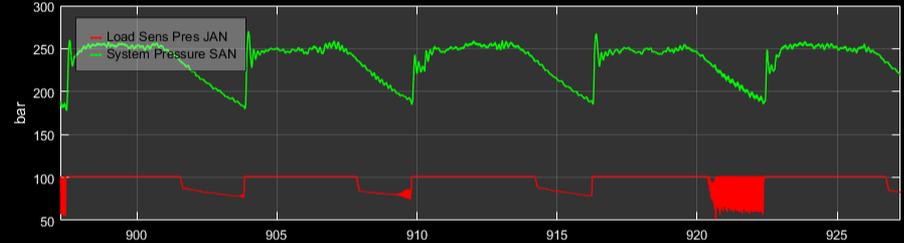
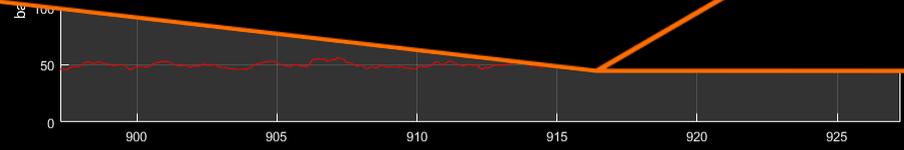
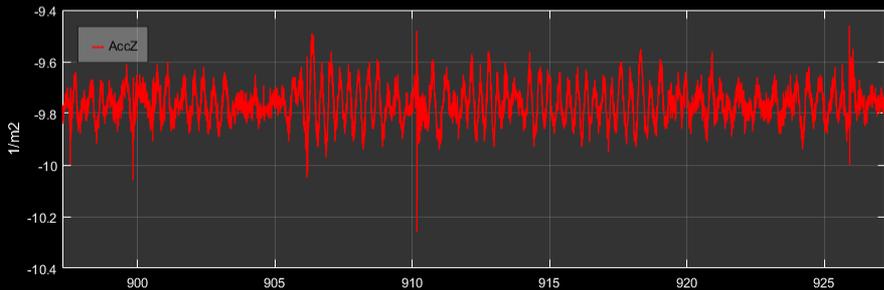
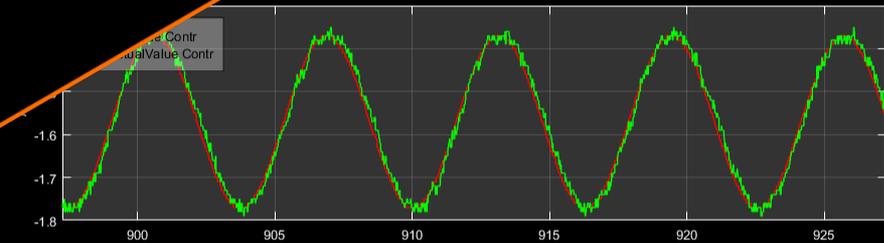
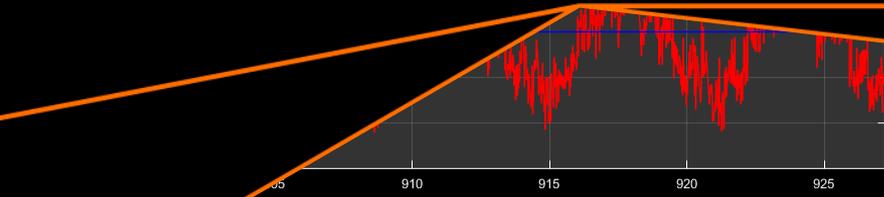


# MATLAB EXPO 2016

## MATLAB OBJECT ORIENTED PROGRAMMING FOR ENGINEERING AND DEVELOPMENT ACTIVITIES



10.5.2016  
MARTIN GIMPEL

# THE COMPANY

## AREAS



### TOOLS AND TOOLING SYSTEMS

for metal cutting and components in cemented carbide and other hard materials



### EQUIPMENT AND TOOLS MINING & CONSTRUCTION



### PRODUCTS IN ADVANCED STAINLESS STEELS, SPECIAL ALLOYS, TITANIUM

and metallic and ceramic resistance materials

# MECHANICAL CUTTING ZELTWEG, AUSTRIA

## PRODUCT OVERVIEW

Applications in underground mining and construction:



# OBJECT ORIENTED PROGRAMMING IN MATLAB

```
classdef Myclass< handle
    %MYCLASS Class syntax demo
    properties
        prop1@double    %fixed data type
        prop2@char
        prop3 %undefined
    end
    properties (SetObservable=true)
        data
    end
    events
        SomethingToDo
    end

    methods
        function obj=Myclass
            %Constructor
            obj.prop2='Hi';
        end
        function dosomething(obj)
            notify(obj, SomethingToDo)
        end
        function set.data(obj, value)
            obj.data=value;
            if value>5
                %do somethingdifferent
            end
        end
    end
end
```

- Bring data and algorithms together
- Powerful once mastered

## Applications:

- ...
- Encapsulation of Matlab graphics objects
- GUIs
- Make external interfaces drivers, dlls etc. „usable“
- Data evaluation

# PARAMETER AND LANGUAGE MANAGEMENT

## PARAMETER + PARAMETERCOLLECTION CLASSES

- Manage parameter values, defaults, minimum, maximum, display unit, display formatting, enumerations datatypes...
- Referenced by client classes
- Current value retrieval in code by key string:

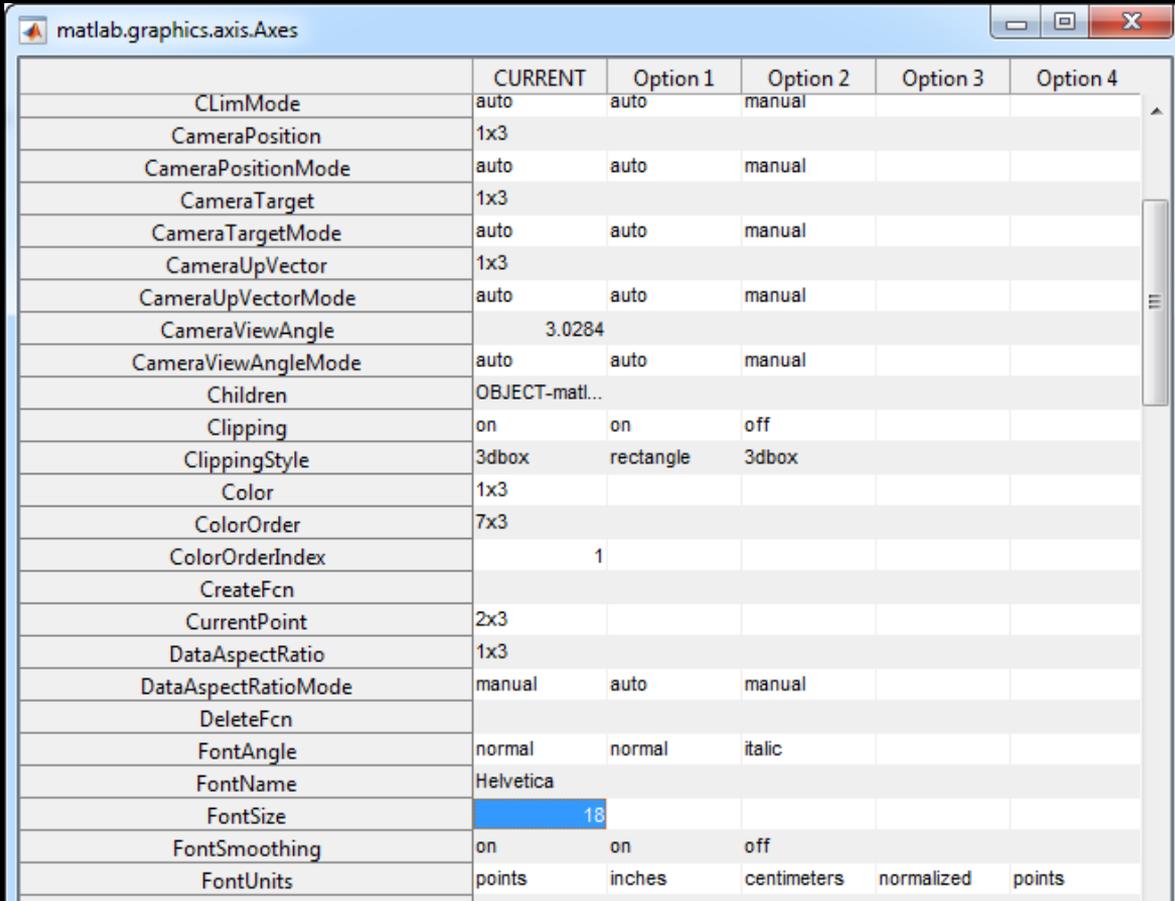
```
value=obj.P.retr('Sump.targetstroke')
```

## RETRIEVE LANGUAGE STRING

- Manage language text and formatting for multi language environment applications
- Languagechange (events)
- Text retrieval:

```
obj.L.retr('machineposition');
```

# ENCAPSULATION OF MATLAB GRAPHICS OBJECTS

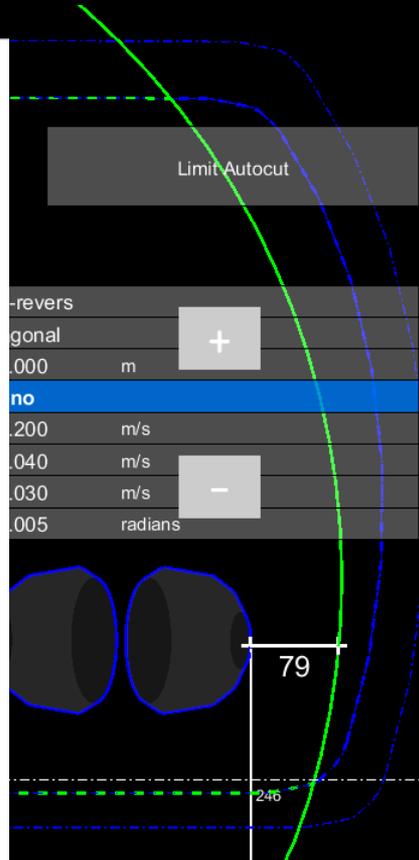


|                     | CURRENT        | Option 1  | Option 2    | Option 3   | Option 4 |
|---------------------|----------------|-----------|-------------|------------|----------|
| CLimMode            | auto           | auto      | manual      |            |          |
| CameraPosition      | 1x3            |           |             |            |          |
| CameraPositionMode  | auto           | auto      | manual      |            |          |
| CameraTarget        | 1x3            |           |             |            |          |
| CameraTargetMode    | auto           | auto      | manual      |            |          |
| CameraUpVector      | 1x3            |           |             |            |          |
| CameraUpVectorMode  | auto           | auto      | manual      |            |          |
| CameraViewAngle     | 3.0284         |           |             |            |          |
| CameraViewAngleMode | auto           | auto      | manual      |            |          |
| Children            | OBJECT-matl... |           |             |            |          |
| Clipping            | on             | on        | off         |            |          |
| ClippingStyle       | 3dbox          | rectangle | 3dbox       |            |          |
| Color               | 1x3            |           |             |            |          |
| ColorOrder          | 7x3            |           |             |            |          |
| ColorOrderIndex     | 1              |           |             |            |          |
| CreateFcn           |                |           |             |            |          |
| CurrentPoint        | 2x3            |           |             |            |          |
| DataAspectRatio     | 1x3            |           |             |            |          |
| DataAspectRatioMode | manual         | auto      | manual      |            |          |
| DeleteFcn           |                |           |             |            |          |
| FontAngle           | normal         | normal    | italic      |            |          |
| FontName            | Helvetica      |           |             |            |          |
| FontSize            | 18             |           |             |            |          |
| FontSmoothing       | on             | on        | off         |            |          |
| FontUnits           | points         | inches    | centimeters | normalized | points   |

- Add functionality to basic graphics objects
- Graphics object reference is a property of encapsulating object
- Publish graphics object properties
- Add custom context menus and functionality

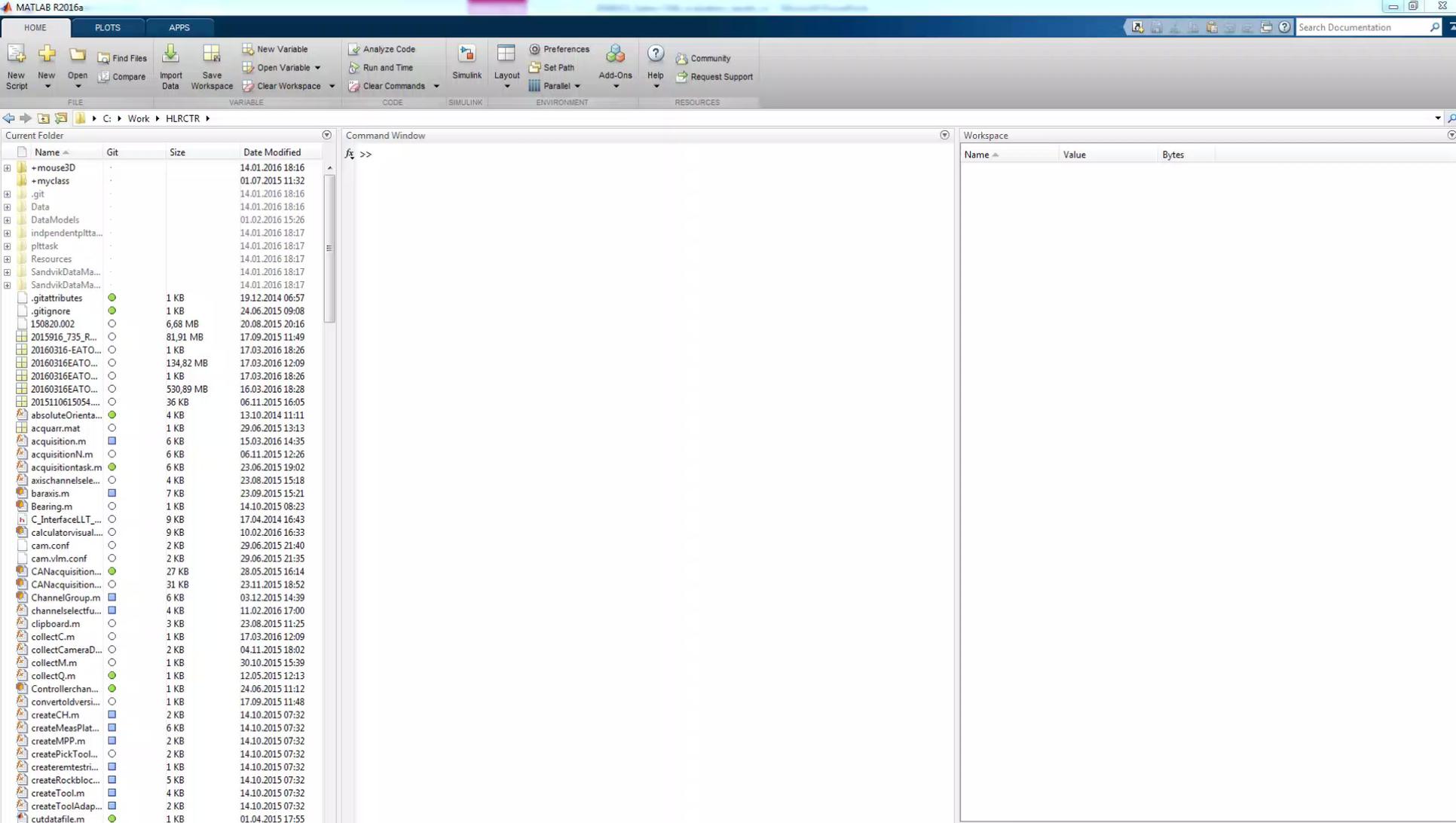
# GUI

```
classdef MenuEntity < handle
%MENUEntity - Superclass for all menu items
properties
    pobj
    gobj
    entercallback
    escapecallback
    activateable=false
    pos
    alignment='center'
    fontsize=14
    txtobj
    backgroundobj
    upN
    downN
    leftN
    rightN
    superN
    selected=false
    activated=false
    L
end
properties (SetObservable=true) ...
methods
function obj=MenuEntity(pobj,L,pos,key) ...
function generatevisuals(obj) ...
function updatelang(obj) ...
function success=select(obj) ...
function unselect(obj) ...
function activate(obj) ...
function deactivate(obj) ...
function delete(obj) ...
function keypress(obj,key) ...
function mousepress(obj,src,event) ...
function set.Visible(obj,value) ...
function set.key(obj,value) ...
end
end
```



- Matlab graphics objects in additional overlay axes
- References to parent, neighbor and child objects
- Multi input navigation
- Callbacks stored as function handle properties
- Multilanguage

# DATA ACQUISITION AND REALTIME PLOTTING



New Script New Open Compare Import Data Save Workspace Clear Workspace Analyze Code Run and Time Simulink Layout Preferences Set Path Add-Ons Help Community Request Support

FILE VARIABLE CODE SIMULINK ENVIRONMENT RESOURCES

Current Folder C:\Work\HLRCTR

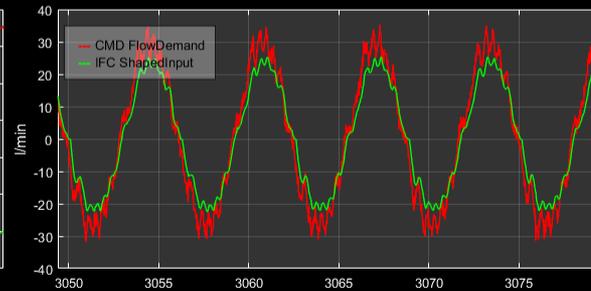
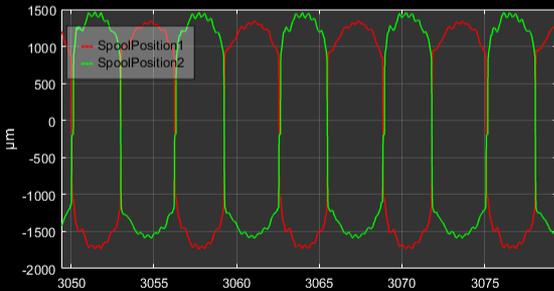
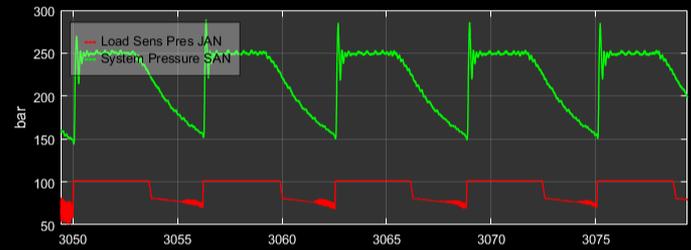
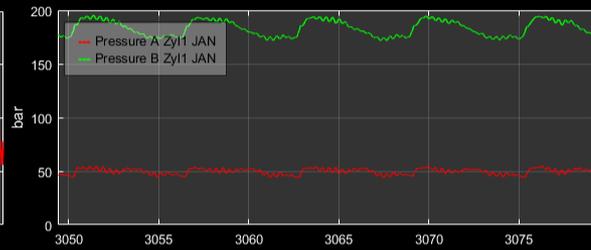
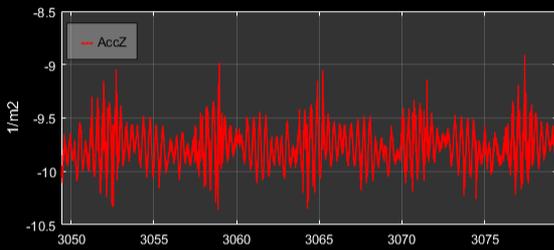
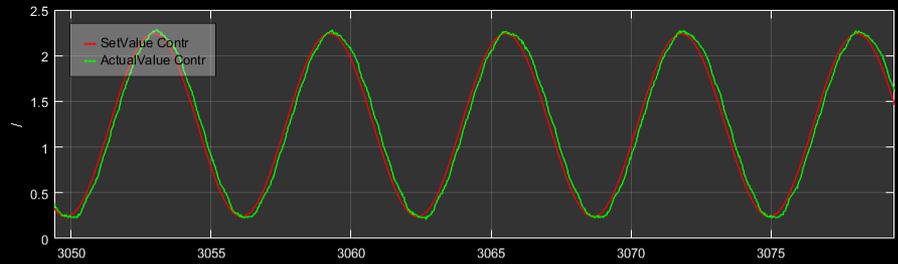
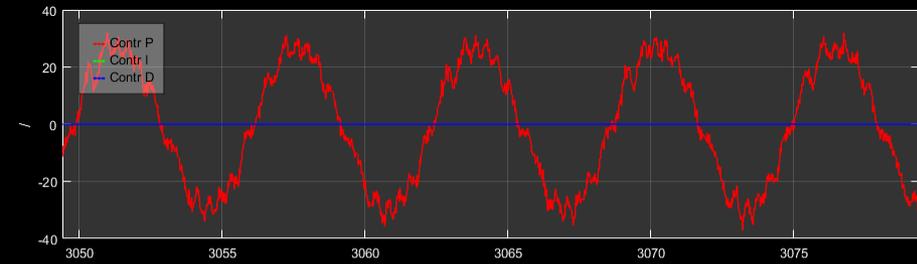
| Name                | Git | Size      | Date Modified    |
|---------------------|-----|-----------|------------------|
| +mouse3D            | .   |           | 14.01.2016 18:16 |
| +myclass            | .   |           | 01.07.2015 11:32 |
| .git                | .   |           | 14.01.2016 18:16 |
| Data                | .   |           | 14.01.2016 18:16 |
| DataModels          | .   |           | 01.02.2016 15:26 |
| independentpitta... | .   |           | 14.01.2016 18:17 |
| pittask             | .   |           | 14.01.2016 18:17 |
| Resources           | .   |           | 14.01.2016 18:17 |
| SandvikDataMa...    | .   |           | 14.01.2016 18:17 |
| SandvikDataMa...    | .   |           | 14.01.2016 18:17 |
| .gitattributes      | ●   | 1 KB      | 19.12.2014 06:57 |
| .gitignore          | ●   | 1 KB      | 24.06.2015 09:08 |
| 150820.002          | ○   | 6,68 MB   | 20.08.2015 20:16 |
| 2015916_735_R...    | ○   | 81,91 MB  | 17.09.2015 11:49 |
| 20160316-EATO...    | ○   | 1 KB      | 17.03.2016 18:26 |
| 20160316EATO...     | ○   | 134,82 MB | 17.03.2016 12:09 |
| 20160316EATO...     | ○   | 1 KB      | 17.03.2016 18:26 |
| 20160316EATO...     | ○   | 530,89 MB | 16.03.2016 18:28 |
| 2015110615054...    | ○   | 36 KB     | 06.11.2015 16:05 |
| absoluteOrienta...  | ●   | 4 KB      | 13.10.2014 11:11 |
| acquarr.mat         | ●   | 1 KB      | 29.06.2015 13:13 |
| acquisition.m       | ■   | 6 KB      | 15.03.2016 14:35 |
| acquisitionN.m      | ○   | 6 KB      | 06.11.2015 12:26 |
| acquisitiontask.m   | ●   | 6 KB      | 23.06.2015 19:02 |
| axischannelsele...  | ○   | 4 KB      | 23.08.2015 15:18 |
| baraxis.m           | ■   | 7 KB      | 23.09.2015 15:21 |
| Bearing.m           | ○   | 1 KB      | 14.10.2015 08:23 |
| C_InterfaceLLT...   | ○   | 9 KB      | 17.04.2014 16:43 |
| calculatorvisual... | ○   | 9 KB      | 10.02.2016 16:33 |
| cam.conf            | ○   | 2 KB      | 29.06.2015 21:40 |
| cam.vlm.conf        | ○   | 2 KB      | 29.06.2015 21:35 |
| CANacquisition...   | ●   | 27 KB     | 28.05.2015 16:14 |
| CANacquisition...   | ○   | 31 KB     | 23.11.2015 18:52 |
| ChannelGroup.m      | ■   | 6 KB      | 03.12.2015 14:39 |
| channelselectfu...  | ■   | 4 KB      | 11.02.2016 17:00 |
| clipboard.m         | ○   | 3 KB      | 23.08.2015 11:25 |
| collectC.m          | ○   | 1 KB      | 17.03.2016 12:09 |
| collectCameraD...   | ○   | 2 KB      | 04.11.2015 18:02 |
| collectM.m          | ○   | 1 KB      | 30.10.2015 15:39 |
| collectQ.m          | ○   | 1 KB      | 12.05.2015 12:13 |
| Controllerchan...   | ●   | 1 KB      | 24.06.2015 11:12 |
| convertIdversi...   | ○   | 1 KB      | 17.09.2015 11:48 |
| createCH.m          | ■   | 2 KB      | 14.10.2015 07:32 |
| createMeasPlat...   | ■   | 6 KB      | 14.10.2015 07:32 |
| createMPP.m         | ■   | 2 KB      | 14.10.2015 07:32 |
| createPickTool...   | ○   | 2 KB      | 14.10.2015 07:32 |
| createreometri...   | ■   | 1 KB      | 14.10.2015 07:32 |
| createRockbloc...   | ■   | 5 KB      | 14.10.2015 07:32 |
| createTool.m        | ■   | 4 KB      | 14.10.2015 07:32 |
| createToolAdap...   | ■   | 2 KB      | 14.10.2015 07:32 |
| cutdatafile.m       | ●   | 1 KB      | 01.04.2015 17:55 |

Command Window

>>

Workspace

| Name | Value | Bytes |
|------|-------|-------|
|------|-------|-------|



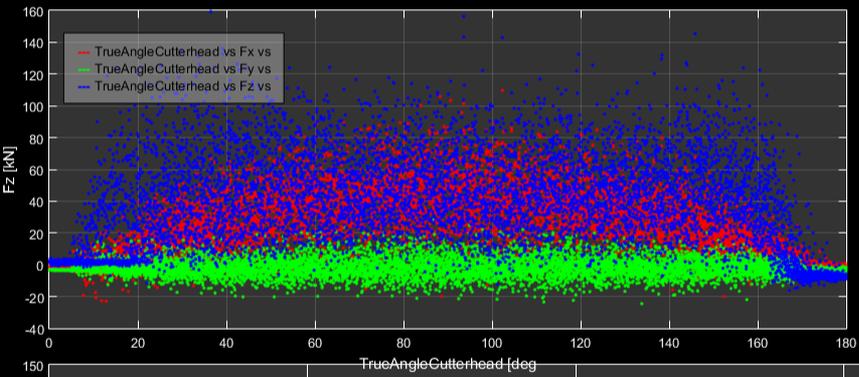
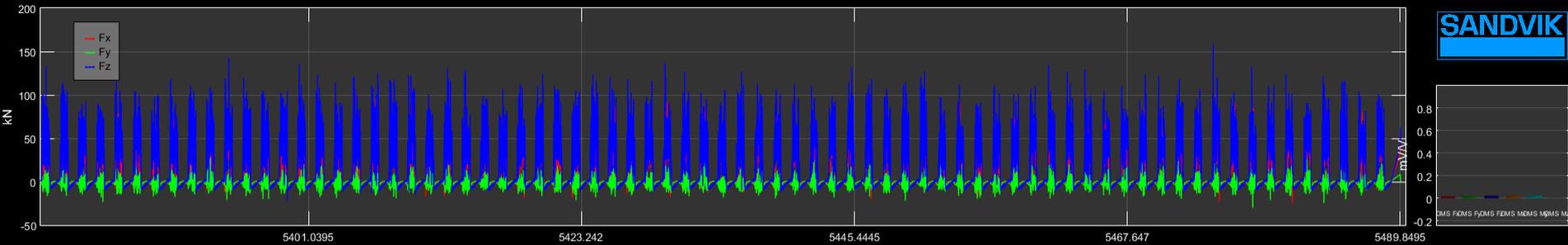
|                      |         |   |
|----------------------|---------|---|
| Kp PositionControl   | 200.000 | - |
| Multiplier Sine Freq | 1.000   | - |
| SpeedOrig            | 1.000   | / |
| Oil Temperature      | 48.000  | ° |

16-Mar-2016 16:33:13

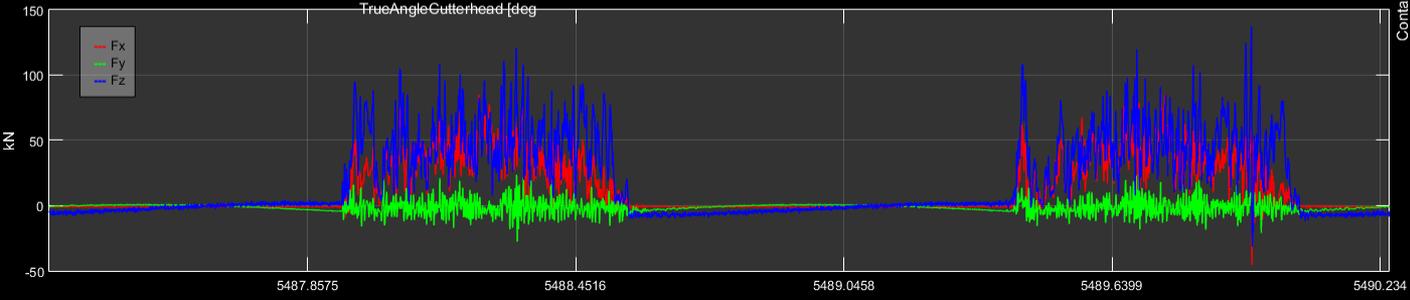
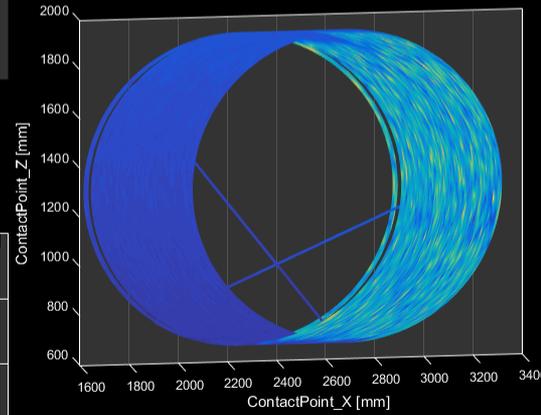
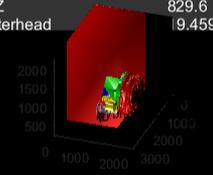
Test 4

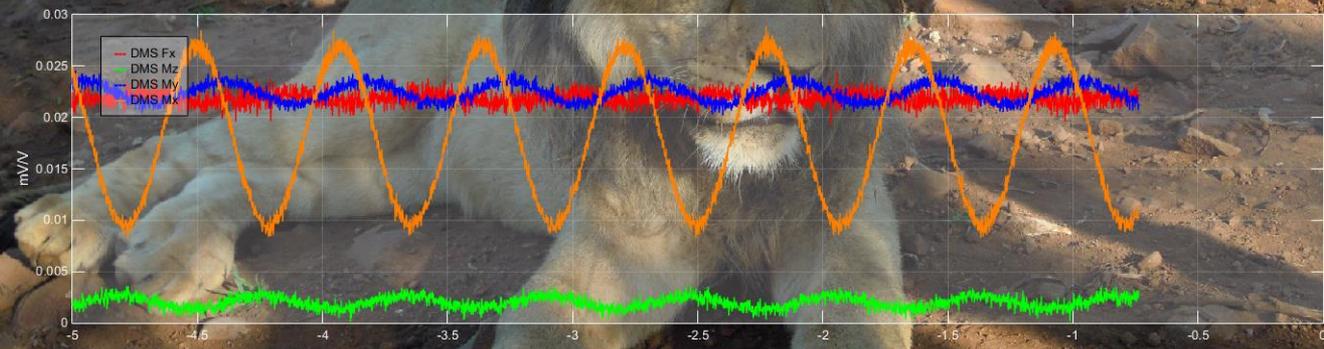
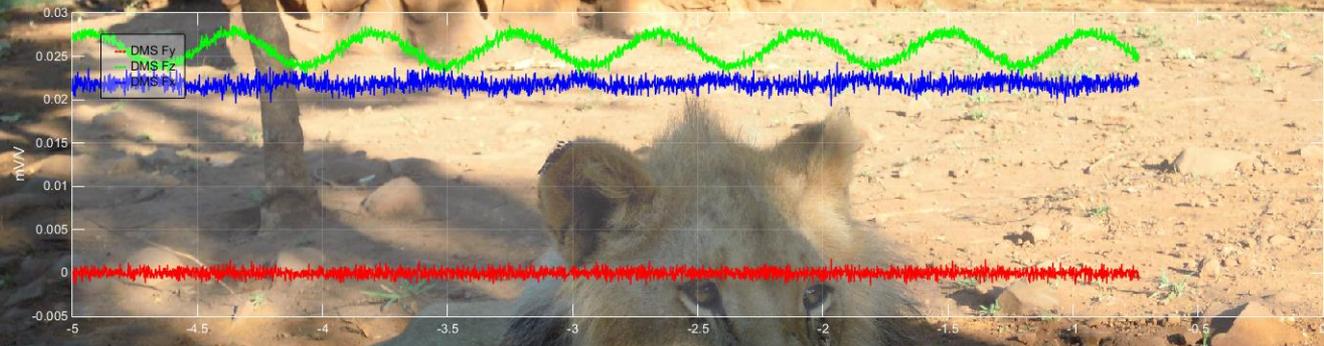
IFC Sine Position Control





|                            |        |     |
|----------------------------|--------|-----|
| Timestamp Measurement fast | 5490   |     |
| Fx                         | -0.908 | kN  |
| Fy                         | 0.061  | kN  |
| Fz                         | -5.377 | kN  |
| Mx                         | -0.181 | kNm |
| My                         | 2.060  | kNm |
| Mz                         | 0.138  | kNm |
| ContactPoint X             | 1860.3 | mm  |
| ContactPoint Y             | 972.3  | mm  |
| ContactPoint Z             | 829.6  | mm  |
| TrueAngleCutterhead        | 19.459 | deg |





# OFFLINE DATA ANALYSIS TOOL



# HIGHLOAD ROCK CUTTING TEST RIG

## DESIGN CONCEPT

### MULTIPURPOSE CONCEPT



#### Disc cutting

Conventional or undercutting



#### Pick cutting

single tool / multiple tools  
radial tool / conical tool

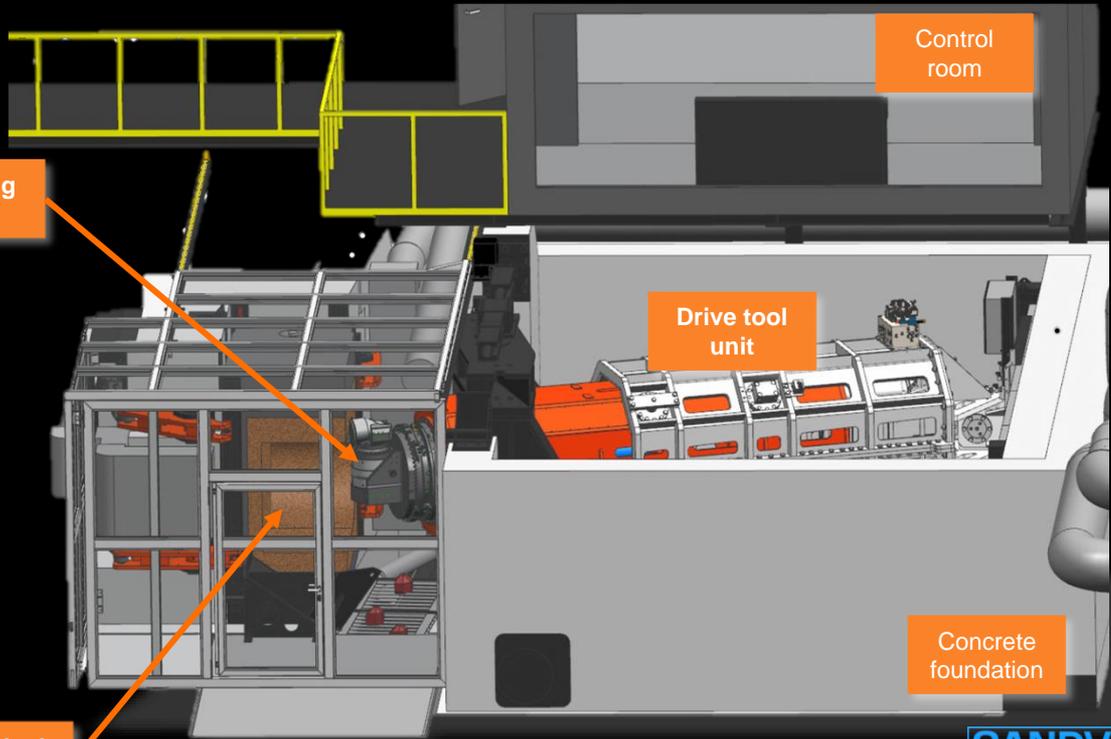


Horizontal raise boring

Horizontal drilling

Cutting unit

Rock block unit



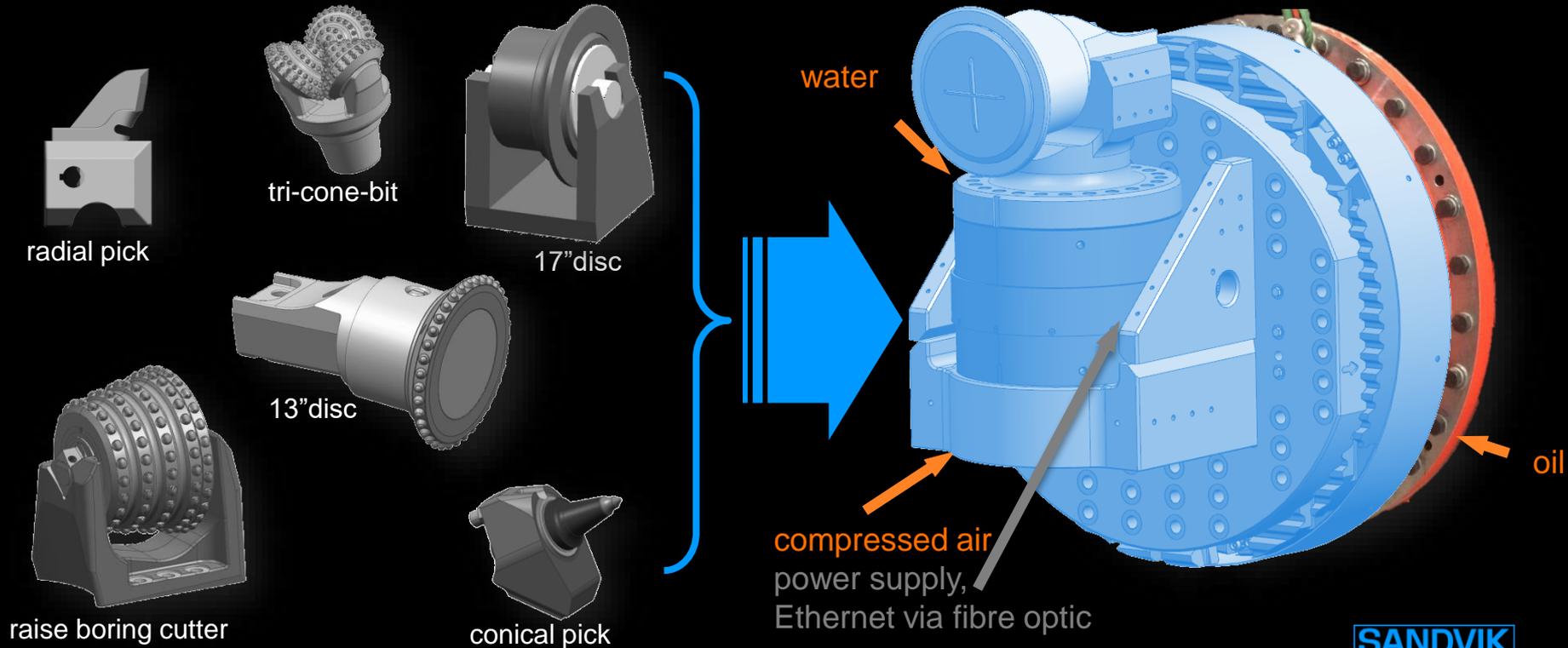
Control room

Drive tool unit

Concrete foundation

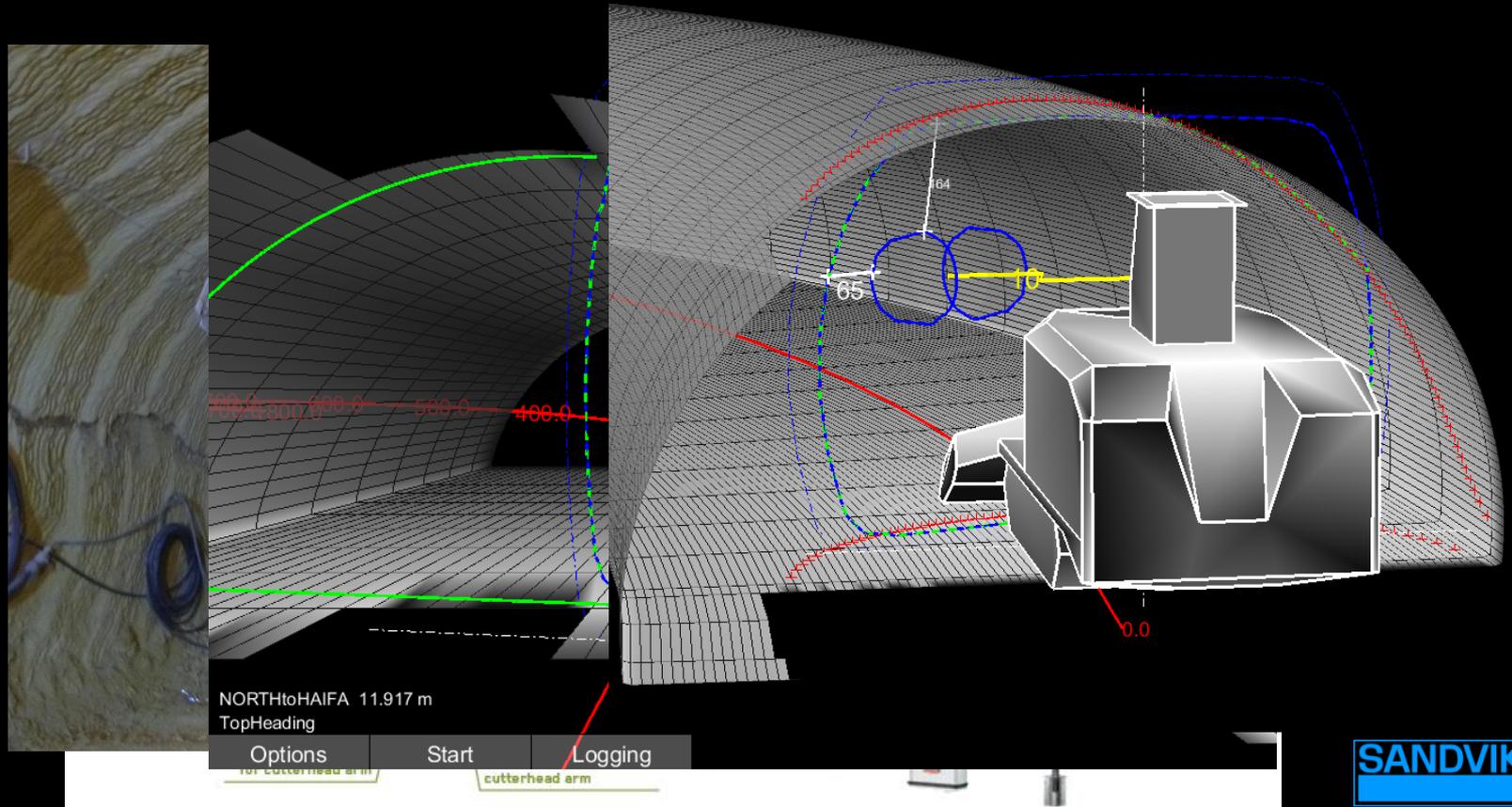
# HIGHLOAD ROCK CUTTING TEST RIG

## MODULAR CUTTERHEAD CONCEPT





# GUIDANCE SYSTEM



THANK YOU FOR YOUR ATTENTION