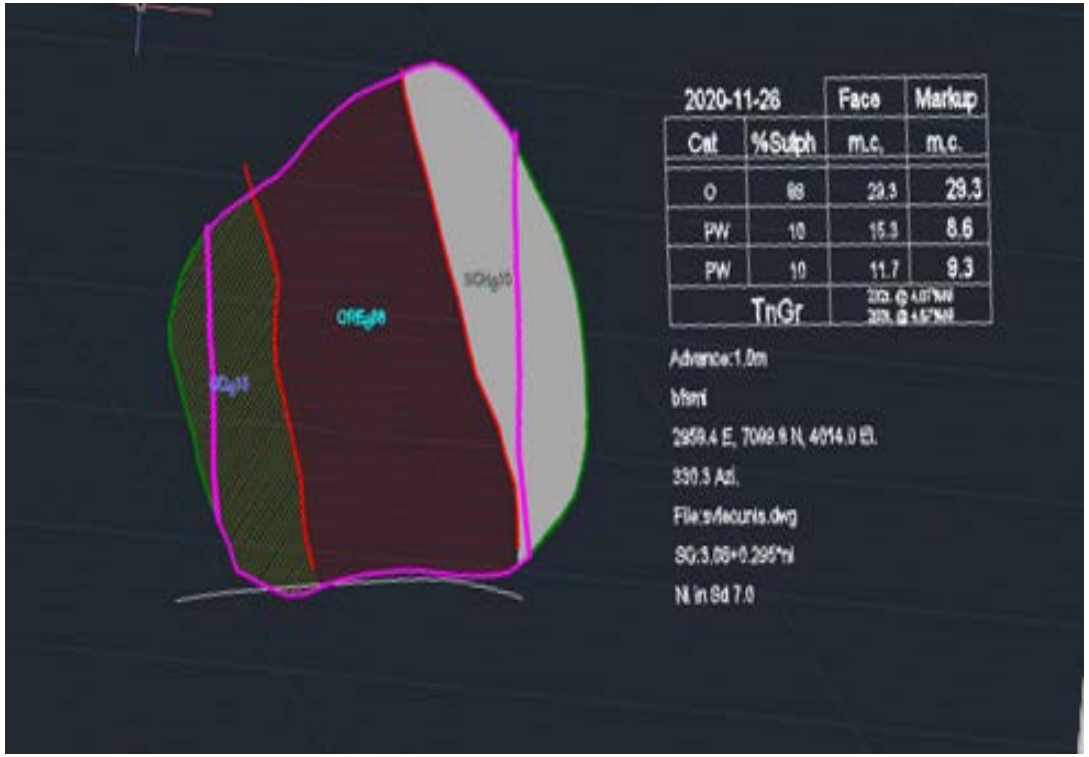
Bore Hole Pickup & Markup



Geology

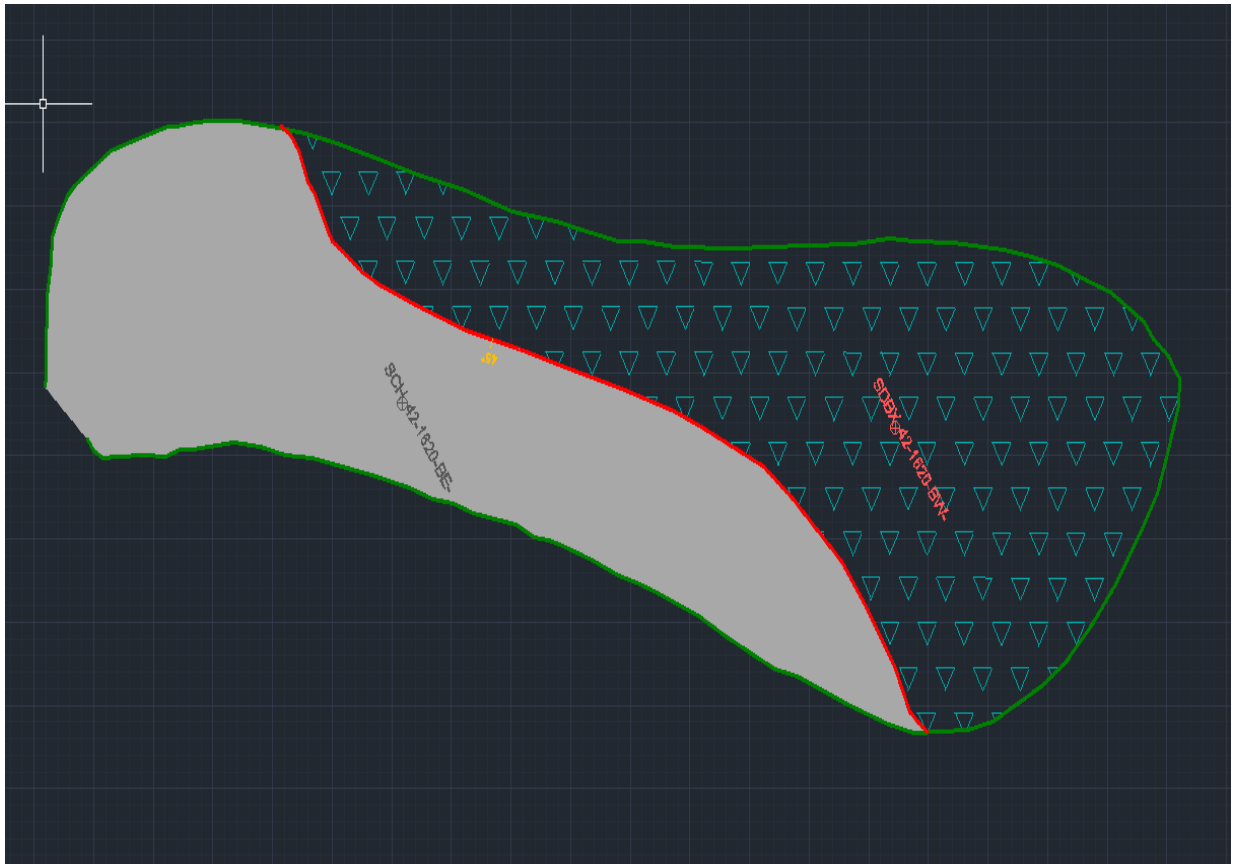
Face and Back Mapping

Geology Face Mapping – Front End



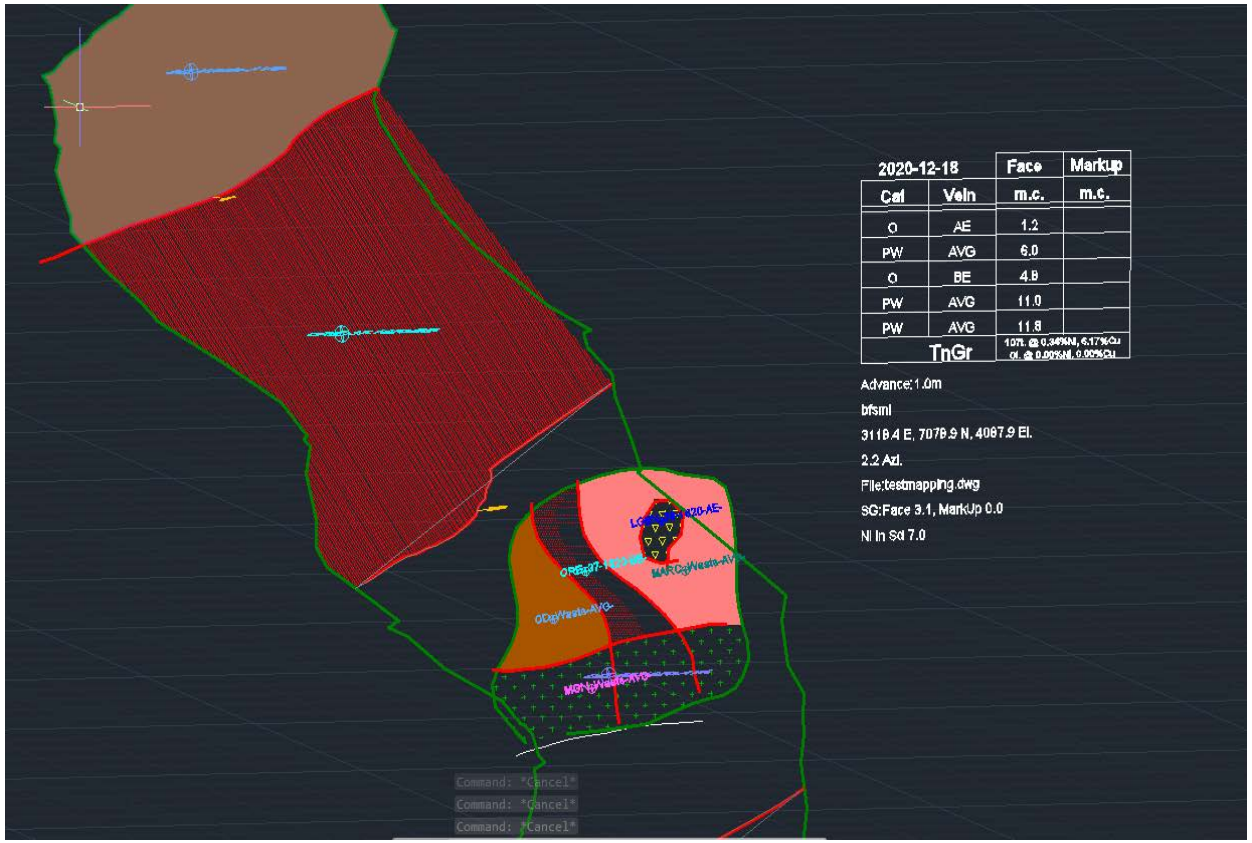
- Simple straight forward workflow with minimal deviation from conventional methods.
- Laser or draw in contacts, assign proper lithologies, mark contact angles, mark inclusions or veins.
- Mark features such as VG/Sulfides, chip sample locations or other points of interest to display on face.

Back Mapping with MOSS – Front End



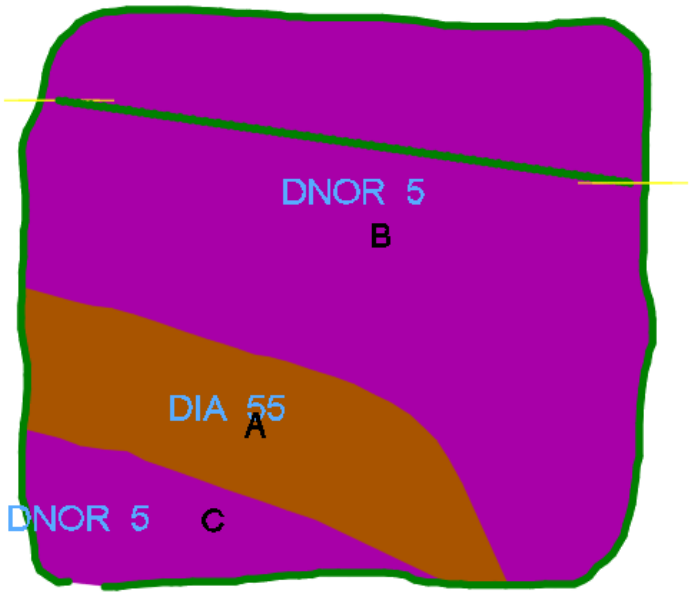
- Exact same process as face mapping.
- All three methods available.
- Ideal for unsupported areas or difficult to reach zones where precision is key.
- Draw in lithologies, mark contacts and contact angle, structure, veining etc.

Example of Back and Face Combined



- Both face and back mapping geo referenced based on level plan and selected elevation point.
- At a glance history of development, showing how daily face mapping ties to overall ore grade and tonnes.
- Break down of ore/waste rounds based on Geo Calls.

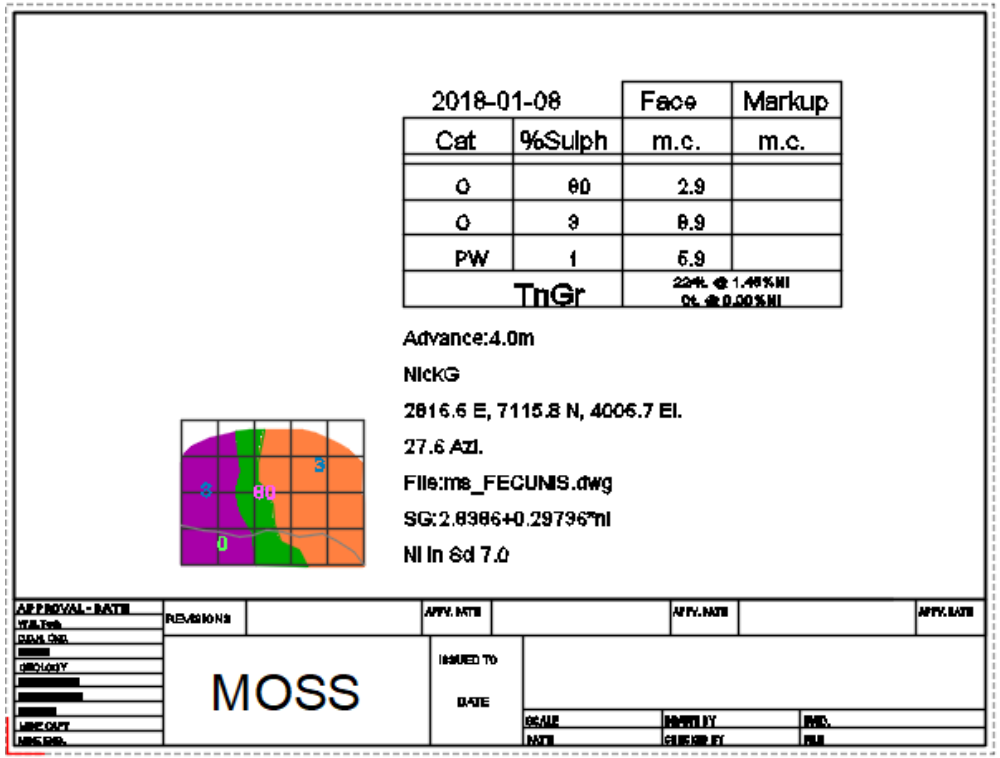
Face and Back Mapping



	2021-02-12		Face	Markup
	Cat	%Sulph	m³	m³
A	O	55	4.0	
B	PW	5	14.9	
C	PW	5	2.1	
	TnGr		213t. @ 1.18%Ni 0t. @ 0.00%Ni	

Advance: 3.0m
User: FrancisN
Coord: 2781.2 E, 7132.5 N, 4002.3 El.
Azi: 36.3
File: Geo.dwg
SG: 3.08+0.295*ni
Ni in Sd: 7.0

Geology Face Mapping – Back End

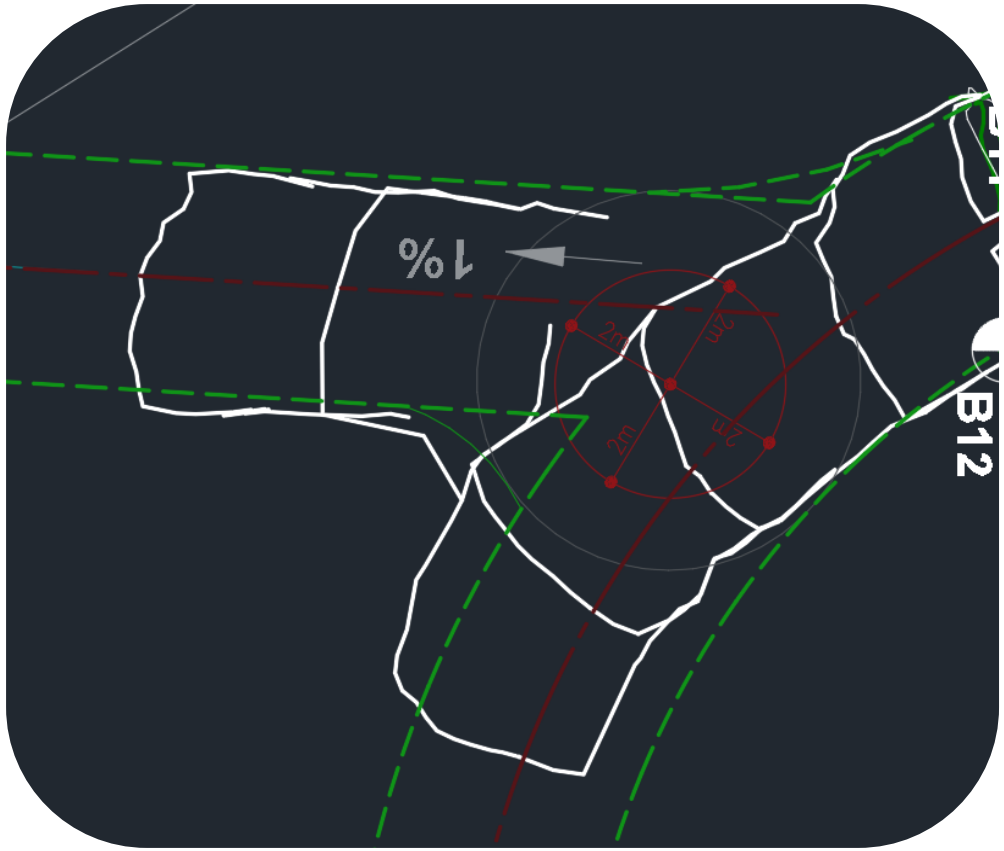


- Final Print can be fully customized or built to match current site-specific sheets.
- Will output image of entire face, showing lithology, grade, chip sample locations, etc.
- Can be built to showcase projected grade/tonnes based on round size and depth.

Viewer

Supervision

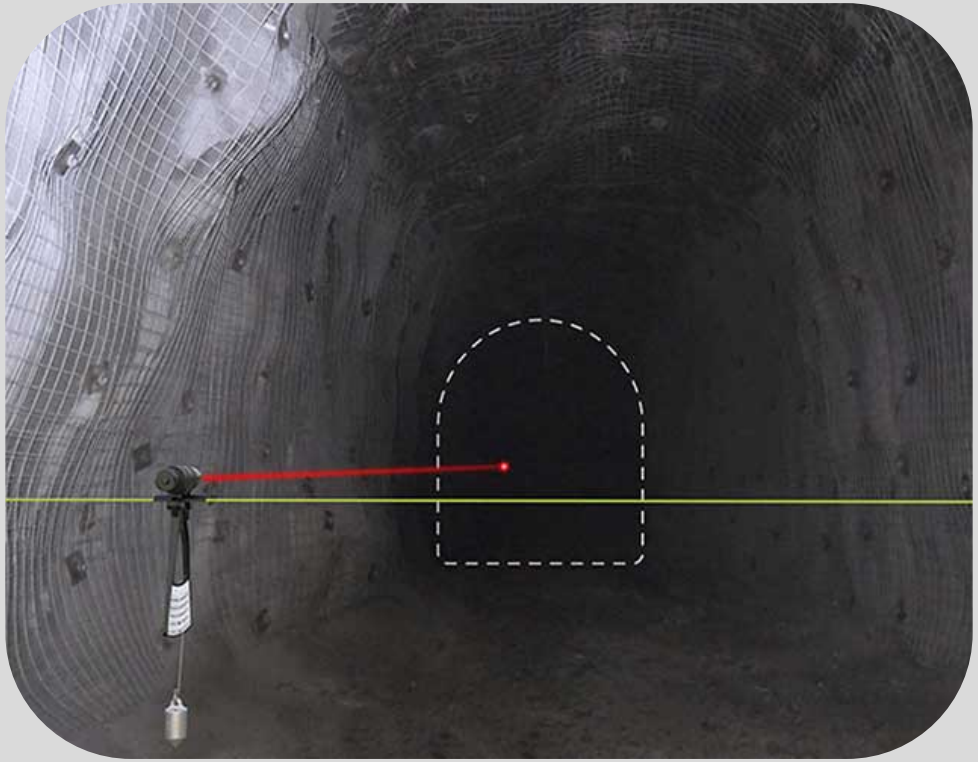
Supervision



- No more waiting for updated prints/drawings
- Crews can be proactive instead of reactive
- Catch errors ahead of time
- Eliminate reworks

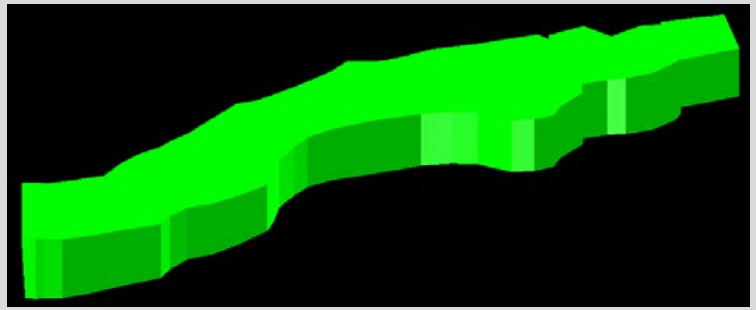
Conventional Methods

Drift Scopes, Chain and Washer

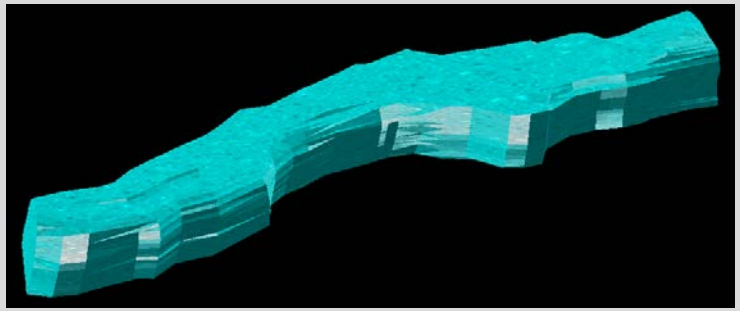


Monopod System

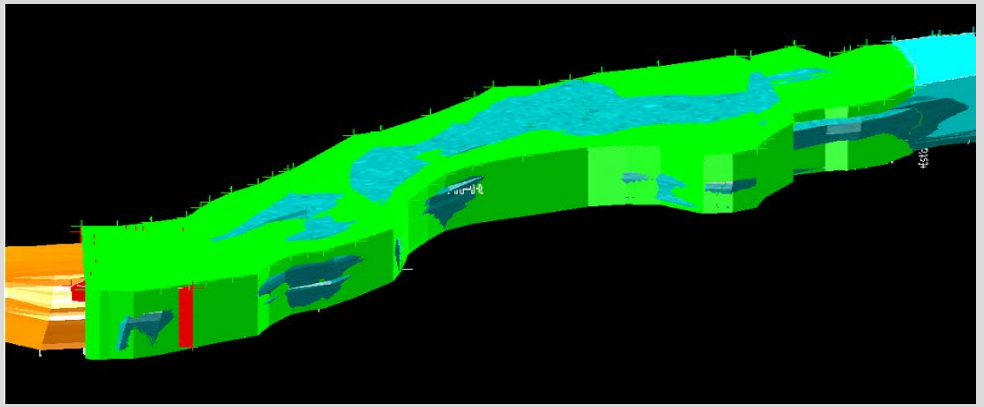
Reconciliation



Conventional Solid



MOSS Solid



Comparison

130 Cubic Meter Difference

House Keeping

Hardware and Software Compatibility

Hardware Compatibility

Current Lineup

TS16

MS60

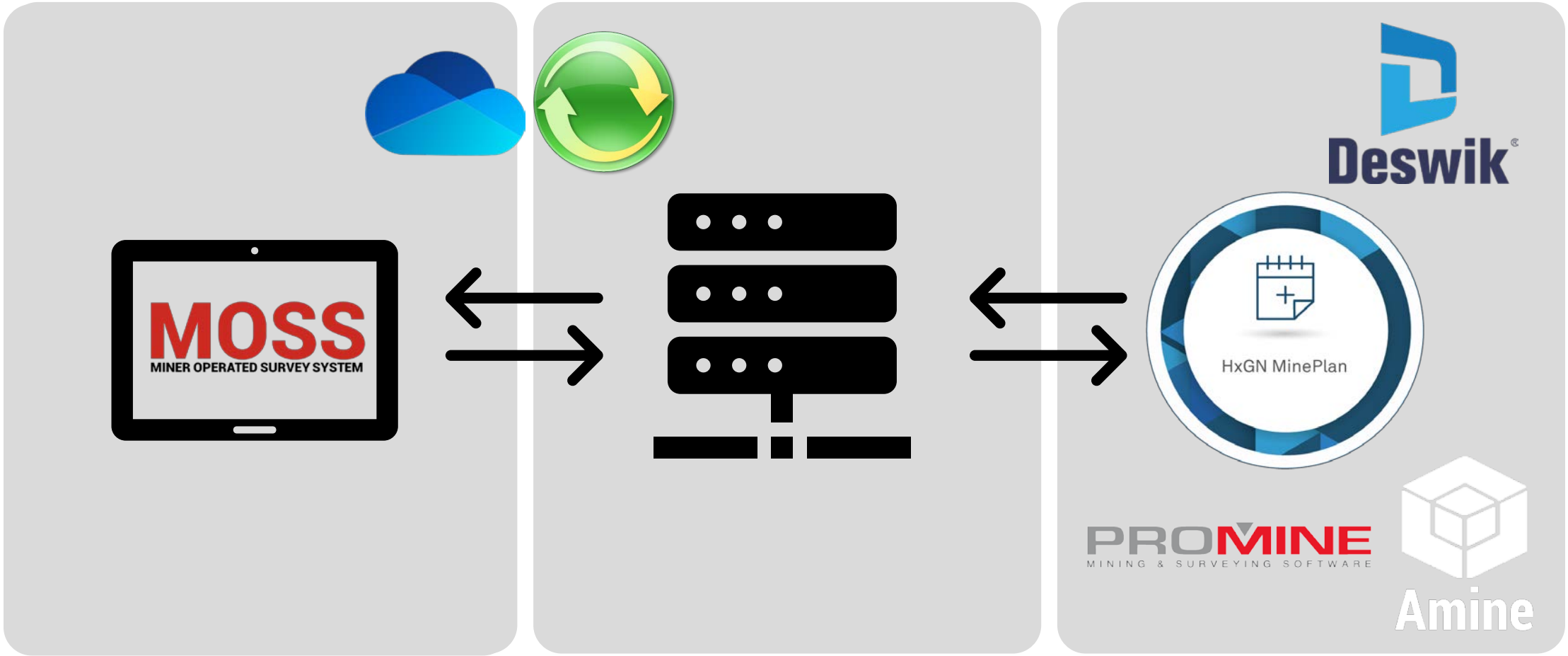
Backwards Compatible

TS12/TPS1200

TS15

MS50

Software Compatibility



Value Proposition

Return on Investment

Calculation based on…	
Width (m)	5
Height (m)	5
Length (m)	3.5
Specific Gravity	3.1
Assumed Overbreak (%)	25
Overbreak Reduction (%)	10
Mining Cost per Tonne ($)	80
Hauling Cost per Tonne ($)	10
Milling Cost per Tonne ($)	30
MOSS Package Cost ($)	88,000
Development to Break Even (m)	95
Annual Development (m)	2,000
Annual Savings ($)	1,766,420

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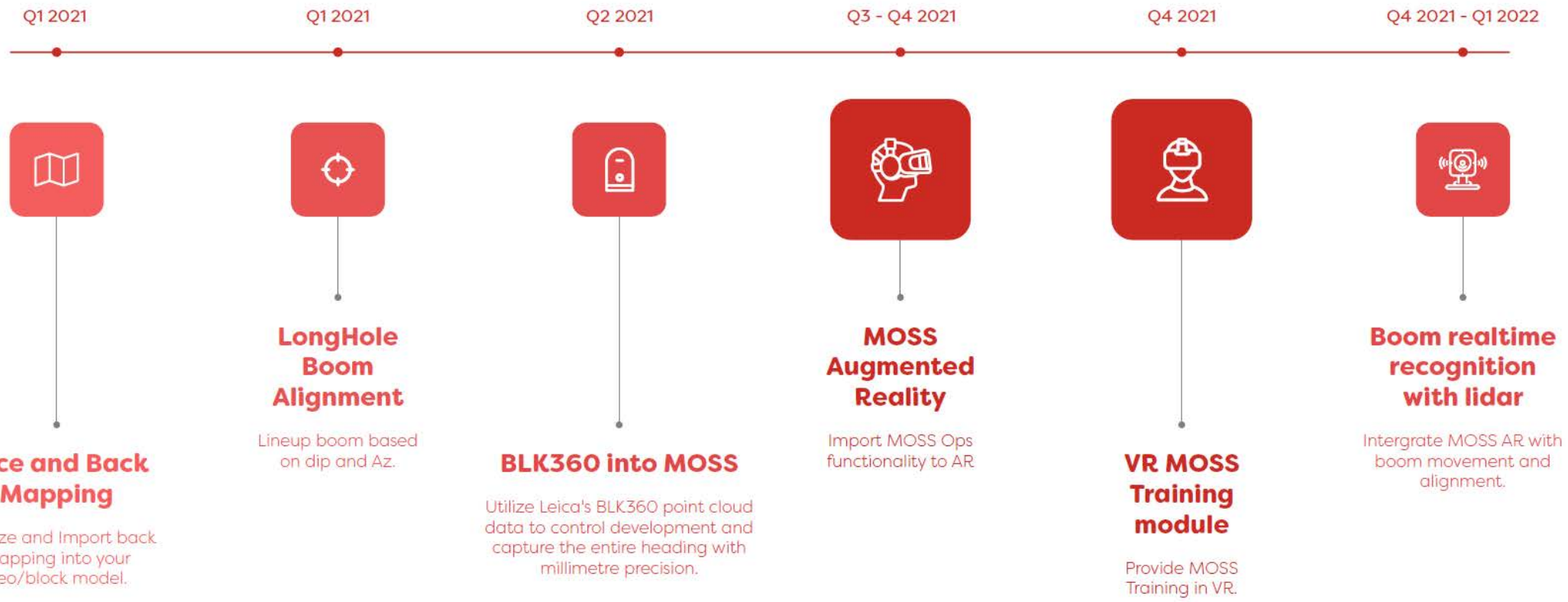
Disrupting Mining Culture

Road Map


Q1 2021
Face and Back Mapping
Digitize and Import back mapping into your geo/block model.
Q1 2021
LongHole Boom Alignment
Lineup boom based on dip and Az.
Q2 2021
BLK360 into MOSS
Utilize Leica's BLK360 point cloud data to control development and capture the entire heading with millimetre precision.
Q3 - Q4 2021
MOSS Augmented Reality
Import MOSS Ops functionality to AR
Q4 2021
VR MOSS Training module
Provide MOSS Training in VR.
Q4 2021 - Q1 2022
Boom realtime recognition with lidar
Intergrate MOSS AR with boom movement and alignment.

Thank you!