The luamplib package

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Abstract

Package to have metapost code typeset directly in a document with LuaTEX.

1 Documentation

This packages aims at providing a simple way to typeset directly metapost code in a document with LuaTEX. LuaTEX is built with the lua `mplib` library, that runs metapost code. This package is basically a wrapper (in Lua) for the Lua `mplib` functions and some TEX functions to have the output of the `mplib` functions in the pdf.

The package needs to be in PDF mode in order to output something, as PDF specials are not supported by the DVI format and tools.

The metapost figures are put in a TEX `hbox` with dimensions adjusted to the metapost code.

Using this package is easy: in Plain, type your metapost code between the macros `\mplibcode` and `\endmplibcode`, and in LATEX in the `mplibcode` environment.

The code is from the `luatex-mplib.lua` and `luatex-mplib.tex` files from ConTEXt, they have been adapted to LATEX and Plain by Elie Roux and Philipp Gesang, new functionalities have been added by Kim Dohyun. The changes are:

- a LATEX environment
- all TEX macros start by `mplib`
- use of luatexbase for errors, warnings and declaration
- possibility to use `btex ... etex` to typeset TEX code. `textext()` is a more versatile macro equivalent to `TEX()` from TEX.mp. `TEX()` is also allowed and is a synomym of `textext()`.

  N.B. Since v2.5, `btex ... etex` input from external `mp` files will also be processed by luamplib. However, `verbatimtex ... etex` will be entirely ignored in this case.

- `verbatimtex ... etex` (in TEX file) that comes just before `beginfig()` is not ignored, but the TEX code inbetween will be inserted before the following mplib hbox. Using this command, each mplib box can be freely moved horizontally and/or vertically. Also, a box number might be assigned to mplib box, allowing it to be reused later (see test files). All other `verbatimtex ... etex`'s are ignored. *E.G.*

```
\mplibcode
verbatimtex \moveright 3cm etex; beginfig(0); ... endfig;
verbatimtex \leavevmode etex; beginfig(1); ... endfig;
verbatimtex \leavevmode\lower 1ex etex; beginfig(2); ... endfig;
verbatimtex \endgraf\moveright 1cm etex; beginfig(3); ... endfig;
\endmplibcode
```

  N.B. `\endgraf` should be used instead of `\par` inside `verbatimtex ... etex`.

- Notice that, after each figure is processed, macro `\MPwidth` stores the width value of latest figure; `\MPheight`, the height value. Incidentally, also note that `\MPllx`, `\MPlly`, `\MPurx`, and `\MPury` store the bounding box information of latest figure without the unit `bp`.

- Since v2.3, new macros `\everymplib` and `\everyendmplib` redefine token lists `\everymplibtoks` and `\everyendmplibtoks` respectively, which will be automatically inserted at the beginning and ending of each mplib code. *E.G.*

```
\everymplib{ verbatimtex \leavevmode etex; beginfig(0); }
\everyendmplib{ endfig; }
\mplibcode % beginfig/endfig not needed; always in horizontal mode
  draw fullcircle scaled 1cm;
\endmplibcode
```

  N.B. Many users have complained that mplib figures do not respect alignment commands such as `\centering` or `\raggedleft`. That's because luamplib does not force horizontal or vertical mode. If you want all mplib figures center- (or right-) aligned, please use `\everymplib` command with `\leavevmode` as shown above.

- Since v2.3, `\mpdim` and other raw TEX commands are allowed inside mplib code. This feature is inpired by gmp.sty authored by Enrico Gregorio. Please refer the manual of gmp package for details. *E.G.*

```
\begin{mplibcode}
  draw origin--(\mpdim{\linewidth},0) withpen pencircle scaled 4
  dashed evenly scaled 4 withcolor \myrulecolor;
\end{mplibcode}
```

N.B. Users should not use the protected variant of `btex ... etex` as provided by gmp package. As **luamplib** automatically protects TEX code inbetween, `\btex` is not supported here.

- Users can choose `numbersystem` option since v2.4. The default value `scaled` can be changed to `double` by declaring `\mplibnumbersystem{double}`. For details see http://github.com/lualatex/luamplib/issues/21.

- To support `btex ... etex` in external `.mp` files, **luamplib** inspects the content of each and every `.mp` input files and makes caches if neceeccsary, before returning their paths to LuaTEX's mplib library. This would make the compilation time longer wastefully, as most `.mp` files do not contain `btex ... etex` command. So **luamplib** provides macros as follows, so that users can give instruction about files that do not require this functionality.

  - `\mplibmakenocache{<filename>[,<filename>,...]}`
  - `\mplibcancelnocache{<filename>[,<filename>,...]}`

  where `<filename>` is a file name excluding `.mp` extension. Note that `.mp` files under `[TEXMFMAIN]/metapost/base` and `[TEXMFMAIN]/metapost/context/base` are already registered by default.

- By default, cache files will be stored in the same directory as pdf output file. This however can be changed by the command `\mplibcachedir{<directory path>}`, where tilde (~) is interpreted as the user's home directory (on windows machines as well). As backslashes (\) should be escaped by users, it is easier to use slashes (/) instead.

- Starting with v2.6, `\mplibtextextlabel{enable}` enables string labels typeset via `textext()` instead of `infont` operator. So, `label("my text",origin)` thereafter is exactly the same as `label(textext("my text"),origin)`. *N.B.* In the background, **luamplib** redefines `infont` operator so that the right side argument (the font part) is totally ignored. Every string label therefore will be typeset with current TEX font. Also take care of `char` operator in the left side argument, as this might bring unpermitted characters into TEX.

- At the end of package loading, **luamplib** searches `luamplib.cfg` and, if found, reads the file in automatically. Frequently used settings such as `\everymplib` or `\mplibcachedir` are suitable for going into this file.

There are (basically) two formats for metapost: *plain* and *metafun*. By default, the *plain* format is used, but you can set the format to be used by future figures at any time using `\mplibsetformat{`⟨*format name*⟩`}`.

2 Implementation

2.1 Lua module

Use the `luamplib` namespace, since `mplib` is for the metapost library itself. ConTEXt uses `metapost`.

```
1
2 luamplib          = luamplib or { }
3
```

Identification.

```
4
5 local luamplib    = luamplib
6 luamplib.showlog  = luamplib.showlog or false
7 luamplib.lastlog  = ""
8
9 local err, warn, info, log = luatexbase.provides_module({
10     name          = "luamplib",
11     version       = "2.6.0",
12     date          = "2014/03/08",
13     description   = "Lua package to typeset Metapost with LuaTeX's MPLib.",
14 })
15
16
```

This module is a stripped down version of libraries that are used by ConTEXt. Provide a few "shortcuts" expected by the imported code.

```
17
18 local format, abs = string.format, math.abs
19
20 local stringgsub    = string.gsub
21 local stringfind    = string.find
22 local stringmatch   = string.match
23 local stringgmatch  = string.gmatch
24 local stringexplode = string.explode
25 local tableconcat   = table.concat
26 local texsprint     = tex.sprint
27
28 local mplib = require ('mplib')
29 local kpse  = require ('kpse')
30 local lfs   = require ('lfs')
31
32 local lfsattributes = lfs.attributes
33 local lfsisdir      = lfs.isdir
34 local lfstouch      = lfs.touch
35 local ioopen        = io.open
36
37 local file = file
38 if not file then
39
```

This is a small trick for LaTeX. In LaTeX we read the metapost code line by line, but it needs to be passed entirely to `process()`, so we simply add the lines in `data` and at the end we call `process(data)`.

A few helpers, taken from `l-file.lua`.

```
  file = { }

  function file.replacesuffix(filename, suffix)
      return (stringgsub(filename,"%.[%a%d]+$","")) .. "." .. suffix
  end

  function file.stripsuffix(filename)
      return (stringgsub(filename,"%.[%a%d]+$",""))
  end
end

```

`btex ... etex` in input .mp files will be replaced in finder.

```
local luamplibtime = kpse.find_file("luamplib.lua")
luamplibtime = luamplibtime and lfsattributes(luamplibtime,"modification")

local currenttime = os.time()

local outputdir = "."
for _,v in ipairs(arg) do
  local t = stringmatch(v,"%-output%-directory=(.+)")
  if t then
    outputdir = t
    break
  end
end

function luamplib.getcachedir(dir)
  dir = stringgsub(dir,"##","#")
  dir = stringgsub(dir,"^~",
    os.type == "windows" and os.getenv("UserProfile") or os.getenv("HOME"))
  if lfstouch and dir then
    if lfsisdir(dir) then
      local tmp = dir.."/_luam_plib_temp_file_"
      local fh = ioopen(tmp,"w")
      if fh then
        fh:close(fh)
        os.remove(tmp)
        luamplib.cachedir = dir
      else
        warn("Directory '"..dir.."' is not writable!")
      end
    else
      warn("Directory '"..dir.."' does not exist!")
```

```
    end
  end
end

local noneedtoreplace = {
    ["boxes.mp"] = true,
--  ["format.mp"] = true,
    ["graph.mp"] = true,
    ["marith.mp"] = true,
    ["mfplain.mp"] = true,
    ["mpost.mp"] = true,
    ["plain.mp"] = true,
    ["rboxes.mp"] = true,
    ["sarith.mp"] = true,
    ["string.mp"] = true,
    ["TEX.mp"] = true,
    ["metafun.mp"] = true,
    ["metafun.mpiv"] = true,
    ["mp-abck.mpiv"] = true,
    ["mp-apos.mpiv"] = true,
    ["mp-asnc.mpiv"] = true,
    ["mp-base.mpiv"] = true,
    ["mp-butt.mpiv"] = true,
    ["mp-char.mpiv"] = true,
    ["mp-chem.mpiv"] = true,
    ["mp-core.mpiv"] = true,
    ["mp-crop.mpiv"] = true,
    ["mp-figs.mpiv"] = true,
    ["mp-form.mpiv"] = true,
    ["mp-func.mpiv"] = true,
    ["mp-grap.mpiv"] = true,
    ["mp-grid.mpiv"] = true,
    ["mp-grph.mpiv"] = true,
    ["mp-idea.mpiv"] = true,
    ["mp-mlib.mpiv"] = true,
    ["mp-page.mpiv"] = true,
    ["mp-shap.mpiv"] = true,
    ["mp-step.mpiv"] = true,
    ["mp-text.mpiv"] = true,
    ["mp-tool.mpiv"] = true,
}
luamplib.noneedtoreplace = noneedtoreplace

local function replaceformatmp(file,newfile,ofmodify)
    local fh = ioopen(file,"r")
    if not fh then return file end
    local data = fh:read("*all"); fh:close()
    fh = ioopen(newfile,"w")
    if not fh then return file end
    fh:write(
```

```
        ”let normalinfont = infont;\n”,
        ”primarydef str infont name = rawtextext(str) enddef;\n”,
        data,
        ”vardef Fmant_(expr x) = rawtextext(decimal abs x) enddef;\n”,
        ”vardef Fexp_(expr x) = rawtextext(\”$^{\”&decimal x&\”}$\”) enddef;\n”,
        ”let infont = normalinfont;\n”
    ); fh:close()
    lfstouch(newfile,currenttime,ofmodify)
    return newfile
end

local function replaceinputmpfile (name,file)
    local ofmodify = lfsattributes(file,”modification”)
    if not ofmodify then return file end
    local cachedir = luamplib.cachedir or outputdir
    local newfile = stringgsub(name,”%W”,”_”)
    newfile = cachedir ..”/luamplib_input_”..newfile
    if newfile and luamplibtime then
        local nf = lfsattributes(newfile)
        if nf and nf.mode == ”file” and ofmodify == nf.modification and luamplib-
  time < nf.access then
            return nf.size == 0 and file or newfile
        end
    end
    if name == ”format.mp” then return replaceformatmp(file,newfile,ofmodify) end

    local fh = ioopen(file,”r”)
    if not fh then return file end
    local data = fh:read(”*all”); fh:close()
    data = stringgsub(data, ”\”[^\n]-\””,
        function(str)
            str = stringgsub(str,”%%”,”!!!!!PERCENT!!!!!”)
            str = stringgsub(str,”([bem])tex%f[^A-Z_a-z]”,”%1!!!T!!!E!!!X!!!”)
            return str
        end)
    data = stringgsub(data,”%%.-\n”,””)
    local count,cnt = 0,0
    data,cnt = stringgsub(data,
        ”%f[A-Z_a-z]btex%f[^A-Z_a-z]%s*(.-)%s*%f[A-Z_a-z]etex%f[^A-Z_a-z]”,
        function(str)
            str = stringgsub(str,”[\n\r]%s*”,” ”)
            str = stringgsub(str,’”’,’”&ditto&”’)
            return format(”rawtextext(\”%s\”)”,str)
        end)
    count = count + cnt
    data,cnt = stringgsub(data,
        ”%f[A-Z_a-z]verbatimtex%f[^A-Z_a-z]%s*.-%s*%f[A-Z_a-z]etex%f[^A-Z_a-z]”,
        ””)
    count = count + cnt
    if count == 0 then
```

```
        noneedtoreplace[name] = true
        fh = ioopen(newfile,"w");
        if fh then
            fh:close()
            lfstouch(newfile,currenttime,ofmodify)
        end
        return file
    end
    data = stringgsub(data,"([bem])!!!T!!!E!!!X!!!","%1tex")
    data = stringgsub(data,"!!!!!PERCENT!!!!!","%%")
    fh = ioopen(newfile,"w")
    if not fh then return file end
    fh:write(data); fh:close()
    lfstouch(newfile,currenttime,ofmodify)
    return newfile
end

local randomseed = nil
```

As the finder function for `mplib`, use the `kpse` library and make it behave like as if MetaPost was used (or almost, since the engine name is not set this way—not sure if this is a problem).

```

local mpkpse = kpse.new("luatex", "mpost")

local function finder(name, mode, ftype)
    if mode == "w" then
        return name
    else
        local file = mpkpse:find_file(name,ftype)
        if file then
            if not lfstouch or ftype ~= "mp" or noneedtoreplace[name] then
                return file
            end
            return replaceinputmpfile(name,file)
        end
        return mpkpse:find_file(name,stringmatch(name,"[a-zA-Z]+$"))
    end
end
luamplib.finder = finder

```

The rest of this module is not documented. More info can be found in the LuaTEX manual, articles in user group journals and the files that ship with ConTEXt.

```

function luamplib.resetlastlog()
    luamplib.lastlog = ""
end

```

Below included is section that defines fallbacks for older versions of mplib.

```
local mplibone = tonumber(mplib.version()) <= 1.50

if mplibone then

    luamplib.make = luamplib.make or function(name,mem_name,dump)
        local t = os.clock()
        local mpx = mplib.new {
            ini_version = true,
            find_file = luamplib.finder,
            job_name = file.stripsuffix(name)
        }
        mpx:execute(format("input %s ;",name))
        if dump then
            mpx:execute("dump ;")
            info("format %s made and dumped for %s in %0.3f seconds",mem_name,name,os.clock()-t)
        else
            info("%s read in %0.3f seconds",name,os.clock()-t)
        end
        return mpx
    end

    function luamplib.load(name)
        local mem_name = file.replacesuffix(name,"mem")
        local mpx = mplib.new {
            ini_version = false,
            mem_name = mem_name,
            find_file = luamplib.finder
        }
        if not mpx and type(luamplib.make) == "function" then
            -- when i have time i'll locate the format and dump
            mpx = luamplib.make(name,mem_name)
        end
        if mpx then
            info("using format %s",mem_name,false)
            return mpx, nil
        else
            return nil, { status = 99, error = "out of memory or invalid format" }
        end
    end

else
```

These are the versions called with sufficiently recent mplib.

```

    local preamble = [[
        boolean mplib ; mplib := true ;
        let dump = endinput ;
        let normalfontsize = fontsize;
```

```
        input %s ;
    ]]

    luamplib.make = luamplib.make or function()
    end

    function luamplib.load(name)
        local mpx = mplib.new {
            ini_version = true,
            find_file = luamplib.finder,
```

Provides `numbersystem` option since v2.4. Default value `"scaled"` can be changed by declaring `\mplibnumbersystem{double}`. See https://github.com/lualatex/luamplib/issues/21.

```
            math_mode = luamplib.numbersystem,
            random_seed = randomseed,
        }
        local result
        if not mpx then
            result = { status = 99, error = "out of memory"}
        else
            result = mpx:execute(format(preamble, file.replacesuffix(name,"mp")))
        end
        luamplib.reporterror(result)
        return mpx, result
    end

end

local currentformat = "plain"

local function setformat (name) --- used in .sty
    currentformat = name
end
luamplib.setformat = setformat


luamplib.reporterror = function (result)
    if not result then
        err("no result object returned")
    elseif result.status > 0 then
        local t, e, l = result.term, result.error, result.log
        if t then
            info(t)
        end
        if e then
            err(e)
        end
        if not t and not e and l then
            luamplib.lastlog = luamplib.lastlog .. "\n " .. l
```

```
            log(l)
        else
            err("unknown, no error, terminal or log messages")
        end
    else
        return false
    end
    return true
end

local function process_indeed (mpx, data)
    local converted, result = false, {}
    local mpx = luamplib.load(mpx)
    if mpx and data then
        local result = mpx:execute(data)
        if not result then
            err("no result object returned")
        elseif result.status > 0 then
            err("%s",(result.term or "no-term") .. "\n" .. (result.error or "no-error"))
        elseif luamplib.showlog then
            luamplib.lastlog = luamplib.lastlog .. "\n" .. result.term
            info("%s",result.term or "no-term")
        elseif result.fig then
            converted = luamplib.convert(result)
        else
            err("unknown error, maybe no beginfig/endfig")
        end
    else
        err("Mem file unloadable. Maybe generated with a different version of mplib?")
    end
    return converted, result
end
local process = function (data)
    return process_indeed(currentformat, data)
end
luamplib.process = process

local function getobjects(result,figure,f)
    return figure:objects()
end

local function convert(result, flusher)
    luamplib.flush(result, flusher)
    return true -- done
end
luamplib.convert = convert

local function pdf_startfigure(n,llx,lly,urx,ury)
```

The following line has been slightly modified by Kim.

```
    texsprint(format("\\mplibstarttoPDF{%f}{%f}{%f}{%f}",llx,lly,urx,ury))
end

local function pdf_stopfigure()
    texsprint("\\mplibstoptoPDF")
end

local function pdf_literalcode(fmt,...) -- table
    texsprint(format("\\mplibtoPDF{%s}",format(fmt,...)))
end
luamplib.pdf_literalcode = pdf_literalcode

local function pdf_textfigure(font,size,text,width,height,depth)
```

The following three lines have been modified by Kim.

```
    -- if text == "" then text = "\0" end -- char(0) has gone
    text = text:gsub(".",function(c)
        return format("\\hbox{\\char%i}",string.byte(c)) -- kerning happens in meta-post
    end)
    texsprint(format("\\mplibtextext{%s}{%f}{%s}{%s}{%f}",font,size,text,0,-( 7200/ 7227)/65536*depth))
end
luamplib.pdf_textfigure = pdf_textfigure

local bend_tolerance = 131/65536

local rx, sx, sy, ry, tx, ty, divider = 1, 0, 0, 1, 0, 0, 1

local function pen_characteristics(object)
    local t = mplib.pen_info(object)
    rx, ry, sx, sy, tx, ty = t.rx, t.ry, t.sx, t.sy, t.tx, t.ty
    divider = sx*sy - rx*ry
    return not (sx==1 and rx==0 and ry==0 and sy==1 and tx==0 and ty==0), t.width
end

local function concat(px, py) -- no tx, ty here
    return (sy*px-ry*py)/divider,(sx*py-rx*px)/divider
end

local function curved(ith,pth)
    local d = pth.left_x - ith.right_x
    if abs(ith.right_x - ith.x_coord - d) <= bend_tolerance and abs(pth.x_coord - pth.left_x - d) <= bend_tolerance then
        d = pth.left_y - ith.right_y
        if abs(ith.right_y - ith.y_coord - d) <= bend_tolerance and abs(pth.y_coord - pth.left_y - d) <= bend_tolerance then
            return false
        end
    end
    return true
```

```
end

local function flushnormalpath(path,open)
    local pth, ith
    for i=1,#path do
        pth = path[i]
        if not ith then
            pdf_literalcode("%f %f m",pth.x_coord,pth.y_coord)
        elseif curved(ith,pth) then
            pdf_literalcode("%f %f %f %f %f %f c",ith.right_x,ith.right_y,pth.left_x,pth.left_y,pth.x_c
        else
            pdf_literalcode("%f %f l",pth.x_coord,pth.y_coord)
        end
        ith = pth
    end
    if not open then
        local one = path[1]
        if curved(pth,one) then
            pdf_literalcode("%f %f %f %f %f %f c",pth.right_x,pth.right_y,one.left_x,one.left_y,one.x_c
        else
            pdf_literalcode("%f %f l",one.x_coord,one.y_coord)
        end
    elseif #path == 1 then
        -- special case .. draw point
        local one = path[1]
        pdf_literalcode("%f %f l",one.x_coord,one.y_coord)
    end
    return t
end

local function flushconcatpath(path,open)
    pdf_literalcode("%f %f %f %f %f %f cm", sx, rx, ry, sy, tx ,ty)
    local pth, ith
    for i=1,#path do
        pth = path[i]
        if not ith then
           pdf_literalcode("%f %f m",concat(pth.x_coord,pth.y_coord))
        elseif curved(ith,pth) then
            local a, b = concat(ith.right_x,ith.right_y)
            local c, d = concat(pth.left_x,pth.left_y)
            pdf_literalcode("%f %f %f %f %f %f c",a,b,c,d,concat(pth.x_coord, pth.y_co-
ord))
        else
           pdf_literalcode("%f %f l",concat(pth.x_coord, pth.y_coord))
        end
        ith = pth
    end
    if not open then
        local one = path[1]
        if curved(pth,one) then
```

```
            local a, b = concat(pth.right_x,pth.right_y)
            local c, d = concat(one.left_x,one.left_y)
            pdf_literalcode("%f %f %f %f %f %f c",a,b,c,d,concat(one.x_coord, one.y_co-
  ord))
        else
            pdf_literalcode("%f %f l",concat(one.x_coord,one.y_coord))
        end
    elseif #path == 1 then
        -- special case .. draw point
        local one = path[1]
        pdf_literalcode("%f %f l",concat(one.x_coord,one.y_coord))
    end
    return t
end

```

Below code has been contributed by Dohyun Kim. It implements `btex` / `etex` functions.

v2.1: `textext()` is now available, which is equivalent to `TEX()` macro from TEX.mp. `TEX()` is synonym of `textext()` unless TEX.mp is loaded.

v2.2: Transparency and Shading

v2.3: `\everymplib`, `\everyendmplib`, and allows naked TEX commands.

```
local further_split_keys = {
    ["MPlibTEXboxID"] = true,
    ["sh_color_a"]    = true,
    ["sh_color_b"]    = true,
}

local function script2table(s)
  local t = {}
  for _,i in ipairs(stringexplode(s,"\13+")) do
    local k,v = stringmatch(i,"(.-)=(.*)") -- v may contain = or empty.
    if k and v and k ~= "" then
      if further_split_keys[k] then
        t[k] = stringexplode(v,":")
      else
        t[k] = v
      end
    end
  end
  return t
end

local mplibcodepreamble = [[
vardef rawtextext (expr t) =
  if unknown TEXBOX_:
    image( special "MPlibmkTEXbox="&t; )
  else:
    TEXBOX_ := TEXBOX_ + 1;
    if known TEXBOX_wd_[TEXBOX_]:
      image ( addto currentpicture doublepath unitsquare
```

```
        xscaled TEXBOX_wd_[TEXBOX_]
        yscaled (TEXBOX_ht_[TEXBOX_] + TEXBOX_dp_[TEXBOX_])
        shifted (0, -TEXBOX_dp_[TEXBOX_])
        withprescript "MPlibTEXboxID=" &
          decimal TEXBOX_ & ":" &
          decimal TEXBOX_wd_[TEXBOX_] & ":" &
          decimal(TEXBOX_ht_[TEXBOX_]+TEXBOX_dp_[TEXBOX_]); )
    else:
      image( special "MPlibTEXError=1"; )
    fi
  fi
enddef;
if known context_mlib:
  defaultfont := "cmtt10";
  let infont = normalinfont;
  let fontsize = normalfontsize;
  vardef thelabel@#(expr p,z) =
    if string p :
      thelabel@#(p infont defaultfont scaled defaultscale,z)
    else :
      p shifted (z + labeloffset*mfun_laboff@# -
        (mfun_labxf@#*lrcorner p + mfun_labyf@#*ulcorner p +
        (1-mfun_labxf@#-mfun_labyf@#)*llcorner p))
    fi
  enddef;
  def graphictext primary filename =
    if (readfrom filename = EOF):
      errmessage "Please prepare '"&filename&"' in advance with"&
      " 'pstoedit -ssp -dt -f mpost yourfile.ps "&filename&"'";
    fi
    closefrom filename;
    def data_mpy_file = filename enddef;
    mfun_do_graphic_text (filename)
  enddef;
  if unknown TEXBOX_: def mfun_do_graphic_text text t = enddef; fi
else:
  vardef textext@# (text t) = rawtextext (t) enddef;
fi
def externalfigure primary filename =
  draw rawtextext("\includegraphics{"& filename &"}")
enddef;
def TEX = textext enddef;
def fontmapfile primary filename = enddef;
def specialVerbatimTeX (text t) = special "MPlibVerbTeX="&t; enddef;
def ignoreVerbatimTeX  (text t) = enddef;
let VerbatimTeX = specialVerbatimTeX;
extra_beginfig := extra_beginfig & " let VerbatimTeX = ignoreVerbatimTeX;" ;
extra_endfig   := extra_endfig   & " let VerbatimTeX = specialVerbatimTeX;" ;
]]

```

```
local textextlabelpreamble = [[
primarydef s infont f = rawtextext(s) enddef;
let normalinfont = infont;
def fontsize expr f =
  begingroup
  save size,pic; numeric size; picture pic;
  pic := rawtextext("\hskip\pdffontsize\font");
  size := xpart urcorner pic - xpart llcorner pic;
  if size = 0: 10pt else: size fi
  endgroup
enddef;
let normalfontsize = fontsize;
]]

local function protecttextext(data)
    local everymplib    = tex.toks['everymplibtoks']    or ''
    local everyendmplib = tex.toks['everyendmplibtoks'] or ''
    data = "\n" .. everymplib .."\n".. data .."\n".. everyendmplib
    data = stringgsub(data,"\r","\n")
    data = stringgsub(data, "\"[^\n]-\"",
        function(str)
            str = stringgsub(str,"%%","!!!!!PERCENT!!!!!")
            str = stringgsub(str,"([bem])tex%f[^A-Z_a-z]","%1!!!T!!!E!!!X!!!")
            return str
        end)
    data = stringgsub(data,"%%.-\n","")
    data = stringgsub(data,
        "%f[A-Z_a-z]btex%f[^A-Z_a-z]%s*(.-)%s*%f[A-Z_a-z]etex%f[^A-Z_a-z]",
        function(str)
            str = stringgsub(str,'"','"&ditto&"')
            str = stringgsub(str,"\n%s*"," ")
            return format("rawtextext(\"%s\")",str)
        end)
    data = stringgsub(data,
        "%f[A-Z_a-z]verbatimtex%f[^A-Z_a-z]%s*(.-)%s*%f[A-Z_a-z]etex%f[^A-Z_a-z]",
        function(str)
            str = stringgsub(str,'"','"&ditto&"')
            str = stringgsub(str,"\n%s*"," ")
            return format("VerbatimTeX(\"%s\")",str)
        end)
    data = stringgsub(data, "\"[^\n]-\"",
        function(str)
            str = stringgsub(str,"([bem])!!!T!!!E!!!X!!!","%1tex")
            str = stringgsub(str,"{", "!!!!!LEFTBRCE!!!!!")
            str = stringgsub(str,"}", "!!!!!RGHTBRCE!!!!!")
            str = stringgsub(str,"#", "!!!!!SHARPE!!!!!")
            return format("\\detokenize{%s}",str)
        end)
    texsprint(data)
end
```

```
602
603 luamplib.protecttextext = protecttextext
604
605 local TeX_code_t = {}
606
607 local function domakeTEXboxes (data)
608     local num = 255 -- output box
609     if data and data.fig then
610         local figures = data.fig
611         for f=1, #figures do
612             TeX_code_t[f] = nil
613             local figure = figures[f]
614             local objects = getobjects(data,figure,f)
615             if objects then
616                 for o=1,#objects do
617                     local object    = objects[o]
618                     local prescript = object.prescript
619                     prescript = prescript and script2table(prescript)
620                     local str = prescript and prescript.MPlibmkTEXbox
621                     if str then
622                         num = num + 1
623                         texsprint(format("\\setbox%i\\hbox{%s}",num,str))
624                     end
```

`verbatimtex ... etex` before `beginfig()` is not ignored, but the TEX code inbetween is inserted before the mplib box.

```
625                     local texcode = prescript and prescript.MPlibVerbTeX
626                     if texcode and texcode ~= "" then
627                         TeX_code_t[f] = texcode
628                     end
629                 end
630             end
631         end
632     end
633 end
634
635 local function makeTEXboxes (data)
636     data = stringgsub(data, "##", "#") -- restore # doubled in input string
637     data = stringgsub(data, "!!!!!PERCENT!!!!!", "%%")
638     data = stringgsub(data, "!!!!!LEFTBRCE!!!!!","{")
639     data = stringgsub(data, "!!!!!RGHTBRCE!!!!!","}")
640     data = stringgsub(data, "!!!!!SHARPE!!!!!",  "#" )
641     local preamble = mplibcodepreamble
642     if luamplib.textextlabel then
643       preamble = textextlabelpreamble .. preamble
644     end
645     randomseed = math.random(65535)
646     local mpx = luamplib.load(currentformat)
647     if mpx and data then
648         local result = mpx:execute(preamble .. data)
```

```
        domakeTEXboxes(result)
    end
    return data
end

luamplib.makeTEXboxes = makeTEXboxes

local factor = 65536*(7227/7200)

local function processwithTEXboxes (data)
    local num = 255 -- output box
    local prepreamble = "TEXBOX_ := "..num..";\n"
    while true do
        num = num + 1
        local box = tex.box[num]
        if not box then break end
        prepreamble = prepreamble ..
        "TEXBOX_wd_["..num.."] := "..box.width /factor.."";\n"..
        "TEXBOX_ht_["..num.."] := "..box.height/factor.."";\n"..
        "TEXBOX_dp_["..num.."] := "..box.depth /factor.."";\n"
    end
    local preamble = prepreamble .. mplibcodepreamble
    if luamplib.textextlabel then
      preamble = textextlabelpreamble .. preamble
    end
    process(preamble .. data)
end

luamplib.processwithTEXboxes = processwithTEXboxes

local function putTEXboxes (object,prescript)
    local box = prescript.MPlibTEXboxID
    local n,tw,th = box[1],box[2],box[3]
    if n and tw and th then
        local op = object.path
        local first, second, fourth = op[1], op[2], op[4]
        local tx, ty = first.x_coord, first.y_coord
        local sx, sy = (second.x_coord - tx)/tw, (fourth.y_coord - ty)/th
        local rx, ry = (second.y_coord - ty)/tw, (fourth.x_coord - tx)/th
        if sx == 0 then sx = 0.00001 end
        if sy == 0 then sy = 0.00001 end
        pdf_literalcode("q %f %f %f %f %f %f cm",sx,rx,ry,sy,tx,ty)
        texsprint(format("\\mplibputtextbox{%i}",n))
        pdf_literalcode("Q")
    end
end

```

Transparency and Shading

```
local pdf_objs = {}
```

```
697
698 -- objstr <string> => obj <number>, new <boolean>
699 local function update_pdfobjs (os)
700     local on = pdf_objs[os]
701     if on then
702         return on,false
703     end
704     on = pdf.immediateobj(os)
705     pdf_objs[os] = on
706     return on,true
707 end
708
709 local transparancy_modes = { [0] =  "Normal",
710     "Normal",       "Multiply",     "Screen",       "Overlay",
711     "SoftLight",    "HardLight",    "ColorDodge",   "ColorBurn",
712     "Darken",       "Lighten",      "Difference",   "Exclusion",
713     "Hue",          "Saturation",   "Color",        "Luminosity",
714     "Compatible",
715 }
716
717 local function update_tr_res(res,mode,opaq)
718     local os = format("<</BM /%s/ca %g/CA %g/AIS false>>",mode,opaq,opaq)
719     local on, new = update_pdfobjs(os)
720     if new then
721         res = res .. format("/MPlibTr%s%g %i 0 R",mode,opaq,on)
722     end
723     return res
724 end
725
726 local function tr_pdf_pageresources(mode,opaq)
727     local res = ""
728     res = update_tr_res(res, "Normal", 1)
729     res = update_tr_res(res, mode, opaq)
730     if res ~= "" then
731         local tpr = tex.pdfpageresources -- respect luaotfload-colors
732         if not stringfind(tpr,"/ExtGState<<.*>>") then
733             tpr = tpr.."/ExtGState<<>>"
734         end
735         tpr = stringgsub(tpr,"/ExtGState<<","%1"..res)
736         tex.set("global","pdfpageresources",tpr)
737     end
738 end
739
740 -- luatexbase.mcb is not yet updated: "finish_pdffile" callback is missing
741
742 local function sh_pdfpageresources(shtype,domain,colorspace,colora,colorb,coordinates)
743     local os, on, new
744     os = format("<</FunctionType 2/Domain [ %s ]/C0 [ %s ]/C1 [ %s ]/N 1>>",
745                 domain, colora, colorb)
746     on = update_pdfobjs(os)
```

```
    os = format("<</ShadingType %i/ColorSpace /%s/Function %i 0 R/Coords [ %s ]/Extend [ true true ]/AntiAlias true>>",
                shtype, colorspace, on, coordinates)
    on, new = update_pdfobjs(os)
    if not new then
        return on
    end
    local res = format("/MPlibSh%i %i 0 R", on, on)
    local ppr = pdf.pageresources or ""
    if not stringfind(ppr,"/Shading<<.*>>") then
        ppr = ppr.."/Shading<<>>"
    end
    pdf.pageresources = stringgsub(ppr,"/Shading<<","%1"..res)
    return on
end

local function color_normalize(ca,cb)
    if #cb == 1 then
        if #ca == 4 then
            cb[1], cb[2], cb[3], cb[4] = 0, 0, 0, 1-cb[1]
        else -- #ca = 3
            cb[1], cb[2], cb[3] = cb[1], cb[1], cb[1]
        end
    elseif #cb == 3 then -- #ca == 4
        cb[1], cb[2], cb[3], cb[4] = 1-cb[1], 1-cb[2], 1-cb[3], 0
    end
end

local function do_preobj_color(object,prescript)
    -- transparency
    local opaq = prescript and prescript.tr_transparency
    if opaq then
        local mode = prescript.tr_alternative or 1
        mode = transparancy_modes[tonumber(mode)]
        tr_pdf_pageresources(mode,opaq)
        pdf_literalcode("/MPlibTr%s%g gs",mode,opaq)
    end
    -- color
    local cs = object.color
    if cs and #cs > 0 then
        pdf_literalcode(luamplib.colorconverter(cs))
    end
    -- shading
    local sh_type = prescript and prescript.sh_type
    if sh_type then
        local domain  = prescript.sh_domain
        local centera = prescript.sh_center_a
        local centerb = prescript.sh_center_b
        local colora  = prescript.sh_color_a or {0};
        local colorb  = prescript.sh_color_b or {1};
```

```
        if #colora > #colorb then
            color_normalize(colora,colorb)
        elseif #colorb > #colora then
            color_normalize(colorb,colora)
        end
        local colorspace
        if     #colorb == 1 then colorspace = ”DeviceGray”
        elseif #colorb == 3 then colorspace = ”DeviceRGB”
        elseif #colorb == 4 then colorspace = ”DeviceCMYK”
        else   return opaq
        end
        colora = tableconcat(colora, ” ”)
        colorb = tableconcat(colorb, ” ”)
        local shade_no
        if sh_type == ”linear” then
            local coordinates = format(”%s %s”,centera,centerb)
            shade_no = sh_pdfpageresources(2,domain,colorspace,colora,colorb,coordinates)
        elseif sh_type == ”circular” then
            local radiusa = prescript.sh_radius_a
            local radiusb = prescript.sh_radius_b
            local coordinates = format(”%s %s %s %s”,centera,radiusa,centerb,radiusb)
            shade_no = sh_pdfpageresources(3,domain,colorspace,colora,colorb,coordinates)
        end
        pdf_literalcode(”q /Pattern cs”)
        return opaq,shade_no
    end
    return opaq
end

local function do_postobj_color(tr,sh)
    if sh then
        pdf_literalcode(”W n /MPlibSh%s sh Q”,sh)
    end
    if tr then
        pdf_literalcode(”/MPlibTrNormal1 gs”)
    end
end

```

End of `btex – etex` and Transparency/Shading patch.

```

local function flush(result,flusher)
    if result then
        local figures = result.fig
        if figures then
            for f=1, #figures do
                info(”flushing figure %s”,f)
                local figure = figures[f]
                local objects = getobjects(result,figure,f)
```

```
                local fignum = tonumber(stringmatch(figure:filename(),"([%d]+)$") or figure:charcode() or 0)
                local miterlimit, linecap, linejoin, dashed = -1, -1, -1, false
                local bbox = figure:boundingbox()
                local llx, lly, urx, ury = bbox[1], bbox[2], bbox[3], bbox[4] -- faster than unpack
                if urx < llx then
                    -- invalid
                    pdf_startfigure(fignum,0,0,0,0)
                    pdf_stopfigure()
                else
```

Insert `verbatimtex` code before mplib box.

```
                    if TeX_code_t[f] then
                        texsprint(TeX_code_t[f])
                    end
                    pdf_startfigure(fignum,llx,lly,urx,ury)
                    pdf_literalcode("q")
                    if objects then
                        for o=1,#objects do
                            local object        = objects[o]
                            local objecttype    = object.type
```

Change from ConTEXt code: the following 5 lines are part of the `btex...etex` patch. Again, colors are processed at this stage.

```
                            local prescript     = object.prescript
                            prescript = prescript and script2table(prescript) -- prescript is now a table
                            local tr_opaq,shade_no = do_preobj_color(object,prescript)
                            if prescript and prescript.MPlibTEXboxID then
                                putTEXboxes(object,prescript)
                            elseif objecttype == "start_bounds" or objecttype == "stop_bounds" then
                                -- skip
                            elseif objecttype == "start_clip" then
                                pdf_literalcode("q")
                                flushnormalpath(object.path,t,false)
                                pdf_literalcode("W n")
                            elseif objecttype == "stop_clip" then
                                pdf_literalcode("Q")
                                miterlimit, linecap, linejoin, dashed = -1, -1, -1, false
                            elseif objecttype == "special" then
                                -- not supported
                                if prescript and prescript.MPlibTEXError then
                                  warn("textext() anomaly. Try disabling \\mplib-textextlabel.")
                                end
                            elseif objecttype == "text" then
                                local ot = object.transform -- 3,4,5,6,1,2
                                pdf_literalcode("q %f %f %f %f %f %f cm",ot[3],ot[4],ot[5],ot[6],ot[1],
                                pdf_textfigure(object.font,object.dsize,object.text,object.width,object
```

```
                                pdf_literalcode("Q")
                            else
```

Color stuffs are modified and moved to several lines above.

```
                                local ml = object.miterlimit
                                if ml and ml ~= miterlimit then
                                    miterlimit = ml
                                    pdf_literalcode("%f M",ml)
                                end
                                local lj = object.linejoin
                                if lj and lj ~= linejoin then
                                    linejoin = lj
                                    pdf_literalcode("%i j",lj)
                                end
                                local lc = object.linecap
                                if lc and lc ~= linecap then
                                    linecap = lc
                                    pdf_literalcode("%i J",lc)
                                end
                                local dl = object.dash
                                if dl then
                                    local d = format("[%s] %i d",tableconcat(dl.dashes or {}," "),dl.of
                                    if d ~= dashed then
                                        dashed = d
                                        pdf_literalcode(dashed)
                                    end
                                elseif dashed then
                                   pdf_literalcode("[] 0 d")
                                   dashed = false
                                end
                                local path = object.path
                                local transformed, penwidth = false, 1
                                local open = path and path[1].left_type and path[#path].right_type
                                local pen = object.pen
                                if pen then
                                   if pen.type == 'elliptical' then
                                        transformed, penwidth = pen_characteris-
   tics(object) -- boolean, value
                                        pdf_literalcode("%f w",penwidth)
                                        if objecttype == 'fill' then
                                            objecttype = 'both'
                                        end
                                   else -- calculated by mplib itself
                                        objecttype = 'fill'
                                   end
                                end
                                if transformed then
                                    pdf_literalcode("q")
                                end
                                if path then
```

```
                                    if transformed then
                                        flushconcatpath(path,open)
                                    else
                                        flushnormalpath(path,open)
                                    end
```

Change from ConTEXt code: color stuff

```
                                    if not shade_no then ----- conflict with shad-
ing
                                        if objecttype == ”fill” then
                                            pdf_literalcode(”h f”)
                                        elseif objecttype == ”outline” then
                                            pdf_literalcode((open and ”S”) or ”h S”)
                                        elseif objecttype == ”both” then
                                            pdf_literalcode(”h B”)
                                        end
                                    end
                                end
                                if transformed then
                                    pdf_literalcode(”Q”)
                                end
                                local path = object.htap
                                if path then
                                    if transformed then
                                        pdf_literalcode(”q”)
                                    end
                                    if transformed then
                                        flushconcatpath(path,open)
                                    else
                                        flushnormalpath(path,open)
                                    end
                                    if objecttype == ”fill” then
                                        pdf_literalcode(”h f”)
                                    elseif objecttype == ”outline” then
                                        pdf_literalcode((open and ”S”) or ”h S”)
                                    elseif objecttype == ”both” then
                                        pdf_literalcode(”h B”)
                                    end
                                    if transformed then
                                        pdf_literalcode(”Q”)
                                    end
                                end
                                if cr then
                                    pdf_literalcode(cr)
                                end
                            end
```

Added to ConTEXt code: color stuff

```
                            do_postobj_color(tr_opaq,shade_no)
                        end
```

```
                    end
                    pdf_literalcode("Q")
                    pdf_stopfigure()
                end
            end
        end
    end
end
luamplib.flush = flush

local function colorconverter(cr)
    local n = #cr
    if n == 4 then
        local c, m, y, k = cr[1], cr[2], cr[3], cr[4]
        return format("%.3g %.3g %.3g %.3g k %.3g %.3g %.3g %.3g K",c,m,y,k,c,m,y,k), "0 g 0 G"
    elseif n == 3 then
        local r, g, b = cr[1], cr[2], cr[3]
        return format("%.3g %.3g %.3g rg %.3g %.3g %.3g RG",r,g,b,r,g,b), "0 g 0 G"
    else
        local s = cr[1]
        return format("%.3g g %.3g G",s,s), "0 g 0 G"
    end
end
luamplib.colorconverter = colorconverter
```

2.2 TEX package

⟨∗package⟩

First we need to load some packages.

```
\bgroup\expandafter\expandafter\expandafter\egroup
\expandafter\ifx\csname ProvidesPackage\endcsname\relax
  \input luatexbase-modutils.sty
\else
  \NeedsTeXFormat{LaTeX2e}
  \ProvidesPackage{luamplib}
    [2014/03/08 v2.6.0 mplib package for LuaTeX]
  \RequirePackage{luatexbase-modutils}
  \RequirePackage{pdftexcmds}
\fi
```

Loading of lua code.

```
\RequireLuaModule{luamplib}
```

Set the format for metapost.

```
\def\mplibsetformat#1{%
  \directlua{luamplib.setformat("\luatexluaescapestring{#1}")}}
```

MPLib only works in PDF mode, we don't do anything if we are in DVI mode, and we output a warning.

```
\ifnum\pdfoutput>0
```

```
    \let\mplibtoPDF\pdfliteral
\else
    %\def\MPLIBtoPDF#1{\special{pdf:literal direct #1}} % not ok yet
    \def\mplibtoPDF#1{}
    \expandafter\ifx\csname PackageWarning\endcsname\relax
      \write16{}
      \write16{Warning: MPLib only works in PDF mode, no figure will be output.}
      \write16{}
    \else
      \PackageWarning{mplib}{MPLib only works in PDF mode, no figure will be output.}
    \fi
\fi
\def\mplibsetupcatcodes{%
  %catcode`\{=12 %catcode`\}=12
  \catcode`\#=12 \catcode`\^=12 \catcode`\~=12 \catcode`\_=12
  \catcode`\&=12 \catcode`\$=12 \catcode`\%=12 \catcode`\^^M=12 \endlinechar=10
}
```

Make `btex...etex` box zero-metric.

```
\def\mplibputtextbox#1{\vbox to 0pt{\vss\hbox to 0pt{\raise\dp#1\copy#1\hss}}}
\newcount\mplibstartlineno
\def\mplibpostmpcatcodes{%
  \catcode`\{=12 \catcode`\}=12 \catcode`\#=12 \catcode`\%=12 }
\def\mplibreplacenewlinebr{%
  \begingroup \mplibpostmpcatcodes \mplibdoreplacenewlinebr}
\begingroup\lccode`\~=`\^^M \lowercase{%
  \gdef\mplibdoreplacenewlinebr#1^^J{\endgroup\luatexscantextokens{{}#1~}}}
\endgroup
```

The Plain-specific stuff.

```
\bgroup\expandafter\expandafter\expandafter\egroup
\expandafter\ifx\csname ProvidesPackage\endcsname\relax
\def\mplibreplacenewlinecs{%
  \begingroup \mplibpostmpcatcodes \mplibdoreplacenewlinecs}
\begingroup\lccode`\~=`\^^M \lowercase{%
  \gdef\mplibdoreplacenewlinecs#1^^J{\endgroup\luatexscantextokens{\relax#1~}}}
\endgroup
\def\mplibcode{%
  \mplibstartlineno\inputlineno
  \begingroup
  \begingroup
  \mplibsetupcatcodes
  \mplibdocode
}
\long\def\mplibdocode#1\endmplibcode{%
  \endgroup
  \def\mplibtemp{\directlua{luamplib.protecttextext([===[\unexpanded{#1}]===])}}%
  \directlua{luamplib.tempdata = luamplib.makeTEXboxes([===[\mplibtemp]===])}%
  \directlua{luamplib.processwithTEXboxes(luamplib.tempdata)}%
  \endgroup
```

```
  \ifnum\mplibstartlineno<\inputlineno\expandafter\mplibreplacenewlinecs\fi
}
\else
```

The LaTeX-specific parts: a new environment.

```
\newenvironment{mplibcode}{%
  \global\mplibstartlineno\inputlineno
  \toks@{}\ltxdomplibcode
}{}
\def\ltxdomplibcode{%
  \begingroup
  \mplibsetupcatcodes
  \ltxdomplibcodeindeed
}
\long\def\ltxdomplibcodeindeed#1\end#2{%
  \endgroup
  \toks@\expandafter{\the\toks@#1}%
  \ifnum\pdf@strcmp{#2}{mplibcode}=\z@
    \def\reserved@a{\directlua{luamplib.protecttextext([===[\the\toks@]===])}}%
    \directlua{luamplib.tempdata=luamplib.makeTEXboxes([===[\reserved@a]===])}%
    \directlua{luamplib.processwithTEXboxes(luamplib.tempdata)}%
    \end{mplibcode}%
    \ifnum\mplibstartlineno<\inputlineno
      \expandafter\expandafter\expandafter\mplibreplacenewlinebr
    \fi
  \else
    \toks@\expandafter{\the\toks@\end{#2}}\expandafter\ltxdomplibcode
  \fi
}
\fi
```

`\everymplib` & `\everyendmplib`: macros redefining `\everymplibtoks` & `\everyendmplibtoks` respectively

```
\newtoks\everymplibtoks
\newtoks\everyendmplibtoks
\protected\def\everymplib{%
  \mplibstartlineno\inputlineno
  \begingroup
  \mplibsetupcatcodes
  \mplibdoeverymplib
}
\long\def\mplibdoeverymplib#1{%
  \endgroup
  \everymplibtoks{#1}%
  \ifnum\mplibstartlineno<\inputlineno\expandafter\mplibreplacenewlinebr\fi
}
\protected\def\everyendmplib{%
  \mplibstartlineno\inputlineno
  \begingroup
  \mplibsetupcatcodes
  \mplibdoeveryendmplib
```

```
}
\long\def\mplibdoeveryendmplib#1{%
  \endgroup
  \everyendmplibtoks{#1}%
  \ifnum\mplibstartlineno<\inputlineno\expandafter\mplibreplacenewlinebr\fi
}
\def\mpdim#1{ begingroup \the\dimexpr #1\relax\space endgroup } % gmp.sty
\def\mplibnumbersystem#1{\directlua{luamplib.numbersystem = "#1"}}
\def\mplibmakenocache#1{\mplibdomakenocache #1,*,}
\def\mplibdomakenocache#1,{%
  \ifx\empty#1\empty
    \expandafter\mplibdomakenocache
  \else
    \ifx*#1\else
      \directlua{luamplib.noneedtoreplace["#1.mp"]=true}%
      \expandafter\expandafter\expandafter\mplibdomakenocache
    \fi
  \fi
}
\def\mplibcancelnocache#1{\mplibdocancelnocache #1,*,}
\def\mplibdocancelnocache#1,{%
  \ifx\empty#1\empty
    \expandafter\mplibdocancelnocache
  \else
    \ifx*#1\else
      \directlua{luamplib.noneedtoreplace["#1.mp"]=false}%
      \expandafter\expandafter\expandafter\mplibdocancelnocache
    \fi
  \fi
}
\def\mplibcachedir#1{\directlua{luamplib.getcachedir("\unexpanded{#1}")}}
\def\mplibtextextlabel#1{%
  \begingroup
  \def\tempa{enable}\def\tempb{#1}%
  \ifx\tempa\tempb
    \directlua{luamplib.textextlabel = true}%
  \else
    \directlua{luamplib.textextlabel = false}%
  \fi
  \endgroup
}
```

We use a dedicated scratchbox.

```
\ifx\mplibscratchbox\undefined \newbox\mplibscratchbox \fi
```

We encapsulate the litterals.

```
\def\mplibstarttoPDF#1#2#3#4{%
  \hbox\bgroup
  \xdef\MPllx{#1}\xdef\MPlly{#2}%
  \xdef\MPurx{#3}\xdef\MPury{#4}%
  \xdef\MPwidth{\the\dimexpr#3bp-#1bp\relax}%
```

```
  \xdef\MPheight{\the\dimexpr#4bp-#2bp\relax}%
  \parskip0pt%
  \leftskip0pt%
  \parindent0pt%
  \everypar{}%
  \setbox\mplibscratchbox\vbox\bgroup
  \noindent
}
\def\mplibstoptoPDF{%
  \egroup %
  \setbox\mplibscratchbox\hbox %
    {\hskip-\MPllx bp%
     \raise-\MPlly bp%
     \box\mplibscratchbox}%
  \setbox\mplibscratchbox\vbox to \MPheight
    {\vfill
     \hsize\MPwidth
     \wd\mplibscratchbox0pt%
     \ht\mplibscratchbox0pt%
     \dp\mplibscratchbox0pt%
     \box\mplibscratchbox}%
  \wd\mplibscratchbox\MPwidth
  \ht\mplibscratchbox\MPheight
  \box\mplibscratchbox
  \egroup
}
```

Text items have a special handler.

```
\def\mplibtextext#1#2#3#4#5{%
  \begingroup
  \setbox\mplibscratchbox\hbox
    {\font\temp=#1 at #2bp%
     \temp
     #3}%
  \setbox\mplibscratchbox\hbox
    {\hskip#4 bp%
     \raise#5 bp%
     \box\mplibscratchbox}%
  \wd\mplibscratchbox0pt%
  \ht\mplibscratchbox0pt%
  \dp\mplibscratchbox0pt%
  \box\mplibscratchbox
  \endgroup
}
```

input luamplib.cfg when it exists

```
\openin0=luamplib.cfg
\ifeof0 \else
  \closein0
  \input luamplib.cfg
```

```
\fi
```

That's all folks!

```
⟨/package⟩
```

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