Useful plot for match analysis

In the following code once can be find some interensting functions that are useful to show the pitch image and some interesting plots, in order to contextualize some match situations.

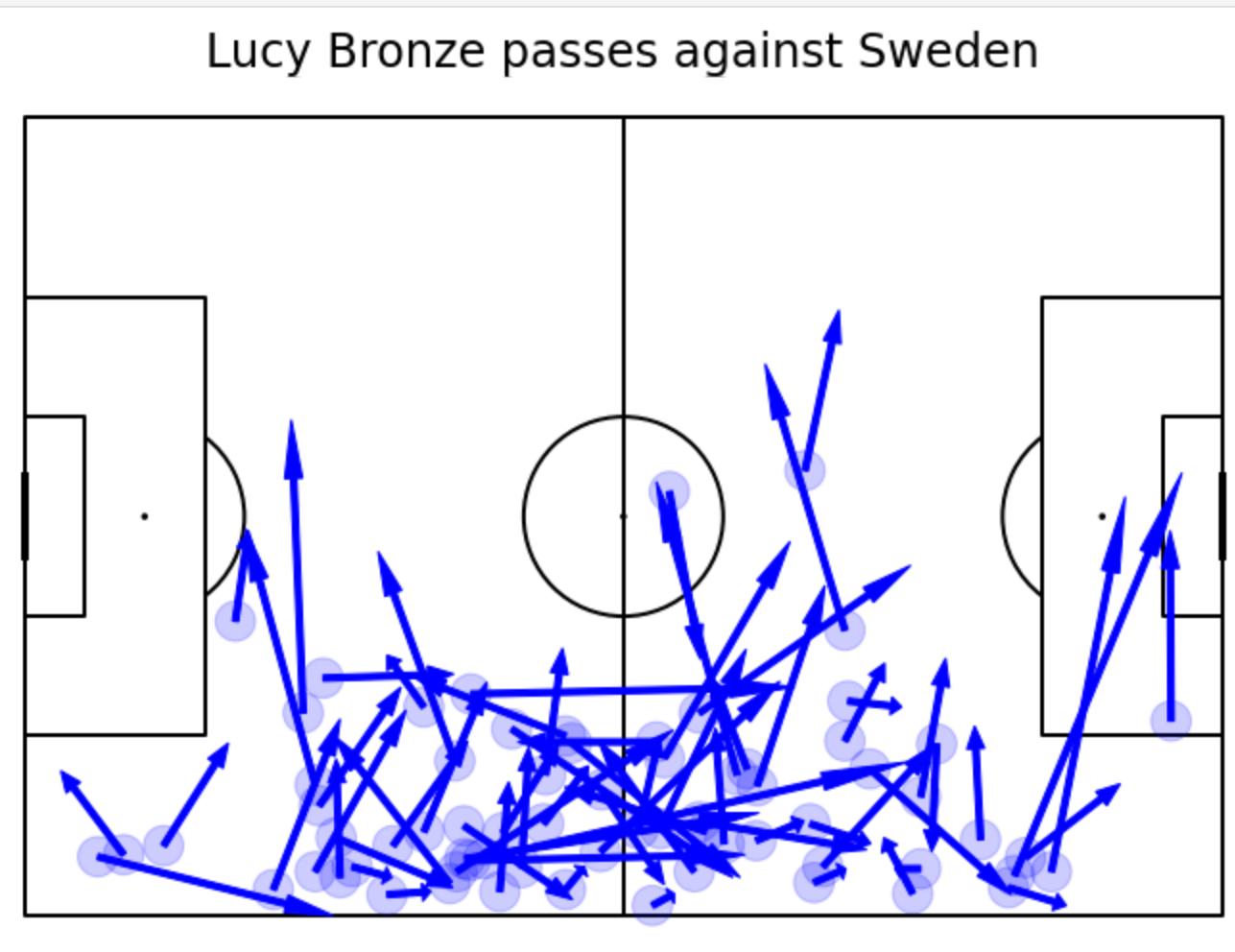
The provided plots are generated by using football woman's data, which are pretty easy to find and clear to read.

In [9]:
```
#importing necessary libraries
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd
from mplsoccer import Pitch, Sbopen
```

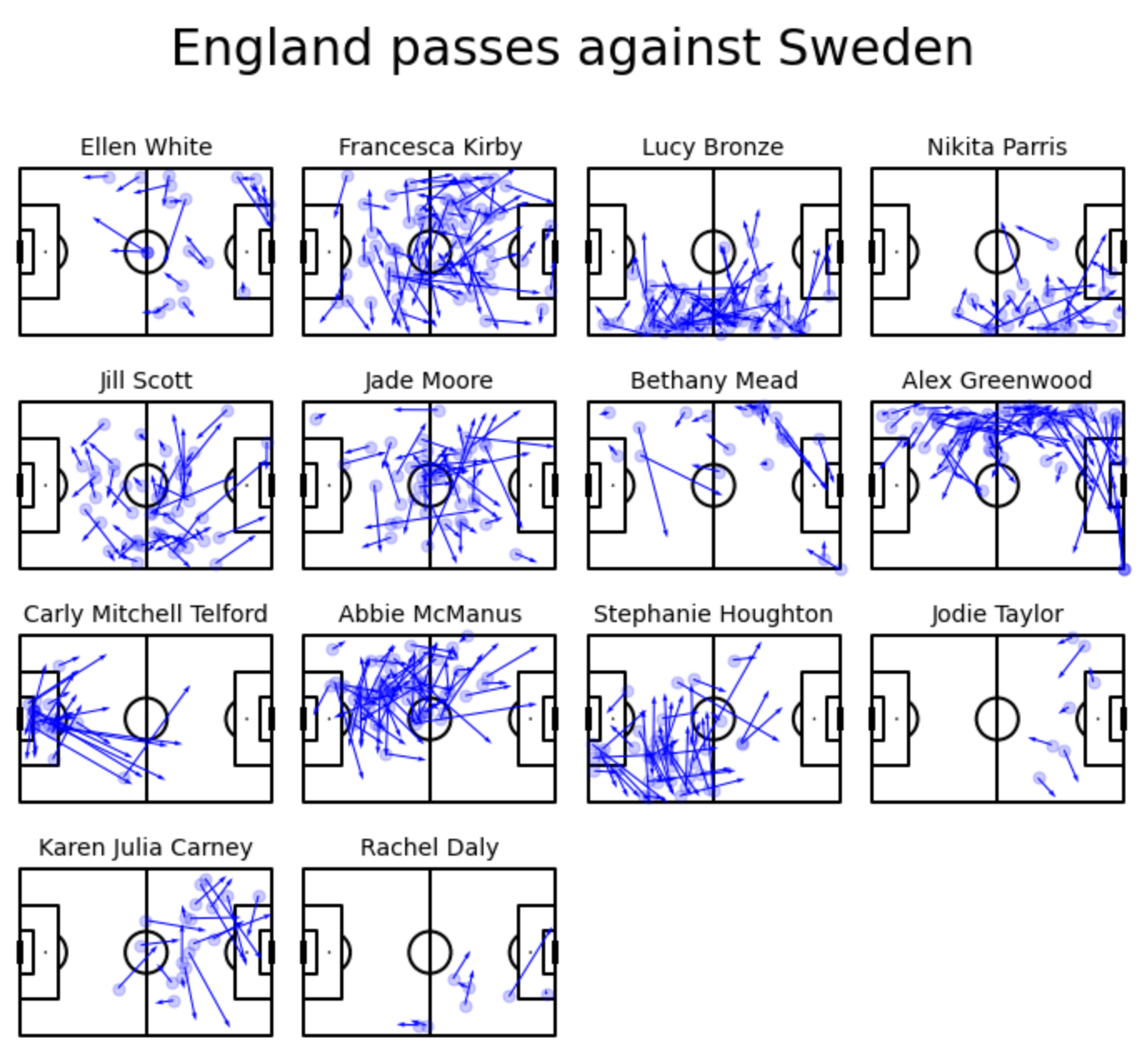
In [3]:
```
parser = Sbopen()
df, related, freeze, tactics = parser.event(69301)
passes = df.loc[df['type_name'] == 'Pass'].loc[df['sub_type_name'] != 'Throw-in'].set_index('id')
```

PLOTTING PASSES

In [4]:
```
#drawing pitch
pitch = Pitch(line_color = "black")
fig, ax = pitch.draw(figsize=(10, 7))

for i,thepass in passes.iterrows():
    #if pass made by Lucy Bronze
    if thepass['player_name']=='Lucy Bronze':
        x=thepass['x']
        y=thepass['y']
        #plot circle
        passCircle=plt.Circle((x,y),2,color="blue")
        passCircle.set_alpha(.2)
        ax.add_patch(passCircle)
        dx=thepass['end_x']-x
        dy=thepass['end_y']-y
        #plot arrow
        passArrow=plt.Arrow(x,y,dx,dy,width=3,color="blue")
        ax.add_patch(passArrow)

ax.set_title("Lucy Bronze passes against Sweden", fontsize = 24)
fig.set_size_inches(10, 7)
plt.show()
```



In [5]:
```
#prepare the dataframe of passes by England that were no-throw ins
mask_england = (df.type_name == 'Pass') & (df.team_name == "England Women's") & (df.sub_type_name != "Throw-in")
df_passes = df.loc[mask_england, ['x', 'y', 'end_x', 'end_y', 'player_name']]
#get the list of all players who made a pass
names = df_passes['player_name'].unique()

#draw 4x4 pitches
pitch = Pitch(line_color='black', pad_top=20)
fig, axs = pitch.grid(ncols = 4, nrows = 4, grid_height=0.85, title_height=0.06, axis=False,
                     endnote_height=0.04, title_space=0.04, endnote_space=0.01)

#for each player
for name, ax in zip(names, axs['pitch'].flat[:len(names)]):
    #put player name over the plot
    ax.text(60, -10, name,
            ha='center', va='center', fontsize=14)
    #take only passes by this player
    player_df = df_passes.loc[df_passes["player_name"] == name]
    #scatter
    pitch.scatter(player_df.x, player_df.y, alpha = 0.2, s = 50, color = "blue", ax=ax)
    #plot arrow
    pitch.arrows(player_df.x, player_df.y,
            player_df.end_x, player_df.end_y, color = "blue", ax=ax, width=1)

#We have more than enough pitches - remove them
for ax in axs['pitch'][-1, 16 - len(names):]:
    ax.remove()

#Another way to set title using mplsoccer
axs['title'].text(0.5, 0.5, 'England passes against Sweden', ha='center', va='center', fontsize=30)
plt.show()
```



NETWORKING PASSES

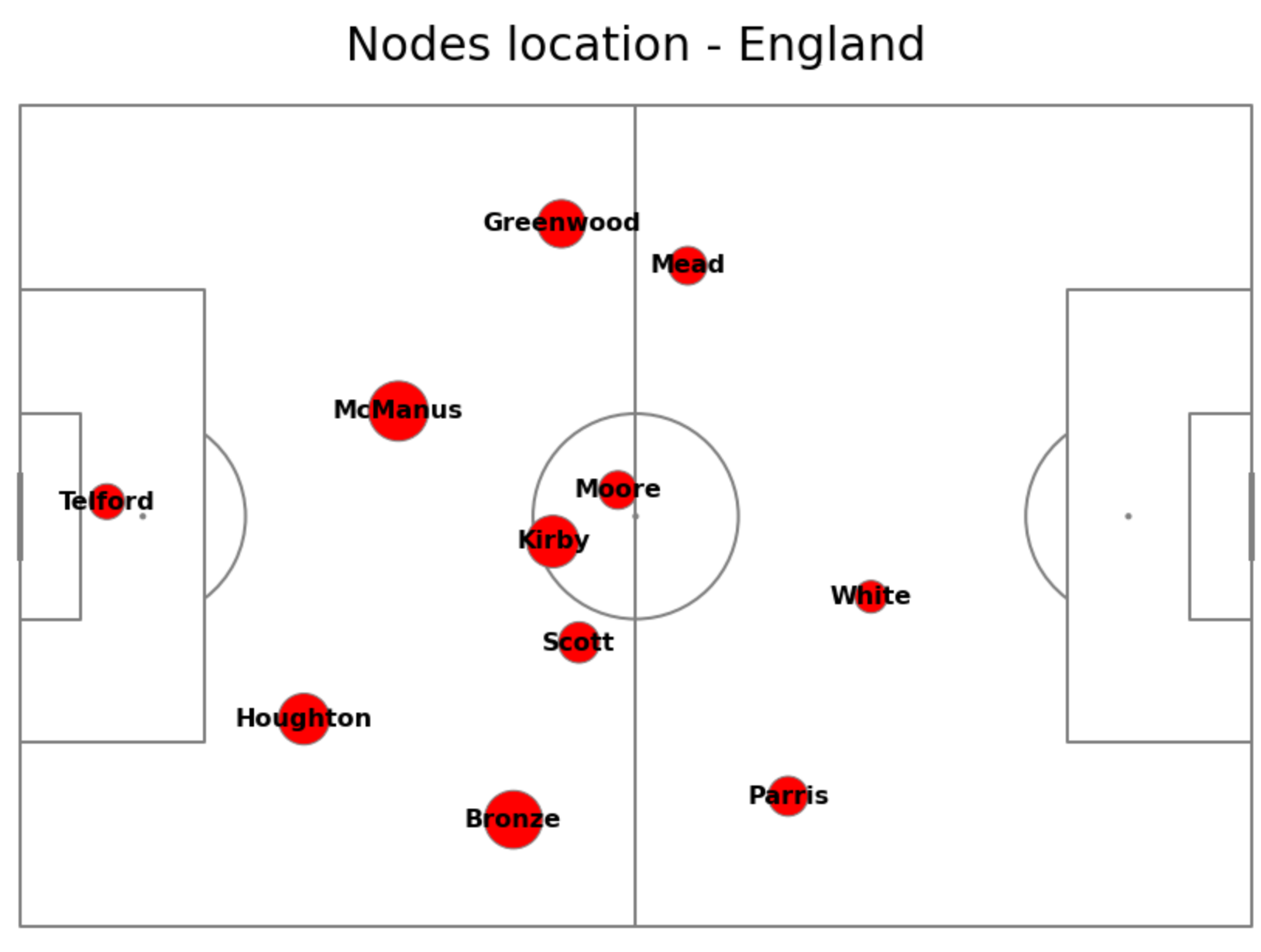
In [6]:
```
parser = Sbopen()
df, related, freeze, tactics = parser.event(69301)
```

In [7]:
```
#check for index of first sub
sub = df.loc[df["type_name"] == "Substitution"].loc[df["team_name"] == "England Women's"].iloc[0]["index"]
#make df with successfull passes by England until the first substitution
mask_england = (df.type_name == 'Pass') & (df.team_name == "England Women's") & (df.index < sub) & (df.outcome_name.isnull()) & (df.sub_type_name != "Throw-in")
#taking necessary columns
df_pass = df.loc[mask_england, ['x', 'y', 'end_x', 'end_y', "player_name", "pass_recipient_name"]]
#adjusting that only the surname of a player is presented.
df_pass["player_name"] = df_pass["player_name"].apply(lambda x: str(x).split()[-1])
df_pass["pass_recipient_name"] = df_pass["pass_recipient_name"].apply(lambda x: str(x).split()[-1])
```

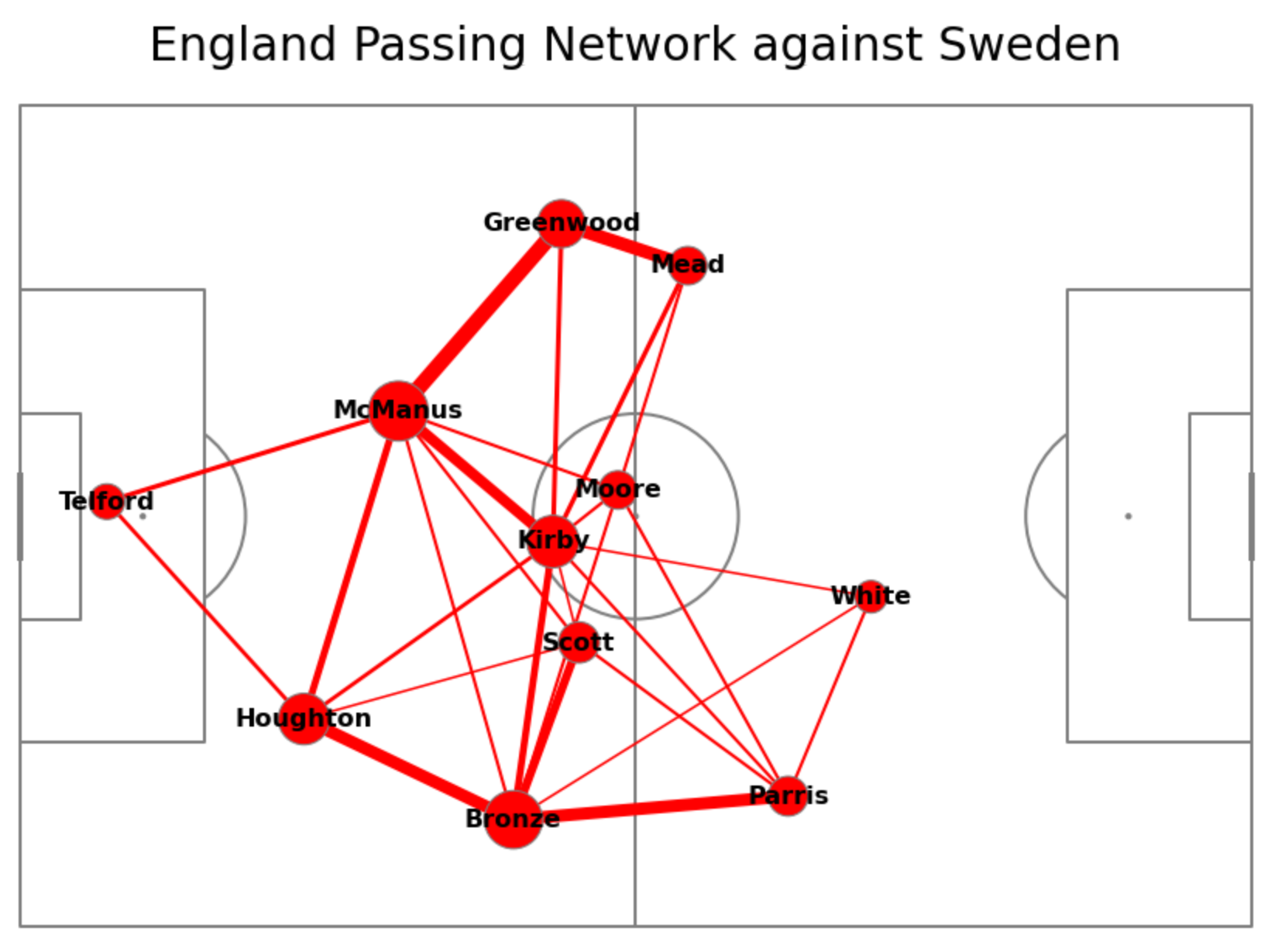
In [10]:
```
scatter_df = pd.DataFrame()
for i, name in enumerate(df_pass["player_name"].unique()):
    passx = df_pass.loc[df_pass["player_name"] == name]["x"].to_numpy()
    recx = df_pass.loc[df_pass["pass_recipient_name"] == name]["end_x"].to_numpy()
    passy = df_pass.loc[df_pass["player_name"] == name]["y"].to_numpy()
    recy = df_pass.loc[df_pass["pass_recipient_name"] == name]["end_y"].to_numpy()
    scatter_df.at[i, "player_name"] = name
    #make sure that x and y location for each circle representing the player is the average of passes and receptions
    scatter_df.at[i, "x"] = np.mean(np.concatenate([passx, recx]))
    scatter_df.at[i, "y"] = np.mean(np.concatenate([passy, recy]))
    #calculate number of passes
    scatter_df.at[i, "no"] = df_pass.loc[df_pass["player_name"] == name].count().iloc[0]

#adjust the size of a circle so that the player who made more passes
scatter_df['marker_size'] = (scatter_df['no'] / scatter_df['no'].max() * 1500)
```

In [11]:
```
#counting passes between players
df_pass["pair_key"] = df_pass.apply(lambda x: "_".join(sorted([x["player_name"], x["pass_recipient_name"]])), axis=1)
lines_df = df_pass.groupby(["pair_key"]).x.count().reset_index()
lines_df.rename({'x':'pass_count'}, axis='columns', inplace=True)
#setting a treshold. You can try to investigate how it changes when you change it.
lines_df = lines_df[lines_df['pass_count']>2]
```

In [12]:
```
#Drawing pitch
pitch = Pitch(line_color='grey')
fig, ax = pitch.grid(grid_height=0.9, title_height=0.06, axis=False,
                     endnote_height=0.04, title_space=0, endnote_space=0)
#Scatter the location on the pitch
pitch.scatter(scatter_df.x, scatter_df.y, s=scatter_df.marker_size, color='red', edgecolors='grey', linewidth=1, alpha=1, ax=ax["pitch"], zorder = 3)
#annotating player name
for i, row in scatter_df.iterrows():
    pitch.annotate(row.player_name, xy=(row.x, row.y), c='black', va='center', ha='center', weight = "bold", size=16, ax=ax["pitch"], zorder = 4)

fig.suptitle("Nodes location - England", fontsize = 30)
plt.show()
```



In [13]:
```
#plot once again pitch and vertices
pitch = Pitch(line_color='grey')
fig, ax = pitch.grid(grid_height=0.9, title_height=0.06, axis=False,
                     endnote_height=0.04, title_space=0, endnote_space=0)
pitch.scatter(scatter_df.x, scatter_df.y, s=scatter_df.marker_size, color='red', edgecolors='grey', linewidth=1, alpha=1, ax=ax["pitch"], zorder = 3)
for i, row in scatter_df.iterrows():
    pitch.annotate(row.player_name, xy=(row.x, row.y), c='black', va='center', ha='center', weight = "bold", size=16, ax=ax["pitch"], zorder = 4)

for i, row in lines_df.iterrows():
        player1 = row["pair_key"].split("_")[0]
        player2 = row['pair_key'].split("_")[1]
        #take the average location of players to plot a line between them
        player1_x = scatter_df.loc[scatter_df["player_name"] == player1]['x'].iloc[0]
        player1_y = scatter_df.loc[scatter_df["player_name"] == player1]['y'].iloc[0]
        player2_x = scatter_df.loc[scatter_df["player_name"] == player2]['x'].iloc[0]
        player2_y = scatter_df.loc[scatter_df["player_name"] == player2]['y'].iloc[0]
        num_passes = row["pass_count"]
        #adjust the line width so that the more passes, the wider the line
        line_width = (num_passes / lines_df['pass_count'].max() * 10)
        #plot lines on the pitch
        pitch.lines(player1_x, player1_y, player2_x, player2_y,
                        alpha=1, lw=line_width, zorder=2, color="red", ax = ax["pitch"])

fig.suptitle("England Passing Network against Sweden", fontsize = 30)
plt.show()
```

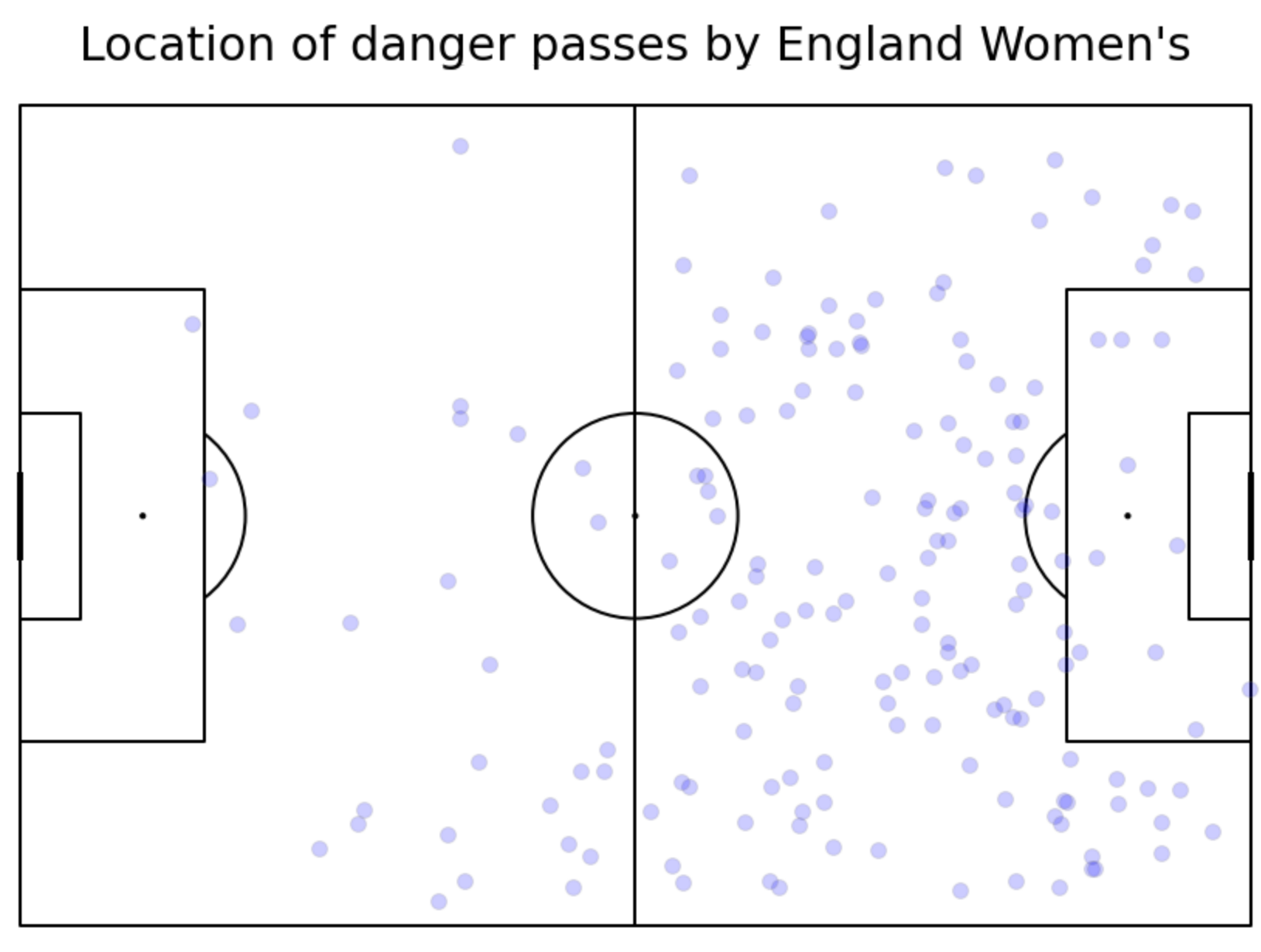


PASS HEAT MAPS

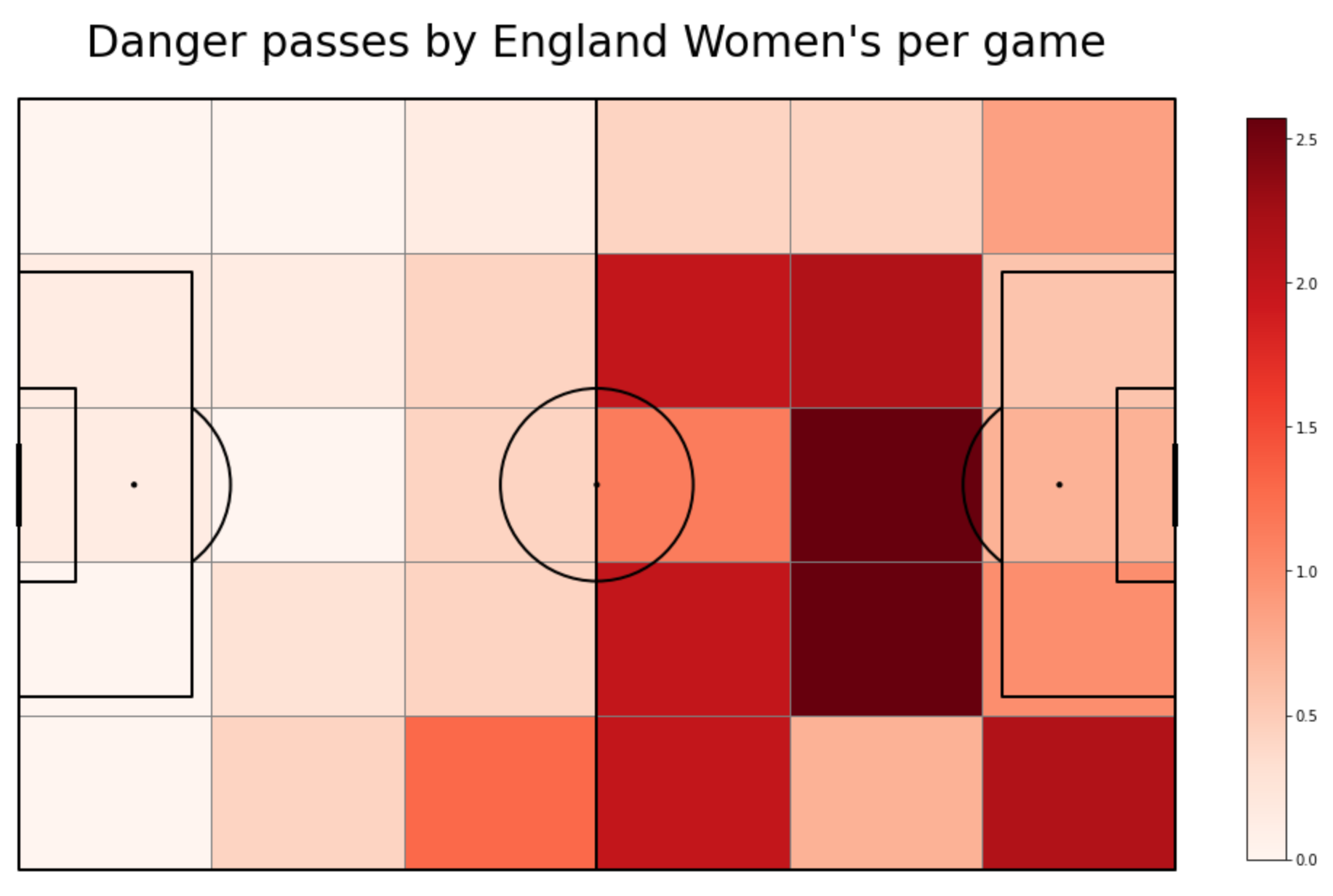
In [14]:
```
#open the data
parser = Sbopen()
df_match = parser.match(competition_id=72, season_id=30)
#our team
team = "England Women's"
#get list of games by our team, either home or away
match_ids = df_match.loc[(df_match["home_team_name"] == team) | (df_match["away_team_name"] == team)]["match_id"].tolist()
#calculate number of games
no_games = len(match_ids)
```

In [15]:
```
#declare an empty dataframe
danger_passes = pd.DataFrame()
for idx in match_ids:
    #open the event data from this game
    df = parser.event(idx)[0]
    for period in [1, 2]:
        #keep only accurate passes by England that were not set pieces in this period
        mask_pass = (df.team_name == team) & (df.type_name == "Pass") & (df.outcome_name.isnull()) & (df.period == period) & (df.sub_type_name.isnull())
        #keep only necessary columns
        passes = df.loc[mask_pass, ["x", "y", "end_x", "end_y", "minute", "second", "player_name"]]
        #keep only Shots by England in this period
        mask_shot = (df.team_name == team) & (df.type_name == "Shot") & (df.period == period)
        #keep only necessary columns
        shots = df.loc[mask_shot, ["minute", "second"]]
        #convert time to seconds
        shot_times = shots['minute']*60+shots['second']
        shot_window = 15
        #find starts of the window
        shot_start = shot_times - shot_window
        #condition to avoid negative shot starts
        shot_start = shot_start.apply(lambda i: i if i>0 else (period-1)*45)
        #convert to seconds
        pass_times = passes['minute']*60+passes['second']
        #check if pass is in any of the windows for this half
        pass_to_shot = pass_times.apply(lambda x: True in ((shot_start < x) & (x < shot_times)).unique())

        #keep only danger passes
        danger_passes_period = passes.loc[pass_to_shot]
        #concatenate dataframe with a previous one to keep danger passes from the whole tournament
        danger_passes = pd.concat([danger_passes, danger_passes_period], ignore_index = True)
```

In [16]:
```
#plot pitch
pitch = Pitch(line_color='black')
fig, ax = pitch.grid(grid_height=0.9, title_height=0.06, axis=False,
                     endnote_height=0.04, title_space=0, endnote_space=0)
#scatter the location on the pitch
pitch.scatter(danger_passes.x, danger_passes.y, s=100, color='blue', edgecolors='grey', linewidth=1, alpha=0.2, ax=ax["pitch"])
#uncomment it to plot arrows
#pitch.arrows(danger_passes.x, danger_passes.y, danger_passes.end_x, danger_passes.end_y, color = "blue", ax=ax['pitch'])
#add title
fig.suptitle('Location of danger passes by ' + team, fontsize = 30)
plt.show()
```



In [17]:
```
#plot vertical pitch
pitch = Pitch(line_zorder=2, line_color='black')
fig, ax = pitch.grid(grid_height=0.9, title_height=0.06, axis=False,
                     endnote_height=0.04, title_space=0, endnote_space=0)
#get the 2D histogram
bin_statistic = pitch.bin_statistic(danger_passes.x, danger_passes.y, statistic='count', bins=(6, 5), normalize=False)
#normalize by number of games
bin_statistic["statistic"] = bin_statistic["statistic"]/no_games
#make a heatmap
pcm  = pitch.heatmap(bin_statistic, cmap='Reds', edgecolor='grey', ax=ax['pitch'])
#legend to our plot
ax_cbar = fig.add_axes((1, 0.093, 0.03, 0.786))
cbar = plt.colorbar(pcm, cax=ax_cbar)
fig.suptitle('Danger passes by ' + team + " per game", fontsize = 30)
plt.show()
```



In [ ]: