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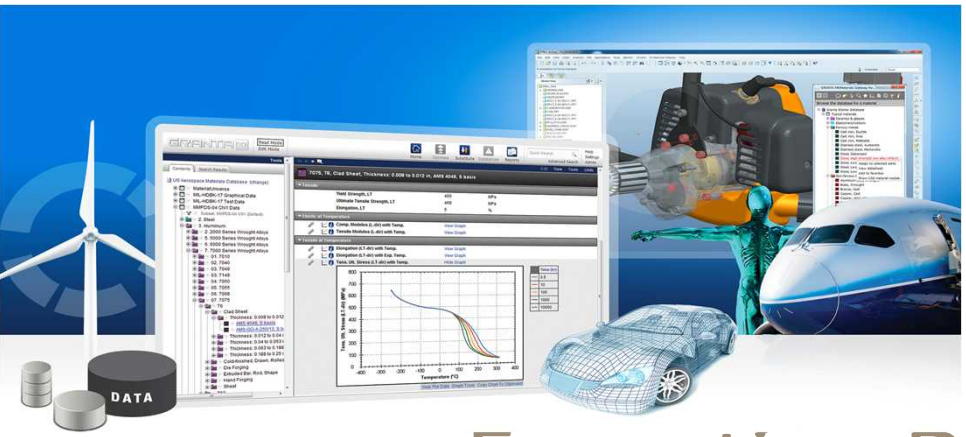


GRANTA MATERIAL INTELLIGENCE

# Exporting Data from Granta MI

Discussion with NEA&AWE, 2015-May-5

Richard Karnesky, rakarne@sandia.gov

U.S. DEPARTMENT OF ENERGY | National Nuclear Security Administration

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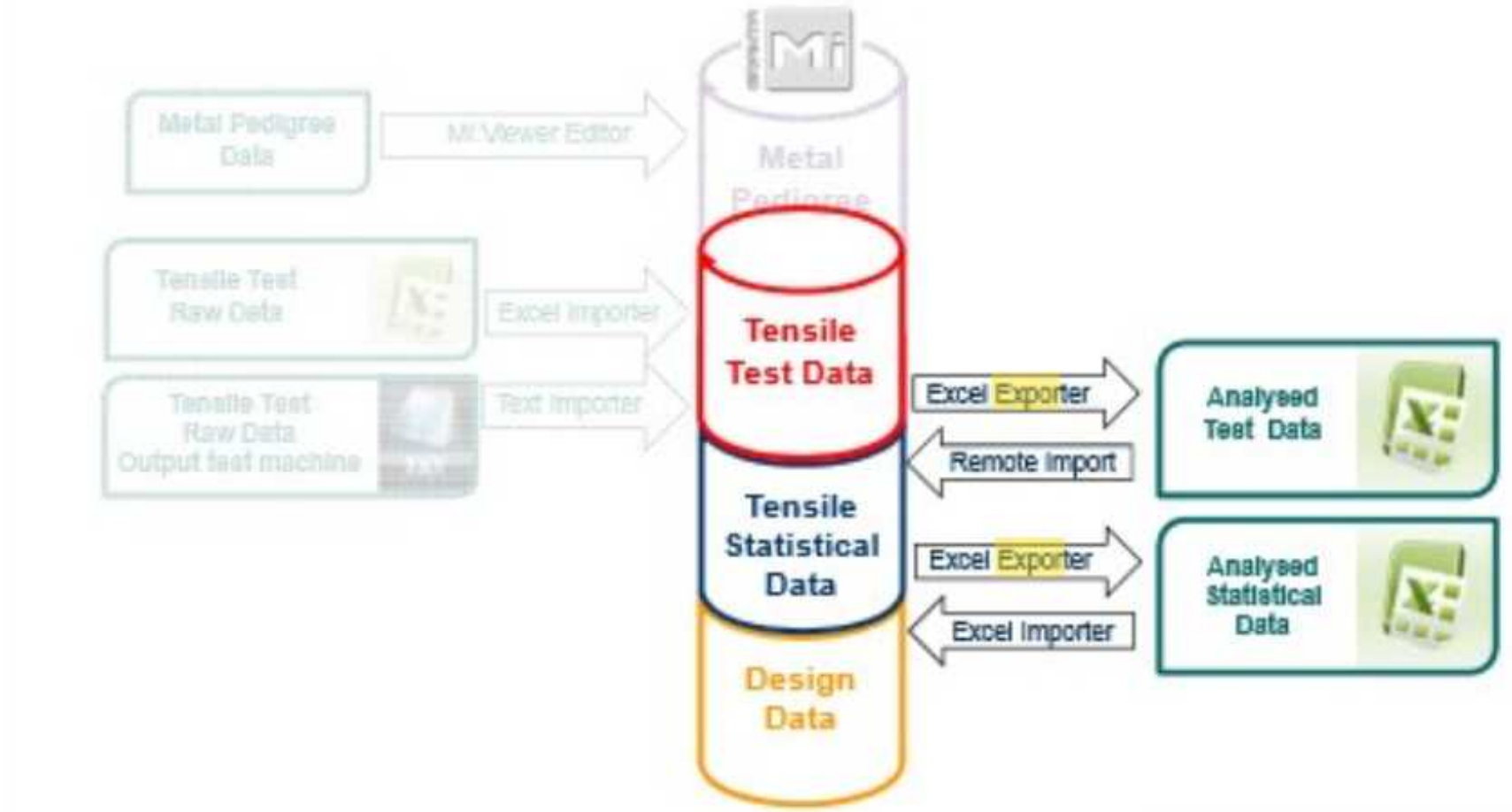
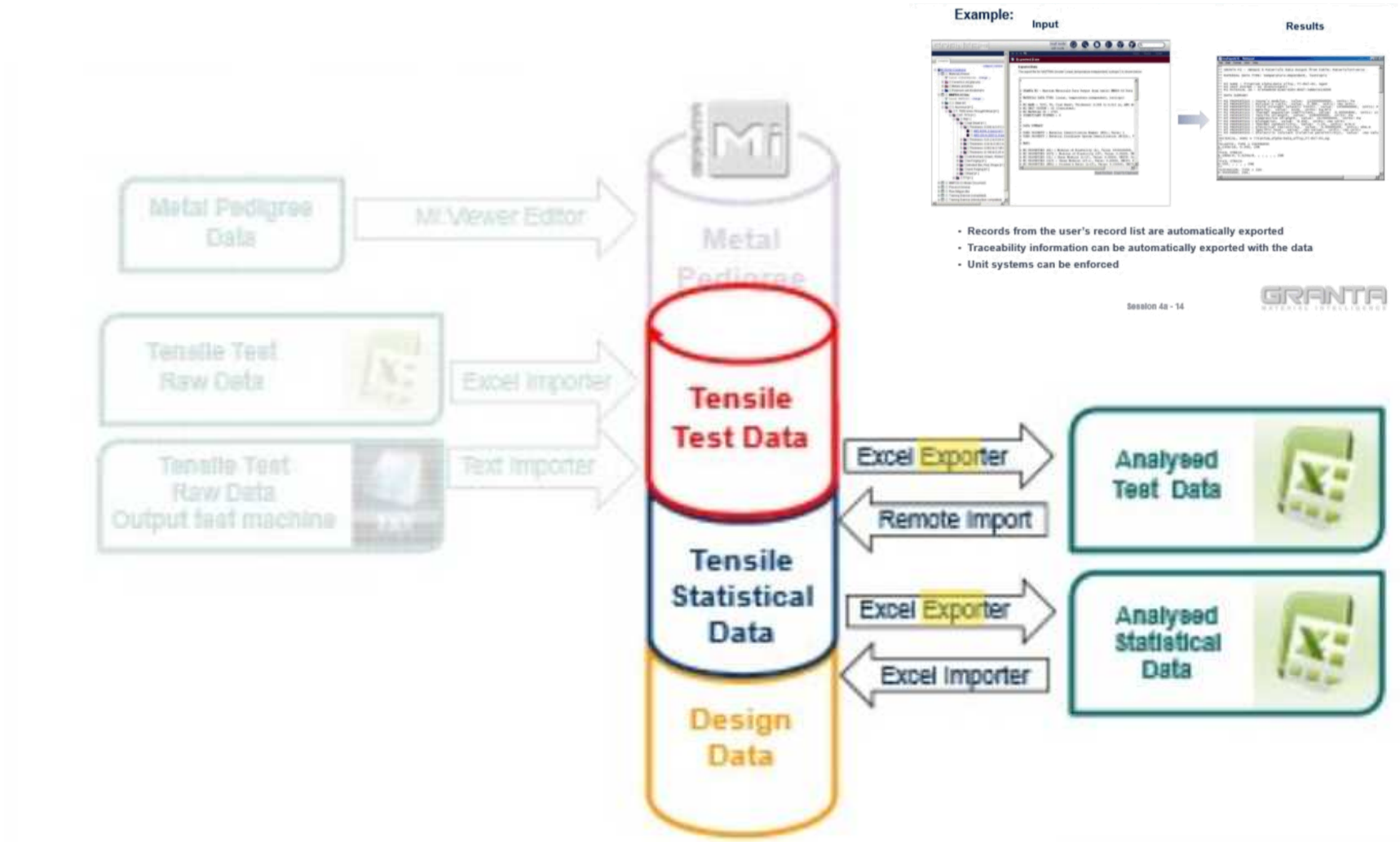
# First: A disclaimer

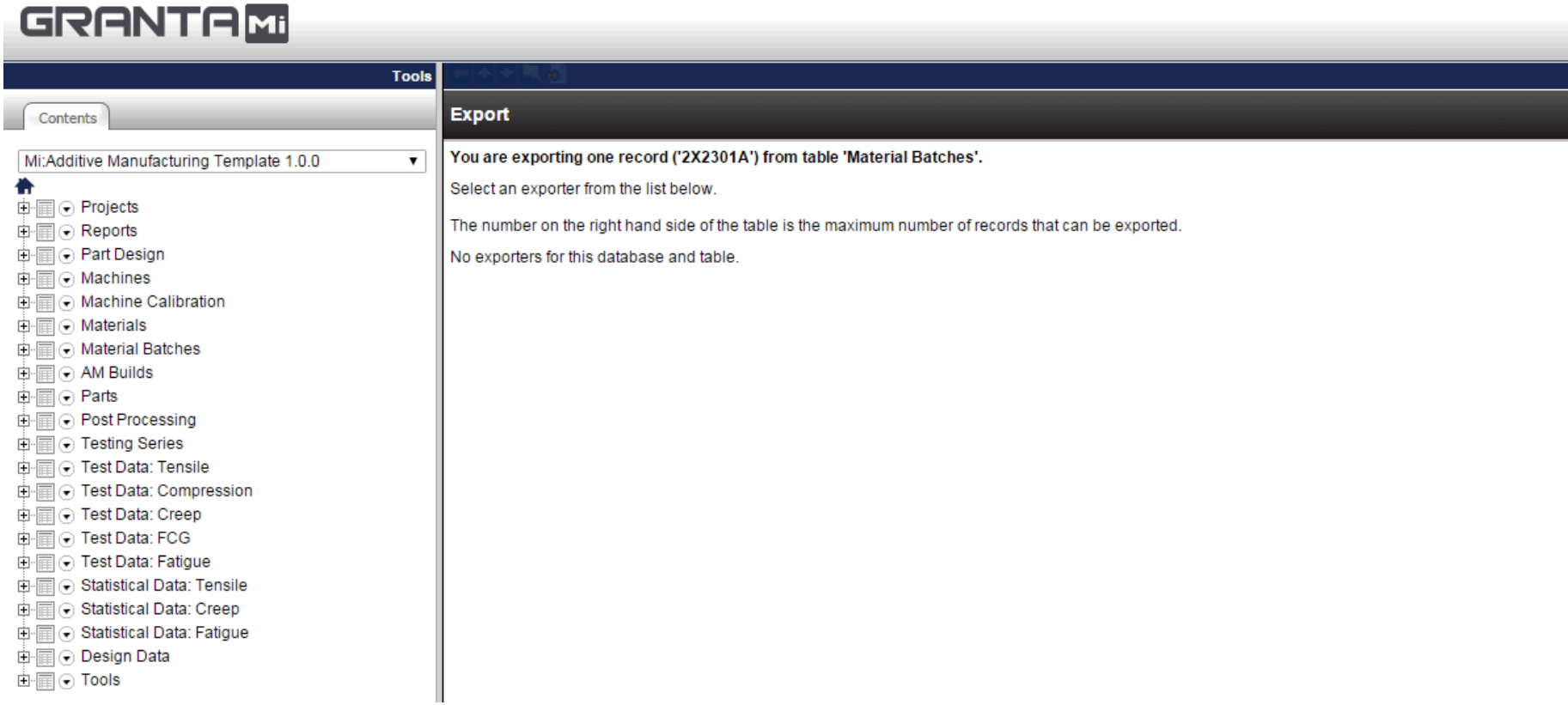
# First: A disclaimer…Desired workflow



# First: A disclaimer…Desired workflow

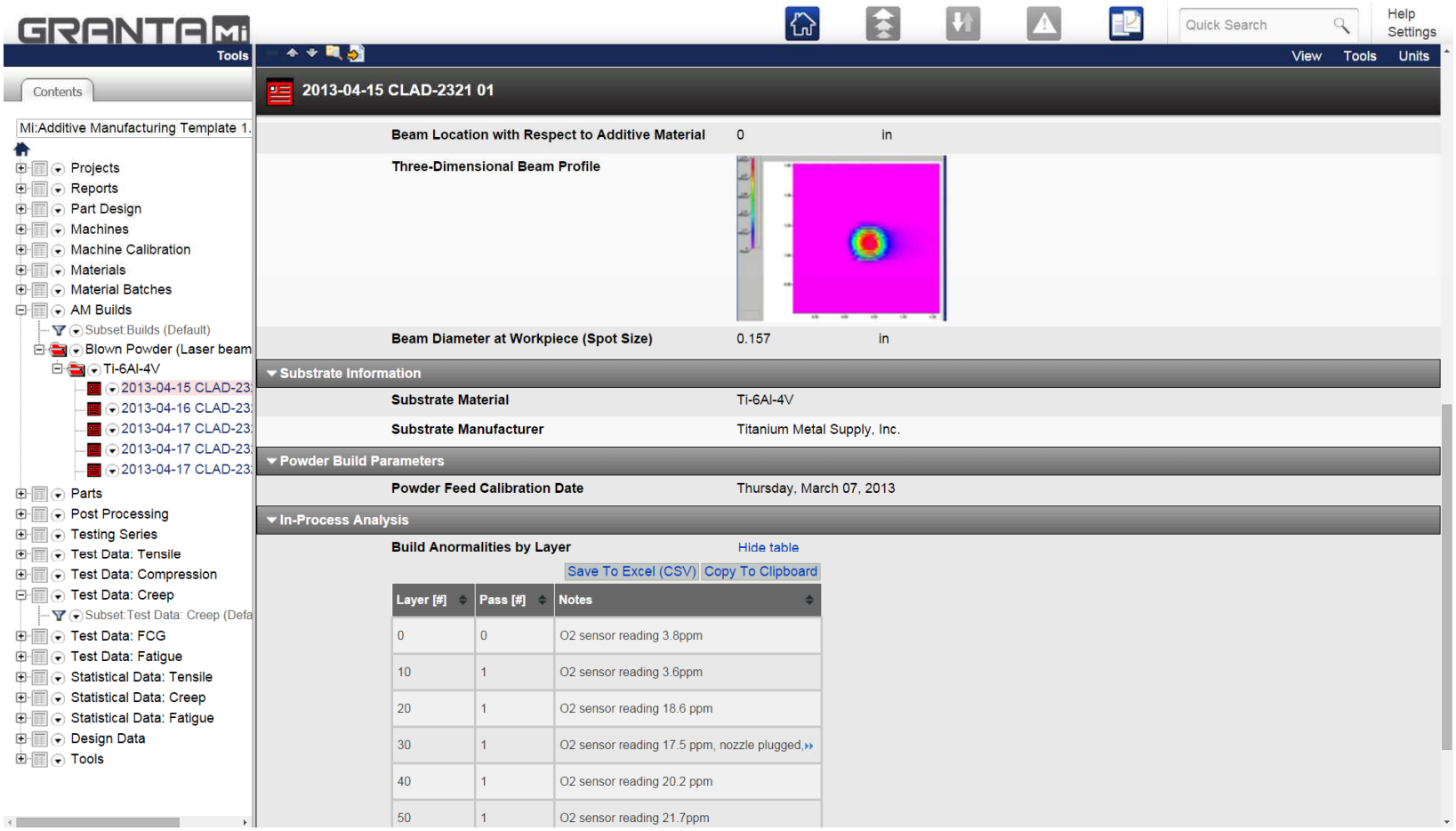


# First: A disclaimer…Current workflow

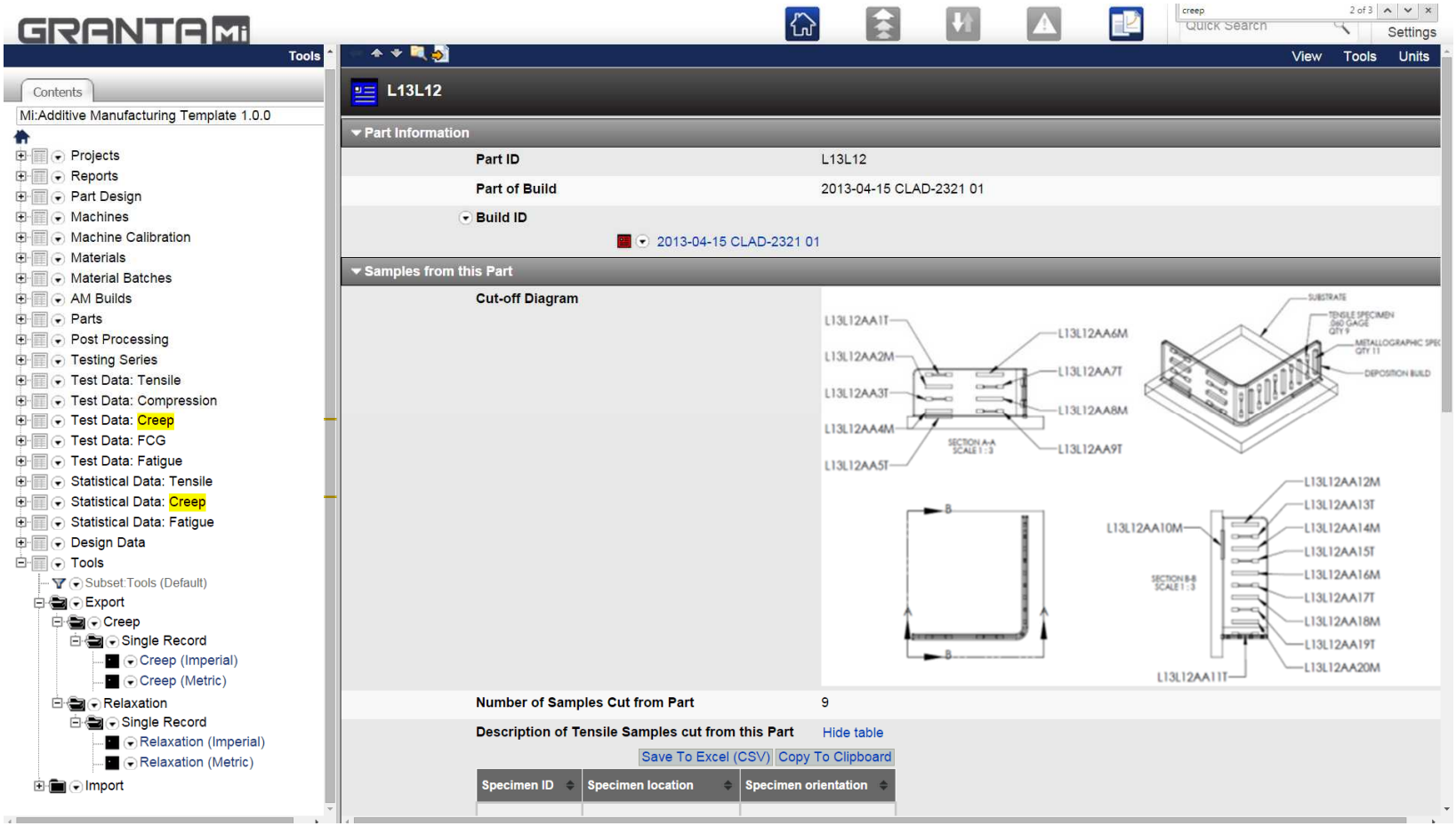



Version 1.0.0 of the MI AM template has very few exporters “built-in”.
Granta and the AM working group will no doubt add more in the future.

# That's not to say we can't already store useful data!

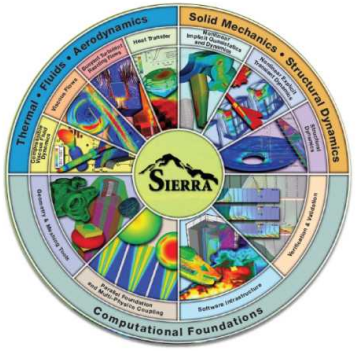


# And there are some extremely basic exporters already

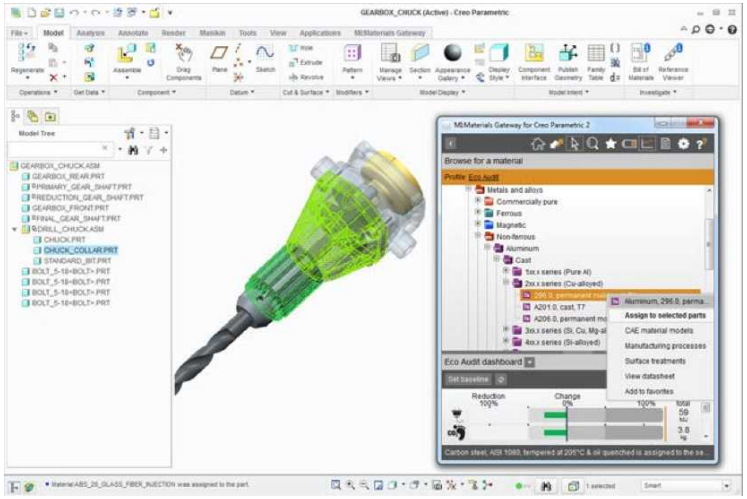


# But: SNL already makes use of GRANTA MI data in design and analysis

- **Sierra Mechanics Exporter *(J. Dike)***
  - Supply Temperature Dependent Response
  - Multiple Alloys
  - For use in statics code




- **Drafting via MI:Materials Gateway Tool *(A. Machado)***
  - Direct access to public and SNL-specific materials information
  - Direct insertion into CAD models





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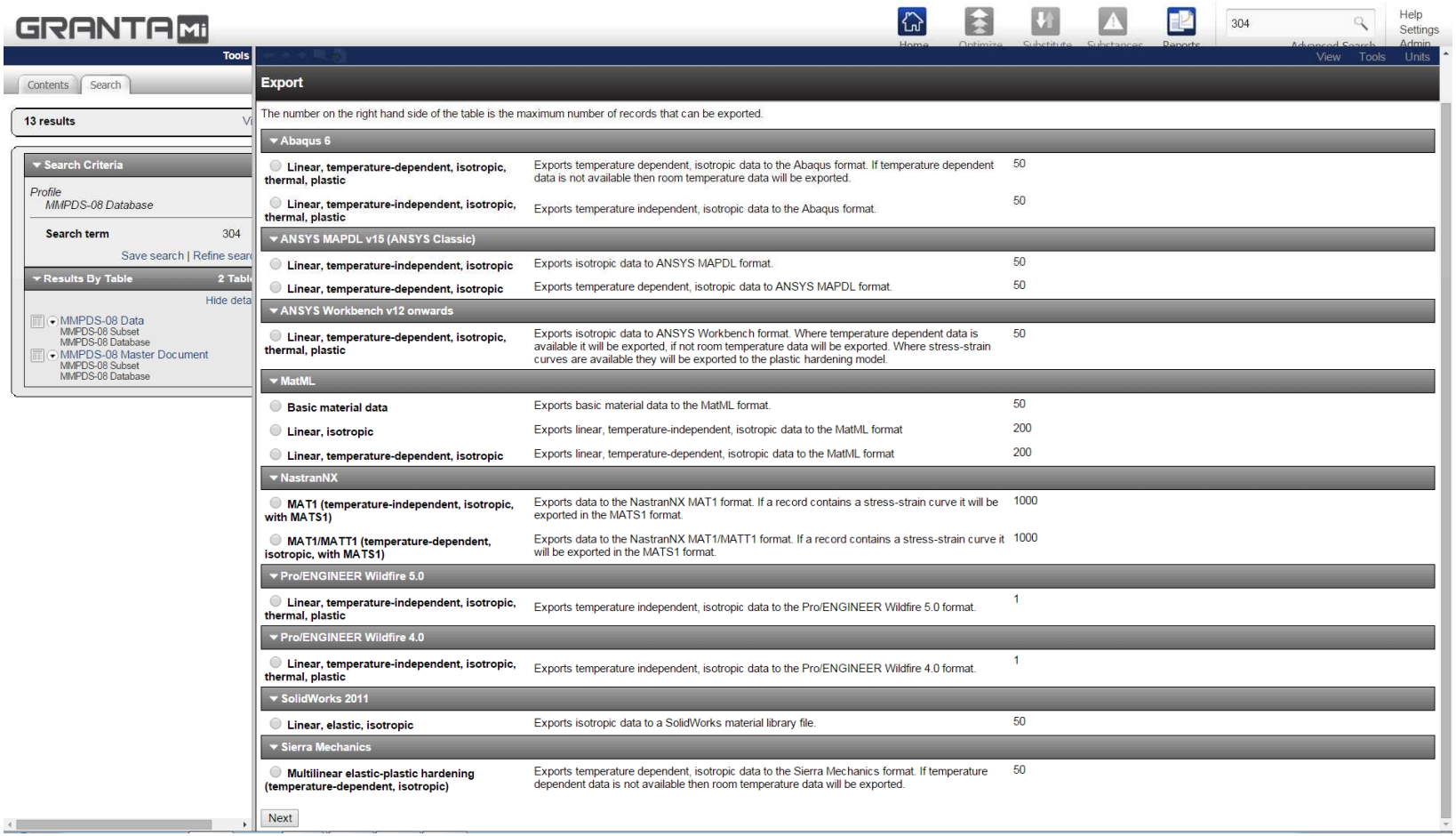
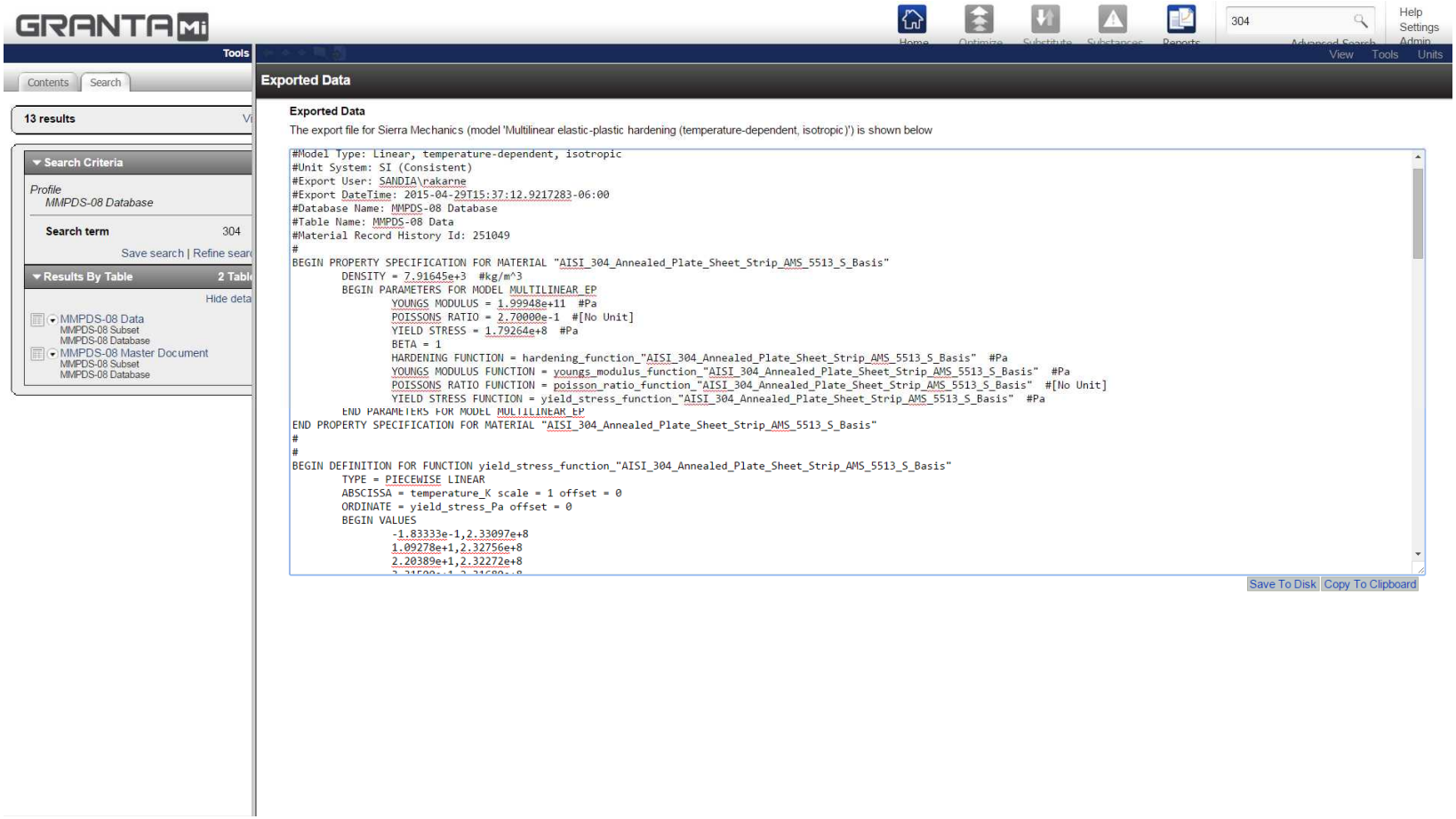
# Envisioned modes of data sharing

- Contribute to external database that uses Granta (e.g. ASM)
- Provide a raw database dump to other Granta users
- Allow web-based access to MI
  - We already do this for users of the SRN (can include non-Sandians)
  - We plan to do this for the SON for a “proof-of-principle” project
- Internally, we will allow integration with CREO
- We will use the export functionality built by the AM working group and in-house

# The MMPDS database gives an example of the rich export possibilities



# The Sierra Mechanics exporter was built for us by Granta



# Exporters are coded in XSLT and can be shared

```
<?xml version="1.0" encoding="utf-8"?>
<!--$Rev: 50662 $-->
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform" xmlns:fe="http://www.grantadesign.com/Granta-MI/exports" xmlns:xtn="http://www.grantadesign.com/xmlns/xtension">

<xsl:import href="CommonUtilities.xsl"/>
<xsl:include href="SierraMechanicsFunctions.xsl"/>

<xsl:output method="text"/>

<!--Some useful constants-->
<xsl:param name="nSigFigs" select="6"/>
<xsl:param name="noValue" select="'[No Value]'"/>
<xsl:param name="noUnit" select="'[No Unit]'"/>

<xsl:template match="tab">
  <xsl:text>&#x09;</xsl:text>
  <xsl:apply-templates select="tab"/>
  <xsl:copy-of select="self::node()[not(tab) and not(*/tab)]"/>
</xsl:template>

<!-- Output the boiler-plate that we put at the start of each record section in the Sierra Mechanics file -->
<xsl:template name="writeRecordHeader">
      <xsl:param name="modelType"/>
#GRANTA Material Name: <xsl:value-of select="xtn:escapeApos(string(@fullname))"/>
#Model Type: <xsl:value-of select="xtn:escapeApos($modelType)"/>
#Unit System: <xsl:value-of select="xtn:escapeApos(string(/fe:FEAExport/fe:definitions/fe:info/fe:UnitSystem))"/>
#Export User: <xsl:value-of select="xtn:escapeApos(string(/fe:FEAExport/fe:definitions/fe:info/fe:user))"/>
#Export DateTime: <xsl:value-of select="/fe:FEAExport/fe:definitions/fe:info/fe:date"/>
#Database Name: <xsl:value-of select="xtn:escapeApos(string(/fe:FEAExport/fe:definitions/fe:volumeDetails/@name))"/>
#Table Name: <xsl:value-of select="xtn:escapeApos(string(/fe:FEAExport/fe:definitions/fe:info/fe:table))"/>
#Material Record History Id: <xsl:value-of select="@recordHistoryIdentity"/>
#
</xsl:template>

<!-- Writes one of the MI PROPERTIES sections as part of the human readable pedigree attribute: Granta name of the attribue to look up in the initial XML -->
<xsl:template name="writePropertyValue">
      <xsl:param name="attribute"/>
      <xsl:param name="modelAttributeName"/>
      <xsl:param name="functionName"/>

  <xsl:variable name="attrDefinition" select="/fe:FEAExport/fe:definitions/fe:attributes/fe:attribute[fe:Name = $attribute]"/>
      <xsl:variable name="attr" select="fe:attributes/fe:attribute[@attributeID = $attrDefinition/@id]"/>

      <xsl:variable name="outputText">
      <xsl:value-of select="$modelAttributeName"/><xsl:text> = </xsl:text>
      <xsl:choose>
            <xsl:when test="$attr/fe:simpleValue"><xsl:apply-templates select="$attr/fe:simpleValue"/></xsl:when>
            <xsl:when test="$attrDefinition/@CESAttributeType='functional'"><xsl:value-of select="$functionName"/></xsl:when>
   <xsl:otherwise><xsl:value-of select="$noValue"/></xsl:otherwise>
      </xsl:choose>
      <xsl:text>  #</xsl:text>
      <xsl:choose>
            <xsl:when test="$attrDefinition/fe:Units/@name"><xsl:value-of select="$attrDefinition/fe:Units/@name"/></xsl:when>
            <xsl:otherwise><xsl:value-of select="$noUnit"/></xsl:otherwise>
      </xsl:choose>
      <xsl:text>&#xD;&#xA;</xsl:text>
      </xsl:variable>

      <xsl:value-of select="xtn:escapeApos(string($outputText))"/>

</xsl:template>

<xsl:template name="writeFunction">
  <xsl:param name="functionName"/>
  <xsl:param name="functionalValues"/>
  <xsl:param name="parameterValues"/>
  <xsl:param name="ordinateName"/>

  <!-- Write the yield stress function -->
  <xsl:text>BEGIN DEFINITION FOR FUNCTION </xsl:text>
  <xsl:value-of select="$functionName"/>
  <xsl:text>&#xD;&#xA;</xsl:text>

  <xsl:choose>
```

# Summary

- We are not yet exporting AM data
  - Nobody else really seems to be either!
- …But we ARE exporting data in other databases
- We will use this experience to carefully critique the AM schema and how we add/use data
- The exporters are likely being built, and we may have the ability to help build them
- In addition to the technical aspects of coding an exporter that is most useful to end users, we are cognizant of other modes of data sharing and of the administrative/permission concerns