```json
{
  "$schema": "https://vega.github.io/schema/vega/v5.json",
  "description": "Process Capability Analysis Dashboard",
  "background": "#f8fafc",
  "padding": 20,
  "width": 1200,
  "height": 800,

  "data": [
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      "name": "dataset",
      "values": []
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    {
      "name": "lotStats",
      "source": "dataset",
      "transform": [
        {
          "type": "aggregate",
          "groupby": ["lot_breaker_id"],
          "ops": ["mean", "max", "min", "max"],
          "fields": ["measuredvalue", "measuredvalue", "measuredvalue", "sampleqty"],
          "as": ["xbar", "max_val", "min_val", "n"]
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        {
          "type": "formula",
          "as": "range",
          "expr": "datum.max_val - datum.min_val"
        }
      ]
    },
    {
      "name": "overallStats",
      "source": "lotStats",
      "transform": [
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          "type": "aggregate",
          "ops": ["mean", "mean", "count", "values"],
          "fields": ["xbar", "range", null, "n"],
          "as": ["grandxbar", "rbar", "num_lots", "sample_sizes"]
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        {
          "type": "formula",
          "as": "n",
          "expr": "datum.sample_sizes[0]"
        },
        {
          "type": "formula",
          "as": "d2",
          "expr": "datum.n == 2 ? 1.128 : datum.n == 3 ? 1.693 : datum.n == 4 ? 2.059 : datum.n == 5 ? 2.326 : datum.n == 6 ? 2.534 : datum.n == 7 ? 2.704 : datum.n == 8 ? 2.847 :
```

```
      datum.n == 9 ? 2.970 : 3.078"
        },
        {
          "type": "formula",
          "as": "sigma",
          "expr": "datum.rbar / datum.d2"
        }
      ]
    },
    {
      "name": "specLimits",
      "source": "dataset",
      "transform": [
        {
          "type": "aggregate",
          "ops": ["max", "max", "max"],
          "fields": ["upperlimit", "lowerlimit", "nominallimit"],
          "as": ["usl", "lsl", "nominal"]
        }
      ]
    },
    {
      "name": "combined",
      "source": "overallStats",
      "transform": [
        {
          "type": "formula",
          "as": "usl",
          "expr": "data('specLimits')[0].usl"
        },
        {
          "type": "formula",
          "as": "lsl",
          "expr": "data('specLimits')[0].lsl"
        },
        {
          "type": "formula",
          "as": "nominal",
          "expr": "data('specLimits')[0].nominal"
        },
        {
          "type": "formula",
          "as": "cp",
          "expr": "(datum.usl - datum.lsl) / (6 * datum.sigma)"
        },
        {
          "type": "formula",
          "as": "cpu",
          "expr": "(datum.usl - datum.grandxbar) / (3 * datum.sigma)"
        },
        {
          "type": "formula",
          "as": "cpl",
```

```
          "expr": "(datum.grandxbar - datum.lsl) / (3 * datum.sigma)"
        },
        {
          "type": "formula",
          "as": "cpk",
          "expr": "min(datum.cpu, datum.cpl)"
        },
        {
          "type": "formula",
          "as": "plus3sigma",
          "expr": "datum.grandxbar + (3 * datum.sigma)"
        },
        {
          "type": "formula",
          "as": "minus3sigma",
          "expr": "datum.grandxbar - (3 * datum.sigma)"
        }
      ]
    },
    {
      "name": "histogram",
      "source": "dataset",
      "transform": [
        {
          "type": "bin",
          "field": "measuredvalue",
          "maxbins": 20,
          "as": ["bin0", "bin1"]
        },
        {
          "type": "aggregate",
          "groupby": ["bin0", "bin1"],
          "ops": ["count"],
          "as": ["count"]
        }
      ]
    }
  ],

  "scales": [
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      "name": "histX",
      "type": "linear",
      "domain": {"data": "histogram", "fields": ["bin0", "bin1"]},
      "range": [400, 1150],
      "nice": true
    },
    {
      "name": "histY",
      "type": "linear",
      "domain": {"data": "histogram", "field": "count"},
      "range": [350, 50],
      "nice": true,
```

```json
        "zero": true
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    "marks": [
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        "type": "group",
        "encode": {
          "enter": {
            "x": {"value": 0},
            "y": {"value": 0},
            "width": {"value": 350},
            "height": {"value": 750}
          }
        },
        "marks": [
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            "type": "rect",
            "encode": {
              "enter": {
                "x": {"value": 0},
                "y": {"value": 0},
                "width": {"value": 350},
                "height": {"value": 750},
                "fill": {"value": "#ffffff"},
                "stroke": {"value": "#e2e8f0"},
                "strokeWidth": {"value": 2},
                "cornerRadius": {"value": 12}
              }
            }
          },
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            "type": "text",
            "from": {"data": "combined"},
            "encode": {
              "enter": {
                "x": {"value": 20},
                "y": {"value": 40},
                "text": {"value": "Sample Size"},
                "fontSize": {"value": 13},
                "fill": {"value": "#64748b"}
              }
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          },
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            "type": "text",
            "from": {"data": "combined"},
            "encode": {
              "enter": {
                "x": {"value": 330},
                "y": {"value": 40},
                "text": {"field": "n"},
                "fontSize": {"value": 16},
```

```
              "fontWeight": {"value": "bold"},
              "fill": {"value": "#1e293b"},
              "align": {"value": "right"}
            }
          }
        },
        {
          "type": "text",
          "from": {"data": "combined"},
          "encode": {
            "enter": {
              "x": {"value": 20},
              "y": {"value": 80},
              "text": {"value": "Number of Lots"},
              "fontSize": {"value": 13},
              "fill": {"value": "#64748b"}
            }
          }
        },
        {
          "type": "text",
          "from": {"data": "combined"},
          "encode": {
            "enter": {
              "x": {"value": 330},
              "y": {"value": 80},
              "text": {"field": "num_lots"},
              "fontSize": {"value": 16},
              "fontWeight": {"value": "bold"},
              "fill": {"value": "#1e293b"},
              "align": {"value": "right"}
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          "type": "rule",
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              "x2": {"value": 330},
              "y": {"value": 110},
              "stroke": {"value": "#e2e8f0"},
              "strokeWidth": {"value": 1}
            }
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          "from": {"data": "combined"},
          "encode": {
            "enter": {
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              "y": {"value": 150},
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          "fontSize": {"value": 13},
          "fill": {"value": "#64748b"}
        }
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      "type": "text",
      "from": {"data": "combined"},
      "encode": {
        "enter": {
          "x": {"value": 330},
          "y": {"value": 150},
          "text": {"signal": "format(datum.grandxbar, '.4f')"},
          "fontSize": {"value": 16},
          "fontWeight": {"value": "bold"},
          "fill": {"value": "#3b82f6"},
          "align": {"value": "right"}
        }
      }
    },
    {
      "type": "text",
      "from": {"data": "combined"},
      "encode": {
        "enter": {
          "x": {"value": 20},
          "y": {"value": 190},
          "text": {"value": "Std Dev (σ)"},
          "fontSize": {"value": 13},
          "fill": {"value": "#64748b"}
        }
      }
    },
    {
      "type": "text",
      "from": {"data": "combined"},
      "encode": {
        "enter": {
          "x": {"value": 330},
          "y": {"value": 190},
          "text": {"signal": "format(datum.sigma, '.5f')"},
          "fontSize": {"value": 16},
          "fontWeight": {"value": "bold"},
          "fill": {"value": "#3b82f6"},
          "align": {"value": "right"}
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      }
    },
    {
      "type": "rule",
      "encode": {
        "enter": {
```

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          "x": {"value": 20},
          "x2": {"value": 330},
          "y": {"value": 230},
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          "strokeWidth": {"value": 1}
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      }
    },
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      "type": "text",
      "from": {"data": "combined"},
      "encode": {
        "enter": {
          "x": {"value": 20},
          "y": {"value": 270},
          "text": {"value": "USL"},
          "fontSize": {"value": 13},
          "fill": {"value": "#64748b"}
        }
      }
    },
    {
      "type": "text",
      "from": {"data": "combined"},
      "encode": {
        "enter": {
          "x": {"value": 330},
          "y": {"value": 270},
          "text": {"signal": "format(datum.usl, '.3f')"},
          "fontSize": {"value": 16},
          "fontWeight": {"value": "bold"},
          "fill": {"value": "#ef4444"},
          "align": {"value": "right"}
        }
      }
    },
    {
      "type": "text",
      "from": {"data": "combined"},
      "encode": {
        "enter": {
          "x": {"value": 20},
          "y": {"value": 310},
          "text": {"value": "Nominal"},
          "fontSize": {"value": 13},
          "fill": {"value": "#64748b"}
        }
      }
    },
    {
      "type": "text",
      "from": {"data": "combined"},
      "encode": {
```

```
      "enter": {
        "x": {"value": 330},
        "y": {"value": 310},
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        "fontSize": {"value": 16},
        "fontWeight": {"value": "bold"},
        "fill": {"value": "#8b5cf6"},
        "align": {"value": "right"}
      }
    }
  },
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    "type": "text",
    "from": {"data": "combined"},
    "encode": {
      "enter": {
        "x": {"value": 20},
        "y": {"value": 350},
        "text": {"value": "LSL"},
        "fontSize": {"value": 13},
        "fill": {"value": "#64748b"}
      }
    }
  },
  {
    "type": "text",
    "from": {"data": "combined"},
    "encode": {
      "enter": {
        "x": {"value": 330},
        "y": {"value": 350},
        "text": {"signal": "format(datum.lsl, '.3f')"},
        "fontSize": {"value": 16},
        "fontWeight": {"value": "bold"},
        "fill": {"value": "#ef4444"},
        "align": {"value": "right"}
      }
    }
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        "x": {"value": 20},
        "x2": {"value": 330},
        "y": {"value": 390},
        "stroke": {"value": "#e2e8f0"},
        "strokeWidth": {"value": 1}
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```

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            "y": {"value": 430},
            "text": {"value": "Cp"},
            "fontSize": {"value": 13},
            "fill": {"value": "#64748b"}
          }
        }
      },
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        "type": "text",
        "from": {"data": "combined"},
        "encode": {
          "enter": {
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            "y": {"value": 430},
            "text": {"signal": "format(datum.cp, '.3f')"},
            "fontSize": {"value": 18},
            "fontWeight": {"value": "bold"},
            "fill": {"value": "#10b981"},
            "align": {"value": "right"}
          }
        }
      },
      {
        "type": "text",
        "from": {"data": "combined"},
        "encode": {
          "enter": {
            "x": {"value": 20},
            "y": {"value": 475},
            "text": {"value": "Cpk"},
            "fontSize": {"value": 13},
            "fill": {"value": "#64748b"}
          }
        }
      },
      {
        "type": "text",
        "from": {"data": "combined"},
        "encode": {
          "enter": {
            "x": {"value": 330},
            "y": {"value": 475},
            "text": {"signal": "format(datum.cpk, '.3f')"},
            "fontSize": {"value": 18},
            "fontWeight": {"value": "bold"},
            "fill": {"value": "#10b981"},
            "align": {"value": "right"}
          }
        }
```

```
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    {
      "type": "rule",
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          "x2": {"value": 330},
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          "stroke": {"value": "#e2e8f0"},
          "strokeWidth": {"value": 1}
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    },
    {
      "type": "text",
      "from": {"data": "combined"},
      "encode": {
        "enter": {
          "x": {"value": 20},
          "y": {"value": 550},
          "text": {"value": "+3σ"},
          "fontSize": {"value": 13},
          "fill": {"value": "#64748b"}
        }
      }
    },
    {
      "type": "text",
      "from": {"data": "combined"},
      "encode": {
        "enter": {
          "x": {"value": 330},
          "y": {"value": 550},
          "text": {"signal": "format(datum.plus3sigma, '.4f')"},
          "fontSize": {"value": 14},
          "fontWeight": {"value": "600"},
          "fill": {"value": "#1e293b"},
          "align": {"value": "right"}
        }
      }
    },
    {
      "type": "text",
      "from": {"data": "combined"},
      "encode": {
        "enter": {
          "x": {"value": 20},
          "y": {"value": 590},
          "text": {"value": "-3σ"},
          "fontSize": {"value": 13},
          "fill": {"value": "#64748b"}
        }
      }
```

```
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            "from": {"data": "combined"},
            "encode": {
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                "x": {"value": 330},
                "y": {"value": 590},
                "text": {"signal": "format(datum.minus3sigma, '.4f')"},
                "fontSize": {"value": 14},
                "fontWeight": {"value": "600"},
                "fill": {"value": "#1e293b"},
                "align": {"value": "right"}
              }
            }
          }
        ]
      },
      {
        "type": "group",
        "encode": {
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            "y": {"value": 0},
            "width": {"value": 800},
            "height": {"value": 400}
          }
        },
        "marks": [
          {
            "type": "rect",
            "encode": {
              "enter": {
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                "y": {"value": 0},
                "width": {"value": 800},
                "height": {"value": 400},
                "fill": {"value": "#ffffff"},
                "stroke": {"value": "#e2e8f0"},
                "strokeWidth": {"value": 2},
                "cornerRadius": {"value": 12}
              }
            }
          },
          {
            "type": "rect",
            "from": {"data": "histogram"},
            "encode": {
              "enter": {
                "x": {"scale": "histX", "field": "bin0"},
                "x2": {"scale": "histX", "field": "bin1"},
                "y": {"scale": "histY", "field": "count"},
                "y2": {"scale": "histY", "value": 0},
```

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        "fill": {"value": "#3b82f6"},
        "stroke": {"value": "#2563eb"},
        "strokeWidth": {"value": 1}
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      "update": {
        "fillOpacity": {"value": 0.7}
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      "hover": {
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      }
    }
  },
  {
    "type": "rule",
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    "encode": {
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        "y": {"value": 50},
        "y2": {"value": 350},
        "stroke": {"value": "#1e293b"},
        "strokeWidth": {"value": 2},
        "strokeDash": {"value": [6, 3]}
      }
    }
  },
  {
    "type": "rule",
    "from": {"data": "combined"},
    "encode": {
      "enter": {
        "x": {"scale": "histX", "field": "usl"},
        "y": {"value": 50},
        "y2": {"value": 350},
        "stroke": {"value": "#ef4444"},
        "strokeWidth": {"value": 2}
      }
    }
  },
  {
    "type": "rule",
    "from": {"data": "combined"},
    "encode": {
      "enter": {
        "x": {"scale": "histX", "field": "lsl"},
        "y": {"value": 50},
        "y2": {"value": 350},
        "stroke": {"value": "#ef4444"},
        "strokeWidth": {"value": 2}
      }
    }
  },
  {
```

```
          "type": "rule",
          "from": {"data": "combined"},
          "encode": {
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              "x": {"scale": "histX", "field": "plus3sigma"},
              "y": {"value": 50},
              "y2": {"value": 350},
              "stroke": {"value": "#64748b"},
              "strokeWidth": {"value": 1},
              "strokeDash": {"value": [4, 2]}
            }
          }
        },
        {
          "type": "rule",
          "from": {"data": "combined"},
          "encode": {
            "enter": {
              "x": {"scale": "histX", "field": "minus3sigma"},
              "y": {"value": 50},
              "y2": {"value": 350},
              "stroke": {"value": "#64748b"},
              "strokeWidth": {"value": 1},
              "strokeDash": {"value": [4, 2]}
            }
          }
        }
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      "axes": [
        {
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          "scale": "histX",
          "labelColor": "#64748b",
          "labelFontSize": 11,
          "domainColor": "#cbd5e1",
          "tickColor": "#cbd5e1",
          "gridColor": "#f1f5f9",
          "format": ".2f"
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        {
          "orient": "left",
          "scale": "histY",
          "labelColor": "#64748b",
          "labelFontSize": 11,
          "domainColor": "#cbd5e1",
          "tickColor": "#cbd5e1",
          "gridColor": "#f1f5f9"
        }
      ]
    }
  ]
}
```