LISE^{++} Config File Previews

Hudson Miltner

New Isotope Research Group

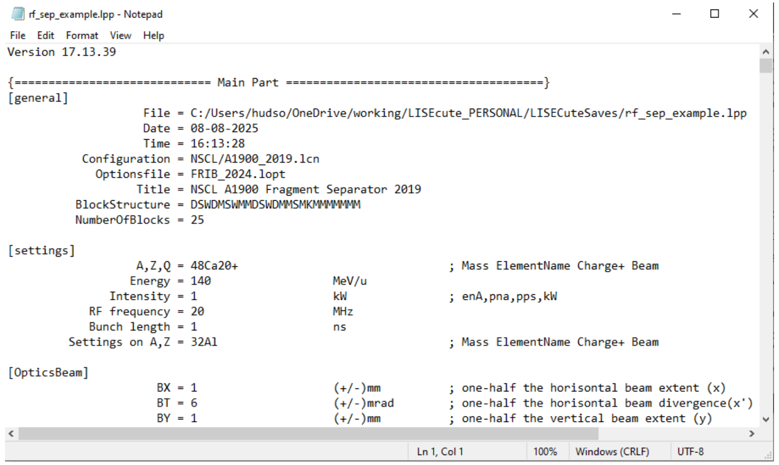
Facility for Rare Isotope Beams, Michigan State University, East Lansing, MI 48824 USA

Date 09/17/2025

This material is based upon work supported by the U.S. Department of Energy, Office of Science, Office of Nuclear Physics and used resources of the Facility for Rare Isotope Beams (FRIB) Operations, which is a DOE Office of Science User Facility under Award Number DE-SC0023633, and by the US National Science Foundation under Grants No. PHY-20-12040 and 23-10078 “Windows on the Universe: Open Quantum Systems in Atomic Nuclei at FRIB”.

.lpp File Format as .txt

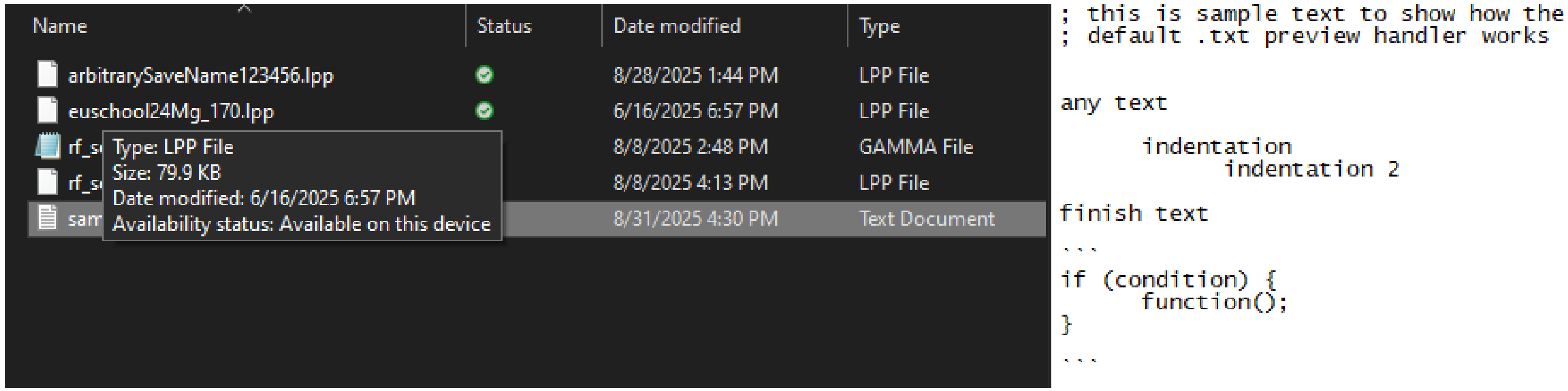
- The .lpp file format is already largely readable in its .txt format, viewable when viewed within notepad.
  - LISE^{++} parses this format for to load the precise configuration



```
Version 17.13.39

{============================= Main Part ======================================}
[general]
                    File = C:/Users/hudso/OneDrive/working/LISEcute_PERSONAL/LISECuteSaves/rf_sep_example.lpp
                    Date = 08-08-2025
                    Time = 16:13:28
           Configuration = NSCL/A1900_2019.lcn
             Optionsfile = FRIB_2024.lopt
                   Title = NSCL A1900 Fragment Separator 2019
          BlockStructure = DSWDMSWMMDSWDMMSMKMMMMMMM
          NumberOfBlocks = 25

[settings]
                   A,Z,Q = 48Ca20+                                ; Mass ElementName Charge+ Beam
                  Energy = 140                  MeV/u
               Intensity = 1                    kW                ; enA,pna,pps,kW
            RF frequency = 20                   MHz
            Bunch length = 1                    ns
         Settings on A,Z = 32Al                                   ; Mass ElementName Charge+ Beam

[OpticsBeam]
                      BX = 1                    (+/-)mm           ; one-half the horisontal beam extent (x)
                      BT = 6                    (+/-)mrad         ; one-half the horisontal beam divergence(x')
                      BY = 1                    (+/-)mm           ; one-half the vertical beam extent (y)
```

Figure 1: View of .lpp in Notepad (.txt-like format)

- Windows previews already exist for .txt type files as scrollable read-only displays integrated in the windows explorer.



Name	Status	Date modified	Type
arbitrarySaveName123456.lpp	✓	8/28/2025 1:44 PM	LPP File
euschool24Mg_170.lpp	✓	6/16/2025 6:57 PM	LPP File
rf_s		8/8/2025 2:48 PM	GAMMA File
rf_s		8/8/2025 4:13 PM	LPP File
sam		8/31/2025 4:30 PM	Text Document

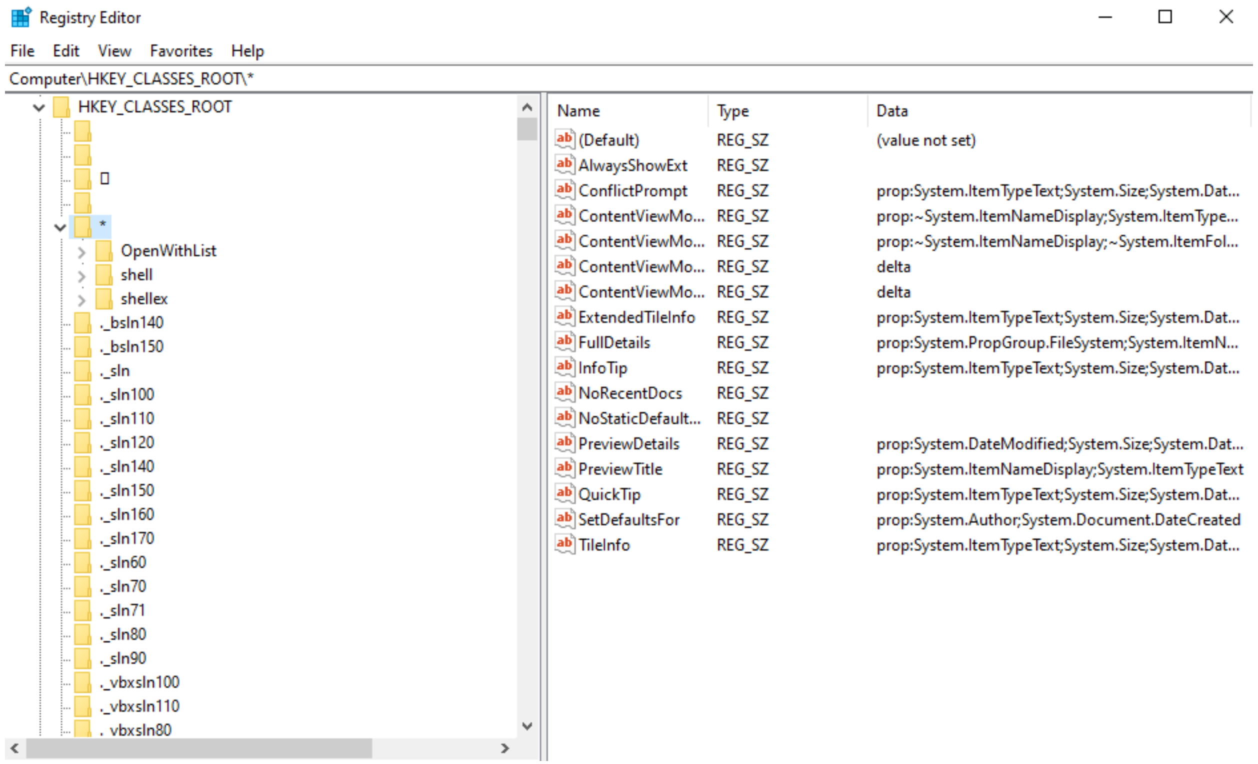
Type: LPP File
Size: 79.9 KB
Date modified: 6/16/2025 6:57 PM
Availability status: Available on this device

```
; this is sample text to show how the
; default .txt preview handler works


any text

        indentation
                indentation 2

finish text

...

if (condition) {
        function();
}

...
```

Figure 2: Text preview in windows explorer

Windows Registry System

- Windows’ Registry is an interface where a user can view and edit high-level aspects of OS logic in handling extensions, file interactions/compatibilities, etc.
  - Most internal OS processes represented by Component Object Model (COM) classes which are complicated objects with unique CLSIDs used for language versatility and powerful capabilities
    - » Operations with memory stream logic, binary interfaces, and low-level C++
    - » Internal COMs are often encrypted in the OS
- CLSID keys act as the interface between the Registry and the internal OS subprocesses used for the registry customization.



Computer\HKEY_CLASSES_ROOT\*

```
HKEY_CLASSES_ROOT


  □

  *
    OpenWithList
    shell
    shellex
  ._bsln140
  ._bsln150
  ._sln
  ._sln100
  ._sln110
  ._sln120
  ._sln140
  ._sln150
  ._sln160
  ._sln170
  ._sln60
  ._sln70
  ._sln71
  ._sln80
  ._sln90
  ._vbxsln100
  ._vbxsln110
  ._vbxsln80
```

Name	Type	Data
ab (Default)	REG_SZ	(value not set)
ab AlwaysShowExt	REG_SZ	
ab ConflictPrompt	REG_SZ	prop:System.ItemTypeText;System.Size;System.Dat...
ab ContentViewMo...	REG_SZ	prop:~System.ItemNameDisplay;System.ItemType...
ab ContentViewMo...	REG_SZ	prop:~System.ItemNameDisplay;~System.ItemFol...
ab ContentViewMo...	REG_SZ	delta
ab ContentViewMo...	REG_SZ	delta
ab ExtendedTileInfo	REG_SZ	prop:System.ItemTypeText;System.Size;System.Dat...
ab FullDetails	REG_SZ	prop:System.PropGroup.FileSystem;System.ItemN...
ab InfoTip	REG_SZ	prop:System.ItemTypeText;System.Size;System.Dat...
ab NoRecentDocs	REG_SZ	
ab NoStaticDefault...	REG_SZ	
ab PreviewDetails	REG_SZ	prop:System.DateModified;System.Size;System.Dat...
ab PreviewTitle	REG_SZ	prop:System.ItemNameDisplay;System.ItemTypeText
ab QuickTip	REG_SZ	prop:System.ItemTypeText;System.Size;System.Dat...
ab SetDefaultsFor	REG_SZ	prop:System.Author;System.Document.DateCreated
ab TileInfo	REG_SZ	prop:System.ItemTypeText;System.Size;System.Dat...

Figure 3: Registry view in HKCR

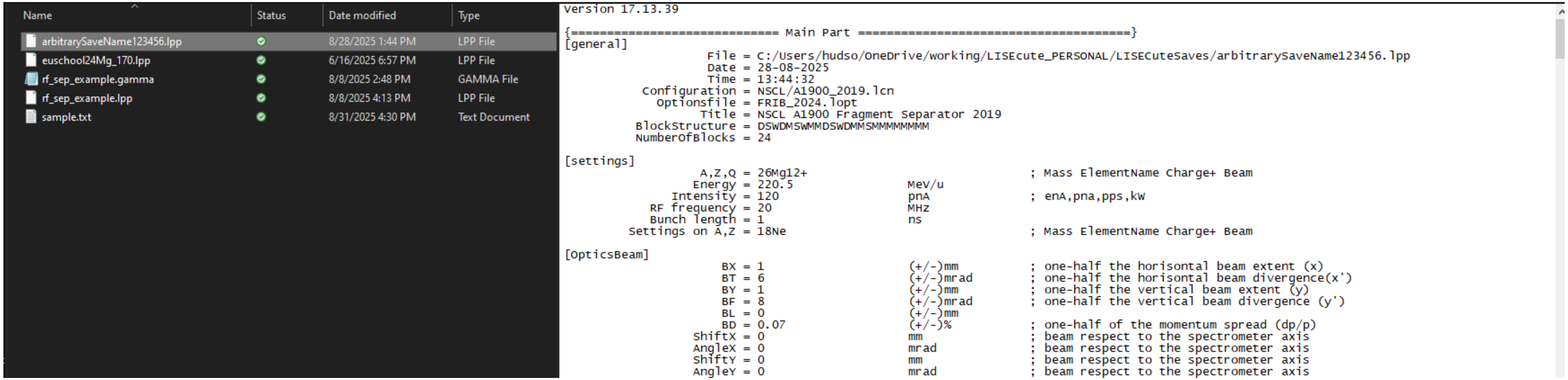
.lpp Registry Process

- To establish the connection for the custom .lpp file extension and the .txt preview handler, the following process is followed:
  - Establish a key in HKEY_CLASSES_ROOT (HKCR) for “.lpp”
    - » HKCR houses local system and user COM objects within the registry
  - Under “HKCR\.lpp”, register a shell executable for the Preview CLSID “HKCR.lpp\shellex\<Preview CLSID>” to enable the extension
    - » Preview Extension CLSID: *{8895b1c6-b41f-4c1c-a562-0d564250836f}**
  - Set the Preview CLSID executable’s the default value to the .txt Preview Handler CLSID
    - » .txt Preview Handler CLSID: *{1531d583-8375-4d3f-b5fb-d23bbd169f22}**
- Now, the Windows OS will know to establish the preview extension for the .lpp file and call the internal .txt Preview Handler COM process to display the .lpp information in the explorer.

*Note: The CLSID’s marked with *’s were obtained from ChatGPT queries for the internal CLSID keys to use for the preview processes*

.lpp Registry Results

- Once the registration for the .lpp file is completed, selecting any .lpp file should display the .txt-like preview we saw in Figures 1 and 2 inside of the file explorer.
  - This solution is fast and relatively simple with minimal performance impact
  - .lpp formatting is convenient for summary information near the top, but adjustments may be made to the formatting for key data to be displayed first



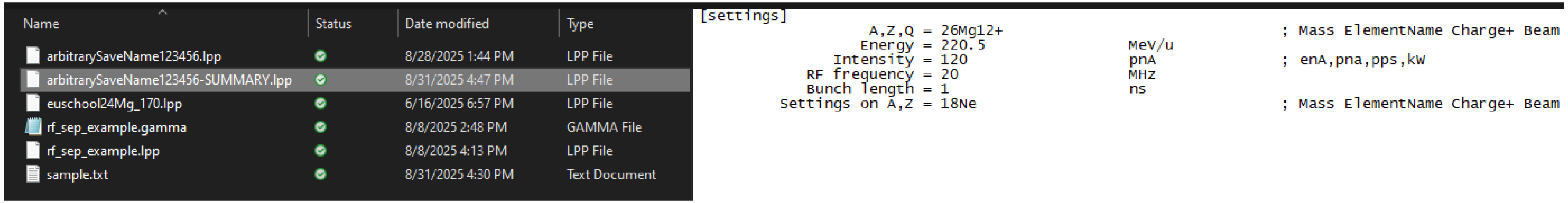
Name	Status	Date modified	Type
arbitrarySaveName123456.lpp	✓	8/28/2025 1:44 PM	LPP File
euschool24Mg_170.lpp	✓	6/16/2025 6:57 PM	LPP File
rf_sep_example.gamma	✓	8/8/2025 2:48 PM	GAMMA File
rf_sep_example.lpp	✓	8/8/2025 4:13 PM	LPP File
sample.txt	✓	8/31/2025 4:30 PM	Text Document

```
Version 17.13.39

{============================ Main Part =====================================}
[general]
                   File = C:/Users/hudso/OneDrive/working/LISEcute_PERSONAL/LISECuteSaves/arbitrarySaveName123456.lpp
                   Date = 28-08-2025
                   Time = 13:44:32
          Configuration = NSCL/A1900_2019.lcn
            Optionsfile = FRIB_2024.lopt
                  Title = NSCL A1900 Fragment Separator 2019
         BlockStructure = DSWDMSWMMDSWDMMSMMMMMMMM
         NumberOfBlocks = 24

[settings]
                  A,Z,Q = 26Mg12+                                  ; Mass ElementName Charge+ Beam
                 Energy = 220.5               MeV/u
              Intensity = 120                 pnA                  ; enA,pna,pps,kW
           RF frequency = 20                  MHz
           Bunch length = 1                   ns
         Settings on A,Z = 18Ne                                    ; Mass ElementName Charge+ Beam

[OpticsBeam]
                     BX = 1                   (+/-)mm              ; one-half the horisontal beam extent (x)
                     BT = 6                   (+/-)mrad            ; one-half the horisontal beam divergence(x')
                     BY = 1                   (+/-)mm              ; one-half the vertical beam extent (y)
                     BF = 8                   (+/-)mrad            ; one-half the vertical beam divergence (y')
                     BL = 0                   (+/-)mm
                     BD = 0.07                (+/-)%               ; one-half of the momentum spread (dp/p)
                 ShiftX = 0                   mm                   ; beam respect to the spectrometer axis
                 AngleX = 0                   mrad                 ; beam respect to the spectrometer axis
                 ShiftY = 0                   mm                   ; beam respect to the spectrometer axis
                 AngleY = 0                   mrad                 ; beam respect to the spectrometer axis
```

Figure 4: .lpp preview in explorer with .txt Preview Handler

Custom Preview Handlers

- The .txt handler creates a preview of the entire contents of the .lpp file so excess information is often included in the preview.
- Because the COM objects are encrypted and the process is not easy to intercept, customizing the preview most efficiently involves creating and registering an addition COM object.
  - A similar process seen in Slide 5 would be required for the extension (.lpp) except the final CLSID would simply change to the new custom COM CLSID



Name	Status	Date modified	Type
arbitrarySaveName123456.lpp	✓	8/28/2025 1:44 PM	LPP File
arbitrarySaveName123456-SUMMARY.lpp	✓	8/31/2025 4:47 PM	LPP File
euschool24Mg_170.lpp	✓	6/16/2025 6:57 PM	LPP File
rf_sep_example.gamma	✓	8/8/2025 2:48 PM	GAMMA File
rf_sep_example.lpp	✓	8/8/2025 4:13 PM	LPP File
sample.txt	✓	8/31/2025 4:30 PM	Text Document

```
[settings]
               A,Z,Q = 26Mg12+                              ; Mass ElementName Charge+ Beam
              Energy = 220.5              MeV/u
           Intensity = 120                pnA               ; enA,pna,pps,kW
        RF frequency = 20                 MHz
        Bunch length = 1                  ns
      Settings on A,Z = 18Ne                                ; Mass ElementName Charge+ Beam
```

Figure 5: Mock-draft of what the preview could look like with custom preview (not functioning)

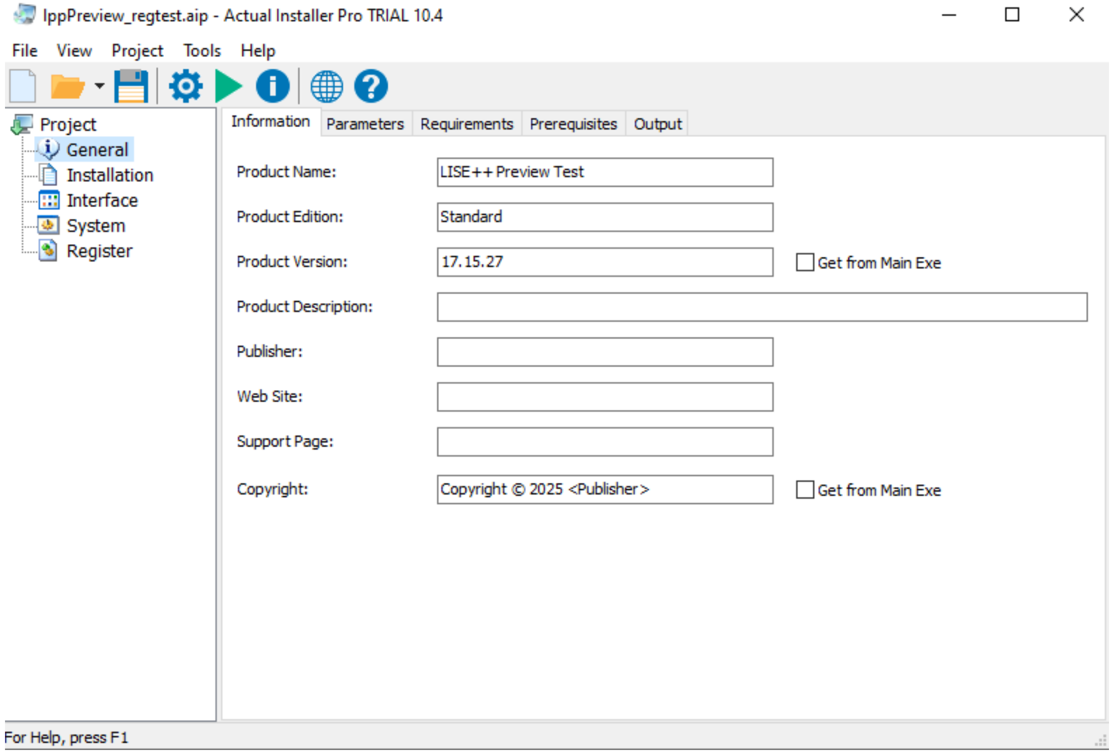
Custom COM Outline

- The custom COM DLL process would go as follows:
  - When extension with the registered custom COM DLL is selected, initialize a preview host (PrevHost.exe) with the custom DLL
  - PrevHost.exe initializes the COM object
  - The DLL parses the .lpp file extracting relevant data into plain text for the memory stream
  - COM object creates an instance of the existing .txt Preview Handler and passes the prepared stream
  - The .txt Preview Handler displays the parsed information in the preview.

- This process requires a strong foundational understanding of information stream management and the multiple interfaces between the DLL, PrevHost, and the COM objects themselves.

Registration on Installation

- Using Windows installers (such as .aip files), it is possible to perform the registration of app-specific extensions and their preview handlers on installation automatically for any user.
    - Modifying the Windows Registry is complicated and can be risky for an inexperienced user, so this automation is ideal
- Applications like “Actual Installer” provide a convenient interface to modify .aip install projects easily.
    - The application lets you customize an installer and then run it as a .exe on some machine



Product Name: LISE++ Preview Test

Product Edition: Standard

Product Version: 17.15.27 □ Get from Main Exe

Product Description:

Publisher:

Web Site:

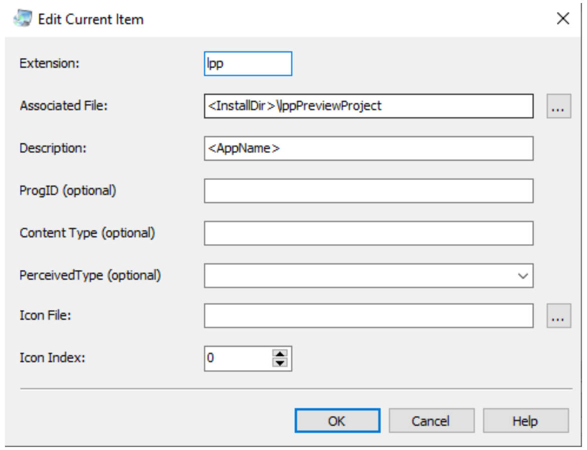
Support Page:

Copyright: Copyright © 2025 <Publisher> □ Get from Main Exe

Figure 6: Actual Installer interface for .aip project

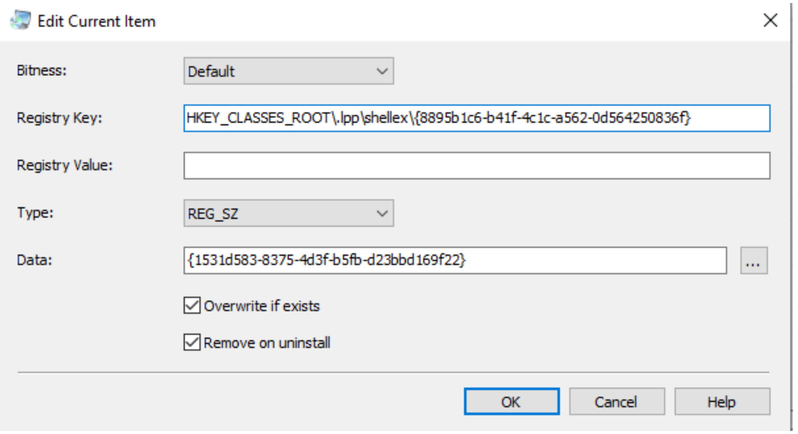
Actual Installer Registry Process

- The process of establishing and registering a new extension with a preview handler is similar to the process discussed in Slide 4:
  - Navigate to the “Register” tab and add the desired extension name “lpp”
    - » Associate the file with the project directory also, and provide the description for its association
    - » The system now recognizes the extension and its source/related application
  - Navigate to the “System” tab and add a new registry key under the same key as the Preview in Slide 4: “HKCR/.lpp/shellex/<Preview CLSID>”
    - » Preview CLSID: *{8895b1c6-b41f-4c1c-a562-0d564250836f}*
  - Set the “Data” value of this new key to the desired preview handler CLSID
    - » .txt Handler CLSID: *{1531d583-8375-4d3f-b5fb-d23bbd169f22}*



Extension:	lpp
Associated File:	<InstallDir>\lppPreviewProject
Description:	<AppName>
ProgID (optional)	
Content Type (optional)	
PerceivedType (optional)	
Icon File:	
Icon Index:	0

Figure 7: Extension registration in “Register”



Bitness:	Default
Registry Key:	HKEY_CLASSES_ROOT\.lpp\shellex\{8895b1c6-b41f-4c1c-a562-0d564250836f}
Registry Value:	
Type:	REG_SZ
Data:	{1531d583-8375-4d3f-b5fb-d23bbd169f22}

☑ Overwrite if exists

☑ Remove on uninstall

Figure 8: Preview Handler registration in “System” for .txt Handler