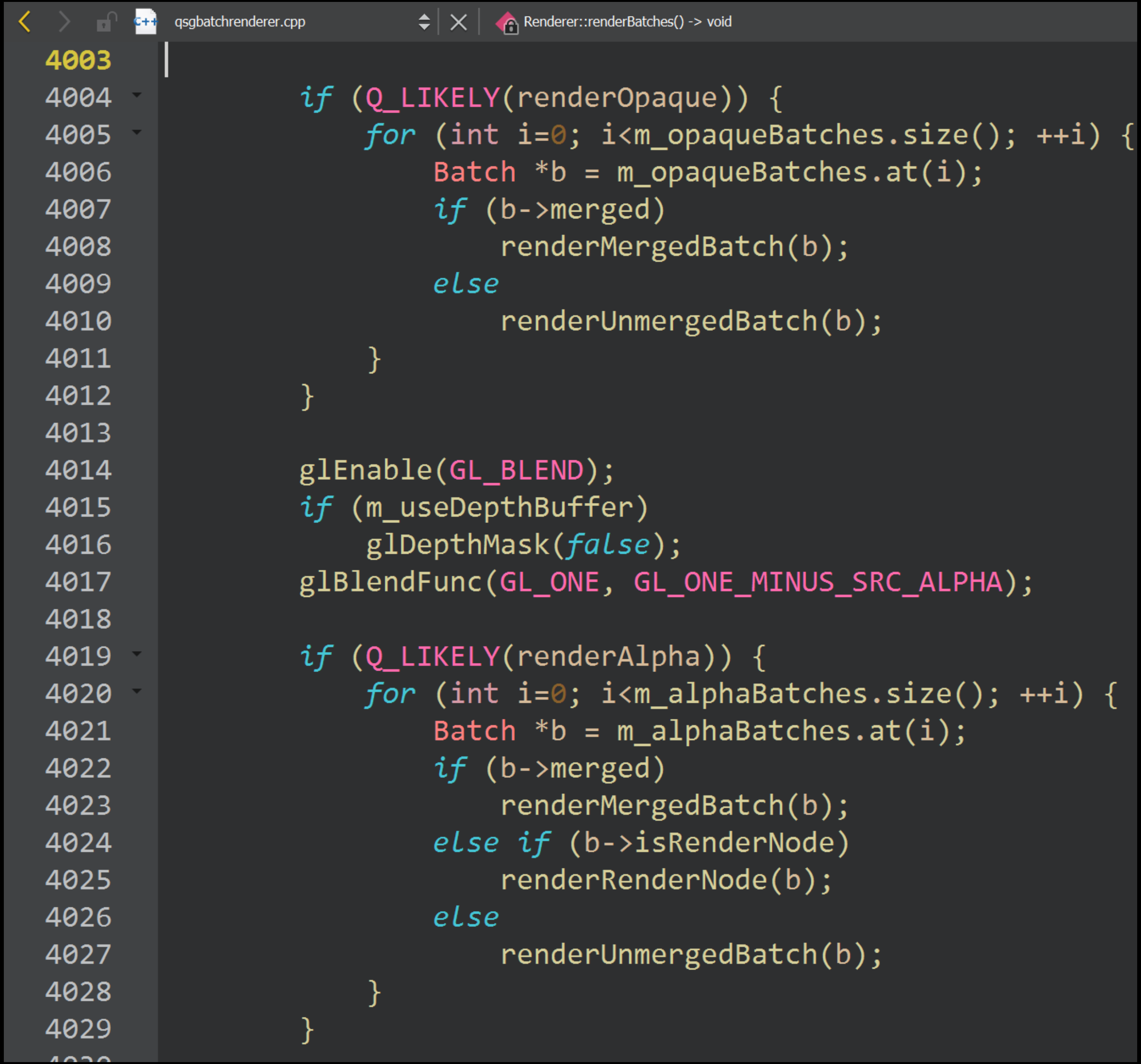
Key takeaway from porting the Qt Quick Renderer onto QRhi



```
        if (Q_LIKELY(renderOpaque)) {
            for (int i=0; i<m_opaqueBatches.size(); ++i) {
                Batch *b = m_opaqueBatches.at(i);
                if (b->merged)
                    renderMergedBatch(b);
                else
                    renderUnmergedBatch(b);
            }
        }

        glEnable(GL_BLEND);
        if (m_useDepthBuffer)
            glDepthMask(false);
        glBlendFunc(GL_ONE, GL_ONE_MINUS_SRC_ALPHA);

        if (Q_LIKELY(renderAlpha)) {
            for (int i=0; i<m_alphaBatches.size(); ++i) {
                Batch *b = m_alphaBatches.at(i);
                if (b->merged)
                    renderMergedBatch(b);
                else if (b->isRenderNode)
                    renderRenderNode(b);
                else
                    renderUnmergedBatch(b);
            }
        }
```

QRhi-based code path

```
// depth test stays enabled but no need to write out depth from the
// transparent (back-to-front) pass
m_gstate.depthWrite = false;

QVarLengthArray<PreparedRenderBatch, 64> alphaRenderBatches;
if (Q_LIKELY(renderAlpha)) {
    for (int i = 0, ie = m_alphaBatches.size(); i != ie; ++i) {
        Batch *b = m_alphaBatches.at(i);
        PreparedRenderBatch renderBatch;
        bool ok;
        if (b->merged)
            ok = prepareRenderMergedBatch(b, &renderBatch);
        else if (b->isRenderNode)
            ok = prepareRhiRenderNode(b, &renderBatch);
        else
            ok = prepareRenderUnmergedBatch(b, &renderBatch);
        if (ok)
            alphaRenderBatches.append(renderBatch);
    }
}

if (m_visualizer->mode() != Visualizer::VisualizeNothing)
    m_visualizer->prepareVisualize();

QRhiCommandBuffer *cb = commandBuffer();
cb->beginPass(renderTarget(), m_pstate.clearColor, m_pstate.dsClear, m_resourceUpdates);
m_resourceUpdates = nullptr;

for (int i = 0, ie = opaqueRenderBatches.count(); i != ie; ++i) {
    PreparedRenderBatch *renderBatch = &opaqueRenderBatches[i];
    if (renderBatch->batch->merged)
        renderMergedBatch(renderBatch);
    else
        renderUnmergedBatch(renderBatch);
}
```

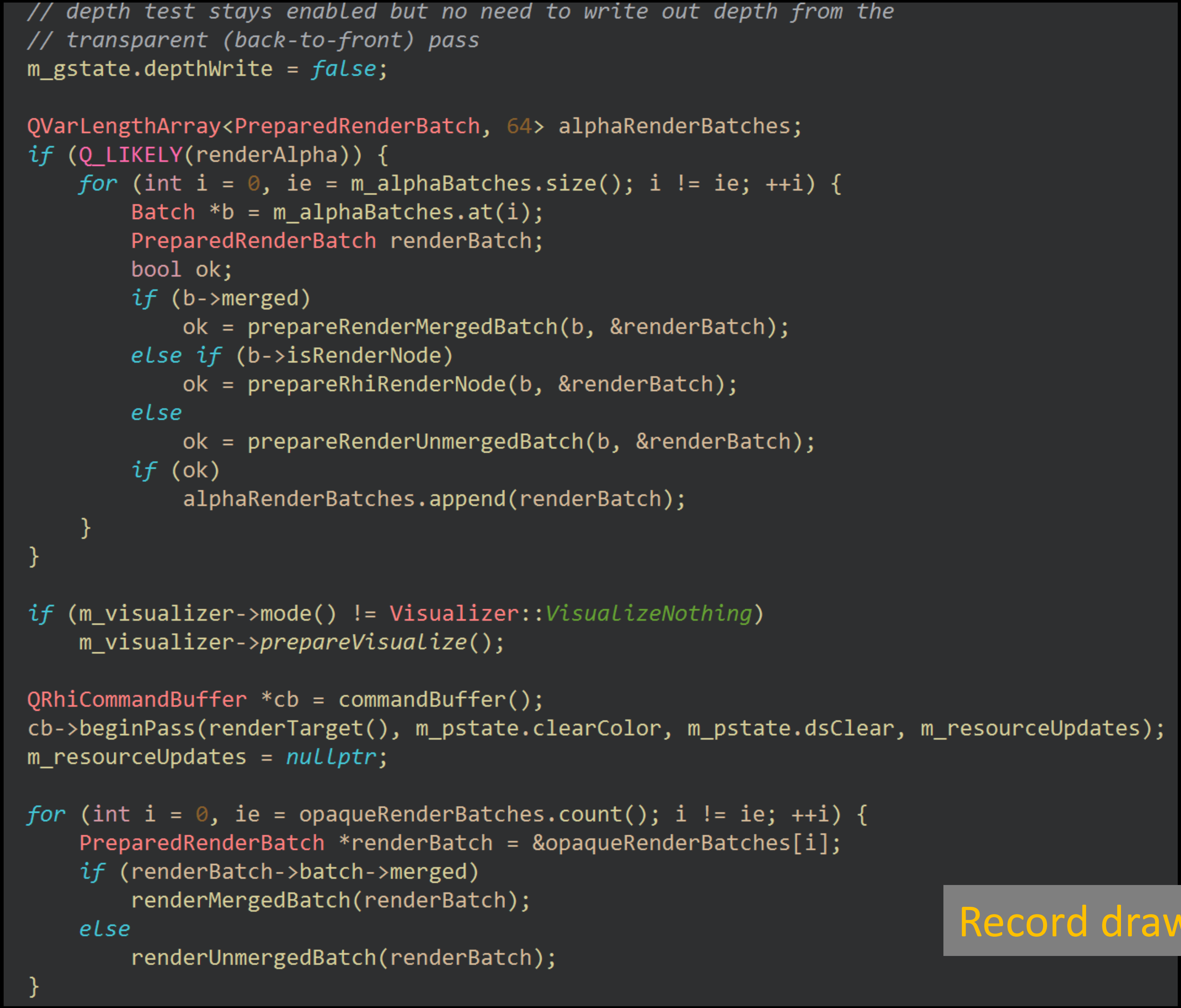
```cpp
// depth test stays enabled but no need to write out depth from the
// transparent (back-to-front) pass
m_gstate.depthWrite = false;

QVarLengthArray<PreparedRenderBatch, 64> alphaRenderBatches;
if (Q_LIKELY(renderAlpha)) {
    for (int i = 0, ie = m_alphaBatches.size(); i != ie; ++i) {
        Batch *b = m_alphaBatches.at(i);
        PreparedRenderBatch renderBatch;
        bool ok;
        if (b->merged)
            ok = prepareRenderMergedBatch(b, &renderBatch);
        else if (b->isRenderNode)
            ok = prepareRhiRenderNode(b, &renderBatch);
        else
            ok = prepareRenderUnmergedBatch(b, &renderBatch);
        if (ok)
            alphaRenderBatches.append(renderBatch);
    }
}

if (m_visualizer->mode() != Visualizer::VisualizeNothing)
    m_visualizer->prepareVisualize();

QRhiCommandBuffer *cb = commandBuffer();
cb->beginPass(renderTarget(), m_pstate.clearColor, m_pstate.dsClear, m_resourceUpdates);
m_resourceUpdates = nullptr;

for (int i = 0, ie = opaqueRenderBatches.count(); i != ie; ++i) {
    PreparedRenderBatch *renderBatch = &opaqueRenderBatches[i];
    if (renderBatch->batch->merged)
        renderMergedBatch(renderBatch);
    else
        renderUnmergedBatch(renderBatch);
}
```

Prepare vertex, index, uniform buffers, shader res.binding and pipeline state objects.

Materials provide **data**, and only data. (no messing with QRhi or graphics API)

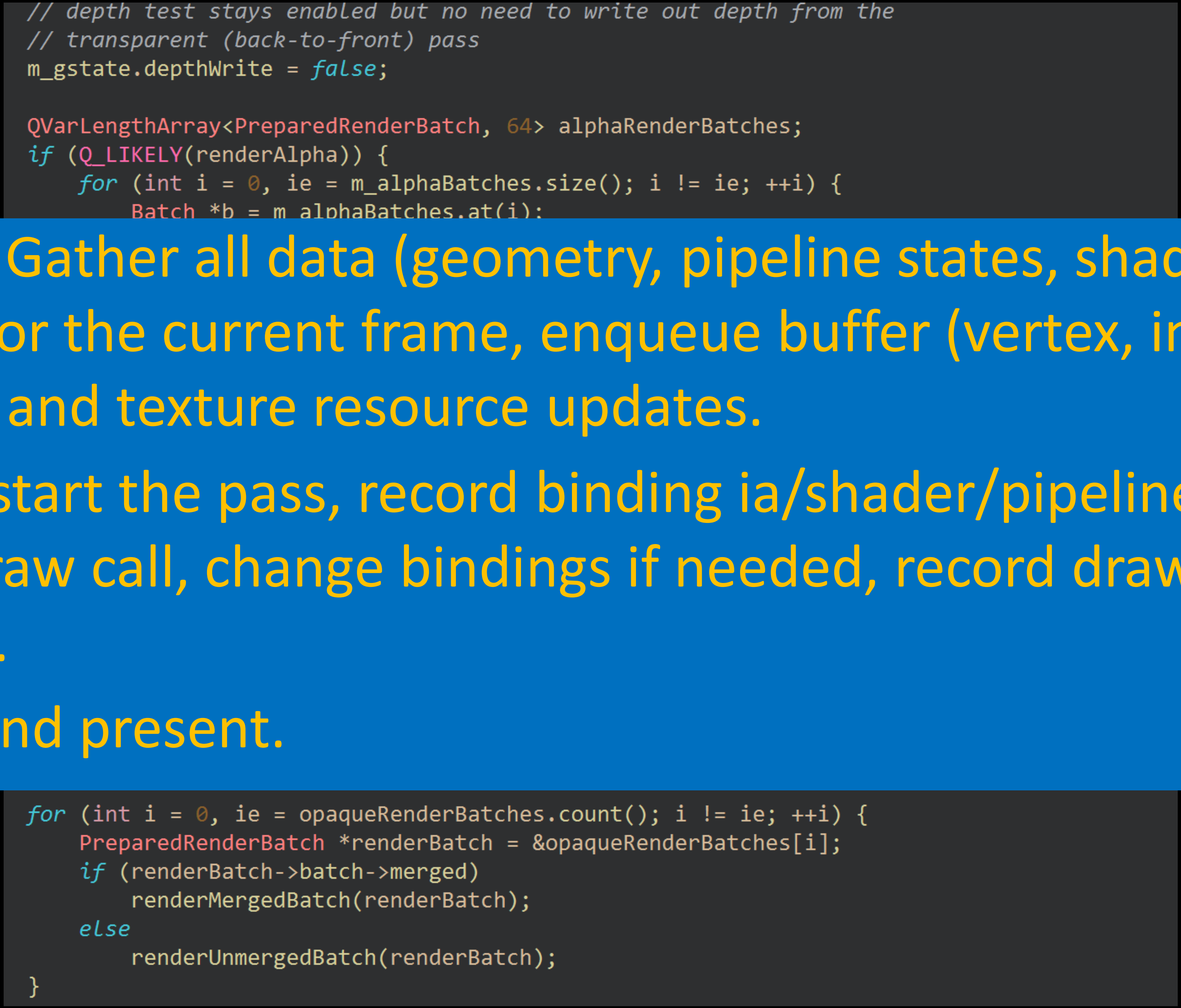
```cpp
// depth test stays enabled but no need to write out depth from the
// transparent (back-to-front) pass
m_gstate.depthWrite = false;

QVarLengthArray<PreparedRenderBatch, 64> alphaRenderBatches;
if (Q_LIKELY(renderAlpha)) {
    for (int i = 0, ie = m_alphaBatches.size(); i != ie; ++i) {
        Batch *b = m_alphaBatches.at(i);
        PreparedRenderBatch renderBatch;
        bool ok;
        if (b->merged)
            ok = prepareRenderMergedBatch(b, &renderBatch);
        else if (b->isRenderNode)
            ok = prepareRhiRenderNode(b, &renderBatch);
        else
            ok = prepareRenderUnmergedBatch(b, &renderBatch);
        if (ok)
            alphaRenderBatches.append(renderBatch);
    }
}

if (m_visualizer->mode() != Visualizer::VisualizeNothing)
    m_visualizer->prepareVisualize();

QRhiCommandBuffer *cb = commandBuffer();
cb->beginPass(renderTarget(), m_pstate.clearColor, m_pstate.dsClear, m_resourceUpdates);
m_resourceUpdates = nullptr;

for (int i = 0, ie = opaqueRenderBatches.count(); i != ie; ++i) {
    PreparedRenderBatch *renderBatch = &opaqueRenderBatches[i];
    if (renderBatch->batch->merged)
        renderMergedBatch(renderBatch);
    else
        renderUnmergedBatch(renderBatch);
}
```

Start the renderpass,
clear color/depth/stencil.



```
// depth test stays enabled but no need to write out depth from the
// transparent (back-to-front) pass
m_gstate.depthWrite = false;

QVarLengthArray<PreparedRenderBatch, 64> alphaRenderBatches;
if (Q_LIKELY(renderAlpha)) {
    for (int i = 0, ie = m_alphaBatches.size(); i != ie; ++i) {
        Batch *b = m_alphaBatches.at(i);
        PreparedRenderBatch renderBatch;
        bool ok;
        if (b->merged)
            ok = prepareRenderMergedBatch(b, &renderBatch);
        else if (b->isRenderNode)
            ok = prepareRhiRenderNode(b, &renderBatch);
        else
            ok = prepareRenderUnmergedBatch(b, &renderBatch);
        if (ok)
            alphaRenderBatches.append(renderBatch);
    }
}

if (m_visualizer->mode() != Visualizer::VisualizeNothing)
    m_visualizer->prepareVisualize();

QRhiCommandBuffer *cb = commandBuffer();
cb->beginPass(renderTarget(), m_pstate.clearColor, m_pstate.dsClear, m_resourceUpdates);
m_resourceUpdates = nullptr;

for (int i = 0, ie = opaqueRenderBatches.count(); i != ie; ++i) {
    PreparedRenderBatch *renderBatch = &opaqueRenderBatches[i];
    if (renderBatch->batch->merged)
        renderMergedBatch(renderBatch);
    else
        renderUnmergedBatch(renderBatch);
}
```

Record draw calls



```
// depth test stays enabled but no need to write out depth from the
// transparent (back-to-front) pass
m_gstate.depthWrite = false;

QVarLengthArray<PreparedRenderBatch, 64> alphaRenderBatches;
if (Q_LIKELY(renderAlpha)) {
    for (int i = 0, ie = m_alphaBatches.size(); i != ie; ++i) {
        Batch *b = m_alphaBatches.at(i);
```

- **Prepare**: Gather all data (geometry, pipeline states, shader res.) needed for the current frame, enqueue buffer (vertex, index, uniform) and texture resource updates.
- **Render**: start the pass, record binding ia/shader/pipeline stuff, record draw call, change bindings if needed, record draw call, …, end pass.
- **Submit** and present.

```
for (int i = 0, ie = opaqueRenderBatches.count(); i != ie; ++i) {
    PreparedRenderBatch *renderBatch = &opaqueRenderBatches[i];
    if (renderBatch->batch->merged)
        renderMergedBatch(renderBatch);
    else
        renderUnmergedBatch(renderBatch);
}
```