## Recent developments and LVK issues

S.HAINO

2016/11/7

## Recent improvements in LIGO calibration

- Quoted calibration uncertainties in amplitude and phase
- GW150914 10% and 10 degrees
- GW151226 8% and 5 degrees
- GW170104 5% and 3 degrees (20 – 1024 Hz)

# Calibration uncertainties in GW150914



# Calibration uncertainties in GW170104

#### LIGO-G1701065



# Fitting sensing parameters with MCMC



## Impact of calibration error on LV localization

#### D.Brown (GWPAW 2017)



Preliminary

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Preliminary

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Preliminary study has been made and presented in GWPAW in Yuki's presentation

- Assume 1.4+1.4 Ms NS-NS Binary
- Among 9 parameters, 4 parameters (RA, Dec, polarization angle and time delay) are assumed to be correlated and scanned
- Antenna pattern of each detector is considered
- Bias in the localization is estimated in the case
  Virgo and KAGRA amplitudes are biased by 10%

LVK localization error: NS-NS 150 Mpc



Virgo +10% KAGRA -10%



Virgo +10% KAGRA -10%



### Summary and Next steps

- LIGO calibration is developing and the calibration errors are decreasing
- By the time KAGRA joins the GW detector network less than a few % calibration errors should be achieved
- With the detector sensitivity improved, large SN events will increase and eventually calibration error will be the major source of parameter estimations
- In KAGRA, we should also develop methods to take account the calibration error in data analysis

### Summary and Next steps

- Impact of localization error is a typical issue for KAGRA because the major contribution of KAGRA is to improve the localization with LVK
- We should make more detailed analysis and prepare for numbers in hand to demonstrate how much improvements in KAGRA calibration can contribute the LVK network

### GWPAW summary talk

