Your partner for future machining

VARNSDORF TOS

Milling machine manufacturer

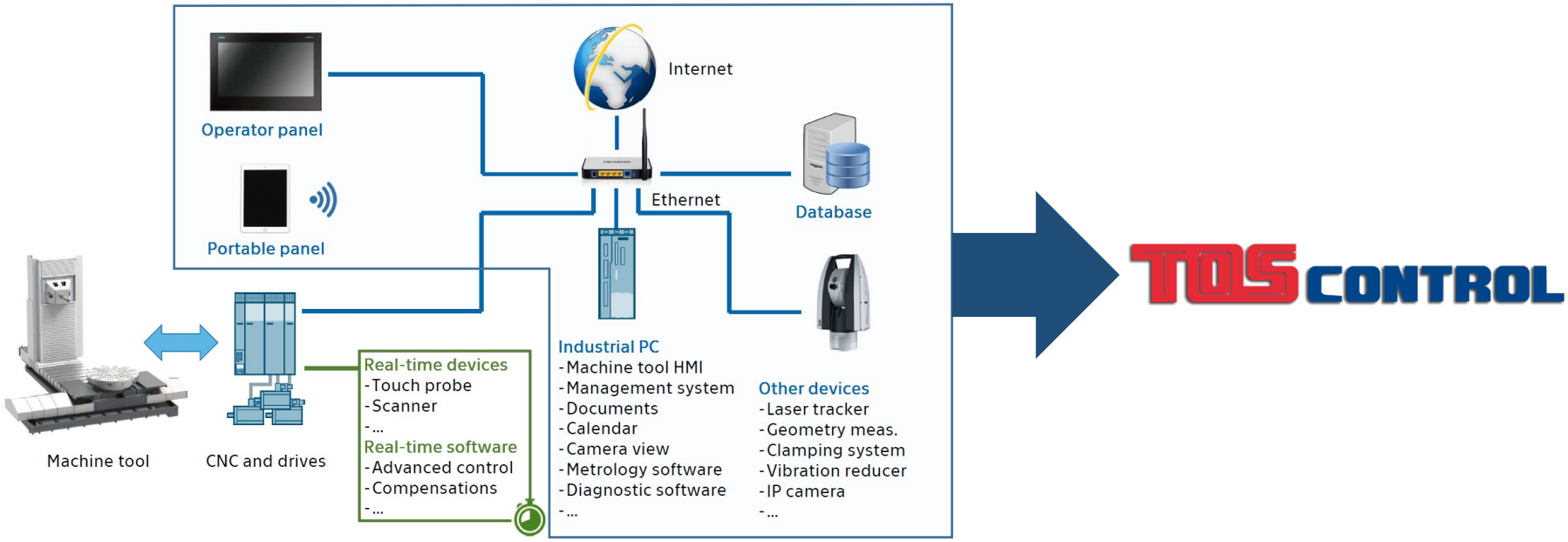
TOS VARNSDORF a.s.

Certifikovaný systém řízení
VARNSDORF TOS
SKQS
ISO 9001:2015

TOS Control

- **Unified machine tool interface** – for operators and also for the external systems
- **Specialized apps** for extended functionality with uniform design
- Shown **directly on control system panel**
- Gate for **communication with other systems** (OPC-UA, database SQL)

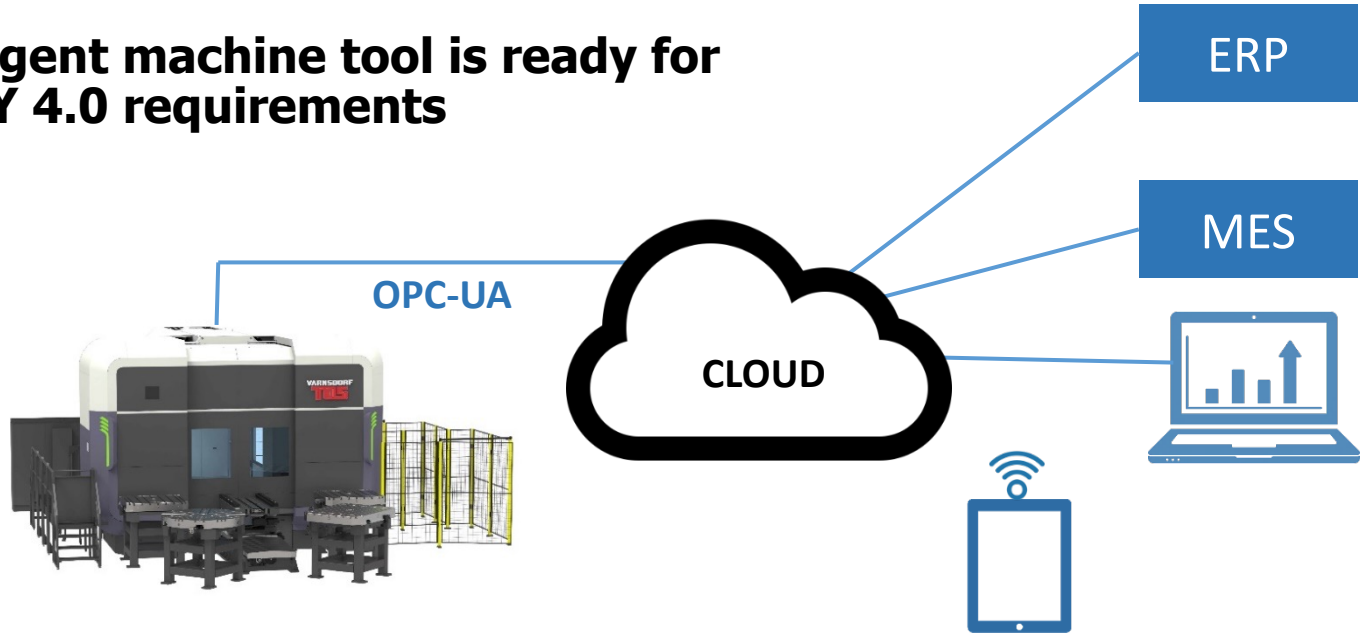
Extension over the basic control system interface that **other manufacturers do not use**



Added Value of TOS Control

- Machine **integration** to plant information system – online data exchange
- Planning with respect to **real machine state – online monitoring and prediction**
- Improvement of machine tool **functionality** – machining, inspection, compensation …
- **Digital twin** for **technology check, machining results** check and **machining process improved monitoring**
- **Unified interface and connectivity**
- User friendly **interaction** with operator, foreman and planner

The intelligent machine tool is ready for INDUSTRY 4.0 requirements



New control panels

Sinumerik 840D SL

- Newly for all machines sold since 01/2020
- Brand new design
- The panel body is always the same, changeable connection arm as needed
- 22“ touch screen

New control panels

Heidenhain TNC 640

- Newly for all machines sold since 01/2020
- Expedition 05/2020
- Brand new design
- The panel body is always the same, changeable connection arm as needed
- 24“ touch screen

New control panels

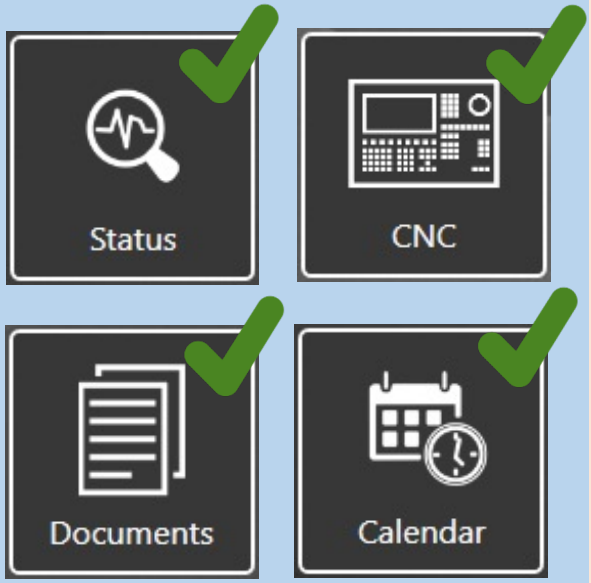
Both control panels can be optionally equipped with an RFID chip unit, which allows:

- Identification of machine operator and access level
- Quick login and logout of machine operator
- Possibility of quick “locking” of the machine

TOS Control – apps overview

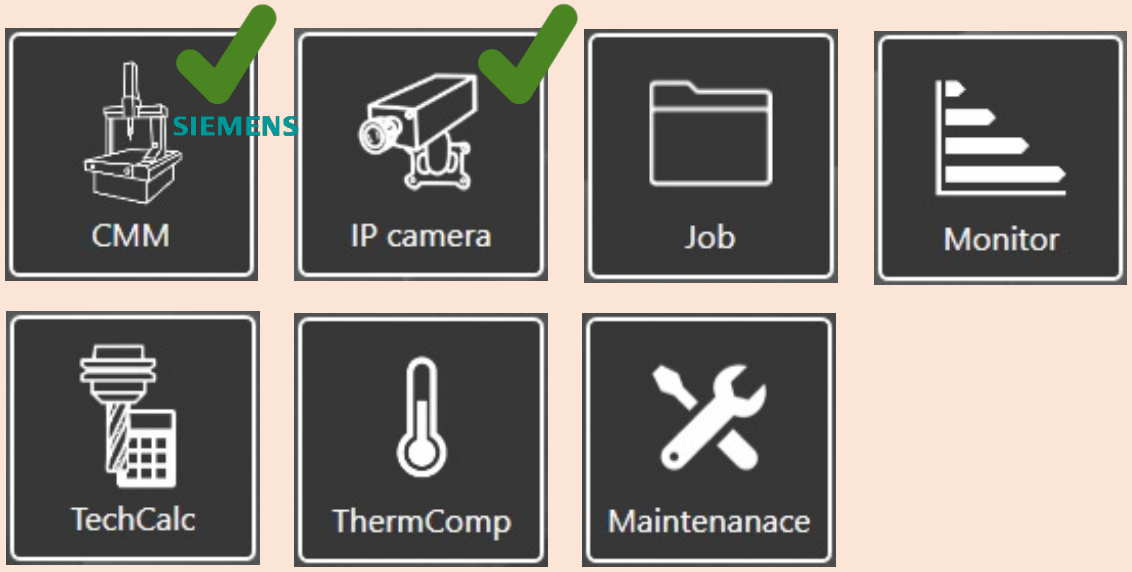
BASIC APPLICATIONS

- Standard equipment
- Included in the basic equipment of the machine



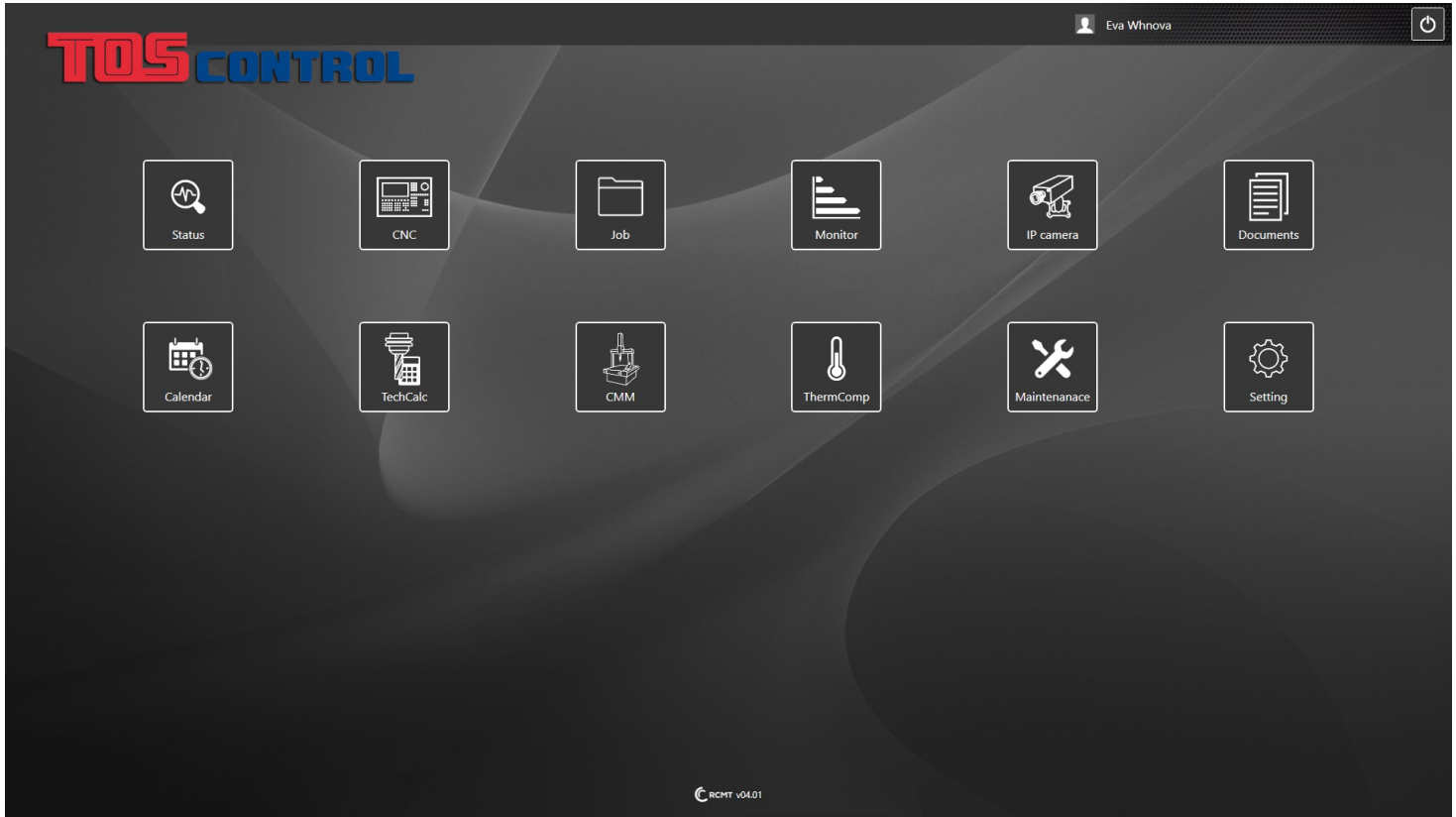
EXTRA APPLICATION

- Additional machine equipment (surcharge)
- Enables full utilization of TOScontrol's potential



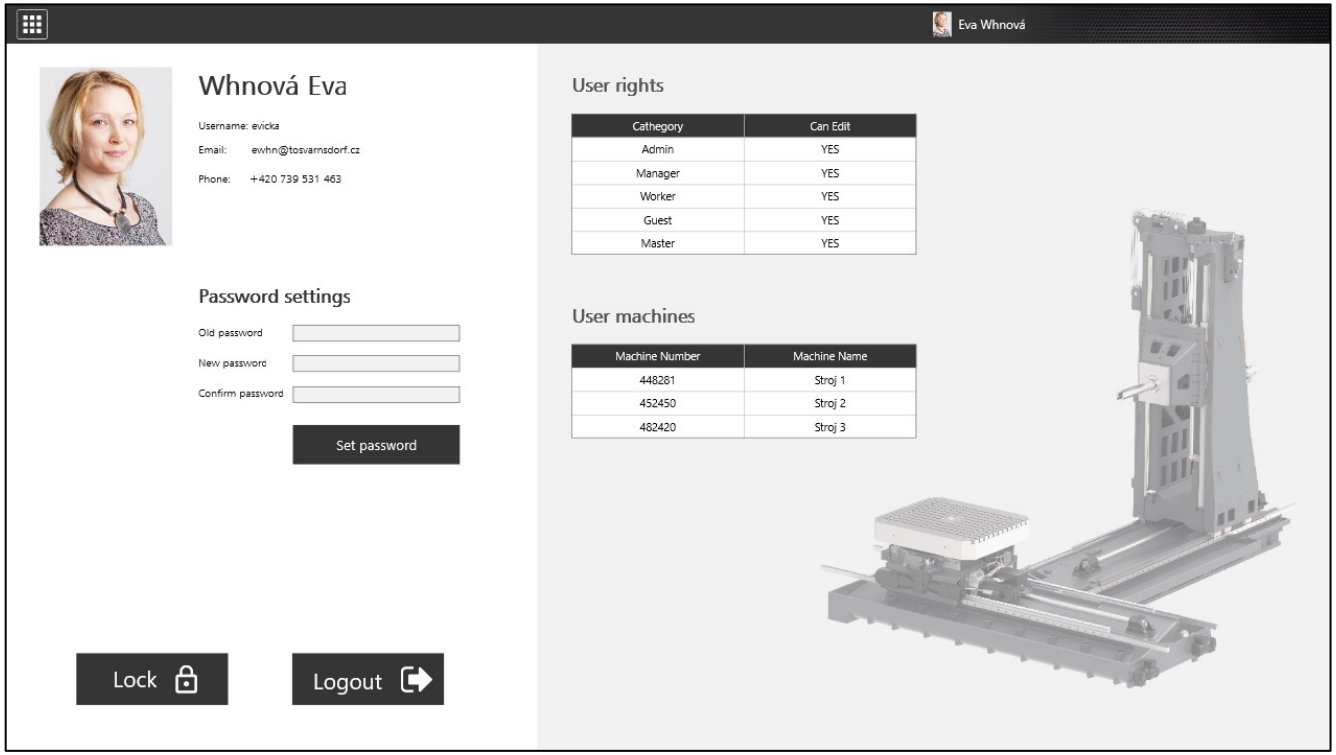
TOS Control – Main menu

- **Main screen** after control system loading
- **Overview** of individual application – like on smartphone
- **Logged user ID**
- Power off button



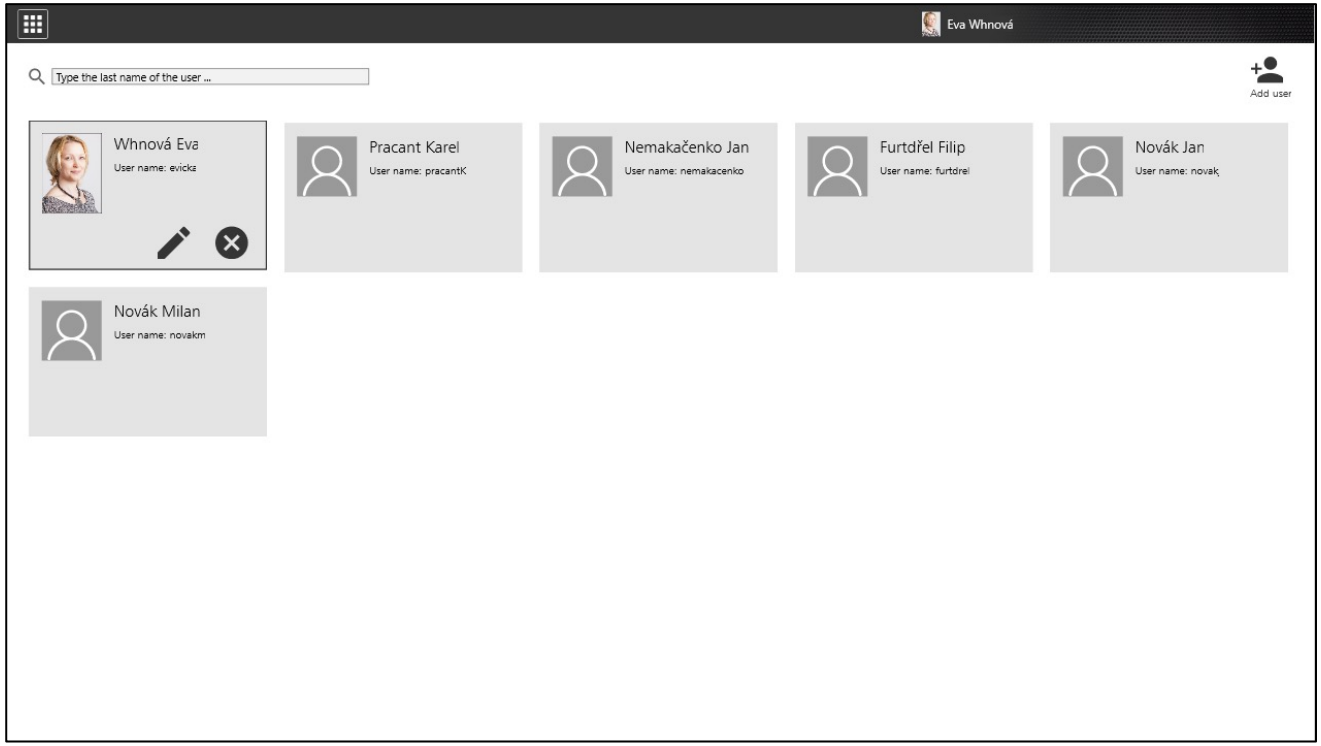
TOS Control – User account

- User Information
- Overview of its rights, folders and access to the machine
- Option to log out or lock screen
- Possibility to change the password



TOS Control – Administration of user accounts

- Access only with Administrator rights
- Overview of all users
- Ability to add a new user
- Editing and deleting users
- Allocation of user rights



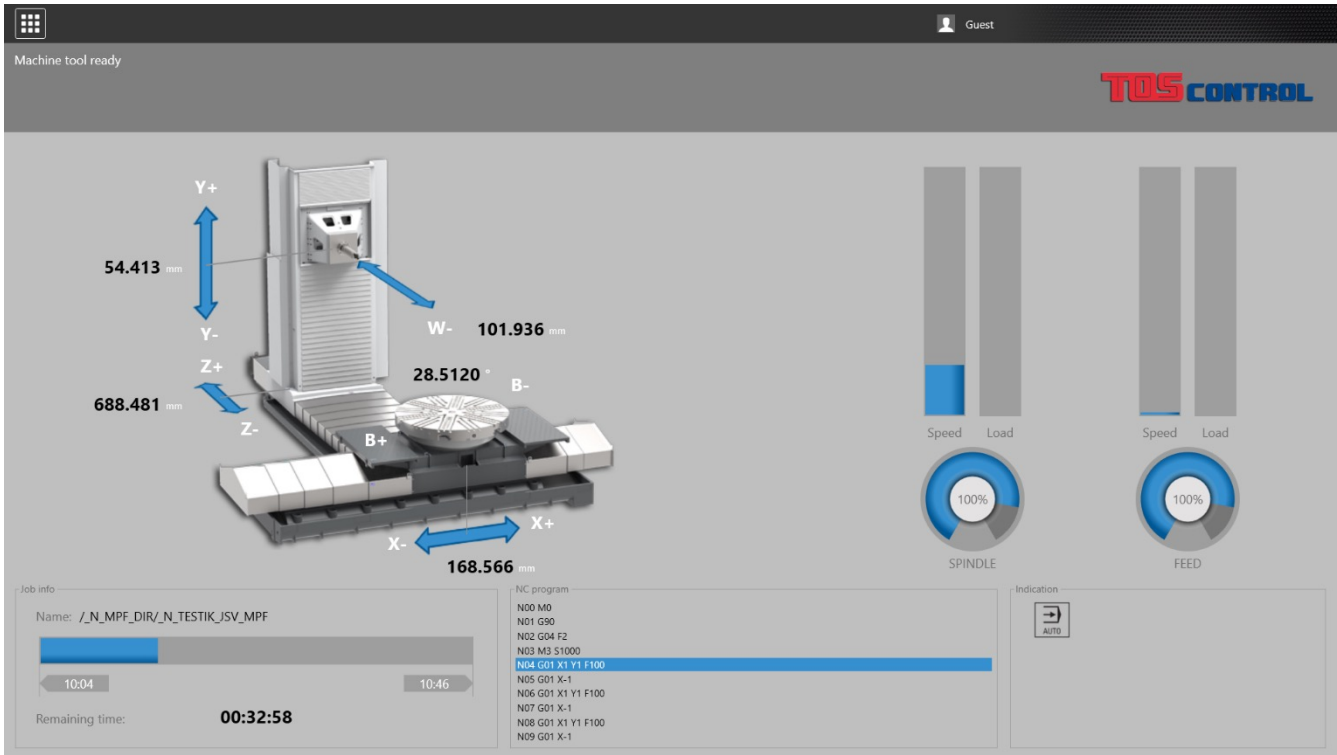
Status

TOS Control – Status

Category: BASIC APP

State: READY

- Overview of **machine tool state** – virtual cockpit
  - Actual program, process flow
  - Actual position of machine axes
  - Override, speed, machine load
  - Operation mode
  - Alarms

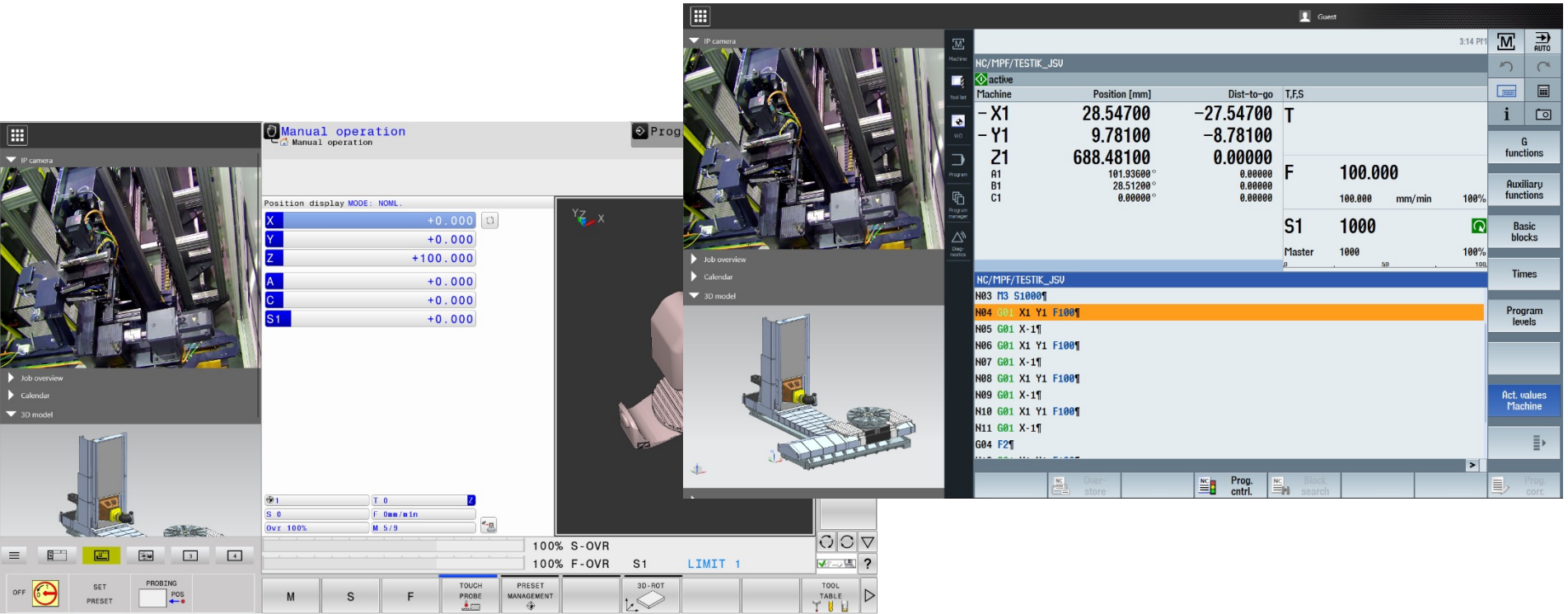


TOS Control – CNC

Category: BASIC APP

State: Ready

- View of **standard control system HMI**
  - Sinumerik Operate
  - Heidenhain HEROS
- Ready for Siemens Sinumerik 840D sl, finalization for Heidenhain TNC640
- Uniform design of side bar – e.g. IP cam, 3D model, Calendar …

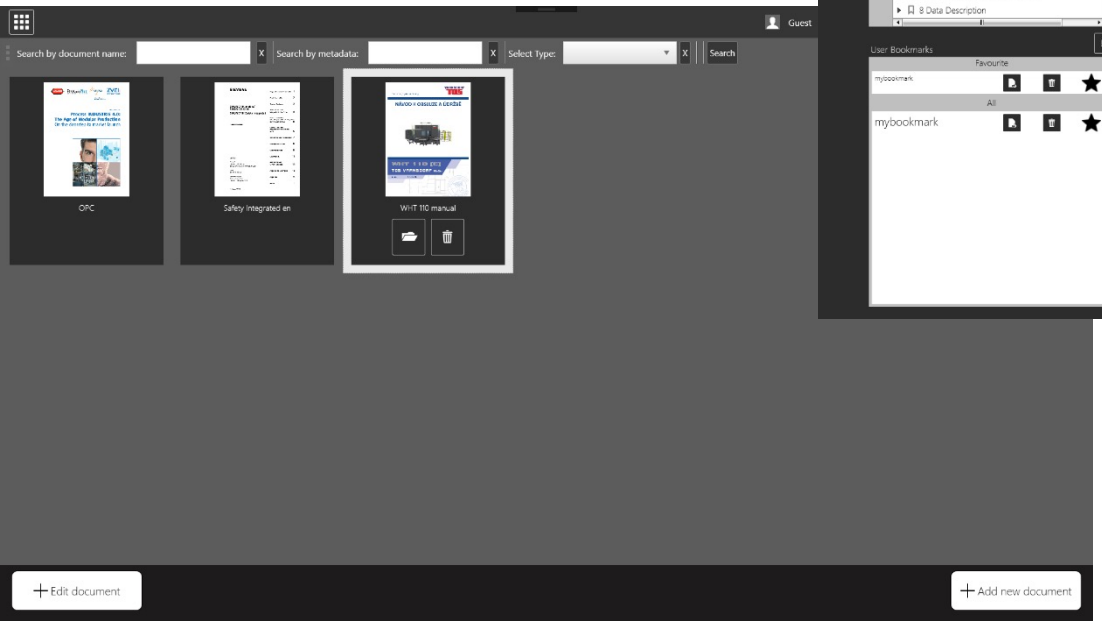


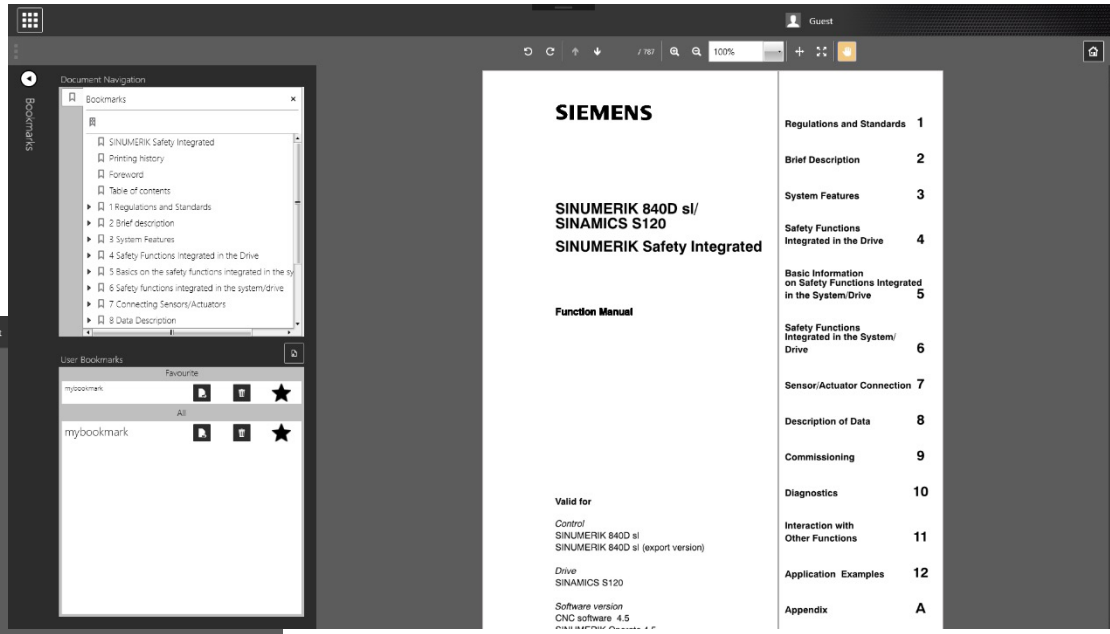
TOS Control – Dokuments

Category: BASIC APP

State: READY

- **PDF document reader**
- Document **access control** based on user group
- Favorite documents
- Bookmarks
- Smart document search based on title, type, and keywords



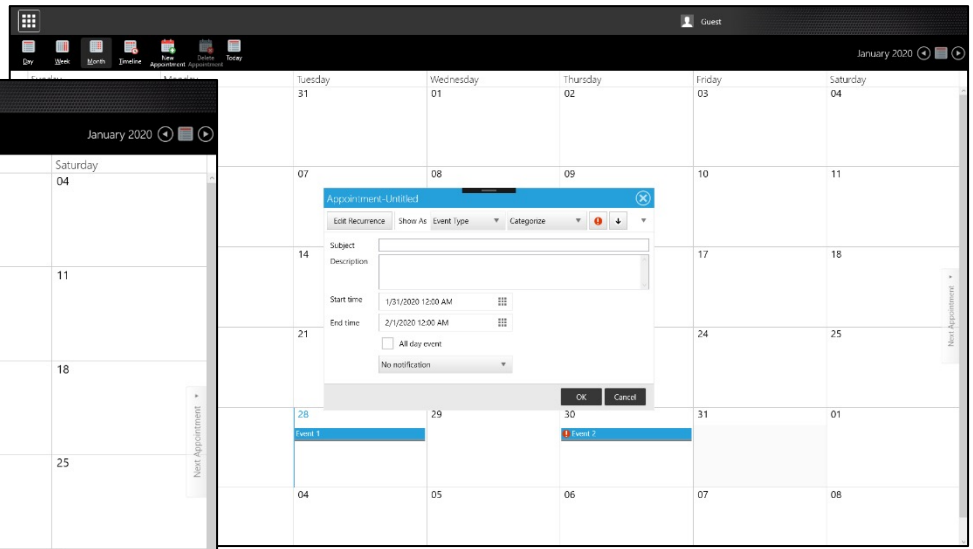


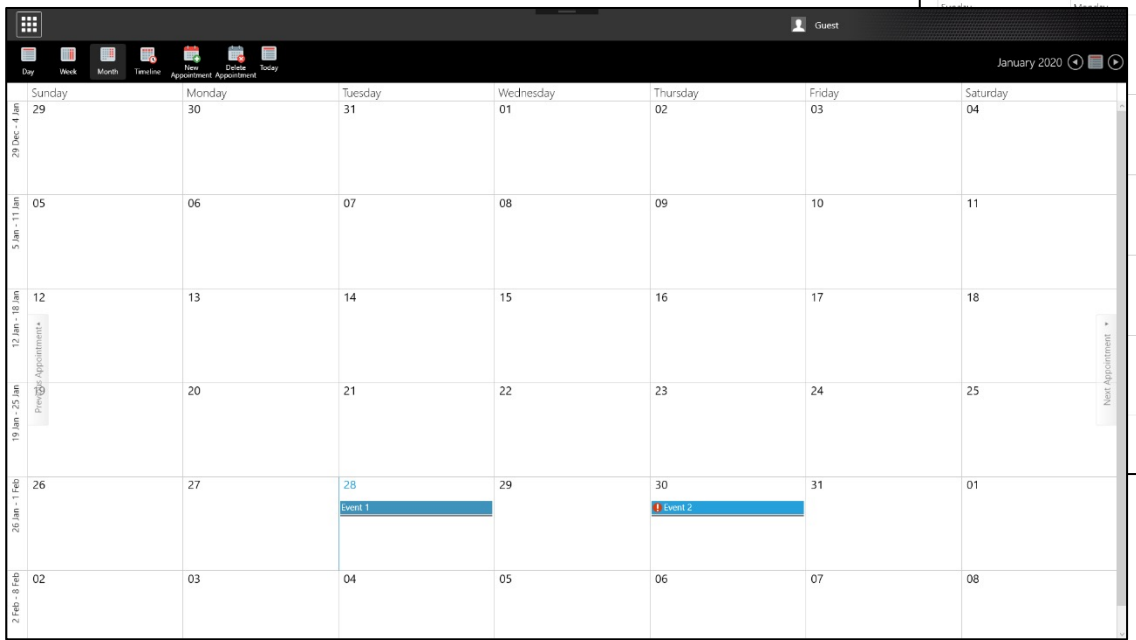
TOS Control – Calendar

Category: BASIC APP

State: READY

- Standard **calendar** view – day, week, month
- **User appointment** – add, modify, delete
- Machine tool producer appointment – **service events**
- Event types based on user needs
- Calendar **reminder**
- All data stored in the **local database**





TOS Control – IP cam

Category: EXTRA APP

State: READY

- Integration of **IP camera view**
- Motorized camera control

TOS Control – Technology calculation

Category: EXTRA APP

State: **Development**

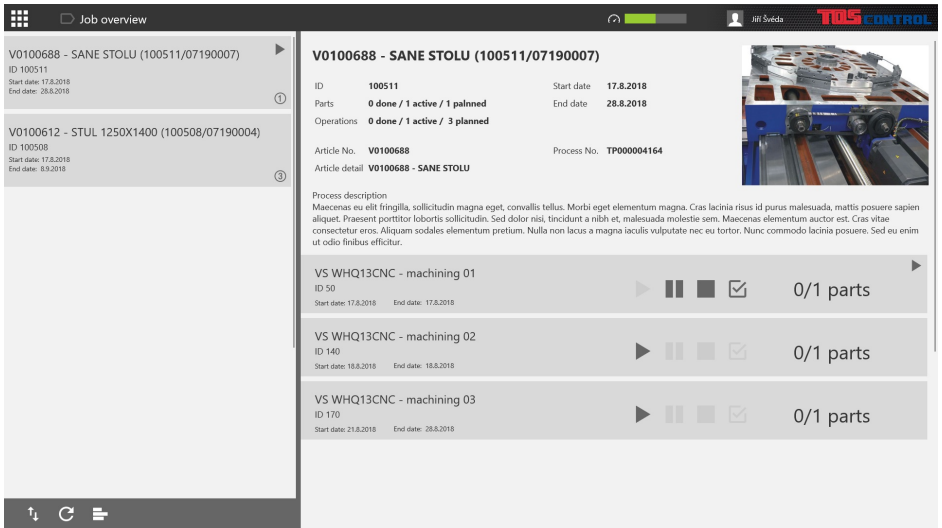
- **Technological advisor** for selected tool
- Support for the selection and check of **cutting conditions:**
  - Cutting speed determination
  - Feed per tooth/revolution
  - Feed speed
  - Theoretical machining time per operation
  - Material removal rate for selected depth of cut
  - Prediction of cutting force and spindle load

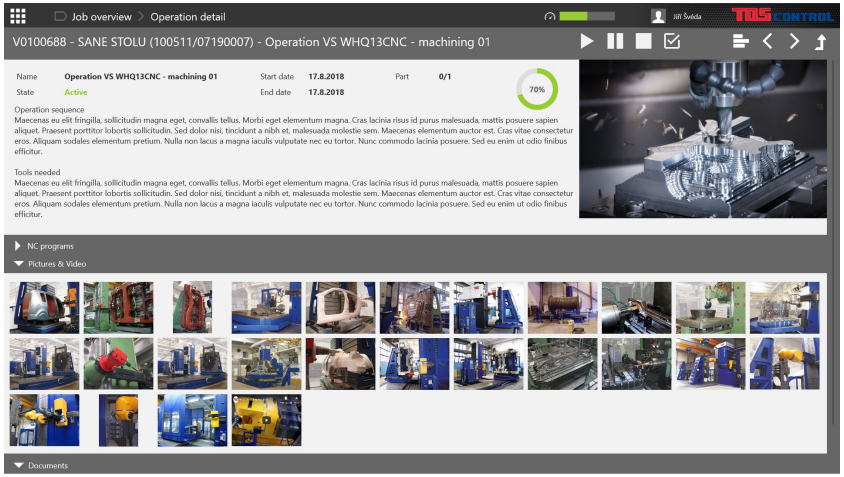
TOS Control – Job management 1/2

Category: EXTRA APP

State: **Development**

- View of **Work order and Operation overview** directly on machine tool control panel
- **Connected with ERP**
- Logging **operation, pause, stop, done**
- Work order time line view
- **Connection** with other documents
  - WO/Operation description
  - NC programs
  - Photos
  - Other documents – pdf, doc, xls, cad …



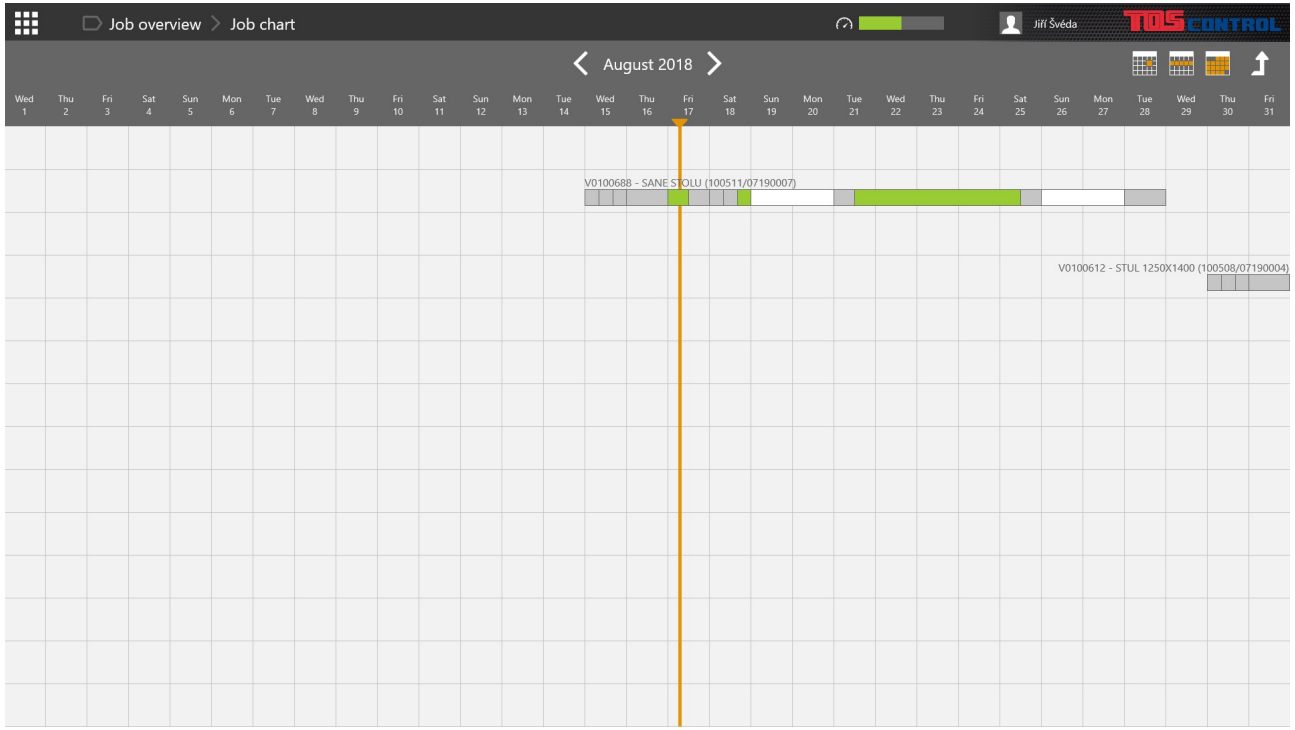


TOS Control – Job management 2/2

Category: EXTRA APP

State: **Development**

- Connection to ERP / MES system
- It can automatically assign tasks to a machine of the same type
- When entering the machine status, takes into account also this parameter for action selection
- Production optimization using logic algorithms



TOS Control – Machine monitor

Category: EXTRA APP

State: **Development**

- Integration of a system for **monitoring the history of machine tool use** – data logging to database, show trends
- **Time line** view of machine tool basic states
  - Production
  - Production slow (override < 100%)
  - Ready
  - Error
  - Power off
- Log of **other variables**
  - Temperature
  - Acceleration
  - Load
- Possible assignment to single operation

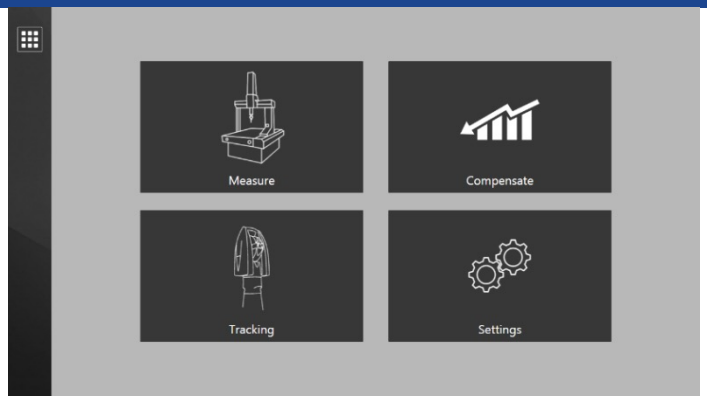
CMM

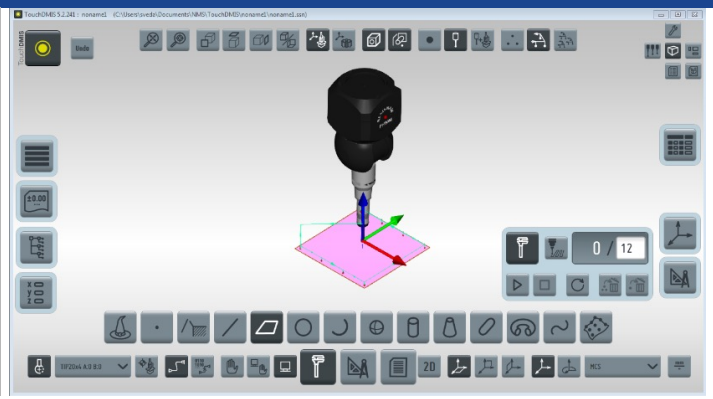
TOS Control – Inspection and compensation 1/2

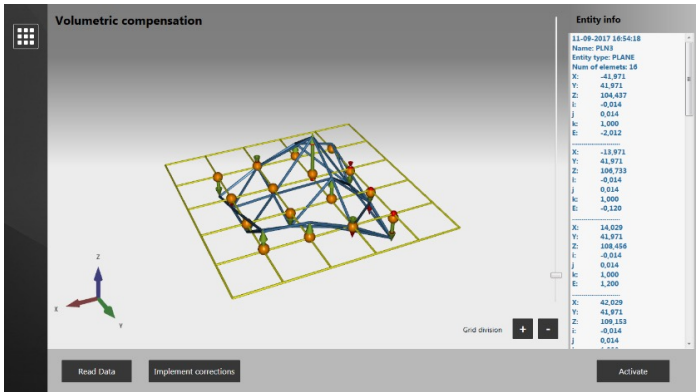
Category: EXTRA APP

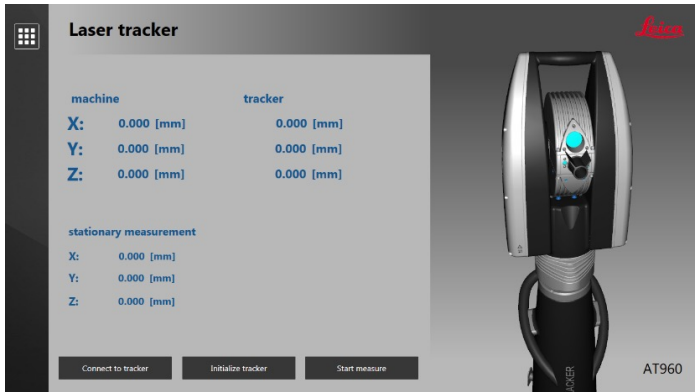
State: READY

- Integration of **CMM with touchprobe into the machine tool**
  - Integration of **metrology software** to machine control
  - Implementation of **additional measurement** for machine error compensation during workpiece inspection
- **Automatic compensation** for consequent machining based on measured data









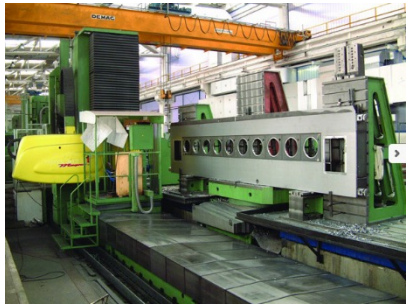
CMM

TOS Control – Inspection and compensation 2/2

Category: EXTRA APP

State: READY

- **Main advantages**
  - It is not necessary to move and clamp the workpiece between CMM and machine tool
  - Machine tool is controlled directly from a **metrology software – comfortable**
  - Measured data can be automatically activated as a **correction in CNC – no NC program modification** for consequent machining
  - Machine tool knows the workpiece real shape



- **Additional measurement**
  - Correction of the touch coordinates
  - Integrated optical measurement of TCP
  - Or external measurement – laser tracker

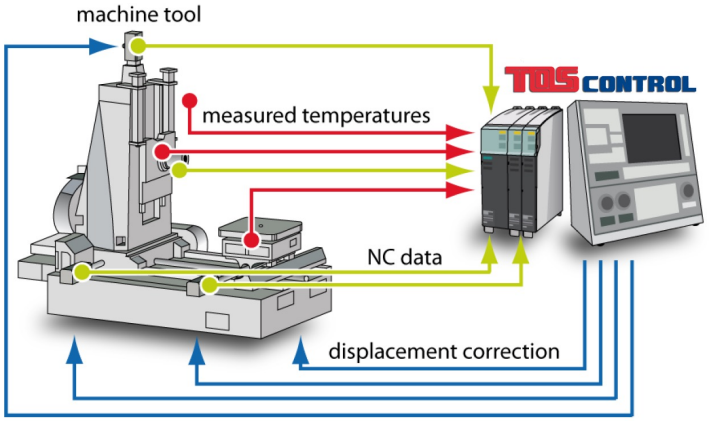
ThermComp

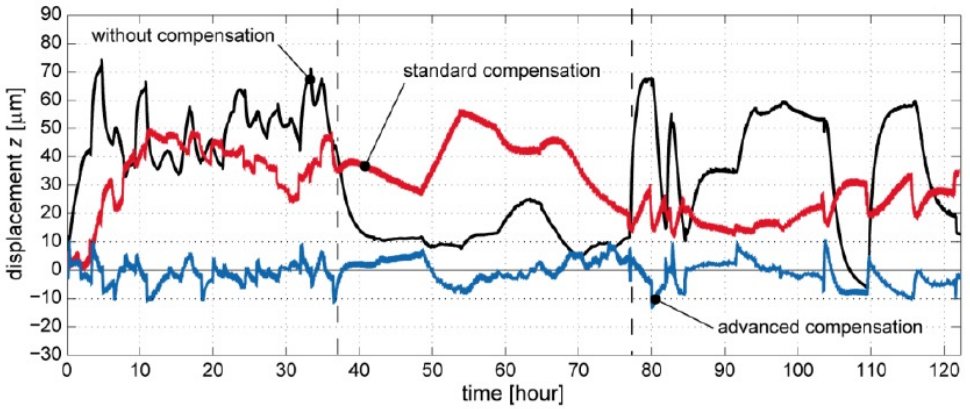
TOS Control – Thermal compensation

Category: EXTRA APP

State: **Development**

- **Virtual model** of the thermal behavior of the machine tool (based on thermal transfer functions)
- Runs simultaneously with real machine and **identifies the thermal error**
- **Respects the history of thermal loading**
- Model inputs
  - Temperature sensors
  - Spindle and feed axis load
  - Other NC data
- **The main advantage is high reliability and accuracy**
- **Top level** of thermal error compensation





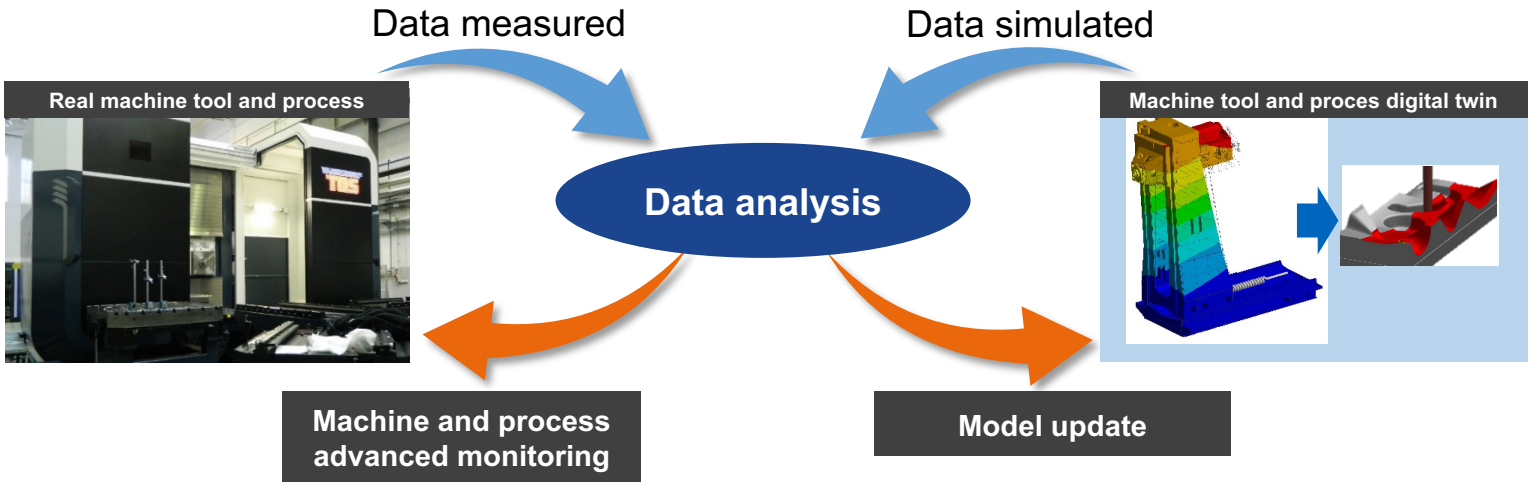
Maintenanace

TOS Control – Predictive maintenance

Category: EXTRA APP

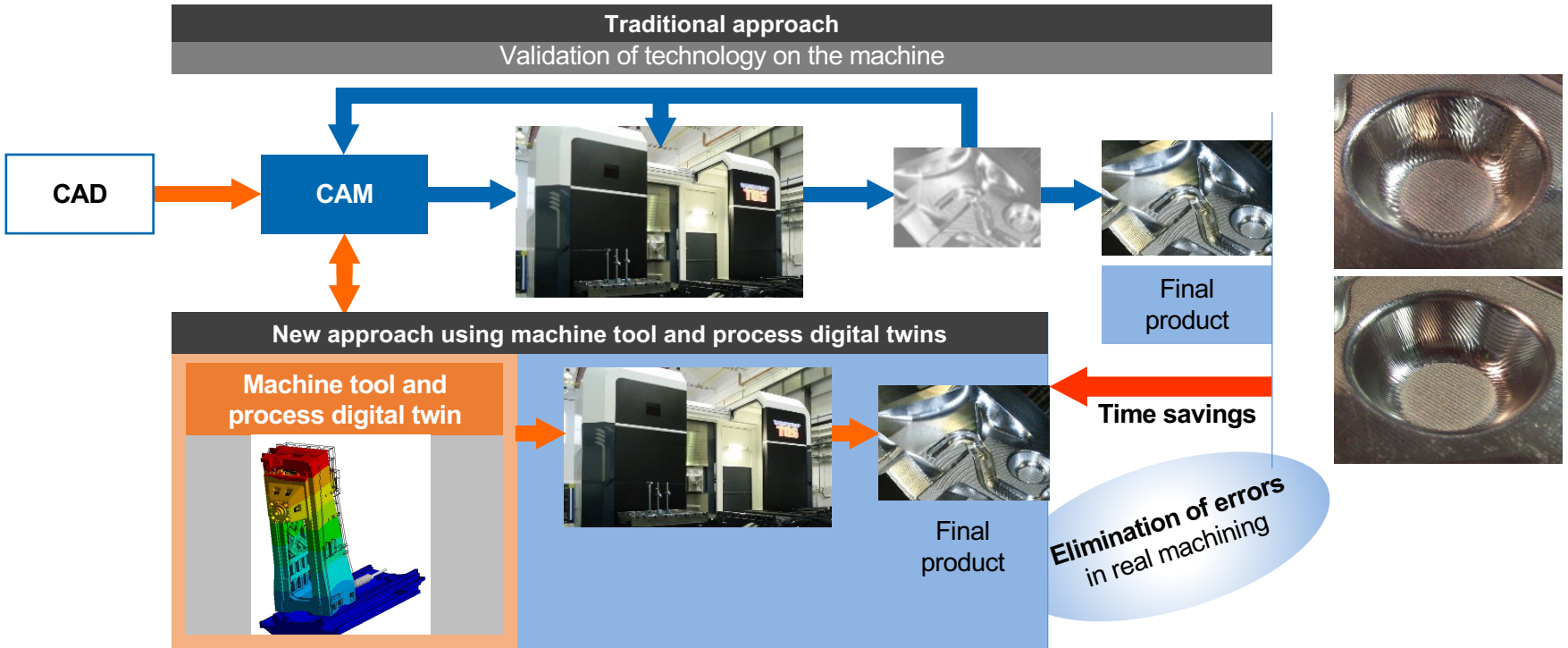
State: **Development**

- Extension of Machine monitor app
- Monitored parameters are **compared with**
  - **Digital twin (virtual machine model)**
  - Model obtained by **machine learning technology**
- Prediction of **service events**
- Focused on selected machine key parts, especially:
  - **Spindle**
  - Milling head
- **Reduction of service costs**, increase of machine operation time



Machine tool digital twin (virtual machine model)

- Common approaches of machining preparation using **standard CAM systems** does not exploit full potential of the machine and technology
- Adjustment of machining technologies is only implemented by trial tests
- **Machine tool and process digital twins** provide effective tools for **higher reliability** and **optimization of real machining processes**
  - Time and cost reduction



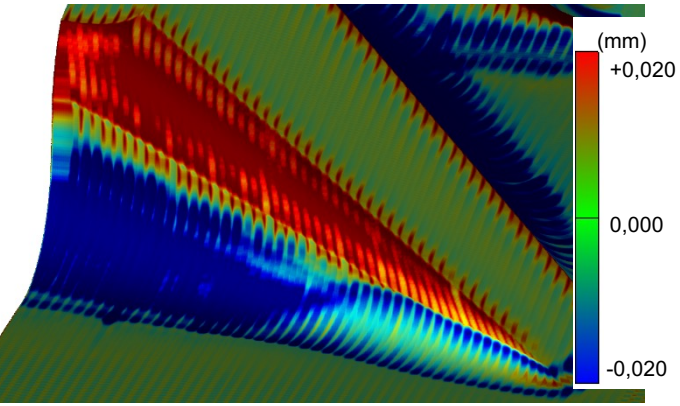
Machine tool digital twin (virtual machine model)

Applications:

- Exact **time studies**
- Check of the **NC data quality**
- Prediction of **machining accuracy and quality**
- Identification of **machining errors**

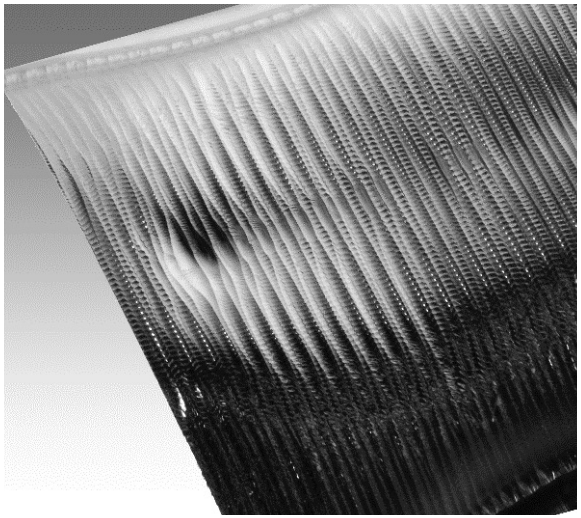
Virtual machine model integrated in the TOScontrol

Virtual machine model as technology support



Errors caused by CNC interpolation and feed drive vibrations

Real workpiece



Virtual simulation