Feasibility studies for XYZ states update, larger bkgd statistics

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Updated bkgd statistics

~factor 10, from 1000 M DPM events
→ 11000 M DPM events

Our Focus: Charmonium-like Exotics

List of channels / charmonia (XYZ states):

- $J/\psi + X$, $J/\psi \rightarrow e^+e^- / \mu^+\mu^-$
- $\eta_c + X$, $\eta_c \rightarrow K^+K^-\pi^0 / K_sK^{+/-}\pi^{-/+}$

→ with **various recoils**: $X = \pi^-\pi^+, \pi^0\pi^0, \eta\eta, KK$

→ at **different energies**: E_{cms} = 4.5, 5.5 GeV

→ and the various **detector options** (1+5)

Scenarios proposed:

a) Nominal Set-up: 1,2,3,4,5
b) w/o Barrel EMC: 1,3,4,5
c) w/o FS: 1,2,3,4
d) w/o Disc DIRC: 1,2,3,5
e) w/o Barrel DIRC: 1,2,4,5
f) STT only: 2,3,4,5

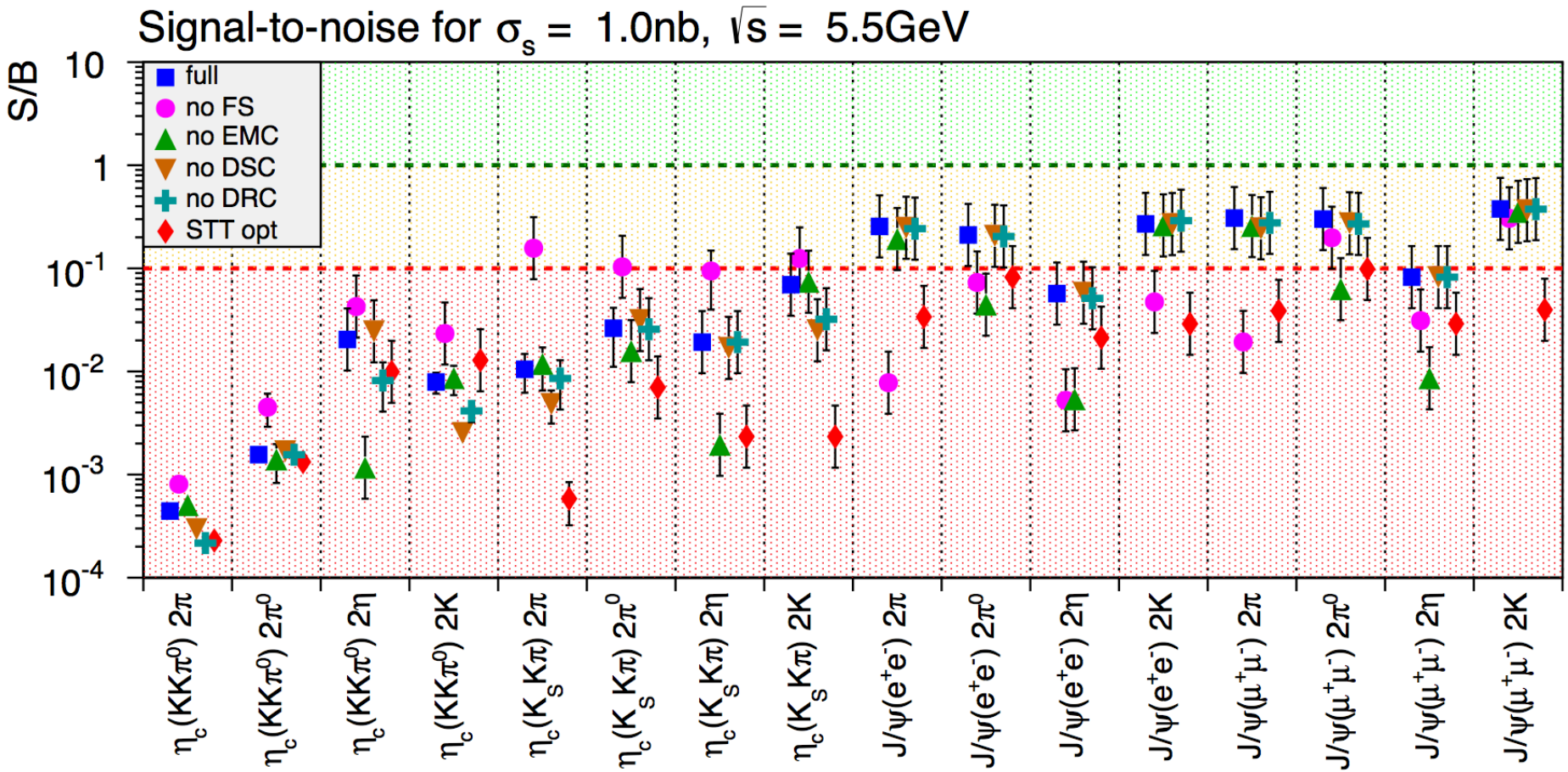
Statistics: 1 M signal evts, 11000 M DPM bkgrd evts

=> ~factor 10 more bkgd events

Results – Signal to Bkgd ratio

$\sigma_s = 1\text{nb}, 5.5\,\text{GeV}$

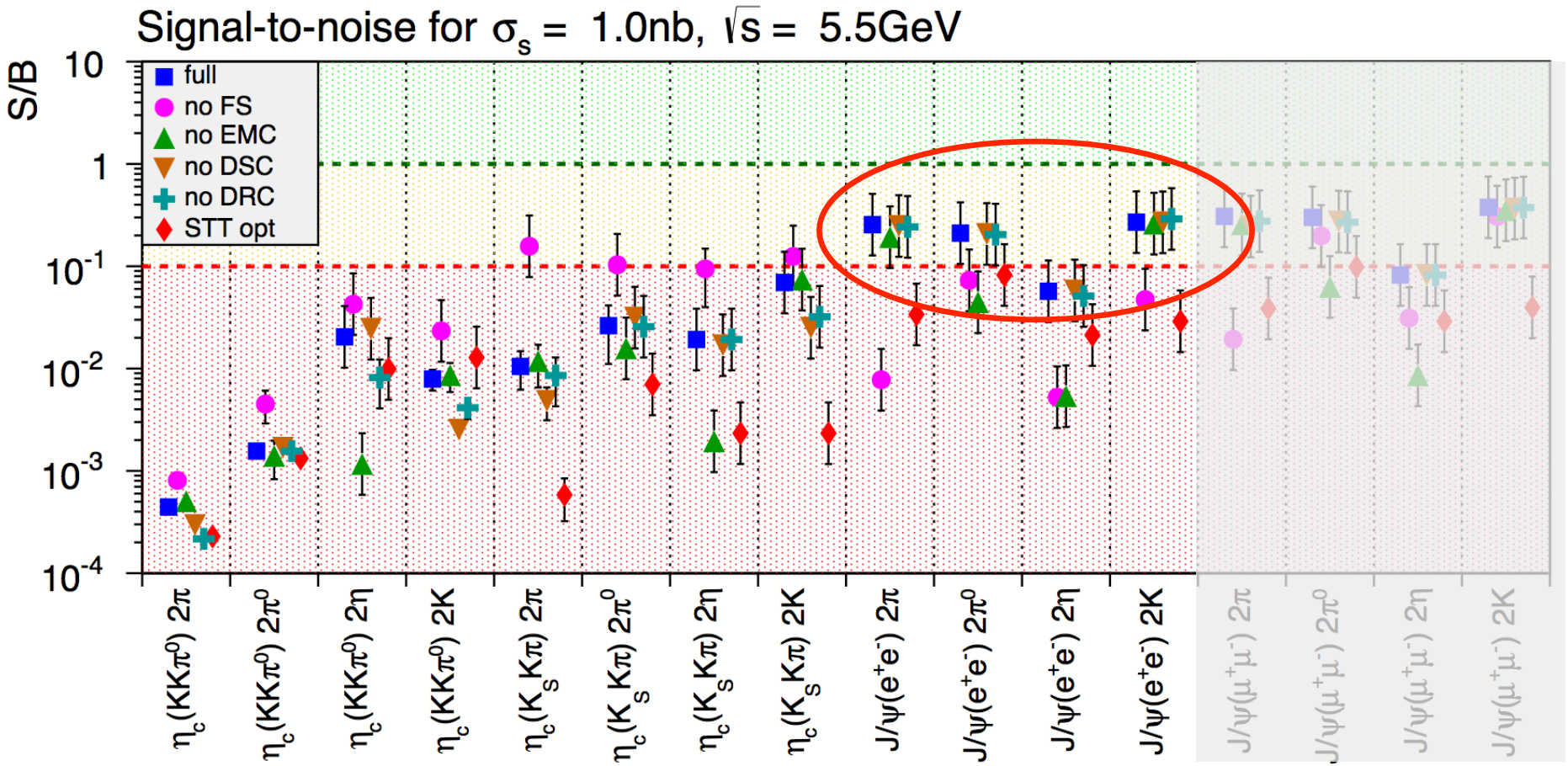
1000 M bkgd events



Results – Signal to Bkgd ratio

$\sigma_s = 1\text{nb}, 5.5\,\text{GeV}$

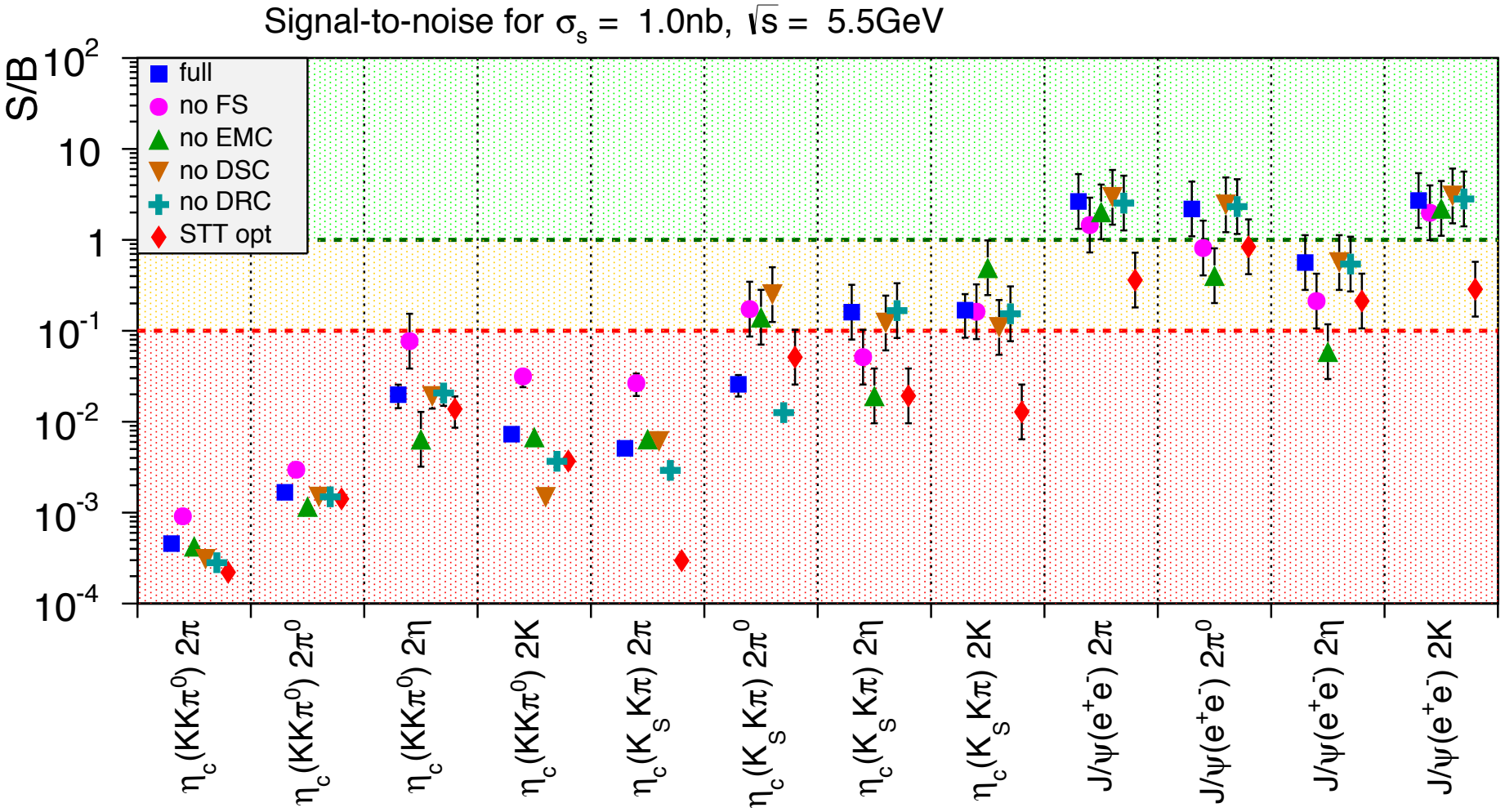
1000 M bkgd events



Results – Signal to Bkgd ratio

σ_s= 1nb, 5.5 GeV

11000 M bkgd events



Results – Signal to Bkgd ratio

$\sigma_s = 1\text{nb}, 5.5\,\text{GeV}$

Analyses rerun with increased bkgd stats (~factor 10)

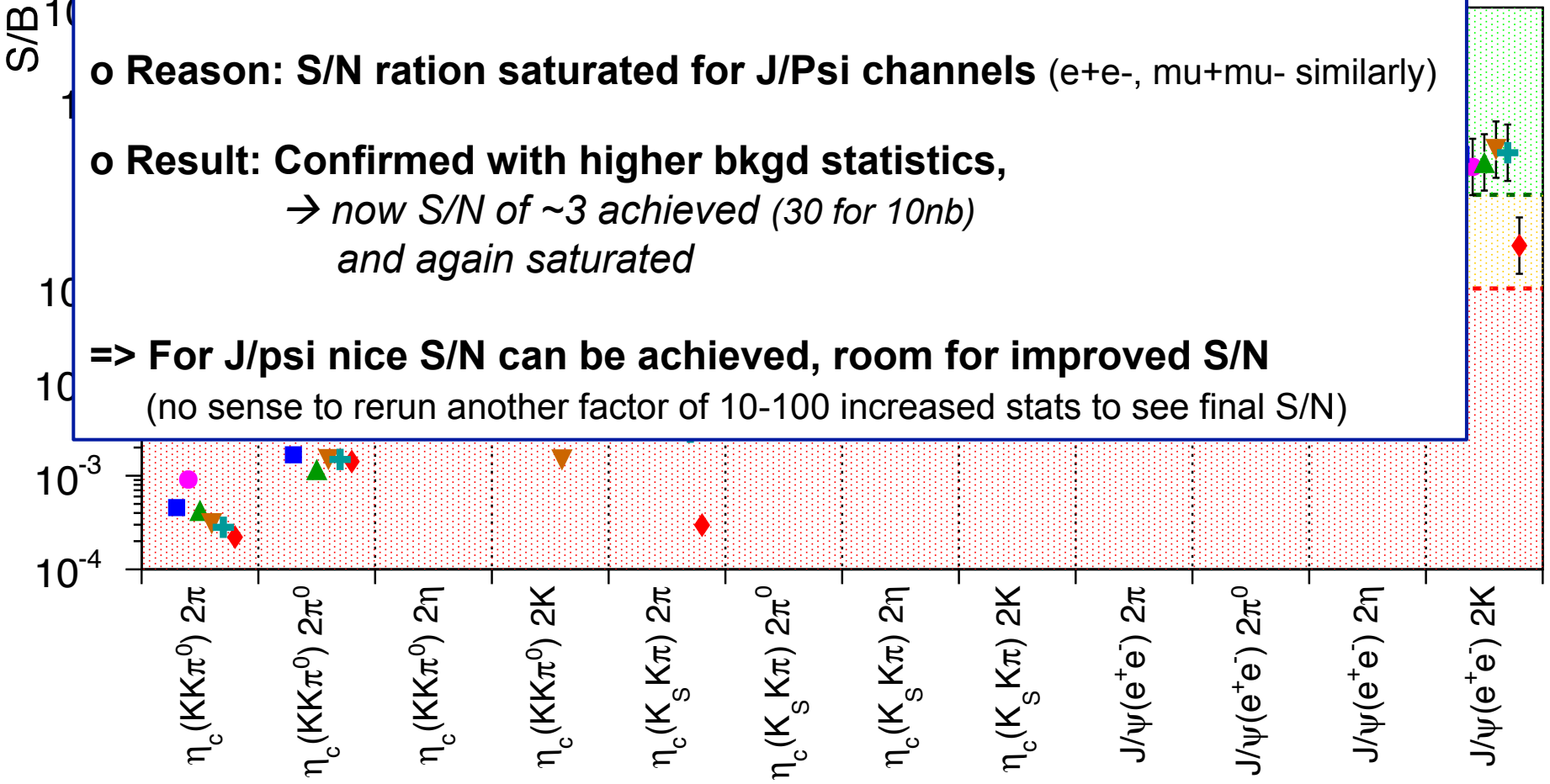
o Reason: S/N ration saturated for J/Psi channels (e+e-, mu+mu- similarly)

o Result: Confirmed with higher bkgd statistics,

→ *now S/N of ~3 achieved (30 for 10nb)*
and again saturated

=> For J/psi nice S/N can be achieved, room for improved S/N

(no sense to rerun another factor of 10-100 increased stats to see final S/N)



Summary

- ✓ **Feasibility studies for charmonium like exotics** (XYZ states)

- ✓ **Extracted, proposed and used FoMs**
  - Time for 5s significance and 1000 signal evts (significance)
  - Signal to background (S/B)
  - Signal efficiency (ε_s)
  - *In Addition:* Check for flatness of acceptance (Pulls-Dalitzplot)

- ✓ **Results summarised by plots and tables** (traffic light indication)

- ✓ **Updated bkgd statistics:**
  → S/N ratios were saturated for J/psi channles (similar for e+e- and mu+mu-)
  → With factor 10 more bkgd stats: S/N improves from <1 to 3 (30 for 10nb)
  → Other channels confirmed not to be saturated
  => J/psi channels: Feasible with good S/N ratios