wQuartic

January 22, 2019

```
In [25]: exec(open('initNotebook.py').read())
```

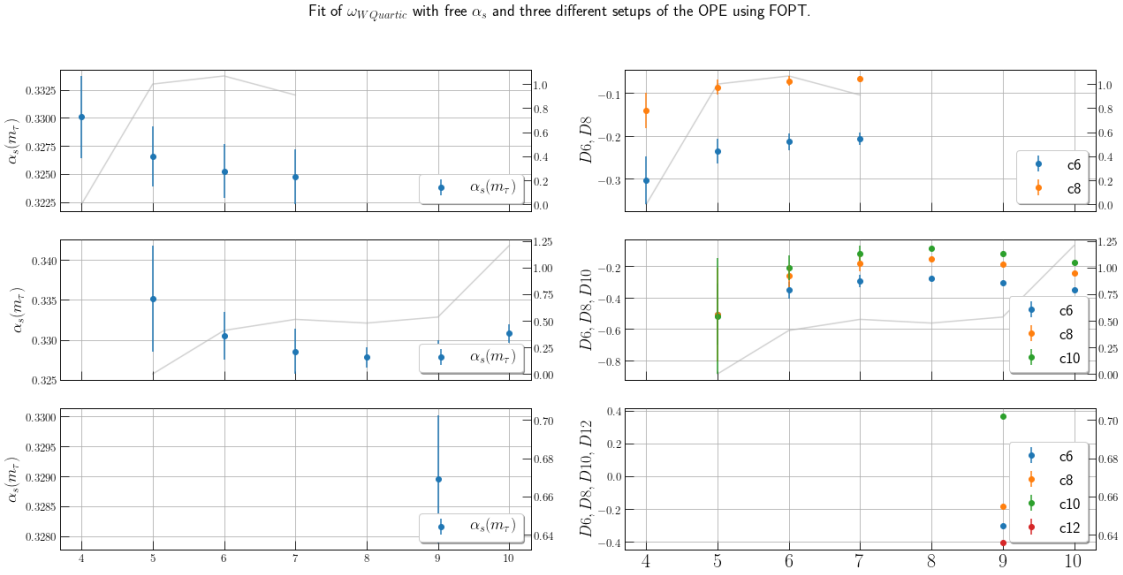
1 Load Data

```
In [4]: wQuarticAlD6D8 = read_csv('../../FESR/configurations/2019/wQuarticAlphaD6D8/fits.csv')
        wQuarticAlD6D8D10 = read_csv('../../FESR/configurations/2019/wQuarticAlphaD6D8D10/fits
        wQuarticAlD6D8D10D12 = read_csv('../../FESR/configurations/2019/wQuarticAlphaD6D8D10D1
        wQuarticD6D8 = read_csv('../../FESR/configurations/2019/wQuarticD6D8/fits.csv')
        wQuarticD6D8D10 = read_csv('../../FESR/configurations/2019/wQuarticD6D8D10/fits.csv')
        wQuarticD6D8D10D12 = read_csv('../../FESR/configurations/2019/wQuarticD6D8D10D12/fits.
```

```
In [10]: fig, (axes) = plt.subplots(3, 2, sharex=True)
         fig.suptitle(r'Fit of $\omega_{WQuartic}$ with free $\alpha_s$ and three different se
         plt.xticks(list(sminMap.values()), fontsize=22)
         addAx(axes[0], 0, ['alpha'], wQuarticAlD6D8, ylabel=r'$\alpha_s(m_\tau)$')
         addAx(axes[1], 0, ['alpha'], wQuarticAlD6D8D10, ylabel=r'$\alpha_s(m_\tau)$')
         addAx(axes[2], 0, ['alpha'], wQuarticAlD6D8D10D12, ylabel=r'$\alpha_s(m_\tau)$')

         addAx(axes[0], 1, ['c6', 'c8'], wQuarticAlD6D8, ylabel='$D6, D8$')
         addAx(axes[1], 1, ['c6', 'c8', 'c10'], wQuarticAlD6D8D10, ylabel=r'$D6, D8, D10$')
         addAx(axes[2], 1, ['c6', 'c8', 'c10', 'c12'], wQuarticAlD6D8D10D12, ylabel=r'$D6, D8,

         fig.savefig('./plots/wQuarticAlpha.png', dpi=300)
         plt.show()
```



We fitted $\omega_{Quartic}$ for three different settings, each represented by a row in the 3x2 subplots figure: The first row fits α_s, c_6 and c_8, the second row fits α_s, c_6, c_8 and c_{10} and the third row fits $\alpha_s, c_6, c_8, c_{10}$ and c_{12}. We notice that $\omega_{Quartic}$ is dificult to fit, especially within the third row. We could only perform convergent fits using up to ten s_0s-moments and for all OPE coefficients included we obtained only one data point with nine s_0s-moments. The best fit values ordered from first row to third row: \ 1. $\chi^2/dof = 1.00, \alpha_s(m_\tau) = 0.327(27), c_6 = -0.235(28), c_8 = -0.087(17)$ for $s_{min} = 2.4GeV^2(6s_0s - moments)$. \ 2. $\chi^2/dof = 1.21, \alpha_s(m_\tau) = 0.331(12), c_6 = -0.3499(62), c_8 = -0.2453(55), c_{10} = -0.1779(45)$ for $s_{min} = 1.95GeV^2(10s_0s - moments)$. \ 3. $\chi^2/dof = 0.67, \alpha_s(m_\tau) = 0.3290(11), c_6 = -0.3030(46), c_8 = -0.1873(28), c_{10} = 0.3678(44)$ for $s_{min} = 2GeV^2(9s_0s - moments)$. \ The χ^2 is good and the values are within error ranges so even with $\omega_{Quartic}$ we achieved solid fits. Unfortunately including four OPE moments produce non converging fits.

1.1 Test OPE for convergence

```
In [27]: print(testOPESeriesForConvergence(wQuarticAlD6D8))
         print(testOPESeriesForConvergence(wQuarticAlD6D8D10, upToDim=10))
         print(testOPESeriesForConvergence(wQuarticAlD6D8D10D12, upToDim=12))

smin22    True
smin23    True
smin24    True
smin26    True
dtype: bool
smin195    True
smin20     True
smin21     True
smin22     True
smin23     True
```

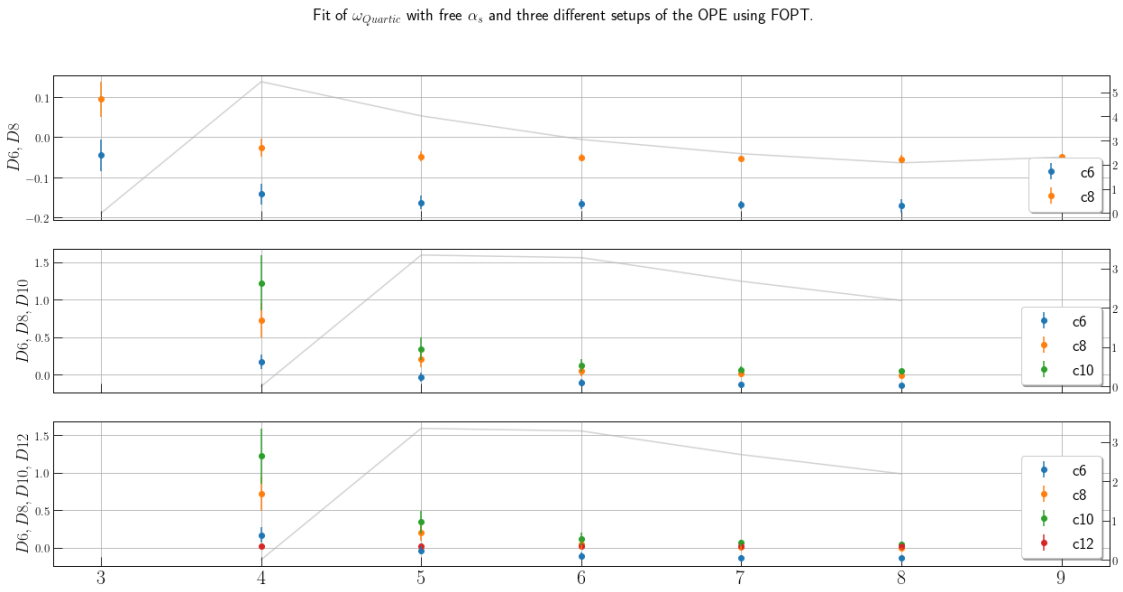
```
smin24     True
dtype: bool
smin20    True
dtype: bool
```

The OPE converges for all fits.

2 Fits with fixed Alpha

```
In [29]: fig, (axes) = plt.subplots(3, sharex=True)
         fig.suptitle(r'Fit of $\omega_{Quartic}$ with free $\alpha_s$ and three different setu
         plt.xticks(list(sminMap.values()), fontsize=22)
         addAx(axes, 0, ['c6', 'c8'], wQuarticD6D8, ylabel=r'$D6, D8$')
         addAx(axes, 1, ['c6', 'c8', 'c10'], wQuarticD6D8D10, ylabel=r'$D6, D8, D10$')
         addAx(axes, 2, ['c6', 'c8', 'c10', 'c12'], wQuarticD6D8D10, ylabel=r'$D6, D8, D10, D12

         fig.savefig('./plots/quarticAlpha.png', dpi=300)
         plt.show()
```



The fits with a fixed α_s value have the same convergence problems as before. Furthermoe the χ^2/dof is bad for every single fit. Consequently the explicit values of the OPE coefficients have not been displayed here. Apart from that the fits behave similar to ω_τ and ω_{Cubic} fits: the OPE contributions form an asymptotic series for increasing s_0s-moments and if we include c_{10} and/or c_{12} the series converges around 0.